Appendix E

Hydrology Study







PRELIMINARY HYDROLOGY STUDY
TOWNES AT BROADHWAY
2323 W. BROADWAY , ANAHEIM, CA
TTM No. 19137
OTH2020-01324

DEPARTMENT OF PUBLIC WORKS
SUBDIVISIONS

APPROVED

Aram Eftekhari, Associate Engineer

4/15/2021, 1:53:07 PM

OTH2020-01324

Aram Eftekhari

Project Address:

2323 W. Broadway
Anaheim, CA 92804

Prepared For:

Melia Homes
8951 Research Drive, Suite 100
Irvine, CA 92618
Chad Brown, Vice President of Planning & Development
(949) 759-4367

Prepared By:

C&V Consulting Inc.
9830 Irvine Center Drive
Irvine, CA 92630
Dane McDougall, P.E.
(949) 916-3800

Prepared: December 2020
Revised: April 2021

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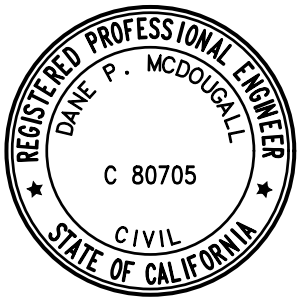
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Preliminary Hydrology Study
for
Townes at Broadway
2323 W. Broadway
Anaheim, Ca 92804

ACKNOWLEDGEMENT AND SIGNATURE PAGE

This Preliminary Hydrology Study was prepared by C&V Consulting, Inc. under the supervision of Dan McDougall, P.E.



Dane McDougall, R.C.E. 80705 Date 4/7/2021
Principal, C&V Consulting, Inc.

1.0 SITE DESCRIPTION

The proposed development encompasses two (2) parcels consisting of approximately 6.49 gross acres and is located at 2323 W. Broadway, in the City of Anaheim, County of Orange. The site is bounded by W. Broadway to the south, single family residences to the west, the Cantada Square condominium multi-family development to the north, and the Madison Park Apartment Homes multi- family development to the east. West Transit Avenue is an existing dead-end street serving two (2) existing single family residential driveways and no cul-de-sac turnaround required. The site is currently occupied by Cornelia Connelly High School with approximately five (5) existing buildings onsite. A little over half a third of the site is currently paved with asphalt concrete utilized for parking, private drive aisles, and sports courts. A large grassy sports field is located near the northeast corner of the site. There are several sheds and storage structures located near the sports courts and sport field area. Concrete walkways and courtyards exist throughout the site. Existing perimeter controls consist of block walls and landscaping along the north, east, and west property lines.

The proposed development will consist of 112 attached condominium units with associated drive aisles, parking, open space recreational area, landscaping, a primary entry and a separate driveway for Emergency Vehicle Access.

2.0 EXISTING CONDITIONS

The site is currently occupied by the Cornelia Connelly High School. Per the City of Anaheim Title 18 Zoning Map, revised July 23, 2020, the site is identified as a Transition (T) zone. This zone is defined as land used for "transitory or interim use restricted to limited uses because of special conditions, or not zoned to one of the zoning districts."

The site is not located within a specific plan area. According to the City of Anaheim Planning and Building Department review letter of the conceptual site plan, dated September 16, 2020 (Case No. GPA2020-00533/ RCL2020-00335/ CUP2020-06094/ SUBTM19137/ DEV2020-00180), the site will require zone Reclassification (RCP) to Multiple-Family Residential (RM-3).

Per the City of Anaheim General Plan Land Use Map, revised June 9, 2020, the site is identified as Public School, defined as "existing public and larger, established private schools, including elementary, junior and high schools." The site is surrounded by low-medium density to the north, medium density to the east and low density to the west. According to the City of Anaheim Planning and Building Department review letter of the conceptual site plan, the site will require General Plan Amendment (GPA) to Low-Medium Residential (R-LM).

Based on site topography, the existing project site contains approximately 59% impervious coverage overall. In the current condition, the site generally sheet flows overland in both the westerly and southerly directions. The northerly portion of the site, approximately one-third of the project site, drains in the westerly direction towards existing perimeter walls which have large existing knockouts to allow stormwater runoff to continue onto W. Transit Avenue. There is an existing 6' wide x 1' deep concrete channel located onsite along the westerly property line near the northwest corner of the site that accepts drainage from the Cantada Square development, TR 16477 to the north and conveys runoff to W. Transit Avenue. The concrete channel is separated by an existing block wall with no openings to the proposed development and is within an existing drainage easement. The existing block wall and concrete drainage channel will be preserved as part of this development. Offsite

existing flows being conveyed through the existing concrete channel will not be modified. Runoff from the site will not comingle with flows in this channel until both the channel and the proposed parkway culvert discharge into the right of way on Transit Avenue. Existing drainage improvements located within easement are referenced on City of Anaheim approved/ permitted Rough Grading Plan for TR 16477 GRA2003-02087 and are provided within Appendix H of this report.

The southern portion of the site (buildings and parking lot) drains in the southerly direction towards the public right-of-way of W. Broadway. There is an existing 14' wide catch basin located within the project's frontage. Per the Orange County Public Work (OCPW), Land Records site, there is an existing 15" storm drain located onsite that connects to the existing public catch basin. No as-built plans are available for this existing storm drain lateral. Area drains present throughout the site are assumed to tie into this lateral. This existing onsite 15" storm drain pipe will be removed as part of the development's onsite demolition.

According to the City of Anaheim, Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area, the site is located within Drainage Basin 8. Drainage Basin 8 has a tributary drainage area of approximately 1100 acres consisting of 2 Drainage Areas. The project site is located within the Drainage Area 8-1 which is defined by the City of Anaheim to drain into an existing storm drain that conveys runoff to Carbon Creek. Stormwater runoff entering W. Broadway continues to flow west into an existing City of Anaheim public 90" Reinforced concrete storm drain pipe slightly east of the intersection of W. Broadway and S. Gilbert Street, referenced on an Orange County Flood Control District (OCFCD) Facility Broadway Storm Drain (Dwg. B01P08-701-1A). Refer to Appendix H of this report for reference to the existing as-built information.

Stormwater runoff from W. Transit Avenue confluences at the intersection and continues west in a 93" Reinforced Concrete storm drain pipe. At Magnolia Avenue runoff continues into a 96" Reinforced concrete pipe where it eventually enters the Carbon Creek Channel at S. Dale Avenue. The Carbon Creek Channel eventually confluences with the San Gabriel River and ultimately outlets into the Pacific Ocean at San Pedro Bay. The storm drain line that runs in Broadway has a capacity of 455 cfs which is equivalent to 45% of the 10-year storm event. Refer to Appendix E for portions of the City of Anaheim, Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area.

The Orange County Flood Control District (OCFCD) Drainage Facilities Maps were utilized to verify the drainage pattern of site runoff. The topographic survey was utilized to identify existing onsite high points and overall site conveyance of storm water runoff. The entire site runoff was quantified based on the longest hydraulic path from the most remote high point to drop inlet low point. Refer to Appendix E for the applicable OCFCD Drainage Facilities Maps. Refer to the "Existing Conditions Hydrology Map" located within Appendix A of this study for additional information.

3.0 PURPOSE OF STUDY

The preliminary hydrology study will determine the amount of stormwater runoff generated from the project site in the existing and proposed conditions. This study will determine whether detention or other peak flow mitigation methods will be required by comparing the proposed and existing condition peak flow rates for the 10-, 25-, and 100-year storm events.

4.0 PROPOSED CONDITIONS

The proposed development will consist of 6.49 acres and provide a total of 112 attached, multi-family residential condominiums. The 2-, 3-, and 4-bedroom units will range in square footage between 1,596 and 1,905. Associated resident and guest parking areas, a private drive aisle, recreational areas, sidewalks, and landscaped areas are also proposed within the development. Based on the proposed land use of the residential lot, the imperviousness was assumed to be 80% per the Orange County Hydrology Manual, Figure C-4. Actual imperviousness will be calculated during final engineering, and hydrology calculations will be updated.

The residential site will be graded to convey stormwater as surface flow to three (3) proposed curb-inlet catch basins near the western and southern property lines of the site. The proposed catch basins will convey low flows to proposed biofiltration systems to treat the required water quality design flow rate. During larger storm events within Subareas P2 and P4, stormwater runoff will overflow within the proposed catch basins and into a proposed storm drain pipe that will convey the overflow into a junction structure connecting to an existing catch basin and existing storm drain system W. Broadway. Emergency (secondary) overflow will pond around the proposed catch basins for both of these areas and sheet flow into the right-of-way of W. Broadway over the proposed entrance driveway/ parkway area.

During storm events within Subarea P3, stormwater runoff will overflow within the proposed catch basin and drain towards W. Transit Avenue via a proposed parkway culvert through an existing wall knockout. Within Subarea P3, emergency (secondary) overflow will be provided by proposed wall knockouts along the project's western property line which drain to W. Transit Avenue. Water quality treated stormwater runoff will be pumped vis a stormwater sump pump system to the proposed parkway drain.

Upon entering the public right-of-way, sheet runoff will follow curb and gutter towards the existing catch basin. Upon entering the relocated catch basin, site runoff will follow the historic drainage pattern and drain to Carbon Creek Channel.

Refer to "Proposed Conditions Preliminary Hydrology Map" in Appendix A within this study for additional information.

5.0 METHODOLOGY

The project site was analyzed using the Orange County Hydrology Manual 1986. The initial subareas were analyzed for acreage, land-use, soil type, peak flow rate and time of concentration according to the Rational Method described in the manual.

In this preliminary hydrology study, the recommended values per the Orange County Hydrology Manual 1986 were utilized for the percentage of impervious area of the proposed condition. Assumptions for impervious cover are shown in the Hydrology Calculations in Appendix B.

6.0 RESULTS

Drainage Tributary to West Broadway

Drainage Area	Area (ac)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)	T_c (min)
Existing Conditions					
X6	2.37	3.74	4.5	5.82	10.75
X7	0.22	0.53	0.64	0.82	9.33
Total	**4.12**	**9.58**	**11.55**	**14.98**	
Proposed Conditions					
P1	0.65	1.88	2.25	2.88	7.29
P2	0.85	2.94	3.61	4.73	13.11
P3	0.52	1.41	1.69	2.16	8.13
P4	1.71	3.47	4.30	5.66	19.02
Total	**3.73**	**6.41**	**7.91**	**10.39**	**--**
Confluence Total	**--**	**5.88**	**7.25**	**9.55**	**13.42**

Drainage Tributary to Transit Avenue

Drainage Area	Area (ac)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)	T_c (min)
Existing Conditions					
X8	**2.39**	**4.61**	**5.59**	**7.23**	**13.24**
Proposed Conditions					
P5	0.50	1.42	1.69	2.17	7.54
P6	2.27	4.67	5.74	7.55	16.8
Sub-Total	**2.77**	**4.67**	**5.74**	**7.55**	**16.8**
Total Mitigated	**-**	**0.06**	**0.15**	**0.32**	**-**

Note: All time of concentrations indicated above refer to the 100-year storm event.

Catch Basin Sizing

Proposed Catch Basin Sizing for Catch Basins #1 and #2 that convey runoff into W. Broadway have been analyzed for the 25-year storm event peak flow rates. Emergency overflow at Catch Basin #1, will pond over the curb/ landscaped area to the public right-of-way of W. Broadway. A proposed wrought iron fence is located near this area to allow for proper overflow. Emergency overflow at Catch Basin #2, will pond over the driveway to the public right-of-way of W. Broadway. Proposed Catch Basin Sizing for Catch Basin #3 was analyzed for the 100-year storm event in order to prevent ponding along the existing screen wall during smaller storm events. Catch basin sizing and a Ponding Exhibit with emergency overflow elevations are provided in Appendix F of this report.

Parkway Culvert

One parkway culvert will provide a by-pass condition for the underground infiltration systems during larger storm events in Subarea P6 to W. Transit Avenue. The 100-year storm event peak runoff flowrates were utilized in sizing parkway culverts. Refer to Appendix F of this report for culvert sizing.

100-Year Water Surface Elevations

A ponding exhibit has been prepared to verify the 100-year water surface elevations at all onsite sump locations and to verify that nearby finish floor elevations have been set providing at least a 1' freeboard condition. Refer to Appendix F of this report for 100-year water surface elevation depth calculations and ponding exhibit.

Detention Calculations

Due to the slight increased peak flow rate tributary to W. Transit Avenue because of the change in land use and increased impervious coverage, a small amount of stormwater will need to be detained and mitigated onsite. The small unit area hydrograph was analyzed to determine the amount increased volume runoff that will need to be mitigated. Approximately 23 cf (cubic feet) will need to be detained onsite and mitigated based on the existing 100-year storm event. The proposed stormwater sump pump for the water quality treatment flow rate will be designed to mitigate both water quality and increased 100-year peak flow rates. Typically, within stormwater sump pump systems a 2' sump is maintained to aid in peak pump performance; this equates to approximately 39 cf which will be detained onsite. The stormwater sump pump system will be designed and specified during final engineering. Refer to Appendix G for the small unit area hydrograph calculations.

7.0 CONCLUSION

The results from this preliminary hydrology study demonstrate that the proposed condition of the project site will generate a higher runoff volume to W. Transit Avenue and a slightly lower runoff volume to W. Broadway than the existing condition. The change in peak flowrates that discharge into W. Broadway is due to the fact that pervious area is increasing in the Drainage Areas from the existing condition to the proposed condition.

In the existing condition, subareas draining towards W. Transit Avenue total approximately 2.20 acres, in which approximately 1.70 aces (77%) is pervious and subareas draining towards W. Broadway total approximately 4.12 acres, in which approximately 0.89 acres (22%) is pervious.

In the proposed condition, subareas draining towards W. Transit Avenue total approximately 2.77 acres, in which approximately 0.50 aces (20%) is pervious and subareas draining towards W. Broadway total approximately 3.73 acres, in which approximately 0.75 acres (20%) is pervious. Note, the proposed pervious coverage is based on land use corresponding to condominiums. Actual pervious coverage will be calculated based on a finalized landscape plan during final engineering.

The increase in peak runoff flow rates into W. Transit Avenue can be accounted by the increase in impervious area from the existing condition to the proposed condition.

Although W. Transit Avenue has an increase in runoff from the existing condition to the proposed condition, the proposed stormwater sump pump system will statically detain the increased peak flow volume that the difference in runoff between existing and proposed conditions produced by a small area unit hydrograph. Downstream facilities will not be hydrologically or hydraulically impacted by the proposed condition of the project site. Refer to Appendix B for Peak Runoff Calculations. Refer to Appendix G for the small area unit hydrograph for runoff tributary to W. Transit Avenue.

Proposed habitable structures have been designed to be at least 1’ above the 100- year water surface elevation at designated sump location onsite. Proper emergency overflow has been established at the sump locations. Refer to Appendix F for 100-year depth of flow calculations and ponding exhibit.

8.0 DESIGN ASSUMPTIONS

1. The property is located in the City of Anaheim, Orange County rainfall region.

2. 100-year storm event flood level protection analysis required for habitable structures per the requirements of the Orange County Flood Control District Design Manual.

3. Site located within Hydrologic Soil Type "A" per the USDA Web Soil Survey Data, (See Appendix D of this report for reference). Although the Orange County WQMP TGD indicates the project site is within Soil Type "B" on the NRCS Hydrologic Soil Groups map, Soil Type "B" was used for hydrology calculations in order to be conservative.

4. Impervious coverage for the existing condition of the site was hand calculated based on existing topography maps.

5. Impervious coverage correlating to the land use category of Multi-Family Residential, Condominiums was assumed for the proposed condition of the site.

6. Peak flow rates and time of concentrations were calculated using Rational Method described in Orange County Hydrology Manual 1986.

7. Per FEMA Flood Map No. 06059C0128J, the project is located within Zone X, "Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood." Refer to Appendix J for a copy of the FEMA Flood Map and additional information regarding the flood elevation.

9.0 REFERENCES

1. Orange County Hydrology Manual 1986

2. Orange County Flood Control District Design Manual 2000

3. NRCS Web Soil Survey

4. City of Anaheim, Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area 2010

5. Orange County Drainage Facilities Map Nos. 12 & 13 and Carbon Creek Channel As-Built Plans

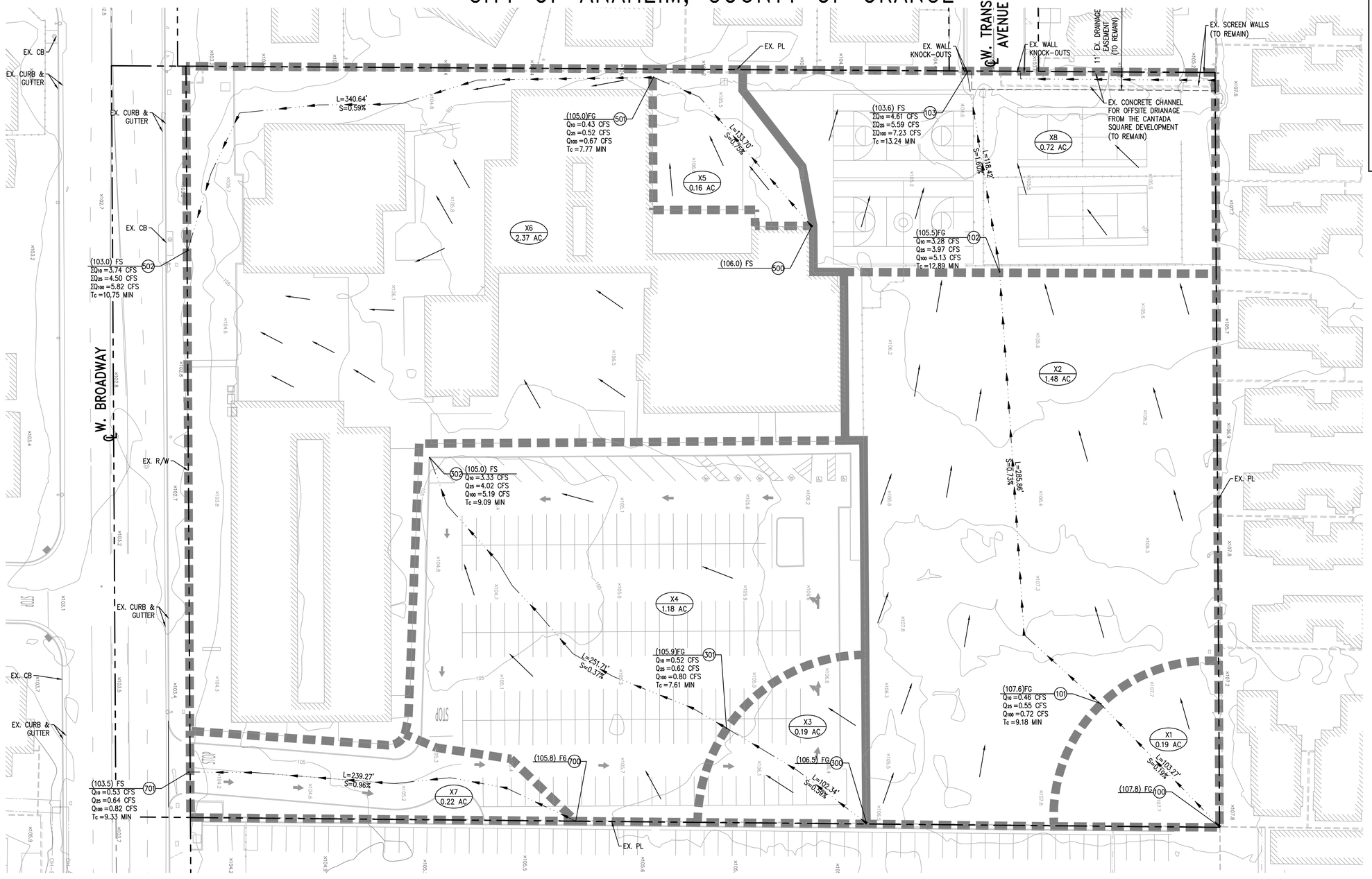
6. FEMA Firm Map Number 06059C0128J, December 3, 2009 and LOMR-F, Case No. No. 13-09-2281A dated September 19, 2013

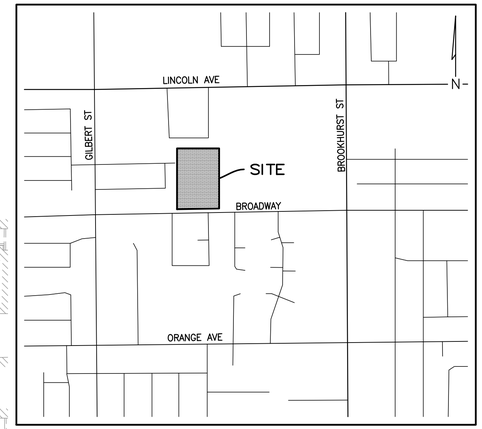
APPENDIX A
HYDROLOGY MAPS

Existing Conditions Hydrology Map

EXISTING CONDITIONS HYDROLOGY MAP

TR 19137
2323 W. BROADWAY
CITY OF ANAHEIM, COUNTY OF ORANGE





VICINITY MAP
NTS

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- DRAINAGE BOUNDARY
- DRAINAGE SUB AREA BOUNDARY
- LONGEST FLOW PATH
- FLOW DIRECTION
- XX / X.XX AC — DRAINAGE AREA ID / DRAINAGE AREA IN ACRES
- 100 — INITIAL SUBAREA NODE
- (100.0) FS — SPOT ELEVATION
- Q100 =X.XX CFS — PEAK RUNOFF (CFS)
- Tc =X.X MIN — TIME OF CONCENTRATION (MIN)

SCALE: 1" = 30'

0 15 30 60

DEVELOPER :

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APP	DATE

OWNER & DEVELOPER :

MELIA HOMES
8951 RESEARCH DRIVE, #100
IRVINE, CA 92618
PHONE (949) 759-4367

SOILS ENGINEER :

PREPARED BY :

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

REGISTERED PROFESSIONAL ENGINEER
DANIE P. MCDOUGALL
C 80705
CIVIL
STATE OF CALIFORNIA

TRACT NO. 19137
EXISTING CONDITIONS HYDROLOGY MAP

DATE: 2/1/2021
SHEET 1 OF 1
SCALE: AS SHOWN
DRAWN BY: SP
CHECKED BY: JH

CITY OF ANAHEIM

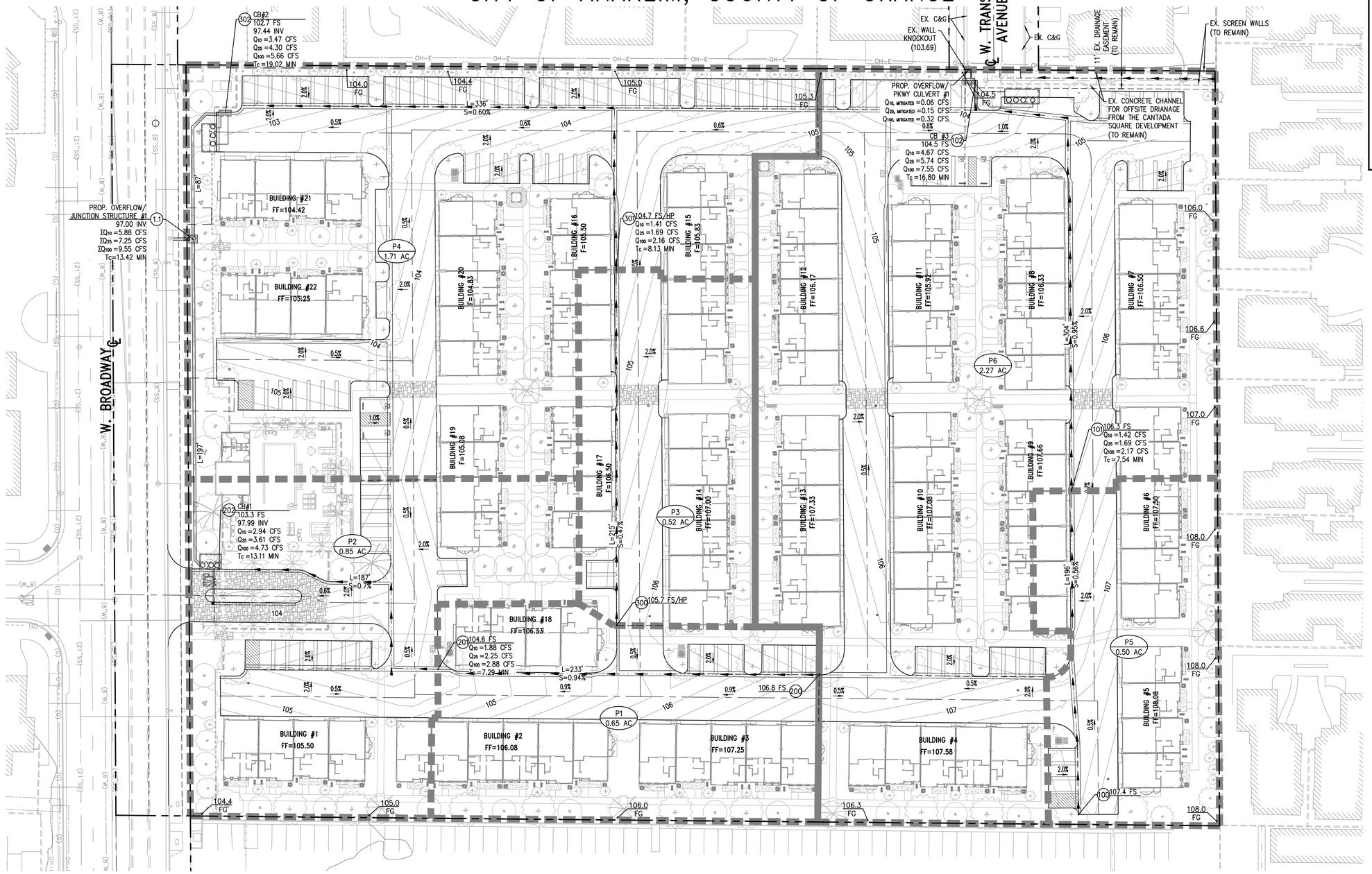
Proposed Conditions Hydrology Map

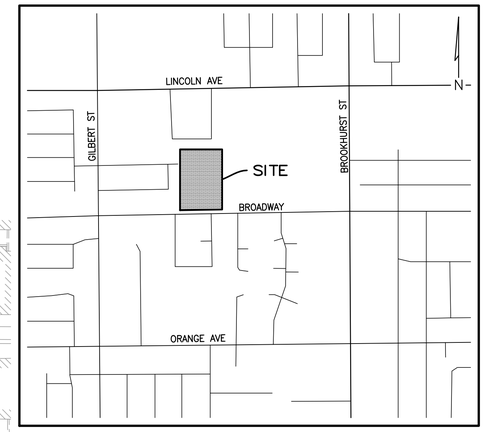
PROPOSED CONDITIONS HYDROLOGY MAP

TR 19137

2323 W. BROADWAY

CITY OF ANAHEIM, COUNTY OF ORANGE





VICINITY MAP

NTS

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- DRAINAGE AREA BOUNDARY
- DRAINAGE SUB AREA BOUNDARY
- LONGEST FLOW PATH
- FLOW DIRECTION
- XX — DRAINAGE AREA ID
- X.XX AC — DRAINAGE AREA IN ACRES
- INITIAL SUBAREA NODE
- (100.0) FS — SPOT ELEVATION
- Q100 =X.XX CFS — PEAK RUNOFF (CFS)
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(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

REGISTERED PROFESSIONAL ENGINEER
DUANE P. McDOUGALL
C 80705
CIVIL
STATE OF CALIFORNIA

TRACT NO. 19137
PROPOSED CONDITIONS HYDROLOGY MAP

DATE: 4/7/2021

SHEET 1 OF 1

SCALE: AS SHOWN | DRAWN BY: SP | CHECKED BY: JH

CITY OF ANAHEIM

APPENDIX B
HYDROLOGY CALCULATIONS

Existing & Proposed Conditions Hydrology Calculations (10-year Storm Event)

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_____
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
        (c) Copyright 1983-2014 Advanced Engineering Software (aes)
            Ver. 21.0  Release Date: 06/01/2014  License ID 1580

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* TOWNES AT BROADWAY                                                    *
* TTM 19137                                                             *
* EXISTING Q10                                                          *
 ************************************************************************

  FILE NAME: ML06X10.DAT
  TIME/DATE OF STUDY: 17:20 01/28/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   103.27
  ELEVATION DATA: UPSTREAM(FEET) =    107.80  DOWNSTREAM(FEET) =    107.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.185
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.865
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.19      0.30     0.600    36    9.18
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.46
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.46

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    107.60  DOWNSTREAM(FEET) =    105.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   285.86   CHANNEL SLOPE =  0.0073
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.46
  FLOW VELOCITY(FEET/SEC) =   1.29
  TRAVEL TIME(MIN.) =   3.71   Tc(MIN.) =   12.89
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     389.13 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   12.89
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.359
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                     B        1.48      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.48      SUBAREA RUNOFF(CFS) =    2.90
  EFFECTIVE AREA(ACRES) =      1.67   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        1.7       PEAK FLOW RATE(CFS) =       3.28
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    105.50
  DOWNSTREAM NODE ELEVATION(FEET) =    103.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   118.42
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.500
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.00500
  MAXIMUM DEPTH(FEET) =   0.55
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.324
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                     B        0.72      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.97
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.67
  AVERAGE FLOW DEPTH(FEET) =   0.50   FLOOD WIDTH(FEET) =    5.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.35   Tc(MIN.) =   13.24
  SUBAREA AREA(ACRES) =    0.72       SUBAREA RUNOFF(CFS) =    1.39
  EFFECTIVE AREA(ACRES) =    2.39     AREA-AVERAGED Fm(INCH/HR) =   0.18
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.60
  TOTAL AREA(ACRES) =        2.4         PEAK FLOW RATE(CFS) =       4.61

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL DEPTH
         IN A FLOWING-FULL GUTTER(NORMAL DEPTH = GUTTER HIKE)


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOOD WIDTH(FEET) =    5.00
  FLOW VELOCITY(FEET/SEC.) =   5.67   DEPTH*VELOCITY(FT*FT/SEC) =   2.84
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     507.55 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   102.34
  ELEVATION DATA: UPSTREAM(FEET) =    106.50  DOWNSTREAM(FEET) =    106.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.606
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.192
```

```
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.19      0.30     0.600    36    7.61
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    106.00
  DOWNSTREAM NODE ELEVATION(FEET) =    105.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   251.71
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.500
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.00500
  MAXIMUM DEPTH(FEET) =   0.55
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.882
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                     B        1.18      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.95
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.82
  AVERAGE FLOW DEPTH(FEET) =   0.50   FLOOD WIDTH(FEET) =    5.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.49   Tc(MIN.) =    9.09
  SUBAREA AREA(ACRES) =    1.18       SUBAREA RUNOFF(CFS) =    2.87
  EFFECTIVE AREA(ACRES) =    1.37     AREA-AVERAGED Fm(INCH/HR) =   0.18
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.60
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       3.33

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL DEPTH
         IN A FLOWING-FULL GUTTER(NORMAL DEPTH = GUTTER HIKE)


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOOD WIDTH(FEET) =    5.00
  FLOW VELOCITY(FEET/SEC.) =   2.82   DEPTH*VELOCITY(FT*FT/SEC) =   1.41
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     354.05 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
```

```
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    105.00  DOWNSTREAM(FEET) =    103.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   207.35   CHANNEL SLOPE =  0.0096
  CHANNEL FLOW THRU SUBAREA(CFS) =       3.33
  FLOW VELOCITY(FEET/SEC) =   1.89
  TRAVEL TIME(MIN.) =   1.83   Tc(MIN.) =   10.92
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   133.70
  ELEVATION DATA: UPSTREAM(FEET) =    106.00  DOWNSTREAM(FEET) =    105.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.773
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.153
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.16      0.30     0.600    36    7.77
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.43
  TOTAL AREA(ACRES) =      0.16   PEAK FLOW RATE(CFS) =      0.43

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    105.00  DOWNSTREAM(FEET) =    103.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   340.64   CHANNEL SLOPE =  0.0059
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.43
  FLOW VELOCITY(FEET/SEC) =   1.15
  TRAVEL TIME(MIN.) =   4.94   Tc(MIN.) =   12.71
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     474.34 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        0.43   12.71    2.378  0.30( 0.18) 0.60       0.2     500.00
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     474.34 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.33   10.92    2.594  0.30( 0.18) 0.60       1.4     300.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.74   10.92    2.594  0.30( 0.18) 0.60       1.5     300.00
      2        3.46   12.71    2.378  0.30( 0.18) 0.60       1.5     500.00
    TOTAL AREA(ACRES) =         1.5

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =        3.74  Tc(MIN.) =   10.923
  EFFECTIVE AREA(ACRES) =      1.51  AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        1.5
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    700.00 TO NODE    701.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   239.27
  ELEVATION DATA: UPSTREAM(FEET) =    105.80  DOWNSTREAM(FEET) =    103.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.330
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.839
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.22      0.30     0.600    36    9.33
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
```

```
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.22   PEAK FLOW RATE(CFS) =      0.53
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.2  TC(MIN.) =      9.33
  EFFECTIVE AREA(ACRES) =      0.22  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.600
  PEAK FLOW RATE(CFS)   =       0.53
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```



```
************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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            Ver. 21.0  Release Date: 06/01/2014  License ID 1580

                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* TOWNES AT BROADWAY                                                   *
* TTM 19137                                                            *
* PROPOSED Q10                                                         *
 ************************************************************************

  FILE NAME: ML06P10.DAT
  TIME/DATE OF STUDY: 22:06 04/07/2021
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   196.00
  ELEVATION DATA: UPSTREAM(FEET) =    107.40  DOWNSTREAM(FEET) =    106.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.544
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.207
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
        LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.50      0.30     0.200    36    7.54
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.42
  TOTAL AREA(ACRES) =      0.50   PEAK FLOW RATE(CFS) =      1.42

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  106.30  DOWNSTREAM ELEVATION(FEET) =  104.50
  STREET LENGTH(FEET) =   304.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.39
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.51
    HALFSTREET FLOOD WIDTH(FEET) =   16.61
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.47
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.24
  STREET FLOW TRAVEL TIME(MIN.) =  10.73   Tc(MIN.) =   18.27
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.932
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        2.27      0.30     0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    2.27      SUBAREA RUNOFF(CFS) =    3.82
  EFFECTIVE AREA(ACRES) =      2.77    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.8         PEAK FLOW RATE(CFS) =       4.67

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.55   HALFSTREET FLOOD WIDTH(FEET) =  24.91
  FLOW VELOCITY(FEET/SEC.) =  0.52   DEPTH*VELOCITY(FT*FT/SEC.) =   0.29
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     500.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   233.00
  ELEVATION DATA: UPSTREAM(FEET) =    106.80  DOWNSTREAM(FEET) =    104.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.286
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.272
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.65      0.30     0.200    36    7.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.88
  TOTAL AREA(ACRES) =      0.65   PEAK FLOW RATE(CFS) =      1.88

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  104.60  DOWNSTREAM ELEVATION(FEET) =  103.30
  STREET LENGTH(FEET) =   187.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.72
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.47
    HALFSTREET FLOOD WIDTH(FEET) =   14.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.46
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.21
  STREET FLOW TRAVEL TIME(MIN.) =   6.85   Tc(MIN.) =   14.13
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.238
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.85      0.30     0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.85      SUBAREA RUNOFF(CFS) =    1.67
  EFFECTIVE AREA(ACRES) =      1.50    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       2.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.48   HALFSTREET FLOOD WIDTH(FEET) =  14.00
  FLOW VELOCITY(FEET/SEC.) =  0.47   DEPTH*VELOCITY(FT*FT/SEC.) =   0.23
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE      1.10 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    97.44  DOWNSTREAM(FEET) =    97.00
  FLOW LENGTH(FEET) =    87.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.14
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.94
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =   14.48
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE      1.10 =     507.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.10 IS CODE =  10
```

```
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   215.00
  ELEVATION DATA: UPSTREAM(FEET) =    105.70  DOWNSTREAM(FEET) =    104.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.128
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.073
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.52      0.30     0.200    36    8.13
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.41
  TOTAL AREA(ACRES) =      0.52   PEAK FLOW RATE(CFS) =      1.41

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  104.70  DOWNSTREAM ELEVATION(FEET) =  102.70
  STREET LENGTH(FEET) =   336.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.79
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.48
    HALFSTREET FLOOD WIDTH(FEET) =   14.00
```

```
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.44
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.21
  STREET FLOW TRAVEL TIME(MIN.) =  12.77   Tc(MIN.) =   20.89
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.789
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        1.71      0.30     0.200    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    1.71      SUBAREA RUNOFF(CFS) =    2.66
  EFFECTIVE AREA(ACRES) =      2.23    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       3.47

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.52   HALFSTREET FLOOD WIDTH(FEET) =  17.34
  FLOW VELOCITY(FEET/SEC.) =  0.47   DEPTH*VELOCITY(FT*FT/SEC.) =   0.25
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     551.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE      1.10 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    97.99  DOWNSTREAM(FEET) =    97.00
  FLOW LENGTH(FEET) =   197.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.32
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.47
  PIPE TRAVEL TIME(MIN.) =   0.76    Tc(MIN.) =   21.65
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.10 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.47   21.65    1.753  0.30( 0.06) 0.20       2.2     300.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
```

```
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1        2.94   14.48    2.207  0.30( 0.06) 0.20       1.5     200.00
LONGEST FLOWPATH FROM NODE    200.00 TO NODE      1.10 =     507.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1        5.88   14.48    2.207  0.30( 0.06) 0.20       3.0     200.00
    2        5.79   21.65    1.753  0.30( 0.06) 0.20       3.7     300.00
  TOTAL AREA(ACRES) =         3.7

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =        5.88  Tc(MIN.) =   14.481
EFFECTIVE AREA(ACRES) =      2.99  AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
TOTAL AREA(ACRES) =        3.7
LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)     =        3.7  TC(MIN.) =     14.48
EFFECTIVE AREA(ACRES) =      2.99  AREA-AVERAGED Fm(INCH/HR)=  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
PEAK FLOW RATE(CFS)   =       5.88

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1        5.88   14.48    2.207  0.30( 0.06) 0.20       3.0     200.00
    2        5.79   21.65    1.753  0.30( 0.06) 0.20       3.7     300.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

Existing & Proposed Conditions Hydrology Calculations (25-year Storm Event)

```
************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
        (c) Copyright 1983-2014 Advanced Engineering Software (aes)
            Ver. 21.0  Release Date: 06/01/2014  License ID 1580

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* TOWNES AT BROADWAY                                                    *
* TTM 19137                                                             *
* EXISTING Q25                                                          *
 ************************************************************************

  FILE NAME: ML06X25.DAT
  TIME/DATE OF STUDY: 17:21 01/28/2021
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   103.27
  ELEVATION DATA: UPSTREAM(FEET) =    107.80  DOWNSTREAM(FEET) =    107.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.185
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.419
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.19      0.30     0.600    36    9.18
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.55
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.55

**************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
--------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    107.60  DOWNSTREAM(FEET) =    105.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   285.86   CHANNEL SLOPE =  0.0073
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.55
  FLOW VELOCITY(FEET/SEC) =   1.29
  TRAVEL TIME(MIN.) =   3.71   Tc(MIN.) =   12.89
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     389.13 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
--------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =   12.89
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.822
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                     B        1.48      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.48      SUBAREA RUNOFF(CFS) =    3.52
  EFFECTIVE AREA(ACRES) =      1.67   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        1.7       PEAK FLOW RATE(CFS) =       3.97
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    105.50
  DOWNSTREAM NODE ELEVATION(FEET) =    103.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   118.42
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.500
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.00500
  MAXIMUM DEPTH(FEET) =   0.55
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.780
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                     B        0.72      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.81
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.67
  AVERAGE FLOW DEPTH(FEET) =   0.50   FLOOD WIDTH(FEET) =    5.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.35   Tc(MIN.) =   13.24
  SUBAREA AREA(ACRES) =    0.72       SUBAREA RUNOFF(CFS) =    1.68
  EFFECTIVE AREA(ACRES) =    2.39     AREA-AVERAGED Fm(INCH/HR) =   0.18
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.60
  TOTAL AREA(ACRES) =        2.4         PEAK FLOW RATE(CFS) =       5.59

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL DEPTH
         IN A FLOWING-FULL GUTTER(NORMAL DEPTH = GUTTER HIKE)


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOOD WIDTH(FEET) =    5.00
  FLOW VELOCITY(FEET/SEC.) =   5.67   DEPTH*VELOCITY(FT*FT/SEC) =   2.84
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     507.55 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   102.34
  ELEVATION DATA: UPSTREAM(FEET) =    106.50  DOWNSTREAM(FEET) =    106.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.606
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.804
```

```
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.19      0.30     0.600    36    7.61
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.62
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.62

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    106.00
  DOWNSTREAM NODE ELEVATION(FEET) =    105.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   251.71
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.500
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.00500
  MAXIMUM DEPTH(FEET) =   0.55
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.439
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                     B        1.18      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.35
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.82
  AVERAGE FLOW DEPTH(FEET) =   0.50   FLOOD WIDTH(FEET) =    5.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.49   Tc(MIN.) =    9.09
  SUBAREA AREA(ACRES) =    1.18       SUBAREA RUNOFF(CFS) =    3.46
  EFFECTIVE AREA(ACRES) =    1.37     AREA-AVERAGED Fm(INCH/HR) =   0.18
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.60
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       4.02

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL
         DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP]

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.54   FLOOD WIDTH(FEET) =    5.00
  FLOW VELOCITY(FEET/SEC.) =   3.08   DEPTH*VELOCITY(FT*FT/SEC) =   1.66
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     354.05 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    105.00  DOWNSTREAM(FEET) =    103.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   207.35   CHANNEL SLOPE =  0.0096
  CHANNEL FLOW THRU SUBAREA(CFS) =       4.02
  FLOW VELOCITY(FEET/SEC) =   1.97
  TRAVEL TIME(MIN.) =   1.75   Tc(MIN.) =   10.85
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==========================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   133.70
  ELEVATION DATA: UPSTREAM(FEET) =    106.00  DOWNSTREAM(FEET) =    105.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.773
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.758
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.16      0.30     0.600    36    7.77
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.16   PEAK FLOW RATE(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    105.00  DOWNSTREAM(FEET) =    103.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   340.64   CHANNEL SLOPE =  0.0059
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.52
  FLOW VELOCITY(FEET/SEC) =   1.15
  TRAVEL TIME(MIN.) =   4.94   Tc(MIN.) =   12.71
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     474.34 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        0.52   12.71    2.845  0.30( 0.18) 0.60       0.2     500.00
 LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     474.34 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        4.02   10.85    3.112  0.30( 0.18) 0.60       1.4     300.00
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        4.50   10.85    3.112  0.30( 0.18) 0.60       1.5     300.00
     2        4.17   12.71    2.845  0.30( 0.18) 0.60       1.5     500.00
   TOTAL AREA(ACRES) =         1.5

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =        4.50  Tc(MIN.) =   10.847
 EFFECTIVE AREA(ACRES) =      1.51  AREA-AVERAGED Fm(INCH/HR) =  0.18
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.60
 TOTAL AREA(ACRES) =        1.5
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    700.00 TO NODE    701.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   239.27
 ELEVATION DATA: UPSTREAM(FEET) =    105.80  DOWNSTREAM(FEET) =    103.50

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.330
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.389
 SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 SCHOOL                     B        0.22      0.30     0.600    36    9.33
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
 SUBAREA RUNOFF(CFS) =      0.64
```

```
  TOTAL AREA(ACRES) =      0.22   PEAK FLOW RATE(CFS) =      0.64
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.2  TC(MIN.) =      9.33
  EFFECTIVE AREA(ACRES) =      0.22  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.600
  PEAK FLOW RATE(CFS)   =       0.64
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```



```
_____________________________________________________________________________
*****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
         (c) Copyright 1983-2014 Advanced Engineering Software (aes)
            Ver. 21.0  Release Date: 06/01/2014  License ID 1580

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* TOWNES AT BROADWAY                                                    *
* TTM 19137                                                             *
* PROPOSED Q25                                                          *
 ************************************************************************

  FILE NAME: ML06P25.DAT
  TIME/DATE OF STUDY: 22:09 04/07/2021
=============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

*****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   196.00
  ELEVATION DATA: UPSTREAM(FEET) =    107.40  DOWNSTREAM(FEET) =    106.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.544
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.822
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
        LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.50      0.30     0.200    56    7.54
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.69
  TOTAL AREA(ACRES) =      0.50   PEAK FLOW RATE(CFS) =      1.69

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  106.30  DOWNSTREAM ELEVATION(FEET) =  104.50
  STREET LENGTH(FEET) =   304.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.13
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.54
    HALFSTREET FLOOD WIDTH(FEET) =   21.98
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.50
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.27
  STREET FLOW TRAVEL TIME(MIN.) =  10.09   Tc(MIN.) =   17.64
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.363
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        2.27      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    2.27      SUBAREA RUNOFF(CFS) =    4.71
  EFFECTIVE AREA(ACRES) =      2.77    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.8         PEAK FLOW RATE(CFS) =       5.74

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.58   HALFSTREET FLOOD WIDTH(FEET) =  29.55
  FLOW VELOCITY(FEET/SEC.) =  0.56   DEPTH*VELOCITY(FT*FT/SEC.) =   0.33
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     500.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   233.00
  ELEVATION DATA: UPSTREAM(FEET) =    106.80  DOWNSTREAM(FEET) =    104.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.286
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.898
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.65      0.30     0.200    56    7.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      2.25
  TOTAL AREA(ACRES) =      0.65   PEAK FLOW RATE(CFS) =      2.25

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  104.60  DOWNSTREAM ELEVATION(FEET) =  103.30
  STREET LENGTH(FEET) =   187.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.28
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.50
    HALFSTREET FLOOD WIDTH(FEET) =   14.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.49
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.24
  STREET FLOW TRAVEL TIME(MIN.) =   6.37   Tc(MIN.) =   13.66
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.732
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.85      0.30     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.85      SUBAREA RUNOFF(CFS) =    2.04
  EFFECTIVE AREA(ACRES) =      1.50    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       3.61

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.51   HALFSTREET FLOOD WIDTH(FEET) =  16.12
  FLOW VELOCITY(FEET/SEC.) =  0.51   DEPTH*VELOCITY(FT*FT/SEC.) =   0.26
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE      1.10 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    97.44  DOWNSTREAM(FEET) =    97.00
  FLOW LENGTH(FEET) =    87.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.36
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.61
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =   13.99
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE      1.10 =     507.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.10 IS CODE =  10
```

```
------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
========================================================================

************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   215.00
  ELEVATION DATA: UPSTREAM(FEET) =    105.70  DOWNSTREAM(FEET) =    104.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.128
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.664
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.52      0.30     0.200    56    8.13
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      1.69
  TOTAL AREA(ACRES) =      0.52   PEAK FLOW RATE(CFS) =      1.69

************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  61
------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
========================================================================
  UPSTREAM ELEVATION(FEET) =  104.70  DOWNSTREAM ELEVATION(FEET) =  102.70
  STREET LENGTH(FEET) =   336.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.38
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.51
    HALFSTREET FLOOD WIDTH(FEET) =   16.61
```

```
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.47
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.24
 STREET FLOW TRAVEL TIME(MIN.) =  11.89   Tc(MIN.) =   20.01
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.200
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       B        1.71      0.30     0.200    56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
 SUBAREA AREA(ACRES) =    1.71      SUBAREA RUNOFF(CFS) =    3.29
 EFFECTIVE AREA(ACRES) =      2.23    AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
 TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       4.30

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.54   HALFSTREET FLOOD WIDTH(FEET) =  22.96
 FLOW VELOCITY(FEET/SEC.) =  0.51   DEPTH*VELOCITY(FT*FT/SEC.) =   0.28
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     551.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    302.00 TO NODE      1.10 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    97.99  DOWNSTREAM(FEET) =    97.00
 FLOW LENGTH(FEET) =   197.00   MANNING'S N =  0.012
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.56
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       4.30
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =   20.73
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      1.10 TO NODE      1.10 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1        4.30   20.73    2.157  0.30( 0.06) 0.20       2.2     300.00
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
```

```
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1        3.61   13.99    2.695  0.30( 0.06) 0.20       1.5     200.00
LONGEST FLOWPATH FROM NODE    200.00 TO NODE      1.10 =     507.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1        7.25   13.99    2.695  0.30( 0.06) 0.20       3.0     200.00
    2        7.17   20.73    2.157  0.30( 0.06) 0.20       3.7     300.00
  TOTAL AREA(ACRES) =         3.7

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =        7.25  Tc(MIN.) =   13.989
EFFECTIVE AREA(ACRES) =      3.00  AREA-AVERAGED Fm(INCH/HR) =  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
TOTAL AREA(ACRES) =        3.7
LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)     =        3.7  TC(MIN.) =     13.99
EFFECTIVE AREA(ACRES) =      3.00  AREA-AVERAGED Fm(INCH/HR)=  0.06
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
PEAK FLOW RATE(CFS)   =       7.25

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1        7.25   13.99    2.695  0.30( 0.06) 0.20       3.0     200.00
    2        7.17   20.73    2.157  0.30( 0.06) 0.20       3.7     300.00
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```



Existing & Proposed Conditions Hydrology Calculations (100-year Storm Event)

```
************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
        (c) Copyright 1983-2014 Advanced Engineering Software (aes)
            Ver. 21.0  Release Date: 06/01/2014  License ID 1580

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* TOWNES AT BROADWAY                                                    *
* TTM 19137                                                             *
* EXISTING Q100                                                         *
 ************************************************************************

  FILE NAME: ML06X100.DAT
  TIME/DATE OF STUDY: 17:22 01/28/2021
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   103.27
  ELEVATION DATA: UPSTREAM(FEET) =    107.80  DOWNSTREAM(FEET) =    107.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.185
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.367
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.19      0.30     0.600    36    9.18
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.72
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.72

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    107.60  DOWNSTREAM(FEET) =    105.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   285.86   CHANNEL SLOPE =  0.0073
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.72
  FLOW VELOCITY(FEET/SEC) =   1.29
  TRAVEL TIME(MIN.) =   3.71   Tc(MIN.) =   12.89
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     389.13 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   12.89
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.596
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                     B        1.48      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.48      SUBAREA RUNOFF(CFS) =    4.55
  EFFECTIVE AREA(ACRES) =      1.67   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        1.7       PEAK FLOW RATE(CFS) =       5.13
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    105.50
  DOWNSTREAM NODE ELEVATION(FEET) =    103.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   118.42
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.500
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.00500
  MAXIMUM DEPTH(FEET) =   0.55
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.542
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                     B        0.72      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.22
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.67
  AVERAGE FLOW DEPTH(FEET) =   0.50   FLOOD WIDTH(FEET) =    5.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.35   Tc(MIN.) =   13.24
  SUBAREA AREA(ACRES) =    0.72       SUBAREA RUNOFF(CFS) =    2.18
  EFFECTIVE AREA(ACRES) =    2.39     AREA-AVERAGED Fm(INCH/HR) =   0.18
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.60
  TOTAL AREA(ACRES) =        2.4         PEAK FLOW RATE(CFS) =       7.23

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL
         DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP]

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.54   FLOOD WIDTH(FEET) =    5.00
  FLOW VELOCITY(FEET/SEC.) =   6.20   DEPTH*VELOCITY(FT*FT/SEC) =   3.35
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     507.55 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   102.34
  ELEVATION DATA: UPSTREAM(FEET) =    106.50  DOWNSTREAM(FEET) =    106.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.606
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.865
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
```

```
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                       B        0.19      0.30     0.600    36    7.61
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.80
  TOTAL AREA(ACRES) =      0.19   PEAK FLOW RATE(CFS) =      0.80

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    106.00
  DOWNSTREAM NODE ELEVATION(FEET) =    105.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   251.71
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.500
  PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.00500
  MAXIMUM DEPTH(FEET) =   0.55
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.392
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  SCHOOL                       B        1.18      0.30     0.600    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.04
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.82
  AVERAGE FLOW DEPTH(FEET) =   0.50   FLOOD WIDTH(FEET) =    5.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.49   Tc(MIN.) =    9.09
  SUBAREA AREA(ACRES) =    1.18       SUBAREA RUNOFF(CFS) =    4.47
  EFFECTIVE AREA(ACRES) =    1.37     AREA-AVERAGED Fm(INCH/HR) =   0.18
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.60
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       5.19

         ==>>ERROR:FLOW EXCEEDS CAPACITY OF CHANNEL WITH
             NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM ALLOWABLE DEPTH.
             AS AN APPROXIMATION, TRAVEL TIME CALCULATIONS ARE BASED
             ON FLOW DEPTH EQUAL TO THE SPECIFIED MAXIMUM ALLOWABLE DEPTH.


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.55   FLOOD WIDTH(FEET) =    9.00
  FLOW VELOCITY(FEET/SEC.) =   3.42   DEPTH*VELOCITY(FT*FT/SEC) =   1.88
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     354.05 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    105.00  DOWNSTREAM(FEET) =    103.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   207.35   CHANNEL SLOPE =  0.0096
  CHANNEL FLOW THRU SUBAREA(CFS) =       5.19
  FLOW VELOCITY(FEET/SEC) =   2.09
  TRAVEL TIME(MIN.) =   1.65   Tc(MIN.) =   10.75
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   133.70
  ELEVATION DATA: UPSTREAM(FEET) =    106.00  DOWNSTREAM(FEET) =    105.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.773
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.805
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
        LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.16      0.30     0.600    36    7.77
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.67
  TOTAL AREA(ACRES) =      0.16   PEAK FLOW RATE(CFS) =      0.67

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    105.00  DOWNSTREAM(FEET) =    103.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   340.64   CHANNEL SLOPE =  0.0059
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.67
  FLOW VELOCITY(FEET/SEC) =   1.15
  TRAVEL TIME(MIN.) =   4.94   Tc(MIN.) =   12.71
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     474.34 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        0.67   12.71    3.625  0.30( 0.18) 0.60       0.2     500.00
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     474.34 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.19   10.75    3.991  0.30( 0.18) 0.60       1.4     300.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.82   10.75    3.991  0.30( 0.18) 0.60       1.5     300.00
      2        5.36   12.71    3.625  0.30( 0.18) 0.60       1.5     500.00
    TOTAL AREA(ACRES) =         1.5

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =        5.82  Tc(MIN.) =   10.745
  EFFECTIVE AREA(ACRES) =      1.51  AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        1.5
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    502.00 =     561.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    700.00 TO NODE    701.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   239.27
  ELEVATION DATA: UPSTREAM(FEET) =    105.80  DOWNSTREAM(FEET) =    103.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.330
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.328
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  SCHOOL                     B        0.22      0.30     0.600    36    9.33
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      0.82
  TOTAL AREA(ACRES) =      0.22   PEAK FLOW RATE(CFS) =      0.82
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.2  TC(MIN.) =      9.33
  EFFECTIVE AREA(ACRES) =      0.22  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.600
  PEAK FLOW RATE(CFS)   =       0.82
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```



```
************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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            Ver. 21.0  Release Date: 06/01/2014  License ID 1580

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* TOWNES AT BROADWAY                                                    *
* TTM 19137                                                             *
* PROPOSED Q100                                                         *
 ************************************************************************

  FILE NAME: ML06P100.DAT
  TIME/DATE OF STUDY: 22:10 04/07/2021
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   196.00
  ELEVATION DATA: UPSTREAM(FEET) =    107.40  DOWNSTREAM(FEET) =    106.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.544
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.888
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.50      0.30     0.200    76    7.54
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      2.17
  TOTAL AREA(ACRES) =      0.50   PEAK FLOW RATE(CFS) =      2.17

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  106.30  DOWNSTREAM ELEVATION(FEET) =  104.50
  STREET LENGTH(FEET) =   304.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.37
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.57
    HALFSTREET FLOOD WIDTH(FEET) =   28.33
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.55
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.31
  STREET FLOW TRAVEL TIME(MIN.) =   9.25   Tc(MIN.) =   16.80
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.090
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        2.27      0.30     0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    2.27      SUBAREA RUNOFF(CFS) =    6.19
  EFFECTIVE AREA(ACRES) =      2.77    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.8         PEAK FLOW RATE(CFS) =       7.55

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.61   HALFSTREET FLOOD WIDTH(FEET) =  35.41
  FLOW VELOCITY(FEET/SEC.) =  0.63   DEPTH*VELOCITY(FT*FT/SEC.) =   0.38
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     500.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   233.00
  ELEVATION DATA: UPSTREAM(FEET) =    106.80  DOWNSTREAM(FEET) =    104.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.286
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.987
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.65      0.30     0.200    76    7.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      2.88
  TOTAL AREA(ACRES) =      0.65   PEAK FLOW RATE(CFS) =      2.88

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  104.60  DOWNSTREAM ELEVATION(FEET) =  103.30
  STREET LENGTH(FEET) =   187.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.23
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.53
    HALFSTREET FLOOD WIDTH(FEET) =   20.52
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.54
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.29
  STREET FLOW TRAVEL TIME(MIN.) =   5.82   Tc(MIN.) =   13.11
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.562
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.85      0.30     0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    0.85      SUBAREA RUNOFF(CFS) =    2.68
  EFFECTIVE AREA(ACRES) =      1.50    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       4.73

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.55   HALFSTREET FLOOD WIDTH(FEET) =  23.45
  FLOW VELOCITY(FEET/SEC.) =  0.55   DEPTH*VELOCITY(FT*FT/SEC.) =   0.30
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE      1.10 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    97.44  DOWNSTREAM(FEET) =    97.00
  FLOW LENGTH(FEET) =    87.00   MANNING'S N =  0.012
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.66
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.73
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =   13.42
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE      1.10 =     507.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.10 IS CODE =  10
```

```
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   215.00
  ELEVATION DATA: UPSTREAM(FEET) =    105.70  DOWNSTREAM(FEET) =    104.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.128
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.684
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        0.52      0.30     0.200    76    8.13
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =      2.16
  TOTAL AREA(ACRES) =      0.52   PEAK FLOW RATE(CFS) =      2.16

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  104.70  DOWNSTREAM ELEVATION(FEET) =  102.70
  STREET LENGTH(FEET) =   336.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 14.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.005
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0950
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.40
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.55
    HALFSTREET FLOOD WIDTH(FEET) =   23.45
```

```
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.51
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.28
  STREET FLOW TRAVEL TIME(MIN.) =  10.89   Tc(MIN.) =   19.02
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.878
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        1.71      0.30     0.200    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA AREA(ACRES) =    1.71      SUBAREA RUNOFF(CFS) =    4.34
  EFFECTIVE AREA(ACRES) =      2.23    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       5.66

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.58   HALFSTREET FLOOD WIDTH(FEET) =  29.31
  FLOW VELOCITY(FEET/SEC.) =  0.56   DEPTH*VELOCITY(FT*FT/SEC.) =   0.32
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     551.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE      1.10 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    97.99  DOWNSTREAM(FEET) =    97.00
  FLOW LENGTH(FEET) =   197.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.85
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.66
  PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =   19.69
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.10 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.66   19.69    2.821  0.30( 0.06) 0.20       2.2     300.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
```

```
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1        4.73   13.42    3.514  0.30( 0.06) 0.20       1.5     200.00
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE      1.10 =     507.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        9.55   13.42    3.514  0.30( 0.06) 0.20       3.0     200.00
      2        9.43   19.69    2.821  0.30( 0.06) 0.20       3.7     300.00
    TOTAL AREA(ACRES) =         3.7

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =        9.55  Tc(MIN.) =   13.418
  EFFECTIVE AREA(ACRES) =      3.02  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =        3.7
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE      1.10 =     748.00 FEET.
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.7  TC(MIN.) =     13.42
  EFFECTIVE AREA(ACRES) =      3.02  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =       9.55

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        9.55   13.42    3.514  0.30( 0.06) 0.20       3.0     200.00
      2        9.43   19.69    2.821  0.30( 0.06) 0.20       3.7     300.00
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```



APPENDIX C
USDA Soil Map

Soil Map—Orange County and Part of Riverside County, California
(2323 W. Broadway, Anaheim)



Map Scale: 1:1,810 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 14, May 27, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 13, 2018—Feb 8, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Orange County and Part of Riverside County, California

196—San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hcpb
Elevation: 10 to 700 feet
Mean annual precipitation: 12 to 81 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 270 to 350 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

San emigdio and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of San Emigdio

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Riser, flat
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 7 inches: fine sandy loam
H2 - 7 to 40 inches: stratified gravelly loamy coarse sand to very fine sandy loam
H3 - 40 to 44 inches: silty clay loam
H4 - 44 to 61 inches: stratified gravelly loamy coarse sand to very fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water capacity: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: R019XD029CA
Hydric soil rating: No

Minor Components

Metz, loamy sand

Percent of map unit: 5 percent
Hydric soil rating: No

Sorrento, sandy loam

Percent of map unit: 5 percent
Hydric soil rating: No

Hueneme, fine sandy loam

Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 14, May 27, 2020

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
196	San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes	15.1	100.0%
Totals for Area of Interest		**15.1**	**100.0%**

APPENDIX D
Portions of the City of Anaheim, Master Plan of Storm Drainage for Carbon Creek Channel Tributary Area

9. Drainage Basin 8

Drainage Basin 8 drains approximately 1100 acres, and is generally bounded by Lincoln Avenue on the north, the I-5 Freeway on the northeast, Orange Avenue on the south, and Dale Avenue on the west. As shown in Figure 9, drainage basins are further divided into drainage areas depending on the existing flow patterns and storm drain outlets. Basin 8 consists of 2 Areas 8-1 and 8-2. Area 8-1 has an existing storm drain which outlets to Carbon Creek. Area 8-2 is a small area which drains directly to Carbon Creek.

9.1 Hydrologic Analysis

The hydrologic analysis for Basin 8 was performed in accordance with the hydrologic criteria outlined in Chapter 3 and is included in Appendix C. The hydrology map for Basin 8 is included in Appendix B. The following table highlights the flow rates at key drainage nodes for Areas within Basin 8 that have street flow and/or existing storm drains. The table shows associated drainage areas and flows for 10-, 25-, and 100-year storm events.

Table 11 – Basin 8 Summary of Hydrology

Drainage Area	Node	Location	Drainage Area (ac)	10-Year Flow (cfs)	25-Year Flow (cfs)	100-Year Flow (cfs)
8-1	802	Loara St and Broadway	31	55	65	85
8-1	807	Empire St and Broadway	378	435	530	690
8-1	810	Brookhurst St and Broadway	636	620	765	1000
8-1	814	Magnolia Ave and Broadway	985	940	1175	1515
8-1	817	Dale Ave at Carbon Creek	1084	960	1195	1555
8-1	822	Euclid St and Lincoln Ave	13	20	25	35
8-1	826	Empire St and Lincoln Ave	193	245	295	385
8-1	833	Valley St and Orange Ave	109	95	125	165
8-1	842	Kathryn Dr and Lincoln Ave	16	16	20	25
8-1	853	Gilbert St and Orange Ave	95	105	135	180
8-1	862	Gilbert St, 500 ft South of Lincoln Ave	19	30	40	50
8-1	872	Magnolia Ave and Orange Ave	68	75	95	125
8-1	882	Shields Dr and Orange Ave	51	60	75	100
8-2	892	350 ft East of Dale Ave at Carbon Creek	11	18	25	30

9.2 Analysis of Existing Improvements

Storm water within Basin 8 is conveyed through a combination of existing storm drains and street flow. One area, Area 8-1, has an existing storm drain system. The main storm drain begins at Broadway and Loara Street and drains west in Broadway to Dale Avenue. At Dale Avenue, the storm drain turns north then outlets into Carbon Creek. This drain varies in size from a 36-inch to 96-inch RCP and has a capacity of 455 cfs which is equivalent to 45 percent of a 10-year storm.

Several lateral storm drains connect to the main line in Broadway. These laterals are located in Shields Drive, Magnolia Avenue, Gilbert Street, Brookhurst Street, Archer Street, Valley Street, and Empire Street/Lincoln Avenue. The Shields Drive storm drain is a 36-inch RCP and has a capacity of 18 cfs which is equivalent to 30 percent of a 10-year storm. The Magnolia Avenue storm drain is a 54-inch RCP and has a capacity of 35 cfs which is equivalent to 40 percent of a 10-year storm. The Gilbert Street storm drain north of Broadway varies in size from a 27-inch to 39-inch RCP and has a capacity of 35 cfs which is equivalent to 60 percent of a 10-year storm.

The Gilbert Street storm drain south of Broadway is a 45-inch RCP and has a capacity of 5 cfs which is equivalent to 5 percent of a 10-year storm. The Brookhurst Street storm drain varies in size from a 27-inch to 57-inch RCP and has a capacity of 70 cfs which is equivalent to 100 percent of a 10-year storm. The Archer Street storm drain is a 36-inch RCP and has a capacity of 30 cfs which is equivalent to 100 percent of a 10-year storm. The Valley Street storm drain varies in size from a 39-inch to 60-inch RCP and has a capacity of 125 cfs which is equivalent to 100 percent of a 10-year storm. The Empire Street/Lincoln Avenue storm drain varies in size from a 30-inch to 72-inch RCP and has a capacity of 230 cfs which is equivalent to 75 percent of a 10-year storm.

9.3 Proposed Improvements

In order to satisfy the City's requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria, the following improvements are recommended for Area 8-1. In order to satisfy the City's flooded width criteria in Area 8-1, 15,075 feet of parallel storm drain is recommended in Broadway. The recommend storm drain varies is size from 42-inch RCP to 15-foot x 8-foot RCB.

Additionally, in order to satisfy the City's requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria in Area 3-1, parallel storm drains in Shields Drive, Magnolia Avenue, Gilbert Street, Valley Street, and Empire Street/Lincoln Avenue are also proposed. In Shields Drive, 1,350 feet of 48-inch parallel RCP is proposed, 1,410 feet of 48-inch parallel RCP is proposed in Magnolia Avenue, 780 feet of 24-inch to 36-inch parallel RCP is proposed in north Gilbert Street, 1,330 feet of 54-inch to 7-foot x 4-foot parallel storm drain is proposed in south Gilbert Street, 1,390 feet of 30-inch to 42-inch parallel RCP is proposed in Valley Street, and 5,320 feet of 24-inch to 54-inch parallel RCP is proposed in Empire Street/Lincoln Avenue.

To satisfy the City's flooded width criteria in Area 8-1, an extension of the existing storm drain in Gilbert Street is proposed consisting of 1,500 feet of 54-inch RCP, an extension of the existing storm drain in Kathryn Drive is proposed consisting of 1,200 feet of 36-inch RCP, an extension of the existing storm drain in Valley Street is proposed consisting of 1,800

feet of 60-inch RCP, and an extension of the existing storm drain in Lincoln Avenue is proposed consisting of 980 feet of 36-inch RCP. The proposed improvements for Basin 8 are shown in Figure 9, the hydraulic calculations are included in Appendix E and the street flow calculations in Appendix F.

9.4 Cost Estimates

The estimated costs summarized in Table 12 include costs for construction, engineering, design, surveying, and construction management. Pipe costs are per linear foot of pipe and have been increased to include excavation, shoring, bedding, backfill, compaction, removal of excess material, and trench resurfacing. The detailed cost estimates for Basin 8 are included in Appendix A.

Since the construction of the recommended facilities will be spread out over a number of years, the total cost of master plan implementation will be subject to future construction cost increases. Therefore, it is recommended that the funding programs established for implementation of the Master Plan of Storm Drainage make provisions for the increased cost of deferred construction. Inflation factors should be applied to reflect a specific year's total cost over the 2010 total costs. Summarized in Table 12 are the construction cost estimates by project location for Area 8-in Basin 8.

Table 12 – Basin 8 Cost Estimate

Area	Storm Drain ID	Street	Type of Facility	Length (feet)	Estimated Cost (2010 Dollars)
8-1	SD 8-1_01 (P)	Broadway St.	Parallel 42-inch to 66-inch RCP and 8' by 8' to 15' by 8' RCB	14,930	$44,534,000
8-1	SD 8-1_02 (P)	Shields Dr.	Parallel 48-inch RCP	1,340	$1,899,000
8-1	SD 8-1_03 (P)	Magnolia Ave.	Parallel 48-inch RCP	1,405	$1,987,000
8-1	SD 8-1_04 (P)	Gilbert St. north of Broadway	Parallel 24-inch/36-inch RCP	825	$767,000
8-1	SD 8-1_05 (P)	Gilbert St. south of Broadway	Parallel 7' by 4' RCB	1,370	$3,441,000
8-1	SD 8-1_06 (P)	Orange Ave.	New 54-inch RCP	1,510	$2,507,000
8-1	SD 8-1_08 (P)	Valley St.	Parallel 30-inch/42-inch RCP	1,465	$1,690,000
8-1	SD 8-1_09 (P)	Orange Ave.	New 60--inch RCP	1,795	$3,345,000
8-1	SD 8-1_10 (P)	Camellia St/Lincoln Ave.	Parallel 42-inch/54-inch RCP	3,420	$5,294,000
TOTAL FOR BASIN 8					$65,464,000

Legend

- Anaheim City Limits
- Street Right of Way
- 5-1 Drainage Area

Proposed Storm Drains

- Priority 1
- Priority 2
- Priority 3

Existing Storm Drains

- 30 Anaheim (Pipe size in inches)
- County
- Caltrans
- Private
- Lateral

SD 1-1_01 (P) Proposed Pipeline ID
Drainage Area_Line No. (Proposed)

Note: Priority 2 proposed improvements will parallel existing storm drains unless otherwise noted

N

0 750 1,500 Feet

1 inch equals 1,500 feet

Figure 9
Drainage Basin 8

Master Plan of Storm Drainage for
Carbon Creek Channel Tributary Area

CH2MHILL

APPENDIX E
Orange County Drainage Facilities Maps

E 6036406.802

N 2260745.312

E 6057907.005

N 2260745.263

12

14

13

13

FULLERTON

ANAHEIM

CITY OF FULLERTON

CITY OF ANAHEIM

ORANGETHORPE

RIVERSIDE

SANTA ANA FREEWAY

SOUTHERN PACIFIC RAILROAD

SOUTHERN FREEWAY

LINCOLN

BROADWAY

ORANGE

LA PALMA

BALL

BROOKHURST PARK

PETER MARSHALL PARK

MAXWELL PARK

CHAPARRAL PARK

CLARA BARTON PARK

PEARSON PARK

MELBOURNE GAUER PARK

WOODCREST PARK

ORANGETHORPE PARK

ANAHEIM PARK

CRESCENT

COUNTY OF ORANGE

GILBERT RETARDING BASIN
BOIB01

BOIB02
CRESCENT
RETARDING BASIN

BOIB03
RAYMOND
RETARDING
BASIN

PROJECT SITE

ALL LATERALS ARE 18" RCP
ON BALLAST LANE AND
OUTRIGGER WAY.

BOI

BOIP01

BOIP02

BOIP03

BOIP08

BOIP10

A03S02

C03P15

GILBERT IN POINT OF DISTRICT OFFICE

E 6036406.959

N 2244945.134

E 6057907.040

N 2244945.106

0 200 400 600 800
FEET

N

NOTICE

The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up-to-date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.

Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.

To notify OC Public Works Flood Control Section of additions or corrections, please contact Sal Gutierrez at (714) 834-5396 or by email at sal.gutierrez@ocpw.ocgov.com

ORANGE COUNTY FLOOD CONTROL DISTRICT

BASE MAP OF DRAINAGE FACILITIES IN ORANGE COUNTY

REVISION	DATE	SHEET NO.	DWG. NO.
S. GUTIERREZ	DEC. 20 2010	13	MAPS-113-3

- Channel Drainage Area Boundary
- Major Sub-Area Drainage Boundary
- Minor Sub-Area Drainage Boundary
- Existing O.C.F.C.D. Facility
- Existing Local Facility
- Existing Retarding Basin or Reservoir
- Natural Watercourse
- City Limits
- G G Greenbelt
- P.S. P.S. Pump Station
- Catch Basin (length in feet)
- Drop Inlet or Other Entry
- OCFCD Basins or Reservoirs

Ownership (If other than City or County): Private = P State = S Federal = F

EXISTING FACILITIES

O.C.F.C.D.	LOCAL	
		Earth Trapezoidal Channel (base width by height in feet)
		Reinforced Concrete Trapezoidal Channel (base width by height in feet)
		Reinforced Concrete Rectangular Channel (base width by height in feet)
		Reinforced Concrete Box (RCB) (number of barrels-span by height in feet)
		Reinforced Concrete Pipe (RCP) (diameter in inches)
		Metal Sheet Channel (MSC) (Base width by pile height in feet./Sheet pile total length)
		Corrugated Metal Pipe (CMP) (diameter in inches)
		Concrete Pipe (diameter in inches)
		Concrete Oval Pipe (width by height in inches)
		Steel Pipe (diameter in inches)
		Reinforced Concrete Arch (base span by height in inches)
		Corrugated Metal Arch (base span by height in inches)

APPENDIX F
Hydraulic Calculations

Catch Basin Sizing

Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 29 2021

CB #1 Sizing Q25

Combination Inlet

Location	= Sag
Curb Length (ft)	= 7.00
Throat Height (in)	= 6.00
Grate Area (sqft)	= 9.00
Grate Width (ft)	= 3.00
Grate Length (ft)	= 3.00

Gutter

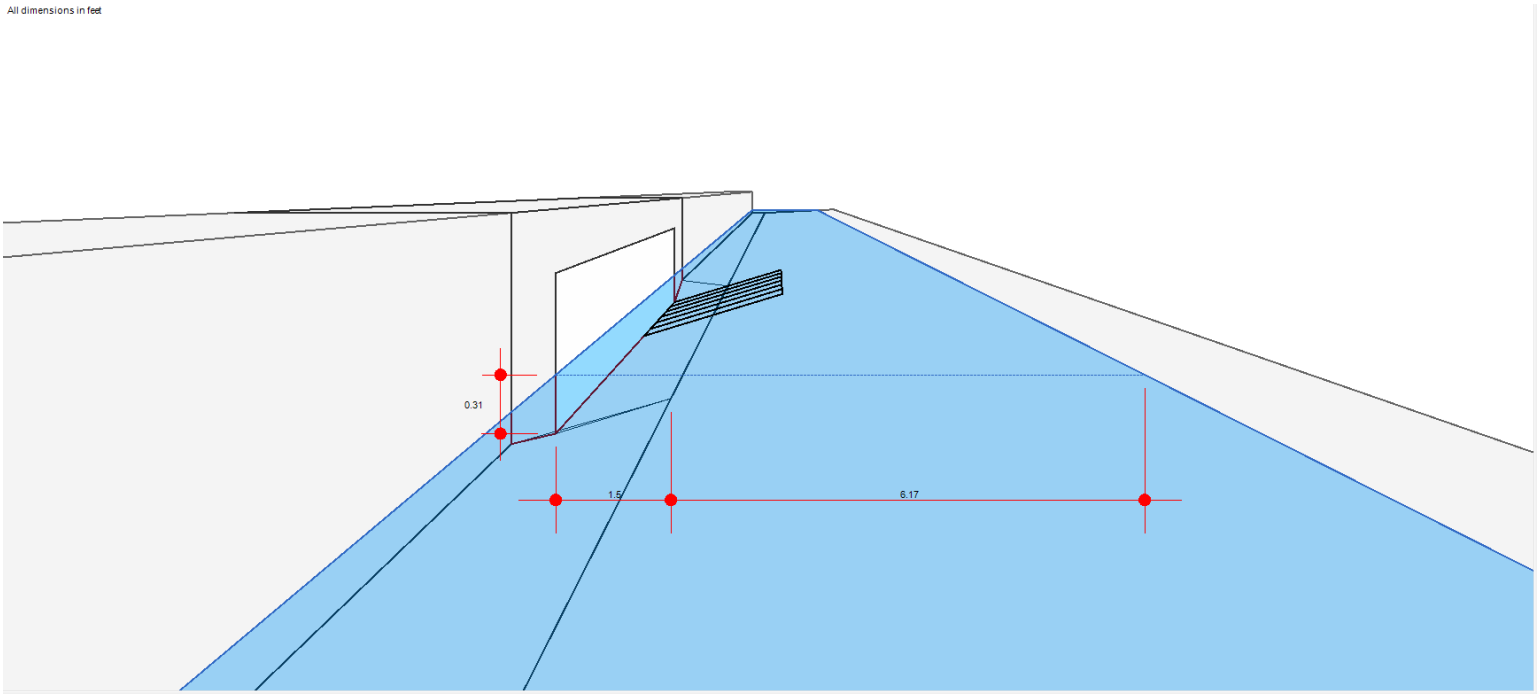
Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.020
Local Depr (in)	= 2.00
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Known Q
Q (cfs)	= 3.60

Highlighted

Q Total (cfs)	= 3.60
Q Capt (cfs)	= 3.60
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 3.66
Efficiency (%)	= 100
Gutter Spread (ft)	= 7.67
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 29 2021

CB # 2 Sizing Q25

Combination Inlet

Location	= Sag
Curb Length (ft)	= 7.00
Throat Height (in)	= 6.00
Grate Area (sqft)	= 9.00
Grate Width (ft)	= 3.00
Grate Length (ft)	= 3.00

Gutter

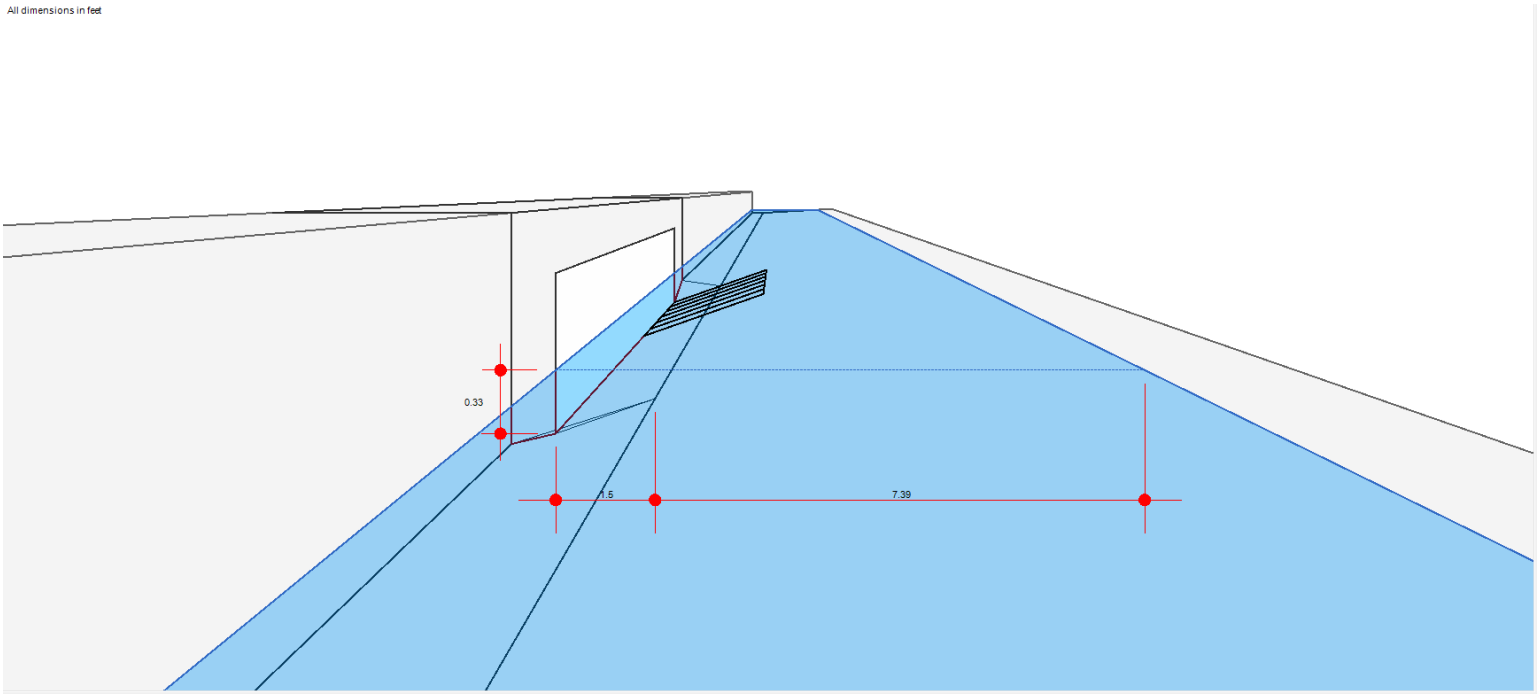
Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.020
Local Depr (in)	= 2.00
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Known Q
Q (cfs)	= 4.30

Highlighted

Q Total (cfs)	= 4.30
Q Capt (cfs)	= 4.30
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 3.95
Efficiency (%)	= 100
Gutter Spread (ft)	= 8.89
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Inlet Report

CB #3 Sizing Q100

Combination Inlet

Location	= Sag
Curb Length (ft)	= 7.00
Throat Height (in)	= 6.00
Grate Area (sqft)	= 9.00
Grate Width (ft)	= 3.00
Grate Length (ft)	= 3.00

Gutter

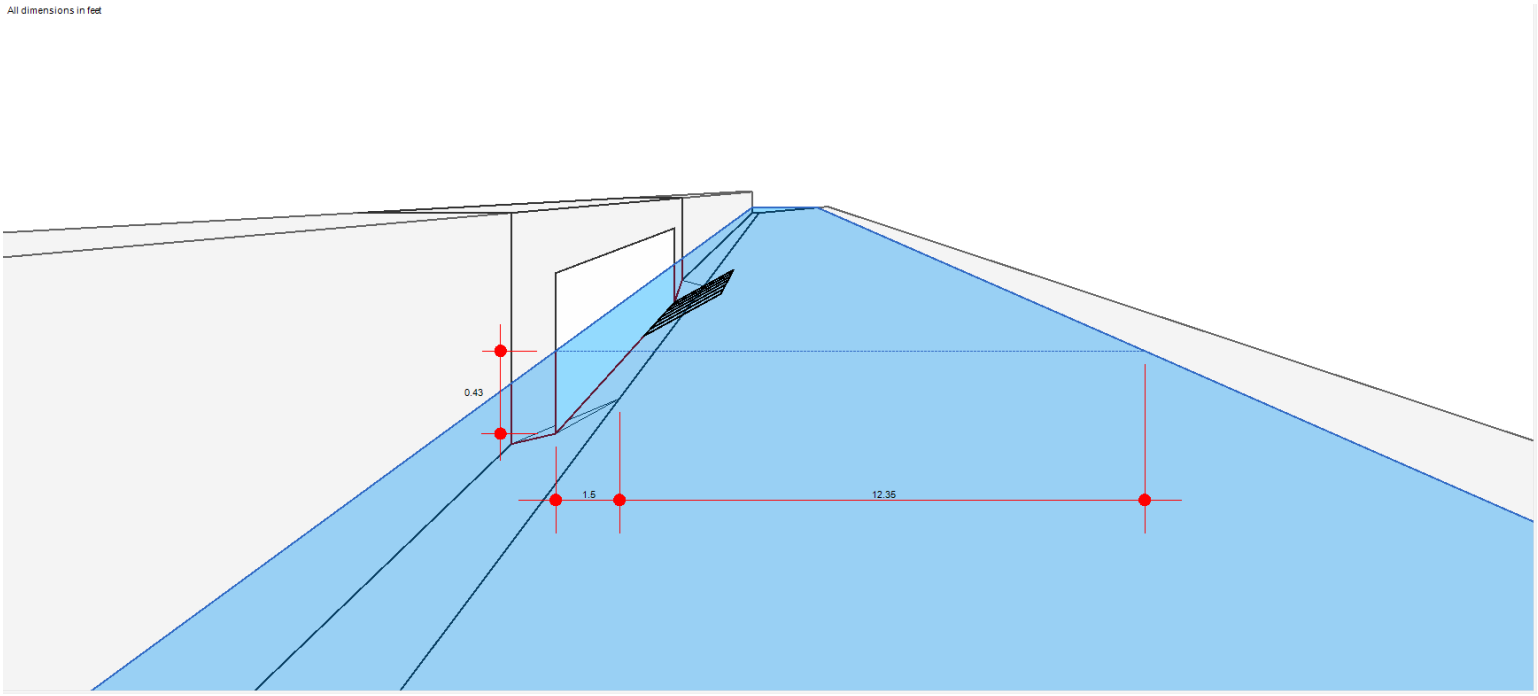
Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.020
Local Depr (in)	= 2.00
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Known Q
Q (cfs)	= 7.55

Highlighted

Q Total (cfs)	= 7.55
Q Capt (cfs)	= 7.55
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 5.14
Efficiency (%)	= 100
Gutter Spread (ft)	= 13.85
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Parkway Drain Sizing

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 29 2021

Q100 Parkway Drain

Rectangular

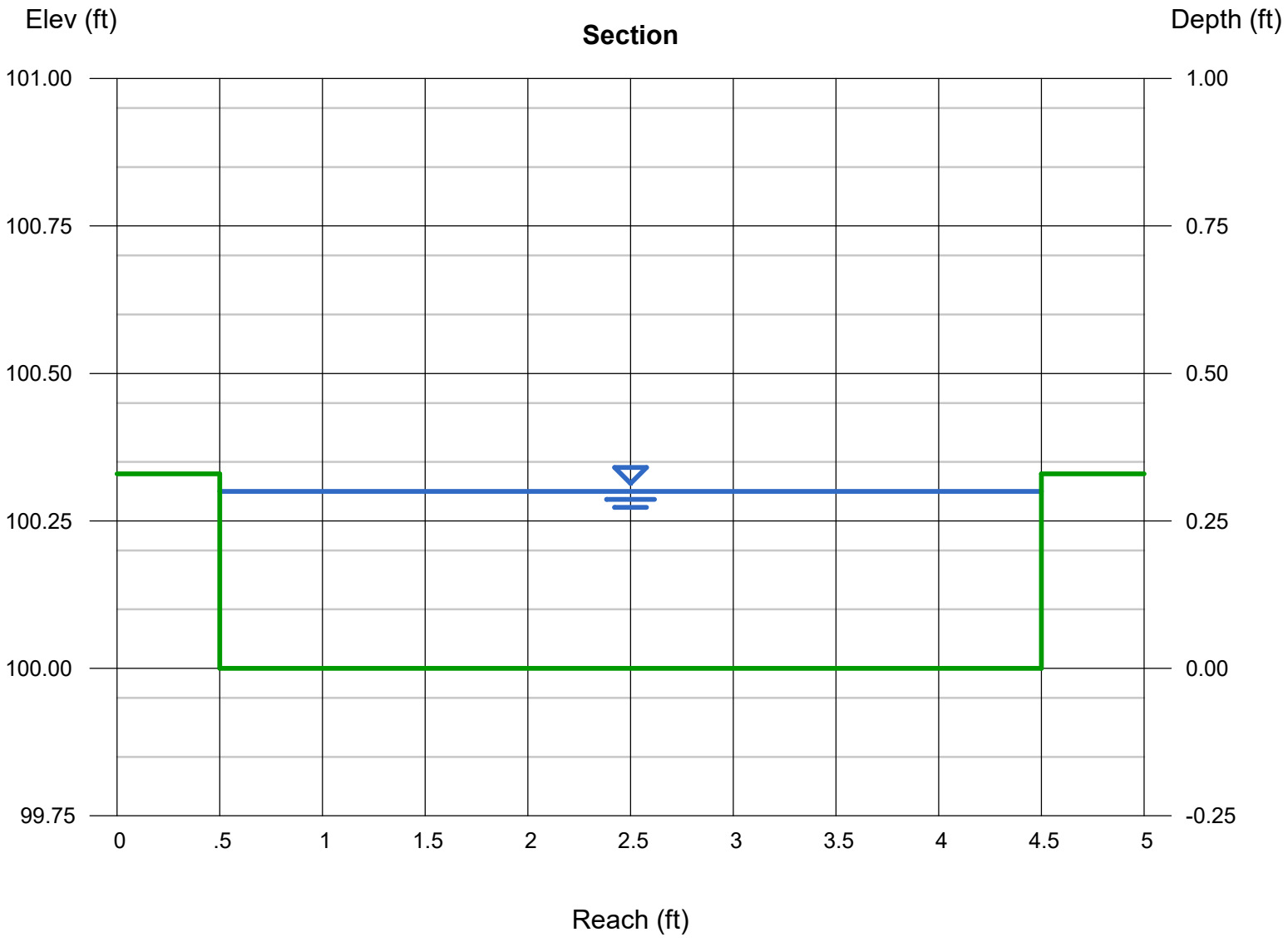
Bottom Width (ft)	= 4.00
Total Depth (ft)	= 0.33
Invert Elev (ft)	= 100.00
Slope (%)	= 2.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.55

Highlighted

Depth (ft)	= 0.30
Q (cfs)	= 7.550
Area (sqft)	= 1.20
Velocity (ft/s)	= 6.29
Wetted Perim (ft)	= 4.60
Crit Depth, Yc (ft)	= 0.33
Top Width (ft)	= 4.00
EGL (ft)	= 0.92



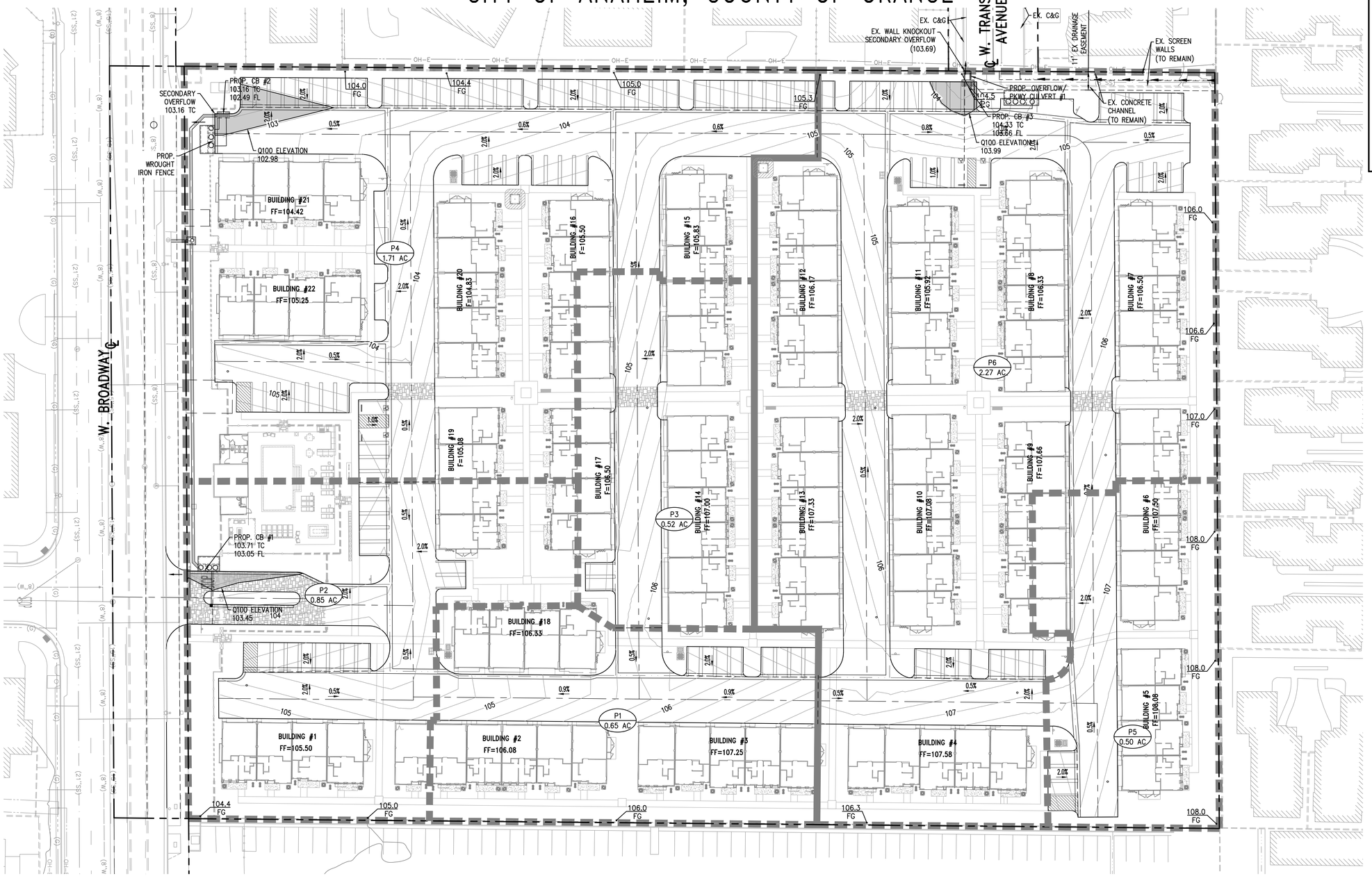
100-Year Ponding Calculations

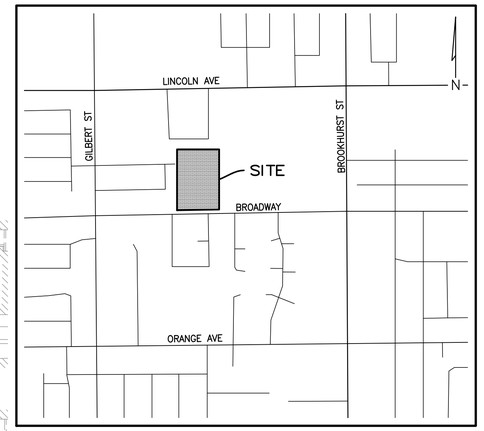
PONDING EXHIBIT

TR 19137

2323 W. BROADWAY

CITY OF ANAHEIM, COUNTY OF ORANGE





VICINITY MAP

NTS

LEGEND

EXISTING RIGHT-OF-WAY/ BOUNDARY

DRAINAGE AREA BOUNDARY

XX — DRAINAGE AREA ID

X.XX AC — DRAINAGE AREA IN ACRES

SCALE: 1" = 30'

0 15 30 60

DEVELOPER :

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APP	DATE

OWNER & DEVELOPER :

MELIA HOMES
8951 RESEARCH DRIVE, #100
IRVINE, CA 92618
PHONE (949) 759-4367

SOILS ENGINEER :

PREPARED BY :

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

REGISTERED PROFESSIONAL ENGINEER — DANIEL P. McDOUGALL — C 80705 — CIVIL — STATE OF CALIFORNIA

TRACT NO. 19137
PONDING EXHIBIT
PRELIMINARY HYDROLOGY

DATE: 3/17/2021

SHEET 1 OF 1

SCALE: AS SHOWN | DRAWN BY: SP | CHECKED BY: JH

CITY OF ANAHEIM

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 29 2021

Q100_CB # 1 Depth of Flow

User-defined

Invert Elev (ft)	= 103.05
Slope (%)	= 0.80
N-Value	= 0.013

Calculations

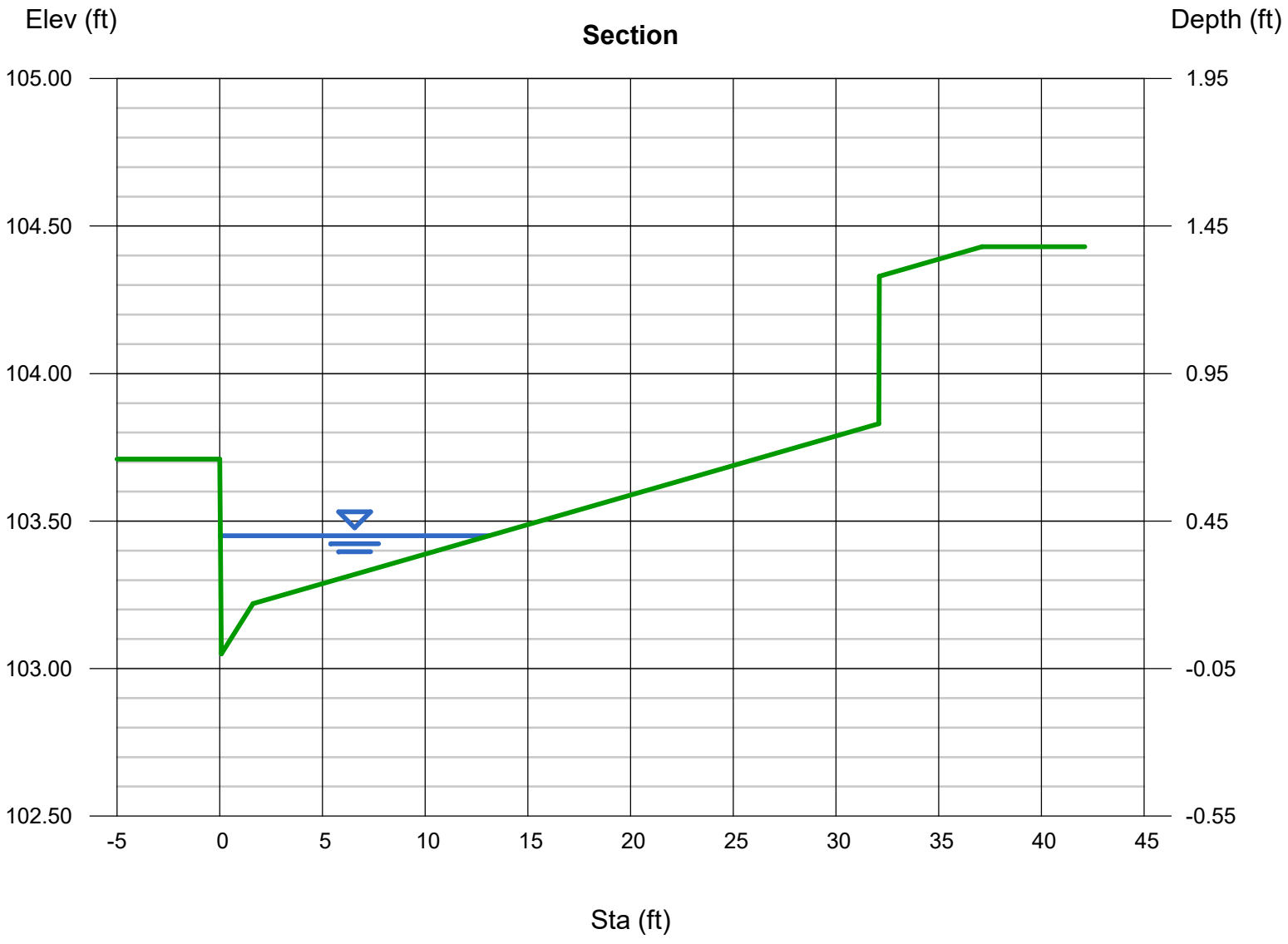
Compute by:	Known Q
Known Q (cfs)	= 4.73

Highlighted

Depth (ft)	= 0.40
Q (cfs)	= 4.730
Area (sqft)	= 1.82
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 13.44
Crit Depth, Yc (ft)	= 0.43
Top Width (ft)	= 13.08
EGL (ft)	= 0.51

(Sta, El, n)-(Sta, El, n)...

(0.00, 103.71)-(0.08, 103.05, 0.013)-(1.62, 103.22, 0.013)-(32.09, 103.83, 0.013)-(32.11, 104.33, 0.013)-(37.11, 104.43, 0.013)



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 29 2021

Q100_CB #2 Depth of Flow

User-defined

Invert Elev (ft)	= 102.49
Slope (%)	= 0.80
N-Value	= 0.013

Calculations

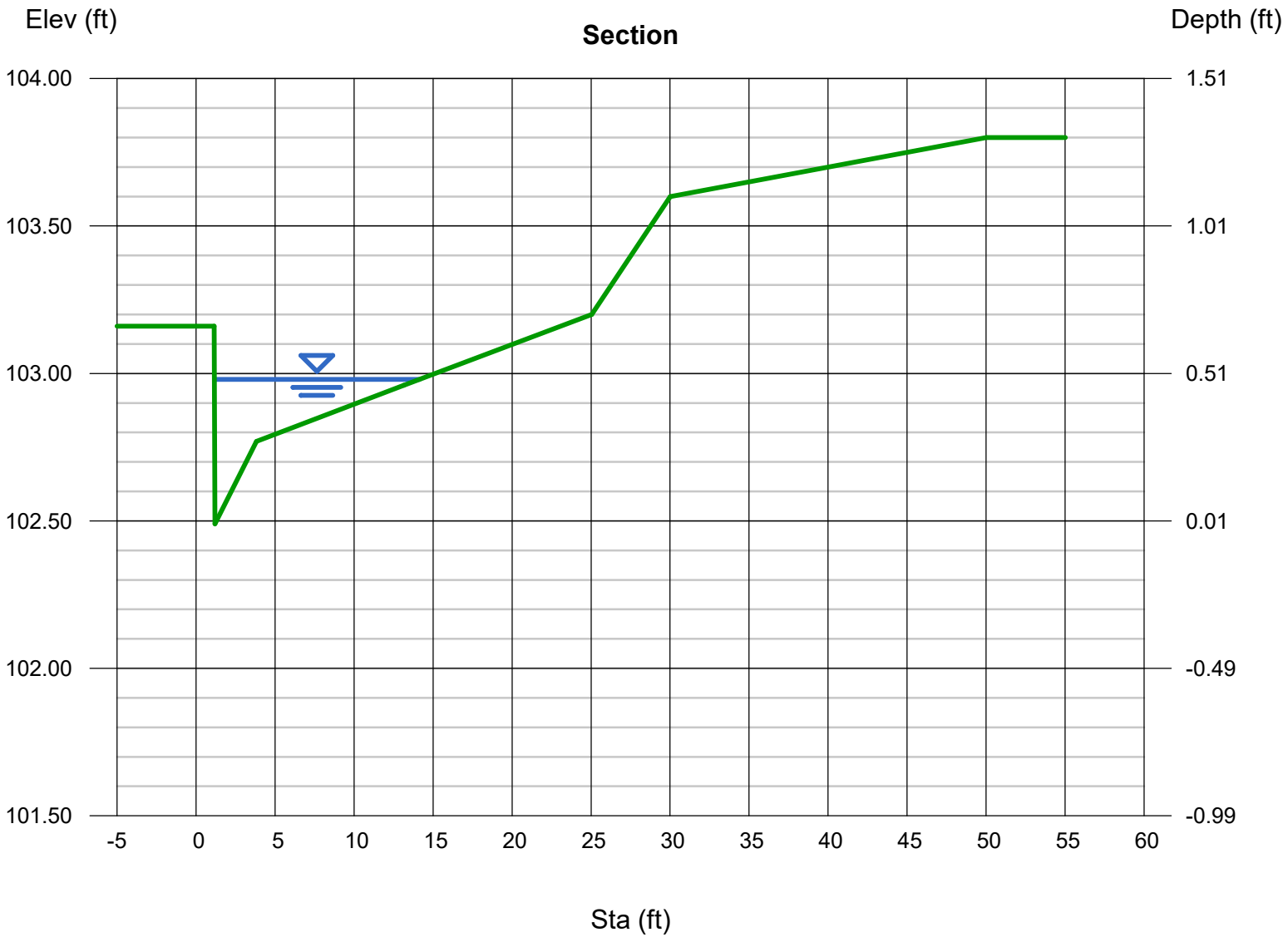
Compute by:	Known Q
Known Q (cfs)	= 5.66

Highlighted

Depth (ft)	= 0.49
Q (cfs)	= 5.660
Area (sqft)	= 2.01
Velocity (ft/s)	= 2.81
Wetted Perim (ft)	= 13.46
Crit Depth, Yc (ft)	= 0.53
Top Width (ft)	= 12.98
EGL (ft)	= 0.61

(Sta, El, n)-(Sta, El, n)...

(0.00, 103.16)-(1.15, 103.16, 0.013)-(1.19, 102.49, 0.013)-(3.83, 102.77, 0.013)-(13.15, 102.96, 0.013)-(25.05, 103.20, 0.013)-(30.01, 103.60, 0.013)
-(50.01, 103.80, 0.013)



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 29 2021

Q100_CB #3 Depth of Flow

User-defined

Invert Elev (ft)	= 103.66
Slope (%)	= 0.80
N-Value	= 0.013

Calculations

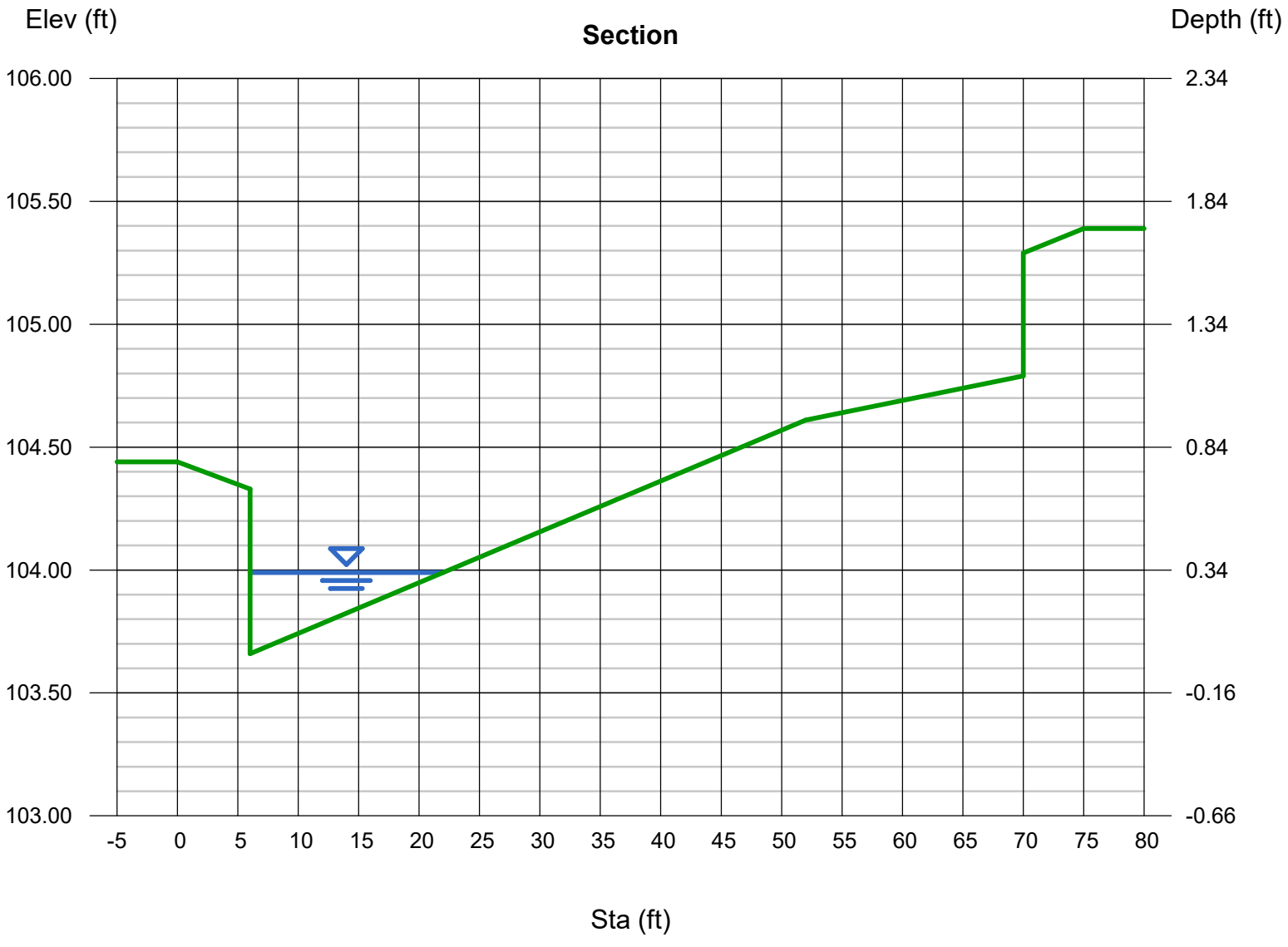
Compute by:	Known Q
Known Q (cfs)	= 7.55

Highlighted

Depth (ft)	= 0.33
Q (cfs)	= 7.550
Area (sqft)	= 2.64
Velocity (ft/s)	= 2.86
Wetted Perim (ft)	= 16.31
Crit Depth, Yc (ft)	= 0.37
Top Width (ft)	= 15.98
EGL (ft)	= 0.46

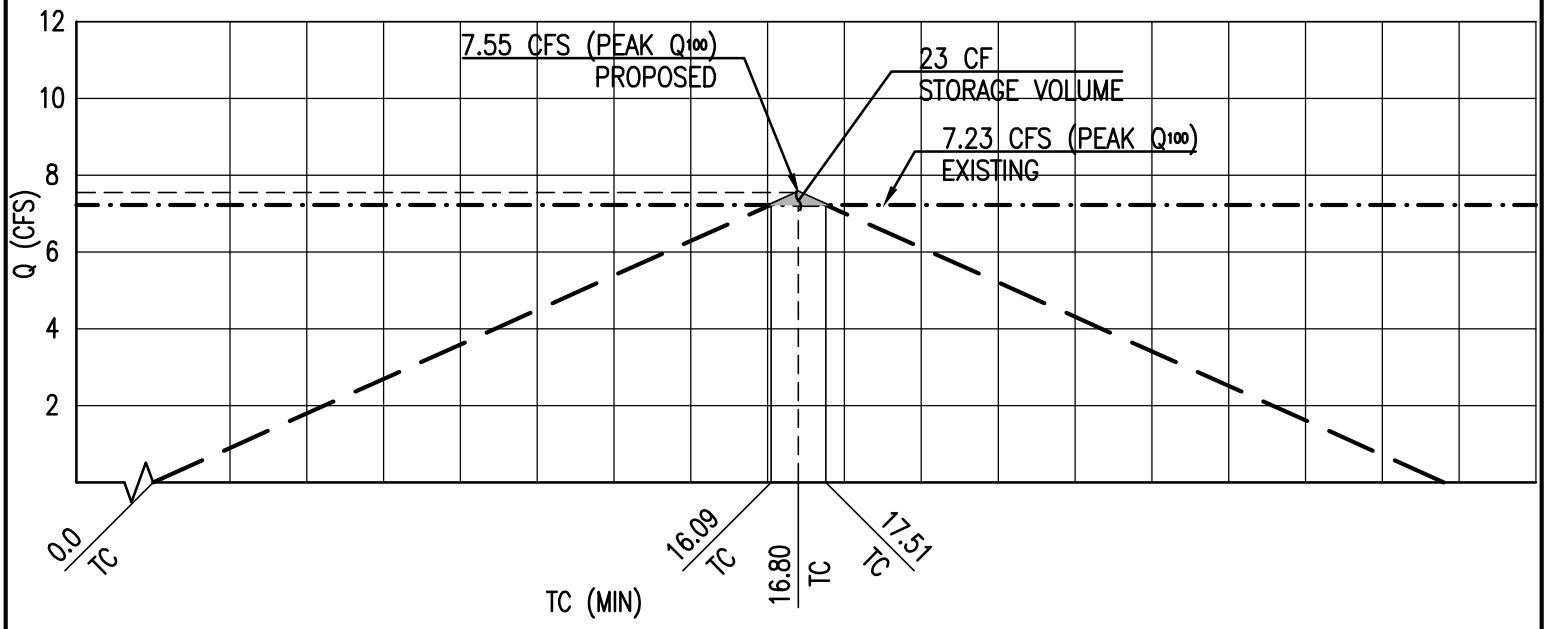
(Sta, El, n)-(Sta, El, n)...

(0.00, 104.44)-(6.00, 104.33, 0.013)-(6.00, 103.66, 0.013)-(52.00, 104.61, 0.013)-(70.00, 104.79, 0.013)-(70.00, 105.29, 0.013)-(75.00, 105.39, 0.013)



APPENDIX G
Small Area Runoff Hydrographs

100-YR STORM SMALL AREA RUNOFF HYDROGRAPH – W. TRANSIT AVENUE TRIBUTARY RUNOFF



CALCULATIONS:

V = VOLUME IN EXCESS OF Q ALLOWABLE OVER 24-HRS

V = 1/2 (dQ)(dTIME)

dTime = 17.51-16.09 = 1.42 min X 60 sec/min = 85.2 sec

dcfs = 7.55-7.23 = 0.27 cfs

VOLUME=1/2 (85.2) (0.27) = 23 CF

STATIC DETENTION PROVIDED BY

INFILTRATION SYSTEM = 8,376 CF > 23 CF OK

LEGEND:

TC-TIME OF CONCENTRATION

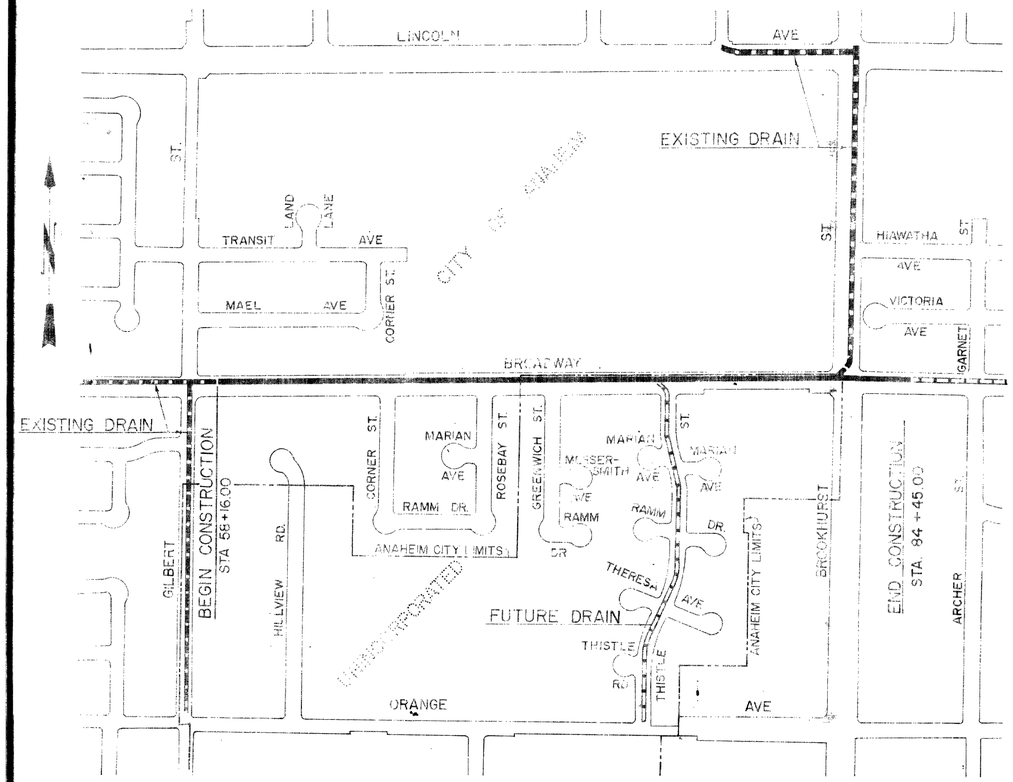
d-RATE OF CHANGE

NOTE:

TC-BASED ON (100 YR STORM EVENT)

HYDROGRAPH BASED ON ORANGE COUNTY HYDROLOGY MANUAL, SECTION J

APPENDIX H
As-Built Plans



LOCATION MAP

0 150 300 600 900 1200

SCALE IN FEET

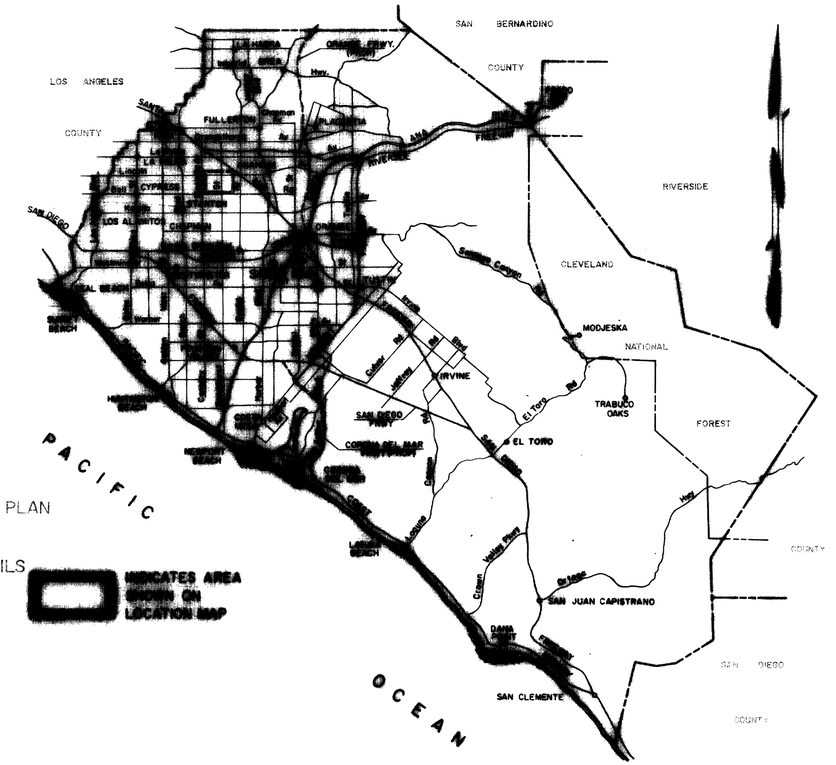
UTILITY OWNERS

NAME	PHONE NO.
PACIFIC TELEPHONE & TELEGRAPH CO.	(714) 633-0811
SOUTHERN CALIFORNIA GAS CO.	(714) 538-0211
CITY OF ANAHEIM WATER DIVISION	(714) 533-5451
SOUTHERN CALIFORNIA EDISON CO.	(714) 835-3833
CITY OF ANAHEIM SEWER DIVISION	(714) 533-5321
CITY OF ANAHEIM ELECTRICAL DIVISION	(714) 533-5775

INDEX OF DRAWINGS

SHT. NO.	DRAWING TITLES
1.	TITLE SHEET
2.	PLAN & PROFILE, STA. 57+16 TO STA. 64+00
3.	PLAN & PROFILE, STA. 64+00 TO STA. 72+00
4.	PLAN & PROFILE, STA. 72+00 TO STA. 79+75
5.	PLAN & PROFILE, STA. 79+75 TO STA 84+45
6.	R.C. BOX CONDUIT - SCHEDULE & DETAILS
7.	SEWER SIPHON DETAILS & LOOP INSTALLATION PLAN
8.	R.C. TRANSITION AND STREET INTERSECTION
9	LATERAL PROFILES, CATCH BASIN & INLET DETAILS
10.	BORING LOGS AND PAYLINE DETAILS

BROOKHURST STREET DETOUR PLANS



ORANGE COUNTY, CALIFORNIA
VICINITY MAP

4 3 2 1 0 2 4 8 12

SCALE IN MILES

MAP FOR THE CONSTRUCTION OF THAT PORTION OF

BROADWAY STORM DRAIN
FROM
EASTERLY OF GILBERT ST.
TO
EASTERLY OF BROOKHURST AVE
FACILITY NO. B01P08
MAY 1976

PREPARED BY
M & Q PACIFIC
CIVIL ENGINEERING - SURVEYING
7021 BUSINESS CENTER DRIVE
SUITE 200
IRVINE, CALIFORNIA
(714) 833 2721

SUBMITTED: Paul E. Lower Date: 4-12-76
PAUL E. LOWER R.C.E. No. 19187

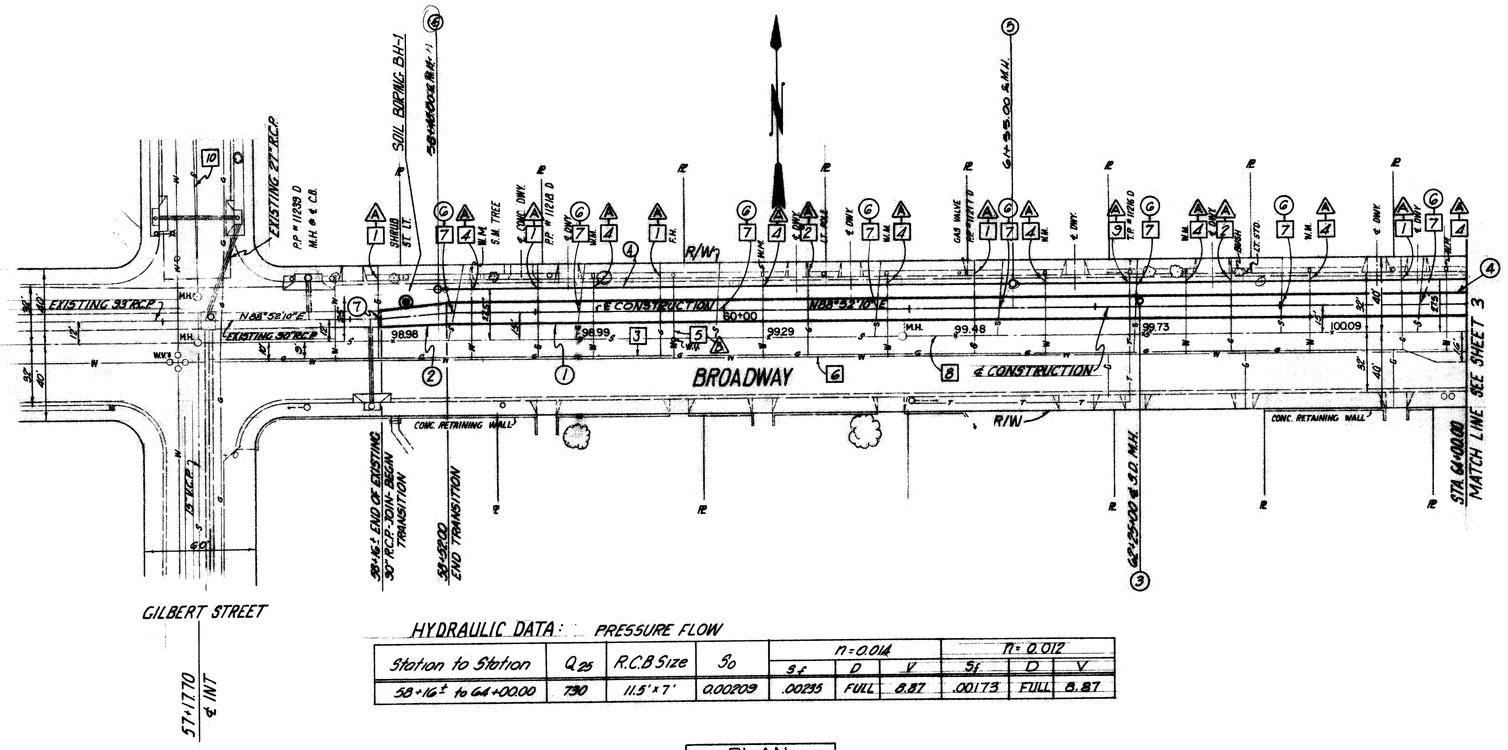
APPROVED: Thornton Virgadamo 4/23/76
AS TO PORTIONS WITHIN THE CITY OF ANAHEIM — DIRECTOR OF PUBLIC WORKS

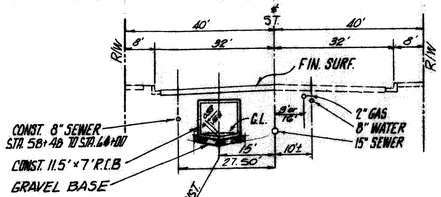
ADMINISTERED BY
ORANGE COUNTY ENVIROMENTAL MANAGEMENT AGENCY

FUNDED BY
ORANGE COUNTY FLOOD CONTROL DISTRICT
SANTA ANA CALIFORNIA

DWG. NO. B01P08-701-1-A

SHEET 1 OF 10 SHEETS





TYPICAL SECTION
SCALE 1"=20'
STA. 58+52 to STA 64+00

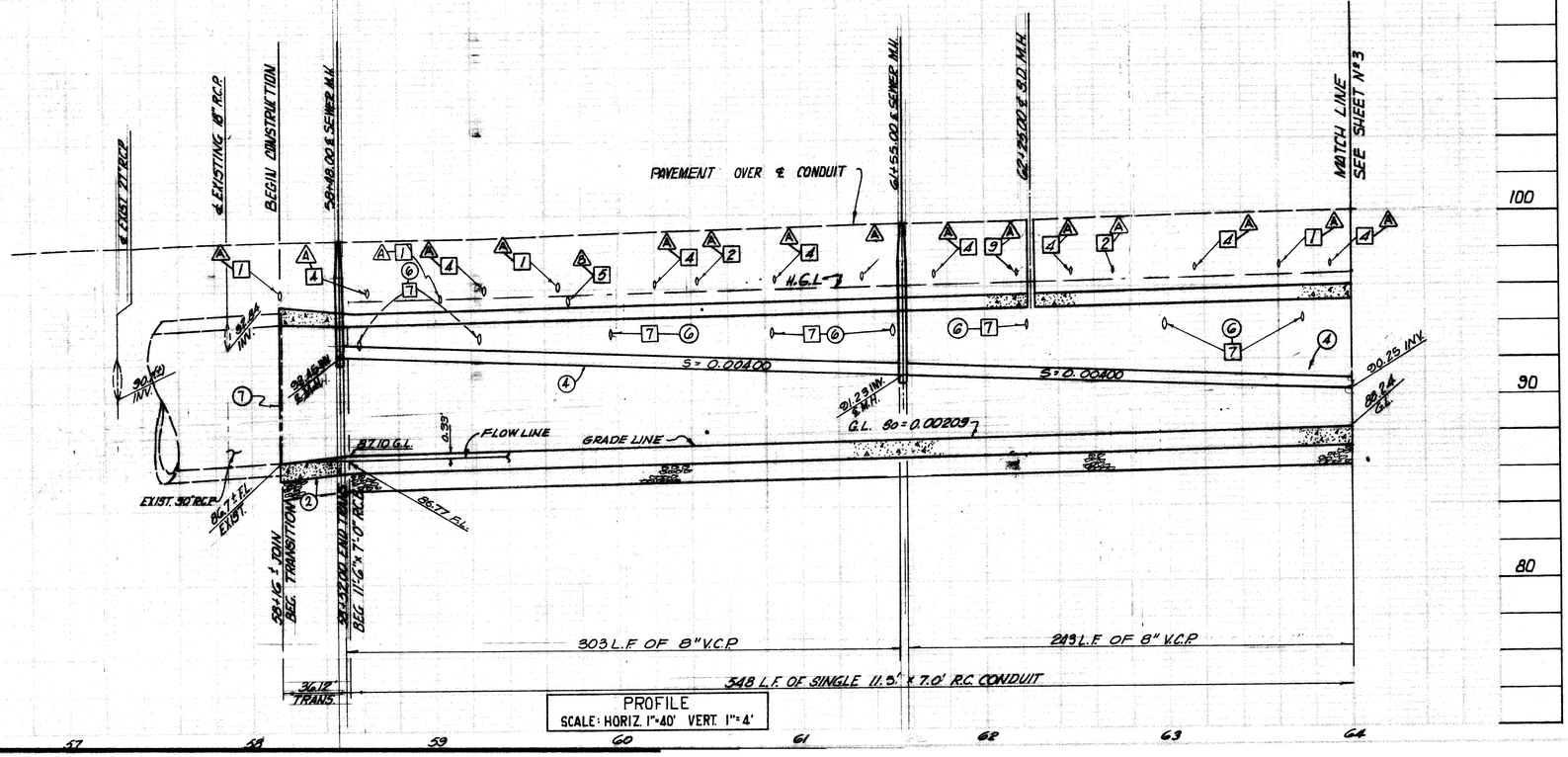
CONSTRUCTION NOTES

1. CONSTRUCT 11.5'x7' R.C. BOX CONDUIT PER PLAN, PROFILE AND TYPICAL SECTION THIS SHEET. SEE STRUCTURAL DETAILS ON SHEET 6. SEE BEDDING & RESURFACING DETAILS ON SHEET 10.
2. CONSTRUCT 30" R.C.P. TO 11.5'x7' R.C.B. TRANSITION PER PLAN AND PROFILE THIS SHEET. SEE DETAIL ON SHEET NO. 8.
3. CONSTRUCT MANHOLE PER O.C.F.C.D. STD. M.H. 3-1 & STD. PM1-1.
4. INSTALL 8" V.C.P. SEWER PER PLAN PROFILE AND TYPICAL SECTION THIS SHEET.
5. CONSTRUCT 4' I.D. PRECAST MANHOLE PER CITY OF ANAHEIM STD. 207-B.
6. REMOVE INTERFERING PORTIONS OF EXISTING 4" HOUSE LATERAL & PLUG REMODEL 4" HOUSE LATERAL PER CITY OF ANAHEIM STD. 205.
7. REMOVE EXISTING DBL COURSE BRICK & MORTAR BULKHEAD.

HYDRAULIC DATA: PRESSURE FLOW

Station to Station	Q_{25}	R.C.B Size	S_o	n=0.014			n=0.012		
				S_f	D	V	S_f	D	V
58+16± to 64+00.00	790	11.5'x7'	0.00209	.00295	FULL	8.87	.00173	FULL	8.87

PLAN
SCALE: 1"= 40'



PROFILE
SCALE: HORIZ. 1"=40' VERT. 1"=4'

UTILITY NOTES

SYMBOL	DESCRIPTION	OWNER
1	3/4" GAS LINE	SO. CALIF GAS CO.
2	1" GAS LINE	"
3	2" GAS LINE	"
4	3/4" WATER LINE	CITY OF ANAHEIM
5	6" WATER LINE	"
6	8" WATER LINE	"
7	4" V.C.P. HSE. LAT.	"
8	15" V.C.P. SEWER LINE	"
9	BURIED TEL. CABLE	PACIFIC TEL. & TEL. CO.
10	10" V.C.P. SEWER LINE	CITY OF ANAHEIM

LEGEND

- △ PROTECT IN PLACE
- △ TO BE RELOCATED BY OTHERS
- ⊙ SOIL BORING

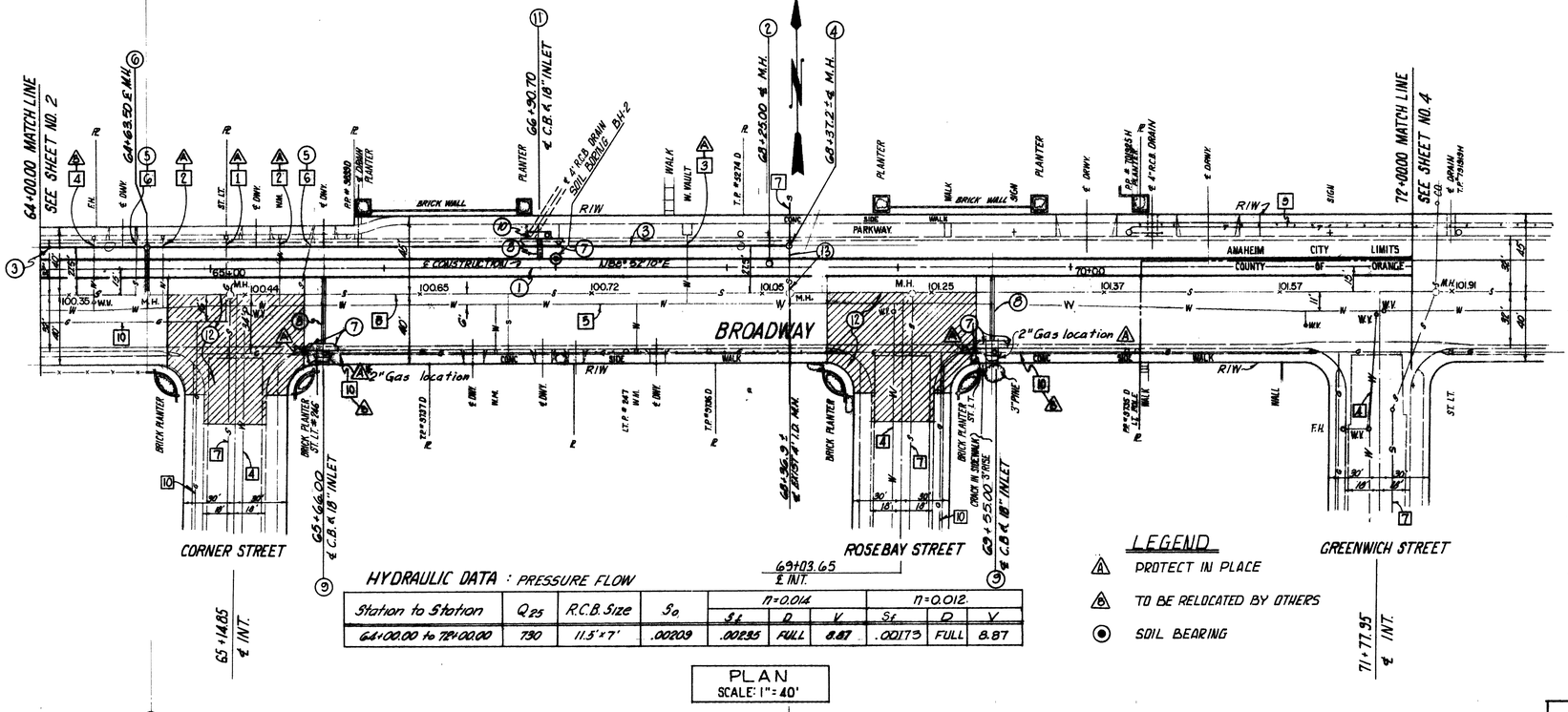
DATUM: OCFCD = OCS (1970 adj.)

BENCH MARK
O.C.S. B.M. 1G-142-69

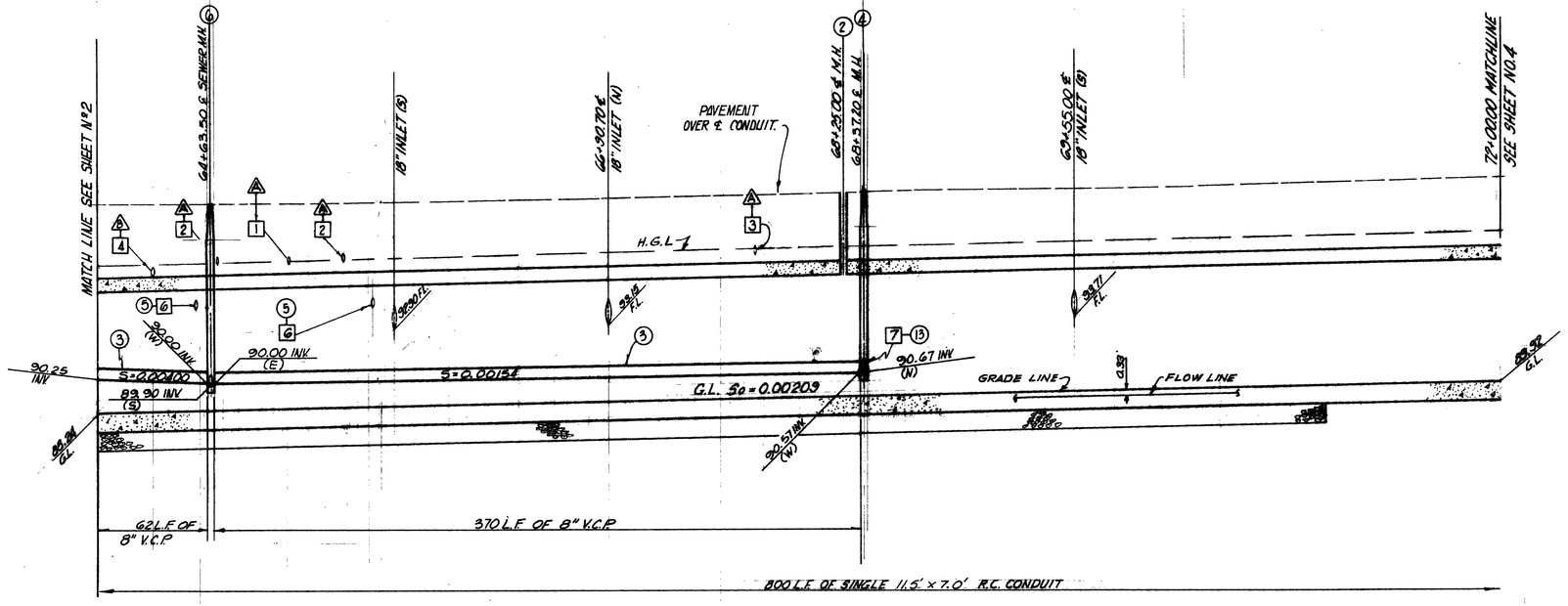
ALUMINUM CAP IN THE NORTHEAST PORTION OF THE INTERSECTION OF MAGNOLIA STREET AND BROADWAY 133 FEET EAST OF THE CENTERLINE OF BROADWAY. SET IN THE NORTHWEST CORNER OF A 10'x4' CONCRETE CATCH BASIN AT SIDEWALK LEVEL. 1970 ADJUSTMENT : ELEV. 33.051

1 1/2 0 1 2
3 inches on original drawing

PRELIMINARY REVISION CODE Disregard Prints Bearing Earlier Codes			
REVISIONS			ORANGE COUNTY FLOOD CONTROL DISTRICT
MARK	DATE	DESCRIPTION	BROADWAY STORM DRAIN
			PLAN & PROFILE
			STA. 58+15.86 to STA. 64+00.00
DESIGNED P.L.			RECOMMENDED Fred W. Williams DESIGN DIVISION ENGINEER
DRAWN C.A.	CHECKED MAC		
SUBMITTED Paul C. Lowe DESIGN ENGINEER			SCALE AS SHOWN / DATE MAY 1976 / DWG. NO. 80IP08-701-1-A



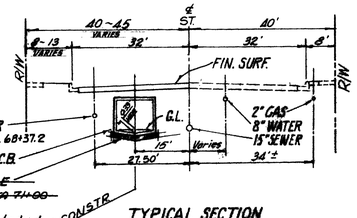
PLAN
SCALE: 1"= 40'



PROFILE
SCALE: HOR. 1"=40'
VERT. 1"=4'

HYDRAULIC DATA : PRESSURE FLOW

Station to Station	Q_{25}	R.C.B. Size	S_o	n=0.014 S_f	n=0.014 Q	n=0.014 V	n=0.012. S_f	n=0.012. Q	n=0.012. V
64+00.00 to 72+00.00	730	11.5'x7'	.00209	.00235	FULL	8.87	.00173	FULL	8.87



TYPICAL SECTION
SCALE: 1"=20' VERT., N.T.S. HORIZ.
STA 64+00 to STA. 72+00

△ Gravel base deleted. ℄ CONSTR

LEGEND

- △ PROTECT IN PLACE
- ◇ TO BE RELOCATED BY OTHERS
- ◉ SOIL BEARING

CONSTRUCTION NOTES

1. CONSTRUCT 11.5'x7' R.C. BOX CONDUIT PER PLAN AND PROFILE AND TYPICAL SECTION THIS SHEET SEE STRUCTURAL DETAILS ON SHT. 6 SEE BEDDING AND RESURFACING DETAILS ON SHT. 10.
2. CONSTRUCT MANHOLE PER O.C.F.C.D. STD. M.H. 3-1 & STD. P.M. 1-1.
3. INSTALL 8" V.C.P. SEWER PER PLAN, PROFILE AND TYPICAL SECTION THIS SHEET.
4. CONSTRUCT 4' I.D. PRECAST MANHOLE PER CITY OF ANAHEIM STD 207-B
5. REMOVE INTERFERING PORTIONS OF EXISTING 4" HOUSE LATERAL & PLUG. REMODEL 4" HOUSE LATERAL PER CITY OF ANAHEIM STD 205.
6. CONSTRUCT 4' I.D. M.H. PER CITY OF ANAHEIM STD. 207-B, REMOVE PORTION OF EXISTING 8" V.C.P. & CONSTRUCT 8" V.C.P. SIPHON AND ENCASEMENT PER DETAIL ON SHEET 7.
7. SAW CUT AND REMOVE EXISTING CURB GUTTER & SIDEWALK AS REQUIRED FOR CONSTRUCTION OF C.B. AND LOCAL DEPRESSION.
8. CONSTRUCT 18" R.C.P. LATERAL. SEE LATERAL PROFILES AND DETAILS ON SHEET 9.
9. CONSTRUCT C.B. No. 1 PER CITY OF ANAHEIM STD. DETAIL No. 302 W= 7.0' V= 4.0'; AND LOCAL DEPRESSION TYPE * PER CITY OF ANAHEIM STD. DETAIL No. 308-A, 10 C.F.
10. SAWCUT AND REMOVE INTERFERING PORTION OF EXISTING 4' R.C.B. DRAIN & JOIN TO BACK OF C.B. SEE MODIFIED CATCH BASIN DETAIL ON SHEET NO. 9.
11. CONSTRUCT MODIFIED CATCH BASIN NO. 1 PER CITY OF ANAHEIM STD. DETAIL NO. 302 W= 14' V= 4.0'; AND LOCAL DEPRESSION TYPE "A" PER CITY OF ANAHEIM STD. DETAIL 308-A 10" C.F. SEE DETAIL ON SHEET 9.
12. RECONSTRUCT STREET INTERSECTION PER DETAIL ON SHEET N° 8
13. REMOVE INTERFERING PORTION OF EXISTING 8" V.C.P. AND PLUG AT EXIST M.H.

UTILITY NOTES

SYMBOL	DESCRIPTION	OWNER
1	1" GAS LINE	SO. CALIF. GAS CO.
2	3/4" WATER LINE	CITY OF ANAHEIM
3	4" WATER LINE	"
4	6" WATER LINE	"
5	8" WATER LINE	"
6	4" V.C.P. HOUSE LATERAL	"
7	8" V.C.P. SEWER LINE	"
8	15" V.C.P. SEWER LINE	"
9	3-4" CEM. CONDUIT	PACIFIC TEL. & TEL. CO.
10	2" GAS LINE	SO. CALIF. GAS CO.

DATUM: O.C.F.C.D. = O.C.S. (1970 adj.)

BENCH MARK
O.C.S. B.M. 16-142-69

ALUMINUM CAP IN THE NORTHEAST PORTION OF THE INTERSECTION OF MAGNOLIA STREET AND BROADWAY 139 FEET EAST OF THE CENTERLINE OF BROADWAY. SET IN THE NORTHWEST CORNER OF A 10'x 4' CONCRETE CATCH BASIN AT SIDEWALK LEVEL. 1970 ADJUSTMENT: ELEV. 93.051

1 1/2 0 1 2
3 inches on original drawing

PRELIMINARY REVISION CODE Disregard Prints Bearing Earlier Codes			
REVISIONS			ORANGE COUNTY FLOOD CONTROL DISTRICT
MARK	DATE	DESCRIPTION	BROADWAY STORM DRAIN
*△	1-77	As Built SG	PLAN & PROFILE
			STA. 64+00.00 to STA. 72+00.00
DESIGNED PL			RECOMMENDED H. W. Williams DESIGN DIVISION ENGINEER
DRAWN C.A.	CHECKED MAC		
SUBMITTED Paul A. Brewer DESIGN ENGINEER			SCALE AS SHOWN / DATE MAY 1976 / DWG. NO. BOIP08-701-1-A

BASF FILE CORP. IRVINE, CA. 6/14/24

ROUGH GRADING PLAN
TR. 16477

GENERAL NOTES FOR FLATLAND GRADING PLANS

1. ALL WORK SHALL CONFORM TO TITLE 17 OF THE ANAHEIM MUNICIPAL CODE, THE STATE CONSTRUCTION SAFETY ORDERS, AND ANY SPECIAL REQUIREMENTS OF THE PERMIT.

2. NO GRADING SHALL COMMENCE WITHOUT FIRST OBTAINING A GRADING PERMIT AND NOTIFYING FIELD ENGINEERING AT (714) 765-5126 48 HOURS IN ADVANCE FOR GRADING INSPECTION.

3. ALL IMPROVEMENTS WITHIN THE PUBLIC RIGHT-OF-WAY WILL REQUIRE A RIGHT-OF-WAY CONSTRUCTION PERMIT.

4. ALL IMPROVEMENTS TO BE CONSTRUCTED PER CITY OF ANAHEIM STANDARD DETAILS, UNLESS OTHERWISE NOTED ON PLAN.

5. THIS PLAN IS APPROVED FOR CONFORMANCE WITH PUBLIC WORKS DEPARTMENTS REQUIREMENTS FOR THE GRADING ORDINANCE ONLY. APPROVAL OF ALL WALLS AND SOUND ATTENUATION DEVICES SHOWN HEREON SHALL BE OBTAINED FROM THE PLANNING DEPARTMENT.

6. THIS PLAN HAS BEEN EXAMINED AND IS APPROVED ONLY AS TO CONFORMANCE TO TITLE 17 OF THE ANAHEIM MUNICIPAL CODE AND IS NOT APPROVED FOR HORIZONTAL OR VERTICAL ALIGNMENT OF STREET OR UTILITY GRADES. REVISIONS TO THIS GRADING PLAN MAY BE REQUIRED PRIOR TO APPROVAL OF THE FINAL SUBDIVISION MAP OR IMPROVEMENT PLANS IN ORDER TO CONFORM TO CITY STANDARDS AND POLICIES. THE DEVELOPER IS RESPONSIBLE FOR THE COST OF MODIFICATIONS DUE TO FINAL UTILITY OR STREET LOCATIONS.

7. BEFORE THE FORMS HAVE BEEN SET AND 24 HOURS PRIOR TO PLACEMENT OF ANY CONCRETE SIDEWALK OR DRIVE APPROACH CONSTRUCTION, THE CONTRACTOR SHALL ADJUST ALL NECESSARY UTILITIES WITHIN THE PARKWAY TO GRADE AND OBTAIN APPROVAL FROM FIELD ENGINEERING, (714) 765-5126.

8. NO CUTS OR REMOVALS PERMITTED UNTIL THE FIELD ENGINEER MARKS DRIVEWAY LOCATION(S). CONTRACT FIELD ENGINEER, AT (714) 765-5126, 24 HOURS PRIOR TO COMMENCING WORK WITHIN THE RIGHT-OF-WAY.

9. ANY EXISTING IRRIGATION LINES FOUND DURING CONSTRUCTION TO BE LOCATED WITHIN THE FURTURE RIGHT-OF-WAY ARE TO BE MAINTAINED IN SERVICE AND ENCASED IN A STEEL SLEEVE OR REPLACED WITH CASTIRON PIPE.

10. THE FOLLOWING APPLIES ONLY TO COMMERCIAL/INDUSTRIAL OPERATIONS DISTURBING LAND AREAS OF ONE TO FIVE ACRES.

a. CONSTRUCTION SITES SHALL BE MAINTAINED IN SUCH A CONDITION THAT AN ANTICIPATED STORM DOES NOT CARRY WASTES OR POLLUTANTS OFF THE SITE.

DISCHARGES OF MATERIAL OTHER THAN STORMWATER ARE ALLOWED ONLY WHEN NECESSARY FOR PERFORMANCE AND COMPLETION OF CONSTRUCTION PRACTICES AND WHERE THEY DO NOT: CAUSE OR CONTRIBUTE TO A VIOLATION OF ANY WATER QUALITIY STANDARD; CAUSE OR THREATEN TO CAUSE POLLUTION, CONTAMINATION, OR NUISANCE; OR CONTAIN A HAZARDOUS SUBSTANCE IN A QUALITY REPORTABLE UNDER FEDERAL REGULATIONS 40 CFR PARTS 117 AND 302.

POTENTIAL POLLUTANTS INCLUDE BUT ARE NOT LIMITED TO: SOLID OR LIQUID CHEMICAL SPILS; WASTES FROM PAINTS, STAINS, SEALANT, GLUES, LIMES, PESTICIDES, HERBICIDES, WOOD PRESEVATIVES AND SOLVANTS; ASBESTOS FIBERS, PAINT FLAKES OR STUCCO FRAGMENTS; FUELS, OILS, LUBRICANTS, AND HYDRAULIC, RADIATOR OR BATTERY FLUIDS; FERTILIZERS, VEHICLE/EQUIPMENT WASTE WATER AND CONCRETE WASH WATER; CONCRETE, DETERGENT OR FLOATABLE WASTES; WASTES FROM AY ENGINE/EQUIPMENT STEAM CLEANING OR CHEMICAL DEGREASING; AND SUPERCHLORINATED POTABLE WATER LINE FLUSHINGS.

DURING CONSTRUCTION, DISPOSAL OF SUCH MATERIALS SHOULD OCCUR IN SPECIFIED AND CONTROLLED TEMPORARY AREAS ON-SITE, PHYSICAL SEPARATED FROM POTENTIAL STORM WATER RUN-OFF, WITH ULTIMATE DISPOSAL IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REQUIREMENTS.

b. DEWATERING OF CONTAMINATED GROUNDWATER, OR DISCHARGING CONTAMINATED SOILS VIA SURFACE EROSION IS PROHIBITED. DEWATERING OF NON-CONTAMINATED GROUNDWATER REQUIRES A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT FROM THE RESPECTIVE STATE REGIONAL WATER QUALITY CONTROL BOARD.

11. PRIVATE STREETS SHALL BE MONUMENTED BY A REGISTERED CIVIL ENGINEER OR LICENSED LAND SURVEYOR IN THE SAME MANNER AS WOULD BE REQUIRED FOR THE MONUMENTATION OF A PUBLIC STREET.

12. ANY VIOLATIONS WILL RESULT IN STOPPING OF ALL WORK UNTIL THE VIOLATIONS ARE CORRECTED.

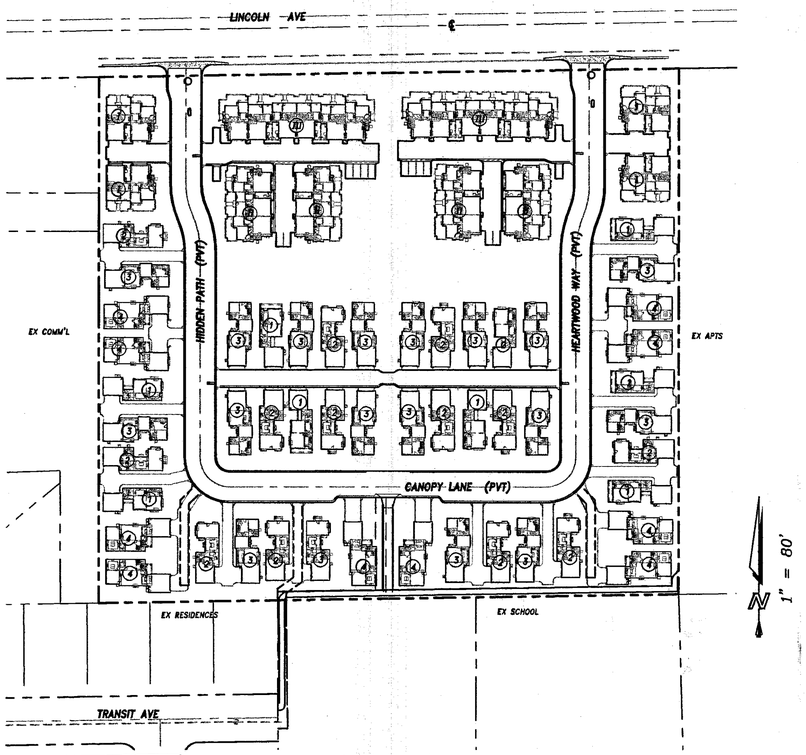
13. THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT AT 1-800-422-4133 A MINIMUM OF 48 HOURS PRIOR TO START OF CONSTRUCTION WITHIN THE RIGHT-OF-WAY.

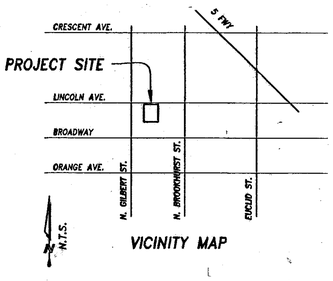
14. BUILDING PERMITS SHALL NOT BE ISSUED PRIOR TO (FINAL MAP, LOT LINE ADJUSTMENT, CERTIFICATION OF COMPLIANCE) RECORDATION.

15. PRIOR TO CONSTRUCTION, ALL SURVEY POINTS THAT MAY BE DISTURBED SHALL BE TIED OUT AND A CORNER RECORD OF EACH POINT SHALL BE FILED WITH THE COUNTY SURVEYOR. A COPY OF THE RECORDED CORNER RECORD SHALL BE SUBMITTED TO THE CITY'S FIELD SERVICES DIVISION. FOLLOWING THE COMPLETION OF THE CONSTRUCTION, A CORNER RECORD OF EACH POINT THAT WAS DISTURBED SHALL BE FILED WITH THE COUNTY SURVEYOR. A COPY OF THE RECORDED CORNER RECORD SHALL BE SUBMITTED TO THE CITY'S FIELD SERVICES DIVISION PRIOR TO THE RECORDING OF A CERTIFICATE OF COMPLETION OR RELEASE OF BONDS.

ENGINEER'S NOTICE TO CONTRACTOR:

1. CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER AND ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR ENGINEER.
2. ALL UNDERGROUND UTILITIES OR STRUCTURES, REPORTED OR FOUND ON PUBLIC RECORDS, ARE INDICATED WITH THEIR APPROXIMATE LOCATION AND EXTENT. THE OWNER, BY ACCEPTING THESE PLANS OR PROCEEDING WITH THE IMPROVEMENTS HEREON, AGREES TO ASSUME LIABILITY AND TO HOLD THE ENGINEER HARMLESS FOR ANY DAMAGES RESULTING FROM THE EXISTENCE OF UNDERGROUND UTILITIES OR STRUCTURES NOT REPORTED OR INDICATED ON PUBLIC RECORDS, OR THOSE CONSTRUCTED AT VARIANCE WITH REPORTED OR RECORDED LOCATIONS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES OR STRUCTURES SHOWN AND ANY OTHERS FOUND AT THE SITE. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE OWNERS OF ALL UTILITIES OR STRUCTURES CONCERNED BEFORE STARTING WORK.
3. THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.
4. THE ENGINEER DOES NOT RECOMMEND OR ENDORSE THE USE OF ASBESTOS-CEMENT WATER PIPE OR ANY PRODUCTS CONTAINING ASBESTOS DUE TO THE HEALTH HAZARD CONNECTED WITH SUCH PRODUCTS. SPECIFICATION HEREON OF ANY SUCH PRODUCT IS AT THE DIRECTION OF THE JURISDICTIONAL AGENCY. CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR ALL CONSTRUCTION, CONNECTION AND REMOVAL OF ASBESTOS PRODUCTS AND SHALL FOLLOW ALL OSHA & EPA GUIDELINES TO MINIMIZE HEALTH HAZARDS.
5. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL DIMENSIONS AND CONDITIONS SHOWN HEREON AT THE JOB SITE PRIOR TO ANY CONSTRUCTION. FUSCOE ENGINEERING, INC. SHALL BE NOTIFIED OF ANY DISCREPANCIES. REVISIONS TO THE PLAN SHALL BE APPROVED BY THE ENGINEERING IN WRITING PRIOR TO IMPLEMENTATION.





VICINITY MAP

EARTHWORK ESTIMATE:

	EXCAVATION	EMBANKMENT	
WEST SIDE	700 CY	15,200 CY	MAXIMUM DEPTH OF CUT 3.0'
EAST SIDE	2,600 CY	9,500 CY	
TOTAL	3,300 CY	24,700 CY	MAXIMUM DEPTH OF FILL 3.5'
IMPORT	24,700 CY	———	

DISTURBED AREA: 9.0 ACRES

NOTES:
1. RAW QUANTITIES INDICATED DO NOT INCLUDE OVER-EXCAVATION, SUBSIDENCE OR SHRINKAGE.
2. EARTHWORK QUANTITIES INDICATED ARE FOR THE OWNER & BONDING PURPOSES ONLY. CONTRACTOR SHALL CALCULATE OWN QUANTITIES.
3. QUANTITIES WERE TAKEN ASSUMING THAT THE SUBGRADE WAS 8" BELOW THE EXISTING AC,
4. CONTRACTOR TO STOCKPILE THE EX. AB FOR FUTURE USE
5. THE EXISTING FACILITIES AND PAVING, ON SITE, WILL BE REMOVED BY THE CITY OF ANAHEIM

CONSTRUCTION NOTES & ESTIMATED QUANTITIES

NO.	DESCRIPTION	QUANTITY	UNITS
(1)	CONSTRUCT CONCRETE RECTANGULAR CHANNEL PER DETAIL A/3	680	LF
(2)	CONSTRUCT TEMPORARY CONCRETE SWALE PER DETAIL 1/3	30	LF
(3)	CONSTRUCT TEMPORARY EARTHEN CHANNEL PER DETAIL B/3	100	LF
(4)	CONSTRUCT SCREEN WALL PER DETAILS C/3 AND H/3 (SEPARATE PERMIT)	64	LF
(5)	PROTECT IN PLACE	–	–
(6)	PROVIDE WALL OPENING FOR RECTANGULAR CHANNEL (6' X 1.33')	2	EA
[1]	REMOVE EXIST 3' WIDE X 6" DEEP CONCRETE RECTANGULAR CHANNEL	120	LF
[2]	REMOVE EXIST CMU WALL	125	LF
[3]	REMOVE EXIST. CHAIN LINK FENCE	65	LF

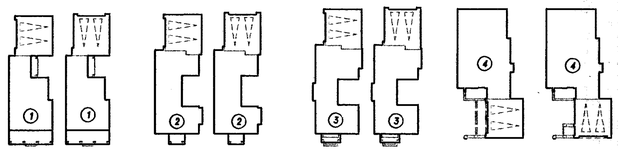
I HEREBY CERTIFY THAT THE FOLLOWING REVISIONS WERE MADE UNDER MY SUPERVISION
THOMAS A. OSHITA RCE 17388 DATE 5/20/03
EXP. 06/30/05

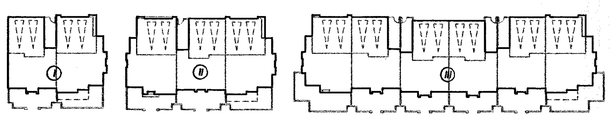
REV.	INIT.	DATE	REV	INIT	DATE	REV	INIT	DATE	REV	INIT	DATE
1	TO	5/21/03									

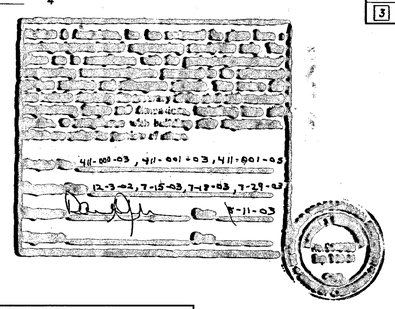
INDEX MAP

SHEET INDEX

TITLE SHEET 1
ROUGH GRADING PLAN 2
SECTIONS & DETAILS 3
EROSION CONTROL PLAN 4







RETAINING & SCREEN WALLS PER SEPARATE PERMIT

APPROVAL OF THIS PLAN DOES NOT CONSTITUTE APPROVAL OF THE STRUCTURAL INTEGRITY OF RETAINING WALLS

ALL EXISTING WATER FACILITIES ARE TO BE PROTECTED IN PLACE. THE CONTRACTOR PERFORMING THIS WORK SHALL BE RESPONSIBLE FOR ALL COSTS AS A RESULT OF ANY DAMAGE OR REPAIRS REQUIRED TO WATER FACILITIES. SMALL SERVICES (i.e. 2" AND SMALLER) ARE NOT SHOWN ON PLANS, BUT MUST BE PROTECTED IN PLACE. THE NORMAL DEPTH OF COVER IS 30". IN CASE OF EMERGENCY CONTACT UTILITY OPERATIONS (714) 765-4560 OR WATER ENGINEERING (714) 765-5196.

WDID # 830C321998

RECOMMEND APPROVAL:
DEVELOPMENT SERVICES MANAGER — DATE 6-4-03

APPROVED FOR GRADING ONLY:
DIRECTOR OF PUBLIC WORKS/CITY ENGINEER — DATE 6-4-03

APPROVED FOR GRADING ONLY

REVISIONS

NO.	INIT.	DATE	DESCRIPTION	APP'D	DATE
1	TO	5/21/03	REV DETAIL 1/3, CHANGE AT STA. 6+37.44, ADD NOTE (7) & (8). ON SHT 3		6-4-03

BENCH MARK:
1M-4-82 ALUMINUM BENCHMARK DISK SET IN THE SW CORNER OF CATCH BASIN, MONUMENT LOCATED NW OF THE "T" INTERSECTION OF GAIN STREET AND LINCOLN AVENUE

ELEV. 93.378 (NAVD 88)

OWNER:
3090 BRISTOL STREET, SUITE 200
COSTA MESA, CA 92626
(714) 427-6868
BROOKFIELD HOMES

SOILS ENGINEER:
NEBLETT & ASSOCIATES
4911 WARNER AVE., SUITE 218
HUNTINGTON BEACH, CA 92649
CONTACT: DAN MORIKAWA
(714) 840-8286
PROJ. NO. 411-000-03
DEC. 3, 2002

Plans prepared by:
FUSCOE ENGINEERING
16795 Von Karman, Ste 100
Irvine, California 92606
Phone (949) 474-1960
FAX (949) 474-5315
Job Number: 308.16

REGISTERED PROFESSIONAL ENGINEER THOMAS A. OSHITA NO. 17388 Exp. 06/30/05 CIVIL STATE OF CALIFORNIA

I hereby certify that:
1) these plans have been prepared under my supervision;
2) the grading shown hereon will not divert drainage from its natural downstream course or obstruct the drainage of adjacent properties;
3) all specimen trees located on this property are shown;
4) existing ground contours and elevations were obtained by field survey on March, 2003

ENGINEER THOMAS A. OSHITA R.C.E. NO.17388 DATE 7/1/03 EXP. DATE 06/30/05

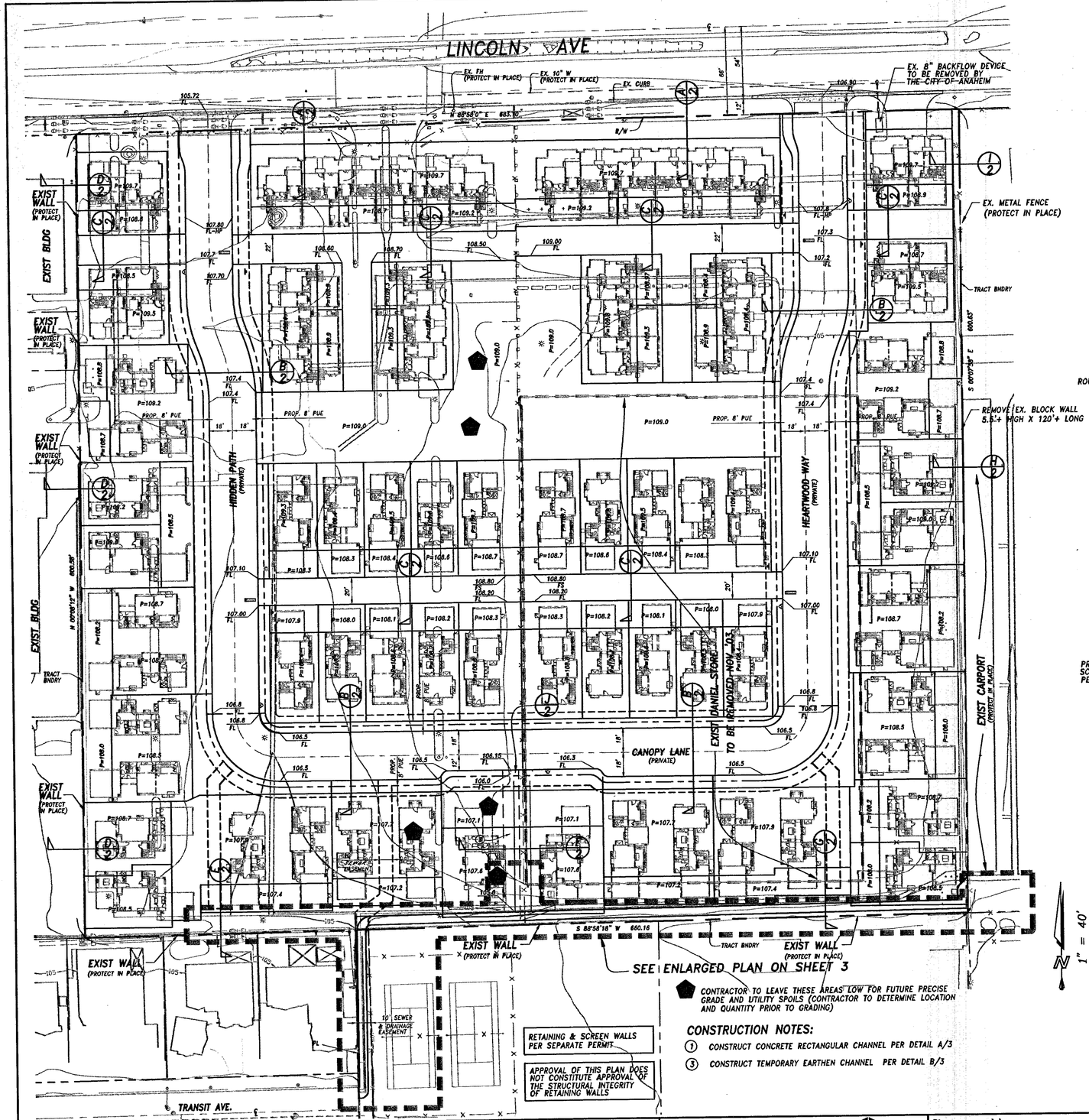
ROUGH GRADING PLAN
TITLE SHEET
TR 16477
SITE ADDRESS: 2300-2340 W. LINCOLN AVE.
SCALE: AS SHOWN | DRAWN BY: HA | CHECKED BY: TO
CITY OF ANAHEIM

G R A 2003-02087
SHT. 1 OF 4

PLAN SET: C
BROOKFIELD HOMES - WEST ANAHEIM
ROUGH GRADING PLANS
07/07/03
USE ONLY Filed 7/1

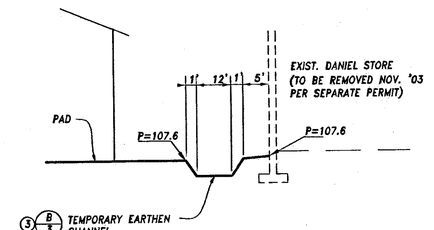
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D-34
D-33

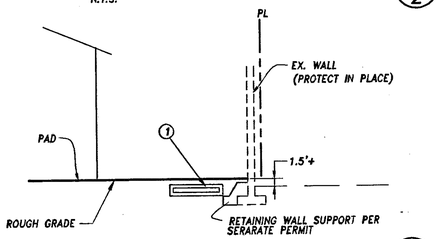


CONSTRUCTION NOTES:

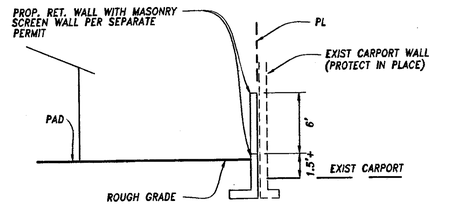
1. CONSTRUCT CONCRETE RECTANGULAR CHANNEL PER DETAIL A/3
3. CONSTRUCT TEMPORARY EARTHEN CHANNEL PER DETAIL B/3



SECTION F/2
N.T.S.

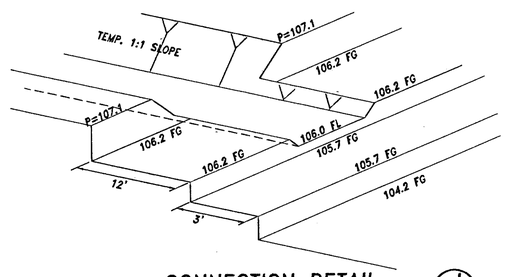


SECTION G/2
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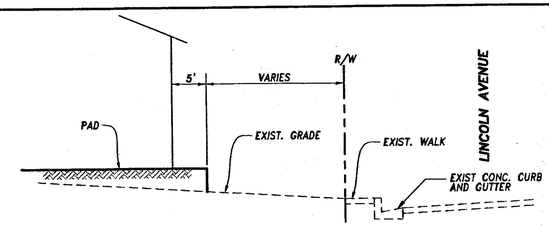


SECTION H/2
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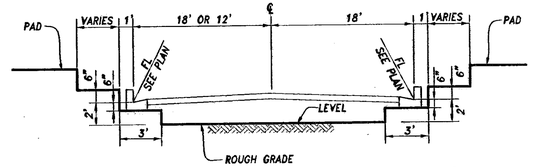
SECTION I/2
N.T.S.



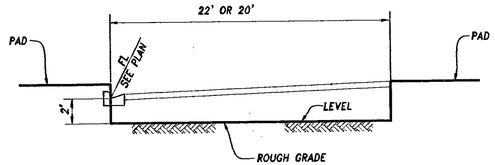
CONNECTION DETAIL J/2
N.T.S.



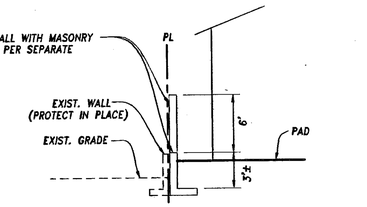
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N.T.S.



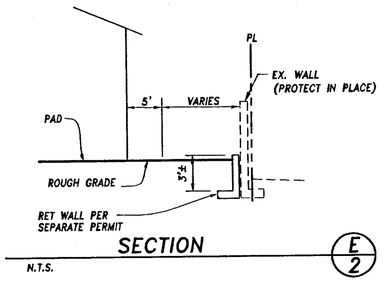
SECTION B/2
N.T.S.



SECTION C/2
N.T.S.



SECTION D/2
N.T.S.



SECTION E/2
N.T.S.

REVISIONS			
NO.	INIT.	DATE	DESCRIPTION

BENCH MARK:

1M-4-82 ALUMINUM BENCHMARK DISK SET IN THE SW CORNER OF CATCH BASIN, MONUMENT LOCATED NW OF THE "T" INTERSECTION OF GAIN STREET AND LINCOLN AVENUE

ELEV. 93.378 (NAVD 88)

OWNER:
3090 BRISTOL STREET, SUITE 200
COSTA MESA, CA 92626
(714) 427-6868

BROOKFIELD HOMES

SOILS ENGINEER:
PROJ. NO. 411-000-03
DEC. 3, 2002

NEBLETT & ASSOCIATES
4911 WARNER AVE., SUITE 218
HUNTINGTON BEACH, CA 92649
CONTACT: DAN MORIKAWA
(714) 840-8286

Plans prepared by:
FUSCOE ENGINEERING
16795 Von Karman, Ste 100
Irvine, California 92606
Phone (949) 474-1960
FAX (949) 474-5315
Job Number: 308.16

REGISTERED PROFESSIONAL ENGINEER THOMAS A. OSHITA NO. 17388 Exp. 06/30/05 CIVIL STATE OF CALIFORNIA

I hereby certify that:
1) these plans have been prepared under my supervision;
2) the grading shown hereon will not divert drainage from its natural downstream course or obstruct the drainage of adjacent properties;
3) all specimen trees located on this property are shown;
4) existing ground contours and elevations were obtained by field survey on March, 2003

ENGINEER Thomas A. Oshita DATE 7/9/03
THOMAS A. OSHITA R.C.E. NO.17388 EXP. DATE 06/30/05

APPROVED FOR GRADING ONLY
GRA 2003-02087
SHT. 2 OF 4

ROUGH GRADING PLAN
SITE ADDRESS: TR 16477
2300-2340 W. LINCOLN AVE.
SCALE: AS SHOWN | DRAWN BY: HA | CHECKED BY: TO

CITY OF ANAHEIM

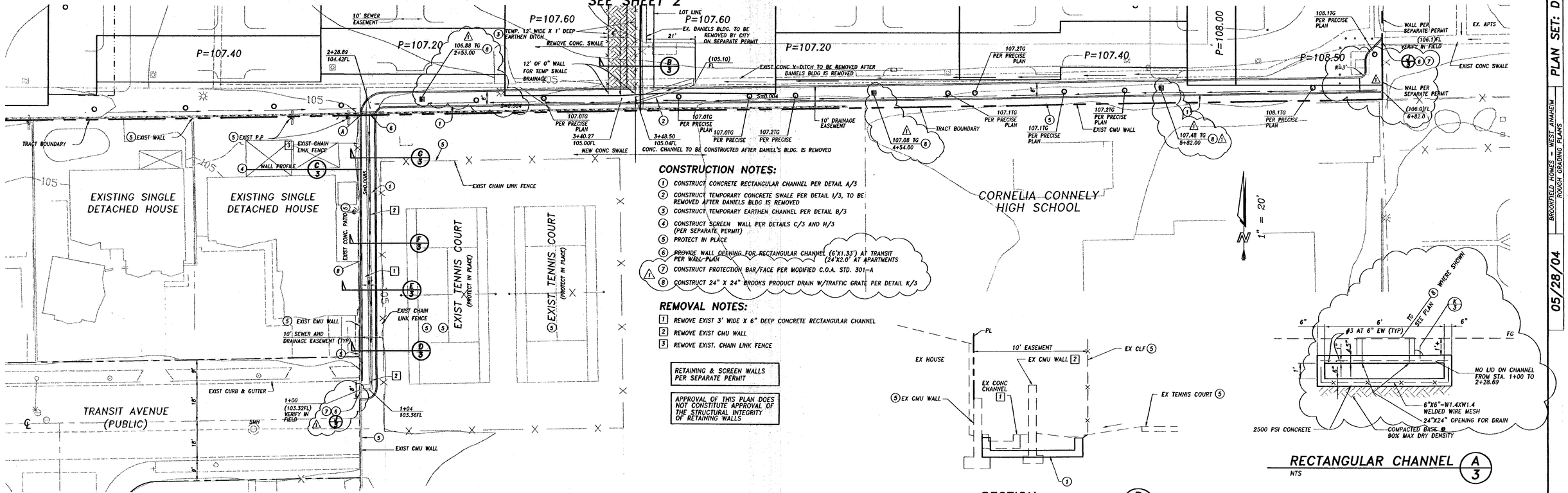
BROOKFIELD HOMES – WEST ANAHEIM | PLAN SET: C
ROUGH GRADING PLANS
07/07/03

GP 2003-02087 D-33 USE ONLY Filed 7-11

X:\JOHN'STEAM\PROJECT\308\16\GRADING\ROUGH\30816RG02RG.DWG (07-09-03 1:56:32PM) Plotted by: Hugo Escobedo

D-33

SEE SHEET 2



CONSTRUCTION NOTES:

1. CONSTRUCT CONCRETE RECTANGULAR CHANNEL PER DETAIL A/3
2. CONSTRUCT TEMPORARY CONCRETE SWALE PER DETAIL I/3, TO BE REMOVED AFTER DANIELS BLDG IS REMOVED
3. CONSTRUCT TEMPORARY EARTHEN CHANNEL PER DETAIL B/3
4. CONSTRUCT SCREEN WALL PER DETAILS C/3 AND H/3 (PER SEPARATE PERMIT)
5. PROTECT IN PLACE
6. PROVIDE WALL OPENING FOR RECTANGULAR CHANNEL (6'X1.33') AT TRANSIT (24'X2.0' AT APARTMENTS PER WALL PLAN
7. CONSTRUCT PROTECTION BAR/FACE PER MODIFIED C.O.A. STD. 301-A
8. CONSTRUCT 24" X 24" BROOKS PRODUCT DRAIN W/TRAFFIC GRATE PER DETAIL K/3

REMOVAL NOTES:

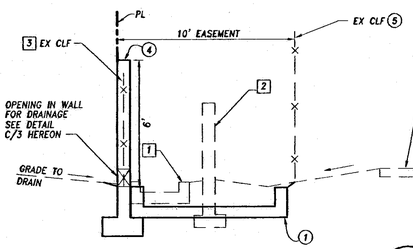
1. REMOVE EXIST 3' WIDE X 6" DEEP CONCRETE RECTANGULAR CHANNEL
2. REMOVE EXIST CMU WALL
3. REMOVE EXIST. CHAIN LINK FENCE

RETAINING & SCREEN WALLS PER SEPARATE PERMIT

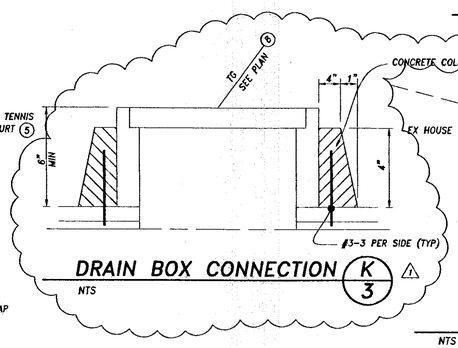
APPROVAL OF THIS PLAN DOES NOT CONSTITUTE APPROVAL OF THE STRUCTURAL INTEGRITY OF RETAINING WALLS

SECTION — D/3 — NTS

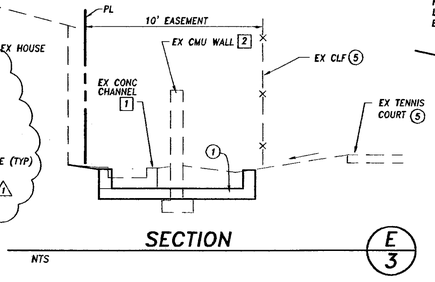
RECTANGULAR CHANNEL — A/3 — NTS



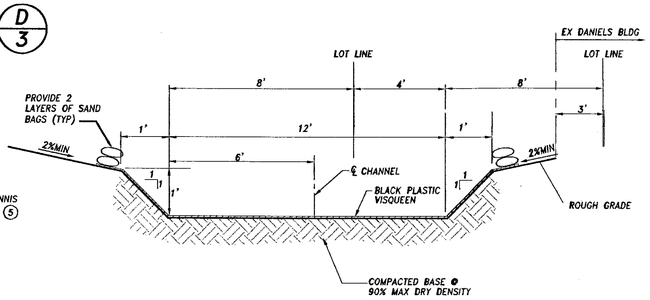
SECTION — G/3 — NTS



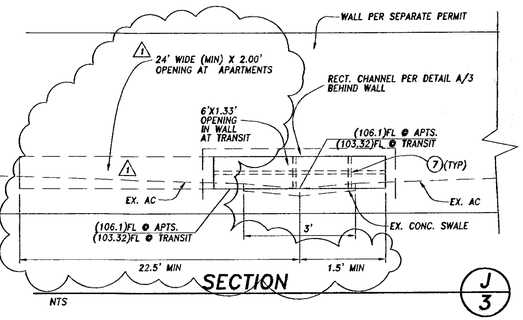
DRAIN BOX CONNECTION — K/3 — NTS



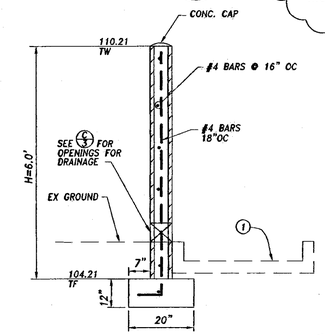
SECTION — E/3 — NTS



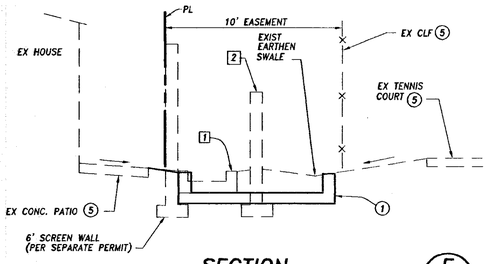
TEMP. EARTHEN TRAPEZOIDAL CHANNEL — B/3 — NTS



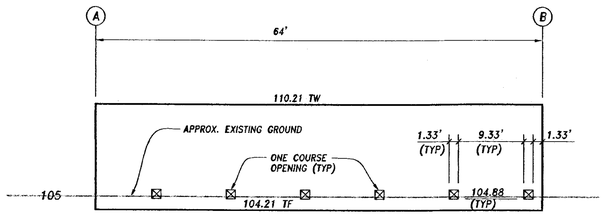
SECTION — J/3 — NTS



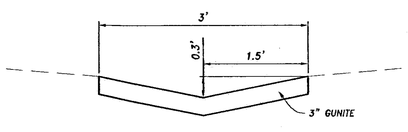
SCREEN WALL — H/3 — NTS



SECTION — F/3 — NTS



SCREEN WALL PROFILE — C/3 — H: 1" = 10', V: 1" = 4'



TEMP. CONC. SWALE — I/3 — NTS

ENLARGED PLAN

1"=20'

REVISIONS

NO.	INIT.	DATE	DESCRIPTION
1	T.O.	05/28/04	REV DETAIL J/3, CHANNEL AT STA 6+72.64, ADD NOTE (7) & (8)

BENCH MARK:
1M-4-82 ALUMINUM BENCHMARK DISK SET IN THE SW CORNER OF CATCH BASIN, MONUMENT LOCATED NW OF THE "T" INTERSECTION OF GAIN STREET AND LINCOLN AVENUE

ELEV. 93.378 (NAVD 88)

OWNER:
3090 BRISTOL STREET, SUITE 200
COSTA MESA, CA 92626
(714) 427-6868
BROOKFIELD HOMES

SOILS ENGINEER:
NEBLETT & ASSOCIATES
4911 WARNER AVE., SUITE 218
HUNTINGTON BEACH, CA 92649
CONTACT: DAN MORIKAWA
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Job Number: 308.16

REGISTERED PROFESSIONAL ENGINEER — THOMAS A. OSHITA — NO. 17388 — Exp. 06/30/05 — CIVIL — STATE OF CALIFORNIA

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4) existing ground contours and elevations were obtained by field survey on March, 2003

ENGINEER T. Oshita DATE 8/27/04
THOMAS A. OSHITA R.C.E. NO.17388 EXP. DATE 06/30/05

ROUGH GRADING PLAN SECTIONS & DETAILS

SITE ADDRESS: TR 16477
2300-2340 W. LINCOLN AVE.

SCALE: AS SHOWN | DRAWN BY: HA | CHECKED BY: TO

CITY OF ANAHEIM

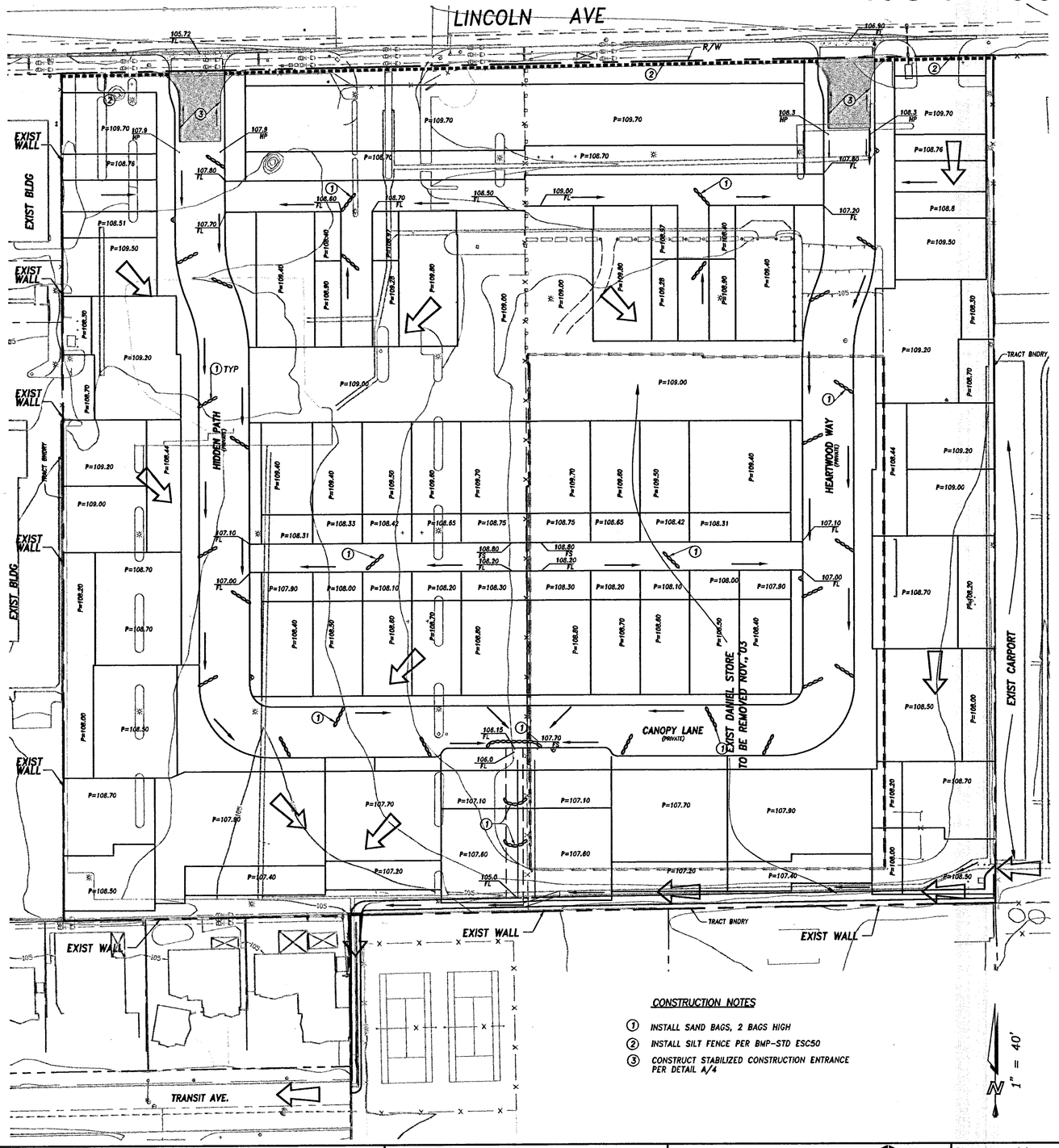
APPROVED FOR GRADING ONLY
G R A
2003-02087
SHT. 3 OF 4

PLAN SET: D
05/28/04
BROOKFIELD HOMES - WEST ANAHEIM
ROUGH GRADING PLANS

USE ONLY

X:\JOHN'STEAM\PROJECT\308\16\GRADING\ROUGH\30816RG03RG.DWG (08-26-04 10:06:20AM) Plotted by: Karina Coronado

EROSION CONTROL



CONSTRUCTION NOTES

1. INSTALL SAND BAGS, 2 BAGS HIGH
2. INSTALL SILT FENCE PER BMP-STD ESC50
3. CONSTRUCT STABILIZED CONSTRUCTION ENTRANCE PER DETAIL A/4

1" = 40'

GRADING LEGEND

- SANDBAGS OR APPROVED EQUAL
- DIRECTION OF FLOW
- SILT FENCE
- PRE CONSTRUCTION DRAINAGE FLOW
- BMP TABLE

SYMBOL		DESCRIPTION
ENTIRE SITE	ESC 21	DUST CONTROLS
	ESC 23	CONSTRUCTION ROAD STABILIZATION
	ESC 31	TEMPORARY DRAINS AND SWALES
	ESC 52	SAND BAG BARRIER
	ESC 54	STORM DRAIN INLET PROTECTION

EROSION CONTROL NOTES:

SANDBAGS
(GRAVEL BAG)

1. GENERAL: SANDBAG SHALL INCLUDE PROVIDING ALL LABOR, MATERIALS, AND EQUIPMENT TO FABRICATE AND INSTALL SANDBAGS AS REQUIRED TO FACILITATE THE CONTROL OF EROSION.
2. LOCATION: SANDBAGS SHALL BE PLACED PER PLAN, AND IN LOCATIONS SPECIFIED BY THE COUNTY, AND IN LOCATIONS DEEMED NECESSARY BY THE CONTRACTOR.
3. FABRICATION: SANDBAGS SHALL BE FABRICATED USING FACTORY SEWN OR SEALED BAGS OF WOVEN POLYPROPYLENE, TREATED TO RESIST DEGRADATION BY ULTRAVIOLET LIGHT AND HAVING SUFFICIENT RESISTANCE TO TEARING TO ALLOW RELOCATION OF BAGS WITHIN SIX MONTHS OF INITIAL PLACEMENT WITH A LOSS OF NOT MORE THAN FIVE PERCENT OF THE BAGS.

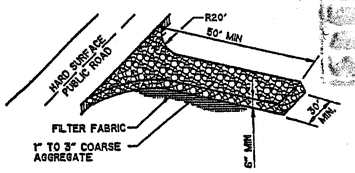
   THE BAGS SHALL BE FILLED WITH SUBROUNDED TO ROUNDED GRAVEL LESS THAN 3/4-INCH IN DIAMETER, WITH LESS THAN FIVE PERCENT OF MATERIAL PASSING A NO. 30 SIEVE. THE FILLED BAGS SHALL HAVE THE OPEN ENDS SECURELY FASTENED PRIOR TO DELIVERY TO THE SITE.
4. INSTALLATION: SANDBAGS SHALL BE INSTALLED IN A MANNER TO ENTRAP SILT AND MUD, AND TO DIVERT THE FLOW OF WATER. NOTWITHSTANDING THE OTHER REQUIREMENTS OF THIS SPECIFICATION, FAILURE OF THE BAGS TO PERFORM THIS FUNCTION SHALL BE REASON TO REJECT THEIR INSTALLATION.

   SANDBAGS SHALL BE INSTALLED WITH THE WIDEST FACE AGAINST THE GROUND SURFACE OR THE UNDERLYING COURSE OF BAGS, AND PRESSED IN PLACE TO CONFORM TO THE UNDERLYING SURFACE. THE BAGS SHALL BE PLACED WITH THE TIED ENDS IN THE "UPHILL" OR "UPSTREAM" DIRECTION, BEGINNING AT THE LOWEST OR MOST DOWNSTREAM BAG. TIED ENDS WILL BE TUCKED UNDER BAG. SUBSEQUENT BAGS WITHIN ONE COURSE OF BAGS SHALL BE PLACED SO AS TO REST UPON THE TIED END OF THE PREVIOUSLY PLACED BAG, WITH NOT LESS THAN 10 PERCENT OF THE BAG IN CONTACT WITH THE PREVIOUS BAG, AND NOT MORE THAN 20 PERCENT IN CONTACT.

   SUBSEQUENT COURSES OF BAGS SHALL BE PLACED AS DESCRIBED PREVIOUSLY, WITH THE MID-POINT OF THE BAGS STRADDLING THE JOINTS OF BAGS IN THE UNDERLYING ROW.

   CONSTRUCTION OF A SANDBAG BERM PERPENDICULAR TO THE DIRECTION OF FLOW SHALL INCORPORATE BAGS PLACED IN A "PYRAMID" CONFIGURATION, WITH ALL INDIVIDUAL BAGS ORIENTED PERPENDICULAR TO THE DIRECTION OF FLOW. THE BERM SHALL BE CONSTRUCTED WITH A SPECIFIED NUMBER OF ROWS AT THE BOTTOM (IN CONTACT WITH THE GROUND), WITH SUCCESSIVELY FEWER ROWS IN EACH OVERLYING COURSE. THE UPSTREAM AND DOWNSTREAM FACES OF THE BERM SHALL BE NO STEEPER THAN 1 1/2 FEET HORIZONTAL TO 1 VERTICAL.

   DAMAGE WHICH COULD FORESEEBLY BE PREVENTED BY PROPER SANDBAG INSTALLATION SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
5. COMPENSATION: THE PERFORMANCE OF THE REQUIREMENTS OF THIS SECTION SHALL BE COMPENSATED AT THE CONTRACT UNIT PRICES FOR SANDBAGS.



STABILIZED CONSTRUCTION ENTRANCE 4/4

ESC24

STORM WATER POLLUTION PREVENTION NOTES:

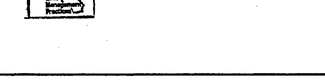
GENERAL NOTES:

1. FOR CONSTRUCTION ACTIVITY COMMENCING ON AND AFTER NOVEMBER 1, 1997, THE SWPPP MUST BE DEVELOPED AND IMPLEMENTED CONCURRENT WITH COMMENCEMENT OF CONSTRUCTION ACTIVITIES.
2. THIS STORM WATER POLLUTION PREVENTION PLAN (SWPPP) IS EFFECTIVE FOR THE 1997 – 1998 EROSION CONTROL SEASON, AND SUBSEQUENT SEASONS WITH REVISIONS AS NOTED ON THE PLAN, FOR WHICH THE FOLLOWING PERMANENT IMPROVEMENTS ARE EXPECTED TO BE IN PLACE: COMPLETED ROUGH GRADING, STORM DRAIN MAIN LINES, CULVERT AND ALL SURFACE DRAINAGE DEVICES.
3. THE SWPPP SHALL BE KEPT ON SITE DURING CONSTRUCTION ACTIVITY AND MADE AVAILABLE UPON REQUEST OF A REPRESENTATIVE OF THE REGIONAL WATER BOARD AND/OR LOCAL AGENCY.
4. THE DISCHARGER (RECORD OWNER) SHALL AMEND THE SWPPP WHENEVER THERE IS A CHANGE IN CONSTRUCTION OR OPERATIONS WHICH MAY AFFECT THE DISCHARGE OF SIGNIFICANT QUANTITIES OF POLLUTANTS TO SURFACE WATERS, GROUND WATERS, OR A MUNICIPAL SEPARATE STORM SEWER SYSTEM. THE SWPPP SHOULD ALSO BE AMENDED IF IT IS VIOLATION OF ANY CONDITION OF THE GENERAL PERMIT OR HAS NOT ACHIEVED THE GENERAL OBJECTIVE OF REDUCING POLLUTANTS IN STORM WATER DISCHARGES.
5. THE REGIONAL WATER BOARD, OR LOCAL AGENCY WITH THE CONCURRENCE OF THE REGIONAL WATER BOARD, MAY REQUIRE THE DISCHARGER (RECORD OWNER) TO AMEND THE SWPPP.
6. THE OWNER HAS MADE ARRANGEMENT FOR MONITORING OF THE SITE TO ENSURE COMPLIANCE WITH THE SWPPP PHYSICAL AND POLICY PLANS. THE ENGINEER AND THE CITY INSPECTOR SHALL HAVE THE AUTHORITY TO STOP WORK WHERE A VIOLATION OF ANY WATER QUALITY STANDARD OCCURS OR IS EXPECTED TO OCCUR. ONLY THE OWNER AND HIS AGENT (THE CONSTRUCTION MANAGER) SHALL HAVE THE AUTHORITY TO AUTHORIZE ADDITIONAL WORK EXCEPTING THAT IN SITUATIONS WHERE A RISK TO HUMAN LIFE EXISTS OR IS ANTICIPATED. THE OWNER, CONSTRUCTION MANAGER, ENGINEER AND INSPECTORS SHALL HAVE THE AUTHORITY TO STOP WORK AND ORDER ADDITIONAL WORK.
7. THE DEVICES SHOWN ON THIS PLAN SHALL BE INSTALLED AT THE END OF EACH WORK DAY WHEN THERE IS RAIN IN THE FORECAST. ALL DEVICES SHALL BE MAINTAINED IN GOOD OPERATING CONDITION FROM NOVEMBER 1 THROUGH APRIL 15. ADEQUATE MATERIALS SHALL BE STORED AT CONVENIENT LOCATIONS ON SITE AND WORK CREWS MADE AVAILABLE TO PERFORM CLEANUP, REPAIRS AND EMERGENCY WORK.
8. REPAIR AND CLEANUP SHALL BE ACCOMPLISHED AS SOON AS POSSIBLE AFTER THE RAINFALL HAS STOPPED. AT THAT TIME, PONDED WATER SHALL BE PUMPED OR LOWERED AND DIVERTED AWAY FROM THE TOPS OF SLOPES.
9. ALL SUMP CONDITIONS SHALL BE PROVIDED WITH SAFE POSITIVE OVERFLOW PATHS.
10. ALL DISTURBED SLOPES SHALL BE STABILIZED WITH LANDSCAPING AND IRRIGATION, TEMPORARY HYDROSEED OR, BLOWN STRAW ETC. AS SOON AS PRACTICAL.
11. ALL WASTES (INCLUDING EQUIPMENT MAINTENANCE WASTE) DISPOSED AT THE SITE OR REMOVED FROM THE SITE FOR DISPOSAL SHALL BE DISPOSED OF IN COMPLIANCE WITH FEDERAL, STATE, AND LOCAL LAWS, REGULATIONS, AND ORDINANCES.
12. THIS SWPPP MAY INCORPORATE, BY REFERENCE, THE APPROPRIATE ELEMENTS OF OTHER PLANS REQUIRED BY LOCAL, STATE, OR FEDERAL AGENCIES. A COPY OF ANY REQUIREMENTS INCORPORATED BY REFERENCE SHALL BE KEPT AT THE CONSTRUCTION SITE.
13. THE SWPPP IS CONSIDERED A REPORT THAT SHALL BE AVAILABLE TO THE PUBLIC UNDER SECTION 308 (B) OF THE CWA. UPON REQUEST BY MEMBERS OF THE PUBLIC, THE DISCHARGER SHALL MAKE AVAILABLE FOR REVIEW A COPY OF THE SWPPP EITHER TO THE REGIONAL WATER BOARD OR DIRECTLY TO THE REQUESTER.
14. THE SWPPP SHALL INCLUDE THE TITLE OF THE PERSON RESPONSIBLE FOR PREPARATION OF THE SWPPP AND INCLUDE THE DATE OF INITIAL PREPARATION AND EACH AMENDMENT, AS SHOWN IN THE REVISION BLOCK. THE DATES OF THE LATEST REVISIONS WILL ALSO BE SHOWN IN THE SUPERVISOR'S "LATEST REVISION" LOG.
15. IN CASE OF EMERGENCY, CONTACT THE CONSTRUCTION MANAGER, AT: JOHN OBRIEN (714) 427-8868

SUPERVISOR'S INSTRUCTIONS:

1. IMPLEMENTATION OF THIS PLAN SHALL BE THE RESPONSIBILITY OF THE CONSTRUCTION SUPERVISOR.
   THIS PLAN SHALL BE REVISED BY THE CONSTRUCTION SUPERVISOR AS AUTHORIZED AGENT OF THE OWNER TO REFLECT THE CURRENT STATUS OF THE CONSTRUCTION SITE.

EXAMPLE: AFTER INLET PROTECTION IS REMOVED



2. THE SYMBOLS ITEMIZED IN THE LEGEND AND SHOWN ON THE PLAN WILL BE MODIFIED BY THE CONSTRUCTION SUPERVISOR WHEN CONSTRUCTION CONDITIONS CHANGE BY USING A MARKING PEN ON THIS PLAN AND NOTING THE CHANGE AND DATE AS FOLLOWS:

   USING A MARKING PEN, CROSS OUT ITEMS SHOWN ON THE PLAN THAT ARE NO LONGER NECESSARY DUE TO THE CONSTRUCTION OF IMPROVEMENTS, ELIMINATION FROM THE SITE, OR RELOCATION OF THE ITEM. SYMBOLS SHOULD BE ADDED TO THE PLAN TO DELINEATE NEW ITEMS OR RELOCATIONS ON THE SITE.

   USING A MARKING PEN, DASH THE STORM DRAIN LINE AFTER THE CONSTRUCTION OF THE STORM DRAIN LINE.

   USING A MARKING PEN, DARKEN IN THE CATCH BASIN SYMBOL ON THE PLAN AFTER CONSTRUCTION IS COMPLETED.

   USING A MARKING PEN, CLOUD LANDSCAPE AREAS WHICH HAVE BEEN PLANTED AND LABEL THE AREA WITH A CIRCLED LETTER FOR REFERENCE.
3. WHEN MARKING ANY CHANGES ON THE PLAN, BE SURE TO NOTE THE DATE ADJACENT TO THE MARKED REVISION.
4. WHEN MAKING ANY REVISIONS ON THE PLAN, THE SUPERVISOR SHALL NOTE THE DATE ON THE SUPERVISOR'S "LATEST REVISION" LOG.

* MATERIAL LOADING

* EQUIPMENT LOADING

* CONCRETE TRUCK WASHOUT AREA, INCLUDES R & R

* LOCATION TO BE DETERMINED BY SUPERINTENDENT DURING CONSTRUCTION, LOCATIONS TO CHANGE DURING CONSTRUCTION

NO EX. BLDGS OR STRUCTURE ON GRADED PORTION OF SITE AT ONSET OF CONSTRUCTION

NO PAST SPILLS OR LEAKAGE

LIST OF CONTRACTORS

THE FOLLOWING CONTRACTORS AND/OR SUBCONTRACTORS HAVE BEEN MADE AWARE OF THE CONDITIONS OF THIS PLAN AND RESPONSIBLE FOR COMPLIANCE OF ITEMS SPECIFIED IN THE GENERAL CONSTRUCTION ACTIVITY STORM WATER PERMIT AS THEY RELATE TO THEIR SPECIFIC MATERIALS AND/OR TASKS.

NAME / COMPANY	SIGNATURE / DATE
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

GENERAL NOTES FOR EROSION CONTROL PLANS:

1. A STAND-BY CREW FOR EMERGENCY WORK SHALL BE AVAILABLE AT ALL TIMES DURING THE RAINY SEASONS (OCTOBER 15 TO APRIL 15). NECESSARY MATERIAL SHALL BE AVAILABLE ONSITE AND STOCKPILED AT CONVENIENT LOCATIONS TO INSURE THE RAPID CONSTRUCTION OF EMERGENCY DEVICES. IN CASE OF AN EMERGENCY, CONTACT: JOHN O'BRIEN AT (714) 200-1653, 24 HOURS A DAY.
2. EROSION CONTROL DEVICES SHOWN ON THIS PLAN MAY ONLY BE REMOVED WHEN APPROVED BY THE CITY ENGINEER IF THE GRADING OPERATION HAS PROGRESSED TO THE POINT WHERE THEY ARE NO LONGER REQUIRED.
3. EXCEPT AS OTHERWISE APPROVED BY THE CITY ENGINEER, ALL DEVICES SHOWN ON THE PLAN SHALL BE IN PLACE AT THE END OF EACH WORKING DAY OR ON WEEKENDS WHEN THE 5 DAY RAIN PROBABILITY FORECAST EXCEEDS 40%.
4. GRADED AREAS ADJACENT TO SLOPES MUST DRAIN AWAY FROM THE TOP OF SLOPE AT THE CONCLUSION OF EACH WORKING DAY WHEN THERE IS A FORECAST RAIN.
5. ALL LOOSE SOIL AND DEBRIS, WHICH MAY CREATE A POTENTIAL HAZARD TO OFFSITE PROPERTY, SHALL BE REMOVED FROM THE SITE.
6. ALL SILT AND DEBRIS SHALL BE REMOVED FROM BEHIND ALL SANDBAGS AND PROPERLY DISPOSED OF WITHIN 24 HOURS AFTER EACH RAINSTORM.
7. DESILTING BASINS SHALL BE DRAINED OR PUMPED DRY WITHIN 24 HOURS AFTER EACH RAINSTORM. SILT AND DEBRIS SHAL BE REMOVED AND PROPERLY DISPOSED OF WHEN THE STORAGE CAPACITY IS MET.
8. THE PLACEMENT OF ADDITIONAL DEVICES TO REDUCE EROSION DAMAGE WITHIN THE SITE IS LEFT TO THE DISCRETION OF THE FIELD ENGINEER.
9. DESILTING BASINS MAY NOT BE REMOVED OR MADE INOPERABLE BETWEEN OCTOBER 15 AND APRIL 15 WITHOUT PRIOR APPROVAL OF THE CITY ENGINEER.
10. THE UNDERSIGNED CIVIL ENGINEER WILL SUPERVISE EROSION CONTROL WORK IN ACCORDANCE WITH THE APPROVED PLANS. THIS INCLUDES, BUT IS NOT LIMITED TO, INSPECTION OF EROSION CONTROL MEASURES BEFORE RAINSTORMS WHEN THERE IS A 5-DAY FORECAST OF RAIN.

SIGNATURE _____ DATE 7/9/03

RCE NO.: 17755
EXP. DATE: 6/30/05

APPROVED FOR EROSION CONTROL ONLY

07/07/03 | BROOKFIELD HOMES – WEST ANAHEM ROUGH GRADING PLANS | PLAN SET: C

USE ONLY filed I-11

GP 2087 D-33

REVISIONS

NO.	INIT.	DATE	DESCRIPTION

BENCH MARK:
1M-4-82 ALUMINUM BENCHMARK DISK SET IN THE SW CORNER OF CATCH BASIN, MONUMENT LOCATED NW OF THE "T" INTERSECTION OF GAIN STREET AND LINCOLN AVENUE

ELEV. 93.378 (NAVD 88)

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FAX (949) 474-5315
Job Number: 308.16

REGISTERED PROFESSIONAL ENGINEER THOMAS A. OSHITA NO. 17388 Exp. 06/30/05 CIVIL STATE OF CALIFORNIA

I hereby certify that:
1) these plans have been prepared under my supervision;

ENGINEER Thomas A. Oshita DATE 7/9/03
THOMAS A. OSHITA R.C.E. NO.17388 EXP. DATE 06/30/05

EROSION CONTROL PLAN
SITE ADDRESS: **TR 16477**
2300-2340 W. LINCOLN AVE.
G R A 2003-02087
SHT. **4** OF **4**
SCALE: AS SHOWN | DRAWN BY: HA | CHECKED BY: TO

CITY OF ANAHEIM D-33

X:\JOHN'STEAM\PROJECT\308\16\GRADING\ROUGH\30816RG04RG.DWG (07-09-03 1:49:18PM) Plotted by: Hugo Escobedo

OTH2020-01325

City of Anaheim
County of Orange/Santa Ana Region
Priority Project
Preliminary Water Quality Management Plan (WQMP)

Project Name:

Townes at Broadway

DEV2020-0018

2323 W. BROADWAY, ANAHEIM, CA 92804

TTM 19137, APN: 127-051-43

Prepared for:

Melia Homes

8951 Research Drive, Suite 100

Irvine, CA 92618

Chad Brown, Vice President of Planning & Development

(949) 759-4367

DEPARTMENT OF PUBLIC WORKS
SUBDIVISIONS
APPROVED
Aram Eftekhari, Associate Engineer
3/29/2021, 5:15:00 PM
OTH2020-01325
Aram Eftekhari

Prepared by:

C&V Consulting, Inc./ Dane McDougall, P.E.

9830 Irvine Center Drive

Irvine, Ca 92630

(949) 916-3800/ dmcdougall@cvc-inc.net

REGISTERED PROFESSIONAL ENGINEER
DANE P. MCDOUGALL
C 80705
CIVIL
STATE OF CALIFORNIA

Prepared December 2020
Revised March 2021

Project Owner's Certification			
Planning Application No. (If applicable)	DEV2020-00180	Grading Permit No.	TBD
		RCP No.	TBD
Tract/Parcel Map and Lot(s) No.	TTM19137, Lot 1	Building Permit No.	TBD
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			2323 W. Broadway Anaheim, CA 92804 APNs: 127-051-43

This Preliminary Water Quality Management Plan (WQMP) has been prepared for Melia Homes by C&V Consulting, Inc. The WQMP is intended to comply with the requirements of the City of Anaheim and County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner: Chad Brown			
Title	Vice President of Planning & Development		
Company	Melia Homes		
Address	8951 Research Drive, Suite 100, Irvine, CA 92618		
Email	chad@melia-homes.com		
Telephone #	(949) 759-4367		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature		Date	

Preparer (Engineer): Dane McDougall, P.E.			
Title	Principal	PE Registration #	80705
Company	C&V Consulting, Inc.		
Address	9830 Irvine Center Drive, Ca 92630		
Email	dmcdougall@cvc-inc.net		
Telephone #	(949) 916-3800		

I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.

Preparer Signature		Date	3/16/21
Place Stamp Here	REGISTERED PROFESSIONAL ENGINEER DANE P. MCDOUGALL C 80705 CIVIL STATE OF CALIFORNIA		

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Attachments

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Attachment B ..... Preliminary WQMP Exhibit
Attachment C ..... Site BMPs
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Attachment E ..... Operations & Maintenance Plan
Attachment F ..... Geotechnical Report & Groundwater Supplemental Letter
Attachment G ..... Notice of Transfer of Responsibility

Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Project Infomation			
Permit/Application No. (If applicable)	DEV2020-00180	Grading Permit No. & RCP No.	TBD
Address of Project Site (or Tract Map and Lot Number if no address) and APN	2323 W. Broadway, Anaheim, CA 92804 TTM: 19137 APN: 127-051-43		
Water Quality Conditions of Approval or Issuance			
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	Conditions of Approval have not been issued at this time. Water Quality Conditions of Approval will be provided in the Final WQMP.		
Conceptual WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	This is a Conceptual WQMP to support entitlement processing.		
Watershed-Based Plan Conditions			
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	Heavy Metals (Technical TMDL[1])		

[1] This TMDL has been adopted for Coyote/San Gabriel River by the Los Angeles Regional Water Quality Control Board (Region 4); however, it applies to the areas of Orange County that drain to Coyote Creek and San Gabriel River

Section II Project Description

II.1 Project Description

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	All significant redevelopment projects, where significant redevelopment is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. If the redevelopment results in the addition or replacement of less than 50 percent of the impervious area on-site and the existing development was not subject to WQMP requirement, the numeric sizing criteria discussed in Section 7.II-2.0 only applies to the addition or replacement area. If the addition or replacement accounts for 50 percent or more of the impervious area, the Project WQMP requirements apply to the entire development.			
Project Area (ft^2): 282,952	Number of Dwelling Units: 112		SIC Code: n/a	
Project Area	Pervious		Impervious	
	Area (square feet)	Percentage	Area (square feet)	Percentage
Pre-Project Conditions	117,002	41%	165,950	59%
Post-Project Conditions**	0	0%	282,952	100%

Drainage Patterns/Connections	The proposed development, referred to as The Townes at Broadway, will consist of 6.49 acres. The existing site is relatively flat. The elevation of the existing site ranges from approximately 104.2′ to 107.8′ above mean sea level. In the current condition, the site generally sheet flows overland in both the westerly and southerly directions. The northerly portion of the site drains in the westerly direction towards existing perimeter walls which have large knockouts to allow stormwater runoff to continue onto W. Transit Avenue. There is an existing 6′ wide x 1′ deep concrete channel located onsite along the westerly property line near the northwest corner of the site that accepts drainage from the Cantada Square development to the north and conveys runoff to W. Transit Avenue and will be maintained as part of this development. No proposed onsite flows will be conveyed to this existing facility. The southern portion of the site (buildings and parking lot) drains in the southerly direction towards the public right-of-way of W. Broadway. Stormwater runoff entering W. Broadway continues to flow west into an existing City of Anaheim public 90″ Reinforced concrete storm drain pipe at the intersection of W. Broadway and S. Gilbert Street. Stormwater runoff from W. Transit Avenue confluences at this location and continues west where it eventually enters the Carbon Creek Channel at S. Dale Avenue. The Carbon Creek Channel eventually confluences with the San Gabriel River and ultimately outlets into the Pacific Ocean at San Pedro Bay. Refer to Attachment D of this report for a copy of the OCFCD Drainage Facilities Maps. The proposed residential development will be divided into three (3) Drainage Management Areas (DMA) which will be graded to match the existing drainage condition. The proposed drainage system will collect and convey stormwater runoff to the proposed biofiltration system designed to treat the design treatment flow rate. During larger storm events, stormwater will overflow within the proposed onsite catch basins and be conveyed offsite via proposed parkway drains which outlet to W. Transit Avenue. For the southern part of the site when the biofiltrations systems are at capacity, larger peak flows will bypass via the Dvert system and/ or internal weir wall to a proposed underground storm drain system, discharging to an existing catch basin within W. Broadway. Refer to Attachment B of this report for the Preliminary WQMP Exhibit. **Post-Project perviousness was assumed to be 100% to produce a conservative value for preliminary design. During final engineering, actual pervious coverage will be calculated as landscape plans become available.

Narrative Project Description: (Use as much space as necessary.)	The proposed 6.49-acre residential site is currently occupied by a school consisting of 5 buildings, associated outdoor recreational areas, and asphalt concrete parking/drive aisles. Existing landscaped areas amount to approximately 41% pervious coverage within this area. Perimeter walls exist along the north, east, and west property lines of the site. The proposed residential development will consist of twenty-two (22) 3-story, multi-family residential buildings which will consist of 112 total units. Units will consist of 2-, 3-, and 4-bedroom layouts and will range in between 1,596 and 1,905 square feet. Associated parking areas will consist of 224 private garages, 99 private open stalls, and 28 guest stalls. In addition, the residential development will include a private drive aisle, recreational areas, sidewalks, and landscaped open-space areas. The drive aisle will be asphalt concrete pavement and sidewalks will be Portland cement concrete (PCC). Landscaped areas are assumed to amount to approximately 20% pervious coverage. During final engineering, actual project perviousness will be calculated. Best Management Practice (BMP) selection for treatment of stormwater has been described in Section IV of this report. Implementation of BMPs will address the pollutants of concern associated with multi-family residential development. No car washing, trash enclosures, outdoor storage or food processing areas will be incorporated on this project. The project will be serviced by onsite private water system and onsite private sanitary sewer system that will be maintained by a homeowner's association. The proposed private water system will have four points of connection to the existing City maintained water line within W. Broadway. The proposed public sewer system will be gravity feed to one of point connection to an existing Orange County Sanitation District trunk main located within W. Broadway. Long-term maintenance is planned to be handled by a Homeowner's Association appointed by Melia Homes. Refer to Attachment B of this report for a copy of the WQMP Exhibit.

II.2 Potential Stormwater Pollutants

Pollutants of Concern			
Pollutant	Check One for each: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	E ☒	N ☐	Expected by proposed landscaped areas.
Nutrients	E ☒	N ☐	Expected by proposed landscaped areas.
Heavy Metals	E ☒	N ☐	Tributary by uncovered parking areas.
Pathogens (Bacteria/Virus)	E ☒	N ☐	Expected by proposed residence and pets.
Pesticides	E ☒	N ☐	Expected by proposed landscaped areas.
Oil and Grease	E ☒	N ☐	Expected by uncovered parking areas.
Toxic Organic Compounds	E ☐	N ☒	Per TGD, Table 2.1 this pollutant is not expected for attached residential developments.
Trash and Debris	E ☒	N ☐	Expected by proposed residence.

II.3 Hydrologic Conditions of Concern

☒ No – Show map

☐ Yes – Describe applicable hydrologic conditions of concern below.

Per the TGD Figure 1, Susceptibility Analysis of San Gabriel-Coyote Creek dated February 2013, the project site is indicated as a potential area of erosion, habitat, and physical structure susceptibility. The project site indirectly drains to the San Gabriel River, however it is downstream of the unstable portion of the river. Therefore, HCOCs do not exist. Refer to Attachment A for a the TGD Figure.

II.4 Post Development Drainage Characteristics

Post–development drainage will be consistent with a proposed attached Multi-Family Residential project. The tributary areas and direction of run-off flows for the proposed site are delineated on the attached WQMP Exhibit based on the grading and drainage design. Refer to the Preliminary WQMP Exhibit in Attachment B of this report.

In the current condition, the site generally sheet flows overland in both the westerly and southerly directions. The northerly portion of the site drains in the westerly direction towards existing perimeter walls which have large knockouts to allow stormwater runoff to continue onto W. Transit Avenue. There is an existing 6′ wide x 1′ deep concrete channel located onsite along the westerly property line near the northwest corner of the site that accepts drainage from the Cantada Square development to the north and conveys runoff to W. Transit Avenue and will be maintained in place. The southern portion of the site (buildings and parking lot) drains in the southerly direction towards the public right-of-way of W. Broadway. Stormwater runoff entering W. Broadway continues to flow west into an existing City of Anaheim public 90″ Reinforced concrete storm drain pipe at the intersection of W. Broadway and S. Gilbert Street. Stormwater runoff from W. Transit Avenue confluences at this location and continues west where it eventually enters the Carbon Creek Channel at S. Dale Avenue. The Carbon Creek Channel eventually confluences with the San Gabriel River and ultimately outlets into the Pacific Ocean at San Pedro Bay.

Proposed drainage runoff will be collected by a series of area drains and by proposed sump curb inlet catch basins within the proposed private drive aisle and conveyed to three Modular Wetlands Systems (MWS) Biofiltration vaults. During larger storm events, stormwater will overflow within the proposed catch basins and be conveyed offsite via proposed parkway drains along the western boundary of the project site. For the southern part of the site when the biofiltration systems are at capacity, stormwater will overflow into a catch basin in W. Broadway. As part of the proposed development, the catch basins onsite will be equipped with storm drain signage and a catch basin trash rack and/or filter that comply with certified full capture system requirements.

The proposed drainage pattern matches the existing historical drainage pattern from the site. Runoff from this area historically flows in the westerly direction and ultimately enters Carbon Creek Channel which flows in the southeasterly direction towards the Pacific Ocean.

II.5 Property Ownership/Management

The property is currently owned by Melia Homes. The Owner will be responsible for the long-term maintenance of the project's storm water facilities and conformance to this WQMP after construction is complete.

A Notice of Transfer of Responsibility is located in Attachment G of this report and should be executed as part of any ownership transfer after construction is complete.

Melia Homes will appoint a Homeowner's Association (HOA) to provide long term BMP maintenance for the proposed development. Refer to Section V of this report for additional information.

Section III Site Description

III.1 Physical Setting

Name of Planned Community/Planning Area (if applicable)	City of Anaheim
Location/Address	2323 W. Broadway
	Anaheim, CA 92804
General Plan Land Use Designation	Low-Medium Density
Existing Zoning	Transitional, T
Proposed Zoning	Multi-Family Residential, RM-3
Acreage of Project Site	6.49 acres
Predominant Soil Type	Per TGD, Figure XVI-2a, NRCS Hydrologic Soils Groups the site is located within Soil Type B. Refer to Attachment A of this report for a copy of the map. **For site specific soil information, refer to Section III.2 and Attachment F of this report.**

III.2 Site Characteristics

Site Characteristics	
Precipitation Zone	The site falls under the 0.90" per the TGD, Figure XVI-1, Rainfall Zones map. Refer to Attachment A of this report for a copy of the map.
Topography	The site topography is relatively flat and sheet flows towards the project's southern and western boundaries. The site ranges in elevations from approximately 104.2' to 107.8'.
Drainage Patterns/Connections	The existing site is currently occupied by a school and has approximately 41% pervious cover. The existing site sheet flows overland towards the project's southern and western perimeter. The northerly portion of the site drains toward the perimeter wall on the westerly property line. The perimeter wall has large knockouts to allow for stormwater runoff to pass through and onto Transit Avenue. The southern portion of the site drains south towards the public right of way of W. Broadway. Stormwater runoff entering W. Broadway flows west to an existing city 90" Reinforced Concrete Pipe at the intersection of Broadway and Gilbert Street. At this location, stormwater runoff from Transit Avenue confluences and continues west within the storm drain in W. Broadway until it enters the Carbon Creek Channel at S. Dale Avenue. The proposed development will maintain the existing drainage condition.
Soil Type, Geology, and Infiltration Properties	Per the Geotechnical and Infiltration Evaluation prepared by GeoTek, Inc. dated October 29, 2020, the site's geotechnical properties are described as the following: "Undocumented fill was encountered in all exploratory borings to approximately two to three feet below the existing ground surface. The fill consisted of brown, moist silty sand, sandy clay, and sandy silt." "Young alluvial fan deposits were encountered in our borings below the fill and extended to the maximum depth explored of about 51.5 feet. The young alluvial fan deposits encountered consisted of interbedded units of silty sand, poorly graded sand, clayey sand, sandy silt, and clay. The alluvium was brown to tan in color, slightly moist to moist, and loose/soft to medium dense/stiff to the total depth explored, based on our field observations, blow counts, and in-place density determination. Collapse tests conducted on the most unfavorable units of the alluvium (selected based on blow counts and in-place soil density) indicated a negligible potential for collapse upon application of water and load. The near surface site soils were found to have "low" expansion potential when tested and classified in accordance with ASTM D 4829." Refer to Attachment F of this report for a copy of the geotechnical report.

	Per correspondence from Orange County Water District (OCWD) regarding infiltration feasibility for this site, it was deemed infeasible due to the potential trajectory of the North Basin Groundwater Plume towards the site. Refer to Attachment A of this report for the Infiltration Feasibility Worksheet and email correspondence with OCWD.
Hydrogeologic (Groundwater) Conditions	Per the Geotechnical and Infiltration Evaluation prepared by GeoTek, Inc. dated October 29, 2020, the site's groundwater conditions are described as the following: "Groundwater was not encountered in the deepest exploratory boring, Boring B-1, excavated at the site. Open hole measurements performed at the end of CPT soundings encountered groundwater at 46 feet in both CPT-1 and -2. CPT-3 and -4 holes collapsed, so no groundwater measurements were taken. Our review of the Historically Highest Groundwater Map published within the Seismic Hazard Zone Report for the Anaheim and Newport Beach Quadrangles (California Department of Conservation, 1997) reveal past high groundwater levels on the order of 35 to 40 feet in the general area of the site. The GeoTracker database shows several properties located within one-third of a mile from the site, with depth to groundwater ranging from 46 to 80 feet. This information agrees with the groundwater levels recorded during our field investigation. Perched groundwater or localized seepage can occur due to variations in rainfall, irrigation practices, and other factors not evident at the time of this investigation." Per additional research on the GeoTracker database, there are no known contaminated sites within 250 feet of the project site. Refer to Attachment D for a copy of the project site located on the GeoTracker map. Per correspondence from Orange County Water District (OCWD) regarding infiltration feasibility for this site, it was deemed infeasible due to the potential trajectory of the North Basin Groundwater Plume towards the site. Refer to Attachment A of this report for the Infiltration Feasibility Worksheet and email correspondence with OCWD.
Geotechnical Conditions (relevant to infiltration)	Per the Geotechnical and Infiltration Evaluation prepared by GeoTek, Inc. dated October 29, 2020, the site's geotechnical infiltration properties are described as the following: "Percolation testing was performed at boring locations P-1 through P-3 to assess the infiltration characteristics of the site soils underlying future storm water system areas. Test locations were chosen by the project civil engineer. The borings were excavated to approximately five feet below the existing grade,

<table>
<tr><td></td><td>which was assumed to be the approximate invert depth of the infiltration systems. The boring diameter was approximately eight inches. Percolation testing was performed within the lower approximately 24 inches in the borings by a representative of our firm, in general conformance with the Boring Percolation Test Procedure outlined in the Technical Guidance Document Appendix VII (Orange County, 2011). As required, the percolation rates were corrected to account for discharge of water from both the sides and bottom of the borings. This correction was done using the Porchet Method, obtaining the infiltration rates tabulated below:

<table>
<tr><th colspan="2">SUMMARY OF RESULTS</th></tr>
<tr><th>Boring</th><th>Measured Infiltration Rate (inches per hour)</th></tr>
<tr><td>P-1</td><td>1.7</td></tr>
<tr><td>P-2</td><td>2.2</td></tr>
<tr><td>P-3</td><td>0.6</td></tr>
</table>
A suitable factor of safety should be applied to the measured rates to design the infiltration system. Detailed percolation/infiltration test data is included in Appendix D. It also should be noted that in the area of P-3, the soils tested were very moist prior to testing. The resulting infiltration rate for this hole was relatively slow. It is our opinion that the infiltration rates measured in borings P-1 and P-2 are more representative of the site as a whole, as the near surface soil conditions are otherwise very similar."

Per correspondence from Orange County Water District (OCWD) regarding infiltration feasibility for this site, it was deemed infeasible due to the potential trajectory of the North Basin Groundwater Plume towards the site. Refer to Attachment A of this report for the Infiltration Feasibility Worksheet and email correspondence with OCWD.</td></tr>
<tr><td>Off-Site Drainage</td><td>No off-site drainage enters the property.</td></tr>
<tr><td>Utility and Infrastructure Information</td><td>Utilities are proposed to be underground. No special setbacks are needed or proposed. Proposed domestic water, storm drain, sanitary sewer and underground fire water system will be private and maintained by the appointed HOA.</td></tr>
</table>

III.3 Watershed Description

Receiving Waters	Site runoff drains towards the surrounding rights-of-way of the site and enters the existing Carbon Creek Channel. Carbon Creek Channel conveys all site runoff in the southwesterly direction and converges with Coyote Creek which drains to San Gabriel River and eventually the Pacific Ocean at San Pedro Bay. The site is located within the San Gabriel-Coyote Creek Watershed.
303(d) Listed Impairments	**Carbon Canyon Creek –** n/a **Coyote Creek –** Ammonia, Dissolved Copper, Diazinon, Indicator Bacteria, Lead, pH, Toxicity **San Gabriel River, Reach 1 –** Coliform Bacteria, pH **San Gabriel River Estuary –** Copper, Dioxin, Nickel, Dissolved Oxygen**,** **San Pedro Bay –** Chlordane, DDT, PCBs, Sediment Toxicity
Applicable TMDLs	**Carbon Canyon Creek –** Chloride, Sulfates **Coyote Creek –** Abnormal Fish, Aluminum, Ammonia, Chloride, Dissolved Copper, Cyanide, Diazinon, Excess Algal Growth, Fluoride, Indicator Bacteria, Lead, Lindane/gamma Hexachlorocyclohexane, Nitrite Nitrogen, Dissolved Oxygen, Pentachlorophenol, pH, Selenium, Toxicity, Zinc **San Gabriel River, Reach 1 –** Abnormal Fish, Ammonia, Coliform Bacteria, Excess Algal Growth, pH, Toxicity **San Gabriel River Estuary –** Abnormal Fish, Ammonia as Nitrogen, Copper, Dioxin, Nickel, Dissolved Oxygen **San Pedro Bay –** Chlordane, Chromium, Copper, DDT, PAHs, PCBs, Sediment Toxicity, Zinc
Pollutants of Concern for the Project	Anticipated and Potential Pollutants of Concern for Attached Residential Development is Suspended Solid/Sediments, Nutrients, Heavy Metals, Pathogens (Bacteria/Virus), Pesticides, Oil & Grease and Trash & Debris.
Environmentally Sensitive and Special Biological Significant Areas	The project is not located within any known Environmentally Sensitive Areas (ESA) or Areas of Special Biological Significance (ASBS).

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

(NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?	YES ☐	NO ☒
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.	There are currently no approved WIHMPs for the Santa Ana Region.	

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	Per 7.II-2.4.2.2 of the MWQMP, HCOCs exist when the proposed condition of the site generates a decrease in the time of concentration beyond 5% and an increase in runoff volume beyond 5% for the 2-year storm event, thus potentially increasing downstream erosion. Since the project proposes to utilize infiltration BMPs which will infiltrate a volume that is greater than the increase in runoff volume, the project will not contribute to erosion of downstream drainage facilities. In addition, although the project site drains to the San Gabriel River, the site is located downstream of the unstable portion of the river.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	According to Section 7.II-2.4.3 of the MWQMP Priority Projects must biotreat/biofilter the 85th percentile, 24-hour storm event (Design Capture Volume). A properly designed biotreatment system may only be considered if infiltration, harvest and use, and evapotranspiration (ET) cannot be feasibly implemented for the full design capture volume. In this case, infiltration, harvest and use, and ET practices must be implemented to the greatest extent feasible and biotreatment be provided for the remaining design capture. This project proposes to utilize biotreatment BMPs to treat the required stormwater runoff flow rate. Per correspondence from Orange County Water District (OCWD) regarding infiltration feasibility for this site, it was deemed infeasible due to the potential trajectory of the North Basin Groundwater Plume towards the site. Refer to Attachment A of this report for the Infiltration Feasibility Worksheet and email correspondence with OCWD.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or off-site prior to discharge to waters of the US. Since the project proposes to satisfy LID performance criteria, therefore treatment control performance criteria is also fully satisfied. Sizing of treatment control BMPs (Biofiltration Systems) shall be based flow-based for the area being redeveloped to medium and high effectiveness for reducing the primary pollutants of concern, which will be considered in compliance. Refer to Attachment C for manufacturer's specifications for the proposed biotreatment BMPs. Refer to Section IV.3.4, Biotreatment BMPs for additional information regarding BMP selection.
Calculate LID design storm capture volume for Project.	Biotreatment BMPs will be utilized for treatment of the required flow rate. The proposed project residential site will generate a total DCV of 19,112 cf. The DCV for each DMA was calculated as follows: DMA 1: V_{design} = 0.75*1.0*1.5 acres*43,560 (sf/acre)*(1 foot/12 inches) = 4,416 cf DMA 2: V_{design} = 0.75*1.0*2.22 acres*43,560 (sf/acre)*(1 foot/12 inches) = 6,540 cf DMA 2: V_{design} = 0.75*1.0*2.77 acres*43,560 (sf/acre)*(1 foot/12 inches) = 8,144 cf

	Due to infiltration being infeasible at the site, biofiltration vaults will treat the required water quality design flow rate. The site will generate a total water quality design flowrate of 1.52 cfs. DMA 1: Q_{design} = 0.90*0.26 (in/hr)*1.50 acres = 0.351 cfs DMA 2: Q_{design} = 0.90*0.26 (in/hr)*2.22 acres= 0.520 cfs DMA 3: Q_{design} = 0.90*0.26 (in/hr)*2.77 acres= 0.648 cfs See Attachment A of this report for DCV and treatment flow rate calculations.

IV.2. Site Design and Drainage

The site proposes three (3) Drainage Management Areas as indicated on the Preliminary WQMP Exhibit. The DMAs are based on the Preliminary Grading and Drainage design. Each DMA will have an area drain system to collect and convey runoff from landscape, surface and roof drainage to the proposed treatment devices. Pervious coverages located throughout the site will promote impervious area dispersion from roof and sidewalk runoff.

Street surface runoff will be collected and conveyed through a curb inlet catch basins equipped with a Dvert System that will divert low flows to proposed Modular Wetlands System (MWS) Biofiltration vaults for water quality treatment. During larger storm events when the proposed biofiltration BMPs are at capacity, stormwater will pond within the catch basins which overflow through proposed parkway culverts or the existing catch basin in W. Broadway.

The Modular Wetland System (MWS) Biofiltration vaults are designed to provide a 3-phase treatment train. Initially, when the stormwater enters the system, a trash rack, filter media and settling chamber will capture large trash/ debris and sediment in the stormwater before entering the planting media. This system is designed to treat stormwater flow horizontally. Before the stormwater enters the planting or "wetland" chamber, the runoff flows through the 2nd phase, a pre-filter cartridge which captures fines TSS, metals, nutrients and bacteria. The pre-filter chamber eliminates additional maintenance of the planting area. The wetland chamber is the 3rd phase of the system which provides final treatment through a combination of physical, chemical and biological processes. Refer to Section IV.3.4 of this report for sizing information of the Biofiltration Vaults.

Refer the WQMP Exhibit in Attachment B for the location of the proposed BMPs. Refer to Attachment C for manufacturer's specifications of the selected BMPs.

IV.3 LID BMP Selection and Project Conformance Analysis

IV.3.1 Hydrologic Source Controls (HSCs)

The full Design Capture Volume (DCV) is being treated with LID BMPs, therefore HSCs are not proposed.

Name	Included?
Localized on-lot infiltration	☐
Impervious area dispersion (e.g. roof top disconnection)	☐
Street trees (canopy interception)	☐
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Blue roofs	☐
Impervious area reduction (e.g. permeable pavers, site design)	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐

** The entire DCV will be treated with an LID BMP, therefore HSC BMPs are not required.*

IV.3.2 Infiltration BMPs

Name	Included?
Bioretention without underdrains	☐
Rain gardens	☐
Porous landscaping	☐
Infiltration planters	☐
Retention swales	☐
Infiltration trenches	☐
Infiltration basins	☐
Drywells	☐
Subsurface infiltration galleries	☒
French drains	☐
Permeable asphalt	☐
Permeable concrete	☐
Permeable concrete pavers	☐
Other:	☐

Per correspondence from Orange County Water District (OCWD) regarding infiltration feasibility for this site, it was deemed infeasible due to the potential trajectory of the North Basin Groundwater Plume towards the site. Refer to Attachment A of this report for the Infiltration Feasibility Worksheet and email correspondence with OCWD.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

Name	Included?
All HSCs; *See Section IV.3.1*	☐
Surface-based infiltration BMPs	☐
Biotreatment BMPs	☐
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

Evapotranspiration, Rainwater Harvesting BMPs will not be utilized and have been determined to be infeasible for this site due to development type, density and available amount of landscaped area for irrigation purposes. Refer to Worksheet J for feasibility calculations within Attachment A of this report.

IV.3.4 Biotreatment BMPs

Name	Included?
Bioretention with underdrains	☐
Stormwater planter boxes with underdrains	☐
Rain gardens with underdrains	☐
Constructed wetlands	☐
Vegetated swales	☐
Vegetated filter strips	☐
Proprietary vegetated biotreatment systems	☒
Wet extended detention basin	☐
Dry extended detention basins	☐
Other:	☐

Modular Wetland System (MWS) Biofiltration vaults will be utilized to treat the design capture volume using the treatment flow rate method per the Orange County Technical Guidance Document worksheets. The MWS Biofiltration vaults utilize a 3-phase treatment train by collecting the stormwater runoff in a Pre-Treatment Chamber, Planting or "Wetland" Chamber and Discharge Chamber.

The MWS Biofiltration vaults were sized separately per DMA. Refer to Worksheet D in Attachment A for calculations.

DMA	Acreage Tributary to Proposed Catch Basins (ac)	Required Treatment Flow Rate, Q (cfs)	MWS Model	Treatment Capacity, Q (cfs)
1	1.502	0.351	MWS-L-8-12-V*	0.346
2	2.224	0.520	MWS-L-8-16-C*	0.462
3	2.770	0.648	MWS-L-8-20-V*	0.577
Total	6.496	1.519		1.385

** High flow capacity models will be implemented*

***Project-specific details will be provided during final engineering. Refer to Attachment C for additional manufacturer information.*

Conclusion:
The utilization of a MWS Biofiltration vault at the three (3) proposed catch basins will provide more than the required treatment flow rate for their tributary drainage areas.

N/E Coordinates of Modular Wetlands Systems:
DMA 1 Modular Wetland System: 6040931.5306E, 2250043.7983N
DMA 2 Modular Wetland System: 6040960.4715E, 2249546.9826N
DMA 3 Modular Wetland System: 6041212.7753E, 2249549.6858N

IV.3.5 Hydromodification Control BMPs

Hydromodification Control BMPs	
BMP Name	**BMP Description**
n/a	n/a

IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub-Regional LID BMPs
Not Applicable for this project.

IV.3.7 Treatment Control BMPs

Treatment Control BMPs	
BMP Name	**BMP Description**
Connector Pipe Screen (CPS) Device	The proposed onsite catch basins in DMAs 1 and 2 will be equipped with a Connector Pipe Screen (CPS) device sized for the 1-year 1-hour storm event for the area located on W. Broadway tributary to the existing public catch basin.
Automatic Retractable Screen (ARS) Device	The proposed catch basin adjacent to Transit Avenue on the westerly side of the site will be equipped with an Automatic Retractable Screen (ARS) sized for the 1 year 1 hour storm event. Refer to Attachment C for manufacturer information.

IV.3.8 Non-structural Source Control BMPs

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	
N6	Local Industrial Permit Compliance	☐	☒	Proposed residential project.
N7	Spill Contingency Plan	☐	☒	Proposed residential project.
N8	Underground Storage Tank Compliance	☐	☒	Proposed residential project.
N9	Hazardous Materials Disclosure Compliance	☒	☐	
N10	Uniform Fire Code Implementation	☒	☐	
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	Proposed residential project.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Proposed residential project.

N1: Education for Property Owners, Tenants & Occupants

Project conditions of approval will require that the Homeowner's Association (HOA) periodically provide environmental awarness education materials, made available by the municipalities, to all of its members. Among other things, these materials will be descrive the use of chemcials (including household type) that should be limited to the property, with no discharge of wastes via hosing or other direct discharge to gutters, catch basins and storm drains. Educational materials available from the County of Orange can be downloaded here:

http://www.ocwatersheds.com/PublicEd/resources/default.aspx

N2: Activity Restrictions

Conditions, covenants and restrictions (CC&Rs) must be prepared by the developer for the appointed HOA for the purpose of surface water quality protection. The CC&Rs shall incorporate the restrictions based on the Project WQMP.

N3: Common Area Landscape Management

All common landscaping and/ or open space areas shall have on-going landscape maintenance by an appointed professional landscaping maintenance company as selected by the HOA. Maintenance shall incorporate all current County Water Conservation Resolution usage and follow the Management Guidelines for Use of Fertilizers per the DAMP Section 5.5. Refer to Section 5 of this report for additional landscape maintenance requirements.

N4: BMP Maintenance

Refer to Section 5 and Attachment E of this report for additional non-structural BMP maintenance requirements, responsibility and frequency.

N5: Title 22 CCR Compliance

HOA is responsible for compliance with Title 22 of the California Code of Regulations (CCR) and relevant sections of the California Health & Safety Code regarding hazardous waste management is enforced by the County Environmental Heath and behalf of the State. Inforamtion regarding hazardous waste management must be provided to all employees, homeowners, tenants and occupants.

N9: Hazardous Materials Disclosure Compliance

HOA is responsible for compliance with the local agencies' ordinances enforced by City Fire Department for the management of hazardous materials including enforcement, waste handling, disposal regulations and documentation.

N10: Uniform Fire Code Implementation

HOA is responsible for compliance with Article 80 of the Uniform Fire Code enforced by the local fire protection agency.

N11: Common Area Litter Control

HOA to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. HOA to contract with landscape maintenance company to provide this service during regularly scheduled maintenance, which will consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposals violations by homeowners, tenants or occupants and reporting the violations to the HOA for investigation.

N12: Employee Training

HOA to provide Educational Materials and Property Management manuals to all employees upon initial hiring. Any updated information shall be provided to employees within a timely manner along with information on implementation.

N14: Common Area Catch Basin Inspections

HOA to inspect, clean and repair common area catch basins within the development to verify that the private drainage system is working properly. All trash/ debris and sediment build up is removed and any repairs/ replacements are conducted. Cleaning should take place in late summer/ early fall prior to the start of the raining season. Drainage facilities include catch basins (storm drain inlets), detention basins, retention basins, sediment basins, open drainage channels, area drains, and lift stations. Records shall be kept onsite to document the annual maintenance.

N15: Street Sweeping of Private Streets & Parking Lots

HOA to schedule at a minimum street sweeping of private streets and parking areas prior to the start of the rainy seasons, in late summer or early fall. Additional sweeping may be required to remove landscaping foliage and/ or pollution.

IV.3.9 Structural Source Control BMPs

Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No proposed outdoor storage areas.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	No proposed trash enclosure areas.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	No proposed slopes or channels.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	Not Applicable.
S6	Dock areas	☐	☒	No proposed dock areas.
S7	Maintenance bays	☐	☒	No proposed maintenance bay areas.
S8	Vehicle wash areas	☐	☒	No proposed vehicle wash areas.
S9	Outdoor processing areas	☐	☒	No proposed outdoor processing areas.
S10	Equipment wash areas	☐	☒	No proposed equipment wash areas.
S11	Fueling areas	☐	☒	No proposed fueling areas.
S12	Hillside landscaping	☐	☒	No proposed hillside landscaping areas.
S13	Wash water control for food preparation areas	☐	☒	No wash water control for food preparation areas.
S14	Community car wash racks	☐	☒	No proposed community car washing racks.

S1 (CASQA Fact Sheet SD-13): Storm Drain Stenciling & Signage

HOA to inspect, repair and/ or replace storm drain stenciling and signage immediately. Inspection of stenciling and signage shall occur at least once per month and prior to the start of the raining season. Storm Drain stenciling and signage with a reference that indicates "Drains to Ocean" per CASQA BMP SD-13 Fact Sheet is required.

S4 (CASQA Fact Sheet SD-12): Use Efficient Irrigation Systems & Landscape Design

HOA shall implement the timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm drain systems. HOA to implement the following methods to reduce excessive irrigation water runoff, where applicable:

- Employ rain shutoff devices to prevent irrigation after precipitation
- Utilizing landscape specific irrigation water requirements
- Utilize flow reducers or shutoff valves triggered by pressure drop to control water loss due to broken sprinkler heads
- Implement landscaping practices per the County Water Conservation Resolution or City agency equivalent
- Group plants or landscaping with similar water consumption in order to promote surface infiltration

Refer to CASQA BMP Fact Sheet SD-12 for additional information.

IV.4 Alternative Compliance Plan (Not Applicable)

IV.4.1 Water Quality Credits

<table>
<tr><th colspan="5">Description of Proposed Project</th></tr>
<tr><td colspan="5">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr><td colspan="2">☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="2">☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.</td><td>☐ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).</td></tr>
<tr><td colspan="2">☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).</td><td colspan="2">☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned</td><td>☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).</td></tr>
<tr><td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td><td>☐ Developments in a city center area.</td><td>☐ Developments in historic districts or historic preservation areas.</td><td>☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.</td><td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td></tr>
<tr><td>Calculation of Water Quality Credits
(if applicable)</td><td colspan="4">Water Quality credits will not be utilized on this development site.</td></tr>
</table>

IV.4.2 Alternative Compliance Plan Information

Not applicable for this project.

Section V Inspection/Maintenance Responsibility for BMPs

The property is currently owned by Melia Homes. The Owner will be responsible for the long-term maintenance of the project's storm water facilities and conformance to this WQMP after construction is complete.

A Notice of Transfer of Responsibility is located in Attachment G of this report and should be executed as part of any ownership transfer after construction is complete.

The owner will appoint a Homeowner's Association (HOA) to provide long term BMP maintenance for the proposed development upon completion of construction.

Owner/ Developer:
Melia Homes
8951 Research Drive, Suite 100
Irvine, CA 92618
(949) 759-4367
Chad Brown, Vice President of Planning & Development

Homeowner's Association
To be determined

The owner is aware of the maintenance responsibilities of the proposed BMPs. A funding mechanism is in place to maintain the BMPs at the frequency stated in the WQMP.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Education for Property Owners, Tenants, Occupants & Employees	Homeowner's Association (HOA)	HOA to provide education material, a copy of the approved WQMP and Operation & Maintenance Plan (O&M) to new property owners, tenants, occupants & employees.	At time of hiring, leasing and/ or home purchase.
Activity Restrictions	HOA	HOA employees notified of activities that are prohibited by homeowners.	Restrictions identified in Employee Manual and reviewed yearly by employees.
Common Area Landscape Management	HOA	HOA to hire professional landscape company to conduct maintenance of landscaping to meet current water efficiency and keep plants healthy and bio areas maintained with proper soil amendments.	Regular maintenance once a week and monthly inspection to determine deficiencies.
BMP Maintenance	HOA	HOA to hire professional BMP maintenance company to conduct regular inspections, repairs and cleanings per manufacturer's specifications.	A minimum 2 inspections/ cleanings per year per manufacturer's specifications prior to October 1st (before rainy season)
Title 22 CCR Compliance	HOA	The distribution of these materials will be the responsibility of the HOA at the time of hire, lease signing or home purchase per property owner, tenant	At time of hiring, leasing and/ or home purchase.

		or occupant or at the initial time of hiring.	
Uniform Fire Code Implementation	HOA	HOA to comply with fire regulations and keep informed of the latest rules and requirements.	Comply with annual fire inspections and maintain building and access per the latest fire codes.
Common Area Litter Control	HOA	HOA to provide litter removal of site parking lot and landscape areas and to empty common area trash bins.	Once per week.
Employee Training	HOA	The distribution of these materials will be the reasonability of the HOA at the initial hiring of the employee.	At time of hiring.
Private Street & Parking Lot Sweeping	HOA	HOA to provide maintenance of Parking Lot and provide Street Sweeping services.	Weekly basis.
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	HOA	HOA to provide maintenance of landscaping to meet current water efficiency standards, and keep plants healthily.	Regular maintenance once a week and monthly inspection to determine any water deficiencies.
Common Area Catch Basin Inspections	HOA	HOA shall inspection common areas where catch basins are located within the surrounding area and remove any trash/ debris.	Inspections/ Cleaning shall occur at least twice per month.

Storm Drain System Stencilling & Signage	HOA	HOA to inspect and repair as needed all onsite storm drain stencilling & signage.	Inspection should occur at minimum twice per year.
Modular Wetlands System (MWS) Biofiltration Vaults	HOA	HOA will be required to hire a professional maintenance company to provide regular inspections, repairs and cleaning per manufacturer's specifications.	Inspections/ Cleanings should occur at least two times per year and before the start of the rainy season (October 1st). Refer to Attachment C for additional information and manufacturer's specifications.
Modular Trough Diversion System	HOA	HOA to inspect system and schedule maintenance when deficiencies are noted. Area near system to be kept free of debris and cleanings shall be scheduled to remove silt from trough as needed	Inspections should occur at least two times per year and before the start of the rainy season (October 1st).
Automatic Retractable Screen (ARS) Device	HOA	HOA to inspect and schedule maintenance to remove debris bluid-up, repair/ replace screen and mechanism, and clean as needed within catch basin and screen area.	Inspections shall occur at least two times per year and once per year for maintenance services before the start of the rainy season (October 1st).
Connector Pipe Screen (CPS) Device	HOA	HOA to inspect and schedule maintenance to remove debris bluid-up, repair/ replace screen and mechanism, and clean as needed within catch basin and screen area.	Inspections shall occur at least two times per year and once per year for maintenance services before the start of the rainy season (October 1st).

Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

Refer to Attachment B of this report for the WQMP Exhibit which provides the location of all proposed BMPs and a site plan of the project.

VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) will be submitted.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) will be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

Section VII Educational Materials

Refer to the Orange County Stormwater Program (www.ocwatersheds.com) for a library of materials available.

Education Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☒	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☒	Proper Maintenance Practices for Your Business	☐
Household Tips	☒	**Other Material**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☒		
Recycle at Your Local Used Oil Collection Center (North County)	☒		☐
Recycle at Your Local Used Oil Collection Center (Central County)	☐		☐
Recycle at Your Local Used Oil Collection Center (South County)	☐		☐
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☒		☐
Sewer Spill	☒		☐
Tips for the Home Improvement Projects	☒		☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☒		☐
Tips for Pet Care	☒		☐
Tips for Pool Maintenance	☐		☐
Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☒		☐

Attachment A

TGD Worksheets and Figures

Table 2.7: Infiltration BMP Feasibility Worksheet

	Infeasibility Criteria	*Yes*	*No*
1	**Would Infiltration BMPs pose significant risk for groundwater related concerns?** Refer to Appendix VII (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria.	X	
Provide basis: Per correspondence from Orange County Water District (OCWD) regarding infiltration feasibility for this site, it was deemed infeasible due to the potential trajectory of the North Basin Groundwater Plume towards the site. Refer to Attachment A of this report for the Infiltration Feasibility Worksheet and email correspondence with OCWD.			
2	Would Infiltration BMPs **pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level**? (Yes if the answer to any of the following questions is yes, as established by a geotechnical expert): • The BMP can only be located less than 50 feet away from slopes steeper than 15 percent • The BMP can only be located less than eight feet from building foundations or an alternative setback. • A study prepared by a geotechnical professional or an available watershed study substantiates that stormwater infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level.		X
Provide basis:			
3	Would infiltration of the DCV from drainage area **violate downstream water rights**?		X
Provide basis:			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

	Partial Infeasibility Criteria	***Yes***	***No***
4	Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils?		X
Provide basis:			
5	Is **measured infiltration rate below proposed facility less than 0.3 inches per hour**? This calculation shall be based on the methods described in Appendix VII.		X
Provide basis:			
6	Would **reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:			
7	Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

Infiltration Screening Results (check box corresponding to result):		
8	Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See Appendix XVII) Provide narrative discussion and supporting evidence:	No
9	If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent. Provide basis:	Yes
10	If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis:	No
11	If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable.	Infiltration is Feasible

Sarah Pfeifer

From: Howard Wen <hwen@fuscoe.com>
Sent: Monday, February 22, 2021 2:48 PM
To: Joy Hendricks
Subject: RE: Townes at Broadway, Anaheim OTH2020-01325 PC2 is "Approvable". Final Approval Pending corrections/resubmittal

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Joy,

Some unfortunate news came back from OCWD for infiltration. They recommend to avoid infiltration at the subject property. Their findings are below:

EPA recently released an updated North Basin Plume Map (2018). The updated map should be posted to our website in a few weeks. Because of the projects proximately to the North Basin Plume I consulted our Geologists most familiar with the North Basin Plume. Below is a summary of his concerns:

Although this project is not within the updated plume boundaries, based on a lack of available data the exact extent and trajectory of the North Basin Plume, particularly on the leading edge, is still being assessed.

Due to this uncertainty his recommendation would be to avoid infiltration at this location.

Please contact me to discuss the approval of this project.

Regards,

Howard.

HOWARD WEN, CPSWQ, QSD | *Senior Project Manager*
hwen@fuscoe.com

FUSCOE ENGINEERING, INC.
an employee owned company

16795 Von Karman, Suite 100, Irvine, CA 92606
949.474.1960 | fuscoe.com
mobile: 949.537.8712

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From: Howard Wen
Sent: Friday, February 19, 2021 2:29 PM
To: Joy Hendricks <jhendricks@cvc-inc.net>
Cc: Aram Eftekhari (AEftekhari@anaheim.net) <AEftekhari@anaheim.net>; Keith Linker - City of Anaheim

(klinker@anaheim.net) <klinker@anaheim.net>; Mostafa Komaee (dslconsultinginc@yahoo.com) <dslconsultinginc@yahoo.com>
Subject: Townes at Broadway, Anaheim OTH2020-01325 PC2 is "Approvable". Final Approval Pending corrections/resubmittal

Good afternoon Joy,

Regarding the Preliminary WQMP for 2323 W. Broadway (OTH2020-01325), the WQMP is “approvable” pending the inclusion of the items listed below. Also, the infiltration BMPs for the project are currently under review by OCWD and we anticipate that the review will be concluded next week. We will not formally approve the PWQMP before the conclusion of this review. Please note that this most recent submittal in EPR will be marked as “CORRECTIONS”; however, the next submittal will be “APPROVED” as long as it addresses the items below:

- Please include updated signed Engineer’s Certification Pages reflecting the most recent revision date. Owner Certification is not required for the PWQMP, but the Engineer’s is.
- Please remove the Trash CPS Full Capture Device at the public catch basin on W. Broadway and replace with CPS at the two private catch basins in DMAs 1 and 2. Adjust the narrative and O&M Plan, accordingly.
- Please provide sufficient detail to demonstrate how CPS at DMA 3 catch basin would capture trash and not allow it to discharge off-site through the parkway drain. It is unclear whether the proposed design would achieve this.

Once these items are included in the PWQMP, the applicant should follow the City’s standard E-Plan Check submittal process (for any questions, please contact PWEPC@anaheim.net). *Electronic PDF versions of the Final Approved WQMP should be compiled directly from the original electronic source files (.docx, .dwg, etc.) to preserve integrity and quality, minimize file size and allow search functionality. Scanned versions of the final report will not be accepted with the exception of the signed Owner’s Certification page, the signed Engineer’s Certification page and the approved Cover Page. Please submit via web-based file transfer or via email (only if file is smaller than 10 MB) to Fuscoe Engineering Plan Checker. The Plan Checker will confirm receipt of WQMP via email.*

In addition, in order to expedite the review, please also email an electronic copy of the PWQMP to the Fuscoe Engineering Plan Checker.

Note that any changes that are made to the grading plans that affect the WQMP or WQMP site plan will require a revised WQMP to be resubmitted for an additional review to ensure consistency. These edits can be a result of grading plan checks, client requests, or internal design changes.

Once the resubmittal is received and accepted by the City, Fuscoe Engineering will review and ensure it satisfies all the requirements above, it will be approved in final and you will receive an email confirmation from the City. Only after the Final WQMP is approved, will the City Case Engineer consider allowing Mylar Grading Plan submittal.

Please let me know if you have any questions.

Regards,

Howard.

HOWARD WEN, CPSWQ | *Senior Project Manager*
hwen@fuscoe.com
CONNECT WITH ME

UPDATED HOURS: M-TH 7:30 AM – 5:30 PM | F 8:00 AM – NOON

FUSCOE ENGINEERING, INC.
an employee owned company

16795 Von Karman, Suite 100, Irvine, CA 92606
949.474.1960 | fuscoe.com
mobile: 949.537.8712

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Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.5	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.90	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	4,416	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate			**N/A**	
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	NA	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	NA	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	NA	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	NA	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	NA	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	NA	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.22	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.9	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	6,540	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate			**N/A**	
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	NA	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	NA	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	NA	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	NA	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	NA	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	NA	sq-ft

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.77	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.9	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	8,144	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate			**N/A**	
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	NA	In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	NA	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	NA	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	NA	Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	NA	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	NA	sq-ft

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5.00	
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	0	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.50	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00 *	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.90	
4	Calculate design flowrate, $Q_{design} = (C \times i_{design} \times A)$	Q_{design}=	0.351	cfs

Supporting Calculations

Describe system:
Surface runoff will be conveyed through the private street to proposed curb inlet catch basins equipped with a Dvert System that diverts flows to proposed Biofiltration Vault for water quality treatment.

*Assumed 100% impervious coverage utilized for preliminary calculations. Actual impervious coverage will be calculated in final engineering.

Provide time of concentration assumptions:
The time of concentration was assumed to be 5 minutes for conservative purposes.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5.00	
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	0	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.22	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00 *	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.90	
4	Calculate design flowrate, $Q_{design} = (C \times i_{design} \times A)$	Q_{design}=	0.520	cfs

Supporting Calculations

Describe system:
Surface runoff will be conveyed through the private street to proposed curb inlet catch basins equipped with a Dvert System that diverts flows to proposed Biofiltration Vault for water quality treatment.

*Assumed 100% impervious coverage utilized for preliminary calculations. Actual impervious coverage will be calculated in final engineering.

Provide time of concentration assumptions:
The time of concentration was assumed to be 5 minutes for conservative purposes.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5.00	
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	0	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	2.77	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	1.00 *	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.90	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.648	cfs

Supporting Calculations

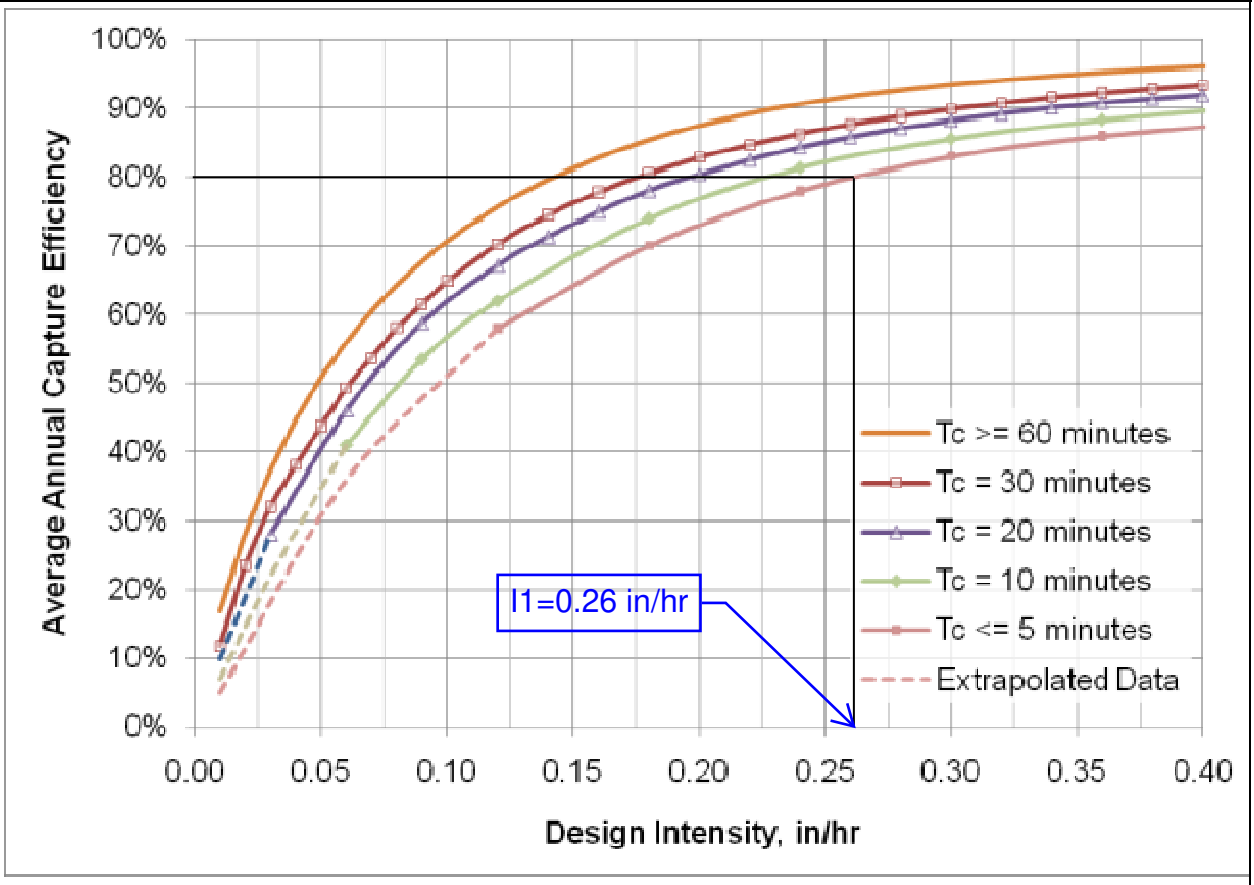
Describe system:
Surface runoff will be conveyed through the private street to proposed curb inlet catch basins equipped with a Dvert System that diverts low flows to proposed Biofiltration Vault for water quality treatment.

*Assumed 100% impervious coverage utilized for preliminary calculations. Actual impervious coverage will be calculated in final engineering.

Provide time of concentration assumptions:
The time of concentration was assumed to be 5 minutes for conservative purposes.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Graphical Operations



Provide supporting graphical operations. See Example III.7.

Worksheet I: Summary of Groundwater-related Feasibility Criteria

1	Is project large or small? (as defined by Table VIII.2) circle one	Large	**Small**	
2	What is the tributary area to the BMP?	A	2.23	acres
3	What type of BMP is proposed?	Underground infiltration		
4	What is the infiltrating surface area of the proposed BMP?	A_{BMP}	6738	sq-ft
5	What land use activities are present in the tributary area (list all) Multi-Family Residential			
6	What land use-based risk category is applicable?	L	**M**	H
7	If M or H, what pretreatment and source isolation BMPs have been considered and are proposed (describe all): Proposed MWS System Biofiltration Vaults will provide pretreatment for the Design Capture Volume prior to entering the proposed infiltration system. In addition, the proposed ADS StormTech Chambers receive pretreated water within an isolator row for further pretreatment prior to infiltrating.			
8	What minimum separation to mounded seasonally high groundwater applies to the proposed BMP? See Section VIII.2 (circle one)	5 ft	**10 ft**	
9	Provide rationale for selection of applicable minimum separation to seasonally high mounded groundwater: Per the TGD Section VIII.2, the following applies to a subsurface infiltration gallery: "Separation to mounded seasonally high groundwater shall be at least 10 feet for infiltration devices that inject water below the subsurface and surface infiltration BMPs with tributary area and land use activities that are considered to pose a more significant risk to groundwater quality."			
10	What is separation from the infiltrating surface to seasonally high groundwater?	SHGWT	10	ft
11	What is separation from the infiltrating surface to mounded seasonally high groundwater?	Mounded SHGWT	n/a	ft
12	Describe assumptions and methods used for mounding analysis: Groundwater was encountered at 46 feet below existing grade			
13	Is the site within a plume protection boundary (See Figure	**Y**	N	N/A

Worksheet I: Summary of Groundwater-related Feasibility Criteria

	VIII.2)?	
14	Is the site within a selenium source area or other natural plume area (See Figure VIII.2)?	Y **N** N/A
15	Is the site within 250 feet of a contaminated site?	Y **N** N/A
16	If site-specific study has been prepared, provide citation and briefly summarize relevant findings: n/a	
17	Is the site within 100 feet of a water supply well, spring, septic system?	Y **N** N/A
18	Is infiltration feasible on the site relative to groundwater-related criteria?	Y **N**
Provide rationale for feasibility determination: OCWD has concerns with the North Basin Groundwater Plume northeast of the site. Infiltration has been rendered infeasible for this site.		

Note: if a single criterion or group of criteria would render infiltration infeasible, it is not necessary to evaluate every question in this worksheet.

SUBJECT TO FURTHER REVISION

LEGEND

- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

Rainfall Zones

Design Capture Storm Depth (inches)

- 0.65"
- 0.7
- 0.75
- 0.80
- 0.85
- 0.90
- 0.95
- 1.00
- 1.10"

Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.
For areas outside of available data coverage, professional judgment shall be applied.

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
San Diego County
Riverside County

0.65 0.7 0.75 0.8 0.85 0.9 0.95 1 1.05 1.1

0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles

TITLE: RAINFALL ZONES

JOB: ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT — ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526.E

PACE Advanced Water Engineering

FIGURE XVI-1

P:\9526E\6-GIS\Mxds\Reports\Infiltration\Feasibility_20110215\9526E_Figure XVI-1_Rainfall Zones_20110215.mxd

SUBJECT TO FURTHER REVISION

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

LEGEND

City Boundaries

Hydrologic Soil Groups

- A Soils
- B Soils
- C Soils
- D Soils

Source:
Soils: Natural Resources Conservation Service (NRCS)
Soil Survey - soil_ca678, Orange County & Western Riverside
Date of publication: 2006-02-08
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

0 2.5 5 10 Kilometers
0 1.8 3.6 7.2 Miles

TITLE
NRCS HYDROLOGIC SOILS GROUPS

JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2a

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SUBJECT TO FURTHER REVISION

LEGEND

- Depth To First Groundwater Contours
- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Note: Data are not available for South Orange County at this time.

Source:
Sprotte, Fuller and Greenwood, 1980.
California Division of Mines and Geology;
California Geological Survey

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

PROJECT SITE

10 20 30 50

Pacific Ocean

0 2 4 8 Kilometers
0 1.25 2.5 5 Miles

TITLE
NORTH ORANGE COUNTY
MAPPED DEPTH TO FIRST
GROUNDWATER

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2d

P:\9526E\6-GIS\Mxds\Reports\Infiltration\Feasibility_20110215\9526E_FigureXVI2d_DepthToGroundwaterOverview_20110215.mxd

SUBJECT TO FURTHER REVISION

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

LEGEND

- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Plume Protection Boundaries

- North Basin Groundwater Protection Project
- South Basin Groundwater Protection Project
- El Toro Marine Base
- Tustin Marine Air Base
- Approximate Selenium Contamination Area

Note: Individual contamination sites are not plotted.
See State Water Resources Control Board Geotracker database (http://geotracker.waterboards.ca.gov),
Department of Toxic Substance Control Envirostor database (http://www.envirostor.dtsc.ca.gov) and other applicable sources for current listing of active contaminated sites.

Groundwater basin and plume protection boundaries for South Orange County are not shown on this exhibit at this time

0 2 4 8 Kilometers
0 1.25 2.5 5 Miles

P:\9526E\6-GIS\Mxds\Reports\Infiltration\Feasability_20110215\9526E_FigureXVI-2f_NorthOCGroundwaterProtectionAreaSkreiMap_20110215.mxd

TITLE
NORTH ORANGE COUNTY
GROUNDWATER PROTECTION
AREAS

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2f

Susceptibility

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

Channel Type

- Earth (Unstable)
- Earth (Stabilized)
- Stabilized

Tidel Influence

- <= Mean High Water Line (4.28')

Water Body

- Basin
- Lake
- Reservoir

Other Lands

- Airport/Military

Los Angeles County

Channel in Retarding Basin

Project Site

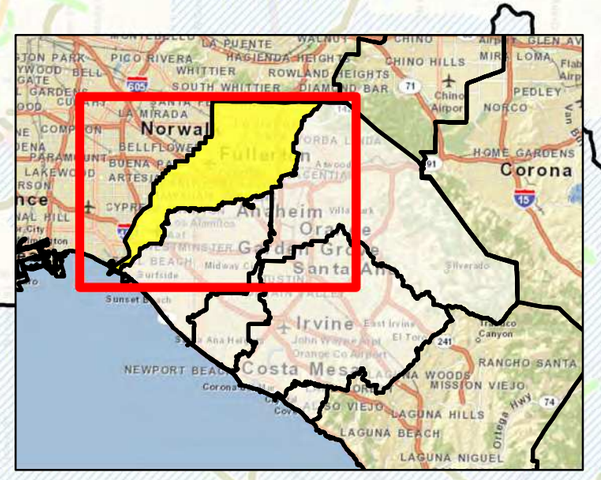
Anaheim Bay-Huntington Harbor Watershed

Santa River Watershed

Newport Bay-Newport Coastal Streams Watershed

Humble Reservoir
Orange County
Valencia Reservoir
Fullerton Reservoir
Loftus Diversion Channel
Desilting Basin
Brea Creek Reservoir
Fullerton Reservoir
Fullerton Reservoir
Hillcrest Park Reservoir
Fullerton Airport
Brea Park
Fullerton
Placentia Retarding Basin
La Jolla Recharge Basin
Miller Retarding Basin
Kraemer Basin
Raymond Retarding Basin
Gilbert Retarding Basin
Crescent Retarding Basin
Anaheim
Cypress Retarding Basin
Rossmoor Retarding Basin
Los Alamitos Naval Air Station
Los Alamitos Retarding Basin
Seal Beach Naval Weapons Station
Seal Beach
Pacific Ocean

0 8,000 16,000 Feet



TITLE
SUSCEPTIBILITY ANALYIS
SAN GABRIEL-COYOTE CREEK

JOB
ORANGE COUNTY
WATERSHED
MASTER PLANNING
ORANGE CO. CA

SCALE	1" = 8000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

1

P:\9526E\6-GIS\Mxds\Susceptability Maps_20100505\9526E_SanGabrielCoyoteCreekSusceptibility_20100430.mxd

Attachment B

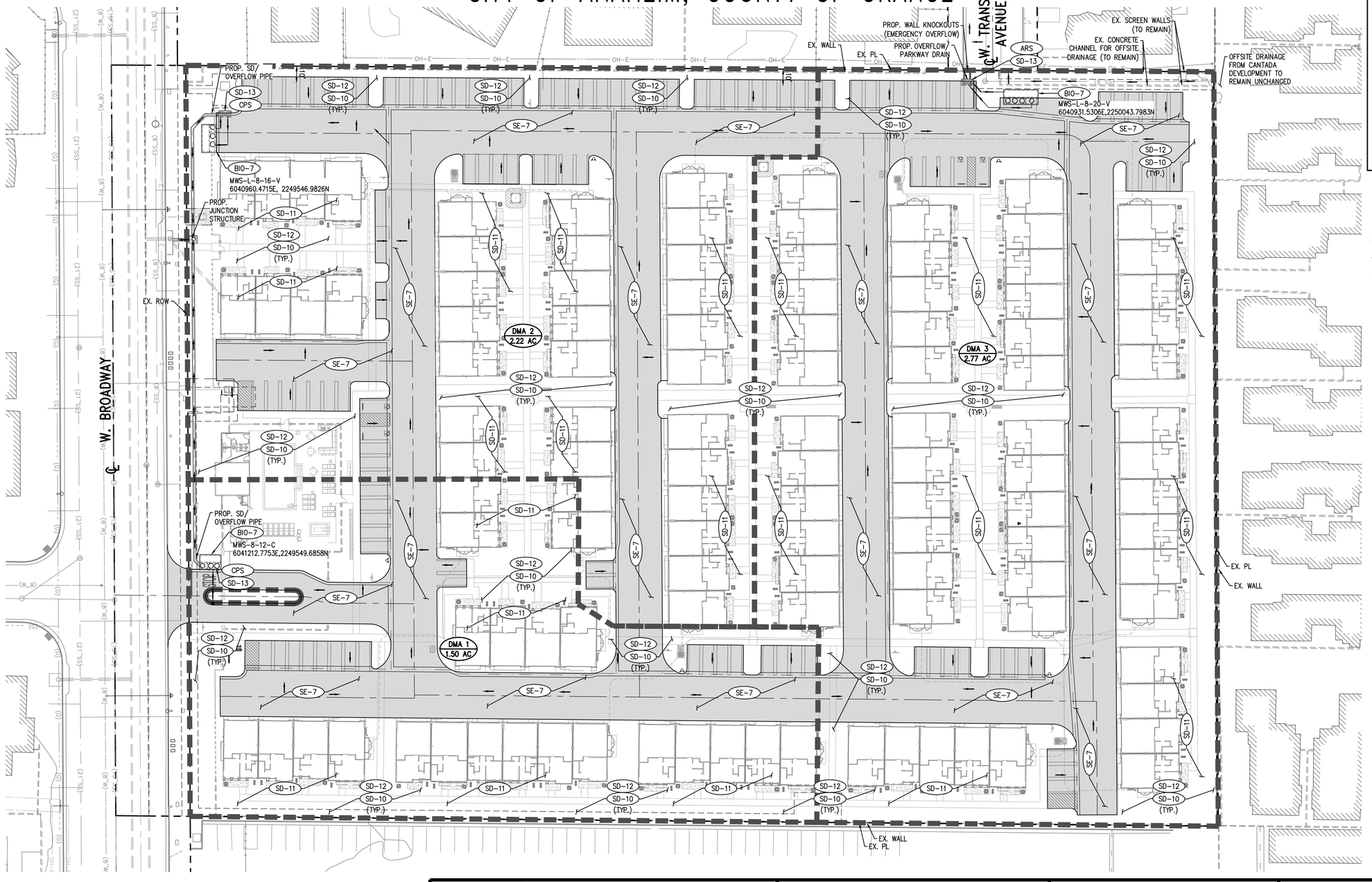
Preliminary WQMP Exhibit

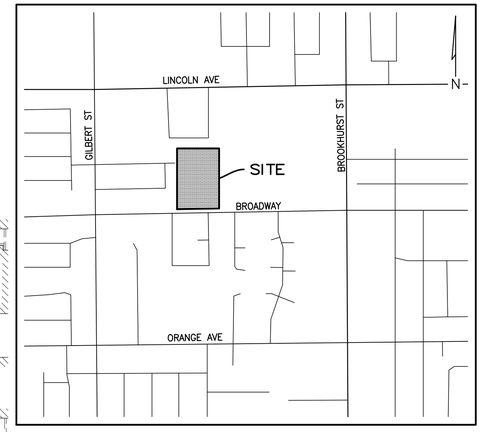
PRELIMINARY WQMP EXHIBIT

TR 19137

2323 W. BROADWAY

CITY OF ANAHEIM, COUNTY OF ORANGE





VICINITY MAP

NTS

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- PROPOSED RIGHT-OF-WAY/ BOUNDARY
- DRAINAGE MANAGEMENT AREA (DMA)
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- DRAINAGE FLOW ARROWS
- PROPOSED MWS BIOFILTRATION VAULT
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPING
- PROPOSED ASPHALT CONCRETE (AC) PAVEMENT
- PROPOSED TURF
- PROPOSED PCC PAVEMENT
- PROPOSED DECORATIVE PAVEMENT

DMA X / X.XX AC — DRAINAGE MANAGEMENT AREA (DMA) / ACREAGE

● ROOF DOWNSPOUT

BEST MANGEMENT PRACTICES (BMPS)

SD-10	SITE DESIGN & LANDSCAPE PLANNING
SD-11	ROOF RUNOFF CONTROLS
SD-12	EFFICIENT IRRIGATION
SD-13	STORM DRAIN SIGNAGE
SE-7	STREET SWEEPING & VACUUMING
BIO-7	PROPRIETARY BIOTREATMENT – MODULAR WETLANDS SYSTEM (MWS) BIOFILTRATION VAULT
CPS	CONNECTOR PIPE SCREEN (CPS) DEVICE FOR FULL TRASH CAPTURE REQUIREMENTS
ARS	AUTOMATIC RETRACTABLE SCREEN (ARS) DEVICE FOR FULL TRASH CAPTURE REQUIREMENTS

SCALE: 1" = 30'

0 15 30 60

NOTES:

1. DURING THE CONSTRUCTION PHASE OF THIS PROJECT, THE INFILTRATION SYSTEM SHALL BE PHYSICALLY SEPARATED/PROTECTED FROM RUNOFF AND/OR ANY OTHER MATERIAL/LIQUID/DEBRIS.
2. AREA DRAIN SYSTEM WILL BE DESIGNED DURING FINAL ENGINEERING. AREA DRAINS WILL COLLECT AND CONVEY RUNOFF FROM LANDSCAPED AREAS DIRECTLY TO INFILTRATION SYSTEMS.
3. ROOF DRAINAGE IS ASSUMED TO BE CONSISTENT WITH THAT OF A PITCHED ROOF. ROOF DOWNSPOUT LOCATIONS TO BE VERIFIED BY ARCHITECT DURING FINAL ENGINEERING.

DEVELOPER :

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APP	DATE

OWNER & DEVELOPER :

MELIA HOMES
8951 RESEARCH DRIVE, #100
IRVINE, CA 92618
PHONE (949) 759-4367

SOILS ENGINEER :

PREPARED BY :

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

REGISTERED PROFESSIONAL ENGINEER
DANE P. McDOUGALL
C 80705
CIVIL
STATE OF CALIFORNIA

TRACT NO. 19137
PRELIMINARY WQMP EXHIBIT

DATE: 3/10/2021

SHEET 1 OF 1

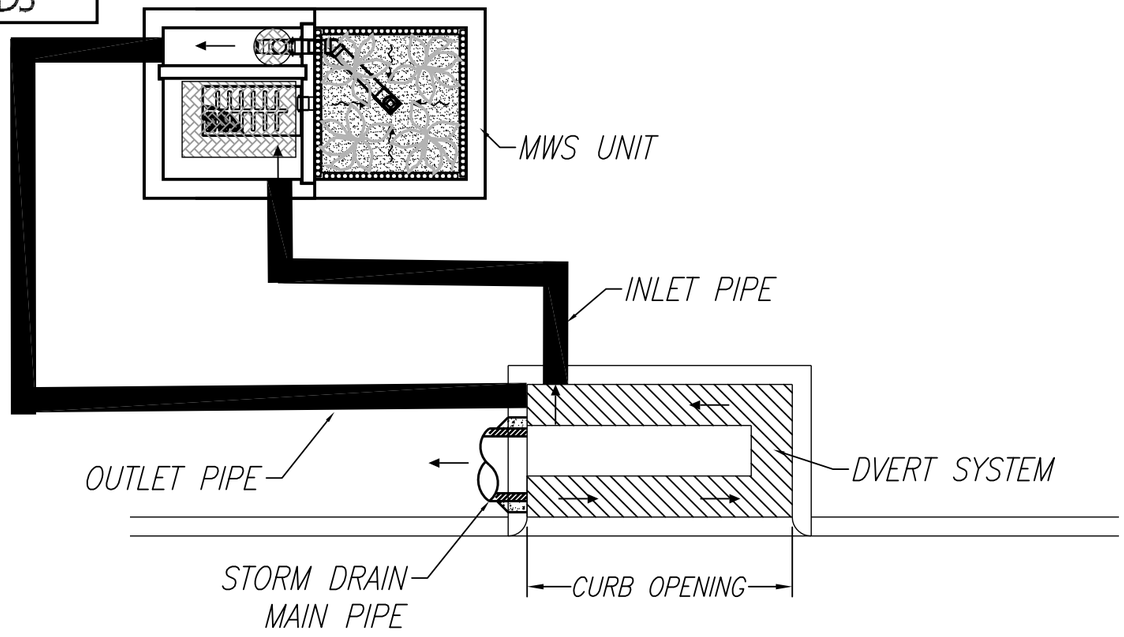
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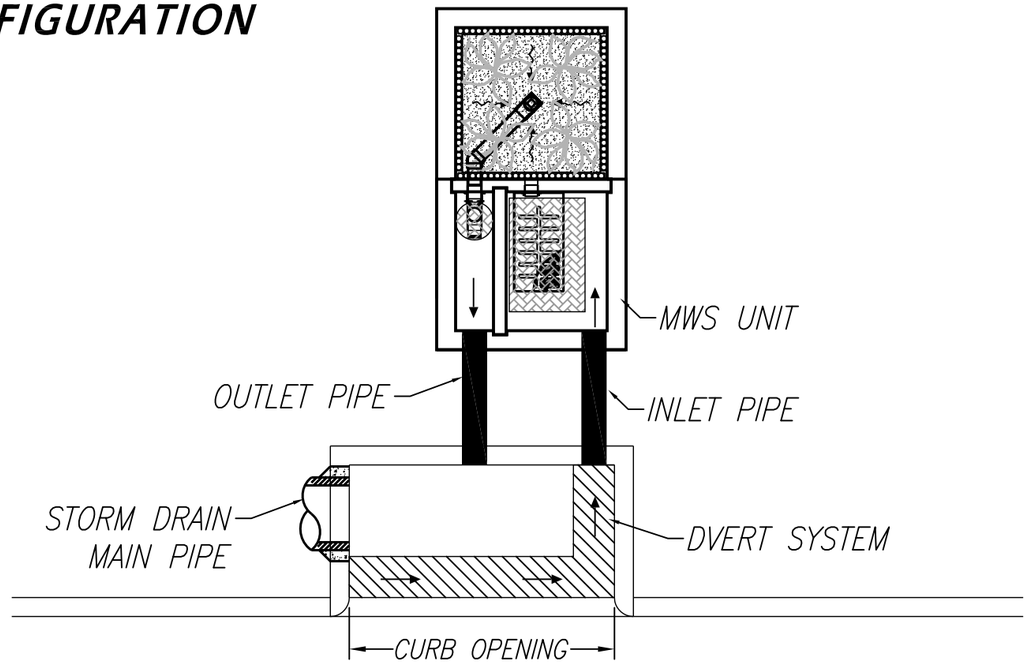
CITY OF ANAHEIM

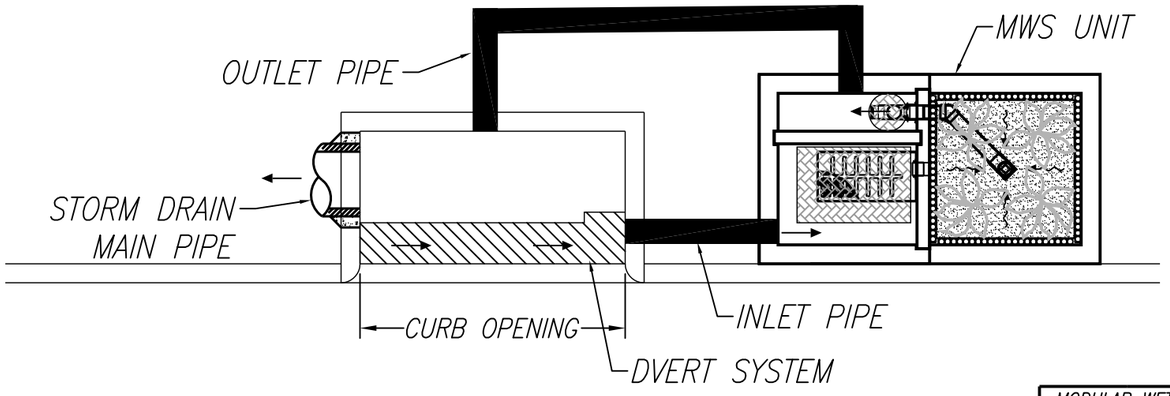
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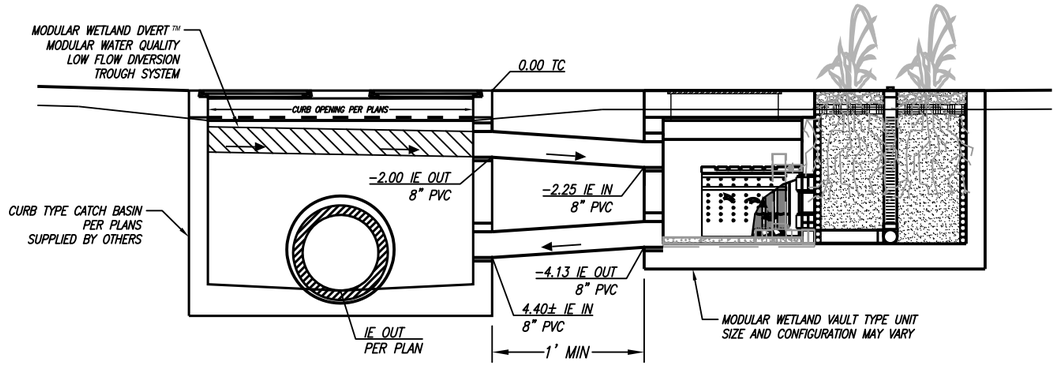
Site BMPs

MODULAR WETLAND SYSTEMS - LINEAR 2.0
STANDARD DVERT CONFIGURATION









MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

PROPRIETARY AND CONFIDENTIAL

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	NAME	DATE
DRAWN		
EDITED		

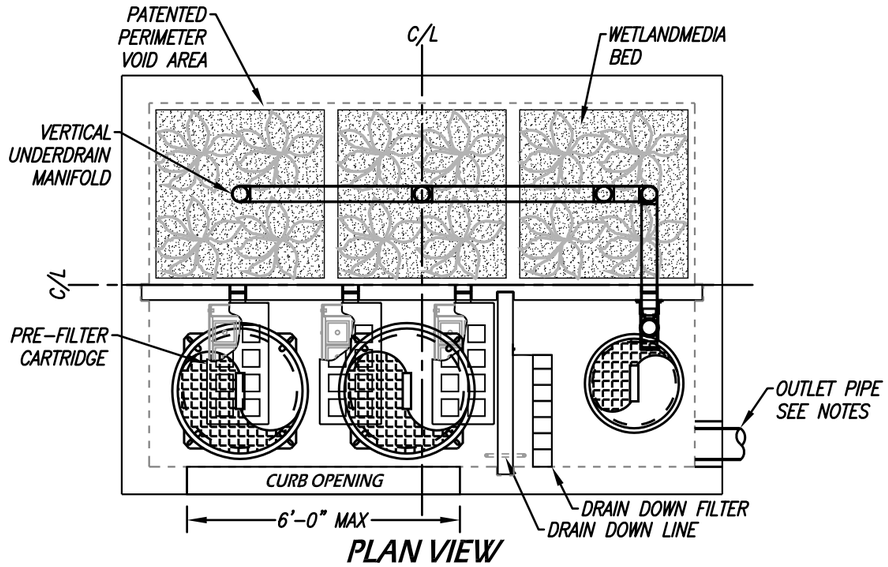
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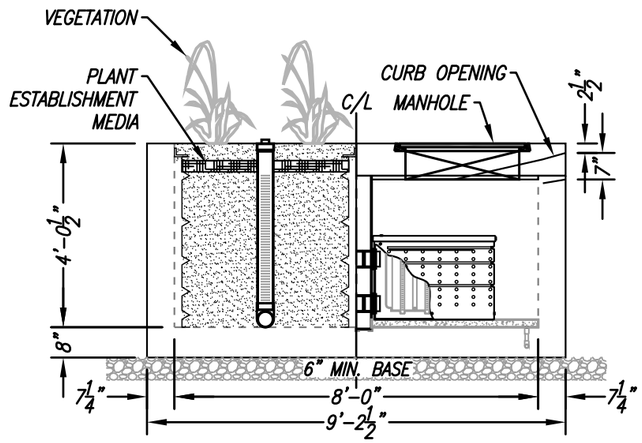
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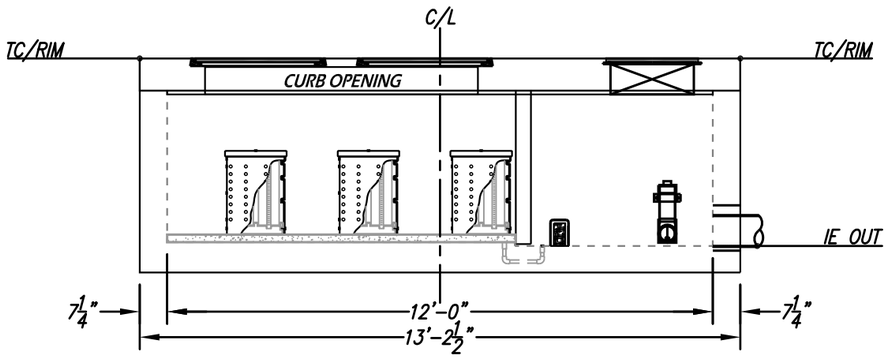
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			7.26
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.66"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



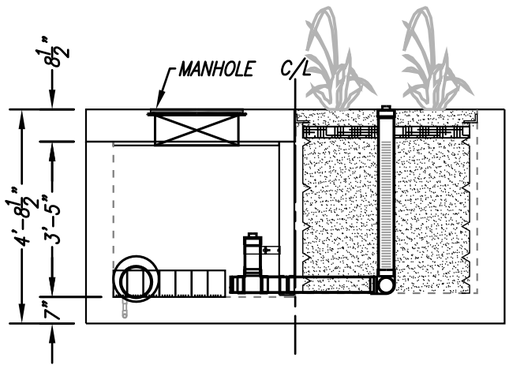
PLAN VIEW



LEFT END VIEW
BIOFILTRATION/PRETREATMENT



ELEVATION VIEW



RIGHT END VIEW
DISCHARGE/BIOFILTRATION

INSTALLATION NOTES

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2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
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4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

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TREATMENT FLOW (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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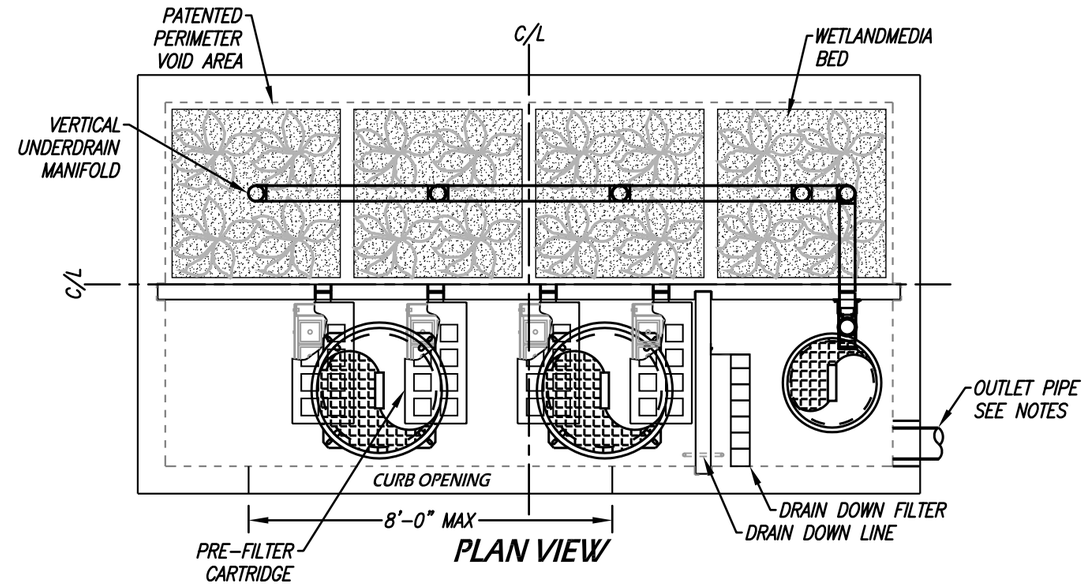
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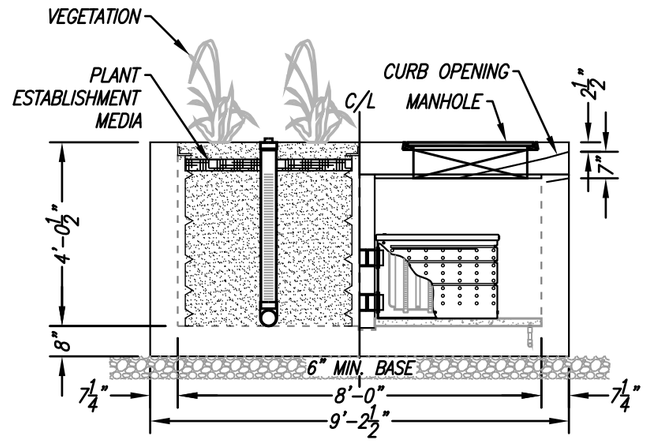
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MWS-L-8-12-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

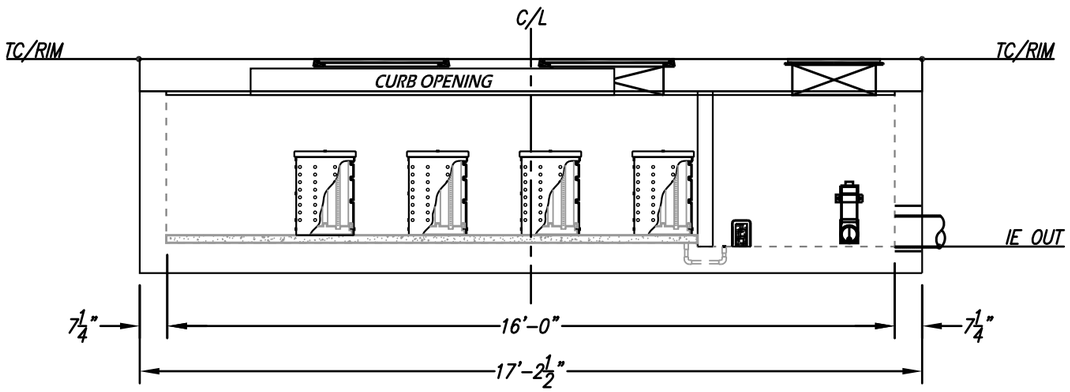
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			9.50
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø3.07"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



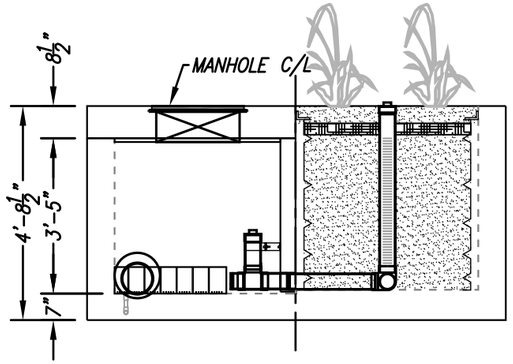
PLAN VIEW



LEFT END VIEW
BIOFILTRATION/PRETREATMENT



ELEVATION VIEW



RIGHT END VIEW
DISCHARGE/BIOFILTRATION

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TREATMENT FLOW (CFS)	0.462
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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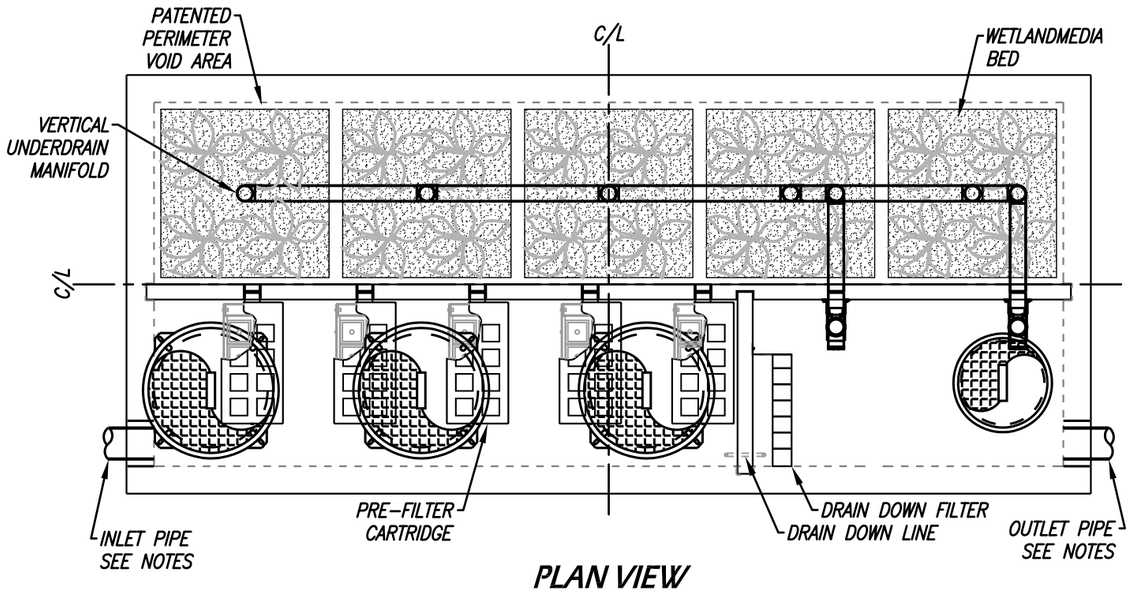
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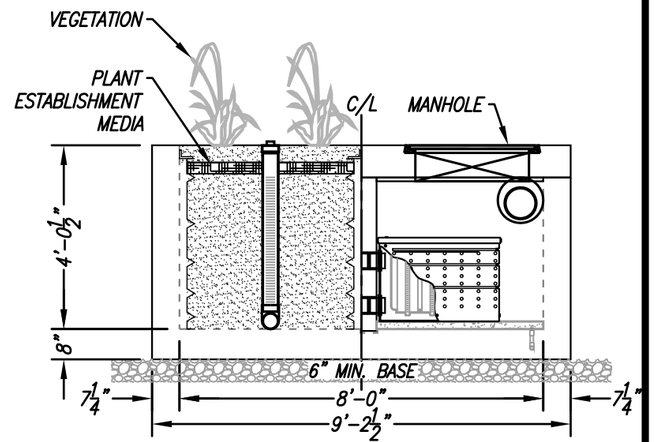
MWS-L-8-16-C
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

3/11/15/JOHN

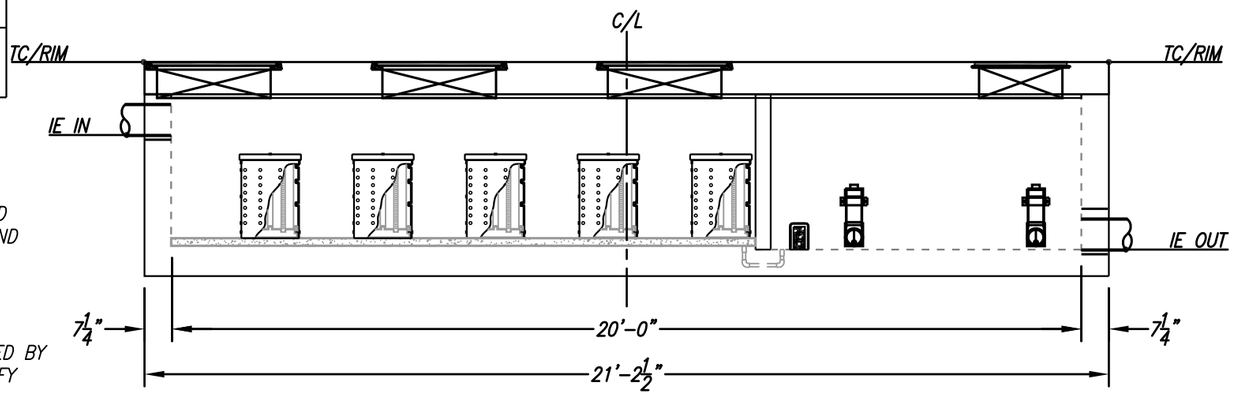
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			11.85
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.43"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



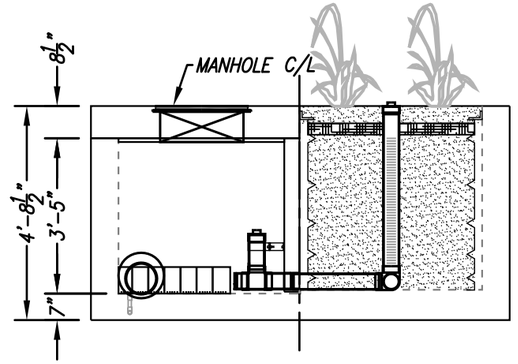
PLAN VIEW



LEFT END VIEW
BIOFILTRATION/PRETREATMENT



ELEVATION VIEW



RIGHT END VIEW
DISCHARGE/BIOFILTRATION

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TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

6/2/15/JOHN

MWS Linear 2.0 HGL Sizing Calculations

MWS MODEL SIZE	WETLAND PERMITER LENGTH	LOADING RATE GPM/SF	HGL HEIGHT																												
			SHALLOW MODELS																			STANDARD HEIGHT MODEL	HIGH CAPACITY MODELS									
			1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.65	3.70	3.75	3.80	3.85	3.90	3.95
MWS-L-4-4	6.70	1.0	0.022	0.023	0.025	0.026	0.028	0.029	0.031	0.032	0.034	0.035	0.037	0.038	0.040	0.042	0.043	0.045	0.046	0.048	0.049	0.051	**0.052**	0.054	0.055	0.056	0.057	0.058	0.058	0.059	0.060	0.061
~~**MWS-L-4-6**~~	~~10.00~~	~~1.0~~	~~0.032~~	~~0.035~~	~~0.037~~	~~0.039~~	~~0.042~~	~~0.044~~	~~0.046~~	~~0.048~~	~~0.051~~	~~0.053~~	~~0.055~~	~~0.058~~	~~0.060~~	~~0.062~~	~~0.065~~	~~0.067~~	~~0.069~~	~~0.072~~	~~0.074~~	~~0.076~~	~~**0.078**~~	~~0.081~~	~~0.083~~	~~0.084~~	~~0.085~~	~~0.087~~	~~0.088~~	~~0.089~~	~~0.090~~	~~0.091~~
MWS-L-4-6	9.30	1.0	0.030	0.032	0.034	0.036	0.038	0.041	0.043	0.045	0.047	0.049	0.051	0.053	0.055	0.058	0.060	0.062	0.064	0.066	0.068	0.070	**0.073**	0.075	0.077	0.078	0.079	0.080	0.081	0.082	0.083	0.084
MWS-L-4-8	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	**0.115**	0.119	0.122	0.124	0.126	0.127	0.129	0.131	0.132	0.134
MWS-L-4-13	18.40	1.0	0.059	0.063	0.068	0.072	0.076	0.080	0.084	0.089	0.093	0.097	0.101	0.106	0.110	0.114	0.118	0.122	0.127	0.131	0.135	0.139	**0.144**	0.148	0.152	0.154	0.156	0.158	0.160	0.163	0.165	0.167
MWS-L-4-15	22.40	1.0	0.072	0.077	0.082	0.087	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.165	0.170	**0.175**	0.180	0.185	0.188	0.190	0.193	0.195	0.198	0.200	0.203
MWS-L-4-17	26.40	1.0	0.085	0.091	0.097	0.103	0.109	0.115	0.121	0.127	0.133	0.139	0.145	0.151	0.158	0.164	0.170	0.176	0.182	0.188	0.194	0.200	**0.206**	0.212	0.218	0.221	0.224	0.227	0.230	0.233	0.236	0.239
MWS-L-4-19	30.40	1.0	0.098	0.105	0.112	0.119	0.126	0.133	0.140	0.147	0.153	0.160	0.167	0.174	0.181	0.188	0.195	0.202	0.209	0.216	0.223	0.230	**0.237**	0.244	0.251	0.255	0.258	0.262	0.265	0.269	0.272	0.276
MWS-L-4-21	34.40	1.0	0.111	0.118	0.126	0.134	0.142	0.150	0.158	0.166	0.174	0.182	0.189	0.197	0.205	0.213	0.221	0.229	0.237	0.245	0.253	0.261	**0.268**	0.276	0.284	0.288	0.292	0.296	0.300	0.304	0.308	0.312
MWS-L-6-8	18.80	1.0	0.060	0.065	0.069	0.073	0.078	0.082	0.086	0.091	0.095	0.099	0.104	0.108	0.112	0.116	0.121	0.125	0.129	0.134	0.138	0.142	**0.147**	0.151	0.155	0.157	0.160	0.162	0.164	0.166	0.168	0.170
MWS-L-8-8	29.60	1.0	0.095	0.102	0.109	0.115	0.122	0.129	0.136	0.143	0.149	0.156	0.163	0.170	0.177	0.183	0.190	0.197	0.204	0.211	0.217	0.224	**0.231**	0.238	0.245	0.248	0.251	0.255	0.258	0.262	0.265	0.268
MWS-L-8-12	44.40	1.0	0.143	0.153	0.163	0.173	0.183	0.194	0.204	0.214	0.224	0.234	0.245	0.255	0.265	0.275	0.285	0.296	0.306	0.316	0.326	0.336	**0.346**	0.357	0.367	0.372	0.377	0.382	0.387	0.392	0.397	0.402
MWS-L-8-16	59.20	1.0	0.190	0.204	0.217	0.231	0.245	0.258	0.272	0.285	0.299	0.312	0.326	0.340	0.353	0.367	0.380	0.394	0.408	0.421	0.435	0.448	**0.462**	0.476	0.489	0.496	0.503	0.509	0.516	0.523	0.530	0.537
MWS-L-8-20	74.00	1.0	0.238	0.255	0.272	0.289	0.306	0.323	0.340	0.357	0.374	0.391	0.408	0.425	0.442	0.459	0.476	0.493	0.509	0.526	0.543	0.560	**0.577**	0.594	0.611	0.620	0.628	0.637	0.645	0.654	0.662	0.671
MWS-L-10-20 or MWS-L-8-24	88.80	1.0	0.285	0.306	0.326	0.346	0.367	0.387	0.408	0.428	0.448	0.469	0.489	0.509	0.530	0.550	0.571	0.591	0.611	0.632	0.652	0.673	**0.693**	0.713	0.734	0.744	0.754	0.764	0.774	0.785	0.795	0.805
4'x'4 media cage	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	**0.115**	0.119	0.122	0.124						

SPECIFICATIONS

MWS – Linear

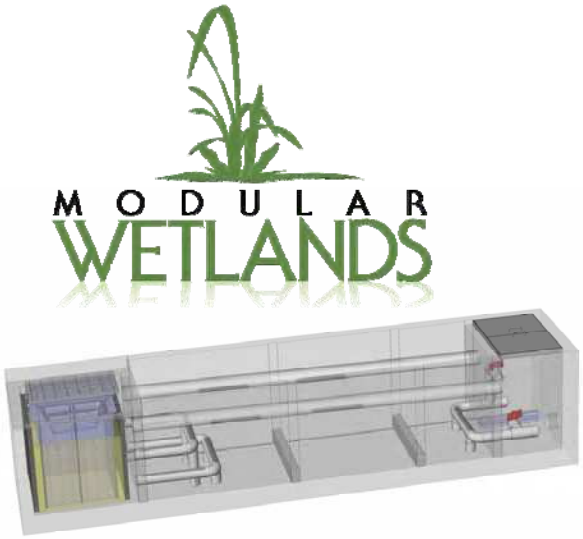
Hybrid Stormwater Filtration System

Modular Wetland Systems, Inc.
P.O. Box 869
Oceanside, CA 92049

www.modularwetlands.com
P 760-433-7640
F 760-433-3179

MWS – Linear

Hybrid Stormwater Filtration System



Save valuable space with small footprint for urban sites.

Improve BMP aesthetics with attractive native and tropical landscape plants.

Reduce lifetime costs with safer and less expensive maintenance

"The MWS – Linear hybrid stormwater treatment system is described as a self contained treatment train. This system utilizes an innovative combination of l treatment processes. Stormwater runoff flows into the system via pipe or curb/grate type catch basin opening. Polluted runoff first encounters a screening device to remove larger pollutants and then enters a hydrodynamic separation chamber which settles out the sediments and larger suspended solids. Next the runoff is treated by a revolutionary filter media, BioMediaGREEN that removes fines and associated pollutants, including bacteria. From there runoff enters of bioretention filter in the form of a subsurface flow vegetated gravel wetland. Within the wetland physical, chemical, and biological mechanisms remove the remaining particulate and dissolved pollutants. The purified runoff leaves the system via the discharge chamber. In the discharge chamber the rate of discharge is controlled by valves set to a desired rate".

Tested Pollutant Removal Efficiencies:

TSS Removal	Dissolved Lead Removal	Dissolved Copper Removal	TPH	E. coli Removal	Turbidity Removal
98%	81%	92%	99%	60.2%	92%

"Nature and Harmony Working Together in Perfect Harmony"

SPECIFICATIONS – MWS- LINEAR

Track Record: The MWS- Linear Hybrid Stormwater Treatment System is manufactured by a company whom is regularly engaged in the engineering design and production of treatment systems for stormwater.

Coverage: The MWS- Linear is designed to treat the water quality volume or water quality flow. For flow based design, high flow bypass is internal, for volume based design, high flow bypass is external and prior to pre-detention system. For offline volume based designs the MWS - Linear has the ability to treat the entire water quality volume when used with pre-storage and properly sized.

Non-Corrosive Materials: The MWS – Linear is designed with non-corrosive materials. All internal piping is SD35 PVC. Catch basin filter components, including mounting hardware, fasteners, support brackets, filtration material, and support frame are constructed of non-corrosive materials (316 stainless steel, and UV protected/marine grade fiberglass). Fasteners are stainless steel. Primary filter mesh is 316 stainless steel welded screens. Filtration basket screens for coarse, medium and fine filtration is ¾" x 1 ¾"expanded, 10 x 10 mesh, and 35 x 35 mesh, respectively. No polypropylene, monofilament netting or fabrics shall be used in this system. Media Protective Panels are constructed of UV protected/marine grade fiberglass. Mounts are constructed of stainless steel. BioMediaGREEN is an inert rock substrate and is non-corrosive. Perimeter filter structure is constructed of lightweight injection molded plastic. Mounting brackets are constructed of SD40 PVC and are mounted with 3/8" diameter stainless steel redheads. Drain down filter cover is constructed of UV protected/marine grade fiberglass and stainless steel hinge and mount.

Weight: Each complete unit weighs approximately 29,000 to 40,000 pounds and requires a boom crane to install. Details of this are provided in the installation section of the MWS-Linear Design Kit.

Transportation: The Modular Wetland System – Linear is designed to be transported on a standard flat bed truck. The unit easily fits on a flat bed truck without the need of special permitting.

Alternative Technology Configurations: The Modular Wetland System – Linear is modular is design. Each module will be up to 22 feet long and 5 feet wide. The system can be made in lengths varying from 13 to 100s of feet long. For lengths longer than 22 feet the system will shipped in modules and assembled on site. The Modular Wetland System – Linear has many alternative configurations. This allows the system to be adapted to many site conditions. Runoff can enter the system through a pipe, and/or a built in curb or grate type opening.

Energy Requirements: The Modular Wetland System – Linear is completely passive and requires no external energy sources.

Buoyancy Issues: Buoyancy is only a an issue when ground water levels rise above the bottom of the Modular Wetland System – Linear's concrete structure. With 8.5 cubic yards of wetland media there is no concern of floatation. As a precaution a footing can also be built into the systems concrete structure.

Durability: The structure of the box will be precast concrete. The concrete will be 28 day compressive strength fc = 5,000 psi. Steel reinforcing will be ASTM A – C857. Structure will support an H20 loading as indicted by AASHTO. The joint between the concrete sections will ship lap and joint sealed with ram-nek. Filter (excluding oil absorbent media) and support structures are of proven durability. The filter and mounting structures are of sufficient strength to support water, sediment, and debris loads when the filter is full, with no slippage, breaking, or tearing. All filters are warranted for a minimum of five (5) years.

Oil Absorbent Media: The MWS – Linear utilizes both physical and biological mechanisms to capture and filter oil and grease. A skimmer and boom system will be positioned on the internal perimeter of the catch basin insert. The primary filtration media, BioMediaGreen, utilized in the perimeter and drain down filters, has excellent hydrocarbon removal abilities. Within the wetland filter biological processes capture and

break down oil and grease. Much of the breakdown and transformation of oil and grease is performed by natural occurring bacteria.

Overflow Protection: The grate and curb type MWS – Linear are designed with an internal bypass consisting of two SD PVC pipes which direct high flows around the perimeter and wetland filter, directly into the discharge chamber. For the volume based vault type configuration, bypass should be located prior to the pre-detention system. For peak flows that exceed internal bypass capacity, external bypass is use.

Filter Bypass: Runoff will bypass filtration (BioMediaGREEN and wetland filter) components of the MWS - Linear. The system will still provide screening and settling during higher flow rates for internally bypassed flows. External bypass will bypass of treatment processes.

Pollutant Removal Efficiency: The MWS - Linear is capable of removing over 90% of the net annual total suspended solids (TSS) load based on a 20-micron particle size. Annual TSS removal efficiency models are based on documented removal efficiency performance from full-scale laboratory tests on BioMediaGreen and quarter-scale laboratory tests on the MWS – Linear flow based system.

POLLUTANT	REMOVAL EFFICIENCY
Trash & Litter	99%
TPH (mg/L)	99%
TSS (mg/L)	98%
E. Coli (MPN/100ml)	60%
Turbidity (NTU)	92%
Dissolved Metals (mg/L)	76%

Sil-Co-Sil 106. Mean particle diameter = 19 microns

Non-Scouring: During heavy storm events the runoff bypasses perimeter and wetland filter components. The system will not re-suspend solids at design flows.

Uniqueness: The Modular Wetland System – Linear is a complete self contained treatment train that incorporates capture, screening, sedimentation, filtration, bioretention, high flow bypass, and flow control into a single modular structure. This system provides four stages of treatment making it the only 4 stage treatment train stormwater filtration system, therefore making it unique to the industry. Other systems do not incorporate all the necessary attributes to make it a complete stormwater management device as with the Modular Wetland System – Linear. Therefore, no equal exists for this system.

Pretreatment & Preconditioning: Since the Modular Wetland System – Linear is a complete capture and treatment train stormwater management system no external pretreatment of preconditioning is necessary.

SPECIFICATIONS – BioMediaGREEN

BioMediaGREEN is a proprietary engineered filter media. Made of a unique combination of the inert naturally occurring material this product is non-combustible and do not pose a fire hazard, stable and non-reactive, and is also biodegradable. It is stable with no known adverse environmental effects.

This product has been tested in long-term carcinogenicity studies [inhalation and intraperitoneal injection (i.p.)] with no significant increase in lung tumors or abdominal tumors. Short-term biopersistent (inhalation and intra-tracheal injection) studies have shown that the products disappear very rapidly from the lung.

In October 2001, IARC classified this product as Group 3, "not classifiable as to its carcinogenicity to humans". The 2001 decision was based on the latest epidemiological studies and animal inhalation studies that show no relation between inhalation exposure and the development of tumors.

The product can typically be disposed of in an ordinary landfill (local regulations may apply). If you are unsure of the regulations, contact your local Public Health Department or the local office of the Environmental Protection Agency (EPA).

Coverage: When properly installed BioMediaGREEN Filter Blocks provide sufficient contact time, at rated flows, of passing contaminate water. The BioMediaGREEN material will capture and retain most pollutants that pass through it. The BioMediaGREEN material is made of a proprietary blend of inert substances. The BioMediaGREEN Filter Blocks can be used in different treatment devices, including but not limited to flume filters, trench drain filters, downspout filters, catch basin inserts, water polishing units, and hydrodynamic separators.

Non-Corrosive Materials: The BioMediaGreen material is made of non-corrosive materials.

Durability: The BioMediaGREEN material has been chosen for its proven durability, with an expected life of 2 plus years. The BioMediaGREEN material is of sufficient strength to support water, sediment, and debris loads when the media is at maximum flow; with no slippage, breaking, or tearing. The BioMediaGREEN material has been tested through rigorous flow and loading conditions.

Oil Absorbent Media: The BioMediaGREEN material has been proven to capture and retain hydrocarbons.

Pollutant Removal Efficiency: The BioMediaGREEN Filter Blocks are designed to capture high levels of Hydrocarbons including but not limited to oils & grease, gasoline, diesel, and PAHs. BioMediaGREEN Filter Blocks have the physical ability to block and filter trash and litter, grass and foliage, sediments, TSS, particulate and dissolved metals, nutrients, and bacteria.

BioMediaGREEN technology is based on a proprietary blend of synthetic inert natural substances aimed at removal of various stormwater pollutants. BioMediaGREEN was created to have a very porous structure capable of selectively removing pollutants while

allowing high flow through rates for water. As pollutants are captured by its structure, BioMediaGREEN captures most pollutants and maintains porosity and filtering capabilities.

Field and laboratory tests have confirmed the BioMediaGREEN capability to capture large percentage of TSS, hydrocarbons, nutrients, and heavy metals. Microbial reduction efficiency will vary depending on colony size, flow rates and site specific conditions.

POLLUTANT	REMOVAL EFFICIENCY
Oil & Grease (mg/L)	90%
TPH (mg/L)	99%
TSS (mg/L)	85%
Turbidity (NTU)	99%
Total Phosphorus (mg/L)	69.6%
Dissolved Metals (mg/L)	75.6%

Sil-Co-Sil 106. Mean particle diameter = 19 microns

Replacement: Removal and replacement of the blocks is simple. Remove blocks from filtration system. Replace with new block of equal size.

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



MWS Linear



Contents

1 Introduction

2 Applications

3 Configurations

4 Advantages

5 Operation

6 Orientations | Bypass

7 Performance | Approvals

8 Sizing

9 Installation | Maintenance | Plants

The Urban Impact

For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.



Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.





MWS Linear

The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.



Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.



Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.



Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.



Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.



Commercial

Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.



Mixed Use

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications are available on our website: www.ModularWetlands.com/Applications

- Agriculture
- Reuse
- Low Impact Development
- Waste Water





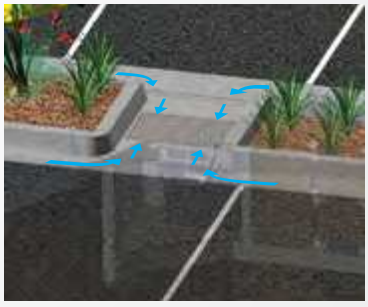
Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.



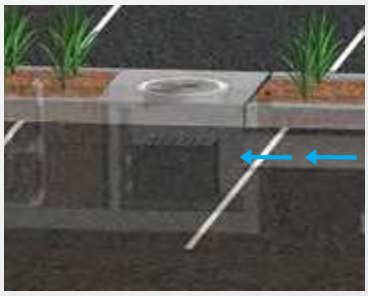
Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.



Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

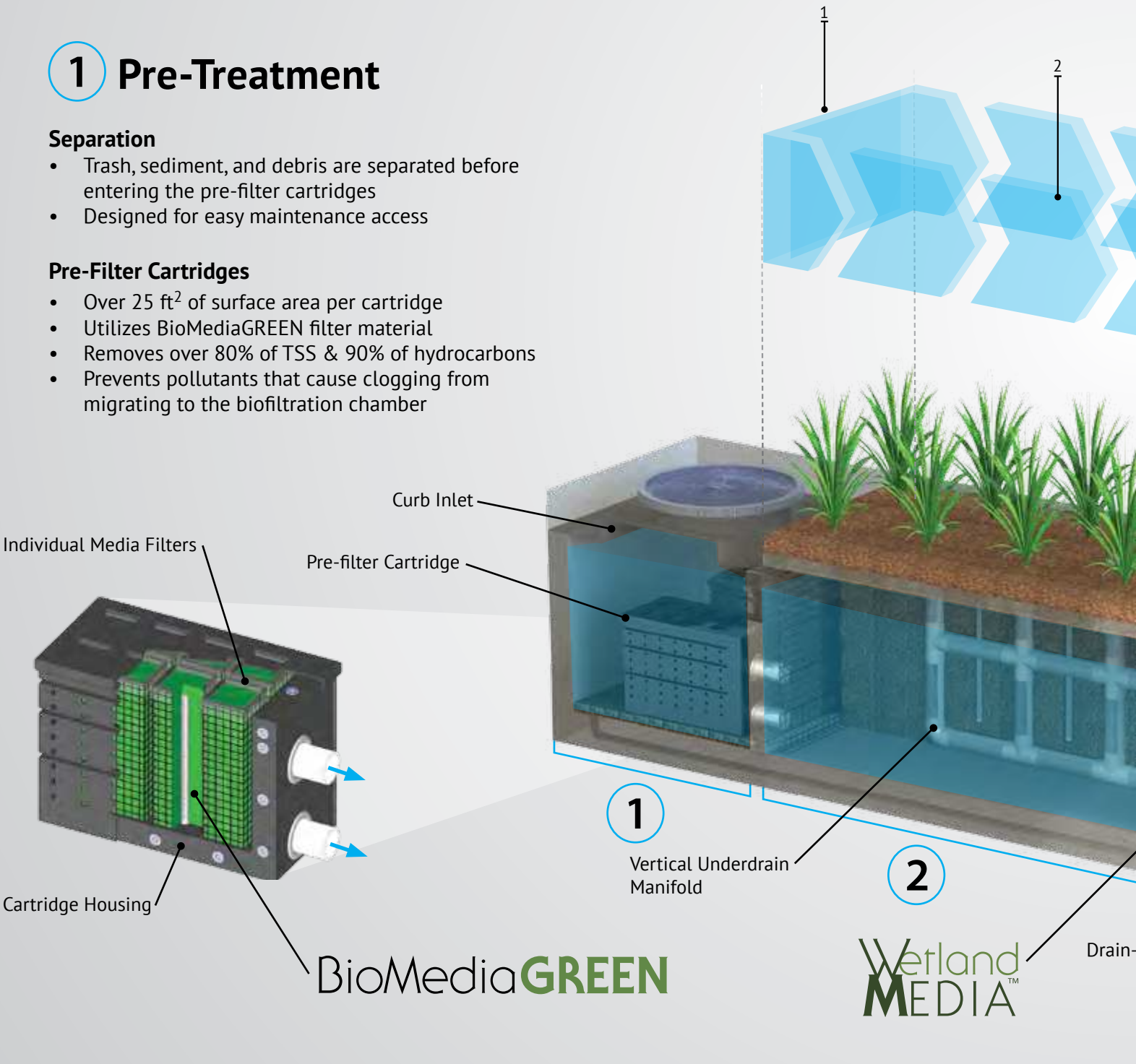
1 Pre-Treatment

Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



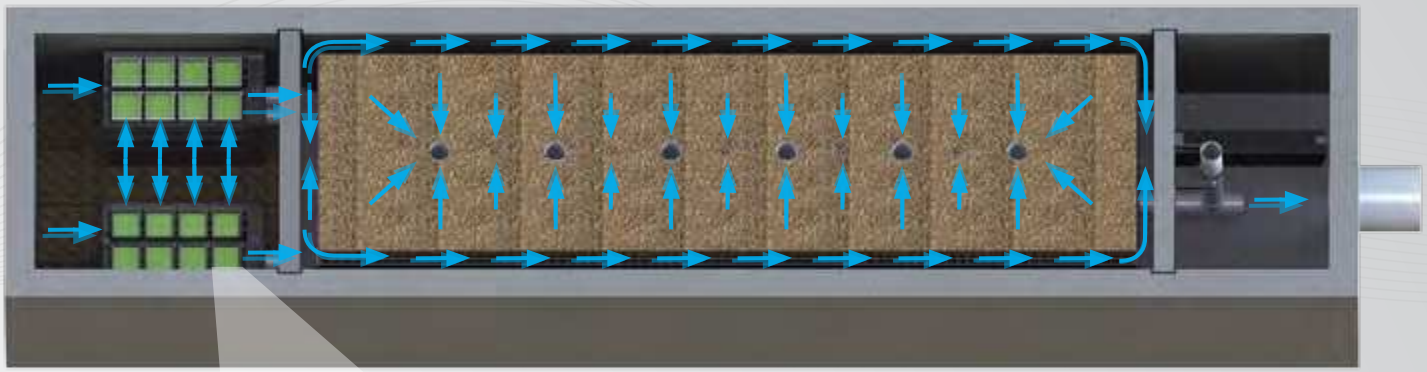


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.



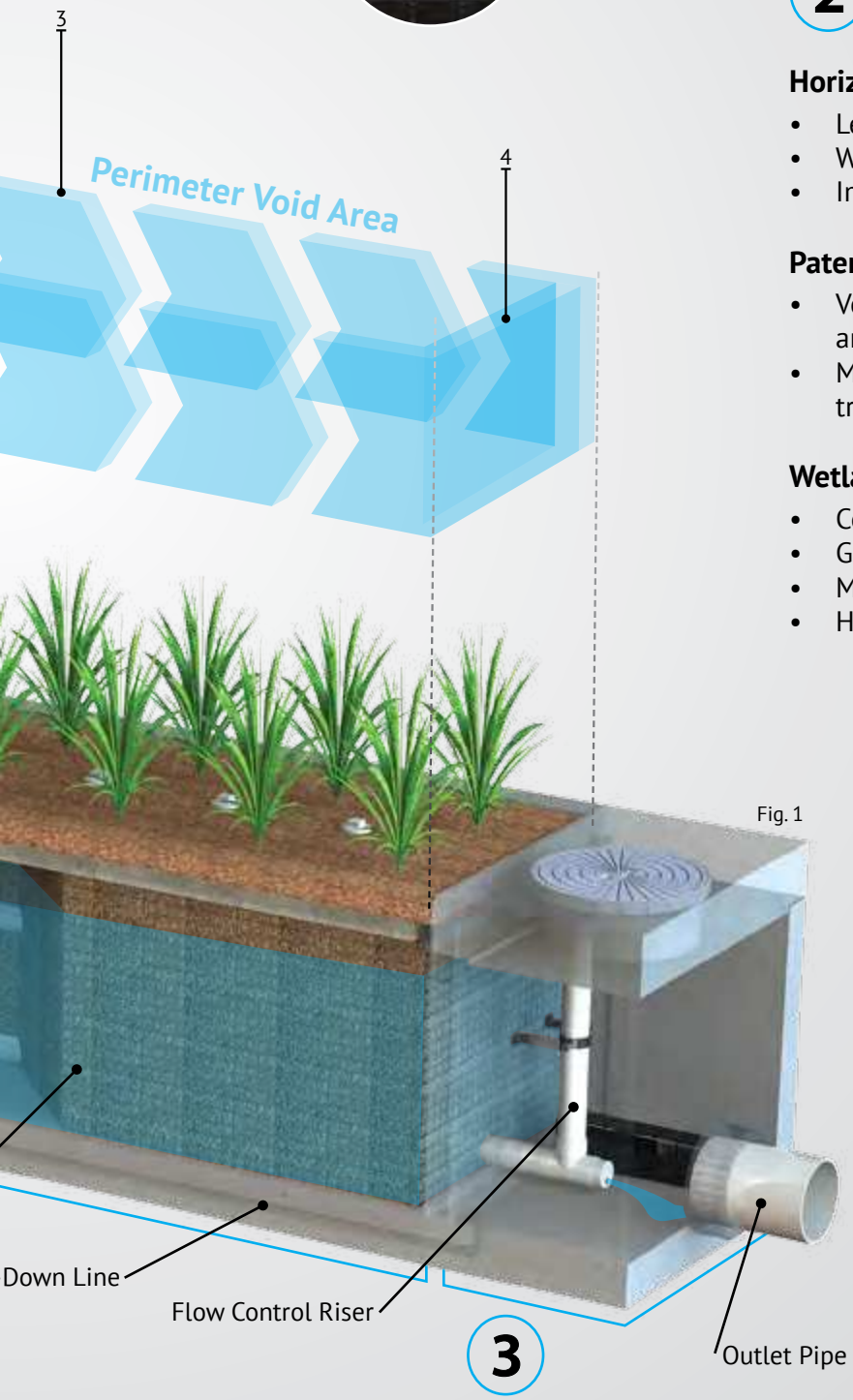


Fig. 1

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

3 Discharge

Flow Control

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

Drain-Down Filter

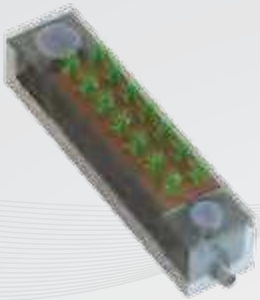
- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations



Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.



End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

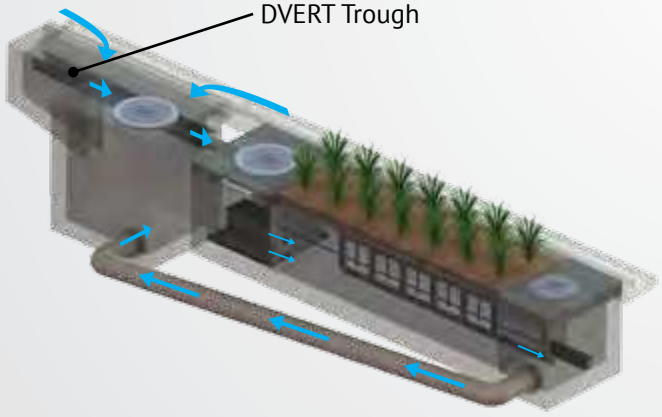
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.





Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.



Washington State DOE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%



DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.



MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.



Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus for discharges to freshwater systems, and 30% Total Nitrogen for discharges to saltwater or tidal systems.

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.



Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.



Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.



Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.



Plant Selection

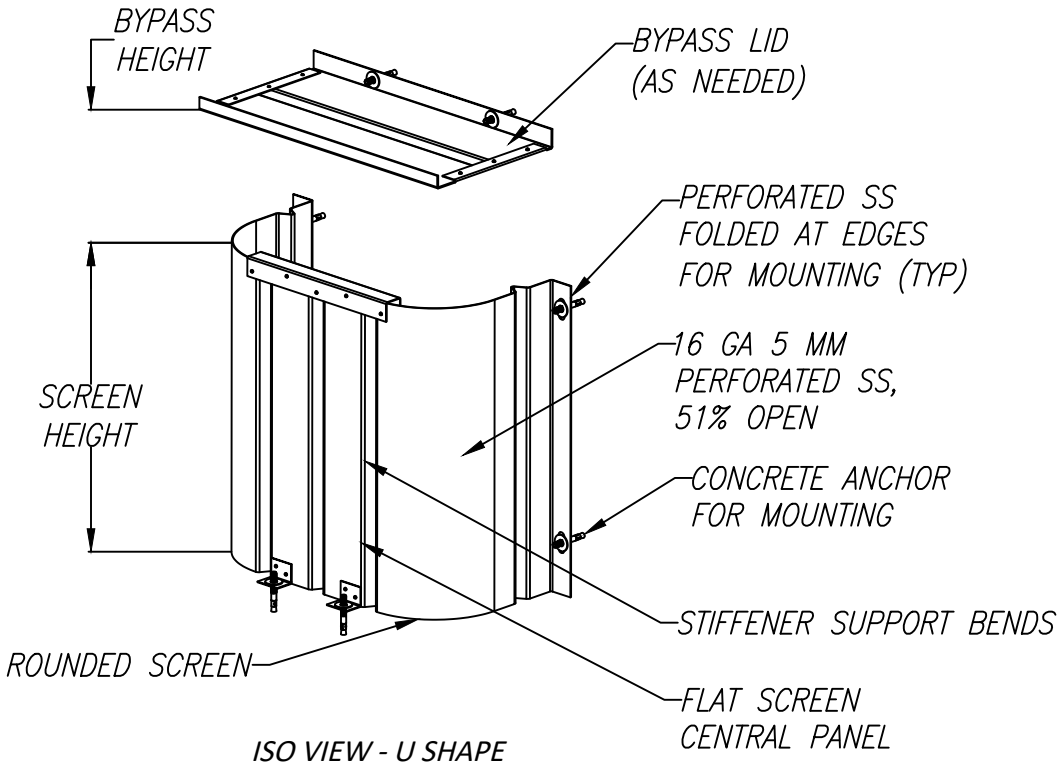
Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

Please visit www.ModularWetlands.com/Plants for more information and various plant lists.

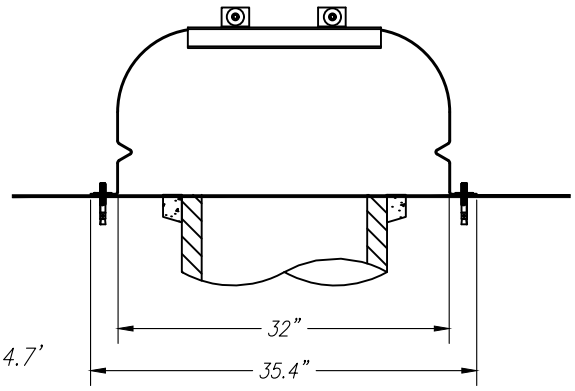


CONNECTOR PIPE SCREEN (CPS)
U 4.7



ISO VIEW - U SHAPE

CPS U WITH 4.7 FT SCREEN LENGTH	
CPS HEIGHT (IN)	SCREEN FLOW (CFS)
12	6.67
18	12.26
24	18.88
30	26.40
36	34.71
NOTE: BYPASS FLOW RATES VARY WITH VAULT DEPTH AND BYPASS HEIGHT. CONTACT BIO CLEAN FOR ADDITIONAL INFORMATION.	



TOTAL SCREEN LENGTH ~ 4.7'
SPAN LENGTH = 32"
COMPATIBLE WITH PIPES UP TO Ø24"

TOP SECTION VIEW - U SHAPE

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE.
3. THIS CPS UNIT IS DESIGNED FOR TREATMENT FLOWS THROUGH THE SCREEN. FLOWS GREATER THAN THE TREATMENT FLOW RATE WILL BYPASS OVER THE SCREEN.
4. A BYPASS LID IS REQUIRED WHEN THE OUTLET PIPE IS DIRECTLY BELOW THE CURB OPENING.
5. CPS IS COMPRISED OF 304 STAINLESS STEEL. THICKNESS IS 16 GAUGE. SCREEN PERFORATIONS ARE 5 MILLIMETERS IN DIAMETER. THE SCREEN AREA IS 51% OPEN SPACE.

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO INSTALL THE CPS UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. POSITION THE CPS SO IT IS EVENLY SPACED AROUND THE CONNECTOR PIPE, ENSURING A MIN. OF 4" SPACING AWAY FROM ANY CORNERS. SCREEN BOTTOM SHALL BE FLUSH WITH THE CATCH BASIN FLOOR, OR WITH GAPS NO GREATER THAN 5 MM.
3. IF A BYPASS LID IS REQUIRED, VERIFY THE BYPASS HEIGHT NEEDED AND MARK THAT LOCATION ON THE WALL DIRECTLY ABOVE THE BASE UPRIGHTS. LIFT THE LID IN PLACE AND MARK THE HOLE LOCATIONS FOR THE LID MOUNTING BRACKETS. SECURE THE LID WITH STAINLESS STEEL NUTS.

WARRANTY: 3 YEAR MANUFACTURER'S		MEETS FULL CAPTURE REQUIREMENTS	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 1/17/2020	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

Bio Clean

A Forterra Company

Bio Clean CPS

A Stormwater Trash Capture Solution

OPERATION & MAINTENANCE MANUAL

5796 Armada Drive Suite 250 | Carlsbad, CA 92008 | 855.566.3938

stormwater@forterrabp.com | biocleanenvironmental.com

OPERATION & MAINTENANCE

CPS devices should be maintained by individuals who are trained in proper disposal procedures, confined space entry and traffic safety regulations. When servicing a Bio Clean CPS device be sure to follow all safety and traffic control protocols as well as wearing all proper personal protection equipment such as gloves, safety glasses, hard-hat, safety vest and work boots.



Visual Inspection

1. Begin by inspecting the inflow of the catch basin where the Bio Clean CPS device is located. Check for any obstructions to inflow of the CB unit. If any large obstructions are found, have them removed. Once the inflow inspection is completed, remove the man-hole cover for further inspection. (Note: Confined Space Entry Procedures may apply if trained personnel intend to enter the interior space of any Catch Basin. Please follow all applicable confined space entry procedures)

2. Remove the manhole cover and visually estimate the amount and types of debris found in the CB unit. Look for any visual signs of damage that may compromise the CB unit to function properly. Inspect for any standing water in the CB unit as well as for large amounts of sediment and debris surrounding the CPS device. If standing water and high sediment volume is found, remove water, sediment and debris by vacuum truck or by other debris removal methods.

Cleaning Procedures and Frequencies

1. Like all other storm water BMP's, Bio Clean CPS devices require periodic maintenance. Routine inspection and maintenance intervals for all CPS devices are typically twice per year for inspections and once per year for maintenance service. Bio Clean CPS devices may require more frequent maintenance service if the device is located in a high debris loading drainage area, such as certain downtown areas, retail/restaurant, or residential areas where a significant amount of vegetation/foliage is located. In such cases, Bio Clean CPS devices may require more frequent inspection and maintenance service, which could range from twice per year to monthly inspection and maintenance service, depending on pollutant load conditions.

2. To begin Bio Clean CPS cleaning procedures, conduct a visual inspection of the CPS device and the surrounding area to ensure a safe working environment. Setup appropriate barriers and signage as necessary to establish a work zone surrounding the catch basin. Once the work zone has been established, remove the manhole cover from the catch basin.

3. Once the manhole cover is removed from the basin the Bio Clean CPS is ready for servicing. All debris can be removed by either a vacuum truck or manually removing sediment and debris by hand.

4. Bio Clean CPS devices shall be cleaned using a pressure washer as may be necessary if any materials are found to cause occlusion or clogging of the screen.

Disposal

1. All trash and debris removed from the Bio Clean CPS unit shall be disposed of in accordance with local, state and federal regulation.

2. Solid waste disposal can be coordinated with local landfills. Liquids may need to be disposed of by wastewater treatment plant, municipal vacuum truck decant facility or approved facility.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com

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Section [_____]
Stormwater Connector Pipe Screen

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for Connector Pipe Screens used for collecting trash and debris inside catch basins. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Stormwater Connector Pipe Screens (CPS) are used to prevent trash and debris from entering the stormwater system during dry weather and moderate storm flows by keeping the trash inside the catch basin. The CPS is a screen placed permanently or temporarily in a catch basin at the location of the outlet pipe. The screen separates trash and debris from stormwater treatment flows. Flows that exceed the treatment flow rate bypass over the top of the screen. When the outlet pipe is located below a curb opening the CPS features a lid to prevent debris from passing behind the screen and flowing directly to the outlet pipe. The CPS shall be designed to retain all trash larger than 5 mm (0.197 inches) in the catch basin.

01.03.00 Manufacturer
The manufacturer of the CPS shall be one that is regularly engaged in the engineering, design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which has a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the CPS(s) shall be a screen device manufactured/distributed by Bio Clean Environmental Services, Inc., or assigned distributors or licensees. Bio Clean Environmental Services, Inc. can be reached at:

5796 Armada Drive, Suite 250
Carlsbad, CA 92008
Phone: (760) 433-7640
Fax: (760) 433-3176
www.biocleanenvironmental.net

01.04.00 Submittals

01.04.01 Submittal drawings will be provided with each order to the contractor and engineer of work.

01.04.02 Submittal drawings are to detail the CPS, its components and the sequence for installation, including:

- CPS configuration with primary dimensions
- Various CPS components
- Any accessory equipment

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of CPS.

01.05.02 Manufacturer to supply CPS(s):

- Screen
- Mounting hardware
- Bypass lid with supports (when required)

PART 2 – COMPONENTS

02.01.01 The CPS shall have a sufficient structural integrity to withstand a lateral force of standing water within the catch basin area when the screen becomes 100% clogged. The CPS unit shall be bolted to the catch basin walls.

02.01.02 The CPS shall be configured with deflector plates or screens preventing trash from falling between the screen and connector pipe. The deflector plate shall be designed to withstand a vertical load.

02.01.03 The gap at the bottom, sides, and joints of the CPS unit shall not exceed 5 mm (0.197 inches).

02.01.04 The CPS shall include vertical structural stiffeners extending the full length of the screen in the form as bends in the screen itself, a bolting surface to fasten the CPS to the wall of the catch basin, and support for the upper portion of the CPS unit referred to as the "bypass."

02.01.05 All parts/components of the CPS unit must be sized to fit through the catch basin's manhole opening.

02.01.06 The CPS frame shall be fabricated from 304 stainless steel.

02.01.07 The CPS screen shall be fabricated from perforated 304 stainless steel. The screen shall have a minimum thickness of 16 gauge. The geometrical opening shape shall have a diameter of 5 mm (0.197 inches).

02.01.08 The screen material used shall have at least 45% open area.

02.01.09 Any edge of the CPS that is not flush with the wall or floor of the catch basin shall be smooth with no prongs or jagged edges.

02.01.10 The assembly bolts, screws, nuts, and washers shall be fabricated entirely from 316 stainless steel. The concrete anchor bolts shall use a wedge anchor, with Type 316 stainless steel threaded rods, nuts, and washers.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The CPS has no moving internal components and functions based on gravity flow, unless otherwise specified. Stormwater runoff enters the catch basin through a curb opening and flows toward the connector pipe. The CPS is placed to intercept flows prior to exiting the catch basin through the connector pipe. The CPS must be able to be removed through the catch basin opening. Stormwater flow up to the peak treatment rate is processed through the screen. Flows in excess of the peak treatment rate will overtop the screen in a bypass. The lid (when required) shall be place high enough above the screen to allow for full bypass flow.

03.01.02 Pollutants - The CPS will remove and retain trash and debris larger than 5 mm in diameter entering the catch basin during frequent storm events and specified flow rates.

03.01.03 Treatment Flow Rate - The CPS operates through gravity flow. The CPS is to be sized so the screen is capable of passing the calculated project specific water quality flow rate per local standards. All treatment flow rates must include a 50% screen clogging factor.

03.01.04 Bypass Flow Rate – The CPS is designed to fit within the catch basin in a way not to affect the existing hydraulics and treat or bypass all flows. The bypass must be sized with a surface area greater than the outlet pipe size, thus the CPS shall not be a critical point of flow restriction.

PART 4 - EXECUTION

04.01.00 General

The installation and use of the CPS shall conform to all applicable national, state, municipal and local specifications.

04.02.00 Installation

The contractor shall furnish all labor, equipment, materials and incidentals required to install the CPS device(s) and appurtenances in accordance with the drawings, installation manual, and these specifications, and be inspected and approved by the local governing agency. Any damage to catch basin and surrounding infrastructure caused by the installation of the CPS is the responsibility of the installation contractor.

04.02.01 CPS and all components or accessories shall be inserted through the catch basin and properly secured per manufactures installation manual and these specifications.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – CPS shall be shipped to the contractor's address and is the responsibility of the contractor to transport the unit(s) to the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the CPS(s) and its components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted, and unloading has commenced shall be born by the contractor. The CPS(s) and its components shall always be stored indoors and transported inside the original shipping container(s) until the CPS(s) are ready to be installed. The CPS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the CPS has been properly installed at the correct location(s), elevations, and with appropriate supports and fasteners. All components associated with the CPS and its installation shall be subject to inspection by the engineer of work, governing agency, and the manufacture at the place of installation. In addition, the contractor shall demonstrate that the CPS has been installed per the manufacturer's specifications and recommendations. CPS(s) shall be physically inspected regularly in accordance to owner's Stormwater Pollution Prevention Plans (SWPPP) and manufacture's recommendations. An inspection record shall be kept by the inspection operator. The record shall include the condition of the CPS and its appurtenances. The most current copy of the inspection record shall always be copied and placed in the owner's SWPPP.

04.04.02 Maintenance – The maintenance shall be performed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The

manual has detailed information regarding the maintenance of the CPS(s). A detailed Maintenance Record shall be kept by the maintenance operator. The Maintenance Record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the CPS. The most current copy of the Maintenance Record shall always be copied and placed in the owner's Stormwater Pollution Prevention Plan (SWPPP) per governing agency. Upon cleaning: no trash or debris shall be located in the catch basin, on top of the bypass lid, or between the screen; no vegetation shall block the catch basin opening or connector pipe; and no trash or debris shall be located within the catch basin opening.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured and removed from the CPS shall be transported and disposed of at an approved facility for disposal in accordance with local and state regulations. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURANCE

05.01.00 Warranty

The manufacturer shall guarantee the CPS against all manufacturing defects in materials and workmanship for a period of (3) years from the date of delivery to the contractor. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The CPS is limited to recommended application for which it was designed.

[End of This Section]

Tools:







- Marker – Sharpie
- Tape Measure
- Square – Straight Edge
- Grinder – Cut off blade
- Hammer (recommend 2lbs sledge hammer)
- Level 24”
- RotoHammer w/ 3/8” x 6” concrete bit
- 9/16 wrench
- Impact Drill with 9/16 socket (not required)

Hardware:





- 3/8” x 2 ¾” Wedge Anchors
- 3/8” x 1 ½” Nuts & Bolt, Washers
- Tringle Mounting Bracket
- Slotted “L” Bracket

Installation:

1. Before cutting the child safety bar, you must slide the ARS unit into the drain opening for a test fit. If the unit slides in, pull the units back out and cut the child safety bars off if necessary. Do not cut the vertical support bars off.
2. Set the ARS unit(s) in front of the drain numerically from left to right.
3. Verify that the end brackets fit into the catch basin correctly. If they do not fit, modify the bracket keeping in mind of the bracket holes that need be used to secure the swiveling bracket.
4. Remove swiveling bracket from back of unit and place into each end section making sure that the bracket leaves 1”-1.5” of clearance for the final ARS installation. Mark the bracket final location making sure the bracket sits at desired vertical angle in the basin. Please not that these can be angled differently dependent on type of catch basin to make sure optimal trash capture.
5. Hammer drill the marked holes and secure in the swiveling bracket into the wall.
6. Remove tensioner spring from back of the unit and slide bracket off of top support bar. Secure bracket into one side of curb using the hex bolts and hex wrench for that particular size.
7. Slide support bar back into bracket and verify that unit fits into basin correctly. Remove Swiveling bracket from unsecured side and repeat steps 4 and 5 securing the swiveling bracket to the inner wall of the catch basin. ****Please note this step will be different if multiple units are strung together. Please refer to 3 steps for multiple units****

AUTOMATIC RETRACTABLE SCREEN (ARS)

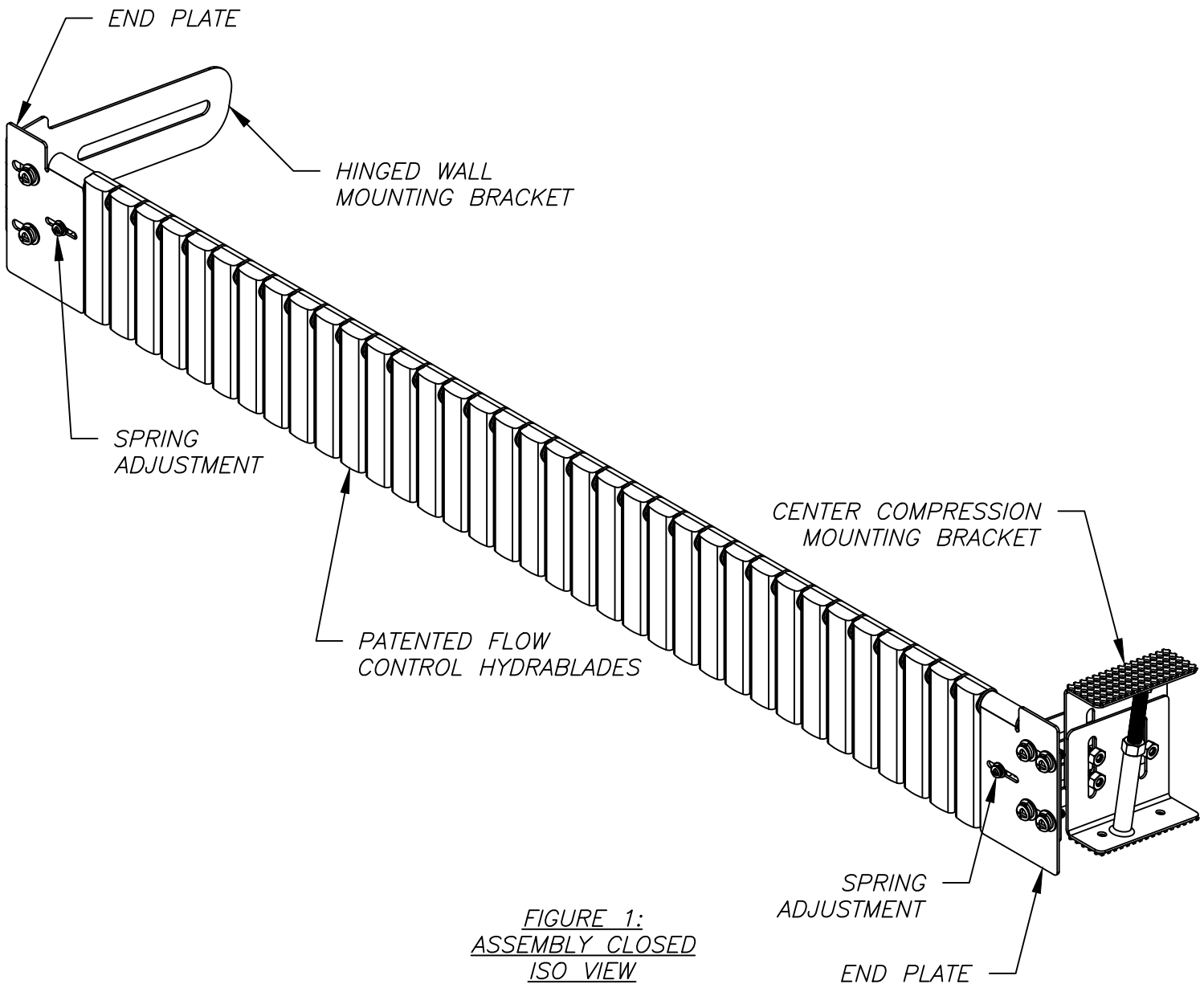


FIGURE 1:
ASSEMBLY CLOSED
ISO VIEW

NOTES:

1. STRUCTURE OF ARS SHALL BE TYPE 304 STAINLESS STEEL.
2. ALL HARDWARE, TAMPER-PROOF SCREWS / ANCHORS SHALL BE TYPE 316 STAINLESS STEEL.
3. CUSTOM SIZING FITS ANY CURB OPENING. OPENINGS 48 INCHES AND LESS DO NOT REQUIRE CENTER COMPRESSION MOUNTING BRACKET. HINGED WALL MOUNTING BRACKET IS AT EACH END OF UNIT.
4. ALL BLADES ARE MADE FROM A HIGH STRENGTH POLYMER WITH UV INHIBITOR.
5. TENSION REGULATORS KEEP BLADES CLOSED. WHEN WATER IN STREET RISES, BLADES AUTOMATICALLY OPEN SLOWLY. NO OVERFLOW GAP NEEDED FOR THIS SYSTEM. TENSION REGULATOR IS UNAFFECTED BY STREET SWEEPER.
6. TENSION REGULATOR FORCES BLADES TO CLOSED POSITION.

DRAWING: AUTOMATIC RETRACTABLE SCREEN		PATENTED	
WARRANTY: 3 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 5796 ARMADA DR STE 250, CARLSBAD, CA 92008 PHONE: 760-433-7640		LOCATION:	
		REVISIONS:	DATE:
DATE: 7/15/19	SCALE: SF = NTS	REVISIONS:	DATE:
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:

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ARS

PART #:	DESCRIPTION:
1	END PLATE W/ HINGED MOUNTING BRACKET
2	CENTER COMPRESSION MOUNTING BRACKET

FRONT VIEW

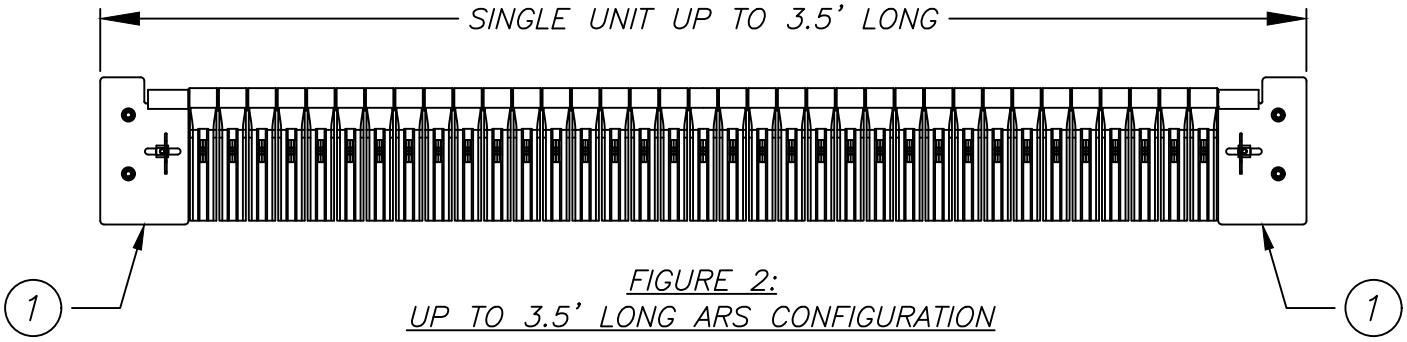


FIGURE 2:
UP TO 3.5' LONG ARS CONFIGURATION

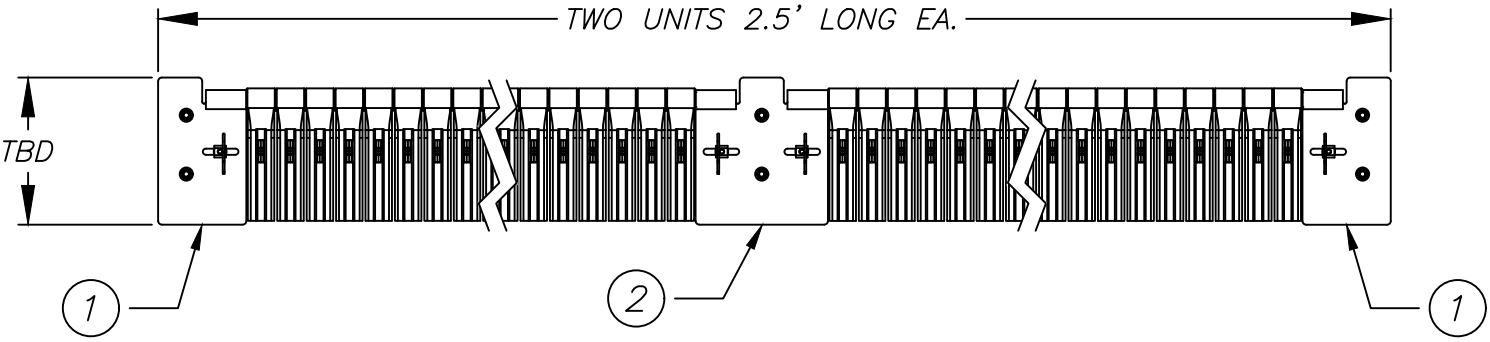


FIGURE 3:
>3.5' TO 7' LONG ARS CONFIGURATION

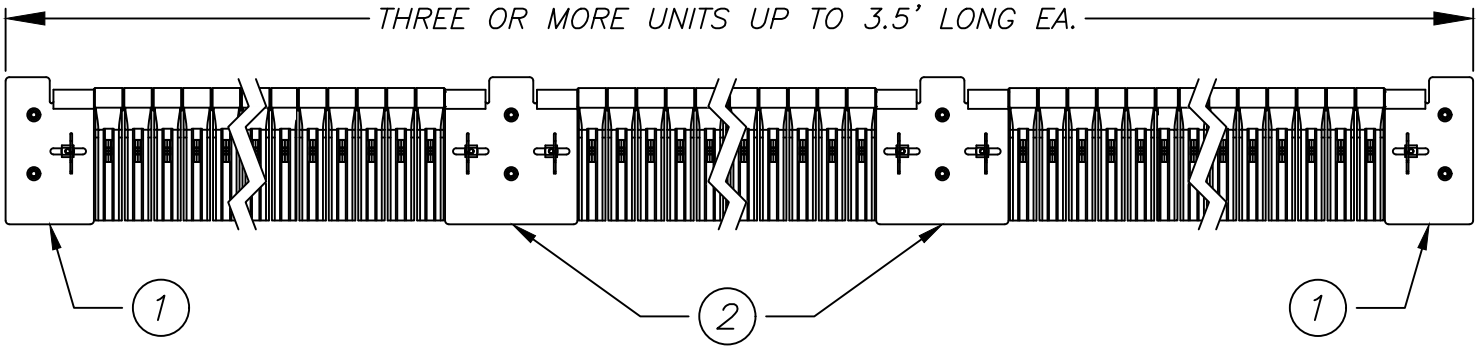


FIGURE 4:
>7' LONG ARS CONFIGURATION

DRAWING: AUTOMATIC RETRACTABLE SCREEN		PATENTED	
WARRANTY: 3 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 5796 ARMADA DR STE 250, CARLSBAD, CA 92008 PHONE: 760-433-7640		LOCATION:	
		REVISIONS:	DATE:
DATE: 10/24/19	SCALE: SF = NTS	REVISIONS:	DATE:
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:

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ARS

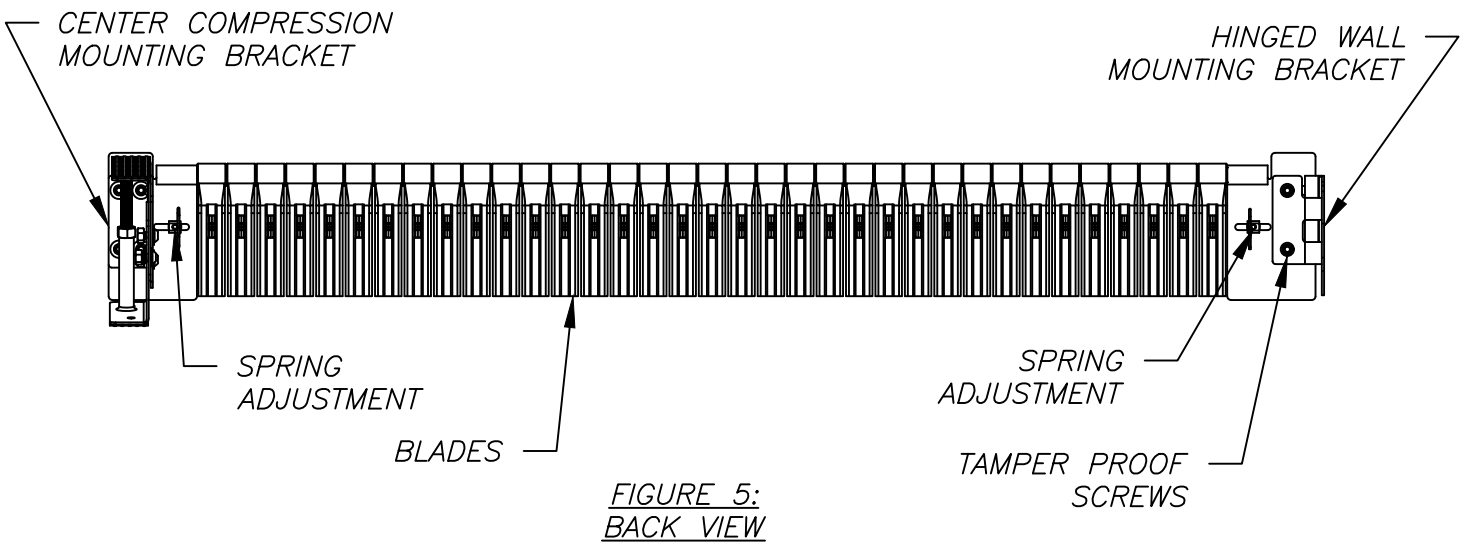


FIGURE 5:
BACK VIEW

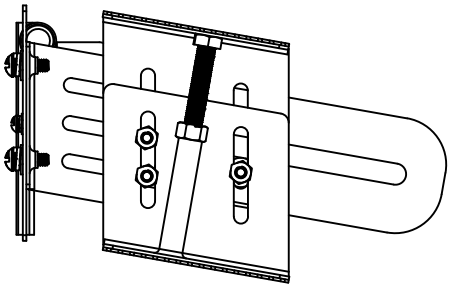


FIGURE 6:
SIDE VIEW
CENTER COMPRESSION
MOUNTING BRACKET

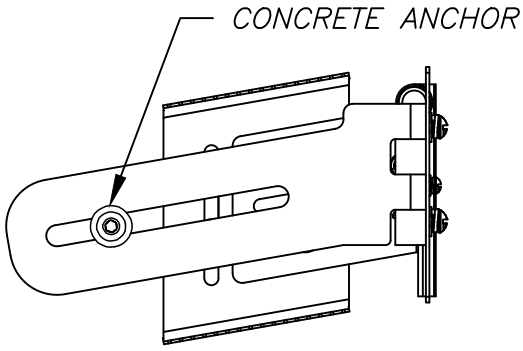


FIGURE 7:
SIDE VIEW
HINGED WALL
MOUNTING BRACKET

INSTALLATION NOTES:

1. SLIDE ARS NTO DRAIN OPENING FOR TEST FIT. SET ARS UNIT(S) IN FRONT OF DRAIN NUMERICALLY FROM LEFT TO RIGHT.
2. IF UNIT(S) DO NOT FIT, MODIFY BRACKET NOTING BRACKET HOLES USED TO SECURE SWIVELING BRACKET.
3. SECURE THE SWIVELING BRACKET INTO WALL.
4. REMOVE TENSIONER SPRING FROM BACK OF THE UNIT AND SLIDE BRACKET OFF TOP SUPPORT BAR. SECURE BRACKET INTO SIDE OF CURB USING HEX BOLTS AND HEX WRENCH.
5. SLIDE SUPPORT BAR BACK INTO BRACKET TO VERIFY UNIT FITS INTO BASIN CORRECTLY. IF MULTIPLE UNITS, SLIDE FIRST UNIT INTO PLACE, PLACE TENSION BRACKET SO THAT FRONT BRACKET HOLES LINE UP WITH TENSION BRACKET HOLES, ADD STRUCTURAL CAULKING ADHESIVE ONTO TENSIONER BRACKET TO ENSURE IT IS SECURE, AND ATTACH FRONT BRACKET HEX SCREWS TO THE TENSIONER BRACKET. REPEAT FOR ADDDITIONAL UNITS.
6. IF UNIT IS TOO LONG FOR CATCH BASIN, REMOVE UNSECURED BRACKET FROM SUPPORT ROD LEAVING BLADES AND SUPPORT ROD IN CATCH BASIN.
7. MEASURE AMOUNT NEEDED TO BE REMOVED FROM SUPPORT BAR. REMOVE BLADES TO HAVE A CLEAR CUT ON SUPPORT BAR. CUT SUPPORT BAR AND REPLACE BLADES AND BRACKET.
8. DETHREAD RETAINING PIN AND CUT THE SPRING TO DESIRED TENSION. RETHREAD THE RETAINING PIN SCREW AND SECURE TENSION SPRING TO BACK OF UNIT.
9. PLACE BRACKET ONTO SWIVELING BRACKET AND SECURE USING HEX WRENCH.
10. VERIFY EACH BLADE MOVES INDEPENDENTLY AND THAT THE DESIRED TENSION IS IN THE SPRING.
11. IF THERE IS A NEED TO ADD OR REMOVE TENSION, ADJUST LATERAL TENSION SCREWS ON THE FRONT BRACKET.

DRAWING: AUTOMATIC RETRACTABLE SCREEN		PATENTED	
MODEL #: SEE TABLE ABOVE			
WARRANTY: 3 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 5796 ARMADA DR STE 250, CARLSBAD, CA 92008 PHONE: 760-433-7640		LOCATION:	
		REVISIONS:	DATE:
DATE: 10/24/19	SCALE: SF = NTS	REVISIONS:	DATE:
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:

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Bio Clean ARS

A Stormwater Trash Capture Solution

INSTALLATION MANUAL

5796 Armada Drive Suite 250 | Carlsbad, CA 92008 | 855.566.3938

stormwater@forterrabp.com | biocleanenvironmental.com

INSTALLATION

The Bio Clean ARS requires minimal time and tools for installation. The system is especially designed to be the easiest system on the market in install. Generally, the system can be installed into the basin from the curb opening. The end mounting brackets are adjustable and require only one wedge anchor per side. The center mount is pressure fitted to the top and bottom of the curb opening with now need to drill into the concrete.



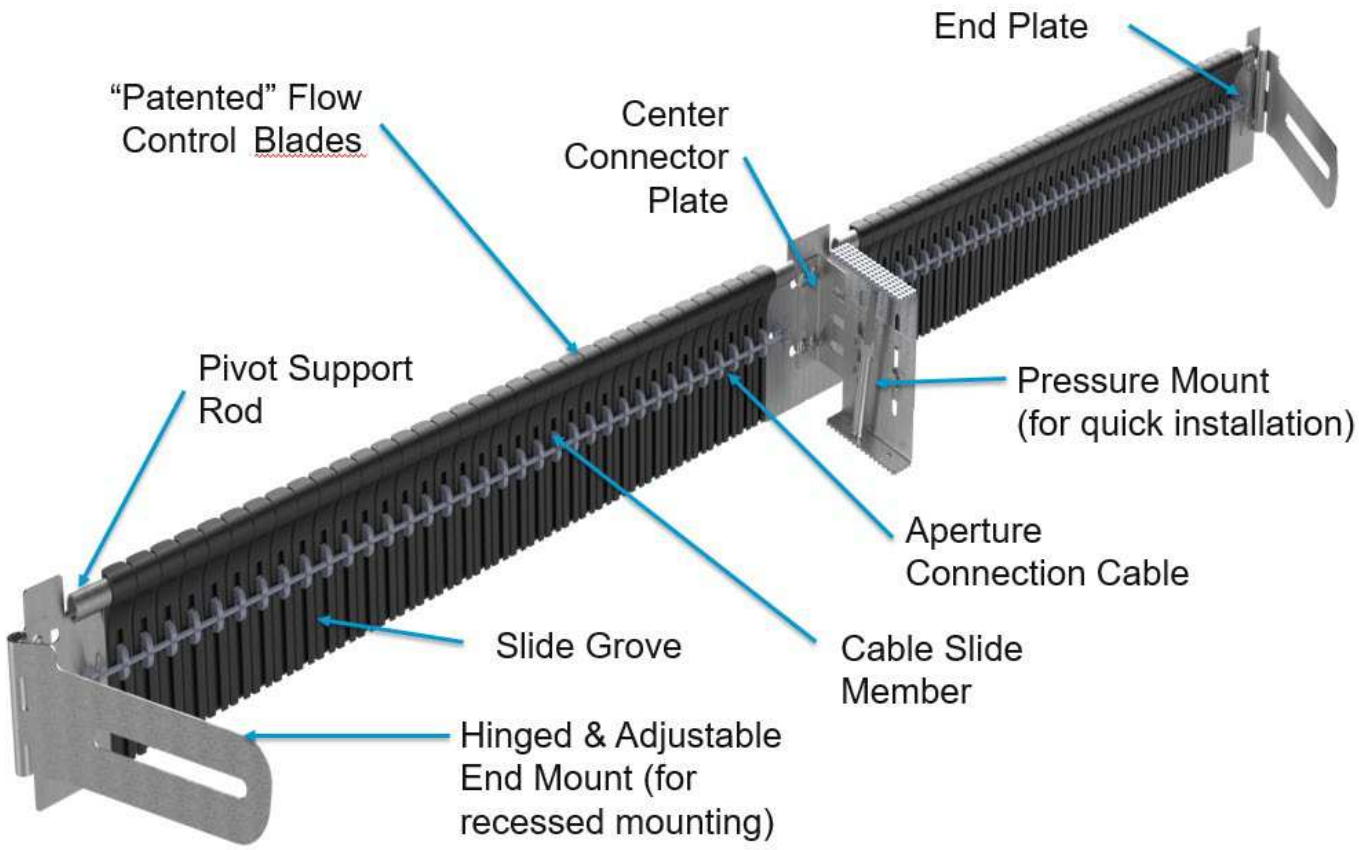
It is recommended that the catch basin be cleaned during time of install as the install can be used as opportunity to do so. Also, this will allow the client to accurately observe the effectiveness of the Bio Clean ARS from preventing trash and debris from entering the basin.

Requirements:

The contractor shall furnish all labor, equipment, materials, and incidentals required to install the ARS and appurtenances in accordance with the contract documents. Any damage to the existing drainage structure (retrofit applications) or surrounding infrastructure that may need to be repaired to allow for proper installation of the ARS shall be considered incidental and to be paid for at no cost to the client. Bio Clean does offer installation services in certain areas. Please contact Bio Clean for more information on pre-authorized 3rd party contractors that can provide install service in your area.

The manufacturer of the Bio Clean ARS does provide a warranty against defects in materials and workmanship for a period of 3 years from the date of acceptance by the Engineer. The Bio Clean ARS also carries a 2-year warranty on installation.

Components:



Tension Regulators

Optional Tension Regulator Allows for Adjustment Based On Catch Basin Flow Conditions



Blade

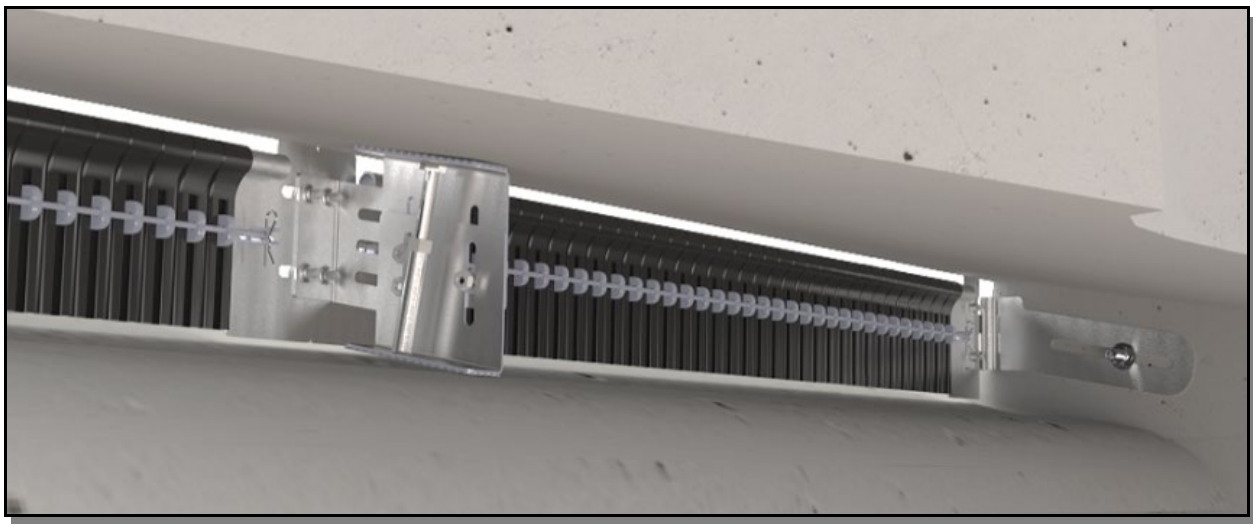


Hydra Blades Are Plastic Injection Molded Out of Durable UV Resistant Resin



a. Loosen tension bracket so that it can be easily adjusted.
b. Verify length of first unit and slide into place the tension bracket that is included so that front bracket holes line up with the first section of holes on the tension bracket.
c. Add structural caulking adhesive onto the tensioner bracket so that bracket stays in place and tighten the unit to fit the catch basin walls
d. Attach front bracket hex screws to the tension bracket and repeat steps to fully install the complete basin

8. If unit is too long for the catch basin, remove the unsecured bracket from the support rod leaving the curb blades and support rod in the catch basin.
9. Measure the amount that is needed to be removed from the top support bar. Pull off necessary amount of blades to have a clear cut onto the support bar. Cut the top support bar to fit the new sized catch basin and replace the necessary amount of blades to make a seamless front ARS unit.
10. Dethread the retaining pin and cut the spring to the desired amount and tension. Rethread the retaining pin screw and secure tension spring to the back of the unit.
11. Place front bracket onto swiveling bracket and secure using hex wrench.
12. Verify that each blade moves independently and that the desired tension is in the spring.
13. If there is a need to add or remove tension to the system, adjust lateral tension screws on the front bracket to make the unit have more or less tension into the system.



For Installation Support
Please Contact Us At:
760-433-7640
stormwater@forterrabpm.com

BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

Also known as:

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*



Proprietary biotreatment
Source: http://www.americastusa.com /index.php/filterra/

Feasibility Screening Considerations

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

OC-Specific Design Criteria and Considerations

☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.

☐ Consult proprietors for specific criteria concerning the design and performance.

☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.

☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

Computing Sizing Criteria for Proprietary Biotreatment Device

- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in **Appendix III.3.2**.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in **Appendix III.3.3)**.

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. Many propretary biotreatment BMPs will not be able to meet the definition of "biofiltration" that applies in South Orange County. See Section III.7 and Worksheet SOC-1.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: **http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf**
- Santa Barbara BMP Guidance Manual, Chapter 6: **http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf**

Site Design & Landscape Planning SD-10



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Roof Runoff Controls SD-11



Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

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barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Street Sweeping and Vacuuming SE-7



Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TR	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

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- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

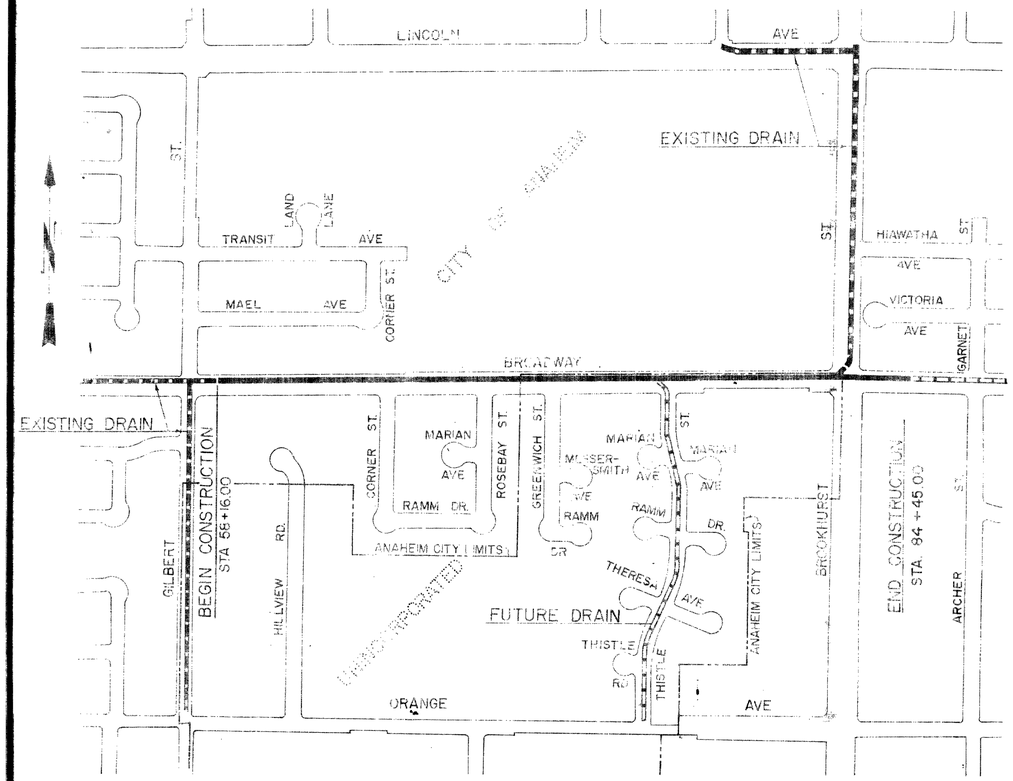
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Attachment D

Reference Material



LOCATION MAP

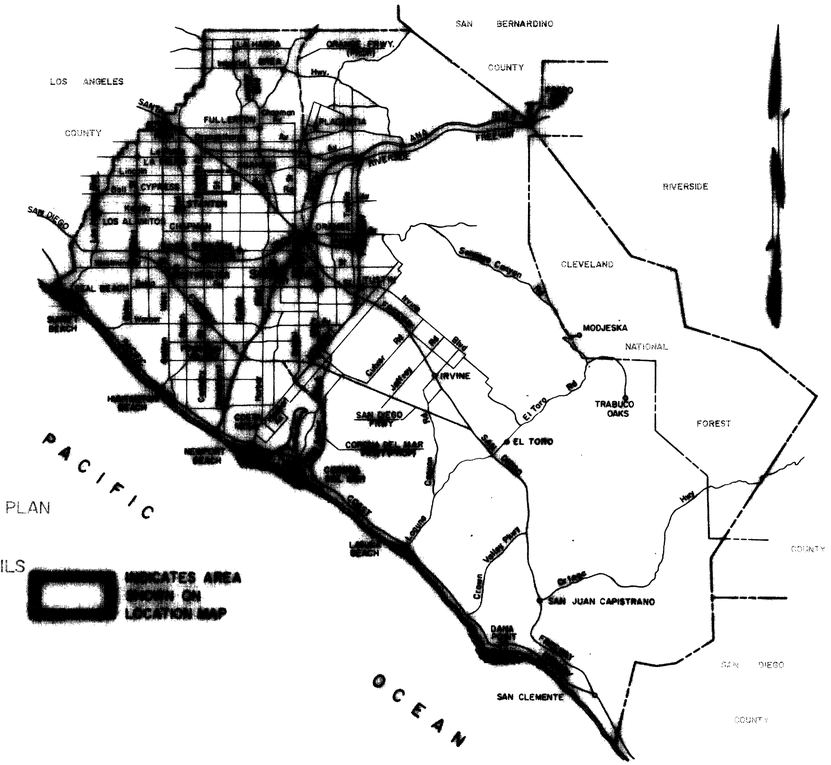
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SCALE IN FEET

INDEX OF DRAWINGS

SHT. NO.	DRAWING TITLES
1.	TITLE SHEET
2.	PLAN & PROFILE, STA. 57+16 TO STA. 64+00
3.	PLAN & PROFILE, STA. 64+00 TO STA. 72+00
4.	PLAN & PROFILE, STA. 72+00 TO STA. 79+75
5.	PLAN & PROFILE, STA. 79+75 TO STA 84+45
6.	R.C. BOX CONDUIT - SCHEDULE & DETAILS
7.	SEWER SIPHON DETAILS & LOOP INSTALLATION PLAN
8.	R.C. TRANSITION AND STREET INTERSECTION
9	LATERAL PROFILES, CATCH BASIN & INLET DETAILS
10.	BORING LOGS AND PAYLINE DETAILS

BROOKHURST STREET DETOUR PLANS



ORANGE COUNTY, CALIFORNIA
VICINITY MAP

4 3 2 1 0 2 4 6 12

SCALE IN MILES

MAP FOR THE CONSTRUCTION OF THAT PORTION OF

BROADWAY STORM DRAIN
FROM
EASTERLY OF GILBERT ST.
TO
EASTERLY OF BROOKHURST AVE
FACILITY NO. B01P08
MAY 1976

UTILITY OWNERS

NAME	PHONE NO.
PACIFIC TELEPHONE & TELEGRAPH CO.	(714) 633-0811
SOUTHERN CALIFORNIA GAS CO.	(714) 538-0211
CITY OF ANAHEIM WATER DIVISION	(714) 533-5451
SOUTHERN CALIFORNIA EDISON CO.	(714) 835-3833
CITY OF ANAHEIM SEWER DIVISION	(714) 533-5321
CITY OF ANAHEIM ELECTRICAL DIVISION	(714) 533-5775

PREPARED BY
M & Q PACIFIC
CIVIL ENGINEERING - SURVEYING
7021 BUSINESS CENTER DRIVE
SUITE 200
IRVINE, CALIFORNIA
(714) 833 2721

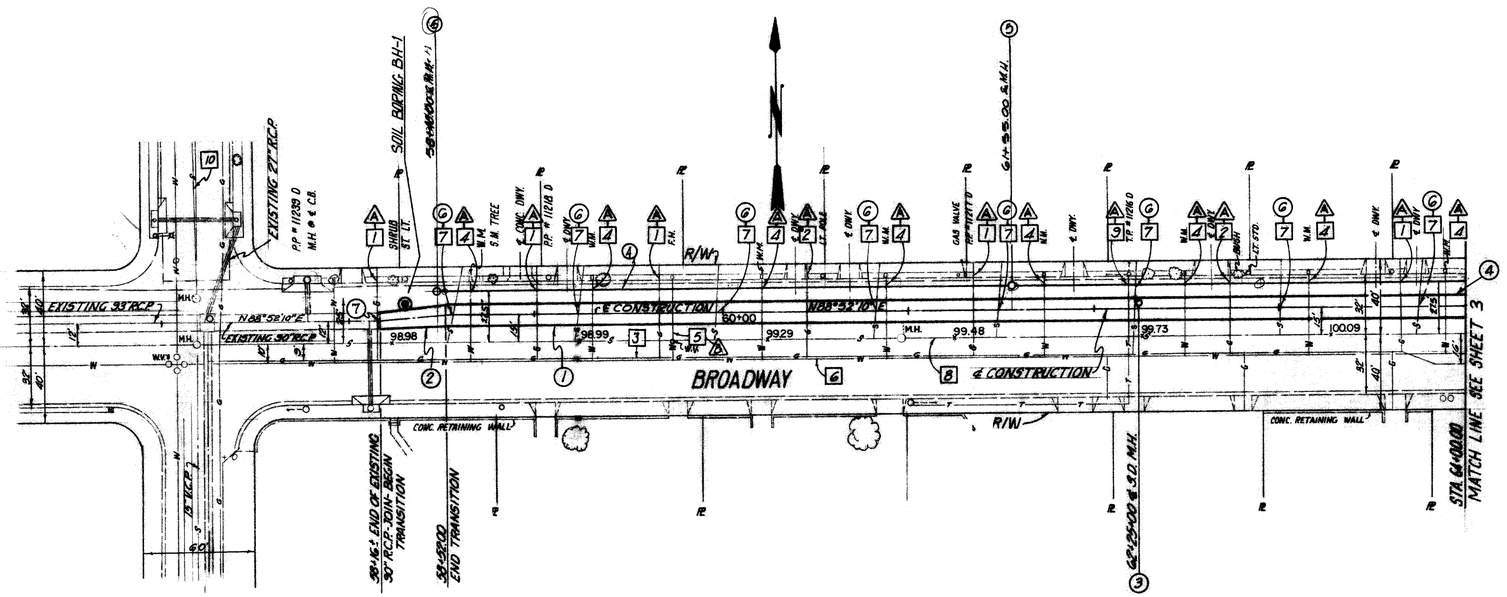
SUBMITTED: Paul E. Lower Date: 4-12-76
PAUL E. LOWER R.C.E. No. 19187

APPROVED: Thornton Virgadamo 4/23/76
AS TO PORTIONS WITHIN THE CITY OF ANAHEIM — DIRECTOR OF PUBLIC WORKS

ADMINISTERED BY
ORANGE COUNTY ENVIROMENTAL MANAGEMENT AGENCY
FUNDED BY
ORANGE COUNTY FLOOD CONTROL DISTRICT
SANTA ANA CALIFORNIA

DWG. NO. B01P08-701-1-A

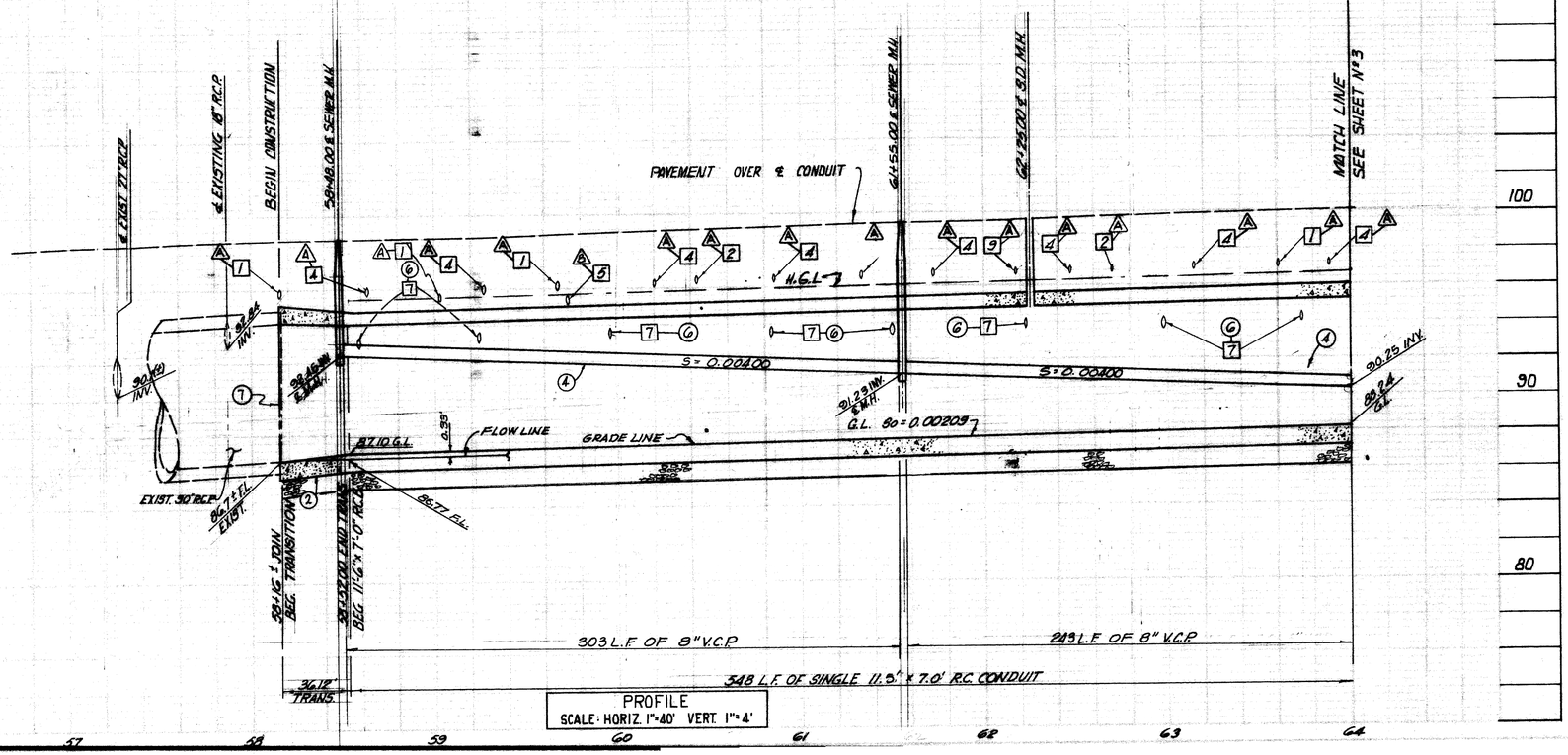
SHEET 1 OF 10 SHEETS



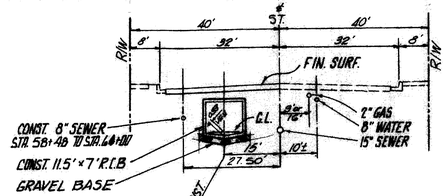
HYDRAULIC DATA: PRESSURE FLOW

Station to Station	Q25	R.C.B Size	So	n=0.014			n=0.012		
				Sf	D	V	Sf	D	V
58+16± to 64+00.00	790	11.5'x7'	0.00209	.00295	FULL	8.87	.00173	FULL	8.87

PLAN
SCALE: 1"= 40'



PROFILE
SCALE: HORIZ. 1"=40' VERT. 1"= 4'



TYPICAL SECTION
SCALE 1"=20'
STA. 58+52 to STA 64+00

CONSTRUCTION NOTES

1. CONSTRUCT 11.5'x7' R.C. BOX CONDUIT PER PLAN, PROFILE AND TYPICAL SECTION THIS SHEET. SEE STRUCTURAL DETAILS ON SHEET 6. SEE BEDDING & RESURFACING DETAILS ON SHEET 10.
2. CONSTRUCT 30" R.C.P. TO 11.5'x7' R.C.B. TRANSITION PER PLAN AND PROFILE THIS SHEET. SEE DETAIL ON SHEET NO. 8.
3. CONSTRUCT MANHOLE PER O.C.F.C.D. STD. M.H.3-1 & STD. PM1-1.
4. INSTALL 8" V.C.P. SEWER PER PLAN PROFILE AND TYPICAL SECTION THIS SHEET.
5. CONSTRUCT 4' I.D. PRECAST MANHOLE PER CITY OF ANAHEIM STD. 207-B.
6. REMOVE INTERFERING PORTIONS OF EXISTING 4" HOUSE LATERAL & PLUG REMODEL 4" HOUSE LATERAL PER CITY OF ANAHEIM STD. 205.
7. REMOVE EXISTING DBL COURSE BRICK & MORTAR BULKHEAD.

UTILITY NOTES

SYMBOL	DESCRIPTION	OWNER
1	3/4" GAS LINE	SO. CALIF GAS CO.
2	1" GAS LINE	"
3	2" GAS LINE	"
4	3/4" WATER LINE	CITY OF ANAHEIM
5	6" WATER LINE	"
6	8" WATER LINE	"
7	4" V.C.P. HSE. LAT.	"
8	15" V.C.P. SEWER LINE	"
9	BURIED TEL. CABLE	PACIFIC TEL. & TEL. CO.
10	10" V.C.P. SEWER LINE	CITY OF ANAHEIM

LEGEND

- PROTECT IN PLACE
- TO BE RELOCATED BY OTHERS
- SOIL BORING

DATUM: OCFCD = OCS (1970 adj.)

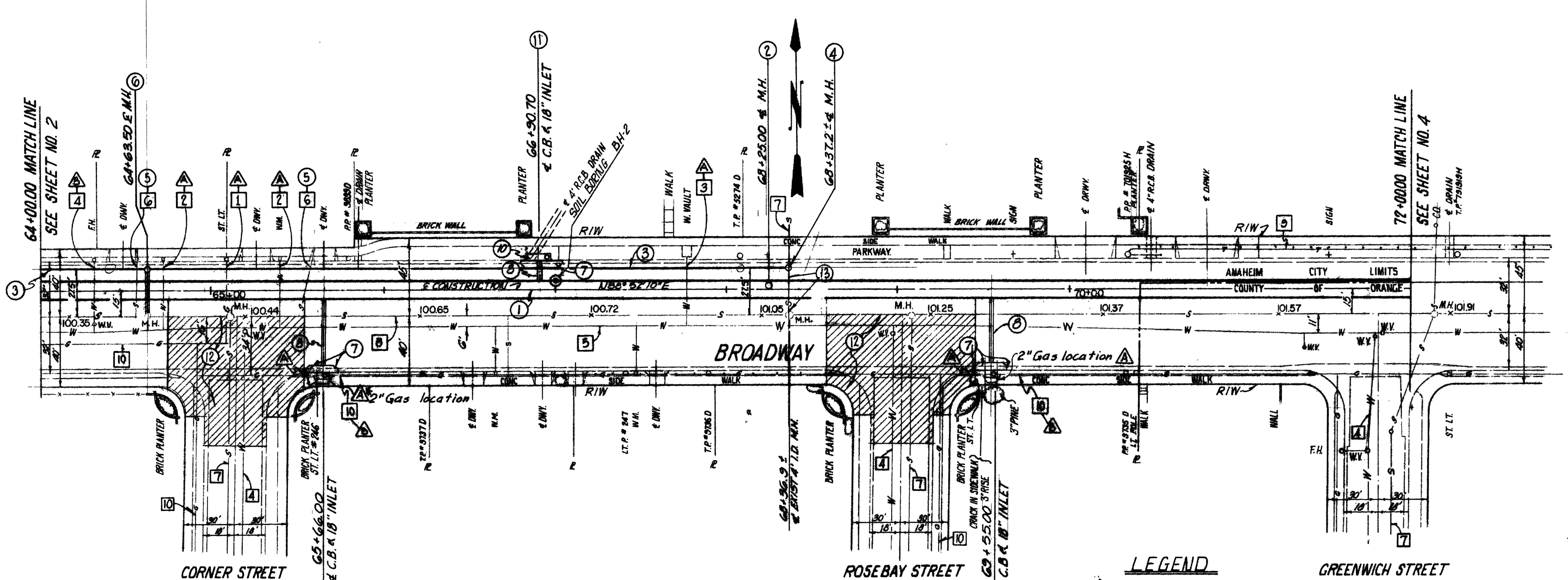
BENCH MARK

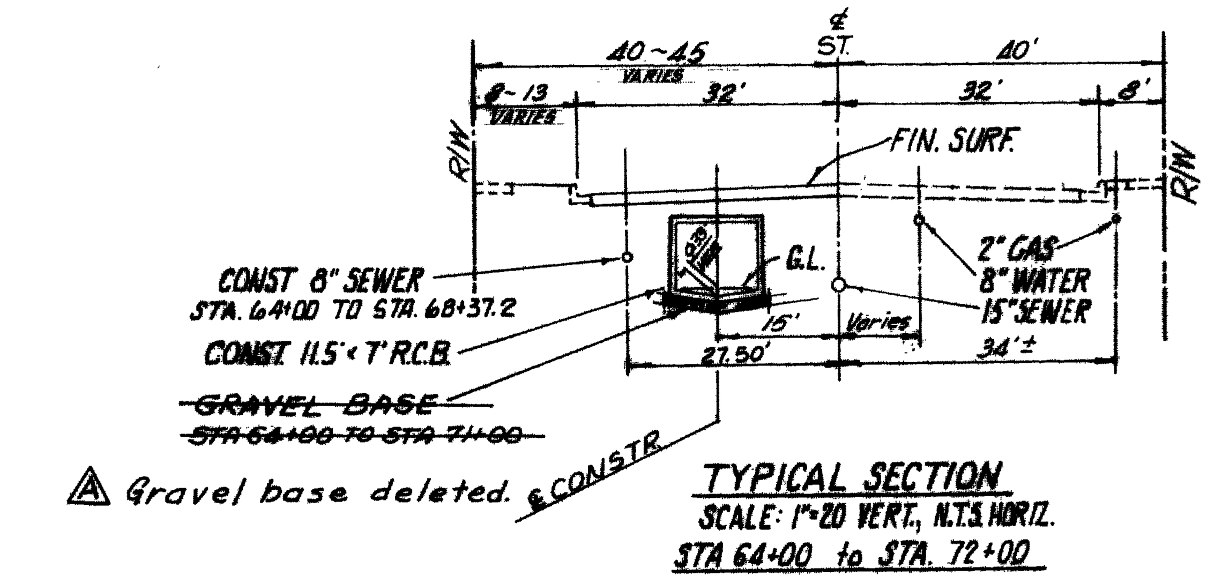
O.C.S. B.M. 1G-142-63

ALUMINUM CAP IN THE NORTHEAST PORTION OF THE INTERSECTION OF MAGNOLIA STREET AND BROADWAY 133 FEET EAST OF THE CENTERLINE OF BROADWAY. SET IN THE NORTHWEST CORNER OF A 10'x4' CONCRETE CATCH BASIN AT SIDEWALK LEVEL. 1970 ADJUSTMENT = ELEV. 33.051

1 1/2 0 1 2
3 inches on original drawing

PRELIMINARY REVISION CODE Disregard Prints Bearing Earlier Codes			
REVISIONS			ORANGE COUNTY FLOOD CONTROL DISTRICT
MARK	DATE	DESCRIPTION	BROADWAY STORM DRAIN
			PLAN & PROFILE
			STA. 58+15.86 to STA. 64+00.00
DESIGNED P.L.			RECOMMENDED Fred W. Williams DESIGN DIVISION ENGINEER
DRAWN C.A.	CHECKED MAC		
SUBMITTED Paul C. Lawler DESIGN ENGINEER			SCALE AS SHOWN / DATE MAY 1976 / DWG. NO. 80IP08-701-1-A





Ⓐ Gravel base deleted.

TYPICAL SECTION
SCALE: 1"=20 VERT., N.T.S. HORIZ.
STA 64+00 to STA. 72+00

HYDRAULIC DATA : PRESSURE FLOW

Station to Station	Q_{25}	R.C.B. Size	S_o	n=0.014			n=0.012		
				S_f	D	V	S_f	D	V
64+00.00 to 72+00.00	730	11.5'×7'	.00209	.00235	FULL	8.87	.00173	FULL	8.87

LEGEND
- Ⓐ PROTECT IN PLACE
- Ⓑ TO BE RELOCATED BY OTHERS
- ◉ SOIL BEARING

PLAN
SCALE: 1" = 40'

CONSTRUCTION NOTES

1. CONSTRUCT 11.5'×7' R.C. BOX CONDUIT PER PLAN AND PROFILE AND TYPICAL SECTION THIS SHEET SEE STRUCTURAL DETAILS ON SHT. 6 SEE BEDDING AND RESURFACING DETAILS ON SHT. 10.
2. CONSTRUCT MANHOLE PER O.C.F.C.D. STD. M.H. 3-1 & STD. P.M. 1-1.
3. INSTALL 8" V.C.P. SEWER PER PLAN, PROFILE AND TYPICAL SECTION THIS SHEET.
4. CONSTRUCT 4' I.D. PRECAST MANHOLE PER CITY OF ANAHEIM STD 207-B
5. REMOVE INTERFERING PORTIONS OF EXISTING 4" HOUSE LATERAL & PLUG. REMODEL 4" HOUSE LATERAL PER CITY OF ANAHEIM STD 205.
6. CONSTRUCT 4' I.D. M.H. PER CITY OF ANAHEIM STD. 207-B, REMOVE PORTION OF EXISTING 8" V.C.P. & CONSTRUCT 8" V.C.P. SIPHON AND ENCASEMENT PER DETAIL ON SHEET 7.
7. SAW CUT AND REMOVE EXISTING CURB GUTTER & SIDEWALK AS REQUIRED FOR CONSTRUCTION OF C.B. AND LOCAL DEPRESSION.
8. CONSTRUCT 18" R.C.P. LATERAL. SEE LATERAL PROFILES AND DETAILS ON SHEET 9.
9. CONSTRUCT C.B. No. 1 PER CITY OF ANAHEIM STD. DETAIL No. 302 W=7.0' V=4.0'; AND LOCAL DEPRESSION TYPE ✱ PER CITY OF ANAHEIM STD. DETAIL No. 308-A, 10 C.F. (*Ⓐ C)
10. SAWCUT AND REMOVE INTERFERING PORTION OF EXISTING 4' R.C.B. DRAIN & JOIN TO BACK OF C.B. SEE MODIFIED CATCH BASIN DETAIL ON SHEET NO. 9.
11. CONSTRUCT MODIFIED CATCH BASIN NO 1 PER CITY OF ANAHEIM STD. DETAIL NO. 302 W=14' V=4.0'; AND LOCAL DEPRESSION TYPE "A" PER CITY OF ANAHEIM STD. DETAIL 308-A 10" C.F. SEE DETAIL ON SHEET 9.
12. RECONSTRUCT STREET INTERSECTION PER DETAIL ON SHEET Nº 8
13. REMOVE INTERFERING PORTION OF EXISTING 8" V.C.P. AND PLUG AT EXIST M.H.

UTILITY NOTES

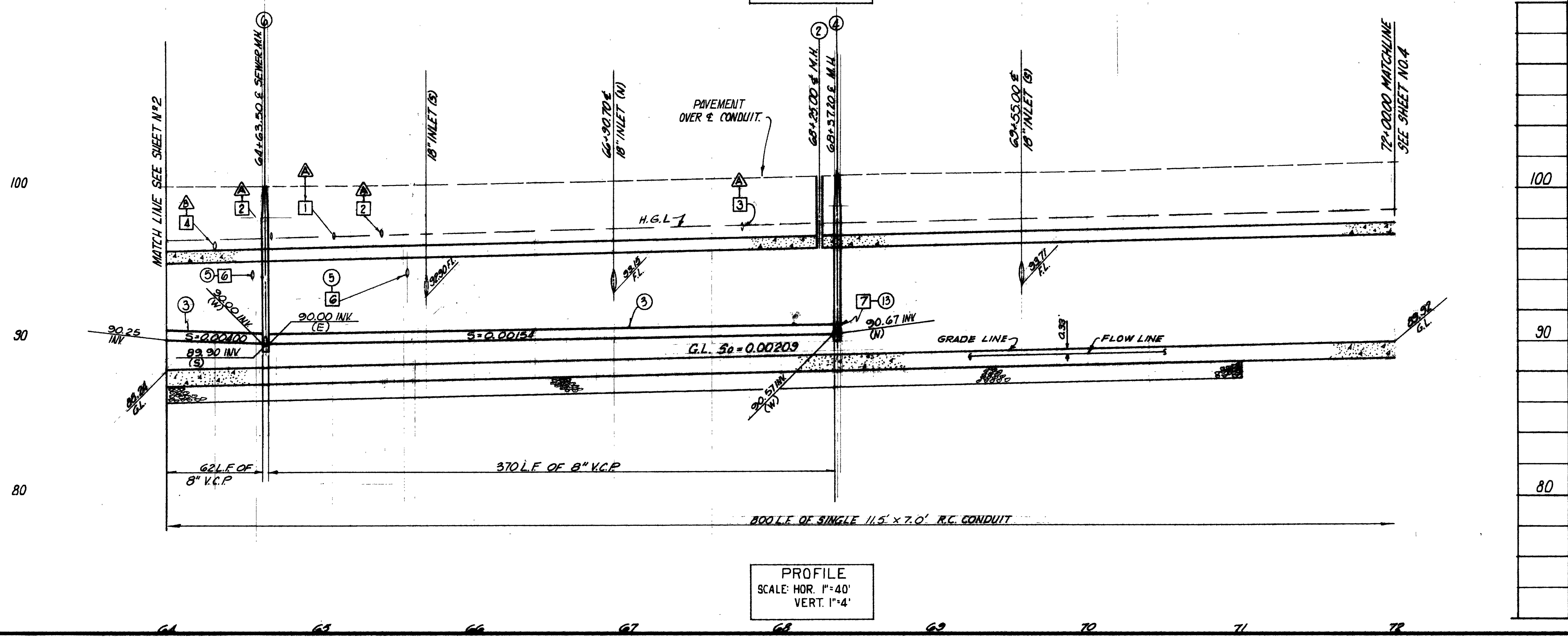
SYMBOL	DESCRIPTION	OWNER
1	1" GAS LINE	SO. CALIF. GAS CO.
2	3/4" WATER LINE	CITY OF ANAHEIM
3	4" WATER LINE	"
4	6" WATER LINE	"
5	8" WATER LINE	"
6	4" V.C.P. HOUSE LATERAL	"
7	8" V.C.P. SEWER LINE	"
8	15" V.C.P. SEWER LINE	"
9	3-4" CEM. CONDUIT	PACIFIC TEL. & TEL. CO.
10	2" GAS LINE	SO. CALIF. GAS CO.

DATUM: O.C.F.C.D. = O.C.S. (1970 adj)

BENCH MARK
O.C.S. B.M. 1G-142-69

ALUMINUM CAP IN THE NORTHEAST PORTION OF THE INTERSECTION OF MAGNOLIA STREET AND BROADWAY 139 FEET EAST OF THE CENTERLINE OF BROADWAY. SET IN THE NORTHWEST CORNER OF A 10'×4' CONCRETE CATCH BASIN AT SIDEWALK LEVEL. 1970 ADJUSTMENT: ELEV. 93.051

1 1/2 0 1 2
3 inches on original drawing

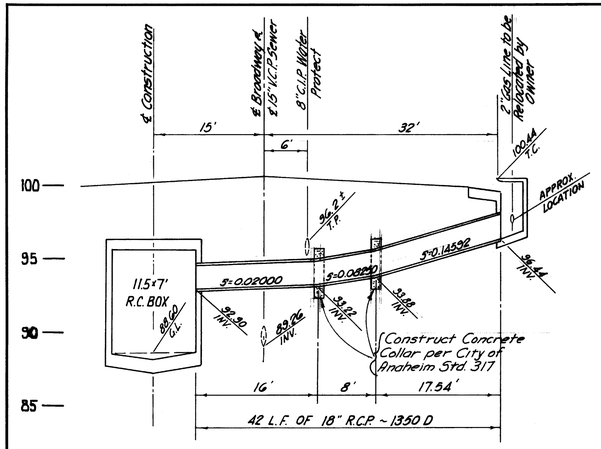


PROFILE
SCALE: HOR. 1"=40'
VERT. 1"=4'

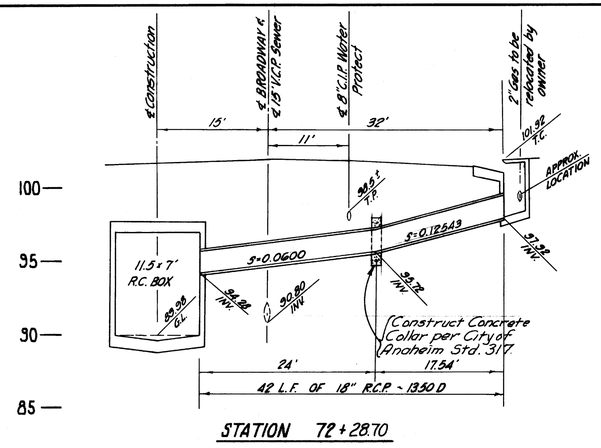
PRELIMINARY REVISION CODE Disregard Prints Bearing Earlier Codes			
REVISIONS			ORANGE COUNTY FLOOD CONTROL DISTRICT
MARK	DATE	DESCRIPTION	BROADWAY STORM DRAIN
*Ⓐ	1-77	As Built SG	PLAN & PROFILE
			STA. 64+00.00 to STA. 72+00.00
DESIGNED P.L.			RECOMMENDED [signature] DESIGN DIVISION ENGINEER
DRAWN C.A.	CHECKED MAC		
SUBMITTED [signature] DESIGN ENGINEER			SCALE AS SHOWN / DATE MAY 1976 / DWG. NO. B01P08-701-1-A

EASI FILE CORP. IRVINE, CA EFH 24

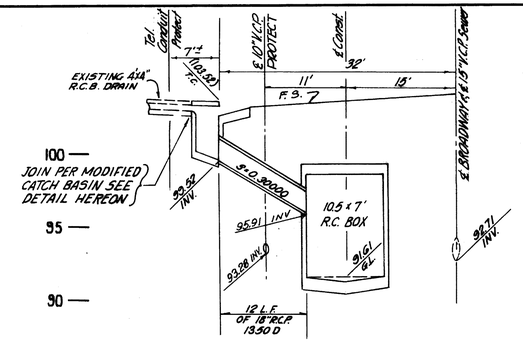
3



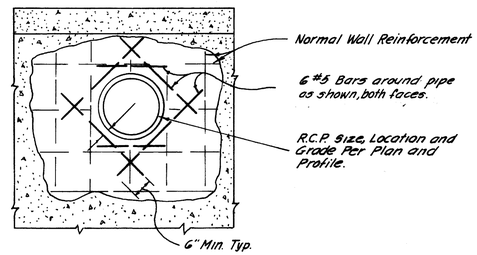
STATION 65+66.00



STATION 72+28.70



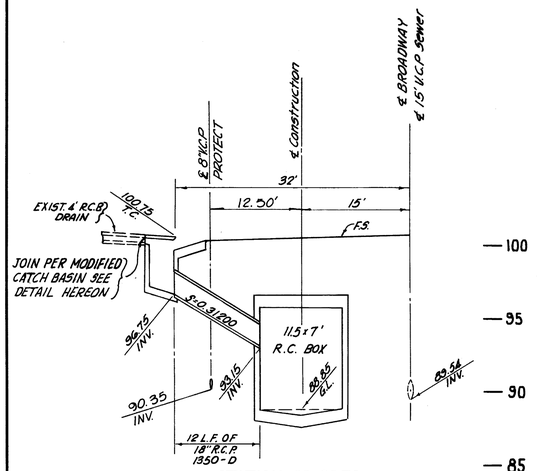
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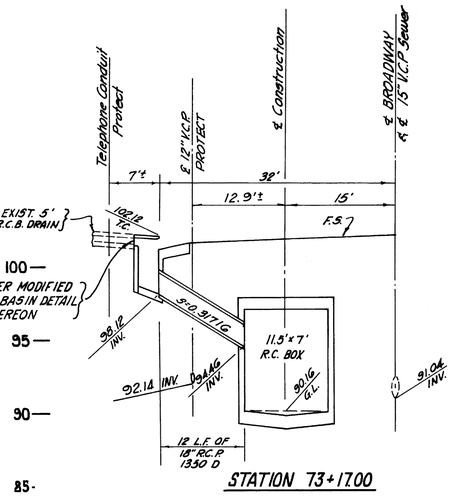
R.C. WALL INLET

30" R.C.P. INLET OR SMALLER (NO SCALE)

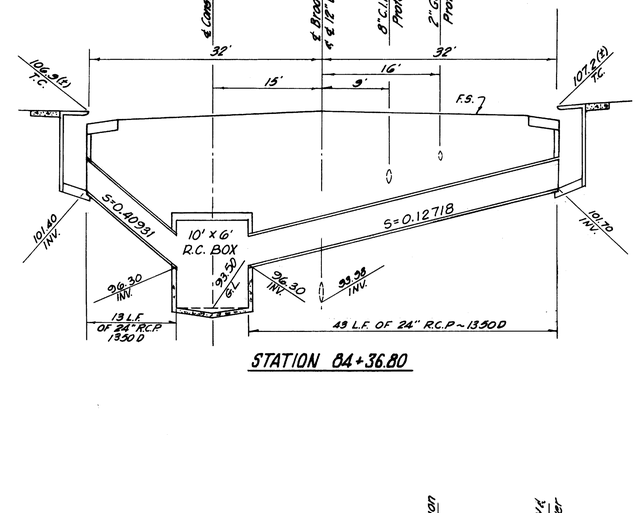
NOTE
BEND OR CUT WALL REINFORCING TO CLEAR INLET PIPE BY 2"



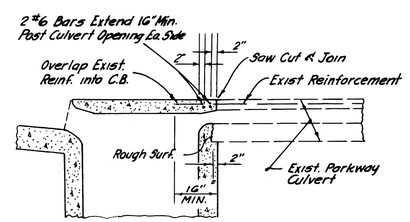
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STATION 73+17.00

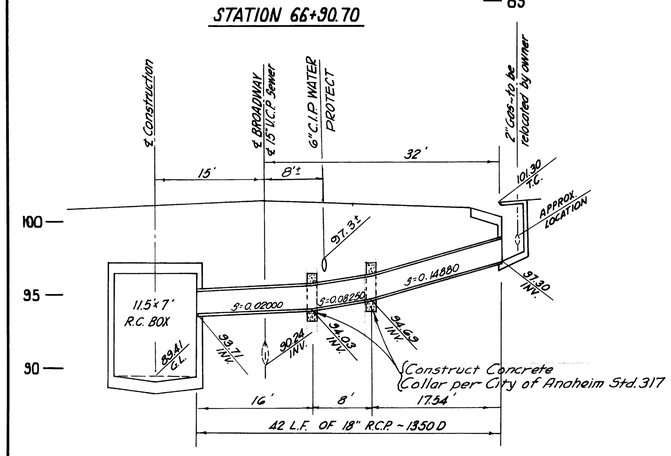


STATION 84+36.80

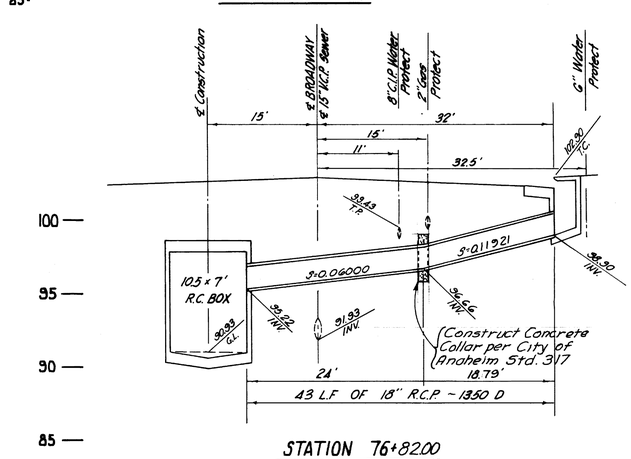


MODIFIED CATCH BASIN DETAIL

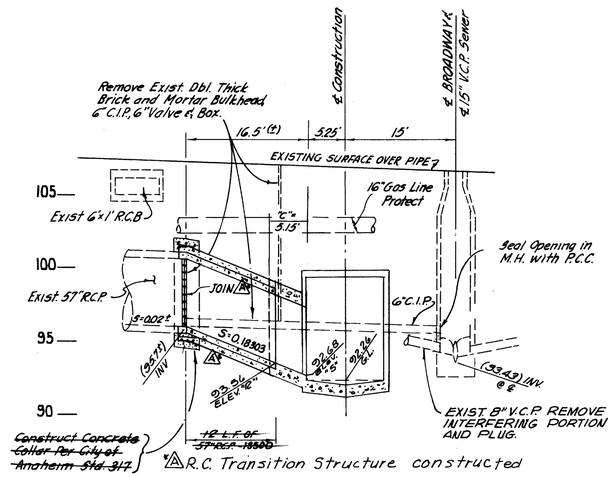
(NO SCALE)



STATION 69+55.00



STATION 76+82.00



STATION 83+25.02

STORM DRAIN LATERAL PROFILES

SCALE: HORIZONAL 1"=10' VERTICAL 1"= 5'

1 1/2 0 1 2

3 inches on original drawing

PRELIMINARY REVISION CODE
Disregard Prints Bearing Earlier Codes

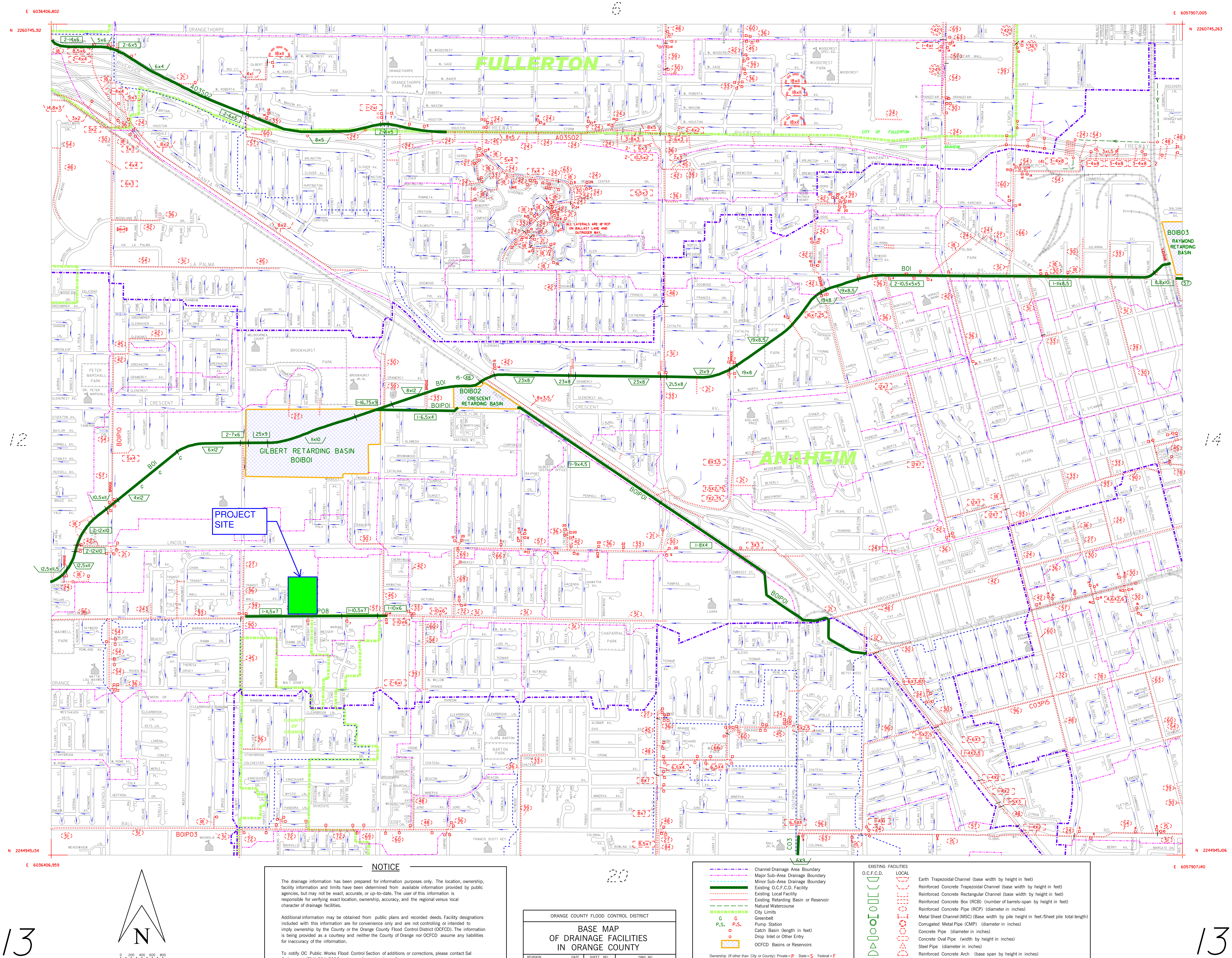
REVISIONS		
MARK	DATE	DESCRIPTION
4	1-77	As Built

ORANGE COUNTY FLOOD CONTROL DISTRICT

BROADWAY STORM DRAIN
LATERAL PROFILES, CATCH BASIN & INLET DETAILS

DESIGNED P.L.
DRAWN C.A. CHECKED MAC
SUBMITTED DESIGN ENGINEER
RECOMMENDED DESIGN DIVISION ENGINEER
SCALE AS SHOWN
DATE MAY 1976
DWG. NO. BOIP8-701-1-A

F-4001-176.1



NOTICE

The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up-to-date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.

Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.

To notify OC Public Works Flood Control Section of additions or corrections, please contact Sal Gutierrez at (714) 834-5396 or by email at sal.gutierrez@ocpw.ocgov.com

ORANGE COUNTY FLOOD CONTROL DISTRICT

BASE MAP OF DRAINAGE FACILITIES IN ORANGE COUNTY

REVISION	DATE	SHEET NO.	DWG. NO.
S. GUTIERREZ	DEC. 20 2010	13	MAPS-113-3

Channel Drainage Area Boundary
Major Sub-Area Drainage Boundary
Minor Sub-Area Drainage Boundary
Existing O.C.F.C.D. Facility
Existing Local Facility
Existing Retarding Basin or Reservoir
Natural Watercourse
City Limits
G G Greenbelt
P.S. P.S. Pump Station
Catch Basin (length in feet)
Drop Inlet or Other Entry
OCFCD Basins or Reservoirs

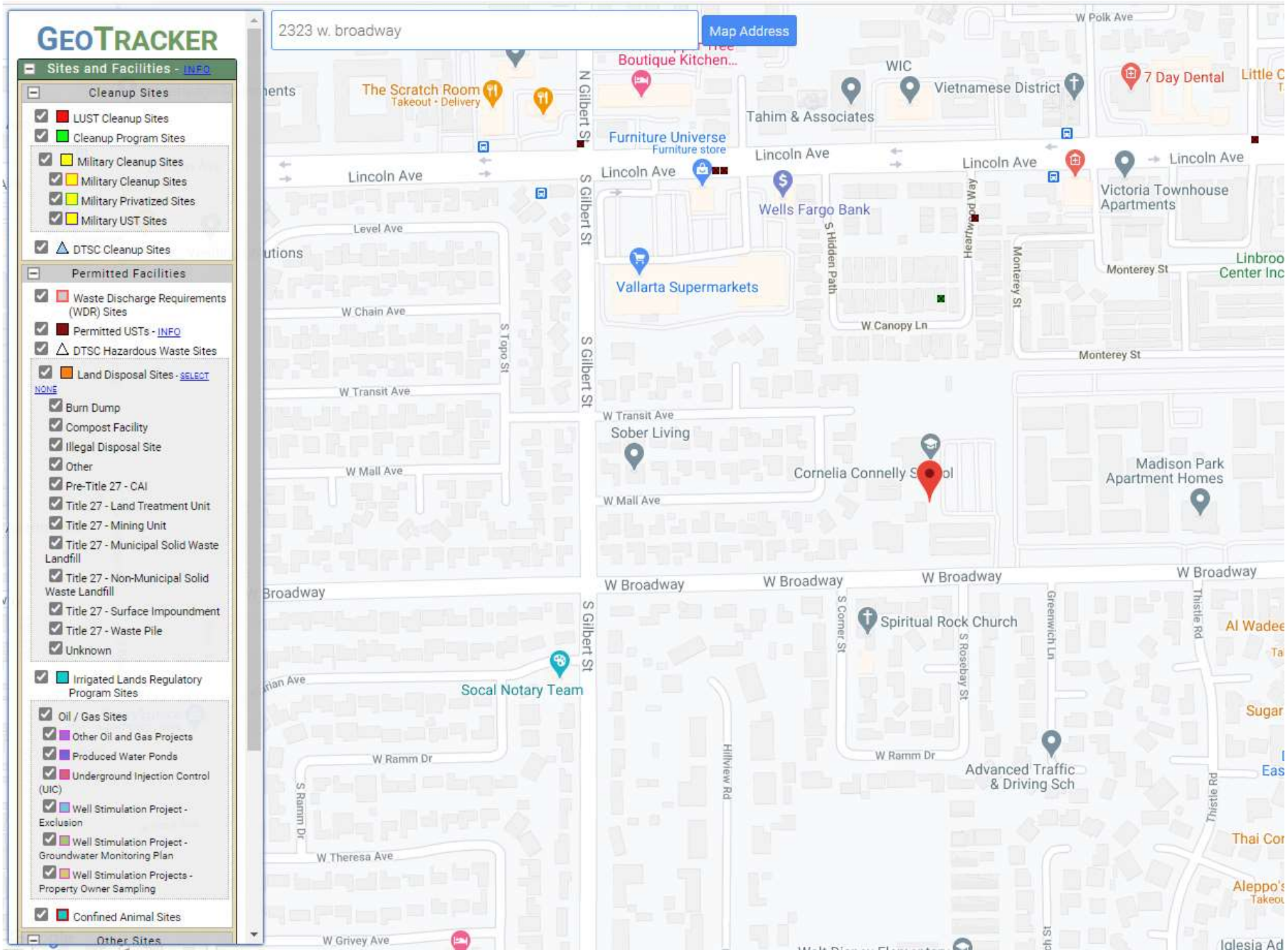
Ownership (If other than City or County): Private = P State = S Federal = F

EXISTING FACILITIES

O.C.F.C.D. LOCAL

Earth Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Rectangular Channel (base width by height in feet)
Reinforced Concrete Box (RCB) (number of barrels–span by height in feet)
Reinforced Concrete Pipe (RCP) (diameter in inches)
Metal Sheet Channel (MSC) (Base width by pile height in feet/Sheet pile total length)
Corrugated Metal Pipe (CMP) (diameter in inches)
Concrete Pipe (diameter in inches)
Concrete Oval Pipe (width by height in inches)
Steel Pipe (diameter in inches)
Reinforced Concrete Arch (base span by height in inches)
Corrugated Metal Arch (base span by height in inches)

2323 W. Broadway, Anaheim – GeoTracker



Attachment E

Operation and Maintenance Plan

To be provided during final engineering

Attachment F

Geotechnical Report

GEOTECHNICAL AND INFILTRATION EVALUATION
FOR
PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
2323 WEST BROADWAY
CITY OF ANAHEIM, ORANGE COUNTY, CALIFORNIA

PREPARED FOR

MELIA HOMES
8951 RESEARCH DRIVE
IRVINE, CALIFORNIA 92618

PREPARED BY

GEOTEK, INC.
1548 NORTH MAPLE STREET
CORONA, CALIFORNIA 92880

PROJECT NO. 2496-CR **OCTOBER 29, 2020**

GEOTEK

GeoTek, Inc.
1548 North Maple Street, Corona, California 92880
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

October 29, 2020
Project No. 2496-CR

Melia Homes
8951 Research Drive
Irvine, California 92618

Attention: Mr. Chad Brown

Subject: Geotechnical and Infiltration Evaluation
Proposed Multi-Family Residential Development
2323 West Broadway
City of Anaheim, Orange County, California

Dear Mr. Brown:

We are pleased to provide herein the results of our geotechnical and infiltration evaluation for the subject property located in the city of Anaheim, Orange County, California. This report presents a discussion of our evaluation and provides preliminary geotechnical recommendations for earthwork, foundation design, and construction. In our opinion, site development appears feasible from a geotechnical viewpoint provided that the recommendations included herein are incorporated into the design and construction phases of site development.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

REGISTERED GEOLOGIST
EDWARD H. LaMONT
No. 1892
Exp.
Certified Engineering Geologist
STATE OF CALIFORNIA

LICENSED PROFESSIONAL ENGINEER
GABY M. BOGDANOFF
NO. 3133
GEOTECHNICAL
STATE OF CALIFORNIA

Edward H. LaMont
CEG 1892, Exp. 07/31/22
Principal Geologist

Gaby M. Bogdanoff
GE 3133, Exp. 06/30/22
Project Engineer

Distribution: (1) pdf file sent via email to addressee

G:\Projects\2451 to 2500\2496CR Melia Homes Townhouses 2323 W. Broadway Irvine\Geo Evaluation\2496 -CR Geotechnical and Infiltration Evaluation 2323 W Broadway Anaheim.docx

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ENCLOSURES

Figure 1 – Site Location Map
Figure 2 – Exploration Location Map

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Appendix C – Laboratory Test Results
Appendix D – Infiltration Test Data
Appendix E – Results of Liquefaction and Settlement Analyses
Appendix F – General Earthwork and Grading Guidelines

1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to complete a geotechnical evaluation of the existing geotechnical conditions of the project site with respect to currently anticipated site development. Services provided for this study included the following:

- Research and review of available geologic and geotechnical data, and general information pertinent to the site,
- Site reconnaissance,
- Site exploration consisting of the excavation, logging, and sampling of six exploratory hollow-stem auger borings; logging and percolation testing of three hollow-stem auger borings; and recording of penetration data of four Cone Penetration Test (CPT) soundings,
- Collection of relatively undisturbed and bulk soil samples of the onsite materials,
- Laboratory testing of the soil samples obtained from the site,
- Review and evaluation of site seismicity,
- Engineering analyses, and
- Compilation of this geotechnical and infiltration report which presents our findings, conclusions, and recommendations for site development.

The intent of this report is to aid in the assessment of the site for future proposed development from a geotechnical perspective. The professional opinions and geotechnical information contained in this report may need to be updated based upon our review of the final site development plans. These plans should be provided to GeoTek, Inc. (GeoTek) for review when available.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The subject site is addressed 2323 West Broadway in the city of Anaheim, Orange County, California. The site is a rectangular-shaped parcel consisting of 6.5-acres and is currently

occupied by a school facility which includes various one-story buildings, tennis/basketball courts, parking/drive areas, hardscape as well as landscape improvements.

The site has generally flat topography with a gentle fall of two to three feet to the south. Surface drainage is to the south, with some local variations.

The site is bounded by single-family residences to the north and west, an apartment complex to the east, and West Broadway Street with single-family homes to the south.

The general location of the site is shown in Figure 1. The current improvements on the site are displayed on a Google Earth aerial image shown as Figure 2, Exploration Location Map.

2.2 PROPOSED DEVELOPMENT

According to the Conceptual Site Plan, prepared by Summa Architects and dated April 7, 2020, the property will be developed with 112 townhomes and related improvements. The structures are anticipated to be up to three stories, of wood-framed construction, and will utilize either concrete slab-on-grade floors and shallow spread foundations or post-tensioned slabs. Cuts and fills are estimated to be less than two feet in height. In addition, we anticipate that stormwater at the site be managed via relatively shallow infiltration systems. Specific test locations for design of these systems were selected by the project civil engineer. A total of three site locations were tested.

If site development differs from the assumptions made herein, the recommendations included in this report should be subject to further review and evaluation. Site development plans should be reviewed by GeoTek when they become available. Additional geotechnical field exploration, analyses and recommendations may be necessary upon review of site development plans.

3. FIELD EXPLORATION, LABORATORY TESTING, AND PERCOLATION TESTING

3.1 FIELD EXPLORATION

The soils underlying the site were explored on September 21, and October 2,2020 by means of excavating four CPT soundings to maximum depths of 50 feet below the ground surface and six exploratory borings to depths between 20 and 51.5 feet. In addition, three percolation test borings approximately 5 feet deep were advanced within the anticipated future infiltration areas. The borings were drilled with a track-mounted hollow-stem auger drill rig and the CPT soundings with a 30-ton CPT rig.

The approximate locations of our site explorations are shown on the Exploration Location Map, Figure 2. Logs of the borings and CPT soundings are provided in Appendices A and B.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected relatively undisturbed and bulk soil samples collected during the field exploration. The purpose of the laboratory testing was to confirm the field classification of the soil materials encountered and to evaluate the soils physical properties for use in the engineering design and analysis. Results of the laboratory testing program along with a brief description and relevant information regarding testing procedures are included in Appendix C.

3.3 PERCOLATION TESTING

Percolation testing was performed at boring locations P-1 through P-3 to assess the infiltration characteristics of the site soils underlying future storm water system areas. Test locations were chosen by the project civil engineer. The borings were excavated to approximately five feet below the existing grade, which was assumed to be the approximate invert depth of the infiltration systems. The boring diameter was approximately eight inches. Percolation testing was performed within the lower approximately 24 inches in the borings by a representative of our firm, in general conformance with the Boring Percolation Test Procedure outlined in the *Technical Guidance Document Appendix VII* (Orange County, 2011). As required, the percolation rates were corrected to account for discharge of water from both the sides and bottom of the borings. This correction was done using the Porchet Method, obtaining the infiltration rates tabulated below:

SUMMARY OF RESULTS	
Boring	Measured Infiltration Rate (inches per hour)
P-1	1.7
P-2	2.2
P-3	0.6

A suitable factor of safety should be applied to the measured rates to design the infiltration system. Detailed percolation/infiltration test data is included in Appendix D. It also should be noted that in the area of P-3, the soils tested were very moist prior to testing. The resulting infiltration rate for this hole was relatively slow. It is our opinion that the infiltration rates measured in borings P-1 and P-2 are more representative of the site as a whole, as the near surface soil conditions are otherwise very similar.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The subject property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. Basically, it extends roughly 975 miles from the north and extends from the Transverse Ranges geomorphic province to the tip of Baja California, from north to south. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found in the near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

More specific to the subject property, Morton, D.M., and Miller, F.K., (2006) map the site to be underlain by Quaternary age younger alluvial fan deposits. Additionally, the nearest known active fault to the site is the Lower Elysian Park Thrust fault located approximately two miles to the northeast.

4.2 GENERAL SOIL/GEOLOGIC CONDITIONS

A brief description of the earth materials encountered in our explorations is presented in the following sections.

4.2.1 Undocumented Fill

Undocumented fill was encountered in all exploratory borings to approximately two to three feet below the existing ground surface. The fill consisted of brown, moist silty sand, sandy clay, and sandy silt.

4.2.2 Young Alluvial Fan Deposits

Young alluvial fan deposits were encountered in our borings below the fill and extended to the maximum depth explored of about 51.5 feet. The young alluvial fan deposits encountered consisted of interbedded units of silty sand, poorly graded sand, clayey sand, sandy silt, and clay. The alluvium was brown to tan in color, slightly moist to moist, and loose/soft to medium dense/stiff to the total depth explored, based on our field observations, blow counts, and in-place density determinations. Collapse tests conducted on the most unfavorable units of the

alluvium (selected based on blow counts and in-place soil density) indicated a negligible potential for collapse upon application of water and load.

The near surface site soils were found to have "low" expansion potential when tested and classified in accordance with ASTM D 4829.

4.3 SURFACE WATER AND GROUNDWATER

4.3.1 Surface Water

If encountered during the earthwork construction, surface water on this site is the result of precipitation or surface run-off from surrounding sites. Overall drainage in the area is variable, and most commonly directed toward the south. Provisions for surface drainage will need to be accounted for by the project civil engineer.

4.3.2 Groundwater

Groundwater was not encountered in the deepest exploratory boring, Boring B-1, excavated at the site. Open hole measurements performed at the end of CPT soundings encountered groundwater at 46 feet in both CPT-1 and -2. CPT-3 and -4 holes collapsed, so no groundwater measurements were taken.

Our review of the *Historically Highest Groundwater Map* published within the *Seismic Hazard Zone Report for the Anaheim and Newport Beach Quadrangles* (California Department of Conservation, *1997)* reveal past high groundwater levels on the order of 35 to 40 feet in the general area of the site.

The GeoTracker database shows several properties located within one-third of a mile from the site, with depth to groundwater ranging from 46 to 80 feet. This information agrees with the groundwater levels recorded during our field investigation.

Perched groundwater or localized seepage can occur due to variations in rainfall, irrigation practices, and other factors not evident at the time of this investigation.

4.4 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone (Bryant and Hart, 2007; CGS, 1986). The northern portion of the subject property is located within a State of California Seismic Hazard Zone for earthquake

induced liquefaction (CGS, 1997). The subject property is not located within a State of California Seismic Hazard Zone for earthquake induced landsliding. The nearest zoned fault is the Newport-Inglewood -Rose Canyon Fault Zone, located approximately 8.5 miles to the southwest.

4.4.1 Seismic Design Parameters

The site is located at approximately 33.8298^0 Latitude and -117.9639^0 Longitude. Based on the conditions observed in the site excavations and review of regional geologic maps, a Site Class "D" appears to be the appropriate category for the property. Site spectral accelerations (Sa and S1), for 0.2 and 1.0 second periods for a Class "D" site, were determined from the SEAOC/OSHPD web interface that utilizes the USGS web services and retrieves the seismic design data and presents that information in a report format. As noted using the ASCE 7-16 option on the SEAOC/OSHPD website, the values for SM1 and SD1 are reported as "null-See Section 11.4.8 (of ASCE 7-16)". As noted in ASCE 7-16, Section 11.4.8, a site-specific ground motion procedure is recommended for Site Class D when the value S1 exceeds 0.2. The value S1 for the subject site exceeds 0.2.

For a Site Class D, an exception to performing a site-specific ground motion analysis is allowed in ASCE 7-16 where S1 exceeds 0.2 provided the value of the seismic response coefficient, Cs, is conservatively calculated by Eq 12.8-2 of ASCE 7-16 for values of $T \leq 1.5Ts$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $TL \geq T > 1.5Ts$ or Eq. 12.8-4 for $T > TL$.

Assuming that the Cs value calculated by and used by the structural engineer allows for the exclusion per ASCE 7-16, noted above, then a site-specific ground motion analysis is not required. For this assumption and condition, the following seismic design parameters, based on the 2015 National Earthquake Hazards Reduction Program (NEHRP)/ASCE 7-16, are presented on the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_s	1.465g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.517g
Site Coefficient for Site Class "D," F_a	1.0
Site Coefficient for Site Class "D," F_v	1.783
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.465g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.922g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	0.977g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.614g
Site Modified Peak Ground Acceleration, PGA_M	0.686g
Seismic Design Category	D

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected building response and desired level of conservatism.

4.5 LIQUEFACTION AND SEISMICALLY INDUCED SETTLEMENT

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless and low plastic soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, consolidation and settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are susceptible to liquefaction are loose, saturated granular soils having low fines content under low confining pressures and some low plastic silts and clays.

Based on the review of available groundwater data, a historic high groundwater depth of 35 feet was used in our liquefaction analysis. The analysis was performed with the aid of the computer program Cliq version 2.2.0.32 (Geologismiki, 2006) in conjunction with the soil profiles identified within all CPT soundings performed at the property. A mean magnitude weighted (Mw) seismic

event of 6.67 obtained with the USGS deaggregation web application (based on a 2 percent exceedance in 50 years) and a PGA_M value of 0.686g were used in the assessment.

The results of the analyses indicated the presence of a few, deep layers of loose sands and silty sands that would be prone to liquefaction during the design-level earthquake. The following table summarizes the amount of settlement (liquefaction settlement plus settlement of dry sands) estimated at each CPT location:

ESTIMATED SEISMICALLY INDUCED TOTAL SETTLEMENT	
CPT Sounding	Total Settlement (in)
1	0.1
2	0.3
3	0.4
4	0.2

As noted above, the seismically induced settlements of the sandy soils at the property was estimated to be less than 0.5 inches total and 0.25 inches differential over a 30-foot span. The results of the liquefaction/settlement analysis are presented within Appendix E.

4.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our investigation. Thus, the potential for landslides is considered negligible.

The potential for secondary seismic hazards such as a seiche or tsunami is considered negligible due to site elevation and distance to an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Development of the site appears feasible from a geotechnical viewpoint. The following recommendations should be incorporated into the design and construction phases of development.

5.2 EARTHWORK CONSIDERATIONS

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Anaheim, the *2019 California Building Code* (CBC), and recommendations contained in this report. Site grading plans should be reviewed by this office

when they become available. Additional recommendations will likely be offered subsequent to review of these plans.

5.2.1 Site Clearing and Preparation

Site preparation should start with demolition/razing of existing site improvements and removal of deleterious materials, and vegetation. Demolition should include removal of all pavements, floor slabs, foundations, and any other below-grade construction. These materials should be properly disposed of off-site. Voids resulting from site clearing (such as removals of underground utilities, foundations, etc.) should be replaced with engineered fill materials.

5.2.2 Removals

Based on our boring data and the field observations, the upper five feet of existing site soils or three feet below footing base should be removed in order to provide a homogeneous, dense fill mat for structural support. Deeper removals may be required in some areas to eliminate all previously existing undocumented fill. As a minimum, removals should extend down and away from foundation elements at a 1:1 (h:v) projection to the recommended removal depth, or a minimum of five feet laterally.

All existing fills should be removed from surface improvement areas. A minimum of 12 inches of engineered fill should be provided below asphaltic concrete pavement and Portland cement concrete hardscape areas. The horizontal extent of removals should extend at least two feet beyond the edge. Development plans should be reviewed by this firm when available. Depending on actual field conditions encountered during grading, locally deeper areas of removal may be recommended.

A representative of this firm should observe the bottom of all excavations. Removal bottoms should be relatively uniform and expose natural alluvium that has an in-place relative compaction of at least 85 percent per ASTM D 1557.

The bottom of all removals should be scarified to a minimum depth of six inches, brought to slightly above the optimum moisture content, and then recompacted to at least 90 percent of the soil's maximum dry density (ASTM D 1557).

In some portions of the site, the bottom of removals may encounter very moist/soft soils that may require stabilization. If necessary, removal bottoms may be stabilized with a layer of gravel and/or geogrid supplemented with gravel, prior to placing engineered compacted fill. A 12-inch layer of gravel has been successfully used on similar project sites that GeoTek has provided services in the past. Specific stabilization recommendations should be provided by GeoTek based on the soil conditions encountered at the time of site grading.

5.2.3 Engineered Fill

The onsite soils are considered suitable for reuse as engineered fill provided they are free from vegetation, roots, and rock/concrete or hard lumps greater than six inches in maximum dimension.

At the time of our field investigation, some of the on-site soils were very moist (up to ten percent above optimum water content). To be suitable for placement as engineered fill, these materials should be dried to approximately optimum moisture content.

Concrete generated from the demolition of existing site improvements may be incorporated into site fills provided the following guidelines are implemented: 1) concrete should be free of rebar or other deleterious materials and should be broken down to a maximum dimension of six inches; 2) concrete should not be placed within three feet of finish grade in the building pad areas or within one foot of subgrade elevations in the street/drive areas; 3) concrete should be distributed in the fill and should not be "nested" or placed in concentrated pockets.

The undercut areas should be brought to final pad elevations with fill materials that are placed and compacted in general accordance with minimum project standards. Fill materials should be placed at or above optimum moisture content and should be compacted to a minimum relative compaction of 90 percent as determined by ASTM Test Method D 1557. Additional recommendations pertaining to fill placement are presented in Appendix F.

5.2.4 Excavation Characteristics

Excavation in the onsite soil materials is expected to be easy using heavy-duty grading equipment in good operating conditions.

All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary excavations within the onsite materials should be stable at 1:1 (h:v) inclinations for cuts less than ten feet in height.

5.2.5 Shrinkage and Subsidence

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage, bulking, and subsidence are primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of 10 to 15 percent for both the existing fills and upper alluvium may be considered. Site balance areas should be

available in order to adjust project grades, depending on actual field conditions at the conclusion of site earthwork construction. Bulking is not considered to be a significant factor with the underlying materials within the vicinity of the anticipated construction. Subsidence on the order of up to 0.1-foot could occur.

5.2.6 Trench Excavations and Backfill

Temporary excavations within the onsite materials should be stable at 1:1 (h:v) inclinations for short durations during construction, and where cuts do not exceed ten feet in height. Temporary cuts to a maximum height of four feet can be excavated vertically, but local sloughing and/or failure could occur due to the granular nature of some of the onsite units. Increased caution should be applied when working near or within any excavations at this site.

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90 percent relative compaction (as determined per ASTM D 1557). Under-slab trenches should also be compacted to project specifications. Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction. Much of the onsite materials may not be suitable for use as bedding material but should be suitable as backfill provided particles larger than 6± inches are removed.

Compaction should be achieved with a mechanical compaction device. Ponding or jetting of trench backfill is not recommended. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

The site soils were found to generally have "low" expansion potential in accordance with ASTM D 4829. The foundation elements for the proposed structures should bear entirely in engineered fill soils and should be designed in accordance with the *2019 California Building Code (CBC).*

A summary of our design recommendations for conventionally reinforced foundations is presented in the table below.

DESIGN PARAMETERS FOR CONVENTIONALLY REINFORCED SPREAD FOOTINGS	
Design Parameter	"Low" Expansion Potential
Foundation Depth or Minimum Perimeter Beam Depth for Both Interior and Exterior Footings (inches below lowest adjacent finished grade)	One- and Two-Story – 12 Three-Story - 18
Minimum Foundation Width (Inches)*	One- and Two-Story – 12 Three-Story – 15
Minimum Slab Thickness (Inches)	4 (actual)
Minimum Slab Reinforcing	6" x 6" – W2.9/W2.9 welded wire fabric or No 3 rebars at 24 inches on center each way placed in the middle of the slab
Minimum Footing Reinforcement for Continuous Footings, Grade Beams, and Retaining Wall Footings	Two No. 4 reinforcing bars, one top and one bottom
Effective Plasticity Index**	17
Presaturation of Subgrade Soil (Percent of Optimum/Depth in inches)	Minimum 110% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete.

*Code minimums per Table 1809.7 of the 2019 CBC should be complied with.
**Effective Plasticity Index should be verified at the completion of the rough grading

In general, an allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for footings a minimum 12 inches deep and 12 inches wide and pad footings 24 inches square and 12 inches deep. This value may be increased by 400 psf for each additional 12 inches in depth and 200 psf for each additional 12 inches in width to a maximum value of 3,000 psf. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads).

For footings designed in accordance with the recommendations presented in this report, we would anticipate a maximum static settlement of less than 1-inch and a maximum differential static settlement of less than ½-inch in a 30-foot span. Seismically induced settlement is estimated to be about 1/2-inch total and ¼-inch differential in a 40-foot span.

The passive earth pressure may be computed as an equivalent fluid having a density of 240 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. The upper one foot of soil below the adjacent grade should not be used in calculating passive pressure.

Presented below are post-tensioned foundation design parameters for the proposed residential structures at the site. These parameters are in general conformance with Design of Post-Tensioned Slabs-on-Ground, Third Edition with 2008 Supplement (PTI, 2008). These are minimal recommendations and are not intended to supersede the design by the project structural engineer.

DESIGN PARAMETERS FOR POST-TENSIONED SLABS	
Foundation Design Parameter	"Low" Expansion Potential (LL≤35; PI≤17; Passing #200 Sieve ≈ 83%; Clay fines ≈ 15%)
Edge Moisture Variation Distance, e_m - Edge Lift (swelling) - Center Lift (shrinkage)	 4.4 ft 8.6 ft
Soil Differential Movement, y_m - Edge Lift (swelling) - Center Lift (shrinkage)	 ≈0.67 in ≈0.28 in
Ext. Perimeter Beam Embedment	One- and Two-Story – 12 inches* Three-Story – 18 inches*
Allowable Bearing Pressure	1,500 psf
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum 110% to a depth of 12 inches

*Required depth of perimeter beam/stiffening rib per structural calculations may govern.
The following assumptions were used to generate e_m and y_m values: Thornthwaite Moisture Index = -20; constant suction value = 3.9pF; post-equilibrium case assumed with wet (swelling) cycle going from 3.9pF to 3.0pF and drying (shrinking) cycle going from 3.9pF to 4.5pF.

Additional testing of the soils should be performed during construction to evaluate the as-graded conditions. Additional recommendations may be necessary based on the as-graded soils conditions.

It should be noted that the above recommendations are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these systems are provided in the 2019 *California Green Building Standards Code (CALGreen)* Section 4.505.2, the 2019 CBC Section 1907.1, ACI 360R-10, and ACI 302.2R-06.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as the result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor

retarders may also be more puncture resistant. It is GeoTek's opinion that a minimum ten mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and atmospheric conditions.

Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e. thickness, composition, strength, and permeance) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

5.3.2 Miscellaneous Foundation Recommendations

- To minimize moisture penetration beneath the slab on grade areas, utility trenches should be backfilled with engineered fill, lean concrete, or concrete slurry where they intercept the perimeter footing or thickened slab edge.
- Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.
- Under-slab utility trenches should be compacted to project specifications. Compaction should be achieved with a mechanical compaction device. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.3.3 Foundation Set Backs

Foundations should comply with the following setbacks. Improvements not conforming to these setbacks are subject to the increased likelihood of excessive lateral movements and/or differential settlements. If large enough, these movements can compromise the integrity of the improvements. The following recommendations are presented:

- The outside bottom edge of all footings should be set back a minimum of H/2 (where H is the slope height) from the face of any ascending slope. The setback should be at least five feet and need not to exceed 15 feet. Where a retaining wall is constructed at the toe of the slope, the height of the slope should be measured from top of the wall to the top of the slope.

- The outside bottom edge of all footings should be set back a minimum of H/3 from the face of any descending slope. The setback should be at least 5 feet and need not exceed 40 feet.
- The bottom of all footings for structures near retaining walls should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom inside edge of the wall foundation.
- The bottom of any existing foundations for structures should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom of the nearest excavation.

5.3.4 Retaining Wall Design and Construction

5.3.4.1 General Design Criteria

Recommendations presented in this report apply to typical masonry or concrete walls retaining up to six feet of soils. Additional review and recommendations should be requested for higher walls. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Retaining wall foundations should be embedded into engineered fill and should be designed in accordance with *Section 5.3.1* of this report. Structural needs may govern and should be evaluated by the project structural engineer.

All earth retention structure plans, as applicable, should be reviewed by this office prior to finalization. The seismic design parameters as discussed in this report remain applicable to all proposed earth retention structures at this site, and should be properly incorporated into the design and construction of the structures.

Earthwork considerations, site clearing and remedial earthwork for all earth retention structures should meet the requirements of this report, unless specifically provided otherwise, or more stringent requirements or recommendations are made by the designer. The backfill material placement for all earth retention structures should meet the requirement of *Section 5.3.4.4* in this report.

In general, cantilever earth retention structures, which are designed to yield at least 0.001H, where H is equal to the height of the earth retention structure to the base of its footing, may be designed using the active condition. Rigid earth retention structures (including but not limited to rigid walls, and walls braced at top, such as typical basement walls) should be designed using the at-rest condition.

In addition to the design lateral forces due to retained earth, surcharges due to improvements, such as an adjacent building or traffic loading, should be considered in the design of the earth retention structures. Loads applied within a 1:1 (h:v) projection from the surcharge on the stem and footing of the earth retention structure should be considered in the design.
Final selection of the appropriate design parameters should be made by the designer of the earth retention structures.

5.3.4.2 Cantilevered Walls

The recommendations presented below are for cantilevered walls retaining up to six feet of soils. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, or adverse geologic conditions.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (h:v)	Equivalent Fluid Pressure (pcf) Native Backfill*
Level	40
2:1	65

*The design pressures assume the native backfill material has an expansion index less than or equal to 50. Backfill zone includes area between the back of the wall and footing to a plane (1:1 h:v) up from the bottom of the wall foundation to the ground surface.

5.3.4.3 Restrained Retaining Walls

Retaining walls that will be restrained prior to placing and compacting backfill material or that have reentrant or male corners should be designed for an at-rest equivalent fluid pressure of 60 pcf, plus any applicable surcharge loading, for native backfill and level back slope condition. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner, or a distance otherwise determined by the project structural engineer.

5.3.4.4 Retaining Wall Backfill and Drainage

Retaining wall backfill should be free of deleterious and/or oversized materials and should have properties indicated in *Section 5.3.4.2*. Retaining walls should be provided with an adequate pipe

and gravel back drain system to help prevent buildup of hydrostatic pressures. Backdrains should consist of a four-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one-cubic foot per linear foot of ¾- to 1-inch clean crushed rock or an approved equivalent, wrapped in filter fabric (Mirafi 140N or an approved equivalent). The drain system should be connected to a suitable outlet. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Retaining wall backfill should be placed in lifts no greater than eight inches in thickness and compacted to a minimum of 90 percent relative compaction in accordance with ASTM Test Method D 1557. The wall backfill should also include a minimum one-foot wide section of ¾- to 1-inch clean crushed rock (or an approved equivalent). The rock should be placed immediately adjacent to the back of the wall and extend up from a back drain to within approximately 24 inches of the finish grade. The rock should be separated from the earth with filter fabric. The upper 24 inches should consist of compacted on-site soil.

As an alternative to the drain rock and fabric, Miradrain 2000, or approved equivalent, may be used behind the retaining wall. The Miradrain 2000 should extend from the base of the wall to within two feet of the ground surface. The subdrain should be placed at the base of the wall in direct contact with the Miradrain 2000.

The presence of other materials might necessitate revision to the parameters provided and modification of the wall designs. Proper surface drainage needs to be provided and maintained.

5.3.4.5 Other Design Considerations

- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved the project geotechnical engineer or their authorized representative.

5.3.5 Pavement Design Considerations

Pavement design for proposed street improvements was conducted per Caltrans *Highway Design Manual* guidelines for flexible pavements. Based on an assumed design R-value of 30 and for Traffic Indices (TIs) of 5.0 and 6.0 generally linked to roads with light vehicular traffic with occasional heavy truck traffic, the following preliminary sections were calculated:

GEOTECHNICAL RECOMMENDATION FOR MINIMUM PAVEMENT SECTION		
Traffic Index	Thickness of Asphalt Concrete (inches)	Thickness of Aggregate Base (inches)
5.0	4*	4*
6.0	4*	7

*Minimum pavement sections for interior streets per City of Anaheim Standard Detail No. 160-A.

Traffic Indices (TIs) used in our pavement design are considered reasonable values for the proposed residential street areas and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving may result in premature pavement failure. Traffic parameters used for design were selected based upon engineering judgment and not upon information furnished to us such as an equivalent wheel load analysis or a traffic study.

The recommended pavement sections provided are intended as a minimum guideline and final selection of pavement cross section parameters should be made by the project civil engineer, based upon the local laws and ordinates, expected subgrade and pavement response, and desired level of conservatism. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. Final pavement design should be checked by testing of soils exposed at subgrade (the upper one foot) after final grading has been completed.

Asphalt concrete and aggregate base should conform to current Caltrans Standard Specifications Section 39 and 26-1.02, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the current Standard Specifications for Public Work (Green Book). Crushed aggregate base or crushed miscellaneous base can conform to Section 200-2.2 and 200-2.4 of the Green Book, respectively. Pavement base should be compacted to at least 95 percent of the ASTM D1557 laboratory maximum dry density (modified proctor).

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement and rolling of asphaltic concrete, should be done in accordance with the City of Anaheim specifications, and under the observation and testing of GeoTek and a City Inspector where required. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

Deleterious material, excessive wet or dry pockets, oversized rock fragments, and other unsuitable yielding materials encountered during grading should be removed. Once existing compacted fill are brought to the proposed pavement subgrade elevations, the subgrade should be proof-rolled in order to check for a uniform and unyielding surface. The upper 12 inches of

pavement subgrade soils should be scarified, moisture conditioned at or near optimum moisture content, and recompacted to at least 95 percent of the laboratory maximum dry density (ASTM D1557). If loose or yielding materials are encountered during construction, additional evaluation of these areas should be carried out by GeoTek. All pavement section changes should be properly transitioned.

5.3.6 Soil Corrosivity

The soil resistivity was tested in the laboratory on two samples collected during our field exploration. The results of the testing (3,149 and 3,685 ohm-cm) indicate that the soil samples are "corrosive" to buried ferrous metals, based on the guidelines provided in *Corrosion Basics: An Introduction* (Roberge, 2005). Consideration should be given to consulting with a corrosion engineer.

5.3.7 Soil Sulfate Content

The sulfate content was determined in the laboratory for two soil samples obtained during our field exploration. The results (0.0033 and 0.0044 percent) indicate that the water-soluble sulfate range is less than 0.1 percent by weight which is considered "not applicable" (i.e. negligible) as per Table 4.2.1 of ACI 318. Based upon the test results, no special concrete mix design is required by Code for sulfate attack resistance. Additional testing of soils collected near finish grade should be performed subsequent to site grading.

5.3.8 Import Soils

Import soils should have an expansion index similar to the on-site soils. GeoTek also recommends that, as a minimum, proposed import soils be tested for soluble sulfate content. GeoTek should be notified a minimum of 72 hours of potential import sources so that appropriate sampling and laboratory testing can be performed.

5.3.9 Concrete Flatwork

5.3.9.1 Exterior Concrete Slabs, Sidewalks, and Driveways

Exterior concrete slabs, sidewalks, and driveways should be designed using a four-inch minimum thickness. No specific reinforcement is required due to the non-structural nature. However, the use of some reinforcement should be considered. Some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in residential construction.

Sidewalks and driveways may be under the jurisdiction of the governing agency. If so, jurisdictional design and construction criteria would apply, if more restrictive than the recommendations presented herein.

Subgrade soils, classified as having "low" expansion potential, should be pre-moistened prior to placing concrete. The subgrade soils below exterior concrete flatwork should be pre-saturated to a minimum of 110 percent of optimum moisture content to a depth of 12 inches.

All concrete installation, including preparation and compaction of subgrade, should be done in accordance with the City of Anaheim specifications, and under the observation and testing of GeoTek and a City Inspector, if necessary.

5.3.9.2 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable to more than 1/8 inch in width. Most cracks in concrete, while unsightly, do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete can also undergo chemical processes that are dependent on a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is also subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two directions and located a distance apart roughly equal to 24 to 36 times the slab thickness.

Exterior concrete flatwork (patios, walkways, driveways, etc.) is often some of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. We suggest that the same standards of care be applied to these features as to the structure itself.

5.4 POST CONSTRUCTION CONSIDERATIONS

5.4.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff, and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. The soils should be maintained in a solid to semi-solid state as defined by the materials Atterberg Limits. Care should be taken when adding soil amendments to avoid excessive watering. Leaching as a method of soil preparation prior to planting is not recommended. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decreased the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundation. This type of landscaping should be avoided. If used, then extreme care should be exercised with regard to the irrigation and drainage in these areas.

5.4.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground. Pad drainage should be directed toward approved area(s) and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.5 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading plans, pool plans, retaining wall plans, foundation plans, and relevant project specifications be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during site grading and foundation construction to check for proper

implementation of the geotechnical recommendations. The owner/developer should verify that GeoTek representatives perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of onsite and import materials for fill placement, and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement, including utility trenches.
- Perform field density testing of the fill materials.
- Observe and probe foundation excavations to confirm suitability of bearing materials.

If requested, a construction observation and compaction report can be provided by GeoTek, which can comply with the requirements of the governmental agencies having jurisdiction over the project. We recommend that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the boundaries of the subject site. This review does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our fee estimate (P-0802220-CR) dated August 10, 2020 and geotechnical engineering standards normally used on similar projects in this region.

7. LIMITATIONS

The materials observed on the project site appear to be representative of the area; however, soil materials vary in character between excavations or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc.

assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusion and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

8. SELECTED REFERENCES

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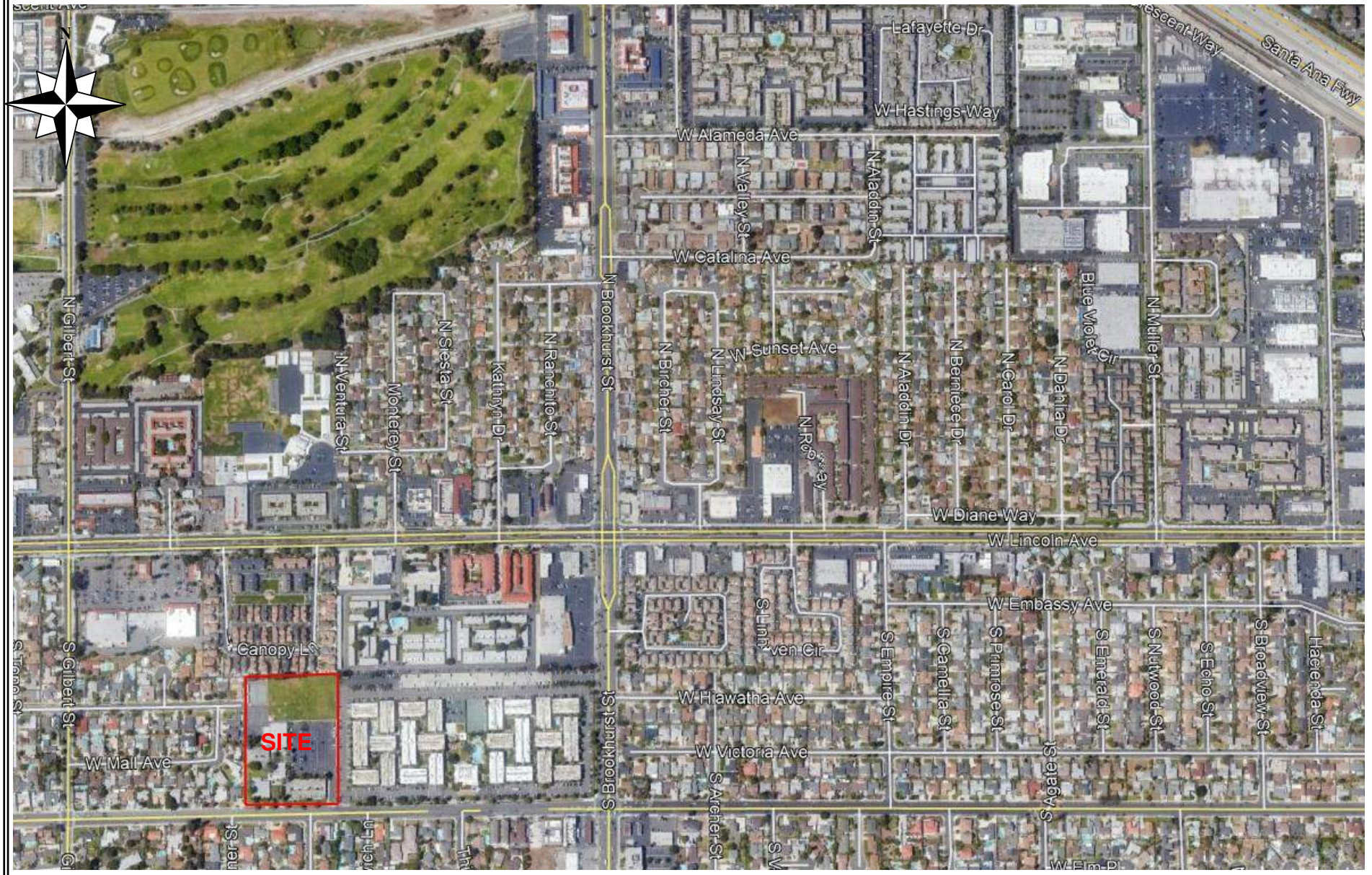
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Melia Homes
Proposed Multi-Family Residential Project
2323 W. Broadway
Anaheim, Orange County, California
Project No. 2496-CR

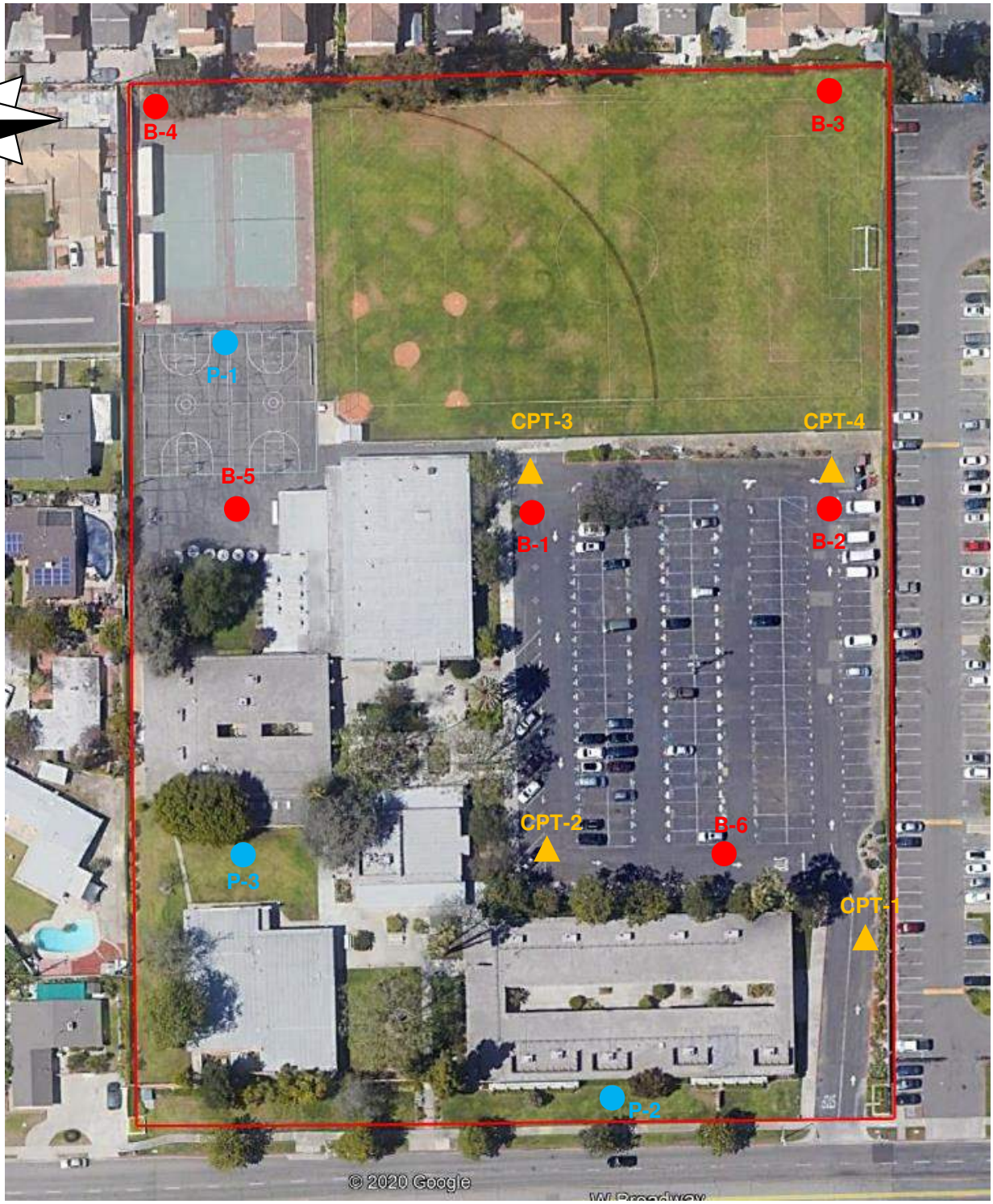
Scale: As Shown

0 0.15 mi

Figure 1

Site Location Map

GEOTEK



Legend

(Locations are Approximate)

Exploratory Boring | Percolation Boring | CPT Sounding | Site Limits

Melia Homes
Proposed Multi-Family Residential Project
2323 W. Broadway, Anaheim, California

Project No. 2496-CR

Scale: As Shown

0 95 ft

Figure 2

Exploration Location Map

GEOTEK

APPENDIX A

EXPLORATORY BORING LOGS

Geotechnical and Infiltration Evaluation
2323 W. Broadway, Anaheim, California
Project No. 2496-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

The Modified Split-Barrel Sampler (Ring)

The ring sampler is driven into the ground in accordance with ASTM Test Method D 3550. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the logs of borings. The samples are removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

Bulk Samples (Large)

These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Bulk Samples (Small)

These are plastic bag samples which are normally airtight and contain less than five pounds in weight of earth materials collected from the field by means of hand digging or exploratory cuttings. These samples are primarily used for determining natural moisture content and classification indices.

B – BORING LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the logs of borings:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
……..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
———	Thick solid line denotes end of boring

(Additional denotations and symbols are provided on the logs of borings)

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B-1 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					5" Asphalt Concrete / 4" Aggregate Base			EI, MD, SR, SH, AL
					Fill:			
				CL	CLAY with sand, brown, moist, stiff			
					Young alluvial fan deposits:			
		9 11 15		SM-ML	Silty f SAND to sandy SILT, light brown, moist to very moist, medium dense to	21.1	102.5	
5		6 9 9		SM	F SAND with some silt, light brown, moist to very moist, medium dense	23.3	97.3	
		6 15 16		SP	F-m SAND, tan, slightly moist, medium dense	4.0	101.7	
10		6 12 12						
15		8 10 15		SC	Clayey SAND, brown, moist, medium dense	12.4	112.8	
20		9 12 22		SP	M SAND, tan, slightly moist, medium dense	2.9	101.3	
25		15 35 36			- Becomes dense @ 25.0 feet	1.8	103.3	
30		5 5 8			F SAND, brown, moist, medium dense			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B-1 (cont.) / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
35		7 12 8		SP	F SAND, brown, moist, medium dense			
40		2 5 5		CL	CLAY with some sand and silt, brown, very moist, stiff			
45		5 9 12		SM	F-m SAND with some silt, brown, moist, medium dense			
50		3 6 10		CL	CLAY with some sand and silt, brown, very moist, stiff			
55					**BORING TERMINATED AT 51.5'** No groundwater encountered Boring backfilled with soil cuttings			
60								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

BORING NO.: B-2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM-ML	**Fill:** Silty f SAND to sandy SILT with some clay, moderate brown, moist, medium dense			
		8				18.4	105.7	
		10 14		SM	**Young alluvial fan deposits:** Silty f SAND, brown, moist, medium dense			
5		9 11 14		SM-ML	Silty f SAND to sandy SILT, light brown, moist to very moist, medium dense to	20.3	103.3	
		3 5 9			- Becomes very moist, loose to stiff @ 6.0 feet	32.7	86.0	HC
				SP	F-m SAND, tan, slightly moist, medium dense			
10		8 14 15				3.9	98.6	
15		5 8 12		SM	Silty f-m SAND, brown, moist, medium dense			
20		9 16 27		SP	M SAND, tan, slightly moist, dense			
					BORING TERMINATED AT 21.5'			
25					No groundwater encountered Boring backfilled with soil cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-3** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**Fill:** Silty f SAND, moderate brown, slightly moist, medium dense			
		10 8 9		SM	**Young alluvial fan deposits:** Silty f SAND, moderate brown, moist, medium dense	11.2	107.3	
5		8 14 14			- Becomes light brown @ 5.0 feet	13.7	111.4	
		5 11		CL	CLAY with silt, brown, very moist, very stiff	19.2	89.7	
		17		SP	F-m SAND, tan-gray, slightly moist, medium dense			
10		4 10 12		SM	Silty f SAND, brown, moist, medium dense	8.3	105.4	
15		9 14 17		SP	M SAND, brown, slightly moist, medium dense			
20		8 15 20			F SAND, tan, slightly moist, medium dense			
					BORING TERMINATED AT 21.5'			
					No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

BORING NO.: B-4

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**Fill:** Silty f SAND, moderate brown, moist			
		9 10 14		SM	**Young alluvial fan deposits:** Silty f SAND, brown, moist, medium dense	12.4	115.4	
5		4 7 8		SP	F-m SAND, tan, slightly moist, loose to medium dense	1.6	93.7	HC
10		6 11 14			M SAND, brown, moist, medium dense	9.5	105.3	
15		7 10 16		SM	Silty f-m SAND, brown, moist, medium dense			
20		10 20 30			- Becomes dense @ 19.0 feet			
					BORING TERMINATED AT 20.5' No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

BORING NO.: B-5

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					3" Asphalt Concrete / 5" Aggregate Base			
				CL	**Fill:** CLAY with sand, light brown, moist, soft			EI, MD, AL, SR
		3 6 7		SM	**Young alluvial fan deposits:** Silty f SAND, light brown, moist to very moist, loose	23.1	102.2	
5		5 8 6		SP	F-m SAND, tan, slightly moist, loose	3.2	96.5	HC
		6 8 9			M SAND, tan-red, slightly moist, medium dense	2.9	100.7	
10		6 8 12				4.7	101.3	HC
15		4 8 9		SM	Silty f-m SAND, brown, moist, medium dense			
20		9 14 22		SP	M SAND, tan, slightly moist, medium dense	5.1	100.1	
					BORING TERMINATED AT 21.5'			
					No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-6** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					2" Asphalt Concrete / 5" Aggregate Base			
				SM	**Fill:** Silty f SAND, brown, slightly moist, medium dense			
		5 8 8		SM	**Young alluvial fan deposits:** Silty f SAND, brown, moist to very moist, medium dense	17.3	107.3	
5		3 7 14		SP	F-m SAND, tan, moist to very moist, medium dense	18.3	103.0	
10		8 14 15			M SAND, tan, light brown, medium dense			
15		9 18 20		SM	Silty f SAND, brown, moist, medium dense	12.0	118.3	
20		9 9 10			**BORING TERMINATED AT 20.5'**			
25					No groundwater encountered Boring backfilled with soil cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: P-1** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					3" Asphalt Concrete / 5" Aggregate Base			
				SM	**Fill:** Silty f SAND, light brown, moist			
				SM	**Young alluvial fan deposits:** Silty f SAND, light brown, moist			
5					**BORING TERMINATED AT 5.0'**			
					No groundwater encountered			
					Boring prepared for subsequent infiltration testing (pvc pipe, filter sock, gravel)			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring; ---SPT; ---Small Bulk; ---Large Bulk; ---No Recovery; ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: P-2** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**Fill:** Silty f SAND, brown, moist			
				SM	**Young alluvial fan deposits:** Silty f SAND, brown, moist			
5					**BORING TERMINATED AT 5.0'** No groundwater encountered Boring prepared for subsequent infiltration testing (pvc pipe, filter sock, gravel)			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DA
PROJECT NAME:	Townhouses 2323 W. Broadway	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Jeff
PROJECT NO.:	2496-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	10/2/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: P-3** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**Fill:** Silty f SAND, moderate brown, very moist			
				SM	**Young alluvial fan deposits:** Silty f SAND, moderate brown, very moist			
5					**BORING TERMINATED AT 5.0'** No groundwater encountered Boring prepared for subsequent infiltration testing (pvc pipe, filter sock, gravel)			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

APPENDIX B

LOGS OF CPT SOUNDINGS

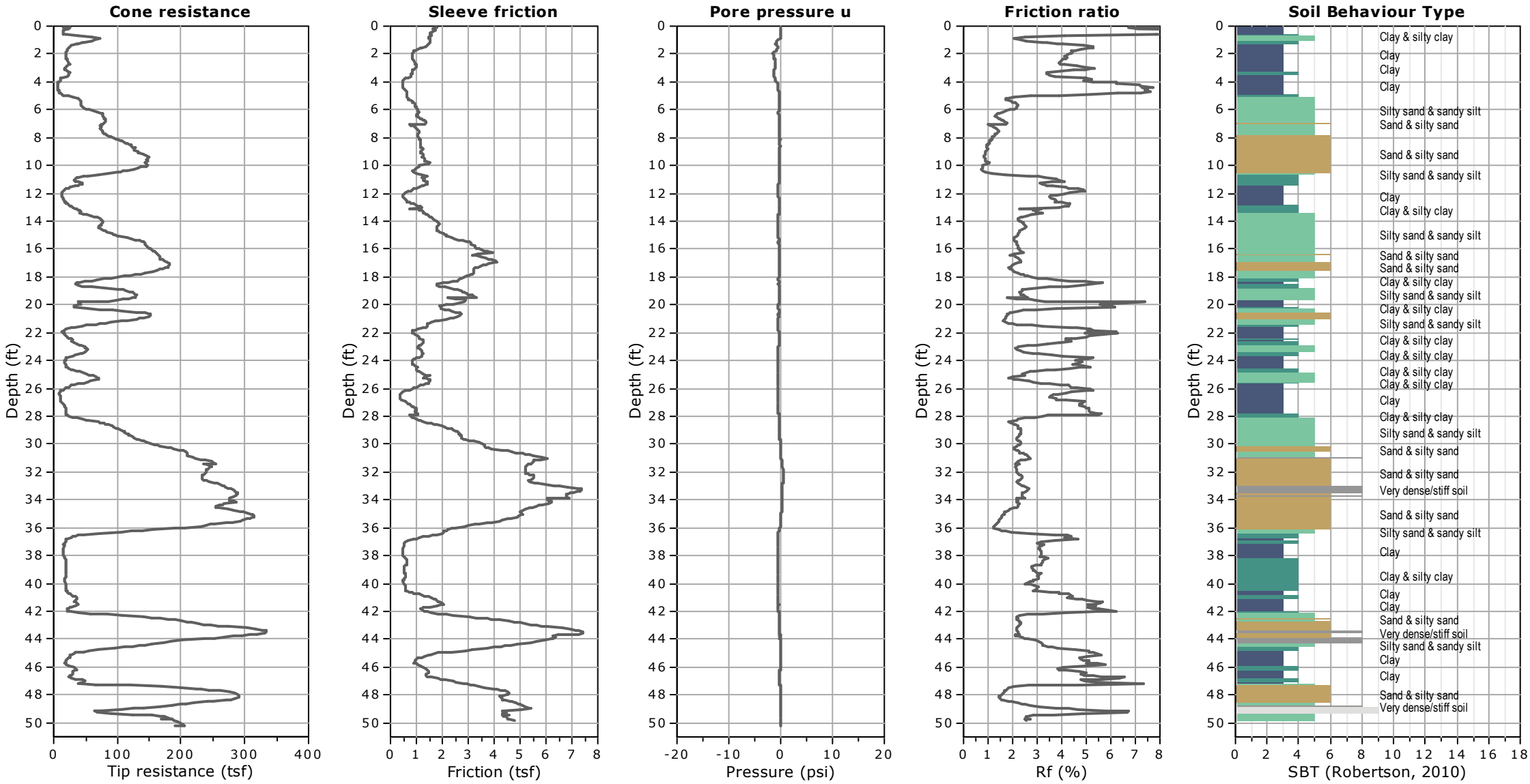
Geotechnical and Infiltration Evaluation
2323 W. Broadway, Anaheim, California
Project No. 2496-CR

GEOTEK

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: GeoTek
Location: 2323 W. Broadway, Anaheim, CA

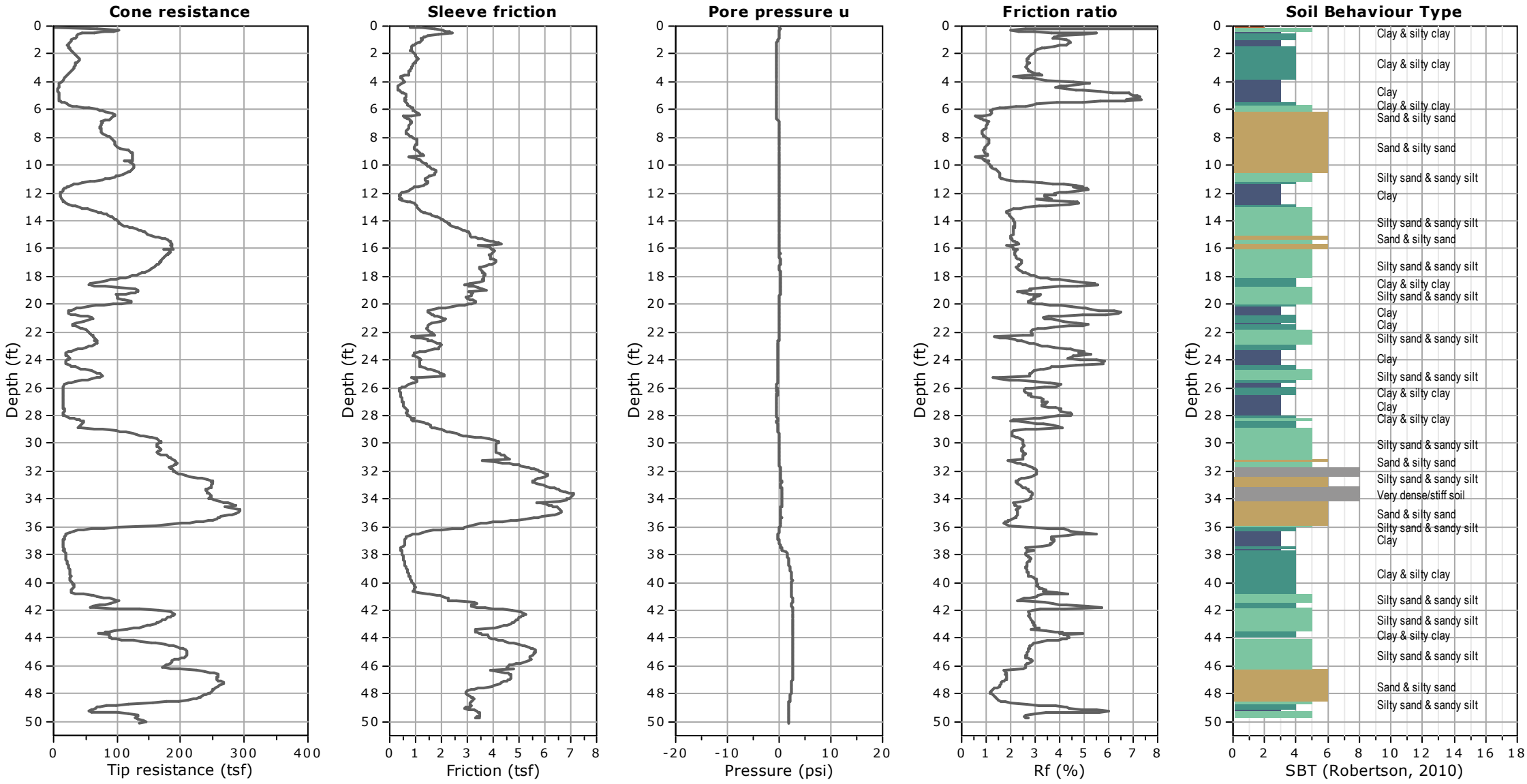
CPT-1
Total depth: 50.24 ft, Date: 9/21/2020



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: GeoTek
Location: 2323 W. Broadway, Anaheim, CA

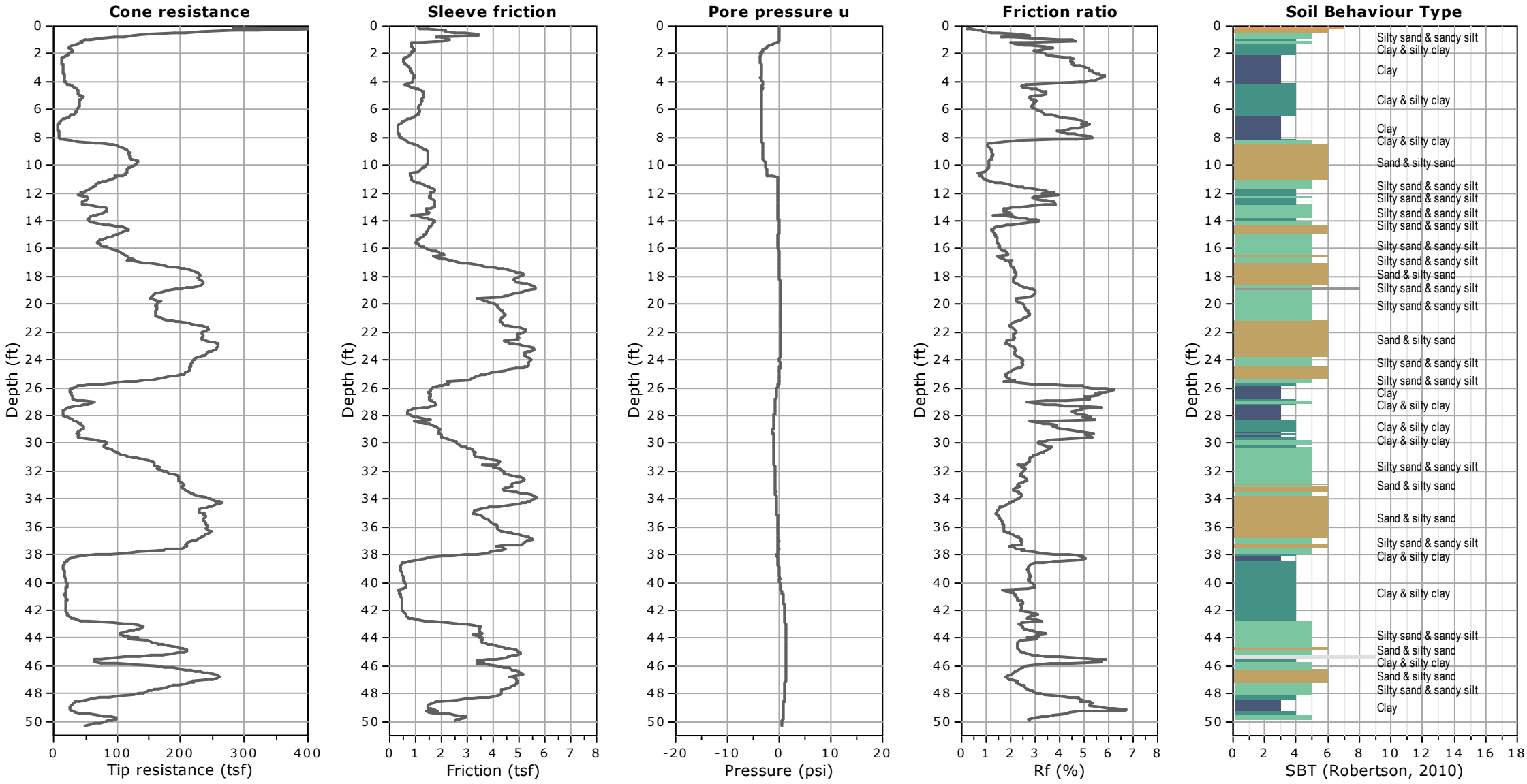
CPT-2
Total depth: 50.13 ft, Date: 9/21/2020



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: GeoTek
Location: 2323 W. Broadway, Anaheim, CA

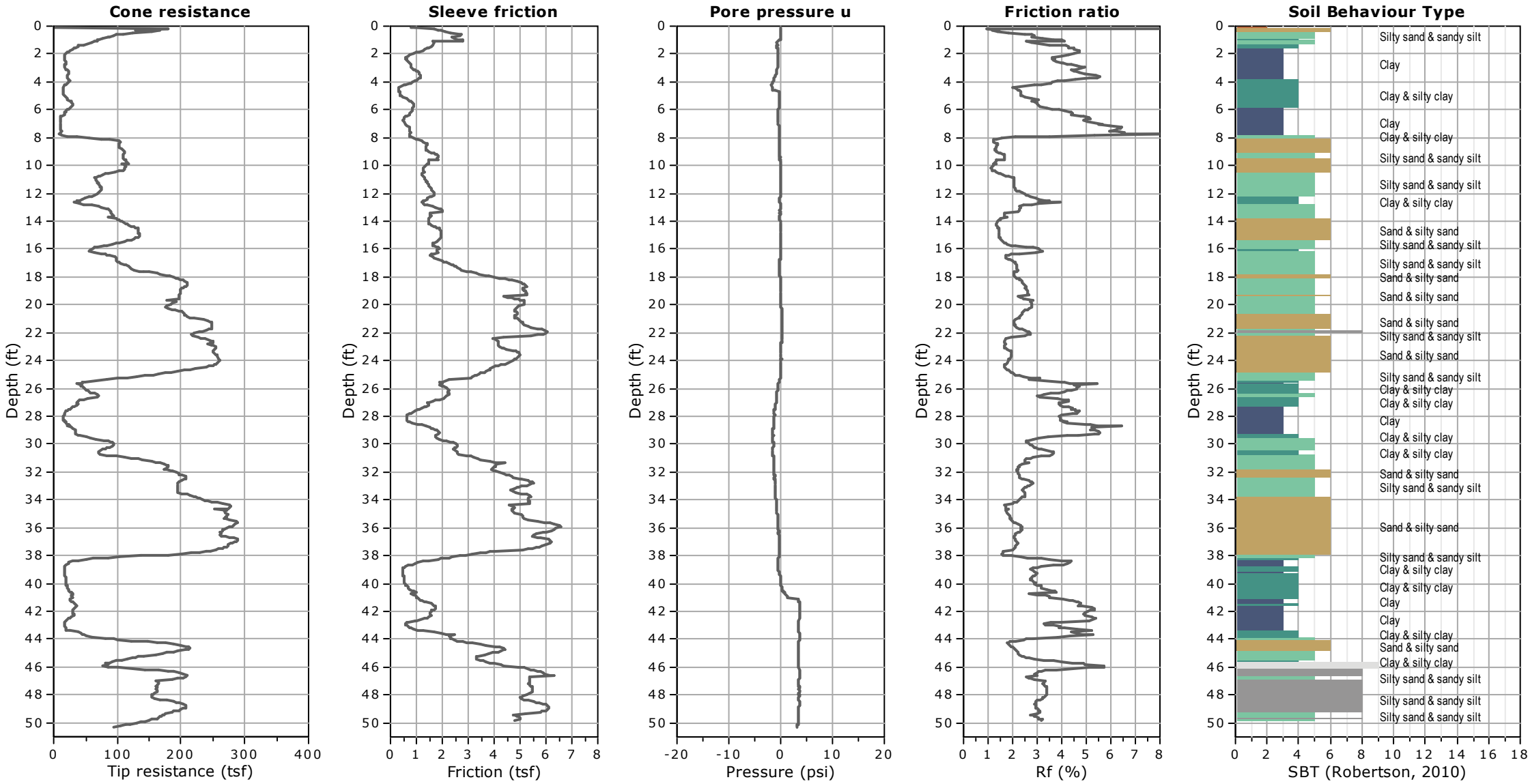
CPT-3
Total depth: 50.28 ft, Date: 9/21/2020



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: GeoTek
Location: 2323 W. Broadway, Anaheim, CA

CPT-4
Total depth: 50.28 ft, Date: 9/21/2020



APPENDIX C

LABORATORY TEST RESULTS

Geotechnical and Infiltration Evaluation
2323 W. Broadway, Anaheim, California
Project No. 2496-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Classification
Soils were classified visually in general accordance to the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the logs of exploratory borings in Appendix A.

In Situ Moisture Content and Unit Weight
The field moisture content was measured in the laboratory on selected samples collected during the field investigation. The field moisture content is determined as a percentage of the dry unit weight. The dry density was measured in the laboratory on selected ring samples. The results are shown on the logs of exploratory borings in Appendix A.

Moisture-Density Relationship
Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with test method ASTM Test Procedure D 1557. The results are presented herein.

Direct Shear
Direct shear testing was performed on remolded samples of the surficial soils according to ASTM Test Method D 3080. The results of these tests are presented herein.

Expansion Index
The expansion potential of the soils was determined by performing expansion index tests on two representative soil samples from the site in general accordance with ASTM D 4829. The results of these tests are presented herein.

Collapse
Collapse tests were conducted in accordance with ASTM D4546. The results of these tests are presented herein.

Atterberg Limits
Atterberg limits testing were performed on two fine-grained samples collected from the site. The tests were performed in general accordance with ASTM D 4318. The test results are presented herein.

Sulfate Content, Resistivity and Chloride Content
Testing to determine the water-soluble sulfate content, minimum resistivity, and chloride concentration in selected soil samples was performed by others. The results are included herein.

GEOTEK

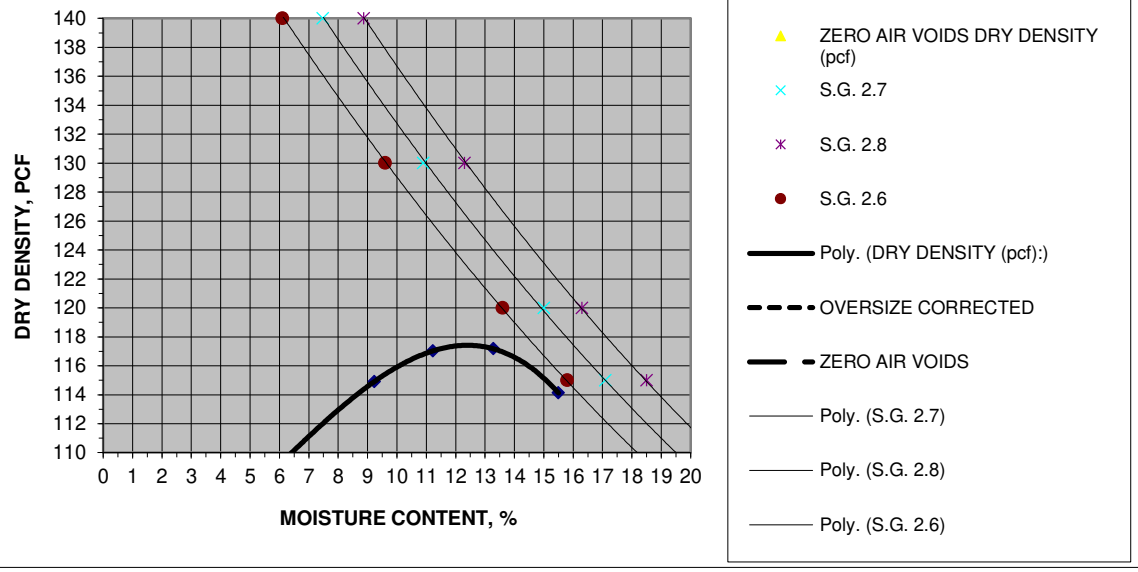
MOISTURE/DENSITY RELATIONSHIP

Client:	Melia Homes	**Job No.:**	2496-CR
Project:	2323 W. Broadway	**Lab No.:**	Corona
Location:	Irvine		
Material Type:	Gray Clayey Silt		
Material Supplier:	-		
Material Source:	-		
Sample Location:	B-1 @ 0 - 5 ft		
	-		
Sampled By:	DA	**Date Sampled:**	10/6/2020
Received By:	DLI	**Date Received:**	10/7/2020
Tested By:	GP	**Date Tested:**	10/15/2020
Reviewed By:	-	**Date Reviewed:**	-

Test Procedure: ASTM D1557 **Method:** A

Oversized Material (%): 5.4 **Correction Required:** [ ] yes [x] no

MOISTURE/DENSITY RELATIONSHIP CURVE



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	118.0	**@ Optimum Moisture, %**	12.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification: _____

AASHTO Soils Classification: _____

GEOTEK

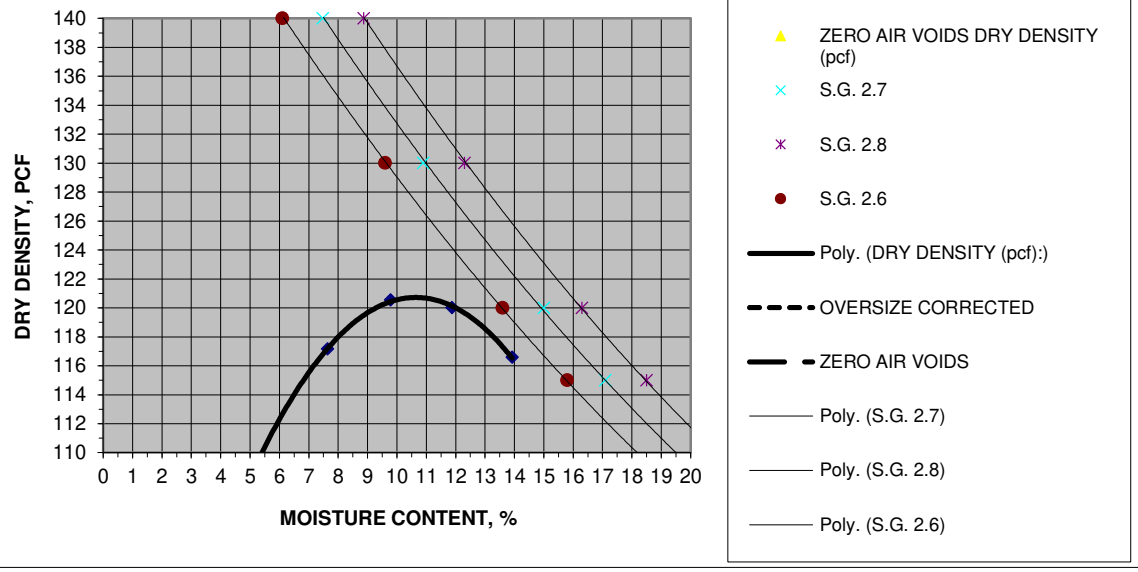
MOISTURE/DENSITY RELATIONSHIP

Client:	Melia Homes	**Job No.:**	2496-CR
Project:	2323 W. Broadway	**Lab No.:**	Corona
Location:	Irvine		
Material Type:	Gray Clayey Silt		
Material Supplier:	-		
Material Source:	-		
Sample Location:	B-5 @ 0 - 5 ft		
	-		
Sampled By:	DA	**Date Sampled:**	10/6/2020
Received By:	DLI	**Date Received:**	10/7/2020
Tested By:	GP	**Date Tested:**	10/15/2020
Reviewed By:	-	**Date Reviewed:**	-

Test Procedure: ASTM D1557 **Method:** A

Oversized Material (%): 2.6 **Correction Required:** [ ] yes [x] no

MOISTURE/DENSITY RELATIONSHIP CURVE



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	121.0	**@ Optimum Moisture, %**	11.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

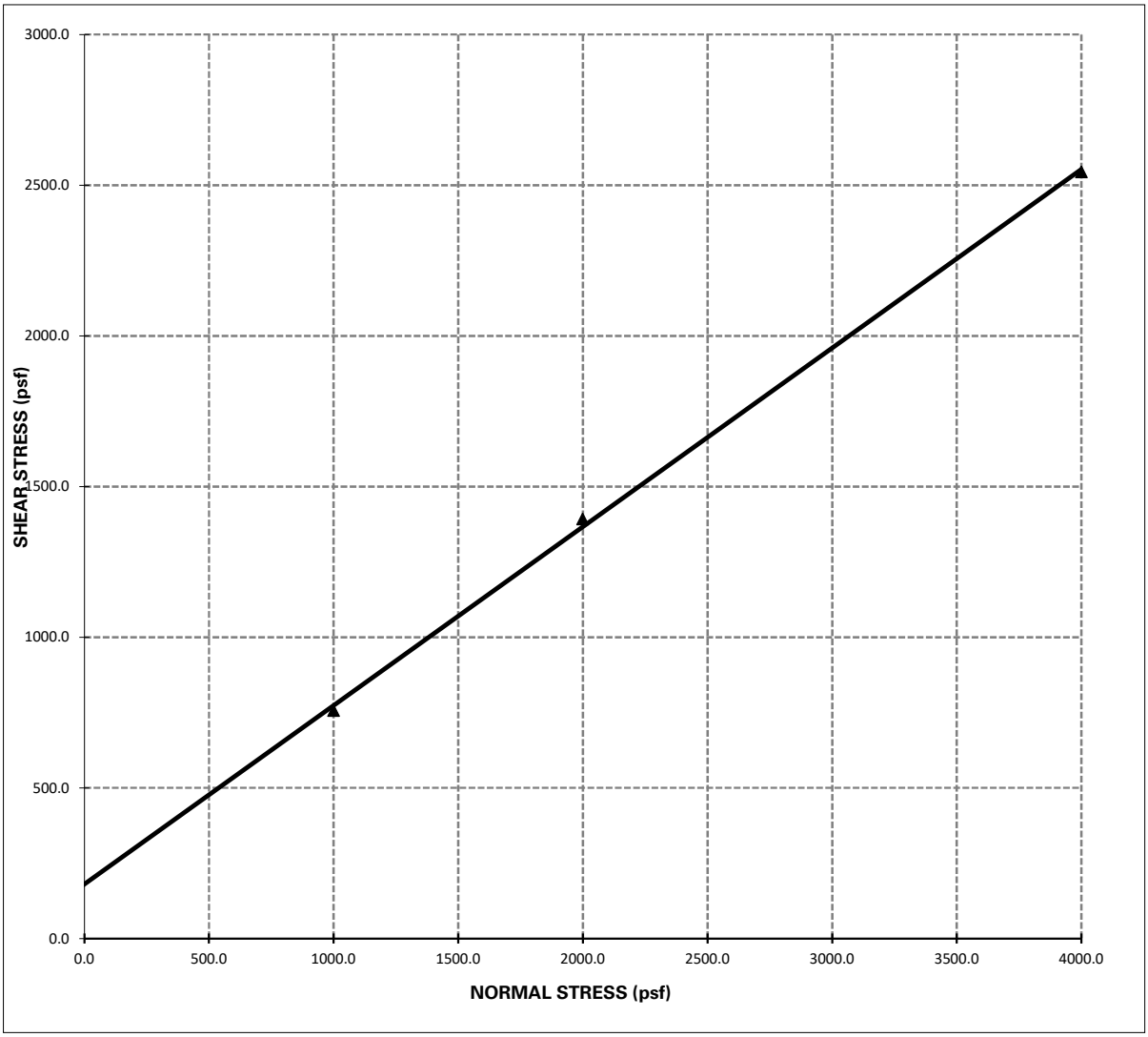
Classification:

Unified Soils Classification: _____

AASHTO Soils Classification: _____

DIRECT SHEAR TEST

Project Name:	2323 W Broadway	***Sample Location:***	B-1 @ 0-5 feet
Project Number:	2496-CR	***Date Tested:***	10/27/2020



Shear Strength: Φ = **30.7** ° , **C = 180.00 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	Melia Homes	***Tested/ Checked By:***	GP Lab No Corona
Project Number:	2496-CR	***Date Tested:***	10/21/2020
Project Location:	2323 W. Broadway, Irvine	***Sample Source:***	B-1 @ 0 - 5 ft
		Sample Description:	

Ring #: _____ Ring Dia. : 4.01" Ring Ht. 1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	747.3
B	Weight of ring (gm)	362.4
C	Net weight of sample (gm)	**384.9**
D	Wet Density, lb / ft3 (C*0.3016)	**116.1**
E	Dry Density, lb / ft3 (D/1.F)	**104.8**

SATURATION DETERMINATION

F	Moisture Content, %	10.8
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**48.0**

READINGS

DATE	TIME	READING	
10/21/2020	11:26	0.0940	Initial
	11:36	0.0940	10 min/Dry
	11:36	0.1200	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
785.9	**20.8**

EXPANSION INDEX = 26

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	Melia Homes	***Tested/ Checked By:***	GP Lab No Corona
Project Number:	2496-CR	***Date Tested:***	10/21/2020
Project Location:	2323 W. Broadway, Irvine	***Sample Source:***	B-5 @ 0 - 5 ft
		Sample Description:	

Ring #: _____ Ring Dia. : 4.01" Ring Ht. 1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	754.2
B	Weight of ring (gm)	362.5
C	Net weight of sample (gm)	**391.7**
D	Wet Density, lb / ft3 (C*0.3016)	**118.1**
E	Dry Density, lb / ft3 (D/1.F)	**106.4**

SATURATION DETERMINATION

F	Moisture Content, %	11.0
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**50.9**

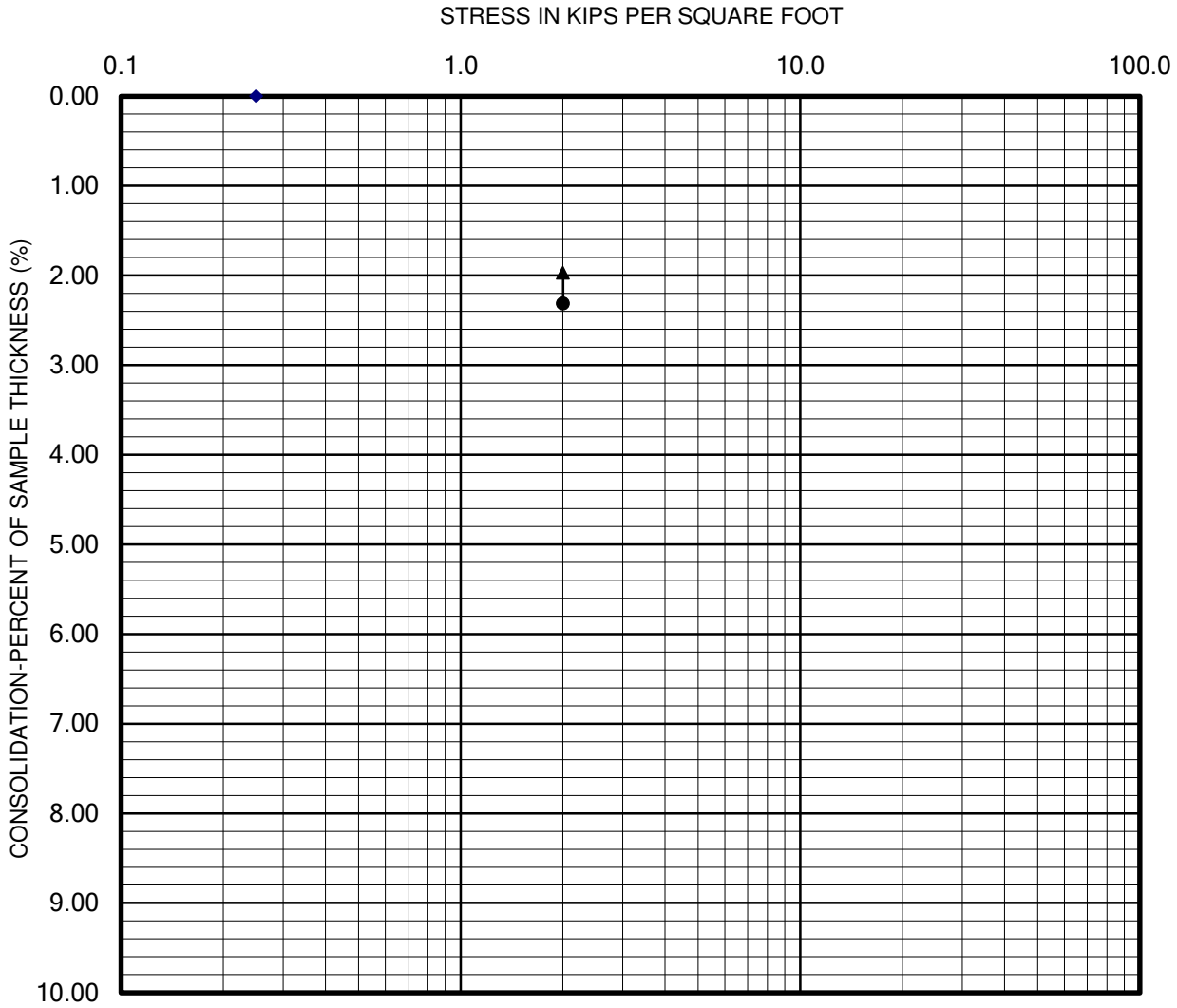
READINGS

DATE	TIME	READING	
10/21/2020	11:47	0.1080	Initial
	11:57	0.1070	10 min/Dry
	11:36	0.1350	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
789.0	**19.9**

EXPANSION INDEX = 28



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

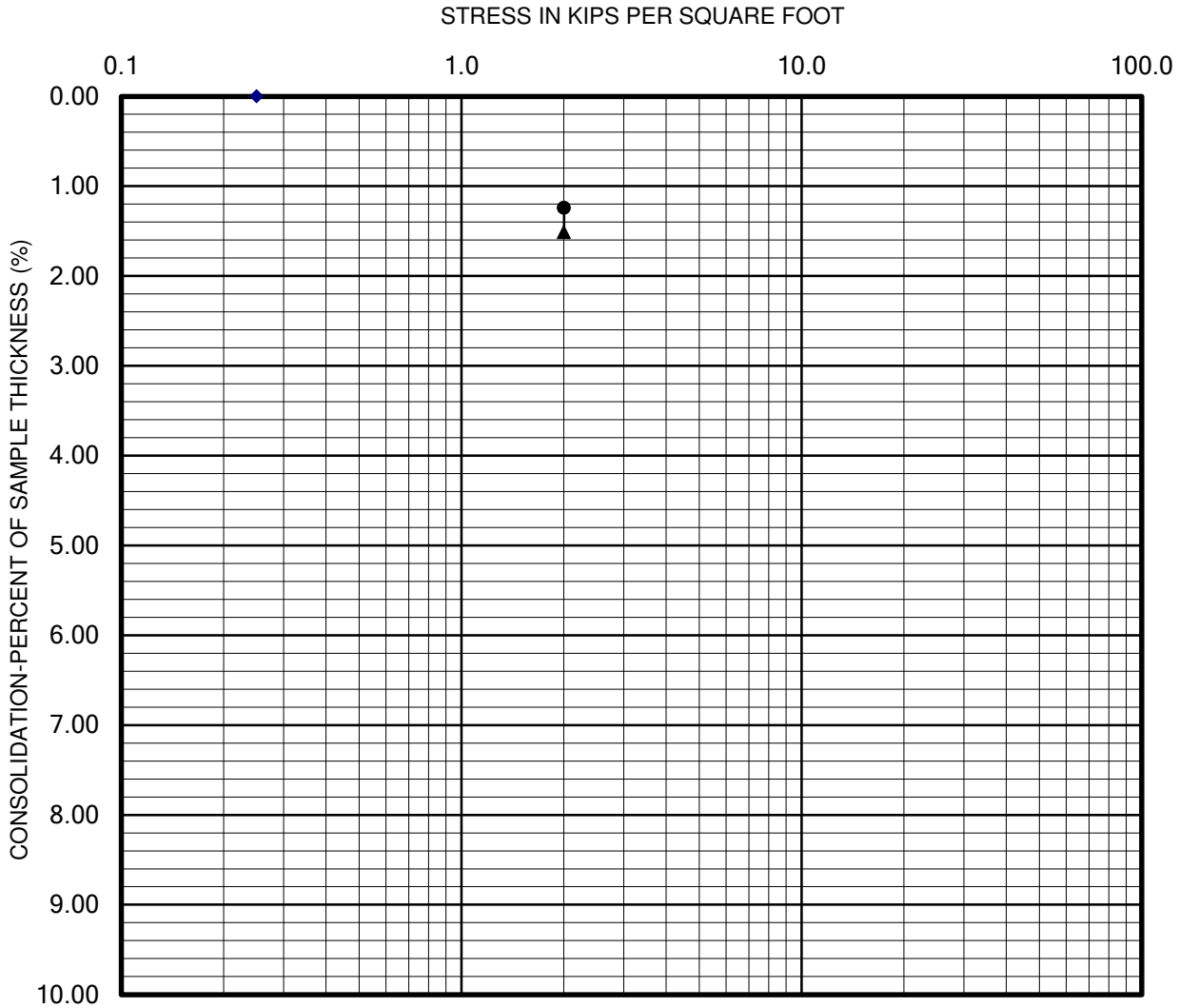
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-2 @ 6 ft

CHECKED BY:	Lab: DI
PROJECT NO.: 2496-CR	Date:



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

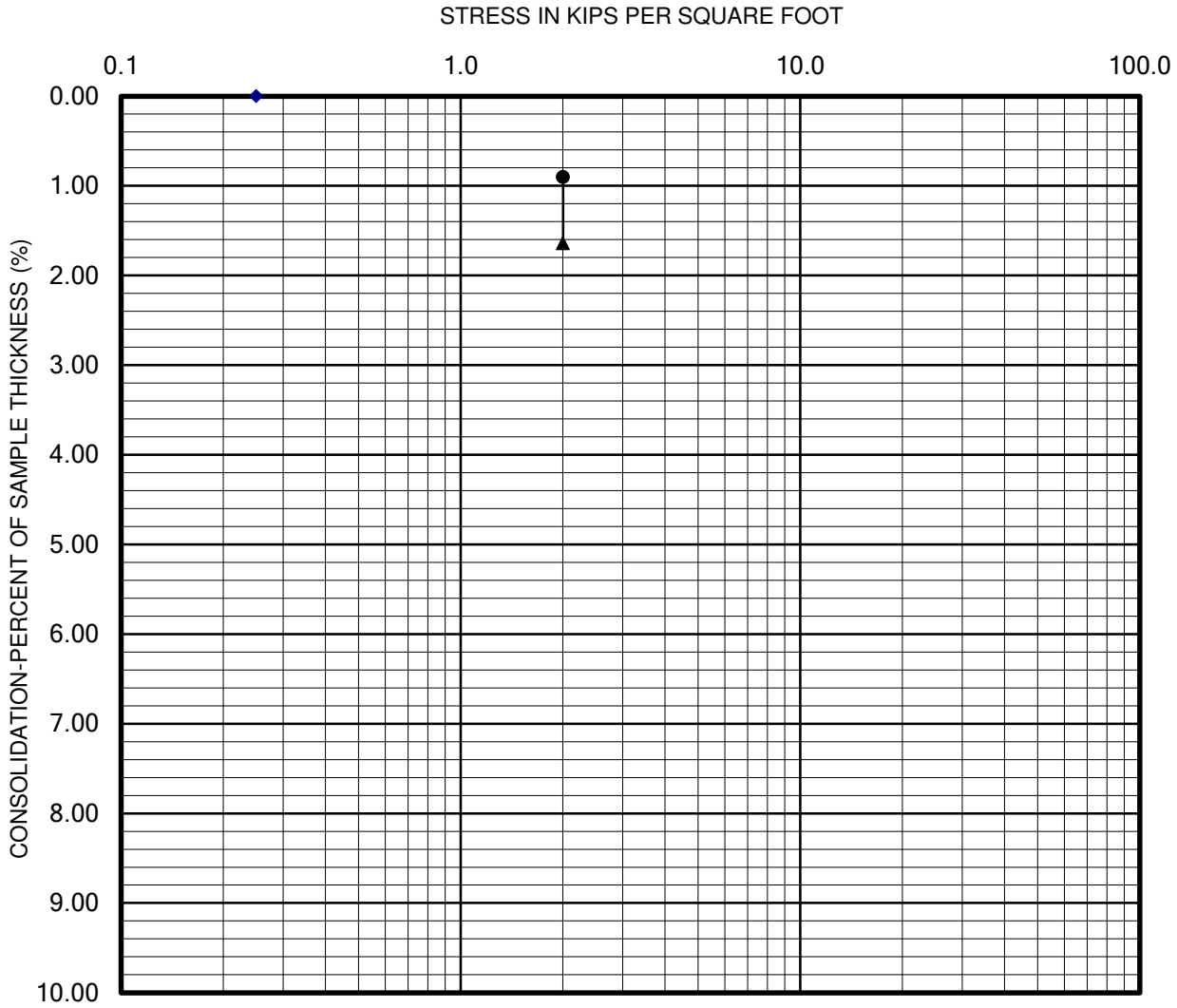
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-4 @ 4 ft

CHECKED BY:	Lab: DI
PROJECT NO.: 2496-CR	Date:



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

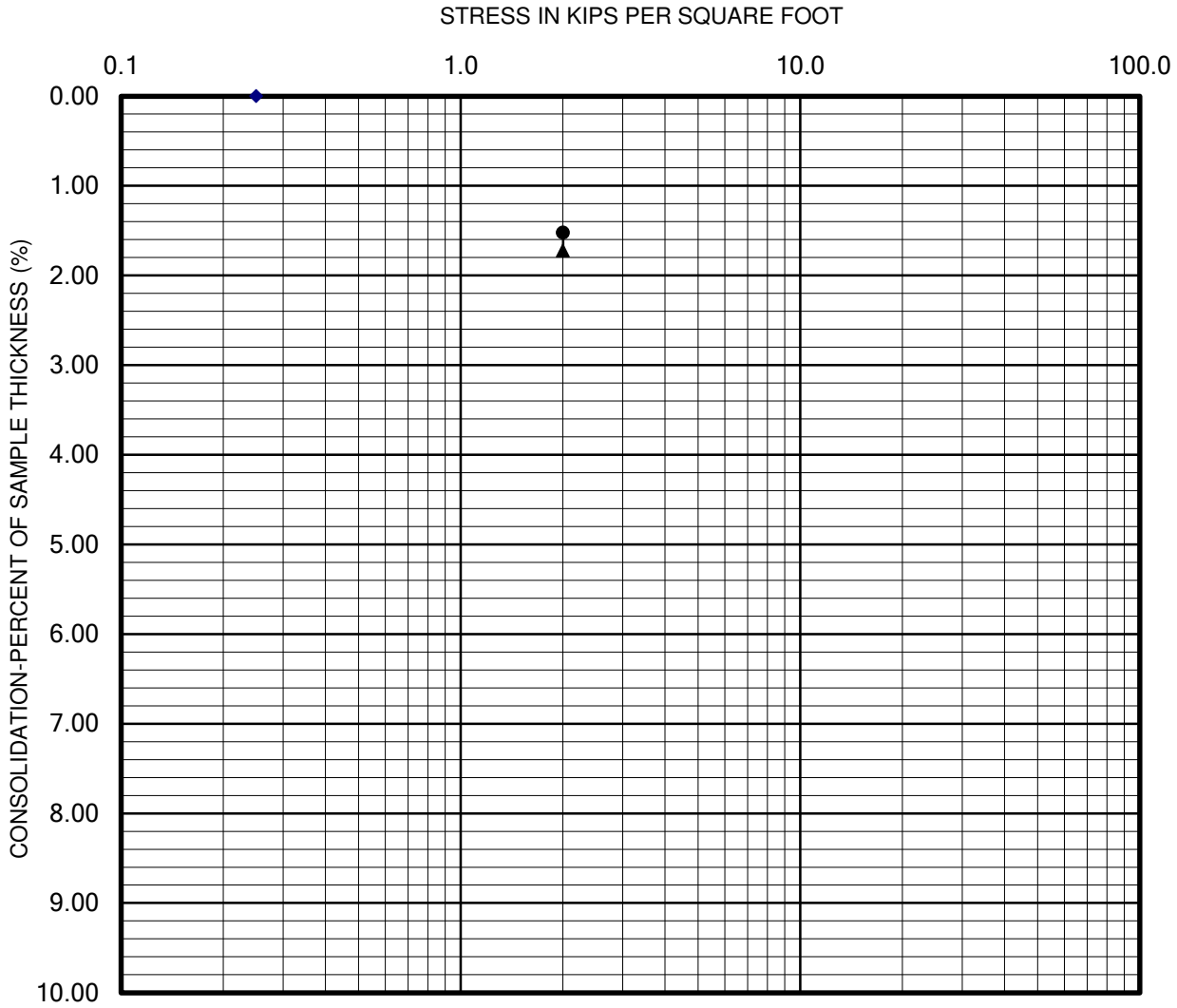
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-5 @ 5 ft

CHECKED BY:	Lab: DI
PROJECT NO.: 2496-CR	Date:



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-5 @ 10 ft

CHECKED BY:	Lab: DI
PROJECT NO.: 2496-CR	Date:

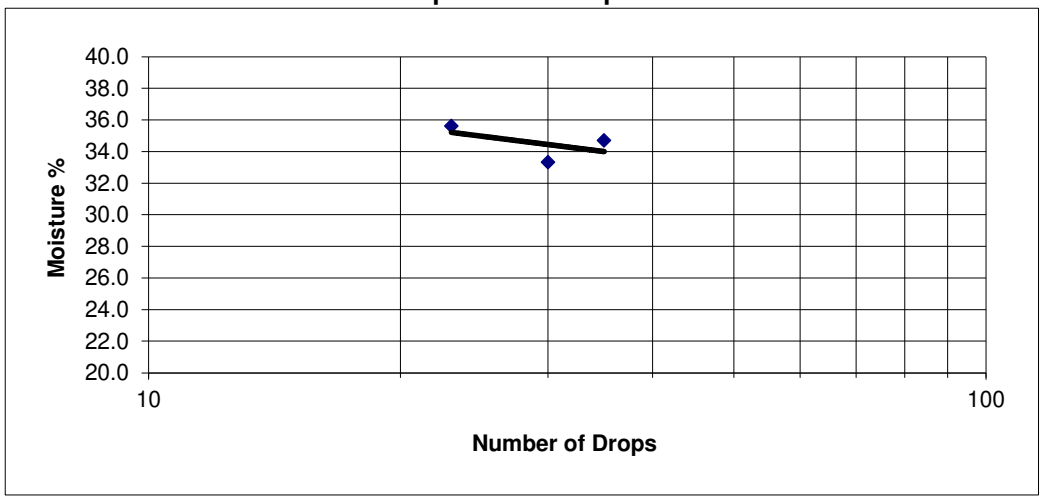
GEOTEK

ATTERBERG LIMITS DATA

Field Classification		Job No.	2496-CR
Sample Number		Client	Melia Homes
Sample Type		Project	2323 W Broadway
Location	B-1 @ 0-5 feet		
Tested by:	DA		

	Plastic Limit			Liquid Limit		
Number of Blows				35	30	23
Wt. of Dish + Wet Soil	13.30	13.00		21.20	20.90	22.51
Wt. of Dish + Dry Soil	12.18	11.90		17.31	17.20	18.20
Wt. of Moisture	1.12	1.10		3.89	3.70	4.31
Wt. of Dish	6.00	6.00		6.10	6.10	6.10
Wt. of Dry Soil	6.18	5.90		11.21	11.10	12.10
Moisture Content %	18.1	18.6		34.7	33.3	35.6

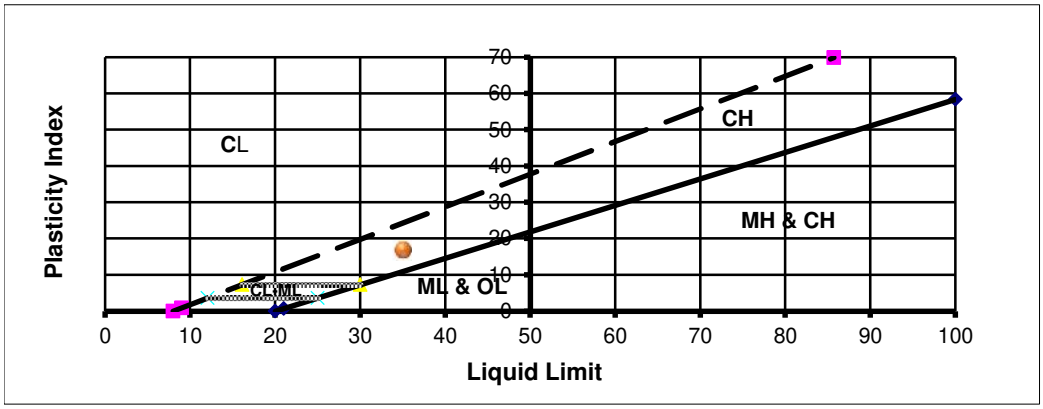
Liquid Limit Graph



Liquid Limit
35

Plastic Limit
18

Plasticity Index
17



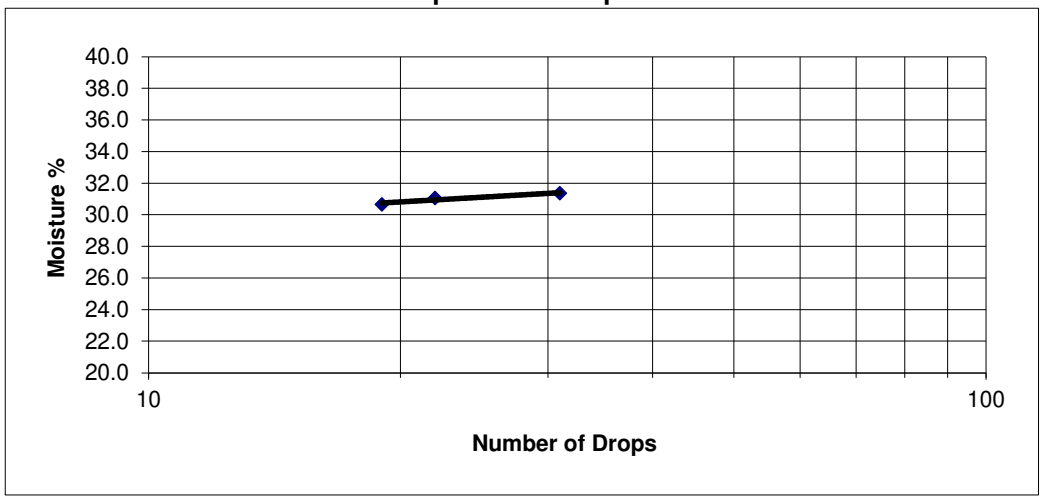
GEOTEK

ATTERBERG LIMITS DATA

Field Classification		Job No.	2496-CR
Sample Number		Client	Melia Homes
Sample Type		Project	2323 W Broadway
Location	B-5 @ 0-5 feet		
Tested by:	DA		

	Plastic Limit			Liquid Limit		
Number of Blows				31	22	19
Wt. of Dish + Wet Soil	13.50	13.00		25.41	22.60	21.91
Wt. of Dish + Dry Soil	12.40	11.95		20.80	18.69	18.20
Wt. of Moisture	1.10	1.05		4.61	3.91	3.71
Wt. of Dish	6.00	6.00		6.10	6.10	6.10
Wt. of Dry Soil	6.40	5.95		14.70	12.59	12.10
Moisture Content %	17.2	17.6		31.4	31.1	30.7

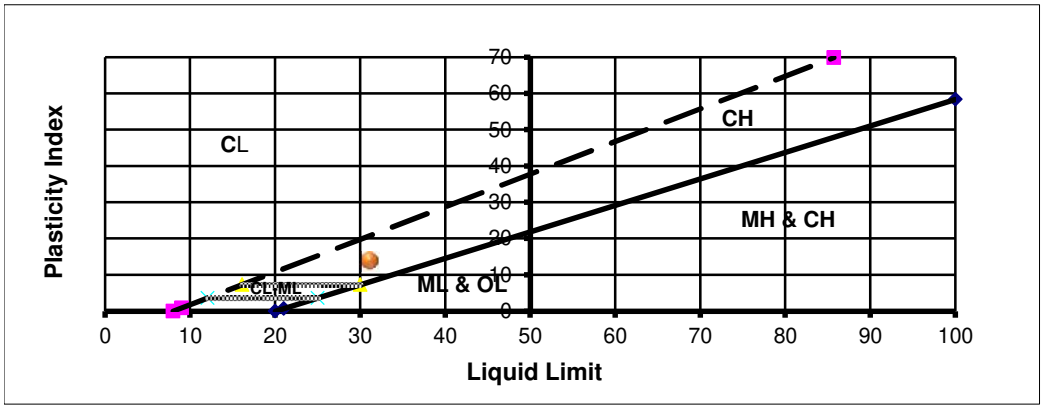
Liquid Limit Graph



Liquid Limit
31

Plastic Limit
17

Plasticity Index
14



Soil Analysis Lab Results

Client: GeoTek, Inc.
Job Name: 2323 Broadway
Client Job Number: 2496-CR
Project X Job Number: S201022D
October 26, 2020

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972	ASTM G200	SM 4500-S2-D	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd | Minimum		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^-	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
B-1	0-5	44.3	0.0044	7.8	0.0008	227,800	3,149	8.7	196	<0.01	15.8	8.6	ND	46.8	8.9	6.2	34.2	8.9	0.5
B-5	1-5	33.4	0.0033	5.3	0.0005	134,000	3,685	9.3	165	<0.01	5.1	19.2	ND	116.4	2.7	8.8	80.5	13.1	1.6

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract

APPENDIX D

INFILTRATION TEST DATA

Geotechnical and Infiltration Evaluation
2323 W. Broadway, Anaheim, California
Project No. 2496-CR

GEOTEK

Client:	**Melia Homes**
Project:	**2323 W. Broadway**
Project No:	**2496-CR**
Date:	**10/23/2020**

Boring No. **P-1/I-1**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	10	min
Final Depth to Water, D_F =	39.5	in
Test Hole Radius, r =	4	in
Initial Depth to Water, D_O =	36	in
Total Test Hole Depth, D_T =	60	in

Equation - $I_t = \dfrac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$

$H_O = D_T - D_O$ =	24	in
$H_F = D_T - D_F$ =	20.5	in
$\Delta H = \Delta D = H_O - H_F$ =	3.5	in
$Havg = (H_O+H_F)/2$ =	22.25	in

I_t = 1.73 **Inches per Hour**

GEOTEK

Client:	**Melia Homes**
Project:	**2323 W. Broadway**
Project No:	**2496-CR**
Date:	**10/23/2020**

Boring No. **P-2/I-2**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	10	min
Final Depth to Water, D_F =	40.5	in
Test Hole Radius, r =	4	in
Initial Depth to Water, D_O =	36	in
Total Test Hole Depth, D_T =	60	in

Equation - $I_t = \dfrac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$

$H_O = D_T - D_O$ =	24	in
$H_F = D_T - D_F$ =	19.5	in
$\Delta H = \Delta D = H_O - H_F$ =	4.5	in
$Havg = (H_O+H_F)/2$ =	21.75	in

I_t = 2.27 **Inches per Hour**

GEOTEK

Client:	**Melia Homes**
Project:	**2323 W. Broadway**
Project No:	**2496-CR**
Date:	**10/23/2020**

Boring No. **P-3/I-3**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	30	min
Final Depth to Water, D_F =	39.75	in
Test Hole Radius, r =	4	in
Initial Depth to Water, D_O =	36	in
Total Test Hole Depth, D_T =	60	in

Equation - $I_t = \dfrac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$

$H_O = D_T - D_O$ =	24	in
$H_F = D_T - D_F$ =	20.25	in
$\Delta H = \Delta D = H_O - H_F$ =	3.75	in
$Havg = (H_O+H_F)/2$ =	22.125	in

I_t = 0.62 **Inches per Hour**

GEOTEK

Percolation Test Data Sheet

Project:	2323 W. Broadway	Project No:	2496-CR	Date:	10/5/2020
Test Hole No:	I-1	Tested By:	D. Alvarez		
Depth of Test Hole, D_T:	60.0"	USCS Soil Classification:			
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8.0"	Sides (if rectangular)=			

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	7:05	7:30	25	36.0	48.5	12.5	Y
2	7:30	7:55	25	36.0	48.5	12.5	Y

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	7:55	8:05	10	36.0	39.75		
2	8:05	8:15	10	36.0	39.75		
3	8:15	8:25	10	36.0	39.5		
4	8:25	8:35	10	36.0	39.5		
5	8:35	8:45	10	36.0	39.5		
6	8:45	8:55	10	36.0	39.5		
7							
8							
9							
10							
11							
12							
13							
14							
15							

COMMENTS:

Percolation Test Data Sheet

Project:	2323 W. Broadway	Project No:	2496-CR	Date:	10/5/2020
Test Hole No:	I-2	Tested By:	D. Alvarez		
Depth of Test Hole, D_T:	60.0"	USCS Soil Classification:			
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8.0"	Sides (if rectangular)=			

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	14:05	14:30	25	36.0	48.75	12.75	Y
2	14:30	14:45	25	36.0	46.5	10.5	Y

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	14:45	14:55	10	36.0	42.25	6.25	
2	14:55	15:05	10	36.0	40.5	4.5	
3	15:05	15:15	10	36.0	40.5	4.5	
4	15:15	15:25	10	36.0	40.5	4.5	
5	15:25	15:35	10	36.0	40.5	4.5	
6	15:35	15:45	10	36.0	40.5	4.5	
7							
8							
9							
10							
11							
12							
13							
14							
15							

COMMENTS:

Percolation Test Data Sheet

Project:	2323 W. Broadway	Project No:	2496-CR	Date:	10/5/2020
Test Hole No:	I-3	Tested By:	D. Alvarez		
Depth of Test Hole, D_T:	60.0"	USCS Soil Classification:			
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8.0"	Sides (if rectangular)=			

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	7:12	7:37	25	36.0	48.5	5.75	N
2	7:37	8:02	25	36.0	48.5	3.5	N

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	8:02	8:32	30	36.0	40.5	4.5	
2	8:32	9:02	30	36.0	40.0	4.0	
3	9:02	9:32	30	36.0	39.75	3.75	
4	9:32	10:02	30	36.0	39.75	3.75	
5	10:02	10:32	30	36.0	39.75	3.75	
6	10:32	11:02	30	36.0	39.75	3.75	
7	11:02	11:32	30	36.0	39.75	3.75	
8	11:32	12:02	30	36.0	39.75	3.75	
9	12:02	12:32	30	36.0	39.75	3.75	
10	12:32	13:02	30	36.0	39.75	3.75	
11	13:02	13:32	30	36.0	39.75	3.75	
12	13:32	14:02	30	36.0	39.75	3.75	
13							
14							
15							

COMMENTS:

APPENDIX E

RESULTS OF LIQUEFACTION AND SETTLEMENT ANALYSES

Geotechnical and Infiltration Evaluation
2323 W. Broadway, Anaheim, California
Project No. 2496-CR

GEOTEK

GeoTek, Inc.
1548 N. Maple Street
Corona, CA 92880
http://www.geotekusa.com

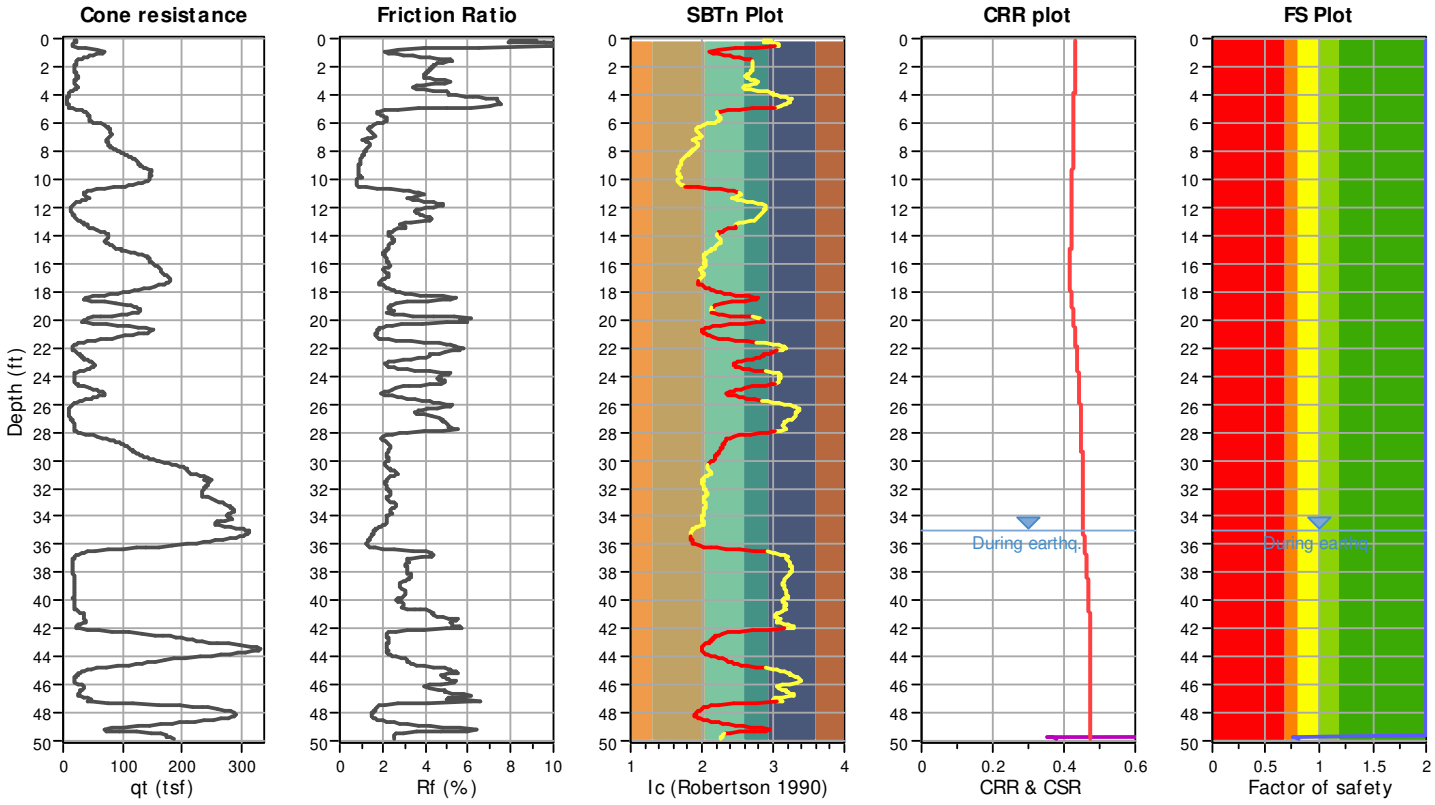
LIQUEFACTION ANALYSIS REPORT

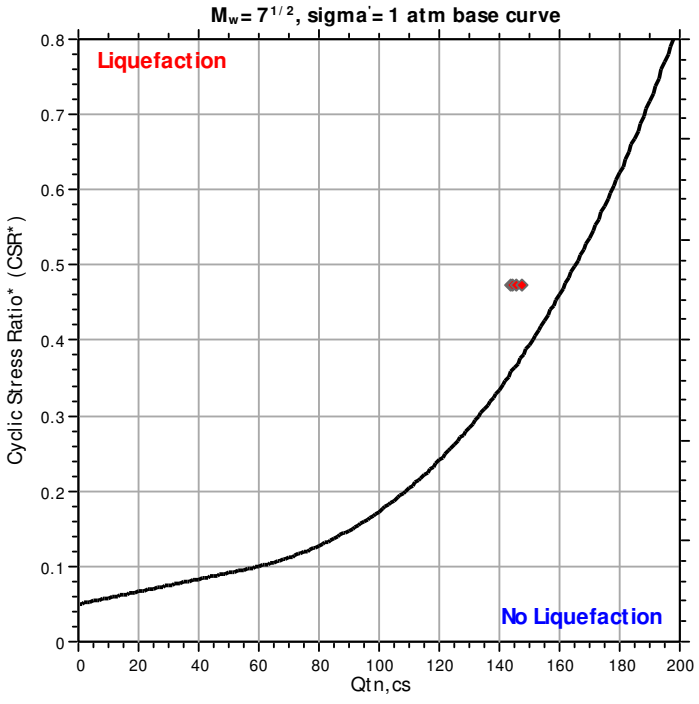
Project title : Proposed Townhouses **Location : 2323 West Broadway, Anaheim, CA**

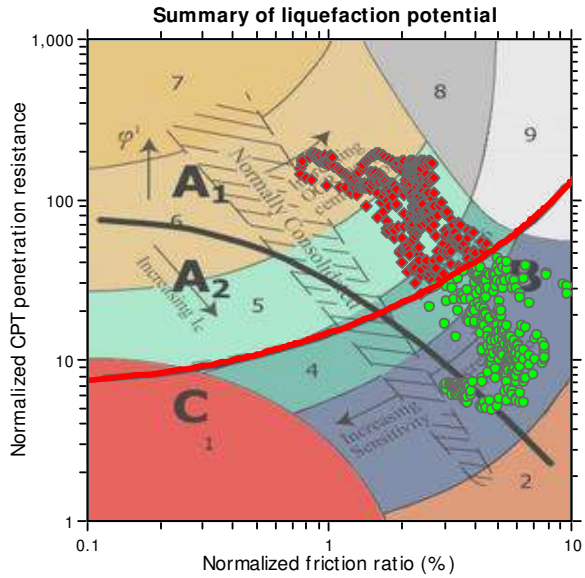
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	46.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	35.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.67	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.69	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

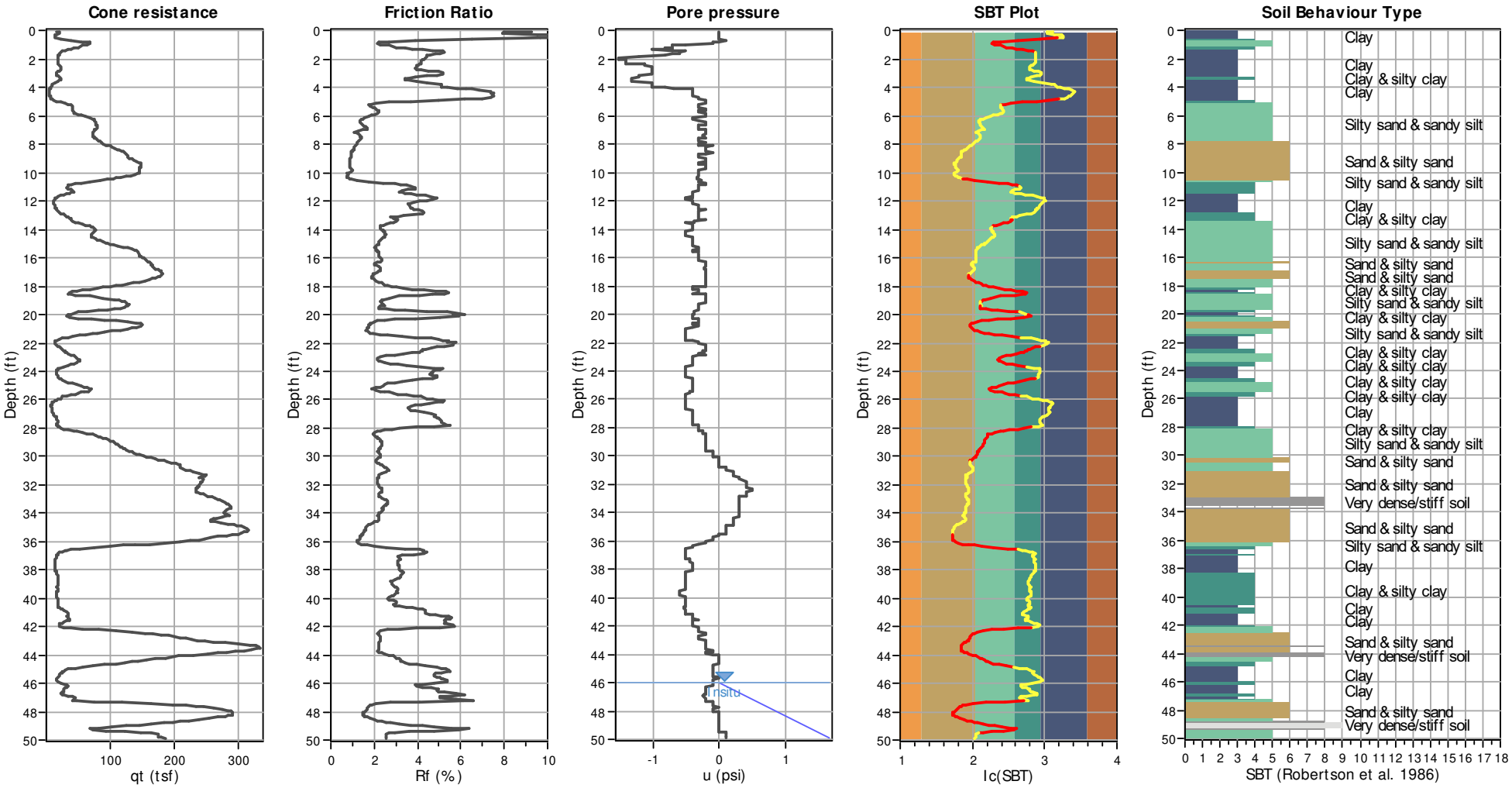






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



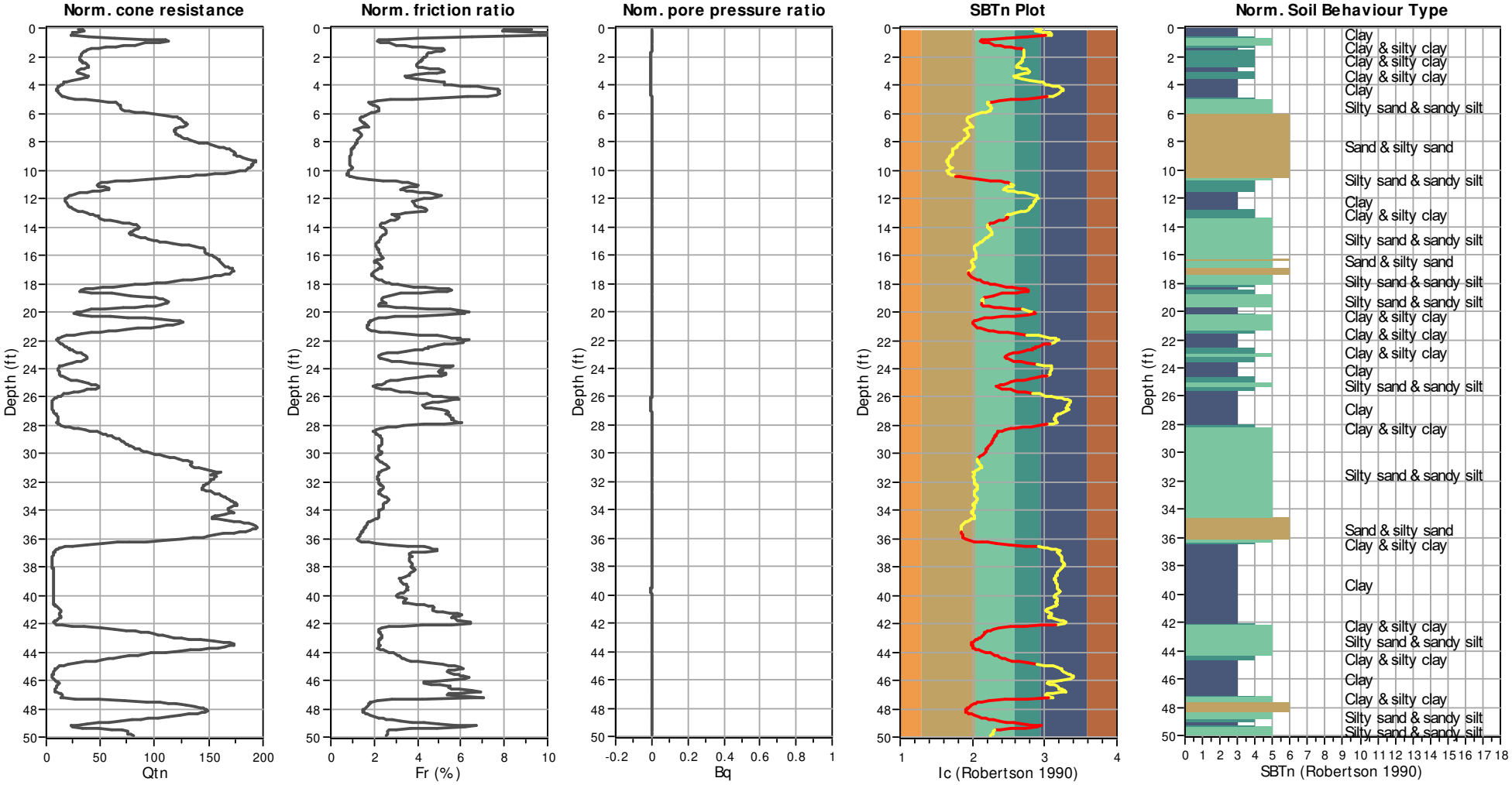
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



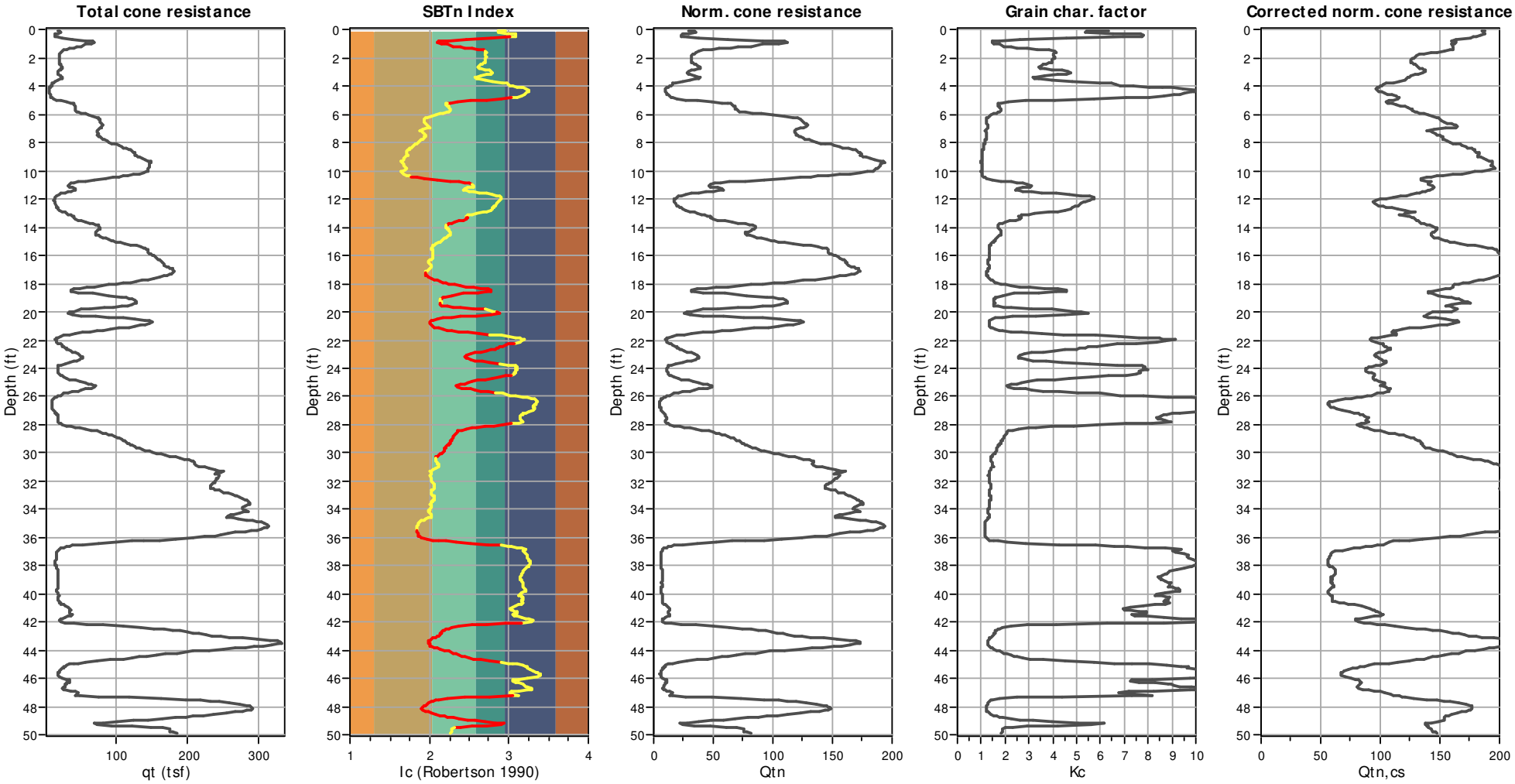
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

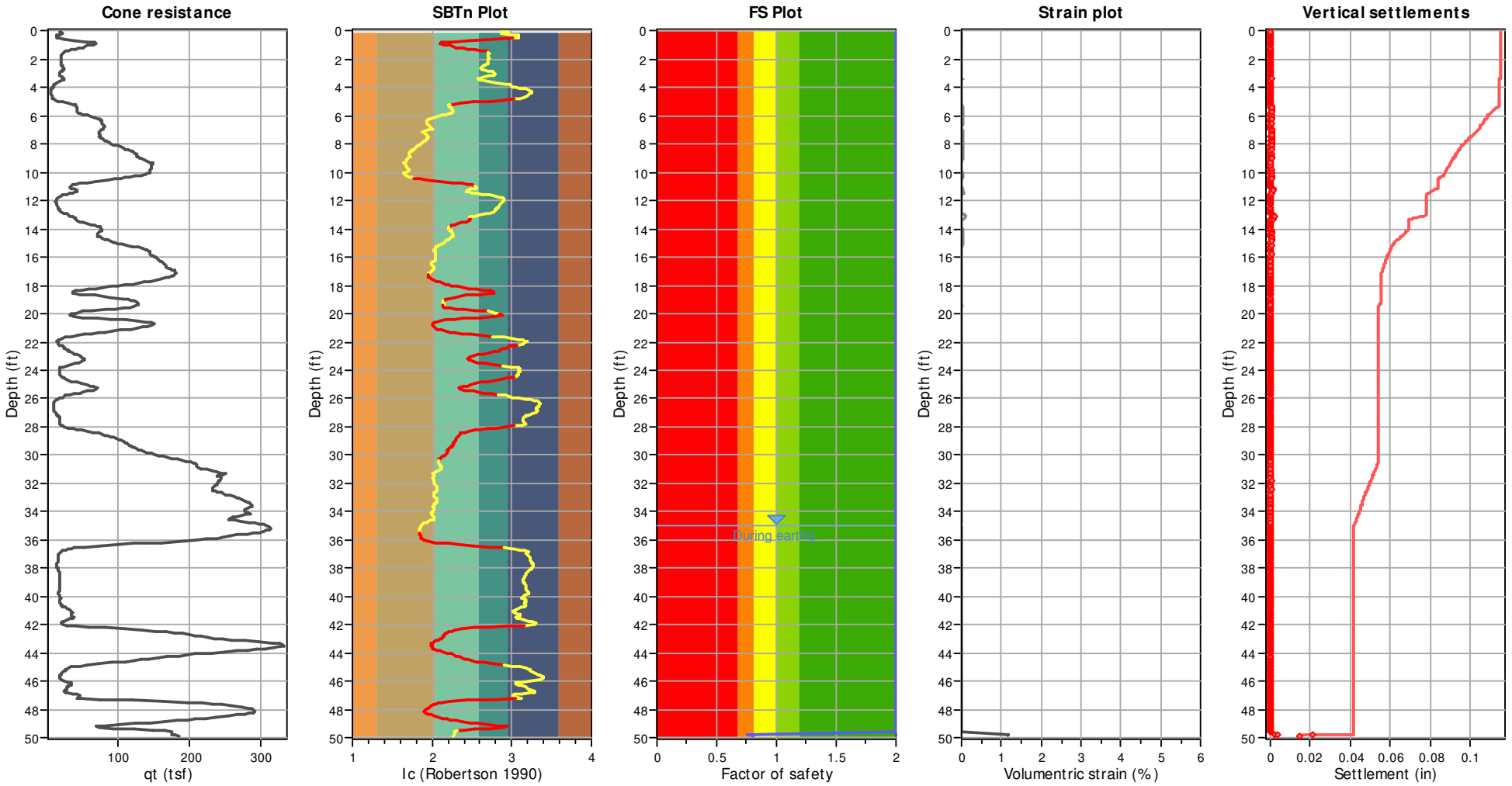
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.09	2.96	29.57	6.34	187.41	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.14	2.87	34.10	5.44	185.34	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.23	2.86	34.83	5.36	186.64	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.27	2.98	28.75	6.54	188.04	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.33	3.08	24.49	7.69	188.18	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.41	3.09	23.55	7.82	184.12	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.49	3.09	23.23	7.77	180.50	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.54	3.02	25.64	6.96	178.44	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.63	2.77	38.35	4.56	175.01	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.68	2.47	62.52	2.61	163.44	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.80	2.24	91.07	1.76	160.22	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.85	2.12	109.63	1.49	163.12	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.92	2.10	112.21	1.46	164.01	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.01	2.15	104.79	1.55	162.02	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.05	2.23	91.57	1.75	160.17	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.17	2.31	81.56	1.97	160.44	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.19	2.39	70.78	2.28	161.12	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.28	2.44	64.44	2.50	161.03	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.32	2.53	55.22	2.92	160.98	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.40	2.60	48.20	3.34	160.99	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.45	2.68	41.18	3.85	158.45	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.56	2.71	37.95	4.06	154.20	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.59	2.72	35.89	4.12	147.78	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.66	2.71	35.01	4.06	142.17	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.71	2.70	34.08	4.01	136.69	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.78	2.70	33.09	4.02	132.96	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.85	2.71	32.30	4.05	130.78	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.94	2.71	31.70	4.08	129.38	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.99	2.71	31.46	4.07	127.96	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.07	2.71	31.35	4.04	126.73	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.12	2.70	31.54	3.99	125.78	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.20	2.70	31.53	3.98	125.65	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.25	2.70	31.67	3.97	125.77	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.33	2.69	31.96	3.94	126.03	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.38	2.68	33.03	3.83	126.66	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.47	2.66	34.15	3.74	127.57	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.50	2.64	35.80	3.61	129.14	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.60	2.63	37.11	3.52	130.44	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.64	2.62	38.57	3.43	132.13	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.73	2.62	38.71	3.45	133.50	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.76	2.65	37.25	3.63	135.36	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.86	2.69	34.75	3.94	136.92	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.90	2.75	31.57	4.37	137.94	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.99	2.78	29.66	4.63	137.27	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.03	2.80	28.30	4.76	134.81	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.13	2.77	28.87	4.57	131.85	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.18	2.73	30.77	4.18	128.66	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.25	2.65	34.56	3.64	125.85	0	0	0.43	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
3.35	2.60	37.37	3.31	123.83	33	562	0.43	0.043	0.02	8.42	0.02	0.000
3.40	2.58	38.58	3.18	122.61	33	564	0.43	0.044	0.02	8.42	0.02	0.000
3.47	2.59	37.75	3.24	122.36	33	559	0.43	0.046	0.03	8.42	0.02	0.000
3.50	2.61	35.94	3.39	121.93	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.60	2.69	30.62	3.94	120.67	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.70	2.80	24.28	4.79	116.31	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.76	2.93	18.48	5.99	110.67	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.83	2.97	16.33	6.46	105.44	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.88	2.99	15.50	6.64	102.96	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.94	3.01	14.81	6.82	101.09	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.00	3.05	13.59	7.35	99.88	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.05	3.11	12.27	8.06	98.96	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.10	3.15	11.39	8.61	98.07	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.14	3.19	10.76	9.04	97.30	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.21	3.22	10.22	9.48	96.87	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.27	3.26	9.68	10.06	97.37	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.40	3.25	9.96	9.94	98.97	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.45	3.24	10.35	9.80	101.37	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.51	3.22	10.92	9.50	103.81	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.57	3.20	11.45	9.30	106.52	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.62	3.19	12.08	9.07	109.65	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.67	3.16	13.01	8.68	112.93	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.80	3.11	14.26	8.08	115.16	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.84	3.03	16.30	7.09	115.53	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.90	2.90	20.00	5.70	114.06	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.97	2.72	26.92	4.11	110.77	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.02	2.52	36.91	2.89	106.71	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.08	2.36	48.70	2.16	105.04	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.19	2.27	57.41	1.85	105.97	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.22	2.22	62.62	1.72	107.77	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.25	2.21	64.57	1.70	109.71	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.33	2.22	66.31	1.71	113.25	26	615	0.43	0.073	0.05	8.42	0.04	0.001
5.42	2.23	67.67	1.73	117.24	27	635	0.43	0.068	0.05	8.42	0.04	0.001
5.46	2.24	68.50	1.77	121.03	28	653	0.43	0.063	0.04	8.42	0.03	0.000
5.53	2.25	68.74	1.80	123.54	28	665	0.43	0.062	0.04	8.42	0.03	0.001
5.59	2.26	68.78	1.82	125.43	29	673	0.43	0.061	0.04	8.42	0.03	0.000
5.66	2.26	69.12	1.83	126.39	29	678	0.43	0.061	0.04	8.42	0.03	0.001
5.77	2.26	70.18	1.81	127.35	29	684	0.43	0.061	0.04	8.42	0.03	0.001
5.82	2.24	72.51	1.78	128.73	30	694	0.43	0.060	0.04	8.42	0.03	0.000
5.87	2.22	76.36	1.71	130.90	30	710	0.43	0.057	0.04	8.42	0.03	0.000
5.95	2.18	82.40	1.62	133.27	30	729	0.43	0.054	0.03	8.42	0.03	0.000
5.99	2.13	90.49	1.51	136.39	30	750	0.43	0.051	0.03	8.42	0.02	0.000
6.04	2.07	99.55	1.41	140.10	30	770	0.43	0.048	0.03	8.42	0.02	0.000
6.12	2.02	109.28	1.32	144.42	30	786	0.43	0.047	0.03	8.42	0.02	0.000
6.23	1.97	116.49	1.27	147.49	30	794	0.43	0.047	0.03	8.42	0.02	0.001
6.29	1.94	121.16	1.23	149.27	30	795	0.43	0.048	0.03	8.42	0.02	0.000
6.34	1.93	122.57	1.22	149.70	30	794	0.43	0.048	0.03	8.42	0.02	0.000
6.40	1.93	123.34	1.21	149.81	30	792	0.43	0.049	0.03	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
6.43	1.93	124.41	1.22	151.27	31	800	0.43	0.049	0.03	8.42	0.02	0.000
6.56	1.93	125.52	1.22	153.32	31	813	0.43	0.048	0.03	8.42	0.02	0.001
6.62	1.94	127.02	1.23	156.66	32	834	0.43	0.046	0.03	8.42	0.02	0.000
6.68	1.95	128.23	1.24	159.38	33	852	0.43	0.044	0.02	8.42	0.02	0.000
6.74	1.96	129.25	1.25	161.92	33	868	0.43	0.043	0.02	8.42	0.02	0.000
6.79	1.97	129.68	1.26	163.78	34	880	0.43	0.042	0.02	8.42	0.02	0.000
6.85	1.99	128.51	1.28	164.70	34	890	0.43	0.042	0.02	8.42	0.02	0.000
6.96	2.00	126.21	1.30	163.74	34	888	0.43	0.043	0.02	8.42	0.02	0.000
7.01	1.96	122.84	1.26	154.31	32	828	0.43	0.052	0.03	8.42	0.02	0.000
7.09	1.92	120.01	1.21	145.38	29	768	0.43	0.064	0.04	8.42	0.03	0.001
7.13	1.88	118.30	1.17	138.55	28	717	0.43	0.079	0.05	8.42	0.04	0.000
7.19	1.90	118.83	1.19	141.24	28	738	0.43	0.074	0.05	8.42	0.04	0.001
7.27	1.92	118.57	1.21	143.33	29	756	0.43	0.070	0.05	8.42	0.03	0.001
7.36	1.93	119.30	1.22	145.76	30	773	0.43	0.067	0.04	8.42	0.03	0.001
7.43	1.95	119.00	1.24	147.15	30	785	0.43	0.066	0.04	8.42	0.03	0.001
7.48	1.95	120.71	1.24	149.58	31	798	0.43	0.063	0.04	8.42	0.03	0.000
7.56	1.95	122.06	1.24	151.05	31	806	0.43	0.063	0.04	8.42	0.03	0.001
7.62	1.94	123.69	1.23	151.96	31	812	0.43	0.063	0.04	8.42	0.03	0.000
7.70	1.92	125.48	1.21	152.15	31	817	0.43	0.063	0.04	8.42	0.03	0.001
7.78	1.91	127.34	1.20	152.58	31	823	0.43	0.063	0.04	8.42	0.03	0.001
7.83	1.89	130.11	1.18	153.90	31	831	0.43	0.062	0.04	8.42	0.03	0.000
7.89	1.88	133.08	1.17	155.56	31	842	0.42	0.060	0.04	8.42	0.03	0.000
7.96	1.86	136.83	1.16	158.05	31	857	0.42	0.058	0.03	8.42	0.03	0.000
8.05	1.85	140.82	1.14	160.96	32	875	0.42	0.056	0.03	8.42	0.03	0.001
8.11	1.84	144.50	1.13	163.74	32	891	0.42	0.055	0.03	8.42	0.02	0.000
8.14	1.82	148.69	1.12	166.63	32	905	0.42	0.053	0.03	8.42	0.02	0.000
8.23	1.81	151.55	1.11	168.41	33	917	0.42	0.052	0.03	8.42	0.02	0.000
8.27	1.79	156.16	1.10	171.45	33	931	0.42	0.051	0.03	8.42	0.02	0.000
8.38	1.78	159.07	1.09	173.25	33	945	0.42	0.050	0.03	8.42	0.02	0.001
8.42	1.76	163.73	1.08	176.23	34	958	0.42	0.049	0.03	8.42	0.02	0.000
8.49	1.74	166.59	1.07	177.83	34	966	0.42	0.048	0.03	8.42	0.02	0.000
8.54	1.73	169.34	1.06	179.28	34	973	0.42	0.048	0.03	8.42	0.02	0.000
8.60	1.72	170.73	1.05	179.74	34	976	0.42	0.048	0.03	8.42	0.02	0.000
8.67	1.72	172.53	1.05	181.01	34	985	0.42	0.048	0.03	8.42	0.02	0.000
8.75	1.72	173.67	1.05	182.65	34	1001	0.42	0.047	0.02	8.42	0.02	0.000
8.80	1.72	174.14	1.05	183.32	34	1008	0.42	0.046	0.02	8.42	0.02	0.000
8.89	1.72	173.04	1.05	182.27	34	1008	0.42	0.047	0.02	8.42	0.02	0.000
8.93	1.71	174.33	1.04	181.68	34	1002	0.42	0.048	0.03	8.42	0.02	0.000
9.02	1.70	175.58	1.04	181.84	34	1005	0.42	0.049	0.03	8.42	0.02	0.000
9.07	1.69	178.48	1.03	183.62	34	1014	0.42	0.048	0.03	8.42	0.02	0.000
9.14	1.68	181.27	1.03	186.07	35	1031	0.42	0.047	0.02	8.42	0.02	0.000
9.20	1.67	185.77	1.02	189.38	35	1049	0.42	0.046	0.02	8.42	0.02	0.000
9.28	1.66	190.24	1.01	192.03	35	1063	0.42	0.045	0.02	8.42	0.02	0.000
9.36	1.65	192.96	1.00	193.40	35	1072	0.42	0.045	0.02	8.42	0.02	0.000
9.40	1.65	193.88	1.00	194.45	36	1081	0.42	0.044	0.02	8.42	0.02	0.000
9.46	1.66	192.09	1.01	194.17	36	1087	0.42	0.044	0.02	8.42	0.02	0.000
9.55	1.67	190.53	1.02	193.65	36	1092	0.42	0.044	0.02	8.42	0.02	0.000
9.59	1.67	189.66	1.02	193.23	36	1094	0.42	0.044	0.02	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
9.68	1.67	190.07	1.02	193.72	36	1102	0.42	0.044	0.02	8.42	0.02	0.000
9.72	1.69	188.80	1.03	195.22	36	1122	0.42	0.043	0.02	8.42	0.02	0.000
9.83	1.71	187.46	1.04	195.76	37	1139	0.42	0.042	0.02	8.42	0.02	0.000
9.88	1.72	186.04	1.05	195.37	37	1144	0.42	0.042	0.02	8.42	0.02	0.000
9.92	1.69	185.66	1.03	191.05	35	1108	0.42	0.046	0.02	8.42	0.02	0.000
10.02	1.66	183.66	1.01	185.57	34	1070	0.42	0.050	0.03	8.42	0.02	0.000
10.07	1.65	179.13	1.00	179.21	33	1032	0.42	0.055	0.03	8.42	0.02	0.000
10.12	1.66	173.07	1.01	174.64	32	1012	0.42	0.058	0.03	8.42	0.03	0.000
10.21	1.67	164.99	1.02	168.12	31	984	0.42	0.063	0.04	8.42	0.03	0.001
10.30	1.69	156.00	1.03	160.37	30	948	0.42	0.070	0.04	8.42	0.03	0.001
10.34	1.71	146.21	1.04	152.50	29	911	0.42	0.079	0.05	8.42	0.04	0.000
10.38	1.74	138.19	1.07	147.26	28	894	0.42	0.083	0.06	8.42	0.04	0.000
10.46	1.77	131.48	1.09	142.97	27	884	0.42	0.087	0.06	8.42	0.05	0.001
10.50	1.83	123.09	1.13	139.28	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.58	1.94	109.60	1.23	134.30	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.64	2.10	92.33	1.45	134.10	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.72	2.25	76.88	1.81	138.93	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.77	2.38	63.79	2.23	142.37	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.86	2.45	55.96	2.51	140.51	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.90	2.50	50.62	2.77	140.01	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.99	2.53	47.82	2.94	140.70	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.03	2.56	46.46	3.11	144.48	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.12	2.55	47.84	3.03	145.00	38	775	0.42	0.149	0.07	8.42	0.05	0.001
11.16	2.49	53.43	2.72	145.28	37	814	0.42	0.127	0.06	8.42	0.05	0.000
11.30	2.44	57.37	2.50	143.49	36	840	0.42	0.118	0.06	8.42	0.04	0.001
11.34	2.43	58.15	2.44	141.68	35	840	0.42	0.118	0.06	8.42	0.05	0.000
11.39	2.46	54.54	2.57	139.90	35	816	0.42	0.131	0.07	8.42	0.05	0.001
11.43	2.50	49.99	2.75	137.69	35	783	0.42	0.152	0.08	8.42	0.06	0.001
11.49	2.56	43.62	3.11	135.69	36	738	0.42	0.190	0.09	8.42	0.07	0.001
11.57	2.64	37.39	3.56	133.08	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.63	2.72	31.29	4.15	129.92	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.70	2.79	26.89	4.67	125.50	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.79	2.85	23.39	5.20	121.49	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.82	2.89	20.96	5.57	116.65	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.89	2.90	19.48	5.70	111.11	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.96	2.91	18.20	5.76	104.85	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.01	2.90	17.59	5.66	99.48	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.11	2.88	17.34	5.52	95.78	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.17	2.87	17.31	5.39	93.36	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.23	2.86	17.65	5.29	93.32	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.34	2.85	18.44	5.19	95.70	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.46	2.83	19.52	5.07	98.88	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.53	2.82	20.73	4.92	101.91	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.58	2.81	21.78	4.83	105.20	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.66	2.80	22.78	4.80	109.28	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.71	2.80	23.99	4.77	114.42	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.77	2.77	26.61	4.53	120.53	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.89	2.73	29.93	4.20	125.72	0	0	0.42	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
12.97	2.67	33.94	3.82	129.55	0	0	0.42	0.000	0.00	0.00	0.00	0.000
13.02	2.59	37.07	3.26	120.78	32	716	0.42	0.280	0.16	8.42	0.12	0.002
13.08	2.54	40.05	2.97	118.98	31	733	0.42	0.257	0.15	8.42	0.12	0.002
13.15	2.48	42.82	2.69	115.33	30	740	0.42	0.250	0.16	8.42	0.12	0.002
13.19	2.49	45.67	2.70	123.13	32	792	0.42	0.194	0.11	8.42	0.09	0.001
13.26	2.46	47.88	2.59	123.89	31	812	0.42	0.179	0.10	8.42	0.08	0.001
13.33	2.47	48.22	2.63	126.66	32	829	0.42	0.168	0.10	8.42	0.07	0.001
13.37	2.48	48.02	2.68	128.51	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.43	2.46	50.00	2.59	129.59	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.48	2.43	53.84	2.42	130.53	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.53	2.37	59.67	2.21	131.63	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.60	2.33	65.45	2.03	133.11	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.69	2.28	71.28	1.89	134.74	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.73	2.24	76.91	1.78	136.84	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.82	2.22	80.28	1.73	138.62	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.87	2.21	83.49	1.69	141.46	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.95	2.21	84.90	1.69	143.65	0	0	0.42	0.000	0.00	8.42	0.00	0.000
14.00	2.21	85.83	1.70	145.90	33	1137	0.42	0.073	0.04	8.42	0.03	0.000
14.05	2.22	85.52	1.72	146.99	33	1145	0.42	0.072	0.04	8.42	0.03	0.000
14.13	2.23	84.59	1.74	147.41	34	1150	0.42	0.072	0.04	8.42	0.03	0.001
14.18	2.24	83.04	1.77	147.04	34	1146	0.42	0.073	0.04	8.42	0.03	0.000
14.26	2.25	81.17	1.80	146.05	34	1139	0.42	0.075	0.04	8.42	0.03	0.001
14.31	2.26	78.98	1.83	144.70	33	1126	0.42	0.078	0.04	8.42	0.03	0.000
14.40	2.27	77.26	1.85	143.30	33	1117	0.42	0.080	0.04	8.42	0.03	0.001
14.44	2.27	76.82	1.86	142.62	33	1114	0.42	0.081	0.04	8.42	0.03	0.000
14.53	2.26	77.75	1.83	142.16	33	1120	0.42	0.081	0.04	8.42	0.03	0.001
14.58	2.24	80.64	1.77	142.60	33	1135	0.42	0.078	0.04	8.42	0.03	0.000
14.67	2.22	83.56	1.72	143.39	33	1155	0.42	0.076	0.04	8.42	0.03	0.001
14.73	2.20	86.75	1.67	145.26	33	1179	0.42	0.073	0.04	8.42	0.03	0.000
14.79	2.19	90.82	1.63	148.37	33	1213	0.42	0.068	0.04	8.42	0.03	0.000
14.91	2.17	94.59	1.60	151.25	34	1249	0.42	0.065	0.03	8.42	0.03	0.001
14.96	2.15	98.75	1.56	154.34	34	1282	0.42	0.061	0.03	8.42	0.02	0.000
15.00	2.14	101.47	1.54	156.44	34	1304	0.42	0.059	0.03	8.42	0.02	0.000
15.05	2.13	104.43	1.52	158.50	35	1326	0.42	0.058	0.03	8.42	0.02	0.000
15.10	2.11	110.36	1.47	162.40	35	1365	0.42	0.054	0.03	8.42	0.02	0.000
15.19	2.08	117.27	1.43	167.18	36	1412	0.42	0.051	0.03	8.42	0.02	0.000
15.26	2.06	125.42	1.38	173.52	37	1469	0.42	0.048	0.02	8.42	0.02	0.000
15.32	2.04	131.81	1.36	179.46	38	1522	0.42	0.045	0.02	8.42	0.02	0.000
15.38	2.04	137.48	1.35	185.55	39	1576	0.42	0.042	0.02	8.42	0.01	0.000
15.44	2.03	141.79	1.34	190.69	40	1624	0.42	0.040	0.02	8.42	0.01	0.000
15.50	2.03	144.64	1.34	194.25	41	1658	0.42	0.039	0.02	8.42	0.01	0.000
15.56	2.03	145.96	1.34	196.11	41	1679	0.42	0.038	0.02	8.42	0.01	0.000
15.63	2.04	146.54	1.35	197.64	42	1698	0.42	0.038	0.02	8.42	0.01	0.000
15.80	2.04	146.45	1.36	198.48	42	1719	0.42	0.037	0.02	8.42	0.01	0.000
15.85	2.04	147.69	1.36	200.39	42	1740	0.42	0.037	0.01	8.42	0.01	0.000
15.93	2.04	149.15	1.35	202.08	43	1760	0.42	0.036	0.01	8.42	0.01	0.000
15.98	2.04	150.89	1.35	204.30	43	1784	0.42	0.036	0.01	8.42	0.01	0.000
16.04	2.04	152.66	1.36	207.09	44	1813	0.42	0.035	0.01	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
16.11	2.04	154.36	1.36	209.73	44	1843	0.42	0.034	0.01	8.42	0.01	0.000
16.16	2.05	156.70	1.36	213.72	45	1883	0.42	0.033	0.01	8.42	0.01	0.000
16.29	2.03	158.15	1.34	212.15	45	1876	0.42	0.034	0.01	8.42	0.01	0.000
16.34	2.00	159.77	1.31	208.73	44	1840	0.42	0.035	0.01	8.42	0.01	0.000
16.41	1.98	160.37	1.28	204.80	42	1800	0.42	0.037	0.01	8.42	0.01	0.000
16.47	1.98	160.98	1.28	205.44	42	1810	0.42	0.036	0.01	8.42	0.01	0.000
16.52	2.00	161.64	1.29	209.25	43	1855	0.42	0.035	0.01	8.42	0.01	0.000
16.64	2.01	161.79	1.31	212.00	44	1895	0.42	0.034	0.01	8.42	0.01	0.000
16.72	2.02	163.17	1.32	215.48	45	1935	0.42	0.033	0.01	8.42	0.01	0.000
16.77	2.02	165.30	1.32	218.77	46	1970	0.42	0.032	0.01	8.42	0.01	0.000
16.81	2.02	168.05	1.32	222.10	47	2002	0.42	0.032	0.01	8.42	0.01	0.000
16.90	2.01	169.59	1.32	223.32	47	2020	0.42	0.032	0.01	8.42	0.01	0.000
16.94	2.00	171.59	1.30	222.64	46	2010	0.42	0.032	0.01	8.42	0.01	0.000
17.06	1.98	172.33	1.28	219.88	45	1986	0.42	0.033	0.01	8.42	0.01	0.000
17.12	1.96	172.97	1.26	217.35	45	1957	0.42	0.034	0.01	8.42	0.01	0.000
17.17	1.96	172.30	1.25	214.74	44	1931	0.42	0.035	0.01	8.42	0.01	0.000
17.25	1.95	170.79	1.24	211.82	43	1907	0.42	0.036	0.01	8.42	0.01	0.000
17.29	1.95	168.63	1.24	208.31	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.36	1.95	165.41	1.24	204.85	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.42	1.96	161.06	1.25	201.31	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.47	1.98	156.28	1.27	198.39	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.54	1.99	151.18	1.29	195.54	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.60	2.02	143.60	1.33	191.52	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.73	2.06	134.86	1.39	186.95	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.78	2.10	125.76	1.45	182.63	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.84	2.13	118.16	1.51	178.43	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.91	2.16	110.04	1.58	174.06	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.95	2.20	101.49	1.67	169.46	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.03	2.25	91.92	1.80	165.55	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.09	2.31	82.01	1.98	162.67	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.15	2.38	71.89	2.24	161.29	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.22	2.46	62.14	2.59	161.13	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.26	2.55	52.50	3.06	160.58	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.33	2.65	43.62	3.63	158.55	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.40	2.73	36.52	4.23	154.58	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.45	2.78	32.25	4.60	148.34	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.53	2.78	31.21	4.58	143.06	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.57	2.72	33.83	4.14	140.00	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.65	2.62	41.00	3.42	140.42	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.70	2.42	59.95	2.39	143.16	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.88	2.28	78.46	1.90	148.75	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.93	2.19	94.87	1.65	156.73	0	0	0.42	0.000	0.00	8.42	0.00	0.000
19.01	2.17	100.04	1.60	160.04	0	0	0.42	0.000	0.00	8.42	0.00	0.000
19.06	2.15	104.44	1.56	163.04	0	0	0.42	0.000	0.00	8.42	0.00	0.000
19.12	2.14	107.95	1.54	165.81	0	0	0.42	0.000	0.00	8.42	0.00	0.000
19.19	2.14	110.55	1.52	168.41	0	0	0.42	0.000	0.00	8.42	0.00	0.000
19.24	2.14	112.10	1.53	171.20	38	1717	0.42	0.050	0.02	8.42	0.02	0.000
19.31	2.14	112.40	1.54	173.03	38	1740	0.42	0.049	0.02	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
19.37	2.16	111.60	1.57	175.05	39	1763	0.42	0.048	0.02	8.42	0.02	0.000
19.43	2.13	109.68	1.52	166.72	37	1685	0.42	0.052	0.03	8.42	0.02	0.000
19.50	2.13	105.99	1.51	160.09	0	0	0.43	0.000	0.00	8.42	0.00	0.000
19.55	2.15	100.25	1.55	154.91	0	0	0.43	0.000	0.00	8.42	0.00	0.000
19.62	2.22	92.05	1.73	159.00	0	0	0.43	0.000	0.00	8.42	0.00	0.000
19.67	2.30	82.30	1.95	160.86	0	0	0.43	0.000	0.00	8.42	0.00	0.000
19.73	2.39	70.52	2.28	160.59	0	0	0.43	0.000	0.00	8.42	0.00	0.000
19.80	2.56	53.13	3.09	164.10	0	0	0.43	0.000	0.00	8.42	0.00	0.000
19.82	2.70	41.22	3.98	164.03	0	0	0.43	0.000	0.00	0.00	0.00	0.000
19.95	2.82	32.24	4.94	159.29	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.00	2.80	31.14	4.79	149.24	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.04	2.85	27.66	5.19	143.53	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.09	2.88	25.80	5.48	141.31	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.19	2.77	30.70	4.54	139.39	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.28	2.59	41.96	3.28	137.64	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.33	2.40	59.10	2.31	136.52	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.37	2.27	75.09	1.87	140.33	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.43	2.17	91.81	1.60	146.78	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.52	2.10	106.33	1.45	154.49	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.60	2.05	117.70	1.37	161.38	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.65	2.03	123.73	1.34	165.19	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.70	2.01	126.08	1.32	166.28	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.74	2.01	125.95	1.31	165.27	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.83	2.01	122.49	1.32	161.32	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.92	2.02	117.31	1.33	156.01	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.96	2.03	111.86	1.34	150.31	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.01	2.05	104.72	1.37	143.00	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.10	2.07	96.39	1.40	134.71	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.15	2.11	84.67	1.48	124.99	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.24	2.16	74.47	1.58	117.99	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.30	2.23	64.65	1.75	112.86	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.35	2.29	57.90	1.91	110.61	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.39	2.38	49.56	2.23	110.36	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.48	2.48	41.59	2.68	111.46	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.54	2.63	32.27	3.52	113.58	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.62	2.76	25.56	4.43	113.28	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.67	2.91	18.98	5.77	109.44	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.76	3.00	15.30	6.76	103.41	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.81	3.08	12.72	7.64	97.15	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.85	3.14	10.97	8.50	93.21	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.94	3.15	10.61	8.58	91.03	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.99	3.19	9.96	9.17	91.28	0	0	0.43	0.000	0.00	0.00	0.00	0.000
22.07	3.16	10.70	8.71	93.21	0	0	0.43	0.000	0.00	0.00	0.00	0.000
22.13	3.14	11.52	8.37	96.49	0	0	0.43	0.000	0.00	0.00	0.00	0.000
22.22	3.06	13.28	7.50	99.58	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.28	3.00	15.14	6.74	101.98	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.37	2.96	16.36	6.29	102.86	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.41	2.91	17.70	5.83	103.28	0	0	0.44	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
22.46	2.88	19.08	5.50	105.02	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.55	2.87	19.83	5.38	106.69	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.59	2.84	21.05	5.14	108.19	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.67	2.82	21.66	4.99	108.05	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.71	2.77	23.59	4.54	107.01	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.81	2.71	25.61	4.10	104.97	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.87	2.64	28.46	3.59	102.05	0	0	0.44	0.000	0.00	0.00	0.00	0.000
22.91	2.56	31.60	3.12	98.53	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.01	2.51	34.10	2.82	96.11	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.06	2.47	36.36	2.62	95.26	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.14	2.46	37.47	2.56	96.03	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.20	2.45	38.24	2.54	97.03	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.24	2.46	37.98	2.58	98.18	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.33	2.48	37.01	2.68	99.33	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.37	2.53	34.82	2.91	101.32	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.46	2.58	32.18	3.20	102.95	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.51	2.66	27.98	3.73	104.29	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.60	2.75	23.91	4.36	104.30	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.65	2.88	18.55	5.55	102.85	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.77	3.00	14.94	6.69	99.91	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.81	3.09	12.41	7.75	96.19	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.86	3.10	11.82	7.88	93.12	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.90	3.09	11.59	7.80	90.35	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.99	3.09	11.34	7.80	88.47	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.03	3.10	11.09	7.89	87.53	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.12	3.10	10.97	7.97	87.41	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.15	3.09	11.20	7.83	87.64	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.24	3.08	11.57	7.64	88.37	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.31	3.07	11.84	7.60	89.97	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.36	3.08	12.06	7.68	92.59	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.43	3.07	12.59	7.51	94.59	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.52	3.03	13.46	7.10	95.54	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.56	2.96	14.97	6.34	94.99	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.65	2.89	16.83	5.61	94.37	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.69	2.79	20.15	4.69	94.42	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.77	2.71	23.37	4.06	94.78	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.80	2.61	28.78	3.36	96.66	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.96	2.54	33.33	2.98	99.25	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.04	2.49	38.39	2.69	103.45	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.09	2.44	41.88	2.47	103.57	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.15	2.39	45.21	2.25	101.87	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.22	2.34	47.76	2.10	100.07	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.27	2.34	48.95	2.08	101.79	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.35	2.36	48.48	2.16	104.55	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.40	2.41	45.09	2.36	106.31	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.44	2.46	41.40	2.59	107.36	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.48	2.52	37.52	2.88	107.94	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.56	2.57	34.35	3.14	107.84	0	0	0.44	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
25.61	2.64	29.98	3.57	107.08	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.68	2.73	24.86	4.24	105.50	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.74	2.83	20.35	5.04	102.61	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.79	2.92	16.49	5.95	98.07	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.90	3.00	13.71	6.80	93.21	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.96	3.09	11.34	7.81	88.49	0	0	0.44	0.000	0.00	0.00	0.00	0.000
26.01	3.17	9.55	8.83	84.39	0	0	0.44	0.000	0.00	0.00	0.00	0.000
26.09	3.24	8.21	9.79	80.35	0	0	0.44	0.000	0.00	0.00	0.00	0.000
26.12	3.28	7.23	10.47	75.67	0	0	0.44	0.000	0.00	0.00	0.00	0.000
26.18	3.31	6.43	10.94	70.34	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.27	3.35	5.61	11.48	64.42	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.33	3.36	5.16	11.60	59.92	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.40	3.36	4.94	11.64	57.53	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.45	3.34	4.97	11.39	56.62	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.53	3.33	5.01	11.23	56.28	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.58	3.32	5.17	10.99	56.80	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.66	3.31	5.30	10.91	57.82	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.72	3.31	5.48	10.79	59.11	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.78	3.32	5.52	10.96	60.48	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.84	3.33	5.73	11.12	63.70	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.97	3.30	6.38	10.73	68.53	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.07	3.26	7.35	10.08	74.09	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.15	3.21	8.36	9.34	78.08	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.19	3.18	9.01	9.02	81.20	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.28	3.17	9.45	8.81	83.28	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.32	3.16	9.82	8.69	85.31	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.38	3.15	10.18	8.55	87.09	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.46	3.14	10.50	8.44	88.66	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.50	3.14	10.70	8.38	89.68	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.57	3.14	10.63	8.41	89.39	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.64	3.15	10.41	8.51	88.56	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.70	3.16	10.09	8.72	88.06	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.76	3.18	9.94	8.91	88.64	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.81	3.18	10.07	8.94	89.99	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.88	3.12	10.67	8.15	87.00	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.94	3.03	11.85	7.08	83.89	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.00	2.91	13.83	5.82	80.53	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.07	2.81	16.93	4.87	82.54	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.12	2.69	21.36	3.96	84.53	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.20	2.60	26.13	3.32	86.75	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.25	2.54	30.01	2.97	89.16	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.29	2.46	35.75	2.57	91.76	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.39	2.40	40.83	2.33	94.96	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.44	2.35	46.75	2.13	99.60	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.52	2.35	49.44	2.10	103.96	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.58	2.34	51.99	2.07	107.80	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.61	2.33	54.58	2.05	111.83	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.71	2.32	57.01	2.02	115.30	0	0	0.45	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
28.76	2.31	60.11	1.98	119.28	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.84	2.30	62.35	1.96	122.37	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.90	2.30	64.50	1.94	125.40	0	0	0.45	0.000	0.00	8.42	0.00	0.000
28.95	2.29	66.51	1.92	127.95	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.03	2.28	68.34	1.90	129.87	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.09	2.28	70.03	1.88	131.51	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.14	2.27	71.35	1.86	132.64	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.22	2.26	72.68	1.84	133.54	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.31	2.26	74.02	1.81	134.22	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.35	2.25	75.19	1.79	134.78	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.40	2.24	76.68	1.76	135.19	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.49	2.23	78.24	1.73	135.59	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.53	2.21	80.59	1.70	136.79	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.62	2.20	82.52	1.67	138.19	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.66	2.19	85.34	1.65	141.12	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.75	2.19	87.70	1.65	144.30	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.80	2.19	90.31	1.64	148.39	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.86	2.19	93.20	1.63	152.21	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.93	2.17	97.00	1.60	155.66	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.03	2.16	100.96	1.57	158.07	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.07	2.14	104.42	1.53	159.54	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.13	2.11	109.08	1.48	161.67	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.23	2.10	113.56	1.45	164.34	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.28	2.08	118.22	1.42	167.78	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.32	2.08	122.19	1.41	172.72	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.41	2.08	126.05	1.41	178.10	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.49	2.08	130.00	1.41	183.66	39	2496	0.45	0.046	0.02	8.42	0.02	0.000
30.54	2.08	132.46	1.41	187.23	40	2548	0.45	0.044	0.02	8.42	0.01	0.000
30.60	2.08	133.74	1.43	190.59	41	2603	0.45	0.043	0.02	8.42	0.01	0.000
30.68	2.09	133.86	1.44	193.28	42	2652	0.45	0.042	0.02	8.42	0.01	0.000
30.72	2.11	133.41	1.47	195.61	42	2695	0.45	0.041	0.02	8.42	0.01	0.000
30.78	2.12	132.91	1.48	197.15	43	2725	0.45	0.040	0.02	8.42	0.01	0.000
30.85	2.12	134.33	1.49	200.60	44	2781	0.45	0.039	0.02	8.42	0.01	0.000
30.98	2.12	136.66	1.50	204.72	45	2848	0.45	0.038	0.01	8.42	0.01	0.000
31.02	2.11	141.24	1.47	207.79	45	2886	0.45	0.037	0.01	8.42	0.01	0.000
31.09	2.08	146.02	1.43	208.31	45	2880	0.45	0.038	0.01	8.42	0.01	0.000
31.16	2.05	152.08	1.37	208.66	44	2858	0.45	0.038	0.01	8.42	0.01	0.000
31.26	2.03	157.01	1.34	209.65	44	2850	0.45	0.038	0.01	8.42	0.01	0.000
31.33	2.01	160.69	1.31	210.98	44	2853	0.45	0.038	0.01	8.42	0.01	0.000
31.38	2.02	157.50	1.32	208.53	44	2833	0.45	0.039	0.02	8.42	0.01	0.000
31.42	2.03	154.13	1.34	206.04	43	2813	0.45	0.039	0.02	8.42	0.01	0.000
31.45	2.03	151.73	1.34	203.98	43	2793	0.45	0.040	0.02	8.42	0.01	0.000
31.50	2.02	154.75	1.32	204.86	43	2790	0.45	0.040	0.02	8.42	0.01	0.000
31.59	2.01	156.67	1.31	205.37	43	2791	0.45	0.040	0.02	8.42	0.01	0.000
31.63	2.01	155.85	1.31	204.79	43	2789	0.45	0.040	0.02	8.42	0.01	0.000
31.77	2.02	153.70	1.32	203.47	43	2788	0.45	0.040	0.02	8.42	0.01	0.000
31.81	2.02	152.26	1.33	202.57	43	2784	0.45	0.041	0.02	8.42	0.01	0.000
31.87	2.02	151.74	1.33	202.11	42	2783	0.45	0.041	0.02	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
31.91	2.02	151.30	1.33	201.78	42	2783	0.45	0.041	0.02	8.42	0.01	0.000
31.99	2.03	150.39	1.34	201.29	42	2785	0.45	0.041	0.02	8.42	0.01	0.000
32.08	2.03	149.21	1.35	200.96	42	2793	0.45	0.041	0.02	8.42	0.01	0.000
32.12	2.04	147.98	1.36	200.93	42	2803	0.45	0.041	0.02	8.42	0.01	0.000
32.16	2.05	146.51	1.37	201.29	43	2823	0.45	0.040	0.02	8.42	0.01	0.000
32.25	2.06	145.27	1.39	201.61	43	2842	0.45	0.040	0.02	8.42	0.01	0.000
32.29	2.07	144.38	1.40	201.78	43	2853	0.45	0.040	0.02	8.42	0.01	0.000
32.43	2.07	143.74	1.40	201.13	43	2854	0.45	0.040	0.02	8.42	0.01	0.000
32.49	2.06	144.04	1.39	200.48	43	2844	0.45	0.040	0.02	8.42	0.01	0.000
32.55	2.05	145.57	1.38	200.29	43	2835	0.45	0.040	0.02	8.42	0.01	0.000
32.60	2.04	148.19	1.36	200.97	42	2833	0.45	0.041	0.02	8.42	0.01	0.000
32.66	2.03	151.93	1.34	203.54	43	2860	0.45	0.040	0.02	8.42	0.01	0.000
32.78	2.02	155.23	1.33	206.50	43	2900	0.45	0.039	0.02	8.42	0.01	0.000
32.82	2.03	159.16	1.33	212.38	45	2989	0.45	0.038	0.01	8.42	0.01	0.000
32.95	2.03	161.51	1.35	217.32	46	3078	0.45	0.036	0.01	8.42	0.01	0.000
32.99	2.04	163.62	1.36	222.90	47	3175	0.45	0.035	0.01	8.42	0.01	0.000
33.04	2.05	165.18	1.38	227.57	48	3258	0.45	0.034	0.01	8.42	0.01	0.000
33.17	2.06	166.66	1.39	231.43	49	3331	0.45	0.033	0.01	8.42	0.01	0.000
33.23	2.06	168.90	1.39	234.66	50	3383	0.45	0.032	0.01	8.42	0.01	0.000
33.30	2.06	170.81	1.38	235.67	50	3394	0.45	0.032	0.01	8.42	0.01	0.000
33.35	2.05	172.25	1.37	235.64	50	3388	0.45	0.032	0.01	8.42	0.01	0.000
33.39	2.04	173.54	1.35	234.89	50	3367	0.45	0.032	0.01	8.42	0.01	0.000
33.47	2.03	174.57	1.34	233.80	49	3343	0.45	0.033	0.01	8.42	0.01	0.000
33.52	2.02	175.54	1.33	232.91	49	3320	0.45	0.033	0.01	8.42	0.01	0.000
33.57	2.02	175.72	1.32	232.09	49	3306	0.45	0.033	0.01	8.42	0.01	0.000
33.62	2.01	175.30	1.32	231.25	48	3295	0.45	0.034	0.01	8.42	0.01	0.000
33.70	2.02	173.39	1.33	229.89	48	3289	0.45	0.034	0.01	8.42	0.01	0.000
33.79	2.03	170.40	1.34	228.52	48	3292	0.45	0.034	0.01	8.42	0.01	0.000
33.86	2.02	168.34	1.33	224.42	47	3229	0.45	0.035	0.01	8.42	0.01	0.000
33.92	2.01	167.56	1.32	220.99	46	3169	0.45	0.036	0.01	8.42	0.01	0.000
33.96	2.00	168.05	1.30	218.13	45	3106	0.45	0.037	0.01	8.42	0.01	0.000
34.03	2.00	169.11	1.30	219.23	46	3124	0.45	0.037	0.01	8.42	0.01	0.000
34.10	1.99	171.13	1.29	220.89	46	3144	0.45	0.037	0.01	8.42	0.01	0.000
34.14	1.99	173.25	1.28	222.40	46	3159	0.45	0.036	0.01	8.42	0.01	0.000
34.21	2.00	169.64	1.30	219.83	46	3143	0.45	0.037	0.01	8.42	0.01	0.000
34.27	2.01	164.67	1.31	215.57	45	3103	0.45	0.037	0.01	8.42	0.01	0.000
34.36	2.02	158.60	1.33	210.32	44	3052	0.45	0.038	0.01	8.42	0.01	0.000
34.41	2.02	155.64	1.33	206.89	43	3008	0.45	0.039	0.02	8.42	0.01	0.000
34.46	2.02	153.04	1.33	203.96	43	2971	0.45	0.040	0.02	8.42	0.01	0.000
34.55	2.02	152.69	1.32	202.18	42	2943	0.45	0.041	0.02	8.42	0.01	0.000
34.60	1.99	157.56	1.29	203.19	42	2921	0.45	0.041	0.02	8.42	0.01	0.000
34.68	1.96	164.58	1.25	205.96	42	2911	0.45	0.042	0.02	8.42	0.01	0.000
34.73	1.93	172.82	1.21	209.77	42	2900	0.45	0.042	0.02	8.42	0.01	0.000
34.82	1.90	178.36	1.19	212.58	43	2898	0.45	0.042	0.02	8.42	0.01	0.000
34.87	1.89	183.06	1.18	215.36	43	2902	0.45	0.042	0.02	8.42	0.01	0.000
34.91	1.88	187.01	1.17	218.25	43	2919	0.45	0.042	0.02	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.07

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
35.00	220.46	2.00	0.00	1.00	0.00	35.05	222.12	2.00	0.00	1.00	0.00
35.14	222.15	2.00	0.00	1.00	0.00	35.19	221.68	2.00	0.00	1.00	0.00
35.24	219.67	2.00	0.00	1.00	0.00	35.32	216.68	2.00	0.00	1.00	0.00
35.37	212.54	2.00	0.00	1.00	0.00	35.46	208.70	2.00	0.00	1.00	0.00
35.51	203.09	2.00	0.00	1.00	0.00	35.60	196.81	2.00	0.00	1.00	0.00
35.64	187.89	2.00	0.00	1.00	0.00	35.73	180.45	2.00	0.00	1.00	0.00
35.77	173.10	2.00	0.00	1.00	0.00	35.86	167.54	2.00	0.00	1.00	0.00
35.91	158.38	2.00	0.00	1.00	0.00	36.01	148.25	2.00	0.00	1.00	0.00
36.06	134.83	2.00	0.00	1.00	0.00	36.16	124.33	2.00	0.00	1.00	0.00
36.21	115.65	2.00	0.00	1.00	0.00	36.26	110.72	2.00	0.00	1.00	0.00
36.30	107.21	2.00	0.00	1.00	0.00	36.39	104.97	2.00	0.00	1.00	0.00
36.48	102.74	2.00	0.00	1.00	0.00	36.53	97.77	2.00	0.00	1.00	0.00
36.57	92.89	2.00	0.00	1.00	0.00	36.63	87.74	2.00	0.00	1.00	0.00
36.70	82.45	2.00	0.00	1.00	0.00	36.77	77.85	2.00	0.00	1.00	0.00
36.83	72.76	2.00	0.00	1.00	0.00	36.92	67.97	2.00	0.00	1.00	0.00
36.96	62.80	2.00	0.00	1.00	0.00	37.06	59.89	2.00	0.00	1.00	0.00
37.15	58.57	2.00	0.00	1.00	0.00	37.22	58.47	2.00	0.00	1.00	0.00
37.27	58.41	2.00	0.00	1.00	0.00	37.34	57.87	2.00	0.00	1.00	0.00
37.46	57.16	2.00	0.00	1.00	0.00	37.51	56.51	2.00	0.00	1.00	0.00
37.61	56.29	2.00	0.00	1.00	0.00	37.66	56.19	2.00	0.00	1.00	0.00
37.74	56.10	2.00	0.00	1.00	0.00	37.80	56.06	2.00	0.00	1.00	0.00
37.88	56.07	2.00	0.00	1.00	0.00	37.92	56.35	2.00	0.00	1.00	0.00
38.00	56.89	2.00	0.00	1.00	0.00	38.05	57.82	2.00	0.00	1.00	0.00
38.11	59.26	2.00	0.00	1.00	0.00	38.18	60.92	2.00	0.00	1.00	0.00
38.31	62.09	2.00	0.00	1.00	0.00	38.36	62.61	2.00	0.00	1.00	0.00
38.43	62.56	2.00	0.00	1.00	0.00	38.53	62.38	2.00	0.00	1.00	0.00
38.62	61.73	2.00	0.00	1.00	0.00	38.67	60.80	2.00	0.00	1.00	0.00
38.73	59.70	2.00	0.00	1.00	0.00	38.79	59.11	2.00	0.00	1.00	0.00
38.85	59.07	2.00	0.00	1.00	0.00	38.93	59.17	2.00	0.00	1.00	0.00
38.97	59.20	2.00	0.00	1.00	0.00	39.03	59.04	2.00	0.00	1.00	0.00
39.10	58.97	2.00	0.00	1.00	0.00	39.15	59.10	2.00	0.00	1.00	0.00
39.22	59.62	2.00	0.00	1.00	0.00	39.28	60.18	2.00	0.00	1.00	0.00
39.41	60.55	2.00	0.00	1.00	0.00	39.46	60.40	2.00	0.00	1.00	0.00
39.52	59.87	2.00	0.00	1.00	0.00	39.59	59.13	2.00	0.00	1.00	0.00
39.63	58.10	2.00	0.00	1.00	0.00	39.71	57.10	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
39.77	56.28	2.00	0.00	1.00	0.00	39.83	56.03	2.00	0.00	1.00	0.00
39.89	56.52	2.00	0.00	1.00	0.00	40.00	57.51	2.00	0.00	1.00	0.00
40.08	58.73	2.00	0.00	1.00	0.00	40.14	59.64	2.00	0.00	1.00	0.00
40.20	59.98	2.00	0.00	1.00	0.00	40.25	59.94	2.00	0.00	1.00	0.00
40.31	59.68	2.00	0.00	1.00	0.00	40.38	59.39	2.00	0.00	1.00	0.00
40.45	59.17	2.00	0.00	1.00	0.00	40.51	59.89	2.00	0.00	1.00	0.00
40.56	62.41	2.00	0.00	1.00	0.00	40.62	65.57	2.00	0.00	1.00	0.00
40.65	69.16	2.00	0.00	1.00	0.00	40.68	73.31	2.00	0.00	1.00	0.00
40.75	78.66	2.00	0.00	1.00	0.00	40.87	84.16	2.00	0.00	1.00	0.00
40.93	88.34	2.00	0.00	1.00	0.00	40.99	91.42	2.00	0.00	1.00	0.00
41.10	93.48	2.00	0.00	1.00	0.00	41.16	95.36	2.00	0.00	1.00	0.00
41.23	96.53	2.00	0.00	1.00	0.00	41.29	97.93	2.00	0.00	1.00	0.00
41.35	99.71	2.00	0.00	1.00	0.00	41.41	101.70	2.00	0.00	1.00	0.00
41.47	101.85	2.00	0.00	1.00	0.00	41.54	99.92	2.00	0.00	1.00	0.00
41.59	95.35	2.00	0.00	1.00	0.00	41.67	89.40	2.00	0.00	1.00	0.00
41.72	83.52	2.00	0.00	1.00	0.00	41.77	79.31	2.00	0.00	1.00	0.00
41.85	78.92	2.00	0.00	1.00	0.00	41.96	81.23	2.00	0.00	1.00	0.00
42.03	86.45	2.00	0.00	1.00	0.00	42.07	91.36	2.00	0.00	1.00	0.00
42.15	98.07	2.00	0.00	1.00	0.00	42.21	103.84	2.00	0.00	1.00	0.00
42.26	112.34	2.00	0.00	1.00	0.00	42.38	121.29	2.00	0.00	1.00	0.00
42.44	131.04	2.00	0.00	1.00	0.00	42.51	137.62	2.00	0.00	1.00	0.00
42.56	143.96	2.00	0.00	1.00	0.00	42.62	150.13	2.00	0.00	1.00	0.00
42.69	156.01	2.00	0.00	1.00	0.00	42.74	161.39	2.00	0.00	1.00	0.00
42.81	165.83	2.00	0.00	1.00	0.00	42.87	170.20	2.00	0.00	1.00	0.00
42.93	174.83	2.00	0.00	1.00	0.00	42.99	179.97	2.00	0.00	1.00	0.00
43.04	185.93	2.00	0.00	1.00	0.00	43.10	195.20	2.00	0.00	1.00	0.00
43.22	204.86	2.00	0.00	1.00	0.00	43.28	214.29	2.00	0.00	1.00	0.00
43.34	219.54	2.00	0.00	1.00	0.00	43.39	222.76	2.00	0.00	1.00	0.00
43.46	223.69	2.00	0.00	1.00	0.00	43.51	221.67	2.00	0.00	1.00	0.00
43.61	215.65	2.00	0.00	1.00	0.00	43.68	207.93	2.00	0.00	1.00	0.00
43.74	200.77	2.00	0.00	1.00	0.00	43.79	195.65	2.00	0.00	1.00	0.00
43.85	190.99	2.00	0.00	1.00	0.00	43.92	186.15	2.00	0.00	1.00	0.00
43.97	179.37	2.00	0.00	1.00	0.00	44.05	172.44	2.00	0.00	1.00	0.00
44.17	166.09	2.00	0.00	1.00	0.00	44.23	159.73	2.00	0.00	1.00	0.00
44.33	153.88	2.00	0.00	1.00	0.00	44.40	148.00	2.00	0.00	1.00	0.00
44.45	144.17	2.00	0.00	1.00	0.00	44.52	140.42	2.00	0.00	1.00	0.00
44.58	136.68	2.00	0.00	1.00	0.00	44.63	130.87	2.00	0.00	1.00	0.00
44.75	124.35	2.00	0.00	1.00	0.00	44.80	115.18	2.00	0.00	1.00	0.00
44.89	107.40	2.00	0.00	1.00	0.00	44.93	100.15	2.00	0.00	1.00	0.00
44.98	94.71	2.00	0.00	1.00	0.00	45.03	90.08	2.00	0.00	1.00	0.00
45.11	86.29	2.00	0.00	1.00	0.00	45.16	82.98	2.00	0.00	1.00	0.00
45.24	80.23	2.00	0.00	1.00	0.00	45.29	76.58	2.00	0.00	1.00	0.00
45.37	73.10	2.00	0.00	1.00	0.00	45.44	69.96	2.00	0.00	1.00	0.00
45.51	68.41	2.00	0.00	1.00	0.00	45.56	67.44	2.00	0.00	1.00	0.00
45.63	66.50	2.00	0.00	1.00	0.00	45.68	66.48	2.00	0.00	1.00	0.00
45.75	67.65	2.00	0.00	1.00	0.00	45.81	71.07	2.00	0.00	1.00	0.00
45.94	75.47	2.00	0.00	1.00	0.00	46.03	78.95	2.00	0.00	1.00	0.00
46.08	81.33	2.00	0.00	1.00	0.00	46.17	82.65	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
46.22	83.42	2.00	0.00	1.00	0.00	46.31	83.61	2.00	0.00	1.00	0.00
46.36	83.35	2.00	0.00	1.00	0.00	46.41	82.69	2.00	0.00	1.00	0.00
46.47	81.75	2.00	0.00	1.00	0.00	46.56	80.95	2.00	0.00	1.00	0.00
46.61	80.68	2.00	0.00	1.00	0.00	46.67	81.77	2.00	0.00	1.00	0.00
46.73	85.26	2.00	0.00	1.00	0.00	46.83	90.10	2.00	0.00	1.00	0.00
46.87	95.20	2.00	0.00	1.00	0.00	46.92	99.76	2.00	0.00	1.00	0.00
47.01	103.75	2.00	0.00	1.00	0.00	47.05	108.48	2.00	0.00	1.00	0.00
47.14	111.54	2.00	0.00	1.00	0.00	47.21	115.31	2.00	0.00	1.00	0.00
47.27	118.78	2.00	0.00	1.00	0.00	47.32	121.20	2.00	0.00	1.00	0.00
47.40	127.74	2.00	0.00	1.00	0.00	47.45	138.62	2.00	0.00	1.00	0.00
47.53	146.95	2.00	0.00	1.00	0.00	47.58	153.64	2.00	0.00	1.00	0.00
47.64	158.80	2.00	0.00	1.00	0.00	47.71	165.37	2.00	0.00	1.00	0.00
47.80	171.52	2.00	0.00	1.00	0.00	47.88	175.56	2.00	0.00	1.00	0.00
47.93	177.22	2.00	0.00	1.00	0.00	47.97	177.43	2.00	0.00	1.00	0.00
48.06	177.11	2.00	0.00	1.00	0.00	48.11	176.64	2.00	0.00	1.00	0.00
48.19	175.71	2.00	0.00	1.00	0.00	48.24	173.95	2.00	0.00	1.00	0.00
48.33	171.75	2.00	0.00	1.00	0.00	48.36	167.81	2.00	0.00	1.00	0.00
48.46	164.24	2.00	0.00	1.00	0.00	48.50	159.97	2.00	0.00	1.00	0.00
48.59	157.12	2.00	0.00	1.00	0.00	48.67	155.05	2.00	0.00	1.00	0.00
48.70	153.84	2.00	0.00	1.00	0.00	48.77	153.06	2.00	0.00	1.00	0.00
48.85	153.20	2.00	0.00	1.00	0.00	48.92	154.09	2.00	0.00	1.00	0.00
48.97	153.29	2.00	0.00	1.00	0.00	49.03	148.21	2.00	0.00	1.00	0.00
49.12	142.12	2.00	0.00	1.00	0.00	49.16	137.61	2.00	0.00	1.00	0.00
49.27	138.29	2.00	0.00	1.00	0.00	49.34	140.54	2.00	0.00	1.00	0.00
49.39	139.50	2.00	0.00	1.00	0.00	49.43	140.00	2.00	0.00	1.00	0.00
49.50	140.49	2.00	0.00	1.00	0.00	49.56	142.56	2.00	0.00	1.00	0.00
49.71	143.57	0.75	1.20	1.00	0.02	49.74	144.68	0.77	1.18	1.00	0.00
49.75	145.92	0.78	1.17	1.00	0.00	49.86	147.58	0.80	1.15	1.00	0.01

Total estimated settlement: 0.04

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

GeoTek, Inc.
1548 N. Maple Street
Corona, CA 92880
http://www.geotekusa.com

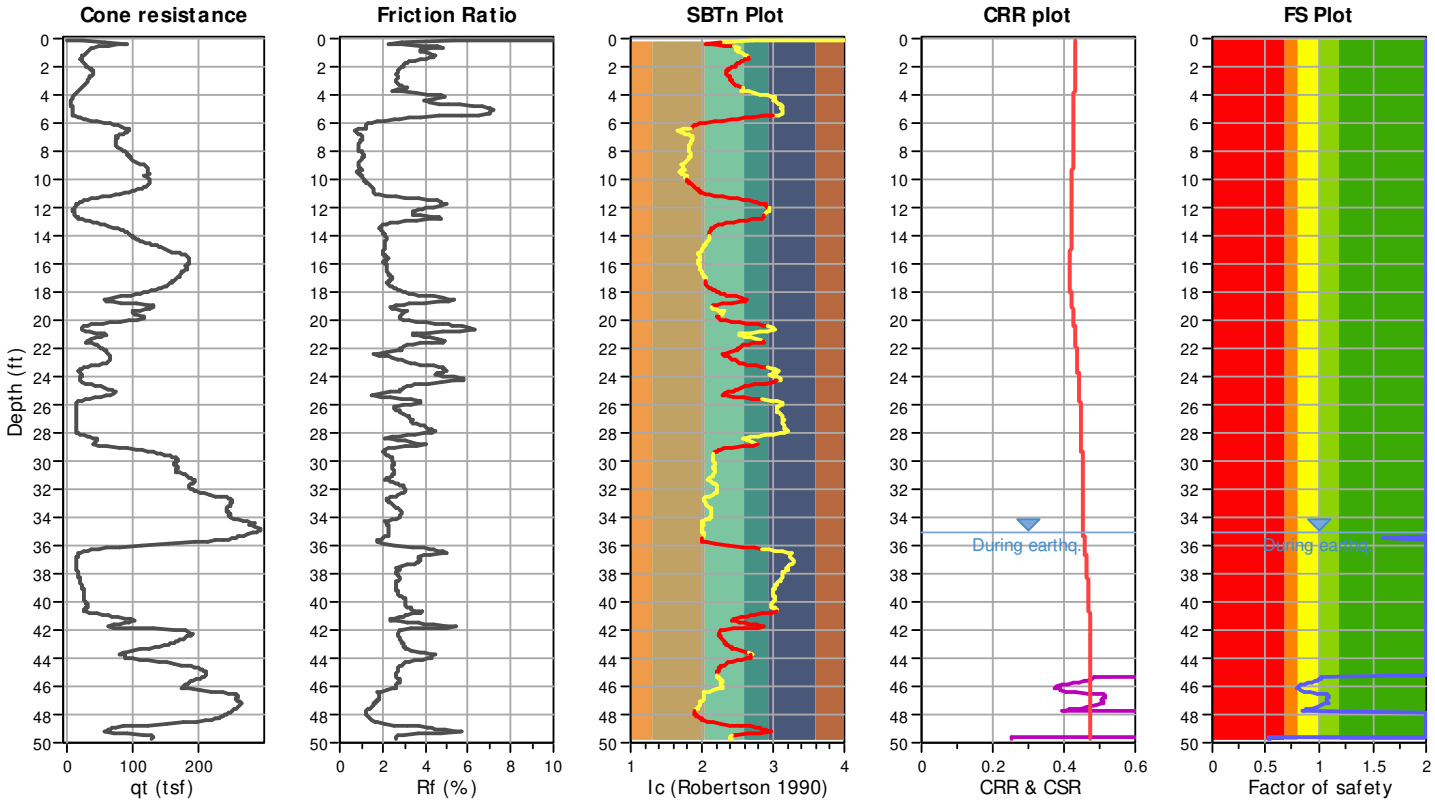
LIQUEFACTION ANALYSIS REPORT

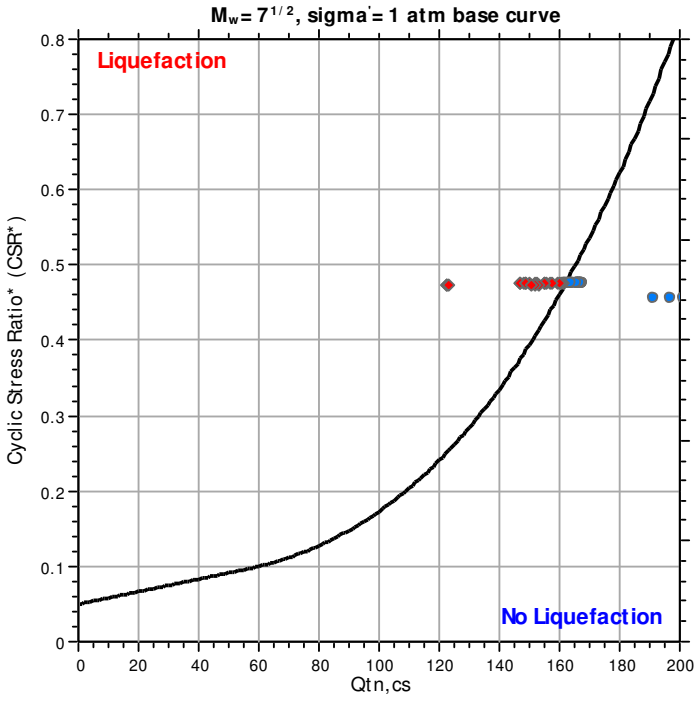
Project title : Proposed Townhouses **Location : 2323 West Broadway, Anaheim, CA**

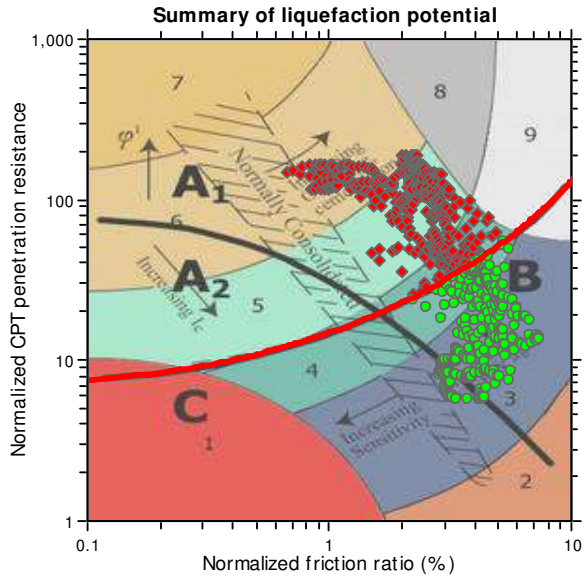
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	46.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	35.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.67	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.69	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

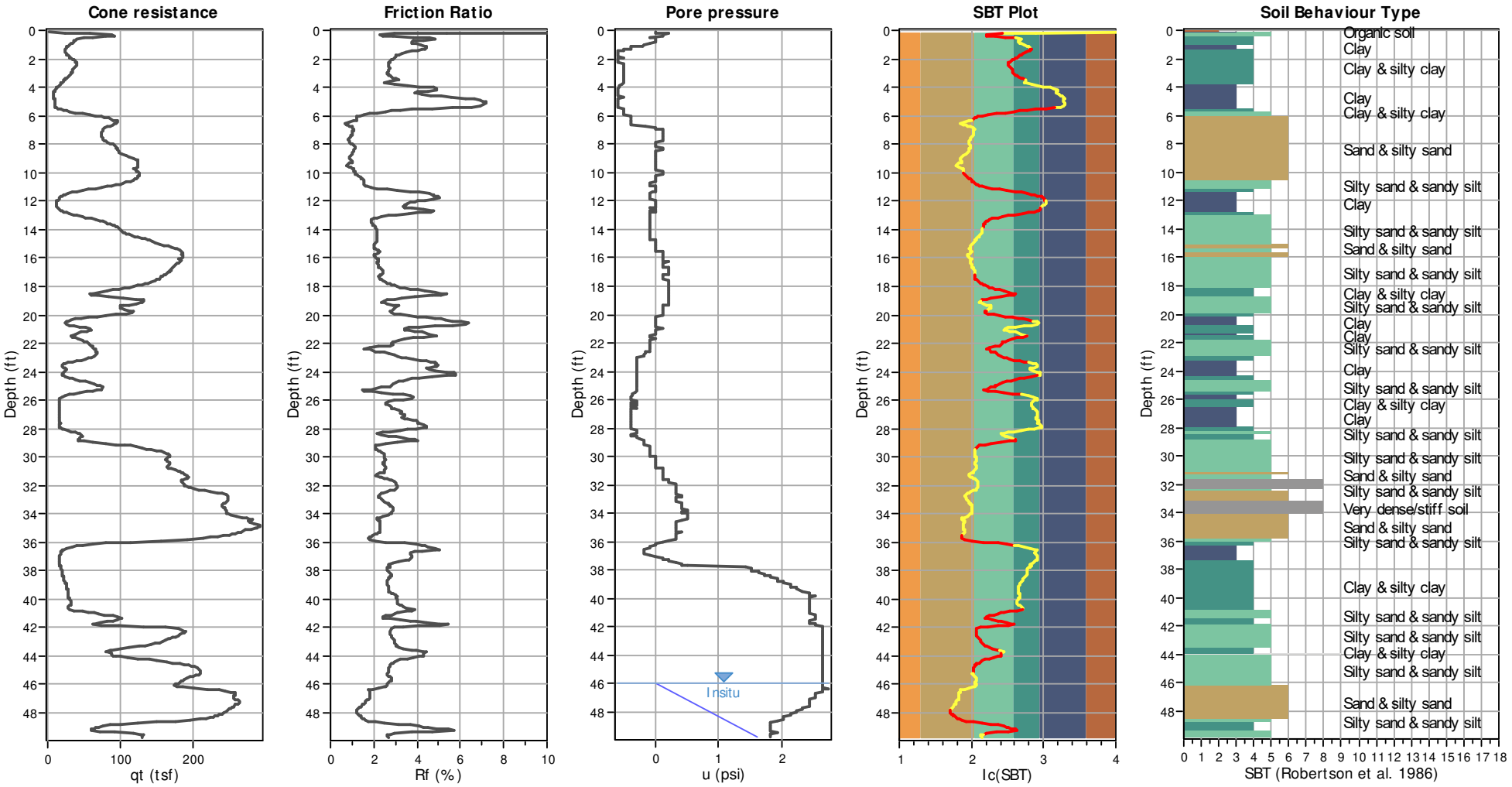






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



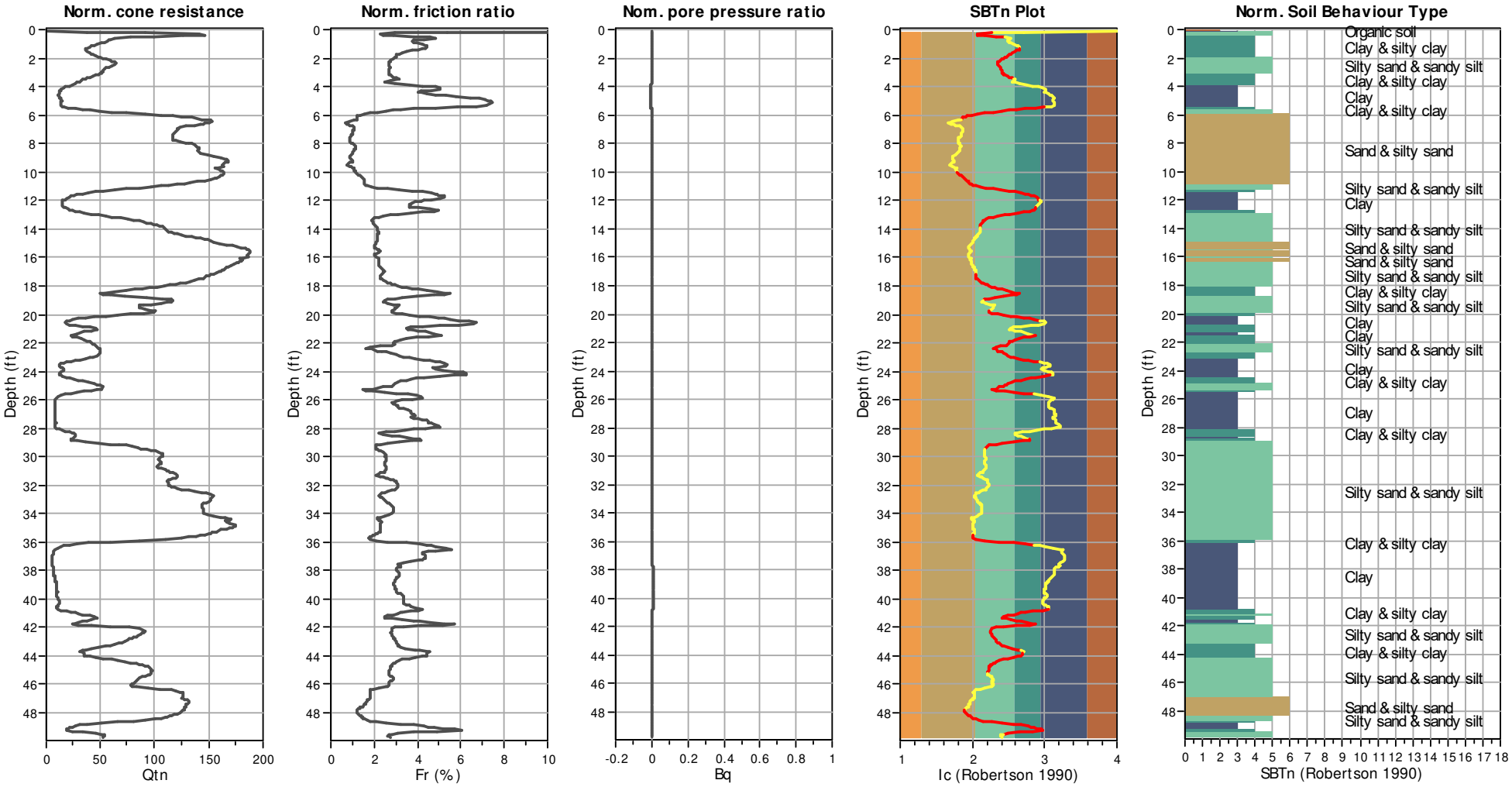
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



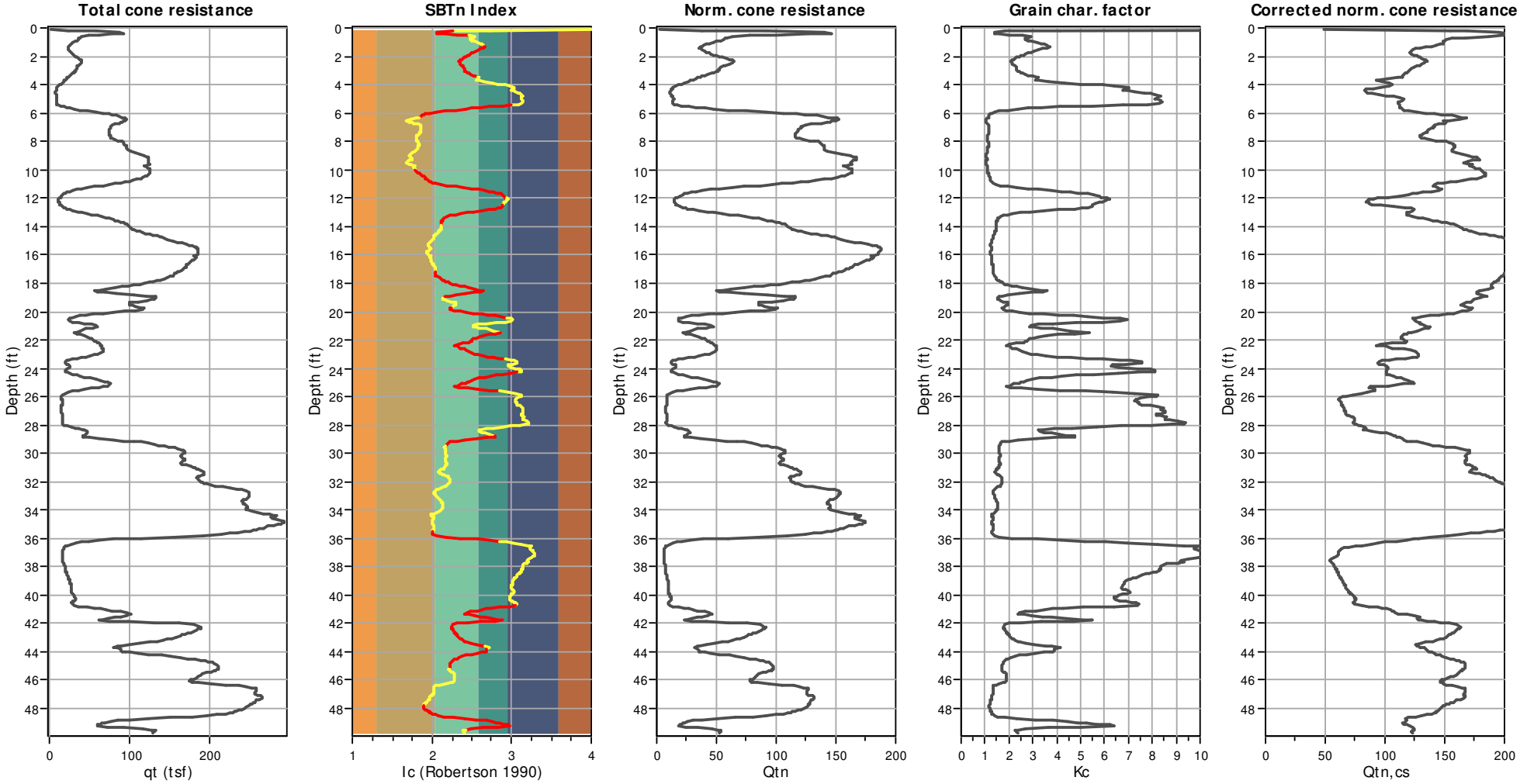
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

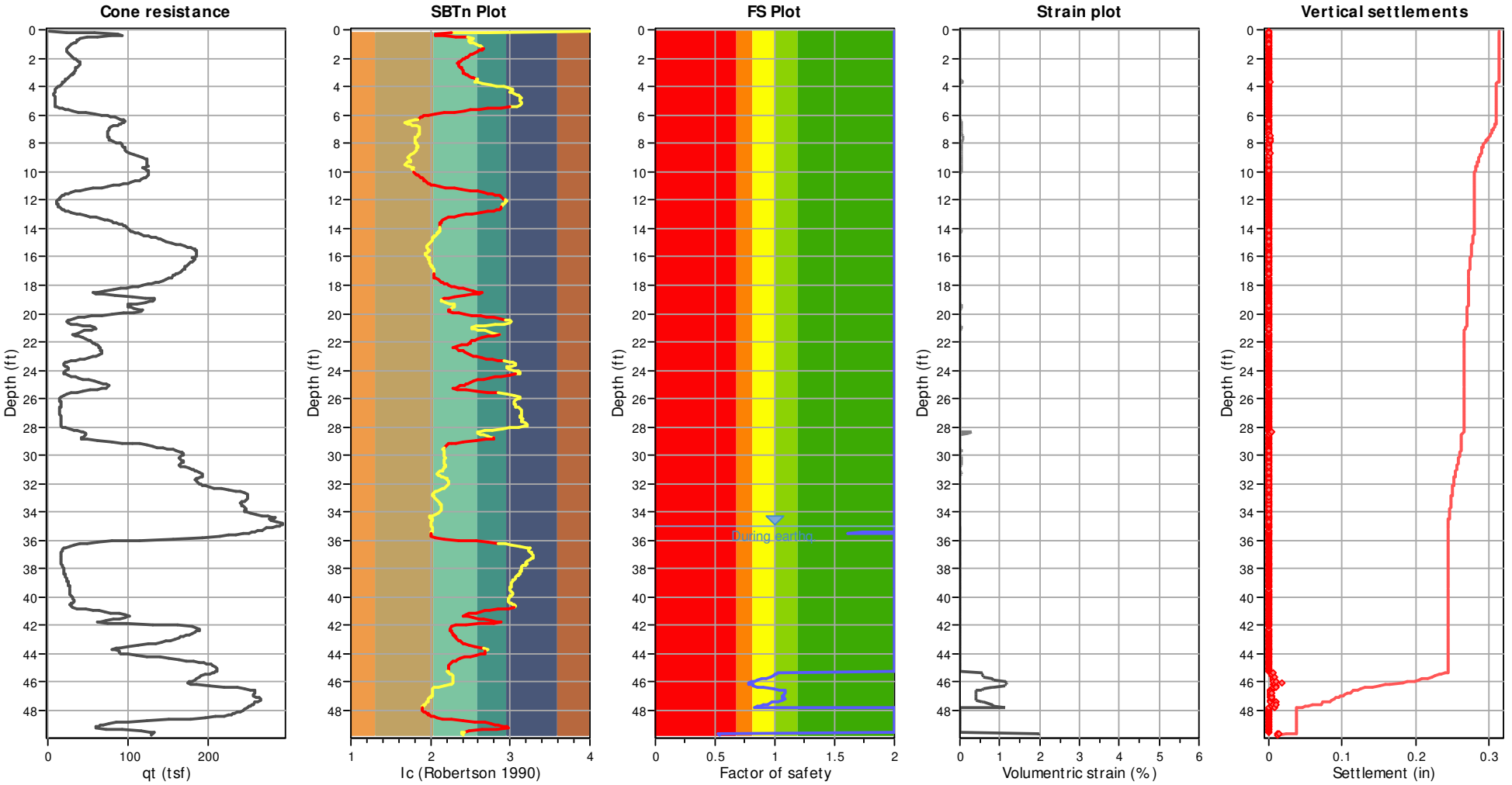
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.09	4.06	1.84	26.61	48.96	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.14	2.72	37.34	4.15	154.86	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.22	2.26	91.29	1.84	167.89	39	899	0.43	0.001	0.00	8.42	0.00	0.000
0.31	2.06	140.72	1.38	194.64	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.35	2.06	146.80	1.39	203.91	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.39	2.17	126.24	1.59	201.09	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.47	2.32	99.83	2.03	202.54	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.53	2.46	77.86	2.55	198.87	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.62	2.53	63.59	2.94	186.92	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.66	2.51	59.11	2.83	167.14	43	797	0.43	0.003	0.00	8.42	0.00	0.000
0.75	2.49	57.78	2.70	155.89	40	754	0.43	0.003	0.00	8.42	0.00	0.000
0.79	2.49	56.07	2.71	151.80	39	733	0.43	0.004	0.00	8.42	0.00	0.000
0.88	2.50	53.87	2.78	149.67	39	717	0.43	0.004	0.00	8.42	0.00	0.000
0.93	2.54	50.36	2.96	148.82	39	700	0.43	0.005	0.00	8.42	0.00	0.000
1.01	2.57	46.99	3.17	149.17	40	686	0.43	0.005	0.00	8.42	0.00	0.000
1.10	2.61	44.01	3.38	148.70	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.14	2.63	41.91	3.50	146.69	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.19	2.64	39.62	3.60	142.81	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.28	2.66	37.66	3.68	138.62	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.32	2.66	36.14	3.70	133.56	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.41	2.65	35.79	3.63	129.79	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.45	2.62	36.66	3.43	125.88	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.54	2.58	38.17	3.24	123.47	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.59	2.55	40.16	3.03	121.67	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.67	2.53	41.66	2.90	120.83	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.72	2.50	43.46	2.78	120.77	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.81	2.48	45.45	2.69	122.17	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.90	2.47	47.72	2.61	124.40	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.95	2.45	49.96	2.53	126.39	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.99	2.43	52.53	2.43	127.92	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.08	2.41	55.20	2.34	129.38	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.14	2.38	58.51	2.24	130.93	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.21	2.36	61.04	2.17	132.58	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.28	2.35	63.13	2.12	133.89	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.31	2.34	64.15	2.10	134.80	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.37	2.34	64.58	2.08	134.62	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.47	2.35	63.26	2.11	133.17	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.59	2.36	60.76	2.16	131.08	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.65	2.38	57.74	2.23	129.01	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.69	2.39	55.59	2.28	126.74	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.77	2.40	54.17	2.30	124.56	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.82	2.40	52.94	2.31	122.31	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.90	2.40	52.16	2.32	121.21	0	0	0.43	0.000	0.00	8.42	0.00	0.000
2.95	2.41	51.37	2.34	120.47	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.01	2.41	50.64	2.37	119.93	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.08	2.42	49.51	2.41	119.28	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.13	2.44	47.85	2.47	118.19	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.20	2.46	45.75	2.56	116.98	0	0	0.43	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
3.26	2.48	43.26	2.68	115.75	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.33	2.51	40.62	2.82	114.69	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.39	2.54	38.13	3.00	114.23	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.43	2.57	36.03	3.17	114.32	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.51	2.59	34.18	3.24	110.74	0	0	0.43	0.000	0.00	8.42	0.00	0.000
3.57	2.57	32.33	3.15	101.98	27	470	0.43	0.087	0.06	8.42	0.05	0.001
3.63	2.56	30.42	3.09	94.06	25	436	0.43	0.119	0.09	8.42	0.07	0.001
3.70	2.58	28.56	3.23	92.30	25	422	0.43	0.143	0.11	8.42	0.09	0.002
3.75	2.65	26.75	3.66	97.92	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.88	2.75	23.72	4.35	103.28	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.97	2.83	21.28	5.01	106.53	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.01	2.92	17.97	5.92	106.32	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.10	2.97	16.11	6.41	103.20	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.14	3.02	13.72	7.00	96.03	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.27	3.02	12.83	7.00	89.78	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.30	3.01	12.29	6.85	84.21	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.37	3.00	12.28	6.76	83.00	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.41	3.02	11.89	6.94	82.55	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.53	3.05	11.49	7.28	83.64	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.57	3.08	11.14	7.68	85.55	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.61	3.10	11.24	7.96	89.41	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.68	3.12	11.67	8.13	94.86	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.76	3.14	12.06	8.37	100.96	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.81	3.13	12.97	8.28	107.48	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.88	3.12	13.65	8.22	112.20	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.96	3.11	14.23	8.10	115.29	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.99	3.12	14.08	8.22	115.75	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.07	3.13	13.68	8.35	114.30	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.21	3.14	13.38	8.38	112.08	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.25	3.14	13.23	8.43	111.58	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.30	3.13	13.47	8.28	111.56	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.36	3.09	14.39	7.78	112.00	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.40	3.00	16.58	6.76	112.05	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.46	2.88	20.52	5.47	112.19	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.52	2.72	26.99	4.17	112.60	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.60	2.61	33.22	3.37	111.99	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.65	2.51	40.27	2.81	113.27	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.75	2.42	47.91	2.39	114.33	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.81	2.30	59.84	1.94	116.29	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.86	2.18	74.25	1.61	119.81	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.91	2.06	91.58	1.39	126.91	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.00	1.98	105.89	1.27	134.54	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.05	1.92	117.18	1.21	141.62	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.11	1.90	124.19	1.19	147.19	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.18	1.87	134.41	1.16	156.20	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.31	1.85	144.08	1.14	164.83	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.35	1.80	151.68	1.11	168.01	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.42	1.73	152.74	1.06	162.08	31	770	0.43	0.053	0.03	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
6.49	1.67	150.49	1.02	153.57	28	704	0.43	0.069	0.05	8.42	0.03	0.001
6.53	1.67	146.50	1.02	149.04	28	685	0.43	0.076	0.05	8.42	0.04	0.000
6.61	1.71	144.64	1.04	151.06	28	706	0.43	0.071	0.05	8.42	0.04	0.001
6.66	1.74	142.30	1.07	151.78	29	724	0.43	0.067	0.04	8.42	0.03	0.000
6.73	1.77	137.52	1.09	149.68	29	729	0.43	0.067	0.04	8.42	0.03	0.001
6.77	1.82	129.44	1.12	145.17	28	727	0.43	0.068	0.04	8.42	0.03	0.000
6.83	1.85	123.83	1.15	142.03	28	724	0.43	0.070	0.05	8.42	0.04	0.001
6.90	1.87	121.25	1.16	140.70	28	724	0.43	0.071	0.05	8.42	0.04	0.001
6.97	1.86	122.22	1.16	141.17	28	724	0.43	0.073	0.05	8.42	0.04	0.001
7.05	1.86	121.24	1.16	140.07	28	718	0.43	0.076	0.05	8.42	0.04	0.001
7.10	1.86	120.16	1.15	138.49	27	709	0.43	0.080	0.06	8.42	0.04	0.000
7.18	1.86	118.83	1.15	136.70	27	699	0.43	0.086	0.06	8.42	0.05	0.001
7.25	1.85	118.36	1.15	135.76	27	692	0.43	0.090	0.06	8.42	0.05	0.001
7.33	1.85	117.40	1.15	134.91	27	691	0.43	0.092	0.07	8.42	0.05	0.001
7.36	1.85	117.44	1.14	134.10	26	687	0.43	0.095	0.07	8.42	0.05	0.000
7.46	1.84	116.33	1.13	132.03	26	681	0.43	0.100	0.07	8.42	0.06	0.001
7.51	1.82	116.13	1.12	130.35	25	672	0.43	0.106	0.08	8.42	0.06	0.001
7.55	1.81	116.23	1.12	129.76	25	670	0.43	0.109	0.08	8.42	0.06	0.001
7.63	1.81	116.27	1.12	129.72	25	673	0.43	0.109	0.08	8.42	0.06	0.001
7.71	1.81	116.77	1.12	130.28	25	680	0.43	0.107	0.08	8.42	0.06	0.001
7.75	1.81	119.40	1.11	133.03	26	696	0.43	0.100	0.07	8.42	0.06	0.000
7.84	1.81	123.54	1.11	137.25	27	722	0.42	0.091	0.06	8.42	0.05	0.001
7.92	1.81	128.33	1.11	142.58	28	755	0.42	0.081	0.06	8.42	0.04	0.001
7.97	1.81	132.19	1.11	147.18	29	782	0.42	0.074	0.05	8.42	0.04	0.000
8.02	1.82	134.88	1.12	151.34	29	810	0.42	0.068	0.04	8.42	0.03	0.000
8.11	1.83	136.38	1.13	154.09	30	832	0.42	0.064	0.04	8.42	0.03	0.001
8.16	1.84	138.41	1.13	156.96	31	853	0.42	0.061	0.04	8.42	0.03	0.000
8.27	1.84	139.30	1.13	157.86	31	865	0.42	0.060	0.04	8.42	0.03	0.001
8.31	1.83	140.64	1.13	158.93	31	872	0.42	0.059	0.03	8.42	0.03	0.000
8.37	1.83	140.75	1.13	158.90	31	876	0.42	0.059	0.03	8.42	0.03	0.000
8.42	1.83	140.52	1.13	158.33	31	874	0.42	0.060	0.04	8.42	0.03	0.000
8.47	1.82	139.93	1.12	157.14	31	870	0.42	0.061	0.04	8.42	0.03	0.000
8.54	1.81	140.77	1.11	156.49	30	866	0.42	0.063	0.04	8.42	0.03	0.000
8.69	1.79	142.45	1.10	156.49	30	870	0.42	0.064	0.04	8.42	0.03	0.001
8.77	1.76	148.83	1.08	160.14	30	885	0.42	0.062	0.04	8.42	0.03	0.001
8.89	1.73	154.86	1.06	164.28	31	907	0.42	0.060	0.04	8.42	0.03	0.001
8.95	1.72	161.74	1.05	170.12	32	938	0.42	0.056	0.03	8.42	0.02	0.000
9.07	1.73	164.46	1.06	173.56	33	967	0.42	0.053	0.03	8.42	0.02	0.001
9.12	1.73	166.77	1.06	176.90	33	991	0.42	0.050	0.03	8.42	0.02	0.000
9.19	1.74	167.29	1.07	178.62	34	1009	0.42	0.049	0.03	8.42	0.02	0.000
9.25	1.75	167.31	1.07	179.83	34	1024	0.42	0.048	0.03	8.42	0.02	0.000
9.30	1.72	165.17	1.05	173.19	32	975	0.42	0.054	0.03	8.42	0.02	0.000
9.38	1.69	163.43	1.03	169.04	31	948	0.42	0.059	0.03	8.42	0.03	0.000
9.49	1.68	161.86	1.02	165.41	31	928	0.42	0.063	0.04	8.42	0.03	0.001
9.56	1.71	163.00	1.05	170.79	32	975	0.42	0.056	0.03	8.42	0.02	0.000
9.61	1.73	163.51	1.06	172.86	33	995	0.42	0.054	0.03	8.42	0.02	0.000
9.67	1.76	158.21	1.08	170.56	32	998	0.42	0.055	0.03	8.42	0.02	0.000
9.70	1.77	157.34	1.08	170.68	33	1004	0.42	0.054	0.03	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
9.72	1.78	155.66	1.09	170.33	33	1008	0.42	0.054	0.03	8.42	0.02	0.000
9.79	1.77	160.29	1.09	174.39	33	1033	0.42	0.051	0.03	8.42	0.02	0.000
9.89	1.78	160.72	1.10	176.06	34	1053	0.42	0.050	0.03	8.42	0.02	0.000
9.93	1.79	162.82	1.10	178.84	34	1074	0.42	0.048	0.02	8.42	0.02	0.000
9.98	1.79	163.71	1.10	180.47	35	1090	0.42	0.047	0.02	8.42	0.02	0.000
10.07	1.80	163.73	1.11	181.32	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.11	1.81	163.62	1.11	182.21	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.17	1.82	162.95	1.12	183.14	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.26	1.84	161.71	1.14	183.78	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.32	1.86	160.08	1.15	184.61	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.42	1.88	157.57	1.17	184.11	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.46	1.89	155.08	1.18	183.32	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.51	1.91	151.18	1.19	180.65	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.59	1.92	146.28	1.21	176.94	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.64	1.94	139.73	1.23	171.49	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.74	1.95	133.37	1.24	165.80	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.79	1.97	127.29	1.26	160.05	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.84	1.98	120.61	1.28	154.34	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.94	2.01	113.23	1.31	148.82	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.98	2.05	105.42	1.37	144.49	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.03	2.11	96.27	1.47	141.96	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.13	2.19	86.18	1.63	140.81	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.17	2.29	73.61	1.93	142.07	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.26	2.39	62.91	2.29	144.14	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.33	2.50	52.58	2.79	146.62	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.37	2.59	45.44	3.24	147.26	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.43	2.67	38.36	3.77	144.64	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.52	2.73	33.00	4.20	138.65	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.58	2.77	28.82	4.56	131.41	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.65	2.81	26.07	4.86	126.57	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.70	2.86	23.35	5.30	123.68	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.76	2.89	21.53	5.57	119.97	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.82	2.91	19.39	5.77	111.81	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.92	2.92	17.51	5.88	102.91	0	0	0.42	0.000	0.00	0.00	0.00	0.000
11.99	2.94	15.39	6.10	93.90	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.05	2.95	14.56	6.19	90.15	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.10	2.95	14.12	6.15	86.87	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.17	2.94	14.10	6.05	85.28	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.23	2.92	14.30	5.90	84.30	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.27	2.91	14.93	5.80	86.69	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.40	2.89	15.33	5.64	86.39	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.45	2.88	16.33	5.46	89.19	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.50	2.88	17.56	5.46	95.99	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.58	2.88	19.55	5.46	106.78	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.63	2.86	21.99	5.30	116.55	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.71	2.83	23.93	5.09	121.73	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.76	2.80	26.21	4.76	124.70	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.80	2.72	30.28	4.11	124.41	0	0	0.42	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
12.90	2.63	35.18	3.49	122.84	0	0	0.42	0.000	0.00	0.00	0.00	0.000
12.95	2.52	42.26	2.85	120.43	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.02	2.44	47.88	2.48	118.83	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.07	2.35	55.14	2.14	117.84	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.15	2.30	60.69	1.94	117.91	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.20	2.23	68.38	1.75	119.98	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.31	2.19	74.53	1.65	123.12	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.37	2.16	80.94	1.58	127.55	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.43	2.15	85.34	1.55	132.20	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.50	2.14	89.39	1.53	136.57	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.55	2.13	93.12	1.51	140.67	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.60	2.12	96.62	1.49	144.33	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.68	2.12	99.59	1.48	147.77	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.73	2.11	102.46	1.48	151.64	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.80	2.11	104.75	1.48	154.94	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.86	2.11	106.87	1.48	157.88	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.92	2.11	108.60	1.47	160.11	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.99	2.11	110.30	1.47	162.30	0	0	0.42	0.000	0.00	8.42	0.00	0.000
14.10	2.11	111.61	1.47	164.33	36	1311	0.42	0.053	0.03	8.42	0.02	0.001
14.17	2.11	113.26	1.47	166.41	36	1332	0.42	0.052	0.03	8.42	0.02	0.000
14.21	2.10	115.21	1.46	168.24	36	1350	0.42	0.050	0.02	8.42	0.02	0.000
14.27	2.10	117.70	1.45	170.22	37	1371	0.42	0.049	0.02	8.42	0.02	0.000
14.34	2.08	120.92	1.43	172.54	37	1395	0.42	0.048	0.02	8.42	0.02	0.000
14.39	2.07	124.88	1.41	175.98	38	1426	0.42	0.046	0.02	8.42	0.02	0.000
14.47	2.06	129.17	1.39	179.57	38	1461	0.42	0.044	0.02	8.42	0.02	0.000
14.52	2.05	133.87	1.37	183.88	39	1499	0.42	0.042	0.02	8.42	0.01	0.000
14.57	2.04	138.39	1.36	187.92	40	1535	0.42	0.041	0.02	8.42	0.01	0.000
14.65	2.03	142.34	1.35	191.56	40	1569	0.42	0.039	0.02	8.42	0.01	0.000
14.70	2.03	145.89	1.34	194.97	41	1600	0.42	0.038	0.02	8.42	0.01	0.000
14.77	2.02	148.43	1.33	197.44	41	1625	0.42	0.037	0.02	8.42	0.01	0.000
14.83	2.02	151.23	1.32	199.93	42	1648	0.42	0.037	0.02	8.42	0.01	0.000
14.95	2.00	155.00	1.30	202.25	42	1673	0.42	0.036	0.01	8.42	0.01	0.000
15.05	1.99	160.00	1.28	205.32	43	1701	0.42	0.036	0.01	8.42	0.01	0.000
15.13	1.97	165.84	1.26	209.58	43	1735	0.42	0.035	0.01	8.42	0.01	0.000
15.18	1.96	171.20	1.25	214.36	44	1774	0.42	0.034	0.01	8.42	0.01	0.000
15.23	1.96	176.26	1.25	219.57	45	1819	0.42	0.032	0.01	8.42	0.01	0.000
15.31	1.95	180.20	1.24	224.14	46	1862	0.42	0.031	0.01	8.42	0.01	0.000
15.35	1.96	183.54	1.25	228.86	47	1906	0.42	0.030	0.01	8.42	0.01	0.000
15.42	1.96	185.64	1.25	232.68	48	1948	0.42	0.029	0.01	8.42	0.01	0.000
15.49	1.97	186.88	1.26	235.69	48	1983	0.42	0.029	0.01	8.42	0.01	0.000
15.53	1.97	187.69	1.27	237.97	49	2009	0.42	0.028	0.01	8.42	0.01	0.000
15.59	1.98	187.92	1.28	239.64	50	2032	0.42	0.028	0.01	8.42	0.01	0.000
15.66	1.97	187.68	1.26	237.27	49	2013	0.42	0.029	0.01	8.42	0.01	0.000
15.72	1.95	187.00	1.24	231.81	47	1958	0.42	0.030	0.01	8.42	0.01	0.000
15.78	1.94	186.42	1.23	228.53	46	1927	0.42	0.031	0.01	8.42	0.01	0.000
15.89	1.94	185.63	1.23	228.47	47	1939	0.42	0.031	0.01	8.42	0.01	0.000
15.97	1.96	185.93	1.25	231.75	47	1983	0.42	0.030	0.01	8.42	0.01	0.000
16.02	1.97	181.35	1.27	229.91	47	1983	0.42	0.030	0.01	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
16.06	1.98	180.78	1.27	230.00	47	1989	0.42	0.030	0.01	8.42	0.01	0.000
16.09	1.99	179.02	1.28	229.51	48	1991	0.42	0.030	0.01	8.42	0.01	0.000
16.18	1.98	181.66	1.27	230.71	48	2005	0.42	0.030	0.01	8.42	0.01	0.000
16.23	1.98	180.41	1.27	229.69	47	2002	0.42	0.030	0.01	8.42	0.01	0.000
16.31	1.98	179.16	1.27	228.17	47	1995	0.42	0.031	0.01	8.42	0.01	0.000
16.36	1.98	177.49	1.28	226.43	47	1985	0.42	0.031	0.01	8.42	0.01	0.000
16.41	1.98	175.34	1.28	224.45	46	1974	0.42	0.031	0.01	8.42	0.01	0.000
16.48	1.99	173.14	1.29	222.73	46	1967	0.42	0.032	0.01	8.42	0.01	0.000
16.54	2.00	170.64	1.30	221.16	46	1962	0.42	0.032	0.01	8.42	0.01	0.000
16.67	2.01	167.98	1.31	219.86	46	1966	0.42	0.032	0.01	8.42	0.01	0.000
16.71	2.02	166.19	1.32	219.83	46	1973	0.42	0.032	0.01	8.42	0.01	0.000
16.78	2.03	164.90	1.34	220.60	46	1990	0.42	0.032	0.01	8.42	0.01	0.000
16.85	2.04	163.77	1.35	221.22	47	2004	0.42	0.032	0.01	8.42	0.01	0.000
16.90	2.04	162.56	1.36	221.10	47	2010	0.42	0.032	0.01	8.42	0.01	0.000
16.97	2.05	160.96	1.37	219.75	47	2004	0.42	0.032	0.01	8.42	0.01	0.000
17.02	2.05	159.08	1.37	217.67	46	1990	0.42	0.033	0.01	8.42	0.01	0.000
17.09	2.05	156.81	1.37	214.51	45	1967	0.42	0.033	0.01	8.42	0.01	0.000
17.15	2.05	154.28	1.37	210.95	45	1939	0.42	0.034	0.01	8.42	0.01	0.000
17.20	2.04	152.07	1.36	206.94	44	1905	0.42	0.035	0.01	8.42	0.01	0.000
17.28	2.04	149.98	1.36	203.26	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.33	2.04	147.67	1.36	200.35	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.46	2.05	144.68	1.37	198.50	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.51	2.07	141.02	1.40	197.59	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.64	2.09	136.92	1.44	196.50	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.69	2.11	132.62	1.48	195.73	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.76	2.13	128.27	1.52	194.77	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.82	2.16	123.81	1.57	193.86	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.87	2.18	119.10	1.62	192.67	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.94	2.20	113.96	1.68	191.24	0	0	0.42	0.000	0.00	8.42	0.00	0.000
17.99	2.23	108.44	1.75	190.08	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.06	2.27	102.12	1.85	189.23	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.12	2.31	95.51	1.97	188.44	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.19	2.35	88.56	2.13	188.57	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.25	2.40	81.46	2.32	189.18	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.30	2.46	73.31	2.59	189.71	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.37	2.54	62.69	2.98	186.74	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.48	2.60	54.31	3.33	180.78	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.55	2.64	49.57	3.61	178.80	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.61	2.62	51.84	3.42	177.34	0	0	0.42	0.000	0.00	0.00	0.00	0.000
18.67	2.54	59.49	3.00	178.51	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.74	2.43	73.10	2.42	177.05	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.79	2.30	92.27	1.95	180.05	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.91	2.22	107.02	1.73	184.76	0	0	0.42	0.000	0.00	8.42	0.00	0.000
18.97	2.16	115.91	1.58	183.03	0	0	0.42	0.000	0.00	8.42	0.00	0.000
19.04	2.14	116.40	1.54	179.08	0	0	0.42	0.000	0.00	8.42	0.00	0.000
19.09	2.13	114.77	1.52	174.08	0	0	0.42	0.000	0.00	8.42	0.00	0.000
19.16	2.16	111.06	1.57	174.13	39	1741	0.42	0.048	0.02	8.42	0.02	0.000
19.22	2.19	105.60	1.64	173.18	39	1730	0.42	0.049	0.02	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
19.30	2.24	96.29	1.78	171.43	39	1699	0.42	0.051	0.02	8.42	0.02	0.000
19.31	2.29	89.69	1.90	170.57	40	1672	0.42	0.053	0.02	8.42	0.02	0.000
19.36	2.31	85.25	1.97	168.31	40	1641	0.42	0.055	0.02	8.42	0.02	0.000
19.44	2.30	85.58	1.94	165.71	39	1627	0.43	0.056	0.03	8.42	0.02	0.000
19.50	2.29	85.27	1.92	163.92	38	1616	0.43	0.057	0.03	8.42	0.02	0.000
19.58	2.28	87.40	1.89	164.88	38	1636	0.43	0.056	0.03	8.42	0.02	0.000
19.63	2.27	90.75	1.85	167.60	39	1673	0.43	0.054	0.02	8.42	0.02	0.000
19.71	2.24	96.94	1.76	170.59	39	1722	0.43	0.051	0.02	8.42	0.02	0.000
19.77	2.22	100.78	1.72	173.02	0	0	0.43	0.000	0.00	8.42	0.00	0.000
19.84	2.23	98.90	1.74	172.13	0	0	0.43	0.000	0.00	8.42	0.00	0.000
19.93	2.27	90.27	1.87	168.71	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.00	2.35	77.89	2.11	164.36	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.06	2.43	66.08	2.43	160.87	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.11	2.52	54.48	2.88	156.80	0	0	0.43	0.000	0.00	8.42	0.00	0.000
20.18	2.62	44.02	3.45	151.95	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.24	2.71	35.66	4.07	145.02	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.30	2.79	29.40	4.69	137.78	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.37	2.86	24.60	5.30	130.41	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.42	2.93	21.00	6.00	125.94	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.48	2.99	18.66	6.63	123.70	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.59	3.02	17.93	6.93	124.22	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.65	2.99	18.86	6.67	125.83	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.72	2.92	21.66	5.89	127.61	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.77	2.80	26.77	4.81	128.70	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.84	2.68	33.55	3.85	129.07	0	0	0.43	0.000	0.00	0.00	0.00	0.000
20.90	2.58	40.64	3.21	130.43	35	1196	0.43	0.131	0.07	8.42	0.05	0.001
20.95	2.53	45.73	2.91	132.95	35	1255	0.43	0.115	0.06	8.42	0.05	0.001
21.03	2.52	47.32	2.87	135.74	35	1290	0.43	0.107	0.05	8.42	0.04	0.001
21.08	2.55	45.49	3.03	137.67	36	1292	0.43	0.107	0.05	8.42	0.04	0.000
21.15	2.60	41.20	3.33	137.16	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.21	2.68	34.67	3.84	133.18	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.34	2.77	27.86	4.57	127.43	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.45	2.86	22.99	5.30	121.93	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.52	2.86	22.33	5.34	119.30	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.57	2.80	24.80	4.75	117.73	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.63	2.71	28.34	4.10	116.15	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.69	2.65	31.69	3.62	114.58	0	0	0.43	0.000	0.00	0.00	0.00	0.000
21.76	2.59	35.00	3.25	113.75	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.87	2.55	37.66	3.02	113.63	0	0	0.43	0.000	0.00	8.42	0.00	0.000
21.94	2.52	39.98	2.86	114.36	0	0	0.43	0.000	0.00	8.42	0.00	0.000
22.00	2.50	41.42	2.79	115.42	0	0	0.43	0.000	0.00	8.42	0.00	0.000
22.06	2.49	42.72	2.74	117.01	0	0	0.43	0.000	0.00	8.42	0.00	0.000
22.13	2.49	43.89	2.70	118.52	0	0	0.43	0.000	0.00	8.42	0.00	0.000
22.18	2.47	45.05	2.60	117.26	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.24	2.40	46.29	2.30	106.49	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.31	2.33	47.53	2.04	96.80	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.37	2.28	48.68	1.89	92.23	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.45	2.32	49.59	2.02	99.97	0	0	0.44	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
22.56	2.36	49.46	2.14	106.02	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.58	2.38	49.90	2.23	111.52	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.64	2.41	49.77	2.34	116.37	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.76	2.43	50.00	2.43	121.60	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.82	2.46	48.71	2.58	125.59	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.94	2.49	46.43	2.73	126.95	0	0	0.44	0.000	0.00	8.42	0.00	0.000
22.99	2.53	43.40	2.94	127.46	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.05	2.58	39.98	3.19	127.52	0	0	0.44	0.000	0.00	8.42	0.00	0.000
23.13	2.64	35.93	3.56	128.03	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.17	2.70	31.52	4.02	126.76	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.25	2.77	26.93	4.57	123.06	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.31	2.85	22.49	5.22	117.31	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.35	2.92	18.62	5.93	110.36	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.43	2.99	15.54	6.66	103.48	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.48	3.03	13.80	7.09	97.76	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.54	3.07	12.58	7.56	95.06	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.60	3.07	12.38	7.59	93.95	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.66	3.06	12.60	7.45	93.85	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.72	3.01	13.84	6.88	95.24	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.79	2.97	15.42	6.37	98.24	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.84	2.96	16.13	6.27	101.17	0	0	0.44	0.000	0.00	0.00	0.00	0.000
23.96	2.99	15.51	6.61	102.50	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.02	3.05	13.93	7.36	102.45	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.09	3.10	12.81	7.92	101.45	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.14	3.12	12.39	8.13	100.76	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.20	3.12	12.40	8.12	100.66	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.27	3.07	13.45	7.50	100.88	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.40	2.99	15.26	6.60	100.71	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.45	2.88	18.36	5.52	101.36	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.50	2.80	21.54	4.81	103.70	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.58	2.73	25.23	4.23	106.80	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.62	2.67	29.10	3.79	110.19	0	0	0.44	0.000	0.00	0.00	0.00	0.000
24.69	2.60	34.20	3.31	113.24	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.80	2.54	39.04	2.98	116.46	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.88	2.49	43.70	2.73	119.50	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.93	2.46	46.97	2.59	121.75	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.99	2.44	49.76	2.48	123.62	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.06	2.42	51.76	2.41	124.94	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.11	2.38	52.17	2.21	115.52	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.24	2.32	50.53	2.02	101.91	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.30	2.28	46.88	1.88	87.94	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.37	2.34	41.60	2.07	86.32	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.42	2.45	35.36	2.52	89.03	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.50	2.58	28.59	3.20	91.39	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.55	2.72	22.16	4.14	91.86	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.61	2.85	17.40	5.20	90.40	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.67	2.96	13.57	6.33	85.93	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.78	3.05	10.98	7.28	79.88	0	0	0.44	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
25.90	3.13	8.86	8.25	73.04	0	0	0.44	0.000	0.00	0.00	0.00	0.000
25.95	3.12	8.25	8.20	67.58	0	0	0.44	0.000	0.00	0.00	0.00	0.000
26.02	3.10	8.15	7.86	64.07	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.08	3.07	8.22	7.52	61.80	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.14	3.06	8.24	7.39	60.92	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.21	3.05	8.37	7.29	61.07	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.26	3.05	8.47	7.28	61.65	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.32	3.05	8.55	7.32	62.55	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.39	3.06	8.58	7.39	63.39	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.44	3.06	8.60	7.42	63.78	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.52	3.06	8.56	7.47	63.88	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.57	3.07	8.41	7.56	63.54	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.63	3.10	8.11	7.90	64.04	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.75	3.12	7.83	8.24	64.53	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.81	3.14	7.72	8.46	65.28	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.88	3.14	7.75	8.43	65.40	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.93	3.14	7.79	8.38	65.34	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.00	3.14	7.79	8.47	65.97	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.06	3.15	7.79	8.53	66.50	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.10	3.15	7.87	8.52	67.03	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.18	3.13	8.03	8.35	67.01	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.24	3.12	8.21	8.18	67.22	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.30	3.12	8.32	8.19	68.16	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.36	3.13	8.36	8.34	69.70	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.41	3.15	8.40	8.53	71.59	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.47	3.15	8.50	8.60	73.10	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.54	3.15	8.66	8.54	74.02	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.59	3.15	8.76	8.51	74.54	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.67	3.16	8.51	8.73	74.33	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.77	3.19	8.14	9.09	73.93	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.85	3.21	7.84	9.40	73.76	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.89	3.21	7.97	9.35	74.54	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.97	3.17	8.56	8.84	75.69	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.03	3.10	9.82	7.90	77.56	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.08	3.00	11.90	6.71	79.85	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.16	2.89	14.70	5.64	82.90	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.20	2.78	18.04	4.64	83.76	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.26	2.69	21.23	3.91	83.09	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.33	2.61	23.98	3.41	81.76	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.38	2.58	26.03	3.22	83.91	23	993	0.45	0.421	0.36	8.42	0.28	0.003
28.42	2.59	27.32	3.28	89.59	24	1057	0.45	0.331	0.26	8.42	0.20	0.002
28.50	2.63	27.50	3.49	96.01	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.56	2.67	27.05	3.75	101.51	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.63	2.71	25.61	4.09	104.75	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.73	2.76	24.20	4.42	106.86	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.78	2.80	22.85	4.75	108.47	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.83	2.80	23.06	4.77	110.04	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.88	2.70	28.05	4.02	112.69	0	0	0.45	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
28.98	2.57	36.20	3.16	114.31	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.02	2.42	48.65	2.38	116.01	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.11	2.32	58.47	2.02	118.24	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.16	2.26	66.94	1.82	121.88	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.21	2.23	73.22	1.73	126.89	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.31	2.20	78.83	1.67	131.71	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.36	2.18	84.11	1.62	136.62	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.42	2.17	87.75	1.60	140.17	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.47	2.16	92.20	1.58	145.61	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.55	2.16	96.20	1.57	151.13	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.60	2.16	100.58	1.57	158.12	35	2136	0.45	0.058	0.03	8.42	0.02	0.000
29.69	2.16	103.22	1.58	163.41	36	2214	0.45	0.054	0.03	8.42	0.02	0.000
29.75	2.17	105.53	1.59	167.88	37	2278	0.45	0.052	0.02	8.42	0.02	0.000
29.81	2.17	106.77	1.59	170.20	38	2314	0.45	0.050	0.02	8.42	0.02	0.000
29.86	2.17	107.63	1.59	171.06	38	2328	0.45	0.050	0.02	8.42	0.02	0.000
29.95	2.17	107.47	1.59	170.88	38	2331	0.45	0.050	0.02	8.42	0.02	0.000
30.00	2.17	106.17	1.60	169.73	38	2319	0.45	0.051	0.02	8.42	0.02	0.000
30.10	2.18	104.24	1.62	168.50	38	2309	0.45	0.051	0.02	8.42	0.02	0.000
30.17	2.18	102.89	1.63	167.65	38	2302	0.45	0.052	0.02	8.42	0.02	0.000
30.21	2.18	103.10	1.63	167.66	38	2305	0.45	0.052	0.02	8.42	0.02	0.000
30.29	2.18	104.21	1.61	167.84	37	2311	0.45	0.052	0.02	8.42	0.02	0.000
30.35	2.17	105.66	1.59	168.24	37	2318	0.45	0.051	0.02	8.42	0.02	0.000
30.40	2.16	106.62	1.58	168.45	37	2323	0.45	0.051	0.02	8.42	0.02	0.000
30.47	2.16	106.41	1.58	168.21	37	2324	0.45	0.051	0.02	8.42	0.02	0.000
30.52	2.17	105.24	1.59	167.68	37	2321	0.45	0.052	0.02	8.42	0.02	0.000
30.58	2.18	103.46	1.61	167.03	37	2317	0.45	0.052	0.02	8.42	0.02	0.000
30.65	2.19	102.43	1.64	167.47	38	2328	0.45	0.052	0.02	8.42	0.02	0.000
30.77	2.19	103.15	1.64	168.82	38	2354	0.45	0.051	0.02	8.42	0.02	0.001
30.83	2.18	106.07	1.61	171.26	38	2391	0.45	0.050	0.02	8.42	0.02	0.000
30.88	2.16	109.56	1.58	173.40	39	2421	0.45	0.049	0.02	8.42	0.02	0.000
30.96	2.15	112.06	1.56	174.97	39	2445	0.45	0.048	0.02	8.42	0.02	0.000
31.01	2.15	113.36	1.55	176.12	39	2463	0.45	0.048	0.02	8.42	0.02	0.000
31.07	2.15	114.27	1.55	177.33	39	2483	0.45	0.047	0.02	8.42	0.02	0.000
31.14	2.12	116.66	1.48	173.10	38	2414	0.45	0.050	0.02	8.42	0.02	0.000
31.25	2.09	118.85	1.44	171.39	37	2384	0.45	0.051	0.02	8.42	0.02	0.000
31.32	2.08	120.90	1.41	170.76	37	2367	0.45	0.052	0.02	8.42	0.02	0.000
31.38	2.10	120.87	1.46	176.17	38	2463	0.45	0.048	0.02	8.42	0.02	0.000
31.45	2.12	120.35	1.49	179.48	39	2524	0.45	0.047	0.02	8.42	0.02	0.000
31.49	2.14	119.26	1.53	182.24	40	2574	0.45	0.045	0.02	8.42	0.02	0.000
31.56	2.16	117.18	1.57	183.67	41	2605	0.45	0.045	0.02	8.42	0.01	0.000
31.58	2.18	114.18	1.62	185.32	41	2636	0.45	0.044	0.02	8.42	0.01	0.000
31.67	2.20	112.12	1.66	186.58	42	2662	0.45	0.043	0.02	8.42	0.01	0.000
31.71	2.21	111.22	1.69	188.25	43	2689	0.45	0.043	0.02	8.42	0.01	0.000
31.77	2.21	111.77	1.70	189.84	43	2715	0.45	0.042	0.02	8.42	0.01	0.000
31.83	2.22	112.12	1.71	191.64	44	2745	0.45	0.041	0.02	8.42	0.01	0.000
31.94	2.22	112.51	1.72	193.19	44	2775	0.45	0.041	0.02	8.42	0.01	0.000
32.00	2.22	113.37	1.72	194.59	44	2800	0.45	0.040	0.02	8.42	0.01	0.000
32.05	2.22	114.26	1.71	195.81	44	2821	0.45	0.040	0.02	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
32.13	2.22	115.70	1.71	197.46	45	2850	0.45	0.040	0.02	8.42	0.01	0.000
32.18	2.21	117.88	1.69	199.37	45	2881	0.45	0.039	0.01	8.42	0.01	0.000
32.23	2.20	120.93	1.66	200.82	45	2905	0.45	0.039	0.01	8.42	0.01	0.000
32.30	2.18	124.73	1.62	201.59	45	2918	0.45	0.038	0.01	8.42	0.01	0.000
32.36	2.15	130.91	1.54	202.06	45	2917	0.45	0.039	0.01	8.42	0.01	0.000
32.48	2.11	137.01	1.48	202.54	44	2914	0.45	0.039	0.02	8.42	0.01	0.000
32.54	2.08	143.63	1.42	203.73	44	2908	0.45	0.039	0.02	8.42	0.01	0.000
32.59	2.06	148.29	1.38	204.81	44	2905	0.45	0.039	0.02	8.42	0.01	0.000
32.65	2.04	152.04	1.35	205.64	43	2899	0.45	0.039	0.02	8.42	0.01	0.000
32.71	2.03	153.91	1.34	205.94	43	2895	0.45	0.039	0.02	8.42	0.01	0.000
32.76	2.03	154.03	1.34	206.02	43	2899	0.45	0.039	0.02	8.42	0.01	0.000
32.84	2.03	153.57	1.34	206.45	44	2915	0.45	0.039	0.02	8.42	0.01	0.000
32.89	2.04	152.71	1.36	207.65	44	2949	0.45	0.039	0.02	8.42	0.01	0.000
32.99	2.05	152.20	1.37	209.08	44	2986	0.45	0.038	0.01	8.42	0.01	0.000
33.06	2.06	151.22	1.39	210.61	45	3026	0.45	0.037	0.01	8.42	0.01	0.000
33.15	2.08	149.85	1.41	211.57	45	3059	0.45	0.037	0.01	8.42	0.01	0.000
33.22	2.09	147.60	1.44	212.25	46	3088	0.45	0.036	0.01	8.42	0.01	0.000
33.28	2.10	145.37	1.46	212.53	46	3108	0.45	0.036	0.01	8.42	0.01	0.000
33.32	2.11	143.96	1.48	212.94	46	3124	0.45	0.036	0.01	8.42	0.01	0.000
33.38	2.12	143.47	1.49	213.72	47	3143	0.45	0.036	0.01	8.42	0.01	0.000
33.46	2.12	143.23	1.50	214.67	47	3166	0.45	0.035	0.01	8.42	0.01	0.000
33.50	2.13	143.07	1.51	215.99	47	3193	0.45	0.035	0.01	8.42	0.01	0.000
33.55	2.13	143.10	1.52	217.54	48	3223	0.45	0.035	0.01	8.42	0.01	0.000
33.62	2.14	143.69	1.52	218.89	48	3249	0.45	0.034	0.01	8.42	0.01	0.000
33.68	2.13	144.76	1.52	219.59	48	3262	0.45	0.034	0.01	8.42	0.01	0.000
33.78	2.13	145.10	1.51	219.14	48	3260	0.45	0.034	0.01	8.42	0.01	0.000
33.84	2.13	145.32	1.50	218.62	48	3255	0.45	0.034	0.01	8.42	0.01	0.000
33.90	2.13	144.33	1.51	217.69	48	3247	0.45	0.035	0.01	8.42	0.01	0.000
33.94	2.12	144.61	1.50	217.06	47	3238	0.45	0.035	0.01	8.42	0.01	0.000
34.01	2.12	145.52	1.49	216.66	47	3232	0.45	0.035	0.01	8.42	0.01	0.000
34.07	2.10	149.54	1.45	216.68	47	3219	0.45	0.035	0.01	8.42	0.01	0.000
34.18	2.06	154.74	1.38	214.08	46	3146	0.45	0.037	0.01	8.42	0.01	0.000
34.25	2.02	160.67	1.33	213.18	45	3086	0.45	0.038	0.01	8.42	0.01	0.000
34.30	1.99	165.58	1.29	213.92	44	3059	0.45	0.038	0.01	8.42	0.01	0.000
34.35	1.99	168.74	1.29	217.59	45	3112	0.45	0.037	0.01	8.42	0.01	0.000
34.41	1.99	170.76	1.29	220.27	46	3154	0.45	0.037	0.01	8.42	0.01	0.000
34.47	2.00	169.05	1.30	220.19	46	3174	0.45	0.036	0.01	8.42	0.01	0.000
34.52	2.02	165.44	1.32	219.14	46	3188	0.45	0.036	0.01	8.42	0.01	0.000
34.58	2.02	166.05	1.33	220.52	46	3216	0.45	0.036	0.01	8.42	0.01	0.000
34.71	2.01	169.63	1.32	223.32	47	3252	0.45	0.035	0.01	8.42	0.01	0.000
34.80	2.00	174.57	1.30	226.59	47	3282	0.45	0.035	0.01	8.42	0.01	0.000
34.88	2.00	174.49	1.30	226.61	47	3288	0.45	0.035	0.01	8.42	0.01	0.000
34.93	2.00	173.43	1.30	226.00	47	3289	0.45	0.035	0.01	8.42	0.01	0.000
34.98	2.01	171.81	1.31	224.62	47	3278	0.45	0.035	0.01	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.07

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
35.03	222.26	2.00	0.00	1.00	0.00	35.11	219.17	2.00	0.00	1.00	0.00
35.15	214.18	2.00	0.00	1.00	0.00	35.27	209.17	2.00	0.00	1.00	0.00
35.33	204.47	2.00	0.00	1.00	0.00	35.37	201.09	2.00	0.00	1.00	0.00
35.43	196.68	1.73	0.00	1.00	0.00	35.50	191.39	1.61	0.00	1.00	0.00
35.55	185.49	2.00	0.00	1.00	0.00	35.59	178.88	2.00	0.00	1.00	0.00
35.66	171.56	2.00	0.00	1.00	0.00	35.72	163.90	2.00	0.00	1.00	0.00
35.77	152.29	2.00	0.00	1.00	0.00	35.90	137.55	2.00	0.00	1.00	0.00
36.00	127.86	2.00	0.00	1.00	0.00	36.07	123.99	2.00	0.00	1.00	0.00
36.13	118.27	2.00	0.00	1.00	0.00	36.20	109.31	2.00	0.00	1.00	0.00
36.25	100.19	2.00	0.00	1.00	0.00	36.33	93.52	2.00	0.00	1.00	0.00
36.43	87.45	2.00	0.00	1.00	0.00	36.50	81.00	2.00	0.00	1.00	0.00
36.56	75.06	2.00	0.00	1.00	0.00	36.61	69.69	2.00	0.00	1.00	0.00
36.69	66.08	2.00	0.00	1.00	0.00	36.74	63.38	2.00	0.00	1.00	0.00
36.81	62.49	2.00	0.00	1.00	0.00	36.87	62.02	2.00	0.00	1.00	0.00
36.92	61.57	2.00	0.00	1.00	0.00	37.05	61.15	2.00	0.00	1.00	0.00
37.11	60.69	2.00	0.00	1.00	0.00	37.18	60.41	2.00	0.00	1.00	0.00
37.23	60.14	2.00	0.00	1.00	0.00	37.30	59.40	2.00	0.00	1.00	0.00
37.35	57.28	2.00	0.00	1.00	0.00	37.48	55.28	2.00	0.00	1.00	0.00
37.53	54.20	2.00	0.00	1.00	0.00	37.62	54.73	2.00	0.00	1.00	0.00
37.66	55.00	2.00	0.00	1.00	0.00	37.71	55.37	2.00	0.00	1.00	0.00
37.75	55.81	2.00	0.00	1.00	0.00	37.80	56.53	2.00	0.00	1.00	0.00
37.89	57.01	2.00	0.00	1.00	0.00	37.94	57.61	2.00	0.00	1.00	0.00
38.04	58.08	2.00	0.00	1.00	0.00	38.10	58.59	2.00	0.00	1.00	0.00
38.15	58.95	2.00	0.00	1.00	0.00	38.20	59.39	2.00	0.00	1.00	0.00
38.28	59.82	2.00	0.00	1.00	0.00	38.33	60.35	2.00	0.00	1.00	0.00
38.43	60.67	2.00	0.00	1.00	0.00	38.49	60.89	2.00	0.00	1.00	0.00
38.53	60.97	2.00	0.00	1.00	0.00	38.59	61.35	2.00	0.00	1.00	0.00
38.68	61.88	2.00	0.00	1.00	0.00	38.74	62.51	2.00	0.00	1.00	0.00
38.81	62.86	2.00	0.00	1.00	0.00	38.86	63.21	2.00	0.00	1.00	0.00
38.92	63.82	2.00	0.00	1.00	0.00	39.03	64.51	2.00	0.00	1.00	0.00
39.10	65.24	2.00	0.00	1.00	0.00	39.17	65.59	2.00	0.00	1.00	0.00
39.21	65.90	2.00	0.00	1.00	0.00	39.29	66.19	2.00	0.00	1.00	0.00
39.34	66.61	2.00	0.00	1.00	0.00	39.47	66.95	2.00	0.00	1.00	0.00
39.52	67.55	2.00	0.00	1.00	0.00	39.60	68.21	2.00	0.00	1.00	0.00
39.65	68.89	2.00	0.00	1.00	0.00	39.71	69.33	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
39.78	69.68	2.00	0.00	1.00	0.00	39.83	70.15	2.00	0.00	1.00	0.00
39.90	70.85	2.00	0.00	1.00	0.00	39.96	71.86	2.00	0.00	1.00	0.00
40.02	73.18	2.00	0.00	1.00	0.00	40.09	74.18	2.00	0.00	1.00	0.00
40.14	74.71	2.00	0.00	1.00	0.00	40.22	74.78	2.00	0.00	1.00	0.00
40.27	75.01	2.00	0.00	1.00	0.00	40.33	75.06	2.00	0.00	1.00	0.00
40.40	74.90	2.00	0.00	1.00	0.00	40.45	74.62	2.00	0.00	1.00	0.00
40.52	73.83	2.00	0.00	1.00	0.00	40.58	73.24	2.00	0.00	1.00	0.00
40.65	74.56	2.00	0.00	1.00	0.00	40.71	80.23	2.00	0.00	1.00	0.00
40.80	86.23	2.00	0.00	1.00	0.00	40.83	93.34	2.00	0.00	1.00	0.00
40.92	97.43	2.00	0.00	1.00	0.00	40.96	101.53	2.00	0.00	1.00	0.00
41.01	104.31	2.00	0.00	1.00	0.00	41.11	106.04	2.00	0.00	1.00	0.00
41.16	107.17	2.00	0.00	1.00	0.00	41.26	108.53	2.00	0.00	1.00	0.00
41.31	110.93	2.00	0.00	1.00	0.00	41.35	117.75	2.00	0.00	1.00	0.00
41.45	124.01	2.00	0.00	1.00	0.00	41.50	128.72	2.00	0.00	1.00	0.00
41.56	128.24	2.00	0.00	1.00	0.00	41.62	127.08	2.00	0.00	1.00	0.00
41.71	127.47	2.00	0.00	1.00	0.00	41.75	130.44	2.00	0.00	1.00	0.00
41.82	135.82	2.00	0.00	1.00	0.00	41.89	141.25	2.00	0.00	1.00	0.00
41.93	146.69	2.00	0.00	1.00	0.00	42.00	153.60	2.00	0.00	1.00	0.00
42.06	160.04	2.00	0.00	1.00	0.00	42.24	163.11	2.00	0.00	1.00	0.00
42.28	163.76	2.00	0.00	1.00	0.00	42.35	162.54	2.00	0.00	1.00	0.00
42.42	161.31	2.00	0.00	1.00	0.00	42.47	160.22	2.00	0.00	1.00	0.00
42.53	158.88	2.00	0.00	1.00	0.00	42.64	157.43	2.00	0.00	1.00	0.00
42.72	155.94	2.00	0.00	1.00	0.00	42.77	154.93	2.00	0.00	1.00	0.00
42.83	153.87	2.00	0.00	1.00	0.00	42.90	152.88	2.00	0.00	1.00	0.00
42.94	150.90	2.00	0.00	1.00	0.00	43.08	148.57	2.00	0.00	1.00	0.00
43.12	145.82	2.00	0.00	1.00	0.00	43.18	143.11	2.00	0.00	1.00	0.00
43.25	140.49	2.00	0.00	1.00	0.00	43.30	134.75	2.00	0.00	1.00	0.00
43.37	130.21	2.00	0.00	1.00	0.00	43.48	126.20	2.00	0.00	1.00	0.00
43.56	126.90	2.00	0.00	1.00	0.00	43.60	127.91	2.00	0.00	1.00	0.00
43.67	129.29	2.00	0.00	1.00	0.00	43.70	130.67	2.00	0.00	1.00	0.00
43.71	132.62	2.00	0.00	1.00	0.00	43.80	134.16	2.00	0.00	1.00	0.00
43.91	135.52	2.00	0.00	1.00	0.00	43.96	136.31	2.00	0.00	1.00	0.00
44.01	137.44	2.00	0.00	1.00	0.00	44.05	139.22	2.00	0.00	1.00	0.00
44.10	141.33	2.00	0.00	1.00	0.00	44.19	143.27	2.00	0.00	1.00	0.00
44.23	145.73	2.00	0.00	1.00	0.00	44.33	147.96	2.00	0.00	1.00	0.00
44.37	151.33	2.00	0.00	1.00	0.00	44.47	154.32	2.00	0.00	1.00	0.00
44.54	157.38	2.00	0.00	1.00	0.00	44.59	159.74	2.00	0.00	1.00	0.00
44.65	161.86	2.00	0.00	1.00	0.00	44.72	163.70	2.00	0.00	1.00	0.00
44.76	165.33	2.00	0.00	1.00	0.00	44.83	166.47	2.00	0.00	1.00	0.00
44.89	167.20	2.00	0.00	1.00	0.00	45.00	167.17	2.00	0.00	1.00	0.00
45.07	166.93	2.00	0.00	1.00	0.00	45.13	166.50	2.00	0.00	1.00	0.00
45.20	165.95	2.00	0.00	1.00	0.00	45.24	165.12	2.00	0.00	1.00	0.00
45.30	164.13	1.03	0.56	1.00	0.00	45.38	163.21	1.02	0.56	1.00	0.01
45.43	162.62	1.01	0.56	1.00	0.00	45.49	162.10	1.00	0.56	1.00	0.00
45.56	161.01	0.98	0.57	1.00	0.00	45.66	159.36	0.96	0.57	1.00	0.01
45.73	157.09	0.93	0.80	1.00	0.01	45.78	154.78	0.89	0.82	1.00	0.01
45.84	152.31	0.86	0.84	1.00	0.01	45.90	150.11	0.83	1.12	1.00	0.01
45.95	147.90	0.80	1.15	1.00	0.01	46.08	146.61	0.78	1.16	1.00	0.02

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
46.13	146.71	0.79	1.16	1.00	0.01	46.18	148.95	0.81	1.14	1.00	0.01
46.25	149.02	0.82	1.13	1.00	0.01	46.35	151.72	0.85	0.85	1.00	0.01
46.41	155.61	0.91	0.81	1.00	0.01	46.48	160.86	0.98	0.57	1.00	0.00
46.53	164.55	1.04	0.56	1.00	0.00	46.57	166.53	1.07	0.40	1.00	0.00
46.62	167.39	1.09	0.39	1.00	0.00	46.68	167.31	1.08	0.39	1.00	0.00
46.77	167.19	1.08	0.39	1.00	0.00	46.82	167.05	1.08	0.39	1.00	0.00
46.87	166.76	1.08	0.40	1.00	0.00	46.95	166.25	1.07	0.40	1.00	0.00
46.99	165.97	1.06	0.40	1.00	0.00	47.08	166.09	1.07	0.40	1.00	0.00
47.13	166.67	1.07	0.40	1.00	0.00	47.22	166.98	1.08	0.40	1.00	0.00
47.26	165.71	1.06	0.40	1.00	0.00	47.39	163.56	1.03	0.56	1.00	0.01
47.44	160.26	0.97	0.57	1.00	0.00	47.55	157.71	0.94	0.80	1.00	0.01
47.61	155.09	0.90	0.82	1.00	0.01	47.66	153.30	0.87	0.83	1.00	0.00
47.70	151.67	0.85	0.85	1.00	0.00	47.76	150.35	0.83	1.12	1.00	0.01
47.83	149.16	2.00	0.00	1.00	0.00	47.93	147.96	2.00	0.00	1.00	0.00
47.99	146.79	2.00	0.00	1.00	0.00	48.05	145.60	2.00	0.00	1.00	0.00
48.10	144.55	2.00	0.00	1.00	0.00	48.17	143.62	2.00	0.00	1.00	0.00
48.23	142.99	2.00	0.00	1.00	0.00	48.28	142.30	2.00	0.00	1.00	0.00
48.33	141.23	2.00	0.00	1.00	0.00	48.41	139.06	2.00	0.00	1.00	0.00
48.46	135.58	2.00	0.00	1.00	0.00	48.51	130.65	2.00	0.00	1.00	0.00
48.58	125.33	2.00	0.00	1.00	0.00	48.63	120.02	2.00	0.00	1.00	0.00
48.76	117.53	2.00	0.00	1.00	0.00	48.81	117.93	2.00	0.00	1.00	0.00
48.87	118.42	2.00	0.00	1.00	0.00	48.94	117.33	2.00	0.00	1.00	0.00
48.99	115.35	2.00	0.00	1.00	0.00	49.07	114.73	2.00	0.00	1.00	0.00
49.12	116.23	2.00	0.00	1.00	0.00	49.16	118.22	2.00	0.00	1.00	0.00
49.23	120.23	2.00	0.00	1.00	0.00	49.29	122.65	2.00	0.00	1.00	0.00
49.38	123.72	2.00	0.00	1.00	0.00	49.43	123.83	2.00	0.00	1.00	0.00
49.52	123.85	2.00	0.00	1.00	0.00	49.59	123.30	2.00	0.00	1.00	0.00
49.64	122.30	0.53	1.98	1.00	0.01	49.69	122.43	0.53	1.98	1.00	0.01
49.74	123.07	0.54	1.97	1.00	0.01						

Total estimated settlement: 0.24

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

GeoTek, Inc.
1548 N. Maple Street
Corona, CA 92880
http://www.geotekusa.com

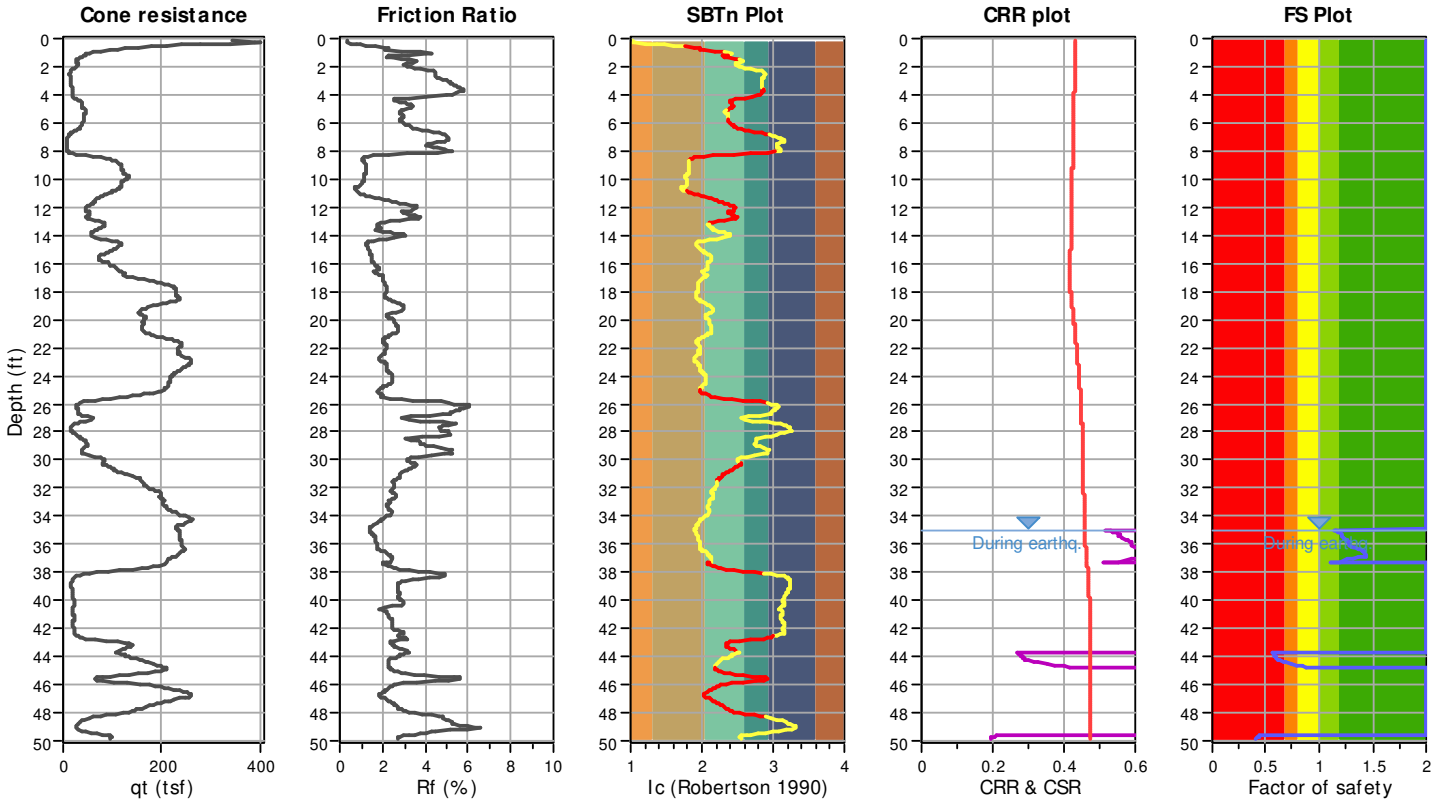
LIQUEFACTION ANALYSIS REPORT

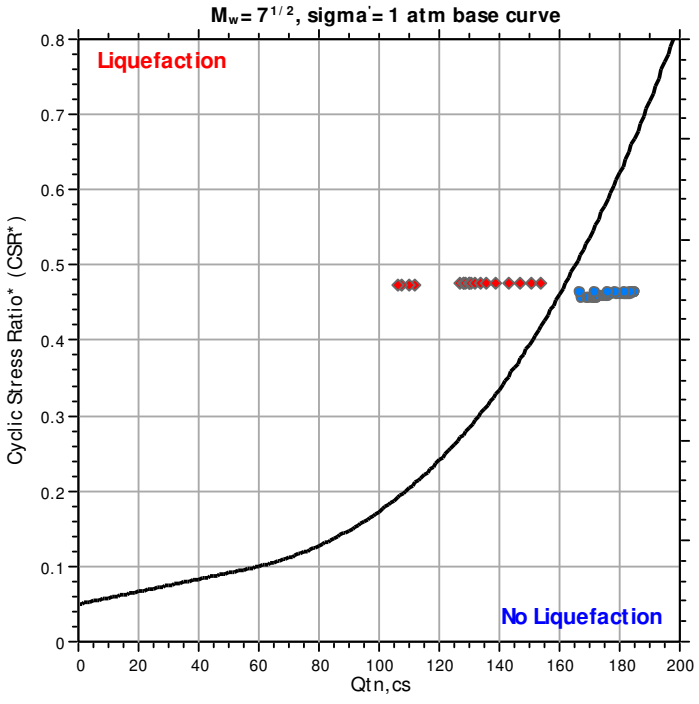
Project title : Proposed Townhouses **Location : 2323 West Broadway, Anaheim, CA**

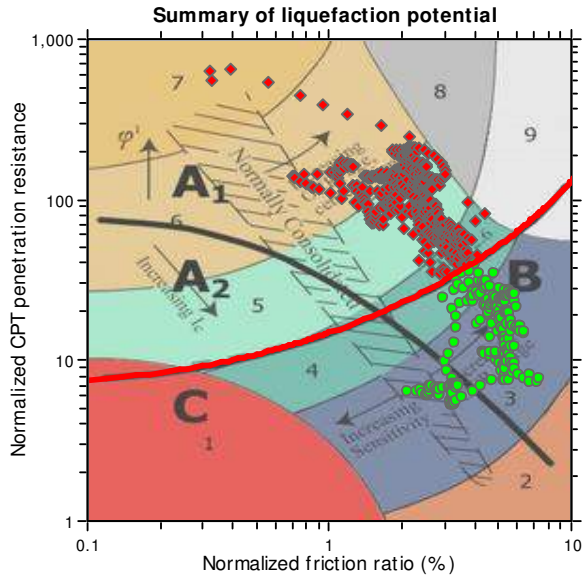
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	46.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	35.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.67	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.69	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

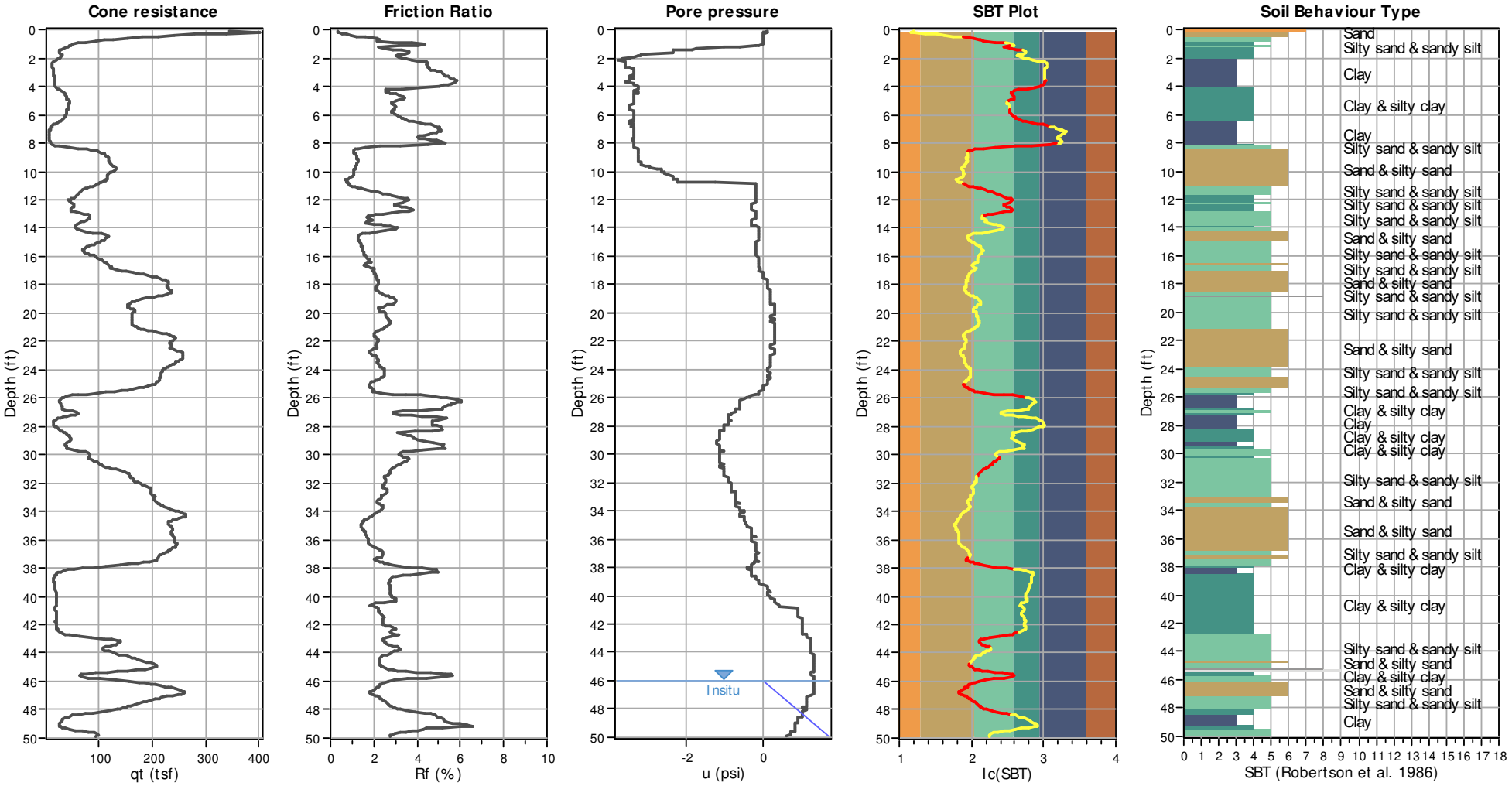






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



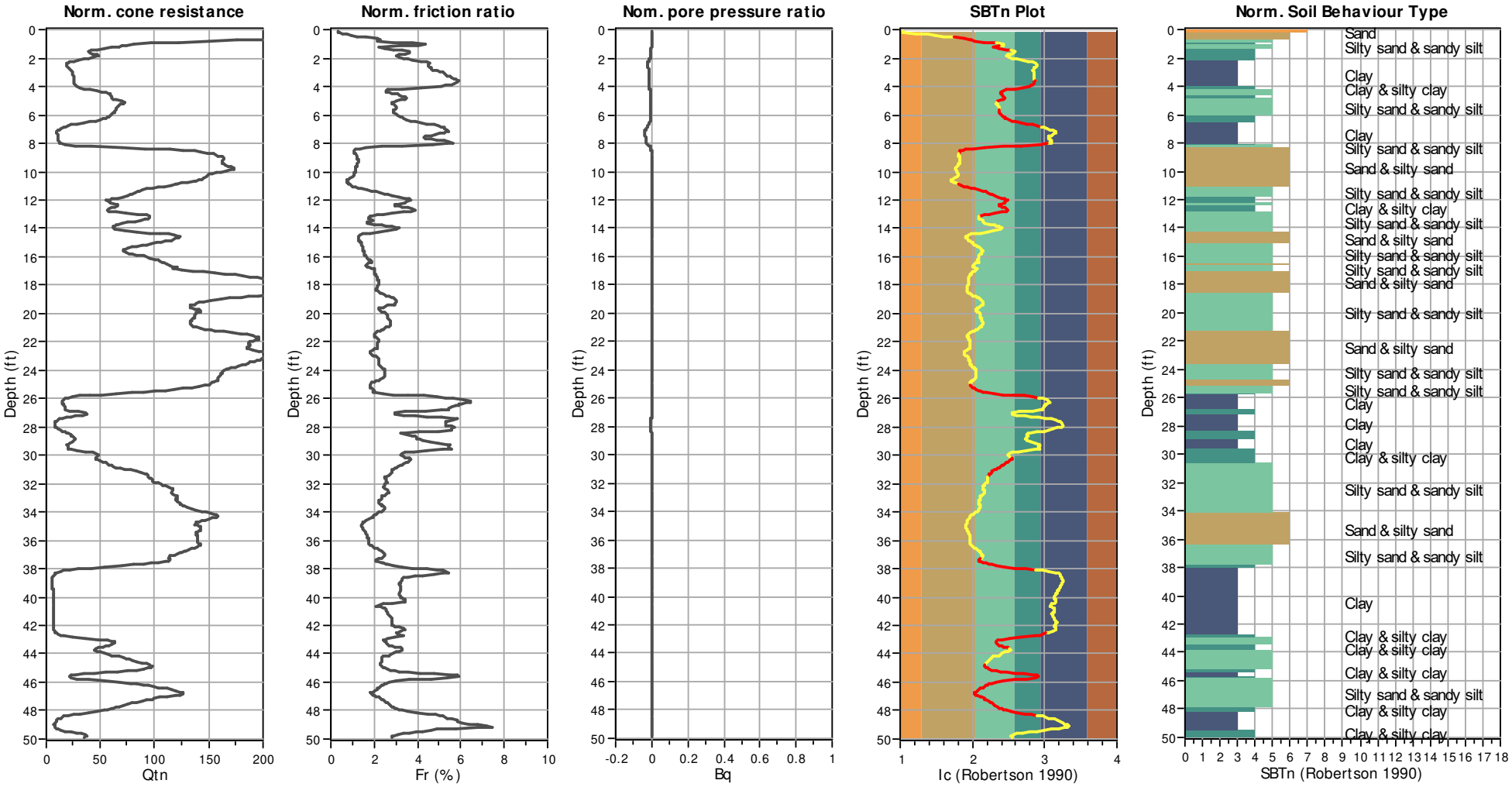
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



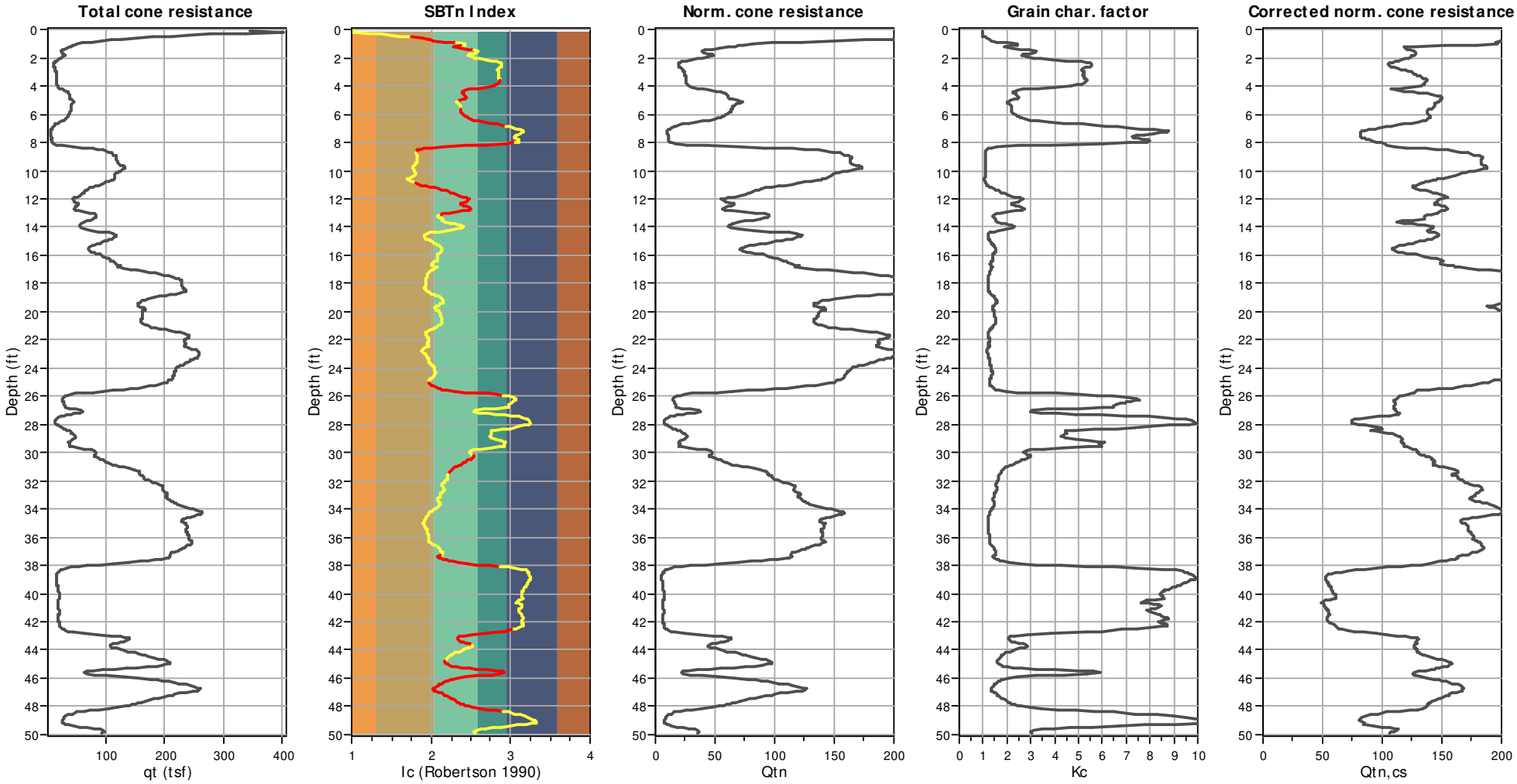
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

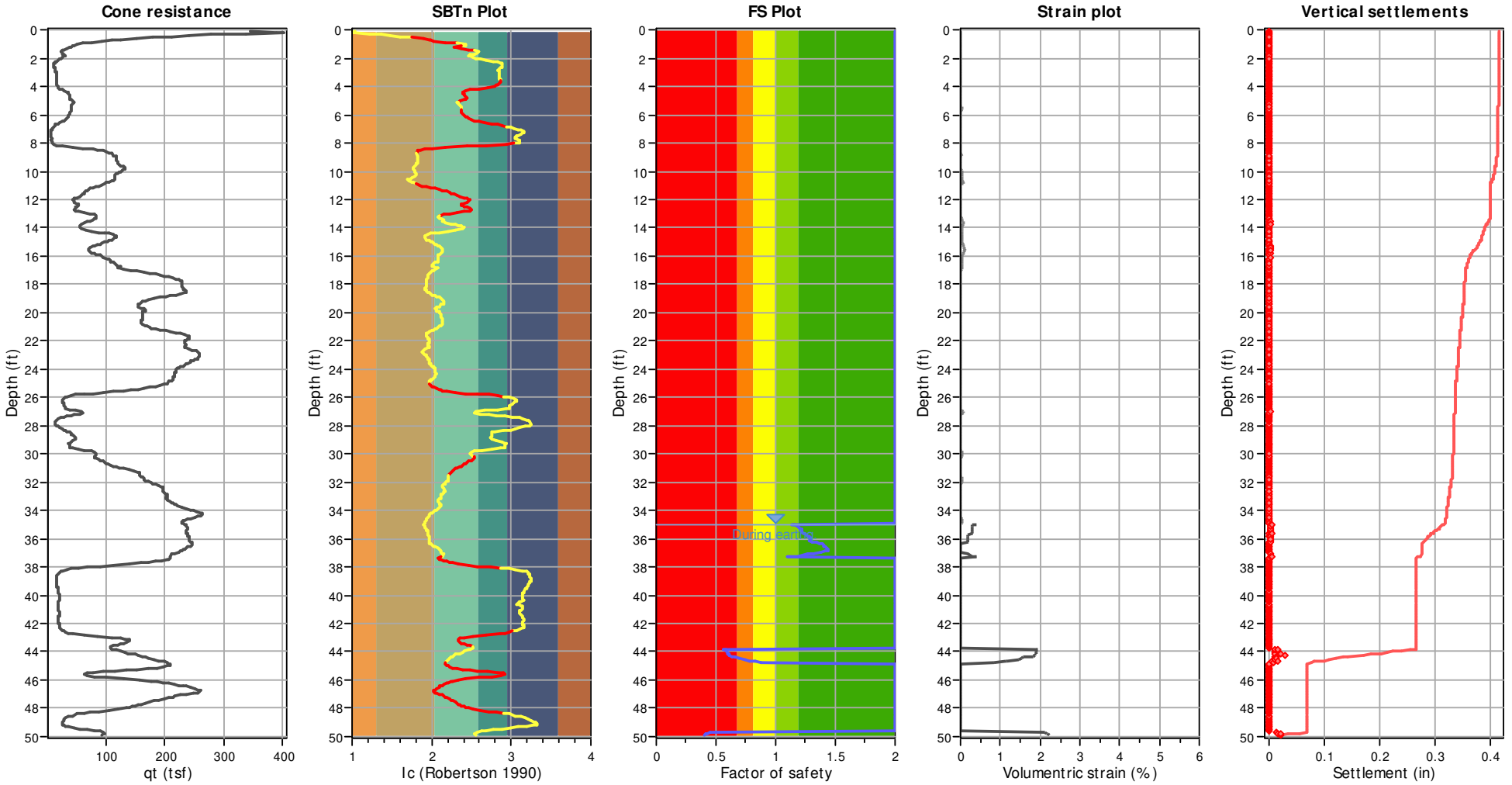
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.08	1.03	554.80	1.00	554.80	84	1149	0.43	0.000	0.00	8.42	0.00	0.000
0.15	0.99	625.46	1.00	625.46	94	1230	0.43	0.000	0.00	8.42	0.00	0.000
0.21	1.05	645.01	1.00	645.01	98	1358	0.43	0.000	0.00	8.42	0.00	0.000
0.29	1.22	543.49	1.00	543.49	87	1421	0.43	0.001	0.00	8.42	0.00	0.000
0.33	1.37	446.94	1.00	446.94	75	1424	0.43	0.001	0.00	8.42	0.00	0.000
0.40	1.48	387.27	1.00	387.27	67	1421	0.43	0.001	0.00	8.42	0.00	0.000
0.49	1.60	338.16	1.00	338.16	61	1441	0.43	0.001	0.00	8.42	0.00	0.000
0.53	1.75	289.59	1.07	310.61	59	1490	0.43	0.001	0.00	8.42	0.00	0.000
0.61	1.89	244.57	1.18	288.07	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.66	1.96	201.98	1.25	253.32	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.75	1.98	176.38	1.28	225.15	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.80	2.02	149.90	1.33	198.97	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.87	2.17	121.61	1.61	195.40	0	0	0.43	0.000	0.00	8.42	0.00	0.000
0.93	2.33	97.18	2.03	197.71	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.01	2.43	81.11	2.43	196.71	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.07	2.43	73.71	2.42	178.72	45	892	0.43	0.004	0.00	8.42	0.00	0.000
1.16	2.37	69.46	2.19	152.18	37	782	0.43	0.006	0.00	8.42	0.00	0.000
1.20	2.29	66.68	1.91	127.06	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.25	2.30	60.53	1.96	118.67	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.35	2.37	54.19	2.20	119.08	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.41	2.46	47.02	2.58	121.17	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.45	2.53	41.99	2.95	123.68	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.54	2.59	38.82	3.26	126.54	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.59	2.58	40.07	3.20	128.25	34	588	0.43	0.013	0.01	8.42	0.01	0.000
1.68	2.53	43.61	2.95	128.46	34	605	0.43	0.013	0.01	8.42	0.01	0.000
1.73	2.49	47.25	2.70	127.60	33	617	0.43	0.013	0.01	8.42	0.01	0.000
1.81	2.47	48.56	2.60	126.25	32	617	0.43	0.014	0.01	8.42	0.01	0.000
1.84	2.48	47.09	2.65	124.93	32	607	0.43	0.015	0.01	8.42	0.01	0.000
1.91	2.51	43.53	2.84	123.79	32	589	0.43	0.017	0.01	8.42	0.01	0.000
1.99	2.56	39.58	3.09	122.18	32	567	0.43	0.019	0.01	8.42	0.01	0.000
2.04	2.61	35.09	3.41	119.82	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.12	2.68	30.03	3.88	116.38	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.25	2.77	25.10	4.51	113.26	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.29	2.84	21.59	5.11	110.42	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.34	2.87	20.18	5.38	108.56	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.39	2.88	19.34	5.51	106.64	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.46	2.88	19.04	5.53	105.37	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.52	2.88	19.09	5.53	105.62	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.65	2.88	19.66	5.47	107.49	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.70	2.86	20.73	5.32	110.26	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.75	2.84	21.99	5.16	113.47	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.82	2.84	22.81	5.10	116.41	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.88	2.84	23.34	5.12	119.56	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.94	2.85	23.58	5.19	122.26	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.00	2.85	23.86	5.21	124.40	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.06	2.85	24.05	5.23	125.87	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.13	2.85	24.34	5.21	126.89	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.18	2.85	24.68	5.20	128.23	0	0	0.43	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
3.27	2.85	24.96	5.19	129.57	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.31	2.85	25.15	5.22	131.28	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.38	2.85	25.34	5.24	132.85	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.44	2.86	25.53	5.27	134.58	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.50	2.86	25.67	5.31	136.20	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.57	2.86	25.72	5.34	137.38	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.62	2.86	25.71	5.35	137.66	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.68	2.86	25.71	5.33	137.00	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.75	2.85	25.99	5.23	135.94	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.88	2.84	26.41	5.11	134.95	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.93	2.82	27.19	4.92	133.86	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.99	2.79	28.20	4.72	133.09	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.06	2.70	30.83	4.00	123.40	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.18	2.60	34.86	3.30	114.94	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.23	2.48	40.49	2.66	107.79	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.30	2.43	46.33	2.44	112.84	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.37	2.40	51.57	2.30	118.66	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.42	2.39	55.32	2.27	125.36	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.49	2.39	57.09	2.28	129.99	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.50	2.40	57.67	2.32	133.88	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.55	2.41	58.63	2.35	137.74	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.63	2.42	59.62	2.38	141.98	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.66	2.43	60.50	2.42	146.31	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.74	2.43	60.47	2.46	148.55	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.80	2.44	60.41	2.48	149.99	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.90	2.43	61.72	2.42	149.65	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.95	2.40	64.46	2.31	149.02	0	0	0.43	0.000	0.00	8.42	0.00	0.000
4.99	2.36	69.18	2.14	148.36	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.08	2.33	72.24	2.05	147.95	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.13	2.32	72.77	2.01	146.57	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.21	2.33	70.91	2.04	144.82	34	758	0.43	0.041	0.02	8.42	0.02	0.000
5.26	2.34	68.57	2.09	143.35	34	745	0.43	0.043	0.02	8.42	0.02	0.000
5.32	2.36	66.71	2.15	143.57	35	741	0.43	0.044	0.02	8.42	0.02	0.000
5.42	2.37	65.39	2.20	144.03	35	739	0.43	0.046	0.02	8.42	0.02	0.000
5.46	2.37	65.19	2.21	143.94	35	738	0.43	0.047	0.02	8.42	0.02	0.000
5.51	2.37	65.04	2.20	142.84	35	733	0.43	0.048	0.03	8.42	0.02	0.000
5.60	2.37	64.69	2.19	141.38	34	727	0.43	0.051	0.03	8.42	0.02	0.000
5.65	2.37	64.00	2.18	139.55	34	718	0.43	0.054	0.03	8.42	0.02	0.000
5.74	2.36	63.61	2.17	138.18	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.79	2.37	62.87	2.19	137.43	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.87	2.38	61.99	2.22	137.49	0	0	0.43	0.000	0.00	8.42	0.00	0.000
5.92	2.39	60.53	2.28	138.29	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.06	2.41	59.05	2.36	139.22	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.10	2.43	57.49	2.44	140.30	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.15	2.44	56.27	2.50	140.47	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.21	2.46	54.76	2.56	140.19	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.25	2.47	53.00	2.63	139.28	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.32	2.50	49.59	2.78	137.98	0	0	0.43	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
6.40	2.54	45.49	3.00	136.34	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.46	2.60	40.38	3.32	134.03	0	0	0.43	0.000	0.00	8.42	0.00	0.000
6.53	2.67	34.34	3.79	130.09	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.63	2.75	28.44	4.37	124.31	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.70	2.84	23.17	5.10	118.15	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.75	2.89	20.01	5.63	112.58	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.82	2.94	17.52	6.15	107.75	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.89	2.99	15.52	6.65	103.16	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.94	3.03	13.86	7.08	98.12	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.02	3.08	12.25	7.65	93.74	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.07	3.12	10.88	8.16	88.77	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.14	3.15	9.90	8.62	85.37	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.20	3.16	9.46	8.76	82.81	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.26	3.16	9.40	8.72	81.94	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.32	3.14	9.64	8.48	81.75	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.37	3.12	10.07	8.14	82.00	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.46	3.09	10.55	7.77	82.00	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.50	3.06	10.99	7.44	81.80	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.56	3.05	11.27	7.28	82.03	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.64	3.05	11.36	7.31	83.02	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.69	3.06	11.36	7.49	85.08	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.75	3.08	11.30	7.68	86.86	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.81	3.10	11.30	7.90	89.27	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.93	3.10	11.53	7.97	91.89	0	0	0.42	0.000	0.00	0.00	0.00	0.000
7.98	3.10	12.07	7.88	95.08	0	0	0.42	0.000	0.00	0.00	0.00	0.000
8.02	3.04	13.86	7.15	99.16	0	0	0.42	0.000	0.00	0.00	0.00	0.000
8.11	2.93	16.97	6.04	102.42	0	0	0.42	0.000	0.00	0.00	0.00	0.000
8.16	2.68	26.99	3.84	103.71	0	0	0.42	0.000	0.00	0.00	0.00	0.000
8.24	2.44	41.73	2.47	103.13	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.29	2.17	69.32	1.59	110.16	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.37	2.01	91.91	1.32	121.33	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.41	1.91	114.31	1.19	136.50	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.50	1.86	126.12	1.15	145.49	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.55	1.83	137.03	1.13	154.67	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.64	1.82	142.95	1.12	160.11	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.68	1.81	148.72	1.11	165.79	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.73	1.81	154.68	1.11	172.38	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.88	1.81	158.73	1.12	177.39	34	1008	0.42	0.046	0.02	8.42	0.02	0.001
8.94	1.82	162.69	1.12	182.00	35	1039	0.42	0.044	0.02	8.42	0.02	0.000
8.99	1.82	163.71	1.12	183.23	36	1050	0.42	0.043	0.02	8.42	0.02	0.000
9.03	1.82	164.38	1.12	183.82	36	1055	0.42	0.043	0.02	8.42	0.02	0.000
9.08	1.82	164.30	1.12	183.77	36	1059	0.42	0.043	0.02	8.42	0.02	0.000
9.12	1.82	163.89	1.12	183.72	36	1063	0.42	0.043	0.02	8.42	0.02	0.000
9.24	1.82	162.84	1.12	183.04	36	1068	0.42	0.043	0.02	8.42	0.02	0.000
9.29	1.82	162.88	1.12	183.19	36	1073	0.42	0.043	0.02	8.42	0.02	0.000
9.34	1.82	162.99	1.12	182.98	36	1074	0.42	0.044	0.02	8.42	0.02	0.000
9.39	1.82	163.04	1.12	182.48	35	1073	0.42	0.044	0.02	8.42	0.02	0.000
9.46	1.81	163.57	1.12	182.50	35	1076	0.42	0.044	0.02	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
9.55	1.81	164.65	1.11	182.87	35	1082	0.42	0.045	0.02	8.42	0.02	0.000
9.59	1.79	168.09	1.10	185.17	36	1093	0.42	0.044	0.02	8.42	0.02	0.000
9.67	1.78	170.87	1.09	186.70	36	1102	0.42	0.044	0.02	8.42	0.02	0.000
9.72	1.77	173.14	1.09	187.97	36	1109	0.42	0.043	0.02	8.42	0.02	0.000
9.81	1.77	172.74	1.08	187.28	36	1110	0.42	0.044	0.02	8.42	0.02	0.000
9.86	1.77	170.72	1.09	185.33	35	1102	0.42	0.045	0.02	8.42	0.02	0.000
9.95	1.78	166.39	1.09	181.58	35	1089	0.42	0.047	0.02	8.42	0.02	0.000
10.04	1.79	161.31	1.10	177.02	34	1071	0.42	0.049	0.03	8.42	0.02	0.000
10.09	1.79	156.88	1.10	172.98	33	1053	0.42	0.052	0.03	8.42	0.02	0.000
10.14	1.80	153.68	1.10	169.80	33	1037	0.42	0.054	0.03	8.42	0.02	0.000
10.18	1.80	150.86	1.11	166.80	32	1022	0.42	0.056	0.03	8.42	0.02	0.000
10.27	1.80	148.82	1.10	164.24	32	1010	0.42	0.059	0.03	8.42	0.03	0.001
10.40	1.79	147.11	1.10	161.30	31	996	0.42	0.062	0.04	8.42	0.03	0.001
10.46	1.75	145.46	1.07	156.18	30	954	0.42	0.070	0.04	8.42	0.03	0.001
10.53	1.72	143.01	1.05	150.70	28	912	0.42	0.080	0.05	8.42	0.04	0.001
10.58	1.70	140.56	1.04	145.98	27	877	0.42	0.090	0.06	8.42	0.05	0.001
10.66	1.71	138.87	1.04	144.80	27	876	0.42	0.092	0.06	8.42	0.05	0.001
10.71	1.71	136.73	1.05	143.24	27	872	0.42	0.094	0.07	8.42	0.05	0.001
10.77	1.74	130.03	1.07	138.83	26	858	0.42	0.099	0.07	8.42	0.06	0.001
10.80	1.77	125.29	1.09	136.08	26	852	0.42	0.102	0.07	8.42	0.06	0.000
10.86	1.80	121.04	1.10	133.68	26	849	0.42	0.104	0.08	8.42	0.06	0.001
10.91	1.81	119.95	1.11	133.42	0	0	0.42	0.000	0.00	8.42	0.00	0.000
10.98	1.84	115.46	1.13	130.96	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.03	1.89	109.13	1.18	128.25	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.12	1.93	103.06	1.22	126.06	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.16	1.99	97.46	1.28	125.20	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.22	2.04	93.05	1.35	125.69	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.30	2.09	88.99	1.44	128.46	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.39	2.14	86.20	1.53	132.09	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.43	2.18	84.07	1.62	136.45	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.51	2.22	81.80	1.71	139.83	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.60	2.25	79.48	1.80	142.89	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.64	2.28	77.55	1.88	145.63	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.69	2.31	75.08	1.99	149.11	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.76	2.36	70.94	2.15	152.49	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.85	2.41	66.06	2.34	154.59	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.90	2.45	60.41	2.55	153.73	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.99	2.46	58.76	2.56	150.50	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.02	2.49	55.27	2.70	149.21	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.12	2.46	57.08	2.57	146.87	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.23	2.44	58.47	2.49	145.76	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.27	2.38	63.94	2.24	143.49	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.31	2.36	66.11	2.17	143.35	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.36	2.36	66.43	2.17	144.09	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.42	2.38	65.52	2.24	147.03	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.49	2.41	63.60	2.35	149.59	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.54	2.45	60.60	2.52	152.58	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.62	2.48	58.04	2.65	153.60	0	0	0.42	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
12.67	2.49	56.49	2.74	154.54	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.80	2.47	57.94	2.63	152.66	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.84	2.41	63.90	2.35	150.28	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.92	2.32	73.93	2.00	147.77	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.98	2.23	84.62	1.73	146.53	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.03	2.16	92.00	1.57	144.71	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.09	2.12	95.25	1.48	141.23	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.15	2.09	95.54	1.44	137.86	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.21	2.09	94.84	1.43	135.67	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.28	2.10	93.38	1.45	135.07	29	1040	0.42	0.084	0.05	8.42	0.04	0.001
13.34	2.12	91.47	1.48	135.75	30	1046	0.42	0.084	0.05	8.42	0.04	0.001
13.41	2.15	87.38	1.55	135.09	30	1040	0.42	0.086	0.05	8.42	0.04	0.001
13.52	2.14	81.70	1.54	125.59	28	973	0.42	0.105	0.07	8.42	0.05	0.001
13.59	2.15	75.32	1.55	116.74	26	907	0.42	0.131	0.10	8.42	0.07	0.001
13.64	2.17	70.06	1.60	112.12	25	869	0.42	0.152	0.12	8.42	0.09	0.001
13.72	2.25	66.21	1.79	118.79	27	902	0.42	0.136	0.09	8.42	0.07	0.001
13.77	2.30	64.15	1.96	125.78	30	934	0.42	0.122	0.08	8.42	0.06	0.001
13.83	2.33	63.08	2.06	130.20	31	956	0.42	0.115	0.07	8.42	0.05	0.001
13.86	2.37	61.87	2.19	135.44	33	978	0.42	0.108	0.06	8.42	0.05	0.000
13.92	2.39	61.27	2.28	139.70	34	998	0.42	0.102	0.05	8.42	0.04	0.001
14.00	2.40	61.57	2.32	142.83	35	1019	0.42	0.098	0.05	8.42	0.04	0.001
14.08	2.38	63.64	2.25	142.99	35	1036	0.42	0.094	0.05	8.42	0.04	0.001
14.13	2.30	72.10	1.94	140.06	33	1065	0.42	0.088	0.05	8.42	0.04	0.000
14.26	2.20	82.59	1.67	138.18	31	1097	0.42	0.083	0.05	8.42	0.04	0.001
14.31	2.10	95.80	1.46	139.45	30	1130	0.42	0.077	0.05	8.42	0.04	0.000
14.36	2.04	104.82	1.35	141.71	30	1150	0.42	0.074	0.05	8.42	0.04	0.000
14.41	1.98	112.58	1.28	144.18	30	1163	0.42	0.073	0.04	8.42	0.03	0.000
14.45	1.94	118.47	1.23	146.22	30	1169	0.42	0.072	0.04	8.42	0.03	0.000
14.54	1.92	121.65	1.21	147.16	30	1173	0.42	0.072	0.04	8.42	0.03	0.001
14.61	1.91	122.94	1.20	147.38	30	1173	0.42	0.073	0.05	8.42	0.04	0.001
14.67	1.91	122.21	1.20	146.70	30	1171	0.42	0.074	0.05	8.42	0.04	0.000
14.71	1.92	119.27	1.21	144.55	29	1161	0.42	0.076	0.05	8.42	0.04	0.000
14.83	1.94	114.86	1.23	141.34	29	1148	0.42	0.079	0.05	8.42	0.04	0.001
14.89	1.96	109.92	1.25	137.90	28	1130	0.42	0.083	0.05	8.42	0.04	0.001
14.95	1.98	105.70	1.28	134.86	28	1113	0.42	0.086	0.06	8.42	0.04	0.001
15.02	2.00	101.41	1.30	131.73	27	1096	0.42	0.091	0.06	8.42	0.05	0.001
15.07	2.02	97.20	1.32	128.40	27	1074	0.42	0.097	0.07	8.42	0.05	0.001
15.15	2.04	92.71	1.35	125.06	26	1052	0.42	0.103	0.07	8.42	0.06	0.001
15.20	2.05	88.20	1.38	121.41	26	1026	0.42	0.112	0.08	8.42	0.06	0.001
15.28	2.08	83.50	1.41	117.88	25	1001	0.42	0.121	0.09	8.42	0.07	0.001
15.33	2.09	79.28	1.44	114.53	25	974	0.42	0.132	0.10	8.42	0.08	0.001
15.41	2.11	75.60	1.48	111.78	24	953	0.42	0.143	0.11	8.42	0.09	0.002
15.46	2.13	72.94	1.50	109.66	24	936	0.42	0.152	0.12	8.42	0.09	0.001
15.52	2.13	71.36	1.52	108.41	24	928	0.42	0.158	0.13	8.42	0.10	0.001
15.59	2.14	70.95	1.53	108.39	24	930	0.42	0.158	0.13	8.42	0.10	0.002
15.64	2.14	71.75	1.53	109.49	24	942	0.42	0.153	0.12	8.42	0.09	0.001
15.69	2.13	73.55	1.52	111.55	24	962	0.42	0.144	0.11	8.42	0.09	0.001
15.77	2.12	76.23	1.50	114.00	25	987	0.42	0.134	0.10	8.42	0.08	0.001

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
15.82	2.11	79.83	1.47	117.38	25	1020	0.42	0.122	0.09	8.42	0.07	0.001
15.89	2.09	83.68	1.45	120.97	26	1055	0.42	0.112	0.08	8.42	0.06	0.001
15.95	2.08	89.89	1.42	128.09	28	1119	0.42	0.095	0.06	8.42	0.05	0.001
16.12	2.08	95.15	1.42	134.77	29	1186	0.42	0.083	0.05	8.42	0.04	0.002
16.20	2.08	100.40	1.41	141.81	30	1252	0.42	0.074	0.04	8.42	0.03	0.001
16.26	2.08	102.92	1.41	145.47	31	1288	0.42	0.069	0.04	8.42	0.03	0.000
16.32	2.08	105.05	1.42	148.79	32	1321	0.42	0.066	0.04	8.42	0.03	0.000
16.39	2.08	106.86	1.42	151.44	33	1348	0.42	0.063	0.04	8.42	0.03	0.000
16.43	2.05	109.31	1.37	149.74	32	1332	0.42	0.065	0.04	8.42	0.03	0.000
16.56	2.02	111.57	1.33	148.40	31	1322	0.42	0.067	0.04	8.42	0.03	0.001
16.61	2.00	114.58	1.30	149.36	31	1328	0.42	0.067	0.04	8.42	0.03	0.000
16.70	2.01	117.20	1.32	154.59	32	1383	0.42	0.062	0.03	8.42	0.03	0.001
16.74	2.02	120.30	1.33	159.75	34	1433	0.42	0.057	0.03	8.42	0.02	0.000
16.81	2.04	118.33	1.36	161.00	34	1454	0.42	0.056	0.03	8.42	0.02	0.000
16.83	2.07	116.53	1.39	162.54	35	1473	0.42	0.055	0.03	8.42	0.02	0.000
16.87	2.07	117.66	1.40	165.13	35	1500	0.42	0.053	0.03	8.42	0.02	0.000
16.93	2.05	125.38	1.37	171.87	36	1562	0.42	0.049	0.02	8.42	0.02	0.000
17.01	2.02	135.41	1.33	180.58	38	1640	0.42	0.045	0.02	8.42	0.02	0.000
17.06	2.01	145.36	1.31	190.57	40	1728	0.42	0.041	0.02	8.42	0.01	0.000
17.15	1.99	156.17	1.29	200.94	42	1820	0.42	0.038	0.02	8.42	0.01	0.000
17.23	1.98	165.31	1.27	210.08	43	1902	0.42	0.035	0.01	8.42	0.01	0.000
17.28	1.97	173.97	1.26	219.04	45	1980	0.42	0.033	0.01	8.42	0.01	0.000
17.36	1.96	181.42	1.25	226.90	47	2053	0.42	0.032	0.01	8.42	0.01	0.000
17.42	1.95	188.52	1.24	234.43	48	2122	0.42	0.030	0.01	8.42	0.01	0.000
17.47	1.95	195.02	1.24	241.24	49	2182	0.42	0.029	0.01	8.42	0.01	0.000
17.54	1.94	200.59	1.23	247.38	50	2241	0.42	0.028	0.01	8.42	0.01	0.000
17.63	1.94	205.63	1.23	252.96	51	2297	0.42	0.027	0.01	8.42	0.01	0.000
17.67	1.94	209.54	1.23	257.58	52	2342	0.42	0.027	0.01	8.42	0.01	0.000
17.73	1.94	211.60	1.23	260.40	53	2374	0.42	0.026	0.01	8.42	0.01	0.000
17.78	1.94	213.17	1.23	262.36	53	2398	0.42	0.026	0.01	8.42	0.01	0.000
17.87	1.94	213.14	1.23	262.24	53	2404	0.42	0.026	0.01	8.42	0.01	0.000
17.94	1.94	212.63	1.23	261.08	53	2397	0.42	0.026	0.01	8.42	0.01	0.000
17.98	1.94	211.29	1.23	258.90	53	2379	0.42	0.027	0.01	8.42	0.01	0.000
18.07	1.93	210.30	1.22	256.84	52	2364	0.42	0.027	0.01	8.42	0.01	0.000
18.14	1.93	209.62	1.22	255.19	52	2352	0.42	0.027	0.01	8.42	0.01	0.000
18.21	1.93	209.85	1.21	254.63	52	2348	0.42	0.028	0.01	8.42	0.01	0.000
18.25	1.92	210.67	1.21	255.02	52	2353	0.42	0.028	0.01	8.42	0.01	0.000
18.33	1.92	211.82	1.21	256.00	52	2366	0.42	0.027	0.01	8.42	0.01	0.000
18.38	1.92	213.27	1.21	258.62	52	2399	0.42	0.027	0.01	8.42	0.01	0.000
18.49	1.93	213.14	1.22	260.60	53	2438	0.42	0.027	0.01	8.42	0.01	0.000
18.53	1.95	212.61	1.24	262.79	54	2475	0.42	0.026	0.01	8.42	0.01	0.000
18.57	1.96	210.28	1.25	263.43	54	2500	0.42	0.026	0.01	8.42	0.01	0.000
18.65	1.98	204.49	1.28	261.70	54	2510	0.42	0.026	0.01	8.42	0.01	0.000
18.75	2.01	196.25	1.32	258.22	54	2507	0.42	0.026	0.01	8.42	0.01	0.000
18.81	2.04	187.13	1.36	253.74	54	2485	0.42	0.027	0.01	8.42	0.01	0.000
18.86	2.06	179.22	1.39	249.60	53	2459	0.42	0.027	0.01	8.42	0.01	0.000
18.90	2.09	169.76	1.44	243.75	53	2412	0.42	0.028	0.01	8.42	0.01	0.000
19.01	2.11	160.53	1.48	237.02	52	2359	0.42	0.029	0.01	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
19.08	2.13	151.24	1.52	229.70	50	2292	0.42	0.030	0.01	8.42	0.01	0.000
19.17	2.15	145.19	1.54	224.01	49	2242	0.42	0.032	0.01	8.42	0.01	0.000
19.23	2.15	140.65	1.56	219.29	48	2199	0.42	0.033	0.01	8.42	0.01	0.000
19.29	2.15	138.31	1.56	215.69	48	2168	0.42	0.034	0.01	8.42	0.01	0.000
19.35	2.15	136.39	1.56	212.37	47	2140	0.42	0.034	0.01	8.42	0.01	0.000
19.39	2.15	134.85	1.55	209.04	46	2110	0.42	0.035	0.01	8.42	0.01	0.000
19.44	2.12	133.46	1.50	199.94	44	2023	0.43	0.038	0.01	8.42	0.01	0.000
19.57	2.10	132.72	1.45	192.15	42	1951	0.43	0.041	0.02	8.42	0.01	0.000
19.62	2.07	134.14	1.40	187.37	40	1900	0.43	0.043	0.02	8.42	0.01	0.000
19.69	2.06	137.30	1.39	190.42	41	1934	0.43	0.042	0.02	8.42	0.01	0.000
19.74	2.05	141.30	1.37	193.98	41	1971	0.43	0.040	0.02	8.42	0.01	0.000
19.79	2.05	142.92	1.38	196.57	42	2002	0.43	0.040	0.02	8.42	0.01	0.000
19.87	2.06	142.26	1.39	197.76	42	2022	0.43	0.039	0.02	8.42	0.01	0.000
19.89	2.08	140.27	1.42	198.79	43	2039	0.43	0.039	0.02	8.42	0.01	0.000
19.95	2.09	138.84	1.44	199.85	43	2058	0.43	0.038	0.02	8.42	0.01	0.000
20.03	2.10	137.65	1.46	200.90	44	2077	0.43	0.038	0.01	8.42	0.01	0.000
20.08	2.11	136.91	1.47	201.39	44	2087	0.43	0.038	0.01	8.42	0.01	0.000
20.17	2.11	136.39	1.47	201.08	44	2090	0.43	0.038	0.01	8.42	0.01	0.000
20.21	2.11	136.48	1.47	201.19	44	2095	0.43	0.038	0.01	8.42	0.01	0.000
20.30	2.11	136.39	1.48	201.47	44	2104	0.43	0.038	0.01	8.42	0.01	0.000
20.36	2.12	135.85	1.49	202.28	44	2118	0.43	0.037	0.01	8.42	0.01	0.000
20.46	2.13	134.80	1.50	202.61	44	2130	0.43	0.037	0.01	8.42	0.01	0.000
20.48	2.13	134.00	1.52	203.09	45	2137	0.43	0.037	0.01	8.42	0.01	0.000
20.57	2.14	133.35	1.52	203.05	45	2143	0.43	0.037	0.01	8.42	0.01	0.000
20.61	2.14	132.98	1.53	203.41	45	2150	0.43	0.037	0.01	8.42	0.01	0.000
20.70	2.14	132.41	1.54	203.43	45	2158	0.43	0.037	0.01	8.42	0.01	0.000
20.74	2.14	132.43	1.54	203.45	45	2161	0.43	0.037	0.01	8.42	0.01	0.000
20.82	2.13	133.92	1.52	203.12	45	2164	0.43	0.037	0.01	8.42	0.01	0.000
20.93	2.12	135.99	1.49	202.72	44	2167	0.43	0.038	0.01	8.42	0.01	0.000
20.97	2.10	138.90	1.46	202.92	44	2169	0.43	0.038	0.01	8.42	0.01	0.000
21.01	2.09	142.10	1.43	203.46	44	2174	0.43	0.037	0.01	8.42	0.01	0.000
21.10	2.07	145.67	1.40	204.37	44	2185	0.43	0.037	0.01	8.42	0.01	0.000
21.14	2.05	151.18	1.37	206.47	44	2200	0.43	0.037	0.01	8.42	0.01	0.000
21.23	2.03	155.98	1.34	208.63	44	2219	0.43	0.037	0.01	8.42	0.01	0.000
21.27	2.00	164.25	1.30	213.09	44	2249	0.43	0.036	0.01	8.42	0.01	0.000
21.38	1.97	171.27	1.27	217.27	45	2282	0.43	0.036	0.01	8.42	0.01	0.000
21.43	1.95	180.06	1.24	223.22	46	2322	0.43	0.035	0.01	8.42	0.01	0.000
21.49	1.94	185.21	1.23	227.21	46	2355	0.43	0.034	0.01	8.42	0.01	0.000
21.54	1.93	190.77	1.22	232.64	47	2407	0.43	0.033	0.01	8.42	0.01	0.000
21.62	1.93	193.80	1.22	236.62	48	2456	0.43	0.032	0.01	8.42	0.01	0.000
21.67	1.94	196.37	1.23	241.21	49	2516	0.43	0.031	0.01	8.42	0.01	0.000
21.80	1.95	196.21	1.24	242.80	50	2553	0.43	0.031	0.01	8.42	0.01	0.000
21.83	1.96	195.39	1.25	243.57	50	2573	0.43	0.030	0.01	8.42	0.01	0.000
21.88	1.96	193.42	1.25	242.33	50	2571	0.43	0.031	0.01	8.42	0.01	0.000
21.92	1.97	190.79	1.26	240.18	49	2557	0.44	0.031	0.01	8.42	0.01	0.000
22.01	1.97	188.28	1.26	237.46	49	2537	0.44	0.031	0.01	8.42	0.01	0.000
22.08	1.97	186.94	1.26	235.11	48	2514	0.44	0.032	0.01	8.42	0.01	0.000
22.16	1.96	186.87	1.25	234.02	48	2503	0.44	0.032	0.01	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
22.19	1.96	187.44	1.25	233.86	48	2500	0.44	0.032	0.01	8.42	0.01	0.000
22.25	1.96	187.38	1.25	233.69	48	2502	0.44	0.033	0.01	8.42	0.01	0.000
22.33	1.96	186.87	1.25	233.26	48	2505	0.44	0.033	0.01	8.42	0.01	0.000
22.38	1.96	185.87	1.25	232.81	48	2508	0.44	0.033	0.01	8.42	0.01	0.000
22.46	1.96	184.90	1.25	232.00	48	2507	0.44	0.033	0.01	8.42	0.01	0.000
22.51	1.94	186.63	1.23	230.30	47	2471	0.44	0.034	0.01	8.42	0.01	0.000
22.61	1.92	190.33	1.21	230.20	47	2448	0.44	0.034	0.01	8.42	0.01	0.000
22.68	1.90	195.62	1.19	231.82	46	2435	0.44	0.035	0.01	8.42	0.01	0.000
22.73	1.89	200.05	1.18	235.59	47	2465	0.44	0.034	0.01	8.42	0.01	0.000
22.78	1.88	202.77	1.17	238.23	47	2492	0.44	0.034	0.01	8.42	0.01	0.000
22.85	1.89	203.71	1.18	240.79	48	2536	0.44	0.033	0.01	8.42	0.01	0.000
22.95	1.91	203.16	1.19	242.64	49	2583	0.44	0.032	0.01	8.42	0.01	0.000
22.99	1.92	202.62	1.21	244.63	49	2627	0.44	0.032	0.01	8.42	0.01	0.000
23.04	1.93	201.90	1.22	246.08	50	2662	0.44	0.031	0.01	8.42	0.01	0.000
23.12	1.94	200.78	1.23	246.91	50	2692	0.44	0.031	0.01	8.42	0.01	0.000
23.17	1.95	199.23	1.24	247.04	50	2710	0.44	0.030	0.01	8.42	0.01	0.000
23.26	1.96	197.21	1.25	245.88	50	2712	0.44	0.031	0.01	8.42	0.01	0.000
23.30	1.96	194.35	1.25	243.38	50	2694	0.44	0.031	0.01	8.42	0.01	0.000
23.39	1.96	191.35	1.26	240.31	49	2671	0.44	0.031	0.01	8.42	0.01	0.000
23.43	1.97	188.29	1.26	236.85	49	2638	0.44	0.032	0.01	8.42	0.01	0.000
23.52	1.97	185.93	1.26	234.41	48	2620	0.44	0.033	0.01	8.42	0.01	0.000
23.56	1.97	183.46	1.27	232.37	48	2607	0.44	0.033	0.01	8.42	0.01	0.000
23.65	1.98	180.99	1.28	230.85	48	2605	0.44	0.033	0.01	8.42	0.01	0.000
23.70	1.99	177.56	1.29	229.24	48	2603	0.44	0.033	0.01	8.42	0.01	0.000
23.78	2.01	174.24	1.31	227.80	48	2606	0.44	0.033	0.01	8.42	0.01	0.000
23.83	2.02	170.77	1.33	226.70	48	2611	0.44	0.033	0.01	8.42	0.01	0.000
23.91	2.03	168.34	1.34	226.10	48	2620	0.44	0.033	0.01	8.42	0.01	0.000
23.96	2.04	166.16	1.36	225.71	48	2627	0.44	0.033	0.01	8.42	0.01	0.000
24.02	2.05	164.41	1.37	224.88	48	2627	0.44	0.033	0.01	8.42	0.01	0.000
24.10	2.05	162.87	1.37	223.43	47	2618	0.44	0.034	0.01	8.42	0.01	0.000
24.18	2.05	161.86	1.37	222.12	47	2610	0.44	0.034	0.01	8.42	0.01	0.000
24.22	2.05	161.45	1.37	221.47	47	2605	0.44	0.034	0.01	8.42	0.01	0.000
24.31	2.05	160.82	1.37	221.02	47	2607	0.44	0.034	0.01	8.42	0.01	0.000
24.36	2.05	160.41	1.37	220.49	47	2605	0.44	0.034	0.01	8.42	0.01	0.000
24.43	2.05	159.52	1.37	219.14	47	2594	0.44	0.035	0.01	8.42	0.01	0.000
24.51	2.05	158.69	1.37	217.44	46	2578	0.44	0.035	0.01	8.42	0.01	0.000
24.54	2.04	158.13	1.36	214.94	45	2546	0.44	0.036	0.01	8.42	0.01	0.000
24.62	2.03	158.15	1.34	211.59	45	2500	0.44	0.037	0.01	8.42	0.01	0.000
24.71	2.01	157.86	1.32	207.75	43	2447	0.44	0.038	0.02	8.42	0.01	0.000
24.75	2.00	156.97	1.30	203.34	42	2383	0.44	0.040	0.02	8.42	0.01	0.000
24.84	1.99	155.03	1.29	199.22	41	2333	0.44	0.042	0.02	8.42	0.01	0.000
24.89	1.98	152.84	1.27	194.04	40	2262	0.44	0.044	0.02	8.42	0.01	0.000
25.02	1.97	149.86	1.26	189.26	39	2208	0.45	0.046	0.02	8.42	0.02	0.001
25.10	1.97	145.97	1.26	184.17	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.15	1.98	140.67	1.28	179.71	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.20	2.00	134.17	1.30	174.66	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.28	2.03	126.41	1.34	169.06	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.33	2.05	118.29	1.38	163.03	0	0	0.45	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
25.41	2.09	109.60	1.44	157.94	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.46	2.11	100.77	1.47	147.99	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.52	2.14	90.51	1.53	138.67	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.59	2.19	78.55	1.64	129.20	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.64	2.30	65.07	1.96	127.45	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.71	2.43	51.66	2.46	126.92	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.77	2.58	39.77	3.18	126.51	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.81	2.72	30.53	4.11	125.46	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.86	2.83	24.19	5.03	121.77	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.96	2.91	20.31	5.79	117.65	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.00	2.97	17.83	6.41	114.27	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.08	3.02	16.15	7.02	113.32	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.13	3.06	15.09	7.44	112.30	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.26	3.07	14.66	7.56	110.76	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.30	3.05	14.97	7.35	110.03	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.34	3.04	15.34	7.18	110.13	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.39	3.02	15.76	7.00	110.31	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.48	3.02	15.87	6.97	110.69	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.52	3.00	16.32	6.78	110.60	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.61	2.98	16.82	6.57	110.54	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.65	2.97	17.03	6.45	109.89	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.74	2.98	16.85	6.49	109.34	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.78	2.94	18.12	6.05	109.68	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.87	2.83	22.00	5.01	110.34	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.92	2.66	29.81	3.71	110.47	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.01	2.55	36.09	3.06	110.51	29	1298	0.45	0.165	0.10	8.42	0.08	0.002
27.05	2.54	37.32	3.00	111.90	29	1323	0.45	0.157	0.10	8.42	0.08	0.001
27.18	2.62	33.06	3.43	113.38	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.23	2.72	27.43	4.17	114.30	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.27	2.81	23.21	4.89	113.55	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.31	2.92	18.67	5.92	110.59	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.40	3.02	15.25	6.96	106.12	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.45	3.10	12.28	7.93	97.42	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.54	3.15	10.39	8.52	88.45	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.59	3.19	8.79	9.13	80.25	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.65	3.22	8.05	9.51	76.54	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.71	3.24	7.59	9.78	74.25	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.89	3.25	7.44	9.92	73.80	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.93	3.25	7.56	10.00	75.63	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.00	3.23	8.36	9.61	80.33	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.06	3.17	9.69	8.84	85.65	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.11	3.11	11.40	8.07	91.96	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.18	3.06	13.42	7.40	99.35	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.29	2.99	15.17	6.59	100.03	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.37	2.89	17.02	5.64	96.02	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.42	2.80	18.90	4.80	90.69	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.49	2.76	20.76	4.47	92.79	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.55	2.76	22.40	4.43	99.19	0	0	0.45	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
28.60	2.77	23.22	4.49	104.35	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.68	2.76	24.34	4.44	108.10	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.74	2.75	25.32	4.39	111.04	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.83	2.74	26.45	4.28	113.06	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.88	2.74	26.59	4.33	115.23	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.96	2.76	26.08	4.46	116.35	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.01	2.81	23.85	4.89	116.69	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.16	2.88	21.28	5.46	116.20	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.23	2.92	19.56	5.93	115.90	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.27	2.94	19.18	6.07	116.53	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.31	2.93	19.62	5.98	117.29	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.36	2.92	19.92	5.93	118.05	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.41	2.91	20.33	5.83	118.50	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.49	2.92	20.15	5.88	118.57	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.55	2.93	19.90	5.97	118.86	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.60	2.87	22.32	5.41	120.75	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.68	2.75	28.35	4.35	123.44	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.76	2.63	35.87	3.51	125.95	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.82	2.54	42.61	3.00	127.76	34	1636	0.45	0.104	0.06	8.42	0.04	0.001
29.90	2.51	46.05	2.80	128.85	33	1675	0.45	0.099	0.05	8.42	0.04	0.001
29.93	2.49	47.89	2.70	129.50	33	1696	0.45	0.096	0.05	8.42	0.04	0.000
30.02	2.49	47.87	2.72	129.99	33	1706	0.45	0.095	0.05	8.42	0.04	0.001
30.07	2.50	46.97	2.79	131.02	34	1713	0.45	0.095	0.05	8.42	0.04	0.000
30.16	2.52	46.02	2.88	132.44	34	1725	0.45	0.093	0.05	8.42	0.04	0.001
30.21	2.54	45.25	2.98	134.88	35	1748	0.45	0.091	0.05	8.42	0.04	0.000
30.29	2.54	45.64	3.00	137.04	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.33	2.54	46.91	2.97	139.14	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.38	2.51	49.52	2.84	140.86	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.46	2.49	52.08	2.73	142.00	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.52	2.47	54.85	2.61	143.28	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.62	2.45	56.61	2.53	143.39	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.66	2.43	58.25	2.46	143.34	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.72	2.42	59.96	2.38	142.63	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.82	2.39	62.09	2.29	142.22	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.87	2.37	65.01	2.20	142.78	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.93	2.35	68.45	2.11	144.69	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.99	2.32	72.64	2.03	147.34	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.04	2.30	77.32	1.95	151.12	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.12	2.28	82.94	1.88	155.98	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.23	2.26	87.65	1.83	160.46	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.30	2.25	91.39	1.79	163.34	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.34	2.24	92.95	1.76	163.85	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.43	2.23	93.59	1.74	163.31	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.48	2.21	94.20	1.69	159.53	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.53	2.20	94.54	1.68	158.65	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.61	2.20	95.42	1.66	158.63	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.66	2.20	96.96	1.67	161.61	36	2340	0.45	0.055	0.03	8.42	0.02	0.000
31.70	2.20	97.74	1.67	162.94	37	2362	0.45	0.054	0.03	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
31.83	2.20	98.45	1.67	163.93	37	2383	0.45	0.054	0.03	8.42	0.02	0.001
31.89	2.20	99.91	1.66	166.15	37	2419	0.45	0.052	0.02	8.42	0.02	0.000
31.98	2.19	102.70	1.63	167.59	38	2443	0.46	0.052	0.02	8.42	0.02	0.000
32.06	2.17	105.48	1.60	168.90	38	2464	0.46	0.051	0.02	8.42	0.02	0.000
32.11	2.16	107.25	1.58	169.77	38	2478	0.46	0.051	0.02	8.42	0.02	0.000
32.16	2.15	109.86	1.56	171.29	38	2499	0.46	0.050	0.02	8.42	0.02	0.000
32.24	2.14	112.80	1.54	173.51	38	2532	0.46	0.049	0.02	8.42	0.02	0.000
32.29	2.14	115.80	1.53	177.09	39	2586	0.46	0.048	0.02	8.42	0.02	0.000
32.38	2.14	117.25	1.54	180.08	40	2636	0.46	0.046	0.02	8.42	0.02	0.000
32.42	2.15	117.42	1.56	182.60	40	2679	0.46	0.045	0.02	8.42	0.01	0.000
32.49	2.16	116.74	1.57	183.53	41	2701	0.46	0.045	0.02	8.42	0.01	0.000
32.61	2.16	115.93	1.58	183.62	41	2711	0.46	0.045	0.02	8.42	0.01	0.000
32.65	2.17	115.61	1.59	183.33	41	2710	0.46	0.045	0.02	8.42	0.01	0.000
32.69	2.16	116.10	1.57	182.41	40	2696	0.46	0.045	0.02	8.42	0.01	0.000
32.77	2.15	117.02	1.55	181.27	40	2680	0.46	0.046	0.02	8.42	0.02	0.000
32.82	2.13	119.06	1.51	180.04	39	2656	0.46	0.046	0.02	8.42	0.02	0.000
32.90	2.12	120.77	1.48	179.15	39	2639	0.46	0.047	0.02	8.42	0.02	0.000
32.95	2.11	121.45	1.47	178.54	39	2628	0.46	0.047	0.02	8.42	0.02	0.000
33.06	2.11	120.43	1.48	177.93	39	2629	0.46	0.047	0.02	8.42	0.02	0.000
33.10	2.11	119.31	1.48	176.86	39	2617	0.46	0.048	0.02	8.42	0.02	0.000
33.18	2.11	118.99	1.47	175.42	38	2597	0.46	0.049	0.02	8.42	0.02	0.000
33.21	2.10	120.15	1.45	173.95	38	2567	0.46	0.050	0.02	8.42	0.02	0.000
33.30	2.09	121.40	1.43	173.61	37	2560	0.46	0.050	0.02	8.42	0.02	0.000
33.35	2.08	123.15	1.43	175.75	38	2592	0.46	0.049	0.02	8.42	0.02	0.000
33.48	2.09	124.02	1.44	178.58	39	2647	0.46	0.048	0.02	8.42	0.02	0.001
33.52	2.10	125.34	1.45	182.15	39	2708	0.46	0.046	0.02	8.42	0.02	0.000
33.56	2.10	126.38	1.46	184.55	40	2750	0.46	0.045	0.02	8.42	0.02	0.000
33.60	2.11	127.85	1.47	187.63	41	2801	0.46	0.044	0.02	8.42	0.01	0.000
33.67	2.11	129.75	1.47	190.62	41	2851	0.46	0.043	0.02	8.42	0.01	0.000
33.75	2.10	134.16	1.45	194.32	42	2902	0.46	0.042	0.02	8.42	0.01	0.000
33.91	2.08	138.63	1.42	196.79	42	2934	0.46	0.041	0.02	8.42	0.01	0.001
33.97	2.06	143.32	1.39	198.91	42	2948	0.46	0.041	0.02	8.42	0.01	0.000
34.01	2.04	147.23	1.36	199.76	42	2939	0.46	0.041	0.02	8.42	0.01	0.000
34.12	2.02	151.23	1.33	200.44	42	2926	0.46	0.042	0.02	8.42	0.01	0.000
34.18	2.00	155.36	1.30	201.37	42	2911	0.46	0.042	0.02	8.42	0.01	0.000
34.23	1.98	157.62	1.28	201.55	42	2894	0.46	0.042	0.02	8.42	0.01	0.000
34.29	1.98	158.00	1.27	200.48	41	2869	0.46	0.043	0.02	8.42	0.01	0.000
34.36	1.97	156.53	1.27	198.17	41	2836	0.46	0.044	0.02	8.42	0.01	0.000
34.40	1.96	153.48	1.26	192.77	40	2747	0.46	0.046	0.02	8.42	0.02	0.000
34.51	1.95	150.05	1.24	186.16	38	2635	0.46	0.050	0.02	8.42	0.02	0.000
34.58	1.93	146.83	1.22	179.67	36	2520	0.46	0.053	0.03	8.42	0.02	0.000
34.63	1.93	143.89	1.22	175.62	36	2461	0.46	0.056	0.03	8.42	0.02	0.000
34.68	1.93	140.64	1.22	171.93	35	2414	0.46	0.058	0.03	8.42	0.02	0.000
34.75	1.93	138.51	1.22	168.58	34	2362	0.46	0.060	0.03	8.42	0.02	0.000
34.80	1.92	137.63	1.21	166.38	34	2320	0.46	0.062	0.03	8.42	0.03	0.000
34.89	1.92	137.53	1.20	165.57	33	2304	0.46	0.063	0.03	8.42	0.03	0.001
34.92	1.91	139.15	1.20	166.42	33	2304	0.46	0.063	0.03	8.42	0.03	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.10

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
35.01	167.45	1.13	0.39	1.00	0.00	35.05	169.21	1.16	0.28	1.00	0.00
35.14	170.13	1.18	0.28	1.00	0.00	35.19	171.35	1.20	0.28	1.00	0.00
35.27	171.96	1.21	0.28	1.00	0.00	35.32	172.34	1.22	0.28	1.00	0.00
35.41	172.21	1.21	0.28	1.00	0.00	35.45	172.09	1.21	0.28	1.00	0.00
35.51	172.52	1.22	0.28	1.00	0.00	35.63	173.05	1.23	0.28	1.00	0.00
35.66	174.27	1.25	0.28	1.00	0.00	35.72	174.97	1.26	0.19	1.00	0.00
35.81	175.48	1.27	0.19	1.00	0.00	35.85	176.15	1.28	0.19	1.00	0.00
35.93	176.55	1.29	0.19	1.00	0.00	36.03	176.55	1.29	0.19	1.00	0.00
36.10	176.18	1.28	0.19	1.00	0.00	36.16	176.46	1.28	0.19	1.00	0.00
36.21	177.75	1.31	0.19	1.00	0.00	36.28	179.38	1.34	0.19	1.00	0.00
36.34	180.83	1.37	0.00	1.00	0.00	36.39	181.84	1.39	0.00	1.00	0.00
36.45	182.47	1.40	0.00	1.00	0.00	36.51	182.87	1.40	0.00	1.00	0.00
36.55	183.53	1.42	0.00	1.00	0.00	36.69	184.13	1.43	0.00	1.00	0.00
36.73	184.85	1.44	0.00	1.00	0.00	36.78	184.95	1.44	0.00	1.00	0.00
36.85	184.74	1.44	0.00	1.00	0.00	36.91	183.69	1.42	0.00	1.00	0.00
36.97	181.63	1.37	0.00	1.00	0.00	37.03	178.79	1.32	0.19	1.00	0.00
37.09	176.19	1.27	0.19	1.00	0.00	37.26	171.69	1.19	0.28	1.00	0.01
37.30	166.91	1.10	0.40	1.00	0.00	37.38	163.25	2.00	0.00	1.00	0.00
37.43	162.26	2.00	0.00	1.00	0.00	37.48	162.84	2.00	0.00	1.00	0.00
37.55	160.64	2.00	0.00	1.00	0.00	37.61	157.88	2.00	0.00	1.00	0.00
37.69	154.21	2.00	0.00	1.00	0.00	37.73	149.14	2.00	0.00	1.00	0.00
37.83	144.37	2.00	0.00	1.00	0.00	37.86	138.86	2.00	0.00	1.00	0.00
37.95	133.09	2.00	0.00	1.00	0.00	38.02	124.83	2.00	0.00	1.00	0.00
38.08	115.53	2.00	0.00	1.00	0.00	38.12	104.76	2.00	0.00	1.00	0.00
38.21	95.58	2.00	0.00	1.00	0.00	38.26	85.91	2.00	0.00	1.00	0.00
38.34	78.03	2.00	0.00	1.00	0.00	38.43	71.07	2.00	0.00	1.00	0.00
38.46	65.25	2.00	0.00	1.00	0.00	38.53	61.08	2.00	0.00	1.00	0.00
38.61	57.08	2.00	0.00	1.00	0.00	38.66	54.72	2.00	0.00	1.00	0.00
38.74	53.55	2.00	0.00	1.00	0.00	38.79	52.77	2.00	0.00	1.00	0.00
38.87	52.45	2.00	0.00	1.00	0.00	38.97	52.31	2.00	0.00	1.00	0.00
39.01	52.40	2.00	0.00	1.00	0.00	39.05	52.76	2.00	0.00	1.00	0.00
39.15	53.19	2.00	0.00	1.00	0.00	39.19	53.75	2.00	0.00	1.00	0.00
39.25	54.34	2.00	0.00	1.00	0.00	39.35	54.84	2.00	0.00	1.00	0.00
39.40	55.32	2.00	0.00	1.00	0.00	39.45	55.75	2.00	0.00	1.00	0.00
39.52	56.18	2.00	0.00	1.00	0.00	39.58	56.85	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
39.71	57.25	2.00	0.00	1.00	0.00	39.76	57.70	2.00	0.00	1.00	0.00
39.82	57.94	2.00	0.00	1.00	0.00	39.89	58.38	2.00	0.00	1.00	0.00
39.94	59.06	2.00	0.00	1.00	0.00	40.02	59.81	2.00	0.00	1.00	0.00
40.06	60.57	2.00	0.00	1.00	0.00	40.14	61.02	2.00	0.00	1.00	0.00
40.20	61.25	2.00	0.00	1.00	0.00	40.25	61.20	2.00	0.00	1.00	0.00
40.32	61.01	2.00	0.00	1.00	0.00	40.37	59.78	2.00	0.00	1.00	0.00
40.43	55.76	2.00	0.00	1.00	0.00	40.50	51.88	2.00	0.00	1.00	0.00
40.62	49.24	2.00	0.00	1.00	0.00	40.68	50.22	2.00	0.00	1.00	0.00
40.75	50.74	2.00	0.00	1.00	0.00	40.77	51.14	2.00	0.00	1.00	0.00
40.86	51.28	2.00	0.00	1.00	0.00	40.89	51.43	2.00	0.00	1.00	0.00
40.95	51.93	2.00	0.00	1.00	0.00	41.03	52.73	2.00	0.00	1.00	0.00
41.08	53.69	2.00	0.00	1.00	0.00	41.17	54.18	2.00	0.00	1.00	0.00
41.21	54.57	2.00	0.00	1.00	0.00	41.30	54.99	2.00	0.00	1.00	0.00
41.36	55.40	2.00	0.00	1.00	0.00	41.44	55.49	2.00	0.00	1.00	0.00
41.48	54.97	2.00	0.00	1.00	0.00	41.61	54.28	2.00	0.00	1.00	0.00
41.65	53.64	2.00	0.00	1.00	0.00	41.74	53.41	2.00	0.00	1.00	0.00
41.78	53.36	2.00	0.00	1.00	0.00	41.82	53.64	2.00	0.00	1.00	0.00
41.90	54.09	2.00	0.00	1.00	0.00	41.98	54.65	2.00	0.00	1.00	0.00
42.02	55.45	2.00	0.00	1.00	0.00	42.09	56.27	2.00	0.00	1.00	0.00
42.14	57.72	2.00	0.00	1.00	0.00	42.23	59.17	2.00	0.00	1.00	0.00
42.27	60.50	2.00	0.00	1.00	0.00	42.35	61.02	2.00	0.00	1.00	0.00
42.39	61.88	2.00	0.00	1.00	0.00	42.49	63.25	2.00	0.00	1.00	0.00
42.54	66.41	2.00	0.00	1.00	0.00	42.62	70.90	2.00	0.00	1.00	0.00
42.68	77.41	2.00	0.00	1.00	0.00	42.75	84.46	2.00	0.00	1.00	0.00
42.80	94.52	2.00	0.00	1.00	0.00	42.92	103.70	2.00	0.00	1.00	0.00
42.98	112.78	2.00	0.00	1.00	0.00	43.02	119.65	2.00	0.00	1.00	0.00
43.09	124.99	2.00	0.00	1.00	0.00	43.15	128.70	2.00	0.00	1.00	0.00
43.20	129.96	2.00	0.00	1.00	0.00	43.27	129.56	2.00	0.00	1.00	0.00
43.33	128.86	2.00	0.00	1.00	0.00	43.39	128.44	2.00	0.00	1.00	0.00
43.46	128.26	2.00	0.00	1.00	0.00	43.51	128.33	2.00	0.00	1.00	0.00
43.58	128.90	2.00	0.00	1.00	0.00	43.68	127.26	2.00	0.00	1.00	0.00
43.76	127.37	2.00	0.00	1.00	0.00	43.81	126.82	0.57	1.92	1.00	0.01
43.88	128.19	0.58	1.91	1.00	0.02	43.94	128.39	0.58	1.90	1.00	0.01
43.99	128.81	0.59	1.90	1.00	0.01	44.03	129.79	0.60	1.89	1.00	0.01
44.12	129.82	0.60	1.89	1.00	0.02	44.17	130.73	0.60	1.88	1.00	0.01
44.30	131.62	0.61	1.87	1.00	0.03	44.35	133.57	0.63	1.84	1.00	0.01
44.41	135.93	0.66	1.59	1.00	0.01	44.48	138.78	0.69	1.54	1.00	0.01
44.53	142.88	0.74	1.48	1.00	0.01	44.65	146.73	0.79	1.16	1.00	0.02
44.70	150.58	0.84	1.12	1.00	0.01	44.77	153.45	0.87	0.83	1.00	0.01
44.83	155.83	2.00	0.00	1.00	0.00	44.88	157.41	2.00	0.00	1.00	0.00
44.94	157.94	2.00	0.00	1.00	0.00	45.01	157.61	2.00	0.00	1.00	0.00
45.07	156.52	2.00	0.00	1.00	0.00	45.14	154.30	2.00	0.00	1.00	0.00
45.18	151.32	2.00	0.00	1.00	0.00	45.24	148.02	2.00	0.00	1.00	0.00
45.32	145.61	2.00	0.00	1.00	0.00	45.36	144.17	2.00	0.00	1.00	0.00
45.43	141.71	2.00	0.00	1.00	0.00	45.49	137.02	2.00	0.00	1.00	0.00
45.54	130.40	2.00	0.00	1.00	0.00	45.63	127.23	2.00	0.00	1.00	0.00
45.73	125.37	2.00	0.00	1.00	0.00	45.80	127.13	2.00	0.00	1.00	0.00
45.85	127.91	2.00	0.00	1.00	0.00	45.90	132.39	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
46.03	137.88	2.00	0.00	1.00	0.00	46.09	143.70	2.00	0.00	1.00	0.00
46.15	147.43	2.00	0.00	1.00	0.00	46.20	150.48	2.00	0.00	1.00	0.00
46.26	153.30	2.00	0.00	1.00	0.00	46.33	156.11	2.00	0.00	1.00	0.00
46.38	158.78	2.00	0.00	1.00	0.00	46.43	161.01	2.00	0.00	1.00	0.00
46.47	163.20	2.00	0.00	1.00	0.00	46.53	165.75	2.00	0.00	1.00	0.00
46.60	167.50	2.00	0.00	1.00	0.00	46.70	167.92	2.00	0.00	1.00	0.00
46.74	167.60	2.00	0.00	1.00	0.00	46.80	167.21	2.00	0.00	1.00	0.00
46.91	166.81	2.00	0.00	1.00	0.00	46.95	165.25	2.00	0.00	1.00	0.00
47.00	161.67	2.00	0.00	1.00	0.00	47.08	158.93	2.00	0.00	1.00	0.00
47.17	156.64	2.00	0.00	1.00	0.00	47.21	155.67	2.00	0.00	1.00	0.00
47.26	153.72	2.00	0.00	1.00	0.00	47.35	151.63	2.00	0.00	1.00	0.00
47.40	149.37	2.00	0.00	1.00	0.00	47.48	147.38	2.00	0.00	1.00	0.00
47.53	144.53	2.00	0.00	1.00	0.00	47.64	141.92	2.00	0.00	1.00	0.00
47.70	139.81	2.00	0.00	1.00	0.00	47.75	139.00	2.00	0.00	1.00	0.00
47.81	138.62	2.00	0.00	1.00	0.00	47.88	138.34	2.00	0.00	1.00	0.00
47.93	138.22	2.00	0.00	1.00	0.00	48.00	137.84	2.00	0.00	1.00	0.00
48.05	136.52	2.00	0.00	1.00	0.00	48.18	134.01	2.00	0.00	1.00	0.00
48.23	129.63	2.00	0.00	1.00	0.00	48.29	122.75	2.00	0.00	1.00	0.00
48.37	114.53	2.00	0.00	1.00	0.00	48.41	104.21	2.00	0.00	1.00	0.00
48.54	96.71	2.00	0.00	1.00	0.00	48.59	90.02	2.00	0.00	1.00	0.00
48.66	86.54	2.00	0.00	1.00	0.00	48.78	83.43	2.00	0.00	1.00	0.00
48.84	81.16	2.00	0.00	1.00	0.00	48.96	80.28	2.00	0.00	1.00	0.00
49.03	80.59	2.00	0.00	1.00	0.00	49.08	82.58	2.00	0.00	1.00	0.00
49.15	85.21	2.00	0.00	1.00	0.00	49.20	85.04	2.00	0.00	1.00	0.00
49.27	84.49	2.00	0.00	1.00	0.00	49.33	85.61	2.00	0.00	1.00	0.00
49.40	92.42	2.00	0.00	1.00	0.00	49.47	99.80	2.00	0.00	1.00	0.00
49.51	106.67	2.00	0.00	1.00	0.00	49.58	110.75	2.00	0.00	1.00	0.00
49.65	113.04	2.00	0.00	1.00	0.00	49.70	112.17	0.45	2.13	1.00	0.01
49.78	109.94	0.43	2.16	1.00	0.02	49.83	107.57	0.41	2.20	1.00	0.01
49.91	106.50	0.41	2.22	1.00	0.02						

Total estimated settlement: 0.32

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

GeoTek, Inc.
1548 N. Maple Street
Corona, CA 92880
http://www.geotekusa.com

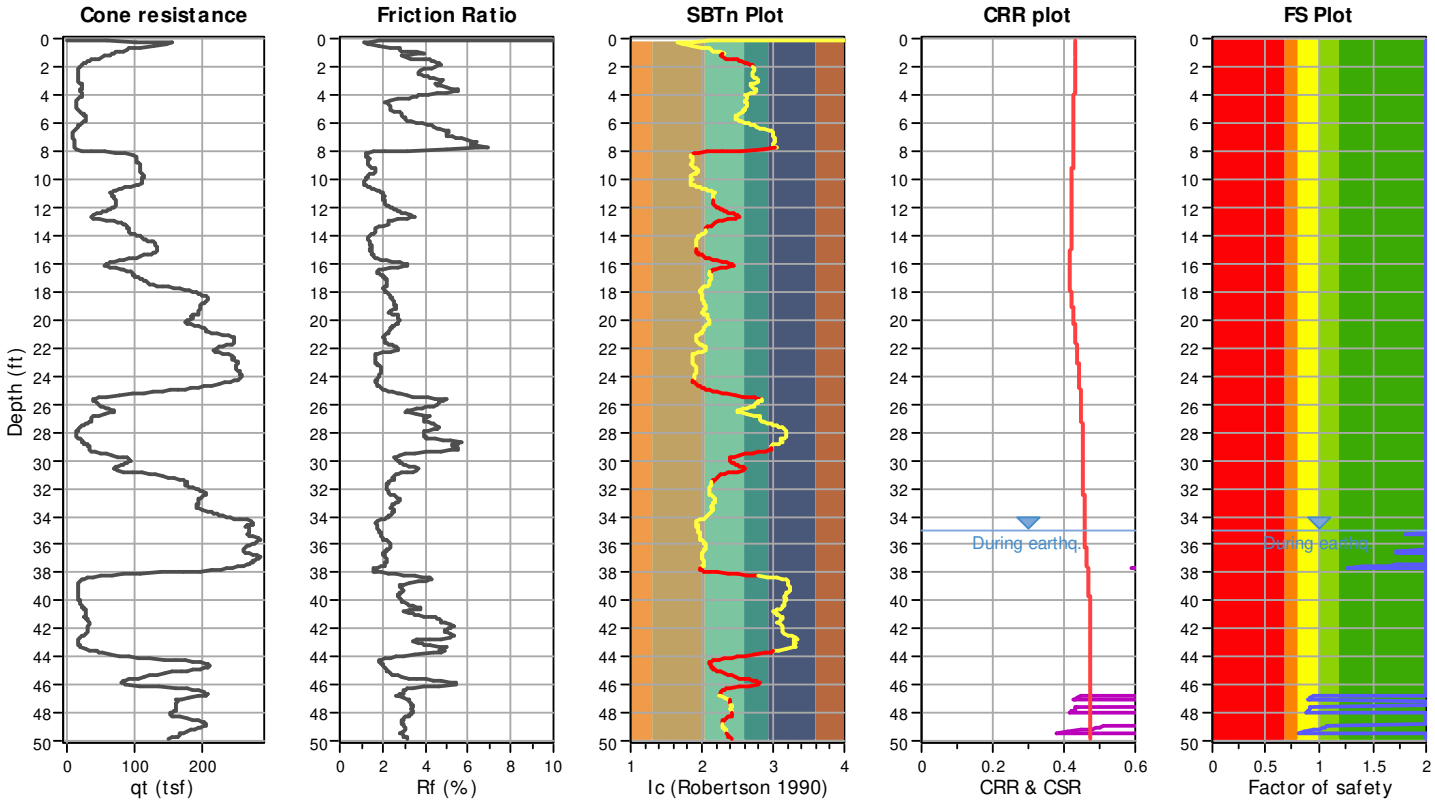
LIQUEFACTION ANALYSIS REPORT

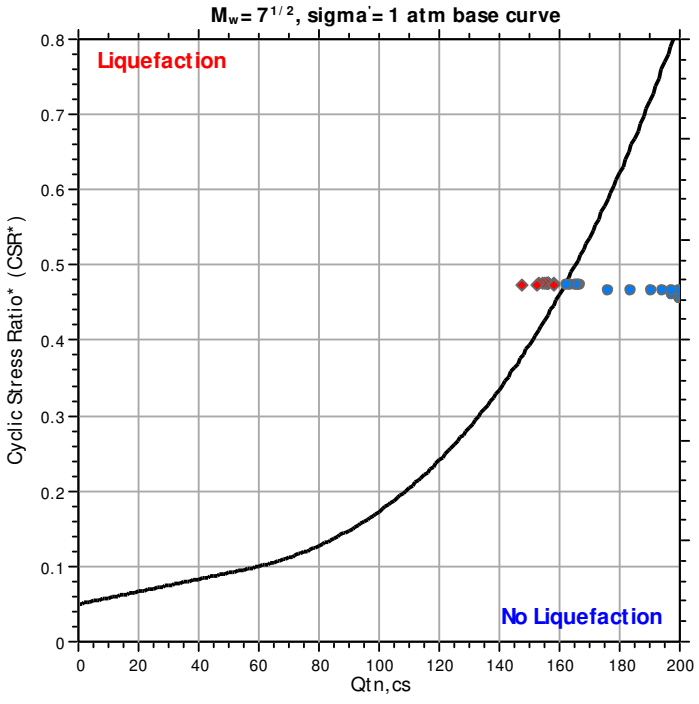
Project title : Proposed Townhouses **Location : 2323 West Broadway, Anaheim, CA**

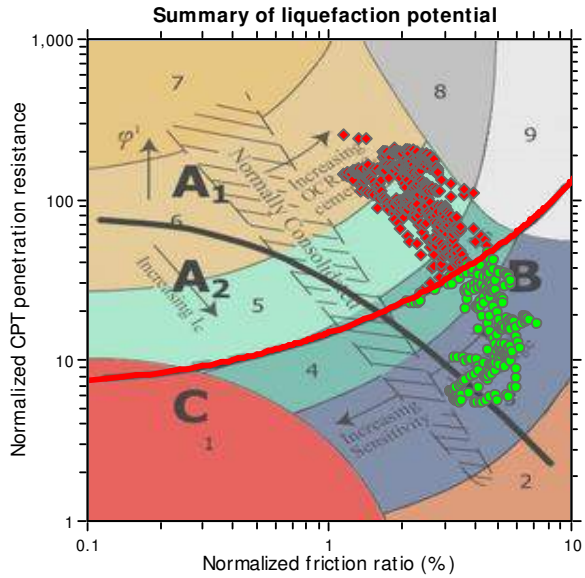
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	46.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	35.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.67	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.69	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

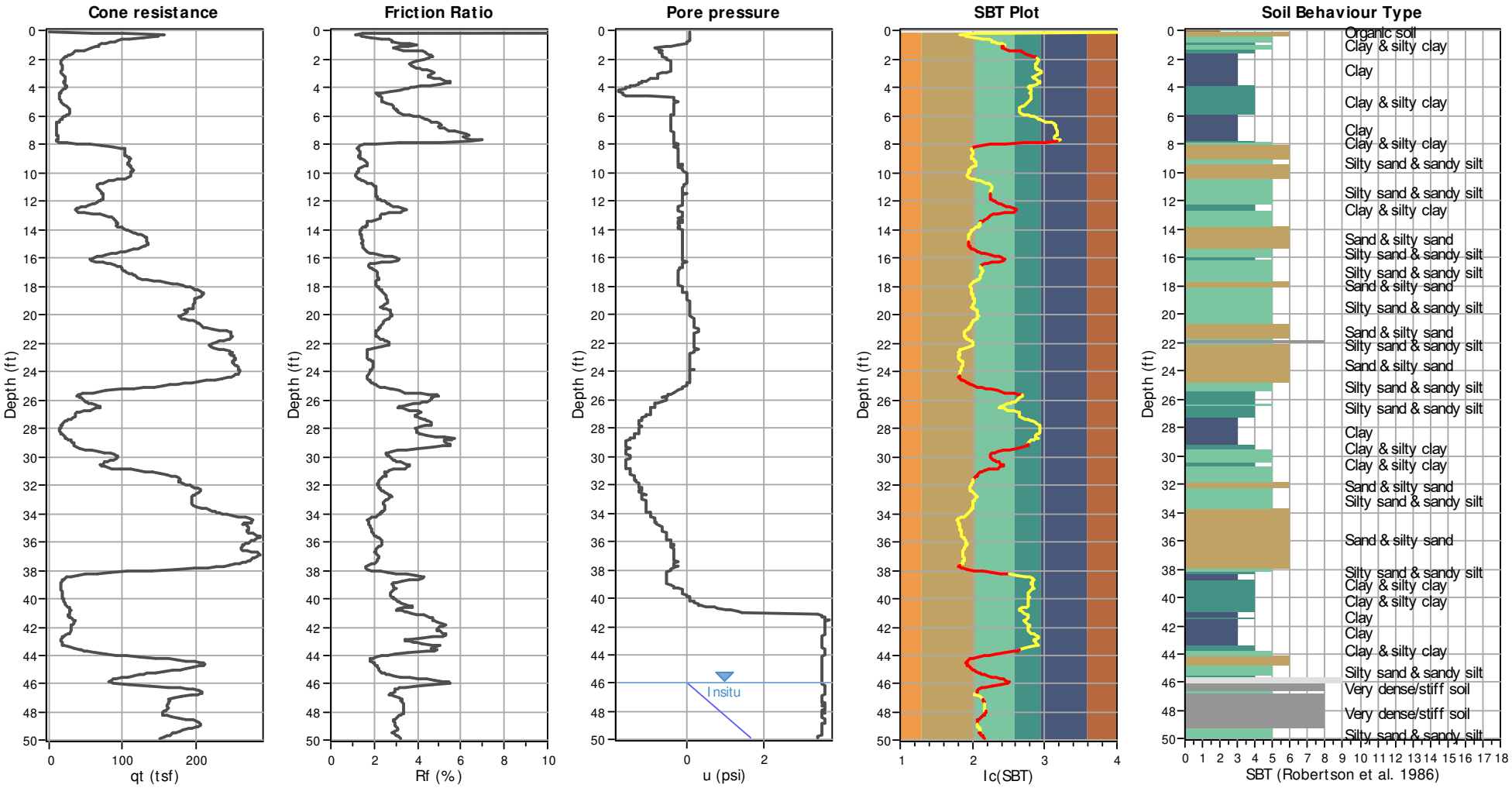






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



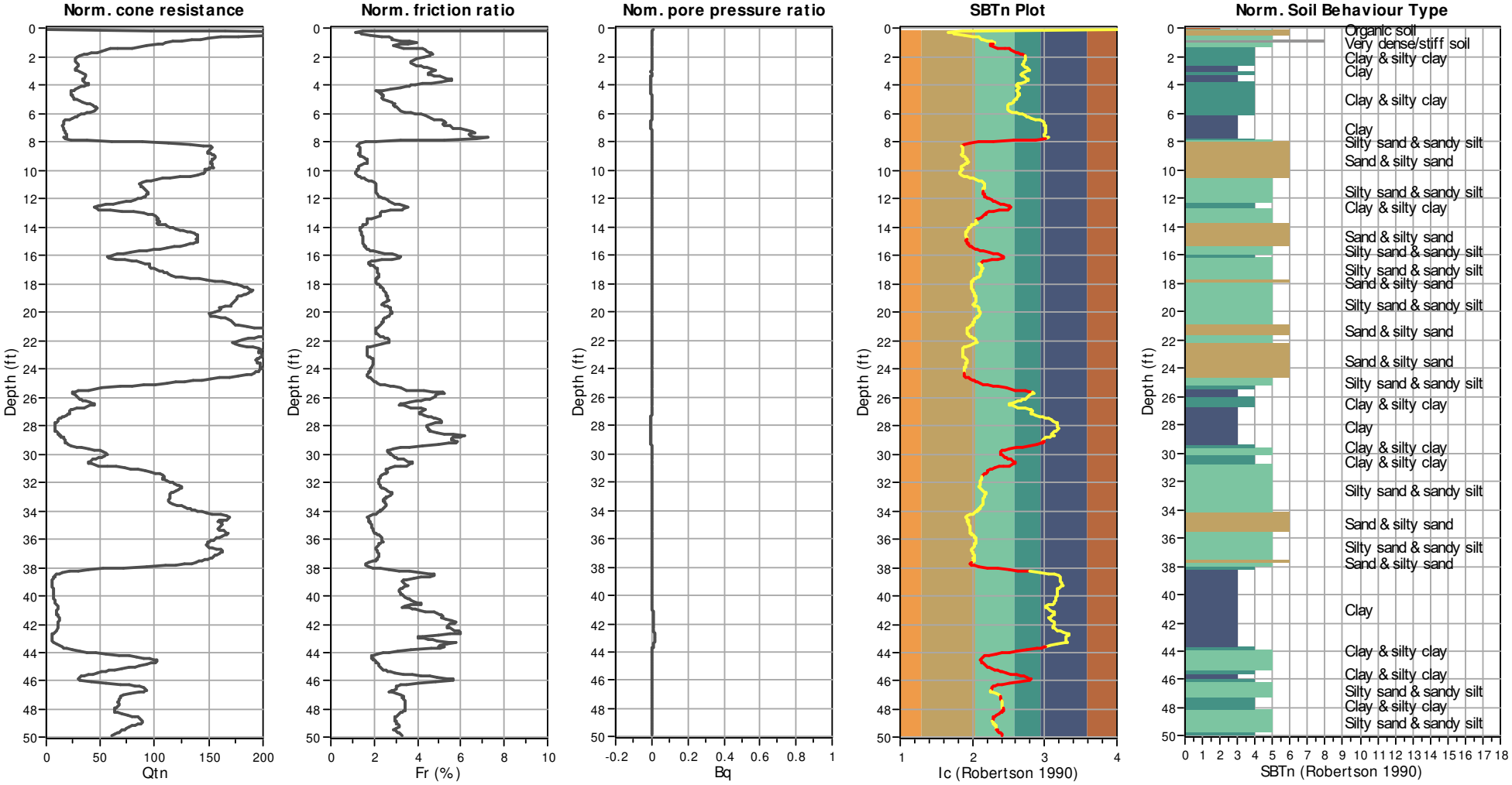
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



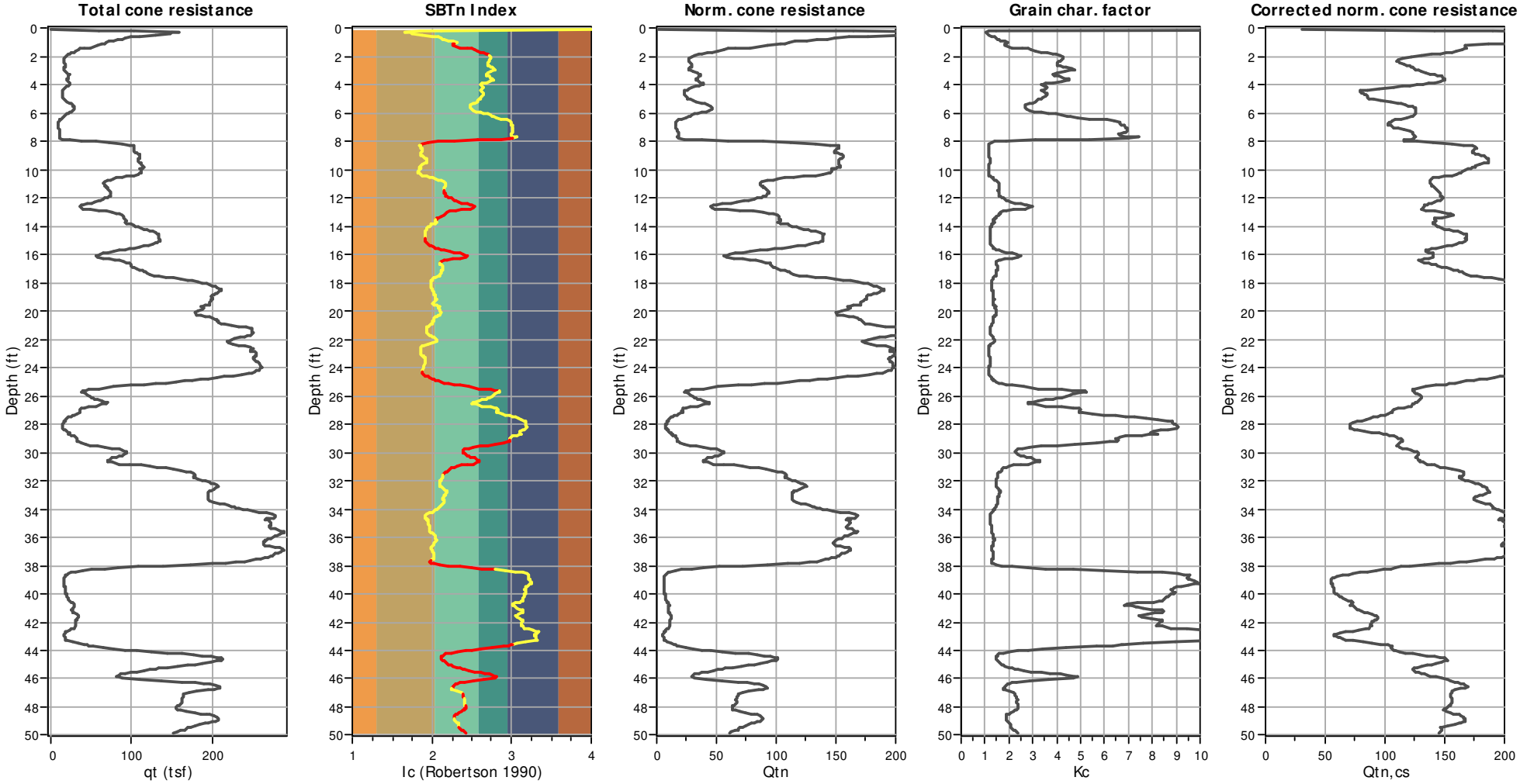
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

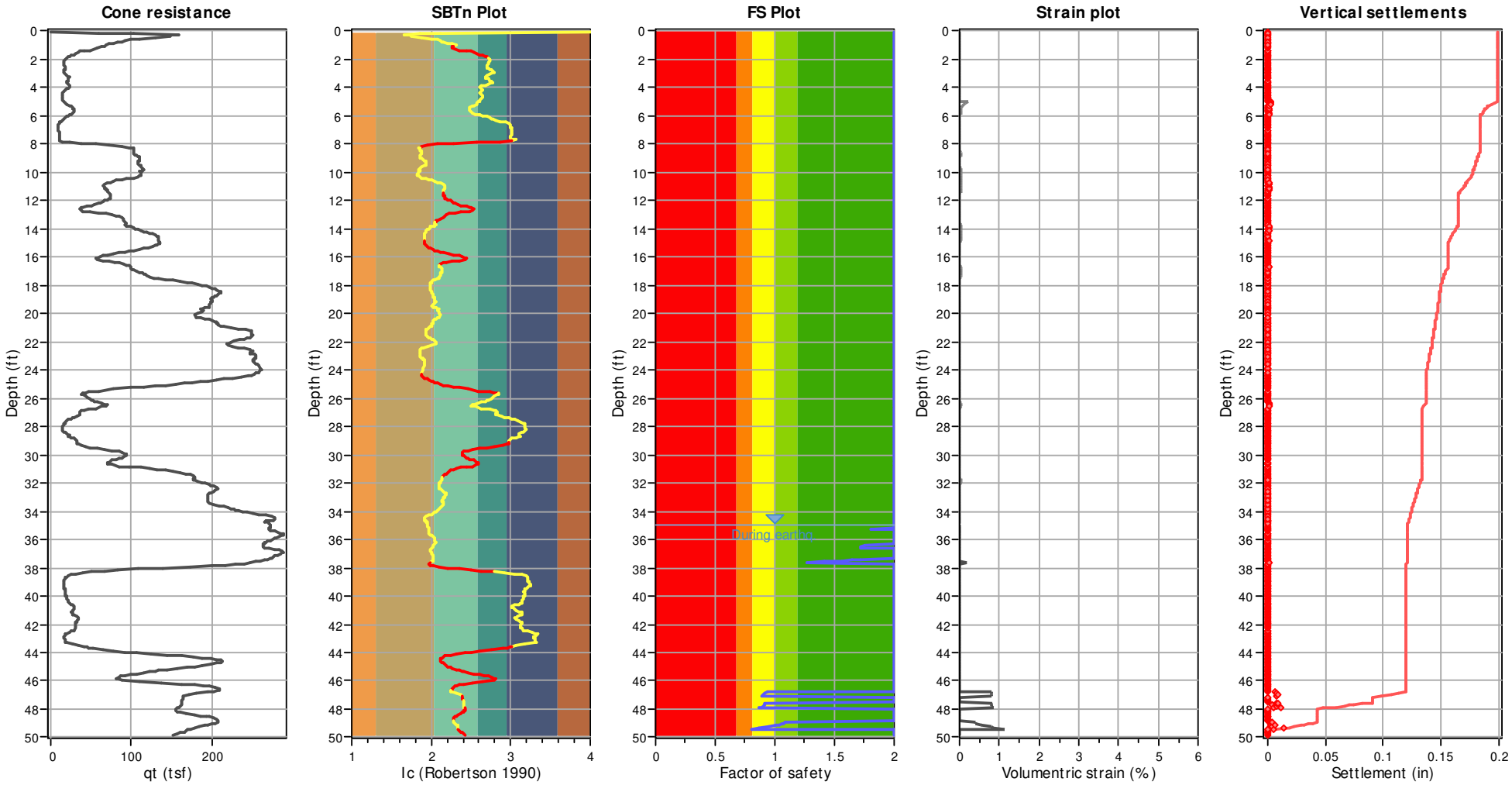
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	35.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.67	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	46.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.08	4.06	1.16	26.61	30.80	0	0	0.43	0.000	0.00	0.00	0.00	0.000
0.13	2.11	96.65	1.47	141.91	31	781	0.43	0.000	0.00	8.42	0.00	0.000
0.22	1.86	164.77	1.16	190.55	38	978	0.43	0.001	0.00	8.42	0.00	0.000
0.26	1.66	253.26	1.01	256.74	47	1168	0.43	0.001	0.00	8.42	0.00	0.000
0.33	1.73	240.06	1.05	253.22	48	1195	0.43	0.001	0.00	8.42	0.00	0.000
0.40	1.75	238.54	1.07	256.41	49	1233	0.43	0.001	0.00	8.42	0.00	0.000
0.52	1.88	207.55	1.17	242.89	48	1257	0.43	0.001	0.00	8.42	0.00	0.000
0.57	2.00	177.30	1.30	231.28	48	1255	0.43	0.001	0.00	8.42	0.00	0.000
0.62	2.08	160.74	1.42	228.36	49	1255	0.43	0.002	0.00	8.42	0.00	0.000
0.66	2.11	149.10	1.48	220.97	48	1216	0.43	0.002	0.00	8.42	0.00	0.000
0.76	2.13	142.80	1.50	214.61	47	1180	0.43	0.002	0.00	8.42	0.00	0.000
0.83	2.15	134.13	1.56	209.51	46	1150	0.43	0.002	0.00	8.42	0.00	0.000
0.89	2.20	125.16	1.68	209.70	47	1142	0.43	0.002	0.00	8.42	0.00	0.000
0.93	2.27	116.15	1.85	214.50	50	1148	0.43	0.003	0.00	8.42	0.00	0.000
1.01	2.31	110.68	1.98	218.73	52	1153	0.43	0.003	0.00	8.42	0.00	0.000
1.07	2.28	107.65	1.90	204.13	48	1087	0.43	0.003	0.00	8.42	0.00	0.000
1.12	2.25	103.21	1.81	186.63	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.19	2.25	92.34	1.81	167.27	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.37	2.35	78.54	2.13	167.27	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.41	2.45	66.02	2.55	168.05	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.46	2.51	59.35	2.81	166.94	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.55	2.54	55.69	2.95	164.50	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.60	2.57	51.30	3.12	160.14	0	0	0.43	0.000	0.00	8.42	0.00	0.000
1.68	2.60	46.67	3.35	156.46	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.73	2.64	42.28	3.57	150.82	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.81	2.67	38.22	3.82	145.84	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.87	2.70	34.91	3.98	138.91	0	0	0.43	0.000	0.00	0.00	0.00	0.000
1.94	2.72	31.49	4.16	131.04	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.04	2.73	28.76	4.26	122.38	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.12	2.73	26.95	4.25	114.59	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.24	2.73	26.50	4.19	110.97	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.30	2.72	26.50	4.12	109.18	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.35	2.71	27.13	4.07	110.48	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.48	2.70	27.99	4.01	112.22	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.54	2.70	28.96	4.00	115.75	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.61	2.71	29.30	4.04	118.50	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.65	2.72	29.25	4.13	120.85	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.74	2.73	28.80	4.24	122.19	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.79	2.75	27.96	4.41	123.42	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.85	2.78	27.03	4.60	124.47	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.92	2.80	26.44	4.75	125.71	0	0	0.43	0.000	0.00	0.00	0.00	0.000
2.97	2.78	27.85	4.60	128.16	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.09	2.74	30.41	4.30	130.85	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.15	2.70	33.72	3.99	134.67	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.22	2.68	35.81	3.86	138.08	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.28	2.68	36.87	3.84	141.54	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.34	2.69	36.82	3.92	144.22	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.41	2.72	35.74	4.11	146.99	0	0	0.43	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
3.53	2.74	34.51	4.32	149.23	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.58	2.76	33.52	4.49	150.50	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.64	2.77	33.22	4.52	150.14	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.71	2.76	33.60	4.43	148.70	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.76	2.72	34.91	4.18	145.84	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.83	2.68	36.80	3.85	141.75	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.90	2.64	38.45	3.56	136.87	0	0	0.43	0.000	0.00	0.00	0.00	0.000
3.95	2.61	38.73	3.40	131.55	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.02	2.61	37.51	3.37	126.36	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.07	2.62	35.12	3.45	121.02	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.13	2.63	32.34	3.54	114.58	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.20	2.64	29.80	3.60	107.27	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.25	2.63	27.12	3.51	95.23	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.38	2.62	25.01	3.43	85.82	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.43	2.61	23.35	3.38	78.85	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.51	2.63	22.76	3.50	79.59	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.56	2.64	22.57	3.56	80.45	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.60	2.64	22.63	3.61	81.66	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.68	2.64	22.97	3.61	82.81	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.73	2.64	23.50	3.58	84.05	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.81	2.63	24.18	3.51	84.84	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.86	2.62	25.05	3.42	85.70	0	0	0.43	0.000	0.00	0.00	0.00	0.000
4.99	2.60	26.06	3.34	87.03	0	0	0.43	0.000	0.00	0.00	0.00	0.000
5.04	2.59	27.62	3.26	89.94	24	410	0.43	0.344	0.27	8.42	0.21	0.002
5.11	2.57	30.68	3.15	96.69	26	446	0.43	0.239	0.18	8.42	0.14	0.002
5.22	2.57	33.34	3.13	104.37	28	482	0.43	0.177	0.12	8.42	0.09	0.002
5.30	2.54	37.33	2.96	110.66	29	520	0.43	0.134	0.09	8.42	0.07	0.001
5.35	2.52	40.01	2.85	114.00	30	542	0.43	0.116	0.07	8.42	0.06	0.001
5.40	2.49	43.12	2.71	116.95	30	565	0.43	0.102	0.06	8.42	0.05	0.001
5.48	2.49	44.52	2.70	120.00	31	580	0.43	0.096	0.06	8.42	0.04	0.001
5.52	2.48	45.59	2.69	122.72	31	594	0.43	0.090	0.05	8.42	0.04	0.000
5.58	2.48	46.31	2.68	124.33	32	602	0.43	0.087	0.05	8.42	0.04	0.001
5.66	2.48	46.55	2.69	125.20	32	606	0.43	0.088	0.05	8.42	0.04	0.001
5.71	2.49	46.01	2.73	125.40	32	604	0.43	0.090	0.05	8.42	0.04	0.001
5.79	2.52	43.86	2.85	125.14	33	595	0.43	0.098	0.05	8.42	0.04	0.001
5.89	2.55	40.92	3.06	125.28	33	583	0.43	0.109	0.06	8.42	0.05	0.001
5.96	2.60	37.46	3.35	125.56	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.01	2.65	34.53	3.64	125.65	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.08	2.69	31.60	3.96	125.11	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.15	2.73	29.36	4.23	124.21	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.19	2.76	27.65	4.45	123.11	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.24	2.77	26.86	4.54	122.05	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.32	2.81	24.18	4.90	118.44	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.42	2.86	21.30	5.35	113.95	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.49	2.94	17.94	6.07	108.82	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.54	2.97	16.56	6.43	106.47	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.61	2.99	15.82	6.62	104.83	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.67	2.99	15.52	6.65	103.28	0	0	0.43	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
6.72	2.99	15.47	6.64	102.79	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.85	2.99	15.41	6.68	102.91	0	0	0.43	0.000	0.00	0.00	0.00	0.000
6.90	3.01	15.41	6.83	105.29	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.03	3.01	15.55	6.89	107.15	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.08	3.02	15.93	6.97	111.05	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.16	3.02	16.61	6.96	115.64	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.26	3.02	17.28	6.97	120.46	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.34	3.01	17.81	6.91	123.10	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.39	3.01	18.05	6.83	123.21	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.44	2.99	18.48	6.66	123.03	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.52	2.99	18.72	6.61	123.67	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.56	2.99	18.71	6.66	124.70	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.63	3.01	18.36	6.82	125.30	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.69	3.06	16.75	7.46	124.97	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.76	3.02	17.82	6.97	124.11	0	0	0.43	0.000	0.00	0.00	0.00	0.000
7.85	2.87	22.72	5.38	122.21	0	0	0.42	0.000	0.00	0.00	0.00	0.000
7.92	2.56	37.33	3.12	116.41	0	0	0.42	0.000	0.00	8.42	0.00	0.000
7.96	2.29	60.21	1.92	115.34	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.03	2.08	88.80	1.42	126.40	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.10	1.96	112.58	1.25	140.76	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.14	1.88	132.82	1.17	156.00	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.27	1.85	144.84	1.15	166.02	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.32	1.84	152.12	1.14	173.46	0	0	0.42	0.000	0.00	8.42	0.00	0.000
8.39	1.86	152.57	1.15	175.54	35	974	0.42	0.046	0.02	8.42	0.02	0.000
8.45	1.87	152.00	1.16	176.44	35	987	0.42	0.045	0.02	8.42	0.02	0.000
8.51	1.87	151.38	1.16	176.17	35	991	0.42	0.045	0.02	8.42	0.02	0.000
8.58	1.87	150.04	1.16	174.58	35	986	0.42	0.046	0.02	8.42	0.02	0.000
8.69	1.87	149.09	1.16	173.12	34	985	0.42	0.047	0.02	8.42	0.02	0.000
8.76	1.86	149.36	1.16	172.84	34	987	0.42	0.047	0.02	8.42	0.02	0.000
8.80	1.86	151.46	1.15	174.19	34	996	0.42	0.047	0.02	8.42	0.02	0.000
8.87	1.85	153.41	1.15	175.90	35	1010	0.42	0.046	0.02	8.42	0.02	0.000
8.93	1.85	154.87	1.15	177.83	35	1026	0.42	0.045	0.02	8.42	0.02	0.000
8.99	1.86	155.87	1.16	180.33	36	1047	0.42	0.043	0.02	8.42	0.02	0.000
9.06	1.88	156.01	1.17	182.42	36	1068	0.42	0.042	0.02	8.42	0.02	0.000
9.11	1.90	155.73	1.19	184.70	37	1090	0.42	0.041	0.02	8.42	0.01	0.000
9.19	1.91	154.59	1.20	185.82	37	1107	0.42	0.040	0.02	8.42	0.01	0.000
9.24	1.93	153.56	1.22	186.67	38	1119	0.42	0.039	0.02	8.42	0.01	0.000
9.29	1.93	152.76	1.22	186.89	38	1125	0.42	0.039	0.02	8.42	0.01	0.000
9.37	1.94	151.89	1.23	186.46	38	1130	0.42	0.039	0.02	8.42	0.01	0.000
9.42	1.94	151.90	1.23	186.10	38	1131	0.42	0.040	0.02	8.42	0.01	0.000
9.50	1.93	152.29	1.22	186.18	38	1137	0.42	0.040	0.02	8.42	0.01	0.000
9.55	1.91	152.61	1.20	182.62	37	1114	0.42	0.042	0.02	8.42	0.02	0.000
9.63	1.88	152.75	1.17	179.34	36	1093	0.42	0.044	0.02	8.42	0.02	0.000
9.68	1.85	153.33	1.15	175.92	35	1066	0.42	0.047	0.02	8.42	0.02	0.000
9.81	1.85	154.10	1.14	175.92	35	1072	0.42	0.047	0.02	8.42	0.02	0.001
9.86	1.85	150.94	1.15	173.27	34	1062	0.42	0.049	0.03	8.42	0.02	0.000
9.91	1.85	149.94	1.15	171.89	34	1056	0.42	0.050	0.03	8.42	0.02	0.000
9.93	1.86	146.87	1.15	169.17	33	1043	0.42	0.051	0.03	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
9.98	1.84	148.36	1.14	168.96	33	1039	0.42	0.052	0.03	8.42	0.02	0.000
10.04	1.84	146.55	1.14	166.56	33	1028	0.42	0.054	0.03	8.42	0.02	0.000
10.11	1.83	146.34	1.13	165.21	32	1020	0.42	0.056	0.03	8.42	0.02	0.000
10.20	1.83	144.99	1.13	163.70	32	1016	0.42	0.057	0.03	8.42	0.03	0.001
10.25	1.83	143.45	1.13	162.50	32	1013	0.42	0.058	0.03	8.42	0.03	0.000
10.34	1.85	139.02	1.15	159.73	31	1008	0.42	0.060	0.03	8.42	0.03	0.001
10.41	1.88	132.83	1.17	156.08	31	999	0.42	0.062	0.04	8.42	0.03	0.001
10.46	1.93	123.15	1.22	149.97	30	974	0.42	0.066	0.04	8.42	0.03	0.000
10.54	1.97	114.55	1.26	144.65	30	950	0.42	0.072	0.04	8.42	0.03	0.001
10.60	2.01	106.87	1.31	140.26	29	928	0.42	0.077	0.05	8.42	0.04	0.001
10.64	2.04	101.78	1.36	138.65	29	920	0.42	0.079	0.05	8.42	0.04	0.000
10.73	2.08	97.27	1.42	137.80	30	917	0.42	0.081	0.05	8.42	0.04	0.001
10.77	2.12	92.22	1.49	137.49	30	911	0.42	0.083	0.05	8.42	0.04	0.000
10.86	2.15	88.37	1.55	137.30	30	908	0.42	0.086	0.05	8.42	0.04	0.001
10.91	2.17	86.06	1.60	137.53	31	906	0.42	0.087	0.05	8.42	0.04	0.000
10.96	2.17	86.04	1.60	138.03	31	912	0.42	0.086	0.05	8.42	0.04	0.001
11.04	2.17	86.95	1.60	138.79	31	923	0.42	0.084	0.05	8.42	0.04	0.001
11.13	2.17	87.46	1.59	139.48	31	933	0.42	0.083	0.05	8.42	0.04	0.001
11.17	2.17	88.51	1.59	140.32	31	943	0.42	0.081	0.05	8.42	0.04	0.000
11.22	2.16	89.40	1.58	140.97	31	951	0.42	0.080	0.05	8.42	0.04	0.000
11.30	2.16	90.32	1.57	141.71	31	962	0.42	0.078	0.05	8.42	0.04	0.001
11.37	2.15	91.28	1.56	142.40	31	972	0.42	0.077	0.04	8.42	0.03	0.001
11.44	2.15	92.18	1.56	143.38	32	984	0.42	0.075	0.04	8.42	0.03	0.001
11.52	2.15	92.81	1.55	144.21	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.57	2.15	93.43	1.56	145.47	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.66	2.16	93.38	1.56	146.02	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.71	2.16	92.93	1.58	146.74	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.83	2.17	91.67	1.60	146.60	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.84	2.18	90.78	1.62	147.09	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.88	2.19	89.44	1.65	147.61	0	0	0.42	0.000	0.00	8.42	0.00	0.000
11.96	2.21	87.35	1.70	148.26	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.02	2.24	84.38	1.76	148.58	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.10	2.26	81.22	1.82	148.10	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.14	2.28	77.31	1.89	146.38	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.23	2.30	73.50	1.96	144.08	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.27	2.34	67.61	2.09	141.04	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.37	2.38	62.02	2.24	138.68	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.41	2.44	55.33	2.47	136.68	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.50	2.49	50.10	2.70	135.24	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.54	2.50	47.85	2.77	132.54	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.60	2.54	44.89	2.96	133.00	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.67	2.51	46.52	2.82	131.20	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.76	2.49	48.57	2.70	131.24	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.80	2.38	58.70	2.22	130.43	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.87	2.29	70.12	1.92	134.65	0	0	0.42	0.000	0.00	8.42	0.00	0.000
12.94	2.23	81.00	1.74	141.07	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.01	2.19	89.45	1.65	147.78	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.11	2.18	93.99	1.62	152.10	0	0	0.42	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
13.16	2.16	98.03	1.58	155.37	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.20	2.15	100.84	1.56	157.31	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.32	2.12	102.06	1.49	152.33	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.38	2.09	102.69	1.43	147.19	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.43	2.06	102.29	1.38	141.38	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.51	2.06	102.56	1.38	141.45	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.56	2.05	103.65	1.37	142.03	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.63	2.05	104.11	1.37	142.21	0	0	0.42	0.000	0.00	8.42	0.00	0.000
13.69	2.06	101.59	1.39	140.97	30	1110	0.42	0.075	0.05	8.42	0.04	0.001
13.73	2.05	102.46	1.37	140.48	30	1108	0.42	0.076	0.05	8.42	0.04	0.000
13.82	2.03	104.00	1.35	140.13	30	1109	0.42	0.076	0.05	8.42	0.04	0.001
13.86	2.00	109.51	1.30	141.87	29	1119	0.42	0.075	0.05	8.42	0.04	0.000
13.95	1.98	111.49	1.28	142.38	29	1125	0.42	0.075	0.05	8.42	0.04	0.001
13.99	1.97	113.80	1.26	143.36	29	1131	0.42	0.074	0.05	8.42	0.04	0.000
14.04	1.95	116.84	1.24	145.14	30	1143	0.42	0.073	0.05	8.42	0.04	0.000
14.16	1.94	119.83	1.23	147.34	30	1163	0.42	0.071	0.04	8.42	0.03	0.001
14.21	1.93	123.40	1.22	150.40	30	1186	0.42	0.068	0.04	8.42	0.03	0.000
14.28	1.93	126.24	1.22	153.45	31	1212	0.42	0.065	0.04	8.42	0.03	0.000
14.34	1.92	129.61	1.21	156.85	32	1240	0.42	0.062	0.04	8.42	0.03	0.000
14.40	1.92	133.28	1.20	160.43	32	1269	0.42	0.059	0.03	8.42	0.03	0.000
14.44	1.91	136.54	1.20	163.83	33	1296	0.42	0.057	0.03	8.42	0.02	0.000
14.52	1.91	138.68	1.20	166.22	33	1319	0.42	0.055	0.03	8.42	0.02	0.000
14.57	1.91	139.74	1.20	167.76	34	1335	0.42	0.054	0.03	8.42	0.02	0.000
14.65	1.91	139.61	1.20	167.94	34	1343	0.42	0.054	0.03	8.42	0.02	0.000
14.70	1.92	139.23	1.21	167.97	34	1348	0.42	0.054	0.03	8.42	0.02	0.000
14.83	1.92	138.80	1.21	167.66	34	1354	0.42	0.054	0.03	8.42	0.02	0.001
14.88	1.92	139.33	1.21	168.00	34	1358	0.42	0.054	0.03	8.42	0.02	0.000
14.95	1.91	139.59	1.20	167.93	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.01	1.92	139.05	1.20	167.50	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.07	1.92	137.80	1.21	166.60	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.13	1.93	135.51	1.22	165.08	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.19	1.94	132.48	1.23	162.78	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.27	1.95	128.40	1.24	159.73	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.32	1.97	123.84	1.26	156.37	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.37	1.99	118.61	1.29	152.71	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.43	2.02	111.88	1.32	147.94	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.54	2.04	105.04	1.36	143.10	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.59	2.07	98.79	1.41	139.07	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.63	2.11	92.52	1.47	136.14	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.72	2.15	86.02	1.56	134.39	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.76	2.22	78.10	1.72	134.71	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.85	2.29	71.52	1.91	136.74	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.89	2.35	65.48	2.13	139.70	0	0	0.42	0.000	0.00	8.42	0.00	0.000
15.96	2.39	61.33	2.29	140.46	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.06	2.42	58.18	2.41	140.29	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.11	2.44	56.41	2.48	139.74	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.16	2.42	58.15	2.40	139.85	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.25	2.35	64.15	2.14	137.07	0	0	0.42	0.000	0.00	8.42	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
16.33	2.27	71.81	1.86	133.26	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.38	2.19	78.55	1.65	129.95	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.43	2.15	82.56	1.56	128.59	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.47	2.12	87.33	1.49	130.34	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.57	2.10	91.52	1.45	133.01	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.62	2.10	94.72	1.45	137.09	0	0	0.42	0.000	0.00	8.42	0.00	0.000
16.72	2.10	95.33	1.46	139.33	30	1262	0.42	0.077	0.05	8.42	0.04	0.001
16.74	2.12	95.49	1.49	142.14	31	1288	0.42	0.073	0.04	8.42	0.03	0.000
16.82	2.13	95.85	1.51	144.46	32	1313	0.42	0.071	0.04	8.42	0.03	0.001
16.89	2.14	96.96	1.52	147.81	32	1346	0.42	0.067	0.04	8.42	0.03	0.000
16.95	2.14	98.72	1.53	150.76	33	1377	0.42	0.064	0.04	8.42	0.03	0.000
17.00	2.13	101.61	1.52	154.35	34	1413	0.42	0.061	0.03	8.42	0.02	0.000
17.09	2.13	104.18	1.51	157.19	34	1445	0.42	0.059	0.03	8.42	0.02	0.001
17.13	2.12	107.54	1.49	160.41	35	1478	0.42	0.056	0.03	8.42	0.02	0.000
17.22	2.11	109.38	1.48	162.02	35	1499	0.42	0.055	0.03	8.42	0.02	0.000
17.26	2.11	111.58	1.47	164.16	36	1521	0.42	0.054	0.03	8.42	0.02	0.000
17.35	2.11	112.74	1.47	165.73	36	1542	0.42	0.053	0.03	8.42	0.02	0.000
17.41	2.11	114.91	1.46	168.34	37	1570	0.42	0.051	0.02	8.42	0.02	0.000
17.49	2.09	119.60	1.44	172.47	37	1613	0.42	0.049	0.02	8.42	0.02	0.000
17.57	2.08	125.16	1.41	176.65	38	1656	0.42	0.047	0.02	8.42	0.02	0.000
17.59	2.05	132.96	1.37	182.36	39	1706	0.42	0.044	0.02	8.42	0.02	0.000
17.67	2.03	140.88	1.34	188.54	40	1762	0.42	0.042	0.02	8.42	0.01	0.000
17.75	2.01	148.32	1.32	195.12	41	1823	0.42	0.040	0.02	8.42	0.01	0.000
17.80	2.00	156.26	1.30	202.66	42	1890	0.42	0.038	0.02	8.42	0.01	0.000
17.88	1.99	162.09	1.28	208.28	43	1944	0.42	0.036	0.01	8.42	0.01	0.000
17.93	1.98	168.46	1.28	214.90	44	2004	0.42	0.034	0.01	8.42	0.01	0.000
18.01	1.98	172.64	1.28	220.15	45	2059	0.42	0.033	0.01	8.42	0.01	0.000
18.06	1.98	176.26	1.28	225.70	47	2119	0.42	0.032	0.01	8.42	0.01	0.000
18.13	1.99	179.31	1.29	230.52	48	2172	0.42	0.031	0.01	8.42	0.01	0.000
18.20	1.99	182.00	1.29	234.69	49	2219	0.42	0.030	0.01	8.42	0.01	0.000
18.24	1.99	184.71	1.29	238.74	50	2264	0.42	0.029	0.01	8.42	0.01	0.000
18.32	2.00	187.19	1.30	242.53	50	2308	0.42	0.029	0.01	8.42	0.01	0.000
18.42	2.00	188.91	1.30	245.30	51	2344	0.42	0.028	0.01	8.42	0.01	0.000
18.46	2.00	190.08	1.30	247.21	51	2367	0.42	0.028	0.01	8.42	0.01	0.000
18.51	2.00	189.89	1.31	247.98	52	2382	0.42	0.028	0.01	8.42	0.01	0.000
18.59	2.01	188.26	1.32	247.87	52	2394	0.42	0.028	0.01	8.42	0.01	0.000
18.68	2.02	186.22	1.33	246.95	52	2397	0.42	0.028	0.01	8.42	0.01	0.000
18.72	2.02	184.14	1.33	245.34	52	2388	0.42	0.028	0.01	8.42	0.01	0.000
18.77	2.03	182.06	1.34	243.20	51	2373	0.42	0.028	0.01	8.42	0.01	0.000
18.84	2.03	179.46	1.34	241.22	51	2363	0.42	0.029	0.01	8.42	0.01	0.000
18.90	2.04	177.23	1.36	240.18	51	2362	0.42	0.029	0.01	8.42	0.01	0.000
18.99	2.04	175.96	1.36	239.90	51	2370	0.42	0.029	0.01	8.42	0.01	0.000
19.03	2.05	175.75	1.37	240.35	51	2379	0.42	0.029	0.01	8.42	0.01	0.000
19.14	2.05	175.12	1.37	239.95	51	2386	0.42	0.029	0.01	8.42	0.01	0.000
19.21	2.05	174.02	1.38	239.53	51	2390	0.42	0.029	0.01	8.42	0.01	0.000
19.26	2.04	172.76	1.35	233.52	49	2326	0.42	0.030	0.01	8.42	0.01	0.000
19.39	2.02	171.30	1.33	228.41	48	2280	0.43	0.031	0.01	8.42	0.01	0.000
19.45	2.01	170.84	1.32	224.75	47	2241	0.43	0.032	0.01	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
19.52	2.02	170.88	1.33	227.14	48	2276	0.43	0.032	0.01	8.42	0.01	0.000
19.56	2.03	170.75	1.34	229.16	48	2305	0.43	0.031	0.01	8.42	0.01	0.000
19.63	2.06	164.65	1.38	227.96	49	2312	0.43	0.031	0.01	8.42	0.01	0.000
19.66	2.08	161.06	1.42	228.46	49	2326	0.43	0.031	0.01	8.42	0.01	0.000
19.72	2.09	159.17	1.44	229.07	49	2341	0.43	0.031	0.01	8.42	0.01	0.000
19.76	2.09	161.65	1.43	230.95	50	2363	0.43	0.030	0.01	8.42	0.01	0.000
19.89	2.09	159.82	1.44	229.76	50	2363	0.43	0.031	0.01	8.42	0.01	0.000
19.95	2.10	155.10	1.46	226.21	49	2334	0.43	0.031	0.01	8.42	0.01	0.000
20.07	2.11	151.08	1.47	222.51	48	2307	0.43	0.032	0.01	8.42	0.01	0.000
20.12	2.11	149.89	1.47	220.00	48	2285	0.43	0.033	0.01	8.42	0.01	0.000
20.25	2.10	151.67	1.45	219.49	47	2288	0.43	0.033	0.01	8.42	0.01	0.000
20.32	2.08	155.90	1.41	220.39	47	2298	0.43	0.033	0.01	8.42	0.01	0.000
20.38	2.06	160.49	1.38	222.00	47	2313	0.43	0.033	0.01	8.42	0.01	0.000
20.43	2.04	164.94	1.36	224.20	47	2332	0.43	0.032	0.01	8.42	0.01	0.000
20.50	2.03	168.01	1.35	225.98	48	2352	0.43	0.032	0.01	8.42	0.01	0.000
20.56	2.03	170.07	1.34	227.39	48	2367	0.43	0.032	0.01	8.42	0.01	0.000
20.61	2.02	171.05	1.33	227.76	48	2373	0.43	0.032	0.01	8.42	0.01	0.000
20.68	2.02	171.42	1.33	227.46	48	2373	0.43	0.032	0.01	8.42	0.01	0.000
20.73	2.01	171.83	1.32	226.80	47	2367	0.43	0.032	0.01	8.42	0.01	0.000
20.79	2.01	172.68	1.31	226.49	47	2364	0.43	0.033	0.01	8.42	0.01	0.000
20.86	2.00	174.43	1.30	227.05	47	2370	0.43	0.033	0.01	8.42	0.01	0.000
20.91	1.99	177.67	1.29	229.11	48	2388	0.43	0.032	0.01	8.42	0.01	0.000
20.97	1.97	184.57	1.27	233.73	48	2424	0.43	0.032	0.01	8.42	0.01	0.000
21.09	1.95	192.00	1.24	238.62	49	2462	0.43	0.031	0.01	8.42	0.01	0.000
21.14	1.93	199.44	1.22	243.69	49	2496	0.43	0.031	0.01	8.42	0.01	0.000
21.22	1.93	202.85	1.21	246.24	50	2519	0.43	0.030	0.01	8.42	0.01	0.000
21.26	1.92	204.20	1.21	247.56	50	2534	0.43	0.030	0.01	8.42	0.01	0.000
21.33	1.93	204.05	1.21	247.92	50	2546	0.43	0.030	0.01	8.42	0.01	0.000
21.40	1.93	203.82	1.22	247.96	50	2554	0.43	0.030	0.01	8.42	0.01	0.000
21.49	1.93	203.55	1.22	248.37	50	2570	0.43	0.030	0.01	8.42	0.01	0.000
21.57	1.94	203.12	1.23	249.17	51	2593	0.43	0.030	0.01	8.42	0.01	0.000
21.62	1.95	202.11	1.24	250.75	51	2629	0.43	0.029	0.01	8.42	0.01	0.000
21.70	1.97	199.84	1.26	251.87	52	2668	0.43	0.029	0.01	8.42	0.01	0.000
21.75	1.99	196.43	1.28	252.26	52	2698	0.43	0.028	0.01	8.42	0.01	0.000
21.80	2.01	191.71	1.31	251.42	53	2714	0.43	0.028	0.01	8.42	0.01	0.000
21.88	2.03	186.59	1.34	249.50	52	2716	0.44	0.028	0.01	8.42	0.01	0.000
21.93	2.04	181.34	1.36	247.19	52	2707	0.44	0.029	0.01	8.42	0.01	0.000
22.06	2.06	176.65	1.38	243.93	52	2691	0.44	0.029	0.01	8.42	0.01	0.000
22.10	2.06	173.31	1.39	240.39	51	2658	0.44	0.030	0.01	8.42	0.01	0.000
22.16	2.05	172.07	1.37	236.51	50	2616	0.44	0.030	0.01	8.42	0.01	0.000
22.24	2.01	174.27	1.32	229.41	48	2514	0.44	0.032	0.01	8.42	0.01	0.000
22.33	1.96	178.78	1.25	223.00	46	2397	0.44	0.035	0.01	8.42	0.01	0.000
22.41	1.90	184.67	1.19	219.81	44	2301	0.44	0.037	0.01	8.42	0.01	0.000
22.46	1.88	190.90	1.17	222.80	44	2300	0.44	0.038	0.01	8.42	0.01	0.000
22.58	1.87	195.65	1.16	226.58	45	2332	0.44	0.037	0.01	8.42	0.01	0.000
22.64	1.86	198.04	1.15	228.56	45	2349	0.44	0.037	0.01	8.42	0.01	0.000
22.68	1.86	198.33	1.15	228.55	45	2349	0.44	0.037	0.01	8.42	0.01	0.000
22.74	1.87	195.42	1.16	226.55	45	2344	0.44	0.037	0.01	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
22.78	1.87	195.75	1.16	226.76	45	2348	0.44	0.037	0.01	8.42	0.01	0.000
22.87	1.87	195.34	1.16	226.49	45	2353	0.44	0.037	0.01	8.42	0.01	0.000
22.91	1.86	198.30	1.15	228.77	45	2368	0.44	0.037	0.01	8.42	0.01	0.000
22.98	1.86	199.33	1.15	229.99	45	2386	0.44	0.037	0.01	8.42	0.01	0.000
23.09	1.86	199.51	1.16	230.89	46	2409	0.44	0.036	0.01	8.42	0.01	0.000
23.13	1.87	198.84	1.16	231.50	46	2430	0.44	0.036	0.01	8.42	0.01	0.000
23.18	1.89	197.45	1.18	232.42	46	2466	0.44	0.035	0.01	8.42	0.01	0.000
23.26	1.90	195.77	1.19	233.14	47	2502	0.44	0.035	0.01	8.42	0.01	0.000
23.31	1.91	194.65	1.20	234.14	47	2534	0.44	0.034	0.01	8.42	0.01	0.000
23.40	1.92	193.90	1.21	234.30	47	2550	0.44	0.034	0.01	8.42	0.01	0.000
23.43	1.92	194.56	1.21	235.34	48	2565	0.44	0.034	0.01	8.42	0.01	0.000
23.57	1.92	194.77	1.21	235.65	48	2579	0.44	0.034	0.01	8.42	0.01	0.000
23.61	1.92	195.98	1.21	236.68	48	2590	0.44	0.033	0.01	8.42	0.01	0.000
23.62	1.92	196.89	1.20	237.00	48	2589	0.44	0.033	0.01	8.42	0.01	0.000
23.71	1.91	197.57	1.20	236.56	48	2580	0.44	0.034	0.01	8.42	0.01	0.000
23.84	1.90	197.79	1.19	235.64	47	2570	0.44	0.034	0.01	8.42	0.01	0.000
23.88	1.90	198.28	1.19	235.21	47	2560	0.44	0.034	0.01	8.42	0.01	0.000
23.93	1.89	198.64	1.18	235.06	47	2557	0.44	0.035	0.01	8.42	0.01	0.000
23.97	1.89	198.96	1.18	234.89	47	2553	0.44	0.035	0.01	8.42	0.01	0.000
24.02	1.89	197.94	1.18	233.00	46	2529	0.44	0.035	0.01	8.42	0.01	0.000
24.16	1.88	195.80	1.17	229.97	46	2501	0.44	0.036	0.01	8.42	0.01	0.000
24.24	1.88	193.37	1.17	226.28	45	2459	0.44	0.037	0.01	8.42	0.01	0.000
24.29	1.88	191.45	1.17	223.62	44	2429	0.44	0.038	0.01	8.42	0.01	0.000
24.36	1.88	188.61	1.17	220.16	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.41	1.88	184.75	1.17	216.28	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.46	1.89	177.66	1.18	210.06	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.59	1.92	168.75	1.20	203.10	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.64	1.94	159.27	1.23	196.42	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.71	1.97	151.17	1.26	191.01	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.77	2.00	143.17	1.30	185.56	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.82	2.02	135.36	1.33	179.77	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.90	2.05	127.48	1.37	174.06	0	0	0.44	0.000	0.00	8.42	0.00	0.000
24.95	2.07	119.66	1.41	168.49	0	0	0.44	0.000	0.00	8.42	0.00	0.000
25.02	2.11	110.75	1.47	163.29	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.08	2.16	101.18	1.57	158.36	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.15	2.21	90.54	1.70	154.07	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.21	2.29	79.39	1.90	151.02	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.25	2.35	67.79	2.11	142.75	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.33	2.46	51.56	2.59	133.72	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.52	2.58	38.45	3.22	123.98	0	0	0.45	0.000	0.00	8.42	0.00	0.000
25.56	2.73	29.17	4.22	123.22	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.61	2.78	26.58	4.66	123.73	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.65	2.84	24.23	5.15	124.82	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.69	2.85	23.75	5.25	124.56	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.74	2.83	24.60	5.06	124.54	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.82	2.80	26.38	4.75	125.27	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.87	2.79	27.17	4.69	127.37	0	0	0.45	0.000	0.00	0.00	0.00	0.000
25.93	2.77	28.37	4.56	129.30	0	0	0.45	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
25.99	2.75	29.92	4.37	130.69	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.11	2.73	31.25	4.19	131.00	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.18	2.70	32.61	4.00	130.46	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.23	2.67	34.03	3.81	129.71	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.29	2.63	36.42	3.54	129.01	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.36	2.59	39.61	3.24	128.20	34	1460	0.45	0.116	0.06	8.42	0.05	0.001
26.42	2.54	42.63	2.97	126.82	33	1474	0.45	0.114	0.06	8.42	0.05	0.001
26.48	2.51	44.32	2.83	125.21	32	1475	0.45	0.114	0.06	8.42	0.05	0.001
26.54	2.51	44.13	2.81	123.87	32	1463	0.45	0.116	0.07	8.42	0.05	0.001
26.61	2.56	40.13	3.08	123.44	33	1433	0.45	0.123	0.07	8.42	0.05	0.001
26.71	2.64	34.41	3.55	122.13	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.79	2.73	28.26	4.24	119.73	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.84	2.79	24.68	4.68	115.64	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.90	2.82	22.51	4.94	111.23	0	0	0.45	0.000	0.00	0.00	0.00	0.000
26.97	2.82	21.53	5.00	107.60	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.02	2.82	21.25	4.97	105.57	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.09	2.81	21.52	4.91	105.68	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.15	2.82	21.47	4.93	105.83	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.21	2.83	20.61	5.08	104.71	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.29	2.88	18.77	5.46	102.48	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.33	2.93	16.66	5.97	99.55	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.40	2.97	14.98	6.43	96.39	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.46	3.01	13.60	6.86	93.38	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.51	3.05	12.44	7.26	90.28	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.59	3.09	11.34	7.75	87.89	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.64	3.12	10.25	8.23	84.38	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.77	3.16	9.35	8.65	80.81	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.82	3.17	8.69	8.82	76.62	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.90	3.17	8.30	8.86	73.49	0	0	0.45	0.000	0.00	0.00	0.00	0.000
27.95	3.17	8.02	8.88	71.22	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.00	3.18	7.86	8.96	70.47	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.08	3.18	7.81	9.02	70.43	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.20	3.19	7.77	9.07	70.52	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.26	3.18	7.88	9.00	70.86	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.31	3.18	7.98	9.00	71.85	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.39	3.16	8.54	8.67	74.04	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.44	3.13	9.30	8.33	77.43	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.49	3.11	10.32	8.05	83.09	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.57	3.10	11.22	7.94	89.12	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.62	3.10	12.04	7.90	95.14	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.69	3.13	11.90	8.25	98.20	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.70	3.10	12.88	7.88	101.56	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.79	3.07	13.80	7.53	103.99	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.84	3.01	15.57	6.86	106.83	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.88	2.99	16.42	6.65	109.17	0	0	0.45	0.000	0.00	0.00	0.00	0.000
28.97	2.98	17.05	6.52	111.17	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.01	2.97	17.58	6.44	113.27	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.10	2.98	17.52	6.53	114.44	0	0	0.45	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
29.14	2.98	17.49	6.57	115.02	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.23	2.98	17.49	6.55	114.56	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.27	2.95	18.23	6.21	113.15	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.36	2.90	19.77	5.66	112.00	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.40	2.80	23.33	4.75	110.88	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.50	2.70	27.57	4.00	110.17	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.54	2.60	32.88	3.36	110.39	0	0	0.45	0.000	0.00	0.00	0.00	0.000
29.61	2.52	39.09	2.87	112.23	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.72	2.46	44.93	2.56	114.91	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.77	2.41	50.09	2.36	118.28	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.83	2.40	52.79	2.30	121.38	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.89	2.39	54.66	2.27	124.30	0	0	0.45	0.000	0.00	8.42	0.00	0.000
29.94	2.39	55.65	2.27	126.60	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.01	2.40	55.75	2.29	127.86	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.08	2.41	54.93	2.34	128.40	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.14	2.42	53.34	2.40	128.03	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.20	2.44	51.17	2.49	127.27	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.26	2.46	48.69	2.59	126.22	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.32	2.49	46.24	2.71	125.49	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.38	2.53	43.27	2.93	126.60	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.51	2.57	40.75	3.14	127.88	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.56	2.60	39.14	3.30	129.28	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.63	2.59	39.36	3.29	129.47	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.69	2.57	42.10	3.13	131.87	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.82	2.51	47.77	2.83	135.17	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.87	2.44	56.11	2.47	138.72	0	0	0.45	0.000	0.00	8.42	0.00	0.000
30.92	2.37	64.60	2.19	141.61	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.00	2.31	71.98	2.00	143.76	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.05	2.28	78.12	1.87	146.16	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.12	2.24	84.88	1.77	150.30	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.22	2.22	90.97	1.71	155.71	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.31	2.21	96.53	1.69	162.69	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.36	2.19	100.73	1.64	165.43	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.43	2.17	104.35	1.60	166.46	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.49	2.15	107.27	1.54	165.45	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.53	2.14	108.64	1.52	165.57	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.58	2.13	109.00	1.52	165.26	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.66	2.13	108.67	1.51	164.34	0	0	0.45	0.000	0.00	8.42	0.00	0.000
31.71	2.13	107.43	1.52	162.79	36	2342	0.45	0.055	0.03	8.42	0.02	0.000
31.79	2.13	106.97	1.51	161.93	35	2334	0.45	0.055	0.03	8.42	0.02	0.000
31.83	2.13	108.07	1.50	162.48	36	2341	0.45	0.055	0.03	8.42	0.02	0.000
31.92	2.12	110.78	1.48	164.33	36	2367	0.45	0.054	0.03	8.42	0.02	0.000
31.96	2.11	113.79	1.47	167.14	36	2406	0.45	0.053	0.03	8.42	0.02	0.000
32.04	2.10	116.31	1.46	169.94	37	2448	0.46	0.052	0.02	8.42	0.02	0.000
32.11	2.10	118.38	1.46	172.78	37	2492	0.46	0.050	0.02	8.42	0.02	0.000
32.17	2.10	120.26	1.46	175.23	38	2530	0.46	0.049	0.02	8.42	0.02	0.000
32.24	2.10	122.35	1.45	177.73	38	2568	0.46	0.048	0.02	8.42	0.02	0.000
32.32	2.10	124.33	1.45	179.89	39	2602	0.46	0.047	0.02	8.42	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
32.36	2.10	125.13	1.46	182.22	39	2642	0.46	0.046	0.02	8.42	0.02	0.000
32.45	2.11	124.09	1.48	183.35	40	2672	0.46	0.045	0.02	8.42	0.02	0.000
32.50	2.13	121.73	1.52	184.99	41	2711	0.46	0.044	0.02	8.42	0.01	0.000
32.64	2.15	118.95	1.56	185.60	41	2738	0.46	0.044	0.02	8.42	0.01	0.000
32.67	2.17	116.48	1.60	186.73	42	2763	0.46	0.043	0.02	8.42	0.01	0.000
32.74	2.18	114.87	1.63	187.08	42	2776	0.46	0.043	0.02	8.42	0.01	0.000
32.77	2.19	114.03	1.64	187.29	42	2782	0.46	0.043	0.02	8.42	0.01	0.000
32.82	2.19	113.87	1.63	186.08	42	2767	0.46	0.043	0.02	8.42	0.01	0.000
32.95	2.18	113.88	1.61	183.70	41	2737	0.46	0.044	0.02	8.42	0.01	0.000
33.02	2.17	113.99	1.59	181.10	40	2699	0.46	0.045	0.02	8.42	0.02	0.000
33.06	2.16	113.78	1.57	178.97	40	2668	0.46	0.046	0.02	8.42	0.02	0.000
33.11	2.15	113.57	1.56	177.30	39	2644	0.46	0.047	0.02	8.42	0.02	0.000
33.15	2.15	113.62	1.55	175.66	39	2619	0.46	0.048	0.02	8.42	0.02	0.000
33.28	2.14	113.39	1.54	174.27	38	2603	0.46	0.049	0.02	8.42	0.02	0.001
33.33	2.14	113.27	1.54	173.88	38	2600	0.46	0.049	0.02	8.42	0.02	0.000
33.38	2.15	112.88	1.55	174.67	39	2618	0.46	0.048	0.02	8.42	0.02	0.000
33.45	2.15	114.16	1.55	177.14	39	2660	0.46	0.047	0.02	8.42	0.02	0.000
33.56	2.15	116.95	1.54	180.55	40	2716	0.46	0.046	0.02	8.42	0.02	0.000
33.62	2.14	121.21	1.52	184.53	41	2774	0.46	0.044	0.02	8.42	0.01	0.000
33.69	2.13	124.89	1.50	187.60	41	2818	0.46	0.043	0.02	8.42	0.01	0.000
33.73	2.11	127.92	1.48	189.41	41	2841	0.46	0.043	0.02	8.42	0.01	0.000
33.79	2.10	130.34	1.46	190.09	41	2845	0.46	0.043	0.02	8.42	0.01	0.000
33.86	2.09	132.31	1.44	190.26	41	2843	0.46	0.043	0.02	8.42	0.01	0.000
33.91	2.08	134.37	1.42	190.81	41	2844	0.46	0.043	0.02	8.42	0.01	0.000
33.97	2.07	136.75	1.40	191.89	41	2854	0.46	0.043	0.02	8.42	0.01	0.000
34.04	2.06	139.53	1.39	193.30	41	2867	0.46	0.043	0.02	8.42	0.01	0.000
34.08	2.04	143.22	1.36	195.21	41	2882	0.46	0.042	0.02	8.42	0.01	0.000
34.14	2.03	147.79	1.34	197.57	42	2897	0.46	0.042	0.02	8.42	0.01	0.000
34.21	2.01	153.28	1.31	200.48	42	2913	0.46	0.042	0.02	8.42	0.01	0.000
34.26	1.97	160.52	1.26	201.75	41	2868	0.46	0.043	0.02	8.42	0.01	0.000
34.38	1.93	165.80	1.22	202.74	41	2831	0.46	0.044	0.02	8.42	0.01	0.000
34.44	1.91	168.68	1.20	202.45	41	2786	0.46	0.045	0.02	8.42	0.01	0.000
34.56	1.92	167.44	1.21	202.00	41	2799	0.46	0.045	0.02	8.42	0.01	0.000
34.61	1.92	166.19	1.21	200.91	41	2792	0.46	0.045	0.02	8.42	0.01	0.000
34.66	1.94	160.72	1.23	197.06	40	2773	0.46	0.046	0.02	8.42	0.02	0.000
34.70	1.94	160.02	1.23	196.43	40	2768	0.46	0.046	0.02	8.42	0.02	0.000
34.73	1.94	158.38	1.23	195.35	40	2765	0.46	0.046	0.02	8.42	0.02	0.000
34.79	1.93	161.91	1.22	197.99	40	2787	0.46	0.046	0.02	8.42	0.02	0.000
34.91	1.94	161.35	1.23	198.93	41	2824	0.46	0.045	0.02	8.42	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.08

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
35.02	200.62	2.00	0.00	1.00	0.00	35.10	201.47	2.00	0.00	1.00	0.00
35.14	200.88	2.00	0.00	1.00	0.00	35.20	200.49	2.00	0.00	1.00	0.00
35.27	199.80	1.80	0.00	1.00	0.00	35.32	200.04	2.00	0.00	1.00	0.00
35.37	201.22	2.00	0.00	1.00	0.00	35.43	205.39	2.00	0.00	1.00	0.00
35.55	209.84	2.00	0.00	1.00	0.00	35.61	213.72	2.00	0.00	1.00	0.00
35.67	215.25	2.00	0.00	1.00	0.00	35.72	215.94	2.00	0.00	1.00	0.00
35.82	215.86	2.00	0.00	1.00	0.00	35.88	215.29	2.00	0.00	1.00	0.00
35.94	213.43	2.00	0.00	1.00	0.00	36.05	210.95	2.00	0.00	1.00	0.00
36.12	208.77	2.00	0.00	1.00	0.00	36.17	207.30	2.00	0.00	1.00	0.00
36.21	205.51	2.00	0.00	1.00	0.00	36.29	203.28	2.00	0.00	1.00	0.00
36.34	200.97	2.00	0.00	1.00	0.00	36.44	198.65	1.75	0.00	1.00	0.00
36.51	197.33	1.72	0.00	1.00	0.00	36.56	197.54	1.72	0.00	1.00	0.00
36.61	200.09	2.00	0.00	1.00	0.00	36.68	203.48	2.00	0.00	1.00	0.00
36.74	207.56	2.00	0.00	1.00	0.00	36.84	210.18	2.00	0.00	1.00	0.00
36.91	211.37	2.00	0.00	1.00	0.00	36.96	210.89	2.00	0.00	1.00	0.00
37.01	209.83	2.00	0.00	1.00	0.00	37.09	208.44	2.00	0.00	1.00	0.00
37.14	206.58	2.00	0.00	1.00	0.00	37.22	204.40	2.00	0.00	1.00	0.00
37.30	202.26	2.00	0.00	1.00	0.00	37.36	200.21	2.00	0.00	1.00	0.00
37.42	197.70	1.72	0.00	1.00	0.00	37.48	194.50	1.64	0.00	1.00	0.00
37.53	190.86	1.56	0.00	1.00	0.00	37.58	183.88	1.41	0.00	1.00	0.00
37.65	176.36	1.27	0.19	1.00	0.00	37.71	168.30	2.00	0.00	1.00	0.00
37.76	162.24	2.00	0.00	1.00	0.00	37.82	154.80	2.00	0.00	1.00	0.00
37.89	145.56	2.00	0.00	1.00	0.00	37.95	133.09	2.00	0.00	1.00	0.00
38.00	120.87	2.00	0.00	1.00	0.00	38.09	113.27	2.00	0.00	1.00	0.00
38.14	108.06	2.00	0.00	1.00	0.00	38.22	104.54	2.00	0.00	1.00	0.00
38.26	98.72	2.00	0.00	1.00	0.00	38.34	92.20	2.00	0.00	1.00	0.00
38.41	84.84	2.00	0.00	1.00	0.00	38.49	78.91	2.00	0.00	1.00	0.00
38.53	73.50	2.00	0.00	1.00	0.00	38.62	69.23	2.00	0.00	1.00	0.00
38.67	64.13	2.00	0.00	1.00	0.00	38.80	60.12	2.00	0.00	1.00	0.00
38.84	57.14	2.00	0.00	1.00	0.00	38.89	55.81	2.00	0.00	1.00	0.00
38.93	54.90	2.00	0.00	1.00	0.00	39.02	54.51	2.00	0.00	1.00	0.00
39.05	54.48	2.00	0.00	1.00	0.00	39.15	54.60	2.00	0.00	1.00	0.00
39.24	54.83	2.00	0.00	1.00	0.00	39.28	55.16	2.00	0.00	1.00	0.00
39.33	55.58	2.00	0.00	1.00	0.00	39.42	55.98	2.00	0.00	1.00	0.00
39.46	56.31	2.00	0.00	1.00	0.00	39.51	56.57	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
39.60	56.71	2.00	0.00	1.00	0.00	39.68	56.79	2.00	0.00	1.00	0.00
39.73	56.84	2.00	0.00	1.00	0.00	39.78	57.08	2.00	0.00	1.00	0.00
39.85	57.41	2.00	0.00	1.00	0.00	39.91	57.87	2.00	0.00	1.00	0.00
39.98	58.37	2.00	0.00	1.00	0.00	40.04	59.30	2.00	0.00	1.00	0.00
40.10	60.68	2.00	0.00	1.00	0.00	40.17	62.09	2.00	0.00	1.00	0.00
40.23	63.29	2.00	0.00	1.00	0.00	40.30	64.64	2.00	0.00	1.00	0.00
40.41	66.91	2.00	0.00	1.00	0.00	40.48	69.50	2.00	0.00	1.00	0.00
40.53	71.92	2.00	0.00	1.00	0.00	40.60	73.50	2.00	0.00	1.00	0.00
40.65	72.39	2.00	0.00	1.00	0.00	40.72	71.71	2.00	0.00	1.00	0.00
40.79	71.14	2.00	0.00	1.00	0.00	40.85	73.09	2.00	0.00	1.00	0.00
40.92	74.10	2.00	0.00	1.00	0.00	40.97	74.99	2.00	0.00	1.00	0.00
41.02	75.92	2.00	0.00	1.00	0.00	41.09	77.09	2.00	0.00	1.00	0.00
41.17	78.26	2.00	0.00	1.00	0.00	41.22	80.27	2.00	0.00	1.00	0.00
41.30	82.35	2.00	0.00	1.00	0.00	41.35	85.87	2.00	0.00	1.00	0.00
41.44	88.81	2.00	0.00	1.00	0.00	41.50	91.52	2.00	0.00	1.00	0.00
41.56	92.88	2.00	0.00	1.00	0.00	41.62	93.81	2.00	0.00	1.00	0.00
41.74	93.87	2.00	0.00	1.00	0.00	41.79	93.09	2.00	0.00	1.00	0.00
41.88	91.60	2.00	0.00	1.00	0.00	41.93	90.25	2.00	0.00	1.00	0.00
41.98	89.15	2.00	0.00	1.00	0.00	42.05	88.48	2.00	0.00	1.00	0.00
42.15	88.26	2.00	0.00	1.00	0.00	42.24	88.49	2.00	0.00	1.00	0.00
42.28	88.16	2.00	0.00	1.00	0.00	42.41	86.69	2.00	0.00	1.00	0.00
42.46	83.78	2.00	0.00	1.00	0.00	42.53	78.59	2.00	0.00	1.00	0.00
42.64	73.18	2.00	0.00	1.00	0.00	42.71	66.76	2.00	0.00	1.00	0.00
42.77	62.70	2.00	0.00	1.00	0.00	42.82	58.61	2.00	0.00	1.00	0.00
42.90	57.09	2.00	0.00	1.00	0.00	42.95	57.29	2.00	0.00	1.00	0.00
43.02	58.72	2.00	0.00	1.00	0.00	43.08	60.68	2.00	0.00	1.00	0.00
43.12	62.43	2.00	0.00	1.00	0.00	43.20	64.40	2.00	0.00	1.00	0.00
43.25	67.42	2.00	0.00	1.00	0.00	43.33	72.60	2.00	0.00	1.00	0.00
43.38	81.37	2.00	0.00	1.00	0.00	43.50	89.61	2.00	0.00	1.00	0.00
43.56	96.77	2.00	0.00	1.00	0.00	43.62	102.62	2.00	0.00	1.00	0.00
43.69	104.70	2.00	0.00	1.00	0.00	43.74	105.97	2.00	0.00	1.00	0.00
43.82	105.44	2.00	0.00	1.00	0.00	43.93	105.99	2.00	0.00	1.00	0.00
44.00	106.72	2.00	0.00	1.00	0.00	44.05	108.25	2.00	0.00	1.00	0.00
44.10	111.60	2.00	0.00	1.00	0.00	44.19	116.86	2.00	0.00	1.00	0.00
44.24	123.23	2.00	0.00	1.00	0.00	44.29	129.17	2.00	0.00	1.00	0.00
44.38	135.13	2.00	0.00	1.00	0.00	44.43	141.37	2.00	0.00	1.00	0.00
44.50	146.34	2.00	0.00	1.00	0.00	44.56	150.12	2.00	0.00	1.00	0.00
44.64	151.69	2.00	0.00	1.00	0.00	44.72	151.88	2.00	0.00	1.00	0.00
44.76	149.78	2.00	0.00	1.00	0.00	44.86	147.02	2.00	0.00	1.00	0.00
44.90	143.13	2.00	0.00	1.00	0.00	44.98	139.59	2.00	0.00	1.00	0.00
45.03	135.40	2.00	0.00	1.00	0.00	45.08	130.75	2.00	0.00	1.00	0.00
45.19	126.60	2.00	0.00	1.00	0.00	45.25	123.89	2.00	0.00	1.00	0.00
45.30	123.14	2.00	0.00	1.00	0.00	45.35	122.94	2.00	0.00	1.00	0.00
45.44	123.86	2.00	0.00	1.00	0.00	45.51	125.52	2.00	0.00	1.00	0.00
45.56	127.93	2.00	0.00	1.00	0.00	45.62	130.10	2.00	0.00	1.00	0.00
45.69	132.41	2.00	0.00	1.00	0.00	45.74	135.53	2.00	0.00	1.00	0.00
45.81	138.20	2.00	0.00	1.00	0.00	45.87	142.84	2.00	0.00	1.00	0.00
46.00	147.32	2.00	0.00	1.00	0.00	46.05	152.86	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
46.16	155.39	2.00	0.00	1.00	0.00	46.23	158.27	2.00	0.00	1.00	0.00
46.28	160.80	2.00	0.00	1.00	0.00	46.35	163.33	2.00	0.00	1.00	0.00
46.41	165.29	2.00	0.00	1.00	0.00	46.46	167.59	2.00	0.00	1.00	0.00
46.58	169.79	2.00	0.00	1.00	0.00	46.63	167.52	2.00	0.00	1.00	0.00
46.71	163.76	2.00	0.00	1.00	0.00	46.76	159.02	2.00	0.00	1.00	0.00
46.82	158.04	0.94	0.80	1.00	0.01	46.89	156.51	0.92	0.81	1.00	0.01
46.98	155.56	0.90	0.82	1.00	0.01	47.05	154.96	0.90	0.82	1.00	0.01
47.14	154.81	2.00	0.00	1.00	0.00	47.18	154.88	2.00	0.00	1.00	0.00
47.32	155.10	2.00	0.00	1.00	0.00	47.36	155.60	2.00	0.00	1.00	0.00
47.41	156.06	2.00	0.00	1.00	0.00	47.46	156.20	2.00	0.00	1.00	0.00
47.54	156.17	0.91	0.81	1.00	0.01	47.62	156.09	0.91	0.81	1.00	0.01
47.66	156.14	0.91	0.81	1.00	0.00	47.70	156.05	0.91	0.81	1.00	0.00
47.78	155.40	0.90	0.82	1.00	0.01	47.90	154.33	0.89	0.82	1.00	0.01
47.94	153.15	0.87	0.83	1.00	0.00	47.98	151.97	2.00	0.00	1.00	0.00
48.07	150.83	2.00	0.00	1.00	0.00	48.12	149.72	2.00	0.00	1.00	0.00
48.20	149.37	2.00	0.00	1.00	0.00	48.24	149.95	2.00	0.00	1.00	0.00
48.31	151.81	2.00	0.00	1.00	0.00	48.39	154.55	2.00	0.00	1.00	0.00
48.48	157.33	2.00	0.00	1.00	0.00	48.52	159.65	2.00	0.00	1.00	0.00
48.56	161.72	2.00	0.00	1.00	0.00	48.65	163.61	2.00	0.00	1.00	0.00
48.69	165.39	2.00	0.00	1.00	0.00	48.78	166.37	2.00	0.00	1.00	0.00
48.82	166.99	2.00	0.00	1.00	0.00	48.91	166.99	1.08	0.40	1.00	0.00
48.98	166.50	1.07	0.40	1.00	0.00	49.05	165.56	1.06	0.40	1.00	0.00
49.10	163.94	1.03	0.56	1.00	0.00	49.18	162.24	1.01	0.56	1.00	0.01
49.22	158.24	0.95	0.79	1.00	0.00	49.36	152.57	0.87	0.84	1.00	0.01
49.40	147.58	0.80	1.15	1.00	0.01	49.44	145.74	2.00	0.00	1.00	0.00
49.48	146.72	2.00	0.00	1.00	0.00	49.58	147.51	2.00	0.00	1.00	0.00
49.65	147.97	2.00	0.00	1.00	0.00	49.69	147.78	2.00	0.00	1.00	0.00
49.75	146.34	2.00	0.00	1.00	0.00	49.85	144.89	2.00	0.00	1.00	0.00

Total estimated settlement: 0.12

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

APPENDIX F

GENERAL EARTHWORK AND GRADING GUIDELINES

Geotechnical and Infiltration Evaluation
2323 W. Broadway, Anaheim, California
Project No. 2496-CR

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the California Building Code, CBC (2019) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.
5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.

6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed unless otherwise specifically indicated in the text of this report.
2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).

2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
    a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
    b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
    a) They are not placed in concentrated pockets;
    b) There is a sufficient percentage of fine-grained material to surround the rocks;
    c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.
6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.
2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

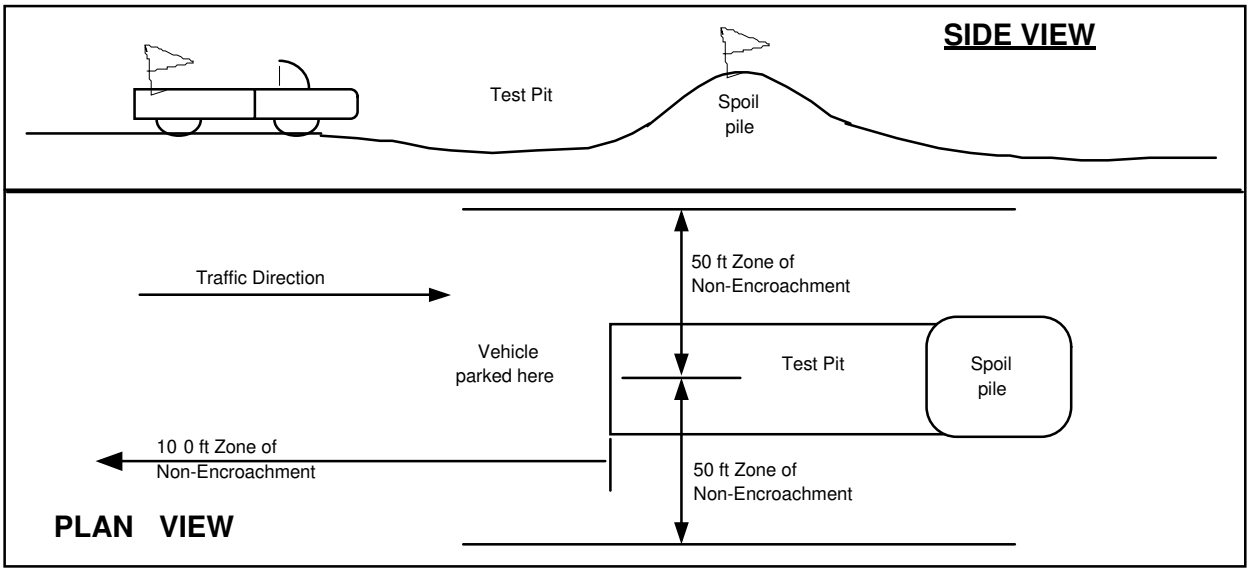
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

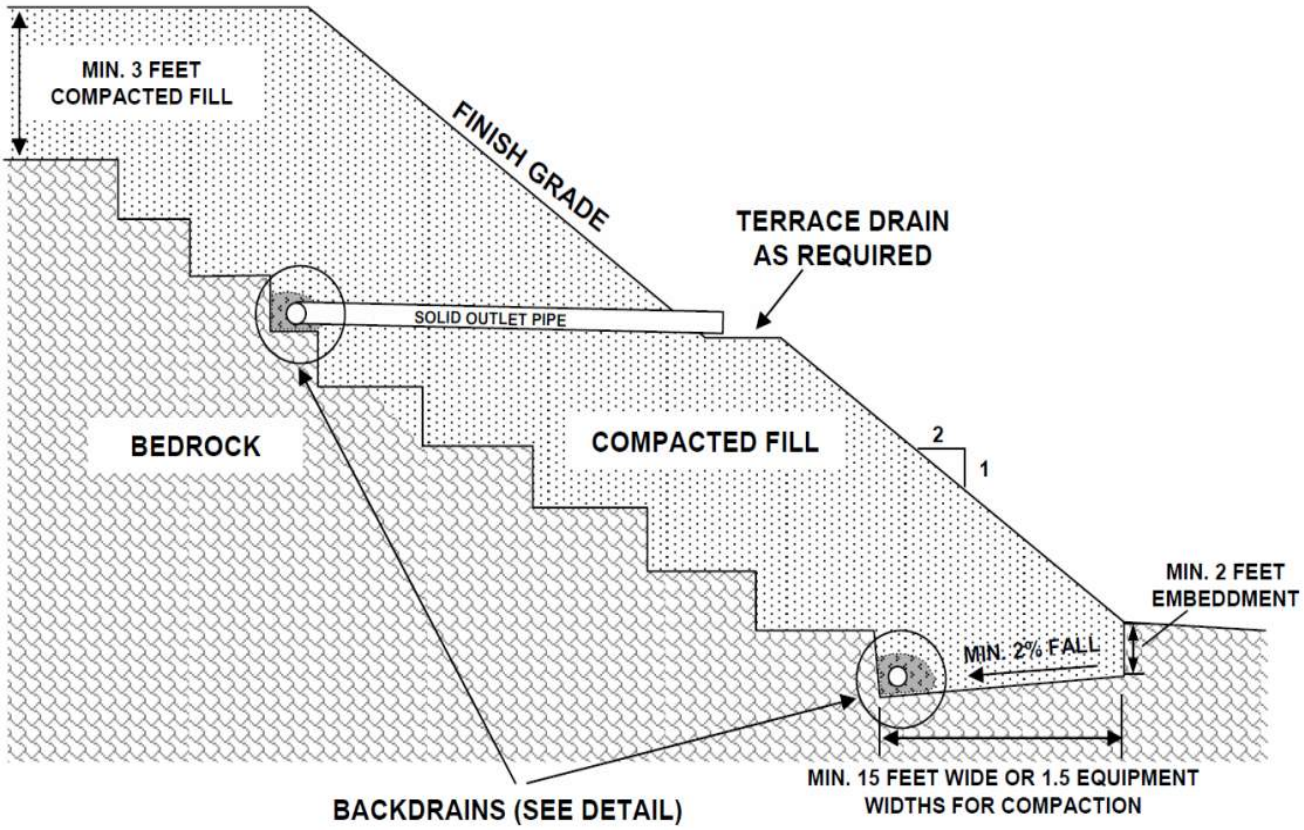
In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

NOTES:

2) MAXIMUM ROCK SIZE IN WINDROWS IS 4 FEET
3) SOIL AROUND WINDROWS TO BE SANDY MATERIAL SUBJECT TO SOIL ENGINEER ACCEPTANCE
4) SPACING AND CLEARANCES MUST BE SUFFICIENT TO ALLOW FOR PROPER COMPACTION
5) INDIVDUAL LARGE ROCKS MAY BE BURIED IN PITS.


MIN. 3 FEET
COMPACTED FILL
FINISH GRADE
TERRACE DRAIN
AS REQUIRED
SOLID OUTLET PIPE
BEDROCK
COMPACTED FILL
2
1
MIN. 2 FEET
EMBEDDMENT
MIN. 2% FALL
MIN. 15 FEET WIDE OR 1.5 EQUIPMENT
WIDTHS FOR COMPACTION
BACKDRAINS (SEE DETAIL)

Attachment G

Notice of Transfer of Responsibility

Water Quality Management Plan
Notice of Transfer of Responsibility

Submission of this Notice of Transfer of Responsibility constitutes notice to the City of Anaheim that responsibility for the Water Quality Management Plan ("WQMP") for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/ her agent) of the site (or a portion thereof) to the New Owner, as further described below.

I. Previous Owner/ Previous Responsibility Party Information

Company/ Individual Name		Contact Person	
Street Address		Title	
City	State	Zip	Phone

II. Information about Site Transferred

Name of Project	
Title of WQMP Applicable to Site:	
Street Address of Site	
Tract Number(s) for Site	Lot Numbers
Date WQMP Prepared (or Revised)	

III. New Owner/ New Responsible Party Information

Company/ Individual Name		Contact Person	
Street Address		Title	
City	State	Zip	Phone

IV. Ownership Transfer Information

General Description of Site Transferred to New Owner	General Description of Portion of Project/ Parcel Subject to WQMP Retained by Owner (if any)
Lot/ Tract Number(s) of Site Transferred to New Owner	
Remaining Lot/ Tract Number(s) to WQMP still held by Owner (if any)	
Date of Ownership Transfer	

Note: When the Previous Owner is transferring a Site that is a portion of a larger project/ parcel addressed by the WQMP, as opposed to the entire project/ parcel addressed by the WQMP, the General Description of the Site transferred and the remainder of the project/ parcel no transferred shall be set forth as maps attached to this notice. These maps shall show those portions of the project/ parcel addressed by the WQMP that are transferred to the New Owner (the Transferred Site), those portions retained by the Previous Owner, and those portions previously transferred by the Previous Owner. Those portions retained by the Previous Owner shall be labeled "Previous Owner," and those portions previously transferred by the Previous Owner shall be labeled as "Previously Transferred."

V. Purpose of Notice of Transfer

The purposes of this Notice of Transfer of Responsibility are: 1) to track transfer of responsibility for implementation and amendment of the WQMP when property to which the WQMP is transferred from the Previous Owner to the New Owner, and 2) to facilitate notification to a transferee of property subject to a WQMP that such New Owner is now the Responsible Party of record for the WQMP for this portions of the site that it owns.

VI. Certifications

A. Previous Owner

I certify under penalty of law that I am no longer the owner of the Transferred Site as described in Section II above. I have provided the New Owner with a copy of the WQMP applicable to the Transferred Site that the New Owner is acquiring from the New Owner.

Print Name of Previous Owner Representative	Title
Signature of Previous Owner Representative	Date

B. New Owner

I certify under penalty of law that I am the owner of the Transferred Site, as described in Section II above, that I have been provided a copy of the WQMP, and that I have informed myself and understand the New Owner's responsibilities related to the WQMP, its implementation, and Best Management Practices associated with it. I understand that by signing this notice, the New Owner is accepting all ongoing responsibilities for implementation and amendment of the WQMP for the Transferred Site, which the New Owner has acquired from the Previous Owner.

Print Name of New Owner Representative	Title
Signature of New Owner Representative	Date