January 27, 2017

Almeria Investments, L.P. Proposal 2150433.02R
P.O. Box 232628
Encinitas, California 92023
Attention: Mr. Michael Fulton, General Partner

Subject: Report of Geotechnical Infiltration Feasibility Study
Proposed Residential Development, 1389 Lieta Street, San Diego, California

References: 1) Christian Wheeler Engineering, Report CWE2150433.01, dated February 16, 2015
2) Civil Landworks, Preliminary Grading Plan for Lieta Street, dated September 12, 2016

Ladies and Gentlemen:

In accordance with your request and our proposal dated December 2, 2016, we have prepared this report to present the results of our storm water infiltration evaluation at the subject site. In general, the purpose of our investigation was to provide design infiltration rates based on percolation rates measured in the field. We understand that the existing structures and improvements at the site will be demolished and the property will be redeveloped into a 13-unit residential development consisting of two separate three-story buildings. Based on our discussions with the project's civil engineer, as well as our review of the referenced plans, we understand that a biofiltration BMP is proposed along the east side of the northerly property line.

FINDINGS

SITE DESCRIPTION

The subject site is a trapezoidal-shaped parcel of land located at the western terminus of Lieta Street in the Bay Park area of San Diego, California. The property is about 0.6 acres in area and is identified as Assessor's Parcel Number 430-680-09. Topographically, the majority of the site is relatively level with an elevation of about 45 feet. Relatively steep, descending slopes of up to about 20 to 25 feet in height bound the site to the south and west. The site is bound to the north by a combination 4-foot-tall retaining wall and ±2-foot-high slope. The wall retains the subject site. Existing improvements on-site are limited to a single-story, single family residence, multiple storage sheds, and on-grade concrete slabs within the eastern portion of the site.

FIELD INVESTIGATION

The subsurface exploration associated with this study consisted of two 7-inch-diameter auger borings and a six-inch-diameter hand auger boring. The borings were drilled within 50 feet of the proposed infiltration BMP in order to supplement our previous borings. The approximate locations of our recent and previous borings are shown on Plate No. 1 of this report. Logs of the explorations are presented in Appendix A of this report. Five percolation test borings were also drilled within the area expected to support the infiltration system. The borings were logged in detail with emphasis on describing the soil profile. Low permeability and relatively impermeable materials were identified in the borings. No evidence of soil contamination was detected within the samples obtained. The approximate locations of the percolation borings are also shown on Plate No. 1.

GEOLOGIC SETTING AND SOIL DESCRIPTION

Based on the results of our subsurface explorations and review of pertinent, readily available geologic literature, we have determined that the proposed BMP area is underlain by undifferentiated artificial fill/topsoil and Quaternary-age old paralic deposits. As observed within our borings, the artificial fill/topsoil was approximately 2 feet thick and consisted of dark brown, moist, loose, silty sand (SM). The old paralic deposits consisted of silty sand (SM), clayey sand (SC), sandy clay (CL), poorly-graded sand (SP), and poorly-graded sand with silt (SP-SM).

GROUNDWATER

Seepage was encountered within our percolation test boring HA-1/PT-4 at depth of approximately 8 feet below existing site grades. The encountered seepage water is not known to have any beneficial usage. It is our opinion that the seasonal high groundwater level at the site is approximately 40 feet below grade.

INFILTRATION RATE DETERMINATION

FIELD MEASUREMENT

Percolation testing was performed in five borings that were drilled within 50 feet of in the planned infiltration area. The approximate locations of the percolation borings are shown on Plate No. 1. Initially we performed three percolation tests (PT-1 through PT-3) at the proposed bottom of basin depth (5 feet below existing grade) on January 6, 2017. The percolation test rates at 5 feet were very low. Additional percolation test borings (PT-4 and PT-5) were drilled on January 5, 2017 in order to identify and test the more permeable sands at depth. These borings were drilled to a depth of approximately 10 feet below existing grade. Perforated pipe was set in the percolation test holes and surrounded by ¾ inch gravel to prevent caving. After pipe installation, the test holes were presoaked.

The field percolation rates were determined the following day by using the falling head test method. It can be noted that the water placed within the percolation borings on the previous day had completely drained during the overnight presoak within test borings PT-1 and PT-5 while water still remained in borings PT-2, PT-3 and PT-4. After pipe installation, the test holes were presoaked and the "Sandy Soil Criteria Test" was performed over two-25 minute periods of time. The testing resulted in water dropping more than 6 inches during each 25 minute period in test boring PT-5. The initial water level was established by refilling the test holes to near the top of the proposed BMP. Percolation rates within PT-5 were monitored and recorded every 10 minutes over a period of 5 hours until the infiltration rates stabilized. Percolation rates within PT1, PT-2, PT-3, and PT-4 were monitored and recorded every 30 minutes over a period of 6 hours until the infiltration rates stabilized. Measurements were taken using a water level meter (Solinst, Model 101) with an accuracy measured to 0.005 foot increments (0.06 inch increments). The measured field percolation rates are presented in Table I. To account for the use of gravel around the perimeter of the perforated pipe, an adjustment factor was used in the calculation of the percolation rate in Table 1.

TABLE I: FIELD PERCOLATION AND INFILTRATION RATES

Test No.	Location	Depth of Testing	Field Percolation Rate	Field Infiltration Rate
PT-1	Northerly PL	5 feet	2.64 inches per hour	0.03 inches per hour
PT-2	Northerly PL	5 feet	0.24 inches per hour	0.00 inches per hour
PT-3	Northerly PL	5 feet	0.24 inches per hour	0.00 inches per hour
PT-4	Northerly PL	10 feet	2.16 inches per hour	0.03 inches per hour
PT-5	Northerly PL	10.58 feet	46.8 inches per hour	1.59 inches per hour

Infiltration and percolation are two related but different processes describing the movement of moisture through soil. Infiltration is the downward entry of water into the soil or rock surface and percolation is the flow of water through soil and porous or fractured rock. The direct measurement yielded by a percolation test tends to overestimate the infiltration rate, except perhaps in cases where a BMP is similarly dimensioned to the borehole. As such, adjustments of the measured percolation rates were converted into infiltration rates using the Porchet Method. The spreadsheet used for the conversion is included in Appendix A of this report.

The average infiltration rate for the soils below the proposed infiltration BMP were approximately 0.01 inches per hour at a depth of 5 feet and 0.81 inches per hour at depths of 7 to 10 feet below existing grade.

FACTOR OF SAFETY

The City of San Diego Storm Water Standards BMP Design Manual states that "a maximum factor of safety of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety (FOS) cannot be used to inappropriately rule out infiltration, unless justified. If the site passes the feasibility analysis at a FOS of 2.0, then infiltration must be investigated, but a higher FOS may be selected at the discretion of the design engineer. Using a FOS of 2.0, an infiltration rate of 0.005 inches per hour and 0.40 inches per hour can be used in the feasibility analysis for the soils below the proposed biofiltration BMP at depths of 5 feet and 7 to 10 feet below grades, respectively.

GEOTECHNICAL CRITERIA FOR INFILTRATION BMPs

GENERAL

Based on the current Storm Water Standards, BMP Design Manual, certain geotechnical criteria need to be addressed when assessing the feasibility and desirability of the use of infiltration BMPs for a project site. Those criteria, Per Section C.2 of the manual, are addressed below.

C2.1 SOIL AND GEOLOGIC CONDITIONS

Site soil and geologic conditions influence the rate at which water can physically enter the soils. Based on the conditions observed in our exploratory borings, the existing soils in the BMP area consist of silty sand (SM), clayey sand (SC), poorly graded sand (SP), sandy clay (CL), and silty sand-poorly graded sand (SM/SP). Seepage was encountered within our exploratory boring HA-1/PT-4 at depth of approximately 8 feet below existing site grades.

C2.2 SETTLEMENT AND VOLUME CHANGE

Settlement and volume change can occur when water is introduced below grade. Based upon the soil conditions observed in our borings, the site is underlain old paralic deposits that are capped by a thin vener of undifferentiated artificial fill/topsoil. The artificial fill/topsoil is subject to a higher potential for hydro-collapse upon wetting while the potential for hydro-collapse within the underlying older paralic deposits is considered to be relatively low to moderately severe.

C2.3 SLOPE STABILITY

Infiltration of water has the potential to increase the risk of failure to nearby slopes. As such, setbacks from slopes have been recommended herein as well as incorporating impermeable liners or cut-off walls.

C2.4 UTILITY CONSIDERATIONS

Utilities are either public or private infrastructure components that include underground pipelines, vaults, and wires/conduit, and above ground wiring and associated structures. Infiltration of water can pose a risk to subsurface utilities, or geotechnical hazards can occur within the utility trenches when water is introduced. Care should be taken when planning proposed utility trench and BMP siting. Mitigation will be provided to reduce the potential for water flow into offsite utility trenches.

C2.5 GROUNDWATER MOUNDING

Groundwater mounding occurs when infiltrated water creates a rise in the groundwater table beneath the facility. Groundwater mounding can affect nearby subterranean structures and utilities. Based on the anticipated depth to groundwater, the potential for groundwater mounding is low.

C2.6 RETAINING WALL AND FOUNDATIONS

Infiltration of water can result in potential increases in lateral pressures and potential reduction in soil strength. Retaining walls and foundations can be negatively impacted by these changes in soil conditions. This should be taken into account when designing the storm water BMPs, retaining walls and foundations for the site. The proposed biofiltration BMP is to be located adjacent to the neighboring slope and retaining wall along the northern property line. Recommendations are provided herein to mitigate for this hazard.

CONCLUSIONS AND RECOMMENDATIONS

Based on a review of our field study and our experience with similar projects, we anticipate that, as long as the recommendations contained herein are followed, infiltration of storm water utilizing the proposed onsite storm water infiltration BMP will not result in soil piping, daylight water seepage, or slope instability for the property or project sites down-gradient of the site.

The soils at approximately 5 feet below grade in the area of the planned storm water BMP consist of silty sands (SM), clayey sands (SC) and sandy clays (CL). Field infiltration rates measured within these soils were very low with an average of 0.01 inches per hour. Highly expansive (Expansion Index = 122) sandy clays (CL) were also encountered within the northeast portion of the site at a depth of 2½ feet to 6½ feet. We recommended that infiltrations occur below these relatively impermeable soils. It is recommended that infiltration occur within the within the sands encountered at a depth of approximately 7 to 10 feet below existing grades.

For the soils tested, after applying a factor of safety of 2.0, a design infiltration rate of 0.40 inches per hour can be used for the sandy soils at depths of 7 to 10 feet below existing grade in the area of the proposed biofiltration BMP. Based on the presence of highly to slight permeable soils, it is our opinion that it is feasible to partially infiltrate storm water at the site. The seasonal high groundwater in the area of the basin is estimated to be at approximately 40 feet below existing and proposed site grades.

For the proposed biofiltration BMP, we recommend that a minimum setback of 50 feet from steep slopes (>25%) or a distance of 1.5H from fill slopes where H is the height of the fill slope. Where the biofiltration BMP is located within 10 feet of a structure, retaining wall or settlement sensitive improvement we recommended that a cut-off wall or impermeable liner be constructed around the perimeter of the BMP. The cut-off wall or impermeable liner should extend a minimum of 5 feet below proposed grade, at least 2 feet below the lowest adjacent existing or proposed footing, and at least 2 feet below the bottom of the BMP, whichever is greater.

It should be recognized that routine inspection and maintenance of the BMP basins are necessary to prevent clogging and failure. A maintenance plan should be specified for each BMP by the designer and followed by the owner during the entire lifetime of the BMP device.

"Worksheet C.4-1: Categorization of Infiltration Feasibility Criteria" has been completed and signed for the subject project, and is included in Appendix B of this report.

It should be noted that it is not our intent to review the civil engineering plans, notes, details, or calculations, when prepared, to verify that the engineer has complied with any particular storm water design standards. It is the responsibility of the designer to properly prepare the storm water plan based on the municipal requirements considering the planned site development and infiltration rates.

Detrimentally expansive soils removed from the area of the proposed BMP basin should not be used as structural fill or backfill at the site.

LIMITATIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on our limited percolation testing, an evaluation of the subsurface soil conditions encountered at our subsurface exploration locations and the assumption that the infiltration rates and soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the BMPs may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the soils engineer so that he may make modifications if necessary. In addition, this office should be advised of any changes in the project scope, proposed site grading or storm water BMP design so that it may be determined if the recommendations contained herein are appropriate. This should be verified in writing or modified by a written addendum.

If you should have any questions regarding this report, please do not hesitate to contact this office. This opportunity to be of professional service is sincerely appreciated.

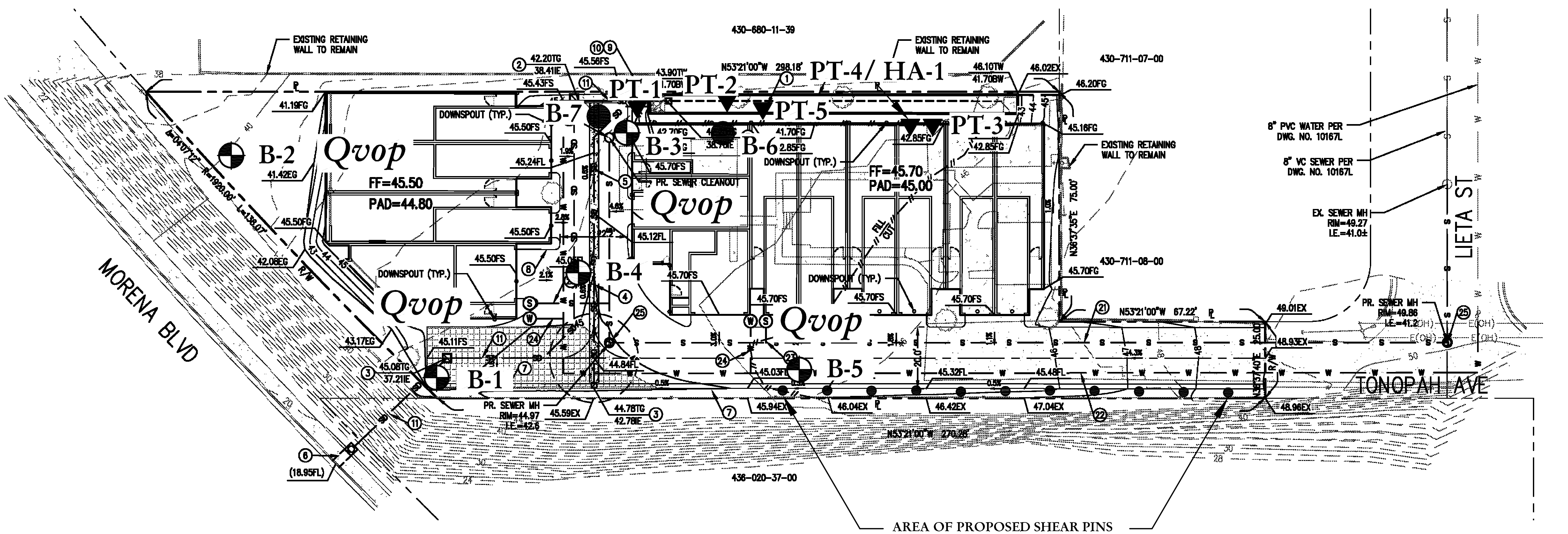
Respectfully submitted,
CHRISTIAN WHEELER ENGINEERING

Daniel J. Flowers, PG #9399

Daniel B. Adler, RCE #36037

David R. Russell, CEG 2215

DBA:drr:djf
ec: michael@almeriainvestments.com
tc@crudorealestate.com



LEGEND:

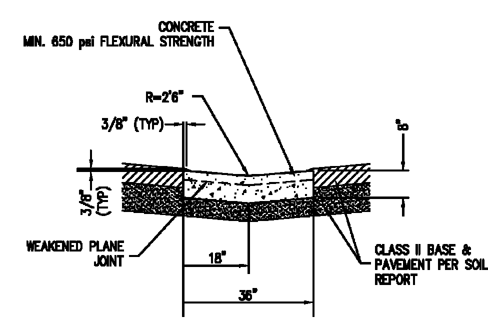
- PROPERTY LINE
- RIGHT OF WAY
- CENTERLINE
- EXISTING CONTOUR (MAJOR)
- EXISTING CONTOUR (MINOR)
- PROPOSED CONTOUR (MAJOR)
- PROPOSED CONTOUR (MINOR)
- CUT / FILL SLOPE
- DAYLIGHT LINE
- DIRECTION OF DRAINAGE
- CURB AND GUTTER
- PR. STORM DRAIN LINE
- PR. STORM INLET
- MASONRY RETAINING WALL
- PR. SEWER LINE
- PR. WATER LINE
- PR. SEWER MANHOLE
- PR. CURB OUTLET
- PR. SEWER CLEANOUT

CONSTRUCTION NOTES:

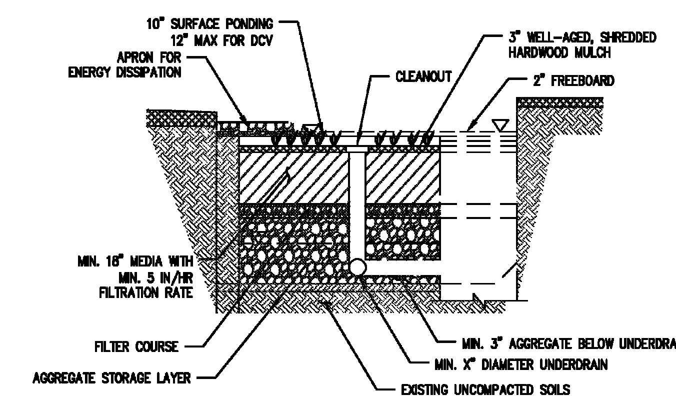
1. CONSTRUCT BIOFILTRATION BASIN PER DETAIL HEREON
2. CONSTRUCT STORM CONTROL VAULT
3. CONSTRUCT 24" X 24" GRATE INLET
4. CONSTRUCT 3' WIDE RIBBON GUTTER PER DETAIL HEREON
5. CONSTRUCT 9" HDPE STORM DRAIN
6. CONSTRUCT CURB OUTLET PER SDRSD D-25
7. CONSTRUCT CURB AND GUTTER PER SDRSD G-2
8. CONSTRUCT CURB ONLY PER SDRSD G-1
9. CONSTRUCT RIPRAP PER SDRSD D-40 NO. 2 BACKING T=1.1'
10. CONSTRUCT HEADWALL PER SDRSD D-30
11. CONSTRUCT 12" HDPE STORM DRAIN
12. CONSTRUCT RETAINING WALL PER SDRSD C-1

UTILITY NOTES:

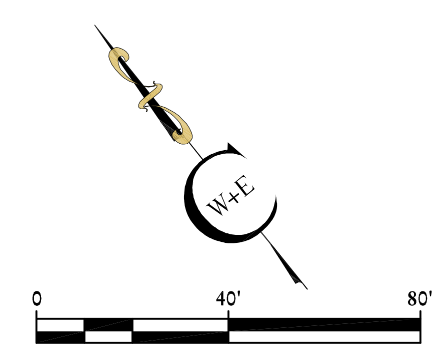
21. CONSTRUCT 8" SEWER MAIN
22. CONSTRUCT 8" WATER MAIN
23. CONSTRUCT 6" SEWER LATERAL PER SDRSD SS-01
24. CONSTRUCT 2" WATER LATERAL PER SDRSD WS-02
25. CONSTRUCT SEWER MANHOLE PER SDRSD SM-01
26. CONSTRUCT SEWER CLEANOUT PER SDRSD SC-01



RIBBON GUTTER
NO SCALE



BIOFILTRATION BMP
N.T.S.



SCALE: 1" = 40'

CWE LEGEND

B-5	APPROXIMATE BORING LOCATION (CWE 2150433.01)
B-7	APPROXIMATE BORING LOCATION (CWE 2150433.02)
PT-5	PERCOLATION TEST LOCATION
PT-4/HA-1	PERCOLATION TEST AND HAND AUGER LOCATION
Qop	OLD PARALIC DEPOSITS

Civil Landworks
110 COPPERWOOD WAY, SUITE P, OCEANSIDE, CA 92058
PH: 760-908-8745 • info@civillandworks.com

SITE PLAN AND GEOTECHNICAL MAP

PROPOSED RESIDENTIAL DEVELOPMENT
1389 LIETA STREET
SAN DIEGO, CALIFORNIA

DATE:	JANUARY 2017	JOB NO.:	2150433.02
BY:	SD	PLATE NO.:	1

CHRISTIAN WHEELER
ENGINEERING

Appendix A

Boring Logs

LOG OF TEST BORING B-1

Date Logged:	12/18/15	Equipment:	Dietrich
Logged By:	DRR	Auger Type:	6 inch Solid Flight
Existing Elevation:	44.0 feet	Drive Type:	140lbs/30 inches
Proposed Elevation:	43.0 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Topsoil**							
			SM	**Old Paralic Deposits (Qop):** Orangish-brown, damp to moist, dense, fine- to medium-grained, SILTY SAND.	77	Cal					SA SO4
5			SM	Light yellowish-brown, damp to moist, medium dense, fine-grained, SILTY SAND.	33	Cal		7.4	109.4		77
10			SP	Light yellowish-brown to orangish-brown, damp, medium dense, fine- to medium-grained, POORLY GRADED SAND.	34	Cal		2.8	99.1		77
15			SM	Orangish-brown, moist, medium dense to dense, fine- to medium-grained, SILTY SAND.	53	Cal		8.6	112.0		
			SP	Light brown, damp to moist, medium dense, fine- to coarse-grained, POORLY GRADED SAND.	36	Cal		2.6	97.8		
20				Boring terminated at 20 feet. No groundwater or seepage encountered.							
25											
30											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED RESIDENTIAL DEVELOPMENT
1389 LIETA STREET
SAN DIEGO, CALIFORNIA

DATE:	JANUARY 2017	JOB NO.:	2150433.02
BY:	SRD	FIGURE NO.:	A-1

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-2

Date Logged:	12/18/15	Equipment:	Dietrich
Logged By:	DRR	Auger Type:	6 inch Solid Flight
Existing Elevation:	42.0 feet	Drive Type:	140lbs/30 inches
Proposed Elevation:	42.0 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Topsoil:** Orangish-brown, dry, loose, fine- to medium-grained, SILTY SAND; abundant animal burrows.							
			SM	Orangish-brown, damp, medium dense.	36	Cal		2.8	102.3		
5											
					44	Cal		4.8	112.4		CP
			SM	Orangish-brown, damp to moist, medium dense, fine-grained, SILTY SAND.							
10											
			SM-SP	Light brown, damp, medium dense, fine- to medium-grained, SILTY SAND-POORLY GRADED SAND.	28	Cal		6.6	106.7		
15											
			SM	Orangish-brown, moist, dense, fine- to coarse-grained, SILTY SAND; trace gravels up to 1".	60	Cal		6.5	106.7		DS
					50/5"	Cal					
20				Boring terminated at 20 feet. No groundwater or seepage encountered.							
25											
30											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED RESIDENTIAL DEVELOPMENT
1389 LIETA STREET
SAN DIEGO, CALIFORNIA

DATE:	JANUARY 2017	JOB NO.:	2150433.02
BY:	SRD	FIGURE NO.:	A-2

CHRISTIAN WHEELER
ENGINEERING

LOG OF TEST BORING B-3

Date Logged:	12/18/15	Equipment:	Dietrich
Logged By:	DRR	Auger Type:	6 inch Solid Flight
Existing Elevation:	43.0 feet	Drive Type:	140lbs/30 inches
Proposed Elevation:	43.0 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Dark brown, damp, loose, fine- to medium-grained, SILTY SAND.							
			SM								
			SM	**Topsoil:** Orangish-brown, damp, loose, fine- to medium-grained, SILTY SAND.	26	Cal					
				Old Paralic Deposits (Qop): Orangish-brown, damp to moist, medium dense, fine- to medium-grained, SILTY SAND.	73	Cal					
5											
					32	Cal					
10				Boring terminated at 10 feet. No groundwater or seepage encountered.							
15											
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED RESIDENTIAL DEVELOPMENT
1389 LIETA STREET
SAN DIEGO, CALIFORNIA

DATE:	JANUARY 2017	JOB NO.:	2150433.02
BY:	SRD	FIGURE NO.:	A-3

CHRISTIAN WHEELER
ENGINEERING

LOG OF TEST BORING B-4

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

Date Logged:	12/18/15	Equipment:	Dietrich
Logged By:	DRR	Auger Type:	6 inch Solid Flight
Existing Elevation:	44.0 feet	Drive Type:	140lbs/30 inches
Proposed Elevation:	44.0 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Topsoil:** Brown, damp, loose, fine- to medium-grained, SILTY SAND; porous.							
			SM	**Old Paralic Deposits (Qop):** Grayish-brown, damp, dense to very dense, fine- to medium-grained, SILTY SAND.	50/5"	Cal		3.7	110.1		
5					28	Cal					
			SM-SP	Light orangish-brown, damp to moist, medium dense, fine- to coarse-grained, SILTY SAND-POORLY GRADED SAND.							
				Boring terminated at 6½ feet. No groundwater or seepage encountered.							
10											
15											
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED RESIDENTIAL DEVELOPMENT
1389 LIETA STREET
SAN DIEGO, CALIFORNIA

DATE:	JANUARY 2017	JOB NO.:	2150433.02
BY:	SRD	FIGURE NO.:	A-4

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-5

Date Logged:	12/18/15	Equipment:	Dietrich
Logged By:	DRR	Auger Type:	6 inch Solid Flight
Existing Elevation:	45.0 feet	Drive Type:	140lbs/30 inches
Proposed Elevation:	42.0 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	Old Paralic Deposits (Qop): Orangish-brown, damp, medium dense, fine-grained, SILTY SAND.							
					38	Cal		7.3	107.6		
5											
			SM-SP	Light orangish-brown, damp, medium dense, fine- to coarse-grained, SILTY SAND-POORLY GRADED SAND.	22	Cal		4.1	95.5		DS
10											
					38	Cal		4.0	101.5		SA
15											
			SM	Orangish-brown, damp to moist, medium dense to dense, fine- to coarse-grained, SILTY SAND; slight gravels.							
					57	Cal		6.6	105.0		
20				Boring terminated at 20 feet. No groundwater or seepage encountered.							
25											
30											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED RESIDENTIAL DEVELOPMENT
1389 LIETA STREET
SAN DIEGO, CALIFORNIA

DATE:	JANUARY 2017	JOB NO.:	2150433.02
BY:	SRD	FIGURE NO.:	A-5

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-6

Date Logged:	12/18/15	Equipment:	Dietrich
Logged By:	DRR	Auger Type:	7 inch Solid Flight
Existing Elevation:	43.5 feet	Drive Type:	140lbs/30 inches
Proposed Elevation:	43.0 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Topsoil:** Dark brown, moist, very loose, very fine- to medium-grained, SILTY SAND with animal burrows.							
			SM	**Old Paralic Deposits (Qop):** Orangish-brown, damp, medium dense, very fine- to medium-grained, SILTY SAND.							
5			SC	Orangish-brown to light gray, moist, medium dense, very fine- to medium-grained, CLAYEY SAND, mottled.	14	SPT					
			SM	Orangish-brown to light gray, moist, medium dense, very fine- to medium-grained, SILTY SAND with clay.	15	SPT					
			SP	Orangish-brown, damp to moist, medium dense, fine- to coarse-grained, POORLY GRADED SAND, friable.	20	SPT					
10				Trace gravels at contact.	26	SPT					
			SP	Orangish-brown to reddish-brown, damp to moist, dense, very fine- to medium-grained, SILTY SAND, slightly cemented.	34	SPT					
15			SM-SP	Orangish-brown, damp, medium dense, fine- to coarse-grained, SILTY SAND - POORLY GRADED SAND.	27	SPT					
					18	SPT					
				Boring terminated at 17.5 feet. No groundwater or seepage encountered.							
20											
25											
30											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED RESIDENTIAL DEVELOPMENT
1389 LIETA STREET
SAN DIEGO, CALIFORNIA

DATE:	JANUARY 2017	JOB NO.:	2150433.02
BY:	SRD	FIGURE NO.:	A-6

CHRISTIAN WHEELER
ENGINEERING

LOG OF TEST BORING B-7

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

Date Logged:	12/18/15	Equipment:	Dietrich
Logged By:	DRR	Auger Type:	7 inch Solid Flight
Existing Elevation:	43.0 feet	Drive Type:	140lbs/30 inches
Proposed Elevation:	43.0 feet	Depth to Water:	N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Topsoil:** Dark brown, moist, very loose, very fine- to medium-grained, SILTY SAND with animal burrows.							
			SM	**Old Paralic Deposits (Qop):** Orangish-brown, damp, medium dense, very fine- to medium-grained, SILTY SAND.							
5			SM	Orangish-brown to light grayish-brown, moist, medium dense, SILTY SAND with clay.	15	SPT					
			SP	Orangish-brown, damp to moist, medium dense, fine- to coarse-grained, POORLY GRADED SAND, friable.	17	SPT					
10				Gravels at 11 to 12 feet.	21	SPT					
			SM	Orangish-brown to reddish-brown, damp to moist, dense, very fine- to medium-grained, SILTY SAND, slightly cemented.	32	SPT					
15			SM-SP	Orangish-brown, damp, medium dense to dense, fine- to coarse-grained, SILTY SAND - POORLY GRADED SAND.	33	SPT					
					30	SPT					
				Boring terminated at 16.5 feet. No groundwater or seepage encountered.							
20											
25											
30											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED RESIDENTIAL DEVELOPMENT
1389 LIETA STREET
SAN DIEGO, CALIFORNIA

DATE:	JANUARY 2017	JOB NO.:	2150433.02
BY:	SRD	FIGURE NO.:	A-7

CHRISTIAN WHEELER ENGINEERING

Appendix B

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Feasibility Condition		Worksheet C.4-1	
Part 1 - Full Infiltration Feasibility Screening Criteria Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
1	Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
An infiltration rate assessment has been performed for the soils beneath the area of the proposed biofiltration basin as presented in the Report of Geotechnical Infiltration Feasibility Study (CWE 2150433.02). The measured percolation rates were converted to infiltration rates using the Porchet Method. The City of San Diego Storm Water Standards BMP Design Manual states that "a maximum factor of safety (FOS) of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified." Using a FOS of 2.0, the average infiltration rate for the soils at a depth of 7 to 10 feet below the proposed biofiltration BMP was 0.40 inches per hour.			
2	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	
An infiltration rate assessment has been performed for the subject site. Based on the underlying soil conditions and our recommendations presented in our report, we anticipate that infiltration greater than 0.5 inches per hour can be allowed without increasing risk of geologic hazards that cannot be mitigated to an acceptable level. C.2.1 A site specific geotechnical investigation was performed. C.2.2 The underlying old paralic deposits are expected to have a low to moderately severe potential for hydro collapse and consolidation. The clayey portions within the northeast portion of the site have a high potential for heave. This can be mitigated by select grading and incorporating impermeable liners or cut-off walls. C.2.3 Setbacks have been recommended to mitigate possible slope stability issues. C.2.4 A vertical liner will be used to prevent lateral migration into nearby utility trenches. C.2.5 Groundwater mounding is not expected to be a concern. C.2.6 Where the biofiltration BMP is located within 10 feet of a structure, retaining wall or settlement sensitive improvement we recommended that a cut-off wall or impermeable liner be constructed around the perimeter of the BMP. The cut-off wall or impermeable liner should extend a minimum of 5 feet below proposed grade, at least 2 feet below the lowest adjacent footing and at least 2 feet below the bottom of the BMP, whichever is greater. The basins should also have an impermeable surface on the sides to prevent lateral water flow.			

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 2 of</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:
Based on our review of items presented in Appendix C.3, we anticipate that infiltration greater than 0.5 inches per hour can be allowed without increasing risk of groundwater contamination that cannot be mitigated to an acceptable level.
C.3.1 The subgrade soil appears to be suitable for onsite infiltration. We have no knowledge of groundwater or soil contamination onsite or down-gradient from the site.
C.3.2 The seasonal high groundwater table is estimated to be greater than 40 feet below existing grade at the proposed BMP. The encountered seepage water is not known to have any beneficial usages.
C.3.3 No existing wellheads are known within the vicinity of the subject site.
C.3.4 The site was not previously used for industrial use.
C.3.5 We recommend that infiltration activities be coordinated with the applicable groundwater management agency.
C.3.6 There does not appear to be a high risk of causing potential water balance issues.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:
There does not appear to be a high risk of causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters by allowing infiltration greater than 0.5 inches per hour.</td></tr>
<tr><td>Part 1 Result*</td><td colspan="2">If all answers to rows 1 - 4 are “Yes” a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

If any answer from row 1-4 is “No”, infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a “full infiltration” design. Proceed to Part 2</td><td>Partial</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in
the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Worksheet C.4-1 Page 3 of 4			
Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
5	Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	
An infiltration rate assessment has been performed for the soils beneath the area of the proposed biofiltration BMP as presented in the Report of Geotechnical Infiltration Feasibility Study (CWE 2150433.02). The measured percolation rates were converted to infiltration rates using the Porchet Method. The City of San Diego Storm Water Standards BMP Design Manual states that “a maximum factor of safety (FOS) of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified.” Using a FOS of 2.0, an infiltration rate of 0.40 inches per hour can be used for the soils at a depth of 7 to 10 feet below the proposed biofiltration basin along the northerly property line.			
6	Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	
An infiltration rate assessment has been performed for the subject site. Based on the underlying soil conditions and our recommendations presented in our report, we anticipate that infiltration in any appreciable quantity can be allowed without increasing risk of geologic hazards that cannot be mitigated to an acceptable level. C.2.2 The underlying old paralic deposits are expected to have a low to moderately severe potential for hydro collapse and consolidation. The clayey portions within the northeast portion of the site have a high potential for heave. This can be mitigated by select grading and incorporating impermeable liners or cut-off walls. C.2.3 Setbacks have been recommended to mitigate possible slope stability issues. C.2.4 A vertical liner will be used to prevent lateral migration into nearby utility trenches. C.2.5 Groundwater mounding is not expected to be a concern. C.2.6 Where the biofiltration BMP is located within 10 feet of a structure, retaining wall or settlement sensitive improvement we recommended that a cut-off wall or impermeable liner be constructed around the perimeter of the BMP. The cut-off wall or impermeable liner should extend a minimum of 5 feet below proposed grade, at least 2 feet below the lowest adjacent existing or proposed footing and at least 2 feet below the bottom of the BMP, whichever is greater. The basins should also have an impermeable surface on the sides to prevent lateral water flow.BMP, whichever is greater.			

Worksheet C.4-1 Page 4 of			
Criteria	Screening Question	Yes	No
7	Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: An infiltration rate assessment has been performed for the subject site. Based on the underlying soil conditions and our recommendations presented in our report, we anticipate that an infiltration rate of 0.40 inches per hour can be allowed without increasing risk of groundwater contamination that cannot be mitigated to an acceptable level. C.3.1 The subgrade soil appears to be suitable for onsite infiltration. We have no knowledge of groundwater or soil contamination onsite or down-gradient from the site. C.3.2 The seasonal high groundwater table is estimated to be at greater than 40 feet below existing grade. C.3.3 No existing wellheads are known within the vicinity of the subject site. C.3.4 We have no knowledge of a previous industrial use.			
8	Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
We did not perform a study regarding water rights. However, these rights are not typical in the San Diego area.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration. If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.		Partial Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in
the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings

Troy S. Wilson, CEG 2551

Appendix C

Porchet Method- Percolation to Infiltration Conversion

Spreadsheet

Percolation to Infiltration Rate Conversion (Porchet Method)

Proposed Residential Development, 1389 Lieta Street, San Diego, CA

CWE 2150433.02

Perc Test #	Gravel Adjustment Factor	Effective Radius (inches) r	Depth of Hole Below Existing Grade (inches)	Time Interval (min.) Δt	Height of pipe above surface (feet)	Initial Water Depth without correction (feet)	Final Water Depth without correction (feet)	Initial Water Height with correction (inches) H_o	Final Water Height with correction (inches) H_f	Change in head (inches) ΔH	Average Head Height (inches) H_{avg}	Tested Infiltration Rate (inch/hour) I_t
1	0.56	3.5	60	30	0.00	3.48	3.59	18.24	16.92	1.32	17.58	0.13
2	0.56	3.5	60	30	0.00	1.98	1.99	36.24	36.12	0.12	36.18	0.01
3	0.64	3	60	30	0.00	2.27	2.28	32.76	32.64	0.12	32.70	0.01
4	0.51	3	120	30	2.00	7.39	7.48	55.32	54.24	1.08	54.78	0.03
5	0.51	3	127	30	1.25	11.08	11.68	9.04	1.84	7.20	5.44	1.59

"Initial and final water depth without correction" are measurements taken from top of pipe if pipe is sticking out of ground (most cases)

"Initial and final water height with correction" factors in the height of pipe above surface, and provides measurement of water above bottom of pipe

If measurements are taken from grade "Height of pipe above surface" = 0

Gravel Adjustment Factor:

4-inch Diameter Pipe: 1.00 - No Gravel Used (No Caving)
0.51 - 3/4 inch gravel with 8 inch diameter hole
0.56 - 3/4 inch gravel with 7 inch diameter hole
0.64 - 3/4 inch gravel with 6 inch diameter hole

3-inch Diameter Pipe: 1.00 - No Gravel Used (No Caving)
0.44 - 3/4 inch gravel with 8 inch diameter hole
0.47 - 3/4 inch gravel with 7 inch diameter hole
0.51 - 3/4 inch gravel with 6 inch diameter hole

Porchet Method - Tested Percolation Rate Conversion to Tested Infiltration Rate

$$I_t = \frac{\Delta H \, 60 \, r}{\Delta t \, (r + 2H_{avg})}$$

I_t = tested infiltration rate, inches per hour
ΔH = change in head over the time interval, inches
Δt = time interval, minutes
r = effective radius of test hole
H_{avg} = average head over the time interval, inches