January 27, 2017

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

Subject:Report of Geotechnical Infiltration Feasibility StudyProposed 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  $\pm$ 2-foothigh 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.

Proposal 2150433.02R



#### 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 <sup>3</sup>/<sub>4</sub> 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. 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.

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

TABLE I: FIELD PERCOLATION AND INFILTRATION RATES

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  $2\frac{1}{2}$  feet to  $6\frac{1}{2}$  feet. We recommended that infiltrations occur below these relatively impermeable soils. It is recommended that infiltration occur 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

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



David R. Russell, CEG 2215





CONSTRUCT BOR (1) CONSTRUCT BOR (2) CONSTRUCT STOR (3) CONSTRUCT 24" (4) CONSTRUCT 24" (4) CONSTRUCT 04 (5) CONSTRUCT 04 (6) CONSTRUCT 04 (6) CONSTRUCT 04 (7) CONSTRUCT 12" (7) CONSTRUCT 12" (7) CONSTRUCT 12" (7) CONSTRUCT 12" (7) CONSTRUCT 12" (7) CONSTRUCT 12"	CTION NOTES: LITRATION BASIN PER DETAIL HEREON M CONTROL VALLT X 24° GRATE INLET DE RIBBON GUTTER PER DETAIL HEREON DPE STORM DRAIN 3 OUTLET PER SDRSD D-25 3 AND GUTTER PER SDRSD C-2 3 ONLY PER SDRSD C-1 NP PER SDRSD D-40 NO. 2 BACKING T=1.1' WALL PER SDRSD D-30 HDPE STORM DRAIN NUMB WALL PER SDRSD C-1	UTILITY NOTE (2) CONSTRUCT 6" SENER MAI (2) CONSTRUCT 6" SENER LAT (2) CONSTRUCT 6" SENER LAT (2) CONSTRUCT 2" WATER LAT (3) CONSTRUCT SENER MANHO (3) CONSTRUCT SENER CLEAN	IN IN IERAL PER SORSO SS-01 IERAL PER SORSO WS-02 ILE PER SORSO SM-01 OUT PER SORSO SC-01	MIN. 650 pel R.D.J.R.AL STRENGTH 3/8" (TTP)	10" SURFACE POINDING 12" MAX FOR DCY DEERGY DISSIPATION MILL 10" MEDIA WITH MILL 10" MEDIA WITH FLITRATION RATE PLITRATION RATE PLITRATION RATE	CLEANOUT S' WELL-ACED, SWEDDED HARDNOOD MALCH S' REEEDONED STATUS REEEDONED SWEDCH STATUS NOT STATUS NOT STATU
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SITE PLAN AND GEOTECHNICAL MAP	DATE:	JANUARY 2017
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PR. CURB OUTLET PR. SEVER CLEANOUT

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SCALE: 1" = 40'



SIDENTIAL DEVELOPMENT 9 LIETA STREET EGO, CALIFORNIA

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PLATE NO.: 1

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## Appendix A

Boring Logs

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										33	Cal		7.4	109.4		77
10			SP	Light yellowish-brow medium-grained, PO	n to orangish ORLY GRAD	brown, dai ED SAND	mp, mediı ).	um dense,	, fine- to	34	Cal		2.8	99.1		77
15-			SM	Orangish-brown, mo SAND.	ist, medium de	ense to den	se, fine- tc	medium	i-grained, SILTY	53	Cal		8.6	112.0		
			SP	Light brown, damp to	o moist, mediu	m dense, fi	ne- to coa	rse-grain	ed, POORLY							
				GRADED SAND.						36	Cal		2.6	97.8		
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			SM	Orangish-brown, dam	p to moist, m	edium dense, fi	ne-grained, SIL	TY SAND.	44	Cal		4.8	112.4		CP
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0 			SM SM	<u>Tops</u> Old 1 mediu	o <mark>il:</mark> Br ?aralic 1m-gra	own, d : Depo ined, S	amp, lo sits (Q ILTY S	oose, op): SANI	fine- to Grayis D.	o medii sh-brov	um-gra vn, da	ained, mp, de	SILTY ense to	SAI	ND; po1	rous. fine- to	50/5"	Cal		3.7	110.1		
			SM- SP	Light SILT	orang Y SAN	ish-bro ID-PO	wn, da ORLY	damp to moist, medium dense, fine- to coarse-grained, _Y GRADED SAND. ½ feet. No groundwater or seepage encountered.							ed,	28	Cal						
								4   feet. No groundwater or seepage encountered.     2   Image: Constraint of the seepage encountered.     3   1     4   1     5   1     5   1     6   1     6   1     7   1     7   1     8   1     9   1     10   1     11   1     12   1     13   1     14   1     15   1     16   1     17   1     18   1     19   1     10   1     10   1     11   1     12   1     13   1     14   1     15   1     16   1     17   1     18   1     19   1     10   1     10   1     11   1    <															
20																							
					I   I																		
Not	es:																						
₹	▼   Symbol Legend     Groundwater Level During Drilling     ▼   Groundwater Level After Drilling     ↑   Apparent Seepage     *   No Sample Recovery     **   Non-Representative Blow Count					DAT	E:	PRC JAN	DPOS UARY	ED R 13 SAN 1 7 2017	ESIDE 89 LIH DIEGO	ETA D, C.	IAL DE STREE ALIFO JOB NO	EVELOI T RNIA D.:	21504	133.02		CH	IRISTIA	N WHEE IEER IN (	LER		
**	No Sample Recovery Non-Representative Blow Count (rocks present)					H	BY:		SRD					FIGUR	E NO.:	A-4							

		I	.00	G OF TE	ST BC	RIN	G B	·5		Cal SPT ST	ample Ty Modified C Standard Pe Shelby Tub	y <b>pe a</b> aliforni netratio	<b>nd Labo</b> a Sampler on Test	CK CH DR DA	est Legen unk Density ensity Ring	<u>1</u>
	Date Logg Exist Prop	Logged: ed By: ing Elev osed Ele	ation: vation:	12/18/15 DRR 45.0 feet 42.0 feet	Ed A D D	quipment: uger Type: rive Type: epth to Water	Diet 6 ino 1401 : N/ <i>I</i>	rich ch Solid bs/30 in	Flight ches	MD SO4 SA HA SE PI CP	Max Densit Soluble Sulf Sieve Analy Hydromete Sand Equiva Plasticity In Collapse Po	y iates sis r alent idex otential		DS Di Con Co EI Ex R-Val Re Chl So Res pF	rect Shear onsolidation pansion Inde: sistance Valu luble Chlorid I & Resistivit	x e les y
DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUM) (bas	MARY OF SU red on Unified	BSURFACE Soil Classific	CONDI ation Sys	TIONS stem)	i	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0 			SM SM- SP	Old Paralic Deposi fine-grained, SILTY Light orangish-brov SAND-POORLY C	its (Qop): Ora SAND. vn, damp, medi FRADED SAN	um dense, fin D.	damp, me	dium de	ense,	38	Cal		7.3	95.5		DS
			SM	Orangish-brown, da SILTY SAND; sligh	ump to moist, r t gravels.	nedium dense	38	Cal		4.0	101.5		SA			
				Boring terminated a	t 20 feet. No g	roundwater o,	r seepage		ered.							
<u>Not</u>	es:															
		Sym Ground Ground Appare No Sar Non-R	<b>bol Le</b> dwater Le dwater Le ent Seepaş nple Recc epresenta	egend evel During Drilling evel After Drilling ge overy tive Blow Count	DATE:	JANUAR	SED RES 138 SAN DI Y 2017	SIDEN' D LIETA EGO, (	TIAL DEVELOI A STREET CALIFORNIA JOB NO.:	21504	33.02		CH	IRISTIA ENGIN	<b>B</b> N WHEE EER IN (	

		Ι	.00	G OF TES	ST BO	RINC	6 B-6		Cal SPT	Ample T Modified C Standard Pe	<b>ype a</b> Californi	<b>nd Labo</b> a Sampler on Test	ratory T CK CI DR D	<b>est Legen</b> nunk Density ensity Ring	<u>d</u>
	Date Logge Existi Prope	Logged: ed By: ing Elev osed Ele	ation: vation:	12/18/15 DRR 43.5 feet 43.0 feet	Equ Au Dri Dej	uipment: ger Type: ve Type: oth to Water:	Dietrich 7 inch Solid 140lbs/30 in N/A	Flight Iches	MD SO4 SA HA SE PI CP	Max Densit Soluble Suli Sieve Analy Hydromete Sand Equiv Plasticity Ir Collapse Po	e Ty fates vsis er alent alent odex otential		DS D Con Ca EI Ez R-Val Ra Chl So Res pl	irect Shear onsolidation spansion Inde: esistance Valu luble Chlorid I & Resistivit	x e les ty
DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMM (base	IARY OF SUE d on Unified S	SURFACE C oil Classificat	CONDITIONS ion System)	;	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0 			SM SM	Topsoil: Dark brown SAND with animal to Old Paralic Deposit to medium-grained, to	1, moist, very lo purrows. <u>8 (Qop)</u> : Oran <sub>j</sub> SILTY SAND.	oose, very fine gish-brown, da	- to medium-gra	ained, SILTY ense, very fine-							
			SC SM	Orangish-brown to li medium-grained, CL Orangish-brown to l medium-grained, SIL	ght gray, moist AYEY SAND, ight gray, moist TY SAND with	, medium den mottled. , medium den 1 clay.	se, very fine- to		14	SPT					
10-			SP	Orangish-brown, dar POORLY GRADEI	np to moist, me D SAND, friabl	edium dense, f e.	ine- to coarse-gi	ained,	20	SPT					
			SP	Trace gravels at cont Orangish-brown to r medium-grained, SIL	act. eddish-brown, TY SAND, slig	damp to moiss htly cemented	, dense, very fin	ne- to	26 34	SPT SPT					
-15			SP	POORLY GRADEI	) SAND.				27	SPT SPT					
20-				No groundwater or s	17.5 teet, seepage encount	ered.									
<u>Not</u>	es:														
	, ,	Sym Ground Ground	<b>bol Le</b> dwater Le dwater Le	e <b>gend</b> vel During Drilling vel After Drilling		PROPOSI	ED RESIDEN 1389 LIETA SAN DIEGO, (	<b>FIAL DEVELOI</b> A STREET CALIFORNIA	PMENT					8	
<b>9</b> (( *		Groundwater Level After Drilling SAN DIEGO, CALIFORNL   Apparent Seepage DATE: JANUARY 2017   No Sample Recovery BY: SRD							21504 A-6	33.02		CH	IRISTIA engin	N WHEE IEERING	LER. G

		L	,00	G OF TES	T BO	RINO	G <b>B-7</b>		Cal SPT ST	<b>ample T</b> Modified C Standard Po Shelby Tub	<b>ype a</b> Californ enetration	<b>nd Labo</b> ia Sampler on Test	ratory T CK C DR D	est Legen hunk Density ensity Ring	<u>d</u>
	Date Logg Existi Prop	Logged: ed By: ing Elev: osed Ele	ation: vation:	12/18/15 DRR 43.0 feet 43.0 feet	Eq Au Dr De	uipment: ger Type: ive Type: pth to Water:	Dietrich 7 inch Sol 140lbs/30 N/A	id Flight inches	MD SO4 SA HA SE PI CP	Max Densit Soluble Sul Sieve Analy Hydromete Sand Equiv Plasticity In Collapse Po	y fates vsis alent alent odex otential		DS E Con C EI E R-Val R Chl S Res p	Pirect Shear onsolidation xpansion Inde esistance Valu oluble Chlorid H & Resistivit	x e les y
DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMM. (based	ARY OF SUI 1 on Unified S	BSURFACE Soil Classific:	CONDITIO ation System)	٧S	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM SM	Topsoil: Dark brown SAND with animal bu Old Paralic Deposits	, moist, very l urrows. s <b>(Qop) :</b> Oran	oose, very fin gish-brown, c	e- to medium- lamp, medium	grained, SILTY dense, very fine-							
			SM	Orangish-brown to lig with clay.	ght grayish-bro	own, moist, n	nedium dense,	SILTY SAND	15	SPT					
			SP	Orangish-brown, dam POORLY GRADED	ip to moist, m SAND, friab	edium dense, le.	fine- to coarse	-grained,	17	SPT SPT					
			SM	Orangish-brown to re medium-grained, SIL7	eddish-brown, IY SAND, sliş	damp to moi ghtly cemente	st, dense, very d.	fine- to	32	SPT					
-15-			SM- SP	Orangish-brown, dam SAND - POORLY G	ip, medium de RADED SAN	nse to dense, ID.	fine- to coarse	grained, SILTY	33	SPT SPT					
				Boring terminated at a No groundwater or se	16.5 teet. eepage encoum	tered.									
	·es•														
	7	Sym Ground Ground	<b>bol Le</b> dwater Le dwater Le	e <b>gend</b> wel During Drilling wel After Drilling		PROPOS	GED RESIDE 1389 LIE SAN DIEGC	NTIAL DEVELO TA STREET , CALIFORNIA	PMENT					B	
( ( *	*	Appare No San Non-R	ent Seepag nple Recc epresenta	e wery tive Blow Count	DATE: BY:	JANUAR SRD	Y 2017	JOB NO.: FIGURE NO.	21504 : A-7	33.02		CH	IRISTIA engin	N WHEE	LER. G

# Appendix B

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

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

Categor	ization of Infiltration Feasibility Condition	Worksheet C.4-	1	
Part 1 - H Would in undesiral	Full Infiltration Feasibility Screening Criteria Infiltration of the full design volume be feasible from a physole consequences that cannot be reasonably mitigated?	sical perspective wit	hout an	у
Criteria	Screening Question		Yes	No
1	Is the estimated reliable infiltration rate below proposed a greater than 0.5 inches per hour? The response to this Scr shall be based on a comprehensive evaluation of the facto Appendix C.2 and Appendix D.	facility locations eening Question rs presented in		Х
An infiltration	ation rate assessment has been performed for the soils bene on basin as presented in the Report of Geotechnical Infiltr	eath the area of the ation Feasibility Stu	propose 1dv (CW	d VF
2150433.0	2). The measured percolation rates were converted to infil	tration rates using t	he Porc	het
Method. 7	The City of San Diego Storm Water Standards BMP Design	n Manual states that	t "a max	imum
factor of s	afety (FOS) of 2.0 is recommended for infiltration feasibili	tv screening such t	hat an	
artificially	high factor of safety cannot be used to inappropriately ru	le out infiltration. 1	ınless	
justified."	Using a FOS of 2.0, the average infiltration rate for the so	ils at a depth of 7 to	o 10 feet	below
the propo	sed biofiltration BMP was 0.40 inches per hour.	1		
	1			
	Can infiltration greater than 0.5 inches per hour be allowed increasing risk of geotechnical hazards (clone stability, group)	without		
2	mounding, utilities, or other factors) that cannot be mitigate	ed to an acceptable	Х	
	level? The response to this Screening Question shall be base	d on a		
	comprehensive evaluation of the factors presented in Appen	dix C.2.		
An infiltrat and our rec hour can b	ion rate assessment has been performed for the subject site. Base commendations presented in our report, we anticipate that infilt e allowed without increasing risk of geologic hazards that canno to apolific geotochnical investigation was performed.	ed on the underlying ration greater than 0. t be mitigated to an a	soil cond 5 inches cceptable	itions per e level.
C.2.1  A s	underlying old paralic deposits are expected to have a low to m	oderately severe pote	ntial for	hvdro
collapse a	nd consolidation. The clayey portions within the northeast port	ion of the site have a	high pot	ential
for heave.	This can be mitigated by select grading and incorporating impe	rmeable liners or cut	off walls	
C.2.3 Set	backs have been recommended to mitigate possible slope stability	v issues.		
C.2.4  A v	ertical liner will be used to prevent lateral migration into nearby	v utility trenches.		
C.2.5 UIC	ere the biofiltration BMP is located within 10 feet of a structure	, retaining wall or set	tlement s	ensitive
improven	nent we recommended that a cut-off wall or impermeable liner b	e constructed around	l the peri	meter of
the BMP.	The cut-off wall or impermeable liner should extend a minimum	n of 5 feet below pro	posed gra	ade, at
least 2 fee	t below the lowest adjacent footing and at least 2 feet below the	bottom of the BMP,	whicheve er flow	er 1s
greater. I	ne basins should also have an imperineable surface on the sides t	o prevent laterar wat	LI 110W.	



	Worksheet C.4-1 Page 2 of		
Criteria	Screening Question	Yes	No
3	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.	Х	
Provide	basis:		
Based on per hour acceptable	our review of items presented in Appendix C.3, we anticipate that infiltration greater can be allowed without increasing risk of groundwater contamination that cannot be e level.	than 0.5 mitigated	inches d to an
C.3.1 The soil conta	e subgrade soil appears to be suitable for onsite infiltration. We have no knowledge of mination onsite or down-gradient from the site.	groundv	vater or
C.3.2 The proposed	e seasonal high groundwater table is estimated to be greater than 40 feet below existing BMP. The encountered seepage water is not known to have any beneficial usages.	g grade a	t the
C.3.3 No	existing wellheads are known within the vicinity of the subject site.		
C.3.4 The	e site was not previously used for industrial use.		
C.3.5 We	recommend that infiltration activities be coordinated with the applicable groundwate	er manag	ement
agency.	and does not appear to be a high right of causing notantial water halongs issues		
C.3.6 1 he	ere does not appear to be a high risk of causing potential water balance issues.		
4	causing potential water balance issues such as change of seasonality of	x	
	surface waters? The response to this Screening Question shall be based on	Α	
D 1	a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide	Dasis:		
There do seasonali waters b	pes not appear to be a high risk of causing potential water balance issues such a ity of ephemeral streams or increased discharge of contaminated groundwater y allowing infiltration greater than 0.5 inches per hour.	as chang to surfac	e of ce
	If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially fe The feasibility screening category is Full Infiltration	asible.	
Part 1			Partial
Result*	If any answer from row 1-4 is "No", infiltration may be possible to some		
	infiltration" design Proceed to Part 2		
*To be con	npleted using gathered site information and best professional judgment considering the	he definit	tion 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								
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	ia Screening Question							
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.							
On a comprehensive evaluation of the factors presented in Appendix C.2.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 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.	Х							
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.	Х							
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.									
*To be completed using gathered site information and best professional judgment considering the definition of MEP in									

the MS4 Permit. Additional testing and/ of studies may be required by City Engineer to substantiate findings

0 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 <sub>o</sub>	Final Water Height with correction (inches) H <sub>f</sub>	Change in head (inches) ΔH	Average Head Height (inches) Havg	Tested Infiltration Rate (inch/hour) I,
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

Porchet Method - Tested Percolation Rate Conversion to Tested Infiltration Rate

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

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

I<sub>t</sub> = tested infiltration rate, inches per hour

 $\Delta H$  = change in head over the time interval, inches

 $\Delta t$  = time interval, minutes

- r = effective radius of test hole
- $H_{avg}$  = average head over the time interval, inches