SUPPLEMENTAL STORM WATER INFILTRATION RATE EVALUATION
PLANNING AREA 3 OF OCEAN BREEZE RANCH
COMMUNITY OF BONSALL, SAN DIEGO, CALIFORNIA

FOR

OCEAN BREEZE RANCH
5820 WEST LILAC ROAD
BONSALL, CALIFORNIA 92003

W.O. 6960-A6-SC MAY 6, 2019

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

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May 6, 2019

W.O. 6960-A6-SC

Ocean Breeze Ranch, LLC
5820 West Lilac Road
Bonsall, California 92003

Attention: Mr. Jim Conrad

Subject: Supplemental Storm Water Infiltration Rate Evaluation, Ocean Breeze Ranch, Bonsall, San Diego County, California

Dear Mr. Conrad:

In accordance with your request and authorization, GeoSoils, Inc. (GSI) has prepared the following supplemental report regarding storm water infiltration within Planning Area PA-3 Project Design Consultants ([PDC], 2019) of the proposed Ocean Breeze Ranch project, located in the Bonsall area of San Diego County, California. GSI's scope of services included a review of the referenced documents (see Appendix A), supplemental infiltration testing, engineering and geologic analysis, and preparation of this report. Unless specifically superceded herein, the conclusions and recommendations presented in the referenced body of work by GSI, remain valid and applicable.

STORM WATER TREATMENT AND HYDROMODIFICATION MANAGEMENT

General Geology

In the Bonsall area during the mid to late Pleistocene (within the Quaternary-age), the granitic rocks belonging to the Peninsular Ranges Batholith have been eroded and alluvial deposits have since filled the lower valleys. Regional mapping by Tan (2007) indicates that the site is primarily underlain by Cretaceous-age granitic rock referred to as the Couser Canyon Tonalite. Pleistocene-age older alluvium (stream terrace deposits), and younger alluvium associated with deposits along the San Luis Rey River, also occurs in the site vicinity (Tan, 2007).

Based on mapping performed by this office, flat-lying ground within Planning Area PA-3 in the vicinity of (primarily north of) Dulin Ranch Road, is underlain by Holocene alluvial sediments. Lower slopes descending to the flood plain, and flatter than about 4:1 (h:v), are developed on deposits of older alluvium (stream terrace deposits). Steeper slopes and upland areas south of Dulin Ranch Road are primarily underlain by granitic bedrock.

Subsurface Exploration

During GSI's site-specific field studies, two separate lots (Lots 395 and 396) were explored with a limited access drill rig. Within each lot, two infiltration test borings (IB-1 and IB-2), with a diameter of 6 inches, were advanced to approximately 5 feet below ground surface, and at the location of the proposed treatment system. The purpose of the borings was to evaluate the site's near-surface soil and geologic conditions, with respect to storm water infiltration.

Groundwater

While groundwater was not encountered in our groundwater borings on Lots 395 and 396, this site has an elevated potential for "perched groundwater." Within alluvial areas north of Planning Area PA 3, regional groundwater is at approximately 178 feet MSL, well below 10 feet from the bottom of the proposed infiltration systems.

USDA Study

A review of the United States Department of Agriculture database (USDA; 1973, 2016) indicates a broad range of infiltration rates, between 0.00 inches per hour, to 19.98 inches per hour for all soil types across the site. Based on the USDA data, the following table provides a summary of representative infiltration rates associated with the three main geologic units on the overall site.

GEOLOGIC UNIT	APPROXIMATE RANGE INFILTRATION RATES (INCHES PER HOUR)	HYDROLOGIC SOIL GROUP (HSG)	COMMENTS
Alluvium	1.98 to 19.98	A, B, D	HSG group D due to potentially shallow groundwater locally
Older Alluvium	0.00 to 0.60	C, D	Contains relatively high clay content within surficial weathered zones
Granitic Bedrock	0.02 to 5.95	C, D	HSG Group D due to shallow depths to rock

It should be noted that the USDA data generally characterizes surficial soil conditions. During the grading/construction process, in areas proposed for improvements, these surficial soils would generally be removed and exported, or recompacted during mass grading, and as such, are not considered entirely representative of "as-built" site conditions, or parent material at greater depths.

Infiltration Feasibility

In accordance with the BMP Design Manual (County, 2019), the infiltration feasibility for this site was evaluated. An evaluation of the soils hydraulic conductivity, or (*K)* was performed in accordance with the Porchet, or inverse auger hole method (Van Hoorm, 1979; USBR, 1984), for the various soil types encountered onsite. Based on the testing performed, corrected (using Porchet method) *K* values ranging from ±0.015 to 0.017 inches per hour for Lot 395, and ±0.03 to 0.43 inches per hour for Lot 396, were evaluated and are summarized in the following table with respect to the corresponding infiltration basins. Infiltration basin locations are shown on Plate 1, which used the Leach Field and Basin Infiltration Test Request plan, prepared by PDC (2019), as a base map.

INFILTRATION TEST HOLE	INITIAL FIELD PERCOLATION RATE (min/in)	CORRECTED INFILTRATION RATE (inches per hour)	INFILTRATION MEDIUM	SOIL UNIT PER USDA (1973)	HYDROLOGIC SOIL GROUP (HSG)
395, IB-1	184	0.017	Clayey Sand	Placentia sandy loam	C
395, IB-2	184	0.015	Clayey Sand	Placentia sandy loam	C
396, IB-1	10.22	0.43	Silty Sand	Fallbrook sandy loam	C
396, IB-2	96	0.03	Silty/Clayey Sand	Placentia sandy loam	C

Differences noted between the USDA data, and this evaluation are likely due to testing being performed on soils generally deeper in the soil profile than characterized in the USDA study. For instance, older alluvium contains relatively more clay in the near surface, than at depth. As such, the zones evaluated result in slightly higher rates than USDA data. Conversely, testing in granitic areas indicates infiltration rates relatively lower than USDA data, as testing was not performed within the near surface soil horizon and is due to decreased permeability with depth within granitic rock.

A combined safety factor (or factor of safety [FOS]) S_A x S_B equal to 2.0 (minimum) per Table D.2-3 (County, 2019), was evaluated, and is also included herein (see Appendix B). An additional discussion of infiltration feasibility is presented in Appendix B (Table D.2-1, also provided by the County [2019]).

The average calculated corrected infiltration rate for lot 395 is ±0.016 inches/hr, while that rate for Lot 396 is ±0.23 inches/hr. Using a minimum "combined safety factor" of 2.0 per Table D.2-3 (County, 2019), a "design infiltration rate" of 0.008 and 0.115 inches/hr are evaluated for Lots 395 and 396, respectively. These are less than the lower limit of infiltration recommended by the USEPA (0.52 inches/hr [see Clar, et al., 2004]), and less

than that currently allowed by the County (>0.50 inches/hr. [see County, 2019]), for full infiltration. Proposed fill, and/or moisture-sensitive improvements, such as pavements, and utility trench backfill, foundations, retaining walls, and below grade building walls, would likely be adversely affected by excessive soil moisture, including offsite improvements, causing settlement and distress. Bio-basins can adversely affect the performance of the onsite and offsite structures, foundation systems by: 1) increasing soil moisture transmission rates through concrete flooring; 2) reducing the stability of slopes; and 3) increase the potential for a loss in bearing strength of soil. Onsite mitigative grading of compressible near-surface soils for the support of structures generally involves removal and recompaction. This is anticipated to create the potential for permeability contrast, and the potential for the development of a shallow "perched" and mounded water table, which can reasonably be anticipated to migrate laterally, beneath the structure(s), or offsite onto adjacent property, causing settlement and associated distress. Based on testing, "partial infiltration" may be considered potentially feasible for Lots 395 and 396. It should also be noted that infiltrating into site soils within 10 feet of any settlement-sensitive structure/improvement is considered poor engineering judgement.

Onsite Infiltration-Runoff Retention Systems

General design criteria regarding the use of onsite infiltration-runoff retention systems (OIRRS) are presented below.

Should onsite infiltration-runoff retention systems (OIRRS) be planned for Best Management Practices (BMPs) or Low Impact Development (LID) principles for the project, some guidelines should be followed in the planning, design, and construction of such systems. Such facilities, if improperly designed or implemented without consideration of the geotechnical aspects of site conditions, can contribute to flooding, saturation of bearing materials beneath site improvements, slope instability, and possible concentration and contribution of pollutants into the groundwater or storm drain and/or utility trench systems.

A key factor in these systems is the infiltration rate (sometimes referred to as the percolation rate) which can be ascribed to, or determined for, the earth materials within which these systems are installed. Additionally, the infiltration rate of the designed system (which may include gravel, sand, mulch/topsoil, or other amendments, etc.) will need to be considered. The project infiltration testing is very site specific, any changes to the location of the proposed OIRRS and/or estimated size of the OIRRS, may require additional infiltration testing. Locally, relatively impermeable formations include the underlying formational (granitic) bedrock, which is anticipated to have a relatively very low vertical infiltration rate.

The following geotechnical guidelines should be considered when designing onsite infiltration-runoff retention systems:

- It is not good engineering practice to allow water to saturate soils, especially near slopes or improvements; however, the controlling agency/authority is now requiring this for OIRRS purposes on many projects.

- Wherever possible, infiltration systems should not be installed within ±50 feet of the tops of slopes steeper than 15 percent or within H/3 from the tops of slopes (where H equals the height of slope).

- Wherever possible, infiltrations systems should not be placed within a distance of H/2 from the toes of slopes (where H equals the height of slope).

- Wherever possible, infiltration systems should not be installed within 10 feet of a residential structure or settlement-sensitive improvement.

- The landscape architect should be notified of the location of the proposed OIRRS. If landscaping is proposed within the OIRRS, consideration should be given to the type of vegetation chosen and their potential effect upon subsurface improvements (i.e., some trees/shrubs will have an effect on subsurface improvements with their extensive root systems). Over-watering landscape areas above, or adjacent to, the proposed OIRRS could adversely affect performance of the system. Soil chemical amendment could alter soil chemistry, which may affect soil corrosion and permeability.

- Areas adjacent to, or within, the OIRRS that are subject to inundation should be properly protected against scouring, undermining, and erosion, in accordance with the recommendations of the design engineer.

- If subsurface infiltration galleries/chambers are proposed, the appropriate size, depth interval, and ultimate placement of the detention/infiltration system should be evaluated by the design engineer, and be of sufficient width/depth to achieve optimum performance, based on the infiltration rates provided. In addition, proper debris filter systems will need to be utilized for the infiltration galleries/chambers. Debris filter systems will need to be self cleaning and periodically and regularly maintained on a regular basis. Provisions for the regular and periodic maintenance of any debris filter system is recommended and this condition should be disclosed to all interested/affected parties.

- Where infiltration systems are located within setback areas noted above, impermeable liners and subdrains should be used along the bottom of bioretention swales/basins located within the influence of slopes and structures. Impermeable liners used in conjunction with bioretention basins should consist of a 30-mil polyvinyl chloride (PVC) membrane that is covered by a minimum of 12 inches of clean soil, free from rocks and debris, with a maximum 4:1 (h:v) slope inclination, or flatter, and meets the following minimum specifications:

Specific Gravity (ASTM D792): 1.2 (g/cc, min.); Tensile (ASTM D882): 73 (lb/in-width, min); Elongation at Break (ASTM D882): 380 (%, min); Modulus (ASTM D882): 32 (lb/in-width, min.); and Tear Strength (ASTM D1004): 8 (lb/in, min); Seam Shear Strength (ASTM D882) 58.4 (lb/in, min); Seam Peel Strength (ASTM D882) 15 (lb/in, min).

- Subdrains should consist of at least 4-inch diameter Schedule 40 or SDR 35 drain pipe with perforations oriented down. The drain pipe should be sleeved with a filter sock.

- Utilities or storm drains ingressing or egressing from an OIRRs, should have the backfill slurried with a two-sack mix, to mitigate piping, the resultant creation of voids, and subsequent settlement and distress.

Final project plans (grading, precise grading, foundation, retaining wall, landscaping, etc.), should be reviewed by this office prior to construction, so that construction is in accordance with the conclusions and recommendations of this report. Based on our review, supplemental recommendations and/or further geotechnical studies may be warranted. It should be noted that structural and landscape plans were not available for review at this time.

LIMITATIONS

The conclusions and recommendations presented herein are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty is express or implied. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

John P. Franklin
Engineering Geologist, CEG 1340

David W. Skelly
Civil Engineer, RCE 47857

MJS/DWS/JPF/jh

Attachments: Appendix A - References
Appendix B - Infiltration Tables D.1-1, D.2-1, and D.2-3
Appendix C - Infiltration Test Data and Groundwater Borings GW-1 and GW-11
Plate 1 - Infiltration Test Location Map

Distribution: (2) Addressee

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

Clar, M.L., Bartfield, B.J., O'Conner, T.P., 2004, Stormwater best management practice design guide, volume 3, basin best management practices, US EPA/600/R-04/121B, dated September.

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_____, 2016a, Geotechnical evaluation for Ocean Breeze Ranch, Bonsall, San Diego County, California, W.O. 6960-A-SC, dated October 6.

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APPENDIX B

INFILTRATION TABLES D.1-1, D.2-1, AND D.2-3

Table D.1-1: Considerations for Geotechnical Analysis of Infiltration Restrictions

Restriction Element (Lot 395)		Is Element Applicable? (Yes/No)
Mandatory Considerations	BMP is within 100' of Contaminated Soils	No
	BMP is within 100' of Industrial Activities Lacking Source Control	No
	BMP is within 100' of Well/Groundwater Basin	No
	BMP is within 50' of Septic Tanks/Leach Fields	No
	BMP is within 10' of Structures/Tanks/Walls	No
	BMP is within 10' of Sewer Utilities	No
	BMP is within 10' of Groundwater Table	No
	BMP is within Hydric Soils	No
	BMP is within Highly Liquefiable Soils and has Connectivity to Structures	No
	BMP is within 1.5 Times the Height of Adjacent Steep Slopes (=25%)	No
	County Staff has Assigned "Restricted" Infiltration Category	No
Optional Considerations	BMP is within Predominantly Type D Soil	No
	BMP is within 10' of Property Line	No
	BMP is within Fill Depths of =5' (Existing or Proposed)	No
	BMP is within 10' of Underground Utilities	No
	BMP is within 250' of Ephemeral Stream	No
	Other (Provide detailed geotechnical support)	
Result	Based on examination of the best available information, I have **not identified any restrictions** above.	☒ Unrestricted
	Based on examination of the best available information, I have **identified one or more restrictions** above.	☐ Restricted

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PLATE B-1

Table D.2-1: Elements for Determination of Design Infiltration Rates (Lot 395)

Item	Value	Unit
Initial Percolation Rate Identify per Section D.2.1	184	min./in.
Corrected Infiltration Rate Identify per Section D.2.2	0.016	in/hr
Safety Factor Identify per Section D.2.3	2.00	unitless
Design Infiltration Rate Corrected Infiltration Rate ÷ Safety Factor	0.008	in/hr

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PLATE B-2

Table D.2-3: Determination of Safety Factor

Consideration (Lot 395)		Assigned Weight (w)	Favor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.50
	Soil Texture Class	0.25		0.50
	Soil Variability	0.25		0.50
	Depth to Groundwater/Obstruction	0.25		0.25
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.75
Design (B)	Pretreatment	0.50	Refer to Table D.2-4i	
	Resiliency	0.25		
	Compaction	0.25		
	Design Safety Factor, $SB = \Sigma pi$			
Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)				2

*Design Criteria has been left blank due to the fact that design plans for an infiltration basin have not been created yet.

W.O. 6960-A6-SC
PLATE B-3

Table D.1-1: Considerations for Geotechnical Analysis of Infiltration Restrictions

Restriction Element (Lot 396)		Is Element Applicable? (Yes/No)
Mandatory Considerations	BMP is within 100' of Contaminated Soils	No
	BMP is within 100' of Industrial Activities Lacking Source Control	No
	BMP is within 100' of Well/Groundwater Basin	No
	BMP is within 50' of Septic Tanks/Leach Fields	No
	BMP is within 10' of Structures/Tanks/Walls	No
	BMP is within 10' of Sewer Utilities	No
	BMP is within 10' of Groundwater Table	No
	BMP is within Hydric Soils	No
	BMP is within Highly Liquefiable Soils and has Connectivity to Structures	No
	BMP is within 1.5 Times the Height of Adjacent Steep Slopes (=25%)	No
	County Staff has Assigned "Restricted" Infiltration Category	No
Optional Considerations	BMP is within Predominantly Type D Soil	No
	BMP is within 10' of Property Line	No
	BMP is within Fill Depths of =5' (Existing or Proposed)	No
	BMP is within 10' of Underground Utilities	No
	BMP is within 250' of Ephemeral Stream	No
	Other (Provide detailed geotechnical support)	
Result	Based on examination of the best available information, I have **not identified any restrictions** above.	☒ Unrestricted
	Based on examination of the best available information, I have **identified one or more restrictions** above.	☐ Restricted

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PLATE B-4

Table D.2-1: Elements for Determination of Design Infiltration Rates (Lot 396)

Item	Value	Unit
Initial Percolation Rate Identify per Section D.2.1	53.11	min./in.
Corrected Infiltration Rate Identify per Section D.2.2	0.23	in/hr
Safety Factor Identify per Section D.2.3	2.00	unitless
Design Infiltration Rate Corrected Infiltration Rate ÷ Safety Factor	0.115	in/hr

W.O. 6960-A6-SC
PLATE B-5

Table D.2-3: Determination of Safety Factor

Consideration (Lot 396)		Assigned Weight (w)	Favor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.50
	Soil Texture Class	0.25		0.50
	Soil Variability	0.25		0.50
	Depth to Groundwater/Obstruction	0.25		0.25
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.75
Design (B)	Pretreatment	0.50	Refer to Table D.2-4i	
	Resiliency	0.25		
	Compaction	0.25		
	Design Safety Factor, $SB = \Sigma pi$			
Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)				2

*Design Criteria has been left blank due to the fact that design plans for an infiltration basin have not been created yet.

W.O. 6960-A6-SC
PLATE B-6

APPENDIX C

INFILTRATION TEST DATA AND GROUNDWATER BORINGS GW-1 AND GW-11

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INVERSED AUGER HOLE (PORCHET) METHOD - DATA SHEET

PROJECT: OBR

DATE: 4/16/19

CLIENT:

WORK ORDER: 6960-A6

HOLE NUMBER: 395 IB-1

BORING LOG/SOIL DESCRIPTION

DEPTH (D') OF TEST HOLE (in) 59"

HOLE DIAMETER (in) 6"

INITIAL WATER LEVEL (in) 29.00"

½(3) = 1.5

Time	Δt (min.)	t (total min.)	Ho/Ht (in)	ho/ht (in)	ht + ½ r	K
11:27	—	—	29.00"	30.00"	31.50	—
12:14	47	47	30.50	28.50	30.00	0.093
1:27	73	120	31.00	28.00	29.50	0.021
2:13	46	166	31.25	27.75	29.25	0.017
3:19	66	232	31.25	27.75	29.25	0
4:22	63	295	31.50	27.50	29.00	0.007

$K = 1.15\ r \tan \alpha$ (x60 for units in inches per hour)

where $\tan \alpha = [\log (h_0 + ½ r) - \log (h_t + ½ r)] / t\text{-}t_0$

W.O. 6960-A6-SC
PLATE C-1

K =

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INVERSED AUGER HOLE (PORCHET) METHOD - DATA SHEET

PROJECT: OBR

DATE: 4/16/19

CLIENT:

WORK ORDER: 6960-A6

HOLE NUMBER: 395-IB2

BORING LOG/SOIL DESCRIPTION

DEPTH (D') OF TEST HOLE (in) 65.5"

HOLE DIAMETER (in) 6"

INITIAL WATER LEVEL (in) 32.75"

+1.5

Time	Δt (min.)	t (total min.)	Ho/Ht (in)	ho/ht (in)	ht + ½ r	K
11:38	—	—	32.75"	32.75	34.25	—
12:16	38	38	33.00	32.50	34.00	0.017
1:29	73	111	33.25	32.25	33.75	0.009
2:15	46	157	33.50	32.00	33.50	0.015
3:20	65	222	33.50	32.00	33.50	0
4:24	64	286	33.50	32.00	33.50	0

$K = 1.15\ r \tan \alpha$ (x60 for units in inches per hour)

where $\tan \alpha = [\log (h_0 + \frac{1}{2} r) - \log (h_t + \frac{1}{2} r)] / t\text{-}t_0$

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PLATE C-2

K =

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INVERSED AUGER HOLE (PORCHET) METHOD - DATA SHEET

PROJECT: OBR

DATE: 4/24/19

CLIENT:

WORK ORDER: 6960-A6

HOLE NUMBER: 396 IB-1

BORING LOG/SOIL DESCRIPTION

DEPTH (D') OF TEST HOLE (in) 56.00"

HOLE DIAMETER (in) 6"

INITIAL WATER LEVEL (in) 21.75"

Time	Δt (min.)	t (total min.)	Ho/Ht (in)	ho/ht (in)	ht + ½ r	K
10:32	–	–	21.75"	34.25	35.75	–
11:28	56		33.75"	22.25	23.75	0.66
1:33	65		40.50"	15.50	17.00	0.46
1:47	–	–	25.50"	30.50	32.00	–
2:19	32		30.00"	26.00	27.50	0.43

$K = 1.15\ r \tan \alpha$ (x60 for units in inches per hour)

where $\tan \alpha = [\log (h_0 + ½\ r) - \log (h_t + ½\ r)] / t\text{-}t_0$

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PLATE C-3

K =

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INVERSED AUGER HOLE (PORCHET) METHOD - DATA SHEET

PROJECT: OBR DATE: 4/24/19

CLIENT: WORK ORDER: 6960-A6

HOLE NUMBER: 396- IB-2

BORING LOG/SOIL DESCRIPTION

DEPTH (D') OF TEST HOLE (in) 60.50"

HOLE DIAMETER (in) 6"

INITIAL WATER LEVEL (in) 23.75"

Time	Δt (min.)	t (total min.)	Ho/Ht (in)	ho/ht (in)	ht + ½ r	K
10:35	—	—	23.75"	36.75	38.25	—
11:26	51	51	26.50	34.00	35.50	0.13
1:32	66	117	29.50	31.00	32.50	0.12
2:20	48	165	30.00	30.50	32.00	0.03

$K = 1.15\ r \tan \alpha$ (x60 for units in inches per hour)

where $\tan \alpha = [\log (h_0 + \frac{1}{2} r) - \log (h_t + \frac{1}{2} r)] / t\text{-}t_0$

W.O. 6960-A6-SC
PLATE C-4

K =

GeoSoils, Inc.

BORING LOG

PROJECT: OCEAN BREEZE RANCH
Planning Area 3 of Ocean Breeze Ranch
Including Residences R7and R8, and Barn B9

W.O. 6960-A6-SC *BORING* GW-1 *SHEET* 1 *OF* 1

DATE EXCAVATED 4/16/19 *LOGGED BY:* MK *APPROX. ELEV.:* 221' MSL

SAMPLE METHOD: Solid Flight Auger

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Material Description
0				SC				@ 0' CLAYEY SAND, reddish brown, dry, loose; trace roots.
5								@ 3' CLAYEY SAND, dark brown, wet, loose to medium dense.
10								@ 6' CLAYEY SAND, brown, wet, dense.
15								Total Depth = 15' No Groundwater/Caving Encountered Backfilled 4-16-2019
20								
25								
30								

▼ *Standard Penetration Test*
⌶ *Undisturbed, Ring Sample*
▽ *Groundwater*
♀ *Seepage*

GeoSoils, Inc.

PLATE C-5

GeoSoils, Inc.

BORING LOG

PROJECT: OCEAN BREEZE RANCH
Planning Area 3 of Ocean Breeze Ranch
Including Residences R7and R8, and Barn B9

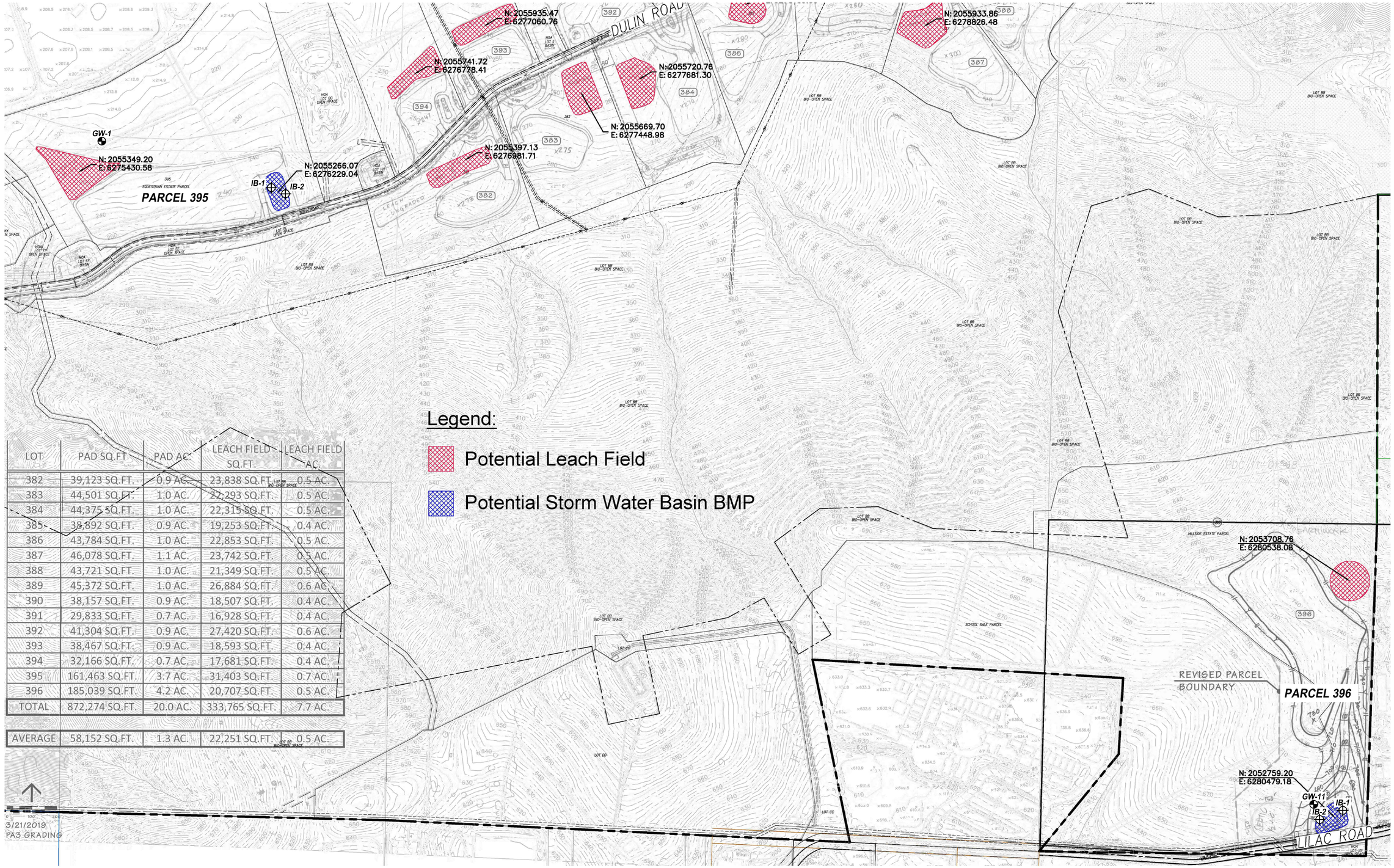
W.O. 6960-A6-SC *BORING* GW-11 *SHEET* 1 *OF* 1

DATE EXCAVATED 4/19/19 *LOGGED BY:* MK *APPROX. ELEV.:* 675'

SAMPLE METHOD: Solid Flight Auger

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Material Description
0				SC				@ 0' CLAYEY SAND, reddish brown, dry, loose.
				SM				@ 3' SILTY SAND, brown, damp, medium dense.
5								@ 5' SILTY SAND, brown, moist, dense.
								Refusal @ 7½'
								Total Depth = 7½'
								No Groundwater/Caving Encountered
10								Backfilled 4-19-19
15								
20								
25								
30								

▼ *Standard Penetration Test*
⌶ *Undisturbed, Ring Sample*
▽ *Groundwater*
♀ *Seepage*



LOT	PAD SQ.FT	PAD AC.	LEACH FIELD SQ.FT.	LEACH FIELD AC.
382	39,123 SQ.FT.	0.9 AC.	23,838 SQ.FT.	0.5 AC.
383	44,501 SQ.FT.	1.0 AC.	22,293 SQ.FT.	0.5 AC.
384	44,375 SQ.FT.	1.0 AC.	22,315 SQ.FT.	0.5 AC.
385	38,892 SQ.FT.	0.9 AC.	19,253 SQ.FT.	0.4 AC.
386	43,784 SQ.FT.	1.0 AC.	22,853 SQ.FT.	0.5 AC.
387	46,078 SQ.FT.	1.1 AC.	23,742 SQ.FT.	0.5 AC.
388	43,721 SQ.FT.	1.0 AC.	21,349 SQ.FT.	0.5 AC.
389	45,372 SQ.FT.	1.0 AC.	26,884 SQ.FT.	0.6 AC.
390	38,157 SQ.FT.	0.9 AC.	18,507 SQ.FT.	0.4 AC.
391	29,833 SQ.FT.	0.7 AC.	16,928 SQ.FT.	0.4 AC.
392	41,304 SQ.FT.	0.9 AC.	27,420 SQ.FT.	0.6 AC.
393	38,467 SQ.FT.	0.9 AC.	18,593 SQ.FT.	0.4 AC.
394	32,166 SQ.FT.	0.7 AC.	17,681 SQ.FT.	0.4 AC.
395	161,463 SQ.FT.	3.7 AC.	31,403 SQ.FT.	0.7 AC.
396	185,039 SQ.FT.	4.2 AC.	20,707 SQ.FT.	0.5 AC.
TOTAL	872,274 SQ.FT.	20.0 AC.	333,765 SQ.FT.	7.7 AC.
AVERAGE	58,152 SQ.FT.	1.3 AC.	22,251 SQ.FT.	0.5 AC.

Legend:

- Potential Leach Field
- Potential Storm Water Basin BMP

3/21/2019
PA3 GRADING

N

GRAPHIC SCALE
200 0 100 200 400 800
1" = 200'

ALL LOCATIONS ARE APPROXIMATE

This document or efile is not a part of the Construction Documents and should not be relied upon as being an accurate depiction of design.

GSI LEGEND

- IB-2 — APPROXIMATE LOCATION OF INFILTRATION TEST BORING IN A GIVEN PARCEL AREA
- GW-11 — APPROXIMATE LOCATION OF GROUNDWATER TEST BORING IN A GIVEN PARCEL AREA

GeoSoils, Inc.

INFILTRATION TEST LOCATION MAP

Plate 1

W.O. 6960-A6-SC	DATE: 05/19	SCALE: 1" = 200'

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

5741 Palmer Way • Carlsbad, California 92010 • (760) 438-3155 • FAX (760) 931-0915 • www.geosoilsinc.com

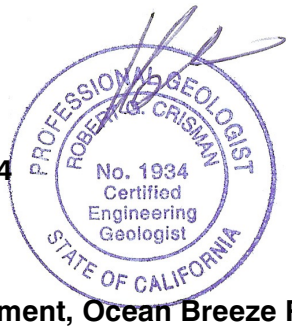
TECHNICAL M E M O R A N D U M

Date: November 29, 2018 (Revised December 12, 2018) **W.O. 6960-A5-SC**

To: Ocean Breeze Ranch
5820 West Lilac Road
Bonsall, California 92003

Attn: Mr. Pete Fagrell

From: Robert G. Crisman, CEG 1934
David W. Skelly, RCE 47857



Subject: Review of Storm Water Treatment, Ocean Breeze Ranch, Bonsall, California

References:

1. "Geotechnical Evaluation for Ocean Breeze Ranch, Bonsall, San Diego County, California," W.O. 6960-A-SC, dated October 6, 2016, by GeoSoils, Inc.

2. "OBR DMA Exhibits," 60 Scale, 5 Sheets, J.N. 4192, Dated November 8, 2018, by Project design Consultants.

3. "County of San Diego BMP Design Manual for Permanent Site Design, Storm Water Treatment and Hydromodification Management, Storm Water Requirements for Development Applications, with Appendices," dated February 2016, pending Revision Dated January 2019, by County of San Diego.

4. "Custom Soils Report for San Diego County Area, Ocean Breeze Ranch, Bonsall, dated August, 2016, by United States Department of Agriculture, National Resources Conservation Service.

In accordance with a request from Project Design Consultants (PDC), GeoSoils, Inc. (GSI), has reviewed storm water infiltration data and discussions presented in Reference No. 1, with respect to the current site design, including Drainage Management Areas (DMAs) and basin locations as shown on Reference No. 2, as well as forthcoming guidelines from the County, regarding storm water treatment (Reference No. 3). Unless specifically superceded herein, the conclusions and recommendations presented in Reference No. 1 remain valid and applicable.

Based on our review of both USDA data (Reference No. 4) and our own site work (Reference No. 1), including infiltration testing on representative soils using the inverse borehole (Porchet) method (Reference No. 1), the following comments are presented regarding storm water basins within Planning Areas 1, 2, and 3. DMAs and basin locations are shown on the attached "Infiltration Exhibits," see Plates 1 through 5, which use Reference No. 2 as a base. Corrected Infiltration Rates, or CIR's, the factor of Safety (FOS) applied to each basin, design rate (inches/hour), infiltration category (i.e., full, partial, or no infiltration), and whether the particular basin is "restricted" or "unrestricted" per Reference No. 3, is indicted on Plates 1 through 5, as well as presented in the following sections.

Planning Area 1, DMA 1, Basin 1A:

Infiltration testing for Basin 1A indicated an infiltration rate of approximately 0.3 in/hr. With an FOS of 3.0 (per Reference No. 3, App. D, Table D.2-3), the design rate would be 0.1 in/hr. However, this basin is considered "restricted" based on the BMP underlain with fill> 5 feet, and within 1.5 times the height of an adjacent "steep" fill slope, as indicated in Table D.1-1 of Reference No. 4. As such, a "no infiltration" design is warranted.

Planning Area 2, Basins 2A, 2B, 2C, 2D, 2E, 2F and 2G:

These basins all occur with the sandy alluviated area of the site. Infiltration testing for these basins indicated a corrected infiltration rate (CIR) of approximately 7.8 in/hr. With an FOS ranging from 2.25 to 3.0, design rates ranging from 2.6 to 3.5 inches/hour were evaluated. Based on the design rates evaluated, Basins 2B, 2D, 2E, 2F, and 2G are considered "full infiltration," and "unrestricted." However, based on relatively shallow groundwater levels to the bottom of the basins in the vicinity of Basins 2A and 2C, these basins are considered as "restricted" even though a full infiltration design is suggested by the design infiltration rates evaluated.

It should be noted that the groundwater table within PA-2 was observed to vary on the order of about 11.5 to 18 feet below existing grades. As also noted in Reference No. 1, this water table appeared to have been relatively stable over the period between 2014 and 2016. Boring logs prepared during subsurface exploration in preparation of Reference No. 1, indicating groundwater depth/elevation, are attached.

A review of County "Restrictions" (Table D.1-1 in Reference No. 3) includes one of the "mandatory" restrictions as "*BMP within highly liquefiable soils and connectivity to structures.*" However, our geotechnical report (Reference No. 1), has evaluated the liquefaction potential and provides both earthwork and foundation recommendations for the mitigation of liquefaction related distress. Furthermore, the liquefaction potential evaluated in Reference No. 1, is not anticipated to be substantially affected by the planned infiltration. As such, this potential restriction is considered "reasonably resolved" per Section D.1 of Reference No. 3, and the basins may be considered "unrestricted" except where shallow groundwater occurs, as noted for Basins 2A and 2C.

Planning Area 3, Basins 3A, 3B, 3C, 3E, 3G:

These basins all occur with areas of older alluvium onsite, predominantly consisting of granular soils with some fines. Infiltration testing for Basins 3A, 3B, 3C, and 3E indicated an infiltration rate of approximately 1.0 in/hr. With an FOS of about 2.6, the design rate would be about 0.38 in/hr. Based on the design rate, these basins are considered "partial infiltration." Groundwater in this area is anticipated to be greater than 15 feet below BMP. These basins are considered "unrestricted."

Planning Area 3, Basins 3D, 3F:

These basins all occur with the sandy alluviated area of the site. Infiltration testing for Basins 3D and 3F indicated an infiltration rate of approximately 6.0 in/hr. With an FOS range of 2.0 to 3.0, the design rate ranges from 2.0 to 3.0 inches/hour. Based on the design rate, these basins are considered "full infiltration." Groundwater is anticipated between 10 to 15 feet below BMP. These basins are considered "unrestricted."

DMA -16, Basin 3H (Offsite)

The predominant USDA soil type (per Reference No. 4) is Placentia sandy loam (2-9% slopes), with an infiltration range of 0.06 to 0.6 in/hr. GSI testing in the vicinity (see Reference No. 1) evaluated a rate of 0.4 in./hr. and appears to be in agreement with USDA data. Regional groundwater in this area is also likely greater than 50 feet below existing grades. As such, the basin location is suited for partial infiltration.

DMA-17, Basin 2H (Offsite)

The predominant USDA soil type is the Bonsall sandy loam. USDA provides an infiltration range of 0.00 to 0.06 in/hr., also noting a high clay percentage. GSI does not have any testing in the immediate vicinity, however, Basin 2H is located a short distance upslope from USDA soils mapped as Tujunga Sand (Reference No. 4), which has a very high infiltration rate (6 to 19 in/hr). While the soil underlying the basin does not appear to be Tujunga, it may not be Bonsall either. Per Reference No. 4, Bonsall soils are defined as a "side slope" soils, while the basin area appears to be more of a "toe slope" soil, or bottom soil, such as the Placentia. Regardless, It is our opinion that soils underlying Basin 2H are neither Bonsall or Tujunga, and the engineering properties are likely somewhere in between, based on topography/geomorphology. Testing of soils mapped as Bonsall, a short distance east of Basin 2H evaluated an infiltration rate of 1 in/hr (see Reference No. 1). As such, it is our opinion that Basin 2H is likely suited for at least partial infiltration, however, no site specific data is available.

Basin 2H appears to have a bottom elevation of around 190 feet. The groundwater elevation in this area is likely around 165 to 170 feet MSL, or 20-25 feet below the basin bottom, based on the available information.

DMA-18 (Offsite)

This area is primarily hard pavement and the planned Hydromod vault appears suitable from a geotechnical viewpoint.

Closure

The conclusions presented herein are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty is express or implied. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction, or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities.

Attachments: Appendix A - Boring Logs HSA-2, HSA-3, FSA-4, HSA-5, HSA-6, and HSA-9
Appendix B - Factor of Safety Determinations
OBR Infiltration Rate Exhibits, Plates 1 through 7

Distribution: Addressee (email)
Project Design Consultants (email)

APPENDIX A

BORING LOGS HSA-2, HSA-3, FSA-4
HSA-5, HSA-6, AND HSA-9

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-2 *SHEET* 1 *OF* 1

DATE EXCAVATED 5-19-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 190'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
1				SM				**COLLUVIUM (TOPSOIL):** @ 0 ' SILTY SAND, grayish brown, dry, loose; few roots, burrowed.
2			8	SP	96.0	7.8	28.4	**QUATERNARY ALLUVIUM:** @ 1½' SAND with SILT, brown, dry, loose.
5			9		88.7	7.6	23.2	@ 5' As per 1½'.
10			10					@ 10' SAND with SILT, brown, moist, loose to medium dense; micaceous.
13 ▽								@ 13' Groundwater encountered.
15			13	SW				@ 15' SAND, brown, saturated, medium dense; fine to medium grained.
20			22	SP				@ 20' SAND, dark gray, saturated, medium dense; medium grained.
22								Total Depth = 21½' Groundwater Encountered @ 13' (EL = 177' MSL) Backfilled 05/19/16

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-3 *SHEET* 1 *OF* 2

DATE EXCAVATED 5-19-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 190'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
1				SM				**COLLUVIUM (TOPSOIL):** @ 0' SILTY SAND, grayish brown, slightly moist, loose; few roots and many burrows.
2				SM/SP				**QUATERNARY ALLUVIUM:** @ 2' SILTY SAND to SAND, brown, dry, loose.
5			8					@ 5' As per 2'.
10			14	SP	94.4	14.0	49.5	@ 10' SAND, brown, moist, loose.
11								@ 11½' Groundwater encountered.
15			14					@ 15' SAND, dark grayish brown, saturated, medium dense; fine to medium grained.
20			26		108.9	15.3	78.1	@ 20' SAND, dark grayish brown, saturated, medium dense; medium to coarse grained.
25			20					@ 25' SAND, medium to dark gray, saturated, medium dense; medium grained.

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-3 *SHEET* 2 *OF* 2

DATE EXCAVATED 5-19-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 190'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
31			39	SP	102.7	21.7	100	@ 30' SAND, dark gray, saturated, medium dense to dense; medium grained.
35			10					@ 35' SAND, dark gray, saturated, medium dense; fine to medium grained.
40			21		103.0	23.0	100	@ 40' As per 35'.
45			20					@ 45' As per 40'.
50			26		134.0	17.6	100	@ 50' SAND, dark gray brown, saturated, dense.
51								Total Depth = 51' Groundwater Encountered @ 11½' (EL = 178½' MSL) Backfilled 05/19/16

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-4 *SHEET* 1 *OF* 2

DATE EXCAVATED 5-19-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 193'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
1				SM				**COLLUVIUM (TOPSOIL):** @ 0' SILTY SAND, light brown, dry, loose; few roots, burrowed.
2				SW				**QUATERNARY ALLUVIUM:** @ 2 ' SAND with SILT, brown, slightly moist, loose.
5		■	15			6.8		@ 5' SAND with SILT, brown, slightly moist, loose.
10		▨	8					@ 10' SAND with SILT, brown, moist, loose.
13 ▽								@ 13½' Groundwater encountered.
15		■	19		108.8	20.4	100	@ 15' SAND, dark to medium gray, saturated, medium dense; fine grained.
20		▨	23	SP				@ 20' SAND, medium gray, saturated, medium dense; fine to medium grained.
25		■	41		109.2	19.4	100	@ 25' SAND, medium gray, saturated, medium dense; fine to medium grained.

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-4 *SHEET* 2 *OF* 2

DATE EXCAVATED 5-19-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 193'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
31			12	SP				@ 30' SAND, dark gray, saturated, medium dense; fine grained.
35			24	SP/SM	97.5	26.4	100	@ 35' SAND with SILT, very dark gray, saturated, medium dense; fine grained, micaceous.
40			34	SP				@ 40' SAND, very dark gray, saturated, dense; fine grained.
45			51		113.6	13.6	100	@45 SAND, medium gray to dark gray, saturated, dense; fine to medium grained.
50			49					@ 50' SAND, dary gray, saturated, dense; fine to medium grained.
52								Total Depth = 51½' Groundwater Encountered @ 13½' (EL = 179½' MSL) Backfilled With Bentonite 05/19/16

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-5 *SHEET* 1 *OF* 2

DATE EXCAVATED 5-18-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 197'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
1				SM				**COLLUVIUM (TOPSOIL):**
2								@ 0' SILTY SAND, grayish brown, dry, loose; few roots, burrowed.
3				SM				**QUATERNARY ALLUVIUM:**
4								@ 2' SILTY SAND, brown, slightly moist, loose; fine.
5			10					
6								@ 5' As per 2'.
7								
8								
9								
10			11	SP	93.1	11.6	39.5	@ 10' SAND with SILT, dark brown, slightly moist, loose.
11								
12								
13								
14								
15			12					@ 15' As Per 10', moist, medium dense.
16								
17								
18 ▽								@ 18' Groundwater encountered.
19								
20			15		No Recovery			@ 20' No recovery.
21								
22								
23								
24								
25			12					@ 25' SAND with SILT, dark brown, saturated, medium dense.
26								
27								
28								
29								

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-5 *SHEET* 2 *OF* 2

DATE EXCAVATED 5-18-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 197'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
31–34			37	SW	112.0	17.7	100	@ 30 SAND with SILT, dark gray, saturated, medium dense; fine to coarse grained.
35–39			15	SP/ML				@ 35' SAND with SILT, dark gray brown, saturated, medium dense; and SANDY SILT, dark gray, saturated, stiff.
40–44			44	SP	104.1	24.5	100	@ 40' SAND with SILT, gray, saturated, medium dense to dense.
45–49			28	SP/SW				@ 45' SAND with SILT and gravel, dark gray, saturated, medium dense to dense.
50–51			30	SP	108.7	18.1	100	@ 50' SAND with SILT, brown, saturated, medium dense.
51–59								Total Depth = 51' Groundwater Encountered @ 18' (EL = 179' MSL) Backfilled 05/18/16

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-6 *SHEET* 1 *OF* 2

DATE EXCAVATED 5-18-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 195'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
1				SM				**COLLUVIUM (TOPSOIL):**
2								@ 0' SILTY fine SAND, dark gray, slightly moist, loose; burrowed, roots.
3				SM				**QUATERNARY ALLUVIUM:**
4								@ 2' SILTY SAND, dark brown, slightly moist, loose; fine grained, micaceous.
5			13		97.4	7.7	29.1	@ 5' As per 2', moist, loose to medium dense.
6								
7								
8								
9								
10			12					@ 10' As per 5', medium dense.
11								
12								
13								
14								
15			17	SP	104.2	21.1	95	@ 15' SAND, gray brown, moist to wet, medium dense; medium grained, few fines.
16								
17 ▽								@ 17' Groundwater encountered.
18								
19								
20			18					@ 20' SAND with SILT, dark gray, saturated, medium dense.
21								
22								
23								
24								
25			29					@ 25' As per 20'.
26								
27								
28								
29								

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-6 *SHEET* 2 *OF* 2

DATE EXCAVATED 5-18-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 195'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
31			19	SP				@ 30' SAND with SILT, dark gray, saturated, medium dense; fine to coarse grained.
35			47		113.7	16.1	100	@ 35' As per 30', dense.
40			8					@ 40' As per 35', loose; some gravel.
45			46		107.8	19.2	100	@ 45' As per 40', dense; no gravel.
50			50					@ 50' As per 45'.
52								Total Depth = 51½' Groundwater Encountered @ 17' (EL = 178' MSL) Backfilled with Bentonite Clay 05/18/16

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-9 *SHEET* 1 *OF* 2

DATE EXCAVATED 7-5-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 225'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
1–10				SM				**ALLUVIUM:** @ 0' SILTY SAND, brown, dry, loose; few roots.
5		■	5		103.8	6.4	28.6	@ 5' SILTY SAND, dark brown, slightly moist, loose.
10		▨	11	SP				@ 10' SAND with SILT, brown, moist, loose.
15		■	16		106.9	4.2	20.1	@ 15' SAND, yellowish brown, moist, loose to medium dense.
20		▨	5					@ 20' No recovery.
21 ▽								@ 21' Groundwater ecountered.
25		■	13		111.3	16.6	100	@ 25' SAND, brown, saturated, loose.

BORING LOG

GeoSoils, Inc.

W.O. 6960-A-SC

PROJECT: OCEAN BREEZE RANCH, LLC
5820 West Lilac Road, Bonsall

BORING HSA-9 *SHEET* 2 *OF* 2

DATE EXCAVATED 7-5-16

SAMPLE METHOD: 140 Lb. Hammer @ 30" Drop

Approx. Elevation: 225'

Standard Penetration Test

Undisturbed, Ring Sample

Groundwater

Seepage

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Description of Material
31			24	CH				@ 30' CLAY, olive brown, wet, stiff.
35			29	CL				@ 35' SANDY CLAY, mottled olive brown to strong brown, moist, very stiff.
37			50-2"	BDR				**BEDROCK:** @ 37' GRANITIC ROCK, very dense (practical refusal). Total Depth = 37¼' Groundwater Encountered @ 21' (EL = 204' MSL) Backfilled 07/5/16 Infiltration Test Location

APPENDIX B

FACTOR OF SAFETY DETERMINATIONS

Table D.2-3: Determination of Safety Factor

PLANNING AREA 1, BASIN 1A Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.50
	Soil Texture Class	0.25		0.50
	Soil Variability	0.25		0.50
	Depth to Groundwater/Obstruction	0.25		0.25
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.75
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	0.50
	Resiliency	0.25		0.50
	Compaction	0.25		0.75
	Design Safety Factor, $S_B = \Sigma p$			1.75
	Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)			3.0

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

PLATE B1
W.O. 6960-A5-SC
11-29-2018
GEOSOILS, INC.

Table D.2-3: Determination of Safety Factor

PLANNING AREA 2, BASIN 2A, 2B, 2C Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.50
	Soil Texture Class	0.25		0.25
	Soil Variability	0.25		0.25
	Depth to Groundwater/Obstruction	0.25		0.50
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.50
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	0.50
	Resiliency	0.25		0.75
	Compaction	0.25		0.25
	Design Safety Factor, $S_B = \Sigma p$			1.50
	Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)			2.25

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

PLATE B2
W.O. 6960-A5-SC
11-29-2018
GEOSOILS, INC.

Table D.2-3: Determination of Safety Factor

PLANNING AREA 2, BASIN 2D Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.50
	Soil Texture Class	0.25		0.25
	Soil Variability	0.25		0.25
	Depth to Groundwater/Obstruction	0.25		0.50
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.50
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	0.50
	Resiliency	0.25		0.75
	Compaction	0.25		0.75
	Design Safety Factor, $S_B = \Sigma p$			2.0
	Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)			3.0

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

PLATE B3
W.O. 6960-A5-SC
11-29-2018
GEOSOILS, INC.

Table D.2-3: Determination of Safety Factor

PLANNING AREA 2, BASIN 2E, 2F, 2G Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.50
	Soil Texture Class	0.25		0.25
	Soil Variability	0.25		0.25
	Depth to Groundwater/Obstruction	0.25		0.25
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	0.50
	Resiliency	0.25		0.75
	Compaction	0.25		0.75
	Design Safety Factor, $S_B = \Sigma p$			2.0
	Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)			2.5

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

PLATE B4
W.O. 6960-A5-SC
11-29-2018
GEOSOILS, INC.

Table D.2-3: Determination of Safety Factor

PLANNING AREA 3, BASIN 3A, 3B, 3C, 3E Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.50
	Soil Texture Class	0.25		0.50
	Soil Variability	0.25		0.50
	Depth to Groundwater/Obstruction	0.25		0.25
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.75
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	0.50
	Resiliency	0.25		0.50
	Compaction	0.25		0.50
	Design Safety Factor, $S_B = \Sigma p$			1.50
Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)				2.6

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

PLATE B5
W.O. 6960-A5-SC
11-29-2018
GEOSOILS, INC.

Table D.2-3: Determination of Safety Factor

PLANNING AREA PA 3, BASIN 3F Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.50
	Soil Texture Class	0.25		0.50
	Soil Variability	0.25		0.50
	Depth to Groundwater/Obstruction	0.25		0.50
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.0
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	0.50
	Resiliency	0.25		0.50
	Compaction	0.25		0.50
	Design Safety Factor, $S_B = \Sigma p$			1.50
	Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)			3.0

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

PLATE B6
W.O. 6960-A5-SC
11-29-2018
GEOSOILS, INC.

Table D.2-3: Determination of Safety Factor

DMA 17, BASIN 2H (OFFSITE) Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.75
	Soil Texture Class	0.25		0.50
	Soil Variability	0.25		0.50
	Depth to Groundwater/Obstruction	0.25		0.25
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.0
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	0.50
	Resiliency	0.25		0.50
	Compaction	0.25		0.25
	Design Safety Factor, $S_B = \Sigma p$			1.25
	Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)			2.5

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

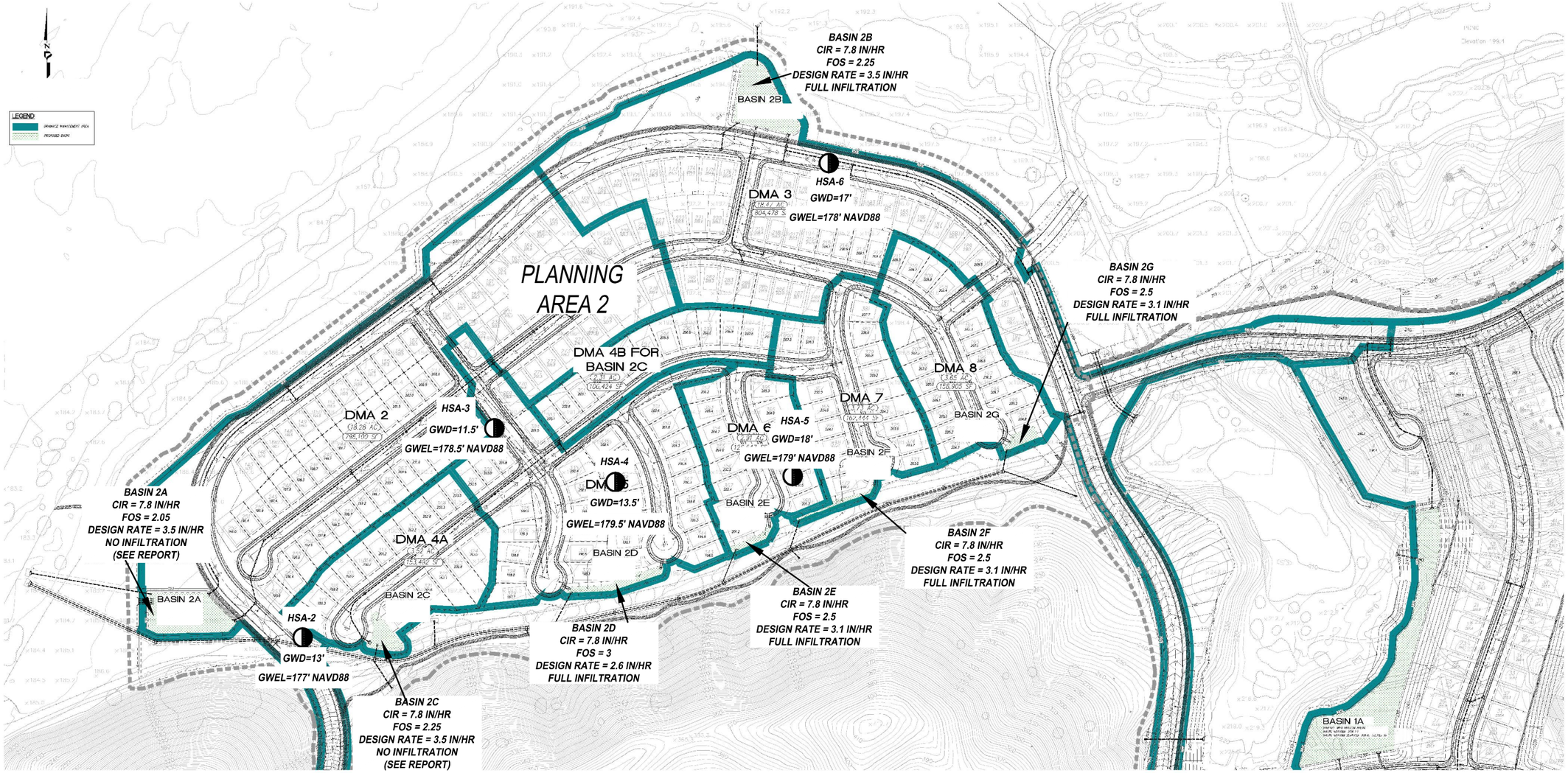
PLATE B7
W.O. 6960-A5-SC
11-29-2018
GEOSOILS, INC.

Table D.2-3: Determination of Safety Factor

DMA 16, BASIN 3H (OFFSITE) Consideration		Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
Suitability Assessment (A)	Infiltration Testing Method	0.25	Refer to Table D.2-4	0.75
	Soil Texture Class	0.25		0.50
	Soil Variability	0.25		0.50
	Depth to Groundwater/Obstruction	0.25		0.25
	Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.0
Design (B)	Pretreatment	0.50	Refer to Table D.2-4	0.50
	Resiliency	0.25		0.50
	Compaction	0.25		0.25
	Design Safety Factor, $S_B = \Sigma p$			1.25
	Safety Factor, $S = S_A \times S_B$ (Must be always greater than or equal to 2)			2.50

The geotechnical engineer should reference Table D.2-4 below in order to determine appropriate factor values for use in the table above. The values in the table below are subjective in nature and the geotechnical engineer may use professional discretion in how the points are assigned.

PLATE B8
W.O. 6960-A5-SC
11-29-2018
GEOSOILS, INC.



GSI LEGEND

CIR — CORRECTED INFILTRATION RATE

FOS — MINIMUM FACTOR OF SAFTEY PER COUNTY BMP MANUAL, TABLE D.2–3

HSA-6 — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING (GSI, 2016) WITH GROUNDWATER DEPTH (GWD) AMD APPROXIMATE GROUNDWATER ELEVATION (GWEL) IN FEET NAVD88

N

GRAPHIC SCALE

300 0 150 300 600

1" = 300'

ALL LOCATIONS ARE APPROXIMATE

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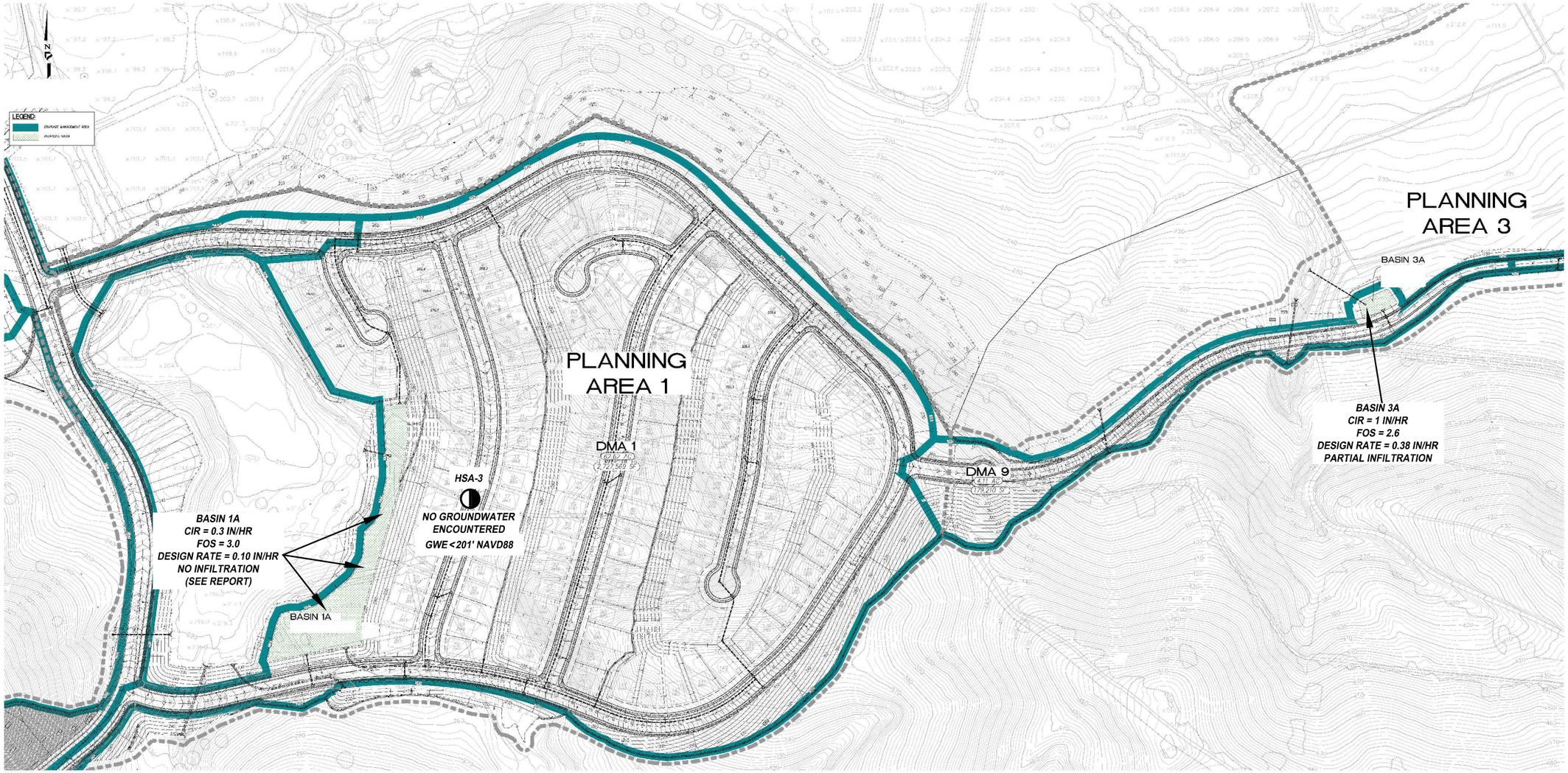
GeoSoils, Inc.

OBR INFILTRATION RATE EXHIBIT

Revised Plate 1

W.O. 6960-A5-SC	DATE: 12/18	SCALE: 1" = 300'



GSI LEGEND

CIR — CORRECTED INFILTRATION RATE

FOS — MINIMUM FACTOR OF SAFTEY PER COUNTY BMP MANUAL, TABLE D.2-3

HSA-6 — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING (GSI, 2016) WITH GROUNDWATER DEPTH (GWD) AMD APPROXIMATE GROUNDWATER ELEVATION (GWEL) IN FEET NAVD88

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GRAPHIC SCALE

300 0 150 300 600

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OBR INFILTRATION RATE EXHIBIT

Plate 2

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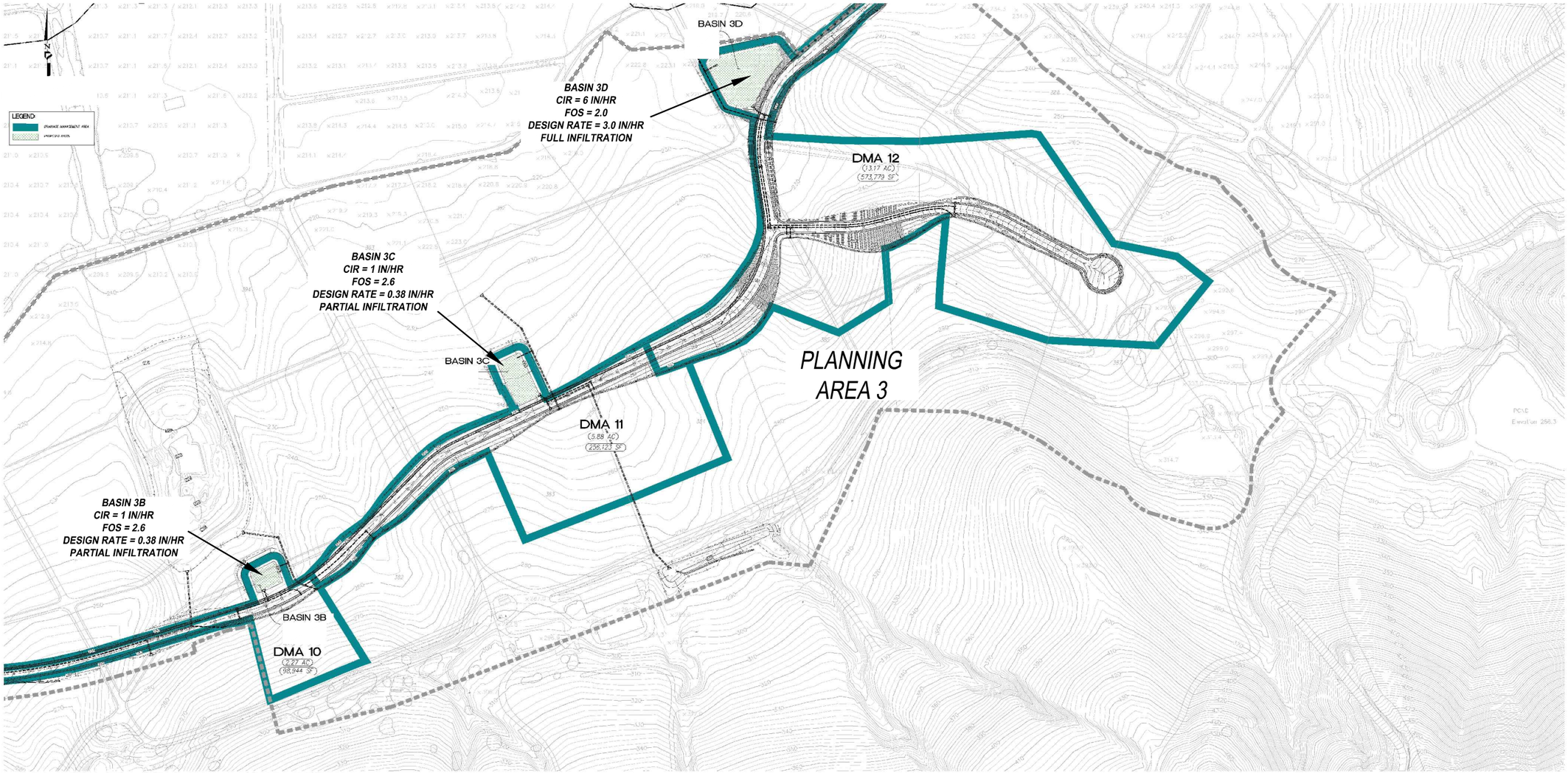

GSI LEGEND

CIR — CORRECTED INFILTRATION RATE

FOS — MINIMUM FACTOR OF SAFTEY PER COUNTY BMP MANUAL, TABLE D.2-3

HSA-6 — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING (GSI, 2016) WITH GROUNDWATER DEPTH (GWD) AMD APPROXIMATE GROUNDWATER ELEVATION (GWEL) IN FEET NAVD88

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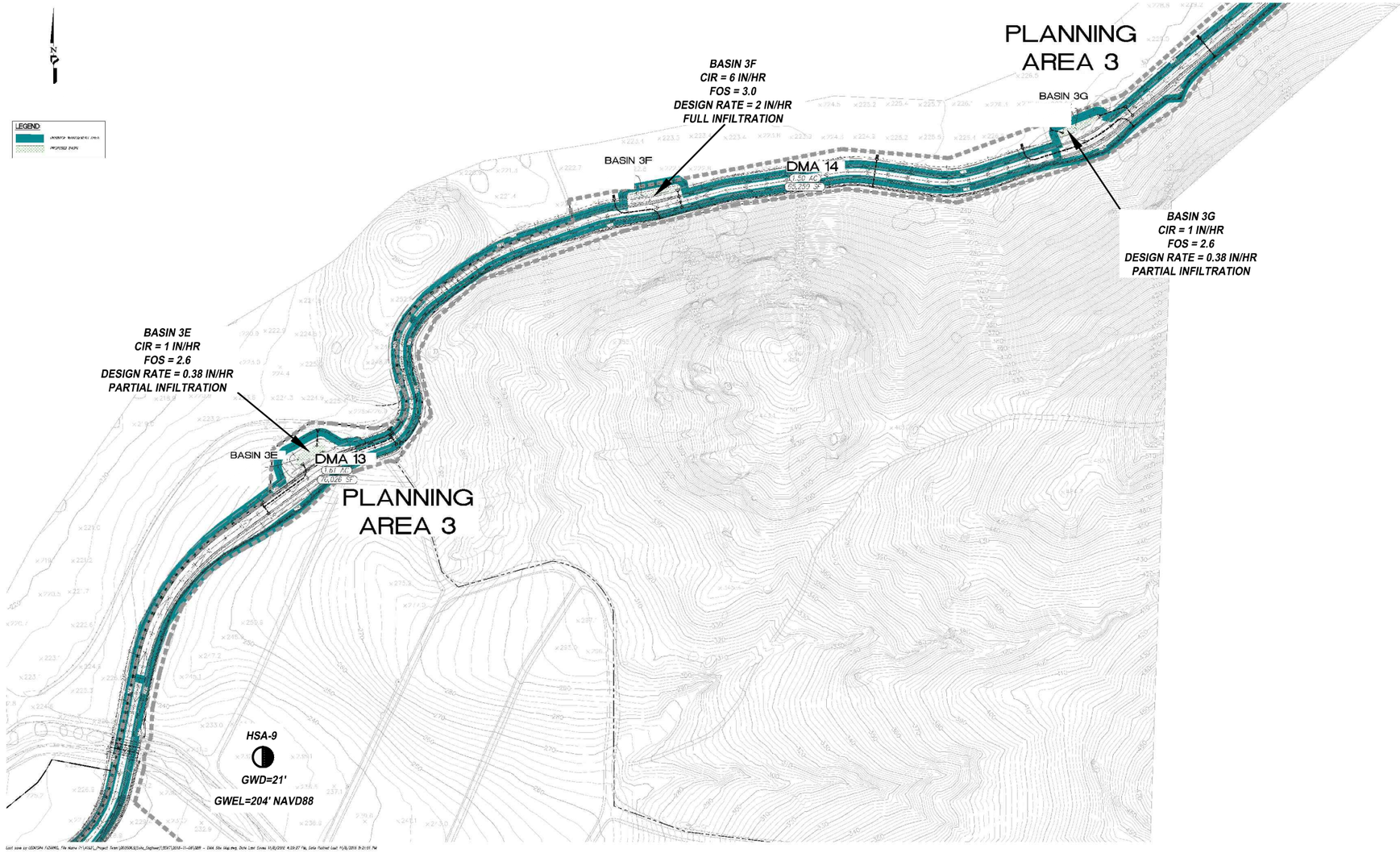
OBR INFILTRATION RATE EXHIBIT

Plate 3

W.O. 6960-A5-SC	DATE: 12/18	SCALE: 1" = 300'



GSI LEGEND

CIR — CORRECTED INFILTRATION RATE

FOS — MINIMUM FACTOR OF SAFTEY PER COUNTY BMP MANUAL, TABLE D.2-3

HSA-6 — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING (GSI, 2016) WITH GROUNDWATER DEPTH (GWD) AMD APPROXIMATE GROUNDWATER ELEVATION (GWEL) IN FEET NAVD88

N

GRAPHIC SCALE

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1" = 300'

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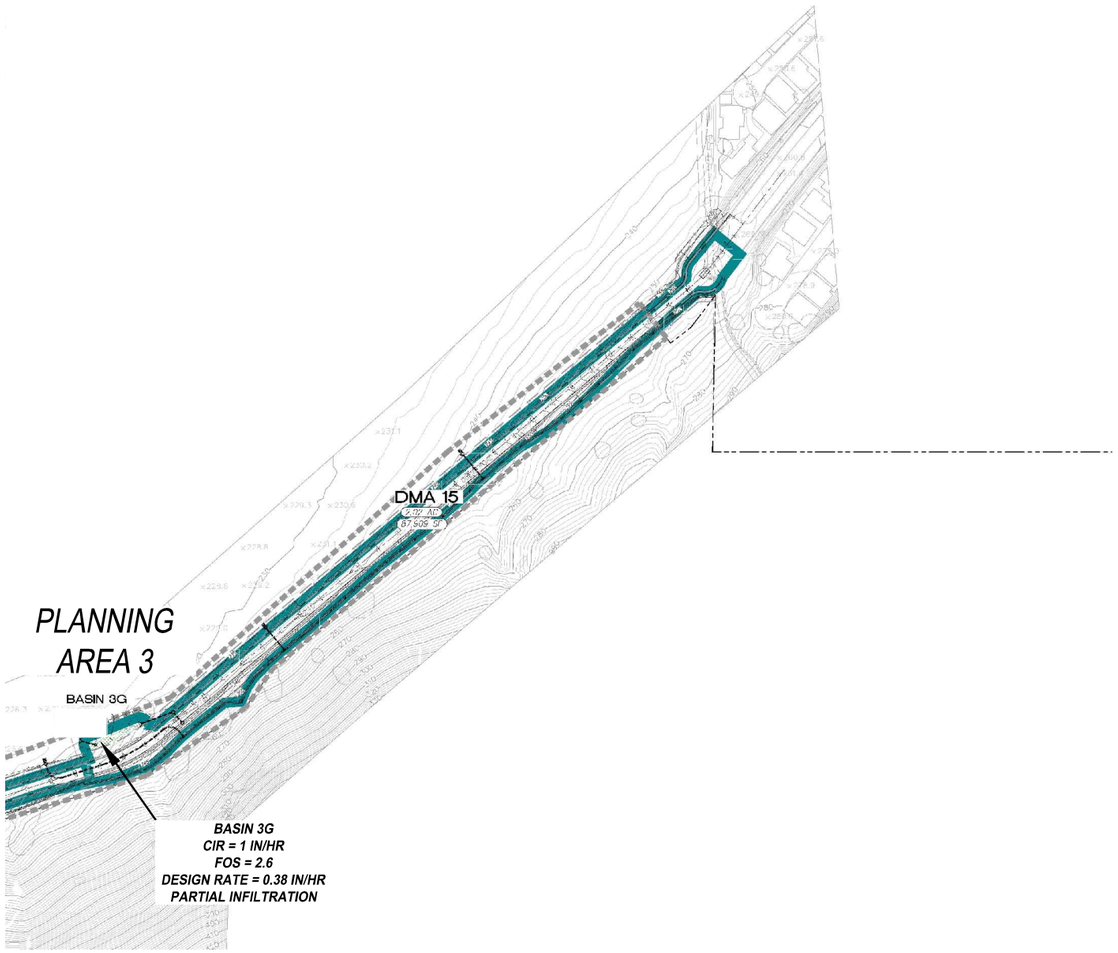
OBR INFILTRATION RATE EXHIBIT

Plate 4

W.O. 6960-A5-SC	DATE: 12/18	SCALE: 1" = 300'



GSI LEGEND

CIR — CORRECTED INFILTRATION RATE

FOS — MINIMUM FACTOR OF SAFTEY PER COUNTY BMP MANUAL, TABLE D.2-3

HSA-6 — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING (GSI, 2016) WITH GROUNDWATER DEPTH (GWD) AMD APPROXIMATE GROUNDWATER ELEVATION (GWEL) IN FEET NAVD88

N

GRAPHIC SCALE

300 0 150 300 600

1" = 300'

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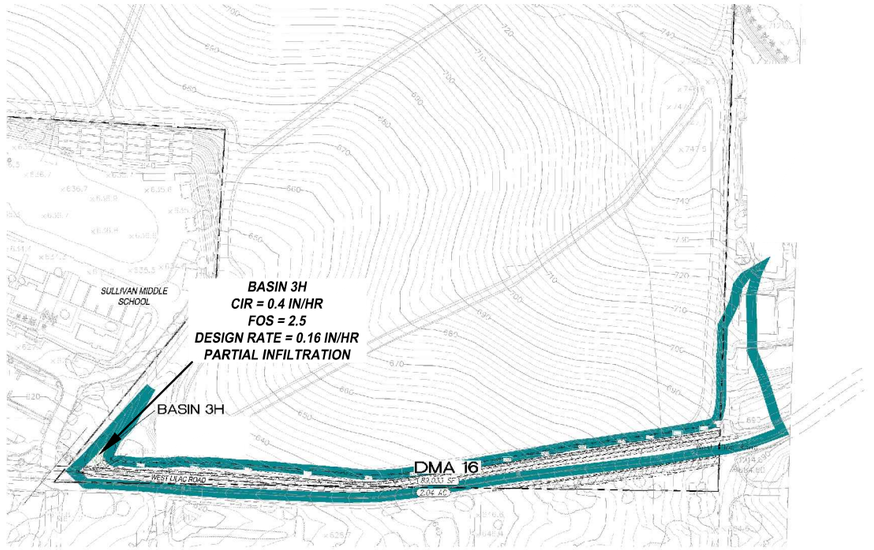
OBR INFILTRATION RATE EXHIBIT

Plate 5

W.O. 6960-A5-SC	DATE: 12/18	SCALE: 1" = 300'



GSI LEGEND

CIR — CORRECTED INFILTRATION RATE

FOS — MINIMUM FACTOR OF SAFTEY PER COUNTY BMP MANUAL, TABLE D.2-3

HSA-6 — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING (GSI, 2016) WITH GROUNDWATER DEPTH (GWD) AMD APPROXIMATE GROUNDWATER ELEVATION (GWEL) IN FEET NAVD88

N

GRAPHIC SCALE

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1" = 300'

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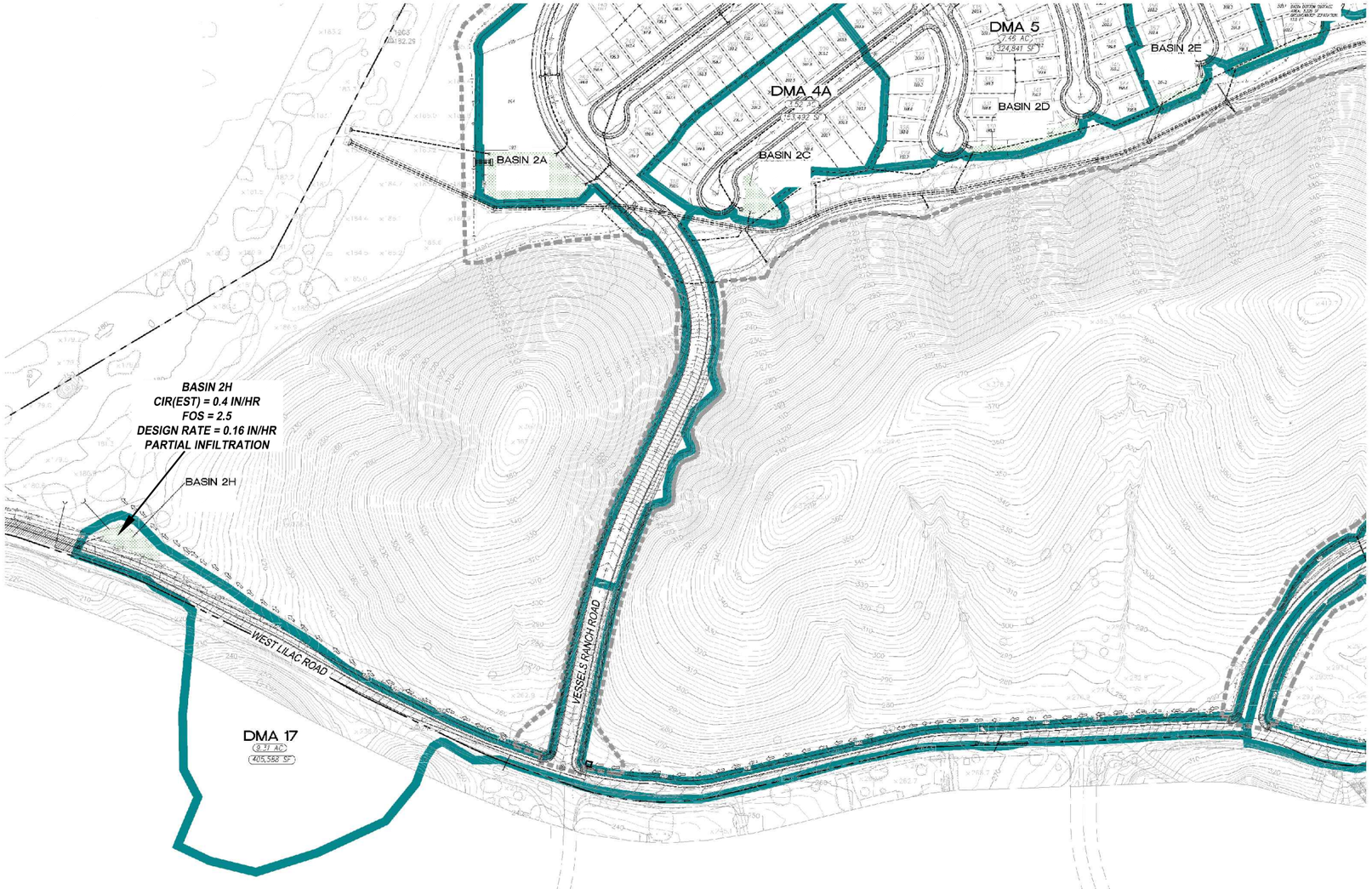
OBR INFILTRATION RATE EXHIBIT

Plate 6

W.O. 6960-A5-SC	DATE: 12/18	SCALE: 1" = 300'



GSI LEGEND

CIR — CORRECTED INFILTRATION RATE

FOS — MINIMUM FACTOR OF SAFTEY PER COUNTY BMP MANUAL, TABLE D.2-3

HSA-6 — APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING (GSI, 2016) WITH GROUNDWATER DEPTH (GWD) AMD APPROXIMATE GROUNDWATER ELEVATION (GWEL) IN FEET NAVD88

N

GRAPHIC SCALE

300 0 150 300 600

1" = 300'

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OBR INFILTRATION RATE EXHIBIT

Plate 7

W.O. 6960-A5-SC	DATE: 12/18	SCALE: 1" = 300'