

BASIS OF DESIGN REPORT TERRIER ROUGE HOUSING PROJECT DRAINAGE AND SANITATION IMPROVEMENTS 100% DESIGN PACKAGE

28 December 2016

DISCLAIMER

This publication was produced for review by the United States Agency for International Development. It was prepared by Tetra Tech.

This report was prepared for the United States Agency for International Development, USAID Contract No. EDH-I-00-08-00027-00, Task Order Number AID-521-TO-15-00001 Engineering Design and Construction Supervision Program.

Contact Information



The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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I.0 GENERAL SUMMARY

This Basis of Design Report was prepared for Task Order No. 521-AID-15-0001, Engineering Design & Construction Supervision under the USAID Global Architect and Engineer Infrastructure IQC, Contract No. EDH-I-00-08-0027. Under this program, Tetra Tech provides urgent architecture and engineering (A-E) recommendations and designs, and construction supervision for the Caracol EKAM New Housing Settlement Terrier Rouge housing settlement, and the Ouanaminthe housing settlement all in the Northern Corridor.

In February 2015, Tetra Tech prepared a Special Report on the Terrier Rouge and Oaunaminthe sites to review the status and condition of the infrastructure being constructed at the two housing sites. Tetra Tech reviewed the design plans prepared by others; assessed the condition of roadway pavers, curbs, gutters, stormwater drainage, sanitation systems, and water supply and distribution systems; and provided recommendations. Two concerns of note at the Terrier Rouge site included standing water in the stormwater detention pond which presents a safety risk and promotes mosquito breeding, and poor performance of the sanitary leach fields which presents a public health risk.

USAID tasked Tetra Tech with developing designs for improvements to the stormwater drainage system and the sanitation collection and disposal systems at the Terrier Rouge location. This Basis of Design Report presents Tetra Tech's rationale and 100 percent design for the proposed stormwater and sanitation systems improvements.

I.I EXISTING SANITARY SYSTEM

The Terrier Rouge sanitation system (Figure 1-1) consists of 16 communal septic tanks and associated leach fields to support 242 housing units. The original contractor was directed to install the leaching systems, which consist of plastic chambers, per the plans and specifications developed by PSA. The leaching chambers were not built according to the plans and specifications and were deemed to be not in compliance with the specified system, so the contractor was directed to replace all the systems in accordance with the design plans. At the time of the remedial construction, the construction contractor (CEEPCO) performed percolation tests in each of the system areas and informed USAID that the percolation rates were above the 120 minutes per inch which would prohibit infiltration of the effluent. The contractor was directed to replace the existing systems according to the design plans and specifications.

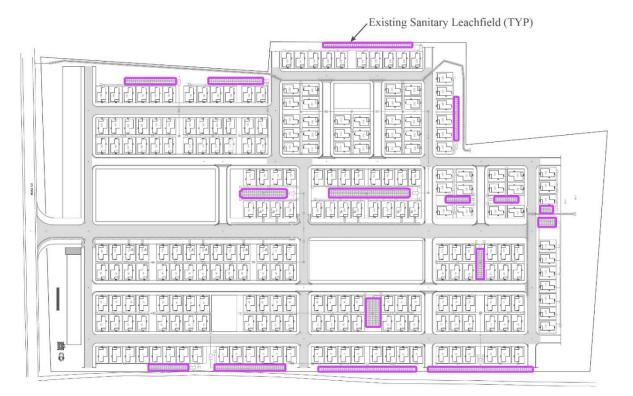


Figure 1-1 Existing Sanitary Leaching System

1.2 EXISTING DRAINAGE SYSTEM

Currently, stormwater for the Terrier Rouge site runs overland across the site where it is captured by a 7,400 cubic meter stormwater basin. Due to the tight soils and poor infiltration rates the runoff collects in the basin where small quantities evaporates or slowly infiltrates over time. The majority of the runoff remains in the basin creating a safety hazard and promoting mosquito breeding.

The Terrier Rouge site slopes downgradient in the northerly direction. Stormwater runoff is collected by roadway gutters and channels and is routed to the north portion of the site into a large pond as shown in Figure 1-2, and Figure 1-3. The original design plans prepared by others showed no proposed outlet structure for the pond, thus the original design intent likely was that collected stormwater in the pond would infiltrate over time. For this basin to perform as originally designed, stormwater would need to infiltrate into the ground prior to the next rainfall event. Given the continuous standing water present at the site, the pond is not draining as originally intended.



Figure 1-2. Standing Water present in the Stormwater Pond

Tetra Tech conducted a topographic survey to verify the information on the design plans and to obtain topographic information in the vicinity of the drainage pond, including on the adjacent property to the north. This additional information was required to develop the design alternatives for the proposed drainage and sanitation systems improvements.

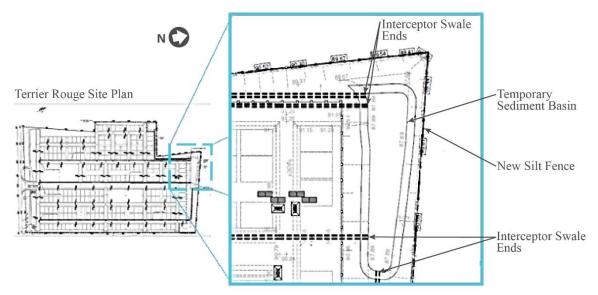


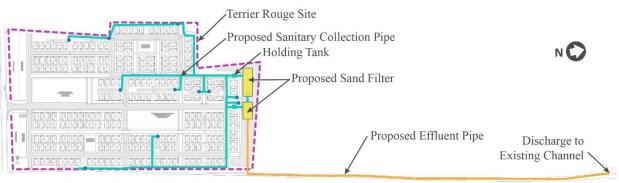
Figure 1-3 Existing Drainage System

2.0 PROPOSED IMPROVEMENTS

2.1 SANITARY SYSTEM IMPROVEMENTS

Tetra Tech has reviewed the project with USAID and recommends the construction of a communal sand filter to treat the effluent to an acceptable standard in accordance with the International Private Sewage Disposal Code (IPSDC). Sand filters are similar to leach fields but contain an underdrain and provide filtration, aeration and biological treatment within the filter before being discharged. The only other alternative considered was individual sand filters at each of the 16 septic fields, however the communal sand filter design was USAID's preferred option.

Figure 2-1 illustrates Tetra Tech's proposed sanitary system improvements which includes proposed collection pipes, holding tanks, two sand filters, and effluent pipes. The existing septic tanks and leaching facilities will be retained to provide settling, organic reduction and some subsurface disposal. The system upgrades will be connected to each of the 16 onsite septic tanks and will redirect the septic tank effluent from the existing chamber system that is unable to percolate at the original soil absorption leaching facility to the proposed multi baffled chamber and sand filter system where filtration, aeration and biological treatment will be provided. The chambers and sand filters will be located on the site of the current drainage basin which will be pumped of any standing water (if necessary) and filled in to an appropriate level to allow for construction.



• Proposed Connection to Existing Septic Tank

Figure 2-1 Proposed Sanitary System

The multi baffled chambers will further reduce the organic loading on the filters and will provide an additional 24 hours detention period. The first sand filter bed provides treatment for 152 dwellings and has an area of 705 M2. The second provides treatment for 90 dwellings and has an area of 405 M2. The total flow to the system is 24,200 gallons per day (GPD) and both beds provide a hydraulic loading rate within the 80 to 200 l/sm/day gal/m2/day (2 to 5 gpd/sf) standards as described in the EPA Wastewater Technology Fact Sheet for Intermittent Sand Filters. In addition, grease traps or holding tanks are to be located just prior to the leaching fields to allow for additional settling of any solids that make it past the existing septic tanks. As part of maintenance of the systems, the septic tanks and holding tanks will need to be pumped out regularly.

Effluent will be discharged through an outlet pipe to a channel approximately 650 meters downgradient. The proposed effluent pipe follows an existing dirt road to the existing channel. The dirt road is on an abutting property, and access to this area will need to be obtained prior to making the proposed improvements.

For the design of repairs and upgrades, the "September 1999" and the International Building Code (IBC) and the IPSDC was used. For items that are not covered by IBC codes, relevant US guidelines or standards were used. USAID's guiding principles were to provide the minimum acceptable standards, to avoid overdesign, and to avoid unnecessarily increasing the cost of the units.

Table I summarizes the site system design parameters. The design analysis of each parameter is discussed below.

Design Parameter	Value	Units	Ref
# Houses/Dwelling Units	242	Houses	N/A
Average Daily Flow per	100	GPD /House	
Dwelling Unit			
Average Daily Flow	24,200	GPD	Projected calculation
Peaking Flow Factor	5		Unified Facility Criteria UFC 3-230-03 Nov
_			2012 Max Hour PF =4, developed from
Peak Flow	81	GPM	Projected calculation
Raw BOD	250	mg/l	Typical domestic value
Raw TSS	200	mg/l	Typical domestic value
Septic Tank Effluent BOD	175	mg/l	30% reduction in Septic Tank
Multi Baffle Chamber	60	mg/l	70+% reduction in Chamber
Effluent BOD		_	
Sand Filter Effluent BOD	25	mg/l	Design Target Value
Sand Filter Effluent TSS	30	mg/l	Design Target Value
Effluent Fecal Coliform	200	#/100ml	Design Target Value

Table 1 Design Criteria

Table 2 Sand Filters

Size/other parameters	EPA Technology Fact Sheet Intermittent Sand Filters	Design
Typical Bed Depths (ft)	3-4	3
Flow Type	Septic Tank Effluent or Other Sedimentation System	ABR effluent
Hydraulic Loading (g/SF/day)	2 to 5	2
Organic Loading Rate (Lb/SF/day)	0.0005 to 0.002	0.002

Table 3 Gravity Sewers

Size/other parameters	Design Criteria	Ref	Design
Min Pipe Slope,	.4%- 1%	IPC	.4%- 1%
Raw Wastewater, 3-6" piping			
Minimum Velocity	2 fps, flowing full	10 State Stnds	2 fps
Raw Wastewater, Gravity Sewer			
Manning's" PVC pipe	0.009 to 0.11		0.010
Sewer Manhole Spacing	400 feet max.	10 State Stnds	400 feet max.

Further information on the design criteria is provided below:

Average Flow

The Average Daily Flow of 24,200 GPD is the capacity of the treatment process. The average daily flow is based on 100 GPD of domestic wastewater per dwelling unit set by USAID. This is based on the criteria that each of the 242 houses is limited to 100 GPD from the water system.

Peak Flow

A peak flow of five times the average flow was selected for design. The criteria was established based on Unified Facility Criteria (UFC) 3-230-03 Nov 2012. Using this criteria the peak flow as 81 gallons per minute (GPM).

Average BOD Loading

The assumed multi baffled chamber effluent BOD concentration will be 60 mg/L. This criteria was established based on the EPA Wastewater Technology Fact Sheet for Intermittent Sand Filters. At an average daily flow, the BOD daily loading rate is 12 lb/day BOD from the 242 homes.

Sand Filters

Filter Area

The hydraulic and organic loading rates for the sand filters follow the recommend design criteria per the EPA Fact Sheet design criteria for Intermittent Sand Filters. An approximate 2 gpd/sf loading rate and the average daily flow rate yield a required surface area of 1,070 SM for the filters. A total area of 1,072 SM is provided.

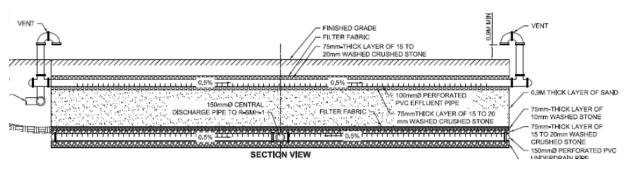
Filter Location

The filters will be located in the area of the current stormwater pond. The basin will be filled in to allow for construction of the sand filters. The limited area does not permit the addition of a reserve area. The identified space can only include the required filter area.

The natural occurring material does not meet the needed characteristic for filter material and cannot be used. This condition requires the filter material to be hauled to the site.

Filter Configuration and Piping

The first sand filter bed provides treatment for 152 dwellings and has an area of 705 M2. The second provides treatment for 90 dwellings and has an area of 405 M2. See Figure 2-2 below for a cross-section of the proposed sand filter.





2.2 DRAINAGE SYSTEM IMPROVEMENTS

After reviewing the existing system with USAID, Tetra Tech and USAID came to the conclusion that filling the basin and directing the stormwater off-site was the only viable option. This will help restore the drainage pattern to generally mimic pre-development conditions. Some trenching and improvements will be required on the abutting property to accomplish this design.

Figure 2-3 illustrates Tetra Tech's proposed drainage system improvements. Paved or stone channels have been designed to connect to the existing channels and reroute the stormwater that flows to the existing basin. The existing basin will be filled in and used for the proposed sanitary sand filter area. The existing stormwater channels which inlets to the basin will be extended across the proposed sand filter area and outlet on the abutting property, which in turn replicates the pre-development conditions.

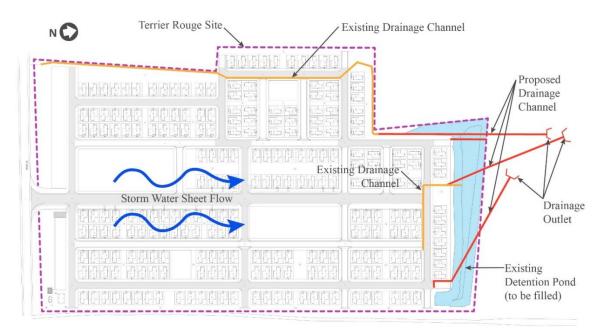


Figure 2-3 Proposed Drainage System

ATTACHMENTS

Flow and Area Computations Terrier Rouge Haiti

Parameter	Unit	Value	Remarks
FLOW			

Building use			single family dwellings
No. of Units		242	
Unit design flow (Local code)	GPCD	100	
Total daily flow (local code design flow)	GPD	24200	

SOIL ABSORPTION AREA

		r	
Design perc rate	MPI	n/a	
Soil class		n/a	1=sand / loamy sand; 2=loams
Bed Loading Rate (min)	GPD/SF	2.00	
Bed Loading Rate (max)	GPD/SF	5.00	
Soil absorption area req'd (min)	SF	4840	450
Soil absorption area req'd (max)	SF	12100	1124
Soil absorption area type		1	1=bed; 2=trenches
length	М	15	Field 1
width	М	47	Field 1
length	М	15	Field 2
width	М	27	Field 2
Soil absorption area provided	SM	667.5	Field 1
Soil absorption area provided	SM	405	Field 2
		1072.5	Total
	[1	

Terrier Rouge Septic Tank Volumes

Date:

2/18/2016

ACCORDING TO AS-BUILT DRAWINGS

System	Tank Volume (Gal)	Houses Served	Min Vol Required (Gal)	Preferred Vol (Gal)	
System	Talik Volulie (Gal)	nouses serveu	24 Hour Storage	48 Hour Storage	
1A	2200	18	1800	3600	
1B	2200	18	1800	3600	
2	1250	10	1000	2000	
3	1250	6	600	1200	
4	5000	36	3600	7200	
5	5000	42	4200	8400	
6	1000	6	600	1200	
7	1000	6	600	1200	
8 a	400	3	300	600	
8b	850	7	700	1400	
9	1250	12	1200	2400	
10	2200	22	2200	4400	
11	5000	28	2800	5600	
11A	1000	20	2000	5000	
12	1250	10	1000	2000	
13	2200	18	1800	3600	

Note: System 11 and 11a are connected

ACCORDING TO INVOICE

Tank Type	Quantity
Furnishing and installation of septic tank, 420 gallons capacity, pre-cast (EA)	6
Furnishing and installation of septic tank, 1,250 gallons capacity, pre-cast (EA	3
Furnishing and installation of septic tank, 5,000 gallons capacity, pre-cast (EA	7

Notes on Sewer and Drainage Calculations for Haiti – Terrier Rouge

Sewer

The invert of the sewer outfall is restricted by the lowest cleanout elevation, which is 89.47m, just south of "LINE-9" (see Figure 1). Given this invert, it is not feasible to site the sewer outfall within the original fenceline. The remaining restriction is a minimum full-pipe flow velocity of 2 fps. The minimum slopes for the pipe sizes under consideration are shown in

Min Slope
0.5%
0.35%
0.25%
0.20%

Table 1: Minimum Slopes for Full-Pipe Velocity of 2 fps.

The resulting outfall and sewer network is shown in Figure 1.

Drainage

For the concrete drainage chutes, the slope is dictated far more by the existence of the drainage basin than by their slopes. Therefore, to determine the requisite hydraulic capacity of any replacement structure, we look to the *upstream* earthen swale that feeds the concrete ditch. One item of note; the second-westernmost drainage chute seems unnecessary, given that the earthen ditch feeding it flows *away* from the chute, according to the proposed finished grade elevations.

The hydraulic capacity of the V-notch swale is determined from Manning's equation. Spot grades and details that show a 0.35m depth of notch indicate that the slopes and hydraulic capacities are as shown in , using 0.022 as the Manning's Roughness coefficient for an Earth channel – Clean (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html):

For structure IL1-OL1, spot grades on the existing ground surface demonstrate that the pipe can follow the same path and daylight before exiting the property. The starting inlet elevation is given on the plan. The intersection of the property boundary with the extension of the drainage ditch's thalweg indicates the location of the ending spot grade on the existing surface. The requisite pipe and ditch size for conveying the flow calculated in Table 2 for this structure are shown in Table 3.

The remaining three structures will not daylight before hitting the property boundary if their current bearing is maintained, regardless of slope. We reroute these structures such that their bearing is perpendicular to the contours (i.e., parallel to the steepest direction of ground slope). Even while chasing the steepest ground slope, the eastern 3 structures cannot daylight before hitting the property boundary.

As a potential solution, we provide the elevation at the property boundary and at the boundary of the proposed future wetlands. We then continue the path of the structures along the steepest ground slope, through the extended contours until the structures daylight. We maintain a minimum slope of 0.5%. The resulting outlet locations required are shown in Figure 1. The requisite pipe size/ditch width for maintaining hydraulic capacity is shown in Table 4.

Structure	Nearest Upstream Spotgrade 2 (m)	Nearest Upstream Spotgrade 1 (m)	Distance (m) P2 to P1	Slope P2 to P1	Hydraulic Capacity m ³ /s
IL1-OL1	90.79	90.61	16.6	0.011	0.73
S1-OL3B	88.54	87.47	46.6	0.023	1.13
IL4-OL4B	90.40	90.26	16.0	0.0088	0.66
IL5-OL5B	90.46	90.25	25.0	0.0084	0.64

Table 2: Hydraulic Capacity Requirements Of Proposed Structures Based On Upstream Contributions

Table 3: Requisite Pipe and Ditch Size for Daylighting Structures: Unmodified Bearings

Structure	Upstream	Downstream	Distance	Slope	Required Hydraulic	Min Pipe	Available Pipe	Min Ditch	Design Ditch
	Invert	Spot Grade	P2 to P1	P2 to P1	Capacity m ³ /s	Diameter (mm)	Diameter (in)	Top Width (m)	Top Width (m)
IL1-OL1	90.61	89.51	30.86	0.036	0.42	0.397	16"	0.746	0.75

Table 4: Requisite Pipe and Ditch Size for Daylighting Structures: Modified Bearings

Structure	Slope	Required Hydraulic Capacity m ³ /s	Min Pipe Diameter (mm)	Available Pipe Diameter (in)	Min Ditch Top Width (m)	Design Ditch Top Width (m)
S1-OL3B	0.50%	1.13	0.833	36	1.63	1.65
IL4-OL4B	0.50%	0.66	0.681	27	1.33	1.35
IL5-OL5B	0.50%	0.64	0.670	27	1.31	1.35

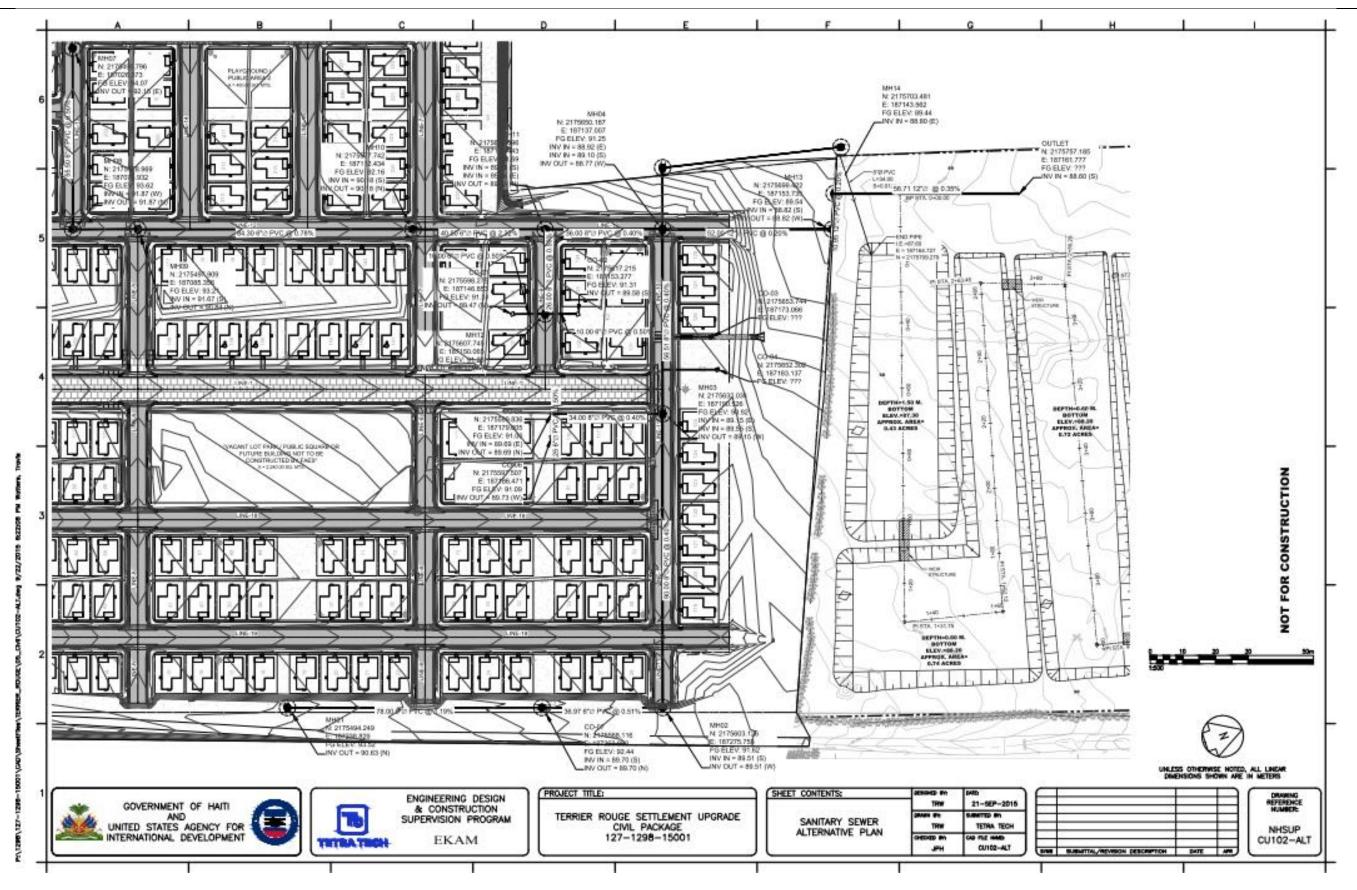
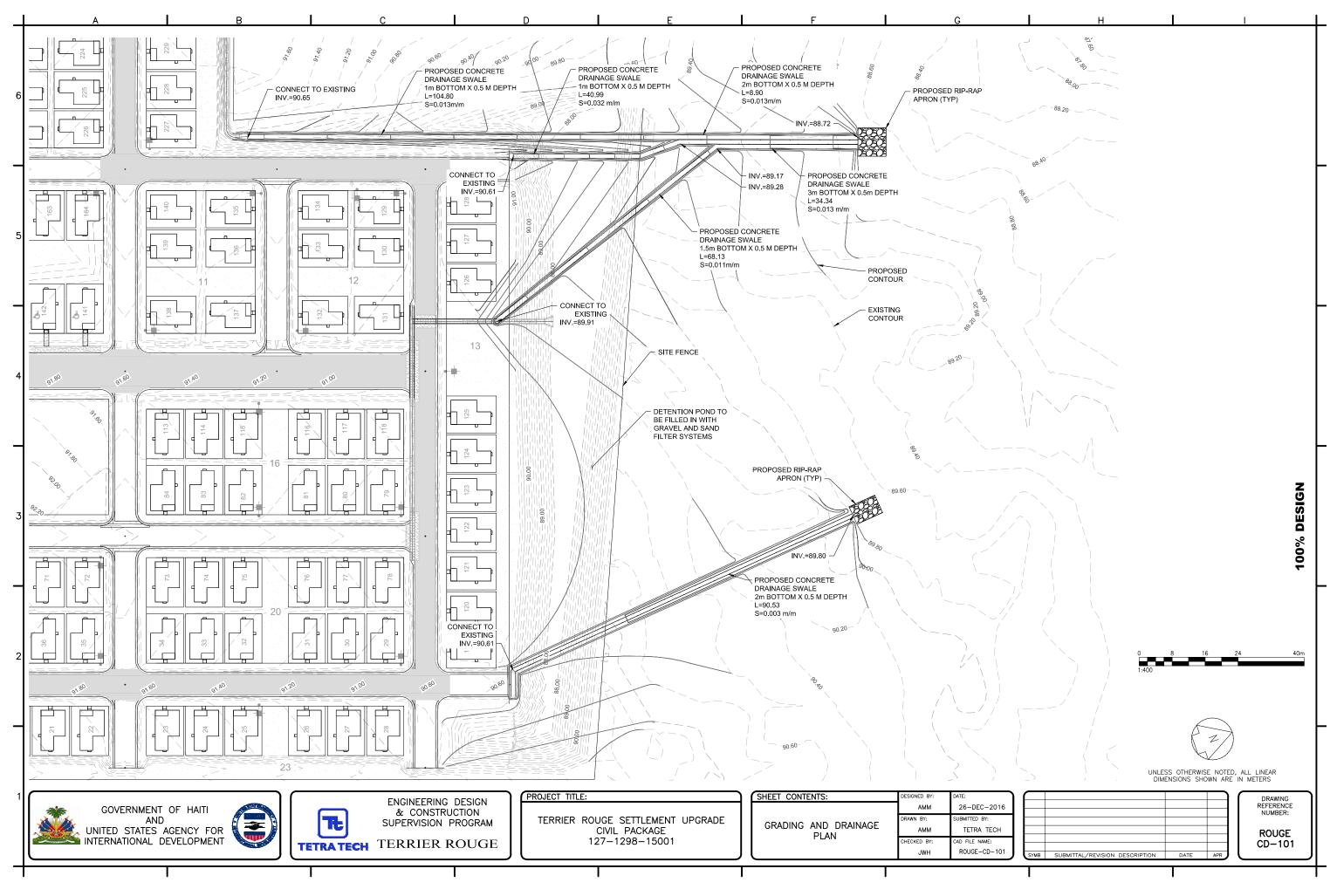
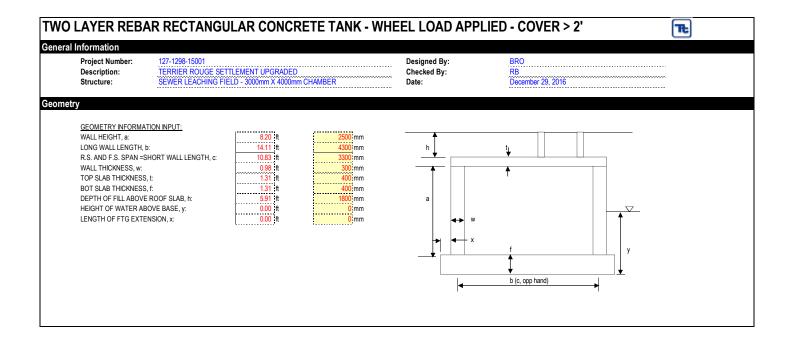


Figure 1: Sanitary Sewer Alternative Plan



AM 6 10:47: 19/2016 12/1 gwb

ormation roject Number:	127-1298-15001	Designed By:	BRO	
Description: Structure:	TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 3000mm X 4000mm CHAMBER	Checked By: Date:	RB December 29, 2016	
leferences:	AASHTO LRFD Bridge Design Specifications 4th Edition, 2007 ACI 318-08			
lotes:	ACI 350-06 Since cover is more than 2 feet, H20 wheel load is considered as	uniformly distributed.		
01001		unionity distributed.		
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	L			
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TWO LAYER REBAR RECTANGU	JLAR CONCRET	E TANK - WHE	EL LOAD APPLIE	ED - COVER > 2	2'	æ
General Information						
	TTLEMENT UPGRADED ELD - 3000mm X 4000mm CHAI	MBER	Designed By: Checked By: Date:	BRO RB December 29, 2016		
Additional Input Parameters						
GEOTECHNICAL INFORMATION: WEIGHT OF SOIL BACKFILL (Dry), gsoil: WEIGHT OF SOIL BACKFILL (Saturated): ALLOWABLE BEARING CAPACITY: PHI: FRICTION ANGLE OF BACKFILL: AT REST PRESSURE COEFF, Ko ACTIVE PRESSURE COEFF, Ka: LIVE LOAD SURCHARGE CONSIDERED:	115.00 135.00 2000 4 0.50 0.50 VES	RAD = 0.3648				
WALL LOADING CONDITION TWO HEIGHT SOIL ABOVE BOT SLAB EXT - WET: HEIGHT SOIL ABOVE BOT SLAB EXT - DRY: HEIGHT SOIL ON TOP SLAB - WET: HEIGHT SOIL ON TOP SLAB - DRY:	0.00 ft 0.00 ft 0.00 ft 5.91 ft	HEIGHT SOIL AB HEIGHT SOIL ON	CONDITION ONE IOVE BOT SLAB EXT - WET: IOVE BOT SLAB EXT - DRY: I TOP SLAB - WET: I TOP SLAB - DRY:	0.00 }tt 15.42 /tt 0.00 /tt 5.91 }tt		
MATERIAL PROPERTIES: CUBIC WEIGHT CONCRETE=wconc: COMP. STRENGTH OF CONC. = F'c: TENSILE STRENGTH OF REBAR = Fy: WEIGHT OF WATER = ww:	150.00 Lbs/CF 4.00 ksi 60.00 ksi 62.40 Lbs/CF					
Design Strength Factors - Environmental Durability Factor (ACI 350-06 R9 2.6)	0.90 0.75					
Environmental Durability Factor (ACI 350-06 EQ 9-8): FLEXURE: SHEAR:	ROOF SLAB 2.08 1.47	WALL CASE 1 Top Bottom 1.99 1.57 1.41 1.11	WALL CASE 2 W/ Top Bottom Top 1.99 1.99 n/a 1.41 1.41 n/a	n/a	BASE SLAB 2.20 1.56	
ENVIRONMENTAL EXPOSURE:	SEVERE					
**Note: No Sd for Seismic load combinations	ACI 350 Section 21.2.1.8					

TWO	LAYER REBAI	R RECTANGU	ILAR CONCRE	ETE TANK - WH	EEL LOAD APPLIED	- COVER > 2	1	æ
General	Information							
	Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SET SEWER LEACHING FIE	TLEMENT UPGRADED ELD - 3000mm X 4000mm C	CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016		
Dead Lo	ad							
	DL1, ROOF SLAB: DL2, WALLS: DL3, BOTTOM SLAB:		233.92 cf conc = 402.59 cf conc = 233.92 cf conc =	35.09 kips 60.39 kips 35.09 kips	TOTAL CONCRETE QUAN	IТПY: <u>32.2</u>	24. cy	
	DL5, SOIL ON FTG EXT - V DL6, SOIL ON FTG EXT - I DL7, SOIL ON TOP SLAB - DL8, SOIL ON TOP SLAB -	DRY: WET:	0.00 cf soil = 0.00 cf soil = 0.00 cf soil = 1052.66 cf soil =	0.00 kips 0.00 kips 0.00 kips 121.06 kips	TOTAL SOIL QUANTITY: (only above plan limits of bas	/	99 cy	
	TOTAL DL CONC: TOTAL DL SOIL: TOTAL DL:			130.57 kips 121.06 kips 251.62 kips				

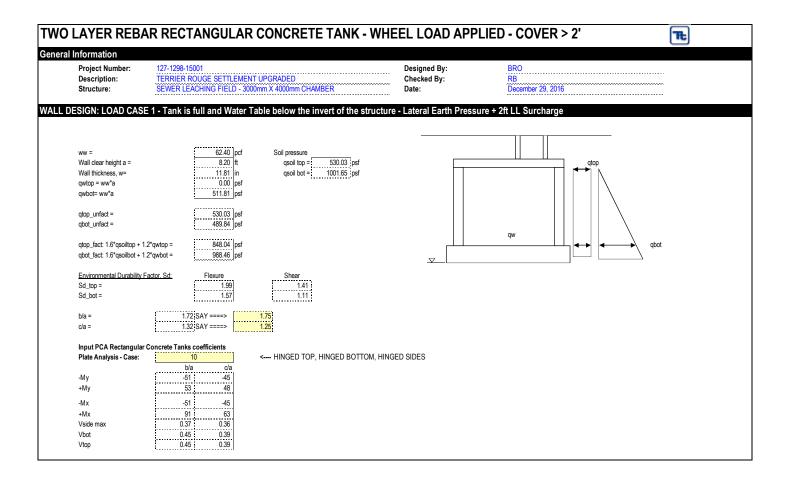
TOTAL UNIFORM DL: 0.20 ksf DL7, SOLLON TOP SLAB - VET: 0.00 cf soil = 0.00 kips DL8, SOLL ON TOP SLAB - DRY: 1052.66 cf soil = 121.06 kips TOTAL SL: 121.06 kips 120.06 kips TOTAL UNIFORM SL: 0.68 ksf Ratio b/c = 1.30 TWO WAY SLAB YES SEE AASHTO 4.6.2.1.5	Project Number: Description: Structure:		1 JGE SETTLEMENT UPGRADED HING FIELD - 3000mm X 4000mm CI	(Designed By: Checked By: Date:	BRO RB December 29, 2016
DL1, ROOF SLAB: 233.92 of conc = 35.99 kps TOTAL UNFORM DL: 0.00 of soil = 0.00 kps DL7, SOIL ON TOP SLAB - VET: 0.00 of soil = 0.00 kps DL8, SOIL ON TOP SLAB - DRY: 1052.66 of soil = 121.06 kps TOTAL LINFORM SL: 121.06 kps 121.06 kps TOTAL UNFORM SL: 0.88 ksf TOTAL UNFORM SL: 0.88 ksf TWO WAY SLAB YES SEE AASHTO 4.62.1.5 130 DERTRBUTE CONCENTRATED LOAD? NO NCLUDE LL IMPACT (AASHTO 3.6.2.1)? NO NCLUDE LL MPACT (AASHTO 3.6.2.2)? 100 #WHEELS ON ALONG WIDTH: 2200 HH-33 WHEEL LOAD 1600 kps DISTRBUTC SONE SLOBE, d2: 1000 HK-32 CONCENTRATED LOAD? 1000 HK-32 CONCENTRATED LOAD? NO ACCORDANCE WITH AASHTO 4.6.2.10. . HK-42 CONCENTRATED LOAD 1000 HK-42 CONCENTRATED LOAD 1000	ROOF SLAE	3				
TOTAL UNIFORM DL: 0.20 ksf DL7, SOL ON TOP SLAB - WET: 0.00 cf soil = 0.00 kips DL8, SOL ON TOP SLAB - DRY: 105266 cf soil = 121.06 kips TOTAL SL: 121.06 kips 121.06 kips TOTAL UNIFORM SL: 0.68 ksf Ratio b/c = 1.30 TWO WAY SLAB YES SEE AASHTO 4.6.2.15	rm Load:					
DL8, SOIL ON TOP SLAB - DRY: 1052.66 of soil = 121.06 kips TOTAL UNIFORM SL: 0.68 ksf Ratio blc = 1.30 TWO WAY SLAB YES SEE AASHTO 4.6.2.1.5 Per AASHTO 12.11.2.1, when the depth of fill is less than 2 ft, the wheel load shall be distributed as in slabs with concentrated loads (4.6.2.10). And also based on the distribution of the wheel load through earth fill DEPTH OF FILL, h: 551 ft DISTRBUTE CONCENTRATED LOAD? NO NCLUDE LL IMPACT (AASHTO 3.6.2.1)? NO HYMEELS ALONG LENGTH: 100 # WHEELS ALONG LENGTH: 100 # STRBUTION WDITH; HOR SIDE, d1: 10.83 DISTRBUTON WDITH; LONG SIDE, d2: 1200 TOTAL UNIFORM LIVE LOAD, wit: 0.25 Kef 2200	DL1, ROOF SLAB: TOTAL UNIFORM DL:		233.92 cf conc =	0.20 ksf		
Ratio b/c = 1.30 TWO WAY SLAB YES Per AASHTO 12 11.2.1, when the depth of fill is less than 2 ft, the wheel load shall be distributed as in slabs with concentrated loads (4.6.2.10). And also based on the distribution of the wheel load through earth fill DEPTH OF FILL, h: 5.91 ft DISTRIBUTE CONCENTRATED LOAD? NO NCLUDE LL MPACT (AASHTO 3.6.2.1)? NO VIVE LOAD MPACT (AASHTO 3.6.2.2): 1.00 # WHEELS ALONG LENGTH: 1.00 # WHEELS ON ALONG WIDTH: 2.00 HI-93 WHEEL LOAD 16.00 NOSTRBUTION WDITH, SHORT SIDE, c11: 10.83 ft C=== Quick check, this dist should be less than 22.34 ft, which would be dist length if areas don't overlap DISTRBUTION WDITH, LONG SIDE, d2: 12.00 ft TOTAL UNIFORM LIVE LOAD, wi: 0.25 ksf	1		·····	121.06 kips		
Per AASHTO 12.11.2.1, when the depth of fill is less than 2 ft, the wheel load shall be distributed as in slabs with concentrated loads (4.6.2.10). And also based on the distribution of the wheel load through earth fill DEPTH OF FILL, h: SINCE THE COVER OVER THE TOP SLAB IS GREATER THAN 2 FT, THE LIVE LOAD IS DISTRIBUTED IN DISTRIBUTE CONCENTRATED LOAD? NO ACCORDANCE WITH AASHTO 4.6.2.10. INCLUDE LL IMPACT (AASHTO 3.6.2.1)? NO LIVE LOAD MPACT (AASHTO 3.6.2.2): 1.00 # WHEELS ALONG LENGTH: 200 HI-93 WHEEL CON DISTRIBUTED IN 2.00 HI-93 WHEEL LOAD 1600 kps DISTRBUTION WDITH, SHORT SIDE, d1: 0.03 ift <=== Quick check, this dist should be less than 22.34 ft, which would be dist length if areas don't overlap DISTRBUTION WDITH, LONG SIDE, d2: 12200 ft <=== Quick check, this dist should be less than 12.00 ft, which would be dist length if areas don't overlap TOTAL UNIFORM LIVE LOAD, wi: 0.25 ksf	TOTAL UNIFORM SL: Ratio b/c = TWO WAY SLAB			·		
# WHEELS ALONG LENGTH: 1.00 # WHEELS ON ALONG WIDTH: 2.00 HI-93 WHEEL LOAD 16.00 DISTRBUTION WDITH, SHORT SIDE, d1: 10.83 DISTRBUTION WDITH, LONG SIDE, d2: 12.00 TOTAL UNIFORM LIVE LOAD, wi: 0.25 Ksf 22.34	DEPTH OF FILL, h: DISTRIBUTE CONCENT INCLUDE LL IMPACT (A LIVE LOAD IMPACT (AA	TRATED LOAD? ASHTO 3.6.2.1)? ASHTO 3.6.2.2):	5.91 ft NO NO	SINCE THE COVER OVER THE T	OP SLAB IS GREATER TH	
	# WHEELS ON ALONG HI-93 WHEEL LOAD DISTRIBUTION WDITH, DISTRIBUTION WDITH, TOTAL UNIFORM LIVE	WIDTH: SHORT SIDE, d1: LONG SIDE, d2:	1.00 2.00 16.00 kips 10.83 ft 12.00 ft 0.25 ksf			3

formation			
Project Number: Description:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED	Designed By: Checked By:	BRO RB
Description: Structure:	SEWER LEACHING FIELD - 3000mm X 4000mm CHAMBER	Date:	December 29, 2016
- Daiafaaraan (in dha	D{0 -}-		
al Reinforcement in the	ROOT SIAD:	V	erify long rebar meets AASHTO 5.14.4
	Bar Dia. (mm) As bar (in) db (in) Spg (in) As prov (in ²)		% Distribution Steel = 30.39 %
Short Direction, Bottom	25.00 0.7609 0.9843 5.12 1.78		As long required = 0.54 in^2
	20.00 0.4869 0.7874 5.12 1.14		As long provided = 1.14 in ² OK
Long Dir, Bottom	20.00 0.4003 0.1014 0.12 1.14		
First, consider steel in s			
	oment - Center - (Rebar at Bottom of Slab)		
	DL + LL + SL 1122.26 psf		
	DL+1.6LL+1.6SL) 1716.88 psf		
S _d :	2.08		
M+Coeff:	0.125		
M+=MCoe	fff*q*c ² /1000*S _d : 35.97 {ff*kips		
Top Slab 1	hickness: 1.31 {ft		
Cover =	2.00 in.		
d (M+) sho			
fc=	4.00 ksi		
bw =	12.00 (per linear ft of slab)		
Check Ma	ment Capacity (M+):		
As T & S=			
As r a 3- Asprov =	to a second s		
	1.78 in2 Asprov>As T&S, OK 0.85*ffc*b): 2.62 in		
phif =	0.90		
L	95.89 kip*ft		

al Information						
Project Number:	127-1298-15001			Designed By:	BRO	
Description:	TERRIER ROUG	E SETTLEMENT UP	'GRADED	Checked By:	RB	00.0040
Structure:	SEWER LEACHI	VG FIELD - 3000mm	NX 4000mm CHAMBER	Date:	December	29, 2016
lexural Reinforcement in th	e Roof Slab Cont.:					
Next, consider steel in						
	moment - Center - (Rebar					
	DL+LL+SL	1122.26 psf				
	.2DL+1.6LL+1.6SL)	1716.88 psf				
S _d :		2.08				
M+Coeff		0.125				
M+=MCo	peff*q*c²/1000*S _d :	27.61 ft*kips				
d (M+) lo	na =	12.37 in. = t - cover	r - db(short) - 1/2db(long)			
fc =	· · · · ·	4.00 ksi				
bw =		12.00 (per linear ft o	of slab)			
	•••••					
Check M	oment Capacity (M+):					
As T & S		0.34 in2	=0.0018bh			
Asprov =	N	1.14 in2	Asprov>As T&S, OK			
	//(0.85*fc*b):	1.68 in	•			
phif =		0.90				
PHI*Mn :	-	59.23 kip*ft				
M+ =			ENT CAPACITY O.K.			
Crack Check - Check I	maximum spacing of ba	Irs (ACI 350 Section	10.6.4)			
Unfactore	ed Moment:				Unfactored Moment:	
	(DL+LL+SL)	1.12 ksf			qunfact =(DL+LL+SL)	1.12 ksf
quntact =					M+ unfactored=	27.92 ft*kips
quntact = M+ unfac		16.44 ft*kips				
		16.44 ft*kips				······
M+ unfac	ctored=				Crack Check (M+ bottom	
M+ unfac <u>Crack Ch</u>	ctored=	ort reinf.):			Crack Check (M+ bottom : Asprov =	face long reinf.):
M+ unfac	ctored=	ort reinf.): 1.78 in2 13.26 in			<u>Crack Check (M+ bottom :</u> Asprov = d=	face long reinf.): 1.14 in2 12.37 in
M+ unfac <u>Crack Ch</u> Asprov =	ctored=	ort reinf.): 1.78 in2			Asprov =	face long reinf.): { 1.14 in2
M+ unfac <u>Crack Ch</u> Asprov = d=	ctored=	ort reinf.): 1.78 (in2 13.26 (in 8.04 0.011			Asprov = d=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008
M+ unfac <u>Crack Ch</u> Asprov = d= n=	ctored=	ort reinf.): 1.78 (in2 13.26 (in 8.04 0.011			Asprov = d= n=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062
M+ unfac <u>Crack Ch</u> Asprov = d= n= ρ= ρ= k=	ctored=	<u>ort reinf.):</u> 1.78 in2 13.26 in 8.04 0.011 0.090 0.344			Asprov = d= n= ρ= ρn= k=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295
M+ unfac <u>Crack Cr</u> Asprov = d= n= p= pn=	ctored=	ort reinf.): 1.78 (in2 13.26 (in 8.04 0.011			Asprov = d= n= ρ= ρn=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062
M+ unfac <u>Crack Ch</u> Asprov = d= n= ρ= ρ= k=	stored=	<u>ort reinf.):</u> 1.78 in2 13.26 in 8.04 0.011 0.090 0.344			Asprov = d= n= ρ= ρn= k=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295
M+ unfac Asprov = d= n= ρ= ρ= k= j= M+ unfac	stored=	ort reinf.): 1.78 in2 1.26 in 8.04 0.011 0.090 0.344 0.885 16.444 kips.ft			Asprov = d= n= p= pn= k= j= M+ unfactored=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295 0.902 27.920 kips.ft
M+ unfac <u>Crack Ch</u> Asprov = d= n= ρ= μ= μ= μ= j=	stored=	ort reinf.): 178 in2 13.26 in 8.04 0.011 0.344 0.885 16.444 kips.ft 9.425 ksi			Asprov = d= n= ρ= ρn= k= j=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.092 0.295 0.995 27.990 kips.ft 26.315 ksi
M+ unfac Asprov = d= n= ρ= ρ= k= j= M+ unfac	stored=	ort reinf.): 1.78 in2 13.26 in 8.04 0.011 0.090 0.344 0.885 16.444 kips.ft 9.425 ksi			Asprov = d= n= p= pn= k= j= M+ unfactored=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295 0.902 27.920 kips.ft 26.315 ksi
M+ unfac <u>Crack Cf</u> Asprov = d= n= p= p= μ= j= M+ unfac fs=	stored=	ort reinf.): 1.78 in2 1.26 in 8.04 0.011 0.090 0.344 0.885 16.444 kips.ft 9.425 ksi 1.35			Asprov = d= n= p= p= k= j= M + unfactored= fs= β=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295 0.302 27.920 kips.ft 26.315 ksi
M+ unfac <u>Crack Cf</u> Asprov = d= n= p= p= μ= j= M+ unfac fs= β= s=	stored=	<u>ort reinf.):</u> 1.78 in2 13.26 in 8.04 0.011 0.090 0.344 0.885 16.444 kips.ft 9.425 ksi 1.35 5.118 in			Asprov = d= n= p= p= k= j= M + unfactored= fs= β= s=	face long reinf): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295 0.302 27.920 kips.ft 26.315 ksi 1.35 5.118 in
M+ unfac <u>Crack Cf</u> Asprov = d= n= p= p= μ= j= M+ unfac fs=	stored=	<u>ort reinf.):</u> 1.78 in2 13.26 in 8.04 0.011 0.090 0.344 0.885 16.444 kips.ft 9.425 ksi 1.35 5.118 in 0.984 in	CE BAR SPACING O.K.		Asprov = d= n= p= p= k= j= M + unfactored= fs= β=	face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295 0.302 27.920 kips.ft 26.315 ksi

Project Number:	127-1298-15001	Designed By:	BRO RB	
Description: Structure:	TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 3000mm X 4000mm CHAMBER	Checked By: Date:	RB December 29, 2016	
r Capacity of Top Slab				
qunfact =	DL + LL + SL 1.12 ksf			
qfact =(1.	2DL+1.6LL+1.6SL) 1.72 ksf			
S _d :	1.47			
Csmax =	0.50 0.75			
phiv =				
d =	13.26 in. = t - cover - 1/2db(short)			
fc =	4.00 ksi			
bw =	12.00 (per linear ft of wall)			
Check Sh	ear in Roof Slab			
Vc = 2*fc				
PHI*Vc =				
Vu = Cs*o	13.67 SHEAR CAPACITY O.K.			
Shear Fri	ction			
u:	1.000 11.6.4.3 0.75			
phiv:	0.75			
Avf (req'd)=Vu/(Fy*u*phi): 0.30{in ²			
As (provid				

TWO LAYER R	EBAR REC	ANGULAR C	ONCRETE TANK - WHE	EL LOAD AP	PLIED - COVER > 2'	TŁ
General Information						
Project Numb Description: Structure:	TERRIER F SEWER LE	ROUGE SETTLEMENT U ACHING FIELD - 3000mr	PGRADED n X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
W W Bo	w = /all clear height a = /all thickness, w= clom slab thickness f = w = ww*a	62.40 pcf 8.20 ft 11.81 in 1.31 ft 511.81 psf	Use at rest Soil pressure Ko			



ral Informati	on		j				
Project N		127-1298-15001			Designed By:	BRO	
Descript			LEMENT UPGRADED		Checked By:	RB	
Structure:		SEWER LEACHING FIELD - 3000mm X 4000mm CHAMBER		Date:	December 29, 2016		
HEAR DESIGN LO	DADS						
			3				
	qtopfact * S _d =	i	ksf				
	qbotfact * S _d =	· · · · · · · · · · · · · · · · · · ·	ksf				
	bw =	12.00	(per linear ft of wall)				
	Vuside= Vutop =	1.96 2.38	Kit <== Shear a	at side of wall is compression (Nu at top of wall is tensile force (Nu)			
	Vulop = Vubot =	2.30			compression force (Nu) in base sl	lah	
	VUDOL -	2.30		at bottom of wall is tensile force of	compression force (Nu) in base si	sau	
	Tension reinforcem	ent requirement for floor	slab and roof slab:				
	Tubot =	2.38	klf				
	Tutop =	2.38					
	phiT=	0.90	1				
Bot slab	Ast =Tu/(Fy*phiT):	0.044	in^2/ft	Main Reinforcement Directi	on		
Top slab	Ast =Tu/(Fy*phiT):	0.044	in^2/ft	Main Reinforcement Directi	on		
	(), ,	•••••••	.(
EXURE DESIGN	I OADS - Vertical Rei	nforcement (MAIN REI					
	qtopfact * S _d =	1.05	ksf				
	gbotfact * S _d =	0.77	- {				
	bw =		(per linear ft of wall)				
ive moment	Muneg =			ce Reinforcement			
ve moment	Mupos =			Reinforcement			
		•••••••••	5				
	LOADS - Horizontal F	Reinforcement (MAIN F	REINFORCEMENT)				
LEXURE DESIGN							
LEXURE DESIGN							
LEXURE DESIGN	bu -	12.00	(por linear thef wall)				
LEXURE DESIGN	bw = Muneg =		(per linear ft of wall) k.ft/ft Outside Fac k.ft/ft Inside Face	ce Reinforcement			

nformation						
Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEN SEWER LEACHING FIELD -	IENT UPGRADED 3000mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016		
SIGN: LOAD CASI	E 2 - Tank is empty and w	ater table at its highest elevation	- Lateral Earth Pressure + 2	ft LL Surcharge		
Surcharge = Soil = Wet Soil = Water = qtop_unfact = qtop_fact 1.6*qtop_unfact qtop_fact 1.6*qtop_unfact Environmental Durability F	= 1602.64 psf actor, Sd: Flexure	gbot 115.00 psf 886.65 psf 0.00 psf 0.00 psf			- dtob	
Sd_top = Sd_bot =	1.99 1.99	1.41 1.41				
b/a = c/a =	1.72:SAY ====> 1.32:SAY ====>	1.75 1.25				
Input PCA Rectangular	Concrete Tanks coefficients		In	put PCA Rectangular Concrete Tank	s coefficients	
Plate Analysis - Case: -My +My -Mx +Mx Vside max Vbot Vtop	10 b/a c/a -51 45 53 48 -51 45 03 48 -51 45 01 63 037 0.36 0.45 0.39 0.45 0.39	< HINGED TOP, HINGED BOTTO HINGED SIDES	 ++ + + + V V	ty		< HINGED TOP, BOTTOM, HIN

		R RECTANGULAR C	ONCRETE TANK - W	HEEL LOAD APP	LIED - COVER > 2'	æ
	nformation Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEMENT U SEWER LEACHING FIELD - 3000m		Designed By: Checked By: Date:	BRO RB December 29, 2016	
A.) SHEAR [DESIGN LOADS					
B.) FLEXUR	qtopfact * S qbotfact * S qtopfact - ql bw = Vuside= Vutop = Vubot = E DESIGN LOADS - Verti qtopfact * S qbotfact * S qtopfact - ql bw =	d = 225 ksf botfact = 1.06 ksf 12.00 kpr linear 5.36 kif 5.52 kif cal Reinforcement (MAIN REINFORCEM d= 1.68 a= 3.18	<== Shear at side of wall is compression <== Shear at top of wall is compressiom <== Shear at bottom of wall is compress ENT)	(Nu) in roof slab		
Negative mor	•	-8.80 k.ft/ft	Outside Face Reinforcement			
Positive mom	nent Mupos =	15.14 k.ft/ft	Inside Face Reinforcement			
C.) FLEXUR	E DESIGN LOADS - Hori	zontal Reinforcement (MAIN REINFORCI	MENT)			
Negative mor Positive mor		12.00 (per linear -8.80 k.ft/ft 9.03 k.ft/ft	t of wall) Outside Face Reinforcement Inside Face Reinforcement			

ormation roject Number: rescription: tructure:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 3000mm X 4000mm CH	AMBER Designed By: Checked By: Date:	BRO RB December 29, 2016
IGN: LOAD CASE	3 - Under Seismic Loads + 2ft LL Surchar	ge	
qltop = qltop = qetop = qetop = qetot = qtop_unfact = qtop_act: 1.6*qltop + 1.0*q qbot_fact: 1.6*qltop + 1.0*q b/a = c/a =			doot
Input PCA Rectangular O Plate Analysis - Case: -My +My +Mx +Mx Vside max Vbot Vtop	in in in bla ola ola ola of1 -45 ola ola of1 -61 ola ola ola ola ola ola ola ola ola ola ola ola ola ola ola ola ola ola	P, HINGED BOTTOM, HINGED SIDES	

TWO LA	YER REBA	R RECTANGULAR CONCRET	E TANK - WHEEL LOAD AP	PLIED - COVER > 2'	æ
General Info	ormation				
D	roject Number: escription: tructure:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 3000mm X 4000mm CH/	Designed By: Checked By: MBER Date:	BRO RB December 29, 2016	
A.) SHEAR DE	SIGN LOADS				
B.) FLEXURE I	qtopfact = qbotfact = bw = Vuside = Vutop = Vubot = DESIGN LOADS - Vertic	1.56 ksf < No Sd for S 12.00 (per linear ft of wall) 4.72 4.72 ktf <== Shear at s	eismic load combinations ACI 350 Section 21.2.1.8 eismic load combinations ACI 350 Section 21.2.1.8 ide of wall is compression (Nu) in other side wall op of wall is compressiom (Nu) in roof slab ottom of wall is compressiom (Nu) in base slab		
Negative mome Positive momer	•				
C.) FLEXURE	DESIGN LOADS - Horiz	ontal Reinforcement (MAIN REINFORCEMENT)			
Negative mome Positive momer	•	12.00 (per linear ft of wall) -5.34 (k.ft/ft -5.55 (k.ft/ft Inside Face R			

	AR RECTANGULAR CONCRETE	TANK - WHEEL LOAD APF	PLIED - COVER > 2'
nformation Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 3000mm X 4000mm CHAMBI	Designed By: Checked By: ER Date:	BRO RB December 29, 2016
WALL REINFORCE	MENT		
Wall - Vertical (outside) Wall - Horiz (outside) Wall - Vertical (inside) Wall - Horiz (inside)	Bar Dia. (mm) As bar (in) db (in) Spg (in) As pr 20.00 0.3116 0.6299 6.69 20.00 0.3116 0.6299 6.69 20.00 0.3116 0.6299 6.69 20.00 0.3116 0.6299 6.69 20.00 0.3116 0.6299 6.69 20.00 0.3116 0.6299 6.69	ov (m [*]) 0.56 0.56 0.56 0.56	
Check Shear Capacity:			
DESIGN I Vubot, tota Vutop, tota Vuside, to	l: 2.38 7.10 5.74 l: 2.38 5.62 5.74	Max (kips) 7.10 5.74 5.36	
phiv = Wall Thick			
Cover = d (M+) ver fc = bw =	t = 2.00 in. 9.50 in. = w - cover - 1/2db(vert) 4.00 ksi 12.00 (per linear ft of wall)	d (M+) horiz =	8.877 in. = w - cover - db(vert) - 1/2db(horiz)
	aar in Tank Wall - top/bot	Check Shear in Tank Wall - side	
Vc = 2*fc/ PHI*Vc = Vubot =	.5"bw*d 14.41 kips 10.81 kips 7.10 SHEAR CAPACITY O.K.	Vc = 2*(1)*fc^.5*bw*d PHI*Vc = Vubot =	13.46 kips 10.09 kips 5.36 SHEAR CAPACITY O.K.
<u>Shear Fric</u> u:	1.000 11.6.4.3		
phiv: Avf (req'd)	0.75 =Vu/(Fy*u*phi): 0.16 in ²		
As (provid	ed): 0.56 in ² OK		

Project Number: Description: Structure:		127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 3000mm X 4000mm CHAMBER		Designed By: Checked By: Date:	BRO RB Decemb	er 29, 2016	
Check Flexural Capac	t <u>y:</u>						
Steel	DESIGN LOADS	Load Cas	e 1 : Load Case 2 : Load Case 3	Max (k*ft) Max (kip*ir	<u>.</u>		
Vertic	Mu+ inside face re	einf. 5.58 einf3.13	15.14 9.53 -8.80 -5.34	15.14 181.74 -8.80 -105.60			
Horizo	tal Mu+ inside face re Mu- outside face r		9.03 5.55 -8.80 -5.34	9.03 108.32 -8.80 -105.60			
Design for Vertical Be	ding Moments (deter	mine Vertical Steel):					
Wall Thic Cover (in d (M+) ve d (M+) he fc = bw =	side) = rt =		over - 1/2db(vert) over - db(vert) - 1/2db(horiz) ft of slab)	Cover (outside) = d (M-) vert = d (M-) horiz =		cover - 1/2db(vert) cover - db(vert) - 1/2db(horiz)	
Check M	ment Capacity (Mu+ in	side face reinf.):		Check Moment Capacity (N	/u- outside face reinf.):		
As T & S	• []	0.21 in2	=0.0030bh/2	As T & S=	0.21 in2	=0.0030bh/2	
Asprov =		0.56 in2	Asprov>As T&S, OK	As =	0.56 in2	Asprov>As T&S, OK	
	(0.85*fc*b):	0.82 in		a =As*Fy/(0.85*f'c*b):	0.82 in		
phif =		0.90		phi =	0.90		
PHI*Mn :		22.84 kip*ft		PHI*Mn =	22.84 kip*ft		
Mu+ insid	e face reinf=	15.14 POS MOI	MENT CAPACITY O.K.	ABS Mu- ourside face=	8.80 NEG MC	MENT CAPACITY O.K.	
Next, consider steel in							
	ment Capacity (Mu+ in			Check Moment Capacity (M			
As T & S	-	0.21 in2	=0.0030bh/2	As T & S=	0.21 in2	=0.0030bh/2	
Asprov =		0.56 in2	Asprov>As T&S, OK	As =	0.56 in2	Asprov>As T&S, OK	
	(0.85*fc*b):	0.82 in		a =As*Fy/(0.85*f'c*b):	0.82 in		
phif =		0.90		phi =	0.90		
PHI*Mn :		21.26 kip*ft		PHI*Mn =	21.26 kip*ft		

TWO LAYER REBAR RECTANGULAR CONCRETE TANK - WHEEL LOAD APPLIED - COVER > 2'							
General Information							
Project Number: 127-1298 Description: TERRIER	-15001 ROUGE SETTLEMENT UPGRADED LEACHING FIELD - 3000mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016				
Crack Check - Check maximum space	ing of bars (ACI 350 Section 10.6.4)						
Unfactored Moment: M+ vert unfactored= M- vert unfactored= M+ horiz unfactored= M- horiz unfactored=	Load Case 1 { Load Case 2 Load Case 3 1.65 4.49 9.11 -0.93 -2.61 -5.10 -0.96 2.67 5.30 -0.93 -2.61 -5.10						
Crack Check (M+ inside	face vertical reinf.):	Crack Check (Mu- outside	face vertical reinf.):				
Asprov = d=	0.56 in2 9.50 in	As = d=	0.56 in2 9.50 in				
n=	8.04	n =	8.04				
ρ=	0.015	ρ=	0.015				
ρn=	0.118	ρn=	0.118				
k=	0.382	k=	0.382				
j=	0.873	j=	0.873				
M+ unfactored=	9.106 kips.ft	M- unfactored=	5.104 ;kips.ft				
fs=	23.606 ksi	fs=	13.230 ksi				
β=	1.35	β=	1.35				
Р S=	6.693 in	s=	6.693 in				
db=	0.630 in	db=	0.630 in				
fs,max=	23.665 INSIDE FACE BAR SPACING O.K.	fs,max=	23.665 OUTSIDE FACE BAR SPACING O.K.				
Crack Check (M+ inside t		Crack Check (Mu- outside	,				
Asprov = d=	0.56 in2 8.87 in	As = d=	0.56 in2 8.87 in				
n=	8.04	n=	8.04				
ρ=	0.016	ρ=	0.016				
pn=	0.127	pn=	0.127				
k=	0.392	k=	0.392				
j=	0.869	j=	0.869				
M+ unfactored=	5.304 kips.ft	M- unfactored=	5.104 kips.ft				
fs=	14.782 ksi	fs=	14.225 ksi				
Q-	125	0-	125				
β= s=	1.35 6.693 in	β= s=	1.35 6.693 in				
db=	0.630 in	db=	0.630 in				
fs.max=	23.665 INSIDE FACE BAR SPACING O.K.	fs,max=	23.665 OUTSIDE FACE BAR SPACING O.K.				
	······································		·				

TWO	LAYER REBA	R RECTANGU	LAR CONCRETE TANK	- WHEEL LOAD APP	LIED - COVER > 2'	æ
General	Information					
	Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SET SEWER LEACHING FIE	ILEMENT UPGRADED LD - 3000mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
BUOY/	ANCY CHECK (F	LOTATION)				
	This loading condition check			⊽		
	Ground water height:	<u>. 0.00</u> jn				
A.) Dead Lo	oad			▲		
	TOTAL DL:		251.62 kips			
B.) Bouyan	t Force					
	TOTAL BOUYANT FORCE	Ξ:	0.00 kips			
C). Safety F	actor					
	Safety Factor = DL / B		25162123.82 > 1.25, OK			

		R RECTANG	JLAR CONCRI	ETE TANK - W	/HEEL LOAD APP	LIED - COVER > 2'	F
General	Information Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SE SEWER LEACHING F	TTLEMENT UPGRADED IELD - 3000mm X 4000mm (CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	······
DESIG	ON BASE SLAB						
	DL1, ROOF SLAB: DL2, WALLS:		233.92 cf conc = 402.59 cf conc =	35.09 kips 60.39 kips		✓	
	DL6, SOIL ON FTG EXT - DL5, SOIL ON FTG EXT - DL8, SOIL ON TOP SLAE DL7, SOIL ON TOP SLAE TOTAL DL CONC: TOTAL DL SOIL: TOTAL DL: TOTAL SOIL LOAD, EV: TOTAL SOIL LOAD, EV: TOTAL UNIFORM LIVE L HYDROSTATIC, B: qurfact =DL + LL + EV + E	WET: - DRY: - WET: OAD, LL:	0.00 ef soil = 0.00 ef soil = 1052 66 ef soil = 0.00 ef soil =	0.00 kips 0.00 kips 121.06 kips 0.00 kips 121.06 kips 121.06 kips 121.06 kips 0.54 ksf 0.68 ksf 0.18 ksf 1.33 ksf 1.84 ksf	BEARING PRESSURE OK		
		.6*EV +1.2*B PER ACI 318		2.02 ksf			
	b/c =	1.30 SAY ====					
	Input PCA Rectangular Plate Analysis - Case:	Concrete Tanks coefficient	ts < HINGED TOP, HINGEI	D BOTTOM, HINGED SID	ES		
	-My +My -Mx +Mx Vside max	-45 48 -45 63 0.36					

General Inform	ation					
Projec Descri Struct		127-1298-15001 TERRIER ROUGE SETTLEMENT SEWER LEACHING FIELD - 3000r		Designed By: Checked By: Date:	BRO RB December 29, 2016	
A.) SHEAR DESIGN	LOADS					
B.) FLEXURE DESK Negative moment Positive moment	qfact * S _d = bw = Vuside= SN LOADS - Short qfact * S _d = bw = Muneg = Mupos =	3.14 ksf 12.00 (per linea 12.23 kif 12.00 (per linea 23.36 k.ft/ft 32.71 k.ft/ft	<== Shear at side of wall is compression	(Nu) in other side wall		
C.) FLEXURE DESK	N LOADS - Long	Dir. (My)				
Negative moment Positive moment	qfact * S _d = bw = Muneg = Mupos =	4.43 ksf 12.00 (per linea -23.36 k.ft/ft 24.92 k.ft/ft	rft of wall) Outside Face Reinforcement Inside Face Reinforcement			

formation				æ
	407 4000 45004	Designed Dec	BBO	
Project Number:	127-1298-15001	Designed By:	BRO	
Description:	TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 3000mm X 4000mm CHAMBER	Checked By:	RB December 29, 2016	
Structure:	SEWER LEACHING FIELD - 3000/11/11 X 4000/11/11 CHAWBER	Date:	December 29, 2016	
Design Flexural Reinfor	cement in the Base Slab:			
	Bar Dia. (mm) As bar (in) db (in) Spg (in) As prov (in	²)		
Short Direction, Inside	20.00 0.4869 0.7874 7.87 0.	74		
Long Dir, Inside		74		
Short Direction, Outside		47		
Long Dir, Outside		47		
phiv =	0.75			
Base Slab	Thickness: 1.31 ft			
Cover (insi	de) = <u>3.00</u> in.	Cover (outside) =	3.00 in.	
d (M+) sho		d (M-) short =	12.43 in. = f - cover - 1/2db(short)	
d (M+) Ion	g = 11.57 in. = f - cover - db(short) - 1/2db(long)	d (M-) long =	11.80 in. = f - cover - db(short) - 1/2db(long)	
fc =	4.00 ksi	dmin=	11.57 in.	
bw =	12.00 (per linear ft of slab)			
	ear in Base Slab			
Vc = 2*fc/				
PHI*Vc =	13.17 kips			
Vu = Cs*q	a = 12.23 SHEAR CAPACITY O.K.			
Check Mo	ment Capacity (Mu (short)+ inside face reinf.): Mx+	Check Moment Canacity (Mu	u (short)- outside face reinf.): Mx-	
As T & S=		As T & S=	0.28 in2 =0.0030bh/2	
Asprov =		As =	0.47 in2 Asprov2As T&S OK	
	0.74 in2 Asprov>As T&S, OK 0.85*fc*b): 1.09 in	a =As*Fy/(0.85*f'c*b):	0.70 in	
phif =	0.90	phi =	0.90	
PHI*Mn =	39.43 kip*ft	PHI*Mn =	24.48 kip*ft	
	a face reinf= 32.71 POS MOMENT CAPACITY O.K.	ABS Mu- ourside face=	23.36 NEG MOMENT CAPACITY O.K.	
WU+ IIISIU		ABS Mu- buiside lace-	23.30 NEG MOMENT CAPACITY O.K.	
Check Mo	ment Capacity (Mu (long)+ inside face reinf.): My+	Check Moment Capacity (Mu	u (long)- outside face reinf.): My-	
As T & S=		As T & S=	0.28 in2 =0.0030bh/2	
Astra 6-	0.74 in2 Asprov>As T&S, OK	As =	0.47 in2 Asprov>As T&S, OK	
	0.85*fc*b): 1.09 in	a =As*Fy/(0.85*f'c*b):	0.70 in	
phif =	0.90	a – As F y/(0.05 TC D). phi =	0.90	
PHI*Mn =	36.80 kip*ft	prii – PHI*Mn =	25.82 kip*ft	
	ace reinf= 24.92 POS MOMENT CAPACITY O.K.	ABS Mu- ourside face=	23.36 NEG MOMENT CAPACITY O.K.	

formation				
Project Number:	127-1298-1500	1	Designed By:	BRO RB
Description:	TERRIER RO	JGE SETTLEMENT UPGRADED	Checked By:	RB
Structure:	SEWER LEAC	HING FIELD - 3000mm X 4000mm CHAMBER	Date:	December 29, 2016
Crack Check - Check	maximum spacing of	f bars (ACI 350 Section 10.6.4)		
Unfactore	ed Moment:	oad Case 1		
M+(short) unfactored=	10.30		
M- (short) unfactored=	-7.35		
M+(long)	unfactored=	7.84		
M- (long)	unfactored=	-7.35		
Crack Ch	neck (M(short)+ inside		Crack Check (Mu(short)-	outside face reinf.): M-x
Asprov =		0.74 in2	As =	0.47 in2
d=		12.35 in 8.04	d=	11.80 in
n=		8.04	n =	8.04
ρ=		0.005	ρ=	0.003
ρn=		0.040	ρn=	0.027
k=		0.246	k=	0.207
j=		0.918	j=	0.931
M+ unfac	ctored=	10.297 kips.ft	M- unfactored=	7.355 kips.ft
fs=	l l	14.684 ksi	fs=	16.912 ksi
β=	0	1.35	β=	1.35
s=		7.874 in	s=	7.874 in
db=	E E	0.787 in	db=	0.630 in
fs,max=		20.900 INSIDE FACE BAR SPACING O.K.	fs,max=	21.085 OUTSIDE FACE BAR SPACING O.K.
Crack Ch	neck (M(long)+ inside	face reinf.): M+y	Crack Check (Mu(long)-	
Asprov =		0.74 in2	As =	0.47 in2
d=		11.57 in	d=	12.43 in 8.04
n=		8.04	n =	8.04
ρ=	~	0.005	ρ=	0.003
ρn=		0.043	pn=	0.026
k=		0.253	k=	0.202
j=		0.916	j=	0.933
M+ unfac	ctored=	7.845 kips.ft	M- unfactored=	7.355 kips.ft
fs=		11.980 ksi	fs=	16.028 ksi
β=	ļ.	1.35	β=	1.35
s=		7.874 jin	s=	7.874 in
db=		0.787 in	db=	0.630 in
fs,max=		20.900 INSIDE FACE BAR SPACING O.K.	fs,max=	21.085 OUTSIDE FACE BAR SPACING O.K.

Information						
Project Number:	127-1298-15001			Designed By:	BRO	
Description:	TERRIER ROUGE S	ETTLEMENT UPGRADED		Checked By:	RB	
Structure:	SEWER LEACHING	FIELD - 3000mm X 4000mm	CHAMBER	Date:	December 29, 2016	
References:	ACI 350-06 Code Requi	irements for Environmental Engine	eering Concrete Structures			
		esign of Liquid-Containing Concre Design Specifications 4th Edition,				
Notes:						
Design Load Par	ramotore					
Design Load - Par	ameters					
Liquid-C	ontaining Concrete Structu	ure				
•						
•	RY INFORMATION INPUT:			OTHER PARAMETERS	<u>:</u>	
	TRY INFORMATION INPUT:	15.09 ft	4600 mm	OTHER PARAMETERS Concrete Weight=	0.15 kcf	
GEOMET	TRY INFORMATION INPUT: ength =	15.09 ft 11.81 ft	3600 mm		0.15 kcf 1 Table 4.1	
<u>GEOMET</u> Outside le	RY INFORMATION INPUT: ength = vidth =	15.09 ft 11.81 ft 13.12 ft	3600 mm 4000 mm	Concrete Weight=	0.15 kcf	
GEOMET Outside le Outside v	TRY INFORMATION INPUT: ength = vidth = ngth L=	15.09 ft 11.81 ft 13.12 ft 9.84 ft	3600 mm 4000 mm 3000 mm	Concrete Weight= I=	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1	.1(b)
<u>GEOMET</u> Outside le Outside v Inside Le Inside Wi	TRY INFORMATION INPUT: ength = vidth = ngth L=	15.09 ft 11.81 ft 13.12 ft 9.84 ft	3600 mm 4000 mm 3000 mm	Concrete Weight= I= Ri=	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1	.1(b)
<u>GEOMET</u> Outside le Outside v Inside Le Inside Wi design liq	TRY INFORMATION INPUT: ength = vidth = ngth L= dth=	15.09 ft 11.81 ft 13.12 ft	3600 mm 4000 mm	Concrete Weight= I= Ri= Rc=	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1	.1(b)
<u>GEOME</u> T Outside le Outside vu Inside Le Inside Wi design liq Exterior V	IRY INFORMATION INPUT: angth = width = ngth L= dth= uid depth HL=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft	3600 mm 4000 mm 3000 mm 2500 mm	Concrete Weight= I= Ri= Rc= Liquid Weight=	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 32.2 ft/s^2 4.66 ib-s^2/ft/^	1(b) 1(b) 4
<u>GEOMET</u> Outside k Outside v Inside Le Inside Wi design liq Exterior V Interior W	rRY INFORMATION INPUT: ength = width = ngth L= dth= uid depth HL= Vall thickness=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.98 ft	3600 mm 4000 mm 3000 mm 2500 mm 300 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9=	0.15 kcf Table 4.1 Table 4.1 Table 4.1 0.0624 kcf 32.2 ft/s^2	1(b) 1(b) 4
<u>GEOMET</u> Outside ke Outside ve Inside Le Inside Wi design liq Exterior V Interior W Roof slab	TRY INFORMATION INPUT: angth = width = ngth L= dth= wid depth HL= Vall thickness= /all Thickness=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.98 ft 0.00 ft	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc=	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 32.2 ft/s^2 4.66 ib-s^2/ft/^	1(b) 1(b) 4
<u>GEOME1</u> Outside k Outside v Inside Le Inside Wi design liq Exterior V Interior V Roof slab Floor slat	TRY INFORMATION INPUT: angth = width = mgth L= dth= uid depth HL= Vall thickness= vall Thickness= thickness=	15.09 ft 11.81 ft 3.12 ft 9.84 ft 8.20 ft 0.98 ft 0.00 ft 1.31 ft 1.31 ft	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL=	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 32.2 ft/s^2 4.66 ib-s^2/ft/^ 1.94 ib-s^2/ft/^	1(b) 1(b) 4
<u>GEOME1</u> Outside ke Outside vi Inside Le Inside Wi design liq Exterior V Interior V Roof slab Floor slat	TRY INFORMATION INPUT: ength = width = ngth L= dth= uid depth HL= Wall thickness= //all Thickness= //all Thickness= // thickness	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.98 ft 0.00 ft 1.31 ft 1.31 ft 2	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' =	0.15 kcf Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 32.2 ft/s^2 4.66 ib-s^2/ft^ 1.94 ib-s^2/ft^ 4000 pci 3.604.997 psi 1.6	1(b) 1(b) 4
<u>GEOME1</u> Outside le Outside vi Inside Vii design liq Exterior V Interior V Roof slab Floor slab	TRY INFORMATION INPUT: ength = width = ngth L= dth= uid depth HL= Vall thickness= /all Thickness= / thickness=) thickness= ior walls= or walls=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.98 ft 0.00 ft 1.31 ft 1.31 ft 2 0	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' = Ec=	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 3.22 ft/s^2 4.66 ib-s^2/ft/^ 1.94 ib-s^2/ft/^ 4000 pci 3.604.997 psi 1.6	.1(b) .1(b) 4 4
GEOMET Outside le Outside vin Inside Vin design liq Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = width = ngth L= tdth= uid depth HL= Vall thickness= /all Thickness= / thickness=) thickness= ior walls= or walls= walls=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.98 ft 0.00 ft 1.31 ft 1.31 ft 2 0 0	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 400 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' = Ec= longi L/H_L =	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 32.2 ft/s^2 4.66/ib-s^2/ft/^ 1.94/ib-s^2/ft/^ 4000 pci 3.604.997 psi 1.6 0.65 Figure 9.2	.1(b) .1(b) 4 4
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = width = ngth L= dth= uid dept HL= Vall thickness= /all Thickness= thickness= thickness= thickness= or walls= or walls= walls= all height Hw=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.96 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' = Ec= longi L/H_L = 2Π/λ= trans	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 32.2 ft/s ⁴ 2 4.66 ilb-s ⁴ 2/ft ⁴ 1.94 ilb-s ⁴ 2/ft ⁴ 4000 pci 3.604.997 psi 1.6 0.65 Figure 9. 1.2	.1(b) .1(b) 4 4. 2.4 page 47
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = width = ngth L= tdth= uid depth HL= Vall thickness= /all Thickness= / thickness=) thickness= ior walls= or walls= walls=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.98 ft 0.00 ft 1.31 ft 1.31 ft 2 0 0	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 400 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' = Ec= longi L/H_L = 2Π/λ= trans	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 3.22 ft/s^2 4.66 ib-s^2/ft^ 1.94 ib-s^2/ft^ 4000 pci 3.604.997 psi 1.6 0.65 Figure 9.1 1.2 0.63 Figure 9.1	.1(b) .1(b) 4 4. 2.4 page 47
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = width = ngth L= dth= uid dept HL= Vall thickness= /all Thickness= thickness= thickness= thickness= or walls= or walls= walls= all height Hw=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.96 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' = Ec= longi L/H_L = 2Π/λ= trans L/H_L = 2Π/λ= Site Clas	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 0.0624 kcf 3.22 ft/s^2 4.66 ib-s^2/ft/^ 4.000 pci 3.604.997 psi 1.6 0.65 Figure 9.1 1.2 0.63 Figure 9.1	.1(b) .1(b) 4 4. 2.4 page 47
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = width = ngth L= dth= uid dept HL= Vall thickness= /all Thickness= thickness= thickness= thickness= or walls= or walls= walls= all height Hw=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.96 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	$\begin{tabular}{l l l l l l l l l l l l l l l l l l l $	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 1 Table 4.1 0.0624 kcf 322 ft/s^2 4.66 ib-s^2/ft^ 4.0400 pci 3.604.997 1.6 0.65 Figure 9. 1.2 0.63 Figure 9. 1.5	.1(b) .1(b) 4 4. 2.4 page 47
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = width = ngth L= dth= uid dept HL= Vall thickness= /all Thickness= thickness= thickness= thickness= or walls= or walls= walls= all height Hw=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.96 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	$\begin{tabular}{l l l l l l l l l l l l l l l l l l l $	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 1 Table 4.1 0.0624 kcf 3.22 ft/s^2 4.66 ilb-s^2/ft^ 4.000 pci 3.604.997 1.6 0.65 Figure 9. 1.2 0.63 Figure 9. 1.5 0.6	.1(b) .1(b) 4 4. 4. 2.4 page 47 2.4 page 47
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = width = ngth L= dth= uid dept HL= Vall thickness= /all Thickness= thickness= thickness= thickness= or walls= or walls= walls= all height Hw=	15.09 ft 11.81 ft 13.12 ft 9.84 ft 8.20 ft 0.96 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	3600 mm 4000 mm 3000 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	$\begin{tabular}{l l l l l l l l l l l l l l l l l l l $	0.15 kcf 1 Table 4.1 3 Table 4.1 1 Table 4.1 1 Table 4.1 0.0624 kcf 3.22 ft/s^2 4.66 ilb-s^2/ft^4 4.004 ib-s^2/ft^4 4000 pci 3.604.997 psi 1.6 0.65 Figure 9. 1.2 0.63 Figure 9. 1.5 0.6 1 ASCE 7-1	.1(b) .1(b) 4 4. 2.4 page 47

SEISMIC DESIGN LOAD									Æ
General Information									
Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SE SEWER LEACHING F				Designed By: Checked By: Date:		BRO RB December 29, 2016		- •
Seismic Design Load Ste	p One and Step Two								
DESIGN IS BASED ON A	ACI350.3-06 CHAPTER 4 - EAF	RTHQUAKE DESIG	GN LOADS						
		al direction:			Transverse	e direction			
Step One		Wr=	25.00 Kino						
		Ww=	35.09 Kips 60.39 Kips						
		L/HL=	1.60			L/HL=	1.20		
		=3	0.75	Equation (9-44)		=3	0.81	Equation (9-44)	
		εWw=	45.56 Kips			εWw=	49.14 Kips		
	We=	εWw+Wr=	80.64 Kips		We=	εWw+Wr=	84.23 Kips		
Step Two			. <u></u>						
	total mass of liquid	WL=	66.11 Kips						
		Wi/WL=	0.64	Equation (9-1)		Wi/WL=	0.75	Equation (9-1)	
		Wi= Wc/WL=	42.09 Kips 0.41	Equation (9-2)		Wi= Wc/WL=	49.47 Kips 0.31	Equation (9-2)	
		Wc=	26.87 Kips	Lquation (9-2)		Wc=	· · · · · · · · · · · · · · · · · · ·	Lyualion (3-2)	
			20.07 1000				20.73 Kips		

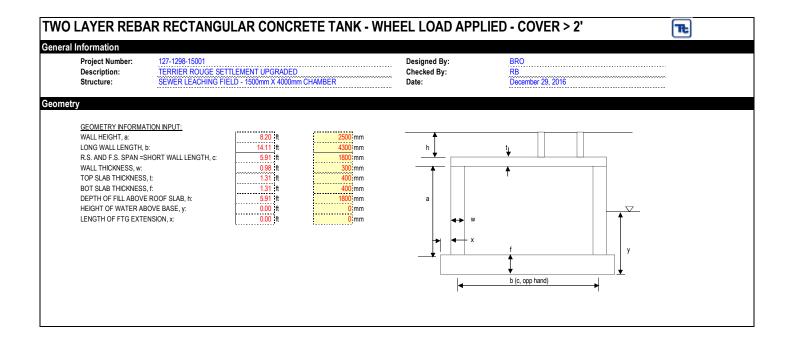
nformation							
Project Number:	127-1298-15001			Designed By	<i>ı</i> :	BRO	
Description:	TERRIER ROUGE S			Checked By	:	RB	
Structure:			4000mm CHAMBER	Date:		December 29, 2016	
Design Load Ster	o Three and Step Te	en					
Step 3 to 9	2	Longitudinal dir	ection: Exterior walls		Transverse	direction Exterior wall	s
		mw=	37.61 lb-s^2/ft^4		mw=	37.61 lb-s^2/ft^4	
		mi=	66.40 lb-s^2/ft^4		mi=	58.53 lb-s^2/ft^4	
		hw=	4.10 ft		hw=	4.10 ft	
		hi/HL=	0.38		hi/HL=	0.39	
		hi=	3.08 ft		hi=	3.18 ft	
		h=	3.45 ft		h=	3.54 ft	
		k=	3022710.90 lb/ft^2		k=	2791154.62 lb/ft^2	
		m=	104.01 lb-s^2/ft^4 0.04 s	Equation (9-10)	m=	96.14 lb-s^2/ft^4	Equation (9-10)
		Ti=		5	Ti= -	0.04 s	E ((0.44)
		Tc= Ts=	2.35 s	Equation (9-14)	Tc=	1.98 s	Equation (9-14)
			0.77 s	Equation (9-34) Equation (9-35)	Ts=	0.77 s 1.00	Equation (9-34) Equation (9-35)
		S _{DS} =	1.00	,	S _{DS} =	······	
		S _{D1} =	0.77	Equation (9-36)	S _{D1} =	0.77	Equation (9-36)
		Ci= Cc=	1.00 s	Equation (9-32/9-33) Equation (9-37/9-38)	Ci=	1.00 s 0.58 s	Equation (9-32/9-33) Equation (9-37/9-38)
		00=	0.43 s	Equation (9-37/9-30)	Cc=	0.56;5	Equation (9-37/9-36)
<u>Step 10</u>		01	4.00		01	4.00	
		Cil= Ccl=	1.00 0.43		Cil= Ccl=	1.00 0.58	
		Pw=	15.19 kips	Equation (4-1)	Pw=	16.38 kips	Equation (4-1)
		Pr=	11.70 kips	Equation (4-2)	Pr=	11.70 kips	Equation (4-2)
		Pi=	14.03 kips	Equation (4-3)	Pi=	16.49 kips	Equation (4-3)
		Pc=	11.63 kips	Equation (4-4)	Pc=	12.08 kips	Equation (4-4)
		V=	42.53 kips	Equation (4-5)	V=	46.17 kips	Equation (4-5)
		hc/HL=	0.62	Equation (9-5)	hc/HL=	0.67	Equation (9-5)
		hc=	5.06		hc=	5.50	
Simplified	method: Considering Uniform	n distribution of shear fo	rce:				
	Unit base shear	v=	1.80 klf	Unit base shear	v=	1.53 klf	
		q=	219.52 psf		q=	186.51 psf	

	DESIGN LOAD					æ
1	Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SET SEWER LEACHING FIE		GRADED X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016
Seismic De	Seismic Des Seismic-Ind	mic-Induced Earth Pro sign Load: uced Earth Pressure: ic Lateral Load:	q= qoe= qe=	219.52 psf 1152.97 psf 1372.49 psf		

al Informatio	n				
Project Nu Descriptio Structure:	mber:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 3000mm X 4000mm CHAMBE	Designed By: Checked By: ER Date:	BRO RB December 29, 2016	
Reference	s:	ACI 350-06 Code Requirements for Environmental Engineering ACI 350.3-06 Seismic Design of Liquid-Containing Concrete Str AASHTO LRFD Bridge Design Specifications 4th Edition, 2007	Concrete Structures		
Notes:					
		•			
AMETERS FOR		AKE-INDUCED EARTH PRESSURE			
RAMETERS FOR	CALCULATIO	AKE-INDUCED EARTH PRESSURE			
RAMETERS FOR	<u>CALCULATIK</u> (REF: ASSH MONONOBE GAMMA = t= h=	IN OF EARTHQUAKE-INDUCED EARTH PRESSURE: O 2007 - Appendix A11.1.1) -OKABE ANALYSIS 115.00 Lbs/CF 1.31 feet 5.91 Feet			
	<u>Calculatik</u> (REF: ASSH Mononobe Gamma = t=	IN OF EARTHQUAKE-INDUCED EARTH PRESSURE: O 2007 - Appendix A11.1.1.1) -OKABE ANALYSIS 115.00 Lbs/CF	RAD= 0.52359878 RAD= 0.29145679		
veight of soil:	CALCULATIC (REF: ASSHT MONONOBE GAMMA = t= h= a = PHI = THETA = DELTA = A =	IN OF EARTHQUAKE-INDUCED EARTH PRESSURE: O 2007 - Appendix A11.1.1.1) OKABE ANALYSIS 115.00 Lbs/CF 1.31 feet 5.91 Feet 8.20 Feet 8.20 Feet 0.00 Degrees:			

SEISMIC-INDUCED EARTH	PRESSURE					æ
General Information						
Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEN SEWER LEACHING FIELD -	IENT UPGRADED 3000mm X 4000mm	CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
EARTHQUAKE-INDUCED E SEISMIC	ARTH PRESSURE ACTIVE EARTH PRESSURE:					
		ψ=	2.278			
		Kae =	0.591	Equation (A11.1.1.1-2)		
SEISMIC	AT-REST EARTH PRESSURE (AAS	HTO Pg C-87)				
		Koe =	0.886			
SEISMIC	FORCE:					
		Eoe =	9456.774 lb	Equation (A11.1.1.1-1)		
		qoe=	1152.97 plf			

ormation				
Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	·····
References:	AASHTO LRFD Bridge Design Specifications 4th Edition, 2007 ACI 318-08 ACI 350-06			····· ····
Notes:	Since cover is more than 2 feet, H20 wheel load is considered a	s uniformly distributed.		
	RESSURE IS ASSUMED. KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU	SED BY EARTHQUAKE		
2. THE MONONOBE-C 3. SANITARY COEFFI	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU XIENTS ARE INCLUDED IN DESIGN	SED BY EARTHQUAKE		
2. THE MONONOBE-C B. SANITARY COEFFI B. CONSIDER WALL H 5. SEISMIC COEFFICI	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU CIENTS ARE INCLUDED IN DESIGN INGED TOP AND BOTTOM ENTS: Ss=1.50g AND S1= 0.60g.			
2. THE MONONOBE-C 3. SANITARY COEFFI 4. CONSIDER WALL H 5. SEISMIC COEFFICI 6. ASSUME GROUND	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU JIENTS ARE INCLUDED IN DESIGN INGED TOP AND BOTTOM INTS: Ss=1.50g AND S1=0.60g. WATER ELEVATION IS 5.0M BELOW GRADE U.N.O. DUE TO SITE SPECIFIC			
2. THE MONONOBE- 3. SANITARY COEFFI 4. CONSIDER WALL H 5. SEISMIC COEFFICI 6. ASSUME GROUND 7. DESIGN LOAD ON H 8. LIVE LOAD IMPACT	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU CIENTS ARE INCLUDED IN DESIGN INGED TOP AND BOTTOM ENTS: SS=1.50g AND S1= 0.60g. WATER ELEVATION IS 5.0M BELOW GRADE U.N.O. DUE TO SITE SPECIFIC IOOF SLAB: AASHTO H20 PER AASHTO SPECIFICATION WILL NOT BE INCLUDED			
2. THE MONONOBE- 3. SANITARY COEFFI 4. CONSIDER WALL H 5. SEISMIC COEFFICI 6. ASSUME GROUND 7. DESIGN LOAD ON H 8. LIVE LOAD IMPACT 9. ROOF SLAB: HINGE	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU JENTS ARE INCLUDED IN DESIGN INGED TOP AND BOTTOM INTS: Ss=1.50g AND S1= 0.60g. WATER ELEVATION IS 5.0M BELOW GRADE U.N.O. DUE TO SITE SPECIFIC INCOF SLAB: AASHTO H20 PER AASHTO SPECIFICATION WILL NOT BE INCLUDED D FOUR SIDES			
2. THE MONONOBE-C 3. SANITARY COEFFI 4. CONSIDER WALL H 5. SEISMIC COEFFICI 6. ASSUME GROUND 7. DESIGN LOAD ON I 8. LIVE LOAD IMPACT 9. ROOF SLAB: HINGE 10. TWO FEET LIVE LI	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU CIENTS ARE INCLUDED IN DESIGN INGED TOP AND BOTTOM ENTS: SS=1.50g AND S1= 0.60g. WATER ELEVATION IS 5.0M BELOW GRADE U.N.O. DUE TO SITE SPECIFIC IOOF SLAB: AASHTO H20 PER AASHTO SPECIFICATION WILL NOT BE INCLUDED			
2. THE MONONOBE- 3. SANITARY COEFFI 4. CONSIDER WALL H 5. SEISMIC COEFFICI 3. ASSUME GROUND 7. DESIGN LOAD ON I 3. LIVE LOAD IMPACT 10. TWO FEET LIVE LI 11. CORROSION RES 12. BOTTOM SLAB: H	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU SIENTS ARE INCLUDED IN DESIGN INGED TOP AND BOTTOM ENTS: SS=1.50g AND S1= 0.60g. WATER ELEVATION IS 5.0M BELOW GRADE U.N.O. DUE TO SITE SPECIFIC ROOF SLAB: AASHTO H20 PER AASHTO SPECIFICATION WILL NOT BE INCLUDED D FOUR SIDES DAD SURCHARGE ON THE TANK WALLS. STANT CONCRETE OR CEMENT SHOULD BE USED, TYPE II CEMENT NGED FOUR SIDES	ESTS		
2. THE MONONOBE-C 3. SANITARY COEFFI 4. CONSIDER WALL H 5. SEISMIC COEFFICI 6. ASSUME GROUND 7. DESIGN LOAD (NH 10. TWO ADD (NH 10. TWO FEET L/NE LI 11. CORROSION RES 12. BOTTOM SLAB: H 13. PER ACI 350 - SEC	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU JENTS ARE INCLUDED IN DESIGN INGED TOP AND BOTTOM INTS: Sen J.S0g AND S1= 0.60g. WATER ELEVATION IS 5.0M BELOW GRADE U.N.O. DUE TO SITE SPECIFIC IOOF SLAB: AASHTO H20 PER AASHTO SPECIFICATION WILL NOT BE INCLUDED D FOUR SIDES JAD SURCHARGE ON THE TANK WALLS. STANT CONCRETE OR CEMENT SHOULD BE USED, TYPE II CEMENT NGOE FOUR SIDES TION 7.12.2.2, MINIMUM FLEXURE REINFORCEMENT IS 13MM AND NOT MO	ESTS		
2. THE MONONOBE-C 3. SANITARY COEFFI 4. CONSIDER WALL H 5. SEISMIC COEFFICI 6. ASSUME GROUND 7. DESIGN LOAD ON H 8. LIVE LOAD IMPACT 9. ROOF SLAB: HINGG 10. TWO FEET LIVE LI 11. CORROSION RES 12. BOTTOM SLAB: H 13. PER ACI 350 - SEC 14. THE SAFETY FAC	KABE APPROACH IS USED TO GET THE LATERAL EARTH PRESSURE CAU SIENTS ARE INCLUDED IN DESIGN INGED TOP AND BOTTOM ENTS: SS=1.50g AND S1= 0.60g. WATER ELEVATION IS 5.0M BELOW GRADE U.N.O. DUE TO SITE SPECIFIC ROOF SLAB: AASHTO H20 PER AASHTO SPECIFICATION WILL NOT BE INCLUDED D FOUR SIDES DAD SURCHARGE ON THE TANK WALLS. STANT CONCRETE OR CEMENT SHOULD BE USED, TYPE II CEMENT NGED FOUR SIDES	ESTS		



TWO LAYER REBAR RECTANGU	JLAR CONCRET	FE TANK - WHE	EL LOAD APPLI	ED - COVER > 2	2'	æ
General Information						
	ITLEMENT UPGRADED ELD - 1500mm X 4000mm CH/	AMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016		-
Additional Input Parameters						
GEOTECHNICAL INFORMATION: WEIGHT OF SOIL BACKFILL (Dry), gsoil: WEIGHT OF SOIL BACKFILL (Saturated): ALLOWABLE BEARING CAPACITY: PHI: FRICTION ANGLE OF BACKFILL: AT REST PRESSURE COEFF, Ko ACTIVE PRESSURE COEFF, Ka: LIVE LOAD SURCHARGE CONSIDERED:	115.00 Lbs/CF 135.00 Lbs/CF 2.00 ksf 20.90 DEG 0.50 0.30 YES	RAD = 0.3648				
WALL LOADING CONDITION TWO HEIGHT SOIL ABOVE BOT SLAB EXT - WET: HEIGHT SOIL ABOVE BOT SLAB EXT - DRY: HEIGHT SOIL ON TOP SLAB - WET: HEIGHT SOIL ON TOP SLAB - DRY:	0.00 ft 0.00 ft 0.00 ft 5.91 ft	HEIGHT SOIL AI HEIGHT SOIL AI HEIGHT SOIL O	CONDITION ONE BOVE BOT SLAB EXT - WET: BOVE BOT SLAB EXT - DRY: N TOP SLAB - WET: N TOP SLAB - DRY:	0.00 }rt 15.42 }rt 0.00 fr 5.91 }rt		
MATERIAL PROPERTIES: CUBIC WEIGHT CONCRETE=wconc: COMP. STRENGTH OF CONC. = F'c: TENSILE STRENGTH OF REBAR = Fy: WEIGHT OF WATER = ww:	15000 Lbs/CF 4.00 ksi 6000 ksi 62.40 Lbs/CF					
Design Strength Factors - Environmental Durability Factor (ACI 350-06 R9 2.6)	or 0.90 0.75					
<u>Environmental Durability Factor (</u> ACI 350-06 EQ 9-8): FLEXURE: SHEAR:	ROOF SLAB 2.06 1.46	WALL CASE 1 Top Bottom 1.99 1.57 1.41 1.11	WALL CASE 2 W. Top Bottom Top 1.99 1.99 n/a 1.41 1.41 n/a	n/a	BASE SLAB 2.21 1.56	
ENVIRONMENTAL EXPOSURE:	SEVERE					
**Note: No Sd for Seismic load combinations	ACI 350 Section 21.2.1.8					

TWO	LAYER REBAI	R RECTANGL	ILAR CONCRE	ETE TANK - WH	EEL LOAD APPLIED) - COVER > 2	I	æ
General	Information							
	Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SET SEWER LEACHING FIL	TLEMENT UPGRADED ELD - 1500mm X 4000mm C	CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016		
Dead Lo	ad							
	DL1, ROOF SLAB: DL2, WALLS: DL3, BOTTOM SLAB:		136.46 cf conc = 323.13 cf conc = 136.46 cf conc =	20.47 kips 48.47 kips 20.47 kips	TOTAL CONCRETE QUA	NTITY: 22.0	8 cy	
	DL5, SOIL ON FTG EXT - V DL6, SOIL ON FTG EXT - I DL7, SOIL ON TOP SLAB - DL8, SOIL ON TOP SLAB - TOTAL DL CONC:	DRY: WET:	0.00 icf soil = 0.00 icf soil = 0.00 icf soil = 614.05 icf soil =	0.00 ikips 0.00 ikips 0.00 ikips 70.62 ikips 89.41 ikins	TOTAL SOIL QUANTITY: (only above plan limits of bar	/	4 cv	
	TOTAL DL SOIL: TOTAL DL:			89.41 kips 70.62 kips 160.02 kips				

DL1, ROOF SLAB: TOTAL UNFORM DL: 136.46 of conc = 20.47 kps DL7, SOL ON TOP SLAB - WET: 0.00 of soll = 0.00 kps DL8, SOL ON TOP SLAB - DRY: 614.05 of soll = 70.62 kps TOTAL UNFORM SL: 70.62 kps 70.62 kps TOTAL UNFORM SL: 0.88 ksf Ratio bic = 2.39 TWO WAY SLAB NO, Use one way slab for top slab design SEE AASHTO 4.62.1.5 ***CHECK fs_max values belownot setup for one-way slab*** Per AASHTO 12.11.2.1, when the depth of fill is less than 2.ft, the wheel load shall be distributed as in slabs with concentrated loads (4.62.10). And also based on the distribution of the wheel load through earth fill DETRIBUTE CONCENTRATED LOAD? 591 ft SINCE THE COVER TWE TOP SLAB IS GREATER THAN 2.FT, THE LIVE LOAD IS DISTRBUTED IN NCLUDE LL IMPACT (AASHTO 3.62.1)? NO ACCORDANCE WITH AASHTO 4.62.10. NUELES ON ALONG WIDTH: 2.00 - #WHEELS ON ALONG WIDTH: 2.00 HH33 WHEEL LOAD 1600 kps DISTRBUTON WDITH, SHORT SIDE, d1: 591 ft <=== Quick check, this dist should be less than 22.34 ft, which would be dist length if areas don't overlap DISTRBUTON WDITH, SHORT SIDE, d1: 591 ft <=== Quick check, this dist should be less than 12.00 ft, which would b	Project Number: Description: Structure:		TTLEMENT UPGRADED IELD - 1500mm X 4000mm CH	C	esigned By: hecked By: ate:	BRO RB December 29, 2016	·····
DL1, ROOF SLAB: 136.46 of conc = 20.47 kips TOTAL UNFORM DL: 0.00 isf 0.20 ksf DL7, SOL ON TOP SLAB - VET: 0.00 if conc = 0.00 kips TOTAL UNFORM SL: 0.66 ksf TOTAL UNFORM SL: 0.68 ksf TOTAL UNFORM SL: 0.68 ksf NO, Use one way slab for top slab design SEE AASHTO 4.62.1.5 ***CHECK fs_max values belownot setup for one-way slab*** Per AASHTO 12.11.2.1, when the depth of fill is less than 2 ft, the wheel load shall be distibuted as in slabs with concentrated loads (4.6.2.10). And also based on the distibution of the wheel load through earth fill DETRIBUTE CONCENTRATED LOAD? NO NO NO NOLUDE LI MPACT (AASHTO 3.6.2.1)? NO ACCORDANCE WITH AASHTO 4.6.2.10. NCLUDE LI MPACT (AASHTO 3.6.2.1)? NO ACCORDANCE WITH AASHTO 4.6.2.10. NUELES ALONG LENGTH: 1.00 + + # WHEELS ON ALONG WIDTH: 2.00 + - H: 33 WHEEL LOAD 16.00 kips 2.234 ft, which would be dist length if areas don't overlap DISTRBUTON WDITH; LONG SIDE, d2: 1.00 + = =	N ROOF SLAB						
TOTAL UNIFORM DL: 0.20 ksf DL7, SOIL ON TOP SLAB - WET: 0.00 cf soil = DL8, SOIL ON TOP SLAB - DRY: 614.05 cf soil = TOTAL UNIFORM SL: 70.62 kips TOTAL UNIFORM SL: 0.08 ksf Ratio blc = 2.39 TWO WAY SLAB NO, Use one way slab for top slab design SEE AASHTO 4.6.2.1.5 ***CHECK fs_max values belownot setup for one-way slab*** Per AASHTO 12.11.2.1, when the depth of fill is less than 2 ft, the wheel load shall be distributed as in slabs with concentrated loads (4.6.2.10). And also based on the distribution of the wheel load through earth fill DEPTH OF FILL h: 5.91 ft DISTRIBUTE CONCENTRATED LOAD? NO NCLUDE LL MPACT (AASHTO 3.6.2.1)? NO WHEELS ALONG LENGTH: 100 # WHEELS ON ALONG WDTH: 2.00 H-93 WHEEL LOAD 16.00 kps DISTRIBUTON WDTH, LONG SIDE, d1: 5.91 ft STRIBUTION WDTH, LONG SIDE, d2: 5.91 ft SISTRBUTON WDTH, LONG SIDE, d2: 2.00 H-93 WHEEL LOAD 16.00 kps DISTRBUTON WDTH, LONG SIDE, d2: 5.91 ft C=== Quick check, this dist should be less than 22.34 ft, which would be dist length if areas don't overlap <tr< th=""><th>rm Load:</th><th></th><th></th><th></th><th></th><th></th><th></th></tr<>	rm Load:						
DL8, SOIL ON TOP SLAB - DRY: 614.05 cf soil = 70.62 kips TOTAL UNIFORM SL: 70.62 kips 0.68 ksf Ratio b/c = 2.39 0.68 ksf TWO WAY SLAB NO, Use one way slab for top slab design SEE AASHTO 4.62.1.5 ***CHECK fs_max values belownot setup for one-way slab*** Per AASHTO 12.11.2.1, when the depth of fill is less than 2 ft, the wheel load shall be distributed as in slabs with concentrated loads (4.6.2.10). And also based on the distribution of the wheel load through earth fill DEPTH OF FILL h: 531 ft SINCE THE COVER OVER THE TOP SLAB IS GREATER THAN 2 FT, THE LIVE LOAD IS DISTRIBUTED IN NCLUDE LLI MPACT (AASHTO 3.6.2.1)? NO ACCORDANCE WITH AASHTO 4.6.2.10. IVE LOAD IMPACT (AASHTO 3.6.2.2): 100 Hi #WHEELS ALONG LENGTH: 100 #WHEELS ALONG LINGTH: 100 #WHEELS ALONG LINGTH: 2.00 HI-93 WHEEL LOAD 16.00 DISTRIBUTION WDITH; LONG SIDE, d1: 5.91 SISTRIBUTION WDITH; LONG SIDE, d2: 12.00 TOTAL UNIFORM LIVE LOAD, w: 0.45			136.46 cf conc =	0.20 ksf			
TOTAL UNIFORM SL: 0.68 isf Ratio blc = 2.39 TWO WAY SLAB NO, Use one way slab for top slab design SEE AASHTO 4.6.2.1.5 ***CHECK fs_max values belownot setup for one-way slab*** Per AASHTO 12.11.2.1, when the depth of fill is less than 2 ft, the wheel load shall be distributed as in slabs with concentrated loads (4.6.2.10). And also based on the distribution of the wheel load through earth fill DEPTH OF FILL h: 5.91 ft SINCE THE COVER OVER THE TOP SLAB IS GREATER THAN 2 FT, THE LIVE LOAD IS DISTRIBUTED IN DISTRIBUTE CONCENTRATED LOAD? NO ACCORDANCE WITH AASHTO 4.6.2.10. NCLUDE LL IMPACT (AASHTO 3.6.2.1)? NO WHEELS ALONG LENGTH: 100 # WHEELS ON ALONG WDTH: 2.00 HI-93 WHEEL LOAD 16.00 isps DISTRIBUTION WDTH, HORT SIDE, d1: 5.91 ft <=== Quick check, this dist should be less than	DL8, SOIL ON TOP SLAB			70.62 kips			
TWO WAY SLAB NO, Use one way slab for top slab design SEE AASHTO 4.6.2.15 ***CHECK fs_max values belownot setup for one-way slab*** Per AASHTO 12.11.2.1, when the depth of fill is less than 2 ft, the wheel load shall be distributed as in slabs with concentrated loads (4.6.2.10). And also based on the distribution of the wheel load through earth fill DEPTH OF FILL, h: 5311 SINCE THE COVER OVER THE TOP SLAB IS GREATER THAN 2 FT, THE LIVE LOAD IS DISTRIBUTED IN ACCORDANCE WITH AASHTO 4.6.2.10. NCLUDE LL IMPACT (AASHTO 3.6.2.1)? NO ACCORDANCE WITH AASHTO 4.6.2.10. WHEELS ALONG LENGTH: 100 # WHEELS ON ALONG WIDTH: 2.00 HI93 WHEEL LOAD 16.00 IDISTRIBUTION WDITH, LONG SIDE, d1: 5.91 DISTRIBUTION WDITH, LONG SIDE, d2: 12.00 TOTAL UNIFORM LIVE LOAD, w: 0.45				0.68 ksf			
DEPTH OF FILL, h: 5.91 ft SINCE THE COVER OVER THE TOP SLAB IS GREATER THAN 2 FT, THE LIVE LOAD IS DISTRIBUTED IN DISTRIBUTE CONCENTRATED LOAD? NO ACCORDANCE WITH AASHTO 4.6.2.10. NCLUDE LL IMPACT (AASHTO 3.6.2.1)? NO # WHEELS ALONG LENGTH: 100 # WHEELS ALONG VIDTH: 200 HI-93 WHEEL LOAD 16.00 kips DISTRIBUTION WDITH, SHORT SIDE, d1: 5.91 ft SINCE THE Cock, this dist should be less than 22.34 ft, which would be dist length if areas don't overlap TOTAL UNIFORM LIVE LOAD, wi: 0.45 ksf		NO, Use one way slab	·····	SEE AASHTO 4.6.2.1.5	***CHECK fs_max	values belownot setup for one-way slab***	
HI-93 WHEEL LOAD 16.00 kips DISTRIBUTION WDITH, SHORT SIDE, d1: 5.91 ft VIENDEVION WDITH, LONG SIDE, d2: 12.00 ft	DEPTH OF FILL, h: DISTRIBUTE CONCENTR INCLUDE LL IMPACT (AAS LIVE LOAD IMPACT (AAS) # WHEELS ALONG LENG	ATED LOAD? HTO 3.6.2.1)? HTO 3.6.2.2): TH:	5.91 ft NO NO 1.00 1.00	SINCE THE COVER OVER THE TO	OP SLAB IS GREATER T		
	HI-93 WHEEL LOAD DISTRIBUTION WDITH, SH DISTRIBUTION WDITH, LO TOTAL UNIFORM LIVE LO	IORT SIDE, d1: NG SIDE, d2:	16.00 kips 5.91 ft 12.00 ft 0.45 ksf			.	

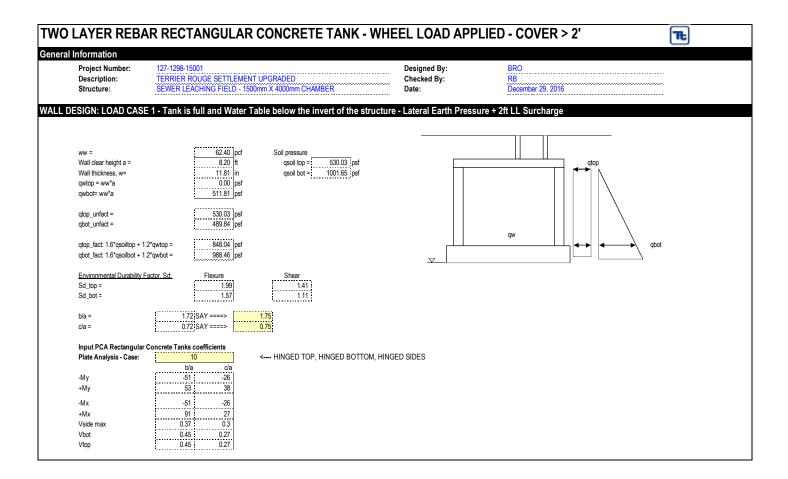
nformation			
Project Number:	127-1298-15001	Designed By:	BRO RB
Description: Structure:	TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER	Checked By:	RB December 29, 2016
Structure:	SEWER LEACHING FIELD - 1300/11/11 X 4000/11/11 CHAMBER	Date:	
ral Reinforcement in the	e Roof Slab:		
		V	/erify long rebar meets AASHTO 5.14.4
1	Bar Dia. (mm) As bar (in) db (in) Spg (in) As prov (in ²)		% Distribution Steel = 41.15 %
Short Direction, Bottom	25.00 0.7609 0.9843 5.12 1.78		As long required = 0.73 in ²
Long Dir, Bottom	20.00 0.4869 0.7874 5.12 1.14		As long provided = 1.14 in ² OK
·····			
First, consider steel in			
	noment - Center - (Rebar at Bottom of Slab)		
	DL + LL + SL 1327.49 psf 2DL+1.6LL+1.6SL) 2045.24 psf		
	· · · · · · · · · · · · · · · · · · ·		
S _d : M+Coeff:	2.06		
M+=MCo	eff*q*c²/1000*S _d : 18.38 {ft*kips		
Top Slab	Thickness: 1.31 ft		
Cover =	2.00 in.		
d (M+) sh			
fc =	4.00 ksi		
bw =	12.00 (per linear ft of slab)		
	oment Capacity (M+):		
As T & S=	()		
Asprov =	1.78 in2 Asprov>As T&S, OK		
a =As*Fy/ phif =	(0.85*fc*b): 2.62 in 0.90		

P:\1298\127-1298-15001\SupportDocs\Calcs\Structural\Terrier Rouge\Sewer Leaching Field\Sewer Leaching Field - 1500mm x 4000mm Chamber - 1800mm Cover

Project Number:	127-1298-15	001		Designed By:	BRO RB	
Description:	TERRIER R	OUGE SETTLEMENT UP	GRADED	Checked By:		
Structure:	SEWER LEA	ACHING FIELD - 1500mm	X 4000mm CHAMBER	Date:	December	<u>r 29, 2016</u>
lexural Reinforcement in	the Roof Slab Cont.	:				
Next, consider steel						
		Rebar at Bottom of Slab)				
	t = DL + LL + SL	1327.49 psf				
	(1.2DL+1.6LL+1.6SL)	2045.24 psf				
S _d :	"	2.06				
M+Co		0.125				
M+=M	1Coeff*q*c²/1000*S _d :	0.00 ft*kips	Since one way slab design is used the	ere is no moment considered i	n the long direction	
d (M+)) long =	12.37 in. = t - cover	- db(short) - 1/2db(long)			
fc=		4.00 ksi				
bw =		4.00 ksi 12.00 (per linear ft c	of slab)			
	Moment Capacity (M+					
As T 8		0.34 in2	=0.0018bh			
Asprov		1.14 in2	Asprov>As T&S, OK			
a =As ⁻ phif =	*Fy/(0.85*fc*b):	1.68 in 0.90				
PHI*M		59.23 kip*ft				
PHIM M+=	in -	0.00 POS MOME	NT CAPACITY O.K.			
Owerste Oberste, Obers		- 4	0.0.0			
Crack Check - Chec	k maximum spacing	of bars (ACI 350 Section 1	10.6.4)			
	k maximum spacing	of bars (ACI 350 Section 1	<u>10.6.4)</u>		Unfactored Moment:	
Unfact		of bars (ACI 350 Section 1 1.33 ksf	<u>10.6.4)</u>		Unfactored Moment: qunfact =(DL+LL+SL)	1.33 iksf
<u>Unfact</u> qunfac	tored Moment:		<u>10.6.4)</u>			1.33 ksf 0.00 tt*kips
<u>Unfact</u> qunfac	tored Moment: ct =(DL+LL+SL)	1.33 ksf	<u>10.6.4)</u>		qunfact =(DL+LL+SL)	1.33 ksf 0.00 ft"kips
<u>Unfact</u> qunfac M+ un	tored Moment: ct =(DL+LL+SL)	1.33 ksf 5.79 ft*kips	<u>10.6.4)</u>		qunfact =(DL+LL+SL)	0.00 ft*kips
<u>Unfact</u> qunfac M+ un	tored Moment: xt =(DL+LL+SL) ffactored= Check (M+ bottom fai	1.33 }ksf 5.79 ft*kips ce short reinf.): 1.78 {in2	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored=	0.00 it*kips f <u>ace long reinf.):</u> 1.14 in2
<u>Unfact</u> qunfac M+ un <u>Crack</u>	tored Moment: xt =(DL+LL+SL) ffactored= Check (M+ bottom fai	1.33 ksf 5.79 ft*kips ce short reinf.): 1.78 in2 13.26 in	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= <u>Crack Check (M+ bottom</u>	0.00 ft"kips face long reinf): 114 in2 12.37 in
<u>Unfact</u> qunfac M+ un <u>Crack</u> Asprov	tored Moment: xt =(DL+LL+SL) ffactored= Check (M+ bottom fai	1.33 }ksf 5.79 ft*kips ce short reinf.): 1.78 {in2	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= <u>Crack Check (M+ bottom</u> Asprov =	0.00 it*kips f <u>ace long reinf.):</u> 1.14 in2
<u>Unfact</u> qunfac M+ un <u>Crack</u> Asprov d=	tored Moment: xt =(DL+LL+SL) ffactored= Check (M+ bottom fai	1.33 ksf 5.79 ft*kips <u>ce short reinf):</u> 1.78 in2 13.26 in 8.04 0.011	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d=	0.00 HTkips face long reinf.): 1.14 in2 12.37 in 8.04 0.006
Un <u>fact</u> qunfac M+ un <u>Crack</u> Asprov d= n=	tored Moment: xt =(DL+LL+SL) ffactored= Check (M+ bottom fai	1.33 ksf 5.79 ft*kips ce short reinf.): 1.78 in2 1.3.26 in 8.04 0.011 0.000	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n=	0.00 ft*kips face long reinf.): 1.14 in2 1.237 in 8.04 0.008 0.062
Un <u>fact</u> qunfac M+ un Asprov d= n= p= pn= k=	tored Moment: xt =(DL+LL+SL) ffactored= Check (M+ bottom fai	1.33 ksf 5.79 ft*kips ce short reinf): 1.78 in2 13.26 in 8.04 0.011 0.099 0.344	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= ρ= pn= k=	0.00 ft*kips face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295
Un <u>fact</u> qunfac M+ un C <u>rack</u> Asprov d= n= p= p=	tored Moment: xt =(DL+LL+SL) ffactored= Check (M+ bottom fai	1.33 ksf 5.79 ft*kips ce short reinf.): 1.78 in2 1.326 in 8.04 0.011 0.090 0.344 0.885	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= ρ= pn=	0.00 ft*kips face long reinf.): 1.14 in2 1.237 in 8.04 0.008 0.062
Un <u>fact</u> qunfac M+ un Asprov d= n= p= k= j=	tored Moment: xt =(DL+LL+SL) ffactored= Check (M+ bottom fai	1.33 ksf 5.79 ft*kips ce short reinf.): 1.78 in2 1.326 in 8.04 0.011 0.090 0.344 0.885	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= ρ= pn= k=	0.00 ft*kips face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295
Un <u>fact</u> qunfac M+ un Asprov d= n= p= k= j= M+ un	tored Moment: xt =(DL+LL+SL) ffactored= <u>Check (M+ bottom fa</u> v =	1.33 ksf 5.79 ft*kips ce short reinf): 1.78 in2 13.26 in 8.04 0.011 0.099 0.344 0.885 5.787 kips.ft	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= p= pn= k= j= M+ unfactored=	0.00 ft*kips face long reinf.): 1.14 in2 12.37 in 8.04 0.062 0.062 0.295 0.902 0.000 kips.ft
Un <u>fact</u> qunfac M+ un Asprov d= n= p= k= j=	tored Moment: xt =(DL+LL+SL) ffactored= <u>Check (M+ bottom fa</u> v =	1.33 ksf 5.79 ft*kips ce short reinf.): 1.78 in2 1.326 in 8.04 0.011 0.090 0.344 0.885	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= φ= φ= φn= k= j=	0.00 #**kips face long reinf.): 1.14 in2 12.37 in 8.04 0.008 0.062 0.295 0.902
Un <u>fact</u> qunfac M+ un <u>Crack</u> Asprov d= n= p= k= j= M+ un fs=	tored Moment: xt =(DL+LL+SL) ffactored= <u>Check (M+ bottom fa</u> v =	1.33 ksf 5.79 ft*kips ce short reinf): 1.76 in2 13.26 in 8.04 0.011 0.090 0.344 0.885 5.787 kips.ft 3.317 ksi	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= p= pn= k= j= M+ unfactored= fs=	0.00 #Tkips face long reinf.): 1.14 12.37 in 8.04 0.008 0.062 0.295 0.902 0.902 0.000 kps.ft 0.000 ksi
Un <u>fact</u> qunfac M+ un Asprov d= n= p= k= j= M+ un fs=	tored Moment: xt =(DL+LL+SL) ffactored= <u>Check (M+ bottom fa</u> v =	1.33 ksf 5.79 ft*kips ce short reinf): 1.76 in2 13.26 in 8.04 0.011 0.090 0.344 0.885 5.787 kips.ft 3.317 ksi	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= p= pn= k= j= M+ unfactored= fs=	0.00 #Tkips face long reinf.): 1.14 12.37 in 8.04 0.062 0.062 0.295 0.902 0.902 0.000 kips.ft 0.000 ksi
Un <u>fact</u> qunfac M+ un Asprox d= n= p= k= j= M+ un fs= s=	tored Moment: xt =(DL+LL+SL) ffactored= <u>Check (M+ bottom fa</u> v =	1.33 ksf 5.79 ft*kips ce short reinf): 1.78 m2 13.26 m 8.04 0.011 0.090 0.344 0.885 5.787 kips.ft 3.317 ksi 1.35 1.18 m	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= p= pn= k= j= M+ unfactored= fs= s=	0.00 #Tkips face long reinf.); 1.14 12.37 in 8.04 0.008 0.002 0.295 0.902 0.902 0.000 kips.ft 0.000 ksi
Un <u>fact</u> qunfac M+ un Asprov d= n= p= k= j= M+ un fs=	tored Moment: xt =(DL+LL+SL) ffactored= <u>Check (M+ bottom fa</u> v =	1.33 ksf 5.79 ft*kips ce short reinf): 1.76 in2 13.26 in 8.04 0.011 0.090 0.344 0.885 5.787 kips.ft 3.317 ksi	<u>10.6.4)</u>		qunfact =(DL+LL+SL) M+ unfactored= Crack Check (M+ bottom Asprov = d= n= p= pn= k= j= M+ unfactored= fs=	0.00 #Tkips face long reinf.): 1.14 12.37 in 8.04 0.062 0.062 0.295 0.902 0.902 0.000 kips.ft 0.000 ksi

Project Number:	127-1298-15001	Designed By:	BRO RB	
Description: Structure:	TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER	Checked By: Date:	RB December 29, 2016	
r Capacity of Top Slab				
qunfact =	DL + LL + SL 1.33 ksf			
	2DL+1.6LL+1.6SL) 2.05 ksf			
S _d :	1.46			
Csmax =	0.50 0.75			
phiv =				
d = fc =	13.26 in. = t - cover - 1/2db(short)			
bw =	4.00 ksi 12.00 (coar linear ft of wall)			
51	12.00 (per linear ft of wall)			
Check Sh	ear in Roof Slab			
Vc = 2*fc				
PHI*Vc =				
Vu = Cs*o	sters a shear capacity o.K.			
Shear Fri	ction			
u:	1.000 11.6.4.3 0.75			
phiv:	0.75			
Avf (req'd)=Vu/(Fy*u*phi): 0.20 in ²			
As (provid				

TWO LAYER R	REBAR REC	TANGULAR (CONCRETE TANK - WHE	EEL LOAD API	PLIED - COVER > 2'	TŁ
General Information						
Project Numb Description: Structure:	TERRIER I	ROUGE SETTLEMENT L	JPGRADED Im X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
W W Br	w = Vall clear height a = Vall thickness, w= dtom slab thickness f = w = ww*a	62.40 pcf 8.20 ft 11.81 in 1.31 ft 511.81 psf	Use at rest Soil pressure Ko			



Project Nu Descriptio Structure: IEAR DESIGN LOA	n: TERRIE SEWER	R ROUGE SETTL LEACHING FIEL 0.75 0.55	D - 1500mm X 40 ksf ksf (per linear ft of wa	000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
	ADS qtopfact * $S_d =$ qboffact * $S_d =$ bw = Vuside= Vuside= Vutop =	0.75 0.55 12.00 1.96 2.38	D - 1500mm X 40 ksf ksf (per linear ft of wa	100mm CHAMBER	~~~~		
	ADS qtopfact * $S_d =$ qbotfact * $S_d =$ bw = Vuside= Vuside=	0.75 0.55 12.00 1.96 2.38	ksf ksf (per linear ft of wa	1)	Date:	December 29, 2016	
SHEAR DESIGN LO	qtopfact * S_d = qbotfact * S_d = bw = Vuside= Vutop =	0.55 12.00 1.96 2.38	ksf (per linear ft of wa klf <=	ll) - Shaar at aida af wall in ganagasasia			
	qtopfact * S_d = qbotfact * S_d = bw = Vuside= Vutop =	0.55 12.00 1.96 2.38	ksf (per linear ft of wa klf <=	II) = Shos et eide of well is compression			
	qbotfact * S _d = bw = Vuside= Vutop =	0.55 12.00 1.96 2.38	ksf (per linear ft of wa klf <=	II) - Shoar at side of wall is comprocess			
	qbotfact * S _d = bw = Vuside= Vutop =	0.55 12.00 1.96 2.38	ksf (per linear ft of wa klf <=	II) - Shaar at aida af wall is compression			
	bw = Vuside= Vutop =	12.00 1.96 2.38	(per linear ft of wa klf <=	ll) - Shoor at side of well is compression			
	Vuside= Vutop =	1.96 2.38	klf <=	ll) - Shoar at side of wall is compression			
	Vutop =	2.38	kif <=		ALX: 0 11 0		
				 Shear at top of wall is tensile force (
	VUDOL -	2.30			rce or compression force (Nu) in base slab		
			{NI <-		ce or compression force (Nu) in base slab		
	Tension reinforcement re	equirement for floor s	alab and roof slab:				
	Tubot =	2.38	klf				
	Tutop =	2.38	klf				
	phiT=	0.90	}				
Bot slab	Ast =Tu/(Fy*phiT):	0.044	in^2/ft	Main Reinforcement Di	rection		
Top slab	Ast =Tu/(Fy*phiT):	0.044	in^2/ft	Main Reinforcement Di	rection		
·			٠				
	OADS - Vertical Reinforc	ement (MAIN PEI					
LEXONE DEGION E	qtopfact * S _d =	1.05					
	gbotfact * S _d =	0.77	{				
	bw =		(per linear ft of wa	ID			
ative moment	Muneg =	-3.13		") Itside Face Reinforcement			
tive moment	Mupos =			side Face Reinforcement			
			3				
FLEXURE DESIGN L	OADS - Horizontal Reinfo	orcement (MAIN R	EINFORCEMENT	ī)			
		40.00	3	10			
	bw =		(per linear ft of wa				
ative moment tive moment	Muneg = Mupos =	-3.13 3.25	κ.π/π Ou	itside Face Reinforcement side Face Reinforcement			

nformation					
Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEN SEWER LEACHING FIELD -	IENT UPGRADED 1500mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
SIGN: LOAD CASE	E 2 - Tank is empty and w	rater table at its highest elevation ·	- Lateral Earth Pressure + 2	ft LL Surcharge	
Surcharge = Soil = Wet Soil = Water = qtop_unfact = qtop_unfact = qtop_fact 1.6°qtop_unfact qtot_fact 1.6°qtop_unfact Environmental Durability F	= 1602.64 psf	gbot 115.00 psf 866.65 psf 0.00 psf 0.00 psf			p dbot
Environmental Durability F Sd_top = Sd_bot =	actor, Sd: Flexure 1.99 1.99	5near 1.41 1.41			
b/a = c/a =	1.72 SAY ====> 0.72 SAY ====>	1.75 0.75			
Input PCA Rectangular	Concrete Tanks coefficients		In	put PCA Rectangular Concrete Tanks coef	ficients
Plate Analysis - Case: -My +My -Mx +Mx Voide max Vbot Vtop	10 bla cla -51 -26 63 38 -51 -26 91 27 0.37 0.3 0.45 0.27	< HINGED TOP, HINGED BOTTON HINGED SIDES	۸, PI -N +۱ -N -N -N -N -N -N -N -N -N - - 	late Analysis - Case: 5 b/a Ny -30 Ny 30	< HINGED TOP, da BOTTOM, HING -17 -17 -17 -18 0.18 0.21 0.06

TWO LA General Inf		R RECTANGULAR (CONCRETE TANK - W	HEEL LOAD APP	PLIED - COVER > 2'	æ
P	Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEMENT L SEWER LEACHING FIELD - 1500m		Designed By: Checked By: Date:	BRO RB December 29, 2016	
A.) SHEAR DE	ESIGN LOADS					
B.) FLEXURE	qtopfact * S; qbotfact * S; qtopfact - qt bw = Vuside= Vutop = Vutop = DESIGN LOADS - Vertin qtopfact * S; qtopfact * S; qtopfact - qt bw =	= 2.25 ksf otfact = 1.06 ksf 12.00 kpr linear 5.36 kf 5.62 kif cal Reinforcement (MAIN REINFORCEM 1= 1.68 3.18 ksf	<== Shear at side of wall is compression <== Shear at top of wall is compressiom <== Shear at bottom of wall is compressi ENT)	(Nu) in roof slab		
Negative mome	ent Muneg =	-8.80 k.ft/ft	Outside Face Reinforcement			
Positive moment	nt Mupos =	15.14 k.ft/ft	Inside Face Reinforcement			
C.) FLEXURE	DESIGN LOADS - Horiz	contal Reinforcement (MAIN REINFORCI	EMENT)			
Negative mome Positive mome	0	12.00 (per linear -8.80 k.ft/ft 9.03 k.ft/ft	ft of wall) Outside Face Reinforcement Inside Face Reinforcement			

TWO LAYER REBA General Information	R RECTANGULAR CONCRETE TANK - WH	IEEL LOAD APPL	LIED - COVER > 2'
Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016
WALL DESIGN: LOAD CASE	: 3 - Under Seismic Loads + 2ft LL Surcharge		
qitop = qibot = qetop = qebot = qtop_unfact = qtop_fact: 1.6*qitop + 1.0*qr qbot_fact: 1.6*qitop + 1.0*qr b/a = c/a =	ebot = 1572.92 psf 1.72 SAY ====> 1.75 0.72 SAY ====> 0.75	▼	dpot
Input PCA Rectangular C Plate Analysis - Case: -My +My -Mx +Mx Vside max Vbot Vtop	Concrete Tanks coefficients 10 HINGED TOP, HINGED BOTTOM, HI b/a c/a -51 -26 53 -38 -51 -26 91 -27 0.37 -0.3 -0.45 -0.27 0.45 -0.27	NGED SIDES	

TWO LA	YER REBA	R RECTANGULAR CONCRETE TAN	K - WHEEL LOAD APP	PLIED - COVER > 2'	æ
General Info	ormation				
De	oject Number: escription: ructure:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	 •
A.) SHEAR DES	SIGN LOADS				
B.) FLEXURE D	qtopfact = qbotfact = bw = Vuside = Vutop = Vutop = Vubot =	1.57 ksf < No Sd for Seismic load co	mbinations ACI 350 Section 21.2.1.8 mbinations ACI 350 Section 21.2.1.8 ompression (Nu) in other side wall mpressiom (Nu) in roof slab s compressiom (Nu) in base slab		
Negative momen Positive moment	•		mbinations ACI 350 Section 21.2.1.8 mbinations ACI 350 Section 21.2.1.8 nt		
C.) FLEXURE D	ESIGN LOADS - Horiz	ontal Reinforcement (MAIN REINFORCEMENT)			
Negative momen Positive moment	•	12.00 (per linear ft of wall) 5.40 k.ft/ft Outside Face Reinforcemer 5.61 k.ft/ft Inside Face Reinforcement	ıt		

	AR RECTANGULA	R CONCRETE TA	NK - WHEEL LOAD AP	PLIED - COVER > 2	Æ
nformation Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEM SEWER LEACHING FIELD - 1		Designed By: Checked By: Date:	BRO RB December 29, 2016	
WALL REINFORCE	MENT				
Wall - Vertical (outside) Wall - Horiz (outside) Wall - Vertical (inside) Wall - Horiz (inside)	Bar Dia. (mm) As bar (in) 16.00 0.3116 16.00 0.3116 16.00 0.3116 16.00 0.3116 16.00 0.3116 16.00 0.3116	b (in) Spg (in) As prov (in') 0.6299 6.69 0.4 0.6299 6.69 0.4 0.6299 6.69 0.4 0.6299 6.69 0.4 0.6299 6.69 0.4	6 6		
Check Shear Capacity:					
DESIGN I Vubot, tota Vutop, tota Vuside, to	al: 2.38 al: 2.38	d Case 2 Load Case 3 7.10 5.81 5.62 5.81 5.36 4.77	Max (kips) 7.10 5.81 5.36		
phiv = Wall Thick	·····				
Cover = d (M+) ver fc = bw =	4.00 ksi	w - cover - 1/2db(vert) linear ft of wall)	d (M+) horiz =	8.87 {in. = w - cover - db(vert) - 1/2db(horiz)	
Check Sh Vc = 2*fc' PHI*Vc = Vubot =	10.81 kips	AR CAPACITY O.K.	<u>Check Shear in Tank Wall - sic</u> Vc = 2*(1)*fc^.5*bw*d PHI*Vc = Vubot =	le 13.46 (kips 10.09 (kips 5.36 (SHEAR CAPACITY O.K.	
<u>Shear Fric</u> u: phiv:	tion 1.000 0.75	11.6.4.3			
	=Vu/(Fy*u*phi): 0.16 in ²	ок			

Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
Check Flexural Capacity:				
Steel Vertical Horizontal	DESIGN LOADS Load Case 1 Load Case 2 Load Case 3 Mu+ inside face reinf. 5.58 15.14 9.63 Mu- outside face reinf. 3.13 -8.80 -5.40 Mu+ inside face reinf. 3.25 9.03 5.61 Mu- outside face reinf. -3.13 -8.80 -5.40	Max (k*ft) Max (kp*in) 15.14 181.74 -8.80 -105.60 9.03 108.32 -8.80 -105.60		
Design for Vertical Bendi	ng Moments (determine Vertical Steel):			
Wall Thickn Cover (insid d (M+) vert = d (M+) horiz fc = bw =	a) = 2.00 in. 9.50 in. = w - cover - 1/2db(vert)	Cover (outside) = d (M-) vert = d (M-) horiz =	2.00 jin. 9.50 jin. = w - cover - 1/2db(vert) 8.87 jin. = w - cover - db(vert) - 1/2db(horiz)	
Check Mom As T & S= Asprov = a =As*Fy/(0 phif = PHI*Mn = Mu+ inside f	0.90 22.84 kip*ft	Check Moment Capacity (Mu- out As T & S = As = a = As*Fyl(0.85*fc*b): phi = PHI*Mn = ABS Mu- ourside face=	tside face reinf.): 0.21 in 2 =0.0030bh/2 0.56 in 2 Asprov>As T&S, OK 0.82 in 22.84 kp*ft 8.80 NEG MOMENT CAPACITY O.K.	
Next, consider steel in ho	rizontal direction.			
Check Mom As T & S= Asprov = a =As*Fy/(0 phif = PHI*Mn = Mu+ inside 1	0.90 21.26 kip*ft	Check Moment Capacity (Mu-out As T & S= As = a =As*Fyi(0.85*fo*b): phi = PHI*M n = AS SMu-ourside face=	listle face reinf.): 0.21 in.2 =0.0030bh/2 0.55 in.2 Asprov>As T&S, OK 0.82 in	

Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SETT SEWER LEACHING FIEL	LEMENT UPGRADED LD - 1500mm X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016
	aximum spacing of bars (AC			
Unfactored	Moment: Load Case 1	Load Case 2 Load Case 3		
M+ vert ur				
M- vert un	factored= -0.93	-2.61 -5.16		
M+ horiz u	infactored= 0.96	2.67 5.36		
M- horiz u	nfactored= -0.93	-2.61 -5.16		
Crack Che	ck (M+ inside face vertical reinf.):	Crack Check (Mu- outsid	ide face vertical rainf):
Asprov =		in2	As =	0.56 in2
d=	9.50		d=	9.50 in
n=	8.04		n =	8.04
ρ=	0.015		ρ=	0.015
	0.013		p= pn=	0.118
ρn= k=			k=	
	0.382 0.873			0.382
j= Mu unfort			j= M- unfactored=	
M+ unfact		kips.ft	fs=	5.160 kips.ft
fs=	23.867	jkai	15-	13.376 ksi
β=	1.35	[]	β=	1.35
s=	6.693	l in	s=	6.693 in
db=	0.630) jin	db=	0.630 in
fs,max=	23.665	**N.G REDUCE INSIDE FACE BAR SPACING****	fs,max=	23.665 OUTSIDE FACE BAR SPACING O.K.
		OK PER INSPECTION		
Crack Che	ck (M+ inside face horiz reinf.):		Crack Check (Mu- outsid	ide face horiz reinf.):
Asprov =		i in2	As =	0.56 in2
d=	8.87	' in	d=	8.87 in
n=	8.04		n =	8.04
ρ=	0.016	j l	ρ=	0.016
pn=	0.127	7	pn=	0.127
k=	0.392		k=	0.392
j=	0.869		j=	0.869
M+ unfact	ored= 5.362	kips.ft	M- unfactored=	5.160 kips.ft
fs=	14.946		fs=	14.382 ksi
β=	1 35	i l	β=	135
μ- s=	1.35 6.693	in	s=	1.35 6.693 in
			db=	·
db= fs.max=	0.630	INSIDE FACE BAR SPACING O.K.	uu-	0.630 in 23.665 OUTSIDE FACE BAR SPACING O.K.

TWO	LAYER REBA	R RECTANGU	LAR CONCRETE TAN	(- WHEEL LOAD	APPLIED - COVE	R > 2'	T E
General	Information						
	Project Number:	127-1298-15001		Designed By:	BRO		
	Description: Structure:	TERRIER ROUGE SET SEWER LEACHING FIE	ILEMENT UPGRADED ILD - 1500mm X 4000mm CHAMBER	Checked By: Date:	RB December 29,	2016	
DUOV							
BUUT/	ANCY CHECK (F	LOTATION)					
	This loading condition check	s for flotation.					
				-			
	Ground water height:	0.00 ft		-			
A.) Dead Lo	oad						
,			(t		<u> </u> T	
	TOTAL DL:		160.02 kips				
B.) Bouyan	t Force						
		_					
	TOTAL BOUYANT FORCE		0.00 kips				
C). Safety F	actor						
			()				
	Safety Factor = DL / B		16002205.56 > 1.25, OK				

			JLAR CONCRE	ETE TANK - W	HEEL LOAD APP	LIED - COVER > 2'	TŁ
General	Information Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SE SEWER LEACHING F	TTLEMENT UPGRADED IELD - 1500mm X 4000mm (CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
DESIG	IN BASE SLAB						
	DL1, ROOF SLAB: DL2, WALLS:		136.46 cf conc = 323.13 cf conc =	20.47 kips 48.47 kips		▽	
	DL6, SOIL ON FTG EXT . DL5, SOIL ON FTG EXT - DL8, SOIL ON TOP SLAE DL7, SOIL ON TOP SLAE TOTAL DL CONC: TOTAL DL SOIL: TOTAL DL SOIL: TOTAL SOIL LOAD, EV: TOTAL UNIFORM LIVE L HYDROSTATIC, B: gunfact = DL + LL + EV + E	- WET: 3 - DRY: 3 - WET: .OAD, LL:	0.00 ef soil = 0.00 ef soil = 614.05 ef soil = 0.00 ef soil =	0.00 kips 0.00 kips 70.62 kips 0.00 kips 70.62 kips 70.62 kips 70.62 kips 70.62 kips 0.66 ksf 0.66 ksf 0.66 ksf	BEARING PRESSURE OK		
	qfact = 1.2*DL + 1.75*LL +	- 1.3*EV +1.0*B PER AASH .6*EV +1.2*B PER ACI 318	ГО	1.65 ksf 2.22 ksf 2.37 ksf	BEARING PRESSURE OK		
	b/c =	2.39 SAY ====	=> 1.25				
	Input PCA Rectangular Plate Analysis - Case: -My +My -Mx +Mx Vside max	Concrete Tanks coefficient 10 45 48 48 46 63 0.36	is HINGED TOP, HINGEI) Bottom, Hinged Sid	ES		

General Inform	ation					
Project Number: Description: Structure:		127-1298-15001 TERRIER ROUGE SETTLEMENT UP SEWER LEACHING FIELD - 1500mm	GRADED X 4000mm CHAMBER	Designed By: Checked By: Date:	BRO RB December 29, 2016	
A.) SHEAR DESIG	LOADS					
B.) FLEXURE DES	qfact * S _d = bw = Muneg =	5.24 ksf 12.00 (per linear ft -8.22 k.ft/ft	<== Shear at side of wall is compression of wall) Outside Face Reinforcement	(Nu) in other side wall		
Positive moment	Mupos =	11.51 jk.ft/ft	Inside Face Reinforcement			
C.) FLEXURE DES	-					
	qfact * S _d =	5.24 ksf				
	bw =	12.00 (per linear ft	of wall)			
Negative moment	Muneg =	-8.22 k.ft/ft	Outside Face Reinforcement			
Positive moment	Mupos =	8.77 k.ft/ft	Inside Face Reinforcement			

formation				
Project Number:	127-1298-15001	Designed By:	BRO	
Description:	TERRIER ROUGE SETTLEMENT UPGRADED	Checked By:	RB	
Structure:	SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER	Date:	December 29, 2016	
Design Flexural Reinfor	cement in the Base Slab:			
	Bar Dia. (mm) As bar (in) db (in) Spg (in) As prov (in ²)			
Short Direction, Inside	20.00 0.4869 0.7874 7.87 0.74			
ong Dir, Inside	20.00 0.4869 0.7874 7.87 0.74	4		
Short Direction, Outside	<u>16.00</u> 0.3116 0.6299 7.87 0.47	<u>7</u>		
Long Dir, Outside	<u>16.00 0.3116 0.6299 7.87</u> 0.47			
phiv =	0.75			
Base Slab	· · · · · · · · · · · · · · · · · · ·		0.00	
Cover (insi	· · · · · · · · · · · · · · · · · · ·	Cover (outside) =	3.00 in.	
d (M+) sho	••••••••	d (M-) short =	12.43 in. = f - cover - 1/2db(short)	
d (M+) lon		d (M-) long =	11.80 in. = f - cover - db(short) - 1/2db(long)	
fc=	4.00 ksi	dmin=	11.57 in.	
bw =	12.00 (per linear ft of slab)			
Check She	ar in Base Slab			
Vc = 2*fc^				
PHI*Vc =	13.17 kips			
Vu = Cs*q				
	······································			
Check Mo	nent Capacity (Mu (short)+ inside face reinf.): Mx+	Check Moment Capacity (Mu (short)- outside face reinf.): Mx-	
As T & S=	0.28 in2 =0.0030bh/2	As T & S=	0.28 in2 =0.0030bh/2	
Asprov =	0.74 in2 Asprov>As T&S, OK	As =	0.47 in2 Asprov>As T&S, OK	
a =As*Fy/(0.85*f°c*b): 1.09 in	a =As*Fy/(0.85*fc*b):	0.70 in	
phif =	0.90	phi =	0.90	
PHI*Mn =	39.43 kip*ft	PHI*Mn =	24.48 kip*ft	
Mu+ inside	face reinf= 11.51 POS MOMENT CAPACITY O.K.	ABS Mu- ourside face=	8.22 NEG MOMENT CAPACITY O.K.	
	nent Capacity (Mu (long)+ inside face reinf.): My+	Check Moment Capacity (Mu (
As T & S=	0.28 in2 =0.0030bh/2	As T & S=	0.28 in2 =0.0030bh/2	
Asprov =	0.74 in2 Asprov>As T&S, OK	As =	0.47 in2 Asprov>As T&S, OK	
a =As*Fy/(a =As*Fy/(0.85*f'c*b):	0.70 in	
phif =	0.90 36.80 kip*ft	phi =	0.90 25.82 kip*ft	
PHI*Mn =	36.80 kip*ft	PHI*Mn =	25.82 kip*ft	

formation				
Project Number:	127-1298-1500)1	Designed By:	BRO RB
Description:	TERRIER RO	UGE SETTLEMENT UPGRADED	Checked By:	RB
Structure:	SEWER LEAC	HING FIELD - 1500mm X 4000mm CHAMBER	Date:	December 29, 2016
Crack Check - Check r	naximum spacing o	f bars (ACI 350 Section 10.6.4)		
Unfactore	ed Moment:	oad Case 1		
) unfactored=	3.63		
) unfactored=	-2.59		
	unfactored=	2.76		
	unfactored=	-2.59		
Crack Ch	eck (M(short)+ inside	face reinf.): M+x	Crack Check (Mu(short)-	- outside face reinf.): M-x
Asprov =		0.74 in2	As =	0.47 in2
d=		12.35 in 8.04	d=	1180_in 8.04
n=		8.04	n =	8.04
ρ=	1	0.005	ρ=	0.003
ρn=		0.040	pn=	0.027
k=		0.246	k=	
j=		0.246 0.918	j=	0.207
, M+ unfac	tored=	3.625 kips.ft	M- unfactored=	2.589 kips.ft
fs=		5.170 ksi	fs=	5.954 ksi
β=	:	1.35 }	β=	1.35
s=	Ì	7.874 in	S=	7.874 in
db=		0.787 in	db=	0.630 in
fs,max=		20.900 INSIDE FACE BAR SPACING O.K.	fs,max=	21.085 OUTSIDE FACE BAR SPACING O.K.
Crack Ch	eck (M(long)+inside	face reinf.): M+y	Crack Check (Mu(long)-	outside face reinf.): M-y
Asprov =		0.74 in2	As =	0.47 in2
d=		11.57 in	d=	12.43 in
n=		8.04	n =	8.04
ρ=		0.005	ρ=	0.003
ρn=	ĺ	0.043	pn=	0.026
k=	ſ	0.253	k=	0.202
j=		0.916	j=	0.933
M+ unfac	tored=	2.762 kips.ft	M- unfactored=	2.589 kips.ft
fs=	ľ.	4.218 ksi	fs=	5.643 ksi
β=	Ï	1.35	β=	1.35
s=		7.874 in	s=	7.8/4 in
db=	1	0.787 in	db=	0.630 in
fs,max=	1	20.900 INSIDE FACE BAR SPACING O.K.	fs,max=	21.085 OUTSIDE FACE BAR SPACING O.K.

Information										
Project Number:	127-1298-15001			Designed By:	BRO	BRO				
Description:	TERRIER ROUGE S	ETTLEMENT UPGRADED		Checked By:	RB					
Structure:	SEWER LEACHING	FIELD - 1500mm X 4000mm	1 CHAMBER	Date:	December 29, 2016	5				
References:	ACI 350-06 Code Requ	ACI 350-06 Code Requirements for Environmental Engineering Concrete Structures								
		Design of Liquid-Containing Concr Design Specifications 4th Edition								
Notes:										
Destand Des										
Design Load Par	rameters									
Liquid-C	Containing Concrete Struct	ure								
•										
	TRY INFORMATION INPUT:			OTHER PARAMETERS	<u>S:</u>					
	TRY INFORMATION INPUT:	15.09 ft	4600 mm	OTHER PARAMETERS Concrete Weight=	<u>S:</u> 0.15 kcf					
GEOMET	TRY INFORMATION INPUT: ength =	,	4600 mm 2100 mm			4.1.1(a)				
<u>GEOMET</u> Outside le	IRY INFORMATION INPUT: ength = vidth =	15.09 ft	••••••••••••••••••••••••••••••••••••••	Concrete Weight=	0.15 kcf					
GEOMET Outside le Outside v	IRY INFORMATION INPUT: ength = vidth = ngth L=	15.09 ft 6.89 ft	2100 mm	Concrete Weight=	0.15 kcf 1 Table 3 Table 1 Table	4.1.1(b)				
<u>GEOMET</u> Outside le Outside v Inside Le Inside Wi	IRY INFORMATION INPUT: ength = vidth = ngth L=	15.09;ft 6.89;ft 13.12;ft 4.92;ft	2100 mm 4000 mm 1500 mm	Concrete Weight= I= Ri=	0.15 kcf 1 Table 3 Table 1 Table	4.1.1(b)				
<u>GEOMET</u> Outside le Outside v Inside Le Inside Wi design liq	TRY INFORMATION INPUT: ength = vidth = ngth L= dth=	15.09]ft 6.89]ft 13.12]ft	2100 mm 4000 mm	Concrete Weight= I= Ri= Rc=	0.15 kcf 1 Table 3 Table 1 Table	4.1.1(b)				
<u>GEOME</u> T Outside le Outside vu Inside Le Inside Wi design liq Exterior V	IRY INFORMATION INPUT: ength = vidth = ngth L= dth= uid depth HL=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft	2100 mm 4000 mm 1500 mm 2500 mm	Concrete Weight= I= Ri= Rc= Liquid Weight=	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf	4.1.1(b) 4.1.1(b)				
<u>GEOMET</u> Outside k Outside v Inside Le Inside Wi design liq Exterior V Interior W	IRY INFORMATION INPUT: ength = vidth = ngth L= dth= uid depth HL= Wall thickness=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 0.00 ft	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc=	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2 ft/s^2	4.1.1(b) 4.1.1(b) /ft^4				
<u>GEOMET</u> Outside ke Outside ve Inside Le Inside Wi design liq Exterior V Interior W Roof slab	IRY INFORMATION INPUT: ength = width = ngth L= dth= uid depth HL= Wall thickness= /all Thickness=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 6.20 ft 0.98 ft 0.00 ft 1.31 ft	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9=	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 32.2 ft/s^2 4.66 ib-s^2/	4.1.1(b) 4.1.1(b) /ft^4				
<u>GEOME1</u> Outside k Outside v Inside Le Inside Wi design liq Exterior V Interior V Roof slab Floor slat	TRY INFORMATION INPUT: ength = width = ngth L= dth= wid depth HL= Vall thickness= vall Thickness= v thickness=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL=	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 32.2 ft/s^2 4.66 lb-s^2/ 1.94 lb-s^2/	4.1.1(b) 4.1.1(b) /ft^4				
<u>GEOME1</u> Outside k Outside v Inside Le Inside Wi design liq Exterior V Interior V Roof slab Floor slat	IRY INFORMATION INPUT: ength = vidth = ngth L= dth= uid depth HL= Wall thickness= /all Thickness= o thickness= o thickness= rior walls=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 2	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm	Concrete Weight= l= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' = Ec=	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2.2 ft/s^2 4.66 ib-s^2/2 1.94 ib-s^2/2 4000 pci 3.604.997 psi 1.6	4.1.1(b) 4.1.1(b) /ft^4				
<u>GEOMET</u> Outside le Outside vi Inside Vi design liq Exterior V Interior V Roof slab Floor slab # of exter # of interi	IRY INFORMATION INPUT: ength = vidth = ngth L= dth= uid depth HL= Wall thickness= /all Thickness= b thickness= o thickness= irior walls= ior walls=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 2 0 0	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm	Concrete Weight=	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2.2 ft/s^2 4.66 lb-s^2/2 1.94 lb-s^2/2 4.000 pci 3.604.997 psi 1.6	4.1.1(b) 4.1.1(b) 'ft^4 'ft^4				
GEOMET Outside le Outside vin Inside Vin design liq Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = vidth = ngth L= dth= uid depth HL= Wall thickness= Vall Thickness= thickness= o thickness= rior walls= ior walls= walls=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 1.31 ft 2 0 0	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' = Ec= longi L/H_L =	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2 ft/s^2 4.66 ib-s^2/ 1.94 ib-s^2/ 4.000 pci 3.604.997 psi 1.6 0.655 Figure	4.1.1(b) 4.1.1(b) /ft^4				
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: angth = vidth = ngth L= dth= uid depth HL= Wall thickness= Vall Thickness= thickness= thickness= to thickness= vidthess=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρL= fc' = Ec= longi L/H_L = 2Π/λ= L/H_L =	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.22 ft/s^2 4.66 lb-s^2/2 1.94 lb-s^2/2 4.000 pci 3.604.997 psi 1.6 0.65 Figure 0.6	4.1.1(b) 4.1.1(b) ftr^4 9.2.4 page 47				
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: ength = vidth = ngth L= dth= uid depth HL= Wall thickness= Vall Thickness= thickness= o thickness= rior walls= ior walls= walls=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 1.31 ft 2 0 0	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm	Concrete Weight= I= Ri= Rc= Liquid Weight= 9= ρc= ρc= ρc= [] ρc= [] c'= Ec= longi L/H_L = 2Π/λ= 2Π/λ=	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2.2 ft/s^2 4.66 lb-s^2/2 1.94 lb-s^2/2 4.000 pci 3.604.997 psi 1.6 0.65 Figure 0.6 1.6 Figure	4.1.1(b) 4.1.1(b) 'ft^4 'ft^4				
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: angth = vidth = ngth L= dth= uid depth HL= Wall thickness= Vall Thickness= thickness= thickness= to thickness= vidthess=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2.2 ft/s^2 4.66 lb-s^2/2 1.94 lb-s^2/2 4.000 pci 3.604.997 psi 1.6 0.65 Figure 0.6 0.63 Figure 0.6	4.1.1(b) 4.1.1(b) ftr^4 9.2.4 page 47				
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: angth = vidth = ngth L= dth= uid depth HL= Wall thickness= Vall Thickness= thickness= thickness= to thickness= vidthess=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2.2 ft/s^2 4.66 lb-s^2/2 1.94 lb-s^2/2 1.95 lb-s^2/2 1.9	4.1.1(b) 4.1.1(b) ftr^4 9.2.4 page 47				
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: angth = vidth = ngth L= dth= uid depth HL= Wall thickness= Vall Thickness= thickness= thickness= to thickness= vidthess=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2.2 ft/s^2 4.66 ib-s^2 1.94 ib-s^2 4.06 jb-s^2 1.94 ib-s^2 1.94 ib-s^2 0.065 Figure 0.65 Figure 0.65 Figure 0.65 Figure 0.65 Figure 0.65 Figure 0.65 Figure 0.65 Figure 0.65 Figure 0.65 Figure	4.1.1(b) 4.1.1(b) /ft^4 9.2.4 page 47 9.2.4 page 47				
GEOMET Outside le Outside vi Inside Vi design lig Exterior V Interior V Roof slab Floor slab # of exter # of interi # of exter # of interi # of exter	TRY INFORMATION INPUT: angth = vidth = ngth L= dth= uid depth HL= Wall thickness= Vall Thickness= thickness= thickness= to thickness= vidthess=	15.09 ft 6.89 ft 13.12 ft 4.92 ft 8.20 ft 0.98 ft 1.31 ft 1.31 ft 2 0 0 2 8.20 ft	2100 mm 4000 mm 1500 mm 2500 mm 300 mm 0 mm 400 mm 400 mm	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	0.15 kcf 1 Table 3 Table 1 Table 0.0624 kcf 3.2.2 ft/s^2 4.66 ib-s^22 4.66 ib-s^22 4.66 ib-s^22 4.00 pci 3.604.997 psi 1.6 0.65 Figure 0.6 0.63 Figure 0.6 1.5 0.6 1.5 0.6 1 ASCE	4.1.1(b) 4.1.1(b) ftr^4 9.2.4 page 47				

SEISMIC DESIGN LOAD									æ
General Information									
Project Number: Description: Structure:	127-1298-15001 TERRIER ROUGE SE SEWER LEACHING F		GRADED X 4000mm CHAMBER		Designed By: Checked By: Date:		BRO RB December 29, 2016		 ••
Seismic Design Load Step	One and Step Two								
DESIGN IS BASED ON A	CI350.3-06 CHAPTER 4 - EAF	RTHQUAKE DESI	GN LOADS						
Step One	Longitudin	al direction:			Transverse	e direction			
	We=	Wr= Ww= L/HL= ε= εWw= εWw+Wr=	20.47 Kips 48.47 Kips 1.60 0.75 36.56 Kips 57.03 Kips	Equation (9-44)	We=	L/HL= ε= εWw= εWw+Wr=	0.60 0.91 44.20:Kips 64.67:Kips	Equation (9-44)	
<u>Step Two</u>	total mass of liquid	WL= Wi/WL= Wc/WL= Wc=	33.05 Kips 0.64 21.05 Kips 0.41 13.43 Kips	Equation (9-1) Equation (9-2)		Wi/WL= Wi= Wc/WL= Wc=	0.92 30.37 Kips 0.16 5.24 Kips	Equation (9-1) Equation (9-2)	

formation							
Project Number:	127-1298-15001			Designed		BRO	
Description: Structure:	TERRIER ROUGE S		X 4000mm CHAMBER	Checked E Date:	sy:	RB	
Structure:	SEWER LEAGHING	FIELD - 1500IIIIII		Date:		December 29, 2016	
esign Load Step	Three and Step Te	en					
Step 3 to 9		Longitudinal of	direction: Exterior walls		Transverse	direction Exterior walk	3
		mw=	37.61 lb-s^2/ft^4		mw=	37.61 lb-s^2/ft^4	
		mi=	66.40 lb-s^2/ft^4		mi=	35.93 lb-s^2/ft^4	
		hw=	4.10 ft		hw=	4.10 ft	
		hi/HL=	0.38		hi/HL=	0.44	
		hi=	3.08 ft		hi=	3.64 ft	
		h=	3.45 ft		h=	3.88 ft	
		k=	3022710.90 lb/ft^2		k=	2125714.52 lb/ft^2 73.54 lb-s^2/ft^4	
		m= Ti=	104.01 lb-s^2/ft^4 0.04 s	Equation (9-10)	m= T:-	73.54 lb-s^2/tt^4 0.04 s	Equation (9-10)
		Tc=		Equation (9-14)	Ti= Tc=		Equation (9-14)
		Ts=	2.35 s	Equation (9-34)	Ts=	1.40 s	Equation (9-34)
		S _{DS} =	0.77 s 1.00	Equation (9-35)	S _{DS} =	0.77 s 1.00	Equation (9-35)
		S _{D1} =	0.77	Equation (9-36)	S _{D1} =	0.77	Equation (9-36)
		Ci=	1.00 s	Equation (9-32/9-33)	Ci=	1.00 s	Equation (9-32/9-33)
		Cc=	0.43 s	Equation (9-37/9-38)	Cc=	0.82 s	Equation (9-37/9-38)
<u>Step 10</u>			,,			,,	
		Cil=	1.00		Cil=	1.00	
		Ccl=	0.43		Ccl=	0.82	
		Pw=	12.19 kips	Equation (4-1)	Pw=	14.73 kips	Equation (4-1)
		Pr=	6.82 kips	Equation (4-2)	Pr=	6.82 kips	Equation (4-2)
		Pi=	7.02 kips	Equation (4-3)	Pi=	10.12 kips	Equation (4-3)
		Pc=	5.82 kips	Equation (4-4)	Pc=	4.32 kips	Equation (4-4)
		V=	26.67 kips	Equation (4-5)	V=	31.97 kips	Equation (4-5)
		hc/HL=	0.62	Equation (9-5)	hc/HL=	0.81	Equation (9-5)
Simplified m	ethod: Considering Uniform	hc=	5.06		hc=	6.66	
<u>omplified fr</u>	Unit base shear	v=	1.94 klf	Unit base shear	v=	1.06 klf	
		q=	235.95 psf		q=	129.15 psf	

SEISMIC	DESIGN LO	DAD					TR]
General I	Information							
	Project Nun Description		127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED			Designed By: Checked By:	BRO RB	
	Structure:		SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER			Date:	December 29, 2016	
Seismic I	Design Loa	d + Seism	ic-Induced Earth Pr	essure				
					·····			
		Seismic Desig	jn Load:	q=	235.95 psf			
		Seismic-Induc	ed Earth Pressure:	qoe=	1152.97 psf			
	Total Seismic Lateral Load:		Lateral Load:	qe=	1388.92 psf			

al Informatio	n –						
Project Nu Descriptio Structure:	mber:	127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBE	Designed By: Checked By: ER Date:	BRO RB December 29, 2016			
Reference	Leferences: ACI 350-06 Code Requirements for Environmental Engineering Concrete Structures ACI 350.3-06 Seismic Design of Liquid-Containing Concrete Structures AASHTO LRFD Bridge Design Specifications 4th Edition, 2007						
Notes:							
					3		
RAMETERS FOR	REARTHQU	IAKE-INDUCED EARTH PRESSURE					
RAMETERS FOR	CALCULATIO	IAKE-INDUCED EARTH PRESSURE					
RAMETERS FOR	<u>CALCULATIK</u> (REF: ASSH MONONOBE GAMMA = t= h=	DN OF EARTHQUAKE-INDUCED EARTH PRESSURE: O 2007 - Appendix A11.1.1.1) -OKABE ANALYSIS 115.00 Lbs/CF 1.31 feet 5.91 Feet					
	<u>Calculatik</u> (REF: ASSH Mononobe Gamma = t=	DN OF EARTHQUAKE-INDUCED EARTH PRESSURE: TO 2007 - Appendix A11.1.1.1) -OKABE ANALYSIS 115.00 Lbs/CF	RAD= 0.52359878 RAD= 0.29145679				
weight of soil:	CALCULATIC (REF: ASSHT MONONOBE GAMMA = t= h= a = PHI = THETA = DELTA = A =	DN OF EARTHQUAKE-INDUCED EARTH PRESSURE: TO 2007 - Appendix A11.1.1.1) -OKABE ANALYSIS 115.00 Lbs/CF 1.31 feet 5.91 Feet 8.20 Feet 8.20 Feet 0.00 Degrees:	······				

SEISMIC-INDUCED EARTH PRESSURE										
General Informa	tion									
Descrip		127-1298-15001 TERRIER ROUGE SETTLEMENT UPGRADED SEWER LEACHING FIELD - 1500mm X 4000mm CHAMBER			Designed By: Checked By: Date:	BRO RB				
Structu	ire:					December 29, 2016	••			
EARTHQUAKE-I		ACTIVE EARTH PRESSURE:								
			ψ =	2.278						
			Kae =	0.591	Equation (A11.1.1.1-2)					
	SEISMIC AT-REST EARTH PRESSURE (AASHTO Pg C-87)									
			Koe =	0.886						
	SEISMIC F	FORCE:								
			Eoe =	9456.774 lb	Equation (A11.1.1.1-1)					
			qoe=	1152.97 plf						

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