

Alcan Gove Alumina Refinery Expansion Project Draft Environmental Impact Statement



Land System - Blue Mud (Bm)

Beach ridge plains and chenier plains; Orthic Tenosols and Shelly Rudosols; variable – mid high open woodland (*Acacia auriculiformis, Acacia hemignosta, Melaleuca nervosa and Casuarina equisetifolia*)

Local Geology - Quaternary(Qr/Qd)

Quaternary coastal dune-fields, cheniers and beach ridges; sand shelly sand siliceous and calcareous sands.

Unit	Landform	Soils	Vegetation
Bm1	Gently undulating sand plains and beach ridges; soft or loose sandy surface; moderately well to well drained.	Orthic Tenosols and Shelly Rudosols	Variable – mid high open woodland (<i>Acacia</i> <i>auriculiformis, Melaleuca</i> <i>nervosa</i> and <i>Casuarina</i> <i>equisetifolia</i>), tall grassland of <i>Sorghum intrans</i> .
Bm2	Tidal flats; poorly drained	Supratidal and Intertidal Hydrosols	Usually bare with mid high open forest of mangroves along tidal channels.
Bm3	Beaches and foredunes; 3-4% slope; loose sandy surface; well drained	Shelly Rudosols	Isolated clumps of Casuarina equistifolia

Land System - Currency (Cr)

Rolling to steep low hills and undulating rises on granite; Leptic Rudosols, some Red, Yellow and Brown Kandolsols; mid high open woodland (*E. tetrodonta, E. tectifica, E. latifolia* and *Erythrophleum chlorostachys*)

Local Geology - Proterozoic (Pxb, Pxd)

Nelville Bay Melamorphics and Drummie Head Granite; mainly granitic greiss, leucogranite, and granulite facies meta-sedimentary and mafic rocks.

Land Unit	Landform	Soils	Vegetation
Cr1	Hillcrests and hillslopes; 2-40% slope; 10-80% granite outcrop and boulders; well to rapidly drained	Leptic Rudosols, minor Leptic Tenosols and Red Kandosols	Mid high open woodland (E tetrodonta, E. tectifica)
Cr2	Colluvial footslopes; 2-5% slope; up to 20% granite outcrop and boulders; well drained	Yellow and Brown Kandosols	Tall open woodland and forest (<i>E. tetrodonta</i> or <i>E. bigalerita</i>)
Cr3	Alluvial flats and drainage depressions	Tenosolic Redoxic Hydrosols	Grassland with sedges and patches of <i>Pandanus</i> spp. and <i>Melaleuca viridiflora</i>
Cr4	Plains and rises; 2-5% slope; occasional granite outcrop and tors; moderately well to well drained	Orthic Tenosols and Yellow Kandosols	Mid high open woodland (<i>E</i> polycarpa, E. tetrodonta)



Land System - Dune (D)

Active and relict duns, beach ridges and coastal sandplains; Shelly and Arenic Rudosols; grasslands with smaller areas of *Casuarina equisetifolia* woodland.

Local Geology - Quaternary (Qr/Qd)

Coastal dune, beach ridges and coastal sand plain deposits – siliceous and calcareous sand deposits.

Land Unit	Landform	Soils	Vegetation
D1	Beaches and foredunes; loose sandy surface	(Loose sand)	
D2	Stable rear dunes and sandplains	Shelly and Arenic Rudosols	Mid high open woodland of Casuarina equisetifolia over Spinifex
D3	Broad sandplains with slight undulations of beach ridges	Shelly and Arenic Rudosols	Very tall grassland of Sorghum intrans; isolated clumps of <i>Casuarina</i> and <i>Pandanus</i>
D4	Narrow drainage depressions; <2% slope; imperfectly drained; short periods of seasonal inundation	Orthic Tenosols Kandosolic Redoxic Hydrosols	Mid high woodland (<i>E. polycarpa</i> and <i>Melaleuca nervosa</i>)

Land System - Effington (Ef)

Level to gently undulating alluvial floodplains; Kandosolic, Tenosolic and Chromosolic Redoxic Hydrosols; mid high open woodland of *Melaleuca viridiflora* and *E. polycarpa*

Local Geology - Quaternary (Qa)

Alluvium in active channels, on floodplains and in swampy areas – gravel, sand, silt and clay.

Land Unit	Landform	Soils	Vegetation
Ef1	Level to gently undulating floodplains and drainage depressions; <2% slope; poorly to imperfectly drained; prolonged seasonal inundation	Kandosolic, Tenosolic and minor Chromosolic Redoxic Hydrosols; some Yellow Kandosols and Orthic Tenosols	Mid high open woodland (<i>Melaleuca viridiflora</i> and <i>E.</i> <i>polycarpa</i>) some riverine woodland/forest
Ef2	Gently undulating levees, 1% slope; imperfectly to moderately well drained; occasional seasonal inundation	Orthic Tenosols, some Red Kandosols	Mid high to tall open woodland (<i>E. tetrodonta</i> and <i>E. polycarpa</i>)
Ef3	Stream channels; very poorly to poorly drained; prolonged seasonal inundation	Tenosolic Redoxic Hydrosols	Mid high woodland and open forest with <i>Melaleuca</i> <i>leucadendra</i>
Ef4	Closed swamps and billabongs; very poorly to poorly drained; prolonged seasonal inundation	Chromosolic Redoxic Hydrosols	Tall open woodland of <i>Melaleuca spp.</i>
Ef5	Slopes fringing upland areas; 2% slope; imperfectly to moderately well drained	Orthic Tenosols and Yellow Kandosols	Tall open woodland of <i>E.</i> tetrodonta



Land System - Giddy (Gi)

Gently undulating plains (associated with weathered granite); Orthic and Leptic Tenosols; mid high open to tall woodland of *E. tetrodonta* with *E. miniata*.

Local Geology - Proterozoic (Pxb / Pxd)

Melville Bay Metamorphies – banded granulite and leucogranite; Drimmie Head Granite – leucogranite, granitic gneiss and granulite.

Land Unit	Landform	Soils	Vegetation			
Gi1	Gently undulating plains, 1-3% slope; occasional granite or laterite outcrop; well drained	Orthic and Leptic Tenosols, minor Leptic Rudosols and Red Chromosols	Mid high open to tall woodland of <i>E. tetrodonta</i> and <i>E. miniata.</i>			
Gi2	Footslopes abutting more elevated land systems; 2-3% slope; well drained	Orthic Tenosols, Red and Yellow Kandosols	Tall woodland/open woodland of <i>E. tetodonta</i> with some <i>E. miniata</i>			
Gi3	Drainage depressions; poorly drained; seasonally flooded	Kandosolic Redoxic Hydrosols	Low open to mid high woodland of Melaleuca viridiflora			

Land System - Klatt (Kl)

Small plateaux, scarps and some rises on deeply weathered Cretaceous sediments (Mullaman Beds); Leptic Rudosols; mid high to tall open woodland of *E. tetrodonta* with *E. bleeseri* and *E. miniata*.

Local Geology - Cainozoic (Czl/K)

Lateritic gravelly and cemented perraginous detritus underlam by Cretavous quartzose sandstone..

Land Unit	Landform	Soils	Vegetation
KI1	Plateau surfaces, 1-3% slope, 10- 50m relief; 40-90% laterite outcrop and surface stone, well drained	Leptic Rudosols, Orthic Tenosols, minor Brown Kandosols	Mid high to tall open woodland (<i>E. tetrodonta</i> and <i>E. miniata</i>)
KI2	Steep hillslopes and scarp footslopes; 5-50% slope; >50% laterite and sandstone outcrop and surface stone; well to rapidly drained	Bare rock with Leptic Rudosols	Mid high open to tall woodland (<i>E. tetrodonta</i> and <i>E. bleeseri</i>)
КІЗ	Lower slopes and footslopes; 3-10% slope; up to 10% sandstone outcrop, well drained.	Orthic Tenosols, some Red and Brown Kandosols	Mid high to tall open woodland of <i>E. tetrodonta</i> and <i>E. miniata</i>
Kl4	Scarps; about 60% slope; >90% laterite and sandstone outcrop; well to rapidly drained.	Bare rock with minor Leptic Rudosols	
KI5	Narrow drainage channels; seasonally flooded	Kandosolic Redoxic Hydrosols	Low woodland of <i>E. papuana</i> and <i>E. polycarpa</i>



Land System - Littoral (L)

Tidal mud flats and coastal floodplains with channels and estuaries; Supratidal and Intertidal Hydrosols; mostly bare ares with isolated clumps of *Melaleuca acacioides* and halophytic forbs, mangroves fringe the shoreline and tidal channels

Local Geology – Quaternary (Qc)

Active tidal and inter-tidal flats, predominantly sand, silt and clay, often shelly.

Land Unit	Landform	Soils	Vegetation				
L1	Broad level tidal flats; very poorly to poorly drained; intermittent tidal inundation	Supratidal Hydrosols	Bare flats with low isolated clumps of <i>Melaleuca</i>				
L2	Mangrove lined shorelines and inlets; daily tidal inundation	Intertidal Hydrosols and marine mud	Mid high open forest of mangroves				
L3	Beach dunes; loose sandy surface; well drained	Arenic and Shelly Rudosols	Variable, mid high open Acacia and Heteropagon woodland.				

Land System - Pinwinkle (Pw)

Low swampy coastal floodplains and depressions; Aquic Vertosols; woodland of *Melaleuca nervosa* and *Melaleuca viridiflora*

Local Geology - Quaternary (Qb)

Coastal floodplain alluvial deposits ..

Land Unit	Landform	Soils	Vegetation			
Pw1	Depressions and floodplains; <1% slope; very poorly drained; very prolonged to permanent inundation	Aquic Vertosols	Low open to tall woodland of <i>Melaleuca nervosa</i> and <i>Melaleuca viridiflora</i>			
Pw2	Margins of floodplains and depressions bordering upland areas; <1% slope; poorly drained' prolonged seasonal inundation	Tenosolic and Kandosolic Redoxic Hydrosols	Tall <i>Heteropagon</i> grassland with <i>Melaleuca nervosa</i> and <i>Pandanus Spp</i> .			

Land System - Disturbed Land (DL)

Land surface modified by cutting and/or filling and associated construction activities; mostly Spodic Anthroposols (man-made soils) overlying coastal sand deposits or residual/colluvial soils comprising Perraginous gravelly sands or highly weathered granitic rock types.

Local Geology

Variable depending on location; typically highly weathered granitic bedrock, Cainozoic residual sand soils or alluvial soils, Perraginous gravel or cemented lateritic detritas.

Land Unit	Landform	Soils	Vegetation
DL	Undifferentiated – includes Refinery Site, Residue Disposal Area, Township/urban development areas.	Spodic Anthroposols	







	CLI	IENT: ALCAN								SHEET 1 OF	
	LAI are bu	NDFORM / VEGETATION : Flat plain some bare scalded eas. Eucalypt woodland and mid-high grasses; rnt area.	SURF CONE	ACE DITIC	/SLOP N: crust		CO-ORE E: -	INATES	5	R.L. (m) DATU - AHD	M
	LOC	CAL GEOLOGY : Cz / Czl underlain by granitic rock.									
	SOIL HORIZON	DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m)	Soil pH (1:5 H ₂ 0)	EC (mS/cm) (1:5H20)	Dispersion Class No.	Sample Details	ADDITIONAL NOTES	
	- AI>	Sand, fine to medium grained, brown (7.5YR 5/4), dry, loose, 5% rounded fine Fe gravel 5-10mm.	SP			6.2	0.02	5	DS	Test pit adjacent to road at Pond 6. Thin surface crust.	
	×	Sand, fine to medium grained, light brown (7.5YR 6/4), weakly coherent, some fine Fe gravel.	SP			6.3	0.01	5	DS		
	A2	Becoming orange/red.									
NY:	*	Gravelly Sand, fine to medium, light brown (7.5YR 6/6) diffusely mottled, moist, weakly coherent, 50% rounded to subrounded Fe gravel 10-20mm.	(GW-SP	2000	5	6.8	0.03	5	DS		
DRILLING COMP	H			0000000000							
DATE COMPLETED : 13-05-03		Test pit terminated at 1.0m depth.									
					- 1.5						
	ata : 1 OB N OGG PPR	TP02 script : S0ILL06 No. 12373-021-559 DATE iED BY RCS 27-05-03 OVED BY GJR 16-07-03	<u> </u>	1		SAMPLE DISTUR BULK S/	TYPE BED SA	MPLE	 	TESTPIT	1 L

PRO	DJECT: ALCAN REFINERY GOVE THIRD STAGE EXPA PRELIMINARY GEOTECHNICAL INVESTIGATIO	NSION ON	-			ΤP	No).	TP03	1 0F	1
LAN	NDFORM / VEGETATION : Flat plain; burnt area; scattere ad eucalypts, mid-high	d SURF		/ SLOPE	 	CO-ORE E: -	DINATES	3	R.L. (m)	DATUM AHD	<u> </u>
LOC gra	DAL GEOLOGY : Cz / Czl underlain by weathered anitic bedrock.										T
SOIL HORIZON	DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m)	Soil pH (1:5 H ₂ 0)	EC (mS/cm) (1:5 H ₂ 0)	Dispersion Class No.	Sample Details	ADDITIONAL NO	TES	RI (m. AHD)
V I	Gravelly Silty Sand, fine to coarse grained, dark brown (7.5YR 3/3), 20% rounded to subrounded Fe gravel 5-10mm.	(GW-SI	D.O.O	4	5.8	0.03			Ferruginous gravelly grou locally.	nd cover	
	Gravelly Sand, medium grained, brown, 40% rounded to subrounded Fe gravel to 10mm, some roots, dry, loose.	-	00		5.6	0.03	5	DS			
A/B	Gravelly Sand, fine to medium grained; brown (7.5YR 5/4), 55% rounded to subrounded Fe gravel up to 40mm.		000		6.2	0.02	5	DS	< 5% silt/clay fines; non-	plastic.	
	- Very gravelly band.	-	00								
	Gravelly Sand, medium to coarse grained, non-plastic, weakly coherent, strong brown (5YR 5/6), 40% rounded to subrounded time Fe gravel 2-5mm < 5% still (clavey, fines	(GP-SN	000	-	6.4	0.01	5	DS	Extremely weathered gran rock.	litic	
			0.00	5							
	Bravelly Sandy Clay - Clayey Sand, low to medium	SC			67	0.04	6	ns	Extremely weathered gran rock.	itic	
	plasticity, orange/red mottles (2:5YR 4/8), slightly moist, friable, ~20% rounded to subrounded Fe and WR gravel to 5mm.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			0.1	0.04	0				
				•							
				- 1							
	lest pit terminated at 1.0m deptn.										
									a 1. webu - Chine Andreada 1. National Angres		
				- 1.5							
			ŀ								
								i.			
la : TI	P03 script : SOILLOG		.				i				
b n Gge Pro	Io. 12373-021-559 DATE ED BY RCS 27-05-03 DVED BY GJR 16-07-03			- 10 - 10 - 10	SAMPL DISTU BULK S	E TYPE RBED SA SAMPLE	MPLE	D	TES	TPIT L	01

DRILLING COMPANY:

DATE COMMENCED :: 13-05-03

			PF	ROJECT : ALCAN REFINERY GOVE THIRD STAGE EXPANSION PRELIMINARY GEOTECHNICAL INVESTIGATION LIENT : ALCAN	N			TP	No	•	TPO4 SHEET 1 OF 1		
			LA de gr	ANDFORM / VEGETATION : Low-lying flat to broadly SUF epressional area; eucalypt woodland and mid-high CON rasses. Fla	RFAC NDIT	Æ∕SLOI ION∶ aflitte	ΡΕ r.	CO-ORD E: - N: -	INATES		R.L. (m) DATUM - AHD	1	
			L0 gr	DCAL GEOLOGY : Cz / CzI underlain by weathered ranitic rock.									
			SOIL HORIZON	DESCRIPTION		UCKAPHIC LOG DOWN HOLE DEPTH (m)	Soil pH (1: 5 H-0)	EC (mS/cm) (1:5 H20)	Dispersion Class No.	Sample Details	ADDITIONAL NOTES	R.L. (m, AHD)	
•				Sandy Gravel, brown (7.5YR 4/3), dry, very loose, sand is fine to medium grained with \sim 60% sub-angular to	SP)	0					Test pit near RDA, low lying area.		
				sud-rounded gravel up to 25mm.			6.5	0.08	5	DS		,	
				Gravel size increasing up to 80mm, angular.									
			*	Sandy Gravel, fine to medium grained, brown (10YR 5/3), (GW-5	SP)		6.9	0.02	5	DS			
				with ~60% rounded to sub-rounded Fe gravel up to 20mm, $< 5\%$ silt/ clayey fines.									
	2		- A/B	Sandy Brayal - Brayally Sand grappe-rod (2 EVE 5 (g) (GM-S	SM)) 5)	7.0	0.00			Extremely weathered rock.	-	
	COMPANN			moist, non-plastic, 50% WR gravel, ~10% silt/clay fines.	No.	0	1.0	0.06	5	US			
	DRILLING	DRILLER:		Test pit terminated at 0.7m depth (backhoe refusal).						ļ	<u>an an a</u>		
					-	+							
		ļ											
			-			- 1							
	-03	03											
	: 13-05	: 13-02-	1						а к. 4.		andar Alexandro andar andar Alexandro andar andar andar		
	MMENCED	MPLETED		, , , , , , , , , , , , , , ,									
	DATE CO												
	%					- 15			·		an 1 Altar an Antonio antonio antonio antonio		
						– 1.5							
												1	
		f				ŀ							
		ł										-	
		ŀ				ŀ		and a second sec				4	
			ata :	TP04 script : SOILLOG						<u>. </u>			
		J	OB I OGG	No. 12373-021-559 DATE GED BY RCS 27-05-03			SAMPL DISTU	. <u>e type</u> IRBED SA	MPLE	D	TESTPIT	LOG	
		R	PPR EVI	ROVED BY GJR 16-07-03 ISION No 1			BULK U50 T	SAMPLE UBE SAMI	PLE	B T			

	CLI	DECT: ALI PRI ENT: ALC	CAN REFINE ELIMINARY G AN	EOTECHNICA	L INVESTIGATIO	NSIUN DN				ΤP	Nc).	TPO SHEE	5 T 1 OF	1
	LAN par	DFORM / VE ndanus pal	GETATION:FI ms, sparse gi	at plain, mixe ass cover.	d eucalypts and	SURF COND Flat.	ACE .	/ SLOP N :	E	CO-ORE E: - N: -	INATES	5	R.L. (m) —	DATUM AHD	
	LOC gra	AL GEOLOGY nitic bedro	Y:Cz / Czlur ock.	iderlain by hi	ghly weathered	_								<u></u>	
	SOIL HORIZON		DES	SCRIPTION		UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m	Soil pH (1: 5 H ₂ O):	EC (mS/cm) (1:5 H ₂ O)i	Dispersion Class No.	Sample Details	ADDITIONAL	NOTES	
	1	Gravell 4/4), dr 2-5mm.	y Silty Sand , fine y, loose, ~25% ro	to medium graine unded to sub-rou	d, brown (7.5YR Inded Fe gravel	SM			6.6	0.04	5	DS			
					······		11011								
	★ B/C	Gravelly (10YR 5, 10mm; 15	/ Loamy Sand , fin /4), ~40% rounde -20% fines.	e to medium grain d to sub-roundec	ed, brown I Fe gravel to	(GC-SC			6.6	0.05	3 (3)	DS	Extremely weathered	granitic	
	<u>2</u>	Sandy L silt/clay Test pil	.oamy Gravel, bro ey fines of low p t terminated at O	wn (7.5YR 5/6), asticity, 60% WR 35m depth.	~40% gravel.	(6M-60	Ē		6.6	0.06	5	DS	TUGK.		
		(Backho	e refusal in rock,	l				5							
LUMPANY:						and the second									
DRILLING															
								•							
-03	-							•							
TED : 13-00	1								н 1 - 12 Ал				a star star star star star star star sta	a Ar an an Ara Ar	
ATE COMPLE					2										
							ŀ	- 1.5	vi n						
							i i i i i i i i i i i i i i i i i i i								
Ļ							Ī								
dəti	a : TI	205	script : S	SOILLOG									<u>وليري ¹</u>	1	
JO LO	B N GGE	o. 12373-0	021-559 RCS	DATE 27-05-03	3			F	SAMPLE	TYPE BED SA	MPLE	<u> </u>	TE	ESTPIT L	0
AP RE	VIS	VED BY	GEP	16-07-03	URS	•		ŀ	BULK S U50 TU	AMPLE BE SAM	PLE	E			

CL LA	IENT: ALCA	AN GETATION : La	nd disturbed	by prior cutti	ing I	SURFA	ACE /	SLOPE		CO-ORI	DINATES		SHEET 1	OF ATUM	1
an -	nd/or filling. Refinerv site	9.				CONDI	TION	:		E: 144 N: 764	0.199		10.172 AI	łD	
L.O WE	CAL GEOLOGY	:Cz / Czl un mitic rock.	derlain by ext	tremely				~			13.100				Γ
SOIL HORIZON		DES	CRIPTION			UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m	Soli pH (1:5 H ₂ 0)	EC (mS/cm) (1:5 H ₂ 0)	Dispersion Class No.	Sample Details	ADDITIONAL NOTES		
	Clayey to medium concretic	(bauxitic) Gravel n plasticity, grave ons up to 25mm.	fill, with ~15% clay el is rounded to s	vey fines of low ub-angular Fe		6C	900	,	9.85	0.54	5	DS	Fill, strongly alkaline.		
	Gravelly medium to	Clay (compacted high plasticity,	d gravelly clay fil yellowish red (5Y	l material), R 4/6), moist.	_	60-01		5	7.2	0.09	6	DS	Fill (EW Granitic Rock).		
×	Clayey S yellowish weathere	Sand - Sandy Cla red (7.5YR 6/8), d granitic rock g	y, medium to high moist, friable with ravel 5-10mm	plasticity, h 10-15% highly		SC									
	********	- grantie fuch g	eyer e tonnu.			in the second		- 1	6.0	0.04	5	DS	EW Granitic Rock.		
		х ,													
•								- 1.5							
								2							
				: :•				2.5							
					-	संस्थान्त्र संस्थान्त्र संस्थान्त्र									
						1.1-1.1-1.1.4		3					n an Arrange		
						जन्म <u>ः</u> नन्द्रा									
								3.5					·mere me súltar com com .		
						1-11-11-11		4							
						146.146.146									
	Extremely 4	veathered GRANI	TE.		,			4.5			A TA A A A A A A A A A A A A A A A A A				
	Test pit te (Limit of ba	erminated at 4.6m ackhoe reach).	1 depth.												-
ata :	TP06	script : S	OILLOG	· · · · · · · · · · · · · · · · · · ·										<u></u>	
OB I	No. 12373-0	21-559	DATE	7				5	SAMPLE	E TYPE			TESTPI	ΤL	C
JGG	ED BY	RCS	27-05-03	in Sugarda -	·2-1			Ir	DISTUR	RED SA	MPLE	D			10

DATE COMMENCED : 4-05-03

N. C.

-	PRC CLI	DJECT : AL PR ENT : ALC	CAN REFINE ELIMINARY (CAN	RY GOVE	THIRD STA ICAL INVE	GE EXPAN STIGATIO	ISION N				TP	Nc).	r · · · ·	TPO SHEET	8	1
	ano - F	DFORM / VE d/or filling. Refinery si	EGETATION:L te.	and disturi	bed by prid	or cutting	SURF COND	ACE . DITIO	/ SLOPE 1 :	E	CO-ORD E: 144 N: 759	INATES 0.153 9.306	5	R.I 8.8	L. (m) 396	AHD	1
	LOC gra	AL GEOLOG Initic rock.	Y : Fill underla	ain by high	ly weather	ed			TH (m)			-0-					
	SOIL HORIZON		DE	SCRIPTIO	N		UNIFIED SYMBO	GRAPHIC LOG	DOWN HOLE DEP	Soil pH (1: 5 H ₂ 0):	EC (mS/cm) (1:5H20)	Dispersion Class I	Sample Details	ADI	DITIONAL	NOTES	
	↑ ∃	Clayey 5/8), wi bauxitic	Gravel (Lime-Bi th 70% sub-angu and calcareous	auxite Mix), ye lar, sub-round gravel up to s	llowish red (5 ded and round 20mm.	YR Ied	GC	DAV		10.0	1.45	5	DS	Fill (str	ongly alkaline	and saline).	
	*	Sandy	Clay Loam, ceme	nted lime and	gravel, hard.		SC.			9.9	0.76	5	0S	Fill (stri saline).	ongly alkaline	, somewhat	
	lual Soit	Gravell	y Sandy Clay, me	edium plasticit	y, red (2.5YR	5/6).		<u>n</u> dati		8.8	0.75	3 (1)	DS	?Fill or r weather dispersiv	esidual soil - ed (granitic) re, clayey fin	extremely rock; slightly es, somewhat	
	Resid							6 PLA	•					saline.			
	-	Test pi (Backho	t terminated at (be refusal in roc)).42m depth. ().				Ŕ	5								
PANY:			·						•								
ILLING COM									•							: : :	
н Н Н Н						- ñ -											
	•								- 1								
13-05-03						والمراجعة المراجعة المراجع		, j									
MENCED :			-					-						:			
DATE CON								-									
								F								n an	1.
-									- 1.5								
												e					
				0071					-								
ăi Ji Li	ata : T OB Ñ OGGE	гов 0. 12373-(ED BY	script : 021-559 RCS	SOILLOG DATE 27-05	-03	n Staal Maria				SAMPLE DISTUR	TYPE BED SA	MPLE	D		TE	STPIT L	_0
A	PPRO	VED BY	GJR 1	16-07	-03	RS			1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	BULK SA	AMPLE BE SAM	PIF	B				

PRO	JECT: ALCAN REFINERY GOVE THIRD STAGE EXPAN PRELIMINARY GEOTECHNICAL INVESTIGATIO	NSION DN				ΤP	No		TP19	1 OF	1
LAN cut	DFORM / VEGETATION : Land disturbed by prior ting and/or filling – Refinery site alcinator area.	SURF COND	ACE /	/ SLOPE N :		CO-ORD E: 1252 N: 754	INATES 2.173 8.685		R.L. (m) 9.711	DATUM	
LOC. gra	AL GEOLOGY : Fill underlain by highly weathered nitic bedrock.										
SOIL HORIZON	DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m)	Soli pH (1:5 H ₂ 0)	EC (mS/cm) (1:5 H ₂ 0)!	Dispersion Class No.	Sample Details	ADDITIONAL NO	TES	RI (m AHD)
	Calcareous Gravel (Fill), with 30% sandy to silty fines (calcareous), non-plastic, pale brown (10YR7/3).	(GM-GC	bland		9.0	0.47	6	DS	Thin layer of calcite dust ground surface.	on	
	Sandy Loamy Gravel, with 30% fine sandy, silty and clayey (sub-plastic) fines of low plasticity, moist, friable;	GC	M4N		8.4	0.44	6	DS	Decomposed granitic rocl	< - Fill.	
	(decomposed) to 25mm.		900		8.1	0.31	6	DS	Decomposed granitic rock	< - Fill.	
			1910101		an marine and a second s						
			100	5							
			700								
siqual Soil	Gravelly Sandy Clay Loam, low to medium placticity, red (2.5YR 4/6) with 20% sub-angular Fe and extremely weathered gravitic gravel	(SC-CL)	0110	-	7.7	0.62	6	DS			ĺ
×	Test pit terminated at 0.79m depth in Sandy Gravel (Extremely weathered Granitic rock). (Backhoe refusal)										
				- 1							
							-				
Alexandra a secondaria		-		- 1.5							
			-								
			Þ				and the second		*		
a:T BN GGI PRC	PI9 script : SOILLOG Io. 12373-021-559 DATE ED BY RCS 27-05-03 OVED BY GJR 16-07-03				SAMPLE DISTUF BULK S	E TYPE RBED SA	MPLE	Ē	TES	TPIT L	.0

DRILLING COMPANY:

DATE COMMENCED : 14-05-03

ſ	PROJECT : ALCAN REFINE PRELIMINARY 6	RY GOVE THIRD STAGE EX GEOTECHNICAL INVESTIGA	PANS	SION				ТΡ	Nc).	TP22	2	
	CLIENT: ALCAN ANDFORM / VEGETATION : L and/or filling. Refinery site	and disturbed by prior cutt	ing	SURF/	ACE / ITION	SLOPE :	E	CO-ORD E: 1409	INATES 9.614 2.248	;	SHEE R.L. (m) 6.729	DATUM AHD	
	- Retinery site. .OCAL GEOLOGY : Fill underla weathered granitic rock.	ain by extremely and deepl	y			(ir		1. 143	2.240			L	
		SCRIPTION		UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (Soil pH (1: 5 H ₂ 0)	EC (mS/cm) (1: 5 H ₂ O)	Dispersion Class No.	Sample Details	ADDITIONAL	NOTES	R.L. (m, AHD)
	Clayey Gravel (bauxitic red, dry, hard, 60% sub- 25mm.	ciay/lime fill), medium plasticity, angular calcareous gravel to		GC GM	1000	•	11.7	0.25	6 5	DS DS	Test pit on hard stand Fill strongly alkaline an	l fill area. nd saline.	
ţ	Sandy Gravel (roadbas	e fill), brown (10YR 4/4).	-⁄/†	SC			9.7	0.38	5	DS	Roadbase fill.		
	Clayey Gravelly Sand, I red (5YY 5/6), moist, fr	ow plasticity, white and yellowish able, with ~25% sub-angular a gravel to 25mm		(SC-CL)		5					Extremely weathered g	ranite fill.	
	Gravelly Sandy Clay, gr medium to high plasticity sand, moist, relict rock s	een-grey, white, and brown, , with fine to coarse grained tructure.				- 1							-
													-
						- 1.5					Weathered granitic roc	k.	
ORILLER:				i the second		- 2							
- - - - -													
						- 2.5							
ر 1	5					- 3							
1.LE I EU : 15-													
	Becoming orange, white a	nd red.				. 3.5	· · · · · · · · · · · · · · · · · · ·						-
						4				,			-
						4.5	والمحاوية و						
				निक्ता संस्थान विद्या संस्थान								and an and a second	
	Test pit terminated at 5.	lm depth.		4.61 		5				-		· · ·	
	(Limit of backhoe reach).	······································											
data	a : TP22 script :	SOILLOG							·			CTDIT I	00
JOI	B No. 12373-021-559	DATE 27-05-03								 ח		יר דו כ	טט.
AP	PROVED BY GJR	16-07-03	C			ŀ	BULK S	AMPLE		B			
RE	VISION No 1					Ĺ	U50 TU	BE SAM	PLE	<u> </u>			

DRILLING COMPANY:

DATE COMMENCED : 15-05-03

U50 TUBE SAMPLE T

		IENT: ALCAN	SURF	ACF /	SLOPF		CO-ORD	INATES	;	SHEET 1 OF R.L. (m) DATUM	1
	ar	Ad/or filling. Refinery site.	COND		1: 	- - -	E: 203 N: 738	3.685 9.591		6.932 AHD	-
	LO sa	ICAL GEOLOGY : Fill underlain by Quaternary coastal and deposits (Qa-Qb).	-		(m						
	SOIL HORIZON	DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (Soil pH (1:5 H ₂ 0);	EC (mS/cm) (1:5H ₂ 0)	Dispersion Class No.	Sample Details	ADDITIONAL NOTES	an state and the state of the
		Loamy Sandy Gravel (bauxitic rock fill), 70% sub-angular to sub-rounded Fe and calcareous gravel.	GM-GC	0		9.9	0.19	5	DS	Test pit in hard stand area. Strongly alkaline.	
		LIMESTONE, rubble white.	GC			12.2	2.94	6	DS	High salinity and alkalinity.	
- 		Loamy Gravel, low plasticity fines, dark red (2.5YR 4/8); moist, friable; 60% sub-rounded to sub-angular calcareous gravel to 15mm, moist, friable.	(GM-GC	3974		9.6	0.17	5	DS	Strongly alkaline.	
	-			PLOP	5						
				000							
				040	- 1						
DRILLEF	-			9494	•						1
		Cond brought block find to modium grained slightly	(SP-SM)	DAN:	•						
	•	moist, non-plastic, highly organic.	· .		- 1.5	5.7	0.04	5	DS	Highly organic sand - no odour.	
4-05-03		Sand, fine to medium grained, non-plastic, reddish brown (5YR 5/4); occasional Fe concretions to 5mm.	(SP-SM)					· · · · · · · · · · · · · · · · · · ·			
ETED : 1		Sand, medium grained, as above, yellowish red.	(SP-SM)			7.7	0.04	5	DS		
DATE COMPLE	-				- 2				· · · · · · · · · · · · · · · · · · ·		
		Sand, medium grained, reddish yellow (5YR 5/6),	(SP-SM)			8.0	0.05	5	DS		
		non-plastic, occasional Fe concretions to 5mm.									
	B/C				- 2.5						
		Test pit terminated at 2.7m depth. (Hole collapsing).									
-				ŀ							AMERICA & LA
	data :	: TP26 script : SOILLOG No. 12373-021-559 DATE				SAMPI	F TYPE			TESTPIT I	

	LAI - I	DFORM / VEGETATION : Cleared land ontractor's camp; grassland.	SURF COND	ACE DITIO	/ SLOPI N : avel st	rewn.	CO-ORD E: - N: -	INATES		R.L. (m) DATUM - AHD
	LO(we	AL GEOLOGY : Cz / Czl underlain by highly thered granitic bedrock.								
	SOIL HORIZON	DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m	Soil pH (1:5 H ₂ 0)	EC (mS/cm) (1: 5 H ₂ O)	Dispersion Class No.	Sample Details	ADDITIONAL NOTES
	A A	Gravelly Loamy Sand - Loamy Gravel, sand is fine grained with silt/clayey fines of low plasticity, dark yellow-brown (10YR 4/6); ~40% rounded to sub-rounded Fe gravel to 15mm.	(GC-SC	NH OTH)	6.6	0.04	3 (3)	05	Test pit in contractors camp area. Eucalyptus trees and good ground cover (grass).
		Gravelly Clayey Sand, low to medium plasticity, yellowish red (5YR 5/6), moist, 35-40% rounded to sub-rounded Fe	(GC-SC			6.9	0.04	6	DS	
	— A/C —	gravêl to 15mm.								
		Bravelly Clavey Sand - Leamy Bravel low placticity	(SC-6C)		5					Extremely weathered granitic
COMPANY:		yellowish red (5YR 5/6).	(00 00,			6.7	0.02	6	DS	
DRILLING	0									
-	×	Sand, fine to medium grained, non-plastic, brown (7.5YR 5/4), ~20% rounded to sub-rounded Fe gravel 2-5mm.	SP			6.7	0.02	5	DS	Approx. 5–10% silty fines.
.UMMENCEU: 14-05-03 .OMPLETED: 14-05-03		Test pit terminated at 1.0m depth.								
DATE										
					- 1.5 -					

•

	CLI	ENT: ALCAN	-							SHEET 1 OF
	LAN gra	DFORM / VEGETATION : Flat plain; cleared land; issland.	SURF. COND	ACE ITIO	/SLOPE N: vel.str	ewn.	CO-ORD E: 1640	INATES 3.874 7.965		R.L. (m) DATUM 7.94 AHD
	LOC gra	AL GEOLOGY : Cz / Czl underlain by weathered nitic bedrock.	1 101.							
and a second	SOIL HORIZON	DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m	Soil pH (1:5 H ₂ 0)	EC (mS/cm) (1:5 H20)	Dispersion Class No.	Sample Details	ADDITIONAL NOTES
		Gravely Sandy Clay Loam - Loamy Gravel, with 30% loamy fines of low plasticity, dark brown (7.5YR 4/6); 40% WR	(GM-GC	PILIT		6.3	0.04	5	DS	Contractors Camp Site.
, , ,	II	graver, sub-rounded to sub-angular.		M. O.						
	X	Gravelly Clay - Clayey Gravel, with ~50% fine sandy, silty and clayey fines of low to medium plasticity, strong brown	(GC-CL	NHX NHX		6.0	0.02	6	DS	Extremely weathered granitic rock.
		(7.5YR 4/6); gravel is sub-angular to sub-rounded weathered granitic rock up to 30mm.		MAR						
	ວ 			P A B						
		Becoming rockies and harder below 0.6m		ANA	5					
	4		·	ð						
RILLER				- - - - -						
0					-					
					- 1					
-03										
0: 16-05			-							an a
COMPLETE					_					
DATE (
								de de la constante de la const		,
					- 1.5					
		Test pit terminated at 1.7m depth. (Backhoe refusal in rock)							-	
-										
-										
	ata : 1	HP28 script : SOILLOG	<u></u>			in in stational stations and st		l		ТЕСТРІТ І
J	OB N	Io. 12373-021-559 DATE ED BY RCS 27-05-03 DVED BY C/R 10.07,02			- 401	SAMPL DISTU	E TYPE RBED SA	MPLE	Ē	

	PF CI	ROJECT : ALCAN REFINERY GOVE THIRD STAGE EXPAN PRELIMINARY GEOTECHNICAL INVESTIGATIO	SION N				ΤP	Nc).	TP29 SHEET 1 OF	1
	L/ 01	ANDFORM / VEGETATION : Land disturbed by cutting and r filling. Refinery site area.	SURF. COND	ACE /	'SLOPE N:		CO-ORD E: 1674 N: 737	INATES 4.416 1.277	5	R.L. (m) DATUM 7.546 AHD	1
	LC	DCAL GEOLOGY : Fill on thin coastal sand deposits (Qr) Inderlain by extremely weathered granitic bedrock.			(m)						
	SOIL HORIZON	DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH	Soil pH (1:5 H ₂ 0)	EC (mS/cm) (1:5H20)	Dispersion Class No.	Sample Details	ADDITIONAL NOTES	R.L. (m, AHD)
•	-	Bauxitic Clayey Sand and calcareous gravelly fill.	GC	9 a l	-					Test pit on hard stand/carpark.	
		clay, dry. Sandy Loamy Gravel, with ~40% sandy to loamy fines of		9 B B		8.3	0.31	. 6	DS	Decomposed granitic rock fill,	
		low plasticity, 60% rounded to sub-rounded and angular Fe and calcareous gravel to 20mm.		00	5						-
				NOL	•						
	F				- 1 - 1						
N.		Sand, fine to medium grained, brown (7.5YR 4/4), dry,	SP	0		01	0.07	5	DS.	Thin veneer of coastal sand	
MPANY	-				- - 1.5		0.07			deposits.	_
ILLER:								· · ·			
HO HO			00		- 2					Extremely weathered granitic rock	-
	•	Sandy Loamy Gravel, red/yellow/orange mottles (5YR 4/6), low plasticity, slightly moist, with ~60% sub-angular to sub-rounded Fe and extremely weathered granite gravel fragments.	60			8.2	0.12	6	US	(decomposed granite).	
	dual Soil -				- 2.5						-
5-05-03 -05-03	Resi										-
VCED : 5	-				- 3						
E COMMEN					3						
DAT DAT	-				- 3.5						1
											-
					- 4						-
	· · ·	Becoming white, with increasing fragments of extremely weathered, very low strength granite.								Hole terminated on hard material	-
	-	Test bit terminated at 4 dm denth								not identified as rock.	
		, eve pre terminated de 4,410 deptil.			- 4.5						
1	data	: TP29 script : SOILLOG			[
		No. 12373-021-559 DATE GED BY RCS 27-05-03 ROVED BY GJR 16-07-03				SAMPL DISTU BUIK	<u>E TYPE</u> RBED SA SAMPI F	MPLE	D		.00
	REV				Ē	U50 T	UBE SAM	PLE	T		

			PRELIMINARY GEOTECHNICAL INVESTIG	ATION					۲۱ 	NC). 	SHEET 1 OF	_
		LAN filli – F	NDFORM / VEGETATION : Area modified by cutting an ing. Refinery site area.	Id/or SU	IRFAC	3E / S TON :	LOPE		CO-ORD E: 1577 N: 729	INATES 7.488 3.234	S	R.L. (m) DATUM 7.660 AHD	1
		LOC gra	CAL GEOLOGY : Fill underlain by highly weathered anitic bedrock. 1				(E						
		SOIL HORIZON	DESCRIPTION			GRAPHIC LOG	DOWN HOLE DEPTH (I	Soil pH (1: 5 H ₂ 0)	EC (mS/cm) (1:5 H ₂ 0)	Dispersion Class No.	Sample Details	ADDITIONAL NOTES	
			Clayey Gravel (bauxitic clayey sand), red, dry, hard (compacted).	6	C TIWWI	NOIN						Test pit on hard stand in Power Station area.	
		FILL	Gravelly Sandy Clay, medium plasticity, brown-red (2.5YR 4/6), with 20% sub-angular to sub-rounded Fe and highly weathered granitic rock gravel.	C				7.0	0.39	6	DS	Decomposed granitic rock fill.	
		*	Gravelly Sandy Clay, medium plasticity, red (10YR 4/6), with ~50% sub-rounded highly weathered granitic rock gravel to 25mm.	(GC-	HINNIAL PURINI	N N N						Decomposed granitic rock, with sub-plastic clayey fines.	
ANY:		-			NTANTA		.5						
DRILLING COMP	DRILLER				NTANTAN								and the second of the second second
		A/C			NATIANT								
05-03 5-53	-03				MIDNIDN								the second s
MMENCED: 15-1			Becoming red, with yellow bands, and rock fragments.					6.2	0.25	6	DS	Decomposed granitic rock,	
			Test pit terminated at 1.3m depth. (Backhoe refusal in rock).								-		-
						- 1	.5						
		alian da managana ngangana na mangana na man				- -							
	d J	ata : T OB N	1933 script : SOILLOG No. 12373-021-559 DATE					SAMPLE	TYPE		<u> </u>		Street Street
	L	oggi PPRC	ED BY RCS 27-05-03 OVED BY GJR 16-07-03	S				DISTUR	BED SA	MPLE	D B		

	PF CL LA fil L0	OJECT: ALCAN REFINERY GOVE THIRD STAGE EXPANS PRELIMINARY GEOTECHNICAL INVESTIGATION IENT: ALCAN NDFORM / VEGETATION: Land modified by cutting and/or ling. Garden bed with casuarinas, shrubs and grasses. CAL GEOLOGY: Fill underlain by residual or colluvial	SION N SURF, COND	ACE / ITION	SLOPE :		CO-ORD E: 1787 N: 759	N C DINATES 7.038 0.605).	TP34 SHEET 1 OF R.L. (m) DATUM 7.556 AHD	1
	SOIL HORIZON	nd deposits (Czs) over EW granitic bedrock. DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m)	Soil pH (1: 5 H ₂ O)	EC (mS/cm) (1:5 H2O)	Dispersion.Class No.	Sample Details	ADDITIONAL NOTES	R.L. (m, AHD)
		Sandy Clayey (bauxitic) Gravel, red (10YR 4/6), dry, hard (compacted).	GC	MARAY						Bauxitic clayey fill material.	
n Antonio ≢tanana Antonio		Gravelly Sandy Clay Loam, low to medium plasticity, brown (7.5YR 5/4), with white flecks; 20% sub-rounded highly weathered rock (decomposed) gravel to 10mm.	CL		5	8.5	0.13	5	DS	Reworked nighly weathered granitic rock fill material.	
		Sandy Clayey Gravel, red-brown (7.5YR 4/4); 60% sub-angular Fe and highly weathered gravel.	GC		- 1	8.8	0.11	5	DS	Decomposed granitic rock fill material.	
DMPANY:		Sand, medium grained, yellowish brown (7.5YR 4/4), loose, dry, with 10% Fe and carbonate concretionary gravel 5-10mm.	SP		- 1.5	8.8	0.10	,5	DS	Buried residual sand soil.	-
Drilling C	A/C				2						
-05-03 05-03		Becoming yellower with depth.			2.5						
COMMENCED: 15-	- - - -	EXTREMELY WEATHERED GRANITE, grange/red/white	•••••••••••••••••••••••••••••••••••••••		3						
DATE		mottles, slightly moist, very low strength.	> > >	× × ×	3.5						
			> > > >	×	4						
			XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX		4.5				vana da con esta esta esta esta esta esta esta esta		
		Test pit terminated at 4.8m depth (limit of backhoe reach).									
	data : JOB LOGO APPR REVI	TP34 script: SOILLOG No. 12373-021-559 DATE SED BY RCS 27-05-03 OVED BY GJR 16-07-03 SION No 1 URS				SAMPLE DISTUF BULK S J50 TU	E TYPE RBED SA AMPLE BE SAMF	MPLE	D B T		06

	ENT: ALCAN		ACE			0_0_0	TNATES		SHEET	1 OF
SPa	arse eucalypt woodland and mid-high grasses;	COND	ITION	SLUPE I:	-	E: -	ITINA (ES)		AHD
ter LOC	mite mounds. CAL GEOLOGY : Cz / CzI underlain by granitic rock.	< 1%;	silty	crust		<u>N: –</u>				
SOIL HORIZON	DESCRIPTION	UNIFIED SYMBOL	GRAPHIC LOG	DOWN HOLE DEPTH (m)	Soil pH (1: 5 H ₂ 0)	EC (mS/cm) (1:5 H20)	Dispersion Class No.	Sample Details	ADDITIONAL N	IOTES
4	Gravelly Loamy Sand, very low plasticity, brown (7.5YR 4/6), ~40-50% rounded to sub-rounded Fe gravel	(GM-SM) <u> </u>		6.1	0.06	3 (2)	DS	Test pit adjacent to ro	ad at Pond
*	Gravelly Sand, non-plastic, brown (7.5YR 5/4), fine to medium grained, dry, loose, ~50% rounded Fe concretions to 15mm.	(GW-SP	100000		6.5	0.05	5	DS	s. Silty crust on ground si Major root zone.	urface.
18 	Becoming moist.		00000		4					
	Gravelly Sand, fine to medium grained, low plasticity, light brown (7.5YR 6/4); 35-40% sub-rounded to rounded Fe gravel to 10mm	(GW-SC)	01110		6.3	0.04	5	DS		
B			10							
X	Sandy Clay – Clayey Sand, low plasticity, apedal, brown (7.5YR 5/6) diffusely mottled, orange with red mottles, slightly moist, ~30-35% rounded to sub-rounded Fe gravel to 10mm	SC								
ں ا					6.2	0.11	6	DS		
	Test pit terminated at 1.0m depth.			- 1						
									n galan an a	
			-	1.5						
ita : T DB N DGGE	P01 script : SOILLOG Io. 12373-021-559 DATE ED BY RCS 27-05-03				SAMPLE DISTUF	TYPE BED SA	MPLE	D	TES	STPIT L

DATE COMMENCED : 13-05-03





Rock Type		Moisture Condition	n
WR	Weathered rock		
EWR	Extremely weathered rock		
HWR	Highly weathered rock	Moisture Condition	n
		MC	Moisture Content
Particle Shape		Wp	Moisture content at plastic limit
r	Rounded		
s/r	Sub-rounded	Electrical Conduct	ivity (EC 1:5 H ₂ O)
s/a	Sub-angular	Values have been re	eported as (mS/cm).
		An indicative poten	tial salinity severity rating is:
Gravel Type		Nil	E.C. <0.28
Gv	Gravel	Slight	E.C.> 0.28-0.57
Fe	Ferruginous / laterite	Moderate	E.C. >0.57-1.10
		High	E.C. > 1.10-2.30
Sample Type		Severe	E.C. > 2.3
DS	Disturbed Sample		
		Soil Acidity/Alkali	nity Levels (pH) are:
Soil Classification		Strongly Acidic	pH <5.0
PPF	Principal Profile Form	Acidic	рН 5.0-6.5
GSG	Great Soil Group	Neutral	рН 6.6-7.3
ASC	Australian Soil classification	Alkaline	рН 7.4-8.5
NSG	No Suitable Group	Strongly Alkaline	pH >8.5

Soil dispersion characteristics were determined using the modified Emerson aggregate stability test (Emerson and Seedsman Tech. Memo 15, 1981). Interpretation of the dispersion class ratings in Appendix 16C is as follows:

Dispersion Class Ratings

This is a measure of soil dispersibility or soil structural stability. The following general levels of dispersibility are assigned:

Dispersibility	Emerson Aggregate Classes
Very High	1 and 2 (3)
High	2 (2)
High to Moderate	2 (1)
Moderate	3 (4) and 3 (3)
Slight	3 (2), 3 (1) and 5
Negligible / Aggregated	6, 7, 8

The sub-classes of the Emerson Test are defined as follows:

- (1) Slight milkiness immediately adjacent to the aggregate
- (2) Obvious milkiness, less than 50% of the aggregate affected
- (3) Obvious milkiness, more than 50% of the aggregate affected
- (4) Total dispersion, leaving only sand grain

Note that Class 2 (4) is equivalent to Class 1.





Soil Residue Disposal Area

Land	Sample	Soil Horizon	Description	Coarse	Soil pH	EC (1:5 H ₂ O)	Dispersion	Comments/Soil Classification
Unit	Site	(depth mm)		Fragments	(1:5 H ₂ O)	(mS/cm)	Class No.	
Gi1	TP01	A1 (0-0.1)	Gravelly Loamy Sand (GM- SM) brown (7.5YR 4/6) dry loose, low plasticity silty/clayey fines.	40-50% r-s/r Fe gravel	6.1	0.06	3(2)	Thin silty surface crust. Ferric Orthic Tenosol – Uc 5.11, Lithosol – Lateritic Earthy Sand
		B1 (0.1-0.5)	Gravelly sand (GW-SP) fine to medium-grained, non-plastic, brown (7.5YR 5/4) dry loose apedal	≈50% r Fe concretions to 15mm	6.5	0.05	5	
		B2 (0.5-0.7)	Gravelly Sand (GW-SC) fine to medium-grained, light brown (7.5YR 6/4) low plasticity silt/clayey fines	35-40% s/r-r Fe gravel to 10mm	6.3	0.04	5	
		C (0.7-1.0+)	Sandy Clay-Clayey Sand (SC) low plasticity, brown (7.5YR 5/6) apedal massive	30-35% r-s/r Fe gravel to 10mm	6.2	0.11	6	
Gi1	TP02	A (0-0.2)	Sand (SP) fine to medium- grained, non-plastic, brown (7.5YR 5/4) dry, loose	5% fine Fe gravel 5- 10mm	6.2	0.02	5	Thin surface crust. Ferric Orthic Tenosol, -Uc4.21, Lateritic – Siliceous Sands
		A2 (0.2-0.5)	Sand (SP) fine to medium- grained, light brown (7.5YR 6/4), weakly coherent, non- plastic	<5% fine Fe gravel	6.3	0.01	5	
		B (0.5-1.0)	Gravelly Sand (GW-SP), fine to medium-grained brown (7.5YR 6/6) diffusely mottled orange, weakly coherent non-plastic	50% r-s/r Fe gravel 10- 20mm	6.8	0.03	5	
Gi1	TP03	A (0-0.15)	Gravelly Silty Sand (GW-SM) fine to coarse-grained, non-	Up to 40% r- s/r Fe gravel	5.8	0.03	5	Ferric Orthic-Leptic Tenosol – Uc5.11, Lateritic Siliceous Sand.



Soil Residue Disposal Area

Land Unit	Sample Site	Soil Horizon (depth mm)	Description	Coarse Fragments	Soil pH (1:5 H₂O)	EC (1:5 H₂O) (mS/cm)	Dispersion Class No.	Comments/Soil Classification
			plastic, dark brown (7.5YR 3/3)	to 10mm	5.6	0.03	5	
		B1 (0.15-0.4)	Gravelly Sand (GM-SM), fine to medium-grained, brown (7.5YR 5/4), non-plastic <5% silt/clay fines	50-60% r-s/r Fe gravel to 40mm	6.2	0.02	5	
		B2 (0.4-0.65)	Gravelly Sand (GP-SM) medium to coarse-grained, weakly coherent, non-plastic, strong brown (5YR 5/6) <5% silt/clay fines	40% r-s/r fine Fe gravel 2- 5mm	6.4	0.01	5	
		C (0.65-1.0)	Gravelly Sandy Clay – Clayey Sand (SC)	≈ 20% r-s/r Fe and WR gravel to 5mm	6.7	0.04	6	EW granitic bedrock (decomposed granite – deco.)
Gi1	TP04	A (0-0.25)	Gravelly Sand (GP-SP) fine to medium-grained non-plastic, brown (7.5YR 4/3)	≈ 60% s/a-s/r Fe and WR gravel up to 25mm	6.5	0.08	5	Ferric Orthic Tenosol –Uc5.11, Lithosol
		A/B1 (0.25-0.55)	Gravelly Sand (GW-SP) fine to medium-grained, non-plastic, brown (10YR 5/3)	≈ 60% r-s/r Fe gravel up to 20mm <5% silt/clay fines	6.9	0.02	5	
		B2/C (0.55-0.70)	Gravelly Sand (GM-SM) red (2.5YR 5/6) with ≈ 10% silt/clay fines, non-plastic	≈ 50% Fe and WR gravel up to 25mm	7.0	0.06	5	Extremely weathered rock decomposed granitic bedrock
Gi1	TP05	A (0-0.2)	Gravelly Silty Sand (SM), fine to medium-grained, brown (7.5YR 4/4) non-plastic dry, loose	25% r-s/r Fe gravel 2-5mm	6.6	0.04	5	Ferric Orthic Tenosol Uc 5.23, Lateritic Earthy Sand



Soil Residue Disposal Area

Land Unit	Sample Site	Soil Horizon (depth mm)	Description	Coarse Fragments	Soil pH (1:5 H₂O)	EC (1:5 H₂O) (mS/cm)	Dispersion Class No.	Comments/Soil Classification
		B/C (0.2-0.3)	Gravelly Loamy Sand (GC- SC), fine to medium-grained, yellowish-brown (10YR 5/7) 15-20% silt/clay fines low plasticity	40% r-s/r Fe gravel to 10mm	6.6	0.05	3(3)	Slightly to moderately dispersive when remoulded
		C (0.3-0.35)	Gravelly Loamy Sand (GC-SC) brown (7.5YR 5/6), 40% fine sandy, silty and clayey fines of low plasticity	60% r-s/r Fe and WR gravel to 25mm	6.6	0.06	5	EW granitic rock





Land Unit	Sample Site	Soil Horizon (depth mm)	Description	Coarse Fragments	Soil pH (1:5 H₂O)	EC (1:5 H₂O) (mS/cm)	Dispersion Class No.	Comments/Soil Classification
Gi1	TP27	F (0-0.2)	Gravelly Loamy Sand (GC-SC) fine-grained with ≈ 20% silt/clay fines of low plasticity, dark yellow brown (10YR 4/6)	40% r-s/r Fe gravel to 15mm	6.6	0.04	3(3)	Spolic – Anthroposol, "Uc1," Earthy Sand – Decomposed granite, slightly to moderately dispersive fines
		F (0.5-0.5)	Gravelly Clayey Sand (GC-SC) low to medium plasticity, yellowish red (5YR 5/6); approximately 25% silt/clay fines	35-40% s/r Fe gravel to 15mm	6.9	0.04	6	Decomposed granitic rock fill
		B/C(b) (0.5-0.9)	Gravelly Clayey Sand (SC-GC) low plasticity, yellowish-red (5YR 5/6), moist friable ≈ 15- 20% silt / clay fines	≈ 40-50% s/a- s/r HWR gravel to 20mm	6.7	0.02	6	Extremely weathered granite
		?C(b) (0.9-1.0+)	Sand (SP) fine to medium- grained, non-plastic, brown (7.5YR 5/4) approximately 5- 10% silty fines	20% r-s/r Fe gravel 2-5mm	6.7	0.02	5	
Gi1	TP28	A (0-0.1)	Gravelly Sandy Clay Loam (GM-GC), with 30% fine sandy, silty and clayey fines of low plasticity dark brown (7.5YR 4/6)	40% s/r-s/a WR gravel	6.3	0.04	5	Paralithic Orthic Tenosol –Uc5.21, Earthy Sand
		B/C (0.1-0.6+)	Gravelly Sandy Clay (GC-CL) low to medium plasticity strong brown (7.5YR 4/6)	50% s/a-s/r WR gravel to 30mm	6.0	0.02	6	EW granitic rock

 Table F.3.2

 Soils - Construction Workforce Accommodation Site



Land Unit	Sample Site	Soil Horizon (depth mm)	Description	Coarse Fragments	Soil pH (1:5 H₂O)	EC (1:5 H ₂ O) (mS/cm)	Dispersion Class No.	Comments/Soil Classification
DL	TP06	F (0-0.2)	Gravelly (Bauxitic) Sandy Clay Loam (GC), low to medium plasticity	Approx 40% r- s/a Fe and calcareous gravel to 25mm	9.85	0.54	5	Spolic Anthroposol; (PPF/GSG-NSC); Weakly cemented bauxitic clay and calcareous fill material
		F (0.2-0.6)	Gravelly Clay (CL), medium to high plasticity, yellowish red (5YR 4/6)	Approx 25% r- s/a gravel to 10mm	7.2	0.09	6	Weakly cemented
		B-C(b) (0.6-1.1+)	Clayey Sand – Sandy Clay (SC) medium to high plasticity, yellowish red, mottled (7.5YR 6/8) moist, friable	10-15% s/a HW granitic rock gravel	6.0	0.04	5	Decomposed granite bedrock
DL	TP08	F (0-0.13)	Clayey Gravel (GC), yellowish red (5YR 5/8)	70% s/a-s/r bauxitic and calcareous gravel up to 20mm	10.0	1.45	5	Spolic Anthroposol (lime-bauxite fill mix) (PPF / GSG – NSG) – strongly alkaline and saline
		F (0.13-0.15)	Gravelly Sandy Silty Clay (SC- CL)		9.9	0.76	5	Cemented calcareous and bauxitic clayey gravel mix
		F (0.15-0.4)	Gravelly Sandy Clay (SC-CL) medium plasticity, red (2.5YR 5/6)	10-15% Fe and WR gravel to 10mm	8.8	0.75	3(1)	Slightly dispersive clayey fines
DL	TP19	F (0-0.12)	Silty (calcareous) Gravel (GM) non-plastic fines, pale brown (10YR 7/3)	70% s/r – s/a calcareous gravel	9.0	0.47	6	Spolic Anthroposal (PPF/GSC-NSG)
		F (0.12-0.67)	Gravelly Sandy Loam (GC), with 요 30% fine sandy, silty and clayey fines of low plasticity	70% s/a-s/r WR gravel 2- 5mm	8.4	0.44	6	Decomposed granitie



Land Unit	Sample Site	Soil Horizon (depth mm)	Description	Coarse Fragments	Soil pH (1:5 H₂O)	EC (1:5 H₂O) (mS/cm)	Dispersion Class No.	Comments/Soil Classification
		B/C(b) (0.67-0.8)	Gravelly Sandy Clay Loam (SC- CL), low plasticity, red (2.5YR 4/6)	20% s/a Fe and WR gravel	7.7	0.62	6	Decomposed granite
DL	TP22	F (0-0.2)	Clayey Gravel (GC) medium plasticity (bauxitic clay/lime mix)	60% s/a calcareous gravel to 25mm	11.7	1.21	6	Spolic Anthoposal – (PPF/GSG-NSG)
		F (0.2-0.3)	Sandy Gravel (GM - Gc) brown (10YR 4/4) – (roadbase gravel fill)		10.2	0.25	5	
		F (0.3-0.5)	Gravelly Clayey Sand (SC), fine to coarse-grained, low plasticity fines, white and yellowish red (5YR 5/6), moist friable	25% s/a Fe and WR gravel to 25mm	9.7	0.38	5	Decomposed granite fill to 0.5m, transitional to:
		Cb (0.9-1.5+)	Gravelly Clayey Sand (SC-CL) medium to high plasticity clayey fines Doriegalved grey, white and brown with relief rock structure.	s/r – s/a	-	-	-	EW granitic rock.
DL	TP26	F (0-0.2)	Gravelly Loamy Sand (GM-GC) (bauxitic clay and calcareous gravelly fill material)	70% s/a-s/r Fe and calcareous gravel to 20mm	9.9	0.19	5	Spolic Anthroposol – overlying –Uc5.11 – siliceous sands



Land	Sample	Soil Horizon	Description	Coarse	Soil pH	EC (1:5 H ₂ O)	Dispersion	Comments/Soil Classification
Onit	Sile	(depth mm)		Fragments	(1:5 H₂O)	(mo/cm)	Class 140.	
		F (0.2-0.3)	Calcareous gravel white in bauxitic clayey matrix (GC)	80% s/a-s/r calcareous gravel	12.2	2.94	6	Very high alkalinity and salinity
		F (0.3-1.35)	Gravelly Loam (GM-GC) low plasticity, dark red (2.5YR 4/8)	60% s/r-s/a calcareous and Fe gravel to 15mm	9.6	0.17	5	Strongly alkaline
		Ab (1.35-1.80)	Sand, (SP-SM) fine to medium- grained, brownish black (7.5YR 3/1) non-plastic	-	5.7	0.04	5	Highly organic black sand - (no odour)
		B/C (1.8-2.7+)	Sand (SP-SM) fine to medium-	Occasional Fe	7.7	0.04	5	
			grained, non plastic reddish brown (5YR 5/4) becoming yellowish red (5YR 5/6)	concretions to 5mm	8.0	0.05	5	
DL	TP29	F (0-0.2)	Bauxitic clayey sand and calcareous gravel fill (GC)	-	-	-	-	Spolic Anthroposol overlying Siliceous sands –Uc1.23
		F (0.2-1.2)	Gravelly Sandy Loam (GC) with 40% sand, silt and clayey fines of low plasticity	60% r-s/r and angular Fe and calcareous gravel to 20mm	8.3	0.31	6	Decomposed granite gravelly fill
		A/Cb (1.2-2.0)	Sand (SP) fine to medium- grained, non-plastic, brown (7.5YR 4/4) dry, loose	Occasional shell fragments	9.1	0.07	6	Buried calcareous coastal sand deposits
		C (2.0-4.5+)	Gravelly Sandy Loam (GC) fine to coarse-grained, low plasticity silt/clayey fines, yellowish red	60% s/a-s/r Fe and WR gravel to 15mm	8.2	0.12	6	EW granitic bedrock (decomposed granite)



Land Unit	Sample Site	Soil Horizon (depth mm)	Description	Coarse Fragments	Soil pH (1:5 H₂O)	EC (1:5 H ₂ O) (mS/cm)	Dispersion Class No.	Comments/Soil Classification
			(5YR 4/6)					
	TP33	F (0-0.12)	Gravelly (Bauxitic) Clayey Sand (GC) fill	-	-	-	-	Spolic Anthroposol (PPF/GSG-NSG)
		F (0.12-0.3)	Gravelly Sandy Clay (CL) medium plasticity, red (2.5YR 4/6)	20% s/a-s/r Fe and HW rock gravel	7.0	0.39	6	Decomposed granitic rock-fill material
		Cb (0.3-1.3)	Gravelly Sandy Clay (Gc – Cl) medium plasticity, red (10 R 4/6) becoming yellowish red (5 YR	Approx. 50% s/r HW took gravel to	6.2	0.25	6	Decomposed granitic rock.
			5/6) with depth.	25mm				
DL	TP34	F (0-0.4)	Gravelly (Bauxitic Clayey Band (GC) fill					Spolic Anthroposol overlying siliceous Sand – Uc 5.11
		F (0.4-1.0)	Gravelly Sandy Clay Loam (CL) low to medium plasticity, brown (7.5 YR 5/4) with white flecks	20% s/r HWR gravel to 10mm	8.5	0.13	5	Reworked EW granitic rock fill.
		F (1.0-1.3)	Gravelly Sandy Clay Loam (GC) low plasticity red – brown (7.5YR 4/4)	60% s/a Fe and HW rock graval	8.8	0.11	5	Decomposed granite rock fill material
		Ab (1.3-3.2)	Sand (SP) medium-grained non- plastic, yellowish brown (7.5YR 4/4) loose dry.	10% Fe and calcareous concretionary gravel to 10mm	8.8	0.10	5	Buried calcareous coastal sand deposits.
		D (3.2)	Extremely weathered Granite variegated orange, red and white, low strength					Weather rock.

