

LAPORAN HIDROGEOLOGI

PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI PULAU MABUL, SEMPORNA, SABAH

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PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI PULAU MABUL, SEMPORNA, SABAH.

1.0 PENGENALAN

Terrain Resources Sdn. Bhd. salah satu kontraktor dalam industri penggerudian telaga air tanah (biasanya dipanggil telaga tiub) telah dilantik oleh Institut Penyelidikan Hidraulik Kebangsaan Malaysia (NAHRIM) bagi “Projek Perkhidmatan Penggerudian Dan Pembinaan Telaga Tiub Air Tanah Di Pulau Mabul, Semporna, Sabah”. Kerja-kerja penggerudian dan pembinaan dua (2) buah telaga tiub bersaiz 50mm dan dua (2) buah telaga pemantauan telah dijalankan bermula dari 21 Oktober 2018 hingga 15 November 2018 manakala ujian pengepaman telah dijalankan pada 17 November 2018 hingga 18 November 2018.

1.1. Objektif

Objektif kajian yang dijalankan adalah seperti berikut:

- i) Mengumpul maklumat geologi dan data hidrogeologi.
- ii) Mengenalpasti potensi air tanah dari segi kuantiti dan kualitinya.
- iii) Membangunkan bekalan air tanah sebagai sumber air alternatif atau tambahan kepada bekalan air sediaada.

1.2. Skop Kerja

Skop kerja yang dilaksanakan adalah seperti berikut:-

- i) Membina dua (2) buah telaga tiub (TW1 dan TW2) sehingga kedalaman 40.0m dan dua (2) buah telaga pemantauan sehingga kedalaman 6.0m (TW1A dan TW2A).
- ii) Melakukan kerja-kerja persampelan pasir untuk ujian makmal.
- iii) Menjalankan ujian pengepaman bagi setiap telaga tiub (TW1 dan TW2).
- iv) Melakukan kerja-kerja persampelan air bagi analisis kimia dan analisis bakteriologi bagi setiap telaga tiub (TW1 dan TW2).
- v) Penyerahan laporan akhir yang mengandungi semua butiran berkaitan.

1.3. Lokasi Kawasan Kajian

Lokasi kajian ini terletak di Pulau Mabul, Semporna, Sabah. Pulau ini terkenal kerana keindahan terumbu karang dan kehidupan lautnya serta menjadi tumpuan para penyelam seluruh dunia. Telaga tiub yang dinamakan sebagai TW1 dan TW2 telah dibina di sekitar kawasan ESSCOMM. Kawasan penggerudian ini terletak di bahagian tengah pulau. Lokasi telaga-telaga tiub ditunjukkan dalam **Rajah 1**. Telaga TW1 ini dianggarkan berada pada kedudukan koordinat latitud U 4°14'48.80" dan longitud T 118°37'51.74", manakala telaga TW2 adalah pada kedudukan koordinat latitud U 4°14'47.33" dan longitud T 118°37'48.32".



Rajah 1: Lokasi telaga air tanah di Pulau Mabul.

2.0 GEOLOGI

2.1 Geologi Rantau

Usia pembentukan geologi Sabah berjulat dari Tertier Awal sehingga Kuarter (Pleistosen) yang berada dalam satu kronologi utama iaitu Cenozoic. Formasi berusia Tertier Awal di Sabah boleh ditemui di Jalur Tengah dan di Timur Sabah manakala formasi berusia Pleistosen boleh ditemui di sekitar perairan Sabah.

Batuan igneus berusia Tertier Awal terdiri daripada serpentinit, peridot, dunit dan pyroxenit terletak di bahagian tengah Sabah dan batuan igneus berusia Pleistosen terletak di bahagian tenggara Sabah. Batuan tertua di Sabah ialah Formasi Kompleks Sabah, yang terletak di bahagian barat Lahad Datu, yang berusia Jura atau Awal Jura (Geological Survey 1967).

Batuan metamorf yang terdiri daripada amfibol, gneiss dan syis terletak di bahagian barat Lahad Datu yang juga dikenali sebagai Kompleks Sabah. Batuan sedimen berusia Jura – Kuaternari terletak di bahagian tengah, utara dan tenggara Sabah manakala batuan sedimen yang berusia Pleistosen terletak di sekitar perairan Sabah.

2.2 Geologi Kawasan Kajian

Batuan tertua adalah batuan metamorf gred tinggi kompleks batuan dasar dan Kompleks Sabah. Batuan Kompleks Sabah (Cs) ditindih tak selaras oleh batuan Formasi Kalumpang, Formasi Kuamut dan Formasi Kalabakan yang ditindih tidak selaras oleh batuan Formasi Balung, Formasi Umas-Umas dan Formasi Simenggaris serta batuan vulkanik Tertier-Kuaternari. Jujukan kawasan ini selari dengan jujukan Semporna yang bersambungan dari lembangan Sabah tengah, dipisahkan dari jujukan Teluk Darvel oleh Kompleks Sabah dan kompleks batuan dasar. Banyak batuan volcano Tertier Akhir sehingga Kuaternari.

3.0 KERJA PENGGERUDIAN DAN PEMBINAAN TELAGA

3.1 Kaedah Penggerudian (*Boring*)

Kerja-kerja penggerudian bagi TW1 telah dijalankan pada 21 Oktober 2018 hingga 30 Oktober 2018, TW1A pada 31 Oktober 2018, TW2 pada 1 November hingga 15 November 2018 dan TW2A pada 15 November 2018.

Penggerudian dijalankan menggunakan mesin gerudi YWE D45R dan aksesori lain seperti dalam (**Gambar 1**). Operasi penggerudian di tapak dijalankan oleh pengendali mesin tempatan yang terlatih, di bawah pemantauan dan arahan teknikal yang diberikan ahli geologi. *Steel casing* (NW 88.9mm O.D.) dengan tapak *tungsten* digunakan sepanjang kerja berjalan. Lubang gerudi dicuci menggunakan air yang diguna pakai semula dari *piston pump*. Sampel tanah diperolehi ketika proses penggerudian seperti diminta Jabatan Mineral dan Geosains (**Gambar 2**).

Secara umumnya, dari penggerudian lubang gerudi bersaiz 75mm didapati permukaan tanah sehingga kedalaman 6m terdiri daripada pasir dan fragmen karang berwarna perang keputihan, diikuti karang berfosil berwarna putih krim sehingga kedalaman 24.0m. Pada kedalaman 24m hingga 40m batu kapur berfosil ditemui di mana terdapat rekahan di batuan dan kawasan berkaviti (**Gambar 3**). Pengelasan geologi dan reka bentuk telaga tiub berdiameter 50mm boleh ditemui pada **Lampiran 1**.

3.2 Pembinaan Telaga

Pembinaan telaga terdiri daripada pemasangan uPVC Class D SIRIM berdiameter 50mm. Skrin dipasang sepanjang lapisan batu kapur berfosil yang menjadi akuifer kedua iaitu pada kedalaman 30m hingga 39m. Ruang kosong antara paip uPVC dan dinding gerudi kemudian diisi dengan kerikil bersaiz 2.0 – 4.0 mm. Setelah kerikil selesai dimasukkan, telaga tiub melalui proses pencucian dan pengepaman di mana air bersih disalurkan ke dasar telaga tiub sehingga air yang keluar jernih serta bersih dari bendasing atau minyak/gris yang tertinggal dalam lubang gerudi ketika proses penggerudian.

Kerikil bersaiz 2.0 – 4.0mm diisi di sekeliling skrin bertujuan menahan atau menapis partikel halus seperti pasir dan lempung yang tidak dikehendaki dari memasuki telaga tiub. Partikel halus ini meyebabkan air menjadi keruh dan dalam jangka masa panjang boleh menyebabkan telaga tiub tersumbat. Kedalaman kerikil yang diisi diukur menggunakan pita pengukur. Kemudian, campuran simen bentonit dimasukkan ke dalam ruang kosong di antara uPVC dengan dinding telaga. Ini bertujuan untuk mengelakkan bahan pencemar dari permukaan memasuki akuifer atau bagi mengelakkan percampuran air tanah berlainan akuifer. Lubang telaga kemudiannya di tambak semula dengan menggunakan tanah atau pasir.

Pembinaan tapak telaga dilakukan bagi mengukuhkan lagi struktur tiub uPVC dan akhir sekali penutup besi yang telah ditempah khas dan boleh dikunci dipasang dan dikonkrit agar telaga selamat (**Gambar 4**).



Gambar 1: Penggerudian telaga tiub menggunakan mesin gerudi YWE D45R.



Gambar 2: Sampel yang diperoleh semasa penggerudian.



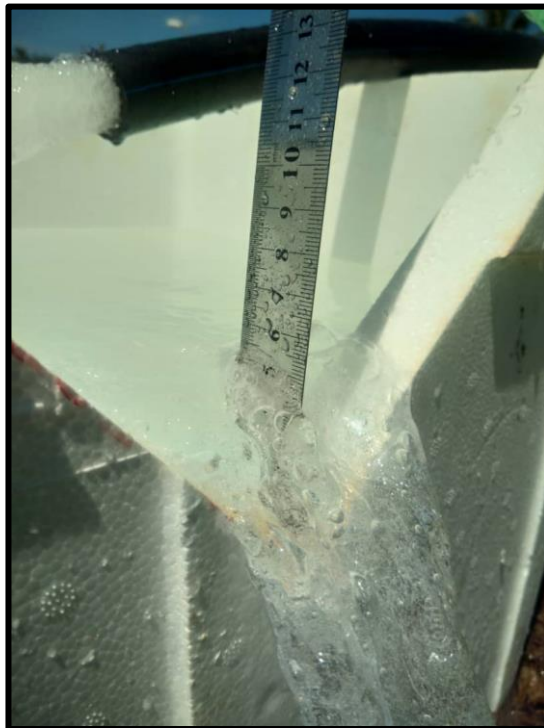
Gambar 3: Sampel batu kapur berfossil.



Gambar 4: Telaga yang telah siap ditutup dengan penutup besi.

4.0 PEMAJUAN TELAGA

Setelah telaga tiub siap dipasang, air dari telaga telah dipam keluar menggunakan pam sentrifugal (pam petrol) sehingga air yang keluar menjadi jernih dan bebas dari pasir halus. Pengeluaran air dari telaga tiub dapat dianggar dari bacaan V-notch iaitu sekitar 1.613m³/jam (354.81gelen/jam) (**Gambar 5**).



Gambar 5: Tangki V-Notch 90⁰ untuk mengukur kadar aliran semasa ujian pengepaman.

4.1 Ujian Pengepaman

Ujian pengepaman dijalankan dari 17 November 2018 hingga 18 November 2018 menggunakan sentrifugal pam dengan kapasiti maksimum 2.5 m³/jam (**Gambar 6**). Pam selam tersebut diletakkan pada kedalaman 40.00 meter di bawah tanah.

Tangki V-notch 90° digunakan untuk mengukur kadar luahan air (**Gambar 7**). Selepas pemasangan pam dan alat-alat berkaitan selesai, Ujian Constant Discharge dan Recovery dijalankan.



Gambar 6: Sentrifugal pam yang digunakan untuk ujian pengepaman.



Gambar 7: Tangki V-notch 90° digunakan untuk mengukur kadar luahan air.

4.2 Ujian *Constant Discharge*

Ujian *Constant Discharge* untuk TW1 dijalankan pada 17 November 2018 selama 6 jam. Kadar pengepaman untuk ujian *Constant Discharge* ditetapkan pada 2.16 m³/jam. Muka air bawah tanah ketika ujian *Constant Discharge* ialah 1.59 meter di bawah paras tanah dan muka air maksimum selepas pengepaman berterusan selama 6 jam ialah 1.76 meter, dengan jumlah penurunan sebanyak 0.17 meter.

Ujian *Constant Discharge* untuk TW2 dijalankan pada 18 November 2018 selama 6 jam. Kadar pengepaman untuk ujian *Constant Discharge* ditetapkan pada 2.16 m³/jam. Muka air bawah tanah ketika ujian *Constant Discharge* ialah 2.48 meter di bawah paras tanah dan muka air maksimum selepas pengepaman berterusan selama 6 jam ialah 1.89 meter, dengan jumlah penurunan sebanyak 0.59 meter.

4.3 Ujian *Recovery*

Ujian *Recovery* untuk TW1 diteruskan sejurus selepas ujian *Constant Discharge* selesai. Ujian *recovery* dijalankan selama 375 minit selepas pam dimatikan. *Residual drawdown* permulaan ialah 0.17 meter, dengan residual drawdown selepas 375 minit ialah 0.00 meter dengan pemulihan sebanyak 100%.

Ujian *Recovery* untuk TW2 diteruskan sejurus selepas ujian *Constant Discharge* selesai. Ujian *recovery* dijalankan selama 375 minit selepas pam dimatikan. Berdasarkan data *ujian recovery*, residual drawdown permulaan ialah -0.59 meter, dengan residual drawdown selepas 375 minit ialah -0.78 meter. Ini disebabkan oleh perubahan pasang surut air laut yang menyebabkan paras air di dalam telaga lebih tinggi dari paras air statik.

5.0 TABURAN SAIZ PARTIKEL (*PARTICLE-SIZE DISTRIBUTION*)

Taburan saiz partikel berdasarkan keputusan ujian makmal boleh ditemui pada **Lampiran 4**.

6.0 ANALISIS KIMIA DAN ANALISIS BAKTERIOLOGI

Keputusan analisis kimia dan bakteriologi sampel air boleh ditemui pada **Lampiran 5**.

7.0 KESIMPULAN

TW1 dan TW2 dibina dan dipasang pada kedalaman 40.0m dengan skrin pada kedalaman 30m meter sehingga 39m. Litologi lubang gerudi terdiri daripada pasir berfragmen karang yang berwarna perang keputihan dari permukaan sehingga kedalaman 6m, diikuti karang berfosil hingga kedalaman 24m. Batu kapur berfosil yang berwarna putih krim ditemui pada kedalaman 24m sehingga akhir lubang gerudi iaitu 40m.

TW1A dibina dan dipasang pada kedalaman 4.0m dengan skrin pada kedalaman 1m sehingga 3m. Litologi lubang gerudi terdiri daripada pasir berfragmen karang yang berwarna perang keputihan dari permukaan sehingga kedalaman 4m. TW2A dibina dan dipasang pada kedalaman 6.0m dengan skrin pada kedalaman 2m sehingga 5m. Litologi lubang gerudi terdiri daripada pasir berfragmen karang yang berwarna perang keputihan dari permukaan sehingga kedalaman 6m.

Berdasarkan analisis ujian pengepaman, kadar pengepaman untuk ujian *Constant Discharge* dengan menggunakan V-notch ialah $2.16 \text{ m}^3/\text{jam}$ untuk TW1 dan TW2.

Pengeluaran air dari telaga tiub dapat dianggarkan dari bacaan V-notch iaitu sekitar 1.613m³/jam (354.81gelen/jam). Air yang diperoleh sedikit keruh, payau dan sedikit berbau.

Penapisan ringkas boleh digunakan untuk menghilangkan pasir dari telaga tiub. Air yang diperoleh tidak galakkan untuk diminum kerana mempunyai kandungan salinity yang agak tinggi. Pemeriksaan berkala aras air dan kualiti air dalam telaga tiub harus dijalankan bagi mengelakkan penurunan kualiti air selari dengan masa disebabkan aktiviti antropogenik di sekitar kawasan telaga tiub.

8.0 RUJUKAN

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LAMPIRAN 1:
LOG GEOLOGI DAN REKA
BENTUK TELAGA

ENGINEERING BOREHOLE LOG

Project : PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI										Sheet 1 of 4	
Location : PULAU MABUL, SEMPORNA, SABAH.										Borehole No: TW 1	
										Coordinate: 993157 E, 472580 N	
Client : NAHRIM										Reduced Level: 3m	
Consultant :										Final water level: 1.09m	
Rig type : YWE-D45R										Driller : JULHANDI	
Drill Method : ROTARY										Supervisor : CYPRIANS	
Casing Type : NMLC										Check by : LUKMAN	
										Date started: 21.10.2018	
										Date Completed: 01.11.2018	

Depth (m)	Strata Thickness	Description of Strata	Log	SAMPLING DETAIL			SPT BLOW COUNT						N Value			
				Sample No.	Depth (m)		Rec. Ratio	Penetration in mm								
					From	To		75	75	75	75	75		75	N Value	
1		Brownish white, medium to coarse SAND with some coral fragments	...	D1	1.500	1.950	200/450								0	
	...															
	...															
	...															
	...															
	...															
2		Brownish white, medium to coarse SAND with some coral fragments	...	D2	3.000	3.450	250/450								0	
	...															
	...															
	...															
	...															
	...															
3		Brownish white, medium to coarse SAND with some coral fragments	...	D3	4.500	4.950	210/450								0	
	...															
	...															
	...															
	...															
	...															
4		Brownish white, medium to coarse SAND with some coral fragments	...	D3	4.500	4.950	210/450								0	
	...															
	...															
	...															
	...															
	...															
5		Brownish white, medium to coarse SAND with some coral fragments	...	D3	4.500	4.950	210/450								0	
	...															
	...															
	...															
	...															
	...															
6		Creamy white, highly fractured and highly weathered, subrounded coral polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C1	6.000	7.500	CL=1.5 CR=0.6 RQD=NIL								0	
	cccc															
	cccc															
	cccc															
	cccc															
	cccc															
7		Creamy white, highly fractured and highly weathered, subrounded coral polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C2	7.500	9.000	CL=1.5 CR=0.6 RQD=NIL								0	
	cccc															
	cccc															
	cccc															
	cccc															
	cccc															
8		Creamy white, highly fractured and highly weathered, subrounded coral polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C2	7.500	9.000	CL=1.5 CR=0.6 RQD=NIL								0	
	cccc															
	cccc															
	cccc															
	cccc															
	cccc															
9		Creamy white, highly fractured and highly weathered, subrounded coral polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C3	9.000	10.500	CL=1.5 CR=0.9 RQD=NIL								0	
	cccc															
	cccc															
	cccc															
	cccc															
	cccc															

LEGEND:

PM Pressuremeter Test

D Disturbed Sample

P Standard Penetration Test

UD Undisturbed Sample

G Geonor Vane Test

VS Vane Share Test

C Rock Coring

CL - Core Length

CR - Core Recovery

RQD - Rock Quality Designation

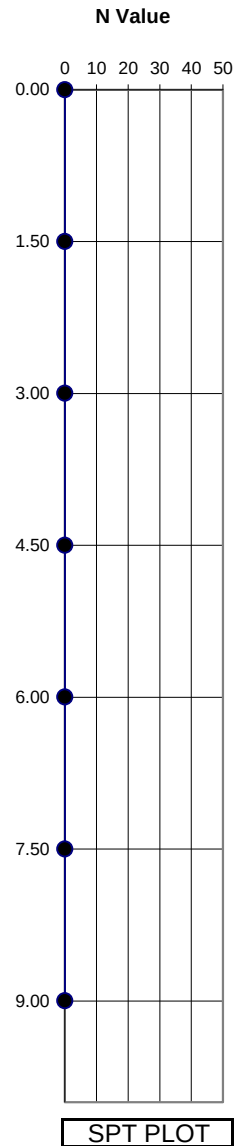
REMARK :

Date	Time hrs	Depth of hole (m)	Depth of casing (m)	Depth of water (m)

TERRAIN RESOURCES SDN BHD

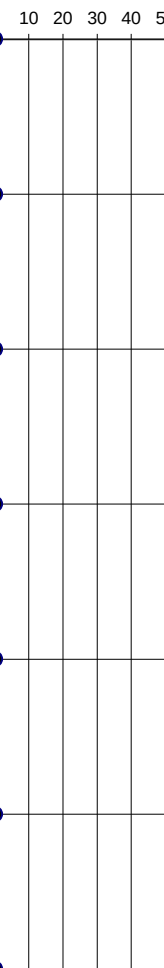
Example:
50/120 = 50 Blows/120mm

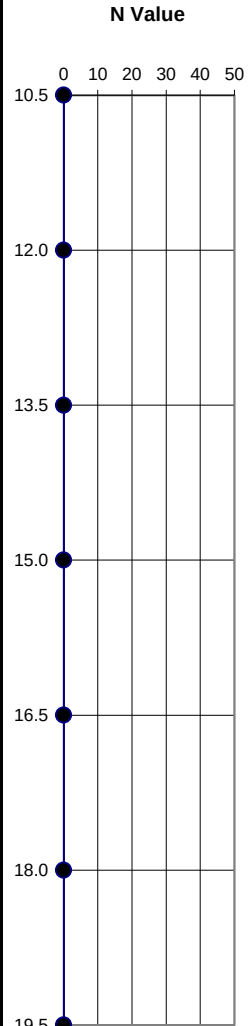
CONSISTENCY / RELATIVE DENSITY			
Cohesive Soil (N)		Non Cohesive Soil (N)	
0 - 2	Very soft	0 - 4	Very loose
2 - 4	Soft	4 - 10	Loose
4 - 8	Medium stiff	10 - 30	Medium dense
8 - 15	Stiff	30 - 50	Dense
15 - 30	Very stiff	50 >	Very dense
30 >	Hard		



ENGINEERING BOREHOLE LOG

Project :	PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI	Sheet 2 of 4
Location :	PULAU MABUL, SEMPORNA, SABAH.	Borehole No: TW 1
Client :	NAHRIM	Coordinate: 993157 E, 472580 N
Consultant :		Reduced Level: 3m
	Rig type : YWE-D45R	Driller : JULHANDI
	Drill Method : ROTARY	Supervisor : CYPRIANS
	Casing Type : NMLC	Check by : LUKMAN
		Final water level: 1.09m
		Date started: 21.10.2018
		Date Completed: 01.11.2018

Depth (m)	Strata Thick- ness	Description of Strata	Log	SAMPLING DETAIL				SPT BLOW COUNT							N Value		
				Sample No.	Depth (m)		Rec. Ratio	Penetration in mm						N Value			
					From	To		75	75	75	75	75	75				
10		Creamy white, highly fractured and highly weathered, subrounded corals polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C4		10.500	12.000	CL=1.5 CR=1.3 RQD=NIL							0	10.5	
	cccc																
	cccc																
	cccc																
	cccc																
11		Creamy white, highly & widely fractured, highly weathered, subrounded corals polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C5		12.000	13.500	CL=1.5 CR=0.7 RQD=NIL							0	12.0	
	cccc																
	cccc																
	cccc																
	cccc																
12		Creamy white, highly & widely fractured, highly weathered, subrounded corals polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C6		13.500	15.000	CL=1.5 CR=0.6 RQD=NIL							0	13.5	
	cccc																
	cccc																
	cccc																
	cccc																
13		Creamy white, close to widely fractured, highly weathered, subrounded corals polyp and calcified sheashells with iron stained spot and irregular cavities CORAL bed.	cccc	C7		15.000	16.500	CL=1.5 CR=0.7 RQD=NIL							0	15.0	
	cccc																
	cccc																
	cccc																
	cccc																
14		Creamy white, close to widely fractured, highly weathered, subrounded corals polyp and calcified sheashells with iron stained spot and irregular cavities CORAL bed.	cccc	C8		16.500	18.000	CL=1.5 CR=1.4 RQD=NIL							0	16.5	
	cccc																
	cccc																
	cccc																
	cccc																
15		Creamy white, close to widely fractured, highly weathered, subrounded corals polyp and calcified sheashells with iron stained spot and irregular cavities CORAL bed.	cccc	C9		18.000	19.500	CL=1.5 CR=1.3 RQD=NIL							0	18.0	
	cccc																
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16		Creamy white, close to widely fractured, highly weathered, subrounded corals polyp and calcified sheashells with iron stained spot and irregular cavities CORAL bed.	cccc	C10		19.500	21.000	CL=1.5 CR=0.8 RQD=NIL							0	19.5	
	cccc																
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LEGEND:			REMARK :					Example: 50/120 = 50 Blows/120mm		SPT PLOT	
PM		Pressuremeter Test						CONSISTENCY / RELATIVE DENSITY			
D		Disturbed Sample									
P		Standard Penetration Test									
UD		Undisturbed Sample									
G		Geonor Vane Test									
VS		Vane Share Test									
C		Rock Coring									
CL	-	Core Length									
CR	-	Core Recovery									
RQD	-	Rock Quality Designation									
			TERRAIN RESOURCES SDN BHD								

ENGINEERING BOREHOLE LOG

Project :	PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI	Sheet 3 of 4
Location :	PULAU MABUL, SEMPORNA, SABAH.	Borehole No: TW 1
		Coordinate: 993157 E, 472580 N
		Reduced Level: 3m
Client :	NAHRIM	Final water level: 1.09m
Consultant :		Date started: 21.10.2018
	Rig type : YWE-D45R	Driller : JULHANDI
	Drill Method : ROTARY	Supervisor : CYPRIANS
	Casing Type : NMLC	Check by : LUKMAN
		Date Completed: 01.11.2018

Depth (m)	Strata Thick- ness	Description of Strata	Log	SAMPLING DETAIL				SPT BLOW COUNT														
				Sample No.	Depth (m)		Rec. Ratio	Penetration in mm						N Value								
					From	To		75	75	75	75	75	75									
21		iron stained spot and irregular cavity CORAL bed.	cccc	C11		21.000	22.500	CL=1.5 CR=1.4 RQD=NIL							0	21.00	0	10	20	30	40	50
			cccc																			
			cccc																			
			cccc																			
			cccc																			
			cccc																			
22		Brownish white, widely to closely fractured, highly weathered, irregular cavity subrounded coral polyp with iron stained spot CORAL bed.	cccc																			
23		Brownish white, closely to highly fractured, highly weathered, fossiliferous LIMESTONE with spotted iron staining on joints and cavities.	TTTT	C12		22.500	24.000	CL=1.5 CR=1.4 RQD=NIL								0	22.50					
24		Brownish white, closely to highly fractured, highly weathered, fossiliferous LIMESTONE with spotted iron staining on joints and cavities.	TTTT	C13		24.000	25.500	CL=1.5 CR=1.4 RQD=NIL								0	24.00					
25			TTTT																			
26		Brownish white, closely to highly fractured, highly weathered, fossiliferous LIMESTONE with spotted iron staining on joints and cavities.	TTTT	C14		25.500	27.000	CL=1.5 CR=1.0 RQD=NIL								0	25.50					
27		Brownish white, highly fractured and highly weathered, fossiliferous LIMESTONE with spotted iron staining on joints and cavities.	TTTT	C15		27.000	28.500	CL=1.5 CR=1.1 RQD=NIL								0	27.00					
28			TTTT																			
29		Brownish white, highly fractured and highly weathered, fossiliferous LIMESTONE with spotted iron staining on joints and cavities.	TTTT	C16		28.500	30.000	CL=1.5 CR=1.1 RQD=NIL								0	28.50					
			TTTT																			
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LEGEND:			REMARK :					Example: 50/120 = 50 Blows/120mm		SPT PLOT	
PM		Pressuremeter Test	Date	Time hrs	Depth of hole (m)	Depth of casing (m)	Depth of water (m)	CONSISTENCY / RELATIVE DENSITY			
D		Disturbed Sample						Cohesive Soil (N)		Non Cohesive Soil (N)	
P		Standard Penetration Test						0 - 2 2 - 4 4 - 8 8 - 15 15 - 30 30 >	Very soft Soft Medium stiff Stiff Very stiff Hard	0 - 4 4 - 10 10 - 30 30 - 50 50 >	Very loose Loose Medium dense Dense Very dense
UD		Undisturbed Sample									
G		Geonor Vane Test									
VS		Vane Shear Test									
C		Rock Coring									
CL	-	Core Length									
CR	-	Core Recovery	TERRAIN RESOURCES SDN BHD								
RQD	-	Rock Quality Designation									

ENGINEERING BOREHOLE LOG

Project : PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI				Sheet 4 of 4
Location : PULAU MABUL, SEMPORNA, SABAH.				Borehole No: TW 1
				Coordinate: 993157 E, 472580 N
				Reduced Level: 3m
Client : NAHRIM	Rig type : YWE-D45R	Driller : JULHANDI	Final water level: 1.09m	
Consultant :	Drill Method : ROTARY	Supervisor : CYPRIANS	Date started: 21.10.2018	
	Casing Type : NMLC	Check by : LUKMAN	Date Completed: 01.11.2018	

[illegible]

SPT PLOT

LEGEND:

PM		Pressuremeter Test
D		Disturbed Sample
P		Standard Penetration Test
UD		Undisturbed Sample
G		Geonor Vane Test
VS		Vane Share Test
C		Rock Coring
CL	-	Core Length
CR	-	Core Recovery
RQD	-	Rock Quality Designation

REMARK: End of TW1 at depth 40m

Example:
50/120 = 50 Blows/120mm

Date	Time hrs	Depth of hole (m)	Depth of casing (m)	Depth of water (m)	CONSISTENCY / RELATIVE DENSITY			
					Cohesive Soil (N)		Non Cohesive Soil (N)	
					0 - 2	Very soft	0 - 4	Very loose
					2 - 4	Soft	4 - 10	Loose
					4 - 8	Medium stiff	10 - 30	Medium dense
					8 - 15	Stiff	30 - 50	Dense
					15 - 30	Very stiff	50 >	Very dense
					30 >	Hard		
TERRAIN RESOURCES SDN BHD								

GROUNDWATER LOG TW1

PROJECT NUMBER	DRILLING DATE 21/10/2018 - 01/11/2018	COORDINATES 993157 E, 472580 N
PROJECT LOCATION Mabul, Semporna, Sabah	WELL DEPTH 40 m	DRILLER Julhandi
CLIENT NAHRIM	WELL DIAMETER 50 mm	SITE GEOLOGIST Cyprians
ADDRESS Lot 5377, Jalan Putra Permai, 43300 Seri Kembangan, Selangor.	CASING TYPE uPVC Class D (SIRIM)	SITE OFFICER Azrul Normi
	SCREEN DEPTH 30m - 39m	DRILLING RIG YWE D45R

PROJECT TITLE PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI PULAU MABUL, SEMPORNA, SABAH.	STATIC WATER LEVEL 1.09 m
	ESTIMATE DISCHARGE 2 m ³ /h

Depth (m)	Material Description	Graphic Log	Samples	Drilling Method	Waterstrike, Q (m ³ /h)	Tubewell Design Specification
-2						
0	Browish white, medium to coarse SAND with some coral fragments		TW1_0-6	Rotary Mud Drilling by using tungsten shoe (75 mm diameter)		
2						
4						
6	Creamy white, highly fractured and highly weathered, subrounded coral polyp and calcified sheashells with iron stained spot and streak CORAL bed.		TW1_6-23	NMLC Diamond Bit coring (63.5 mm diameter)		
8						
10						
12						
14						
16						
18						
20						
22						
24	Brownish white, closely to highly fractured, highly weathered, fossiliferous LIMESTONE with spotted iron stained on joints and cavities.		TW1_23-40			
26						
28						
30						
32						
34						
36						
38						
40	End of Borehole at depth 40.0m					
42						
44						
46						
48						

ENGINEERING BOREHOLE LOG

Project :	PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI	Sheet 1 of 1
Location :	PULAU MABUL, SEMPORNA, SABAH.	Borehole No: TW 1A
		Coordinate: 993152 E, 472472568 N
		Reduced Level: 3m
Client :	NAHRIM	Driller : JULHANDI
Consultant :		Supervisor : CYPRIANS
	Rig type : YWE-D45R	Check by : LUKMAN
	Drill Method : ROTARY	
	Casing Type : NMLC	
		Final water level: 1.4m
		Date started: 02.11.2018
		Date Completed: 02.11.2018

Depth (m)	Strata Thick- ness	Description of Strata	Log	SAMPLING DETAIL				SPT BLOW COUNT							N Value				
				Sample No.	Depth (m)		Rec. Ratio	Penetration in mm											
					From	To		75	75	75	75	75	75						
1		Brownish white, medium to coarse SAND with some coral fragments	...	D1		1.500	1.950	250/450								0			
			...																
			...																
			...																
			...																
2		Brownish white, medium to coarse SAND with some coral fragments	...	D2		3.000	3.450	280/450								0			
			...																
			...																
			...																
			...																
3		Brownish white, medium to coarse SAND with some coral fragments	...	D3		4.500	4.950	200/450								0			
			...																
			...																
			...																
			...																
4		Brownish white, medium to coarse SAND with some coral fragments	...													0			
			...																
			...																
			...																
			...																
5		End of TW1A at depth 6.0m	...													0			
			...																
			...																
			...																
			...																
6			...													0			
			...																
			...																
			...																
			...																
7			...													0			
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			...																
8			...													0			
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			...																
			...																
9			...													0			
			...																
			...																
			...																
			...																

PM



Pressuremeter Test

REMARK :

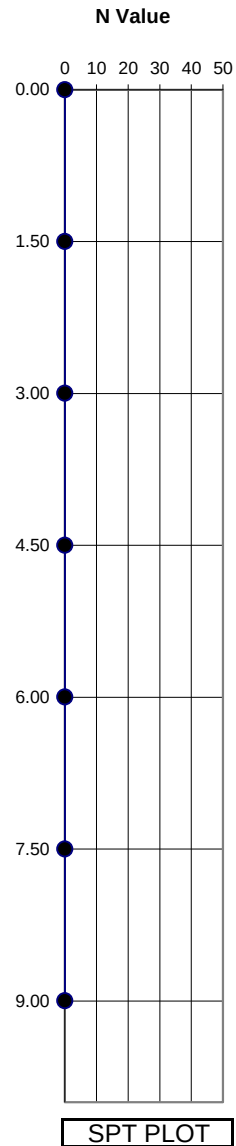
Example:
50/120 = 50 Blows/120mm

N Value

0 10 20 30 40 50

0.00 1.50 3.00 4.50 6.00 7.50 9.00

SPT PLOT

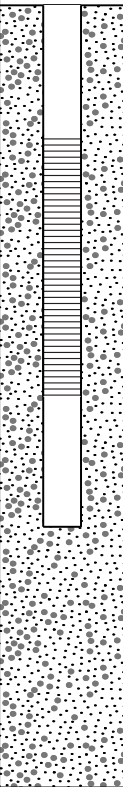
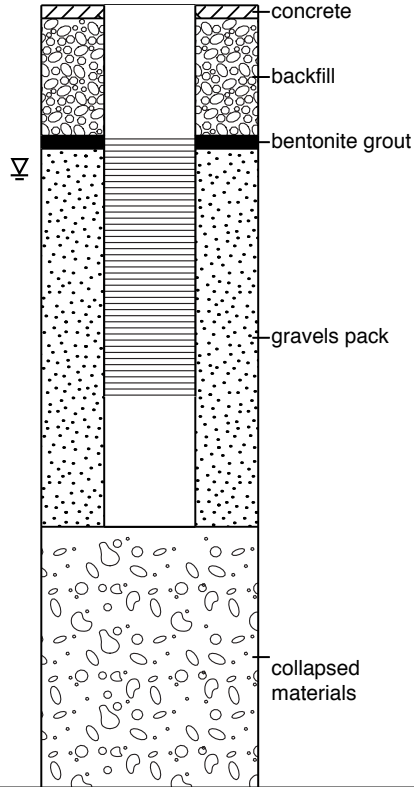


LEGEND:		REMARK :			Example: 50/120 = 50 Blows/120mm		
PM		Pressuremeter Test	Date	Time	Depth of hole (m)	Depth of casing (m)	Depth of water (m)
D		Disturbed Sample					
P		Standard Penetration Test					
UD		Undisturbed Sample					
G		Geonor Vane Test					
VS		Vane Share Test					
C		Rock Coring					
CL	-	Core Length					
CR	-	Core Recovery					
RQD	-	Rock Quality Designation					
		TERRAIN RESOURCES SDN BHD			CONSISTENCY / RELATIVE DENSITY		
					Cohesive Soil (N)		Non Cohesive Soil (N)
					0 - 2	Very soft	0 - 4
					2 - 4	Soft	4 - 10
					4 - 8	Medium stiff	10 - 30
					8 - 15	Stiff	30 - 50
					15 - 30	Very stiff	50 >
					30 >	Hard	
							Very loose
							Loose
							Medium dense
							Dense
							Very dense

GROUNDWATER LOG TW1A

PROJECT NUMBER	DRILLING DATE 21/10/2018 - 01/11/2018	COORDINATES 993152 E, 472568 N
PROJECT LOCATION Mabul, Semporna, Sabah	WELL DEPTH 4 m	DRILLER Julhandi
CLIENT NAHRIM	WELL DIAMETER 50 mm	SITE GEOLOGIST Cyprians
ADDRESS Lot 5377, Jalan Putra Permai, 43300 Seri Kembangan, Selangor.	CASING TYPE uPVC Class D (SIRIM)	SITE OFFICER Azrul Normi
	SCREEN DEPTH 1m - 3m	DRILLING RIG YWE D45R

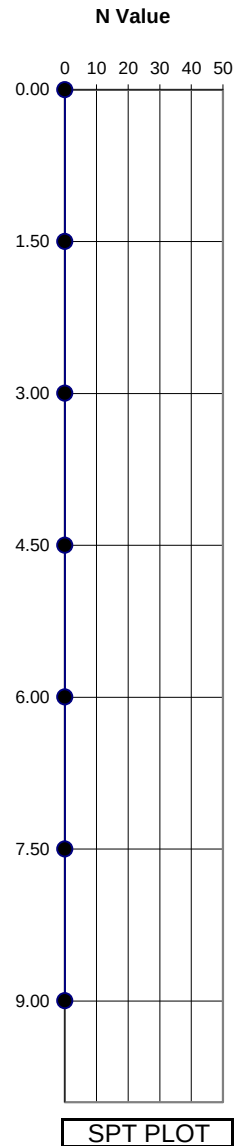
PROJECT TITLE PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI PULAU MABUL, SEMPORNA, SABAH.	STATIC WATER LEVEL 1.3 m
	ESTIMATE DISCHARGE 2 m ³ /h

Depth (m)	Material Description	Graphic Log	Samples	Drilling Method	Waterstrike, Q (m ³ /h)	Tubewell Design Specification
-0.5						
0	Browish white, medium to coarse SAND with some coral fragments		TW1_0-6	Rotary Mud Drilling by using tungsten shoe (75 mm diameter)		 concrete backfill bentonite grout gravels pack collapsed materials
0.5						
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6	End of Borehole at depth 6.0m					
6.5						
7						
7.5						
8						
8.5						
9						
9.5						

ENGINEERING BOREHOLE LOG

Project :	PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI	Sheet 1 of 4
Location :	PULAU MABUL, SEMPORNA, SABAH.	Borehole No: TW 2
Client :	NAHRIM	Coordinate: 993057 E, 472537 N
Consultant :		Reduced Level: 3m
	Rig type : YWE-D45R	Driller : JULHANDI
	Drill Method : ROTARY	Supervisor : CYPRIANS
	Casing Type : NMLC	Check by : LUKMAN
		Final water level: 1.87m
		Date started: 01.11.2018
		Date Completed: 09.11.2018

Depth (m)	Strata Thick- ness	Description of Strata	Log	SAMPLING DETAIL				SPT BLOW COUNT							N Value	N Value 0 10 20 30 40 50	
				Sample No.	Depth (m)		Rec. Ratio	Penetration in mm									
					From	To		75	75	75	75	75	75				
1		Brownish white, medium to coarse SAND with some coral fragments	...C...	D1		1.500	1.950	220/450							0	0.00	
	...C...																
	...C...																
	...C...																
	...C...																
2		Brownish white, medium to coarse SAND with some coral fragments	...C...	D1		1.500	1.950	220/450							0	1.50	
	...C...																
	...C...																
	...C...																
	...C...																
3		Brownish white, medium to coarse SAND with some coral fragments	...C...	D2		3.000	3.450	290/450							0	3.00	
	...C...																
	...C...																
	...C...																
	...C...																
4		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	...C...	D2		3.000	3.450	290/450							0	3.00	
	...C...																
	...C...																
	...C...																
	...C...																
5		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C1		4.500	6.000	CL=1.5 CR=0.2 RQD=NIL							0	4.50	
	cccc																
	cccc																
	cccc																
	cccc																
6		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C2		6.000	7.500	CL=1.5 CR=0.15 RQD=NIL							0	6.00	
	cccc																
	cccc																
	cccc																
	cccc																
7		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C2		6.000	7.500	CL=1.5 CR=0.15 RQD=NIL							0	6.00	
	cccc																
	cccc																
	cccc																
	cccc																
8		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C3		7.500	9.000	CL=1.5 CR=0.25 RQD=NIL							0	7.50	
	cccc																
	cccc																
	cccc																
	cccc																
9		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C3		7.500	9.000	CL=1.5 CR=0.25 RQD=NIL							0	7.50	
	cccc																
	cccc																
	cccc																
	cccc																
		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C4		9.000	10.500	CL=1.5 CR=0.25 RQD=NIL						0	9.00		
	cccc																
	cccc																
	cccc																
	cccc																



LEGEND:		REMARK :			Example: 50/120 = 50 Blows/120mm			
PM		Pressuremeter Test	Date	Time	Depth of hole (m)	Depth of casing (m)	Depth of water (m)	CONSISTENCY / RELATIVE DENSITY
D		Disturbed Sample						
P		Standard Penetration Test						Cohesive Soil (N)
UD		Undisturbed Sample						
G		Geonor Vane Test						Non Cohesive Soil (N)
VS		Vane Shear Test						
C		Rock Coring						0 - 2 Very soft
CL	-	Core Length						
CR	-	Core Recovery						2 - 4 Soft
RQD	-	Rock Quality Designation						4 - 8 Medium stiff
								8 - 15 Stiff
								15 - 30 Very stiff
								30 > Hard
								0 - 4 Very loose
								4 - 10 Loose
								10 - 30 Medium dense
								30 - 50 Dense
								50 > Very dense

TERRAIN RESOURCES SDN BHD

ENGINEERING BOREHOLE LOG

Project :	PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI	Sheet 2 of 4
Location :	PULAU MABUL, SEMPORNA, SABAH.	Borehole No: TW 2
		Coordinate: 993057 E, 472537 N
		Reduced Level: 3m
Client :	NAHRIM	Driller : JULHANDI
Consultant :		Supervisor : CYPRIANS
	Rig type : YWE-D45R	Check by : LUKMAN
	Drill Method : ROTARY	Final water level: 1.87m
	Casing Type : NMLC	Date started: 01.11.2018
		Date Completed: 09.11.2018

Depth (m)	Strata Thick- ness	Description of Strata	Log	SAMPLING DETAIL					SPT BLOW COUNT							N Value		
				Sample No.	Depth (m)		Rec. Ratio	Penetration in mm						N Value				
					From	To		75	75	75	75	75	75					
10		Creamy white, close to widely fractured, highly weathered, subrounded corals and calcified sheashells with iron stained spot and irregular cavity. CORAL bed.	cccc	C5		10.500	12.000	CL=1.5 CR=0.5 RQD=NIL							0	10.5		
	cccc																	
	cccc																	
	cccc																	
	cccc																	
11			Creamy white, highly fractured and highly weathered, irregular cavity coral skeleton, calcified seashells. CORAL bed.	cccc	C6		12.000	13.500	CL=1.5 CR=0.1 RQD=NIL							0	12.0	
	cccc																	
	cccc																	
	cccc																	
	cccc																	
12			Creamy white, close to widely fractured, highly weathered, subrounded corals and calcified sheashells with iron stained spot and irregular cavity. CORAL bed.	cccc	C7		13.500	15.000	CL=1.5 CR=1.1 RQD=NIL							0	13.5	
	cccc																	
	cccc																	
	cccc																	
	cccc																	
13		Creamy white, highly fractured and highly weathered, irregular cavity coral skeleton, calcified seashells. CORAL bed.	cccc	C8		15.000	16.500	CL=1.5 CR=0.3 RQD=NIL							0	15.0		
	cccc																	
	cccc																	
	cccc																	
	cccc																	
14		Creamy white, highly fractured and highly weathered, subrounded corals and calcified sheashells with iron stained spot and streak. CORAL bed.	cccc	C9		16.500	18.000	CL=1.5 CR=0.6 RQD=NIL							0	16.5		
	cccc																	
	cccc																	
	cccc																	
	cccc																	
15		Creamy white, highly fractured and highly weathered, subrounded corals and calcified sheashells with iron stained spot and streak. CORAL bed.	cccc	C10		18.000	19.500	CL=1.5 CR=0.7 RQD=NIL							0	18.0		
	cccc																	
	cccc																	
	cccc																	
	cccc																	
16		Creamy white, highly fractured and highly weathered, subrounded corals and calcified sheashells with iron stained spot and streak. CORAL bed.	cccc	C11		19.500	21.000	CL=1.5 CR=1.0 RQD=NIL							0	19.5		
	cccc																	
	cccc																	
	cccc																	
	cccc																	

ENGINEERING BOREHOLE LOG																
Project : PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI										Sheet 3 of 4						
Location : PULAU MABUL, SEMPORNA, SABAH.										Borehole No: TW 2 Coordinate: 993057 E, 472537 N Reduced Level: 3m						
Client : NAHRIM						Rig type : YWE-D45R			Driller : JULHANDI			Final water level: 1.87m				
Consultant :						Drill Method : ROTARY			Supervisor : CYPRIANS			Date started: 01.11.2018				
						Casing Type : NMLC			Check by : LUKMAN			Date Completed: 09.11.2018				
Depth (m)	Strata Thick- ness	Description of Strata	Log	SAMPLING DETAIL				SPT BLOW COUNT								
				Sample No.	Depth (m)		Rec. Ratio	Penetration in mm						N Value		
					From	To		75	75	75	75	75	75			
21		Iron stained spot and streak CORAL bed.	cccc	C12		21.000	22.500	CL=1.5 CR=0.5 RQD=NIL							0	21.00
			cccc													
			cccc													
			cccc													
22		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C13		22.500	24.000	CL=1.5 CR=1.0 RQD=NIL							0	22.50
			cccc													
			cccc													
			cccc													
23		Creamy white, highly fractured and highly weathered, subrounded cora polyp and calcified sheashells with iron stained spot and streak CORAL bed.	cccc	C14		24.000	25.500	CL=1.5 CR=1.4 RQD=NIL							0	24.00
			cccc													
			cccc													
			cccc													
24		Brownish white, closely to highly fractured, highly weathered, fossile LIMESTONE with spotted iron stair on joints and cavities.	TTTT	C15		25.500	27.000	CL=1.5 CR=1.4 RQD=NIL							0	25.50
			TTTT													
			TTTT													
			TTTT													
25		Brownish white, closely to highly fractured, highly weathered, fossile LIMESTONE with spotted iron stair on joints and cavities.	TTTT	C16		27.000	28.500	CL=1.5 CR=1.3 RQD=NIL							0	27.00
			TTTT													
			TTTT													
			TTTT													
26		Brownish white, closely to highly fractured, highly weathered, fossile LIMESTONE with spotted iron stair on joints and cavities.	TTTT	C17		28.500	30.000	CL=1.5 CR=1.25 RQD=NIL							0	28.50
			TTTT													
			TTTT													
			TTTT													
27		Brownish white, closely to highly fractured, highly weathered, fossile LIMESTONE with spotted iron stair on joints and cavities.	TTTT													
			TTTT													
			TTTT													
			TTTT													
28		Brownish white, closely to highly fractured, highly weathered, fossile LIMESTONE with spotted iron stair on joints and cavities.	TTTT													
			TTTT													
			TTTT													
			TTTT													
29		Brownish white, closely to highly fractured, highly weathered, fossile LIMESTONE with spotted iron stair on joints and cavities.	TTTT													
			TTTT													
			TTTT													
			TTTT													

LEGEND:

- PM Pressuremeter Test
- D Disturbed Sample
- P Standard Penetration Test
- UD Undisturbed Sample
- G Geonor Vane Test
- VS Vane Share Test
- C Rock Coring
- CL Core Length
- CR Core Recovery
- RQD Rock Quality Designation

REMARK :

Date	Time hrs	Depth of hole (m)	Depth of casing (m)	Depth of water (m)

TERRAIN RESOURCES SDN BHD

Example:
50/120 = 50 Blows/120mm

SPT PLOT

Cohesive Soil (N)		Non Cohesive Soil (N)	
0 - 2	Very soft	0 - 4	Very loose
2 - 4	Soft	4 - 10	Loose
4 - 8	Medium stiff	10 - 30	Medium dense
8 - 15	Stiff	30 - 50	Dense
15 - 30	Very stiff	50 >	Very dense
30 >	Hard		

ENGINEERING BOREHOLE LOG

Project :	PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI			Sheet	4	of	4
Location :	PULAU MABUL, SEMPORNA, SABAH.			Borehole No:	TW 2		
				Coordinate:	993057 E, 472537 N		
				Reduced Level:	3m		
Client :	NAHRIM	Rig type :	YWE-D45R	Driller :	JULHANDI		
Consultant :		Drill Method :	ROTARY	Supervisor :	CYPRIANS		
		Casing Type :	NMLC	Check by :	LUKMAN		
				Final water level:	1.87m		
				Date started:	01.11.2018		
				Date Completed:	09.11.2018		

[illegible]

SPT PLOT

LEGEND:

PM		Pressuremeter Test
D		Disturbed Sample
P		Standard Penetration Test
UD		Undisturbed Sample
G		Geonor Vane Test
VS		Vane Share Test
C		Rock Coring
CL	-	Core Length
CR	-	Core Recovery
RQD	-	Rock Quality Designation

REMARK : End of TW2 at depth 40m

Example:
50/120 = 50 Blows/120mm

Date	Time hrs	Depth of hole (m)	Depth of casing (m)	Depth of water (m)	CONSISTENCY / RELATIVE DENSITY			
					Cohesive Soil (N)		Non Cohesive Soil (N)	
					0 - 2	Very soft	0 - 4	Very loose
					2 - 4	Soft	4 - 10	Loose
					4 - 8	Medium stiff	10 - 30	Medium dense
					8 - 15	Stiff	30 - 50	Dense
					15 - 30	Very stiff	50 >	Very dense
					30 >	Hard		
TERRAIN RESOURCES SDN BHD								

PROJECT NUMBER	DRILLING DATE 01/11/2018 - 09/11/2018	COORDINATES 993057 E, 472537 N
PROJECT LOCATION Mabul, Semporna, Sabah	WELL DEPTH 40 m	DRILLER Julhandi
CLIENT NAHRIM	WELL DIAMETER 50 mm	SITE GEOLOGIST Cyprians
ADDRESS Lot 5377, Jalan Putra Permai, 43300 Seri Kembangan, Selangor.	CASING TYPE uPVC Class D (SIRIM)	SITE OFFICER Azrul Normi
	SCREEN DEPTH 20m - 29m	DRILLING RIG YWE D45R

PROJECT TITLE PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI PULAU MABUL, SEMPORNA, SABAH.	STATIC WATER LEVEL 1.2 m
	ESTIMATE DISCHARGE 2 m ³ /h

Depth (m)	Material Description	Graphic Log	Samples	Drilling Method	Waterstrike, Q (m ³ /h)	Tubewell Design Specification
-2						
0	Browish white, medium to coarse SAND with some coral fragments		TW2_0-4	Rotary Mud Drilling (75 mm diameter)		
2						
4	Creamy white, highly fractured and highly weathered, subrounded coral polyp and calcified sheashells with iron stained spot and streak CORAL bed.		TW2_4-24	NMLC Diamond Bit coring (63.5 mm diameter)		
6						
8						
10						
12						
14						
16						
18						
20						
22						
24	Brownish white, closely to highly fractured, highly weathered, fossiliferous LIMESTONE with spotted iron stained on joints and cavities.		TW2_24-40			
26						
28						
30						
32						
34						
36						
38						
40	End of Borehole at depth 40.0m					
42						
44						
46						
48						

ENGINEERING BOREHOLE LOG

Project :	PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI	Sheet 1 of 1
Location :	PULAU MABUL, SEMPORNA, SABAH.	Borehole No: TW 2A
Client :	NAHRIM	Coordinate: 993152 E, 472472568 N
Consultant :	Rig type : YWE-D45R Drill Method : ROTARY Casing Type : NMLC	Reduced Level: 3m Final water level: 1.4m Date started: 02.11.2018 Date Completed: 02.11.2018
	Driller : JULHANDI Supervisor : CYPRIANS Check by : LUKMAN	

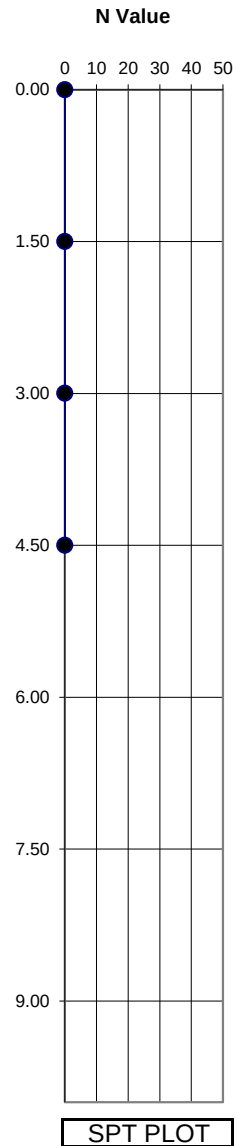
Depth (m)	Strata Thick- ness	Description of Strata	Log	SAMPLING DETAIL				SPT BLOW COUNT						N Value	N Value														
				Sample No.	Depth (m)		Rec. Ratio	Penetration in mm																					
					From	To		75	75	75	75	75	75																
1		Brownish white, medium to coarse SAND with some coral fragments	...C...	D1		1.500	1.950	250/450							0	0													
	...C...																												
	...C...																												
	...C...																												
	...C...																												
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	...C...																												
	...C...																												
	...C...																												
	...C...																												
2		Brownish white, medium to coarse SAND with some coral fragments	...C...	D2		3.000	3.450	280/450								0	1.50												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
3		End of TW2A at depth 4.5 m	...C...													0	3.00												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
4			...C...													0	4.50												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
	...C...																												
5			...C...													0	6.00												
	...C...																												
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	...C...																												
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	...C...																												
	...C...																												
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	...C...																												
6			...C...													0	7.50												
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7			...C...													0	9.00												
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8			...C...													0													
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9			...C...													0													
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	...C...																												
	...C...																												
	...C...																												

PM

Pressuremeter Test

REMARK :
Example:
50/120 = 50 Blows/120mm

SPT PLOT

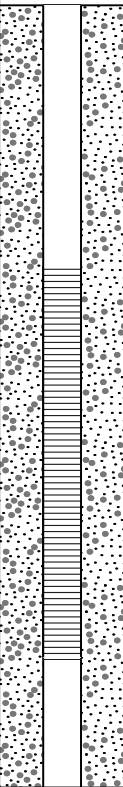
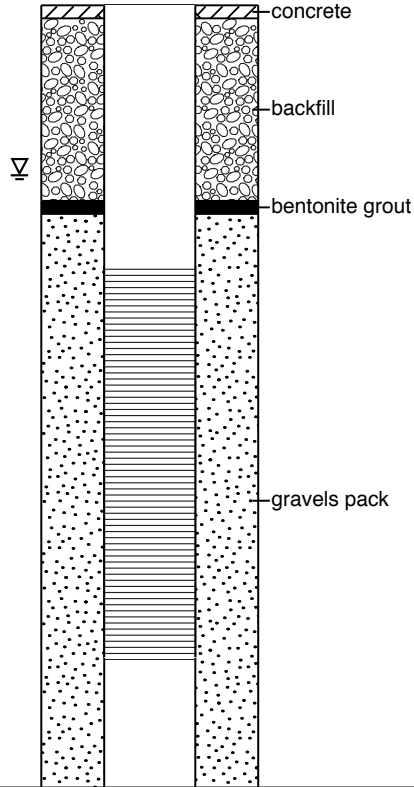


LEGEND: PM Pressuremeter Test D Disturbed Sample P Standard Penetration Test UD Undisturbed Sample G Geonor Vane Test VS Vane Share Test C Rock Coring CL Core Length CR Core Recovery RQD Rock Quality Designation		REMARK :			Example: 50/120 = 50 Blows/120mm	
					CONSISTENCY / RELATIVE DENSITY	
		Date	Time hrs	Depth of hole (m)	Depth of casing (m)	Depth of water (m)
				Cohesive Soil (N)		Non Cohesive Soil (N)
				0 - 2		0 - 4
				2 - 4		4 - 10
				4 - 8		10 - 30
				8 - 15		30 - 50
				15 - 30		50 >
				30 >		
				Very soft		Very loose
				Soft		Loose
				Medium stiff		Medium dense
				Stiff		Dense
				Very stiff		Very dense
				Hard		

TERRAIN RESOURCES SDN BHD

PROJECT NUMBER	DRILLING DATE 15/11/2018 - 16/11/2018	COORDINATES 993055 E, 472531 N
PROJECT LOCATION Mabul, Semporna, Sabah	WELL DEPTH 6 m	DRILLER Julhandi
CLIENT NAHRIM	WELL DIAMETER 50 mm	SITE GEOLOGIST Cyprians
ADDRESS Lot 5377, Jalan Putra Permai, 43300 Seri Kembangan, Selangor.	CASING TYPE uPVC Class D (SIRIM)	SITE OFFICER Azrul Normi
	SCREEN DEPTH 2m - 5m	DRILLING RIG YWE D45R

PROJECT TITLE PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI PULAU MABUL, SEMPORNA, SABAH.	STATIC WATER LEVEL 1.3 m
	ESTIMATE DISCHARGE 2 m ³ /h

Depth (m)	Material Description	Graphic Log	Samples	Drilling Method	Waterstrike, Q (m ³ /h)	Tubewell Design Specification
-0.5						
0	Browish white, medium to coarse SAND with some coral fragments		TW2A_0-6	Rotary Mud Drilling by using tungsten shoe (75 mm diameter)		
0.5						
1						
1.5						
2						
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6	End of Borehole at depth 6.0m					
6.5						
7						
7.5						
8						
8.5						
9						
9.5						

LAMPIRAN 2:
DATA UJIAN *CONSTANT*
DISCHARGE

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

WATER WELL CONTINUOUS PUMPING TEST

PROJECT : Kerja Penggerudien dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

CLIENT : Terrain Resources Sdn. Bhd.

LOCATION : TW - 1

1

OF

2

DATE	TIME		ELAPSED TIME		TIME INTERVAL		WATER LEVEL (m)	DRAW-DOWN (m)	V-NOTCH READING (mm)	YIELD (m ³ /h)	Monitoring Well 1 W.L. (m)	REMARKS
	Hr.	Min.	Hr.	Min.	Hr.	Min.						
17/11/2018	12	30	0	00	0	00	1.59	0.00	0.00	0.00	1.53	Beginning of continuous pumping test
	12	30.5	0	00.50	0	00.5	1.59	0.00	50	2.82	1.53	
	12	31.0	0	01.00	0	00.5	1.59	0.00	50	2.82	1.53	
	12	31.5	0	01.50	0	00.5	1.59	0.00	50	2.82	1.53	
	12	32.0	0	02.00	0	00.5	1.59	0.00	50	2.82	1.53	
	12	32.5	0	02.50	0	00.5	1.59	0.00	50	2.82	1.53	
	12	33.0	0	03.00	0	00.5	1.59	0.00	50	2.82	1.53	
	12	33.5	0	03.50	0	00.5	1.61	0.02	50	2.82	1.53	
	12	34.0	0	04.00	0	00.5	1.61	0.02	50	2.82	1.53	
	12	34.5	0	04.50	0	00.5	1.61	0.02	50	2.82	1.53	
	12	35.0	0	05.00	0	00.5	1.61	0.02	50	2.82	1.53	
	12	36.0	0	06.00	0	01.0	1.61	0.02	50	2.82	1.53	
	12	37.0	0	07.00	0	01.0	1.62	0.03	50	2.82	1.53	
	12	38.0	0	08.00	0	01.0	1.62	0.03	50	2.82	1.53	
	12	39.0	0	09.00	0	01.0	1.62	0.03	50	2.82	1.53	
	12	40.0	0	10.00	0	01.0	1.62	0.03	50	2.82	1.53	
	12	41.0	0	11.0	0	01.0	1.62	0.03	50	2.82	1.53	
	12	42.0	0	12.0	0	01.0	1.62	0.03	50	2.82	1.53	
	12	43.0	0	13.0	0	01.0	1.62	0.03	50	2.82	1.53	
	12	44.0	0	14.0	0	01.0	1.62	0.03	50	2.82	1.53	
	12	45.0	0	15	0	01.0	1.61	0.02	45	2.16	1.53	
	12	50.0	0	20	0	05.0	1.61	0.02	45	2.16	1.53	
	12	55.0	0	25	0	05.0	1.59	0.00	45	2.16	1.53	
	13	00.0	0	30	0	05.0	1.58	-0.01	45	2.16	1.53	
	13	05.0	0	35	0	05.0	1.57	-0.02	45	2.16	1.53	
	13	10.0	0	40	0	05.0	1.57	-0.02	45	2.16	1.53	
	13	15.0	0	45	0	05.0	1.56	-0.03	45	2.16	1.53	
	13	20.0	0	50	0	05.0	1.56	-0.03	45	2.16	1.53	
	13	25.0	0	55	0	05.0	1.56	-0.03	45	2.16	1.53	
	13	30.0	1	00.0	0	05.0	1.56	-0.03	45	2.16	1.53	
	13	35.0	1	05.0	0	05.0	1.56	-0.03	45	2.16	1.53	
	13	40.0	1	10.0	0	05.0	1.55	-0.04	45	2.16	1.53	
	13	50.0	1	20.0	0	10.0	1.54	-0.05	45	2.16	1.53	
	14	00.0	1	30.0	0	10.0	1.53	-0.06	45	2.16	1.53	
	14	10.0	1	40.0	0	10.0	1.52	-0.07	45	2.16	1.53	
	14	20.0	1	50.0	0	10.0	1.51	-0.08	45	2.16	1.53	
	14	30.0	2	00.0	0	10.0	1.51	-0.08	45	2.16	1.53	
	14	40.0	2	10.0	0	10.0	1.51	-0.08	45	2.16	1.53	
	14	50.0	2	20.0	0	10.0	1.51	-0.08	45	2.16	1.53	

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

WATER WELL CONTINUOUS PUMPING TEST

PROJECT : Kerja Penggerudian dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

CLIENT : Terrain Resources Sdn. Bhd.

LOCATION : TW - 1

2

OF

2

[illegible]

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

WATER WELL CONTINUOUS PUMPING TEST

PROJECT : Kerja Penggerudien dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

CLIENT : Terrain Resources Sdn. Bhd.

LOCATION TW - 2

1

OF

2

DATE	TIME		ELAPSED TIME		TIME INTERVAL		WATER LEVEL (m)	DRAW-DOWN (m)	V-NOTCH READING (mm)	YIELD (m ³ /h)	Monitoring Well 1 W.L. (m)	REMARKS
	Hr.	Min.	Hr.	Min.	Hr.	Min.						
18/11/2018	9	40	0	00	0	00	2.48	0.00	0.00	0.00	1.98	Beginning of
	9	40.5	0	00.50	0	00.5	2.51	0.03	50	2.82	1.98	continuous
	9	41.0	0	01.00	0	00.5	2.59	0.11	50	2.82	1.98	pumping test
	9	41.5	0	01.50	0	00.5	2.63	0.15	50	2.82	1.98	
	9	42.0	0	02.00	0	00.5	2.66	0.18	50	2.82	1.98	
	9	42.5	0	02.50	0	00.5	2.66	0.18	50	2.82	1.98	
	9	43.0	0	03.00	0	00.5	2.66	0.18	50	2.82	1.98	
	9	43.5	0	03.50	0	00.5	2.66	0.18	50	2.82	1.98	
	9	44.0	0	04.00	0	00.5	2.66	0.18	50	2.82	1.98	
	9	44.5	0	04.50	0	00.5	2.66	0.18	50	2.82	1.98	
	9	45.0	0	05.00	0	00.5	2.66	0.18	50	2.82	1.98	
	9	46.0	0	06.00	0	01.0	2.66	0.18	50	2.82	1.98	
	9	47.0	0	07.00	0	01.0	2.66	0.18	50	2.82	1.98	
	9	48.0	0	08.00	0	01.0	2.66	0.18	50	2.82	1.98	
	9	49.0	0	09.00	0	01.0	2.66	0.18	50	2.82	1.98	
	9	50.0	0	10.00	0	01.0	2.66	0.18	50	2.82	1.98	
	9	51.0	0	11.0	0	01.0	2.66	0.18	50	2.82	1.98	
	9	52.0	0	12.0	0	01.0	2.66	0.18	50	2.82	1.98	
	9	53.0	0	13.0	0	01.0	2.66	0.18	50	2.82	1.98	
	9	54.0	0	14.0	0	01.0	2.66	0.18	50	2.82	1.98	
	9	55.0	0	15	0	01.0	2.66	0.18	45	2.16	1.98	
	10	00.0	0	20	0	05.0	2.66	0.18	45	2.16	1.98	
	10	05.0	0	25	0	05.0	2.65	0.17	45	2.16	1.98	
	10	10.0	0	30	0	05.0	2.64	0.16	45	2.16	1.98	
	10	15.0	0	35	0	05.0	2.63	0.15	45	2.16	1.98	
	10	20.0	0	40	0	05.0	2.63	0.15	45	2.16	1.98	
	10	25.0	0	45	0	05.0	2.62	0.14	45	2.16	1.98	
	10	30.0	0	50	0	05.0	2.61	0.13	45	2.16	1.98	
	10	35.0	0	55	0	05.0	2.60	0.12	45	2.16	1.98	
	10	40.0	1	00.0	0	05.0	2.59	0.11	45	2.16	1.98	
	10	45.0	1	05.0	0	05.0	2.57	0.09	45	2.16	1.98	
	10	50.0	1	10.0	0	05.0	2.55	0.07	45	2.16	1.98	
	11	00.0	1	20.0	0	10.0	2.53	0.05	45	2.16	1.98	
	11	10.0	1	30.0	0	10.0	2.49	0.01	45	2.16	1.98	
	11	20.0	1	40.0	0	10.0	2.46	-0.02	45	2.16	1.98	
	11	30.0	1	50.0	0	10.0	2.44	-0.04	45	2.16	1.98	
	11	40.0	2	00.0	0	10.0	2.42	-0.06	45	2.16	1.98	
	11	50.0	2	10.0	0	10.0	2.39	-0.09	45	2.16	1.98	
	12	00.0	2	20.0	0	10.0	2.35	-0.13	45	2.16	1.98	

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

WATER WELL CONTINUOUS PUMPING TEST

PROJECT : Kerja Penggerudien dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

CLIENT : Terrain Resources Sdn. Bhd.

LOCATION TW - 2

2

OF

2

[illegible]

LAMPIRAN 3:
UJIAN *WELL RECOVERY*

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

WATER WELL RECOVERY TEST

Project : Kerja Penggerudien dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

Client : Terrain Resources Sdn. Bhd.

Location : TW - 1 1 OF 2

DATE	TIME		ELAPSED TIME		TIME INTERVAL		WATER LEVEL (m)	DRAW-DOWN (m)	REMARKS	
	Hr.	Min.	Hr.	Min.	Hr.	Min.				
17/11/2018	18	20	5	50	0	00.0	1.76	0.17		Beginning of
	18	21	5	50.5	0	00.5	1.76	0.17		recovery test
	18	21	5	51.0	0	00.5	1.76	0.17		
	18	22	5	51.5	0	00.5	1.76	0.17		
	18	22	5	52.0	0	00.5	1.75	0.16		
	18	23	5	52.5	0	00.5	1.75	0.16		
	18	23	5	53.0	0	00.5	1.75	0.16		
	18	24	5	53.5	0	00.5	1.75	0.16		
	18	24	5	54.0	0	00.5	1.75	0.16		
	18	25	5	54.5	0	00.5	1.74	0.15		
	18	25	5	55.0	0	00.5	1.74	0.15		
	18	26	5	56.0	0	01.0	1.74	0.15		
	18	27	5	57.0	0	01.0	1.73	0.14		
	18	28	5	58.0	0	01.0	1.73	0.14		
	18	29	5	59.0	0	01.0	1.73	0.14		
	18	30	6	00.0	0	01.0	1.72	0.13		
	18	31	6	01.0	0	01.0	1.72	0.13		
	18	32	6	02.0	0	01.0	1.72	0.13		
	18	33	6	03.0	0	01.0	1.71	0.12		
	18	34	6	04.0	0	01.0	1.71	0.12		
	18	35	6	05.0	0	01.0	1.71	0.12		
	18	40	6	10.0	0	05.0	1.70	0.11		
	18	45	6	15.0	0	05.0	1.70	0.11		
	18	50	6	20.0	0	05.0	1.70	0.11		
	18	55	6	25.0	0	05.0	1.69	0.10		
	19	00	6	30.0	0	05.0	1.69	0.10		
	19	05	6	35.0	0	05.0	1.68	0.09		
	19	10	6	40.0	0	05.0	1.68	0.09		
	19	15	6	45.0	0	05.0	1.67	0.08		
	19	20	6	50.0	0	05.0	1.67	0.08		
	19	25	6	55.0	0	05.0	1.66	0.07		
	19	35	7	05.0	0	10.0	1.65	0.06		
	19	45	7	15.0	0	10.0	1.64	0.05		
	19	55	7	25.0	0	10.0	1.64	0.05		
	20	05	7	35.0	0	10.0	1.64	0.05		
	20	15	7	45.0	0	10.0	1.63	0.04		
	20	25	7	55.0	0	10.0	1.63	0.04		
	20	35	8	05.0	0	10.0	1.63	0.04		
	20	45	8	15.0	0	10.0	1.62	0.03		

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

WATER WELL RECOVERY TEST

Project : Kerja Penggerudien dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

Client : Terrain Resources Sdn. Bhd.

Location : TW - 1

2 OF 2

[illegible]

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

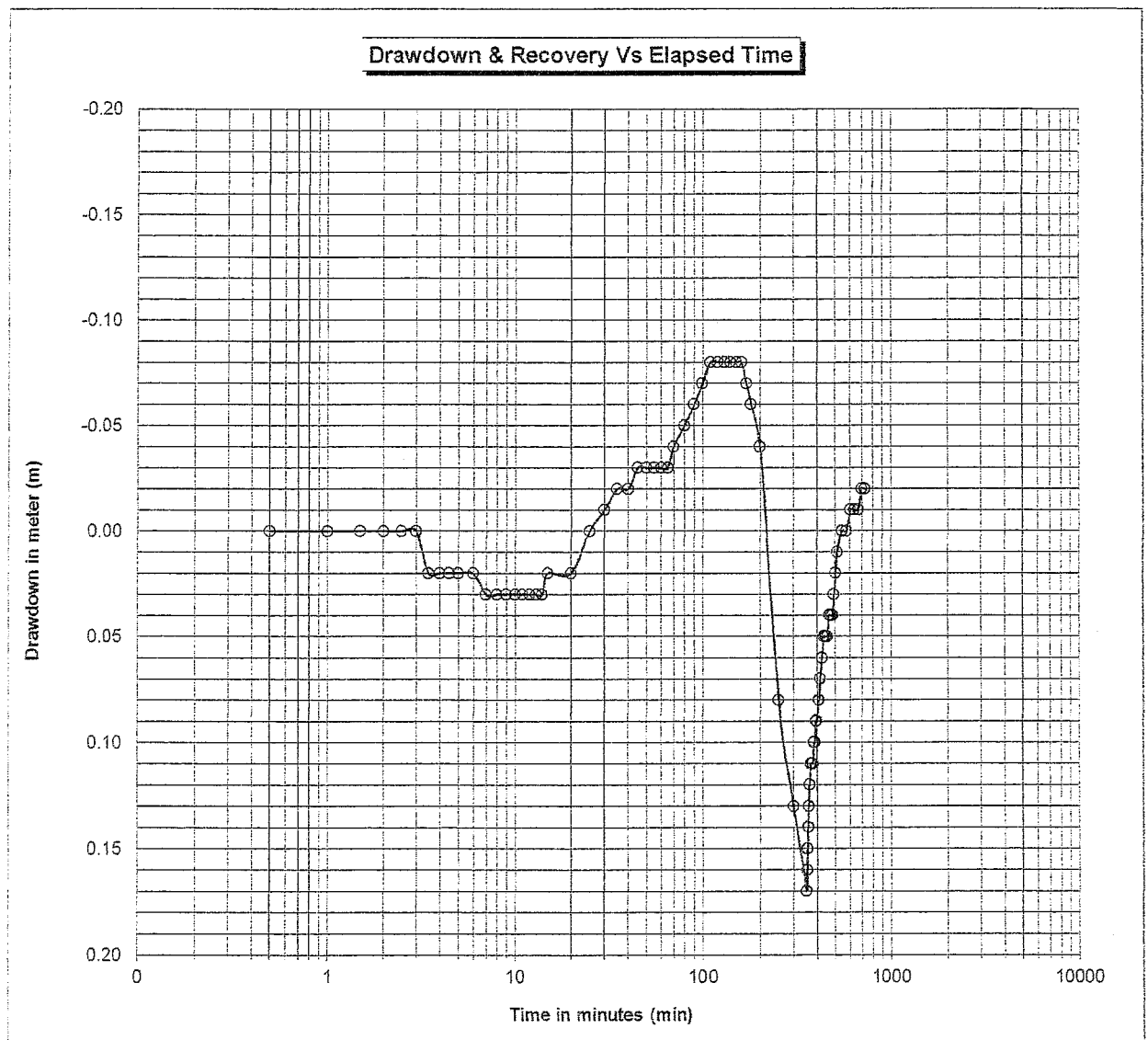
WATER WELL RECOVERY TEST

Project : Kerja Penggerudien dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

Client : Terrain Resources Sdn. Bhd.

Location : TW - 1

Sheet : 1 OF 1



(WATER LEVELS AFFECTED BY LOCAL HIGH AND LOW TIDES)

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

WATER WELL RECOVERY TEST

Project : Kerja Penggerudien dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

Client : Terrain Resources Sdn. Bhd.

Location : TW - 2 1 OF 2

DATE	TIME		ELAPSED TIME		TIME INTERVAL		WATER LEVEL (m)	DRAW-DOWN (m)	REMARKS	
	Hr.	Min.	Hr.	Min.	Hr.	Min.				
18/11/2018	15	30	5	50	0	00.0	1.89	-0.59	Beginning of recovery test	
	15	31	5	50.5	0	00.5	1.89	-0.59		
	15	31	5	51.0	0	00.5	1.89	-0.59		
	15	32	5	51.5	0	00.5	1.88	-0.60		
	15	32	5	52.0	0	00.5	1.88	-0.60		
	15	33	5	52.5	0	00.5	1.88	-0.60		
	15	33	5	53.0	0	00.5	1.88	-0.60		
	15	34	5	53.5	0	00.5	1.87	-0.61		
	15	34	5	54.0	0	00.5	1.87	-0.61		
	15	35	5	54.5	0	00.5	1.87	-0.61		
	15	35	5	55.0	0	00.5	1.87	-0.61		
	15	36	5	56.0	0	01.0	1.86	-0.62		
	15	37	5	57.0	0	01.0	1.86	-0.62		
	15	38	5	58.0	0	01.0	1.85	-0.63		
	15	39	5	59.0	0	01.0	1.85	-0.63		
	15	40	6	00.0	0	01.0	1.84	-0.64		
	15	41	6	01.0	0	01.0	1.84	-0.64		
	15	42	6	02.0	0	01.0	1.84	-0.64		
	15	43	6	03.0	0	01.0	1.83	-0.65		
	15	44	6	04.0	0	01.0	1.83	-0.65		
	15	45	6	05.0	0	01.0	1.82	-0.66		
	15	50	6	10.0	0	05.0	1.82	-0.66		
	15	55	6	15.0	0	05.0	1.82	-0.66		
	16	00	6	20.0	0	05.0	1.81	-0.67		
	16	05	6	25.0	0	05.0	1.81	-0.67		
	16	10	6	30.0	0	05.0	1.81	-0.67		
	16	15	6	35.0	0	05.0	1.80	-0.68		
	16	20	6	40.0	0	05.0	1.80	-0.68		
	16	25	6	45.0	0	05.0	1.80	-0.68		
	16	30	6	50.0	0	05.0	1.79	-0.69		
	16	35	6	55.0	0	05.0	1.79	-0.69		
	16	45	7	05.0	0	10.0	1.78	-0.70		
	16	55	7	15.0	0	10.0	1.78	-0.70		
	17	05	7	25.0	0	10.0	1.78	-0.70		
	17	15	7	35.0	0	10.0	1.77	-0.71		
	17	25	7	45.0	0	10.0	1.77	-0.71		
	17	35	7	55.0	0	10.0	1.76	-0.72		
	17	45	8	05.0	0	10.0	1.76	-0.72		
	17	55	8	15.0	0	10.0	1.75	-0.73		

GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

WATER WELL RECOVERY TEST

Project : Kerja Penggerudien dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

Client : Terrain Resources Sdn. Bhd.

Location : TW - 2 2 OF 2

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GROUND ENGINEERING (SABAH) SDN. BHD. (019025-K)

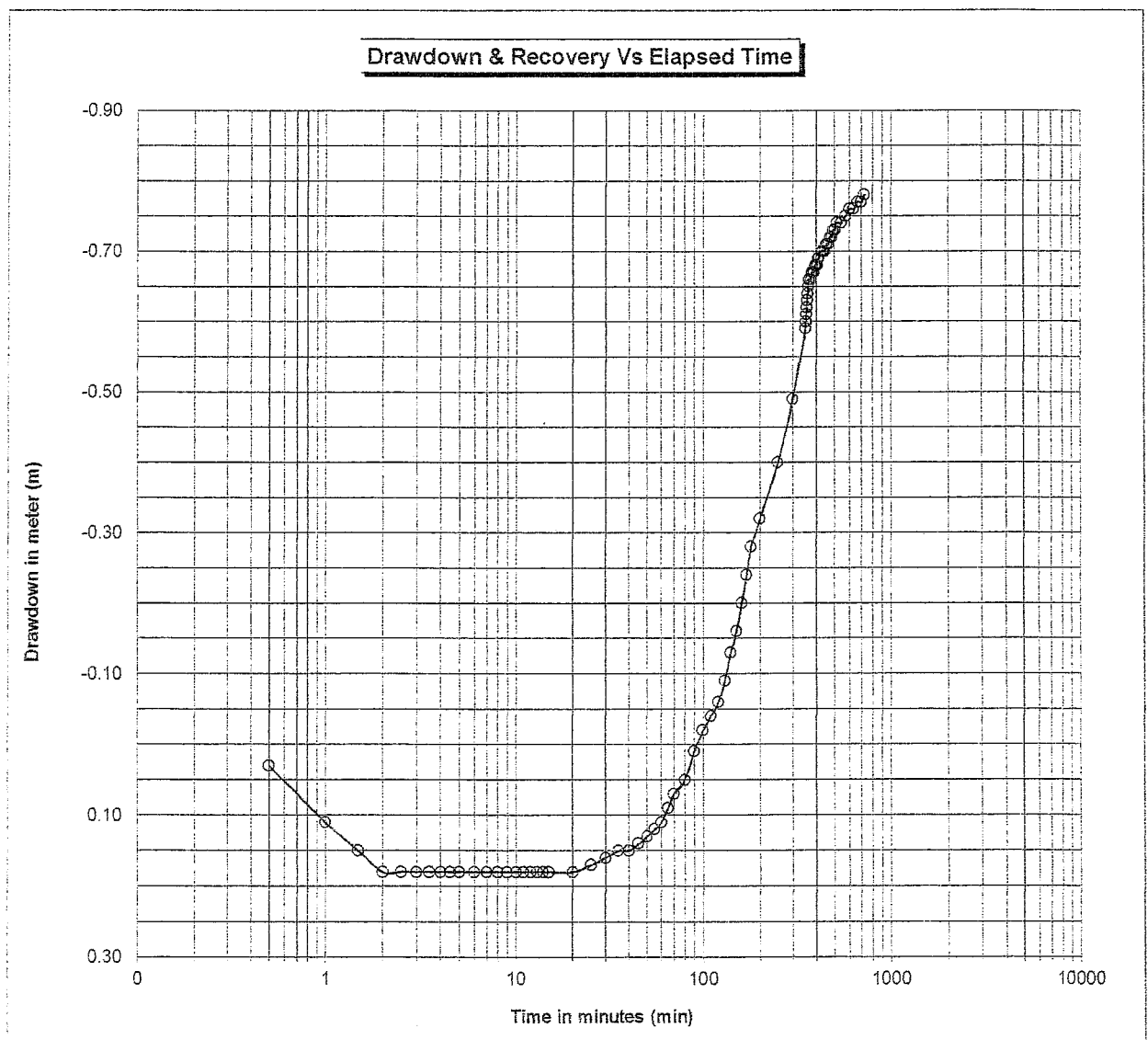
WATER WELL RECOVERY TEST

Project : Kerja Penggerudian dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, sabah.

Client : Terrain Resources Sdn. Bhd.

Location : TW - 2

Sheet : 1 OF 1



(WATER LEVELS AFFECTED BY LOCAL HIGH AND LOW TIDES)

LAMPIRAN 4:

TABURAN SAIZ PARTIKEL

GROUND ENGINEERING (SABAH) SDN. BHD.

(Company No. 019025K)

Project No. :		LABORATORY TEST RESULTS SUMMARY			Page : 1 of 4	
Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, Sabah.						
Borehole No.		TW-1	TW-1	TW-1		
Depth (m)		1.50	3.00	4.50		
Sample No.		D-1	D-2	D-3		
Classification		BS 5930				
Clay	< 0.002 mm (%)					
Silt	0.002 - 0.063 mm (%)	3	1	6		
Sand	0.063 - 2.000 mm (%)	97	97	94		
Gravel	2.000 - 63.000 mm (%)	0	2	0		
Particle Size Distribution (% Passing)	37.500 mm (%)					
	28.000 mm (%)					
	20.000 mm (%)					
	14.000 mm (%)					
	10.000 mm (%)					
	6.300 mm (%)					
	5.000 mm (%)		100.00			
	3.350 mm (%)	100.00	99.93	100.00		
	2.000 mm (%)	99.91	97.98	99.90		
	1.180 mm (%)	98.41	70.69	98.39		
	0.600 mm (%)	78.46	20.26	84.47		
	0.425 mm (%)	55.07	7.45	71.50		
	0.300 mm (%)	24.01	2.68	53.08		
	0.212 mm (%)	9.75	1.55	37.06		
0.150 mm (%)	4.36	1.21	22.71			
0.063 mm (%)	2.66	1.08	6.47			
Liquid Limit	LL (%)					
Plastic Limit	PL (%)					
Plastic Index	PI (%)					
Natural Moisture Content	MC (%)					
Specific Gravity	SG					
Unit Weight	Kg/m ³					
One Dimensional Consolidation Test	m _v (m ² /MN)					
	Void Ratio					
	Eff. Overburden, P _o					
Triaxial Compression Test						
Unsaturated Unconsolidated Undrained	C _u kN/m ²					
	φ°					
Consolidated Isotropic Undrained	c' kN/m ²					
	φ°					
Unconfined Compression	C _u kN/m ²					
Rock Strength Test						
Unconfined Compression	kN/m ²					
Point Load Strength Index	Is(50)(mpa)					
Chemical Test						
pH						
Water Soluble Sulphate	(%)					
Water Soluble Sulphate	g/L					
Chloride Content	(%)					
Organic Content	(%)					
LAPORAN DISEDIAKAN OLEH : JENNIFER J.				LAPORAN DISAHKAN OLEH : S. F. HO		

GROUND ENGINEERING (SABAH) SDN. BHD.

(Company No. 019025K)

Project No. :		LABORATORY TEST RESULTS SUMMARY				Page : 2 of 4	
Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, Sabah.							
Borehole No.		TW-2		TW-2			
Depth (m)		1.50		3.00			
Sample No.		D-1		D-2			
Classification		BS 5930					
Clay	< 0.002 mm (%)						
Silt	0.002 - 0.063 mm (%)	2		2			
Sand	0.063 - 2.000 mm (%)	94		89			
Gravel	2.000 - 63.000 mm (%)	4		9			
Particle Size Distribution	(% Passing)						
	37.500 mm (%)						
	28.000 mm (%)						
	20.000 mm (%)						
	14.000 mm (%)						
	10.000 mm (%)						
	6.300 mm (%)			100.00			
	5.000 mm (%)	100.00		99.19			
	3.350 mm (%)	99.37		98.54			
	2.000 mm (%)	95.66		91.16			
	1.180 mm (%)	77.86		67.25			
	0.600 mm (%)	42.74		33.89			
	0.425 mm (%)	27.69		21.66			
	0.300 mm (%)	13.57		10.95			
	0.212 mm (%)	6.04		5.29			
	0.150 mm (%)	2.72		2.90			
	0.063 mm (%)	1.60		2.13			
Liquid Limit	LL (%)						
Plastic Limit	PL (%)						
Plastic Index	PI (%)						
Natural Moisture Content	MC (%)						
Specific Gravity	SG						
Unit Weight	Kg/m ³						
One Dimensional Consolidation Test	m _v (m ² /MN)						
	Void Ratio						
	Eff. Overburden, P _o						
Triaxial Compression Test							
Unsaturated Unconsolidated Undrained	C _u kN/m ²						
	φ°						
Consolidated Isotropic Undrained	c' kN/m ²						
	φ°						
Unconfined Compression	C _u kN/m ²						
Rock Strength Test							
Unconfined Compression	kN/m ²						
Point Load Strength Index	Is(50)(mpa)						
Chemical Test							
pH							
Water Soluble Sulphate	(%)						
Water Soluble Sulphate	g/L						
Chloride Content	(%)						
Organic Content	(%)						

LAPORAN DISEDIAKAN OLEH :

JENNIFER J.

LAPORAN DISAHKAN OLEH :

S. F. HO

GROUND ENGINEERING (SABAH) SDN. BHD.

(Company No. 019025K)

Project No. :		LABORATORY TEST RESULTS SUMMARY				Page : 3 of 4	
Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, Sabah.							
Borehole No.		TW-1A	TW-1A	TW-1A	TW-1A		
Depth (m)		1.50	3.00	4.50	6.00		
Sample No.		D-1	D-2	D-3	D-4		
Classification		BS 5930					
Clay	< 0.002 mm (%)						
Silt	0.002 - 0.063 mm (%)	2	2	13	31		
Sand	0.063 - 2.000 mm (%)	87	94	87	68		
Gravel	2.000 - 63.000 mm (%)	11	4	0	1		
Particle Size Distribution	(% Passing)						
	37.500 mm (%)						
	28.000 mm (%)						
	20.000 mm (%)						
	14.000 mm (%)						
	10.000 mm (%)						
	6.300 mm (%)	100.00					
	5.000 mm (%)	99.15	100.00	100.00			
	3.350 mm (%)	97.82	99.47	99.95	100.00		
	2.000 mm (%)	88.59	96.44	99.54	99.14		
	1.180 mm (%)	61.01	78.56	98.05	96.01		
	0.600 mm (%)	30.93	44.66	84.64	88.60		
	0.425 mm (%)	20.73	25.10	71.51	78.65		
	0.300 mm (%)	11.69	8.80	52.36	61.52		
	0.212 mm (%)	6.09	3.42	43.09	49.30		
	0.150 mm (%)	2.51	2.00	28.36	40.66		
	0.063 mm (%)	1.52	1.70	13.07	31.19		
Liquid Limit	LL (%)						
Plastic Limit	PL (%)						
Plastic Index	PI (%)						
Natural Moisture Content	MC (%)						
Specific Gravity	SG						
Unit Weight	Kg/m ³						
One Dimensional Consolidation Test	m _v (m ² /MN)						
	Void Ratio						
	Eff. Overburden, P _o						
Triaxial Compression Test							
Unsaturated Unconsolidated	C _u kN/m ²						
Undrained	φ°						
Consolidated Isotropic	c' kN/m ²						
Undrained	φ°						
Unconfined Compression	C _u kN/m ²						
Rock Strength Test							
Unconfined Compression	kN/m ²						
Point Load Strength Index	Is(50)(mpa)						
Chemical Test							
pH							
Water Soluble Sulphate	(%)						
Water Soluble Sulphate	g/L						
Chloride Content	(%)						
Organic Content	(%)						

Empty graph area for additional data or notes.

LAPORAN DISEDIAKAN OLEH : JENNIFER J.	LAPORAN DISAHKAN OLEH : S. F. HO
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GROUND ENGINEERING (SABAH) SDN. BHD.

(Company No. 019025K)

Project No. :		LABORATORY TEST RESULTS SUMMARY				Page : 4 of 4	
Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di Pulau Mabul, Semporna, Sabah.							
Borehole No.		TW-2A	TW-2A	TW-2A	TW-2A		
Depth (m)		1.50	3.00	4.50	6.00		
Sample No.		D-1	D-2	D-3	D-4		
Classification		BS 5930					
Clay < 0.002 mm (%)							
Silt 0.002 - 0.063 mm (%)		5	8	2	2		
Sand 0.063 - 2.000 mm (%)		88	91	90	88		
Gravel 2.000 - 63.000 mm (%)		7	1	8	10		
Particle Size Distribution (% Passing)	37.500 mm (%)						
	28.000 mm (%)						
	20.000 mm (%)						
	14.000 mm (%)						
	10.000 mm (%)						
	6.300 mm (%)						
	5.000 mm (%)	100.00					
	3.350 mm (%)	96.87	100.00	100.00	100.00		
	2.000 mm (%)	93.39	99.26	91.66	90.50		
	1.180 mm (%)	79.93	90.15	69.53	67.04		
	0.600 mm (%)	62.92	76.96	34.10	31.83		
	0.425 mm (%)	53.31	65.15	20.04	19.04		
	0.300 mm (%)	37.32	42.80	9.27	9.32		
	0.212 mm (%)	23.97	27.57	4.19	4.45		
0.150 mm (%)	12.49	15.96	2.16	2.45			
0.063 mm (%)	4.82	7.57	1.51	1.68			
Liquid Limit	LL (%)						
Plastic Limit	PL (%)						
Plastic Index	PI (%)						
Natural Moisture Content	MC (%)						
Specific Gravity	SG						
Unit Weight	Kg/m ³						
One Dimensional Consolidation Test	m _v (m ² /MN)						
	Void Ratio						
	Eff. Overburden, P _o						
Triaxial Compression Test							
Unsaturated Unconsolidated Undrained	C _u kN/m ²						
	φ°						
Consolidated Isotropic Undrained	c' kN/m ²						
	φ°						
Unconfined Compression	C _u kN/m ²						
Rock Strength Test							
Unconfined Compression	kN/m ²						
Point Load Strength Index	Is(50)(mpa)						
Chemical Test							
pH							
Water Soluble Sulphate	(%)						
Water Soluble Sulphate	g/L						
Chloride Content	(%)						
Organic Content	(%)						

Particle Size (mm)

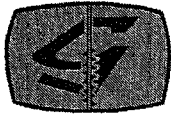
Particle Size (mm)

LAPORAN DISEDIAKAN OLEH :

JENNIFER J.

LAPORAN DISAHKAN OLEH :

S. F. HO

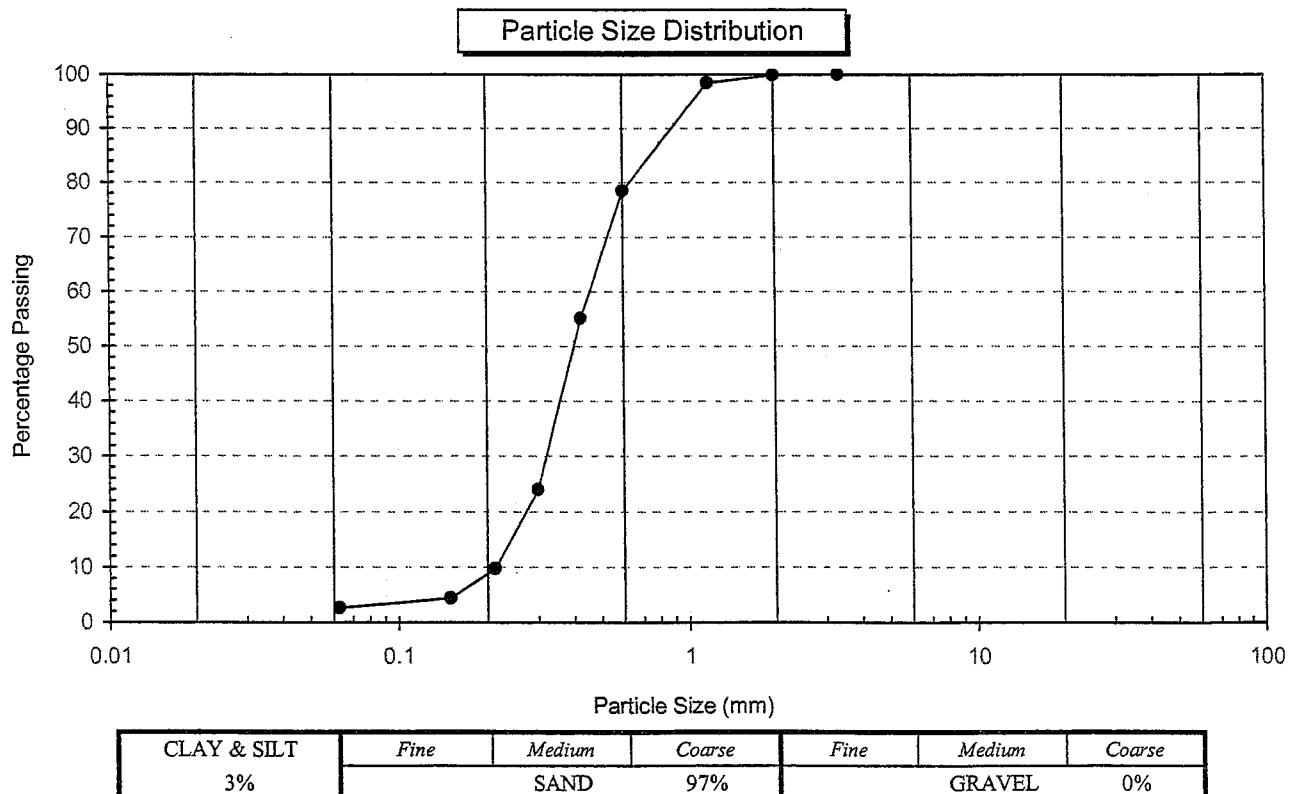


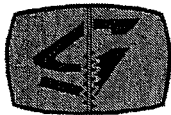
GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/891	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW1/D1	
Client: Terrain Resources Sdn. Bhd.				Depth : 1.50 m	
DRY SIEVING				WET SIEVE	
B.S. Seive (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.19
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	97.52
63.000				Weight of material washed through 0.063 mm sieve (gm)	2.67
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000					
3.350	0.00	0.00	100.00		
2.000	0.09	0.09	99.91		
1.180	1.50	1.59	98.41		
0.600	19.99	21.54	78.46		
0.425	23.44	44.93	55.07		
0.300	31.11	75.99	24.01		
0.212	14.29	90.25	9.75		
0.150	5.40	95.64	4.36		
0.063	1.70	97.34	2.66		
-0.063 mm dry	0.00			Tested By : Hastuti	
-0.063 mm wet	2.67			Checked By : Christine	
-0.063 mm total	2.67			Date : 10/12/2018	
TOTAL	100.19				





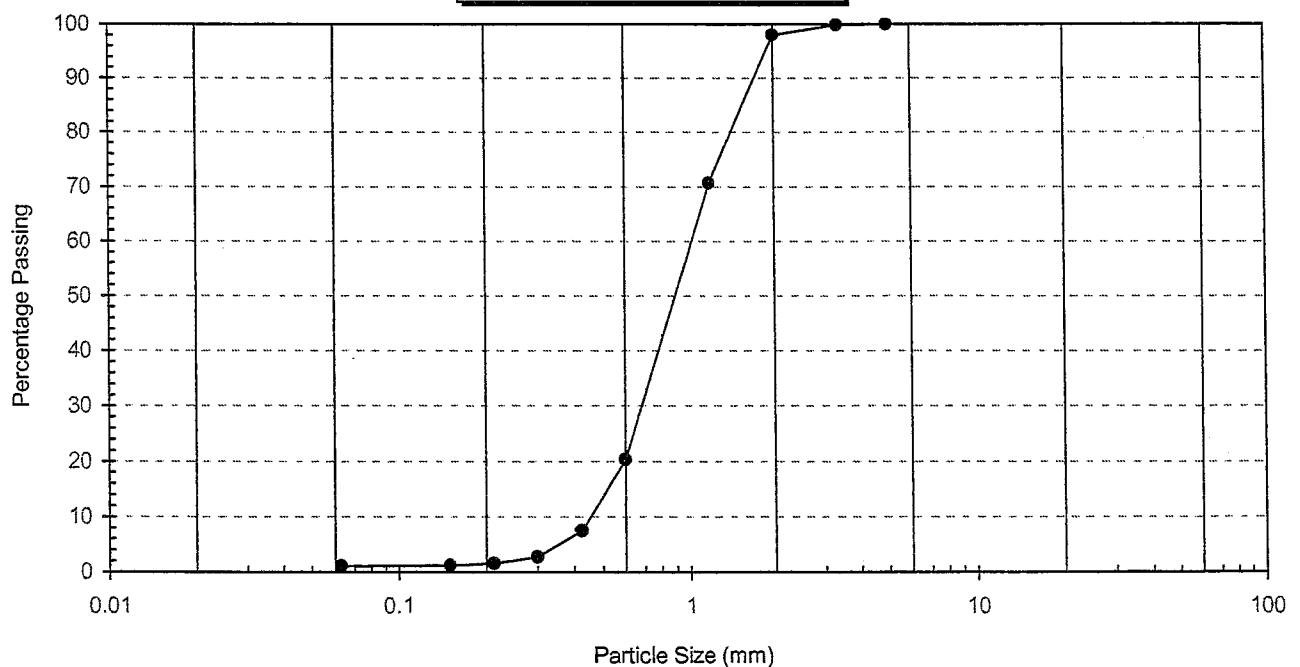
GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/892	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW1/D2	
Client: Terrain Resources Sdn. Bhd.				Depth : 3.00 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.64
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	99.55
63.000				Weight of material washed through 0.063 mm sieve (gm)	1.09
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000	0.00	0.00	100.00		
3.350	0.07	0.07	99.93		
2.000	1.96	2.02	97.98		
1.180	27.47	29.31	70.69		
0.600	50.75	79.74	20.26		
0.425	12.89	92.55	7.45		
0.300	4.80	97.32	2.68		
0.212	1.14	98.45	1.55		
0.150	0.34	98.79	1.21		
0.063	0.13	98.92	1.08		
-0.063 mm dry	0.00			Tested By : Hastuti	
-0.063 mm wet	1.09			Checked By : Christine	
-0.063 mm total	1.09			Date : 10/12/2018	
TOTAL	100.64				

Particle Size Distribution



CLAY & SILT	Fine	Medium	Coarse	Fine	Medium	Coarse
1%	SAND			GRAVEL		
			97%			2%

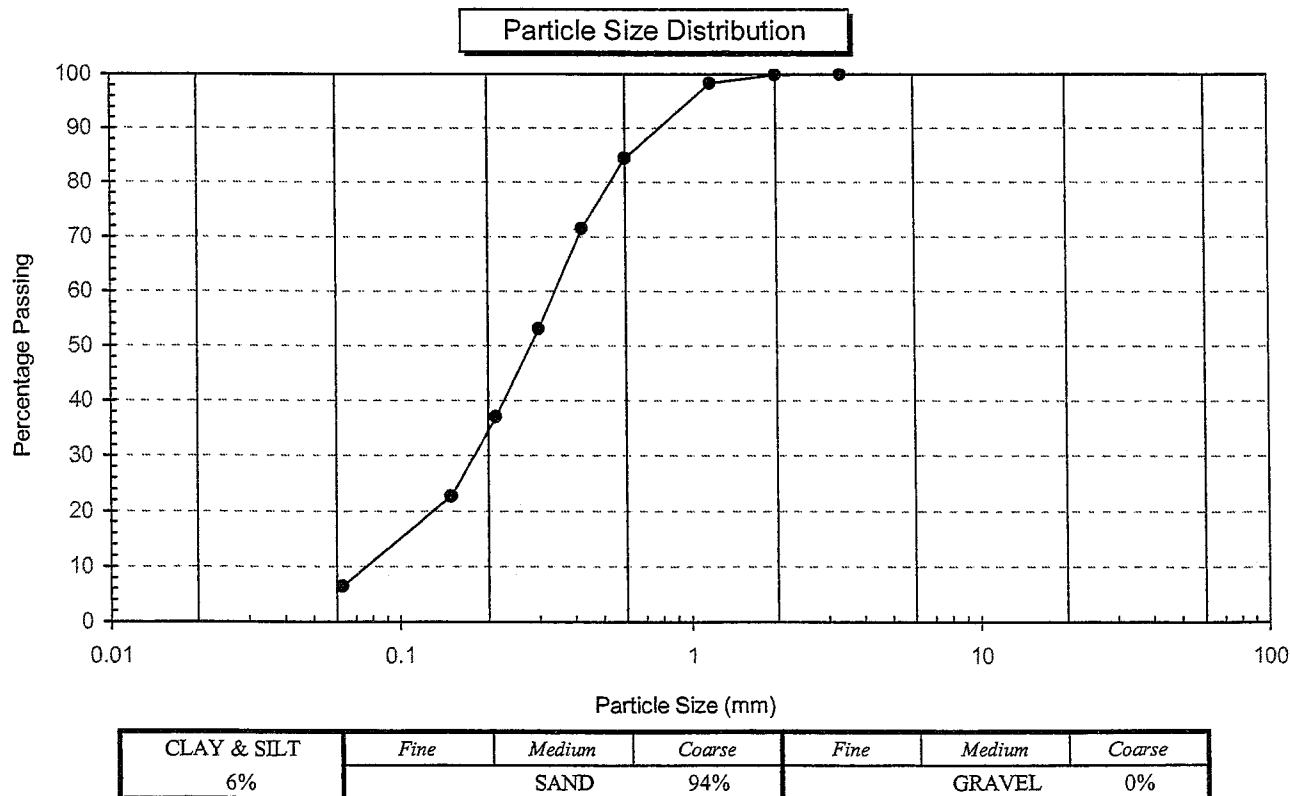


GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/893	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW1/D3	
Client: Terrain Resources Sdn. Bhd.				Depth : 4.50 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.96
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	94.54
63.000				Weight of material washed through 0.063 mm sieve (gm)	6.42
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000					
3.350	0.00	0.00	100.00		
2.000	0.10	0.10	99.90		
1.180	1.53	1.61	98.39		
0.600	14.05	15.53	84.47		
0.425	13.09	28.50	71.50		
0.300	18.60	46.92	53.08		
0.212	16.17	62.94	37.06		
0.150	14.49	77.29	22.71		
0.063	16.40	93.53	6.47		
-0.063 mm dry	0.11			Tested By : Hastuti	
-0.063 mm wet	6.42			Checked By : Christine	
-0.063 mm total	6.53			Date : 10/12/2018	
TOTAL	100.96				



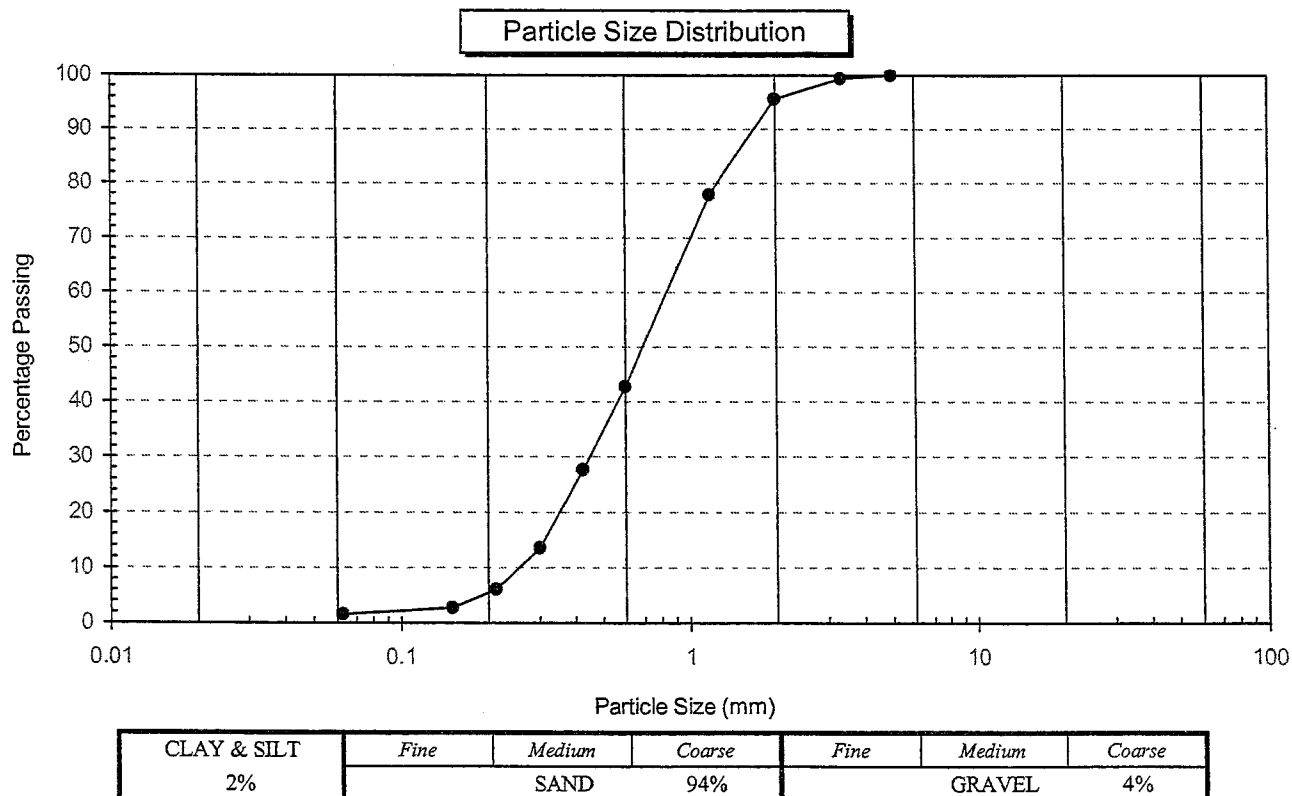


GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/894	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW2/D1	
Client: Terrain Resources Sdn. Bhd.				Depth : 1.50 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.51
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	98.90
63.000				Weight of material washed through 0.063 mm sieve (gm)	1.61
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000	0.00	0.00	100.00		
3.350	0.63	0.63	99.37		
2.000	3.73	4.34	95.66		
1.180	17.89	22.14	77.86		
0.600	35.30	57.26	42.74		
0.425	15.13	72.31	27.69		
0.300	14.19	86.43	13.57		
0.212	7.57	93.96	6.04		
0.150	3.34	97.28	2.72		
0.063	1.12	98.40	1.60		
-0.063 mm dry	0.00			Tested By : Hastuti	
-0.063 mm wet	1.61			Checked By : Christine	
-0.063 mm total	1.61			Date : 10/12/2018	
TOTAL	100.51				



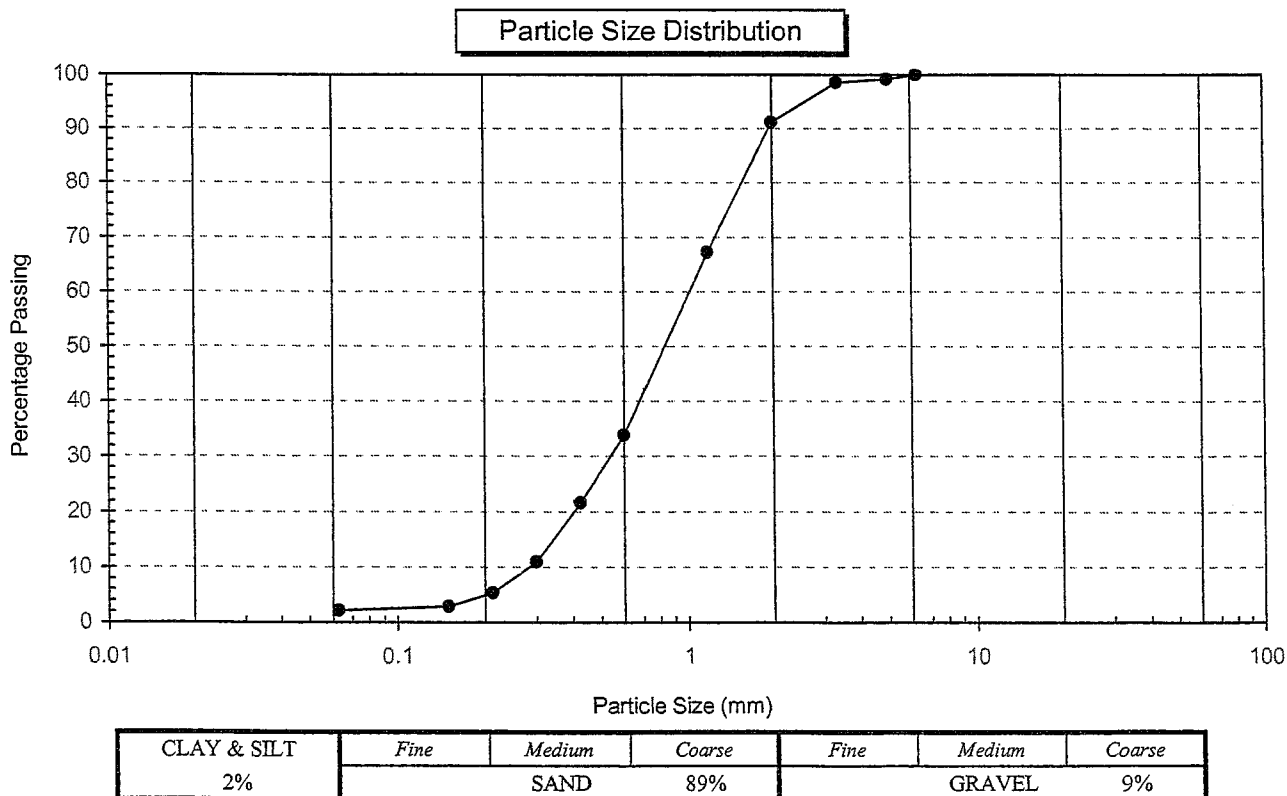


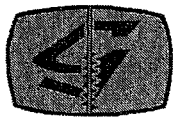
GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/895	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW2/D2	
Client: Terrain Resources Sdn. Bhd.				Depth : 3.00 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.25
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	98.11
63.000				Weight of material washed through 0.063 mm sieve (gm)	2.14
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300	0.00	0.00	100.00		
5.000	0.81	0.81	99.19		
3.350	0.65	1.46	98.54		
2.000	7.40	8.84	91.16		
1.180	23.97	32.75	67.25		
0.600	33.45	66.11	33.89		
0.425	12.26	78.34	21.66		
0.300	10.73	89.05	10.95	Tested By : Hastuti	
0.212	5.68	94.71	5.29		
0.150	2.39	97.10	2.90		
0.063	0.77	97.87	2.13		
-0.063 mm dry	0.00			Checked By : Christine	
-0.063 mm wet	2.14				
-0.063 mm total	2.14			Date : 10/12/2018	
TOTAL	100.25				





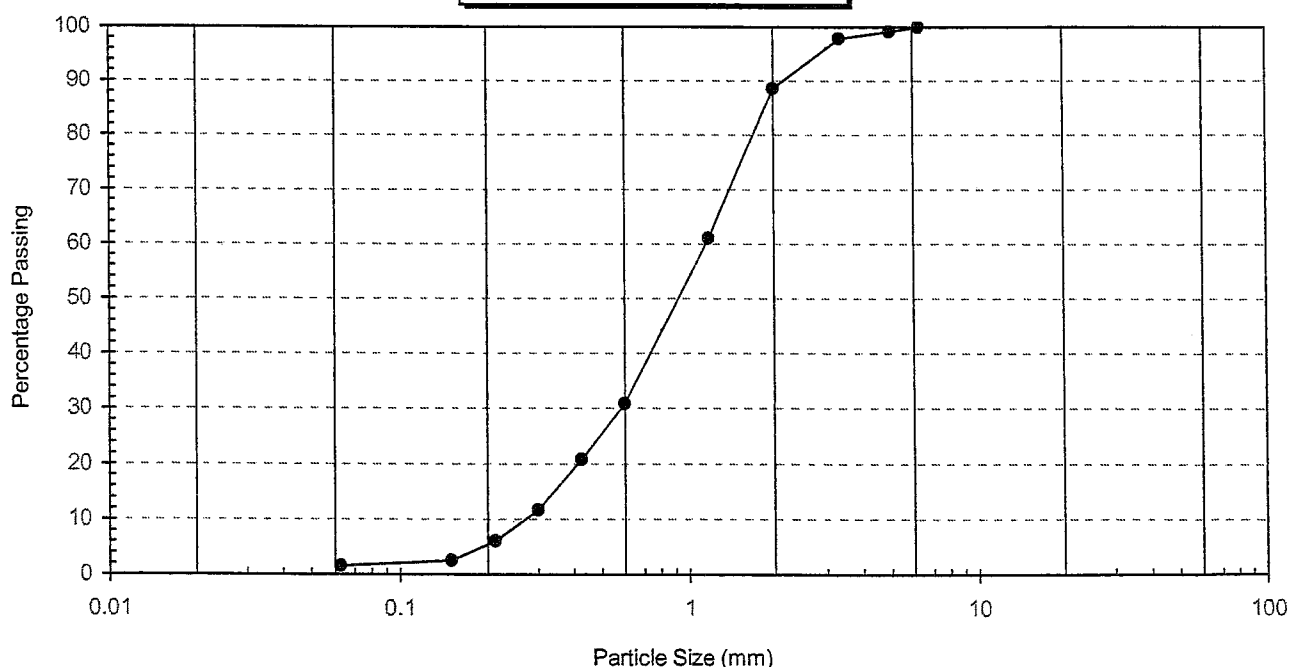
GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

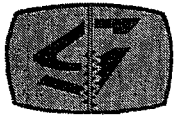
(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/896	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW 1A/D1	
Client: Terrain Resources Sdn. Bhd.				Depth : 1.50 m	
DRY SIEVING				WET SIEVE	
B.S. Seive (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.84
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	99.31
63.000				Weight of material washed through 0.063 mm sieve (gm)	1.53
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300	0.00	0.00	100.00		
5.000	0.86	0.85	99.15		
3.350	1.34	2.18	97.82		
2.000	9.31	11.41	88.59		
1.180	27.81	38.99	61.01		
0.600	30.33	69.07	30.93		
0.425	10.29	79.27	20.73		
0.300	9.11	88.31	11.69	Tested By : Hastuti	
0.212	5.65	93.91	6.09	Checked By : Christine	
0.150	3.61	97.49	2.51	Date : 12/12/2018	
0.063	1.00	98.48	1.52		
-0.063 mm dry	0.00				
-0.063 mm wet	1.53				
-0.063 mm total	1.53				
TOTAL	100.84				

Particle Size Distribution



CLAY & SILT	Fine	Medium	Coarse	Fine	Medium	Coarse
2%	SAND			GRAVEL		
	87%			11%		

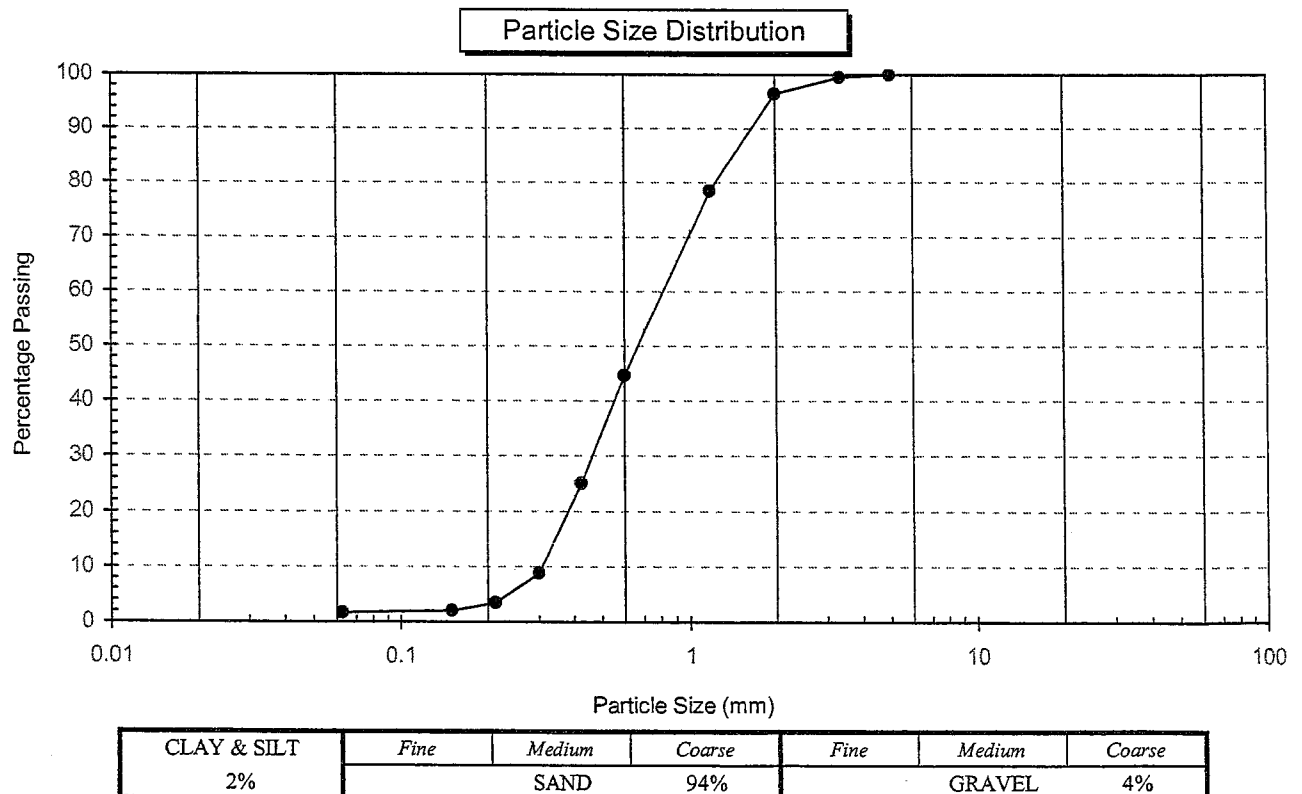


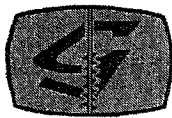
GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/897	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW1A/D2	
Client: Terrain Resources Sdn. Bhd.				Depth : 3.00 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.14
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	98.44
63.000				Weight of material washed through 0.063 mm sieve (gm)	1.70
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000	0.00	0.00	100.00		
3.350	0.53	0.53	99.47		
2.000	3.03	3.56	96.44		
1.180	17.91	21.44	78.56		
0.600	33.95	55.34	44.66		
0.425	19.58	74.90	25.10		
0.300	16.33	91.20	8.80		
0.212	5.39	96.58	3.42		
0.150	1.42	98.00	2.00		
0.063	0.30	98.30	1.70		
-0.063 mm dry	0.00			Tested By : Hastuti	
-0.063 mm wet	1.7			Checked By : Christine	
-0.063 mm total	1.70			Date : 12/12/2018	
TOTAL	100.14				



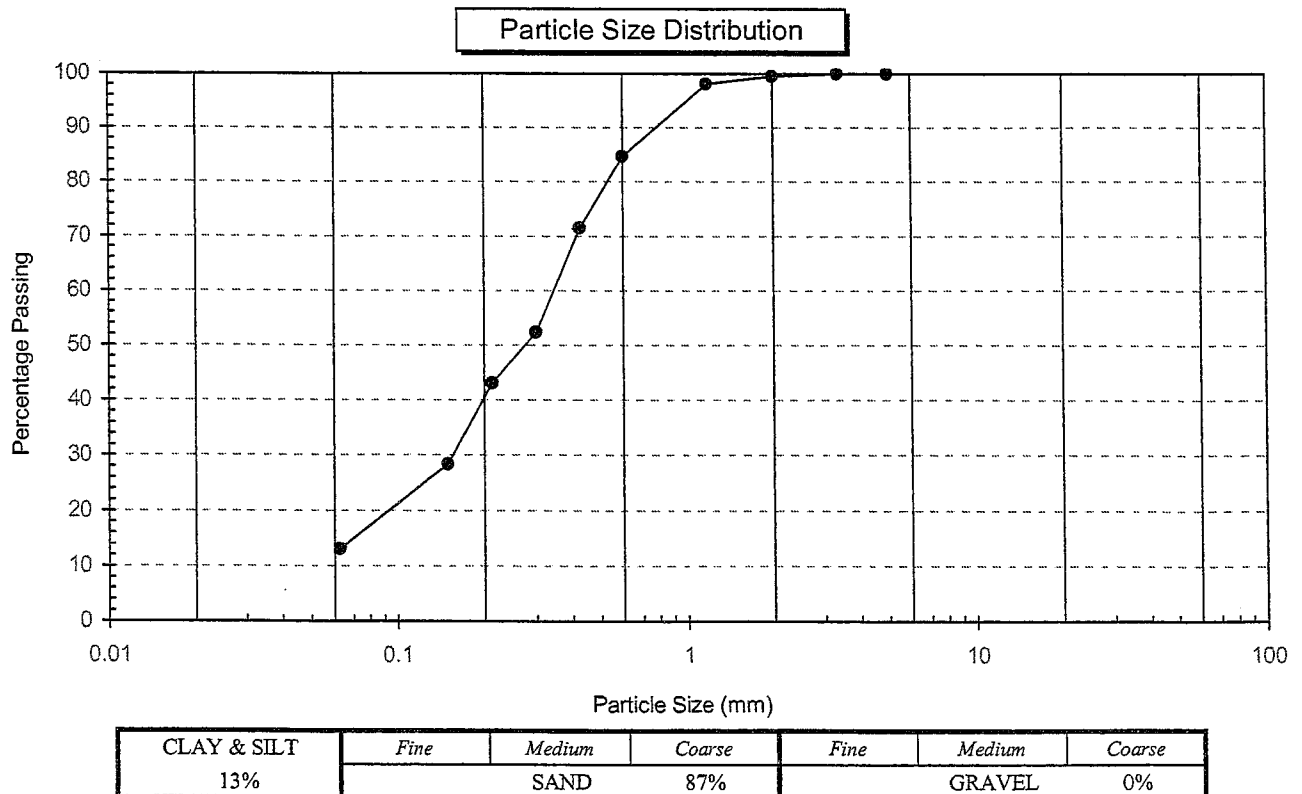


GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/898	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW1A/D3	
Client: Terrain Resources Sdn. Bhd.				Depth : 4.50 m	
DRY SIEVING				WET SIEVE	
B.S. Seive (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.72
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	87.63
63.000				Weight of material washed through 0.063 mm sieve (gm)	13.09
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000	0.00	0.00	100.00		
3.350	0.05	0.05	99.95		
2.000	0.41	0.46	99.54		
1.180	1.50	1.95	98.05		
0.600	13.51	15.36	84.64		
0.425	13.23	28.49	71.51		
0.300	19.28	47.64	52.36	Tested By : Hastuti	
0.212	9.34	56.91	43.09	Checked By : Christine	
0.150	14.84	71.64	28.36	Date : 12/12/2018	
0.063	15.40	86.93	13.07		
-0.063 mm dry	0.07				
-0.063 mm wet	13.09				
-0.063 mm total	13.16				
TOTAL	100.72				



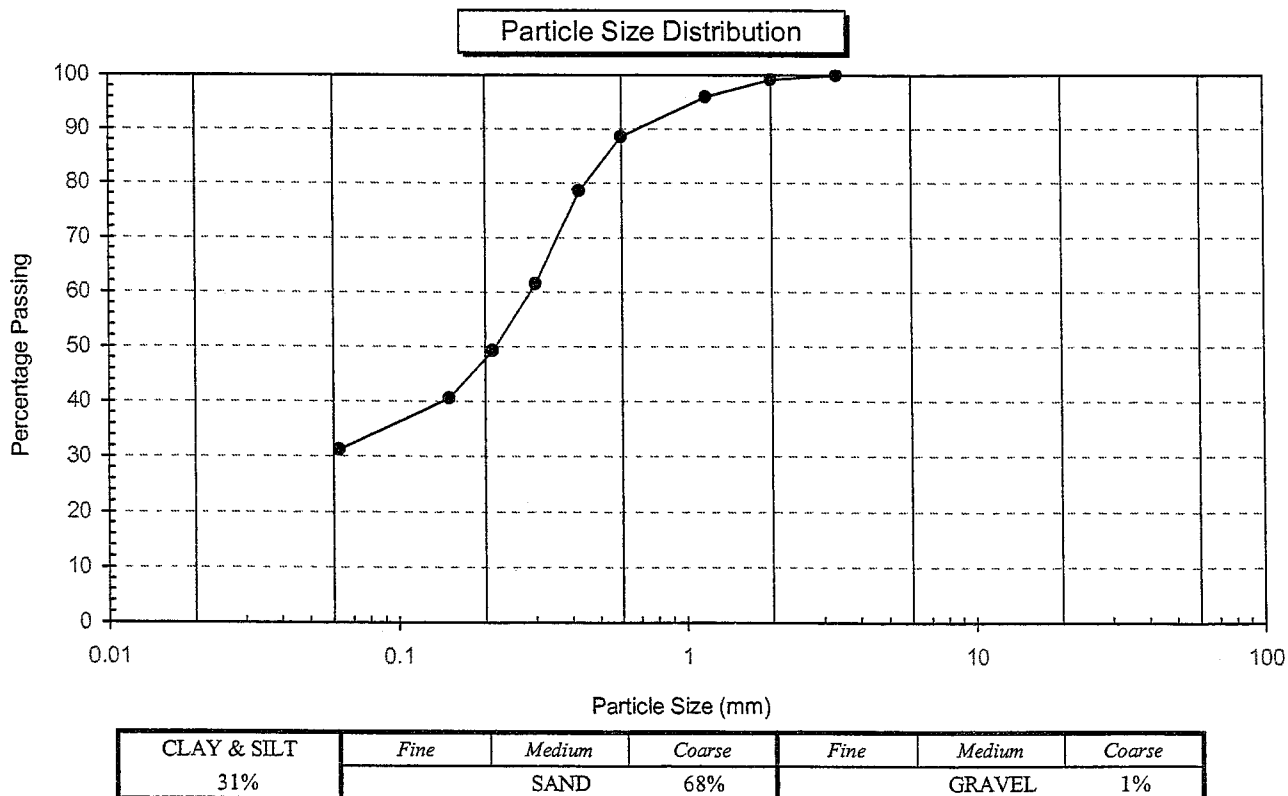


GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/899	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW 1A/D4	
Client: Terrain Resources Sdn. Bhd.				Depth : 6.00 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.59
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	69.30
63.000				Weight of material washed through 0.063 mm sieve (gm)	31.29
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000					
3.350	0.00	0.00	100.00		
2.000	0.87	0.86	99.14		
1.180	3.14	3.99	96.01		
0.600	7.46	11.40	88.60		
0.425	10.01	21.35	78.65		
0.300	17.23	38.48	61.52		
0.212	12.29	50.70	49.30		
0.150	8.69	59.34	40.66		
0.063	9.53	68.81	31.19		
-0.063 mm dry	0.08			Tested By : Hastuti	
-0.063 mm wet	31.29			Checked By : Christine	
-0.063 mm total	31.37			Date : 12/12/2018	
TOTAL	100.59				



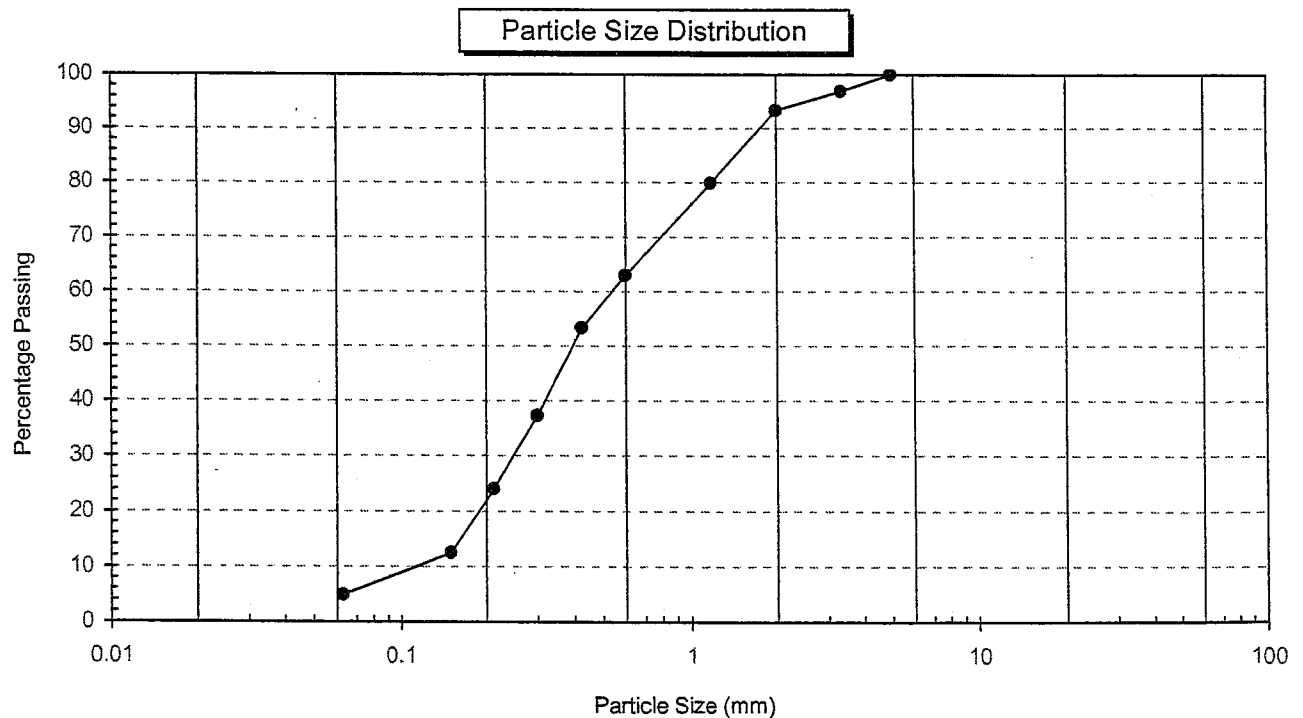


GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/900	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW2A/D1	
Client: Terrain Resources Sdn. Bhd.				Depth : 1.50 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.53
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	95.68
63.000				Weight of material washed through 0.063 mm sieve (gm)	4.85
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000	0.00	0.00	100.00		
3.350	3.15	3.13	96.87		
2.000	3.50	6.61	93.39		
1.180	13.53	20.07	79.93		
0.600	17.10	37.08	62.92		
0.425	9.66	46.69	53.31		
0.300	16.07	62.68	37.32		
0.212	13.42	76.03	23.97		
0.150	11.54	87.51	12.49		
0.063	7.71	95.18	4.82		
-0.063 mm dry	0.00			Tested By : Hastuti	
-0.063 mm wet	4.85			Checked By : Christine	
-0.063 mm total	4.85			Date : 12/12/2018	
TOTAL	100.53				



CLAY & SILT	Fine	Medium	Coarse	Fine	Medium	Coarse
5%	SAND		88%	GRAVEL		
						7%

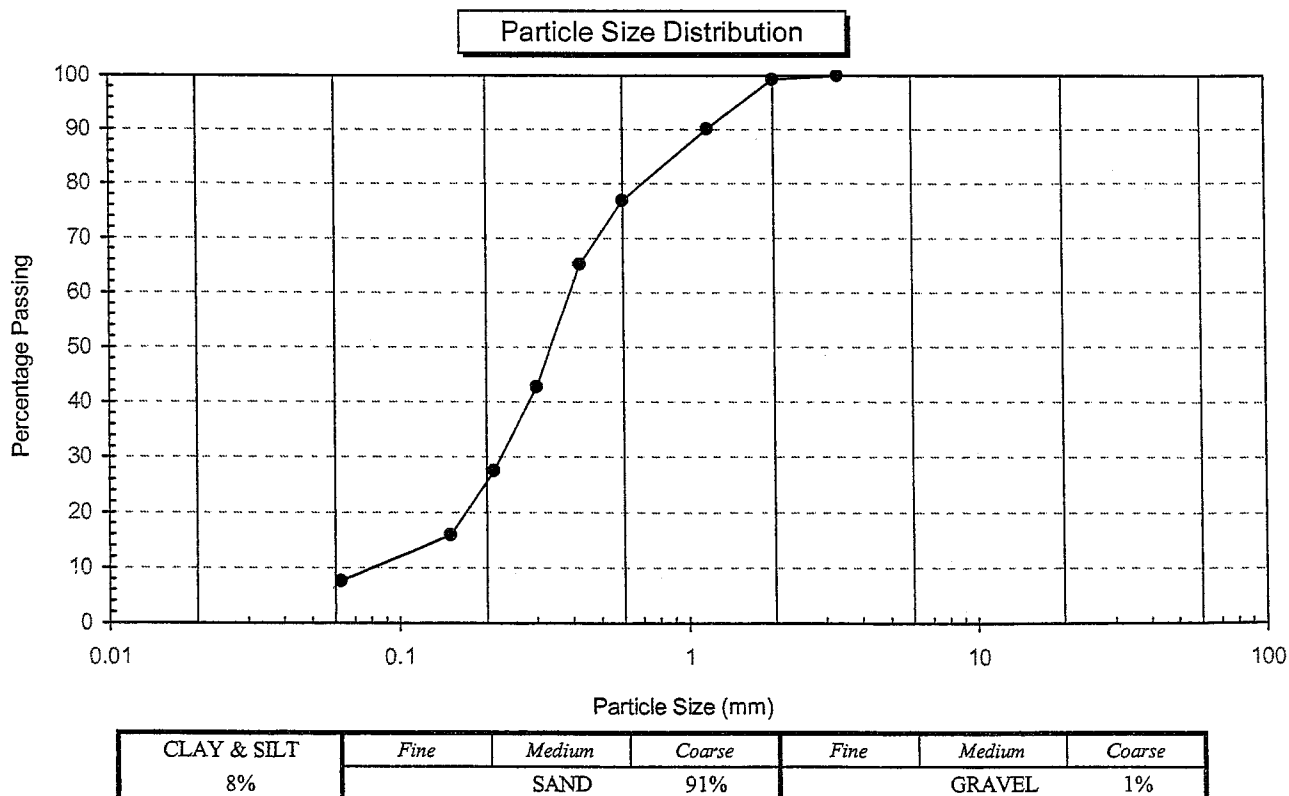


GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/901	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW2A/D2	
Client: Terrain Resources Sdn. Bhd.				Depth : 3.00 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.38
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	92.78
63.000				Weight of material washed through 0.063 mm sieve (gm)	7.60
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000				Remarks :	
14.000					
10.000					
6.300					
5.000					
3.350	0.00	0.00	100.00		
2.000	0.74	0.74	99.26		
1.180	9.15	9.85	90.15		
0.600	13.24	23.04	76.96		
0.425	11.85	34.85	65.15		
0.300	22.44	57.20	42.80		
0.212	15.29	72.43	27.57		
0.150	11.65	84.04	15.96		
0.063	8.42	92.43	7.57		
-0.063 mm dry	0.00			Tested By : Hastuti	
-0.063 mm wet	7.6			Checked By : Christine	
-0.063 mm total	7.60			Date : 12/12/2018	
TOTAL	100.38				



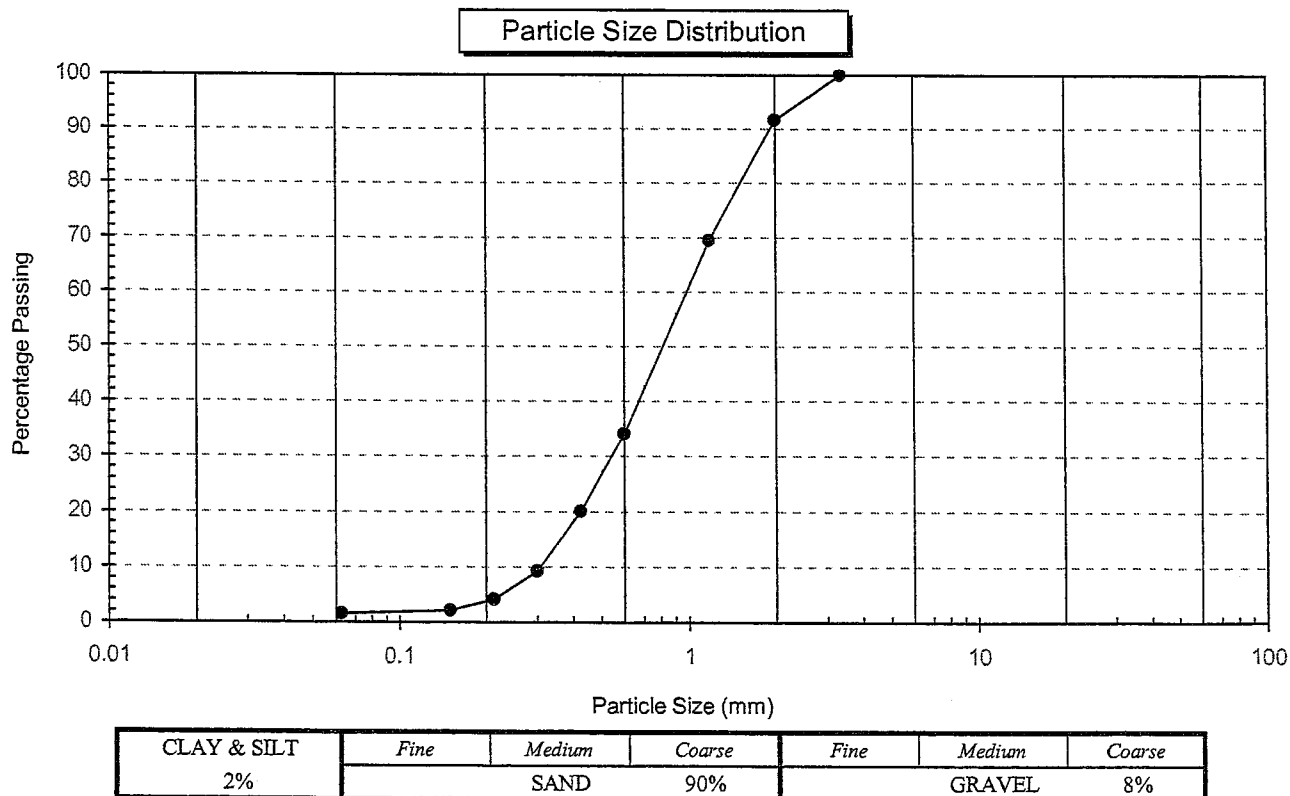


GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/902	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW2A/D3	
Client: Terrain Resources Sdn. Bhd.				Depth : 4.50 m	
DRY SIEVING				WET SIEVE	
B.S. Seive (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.38
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	98.86
63.000				Weight of material washed through 0.063 mm sieve (gm)	1.52
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000					
14.000					
10.000					
6.300					
5.000					
3.350	0.00	0.00	100.00		
2.000	8.37	8.34	91.66		
1.180	22.22	30.47	69.53		
0.600	35.56	65.90	34.10		
0.425	14.11	79.96	20.04		
0.300	10.81	90.73	9.27		
0.212	5.10	95.81	4.19		
0.150	2.04	97.84	2.16		
0.063	0.65	98.49	1.51		
-0.063 mm dry	0.00				
-0.063 mm wet	1.52				
-0.063 mm total	1.52			Tested By : Hastuti	
TOTAL				Checked By : Christine	
				Date : 12/12/2018	



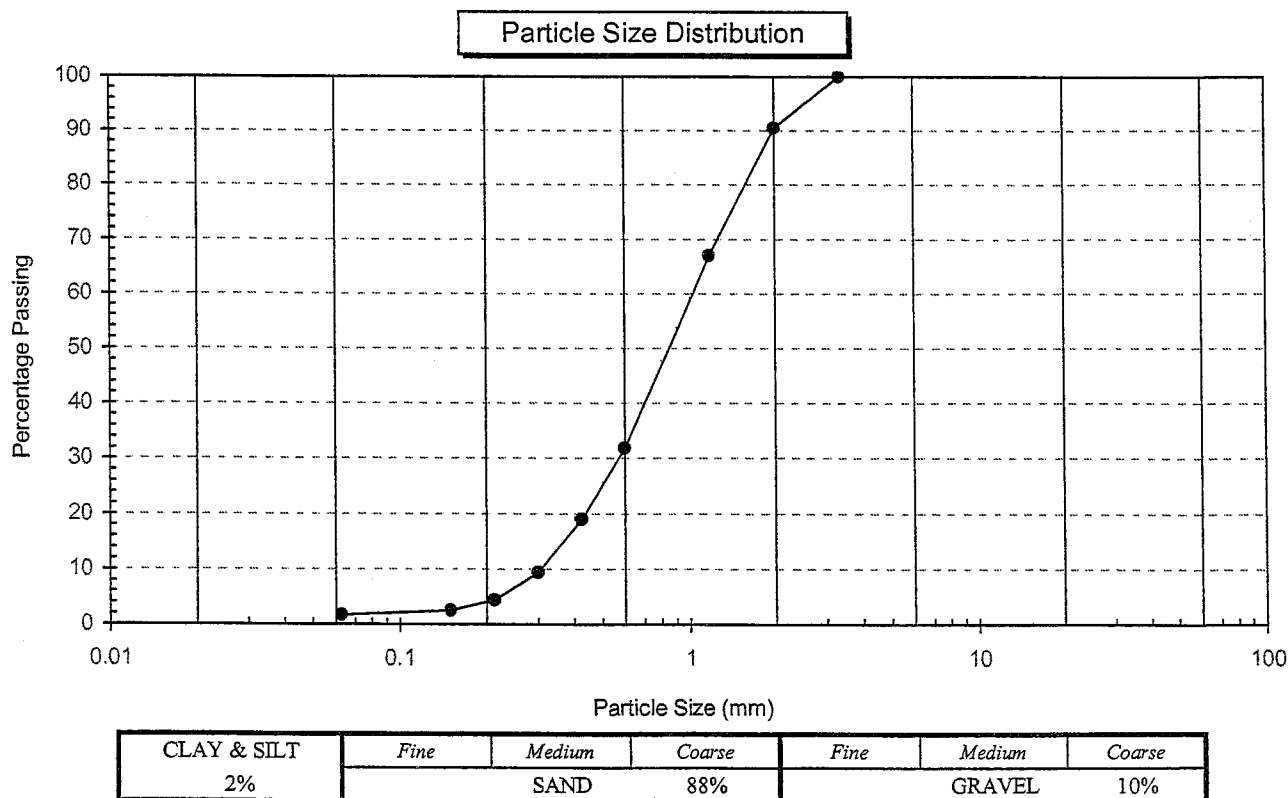


GROUND ENGINEERING [SABAH] SDN BHD

Kejuruteraan Bumi

(Company No. 019025K)

Project : Perkhidmatan Penggerudian dan Pembinaan Telaga Tiub Air Tanah di				Lab Sample No. : JE/2018/903	
Pulau Mabul, Semporna, Sabah.				Field Sample No. : TW2A/D4	
Client: Terrain Resources Sdn. Bhd.				Depth : 6.00 m	
DRY SIEVING				WET SIEVE	
B.S. Sieve (mm)	Weight Retained (gm)	Percentage Retained (%)	Total Percentage Passing (%)	Weight of dried sample before washing through 0.063 mm sieve (gm)	100.61
75.000				Weight of dried sample after washing through 0.063 mm sieve (gm)	98.92
63.000				Weight of material washed through 0.063 mm sieve (gm)	1.69
50.000				Natural Moisture Content (%)	
37.500				Sample Description : Refer to Borehole Log.	
28.000					
20.000					
14.000					
10.000					
6.300					
5.000					
3.350	0.00	0.00	100.00		
2.000	9.56	9.50	90.50		
1.180	23.60	32.96	67.04		
0.600	35.43	68.17	31.83	Remarks :	
0.425	12.86	80.96	19.04		
0.300	9.78	90.68	9.32		
0.212	4.90	95.55	4.45		
0.150	2.02	97.55	2.45		
0.063	0.77	98.32	1.68		
-0.063 mm dry	0.00				
-0.063 mm wet	1.69				
-0.063 mm total	1.69				
TOTAL	100.61			Tested By : Hastuti	
				Checked By : Christine	
				Date : 12/12/2018	



LAMPIRAN 5:
ANALISIS KIMIA DAN
BAKTERIOLOGI



CHEMSAIN KONSULTANT SDN BHD (130904-U)

Lots 2 & 7, Lorong Suria, Off Lorong Buah Duku 1,
Taman Perindustrian Suria, Jalan Kolombong,
88450, Kota Kinabalu, Sabah, Malaysia.

Phone +6088 - 389 671 / 381 278 Fax +6088 - 381 280

Email laboratory@chemsain.com

www.chemsain.com



MS ISO/IEC 17025
TESTING
SAMM NO. 238

TEST REPORT

NOT FOR ADVERTISEMENT PURPOSES

Customer	:	Ground Engineering (Sabah) Sdn Bhd	Lab No.	:	CK/CL405/4562/18
		Lot No. 3-3, 3 rd Floor, Block C	Type (No.) of Sample	:	Water (2)
		Ruang Perdangangan T1	Date Received	:	27 th November 2018
		Inanam Business Centre, Mile 6	Date of Report	:	12 th December 2018
		Tuaran Road, 88444 Kota Kinabalu.	Service Order	:	-
Attn	:	Watin B. Malun			

Project: PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI PULAU MABUL, SEMPORNA, SABAH.

Lab No.	4562-1	4562-2	Test Method
Parameter(s)	TW - 1	TW - 2	
pH Value @ 25°C	7.55	7.69	APHA 4500H ⁺ B, 2017
Colour (Colour Units)	<2.00	<2.00	APHA 2120 C, 2017
Turbidity, NTU	<0.20	<0.20	APHA 2130 B, 2017
Total Suspended Solids, mg/L	<5.00	<5.00	APHA 2540 D, 2017
Total Dissolved Solid, mg/L	45,000	40,700	APHA 2540 C 2017
Anionic Surfactant (MBAS calculated as LAS, Mol.wt.348.48), mg/L	0.02	0.01	APHA 5540 C, 2017
Total Hardness, by Calculation (as CaCO ₃), mg/L	6,460	6,090	APHA 2340 B, 2017
Iron (as Fe), mg/L	<0.03	<0.03	APHA 3120 B, 2017
Sulphate (as SO ₄ ²⁻), mg/L	730	740	APHA 4500- SO ₄ ²⁻ E, 2017
Nitrate Nitrogen (as NO ₃ -N), mg/L	1.73	1.05	APHA 4500-NO ₃ E, 2017
Nitrite Nitrogen (as NO ₂ -N), mg/L	0.06	0.04	APHA 4500-NO ₂ B, 2017
Chloride (as Cl ⁻), mg/L	19,700	18,400	APHA 4500-Cl ⁻ B, 2017
Total Alkalinity (as CaCO ₃), mg/L	106	109	APHA 2320 B, 2017
Calcium (as Ca), mg/L	393	397	APHA 3120 B, 2017

Page 1 of 2

NOTE: 1) This Test Report shall not be reproduced, except in full, without the written approval of the laboratory.
2) The above result(s) are based on sample(s) as received.
3) The result(s) relates to the sample(s) tested.



CHEMSAIN KONSULTANT SDN BHD (130904-U)

Lots 2 & 7, Lorong Suria, Off Lorong Buah Duku 1, Taman Perindustrian Suria,

Jalan Kolombong, 88450 Kota Kinabalu, Sabah, Malaysia.

Tel: +60-88-389671 / 381278 Fax: +60-88-381280

Email: laboratory.kk@chemsain.com



MS ISO/IEC 17025
TESTING
SAMM No 238

TEST REPORT

* NOT FOR ADVERTISEMENT PURPOSES *

Lab No.: CK/CL405/4562/18

Lab No.	4562-1	4562-2	Test Method
Parameter(s)	TW - 1	TW - 2	
Cadmium (as Cd), mg/L	<0.003	<0.003	APHA 3120 B, 2017
Lead (as Pb), mg/L	<0.01	<0.01	APHA 3120 B, 2017
Chromium (as Cr), mg/L	<0.02	<0.02	APHA 3120 B, 2017
Copper (as Cu), mg/L	<0.03	<0.03	APHA 3120 B, 2017
Magnesium (as Mg), mg/L	1,330	1,240	APHA 3120 B, 2017
Manganese (as Mn), mg/L	0.02	<0.02	APHA 3120 B, 2017
Zinc (as Zn), mg/L	<0.02	<0.02	APHA 3120 B, 2017
Silica (as Si), mg/L	3.93	2.24	APHA 3120 B, 2017
Sodium (as Na), mg/L	11,600	13,000	APHA 3120 B, 2017
Aluminium (as Al), mg/L	<0.05	<0.05	APHA 3120 B, 2017
Bicarbonate (as HCO ₃), mg/L	130	132	APHA 2320 B, 2017

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- NOTE: 1) This Test Report shall not be reproduced, except in full, without the written approval of the laboratory.
2) The above result(s) are based on sample(s) as received.
3) The result(s) relates to the sample(s) tested.



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MS ISO/IEC 17025
TESTING
SAMM NO. 238

TEST REPORT

NOT FOR ADVERTISEMENT PURPOSES

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Lot No. 3-3, 3rd Floor, Block C
Ruang Perdagangan T1
Inanam Business Centre, Mile 6
Tuaran Road, 88444 Kota Kinabalu.
Attn : Watin B. Malun

Lab No. : CK/ML405/4563/18
Type (No.) of Sample : Water (2)
Date Received : 27th November 2018
Date of Report : 05th December 2018
Service Order : -

Project: PERKHIDMATAN PENGGERUDIAN DAN PEMBINAAN TELAGA TIUB AIR TANAH DI PULAU MABUL, SEMPORNA, SABAH.

Lab No.	Identification of Sample(s)	<i>E. coli</i> Count MPN/100mL, 44.5±0.2°C/24 h (Test Method: In-House Method 0601 based on AS 4276.6, 1995)
4563-1	TW - 1	<1.8
4563-2	TW - 2	<1.8

C. Evert
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