

**Appendix 6:
Ground Investigation – AMETS
substation – Belderra, Co. Mayo**

Ground investigation

AMETS Substation Belderra, Co. Mayo



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Report No. 11-269

Client: ESBI

Engineer: ESBI Engineering

September 2011

AMETS Substation, Belderra, Co. Mayo

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Document Control Sheet**Report No.:** 11-269**Project title:** AMETS Substation, Belderra, Co. Mayo**Client:** ESBI**Engineer:** ESBI Engineering

Revision	Status	Report prepared by:	Report Reviewed by:	Issue date
		Chris Anderson MEng	Gabriel Gallagher BSc PhD CEng MICE MCIHT	20 September 2011

The works were conducted in accordance with:

Specification and related documents for ground investigation in Ireland
(Engineers Ireland, 2006)

British Standards Institute (1999) *BS 5930:1999, Code of practice for site investigations*. Incorporating Amendment No. 1 of December 2007, as partially replaced by:

- IS EN 1997-2:2007: *Eurocode 7. Geotechnical design. Ground investigation and testing*
- EN ISO 22475-1:2006: *Geotechnical investigation and testing. Sampling methods and groundwater measurements. Technical principles for execution*
- EN ISO 14688-1:2002: *Geotechnical investigation and testing. Identification and classification of soil. Identification and description*
- EN ISO 14688-2:2004: *Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification*
- EN ISO 14689-1:2003: *Geotechnical investigation and testing. Identification and classification of rock. Identification and description*
- EN ISO 22476-2:2005: *Geotechnical investigation and testing. Field testing. Dynamic probing*
- EN ISO 22476-3:2005: *Geotechnical investigation and testing. Field testing. Standard penetration test*

Methods of describing soils and rocks

Soil and rock descriptions are based on the guidance in Section 6 of BS 5930: 1999, *The Code of Practice for Site Investigation*, Amendment 1. The amendment revised the Standard to remove text superseded by EN ISO 14688-1:2002, EN ISO 14688-2:2004 and EN ISO 14689-1:2003 and refers to the relevant standard for each affected subclause. The following exceptions apply:

- The following terms are used in the description of fine-grained soils, where applicable:
 - soft to firm: fine-grained soil with consistency description close to the boundary between soft and firm soil (Table 13 of BS5930).
 - firm to stiff: fine-grained soil with consistency description close to the boundary between firm and stiff soil (Table 13 of BS5930).

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
D	Small disturbed sample
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (C)	Standard penetration test using 60 degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
Abbreviations relating to rock core – reference Clause 44.4.4 of BS 5930: 1999	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of <i>solid core</i> to the total length of core run. <i>Solid core</i> has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of <i>solid core</i> pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.

AMETS Substation, Belderra, Co. Mayo

1 AUTHORITY

On the instructions of ESBI Engineering, acting on behalf of the Client, ESBI, a ground investigation was undertaken at a site in Belderra, Co. Mayo. The works were conducted to provide geotechnical information for the design and construction of a new electrical substation at the Atlantic Marine Energy Test Site (AMETS).

2 SCOPE

The investigation, as instructed by the Engineer, included boreholes, trial pits, sampling, insitu and laboratory testing and the preparation of a report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the site is adjacent the coast, near Belderra Strand, in west Mayo. The site is previously undeveloped and has been used for agricultural purposes.

The exploratory hole locations, and details of the proposed development are shown on the plan in Appendix A.

4 SITE OPERATIONS

The Site Operations, conducted on 27 July – 3 August 2011, comprised:

- two rotary boreholes
- six trial pits
- an infiltration test carried out in two trial pits
- an EPA Site Suitability Assessment

The plan in Appendix A shows the exploratory hole and test positions.

4.1 Rotary boreholes

Rotary drilling was conducted in two boreholes (BH01 and 02) using a Comacchio 450 rig as follows:

- Symmetrix cased full-hole rotary drilling, in 131mm diameter, to advance boreholes to rockhead at depths of 4.1m and 4.8m
- rotary coring, to extract rock core to a depth of 8.40 and 10.12m, using a T2-101 core barrel, producing core of 84mm nominal diameter.

Standard penetration tests were carried out at 1.0m intervals to rock head using the split spoon sampler (SPT). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Appendix C includes the rotary borehole logs with photographs of the extracted rock core presented in Appendix D.

4.2 Trial pits

Six trial pits (SA01 and TP01-TP05) were excavated using a 7t tracked excavator fitted with an 600mm wide bucket. Trial pits were excavated to depths of 1.3m – 3.0m, terminating on gravelly sand.

SA01 was excavated adjacent TP02 to allow completion of an infiltration test at suitable depth.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls were noted on completion.

Appendix E presents the trial pit logs, while associated photographs are presented in Appendix F.

4.3 Infiltration tests

An infiltration test was carried out in SA01 and TP01 in accordance with BRE Digest 365 - Soakaways (BRE, 2007), in excavations of 0.8 and 1.3m depth, respectively.

Appendix G presents the results and analysis of the infiltration tests. The absence of the outflow from the pit precluded calculation of the infiltration coefficient.

4.4 EPA Site Suitability Assessment

An EPA Site Suitability Assessment was carried out by an Mayo County Council approved assessor. The report is presented in Appendix H and includes the results and analysis of percolation tests and recommendations on the suitability of the disposal of effluent from an on-site wastewater treatment system.

5 LABORATORY TESTING

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described and their descriptions incorporated into the borehole logs. The logs were revised, where necessary, based on the laboratory test results.

Laboratory testing comprised:

- classification tests: natural moisture content and particle size distribution
- chemical tests: pH and water soluble sulfate content of soils.
- rock tests: uniaxial compressive strength and point load index tests
- Waste Acceptance Criteria testing: Murphy Suite, conducted by Chemtest at its laboratory in Newmarket, Suffolk.

Appendix I provides the laboratory test results. Unless noted otherwise, tests were conducted in accordance with BS 1377:1990, *Methods of test for soils for civil engineering purposes. Parts 1 to 9*.

6 GROUND CONDITIONS

6.1 General geology of the site

6.2 General geology of the site

Appendix B presents an excerpt of the bedrock geology map of the area (Geological Survey of Ireland, 1992).

The map shows the bedrock in the area to be of the Annagh Division belonging to the Precambrian period, described as *Dark Gneiss and Grey Gneiss*.

The online database of the Geological Survey of Ireland indicates the drift cover at the site to comprise wind blown sands.

The bedrock aquifer is classified as *Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones*. The National Vulnerability is rated as *E: extreme*. There are no karst features recorded as being present near the site.

6.3 Ground types

The exploratory holes revealed the following ground types:

- Topsoil: penetrated in all trial pits, in thicknesses ranging 200 - 600mm.
- Peat: penetrated in both boreholes, from ground level in thicknesses of 500mm and 600mm, respectively, and penetrated to depths of 1.2m and 1.4m in trial pits SA01 and TP02, respectively.
- Fine grained material: encountered in BH02 as stiff black silt with cobbles to a depth of 1.6m.
- Coarse grained material: encountered to depths of completion or refusal in trial pits to 4.1m and 4.8m in BH01 and BH02, respectively. Coarse grained material was predominantly encountered as fine to coarse sand with high cobble content. And measured as medium dense to dense in the boreholes.
- Bedrock as recovered in both boreholes at depths of 4.1-8.4m (BH01) and 4.8-10.1m (BH02).

The rock is medium strong to strong and strong to very strong, greenish grey or pink grey medium to coarse grained gneiss or granite. Discontinuities are typically close to medium spaced with varying dips ranging from sub horizontal to 60 degrees. Joints are generally rough, planar to undulating and moderately open and generally clean.

Four UCS tests provided compressive strengths of 27-34MPa. Eight point load index tests indicated, applying the frequently adopted conversion factor of 22, compressive strengths of 12-156MPa, average 32MPa.

Assessment of the UCS results and point load estimated strength values are as follows:

Strength term (BS5930 – Amendment No. 1)	Strength range (MPa)		Number of test results
	min	max	
Weak	5	25	1
Medium strong	25	50	4
Strong	50	100	3
Very Strong	100	250	4

6.4 Groundwater

Groundwater was encountered as follows:

Exploratory hole	Depth of strike (m)	Comments
BH02	1.400	Water Strike with no noted rise
SA01	1.800	Slight Seepage
TP02	3.000	Moderate Seepage
TP05	2.400	Slight Seepage

No significant water entries were detected in the rotary drilled boreholes. The use of compressed air during Symmetrix drilling and flush during coring would have masked small water entries in boreholes.

7 DISCUSSION

7.1 Proposed construction

The development of the site will include the construction of a an electricity substation with layout as shown on the exploratory hole plan in Appendix A..

No further details were available to Glover Site Investigations Ltd when preparing this Report.

7.2 Recommendations for construction

7.2.1 Substation foundation and ground floor construction

Spread foundations, should be taken down to a consistent bearing stratum on medium dense coarse grained soil as encountered at 1m and 2m in the two boreholes. An allowable bearing pressure of 250kPa is applicable as derived from the standard penetration test *N*-values, limiting settlement to 25mm.

The base of the excavations for spread foundations should be thoroughly inspected. Any pockets of loose/soft soil should be excavated with the resultant void backfilled with Grade ST1 concrete. A consistent bearing stratum should be provided for any building unit.

Given the prevalence of coarse grained soils, surface peat and low depth water entries, excavations for foundations are likely to be unstable. Instability can be minimised by temporary support and/or

by battering the side slopes and limiting the duration that the excavation is open. Groundwater entries into excavations should be controlled by pumping from sumps formed in the base of the excavation.

The use of ground bearing floor slabs is appropriate following the removal of peat layers and their replacement using well-graded well-compacted granular fill. However, a suspended floor slab should be adopted where the difference in levels of the underside of the proposed floor slab and the base of soft/compressible soils is greater than 600mm.

Chemical tests (pH and water soluble sulfate contents), presented in Appendix D, performed on soil samples, indicate Design Sulfate Class DS-1 and ACEC Class AC-1 – reference Table C1 of BRE Special Digest 1 (Building Research Establishment, 2005). The Special Digest does not require any measures to protect underground concrete elements greater than 140mm thick.

7.2.2 Access roads, car parks and hard standing

The sub-base level should be provided on coarse grained material below peat layers. Based on the strata descriptions and results of grading analysis, a design CBR value of over 15% is applicable obviating the requirement for a capping layer.

7.2.3 Infiltration drainage

In the two infiltration tests, the small fall in water level, precluded an estimation of the infiltration coefficient. Given the coarse grained nature of the soil encountered in the test pits, it is likely that the lack of infiltration recorded is due to the equalisation of water levels with the natural water table.

7.2.4 EPA Site Suitability Assessment

An EPA Site Suitability Assessment is presented in Appendix G.

7.2.5 Disposal of Spoil from site

Appendix I includes the results of a Murphy Suite waste acceptance criteria (WAC) test on a soil sample taken from TP05.

In assessment of the disposal of waste, the test results have been compared with the limits for “Inert Waste” as defined in European Union Directives.

The test results indicate that spoil removed from site may be considered as “Inert Waste”.

8 REFERENCES

British Standards Institute (1990) *BS 1377:1990, Methods of test for soils for civil engineering purposes. Parts 1 to 9.*

British Standards Institute (1999) *BS 5930:1999, Code of practice for site investigations.* Incorporating Amendment No. 1 of December 2007.

Building Research Establishment (2007), *BRE Digest 365: Soakaways.*

Geological Survey of Ireland (1992) *Solid Geology Ireland 1:100,000 Series Map, North Mayo, Sheet 6.*

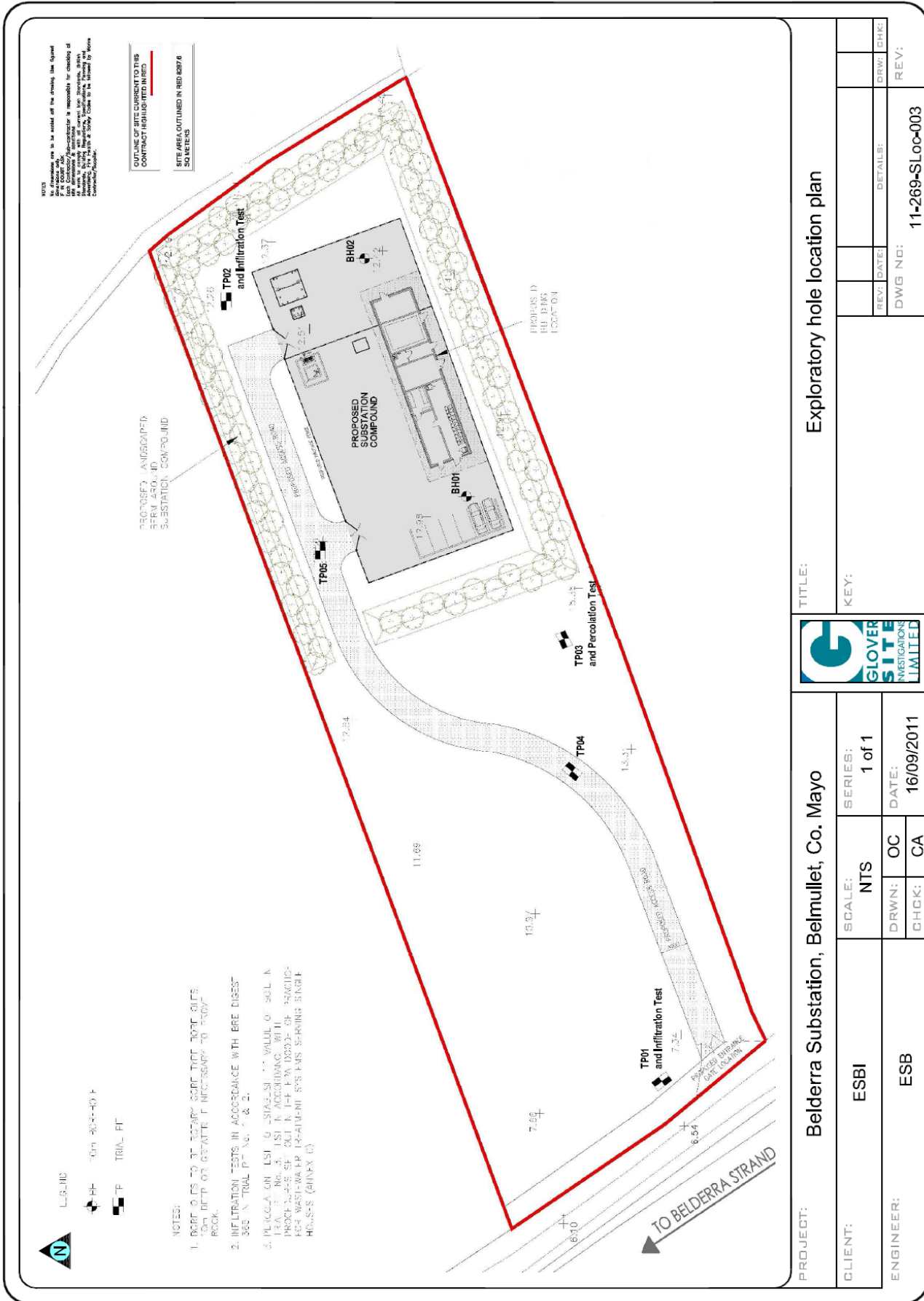
Appendix A

Site and exploratory hole location plans



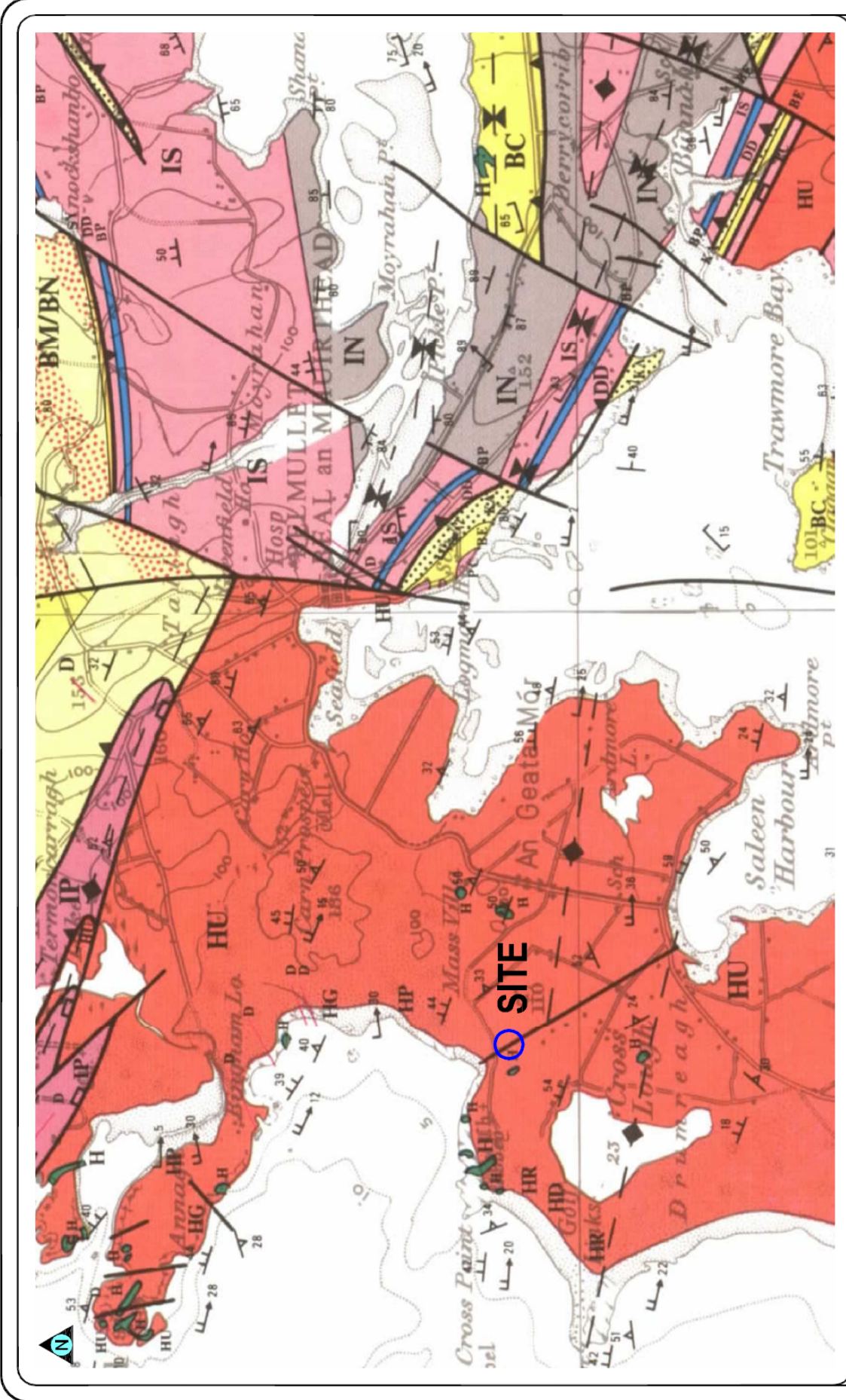
PROJECT: Belderra Substation, Belmullet, Co. Mayo		TITLE: Site location plan	
CLIENT: ESBI	SCALE: NTS	REV: DATE:	DRW: DWS:
	DRWN: OC CHK: CA	DETAILS:	
ENGINEER: ESB	SERIES: 1 of 1	DWG NO: 11-269-SLoc-001	REV:
DATE: 16/09/2011			





Appendix B



Excerpt of geology map





PROJECT: Belderra Substation, Belmullet, Co. Mayo		TITLE: Geology location plan	
CLIENT: ESBI	SCALE: NTS	KEY: HU: Annagh Division undifferentiated	REV: DATE: DETAILS: DRWG: ENGR: REV:
	DRWN: OC		
ENGINEER: ESB	CHCK: CA	DATE: 16/09/2011	
SERIES: 1 of 1			

Appendix C

Borehole logs

				Project No. 11-269	Project Name: Belderra Substation, Belmullet, Co. Mayo	Borehole No. BH01		
Method and Equipment: Rotary drilling 0.00-4.10m Symmetrix Drilling Rotary coring 4.10-8.40m Comacchio 450				Co-ords: 65713.5mE 330674.5mN	Client: ESBI	Sheet 1 of 1		
				Ground Level: 13.00mOD	Engineer: ESB	Scale: 1:50		
					Dates: 02/08/2011 - 03/08/2011	Driller: TA		
						Logger: JR		
Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/Installs
1.00	SPT	1.00	dry	N=22 N=22 (4,7,6,6,5,5)	(0.60) 12.40 0.60	Black silty PEAT (Driller's description)		
2.00	SPT	2.00	dry	N=29 N=29 (4,5,6,7,8,8)	(2.80)	Medium dense grey brown coarse SAND with gravel and cobbles (Driller's description)		
3.00	SPT	3.00	dry	N=30 N=30 (4,4,7,7,8,8)	9.60 3.40	Dense grey gravelly SAND (Driller's description)		
4.00 4.10	SPT	4.00	dry	50/20mm 20mm (25.50)	(0.70) 8.90 4.10	Medium strong to strong greenish grey medium to coarse grained micaceous GNEISS/GRANITE. Fresh, locally slightly to moderately weathered adjacent to discontinuity surfaces with orange brown surface discoloration and occasional brown sandy clay infill up to 1-2mm		
4.57				NI 4.55 12 4.57 NI 4.88 5.10		Discontinuity Set 1: sub-horizontal to 20 degrees, rough planar to undulating, close to medium spaced, moderately open and generally clean, occasionally discoloured brown		
6.00				94 83 48 8	6.00 (3.90)	Discontinuity Set 2: 60 degrees to sub-vertical, rough, undulating, stepped, medium widely spaced, open and orange brown sandy clay infilled up to 1mm		
7.00				100 100 0 10				
7.40				94 38 0 NI 19				
				98 98 28 8	8.00 (0.40) 4.60 8.40	Strong to very strong pink grey coarse banded GNEISS		
				03/08/2011 dry 8.40		Discontinuity 10-15 degrees rough planar, closely spaced, moderately open to moderately tight and clean		
						End of Borehole at 8.40 m		
Remarks: Borehole backfilled on completion.						Water Strikes: Struck rising to time (m) (m) (min) No Groundwater Encountered	Last Revised: 20/09/2011	
Core Barrel: T2 101 Flush type: Air/Water						Casing: to (m) dia. (mm) 4.10 150	 www.glover-si.com (c) Glover Site Investigation Ltd	

				Project No. 11-269	Project Name: Belderra Substation, Belmullet, Co. Mayo	Borehole No. BH02		
Method and Equipment: Rotary drilling 0.00-4.80m Symmetrix Drilling Rotary coring 4.80-10.12m Comacchio 450				Co-ords: 65750.3mE 330690.8mN	Client: ESBI Engineer: ESB	Sheet 1 of 2 Scale: 1:50 Driller: TA Logger: JR		
				Ground Level: 12.48mOD	Dates: 27/07/2011 - 02/08/2011			
Depth (m)	Sample / Test	Casing Depth (m)	Water Depth (m)	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill Installs
1.00	SPT		dry	N=50 N=50 (1,2,2,28,12,8)	(0.50) 11.98 0.50	Black silty PEAT (Driller's description)		
2.00	SPT		dry	N=29 N=29 (4,5,5,6,8,10)	(0.90) 11.08 1.40	Dense brown SAND (Driller's description)		
3.00	SPT		dry	N=28 N=28 (3,5,6,7,8,7)	(0.60) 10.48 2.00	Soft black SILT with cobbles (Driller's description)		
4.00	SPT		dry	N=50 N=50 (4,5,5,7,18,20)	(2.80)	Medium dense grey coarse SAND with cobbles (Driller's description)		
4.80				27/07/2011 1.40m 02/08/2011 dry	7.68 4.80	Dense below 4.00m		
5.76	98 96 47 10				5.76	Strong to very strong pink grey medium to coarse grained banded GNEISS Fresh, locally slightly weathered adjacent to discontinuity surfaces occasionally discoloured to grey black.		
6.80	88 84 42 9				6.80 6.85	Occasional xenoliths present within Gneiss of possible mudstone/limestone		
7.30	88 78 22				12	Discontinuities are generally 10-30 degrees, rough planar to undulating, close to medium spaced, moderately tight, occasionally moderately open and clean		
7.79	100 92 22				(5.32)			
7.79	95 84 74				7.79 7.84			
8.17	100 100 91				8.17			
8.40	100 100 92				11			
8.78	97 89 75				10 9.21 9.27			
9.65	91 85 36				8			
	TCR SCR RQD FI							
Remarks: Borehole backfilled on completion.						Water Strikes: Struck (m) rising to (m) time (min) 1.40 - -	Last Revised: 20/09/2011	
Core Barrel: T2 101 Flush type: Water						Casing: to (m) dia. (mm) 4.80 150	 www.glover-si.com (c) Glover Site Investigation Ltd.	

Continued next sheet

				Project No. 11-269	Project Name: Belderra Substation, Belmullet, Co. Mayo	Borehole No. BH02			
Method and Equipment: Rotary drilling 0.00-4.80m Symmetrix Drilling Rotary coring 4.80-10.12m Comacchio 450				Co-ords: 65750.3mE 330690.8mN	Client: ESBI Engineer: ESB	Sheet 2 of 2 Scale: 1:50			
				Ground Level: 12.48mOD	Dates: 27/07/2011 - 02/08/2011	Driller: TA Logger: JR			
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes	Backfill/ Installs
					02/08/2011 dry 10.12	2.36 10.12	Strong to very strong pink grey medium to coarse grained banded GNEISS Fresh, locally slightly weathered adjacent to discontinuity surfaces occasionally discoloured to grey black. Occasional xenoliths present within Gneiss of possible mudstone/limestone Discontinuities are generally 10-30 degrees, rough planar to undulating, close to medium spaced, moderately tight, occasionally moderately open and clean End of Borehole at 10.12 m		
	TCR	SCR	RQD	FI					
Remarks: Borehole backfilled on completion.							Water Strikes: Struck rising to time (m) (m) (min)	Last Revised: 20/09/2011	
							Core Barrel: T2 101 Flush type: Water	Casing: to (m) dia. (mm) 4.80 150	 www.glover-si.com <small>(c) Glover Site Investigation Ltd</small>

Appendix D

Rock core photographs



BH01: 4.10m – 7.00m



BH01: 7.00m – 8.40m



BH02: 4.80m – 7.79m



BH02: 7.79m – 10.12m

Appendix E

Trial pit logs

Method and Equipment:
Excavation 0.00- 2.00m 7 Tonne Tracked Excavator

Co-ords:
65734.7mE
330711.3mN

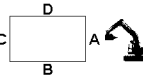
Client: ESBI

Sheet 1 of 1

Engineer: ESB

Scale: 1:25

Width: - Bearing: -
Length: - (deg. N)



Ground Level:
12.48mOD

Dates: 02/08/2011

Driver: RA

Logger: RN

Depth (m)	Sample / Tests	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes
			(0.60)	Soft black sandy peaty TOPSOIL. Sand is fine to medium	
			11.88 0.60 (0.60)	Spongy brown fibrous PEAT with many plant remains	
			11.28 1.20 (0.80)	Grey gravelly fine to coarse SAND with medium cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to subrounded	
		02/08/2011 1.80m	10.48 2.00	Running sand at 1.80m End of Trial Pit at 2.00 m	

Remarks:

Groundwater Entries:		
No.	Struck	Flow details
1	1.80m	Slight Seepage

Stability:					
Difficulty:					
Photos:					
Side A	Side B	Side C	Side D	Spoil	Reinstated
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Last Revised: 20/09/2011

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Project No.
11-269

Project Name: Belderra Substation, Belmullet, Co. Mayo

Trial Pit No.
TP01

Method and Equipment:
Excavation 0.00- 1.30m 7 Tonne Tracked Excavator

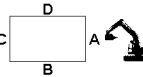
Co-ords:
65623.5mE
330645.4mN

Client: ESBI

Sheet 1 of 1

Engineer: ESB



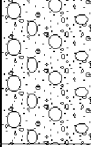
Scale: 1:25

Width: - **Bearing:** -
Length: - (deg. N)

Ground Level:
8.24mOD

Dates: 02/08/2011

Driver: RA

Logger: RN

Depth (m)	Sample / Tests	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes
0.50	B		8.04 0.20	Brown very sandy TOPSOIL	
0.50	D		(0.60)	Brown slightly gravelly fine to medium SAND. Gravel is subangular to angular fine to coarse	
		02/08/2011 dry	7.44 0.80	Brown gravelly fine to coarse SAND with high cobble content and high boulder content. Gravel is subangular to angular fine to coarse. Cobbles and boulders are subangular to angular of granite/orthogneiss (Possible weathered rock)	
			6.94 1.30	End of Trial Pit at 1.30 m	

Remarks:
Infiltration test carried out in trial pit

Groundwater Entries:
No. Struck Flow details
No Groundwater Encountered

Stability: Pit walls slightly unstable.

Difficulty:
Last Revised:
20/09/2011

Photos: Side A Side B Side C Side D Spoil Reinstated


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Project No.
11-269

Project Name: Belderra Substation, Belmullet, Co. Mayo

Trial Pit No.
TP02

Method and Equipment:
Excavation 0.00- 3.00m 7 Tonne Tracked Excavator

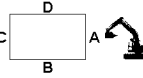
Co-ords:
65732.6mE
330709.4mN

Client: ESBi

Sheet 1 of 1

Engineer: ESB





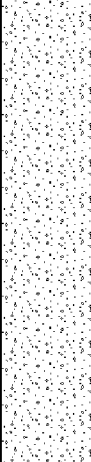
Scale: 1:25

Width: - **Bearing:** -
Length: - (deg. N)

Ground Level:
12.47mOD

Dates: 02/08/2011

Driver: RA

Logger: RN

Depth (m)	Sample / Tests	Field Records	Level	Depth (Thickness)	Stratum Description	Legend & Water Strikes
			12.27	0.20	Brown very sandy peaty TOPSOIL	
0.50	B					
0.50	ES			(0.40)	Spongy black very sandy fibrous PEAT. Sand is fine to medium	
			11.87	0.60	Spongy brown fibrous PEAT with many plant remains	
0.80	B					
0.80	ES			(0.80)		
			11.07	1.40	Brown slightly gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse	
				(1.60)		
		02/08/2011 3.00m	9.47	3.00	End of Trial Pit at 3.00 m	

Remarks:
Groundwater Entries:
 No. Struck Flow details
 1 3.00m Moderate Seepage

Stability:
Difficulty:
Photos: Side A Side B Side C Side D Spoil Reinstated

Last Revised:
20/09/2011


Project No.
11-269

Project Name: Belderra Substation, Belmullet, Co. Mayo

Trial Pit No.
TP03

Method and Equipment:
Excavation 0.00- 1.40m 7 Tonne Tracked Excavator

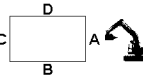
Co-ords:
65680.3mE
330661.4mN

Client: ESBi

Sheet 1 of 1

Engineer: ESB


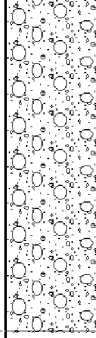
Scale: 1:25

Width: - **Bearing:** -
Length: - (deg. N)

Ground Level:
14.12mOD

Dates: 02/08/2011

Driver: RA

Logger: RN

Depth (m)	Sample / Tests	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes
0.50	B		13.82 0.30	Brown very sandy TOPSOIL	
0.50	ES		(1.10)	Brown gravelly fine to coarse SAND with high cobble content and high boulder content. Gravel is angular to subangular fine to coarse. Cobbles and boulders are angular to subangular of granite/orthogneiss (Possible weathered rock)	
		02/08/2011 dry	12.72 1.40	End of Trial Pit at 1.40 m	
				1.40m: Refusal met on large boulders	

Remarks:
Groundwater Entries:
No. Struck Flow details
No Groundwater Encountered

Stability:
Difficulty:
Last Revised:
20/09/2011

Photos: Side A Side B Side C Side D Spoil Reinstated


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Project No.
11-269

Project Name: Belderra Substation, Belmullet, Co. Mayo

Trial Pit No.
TP04

Method and Equipment:
Excavation 0.00- 1.60m 7 Tonne Tracked Excavator

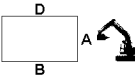
Co-ords:
65663.2mE
330657.4mN

Client: ESBi

Sheet 1 of 1

Engineer: ESB

Scale: 1:25

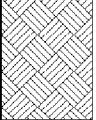
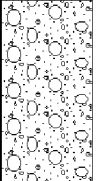
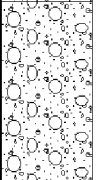
Width: - Bearing: 
Length: - (deg. N)

Ground Level:
12.64mOD

Dates: 02/08/2011

Driver: RA

Logger: RN

Depth (m)	Sample / Tests	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes
0.50	B ES	02/08/2011 dry	(0.40)	Brown very sandy TOPSOIL. Sand is fine to medium	
0.50			12.24 0.40	Orange very gravelly fine to coarse SAND with high cobble content and high boulder content. Gravel is subangular to angular fine to coarse. Cobbles and boulders are angular to subangular of granite/orthogneiss (Possible weathered rock)	
			11.64 1.00	Brown gravelly fine to coarse SAND with high cobble content and high boulder content. Gravel is angular to subangular fine to coarse. Cobbles and boulders are angular to subangular of granite/orthogneiss (Possible weathered rock)	
			11.04 1.60	End of Trial Pit at 1.60 m	1.60m: Refusal met on large boulders

Remarks:

Groundwater Entries:
No. Struck Flow details
No Groundwater Encountered

Stability:

Difficulty:

Photos: Side A Side B Side C Side D Spoil Reinstated

Last Revised:
20/09/2011



Project No.
11-269

Project Name: Belderra Substation, Belmullet, Co. Mayo

Trial Pit No.
TP05

Method and Equipment:
Excavation 0.00- 2.40m 7 Tonne Tracked Excavator

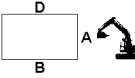
Co-ords:
65700.5mE
330706.3mN

Client: ESBi

Sheet 1 of 1

Engineer: ESB

Scale: 1:25

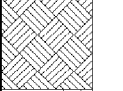

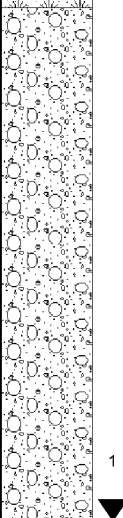
Width: - **Bearing:** 
Length: - (deg. N)

Ground Level:
12.61mOD

Dates: 02/08/2011

Driver: RA

Logger: RN

Depth (m)	Sample / Tests	Field Records	Level Depth (Thickness)	Stratum Description	Legend & Water Strikes
0.50	B		12.31 0.30	Soft brown very sandy peaty TOPSOIL	
0.50	ES		(0.40)	Spongy black sandy fibrous PEAT. Sand is fine to medium	
0.90	B		11.91 0.70	Brown gravelly fine to medium SAND with high cobble content and high boulder content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular to angular of granite/orthogneiss (Possible weathered rock)	
0.90	ES		(1.70)		
		02/08/2011 2.40m	10.21 2.40	End of Trial Pit at 2.40 m	2.40m: Refusal met on large boulders

Remarks:
Groundwater Entries:
 No. Struck Flow details
 1 2.40m Slight Seepage

Stability:
Last Revised:
20/09/2011

Difficulty:
Photos:

Side A	Side B	Side C	Side D	Spoil	Reinstated
-	-	-	-	-	-



Appendix F

Trial pit photographs



TP01





TP02





TP03





TP04





TP05



Appendix G

Infiltration test results

Project No.: 11-269
 Site: Belderra Substation Belmullet Co. Mayo
 Test Location: SA01
 Date: 02-Aug-11

Glover Site Investigations Ltd
Infiltration Test

Analysis using method as described in
 BRE Digest 365 and
 CIRIA Report C697-The SUDS Manual

test pit top dimensions width (m) length (m)
 test pit top dimensions 0.64 1.5
 test pit base dimensions 0.6 1
 test pit depth 2 m

infiltration rate (q) is very low
 depth to groundwater before adding water (m) = 1.96

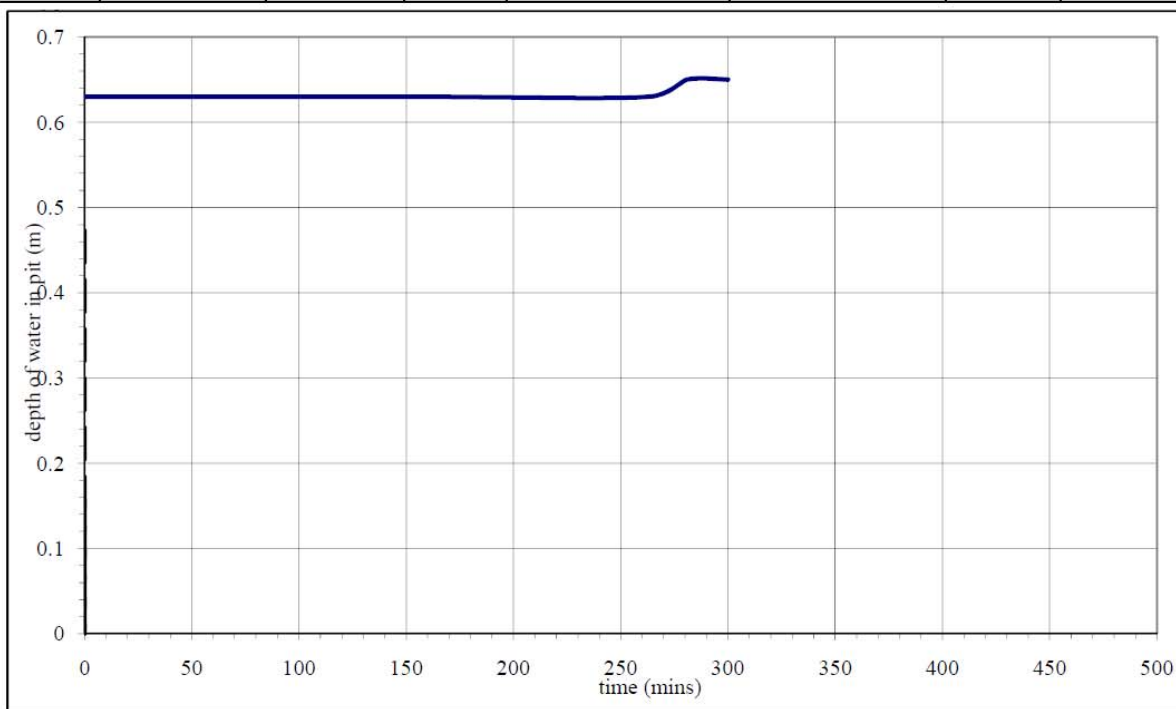
time (mins)	depth to water surface (m)	depth of water in pit (m)
0	1.37	0.63
1	1.37	0.63
2	1.37	0.63
4	1.37	0.63
6	1.37	0.63
8	1.37	0.63
10	1.37	0.63
15	1.37	0.63
20	1.37	0.63
25	1.37	0.63
30	1.37	0.63
45	1.37	0.63
159	1.37	0.63
263	1.37	0.63
281	1.35	0.65
300	1.35	0.65

From graph below:

test start - 75% depth at
 0.4725 m water depth
 is not reached during the test

test end - 25% depth at
 0.1575 m water depth
 is not reached during the test

time (mins)	depth to water surface (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m ³)	Area of walls and base at 50% drop (m ²)	q (m/min)	q (m/h)
	1.5275	0.4725					
	1.8425	0.1575		0.21	1.64		



Project No.: 11-269
 Site: Belderra Substation Belmullet Co. Mayo
 Test Location: TP01
 Date: 02-Aug-11

Glover Site Investigations Ltd
Infiltration Test

Analysis using method as described in
 BRE Digest 365 and
 CIRIA Report C697-The SUDS Manual

test pit top dimensions width (m) length (m)
 test pit top dimensions 0.76 3
 test pit base dimensions 0.63 2.7
 test pit depth 1.3 m

infiltration rate (q) is very low
 depth to groundwater before adding water (m) = DRY

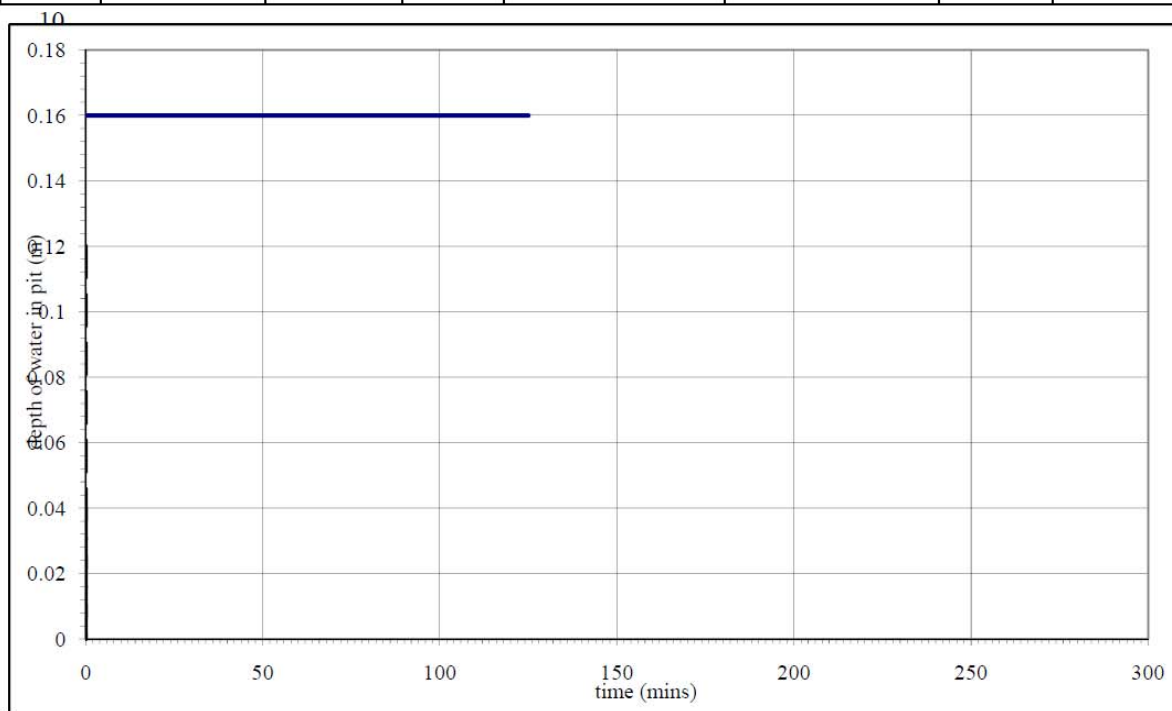
time (mins)	depth to water surface (m)	depth of water in pit (m)
0	1.14	0.16
1	1.14	0.16
2	1.14	0.16
4	1.14	0.16
6	1.14	0.16
8	1.14	0.16
10	1.14	0.16
15	1.14	0.16
20	1.14	0.16
25	1.14	0.16
30	1.14	0.16
45	1.14	0.16
60	1.14	0.16
80	1.14	0.16
100	1.14	0.16
125	1.14	0.16

From graph below:

test start - 75% depth at
 0.12 m water depth
 time is 1200mins by extrapolation

test end - 25% depth at
 0.04 m water depth
 time is 3800 mins by extrapolation

time (mins)	depth to water surface (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m ³)	Area of walls and base at 50% drop (m ²)	q (m/min)	q (m/h)
	1.18	0.12					
	1.26	0.04		0.14	2.24		



Appendix H

EPA Site Suitability Assessment

EPA SITE SUITABILITY ASSESSMENT

CLIENT:
Belderra
Binghamstown
Belmullet
Co. Mayo

ALL SITE SUITABILITY ASSESSMENTS ARE CARRIED OUT IN STRICT ACCORDANCE WITH EPA REQUIREMENTS.

HMN CONSULTANTS ARE NOT ENGAGED IN THE SALE OR RECOMMENDATION OF PARTICULAR PROPRIETARY TREATMENT UNITS AND AS SUCH ARE NOT SUBJECT TO THE CONFLICT OF INTEREST THERE IN.

HMN CONSULTANTS ARE NOT ENGAGED IN THE SALE OR DEVELOPMENT OF LANDS.

ALTHOUGH CONTRACTED BY THE CLIENT HMN CONSULTANTS REPORTS ARE PREPARED INDEPENDANTLY AND ARE NOT SUBJECT TO EXTERNAL INFLUENCES.

THE REPORTS MAY NOT BE REPRODUCED IN PART OR IN FULL BUT WITH THE EXPRESS PERMISSION OF HMN ENVIRONMENTAL CONSULTANTS.

ONLY ORIGIONAL SIGNED AND/OR INITALED SHEETS MAY BE CONSIDERED AUTHENTIC.

ALL SITE SUITABILITY ASSESSMENTS ARE PERFORMED IN ACCORDANCE WITH THE PRECAUTIONARY PRINCIPLE. THEREFORE WHERE FEASIBLE GREATER UNSATURATED DEPTHS BETWEEN THE BASE OF THE PERCOLATION TRENCH AND GROUNDWATER / BEDROCK ARE RECOMMENDED THAN ARE REQUIRED IN THE EPA MANUAL.

Paul Neary

Paul Neary B.Sc. M.Sc.

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SITE CHARACTERISATION FORM

File Reference:

1.0 GENERAL DETAILS (FROM PLANNING APPLICATION)

Prefix:

First Name:

Surname:

Address:

Belderra
Binghamstown
Belmullet
Co. Mayo

Site Location and Townland:

Belderra
Binghamstown
Belmullet
Co. Mayo

TELEPHONE NO:

FAX NO:

E-MAIL.:

Maximum no. of Residents

**p.e. 0.3
(BOD)**

No. of Double Bedrooms

No. of Single Bedrooms

PROPOSED WATER SUPPLY:

Mains

Private well/borehole

Group well/borehole

2.0 DESK STUDY

Soil type: (Specify Type):

**Soil Association Number: 16, Principal Soil Group: Acid Brown Earth 90%: Parent Material :
Moranic sands and gravels and blown sands. Associated Soil: Gley (5%) Regosol (3%) Podzol**

Aquifer Category:

Regionally Important

Locally Important

Poor

Vulnerability:

Extreme

High

Moderate

Low

High to Low

Unknown

Bedrock type:

POGS (Precambrian gneiss quartzites and schist)

Name of Public/Group Water Supply within 1 km:

Groundwater Protection Scheme (Y/N):

Source Protection Area

SI

SO

Groundwater Protection Response:

R1

Presence of Significant Sites

(Archaeological, Natural & Historical):

Past experience in the area:

No dwellings contiguous for comparison, each report is site specific.

Comments:

(integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions)

The site appears suitable for on site waste water treatment however this is subject to on site investigations and relevant percolation testing.

NOTE: Only the information available at the desk study stage should be used in this section.

3.0 ON SITE ASSSSMENT

3.1 Visual Assessment

Landscape Position: North facing site on agricultural atlantic rolling low land:

Slope: Steep (>1:5) Shallow (1:5-1:20) Relatively Flat

Surface Features Within a minimum of 250m (Distance To Features Should Be Noted in Meters)

Houses: Dwellings to the West and South of site

Existing Land Use: Fodder production and ovine after grazing

Vegetation Indicators: See appendix

Groundwater Flow Direction: GWF in a Northerly direction

Ground Conditions: Firm

Site Boundaries: Banks, wire fencing and ditches **Roads:** Road to North and West of site

Outcrops (Bedrock And/Or Subsoil) Out crop to West of site

Surface Water Ponding: N/A **Lakes:** N/A

Beaches/Shellfish: Belderra strand 343M to North **Areas/Wetlands** N/A

Karst N/A **Watercourse/Stream*:** None

Drainage Ditches*: Ditch along Southern and Eastern Boundary (dry to 1.3M on day of test) **Springs/Wells*:** N/A

Comments:

(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site).

Subject to the results of the P/T test the site appears suitable for on site waste water treatment. The minimum mandatory separation distance required from the identified receptors can be achieved on site.

* Note and record Water level

3.2 Trial Hole (Should be a minimum of 2.1m deep (3m for regionally important aquifers))

To avoid accidental damage, a trial hole assessment or percolation tests should not be undertaken in areas, which are at or adjacent to significant sites (e.g. NHAs, SACs, SPAs, and /or Archaeological etc.), without prior advice from National Parks and Wildlife Services or the Heritage Service.

Depth of Trial Hole (m):

1.4M

Depth from ground surface to water table (m): (if present)

1.4M

Depth from ground surface to bedrock (m): (if present)

N/A

Depth of water ingress:

N/A

Rock type (if present):

N/A

Date and Time of excavation:

01/08/11

10:20

Date and Time of examination:

02/08/11

10:09

Depth of P/T Test	Soil/Subsoil Texture & Classification	Plasticity and dilatancy***	Soil Structure	Density / Compactness	Colour****	Preferential flowpaths	
0.1m	Sandy ORGANIC	Dilutant Cohesive Threads 11 Ribbon 71	Granular	Soft	Dark Brown / White due to snad)	No	
0.2m							
0.3m							
0.4m							PPP
0.5m							
0.6m	ORGANIC	Cohesive Threads 16 Ribbon 82	Bulk massive	Soft	Dark Brown	No	
0.6m							TT
.07m							T
0.8m							
0.9m							
1.0m							
1.1m							
1.2m							
1.3m							
1.4m							
1.5m							
1.6m							
1.7m							
1.8m							
1.9m							
2.0m							
2.1m							
2.2m							
2.3m							
2.4m							
2.5m							
2.6m							
2.7m							
2.8m							
2.9m							
3.0m							

Evaluation:

No mottling, seeps or bedrock noted. Water table at 1.4M on day of test, Subject to the results of P/T test the site appears suitable for wastewater treatment. Anticipated winter water table at 0.5M BGL.

Projected T Value

<75

Note: * Depth of percolation test holes should be indicated on log above. (Enter P or T at depths as appropriate).
 **See Appendix E for BS5930 classification
 ***3 samples to be tested for each horizon and results should be entered above for each horizon.
 ****All signs of mottling should be recorded.

3.3(a) Percolation (“T”) Test for Deep Subsoils and /or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole

	1	2	3
Depth from ground surface to top of hole (mm) (A)	200	300	200
Depth from ground surface To base of hole (mm) (A)	600	600	600
Depth of hole (mm) [B-A]	400	300	400
Dimensions of hole [length x breadth (mm)]	300 X 300	300 X 300	300 X 300

Step 2: Pre-Soaking Test Holes

Date and Time Pre-soaking started	02/08/2011	10:45	02/08/2011	10:48	02/08/2011	10:50
-----------------------------------	------------	-------	------------	-------	------------	-------

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring T_{100}

Percolation Test Hole No.

	1	2	3
Date of test	03/08/2011	03/08/2011	03/08/2011
Time filled to 400mm	12:15	12:19	12:25
Time water level at 300mm	12:42	12:47	12:58
Time to drop 100mm (T_{100})	27	28	33
Average T_{100}			29.33

If $T_{100} > 300$ minutes then T-value > 90 - site unsuitable for discharge to ground

If $T_{100} < 210$ minutes then go to step 4;

If $T_{100} > 210$ then go to step 5;

3.4(b) Percolation (“P”) Test for Shallow Soil / Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm) (A)	0	0	0
Depth from ground surface To base of hole (mm) (A)	400	400	400
Depth of hole (mm) [B-A]	400	400	400
Dimensions of hole [length x breadth (mm)]	300 X 300	300 X 300	300 X 300

Step 2: Pre-Soaking Test Holes

Date and Time	02/08/2011	10:53	02/08/2011	10:55	02/08/2011	11:01
---------------	------------	-------	------------	-------	------------	-------

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring P_{100}

Percolation Test Hole No.	1	2	3
Date of test	03/08/2011	03/08/2011	03/08/2011
Time filled to 400mm	12:02	12:07	12:11
Time water level at 300mm	13:01	13:05	13:06
Time to drop 100mm (P_{100})	59	58	55
Average P_{100}			57.33

If $P_{100} > 300$ minutes then T-value > 90 - site unsuitable for discharge to ground

If $P_{100} < 210$ minutes then go to step 4;

If $P_{100} > 210$ then go to step 5;

Step 4: Standard Method (Where $T_{100} < 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200mm)	Δt (min)
1	12:42	13:39	57	12:47	13:48	61	12:58	14:01	63
2	13:39	14:42	63	13:48	15:36	108	14:01	15:26	85
3	14:42	15:50	68	15:36	17:22	106	15:26	17:24	118
Average Δt Value			62.67			91.67			88.667
Average $\Delta t/4 =$ [Hole No. 1]			15.67	Average $\Delta t/4 =$ [Hole No. 2]		22.92	Average $\Delta t/4 =$ [Hole No. 3]		22.17
Result of Test: T =	20.25			(min/25mm)					

Comments:

T test results indicate a value of 20.25min therefore site suitable for onsite wastewater treatment system subject to the conditions of the groundwater protection scheme.

Step 5: Modified Method (Where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of Water in hole (mm)	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T - Value = $4.45 / K_{fs}$	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T - Value = $4.45 / K_{fs}$	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T - Value = $4.45 / K_{fs}$
300-250	8.1		#DIV/0!	#DIV/0!	8.1		#DIV/0!	#DIV/0!	8.1		#DIV/0!	#DIV/0!
250-200	9.7		#DIV/0!	#DIV/0!	9.7		#DIV/0!	#DIV/0!	9.7		#DIV/0!	#DIV/0!
200-150	11.9		#DIV/0!	#DIV/0!	11.9		#DIV/0!	#DIV/0!	11.9		#DIV/0!	#DIV/0!
150-100	14.1		#DIV/0!	#DIV/0!	14.1		#DIV/0!	#DIV/0!	14.1		#DIV/0!	#DIV/0!
Average T-Value	T-Value Hole 1=(t_1)			#DIV/0!	T-Value Hole 2=(t_2)			#DIV/0!	T-Value Hole 3=(t_3)			#DIV/0!
Result of T =	#DIV/0!				(min/25mm)							

Comments:

Step 4: Standard Method (Where $P_{100} < 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200mm)	Δp (min)	Start Time (at 300 mm)	Finish Time (at 200mm)	Δp (min)	Start Time (at 300 mm)	Finish Time (at 200mm)	Δp (min)
1	13:01	14:41	100	13:05	14:29	84	13:06	14:39	93
2	14:41	16:30	109	14:29	15:58	89	14:39	16:15	96
3	16:30	18:24	114	15:58	17:45	107	16:15	17:54	99
Average Δp Value			107.67			93.33			96.00
Average $\Delta p/4 =$ [Hole No. 1]			26.92	Average $\Delta p/4 =$ [Hole No. 2]		23.33	Average $\Delta p/4 =$ [Hole No. 3]		24.00
Result of Test: P =	24.75			(min/25mm)					

Comments:

P test results indicate a value of 24.75min therefore site suitable for onsite wastewater treatment system subject to the conditions of the groundwater protection scheme.

Step 5: Modified Method (Where $P_{100} > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of Water in hole (mm)	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P-Value = $4.45 / K_{fs}$	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P-Value = $4.45 / K_{fs}$	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P-Value = $4.45 / K_{fs}$
300-250	8.1		#DIV/0!	#DIV/0!	8.1		#DIV/0!	#DIV/0!	8.1		#DIV/0!	#DIV/0!
250-200	9.7		#DIV/0!	#DIV/0!	9.7		#DIV/0!	#DIV/0!	9.7		#DIV/0!	#DIV/0!
200-150	11.9		#DIV/0!	#DIV/0!	11.9		#DIV/0!	#DIV/0!	11.9		#DIV/0!	#DIV/0!
150-100	14.1		#DIV/0!	#DIV/0!	14.1		#DIV/0!	#DIV/0!	14.1		#DIV/0!	#DIV/0!
Average P-Value	P-Value Hole 1=(P_1)			#DIV/0!	P-Value Hole 2=(P_2)			#DIV/0!	P-Value Hole 3=(P_3)			#DIV/0!
Result of P =	#DIV/0!				(min/25mm)							

Comments:

4.0 CONCLUSION of SITE CHARACTERISATION

Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system (s) that is (are) appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater.

Not Suitable for Development

N/A

Suitable for ¹

- | | |
|--|------------------------------------|
| 1. Septic tank system (septic tank and percolation area) | <input type="checkbox" value="√"/> |
| 2. Secondary Treatment System | |
| (a) septic tank and filter system constructed on-site and polishing filter; or | <input type="checkbox" value="√"/> |
| (b) packaged wastewater treatment system and polishing filter | <input type="checkbox" value="√"/> |

Discharge Route

Groundwater

5.0 RECOMMENDATION

Propose to install:

SEPTIC TANK, SUMP /PUMP AND SOIL INJECT SYSTEM

And discharge to:

GROUNDWATER

Invert Level (m):

0.7m AGL

Site Specific Conditions (e.g. special works, site improvement works testing etc.)

Sizing of soil injection system is based on hydraulic loading of p.e. 0.2

Measures must be employed on site to prevent the compaction of the area designated for the percolation area during construction.

Construction of the percolation area must only occur during dry weather to avoid smearing of soils.

Area designated for soil polishing filter to be deep ploughed prior to rising with 700mm (soil / subsoil P/T<30) with the distribution system placed on top of this area.

An apron 4M wide shall surround the entire polishing filter and be raised to the final height of the polishing filter.

Where imported soil is utilised on site the methodology as prescribed by the EPA for such activity shall be adhered to at all times.

Given the percolation rate and slope on site it is recommended that surface water interceptor drains be constructed at a distance of 2M from the polishing filter (under apron). These shall be 500mm wide and 500mm deep, and shall be piped (land drainage) and refilled back to existing ground level with drainage chips and outfall to drain along the South boundary

¹ note: more than one option may be suitable for a site and this should be recorded

² A discharge of sewage effluent to "waters" (definition includes any or any part of any river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial) will require a licence under the Water Pollution Acts 1977-90. Refer to section 2.6.2

Site Specific Conditions (e.g. special works, site improvement works testing etc.) continued.

Minimum soil thickness beneath invert of distribution system	1.2 m ¹
Imported Soil percolation value²	In situ material should have a P/T-value between 3 and 30
Hydraulic loading	<10 l/m ² /day on plan area of filter
Design criteria³	
Soil layers	Lifts of 300 mm of soil (lightly compacted) when imported
Gravel protection layer	150 mm of 8- to 32-mm washed gravel
Infiltration laterals	32 mm □ PVC with 4- to 6-mm orifices ⁴ at 0.3-m spacings
Gravel distribution layer	250 mm of 8- to 32-mm washed gravel
Lateral centres separation	0.6 m
Geotextile	In accordance with EN ISO 10319
Dosing frequency	Minimum of four times per day (at equal time intervals for optimum treatment efficiency)
Pumping system	Pumps should be installed in a separate pumping chamber and only suitable wastewater treatment pumps with a minimum free passage of 10 mm should be used
Zoned regions	It is recommended that the manifold is designed to operate in at least two separate zones within any one polishing filter. This design facilitates maintenance should any problem occur and also allows sequential loading to different zones
Access/Inspection points Backpressure gauges	Recommended to be installed in the distribution system for rodding/scouring purposes. These vertically attached pipes to the manifold should extend to an inspection chamber and can also be used as a point to measure the backpressure of the system
In-line filter	An in-line filter between the pump chamber and the infiltration pipe is recommended to prevent blockages in the orifices. It should be designed to have a mesh size of 10 mm
Side sealing	
Mound system	Topsoil on the top and the vertical sides should be protected by a geotextile
Base sealing	No sealer required. Ground base layer in mound systems to be ploughed/tilled ⁵
Covering	Geotextile over the gravel distribution layer 300 mm topsoil over geotextile

6.0 TREATMENT SYSTEM DETAILS

SYSTEM TYPE: Septic Tank System

Tank Capacity (m ³)	2.4 m³	Percolation Area	Mounded Percolation Area
No. of Trenches		No. of Trenches	N/A
Length of Trenches (m)		Length of Trenches (m)	
Invert Level (m)		Invert Level (m)	

SYSTEM TYPE: Secondary Treatment System

Filter Systems

Media Type	Area (m ²)	Depth of filter	Invert Level
Sand/Soil	4 m²	1200mm	0.7M AGL
Soil			
Constructed Wetland			
Other			

Package Treatment Systems

Type	N/A
Capacity PE	
Sizing of primary Compartment	
	m ³

SYSTEM TYPE: Tertiary Treatment System

Polishing Filter: Surface Area (m ²)*	N/A	Package Treatment System : Capacity (pe)	N/A
Or Gravity Fed:		Constructed Wetland: Surface Area (m ²)*	
No. of Trenches			
Length of Trenches (m)			
Invert Level (m)			

DISCHARGE ROUTE:

Groundwater	X	Hydraulic Loading Rate* (l/m ² .d)	<10l/m².d
Surface Water**		Discharge Rate (m ³ /hr)	

TREATMENT STANDARDS:

Treatment System Performance Standard (mg/l)	BOD	SS	NH ₃	Total N	Total P
	N/A				

QUALITY ASSURANCE:

Installation & Commissioning

Installation and commissioning by competent person

On-going Maintenance

**Annual desludging
Inspection of percolation Area on a monthly basis**

*Hydraulic loading rate is determined by the percolation rate of subsoil
**Water Pollution Act discharge licence required

7.0 SITE ASSESSORS DETAILS

Company: HMN Environmental Consultants Ltd.

Prefix: Mr. First Name: Paul Surname: Neary

Address: Stonehall
Foxford
Co. Mayo

Qualifications / Experience: B.Sc. Environmental Science & Technology (hns)
M.Sc. EcoTox
Lecturer / Practical demonstrator: Land Impact, Ecology, Microbiology, Soil Science.
FETAC Cert: Site Suitability Assessor for on site waste water treatment systems.
FETAC Cert: Site suitability assessor for ELSS
FETAC Cert: Hazard analysis and critical control points.

Date of Report:

Phone: 087 2352811

e-mail: pnearyfoxford@gmail.com

Indemnity Insurance Number: GEI/COM/001501859

Signature: Paul Neary

APPENDIX

SITE BOTANY

Assessor:

Townland:

County:

Date:

Transect:

Habitat :

Species Identified

Non Specific species	% Cover*	Wet Indicators	% Cover*	Dry Indicators	% Cover*
<i>Bellis perennis</i>	O	<i>Juncus effusus</i>	O	<i>Senecio Jacobaea</i>	
<i>Rumex obtusifolia</i>	O	<i>Filipendula ulmaria</i>		<i>Cirsium arvense</i>	O
<i>Trifolium pratense</i>		<i>Potentilla anserine</i>		<i>Leucanthemum vulgare</i>	
<i>Trifolium repense</i>	O	<i>Salix spp.</i>		<i>Ulex europaeus</i>	
<i>Polygonum persicaria</i>		<i>Iris pseudacorus</i>	O	<i>Pteridium aquilinum</i>	
<i>Plantago Major</i>					
<i>Plantago lanceolata</i>					
<i>Leontodon autumnalis</i>					
<i>Potentilla erecta</i>					
<i>Rubus fruticosus</i>					
<i>Urtica dioica</i>					
<i>Ranunculus acris</i>	O				

* Species presence is confirmed by % cover code, where the code is absent the species was not present.

% Cover Codes: D = Dominant >50%, A = Abundant 25-50%, F = Frequent 5-25%, O= Occasional <5%


Total % Cover of Vegetation. % Bare Soil % Rock

**Comment:

N/A

**Where the species identified conflict with observations on mottling / groundwater then a comprehensive explanation must be given.

1:50,000 Discovery Map

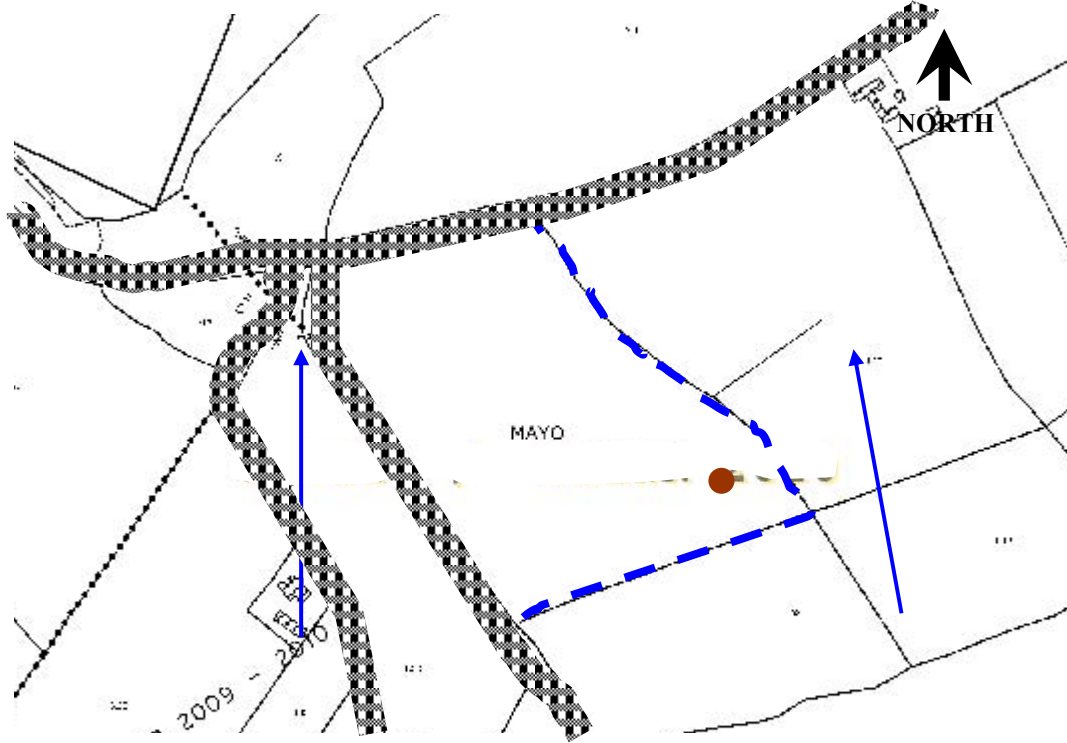
Groundwater Flow Direction indicated by 



Scale may be altered due to electronic configuration.

Site Sketch

Sketch of site showing measurement to Trial Hole location and percolation Test Hole locations, wells and direction of groundwater flow, proposed house (incl. Distances from boundaries) adjacent houses, watercourses, significant sites and other features. North point should always be included.



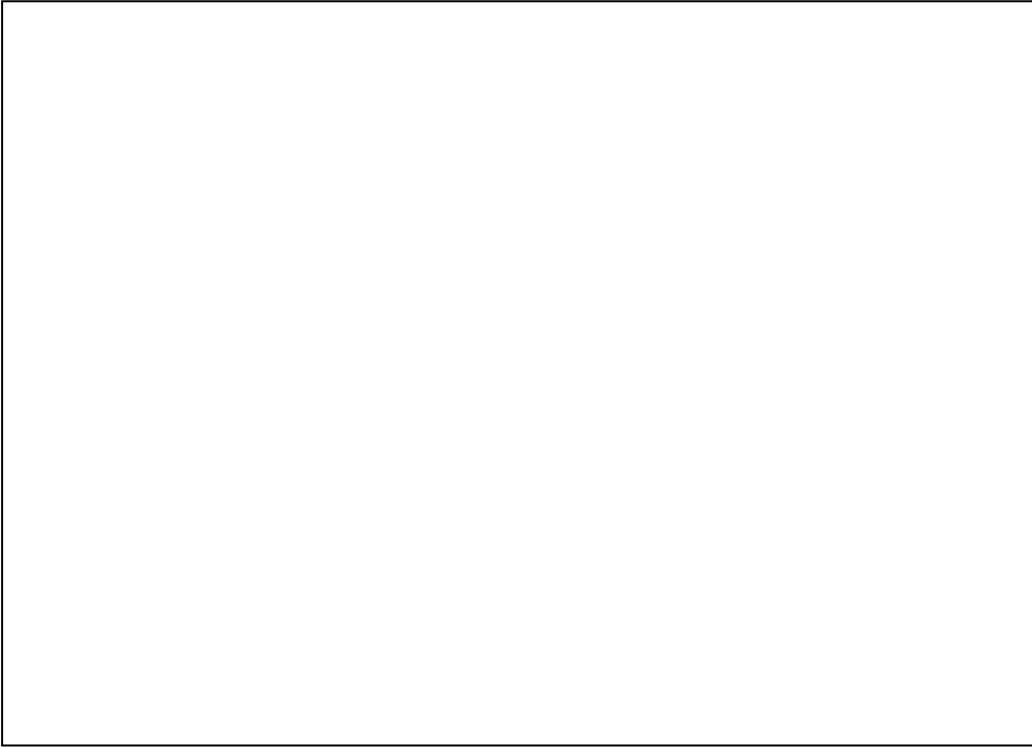
- Well
●
- Drain
- - -
- Watercourse
~ ~ ~
- GW Direction
→
- Site Boundary
□
- Trial Hole Location
●
- Road
▤

**Site Overview
Photograph**

N/A

**Soil Profile Photographs
From Ground Level to Base of Trial Hole**





T Test Hole Photographs

Test Hole 1 (Start)



Test Hole 1 (Finish)



Test Hole 2 (Start)



Test Hole 2 (Finish)



Test Hole 3 (Start)



Test Hole 3 (Finish)



P Test Hole Photographs

Test Hole 1 (Start)



Test Hole 3 (Finish)



Test Hole 2 (Start)



Test Hole 2 (Finish)



Test Hole 3 (Start)

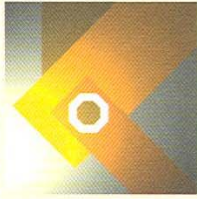


Test Hole 3 (Finish)



Photographs illustrating sandy nature of sub soil and post pre-soak silting





National Skills Certificate (FÁS)

Awarded to
Bronnta ar

Paul Neary

who has achieved the National Standards for
a bhain Caighdeáin Náisiúnta amach maidir le

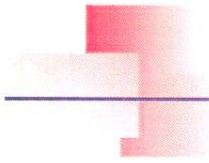
Site Suitability Assessments for On-Site

Wastewater Treatment Systems

Chair, FETAC

Chief Executive, FETAC





BURKE

Insurance Brokers

The following pages are a summary of insurances held through our offices
These are summary schedules only and for full policy terms limits and conditions exclusions you need refer to the policy document .
If you see a figure or item that requires amendment on the schedules you should immediately bring to our attention.

Professional Indemnity Risk Schedule of Insurances

Inception Date:	03 MAY 11
Renewal Date:	3rd May, 2012.
Underwriter:	W.R. Berkley
Policy Number:	NEW ORDER
Client Reference:	HMN001001

A Client Details

Full Name: Hmn Environmental Consultants Ltd
Address: Stonehall
Foxford
Co Mayo

Work Telephone: 087 2352811
Email Address: pnearyfoxford@gmail.com

B Risk Details

Business Description: Ecological Surveys, Natura Impact Statements, Site Suitability Assesments, REPS
Indemnity Limit: €1,000,000 Any one claim plus costs and expenses
Excess: €1,500 each and every claim

C Additional Benefits and Conditions

Retroactive Date: Inception

This Schedule of Insurances is designed to give you a concise working record for each of your general insurances. The main essentials of cover given to us during your application have been summarised below for your ease of reference.

It will be appreciated that details of the protection provided remain subject to the terms of your insurance contracts, as more fully described in your policy documents.

If there is any point concerning a policy which is not clear, please let us know as soon as possible, and we will give the matter our immediate attention.

Duty of Disclosure

Any facts known to you and any changes affecting the risk since inception of the policy or last renewal date (whichever is the later) must be disclosed to us. Failure to disclose may mean that your policy may not provide you with the cover you require, or may invalidate the policy altogether. Subject otherwise to the terms and conditions of the policy document.

Appendix I

Laboratory test results

Glover Site Investigations Ltd
8 Drumahiskey Road
Balnamore, Ballymoney
Co. Antrim
BT53 7QL

FAO John Cameron
22 August 2011

Dear John Cameron


Test Report Number 138617
Your Project Reference 11-269 - AMETS Belderra, Co.Mayo

Please find enclosed the results of analysis for the samples received 11 August 2011.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely


Authorised Signatory

Darrell Hall Director
 Phil Hellier Director
 Keith Jones Technical Manager
 John Crawford Quality Manager
 Malcolm Avis Director



Notes to accompany report:

- The sign < means 'less than'
- Tests marked 'U' hold UKAS accreditation
- Tests marked 'M' hold MCertS (and UKAS) accreditation
- Tests marked 'N' do not currently hold UKAS accreditation
- Tests marked 'S' were subcontracted to an approved laboratory
- n/e means 'not evaluated'
- i/s means 'insufficient sample'
- u/s means 'unsuitable sample'
- Comments or interpretations are beyond the scope of UKAS accreditation
- The results relate only to the items tested



The right chemistry to deliver results

LABORATORY TEST REPORT

Waste Acceptance Criteria BS EN 12457 Part 2 Single Stage

Glover Site Investigations Ltd
8 Drumahiskey Road
Balnamore, Ballymoney
Co. Antrim
BT53 7QL
FAO John Cameron

Results of analysis of 1 sample
received 11 August 2011
11-269 - AMETS Belderra, Co.Mayo

Report Date
22 August 2011

Login Batch No

Chemtest LIMS ID

Sample ID

Sample No

Depth

Matrix

Determinand↓

SOP↓

*

CAS No↓

Units↓

Inert waste
landfill

Limit values
Stable
non-reactive
hazardous
waste in
non-hazardous
landfill

Hazardous
waste landfill

138617

AG34689

TP05

0.9m

LEACHATE

Arsenic	1450	U	7440382	µg l ⁻¹		6.9
Barium	1450	U	7440393	µg l ⁻¹		120
Cadmium	1450	U	7440439	µg l ⁻¹		0.37
Chromium (total)	1450	U	7440473	µg l ⁻¹		2.7
Copper	1450	U	7440508	µg l ⁻¹		4.6
Mercury	1450	U	7439976	µg l ⁻¹		<0.50
Molybdenum	1450	U	7439987	µg l ⁻¹		1.9
Nickel	1450	U	7440020	µg l ⁻¹		13
Lead	1450	U	7439921	µg l ⁻¹		<1.0
Antimony	1450	U	7440364	µg l ⁻¹		<1.0
Selenium	1450	U	7782492	µg l ⁻¹		2.1
Zinc	1450	U	7440666	µg l ⁻¹		34
F (Fluoride)	1220	N	16984488	mg l ⁻¹		0.19
Cl (Chloride)	1220	N	16887006	mg l ⁻¹		3.3
SO ₄ (Sulfate)	1220	N	14808798	mg l ⁻¹		43
Total Dissolved Solids	1040	N	TDS	mg l ⁻¹		75
Phenols (total)	1920	N		mg l ⁻¹		< 0.03
Total Organic Carbon	1610	N	TOC	mg l ⁻¹		11
Arsenic L/S=10	1450	N	7440382	mg kg ⁻¹		0.069
Barium L/S=10	1450	N	7440393	mg kg ⁻¹		1.2
Cadmium L/S=10	1450	N	7440439	mg kg ⁻¹		0.0037
Chromium L/S=10	1450	N	7440473	mg kg ⁻¹		0.027
Copper L/S=10	1450	N	7440508	mg kg ⁻¹		0.046
Mercury L/S=10	1450	N	7439976	mg kg ⁻¹		< 0.005
Molybdenum L/S=10	1450	N	7439987	mg kg ⁻¹		0.019
Nickel L/S=10	1450	N	7440020	mg kg ⁻¹		0.13
Lead L/S=10	1450	N	7439921	mg kg ⁻¹		< 0.01
Antimony L/S=10	1450	N	7440360	mg kg ⁻¹		< 0.01
Selenium L/S=10	1450	N	7782492	mg kg ⁻¹		0.021
Zinc L/S=10	1450	N	7440666	mg kg ⁻¹		0.34
F (fluoride) L/S=10	1220	N	16984488	mg kg ⁻¹		1.9
Cl (chloride) L/S=10	1220	N	16887006	mg kg ⁻¹		33
SO ₄ (sulfate) L/S=10	1220	N	14808798	mg kg ⁻¹		430
Total Dissolved Solids L/S=10	1040	N	TDS	mg kg ⁻¹		750
Phenols (total) L/S=10	1920	N		mg kg ⁻¹		< 0.3
Total Organic Carbon L/S=10	1610	N	TOC	mg kg ⁻¹		110

All tests undertaken between 17-Aug-2011 and 19-Aug-2011

Column page 1

* Accreditation status

Report page 1 of 1

Report sample ID range

AG34689 to AG34689



The right chemistry to deliver results

LABORATORY TEST REPORT

Waste Acceptance Criteria Waste Parameters

Glover Site Investigations Ltd
8 Drumahiskey Road
Balnamore, Ballymoney
Co. Antrim
BT53 7QL
FAO John Cameron

Results of analysis of 0 samples
received 11 August 2011
11-269 - AMETS Belderra, Co.Mayo

Report Date
22 August 2011

LogIn Batch No

Chemtest LIMS ID

138617

AG34688

Sample ID	Sample No	Depth	Matrix	Determinand↓	SOP↓	*	CAS No↓	Units↓	Inert waste landfill	Limit values Stable non-reactive hazardous waste in non-hazardous landfill	Hazardous waste landfill	TP05
				Total Organic Carbon	2625	M		%	3	5	6	0.49
				Loss on ignition	2610	N		%			10	1.22
				Benzene	2760	M	71432	µg kg ⁻¹				< 1.0
				Toluene	2760	M	108883	µg kg ⁻¹				< 1.0
				m- & p-Xylene	2760	U	1330207	µg kg ⁻¹				< 1.0
				o-Xylene	2760	U	95476	µg kg ⁻¹				< 1.0
				Total BTEX	2761	M		mg kg ⁻¹	6			<0.005
				PCB 28	2810	N	7012375	mg kg ⁻¹				<0.1
				PCB 52	2810	N	35693993	mg kg ⁻¹				<0.1
				PCB 101	2810	N	37680732	mg kg ⁻¹				<0.1
				PCB 118	2810	N	31508006	mg kg ⁻¹				<0.1
				PCB 138	2810	N	35065282	mg kg ⁻¹				<0.1
				PCB 153	2810	N	35065271	mg kg ⁻¹				<0.1
				PCB 180	2810	N	35065293	mg kg ⁻¹				<0.1
				Total PCBs (7 congeners)	2811	N		mg kg ⁻¹	1			<1
				Naphthalene	2700	M	91203	mg kg ⁻¹				<0.1
				Acenaphthylene	2700	M	208968	mg kg ⁻¹				<0.1
				Acenaphthene	2700	M	83329	mg kg ⁻¹				<0.1
				Fluorene	2700	M	86737	mg kg ⁻¹				<0.1
				Phenanthrene	2700	M	85018	mg kg ⁻¹				<0.1
				Anthracene	2700	M	120127	mg kg ⁻¹				<0.1
				Fluoranthene	2700	M	206440	mg kg ⁻¹				<0.1
				Pyrene	2700	M	129000	mg kg ⁻¹				<0.1
				Benzo[a]anthracene	2700	M	56553	mg kg ⁻¹				<0.1
				Chrysene	2700	M	218019	mg kg ⁻¹				<0.1
				Benzo[b]fluoranthene	2700	M	205992	mg kg ⁻¹				<0.1
				Benzo[k]fluoranthene	2700	M	207089	mg kg ⁻¹				<0.1
				Benzo[a]pyrene	2700	M	50328	mg kg ⁻¹				<0.1
				Dibenzo[a,h]anthracene	2700	M	53703	mg kg ⁻¹				<0.1
				Indeno[1,2,3-cd]pyrene	2700	M	193395	mg kg ⁻¹				<0.1
				Benzo[g,h,i]perylene	2700	M	191242	mg kg ⁻¹				<0.1
				Coronene	2700	N	191071	mg kg ⁻¹				<0.1
				Total (of 17) PAHs	2700	N		mg kg ⁻¹	100			<2
				pH	2010	M				>6		4.2
				Acid Neutralisation Capacity	2015	N	ANC	mol kg ⁻¹		To evaluate	To evaluate	< 0.002
				Dry Matter	2030	N		%	0.02		100	86.8
				Ethylbenzene	2760	M	100414	µg kg ⁻¹				< 1.0
				TPH Total WAC	2670	M		mg kg ⁻¹	500			24

All tests undertaken between 15-Aug-2011 and 19-Aug-2011

Column page 1

* Accreditation status

Report page 1 of 1

Report sample ID range AG34688 to AG34688

8 Drumahiskey Road
Balnamore
Ballymoney
Co. Antrim
N. Ireland
BT53 7QL

Tel: +44 (0)28 2766 2083
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Email: admin@glover-si.com
Web: www.glover-si.com

