



tms environment ltd

53 Broomhill Drive, Tallaght,
Dublin 24, Ireland. Tel: +353-1-4626710

BOREHOLE LOG

Sheet 1 of 2

BOREHOLE NO. TW 01

GENERAL DETAILS

Project No: 18794
Client: Lagan
Site Name: Rossmore Quarry
Grid Ref: 182477 71022
Top of Casing: 1.155 mOD
Total Depth: 50 meters



Commenced: 22/02/2012
Completed: 22/02/2012
Contractor: Leo O'Sullivan & Co.
Drilling Method: DTH Hammer (Air Flush)
Logged by: Craig O'Connor, TMS Environment Ltd.

DRILLING DETAILS

Ground level - 5mbgl: drilled at 12-inch diameter.
5 - 50 mbgl: drilled at 8-inch diameter
Casing depth: 0 - 5mbgl
Casing diameter: 8-inch steel to 5mbgl

WATER

Water strikes at 7 - 35mbgl(700gph), 35 - 42mbgl (400gph) and 42 - 50mbgl (100gph)
Estimated Final Yield at 50mbgl: 1200 gallons per hour

FINAL INSTALLATION

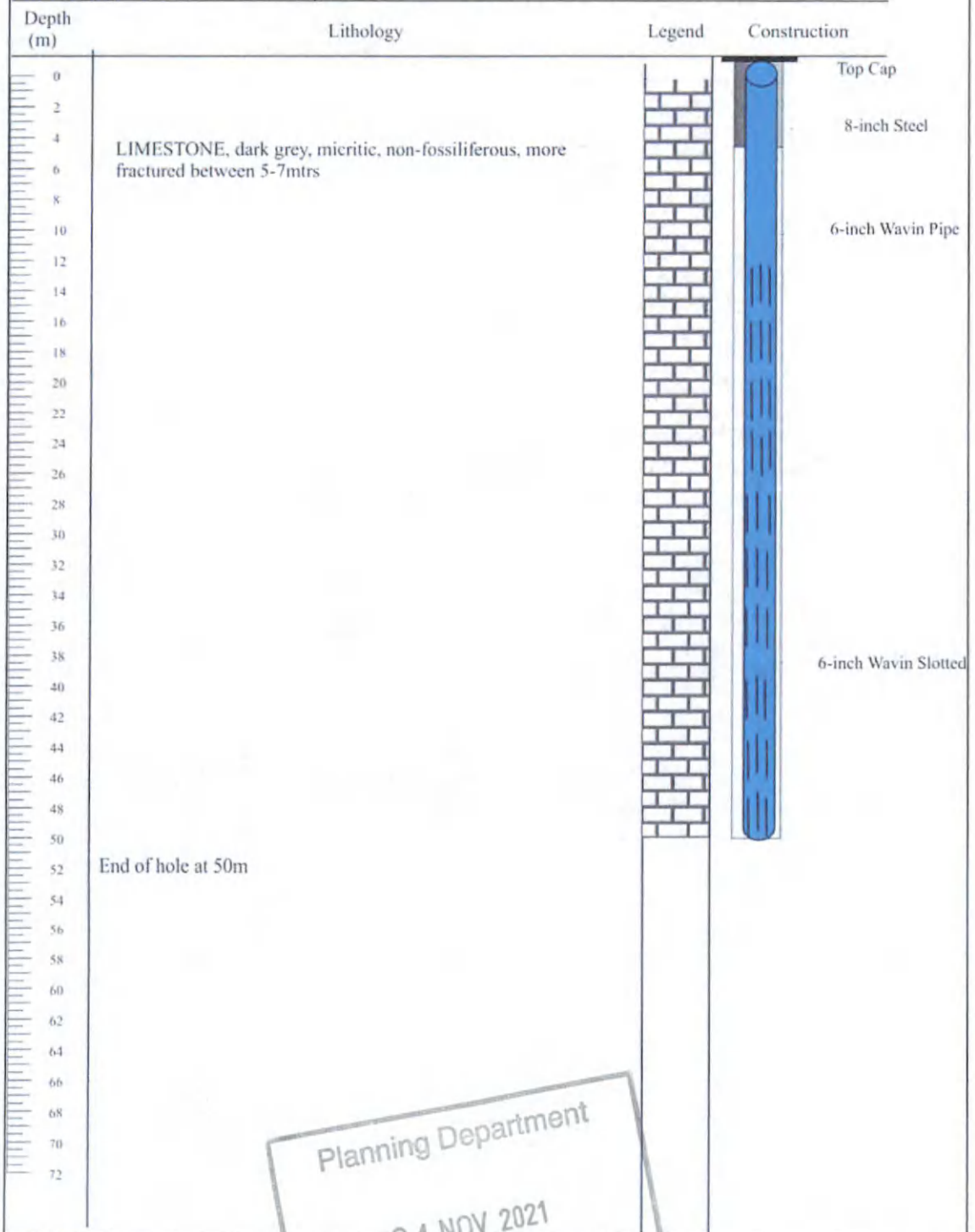
Plastic Liner Installed:
Ground level - 12mbgl: 6 inch wavin pipe, 12-50mbgl: slotted 6 inch wavin pipe.

NOTES

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BOREHOLE LOG

Sheet 1 of 2

BOREHOLE NO. TW 02

GENERAL DETAILS

Project No: 18794
Client: Lagan
Site Name: Rossmore Quarry
Grid Ref: 182447 70760
Top of Casing: 5.109 mOD
Total Depth: 50 meters

Commenced: 23/03/2012
Completed: 23/03/2012
Contractor: JS Drilling
Drilling Method: DTH / Continuous Casing (Beretta T51)
Logged by: Craig O'Connor, TMS Environment Ltd.

DRILLING DETAILS

Simultaneous drilling & casing, Ground level - 28mbgl: 220mm borehole with 165mm steel casing (pulled back to 15mbgl on completion)
28 - 50mbgl: 152mm borehole, drilled open hole

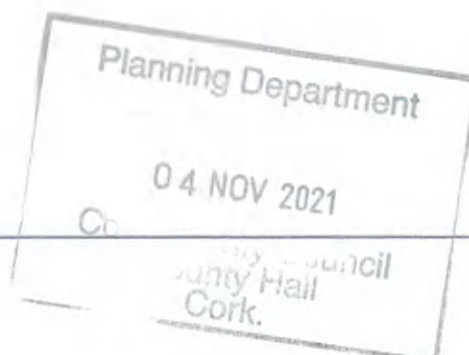
WATER

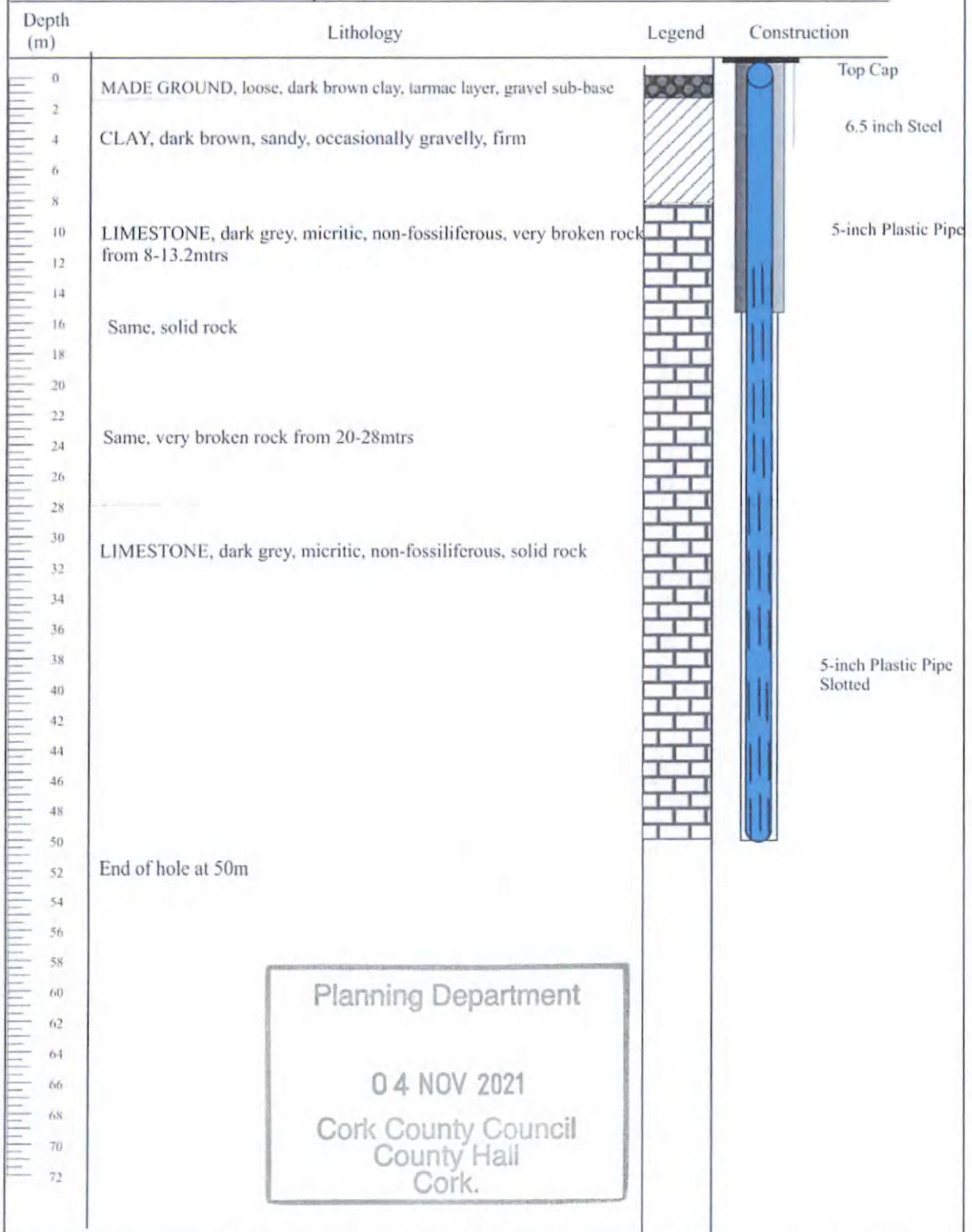
- Water strike at 8mbgl (approx. 3500 - 4000 gallons per hour) at top of broken rock
 - Water strike at 20mbgl (approx. 2000 gallons per hour) within broken rock zone
 - Water strike at 32mbgl (approx. 600 gallons per hour)
- Estimated Final Yield at 50mbgl: 6100 - 6600 gallons per hour

FINAL INSTALLATION

5" Plastic Liner Installed: 0 - 50mbgl (lower 32m slotted by hand at 8" intervals on 3 faces)

NOTES







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BOREHOLE LOG

Sheet 1 of 2

BOREHOLE NO. TW 03

GENERAL DETAILS

Project No: 18794
Client: Lagan
Site Name: Rossmore Quarry
Grid Ref: 182448 70764
Top of Casing: 4.859 mOD
Total Depth: 50 meters

Commenced: 02/04/2012
Completed: 02/04/2012
Contractor: Dunnes Drilling
Drilling Method: Tricone & Mud Circulation / DTH Hammer (Air Flush)
Logged by: Craig O'Connor, TMS Environment Ltd.

DRILLING DETAILS

Ground level - 12.3 mbgl: 17.5 - inch diameter, 12.3 - 32.4 mbgl: 12 inch diameter
32.4 - 50 mbgl: 8 inch diameter
Casing: 12" steel 0 - 12.3 mbgl
8" steel 0 - 32.4 mbgl (lower 18m slotted)
Open hole: 32.4 - 50 mbgl

WATER

Estimated Final Yield at 50 mbgl (following airlift): 3600 gallons per hour

FINAL INSTALLATION

0 - 12.3 mbgl: 12 inch steel, 0 - 32.4 mbgl: 8 inch steel (lower 18 mtrs slotted),
32.4 - 50 mbgl: Open hole

NOTES

Development by airlifting & surging for 2 hours.



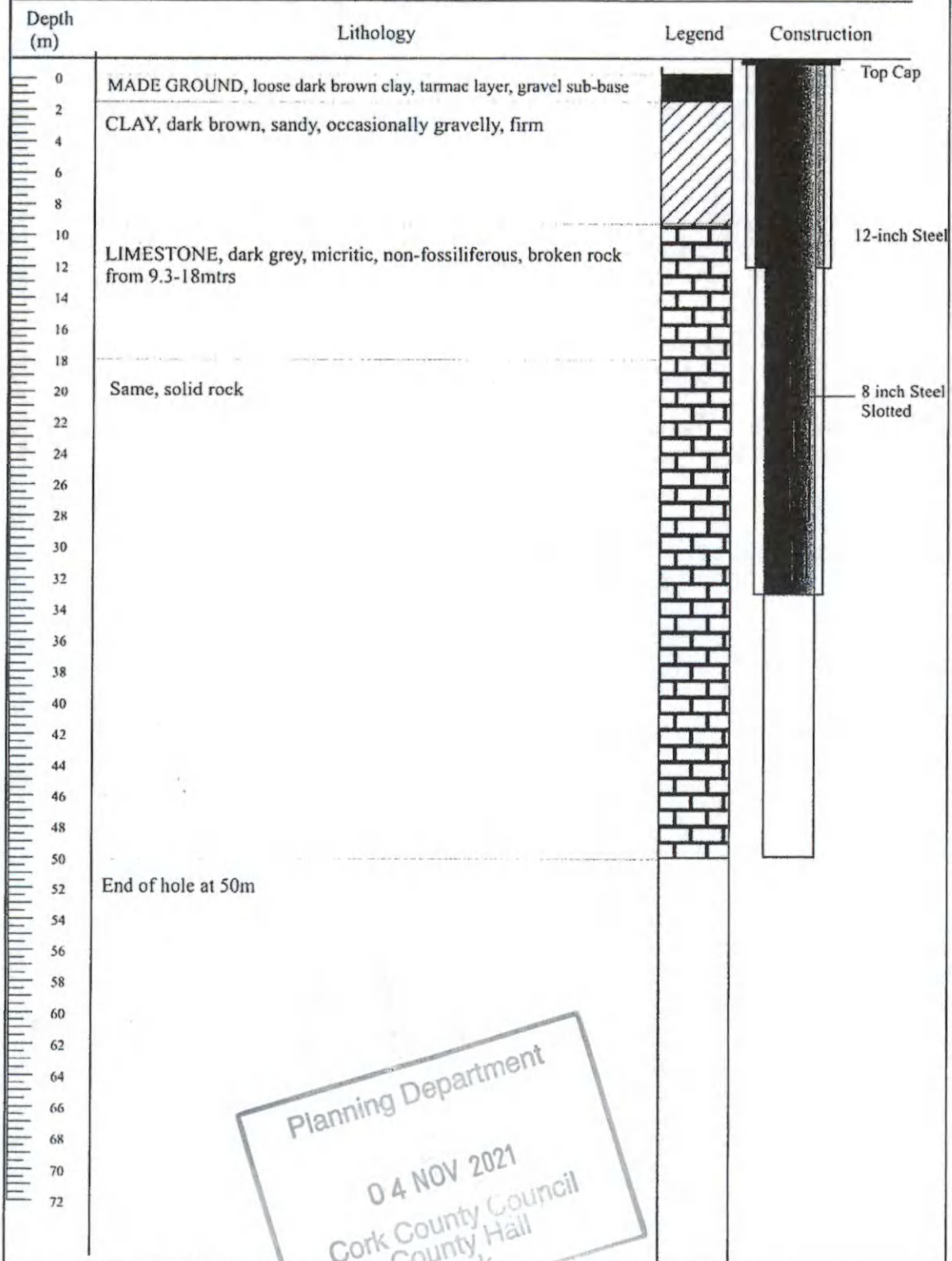


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Project No. 18794
Site Name: Rossmore Quarry
Borehole No. TW 03

Sheet 2 of 2

NOT TO SCALE



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Borehole Log



Soil Mechanics

Drilled M/NAL Logged AO Checked AO	Start 21/02/2012 End 23/02/2012	Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.	Depth from 0.00m to 25.20m Diameter 121mm Casing Depth 15.00m	Ground Level Coordinates National Grid E 182441.00 N 70753.00 Chainage
------------------------------------------	------------------------------------	---------------------------------------------------------------------------	---------------------------------------------------------------------	---------------------------------------------------------------------------------

Samples and Tests				Strata			Depth, Level (Thickness)	Legend	Backfill/ Instruments
Depth	Type & No	Records	Date Casing	Time Water	Description				
0.50-0.80	0 N/A N/A	TCR 0, SCR NR, RQD NR			Gravel with clay FILL. (MADE GROUND) (Foreman's description)	(3.70)			
0.80-1.40	0 N/A N/A								
1.40-2.10	29 N/A N/A								
2.10-3.70	0 N/A N/A								
3.70-5.90	34 N/A N/A				Purple brown slightly sandy slightly gravelly CLAY.	3.70			
5.90-6.60	80 N/A N/A								
6.60-7.20	127 N/A N/A								
7.20-8.70	33 N/A N/A					(8.30)			
8.70-10.40	0 N/A N/A		21/02/2012 8.70	6.20					
			22/02/2012 8.70	0800 4.20					

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Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water	Stratum continues to 12.00m	Chiselling Depths (m)	Time	Tools used
Groundwater Entries	No.	Struck (m)	Post strike behaviour	Depth sealed (m)	Depth Related Remarks * From to (m)				
1	5.40	Rose to 5.10 m after 20 minutes.							

Notes: For explanation of symbols and deviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

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420.462805/2012 16:41:02

Project Rossmore Site Investigation
 Project No. Y2110-12
 Carried out for Irish Asphalt Limited

Borehole
RC1
 Sheet 1 of 3

Scale 1:50

Borehole Log

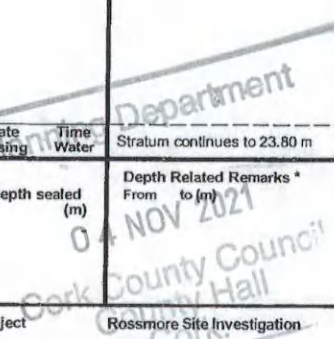


Drilled MVAL Logged AO Checked AO	Start 21/02/2012 End 23/02/2012	Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.	Depth from 0.00m to 25.20m Diameter 121mm Casing Depth 15.00m	Ground Level Coordinates National Grid E 182441.00 N 70753.00 Chainage
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Samples and Tests			Strata		Description (Continued from Sheet 1)			Depth, Level (Thickness)	Legend	Backfill/ Instruments
Depth	TOR SCR ROD	If	Records/Samples	Date Casing	Time Water					
10.40-12.00	0 N/A N/A		Flush: 0.00-23.10 Air mist, 100 %			Purple brown slightly sandy slightly gravelly CLAY.				
12.00-13.20	0 N/A N/A					GRAVEL. Broken rock. (Foreman's description)		12.00 (1.20)		
13.20-14.20	100 52 37					Medium strong to strong grey to dark grey fine grained LIMESTONE with frequent calcite veins up to 25mm thick. Weathering: Moderate becoming highly weathered. Widespread clay smearing and infilling of fracture joints up to 10mm thick. Large sections weathered to NI. Some orange staining of fracture faces. Fractures: Moderately becoming highly fractured. Bedding difficult to determine. Fracture Set 1) 70 deg to subvertical closely to medium spaced planar smooth fractures. Fracture Set 2) Subhorizontal closely to widely spaced undulating smooth fractures.		13.20		
14.20-15.20	100 51 45									
15.20-15.80	100 47 40									
15.80-16.50	100 63 39									
16.50-17.00	100 54 54					16.63-16.80 m NI 16.65-17.00 m NI stained very dark grey				
17.00-18.15	100 68 37									
18.15-19.35	100 24 8	NI 50 240				19.10-19.40 m NI		(10.60)		
19.35-20.40	100 22 0					19.75-19.90 m NI				
Depth	TOR SCR ROD	If	Records/Samples	Date Casing	Time Water	Stratum continues to 23.80 m				

Groundwater Entries	Depth sealed (m)	Depth Related Remarks *	Chiselling Depths (m)	Time	Tools used
No. Struck Post strike behaviour		From to (m)			
2 11.00 -					

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.	Project Rossmore Site Investigation	Borehole RC1
Scale 1:50	Project No. Y2110-12	Sheet 2 of 3
(c) ESG www.esg.co.uk 426.4828/05/2012 15:41:03	Carried out for Irish Asphalt Limited	



Borehole Log



Soil Mechanics

Drilled MN/AL Logged AO Checked AO	Start 21/02/2012 End 23/02/2012	Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.	Depth from 0.00m to 25.20m Diameter 121mm Casing Depth 15.00m	Ground Level Coordinates National Grid Chainage
				E 182441.00 N 70753.00

Samples and Tests				Strata					
Depth	TOR RSD ROD	If	Records/Samples	Date Casing	Time Water	Description (Continued from Sheet 2)	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
20.40-21.00	100 42 20			22/02/2012 15.00	3.40	Medium strong to strong grey to dark grey fine grained LIMESTONE with frequent calcite veins up to 25mm thick.	20.00-20.40 m many calcite veins up to 25mm thick		
21.00-21.50	100 0 0			23/02/2012 15.00	0800 2.80	Weathering: Moderate becoming highly weathered. Widespread clay smearing and infilling of fracture joints up to 10mm thick. Large sections weathered to NI. Some orange staining of fracture faces.	20.75-21.60 m NI		
21.50-22.30	100 23 18					Fractures: Moderately becoming highly fractured. Bedding difficult to determine.	21.76-22.10 m NI		
22.30-23.10	100 0 0					Fracture Set 1) 70 deg to subvertical closely to medium spaced planar smooth fractures.	22.30-22.65 m NI		
23.10-23.90	100 21 21					Fracture Set 2) Subhorizontal closely to widely spaced undulating smooth fractures.			
23.90-25.20	0 NA NA		Flush: 23.10-25.20 Air mist, 50 %	23/02/2012 15.00	4.10	Multicoloured sandy gravelly CLAY. CLAY with loose limestone. (Foreman's description)	23.80 23.90 (1.30)		
						EXPLORATORY HOLE ENDS AT 25.20 m	25.20		SP

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Groundwater Entries No. Struck Post strike behaviour	Depth sealed (m)	Depth Related Remarks * From to (m)	Chiselling Depths (m) Time Tools used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:50 (c) ESG www.esg.co.uk 425.4826/052012 15:41:05	Project Rossmore Site Investigation Project No. Y2110-12 Carried out for Irish Asphalt Limited	Borehole RC1 Sheet 3 of 3
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Borehole Log



Soil Mechanics

Drilled MVAL Logged AO Checked AO	Start 23/02/2012 End 27/02/2012	Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.	Depth from 0.00m to 20.35m Diameter 121mm Casing Depth 2.30m	Ground Level Coordinates National Grid Chainage
				E 182505.00 N 70970.00

Samples and Tests				Strata			Ground Level		
Depth	TCR SCR RSD	If	Records/Samples	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-1.15	87 N/A N/A					Light brown clayey sandy GRAVEL. (Compacted quarry floor) (MADE GROUND)	(1.15)		
1.15-2.30	100 46 22					Strong occasionally moderately strong light grey fine grained LIMESTONE with frequent calcite veins up to 60mm thick. Weathering: Moderately weathered with widespread orange staining of fracture surfaces and occasional clay smearing. Fractures: Moderately fractured.	1.15 1.15-2.30 m highly fractured 1.55-1.75 m NI		
2.30-2.90	100 67 35					Fracture Set 1) (Bedding Fractures) Subhorizontal closely to widely spaced undulating and stepped smooth fractures.			
2.90-4.40	100 89 72					Fracture Set 2) 40 to 50 deg dip closely to widely spaced undulating smooth fractures.			
				23/02/2012 2.30	1.80				
				24/02/2012 2.30	0800 0.80				
4.40-5.90	100 81 51						4.40-4.50 m NI		
							5.78-5.90 m subvertical undulating smooth fracture		
5.90-7.40	100 82 82								
7.40-8.85	100 95 95						8.75-8.85 m subvertical undulating smooth fracture		
8.85-10.35	100 100 100								

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Groundwater Entries		Depth Related Remarks *		Chiselling	
No.	Struck (m)	Post strike behaviour	Depth sealed (m)	From	to (m)
1	2.85	-	-		
				Depths (m)	Time Tools used

Borehole Log



Soil Mechanics

Drilled MN/AL Logged AO Checked AO		Start 23/02/2012 End 27/02/2012		Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.		Depth from 0.00m to 20.35m		Diameter 121mm		Casing Depth 2.30m		Ground Level Coordinates National Grid E 182505.00 N 70970.00	
Samples and Tests						Strata							
Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water	Description (Continued from Sheet 1)		Depth, Level/ (Thickness)	Legend	Backfill/ Instruments			
		NI 220 1020	Flush: 0.00-20.35 Air mist, 100 %			Strong occasionally moderately strong light grey fine grained LIMESTONE with frequent calcite veins up to 60mm thick.							
10.35-11.85	100 93 91					Weathering: Moderately weathered with widespread orange staining of fracture surfaces and occasional clay smearing.	(19.20)						
11.85-12.53	100 85 85					Fractures: Moderately fractured.							
12.53-13.40	100 98 98					Fracture Set 1) (Bedding Fractures) Subhorizontal closely to widely spaced undulating and stepped smooth fractures.							
13.40-14.05	100 97 97					Fracture Set 2) 40 to 50 deg dip closely to widely spaced undulating smooth fractures.							
14.05-14.95	100 93 93			24/02/2012 2.30	1.25								
14.95-15.22	100 100 100		TCR 100, SCR 100, RQD 100	27/02/2012 2.30	0800 1.80		14.95-15.22 m subvertical undulating smooth fracture						
15.22-15.90	100 57 34						15.45-15.90 m subvertical undulating smooth fracture						
15.90-16.08	100		TCR 100, SCR 83, RQD 83										
16.08-16.37	100 100		TCR 100, SCR 100, RQD 100										
16.37-16.60	100 57 48		TCR 100, SCR 57, RQD 48										
16.60-17.90	100 98 98												
17.90-19.35	100 94 91												
19.35-20.35	100 96 96						19.77-20.07 m subvertical						
Stratum continues to 20.35 m													
Groundwater Entries No. Struck Post strike behaviour				Depth sealed (m)		Depth Related Remarks *				Chiselling Depths (m) Time Tools used			
ss: For explanation of symbols and deviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.						Project Rossmore Site Investigation Project No. Y2110-12 Carried out for Irish Asphalt Limited						Borehole RC2 Sheet 2 of 3	
Scale 1:50						(c) ESG www.esg.co.uk 433.482805/2012 19:41:12							

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Borehole Log



Soil Mechanics

Drilled MN/AL Logged AO Checked AO	Start 23/02/2012 End 27/02/2012	Equipment, Methods and Remarks Casagrande C6. Rotary core drilling.	Depth from 0.00m to 20.35m Diameter 121mm Casing Depth 2.30m	Ground Level Coordinates National Grid E 182505.00 N 70970.00 Chainage
------------------------------------------	------------------------------------	---------------------------------------------------------------------------	--------------------------------------------------------------------	---------------------------------------------------------------------------------

Samples and Tests				Strata				Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
Depth	TCR SCR RCD	If	Records/Samples	Date Casing	Time Water	Description (Continued from Sheet 2)				
				27/02/2012		Strong occasionally moderately strong light grey fine grained LIMESTONE with frequent calcite veins up to 60mm thick. Weathering: Moderately weathered with widespread orange staining of fracture surfaces and occasional clay smearing. Fractures: Moderately fractured. Fracture Set 1) (Bedding Fractures) Subhorizontal closely to widely spaced undulating and stepped smooth fractures. Fracture Set 2) 40 to 50 deg dip closely to widely spaced undulating smooth fractures. EXPLORATORY HOLE ENDS AT 20.35 m	20.35		SP	

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Groundwater Entries No. Struck Post strike behaviour (m)	Depth sealed (m)	Depth Related Remarks * From to (m)	Chiselling Depths (m) Time Tools used
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Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:50 (c) ESG www.esg.co.uk 420.482805/2012 15:41:14	Project Rossmore Site Investigation Project No. Y2110-12 Carried out for Irish Asphalt Limited	Borehole RC2 Sheet 3 of 3
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Window Sampler Hole Log



Soil Mechanics

Drilled MM Logged AO Checked AO		Start 28/02/2012 End 28/02/2012		Equipment, Methods and Remarks Global Geotool Windowless sampling.		Depth from 0.00m to 5.00m		Diameter 86mm Casing Depth 3.00m		Ground Level Coordinates National Grid Chainage	
						E 182823.00 N 70764.00					
Samples and Tests					Strata						
Depth	Type & No	Records	Date Casing	Time Water	Description			Depth, Level (Thickness)	Legend	Backfill/ Instruments	
					Purple and brown silty fine to medium SAND.			(0.55)			
					Purple and brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of various lithologies.			0.55 (0.55)			
					Purple and brown sandy GRAVEL. Gravel is subangular to subrounded fine to coarse of various lithologies.			1.10 (1.90)			
					Purple and brown gravelly silty fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobbles are subangular of sandstone.			2.80 m large subangular sandstone cobble 3.00 (2.00)			
			28/02/2012 3.00		EXPLORATORY HOLE ENDS AT 5.00 m			4.90 m subrounded sandstone cobble 5.00			
Groundwater Entries No. Struck Post strike behaviour (m) None observed (see Key Sheet)					Depth sealed (m)		Depth Related Remarks * From to (m)		Chiselling Depths (m) Time Tools used		
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project Rossmore Site Investigation		Project No. Y2110-12		Borehole WS1		
Scale 1:50 (c) ESG www.esg.co.uk 426.4828052012 15:41:18					Carried out for Irish Asphalt Limited				Sheet 1 of 1		

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Window Sampler Hole Log



Soil Mechanics

Drilled MM Logged AO Checked AO		Start 28/02/2012 End 28/02/2012		Equipment, Methods and Remarks Global Geotool. Windowless sampling.		Depth from 0.00m to 4.00m		Diameter 86mm Casing Depth 3.00m		Ground Level Coordinates National Grid Chainage	
						E 182821.00 N 70763.00					
Samples and Tests					Strata						
Depth	Type & No	Records	Date Casing	Time Water	Description		Depth, Level (Thickness)	Legend	Backfill/ Instruments		
					TOPSOIL.		0.15				
					Brown sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies.		(0.30) 0.45				
					Purple and brown sandy GRAVEL with low cobble content. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobbles are subangular of sandstone.		(1.35)				
					Purple and brown slightly silty gravelly SAND. Gravel is subangular to subrounded fine to coarse of various lithologies.		1.80 (0.75)				
					Purple and brown slightly silty slightly sandy GRAVEL. Gravel is subangular to subrounded fine to coarse of various lithologies.		2.55 (1.45)				
			01/03/2012 3.00	4.00	EXPLORATORY HOLE ENDS AT 4.00 m		4.00			SP	
<div style="border: 1px solid black; padding: 10px; transform: rotate(-5deg); display: inline-block;"> <p>Planning Department</p> <p>04 NOV 2021</p> <p>Cork County Council County Hall Cork.</p> </div>											
Depth	Type & No	Records	Date Casing	Time Water	Depth Related Remarks *		Chiselling Depths (m) Time Tools used				
Groundwater Entries					From to (m)						
No.	Struck (m)	Post strike behaviour	Depth sealed (m)								
1	4.00	-									
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project Rossmore Site Investigation		Borehole WS2				
Scale 1:50					Project No. Y2110-12		Sheet 1 of 1				
(c) ESG www.esg.co.uk 428.4828/05/2012 15:41:22					Carried out for Irish Asphalt Limited						

Window Sampler Hole Log



Drilled MM Logged AJ Checked AO	Start 29/02/2012 End 29/02/2012	Equipment, Methods and Remarks Gibbal Geotool Windowless sampling.	Depth from 0.00m to 4.00m	Diameter 86mm	Casing Depth 4.00m	Ground Level Coordinates National Grid Chainage E 182830.00 N 70771.00		
Samples and Tests			Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
0.00-1.00	W 1				Brown medium dense slightly clayey slightly gravelly SAND with low cobble content. Gravel is angular to rounded fine to coarse of various lithologies. Medium dense occasional dense brown clayey gravelly SAND. Gravel is rounded to subangular fine to medium. Stiff to very stiff brown slightly gravelly very sandy CLAY. Gravel is angular to rounded fine to medium.	(1.60)		
1.00-2.00	W 2			1.60				
2.00-3.00	W 3			(1.40)				
3.00-4.00	W 4		29/02/2012 4.00	dry		3.00 (1.00)		
EXPLORATORY HOLE ENDS AT 4.00 m						4.00		SP
Groundwater Entries No. Struck Post strike behaviour (m) None observed (see Key Sheet)			Depth sealed (m)			Depth Related Remarks * From to (m)		
Chiselling Depths (m)			Time			Tools used		
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project Rossmore Site Investigation			Borehole WS3		
Scale 1:50 (c) ESG www.esg.co.uk 420.4828.05/2012 15.41.25			Project No. Y2110-12			Sheet 1 of 1		
AGS			Carried out for Irish Asphalt Limited					

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Window Sampler Hole Log



Soil Mechanics

Drilled MM Logged MM Checked AO		Start 29/02/2012 End 29/02/2012		Equipment, Methods and Remarks Global Geotool. Windowless sampling.		Depth from 0.00m to 4.00m Diameter 86mm Casing Depth 4.00m		Ground Level Coordinates National Grid Chainage		
								E 182829.00 N 70773.00		
Samples and Tests				Strata						
Depth	Type & No	Records	Date Casing	Time Water	Description		Depth, Level (Thickness)	Legend	Backfill/ Instruments	
0.00-1.00	W 1				Brown slightly sandy fine CLAY with rootlets.		0.05			
					Brown slightly clayey SAND and GRAVEL. Gravel is subangular to subrounded fine to coarse of various lithologies.		(0.55)			
1.00-2.00	W 2				Brown very sandy gravelly CLAY. Gravel is fine to coarse subrounded to angular of various lithologies.		0.60			
					Brown clayey SAND and GRAVEL. Gravel is fine to coarse subangular to subrounded of various lithologies.		(0.40)			
2.00-3.00	W 3				Brown very clayey gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of various lithologies.		1.00			
							(0.30)			
							1.30			
3.00-4.00	W 4				Brown clayey gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of various lithologies.		(1.70)			
							3.00			
							(0.50)			
							3.50			
							(0.50)			
			29/02/2012	dry	Brown very silty fine to medium SAND.		4.00			
			4.00		EXPLORATORY HOLE ENDS AT 4.00 m				SP	
Groundwater Entries		No. Struck Post strike behaviour		Depth sealed (m)		Depth Related Remarks *		Chiselling Depths (m) Time Tools used		
None observed (see Key Sheet)										
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.				Project Project No. Carried out for				Borehole		
Scale 1:50				Rossmore Site Investigation Y2110-12 Irish Asphalt Limited				WS4 Sheet 1 of 1		

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Window Sampler Hole Log



Soil Mechanics

Filled MM Logged MM Checked AO		Start 29/02/2012 End 29/02/2012		Equipment, Methods and Remarks Global Geotool Windowless sampling.		Depth from 0.00m to 4.00m Diameter 86mm Casing Depth 4.00m		Ground Level Coordinates National Grid Chainage E 182838.00 N 70764.00	
Samples and Tests				Strata					
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments	
0.00-1.00	W 1				Brown clayey SAND and GRAVEL. Gravel is fine to coarse subangular to subrounded of various lithologies.	0.10 (0.60)			
1.00-2.00	W 2			Brown very sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded of various lithologies.	0.70 (0.90)				
2.00-3.00	W 3			Brown slightly silty gravelly SAND. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded of various lithologies.	1.60 (0.40) 2.00				
3.00-4.00	W 4			Brownish grey SAND and GRAVEL. Gravel is fine to medium subangular to rounded of various lithologies.	(0.90) 2.90				
			29/02/2012 4.00	dry	Brown very sandy SILT. Sand is fine.	(1.10) 4.00		SP	
					EXPLORATORY HOLE ENDS AT 4.00 m				
Groundwater Entries		Depth sealed (m)		Depth Related Remarks *		Chiselling			
No.	Struck	Post strike behaviour		From	to (m)	Depths (m)	Time	Tools used	
None observed (see Key Sheet)									
is: For explanation of symbols and variations see key sheet. All depths and reduced records in metres. Stratum thickness given in brackets in depth column.				Project Rossmore Site Investigation		Borehole WS5			
Scale 1:50 (c) ESG www.esg.co.uk 428.4828052012 15:41:31				Project No. Y2110-12 Carried out for Irish Asphalt Limited		Sheet 1 of 1			

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Window Sampler Hole Log



Soil Mechanics

Drilled MM Logged MM Checked AO		Start 29/02/2012 End 29/02/2012		Equipment, Methods and Remarks Global Geotool Windowless sampling.		Depth from 0.00m to 4.00m		Diameter 86mm		Casing Depth 4.00m		Ground Level Coordinates National Grid Chainage	
												E 182840.00 N 70765.00	
Samples and Tests						Strata							
Depth	Type & No	Records	Date Casing	Time Water	Description		Depth, Level (Thickness)	Legend	Backfill/ Instruments				
0.00-1.00	W 1				Brown very sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded of various lithologies.		(0.50)						
1.00-2.00	W 2				Brown slightly silty gravelly SAND. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded of various lithologies.		0.50 (1.70)						
2.00-3.00	W 3				Brownish grey slightly silty SAND and GRAVEL. Gravel is fine to coarse subangular to rounded of various lithologies.		2.20 (1.40)						
3.00-4.00	W 4		29/02/2012 4.00	dry	Brown very sandy SILT. Sand is fine.		3.60 (0.40)						
						EXPLORATORY HOLE ENDS AT 4.00 m							
<div style="border: 2px solid black; padding: 10px; transform: rotate(-5deg); display: inline-block;"> <p>Planning Department</p> <p>04 NOV 2021</p> <p>Cork County Council</p> <p>County Hall</p> <p>Cork.</p> </div>													
Depth	Type & No	Records	Date Casing	Time Water	Depth Related Remarks *		Chiselling Depths (m)		Time	Tools used			
Groundwater Entries No. Struck Post strike behaviour (m) None observed (see Key Sheet)					Depth sealed (m)								
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project Rossmore Site Investigation					Borehole WS6			
Scale 1:50 (c) ESG www.esg.co.uk 420.48280592012 15:41:35					Project No. Y2110-12 Carried out for Irish Asphalt Limited					Sheet 1 of 1			

Window Sampler Hole Log



Soil Mechanics

Drilled MM Logged AO Checked AO	Start 28/02/2012 End 28/02/2012	Equipment, Methods and Remarks Global Geotool Windowless sampling.	Depth from 0.00m to 4.00m Diameter 86mm Casing Depth 4.00m	Ground Level Coordinates National Grid E 182830.00 N 70756.00 Chalnage
---------------------------------------	------------------------------------	--------------------------------------------------------------------------	------------------------------------------------------------------	---------------------------------------------------------------------------------

Samples and Tests				Strata				
Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instruments
					Red and brown slightly gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse of various lithologies.	(0.60)		
					Brown sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of various lithologies.	(0.70)		
					orange and brown, becoming purple and brown at 2.00m, gravelly SAND. Gravel is subangular to subrounded fine to coarse of various lithologies.	(1.20)		
					Purple and brown sandy fine to coarse GRAVEL. Gravel is subangular to subrounded fine to coarse of various lithologies.	(1.50)		
			28/02/2012 4.00	dry	EXPLORATORY HOLE ENDS AT 4.00 m	4.00		SP

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Groundwater Entries No. Struck Post strike behaviour (m) None observed (see Key Sheet)	Depth sealed (m)	Depth Related Remarks * From to (m)	Chiselling Depths (m) Time Tools used
----------------------------------------------------------------------------------------------	------------------	----------------------------------------	---------------------------------------

Notes: For explanation of symbols and variations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:50 (c) ESG www.esg.co.uk 420.4828/05/2012 15:42:16 	Project Rossmore Site Investigation Project No. Y2110-12 Carried out for Irish Asphalt Limited	Borehole WS7 Sheet 1 of 1
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Window Sampler Hole Log



Soil Mechanics

Drilled MM Logged MM Checked AD		Start 29/02/2012 End 29/02/2012		Equipment, Methods and Remarks Global Geobool. Windowless sampling.		Depth from 0.00m to 4.00m		Diameter 86mm		Casing Depth 4.00m		Ground Level Coordinates National Grid Chainage		
												E 182831.00 N 70755.00		
Samples and Tests					Strata									
Depth	Type & No	Records	Date Casing	Time Water	Description					Depth, Level/ (Thickness)	Legend	Backfill/ Instruments		
0.00-1.00	W 1				Brown slightly clayey SAND and GRAVEL. Gravel is fine to coarse subangular to angular of various lithologies.					(0.50)				
					Brown very clayey SAND and GRAVEL. Gravel is fine to coarse subangular to angular of various lithologies.					0.50 0.60				
1.00-2.00	W 2				Brown slightly clayey slightly gravelly fine to coarse SAND. Gravel is subrounded of various lithologies.					(0.70)				
					Brown sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded of various lithologies.					1.30 (0.40)				
2.00-3.00	W 3				Orangish brown gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of various lithologies.					1.70 (0.30)				
					Orangish brown very gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of various lithologies.					2.00 (0.40)				
3.00-4.00	W 4				Brown very clayey SAND and GRAVEL. Gravel is fine to coarse subangular to subrounded of various lithologies.					2.40				
			29/02/2012	dry	Greyish brown slightly clayey very sandy GRAVEL. Gravel is subangular to subrounded various lithologies fine to coarse.					3.80 4.00		SP		
EXPLORATORY HOLE ENDS AT 4.00 m														
Groundwater Entries		No. Struck Post strike behaviour (m)		Depth sealed (m)		Depth Related Remarks *					Chiselling Depths (m)		Time Tools used	
None observed (see Key Sheet)														
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.				Project		Rossmore Site Investigation					Borehole			
Scale 1:50				Project No.		Y2110-12					WS8			
(c) ESG www.esg.co.uk 425 482865/2012 15:42:19				Carried out for		Irish Asphalt Limited					Sheet 1 of 1			

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Project No: 18794
Client: Lagan
Site Location: Rossmore, Co. Cork

Date: 16/4/2009
Irish Grid Ref: 182719 70751
Drilling method: JCB JS200
Supervisor: Phoebe Conway

Lithology:

0 – 0.2m TOPSOIL
0.2 – 0.5m MADE GROUND (clay with domestic waste, bricks, concrete pipes)
0.5 – 1.1m CLAY (light brown, sandy, silty, loose, dry)
1.1 – 3.1m GRAVEL (light brown, sandy, clayey, loose, mostly rounded clasts, stratified with boulders at base, wet from 2.5m)
3.1 – 4.2m CLAY (light grey/green, soft, homogeneous)
4.2m End of Pit

Pit Dimensions: 3m long x 2m wide
Water Strike: 2.5m
Bedrock: Not encountered
Completion: Backfilled and compacted



TP1

Planning Department
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Cork.

Project No: 18794
Client: Lagan
Site Location: Rossmore, Co. Cork

Date: 16/4/2009
Irish Grid Ref: 182792 70749
Drilling method: JCB JS200
Supervisor: Phoebe Conway

Lithology:

0 – 0.25m TOPSOIL
0.25 – 5.2m Interbedded SILTS & GRAVELS (Silts: light brown, sandy, loose.
Gravels: light brown, sandy, clayey, loose, mostly rounded clasts.
Silts form narrow discontinuous beds. Wet from 2.5m.)
5.2m End of Pit

Pit Dimensions: 3m long x 2m wide
Water Strike: 2.5m
Bedrock: Not encountered
Completion: Backfilled and compacted



TP2

Planning Department

04 NOV 2021

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Project No: 18794
Client: Lagan
Site Location: Rossmore, Co. Cork

Date: 16/4/2009
Irish Grid Ref: 182877 70767
Drilling method: JCB JS200
Supervisor: Phoebe Conway

Lithology:

0 – 0.3m TOPSOIL
0.3 – 3.0m Interbedded SILTS & GRAVELS (Silts: light brown, sandy, loose.
Gravels: light brown, sandy, clayey, loose, mostly rounded clasts.
Silts form narrow discontinuous beds. Wet from 2.5m.)
3.0m End of Pit

Pit Dimensions: 3m long x 2m wide
Water Strike: 2.5m
Bedrock: Not encountered
Completion: Backfilled and compacted



TP3

Planning Department

04 NOV 2021

Cork County Council
County Hall
Cork.

Project No: 18794
Client: Lagan
Site Location: Rossmore, Co. Cork

Date: 16/4/2009
Irish Grid Ref: 182776 70758
Drilling method: JCB JS200
Supervisor: Phoebe Conway

Lithology:

0 – 0.2m TOPSOIL
0.2 – 3.0m Interbedded SILTS & GRAVELS (Sils: light brown, sandy, loose.
Gravels: light brown, sandy, clayey, loose, mostly rounded clasts.
Sils form narrow discontinuous beds. Wet from 2.5m.)
3.0m End of Pit

Pit Dimensions: 3m long x 2m wide
Water Strike: 2.5m
Bedrock: Not encountered
Completion: Backfilled and compacted



TP4
04 NOV 2021
Cork County Council
County Hall
Cork.

Project No: 18794
Client: Lagan
Site Location: Rossmore, Co. Cork

Date: 16/4/2009
Irish Grid Ref: 182691 70740
Drilling method: JCB JS200
Supervisor: Phoebe Conway

Lithology:

0 – 0.15m TOPSOIL
0.15 – 2.7m Interbedded SILTS & GRAVELS (Silts: light brown, sandy, loose.
Gravels: light brown, sandy, clayey, loose, mostly rounded clasts.
Silts form narrow discontinuous beds. Wet from 2.5m.)
2.7 – 2.8m CLAY (light grey/green, soft, homogeneous)
2.8 – 3.0m Interbedded SILTS & GRAVELS
3.0m End of Pit

Pit Dimensions: 3m long x 2m wide
Water Strike: 2.5m
Bedrock: Not encountered
Completion: Backfilled and compacted




TP5

Planning Department
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Cork.

 tms environment ltd 53 Broomhill Drive, Tallaght, Dublin 24, Ireland. Tel: +353-1-4626710	<h1>Trial Pit Record</h1>	<h1>TP6</h1>
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Project No: 18794 Client: Lagan Site Location: Rossmore, Co. Cork	Date: 23/2/2012 Irish Grid Ref: 182399 70729 Drilling method: JCB JS200 Supervisor: Craig O'Connor
-------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------

<p><u>Lithology:</u></p>	
0 – 0.2m	SAND (grey-purple, fine grained, loose, well sorted with little or no clay, well rounded gravel and cobbles, shells, seaweed)
0.2 – 1.2m	GRAVEL (light brown-grey, well rounded gravel and boulder clasts, loose, sandy and clayey)
1.2 – 3.0m	CLAY (light brown-purple, firm, with occasional well rounded pebbles)
3.0m	End of Pit
<p>Pit Dimensions: 3m long x 2m wide</p>	
<p>Water Strike: seepage at 1.1m</p>	
<p>Bedrock: Not encountered</p>	
<p>Completion: Backfilled and compacted</p>	
	

TP6

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 <p>tms environment ltd 53 Broomhill Drive, Tallaght, Dublin 24, Ireland. Tel: +353-1-4626710</p>	<h1>Trial Pit Record</h1>	<h1>SP1</h1>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------	--------------

<p>Project No: 18794 Client: Lagan Site Location: Rossmore, Co. Cork</p>	<p>Date: 23/2/2012 Irish Grid Ref: 182412 70736 Drilling method: JCB JS200 Supervisor: Craig O'Connor</p>
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Lithology:

0 – 0.2m	GRAVEL (fine, light brown-grey, well sorted/rounded clasts, no clay, dry)
0.2 – 1.4m	GRAVEL (coarse, light brown-grey, well rounded gravel and boulder clasts, loose, sandy and clayey, dry)
1.4 – 2.9m	CLAY (light brown-purple, firm, with occasional well rounded pebbles, dry)
2.9 – 3.15m	GRAVEL (narrow band of well rounded gravel and boulder clasts, loose, sandy and clayey, wet)
3.15 – 4.0m	CLAY (same as above)
4.0m	End of Pit

Pit Dimensions: 3m long x 2m wide
Water Strike: 2.9m
Bedrock: Not encountered
Completion: 50mm standpipe installed (lower 3m slotted), backfilled and compacted



SP1

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Cork.

 tms environment ltd 53 Broomhill Drive, Tallaght, Dublin 24, Ireland. Tel: +353-1-4626710	<h1>Trial Pit Record</h1>	<h1>SP2</h1>
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Project No: 18794 Client: Lagan Site Location: Rossmore, Co. Cork	Date: 23/2/2012 Irish Grid Ref: 182745 70774 Drilling method: JCB JS200 Supervisor: Craig O'Connor
-------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------

Lithology:

0 – 0.3m TOPSOIL

0.3 – 0.8m GRAVEL (light brown, sandy, clayey, some boulders, loose-firm, mostly rounded clasts, dry)

0.8 – 5.0m CLAY (light brown, very sandy, very gravelly, firm, wet from 3.5m)

5.0m End of Pit

Pit Dimensions: 3m long x 2m wide
Water Strike: 3.5m
Bedrock: Not encountered
Completion: 50mm standpipe installed (lower 3m slotted), backfilled and compacted

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tms environment ltd

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Trial Pit Record

SP3

Project No: 18794
Client: Lagan
Site Location: Rossmore, Co. Cork

Date: 23/2/2012
Irish Grid Ref: 182793 70785
Drilling method: JCB JS200
Supervisor: Craig O'Connor

Lithology:

0 – 0.25m TOPSOIL
0.25 – 4.0m Interbedded SILTS & GRAVELS (Silt: light brown, sandy, loose.
Gravels: light brown, sandy, clayey, loose, mostly rounded clasts.
Silt forms narrow discontinuous beds. Wet from 3.9m.)
4.0m End of Pit

Pit Dimensions: 3m long x 2m wide

Water Strike: 3.9m

Bedrock: Not encountered

Completion: 50mm standpipe installed (lower 3m slotted), backfilled and compacted

Planning Department

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Cork.

 tms environment ltd 53 Broomhill Drive, Tallaght, Dublin 24, Ireland. Tel: +353-1-4626710	Trial Pit Record	SP4
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Project No: 18794 Client: Lagan Site Location: Rossmore, Co. Cork	Date: 23/2/2012 Irish Grid Ref: 182869 70779 Drilling method: JCB JS200 Supervisor: Craig O'Connor
-------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------

<p><u>Lithology:</u></p> <p>0 – 0.3m TOPSOIL</p> <p>0.3 – 3.7m Interbedded SILTS & GRAVELS (Silt: light brown, sandy, loose. Gravels: light brown, sandy, clayey, loose, mostly rounded clasts. Silt form narrow discontinuous beds, dry.)</p> <p>3.7m End of Pit</p> <p>Pit Dimensions: 3m long x 2m wide Water Strike: No Bedrock: Not encountered Completion: 50mm standpipe installed (lower 3m slotted), backfilled and compacted</p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 20px auto; transform: rotate(-2deg);"><p>Planning Department</p><p>04 NOV 2021</p><p>Cork County Council County Hall Cork.</p></div>



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Trial Pit Record

SP5

Project No: 18794

Client: Lagan

Site Location: Rossmore, Co. Cork

Date: 23/2/2012

Irish Grid Ref: 182795 70761

Drilling method: JCB JS200

Supervisor: Craig O'Connor

Lithology:

0 – 0.25m TOPSOIL

0.25 – 3.5m Interbedded SILTS & GRAVELS (Silts: light brown, sandy, loose.
Gravels: light brown, sandy, clayey, loose, mostly rounded clasts.
Silts form narrow discontinuous beds. Wet from 3.4m.)

3.5m End of Pit

Pit Dimensions: 3m long x 2m wide

Water Strike: 3.4m

Bedrock: Not encountered

Completion: 50mm standpipe installed (lower 3m slotted), backfilled and compacted

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APPENDIX 7.2
GEOTECHNICAL REVIEW REPORT

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County Hall
Cork.

GEOTECHNICAL REVIEW
ROSSMORE QUARRY, CARRIGTWOHILL, CO. CORK

Prepared for:

Irish Asphalt

June 2012

AGEC Ltd
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
Ireland

E-mail: info@agec.ie



DOCUMENT APPROVAL FORM

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Note: Amendments marked with line in right-hand margin			
File Reference Number	Document Revision No.	Amendment/Comment	
1221_011	0	Draft	
1221_014	1	Final	

Task	Nominated authority	Approved (signature)
Prepared by	Author: Dr Paul Jennings	<i>Paul Jennings</i>
Checked by	Geotechnical Project Manager: Turlough Johnston	<i>T. Johnston</i>
Approved by	Geotechnical Project Director: Turlough Johnston	<i>T. Johnston</i>
Quality check	Quality Manager: Marion English	<i>Marion English</i>

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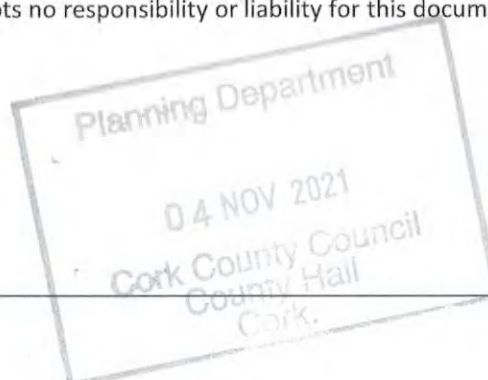


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TABLES (within text)

Table 1	Details of rock faces analysed
Table 2	Results of kinematic assessment for working faces

FIGURES (at end of text)

Figure 1	Plan of Rossmore Quarry workings (2012)
Figure 2	View of western face of Rossmore Quarry that borders neighbouring quarry
Figure 3	View of southern part of western face
Figure 4	View of central part of western face
Figure 5	View of central part of western face showing clay infilled joint
Figure 6	View of northern face
Figure 7	Stereonet showing pole data for all discontinuities in rock faces
Figure 8	Stereonet showing major discontinuity sets for all discontinuities in rock faces
Figure 9	Stereonet showing major discontinuity sets for western face
Figure 10	Stereonet showing major discontinuity sets for northern face
Figure 11	Stereonet showing major discontinuity sets for eastern face

APPENDICES

Appendix A	Previous Site Investigations (Location map and borehole logs)
Appendix B	Discontinuity Survey Data



ABBREVIATIONS

AGEC	Applied Ground Engineering Consultants
IA	Irish Asphalt Ltd
GSI	Geological Survey of Ireland



1 INTRODUCTION

Applied Ground Engineering Consultants Ltd (AGEC) was requested by Rossmore Quarry, part of Irish Asphalt Ltd, to provide a geotechnical assessment of the quarry working faces as part of a planning proposal to lower the floor across the quarry to -20m OD.

The inspection was carried out on 18 June 2012. The inspection involved a visual examination of faces with measurement of rock discontinuities.

This report presents a geotechnical assessment of the above with particular attention given to quarry faces bordering the neighbouring quarry on the western side of Rossmore Quarry (Figure 1) and the risk of slope failures as working faces are advanced and lowered.

The quarry workings comprise the extraction and processing of limestone rock into aggregate for use in construction.



2 SITE TOPOGRAPHY AND GROUND CONDITION

2.1 Topography

The quarry site is located on the shoreline of Rossmore Bay near Carrigtwohill (Figure 1). The original ground surface rises from the shoreline northward to about 11m OD. A road is located along the southern and eastern boundaries of the quarry.

The western boundary of the quarry comprises a ridge of in situ ground that separates Rossmore Quarry from the neighbouring working quarry. The separating ridge is about 30 to 40m wide.

The neighbouring quarry is currently active and its operating floor is notably lower than the current floor of the Rossmore Quarry. The neighbouring quarry is located within the same rock type and structural domain as Rossmore Quarry.

2.2 Soil Type

The original soil cover on the site comprised sand and gravel. The quarries in this area originally extracted both limestone rock and sand and gravel deposits.

The quarry has been in operation for some time, and at the time of the inspection all soil had been removed from the site.

2.3 Rock Type

Based on the Geological Survey of Ireland (GSI) (1994) the quarry is located within Carboniferous Limestone rock.

The rock type found within the quarry is the Little Island Formation which comprises essentially fine-grained mud mound limestone which is overlain by bedded limestones of the Clashavodig Formation.

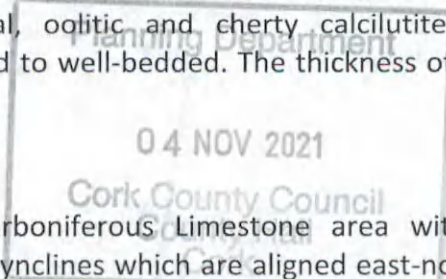
The Little Island Formation comprises massive calcilutite limestone (mud bank facies formed dominantly of limestone clay sized particles) and crinoidal calcilutites (fossilised crinoid remains within limestone of dominantly clay sized particles). The top of the formation is gradational into the overlying Clashavodig Formation. The thickness of the Little Island Formation is estimated at 250 to 500m.

The Clashavodig Formation which is located close to the northern boundary of the quarry comprises skeletal, peloidal, oolitic and cherty calcilutite limestone. The formation is generally poorly-bedded to well-bedded. The thickness of the formation is estimated at several 100m.

2.4 Structural Geology

The structural geology of the Carboniferous Limestone area within the area is dominated by the Cork and Cloyne synclines which are aligned east-north-east to west-south-west. The geological structure is reflected in the topography of the area with elongate valleys and intervening ridges aligned similarly to the synclines.

Rossmore Quarry is located within the southern limb of the Cork syncline. The limb dips generally to the north at a shallow inclination. The central axis of the syncline is formed



by a band of the Clashavodig Formation, located close to the northern boundary of the quarry and which is about 0.3km in width at the ground surface (north to south).

The Little Island Formation, the main rock type found within the quarry, dips to the north at about 10 to 20 degrees. The bedding within the formation is poorly defined, though the sub-vertical discontinuities are well-defined and persistent. The formation covers most of the quarry site and extends to the south; the width of the formation at the ground surface is about 0.6km (north to south).

There are no major faults shown within the quarry site on the geological plan (GSI, 1994). Inspection of the faces shows possible minor sub-vertical faults striking north-south.

2.5 Previous Site Investigation

Site investigations comprising dominantly boreholes with trial pits have been carried out at the quarry site between 2008 and 2012 (Appendix A). The boreholes were drilled to depths down to 72m. Within some of the boreholes water monitoring installations have been installed.



3 FINDINGS OF INSPECTION

3.1 General

The inspection involved a survey to determine the major discontinuity sets within particularly the quarry rock (western) face bordering the neighbouring quarry on the western side of Rossmore Quarry. The findings of the survey are used to assess the risk of slope failures as working faces are advanced and lowered.

An inspection of the soil slope above the rock faces along the western boundary was also carried out.

3.2 Soil Slope on Western Quarry Boundary

The original soil (overburden) cover on the site essentially comprised sand and gravel.

Inspection of the soil slope along the western quarry bound showed that the slope comprised dominantly placed soil material, with some in situ soil present. The soil was described as firm to stiff sandy very gravelly SILT/CLAY with much sub-rounded to angular limestone cobbles and occasional boulders.

The soil slope ranged in height from a few metres up to about 7m (Figure 2). The inclination of the soil slope was about 35 to 38 degrees. The crest of the slope was vegetated with some semi-mature trees and shrubs present in places. The face of the slope was covered in grass and was in part bare.

Inspection of the soil slope showed no signs of adverse instability.

3.3 Rock Faces

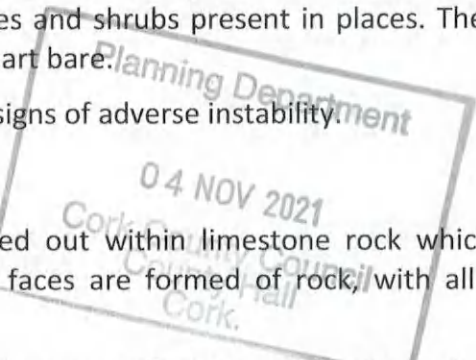
Rock discontinuity surveys were carried out within limestone rock which forms the working faces within the quarry. The faces are formed of rock, with all overburden having been previously removed.

The rock within the faces was described as generally strong to locally moderately strong light grey fine-grained LIMESTONE with occasional calcite veining. Rock was generally moderately weathered with notable staining along fracture surfaces and occasional clay smearing. Local karst features exists, this included clay infilled joints and zones of deeper weathering.

Estimated face height was 8 to 12m with inclinations from generally 70 to locally 90 degrees.

Discontinuity surveys were carried out at the following locations in Rossmore Quarry, namely (Figure 1):

- (1) Western face south. This was an old quarry face and had not been worked for some time (Figures 2 and 3). The face was formed along a pre-existing discontinuity.
- (2) Western face central. This in part was recently worked (Figure 4). The face was formed predominantly along a pre-existing discontinuity. There are locally karstic features present within the rock face; this included deeper zones of weathering and clay infilled joints (Figure 5).



(3) North face. This was recently created by blasting, and is an active working face. The northern face was formed along a pre-existing discontinuity (Figure 6).

3.4 Discontinuity Survey of Rock Faces

Discontinuity surveys were carried out during the site inspection on 18 June 2012. All recorded discontinuities are shown in Figures 7 and 8 and survey data presented in Appendix B.

A comparison of discontinuity survey data from the rock faces showed a similar discontinuity/structural domain throughout the rock within the quarry. Based on all data, 3 major discontinuity sets are present, namely sets A, B and C (Figure 8) as follows:

- (1) Discontinuity set A: dip 70 to 80 degrees with dip direction of 095 degrees
- (2) Discontinuity set B: dip 70 degrees with dip direction of 170 degrees
- (3) Discontinuity set C: dip 15 degrees with dip direction of 265 degrees

Discontinuity sets A and B are notably persistent with discontinuities measured in excess of 10m. Discontinuity set C, which represents the bedding plane, is poorly defined and is less persistent in some areas, with a wavy appearance in other areas.

Discontinuity set A controls the orientation of the west and east face of the quarry. Most of the existing west face has formed along discontinuity set A. Discontinuity set A dips at between about 70 to locally 80 degrees.

The existing north face, which at the time of inspection was recently formed, has formed along the discontinuity set B. Discontinuity set B dips at between about 65 to 70 degrees.

Discontinuity set C comprises a sub-horizontal dipping discontinuity set. This set has relatively minor control on face stability and orientation.

In general, the discontinuity pattern within the rock faces is a rectilinear pattern comprising two orthogonal sub-vertical discontinuity sets (A and B) and a major sub-horizontal discontinuity set (C). There is a minor amount of scattered discontinuities.

For analysis of potential failure mechanisms the discontinuities identified above are plotted on individual stereonet for the proposed orientation of the main working faces in the quarry (Figures 9 to 11).



4 ANALYSIS OF POTENTIAL FAILURE MECHANISMS IN ROCK FACES

4.1 General

To assess the likelihood of potential failures in the rock faces as the quarry floor is lowered, a kinematic assessment was carried out using stereonet and the survey data obtained during the recent inspection.

Details of rock faces analysed are as given in Table 1.

Table 1 Details of rock faces analysed

Face Location	Orientation of Face ⁽¹⁾	Face Inclination (Degrees) ⁽²⁾
Western Face	090	70
Northern Face	180	70
Eastern Face	270	70

Notes

- (1) Orientation of face is based on the general orientation of the quarry workings. Localised curvature in faces is not included.
- (2) The face inclination is based on typical stable inclinations and taking into account the current face inclinations. Locally steeper inclinations may be present on the face.

Discontinuity data has been examined to assess the potential for planar sliding, wedge and block toppling failure. The great circle of the working faces, associated daylighting envelope, friction cone and discontinuity data have been plotted on to stereonets.

Friction envelope is assumed as 40°, which represents a typical friction angle for rock joints.

4.2 Results of Kinematic Assessment

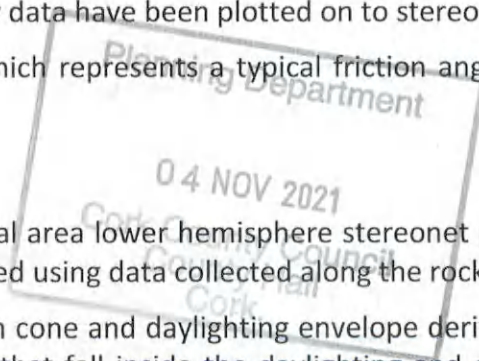
Results of the survey are shown on equal area lower hemisphere stereonet projections in Figures 9 to 11. Stereonets were plotted using data collected along the rock faces.

Planar sliding was assessed using friction cone and daylighting envelope derived for the face geometry. Poles to discontinuities that fall inside the daylighting and outside the friction envelope represent potential planar sliding instability.

An assessment of potential toppling failure was carried out using toppling envelopes superimposed on stereonets. The toppling envelope assumes that toppling failures are much more likely to occur where the difference between slope and discontinuity dip is +/- 15°. A basal plane also needs to be present.

By inspection, intersecting wedge failures appear to be limited. This however does not discount the possibility of intersection of rogue inclined discontinuities.

Minor rockfall is possible from all faces. Particularly where minor overhangs are present and where slope crest areas contain loose rock pieces.



Kinematic analysis has examined potential failures using data from the working faces with the results given in Table 2.

Table 2 Results of kinematic assessment for working faces

Face Location	Potential Failure Assessment		
	Description of Potential Failures	Details of Potential Failure	Failure Potential
Western Face (Figure 9)	Minor/negligible potential for toppling. Minor/negligible potential of sliding failure on minor random inclined discontinuities	Toppling failures are considered to be localised and limited in scale Stereonet analysis indicates locally minor/negligible potential for sliding failure.	Low
Northern Face (Figure 10)	Minor/negligible potential for toppling. Minor/negligible potential of sliding failure on minor random inclined discontinuities	Toppling failures are considered to be localised and limited in scale Stereonet analysis indicates locally minor/negligible potential for sliding failure. Where sliding is possible then it would be at high inclinations of about +60°, and it is likely that the face would naturally form at these inclinations.	Low
Eastern Face (Figure 11)	Moderate potential for toppling. Minor/negligible potential of sliding failure on minor random inclined discontinuities	There is a moderate potential for toppling failures due to particularly discontinuity set A with the basal release provided by set C. Stereonet analysis indicates locally minor/negligible potential for sliding failure.	Low to Medium (for toppling)

Note: The above failure potential is based on judgment using the findings from stereonets.

Minor rockfall is possible from all faces, particularly on the uppermost faces where the rock is more weathered and fractured. Where there are minor overhangs and a slope crest area that contains loose rock pieces then there is an elevated potential for minor rockfall.

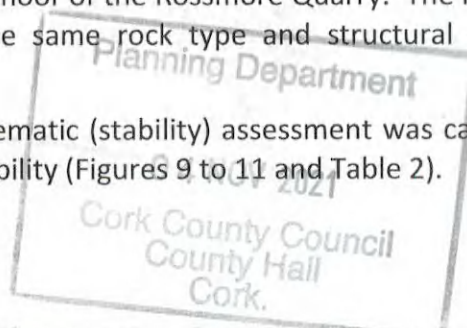
Analysis of the southern face has not been carried out as this face will not be as high as the above faces. Results for a southern face would be similar to the northern face with an elevated potential for toppling.



5 CONCLUSIONS

The findings of the geotechnical assessment are as follows:

- (1) This report includes a geotechnical assessment of the quarry working faces as part of a planning proposal to lower the floor across the quarry to -20m OD. The current layout of the quarry is shown in Figure 1. The quarry workings comprise the extraction and processing of limestone rock into aggregate for use in construction.
- (2) The inspection involved a survey to determine the major discontinuity sets within particularly the quarry rock faces bordering the neighbouring quarry on the western side of Rossmore Quarry. The findings of the survey were used to assess the risk of slope failures as working faces are advanced and lowered. An inspection of the soil slope above the rock faces along the western boundary was also carried out.
- (3) Inspection of the soil slope along the western quarry bound showed that the slope comprised dominantly placed soil material, with some in situ soil present. The soil was described as firm to stiff sandy very gravelly SILT/CLAY with much sub-rounded to angular limestone cobbles and occasional boulders. Inspection of the soil slope showed no signs of adverse instability.
- (4) The rock within the quarry comprised essentially a fine-grained mud mound limestone. The rock was described as strong to locally moderately strong light grey fine-grained LIMESTONE with occasional calcite veining. Localised karst features exist, which included clay infilled joints and zones of deeper weathering.
- (5) The discontinuity pattern within the rock faces was rectilinear comprising two orthogonal sub-vertical discontinuity sets (A and B) and a major sub-horizontal discontinuity set (C), see Figures 7 and 8. This discontinuity pattern provides a relatively stable rock face configuration.
- (6) Rock face configuration is controlled to a degree by the existing discontinuity pattern, notably discontinuity sets A and B.
- (7) The rock discontinuity survey was carried out at a number of locations along the east and north faces of the quarry. A comparison of discontinuity survey data from the rock faces showed a similar discontinuity/structural domain throughout the rock within the quarry. Lowering of the quarry floor will expose a similar structural domain within the rock faces.
- (8) The neighbouring quarry is currently active and its operating floor is notably lower than the current floor of the Rossmore Quarry. The neighbouring quarry is also located within the same rock type and structural domain as Rossmore Quarry.
- (9) Using stereonet a kinematic (stability) assessment was carried out for the rock faces to assess face stability (Figures 9 to 11 and Table 2).



- (10) With respect to face stability there is considered a minor to negligible potential of sliding from all faces. There is an increasing potential for toppling failure from the eastern face, though this is an internal face and would not affect neighbouring property.
- (11) Failure potential is given as low for the western face that forms the boundary to the neighbouring quarry. Lowering of the quarry floor will have no adverse effect on the stability of the neighbouring property. The current rock face configuration is stable and will not be adversely affected by lowering of the quarry floor.

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6 REFERENCES

Geological Survey of Ireland (1994). Geology of South Cork. A Geological Description of the South Cork and Adjoining Parts of Waterford to Accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 25, South Cork. Geological Survey of Ireland, Department of Transport, Energy and Communications.

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FIGURES

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Figure 2 View of western face of Rossmore Quarry that borders neighbouring quarry

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Figure 3 View of southern part of western face



Figure 4 View of central part of western face

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Figure 5 View of central part of western face showing clay infilled joint



Figure 6 View of northern face

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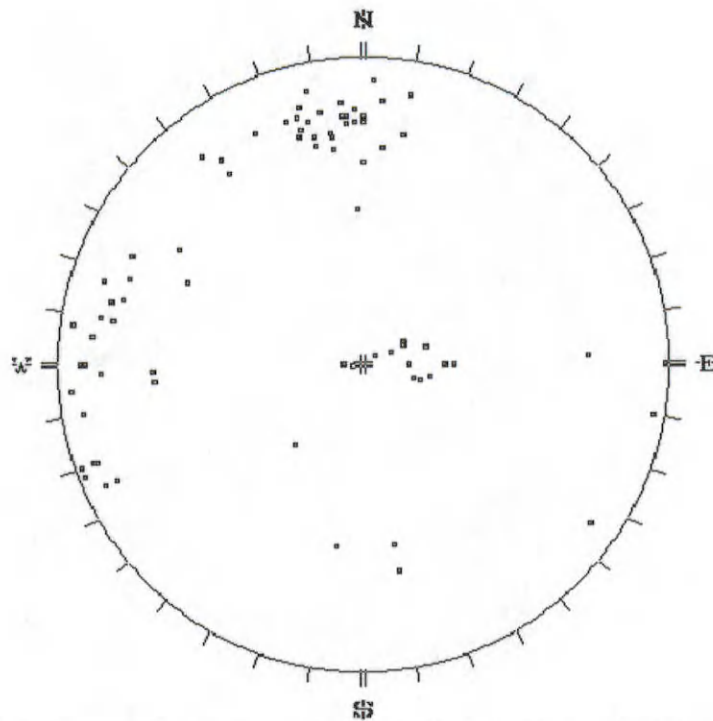


Figure 7 Stereonet showing pole data for all discontinuities in rock faces

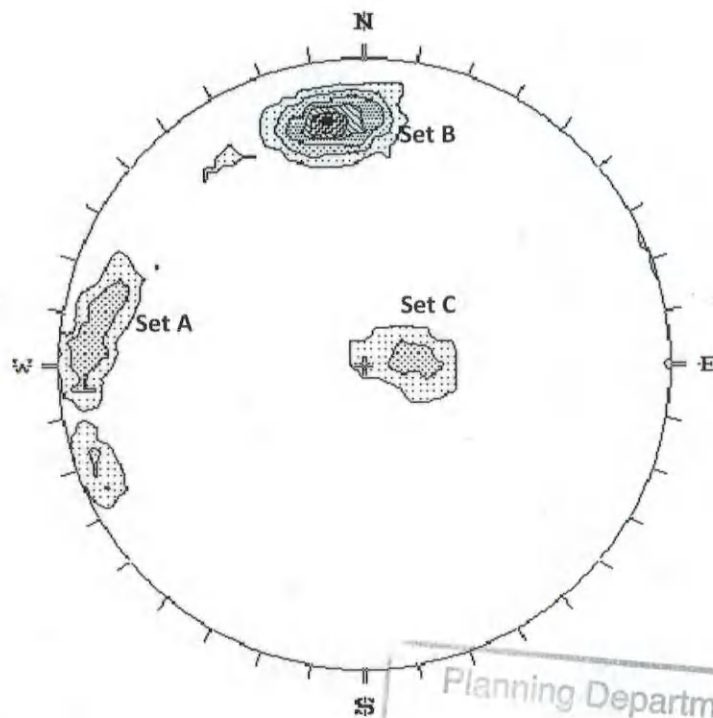


Figure 8 Stereonet showing major discontinuity sets for all discontinuities in rock faces

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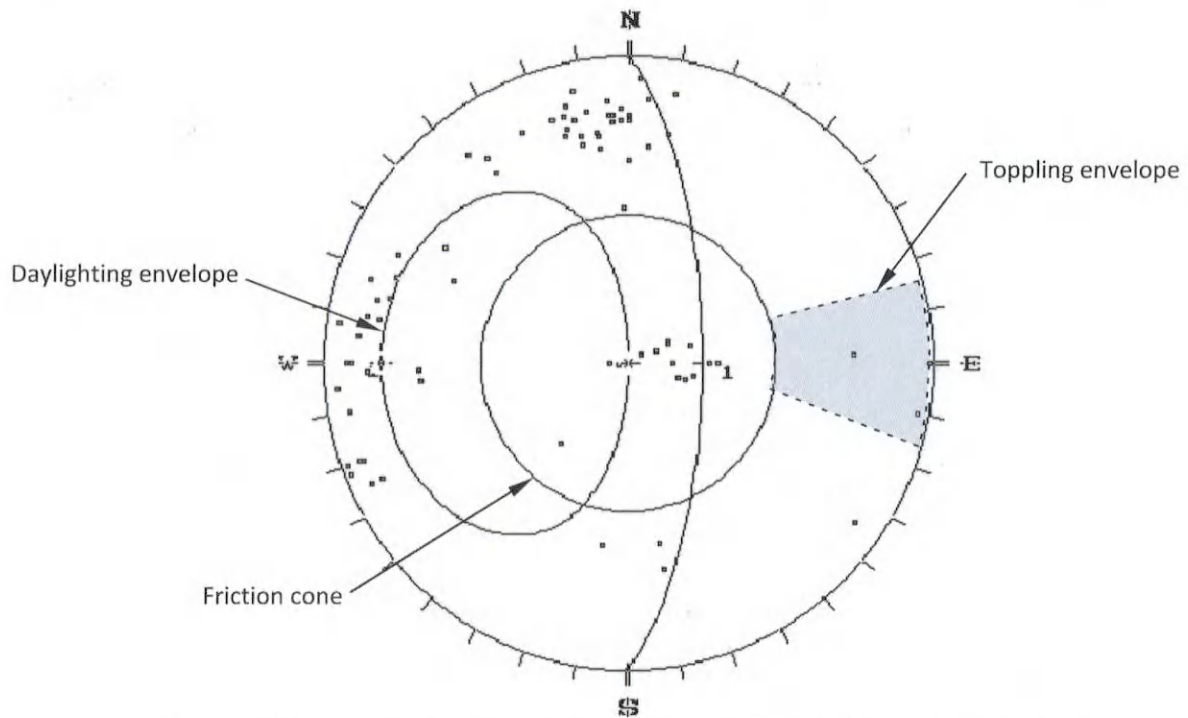


Figure 9 Stereonet showing major discontinuity sets for western face

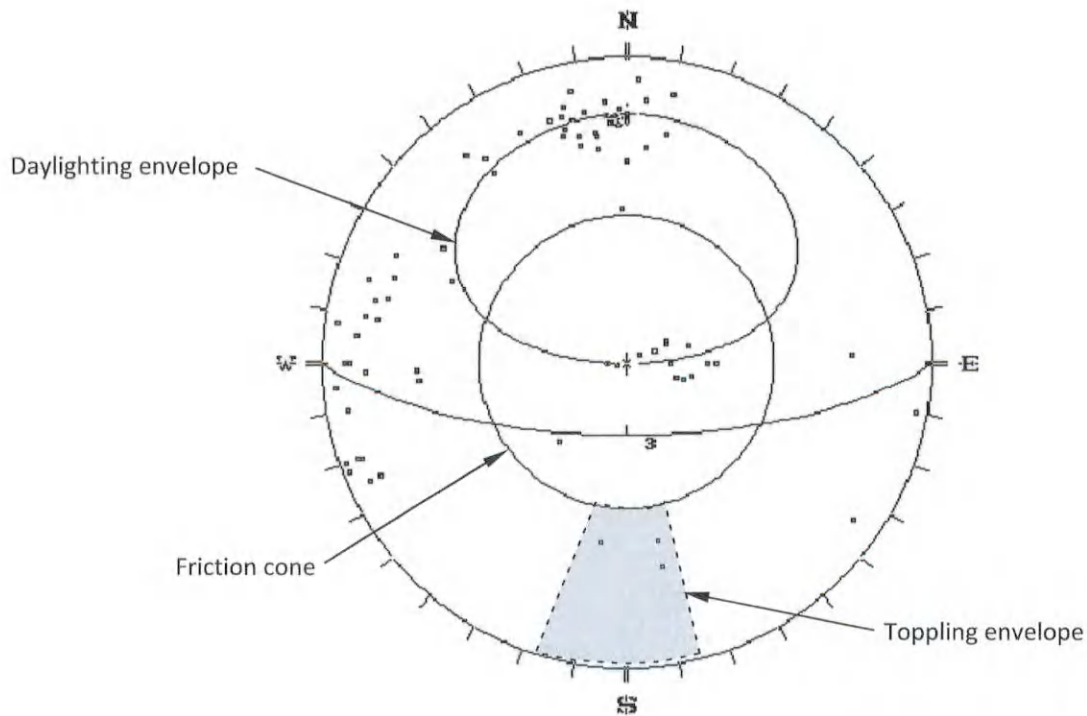


Figure 10 Stereonet showing major discontinuity sets for northern face

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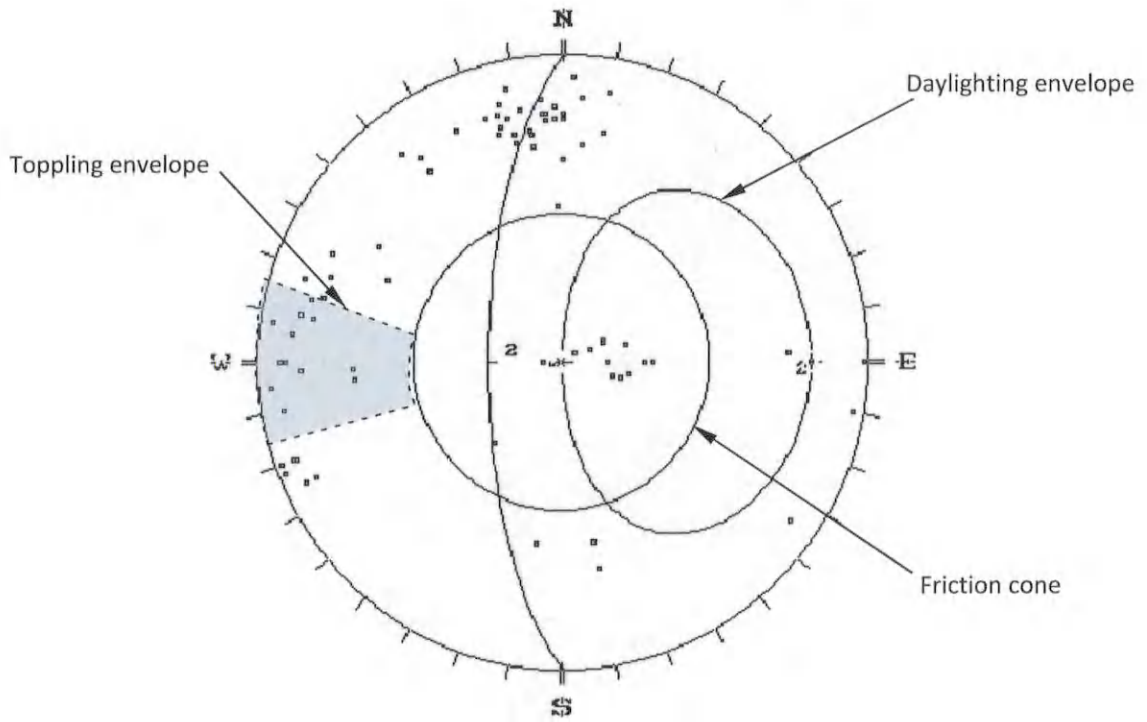
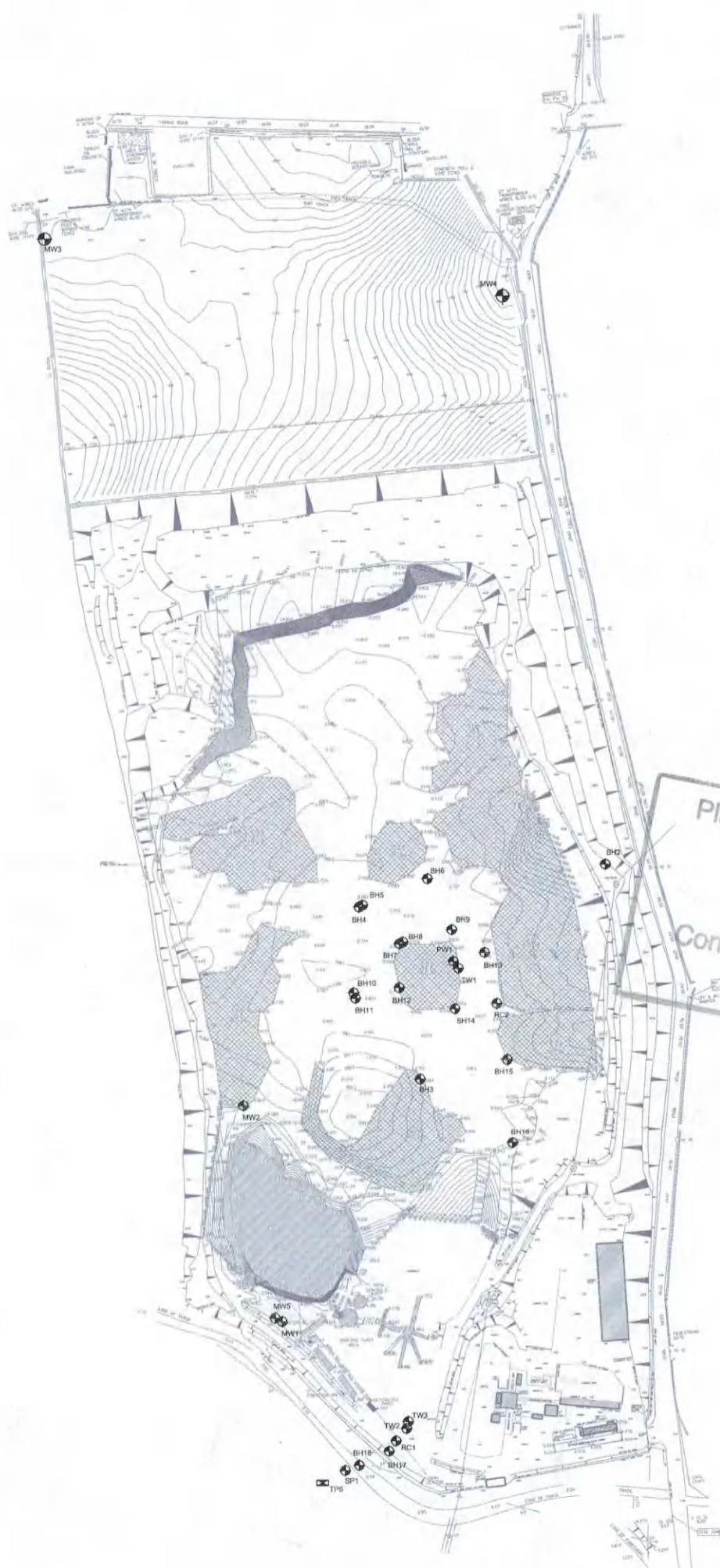


Figure 11 Stereonet showing major discontinuity sets for eastern face

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APPENDIX A

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Legend:
● Borehole
■ Trench

tms environment ltd
TMS Environment Ltd
53 Broomhill Drive
Tallaght
Dublin 24
Phone: +353-1-4626710
Fax: +353-1-4626714

Client: Irish Asphalt

Job: 18794

Title: Site Investigation
Locations, Quarry

Drng No: 7.1	Drawn: CM
Scale: 1:2500 @A3	Checked: G. O'C
Date: JUNE 2012	Approved: G. O'C



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Dublin 24, Ireland. Tel: +353-1-4626710

BOREHOLE LOG

Sheet 1 of 2

BOREHOLE NO. MW01

GENERAL DETAILS

Project No: 13692
Client: Irish Asphalt Ltd.
Site Name: Rossmore Quarry
Grid Ref: 182376 70821
Top of Casing: 3.634 mOD
Total Depth: 72 meters

Commenced: 17/07/2008
Completed: 17/07/2008
Contractor: Southern Pumps Ltd.
Machine: Atlas Copco
Drilling Method: Air Rotary
Logged by: Phoebe Conway, TMS Environment Ltd.

DRILLING DETAILS

Ground level - 6mbgl: drilled at 8-inch diameter.
6 - 72mbgl: drilled at 6-inch diameter
Casing depth: 0 - 6mbgl

Casing diameter: 6-inch steel to 6mbgl

WATER

Water strikes at 9mbgl, 35mbgl, 51mbgl and 64mbgl
Estimated Final Yield: 1100 gallons per hour

FINAL INSTALLATION

1 Standpipe installed.
Ground level - 24mbgl: plain 2-inch PVC, 24 - 72mbgl: 2-inch PVC screen.
Ground level - 6mbgl: pea gravel (5mm to 8mm), 6 - 7mbgl: bentonite pellets,
7 - 72mbgl: pea gravel (5mm to 8mm).

NOTES

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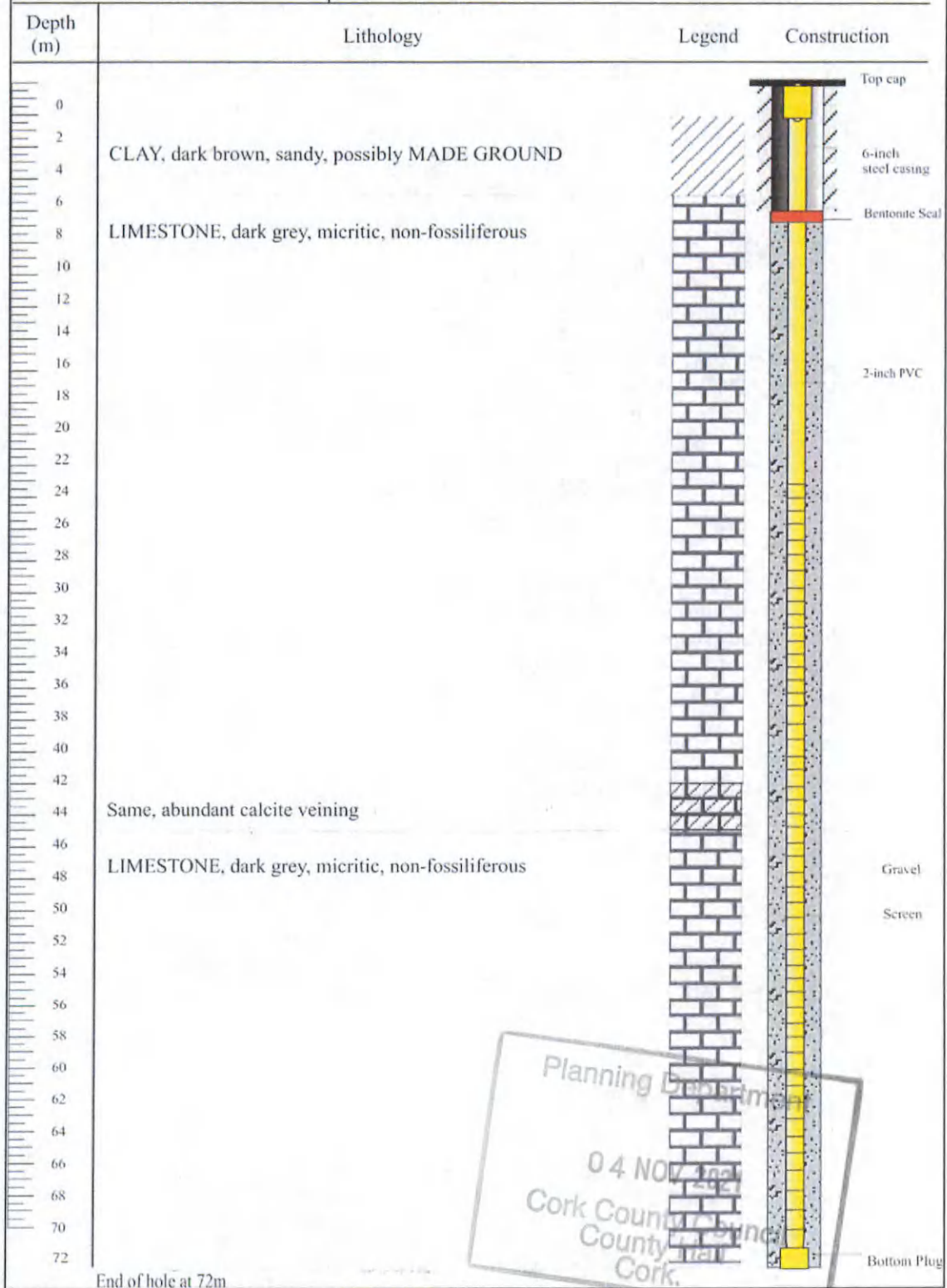


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Project No.13692
Site Name: Rossmore Quarry
Borehole No. MW01

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BOREHOLE LOG

Sheet 1 of 2

BOREHOLE NO. MW 02

GENERAL DETAILS

Project No: 13692
Client: Irish Asphalt Ltd.
Site Name: Rossmore Quarry
Grid Ref: 182354 70944
Top of Casing: -0.675 mOD
Total Depth: 66 meters

Commenced: 18/07/2008
Completed: 18/07/2008
Contractor: Southern Pumps Ltd.
Machine: Atlas Copco
Drilling Method: Air Rotary
Logged by: Phoebe Conway, TMS Environment Ltd.

DRILLING DETAILS

Ground level - 6mbgl: drilled at 8-inch diameter.
6 - 66mbgl: drilled at 6-inch diameter
Casing depth: 0 - 6mbgl
Casing diameter: 6-inch steel to 6mbgl

WATER

Water strikes at 7mbgl and 36mbgl
Estimated Final Yield: 20 gallons per hour

FINAL INSTALLATION

1 Standpipe installed.
Ground level - 18mbgl: plain 2-inch PVC, 18 - 66mbgl: 2-inch PVC screen.
Ground level - 6mbgl: pea gravel (5mm to 8mm), 6 - 7mbgl: bentonite pellets,
7 - 66mbgl: pea gravel (5mm to 8mm).

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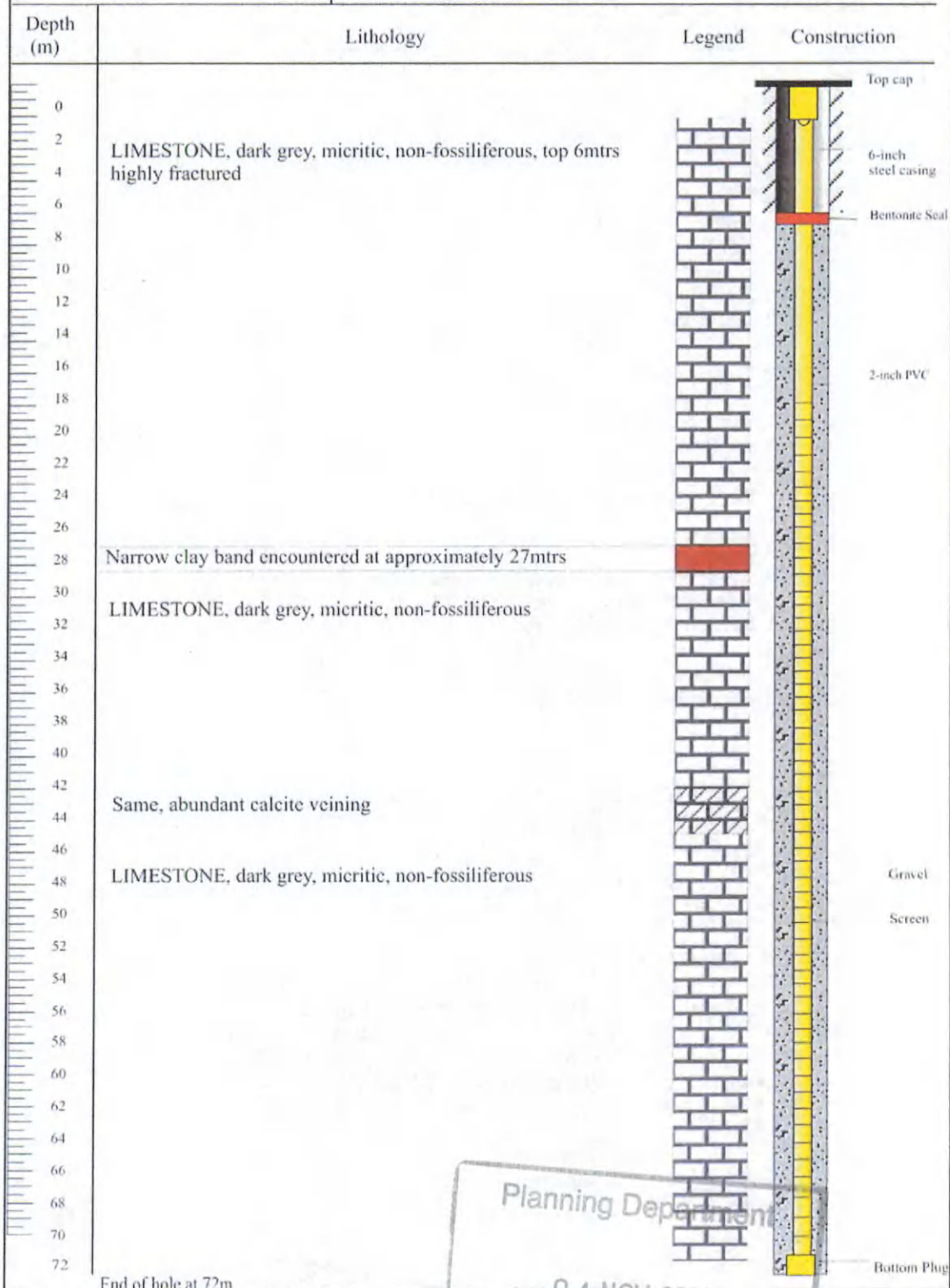


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Project No. 13692
Site Name: Rossmore Quarry
Borehole No. MW 02

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BOREHOLE LOG

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BOREHOLE NO. MW 05

GENERAL DETAILS

Project No: 13692
Client: Irish Asphalt Ltd.
Site Name: Rossmore Quarry
Grid Ref: 182372 70823
Top of Casing: 4.543 mOD
Total Depth: 50 meters

Commenced: 17/11/2009
Completed: 17/11/2009
Contractor: Leo O'Sullivan & Co.
Machine: Atlas Copco
Drilling Method: Air Rotary
Logged by: Phoebe Conway, TMS Environment Ltd.

DRILLING DETAILS

Ground level - 9mbgl: drilled at 10-inch diameter.
9 - 50mbgl: drilled at 6-inch diameter
Casing depth: 0 - 9mbgl

Casing diameter: 6-inch steel to 9mbgl

WATER

Water strikes at 8mbgl, 12mbgl, 15mbgl and 36mbgl
Estimated Final Yield: 920 gallons per hour

FINAL INSTALLATION

2 Standpipes installed.
Ground level - 35mbgl: plain 2-inch PVC, 35 - 50mbgl: 2-inch PVC screen.
Ground level - 9mbgl : plain 1-inch PVC, 9 - 24mbgl: 1-inch PVC screen
Ground level - 8.5mbgl: Bentonite/cement mix, 8.5 - 9mbgl: Bentonite Pellet Layer,
9 - 24mbgl: pea gravel (5mm to 8mm), 24 - 32.5mbgl: bentonite/cement mix,
32.5 - 33.5mbgl: Bentonite Pellet Layer, 33.5 - 34mbgl: Sand Layer,
34 - 50mbgl: pea gravel (5mm to 8mm).

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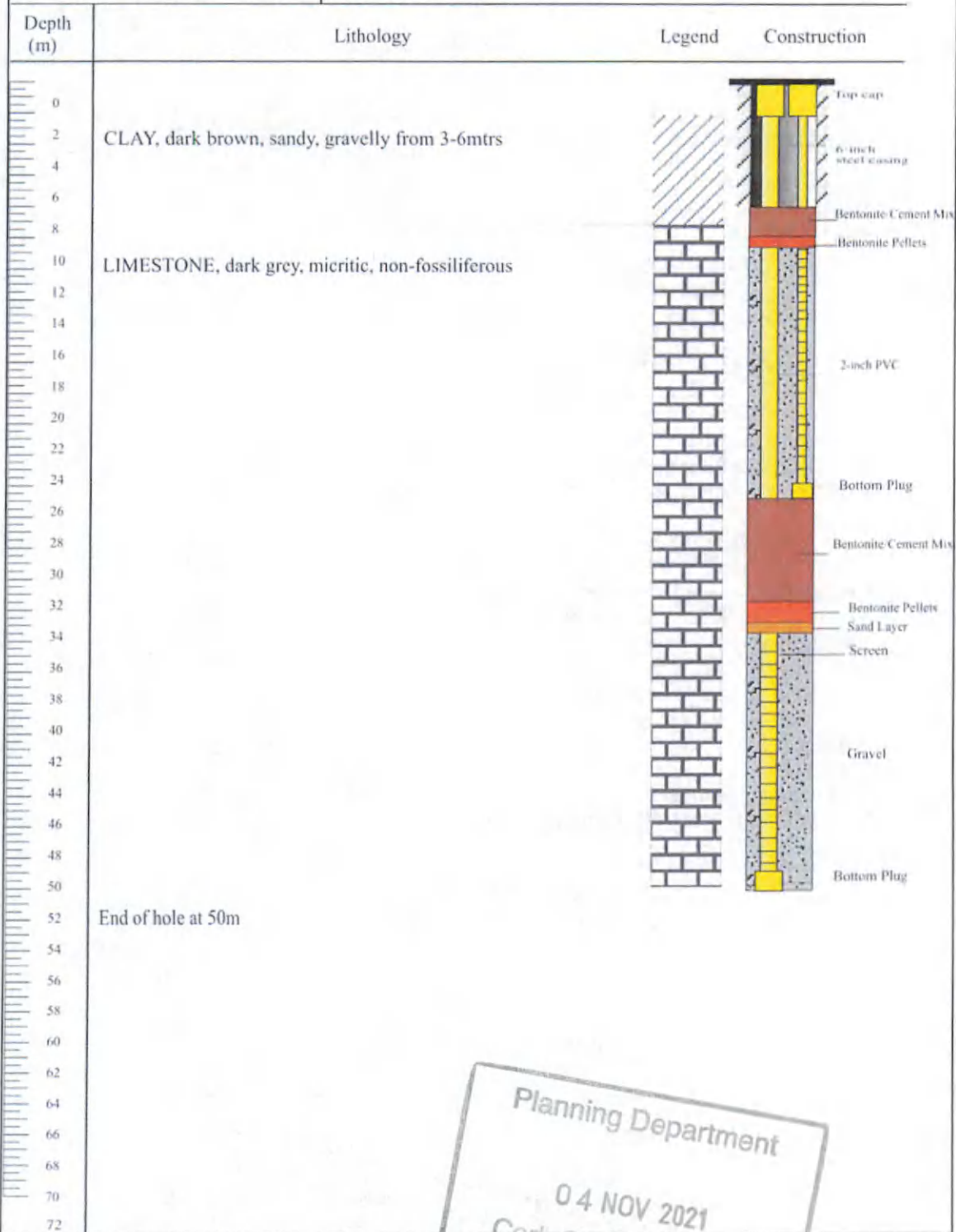
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Project No.13692
Site Name: Rossmore Quarry
Borehole No. MW 05

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BOREHOLE LOG

Sheet 1 of 2

BOREHOLE NO. BH 03

GENERAL DETAILS

Project No: 13692
Client: Irish Asphalt Ltd.
Site Name: Rossmore Quarry
Grid Ref: 182455 70960
Top of Casing: 2.222 mOD
Total Depth: 66 meters

Commenced: 17/07/2008
Completed: 17/07/2008
Contractor: Southern Pumps Ltd.
Machine: Atlas Copco
Drilling Method: Air Rotary
Logged by: Phoebe Conway, TMS Environment Ltd.

DRILLING DETAILS

Ground level - 3mbgl: drilled at 12-inch diameter.
3 - 66mbgl: drilled at 8-inch diameter
Casing depth: 0 - 3mbgl

Casing diameter: 8-inch steel to 3mbgl

WATER

Water strike at 48mbgl
Estimated Final Yield: 50 gallons per hour

FINAL INSTALLATION

No installation in well, borehole completed open hole.

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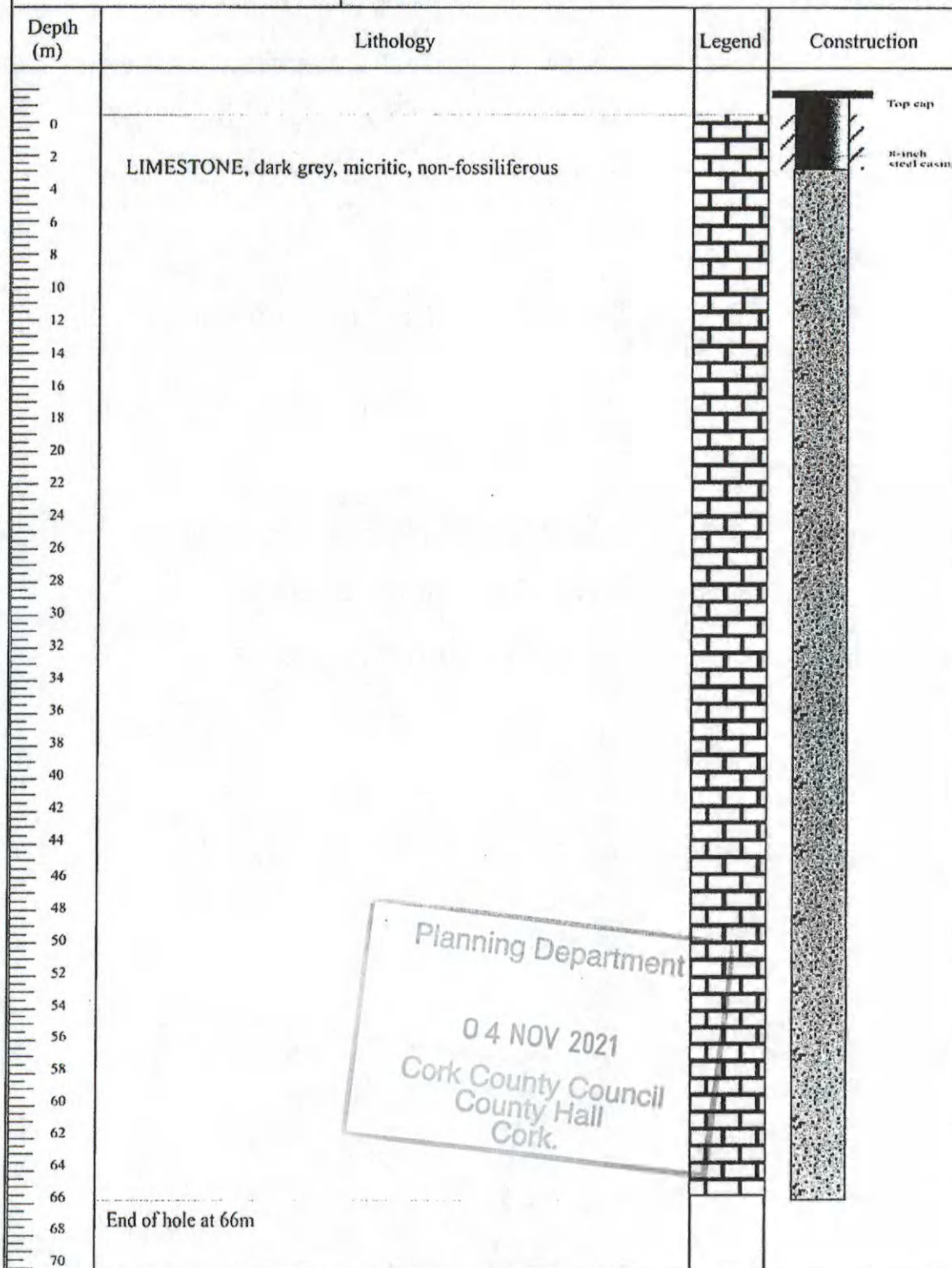


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Project No. 13692
Site Name: Rossmore Quarry
Borehole No. BH 03

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 <p>tms environment ltd 53 Broomhill Drive, Tallaght, Dublin 24, Ireland. Tel: +353-1-4626710</p>	<h1>Borehole Record</h1>	<h1>BH4</h1>
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<p>Project No: 18794 Client: Irish Asphalt Ltd Site Location: Rossmore, Co. Cork</p>	<p>Date: 13/2/2012 Driller: Eddie Hogan Drilling Method: DTH hammer/air flush Supervisor: Craig O'Connor Irish Grid Ref: 182420 71057</p>
----------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------

Lithology:

0 – 10m LIMESTONE, dark grey, micritic, non-fossiliferous
10m End of Hole

Comments:

Borehole Diameter: 120mm

Fractures: Solid rock, no cavities or significant fracture zones encountered

Water Strikes: No significant water strikes, returns wet from 7m

Completion: Open hole - 3m plastic liner installed at surface

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