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Coolnabacky 400/110kV Substation Drainage and Services Report

EIRGRID

Laois - Kilkenny Reinforcement Project
Coolnabacky 400/110kV Substation

PE687-F0261-R261-016

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APPROVED: Donal Walsh ***TITLE:*** ***CBE Team Leader***	***DATE: 10/11/12***

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Executive Summary

This report covers aspects of the surface water drainage, foul water drainage and water supply for the Coolnabacky 400/110kV Electrical Substation.

Sustainability and minimising the impact of the proposed Electrical Substation Development have been key factors in formulating the proposals for the associated Surface Water drainage, Foul Water drainage and Water Supply services discussed in this report.

The use of Sustainable Drainage Systems (SuDS) in the Surface Water drainage will be referred to throughout the report. The SuDS techniques proposed in the design of the station will ensure that the natural drainage patterns are replicated and no negative impact results from the development in terms of water quality discharged from the development in the construction or operational stage or in the quantity of runoff from the development.

Proposals for the treatment and disposal of the Foul Water generated on site were considered and discussed with the most appropriate system to the development selected following on site testing and subsequent consultation with the relevant department of the Local Authority – Laois County Council (LCC). The foul water management proposal selected and agreed with LCC following this process is for provision of a foul water holding tank in the development.

Similarly the water supply proposals to the station have been the subject of consultation with the relevant department of LCC and have been agreed.

Contents

1 Introduction

1.1 Background

The site of the proposed 400/110kV Gas Insulated Switchgear (GIS) substation is located in the townland of Coolnabacky in County Laois. Access to the site is just off the R426 which connects Portlaoise and Timahoe. The site is approximately 2.5km from the village of Timahoe.

The site of the proposed substation development itself is predominantly in one field currently utilised for agricultural purposes with the access roadway along an existing private track which will require widening, some resurfacing and slight route alterations to remove bad bends. The existing track entrance junction with the public roadway will be moved in accordance with the wishes of the local authority and this is covered elsewhere in the application.

1.2 Project Description

The proposed development of the 400kV & 110kV Electrical GIS Substation will include two buildings to house electrical equipment and two electrical transformer bunds within a fenced off compound with internal concrete roadways and the remaining area surfaced with permeable single size clean stone. There will be an entrance road to the gate of the compound from the main public road, the R426. These are the areas of the development within the station compound that require surface water drainage. Improved drainage will be provided to the existing access track as part of the track widening works.

The Substation will be an unmanned facility in the operational phase but will require welfare facilities for staff visiting the substation for inspections, routine maintenance and extraordinary maintenance as the need arises. These welfare facilities including toilets (WC), wash hand basin (WHB) and sinks will have a water demand and will generate wastewater.

2 Surface Water

2.1 Existing Surface Water

The field where the Electrical Substation compound is proposed to be located is currently well served by existing drainage ditches along the field boundary on all sides. These drainage ditches are well established and vegetated. There are some minor culverts of the drainage ditches where there is access between fields.

An un-named watercourse runs along the North Eastern boundary on the other side of the hedgerow. The drainage ditches around the site all discharge to this watercourse. The un-named watercourse is a tributary of the Timahoe River. The Timahoe River joins with the Honey Stream to become the Bauteogue River which in turn joins with the Timogue River in the town of Stradbally to become the Stradbally River. The Stradbally River is a tributary of the River Barrow.

2.2 Surface Water Drainage Proposals

Surface Water proposals for the development have been developed to mimic the natural drainage patterns of the site and in accordance with the Best Management Practices (BMPs) of Sustainable Drainage Systems (SuDS). The site drainage proposals are shown on drawings PE610-D002-001, 002, 003, 005, 006, 007, 008 and 009 which are located in Volume 1 of the planning pack. A full drainage drawing list is appended to this report (Appendix G) for reference purposes.

The surface water proposals include measures to attenuate surface water to Greenfield runoff rates and to provide extensive treatment of surface water prior to discharge from the site.

The surface water treatment measures proposed for the development include swales, vegetated filter strips, land drains, silt fences, oil separators, settlement ponds with check dams and wetland planting to ensure the highest quality of surface water discharge to existing vegetated drainage ditches. Protection of the watercourse in both the construction and operation phase of the proposed development was paramount in developing the drainage proposals.

Surface water attenuation on site was a requirement of the Local Authority (LCC) following consultations in the offices of LCC on the 18/04/12 and 01/08/12. Surface water attenuation is also a key element of Sustainable Development and forms part of the proposals.

Source control and infiltration techniques such as soakaways were considered for the disposal of surface water generated on the site. Accordingly, infiltration tests were carried out on the site during the site investigations. The tests were carried out in accordance with the Building Research Establishment (BRE) Digest 365 at two locations in the field where the compound is proposed. The results of these tests showed a lack of infiltration possibilities on the main part of the site where the compound is located. The results of the infiltration tests are included in Appendix B – Site Investigations.

2.2.1 Water Volumes

It is proposed to limit the discharge from the development to Greenfield runoff rates. The Greenfield runoff rate from the site has been estimated using equations in the Flood Studies Report for the estimation of the mean annual flood, more commonly known as the $Q_{BARrural}$ calculation. Discharge from the site compound will be limited to the Greenfield runoff rate through the use of vortex flow control units and surface water will be attenuated within the ponds located around the compound. The Greenfield runoff rate for the site has been calculated as 26.6 l/s which equates to a value of just over 4 l/s/hA.

The attenuation volume has been calculated from runoff generated within the compound and using Rainfall Data from Met Éireann for the site for the 1 in 100 year storm. Runoff rates have been calculated on the basis that 100% of the rainfall from the hard surfaces, which are positively connected to the drainage network i.e. building roofs and bunds, and 50% of rainfall in the stone compound area will discharge from the site. These runoff coefficients (or C_v values) have been agreed with the local authority. The rainfall data has been factored up by 10% to allow for climate change in accordance with best practice and the wishes of the local authority. The attenuation volume has been calculated so that no flooding will occur on the site for the 100 year return period.

The calculations for the Greenfield runoff rates and the attenuation volume are appended herewith. The allowable Greenfield runoff rate from the site has been proportionally divided between the two discharge points from the

compound drainage network to internal drainage ditches surrounding the site based on the area and associated runoff coefficients of the surfaces draining to each discharge point. There will be a flow control unit on each discharge downstream of the two proposed pond systems that when combined add up to the total allowable runoff rate from the site.

The total required attenuation volume is $163m^3$ and the combined attenuation volume provided within the settlement ponds is $250m^3$. This attenuation volume is in addition to a permanent water treatment volume of $180m^3$ which will be set out in Section 2.2.2. The attenuation volume allows for 65% greater capacity than is required that may allow for any siltation in the ponds between maintenance periods or storm events in excess of the design return period.

Details of the combined attenuation and settlement ponds are shown on drawing PE610-D002-004-009. All attenuation calculations, design approach and proposals in drawing format have been tabled, discussed and agreed with representatives of the relevant department of LCC at meetings held in their offices.

It is anticipated that the permanent water volume in the ponds combined with wetland planting will allow for evapotransporation and further infiltration prior to discharge. This will further reduce the ultimate discharge volumes to the watercourse and will further increase the attenuation capacity in the ponds.

2.2.2 Water Quality

Surface water discharge quality was a major consideration in the formation of the proposals as the watercourse that it is proposed to discharge to is within the River Barrow Catchment. This catchment is an environmentally protected conservation area. This is covered in more detail in the Environmental Report and screening for appropriate assessment is contained elsewhere in the application. The drainage design has been formulated to limit the impact of the proposed development using the Best Management Practices of SuDS. Sediment control in particular during the construction and post construction stages are important considerations for the protection of the receiving waters.

Erosion control measures to prevent runoff flowing across exposed or excavated ground and becoming polluted with sediments will be provided for in the construction management proposals. Silt fences and a land drain will be provided around the on site berms to intercept sediment runoff from

the stored excavated material until the berms become vegetated. An additional temporary settlement pond will be provided for the larger of the two berms during the construction period and until the berm is vegetated.

Drainage runoff controls such as settlement ponds will be provided and installed before starting site clearance and earthworks. The settlement ponds proposed comprise a system of check dams which will further divide the ponds into primary, secondary and final settlement ponds. These will be lined with a geotextile material a bed of 200mm of single size clean stone.

The settlement ponds will have a permanent water depth of 300mm and a combined treatment volume of 180m^3. These ponds will remain in place post construction and will provide water treatment for the constructed compound also. Details of the settlement ponds are shown on drawing PE610-D002-004-009.

As the ponds provide well in excess of the attenuation capacity required for a 100 year return period, the permanent water depth and treatment volume may be increased temporarily during the construction period when silt generation will be at its worst. Temporary drainage from the site berms will be provided via French Drains until the berms are vegetated and construction vehicle access to the berms is no longer required. The berms will be surrounded with silt fences also.

Ultimately, the ponds will have a permanent treatment volume capable of treating the surface water runoff generated from the developed site. Pond system 1 to the North of the site will have capacity to treat approximately the first 20mm of rainfall on the 400kV building and the stone area of the site. Pond system 2 will have capacity to treat the first 33mm of rainfall generated in the Electrical Transformer bunds and the 110kV building. Both pond systems have capacity to treat well in excess of the accepted 'first flush' standard of the first 15mm of rainfall that transports the majority of sediment/ pollution from hardstanding surfaces.

In addition to settlement out of suspended solids carried by surface water runoff, the final settlement pond will incorporate wetland planting in accordance with the Ecologist's recommendations. The detail of the wetland planting is detailed on the Landscape Architects drawings in Volume 1 of the planning pack.

The surface water generated in the bunded areas will discharge to the ponds via a Class 1 Full Retention Oil Separator. The two electrical transformers in the substation are oil filled equipment and as such are placed within impermeable bunds. Surface water generated in these bunds will be pumped out by an oil sensitive pump ensuring that only non contaminated water enters the site drainage network. The Class 1 Full Retention Oil Separator will provide a second level of defence. The ponds will provide a third level of defence with filtration through the check dams and exposure to sunlight within the ponds that will provide further opportunity for the breakdown of hydrocarbons in the extremely unlikely event of any being present at this point.

Vegetated swales will be constructed alongside the existing access track to the site which currently has no dedicated drainage. It is proposed to widen the access track. The surfacing of the access track will remain as stone except for a small section at the entrance and junction with the public roadway. The vegetated swales will fall with the road and will discharge to nearby existing drainage ditches. Where the fall in the swale exceeds 1:100, a combination of timber and stone check dams will be provided at construction stage to encourage infiltration and settlement of solids. The swale serving a short section of roadway closest to the public roadway and the entrance bell mouth at the junction with the public roadway will discharge to what is an existing vegetated grassy area as a filter strip/ vegetated buffer zone prior to discharge to an adjacent existing watercourse.

These water quality proposals set out herein have had a favourable response from and have been agreed in meetings with the relevant department of LCC in consultations held in their offices on the 18/04/2012 and 01/08/2012.

3 Foul Water

3.1 Existing Foul

There are no existing foul water drains on the site or in the vicinity of the site. The dispersed settlement pattern of the surrounding area suggests that the individual farm dwellings use standalone private foul treatment and disposal systems.

3.2 Foul Water Drainage Proposals

The foul drainage proposals have to cater for the wastewater generated in the welfare facilities of the proposed development. These welfare facilities include for a toilet and wash hand basin in each of the two buildings and a sink within a small canteen or mess room. The station will be unmanned in normal operation so demand for the facilities which generate foul flows will be low.

On site treatment and disposal of foul waste was considered and a site characterisation testing was carried out as part of the site investigations. The test was carried out on the site by a suitably qualified site assessor in accordance with EPA guidelines. The results of the test showed that the area is suitable for a septic tank and intermittent filter system and polishing unit or a package wastewater treatment system and polishing unit. The site characterisation report is appended herewith (Appendix E). The site characterisation report indicates that a packaged foul treatment unit with a raised polishing filter may be acceptable as an option. However, the low volumes of foul waste that will be generated and consequently the low biological loading may impact on the successful continual operation of a treatment system reliant on bacterial action. For this reason an alternative of a foul holding tank to be emptied periodically was proposed in correspondence with the relevant department of LCC.

A foul holding tank to be maintained and emptied bi-annually is considered the most preferable means of treating and disposing of foul waste from the site by LCC subject to conditions. The licensed contractor charged to empty and dispose of the waste will be the holder of a valid waste collection permit issued by LCC.

The foul holding tank proposed will have a capacity of $10m^3$ which is a multiple of the foul water generated over 6 months of normal operation of the station as outlined in section 3.2.1 and Appendix D of this report. The

foul holding tank will also be inspected by a suitably qualified and indemnified person at these intervals and records of inspections will be held on site for inspection by the local authority. This is in accordance with the expressed requirements of LCC.

A freeboard in excess of 300mm will be provided for and the foul holding tank will be fitted with a high level alarm. This alarm will be connected back to the station control panel which is connected to a manned control centre via the station's Supervisory Control and Data Acquisition (SCADA) telecom relay system. This will allow for non scheduled maintenance and emptying of the tank between the regular 6 monthly intervals in the very unlikely event that this is required. This satisfies the requirements arising out of correspondence with LCC.

The foul holding tank will also be vented to the atmosphere to avoid the build up of noxious and dangerous gases.

3.2.1 Foul Water Volumes

The proposed station will be unmanned and as such will generate small quantities of foul waste. There will be visits to the station for scheduled and unscheduled visits for inspections, maintenance and repairs as necessary. A two man crew visiting the site for two days a week would be the most that would be expected on the site. In such circumstances the operatives could be expected to use each of the facilities four times a day. This would result in a weekly contribution of 60 litres of foul waste per week. The breakdown of usage is included in Appendix D. In the very unlikely event that such a high visitation rate would be extrapolated throughout the year, this would result in 6,323 litres per annum. While such a consistently high visitation rate is improbable, there is the possibility of increased numbers of staff being present on site for short durations of one to two weeks for the commissioning of electrical elements of the station from time to time. It is envisaged that these extraordinary occurrences would balance out with the ordinary operation of the unmanned station to produce foul flows no greater than the 6,323 litres per annum.

It is common for much lower usage of the facilities on unmanned stations and therefore a much lower foul loading. A common problem on such unmanned stations is odours in the toilet areas due to the drying out of the water trap in the WC through evaporation resulting from the lack of use. For this reason it is proposed to use self flushing toilets in the station, which would flush automatically twice a week. The station will include 2 no. 6 litres flush WC's so a minimum weekly foul flow of 24 litres can be

expected. The self flushing WC's will therefore contribute 1,248 litres per annum.

Combining the automatic flush and maximum user demand figures would result in a maximum annual generation of 7,571 litres of foul water.

The maximum and minimum foul flows are set out in Appendix D of this report.

4 Water Supply

4.1 Existing Water Supply

There is currently no water connection within the main body of the site of the proposed electrical substation compound.

4.2 Water Supply Proposals

The proposed substation site is remote from the public roadway and the public water supply system. It is proposed to provide the required potable water demand of the station with a well on the site.

The potable water demand within the site will be low as the proposed station is to be unmanned. To avoid problems like stagnation in the water supply line and problems resulting from this there will be a continual water demand of 24 litres per week from automatically flushing WC's within the station.

Consultation with the relevant departments of Laois Co. Co. was an important consideration in formulating the water supply proposals for the proposed development.

4.2.1 Water Supply Volumes

The water demand within the proposed development will be low and will be similar to the figures for the foul water generation as set out in section 3.2.1 of this report. The water demand will be slightly higher than the figure for the foul flow allowing for consumption within the tea making station or mess room located within one of the buildings in the proposed development.

Water supply demand calculations are set out in Appendix C of this report.

Appendices

Appendix A – Surface Water Calculations

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PROJECT		CONTRACT		Calculation No.	
Coolnabacky Substation		Laois Kilkenny			
CALCULATION TITLE				Calc Sheet No.	Change No.
QBARrural (Greenfield Runoff Rate) Calculation				1 of 2	
REF		Calc by	Date	Check by	Date
		John MacCarthy	20/06/2012		

Ref	Calculations	Output
	Allowable Discharge to Stream from proposed Coolnabacky Electrical Substation	
	QBARrural Calculation - mean annual flood flow from a rural catchment (assessment of greenfield runoff rate into local watercourse and factored to allowable discharge from the development site)	
FSR	QBARrural = 0.00108 Area^0.89 SAAR^1.17 SOIL^2.17	
	Area = Area of Catchment in km^2 (Stream/ Watercourse is a tributary of the Timahoe River, Catchment marked on OS Map	
OSI	= 9.5 km^2 (Approx - See OS Map, Catchment Marked)	
	SAAR = Standard Average Annual Rainfall	
ME	860 mm (Met Eireann Rainfall Data)	
SI	SOIL = SOIL Type 4 (Site Investigations)	
FSR	= 0.45 (Flood Studies Report)	
	QBARrural = 0.00108 (9.5)^0.89 (860)^1.17 (0.45)^2.17	
	= 3.84 m3/s	
	QBARrural = 3,841 l/s	QBARrural 3.84 m3/s
	Site Area : Catchment Area = 0.0662 : 9.5 (in km^2) 1 : 143.4	
	Site Greenfield Runoff = 26.78 l/s	Site Green field run-off = 26.8 l/s

JOB NAME: Coolnabacky Substation	JOB NO: QG-000028-01	ESB International	
TITLE: Surface Water Storage Volume Calculations	CALCS BY: Donnacha Cody BE MIEI ESB International	DATE: 05/07/2012	Chk'd by: JMacC

SURFACE WATER STORAGE Pond System 1

Storm Return Period =	100	Years			
Total Site Area =	6.6238	Hectares (hA)			
Proposed Impermeable Area					
Roof Area =	0.09703	hA	.....@	100%	Impermeable
Bund Area =	0	hA	.....@	100%	Impermeable
Road to Gullies Area =	0	hA	.....@	100%	Impermeable
Road to Stone Area =	0.04064	hA	.....@	50%	Impermeable
Stone Area =	0.67306	hA	.....@	50%	Impermeable
Total Impermeable Area =	0.45388	hA			

Site Location Coolnabacky

Allowable Outflow = 26.6 **litres/sec** Total QBARrural - mean flood flow for site

16.0 **litres/sec** Proportional flow for site area

Duration (min)	Rainfall 100 Year (mm)	Intensity (mm/hr)	Discharge Q (=2.78AI) (l/s)	Proposed Runoff (m^3)	Contiguous Land Runoff (m^3)	Total Runoff (m^3)	Allowable Outflow (m^3)	Storage Req'd (m^3)
5	14.1	168.96	213	64	0	64	5	59
10	19.7	118.14	149	89	0	89	10	80
15	23.1	92.40	117	105	0	105	14	91
30	27.7	55.44	70	126	0	126	29	97
60	33.2	33.22	42	151	0	151	58	93
120	39.9	19.97	25	181	0	181	115	66
180	44.3	14.78	19	201	0	201	173	29
240	47.9	11.96	15	217	0	217	230	-13
360	53.2	8.87	11	242	0	242	346	-104
540	59.2	6.58	8	269	0	269	518	-250
720	63.8	5.32	7	290	0	290	691	-401
1080	71.1	3.95	5	323	0	323	1037	-714
1440	76.6	3.19	4	348	0	348	1382	-1035
2880	88.9	1.85	2	404	0	404	2765	-2361
4320	99.3	1.38	2	451	0	451	4147	-3696

Storage Required = 97 m^3

Note: Met Eireann Rainfall Data Increased by 10% - LCC Requirements

JOB NAME: Coolnabacky Substation	JOB NO: QG-000028-01	ESB International	
TITLE: Surface Water Storage Volume Calculations	CALCS BY: Donnacha Cody BE MIEI ESB International	DATE: 05/07/2012	Chk'd by: JMacC

SURFACE WATER STORAGE **Pond System 2**

Storm Return Period =	100	Years			
Total Site Area =	6.6238	Hectares (hA)			
Proposed Impermeable Area					
Roof Area =	0.05636	hA	.....@	100%	Impermeable
Bund Area =	0.08391	hA	.....@	100%	Impermeable
Road to Gullies Area =	0.16081	hA	.....@	100%	Impermeable
Road to Stone Area =	0	hA	.....@	50%	Impermeable
Stone Area =	0	hA	.....@	50%	Impermeable
Total Impermeable Area =	0.30108	hA			

Site Location Coolnabacky

Allowable Outflow =	26.6	**litres/sec**	Total QBARrural - mean flood flow for site
	10.0	**litres/sec**	Proportional flow for site area

Duration (min)	Rainfall 100 Year (mm)	Intensity (mm/hr)	Discharge Q (=2.78AI) (l/s)	Proposed Runoff (m^3)	Contiguous Land Runoff (m^3)	Total Runoff (m^3)	Allowable Outflow (m^3)	Storage Req'd (m^3)
5	14.1	168.96	141	42	0	42	3	39
10	19.7	118.14	99	59	0	59	6	53
15	23.1	92.40	77	70	0	70	9	61
30	27.7	55.44	46	84	0	84	18	66
60	33.2	33.22	28	100	0	100	36	64
120	39.9	19.97	17	120	0	120	72	48
180	44.3	14.78	12	134	0	134	108	26
240	47.9	11.96	10	144	0	144	144	0
360	53.2	8.87	7	160	0	160	216	-56
540	59.2	6.58	6	178	0	178	324	-146
720	63.8	5.32	4	192	0	192	432	-240
1080	71.1	3.95	3	214	0	214	648	-434
1440	76.6	3.19	3	231	0	231	864	-633
2880	88.9	1.85	2	268	0	268	1728	-1460
4320	99.3	1.38	1	299	0	299	2592	-2293

Storage Required =	**66**	m^3

Note: Met Eireann Rainfall Data Increased by 10% - LCC Requirements

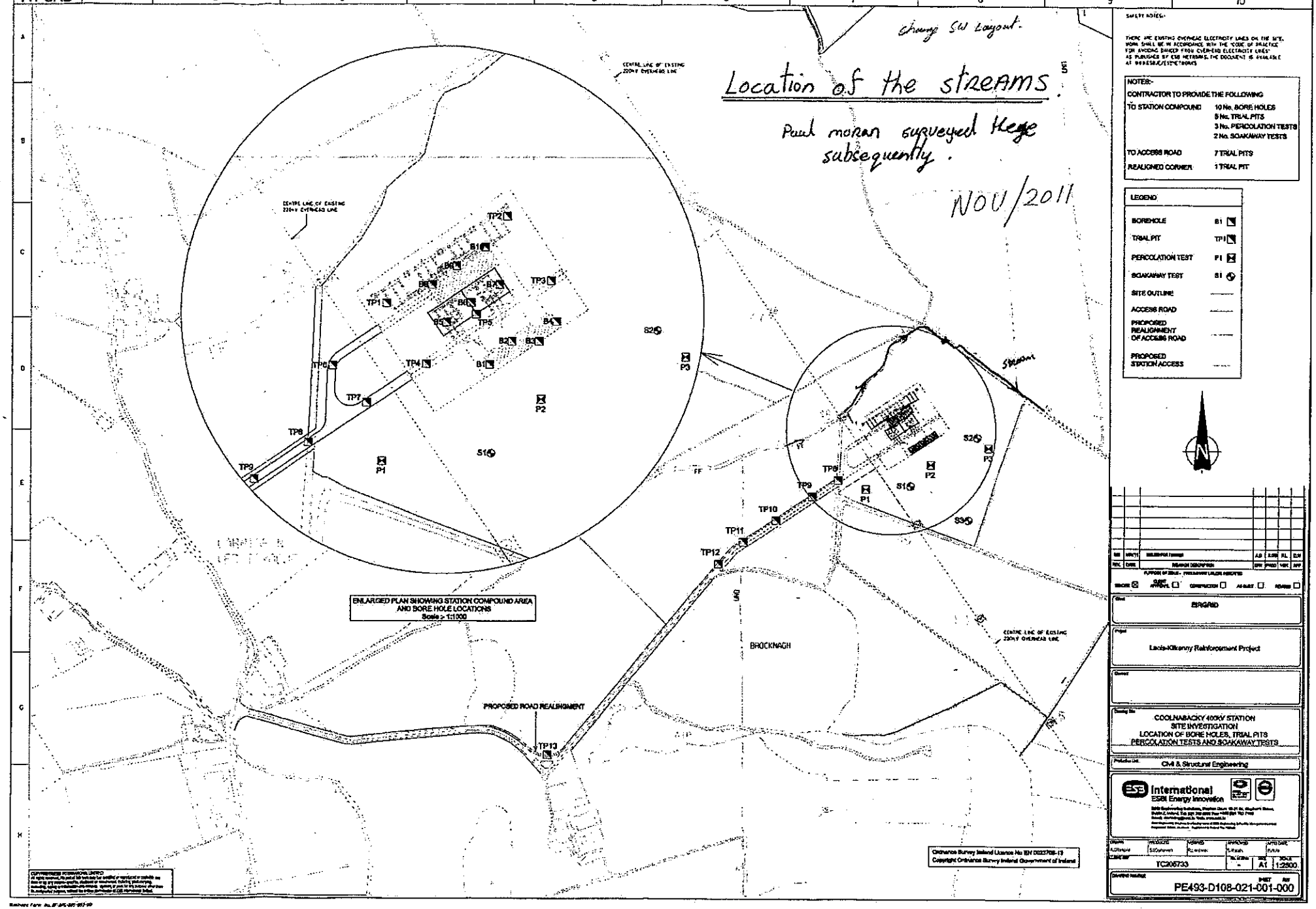

TRIBUTARY OF
TIMAHOE
RIVER
CATCHMENT
FOR DRAINAGE CALCS

Return Period Rainfall Depths for sliding Durations
Location: Coolnabacky, Easting: 253927, Northing: 193179,
Average Annual Rainfall(1961-1990) for Coolnabacky: 860mm

	Average Recurrence Interval		Return Period Years												
DURATION,	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins,	2.5,	3.5,	4.0,	4.7,	5.3,	5.7,	7.0,	8.4,	9.4,	10.7,	11.9,	12.8,	14.2,	15.3,	16.2,	N/A ,
10 mins,	3.5,	4.8,	5.5,	6.6,	7.3,	7.9,	9.7,	11.7,	13.1,	14.9,	16.6,	17.9,	19.8,	21.4,	22.6,	N/A ,
15 mins,	4.1,	5.7,	6.5,	7.8,	8.6,	9.3,	11.4,	13.8,	15.4,	17.6,	19.5,	21.0,	23.3,	25.1,	26.6,	N/A ,
30 mins,	5.4,	7.4,	8.4,	9.9,	10.9,	11.7,	14.2,	17.0,	18.8,	21.3,	23.5,	25.2,	27.8,	29.8,	31.4,	N/A ,
1 hours,	7.2,	9.6,	10.9,	12.7,	13.9,	14.8,	17.7,	20.9,	23.0,	25.9,	28.3,	30.2,	33.1,	35.3,	37.1,	N/A ,
2 hours,	9.6,	12.6,	14.1,	16.2,	17.6,	18.7,	22.1,	25.8,	28.2,	31.4,	34.2,	36.3,	39.5,	41.9,	43.9,	N/A ,
3 hours,	11.4,	14.7,	16.3,	18.7,	20.3,	21.5,	25.2,	29.2,	31.7,	35.1,	38.1,	40.3,	43.7,	46.3,	48.4,	N/A ,
4 hours,	12.8,	16.4,	18.2,	20.7,	22.4,	23.6,	27.6,	31.8,	34.5,	38.1,	41.2,	43.5,	47.0,	49.7,	51.8,	N/A ,
6 hours,	15.2,	19.1,	21.1,	23.9,	25.7,	27.1,	31.4,	35.9,	38.8,	42.6,	45.9,	48.4,	52.1,	54.9,	57.1,	N/A ,
9 hours,	17.9,	22.4,	24.5,	27.6,	29.6,	31.1,	35.7,	40.6,	43.6,	47.7,	51.2,	53.8,	57.7,	60.6,	63.0,	N/A ,
12 hours,	20.2,	25.0,	27.3,	30.6,	32.7,	34.3,	39.2,	44.3,	47.5,	51.7,	55.3,	58.0,	62.1,	65.1,	67.5,	N/A ,
18 hours,	23.9,	29.2,	31.7,	35.3,	37.6,	39.3,	44.6,	50.0,	53.4,	57.9,	61.7,	64.6,	68.8,	71.9,	74.5,	N/A ,
24 hours,	26.9,	32.6,	35.3,	39.1,	41.5,	43.3,	48.9,	54.6,	58.1,	62.8,	66.7,	69.6,	74.0,	77.2,	79.8,	88.4,
2 days,	33.9,	40.3,	43.4,	47.6,	50.3,	52.3,	58.4,	64.6,	68.4,	73.5,	77.7,	80.8,	85.4,	88.8,	91.5,	100.6,
3 days,	39.6,	46.8,	50.1,	54.8,	57.7,	59.9,	66.4,	73.1,	77.2,	82.5,	87.0,	90.3,	95.2,	98.8,	101.7,	111.1,
4 days,	44.8,	52.5,	56.2,	61.2,	64.3,	66.6,	73.6,	80.7,	85.0,	90.7,	95.4,	98.8,	103.9,	107.7,	110.7,	120.6,
6 days,	54.2,	62.9,	67.0,	72.6,	76.0,	78.6,	86.4,	94.2,	98.9,	105.1,	110.2,	114.0,	119.5,	123.6,	126.8,	137.4,
8 days,	62.6,	72.2,	76.7,	82.8,	86.6,	89.4,	97.8,	106.2,	111.3,	118.0,	123.5,	127.5,	133.4,	137.7,	141.2,	152.5,
10 days,	70.5,	80.9,	85.7,	92.3,	96.4,	99.4,	108.4,	117.4,	122.8,	129.8,	135.7,	139.9,	146.2,	150.8,	154.4,	166.3,
12 days,	78.0,	89.1,	94.3,	101.3,	105.6,	108.8,	118.3,	127.9,	133.6,	141.0,	147.1,	151.6,	158.2,	163.0,	166.8,	179.2,
16 days,	92.2,	104.6,	110.4,	118.2,	123.0,	126.5,	137.0,	147.4,	153.7,	161.8,	168.5,	173.4,	180.5,	185.7,	189.8,	203.3,
20 days,	105.6,	119.3,	125.5,	134.0,	139.2,	143.1,	154.4,	165.7,	172.4,	181.2,	188.4,	193.6,	201.2,	206.8,	211.2,	225.5,
25 days,	121.7,	136.7,	143.6,	152.8,	158.5,	162.7,	175.0,	187.3,	194.6,	204.0,	211.7,	217.4,	225.5,	231.5,	236.2,	251.5,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For frequencies less that two years Average Recurrence Intervals(ARI) are used
For details refer to:
'Fitzgerald, D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

Appendix B – Site Investigations

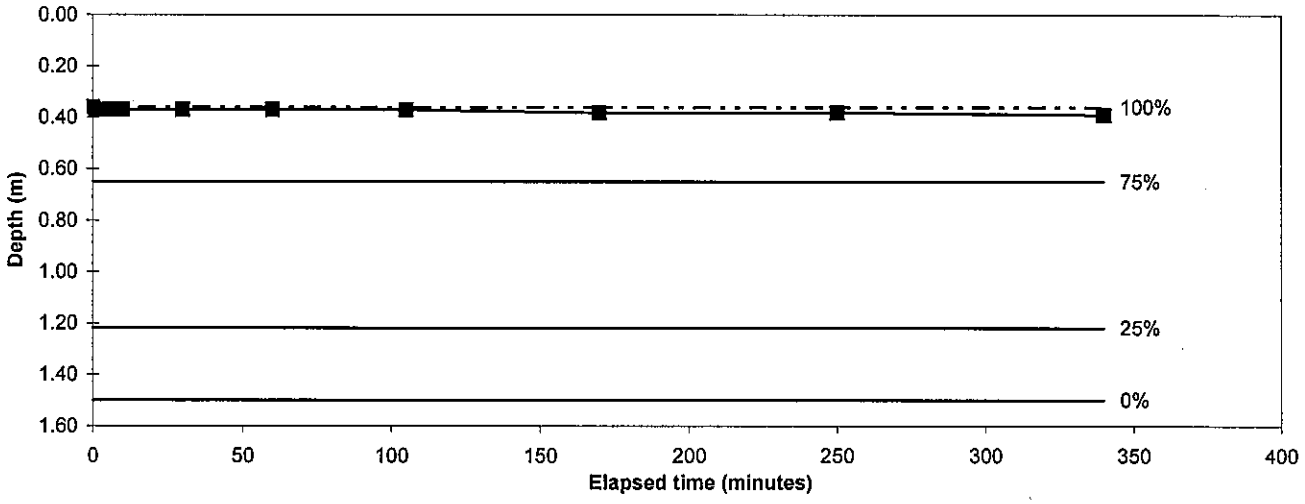

A1 CAD
Change SW Layout.
Location of the streams.
Paul moran surveyed these subsequently.
NOV/2011
SAFETY NOTES:-
THERE ARE EXISTING OVERHEAD ELECTRICITY LINES ON THE SITE, WORK SHALL BE IN ACCORDANCE WITH THE "CODE OF PRACTICE FOR AVOIDING DANGER FROM OVERHEAD ELECTRICITY LINES" AS PUBLISHED BY ESB NETWORKS. THE DOCUMENT IS AVAILABLE AT WWW.ESB.IE/ESBNETWORKS
NOTES:-
CONTRACTOR TO PROVIDE THE FOLLOWING
TO STATION COMPOUND 10 No. BORE HOLES
5 No. TRIAL PITS
3 No. PERCOLATION TESTS
2 No. SOAKAWAY TESTS
TO ACCESS ROAD 7 TRIAL PITS
REALIGNED CORNER 1 TRIAL PIT
LEGEND
BOREHOLE B1
TRIAL PIT TP1
PERCOLATION TEST P1
SOAKAWAY TEST S1
SITE OUTLINE
ACCESS ROAD
PROPOSED REALIGNMENT OF ACCESS ROAD
PROPOSED STATION ACCESS
CENTRE LINE OF EXISTING 220kV OVERHEAD LINE
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
B1
B2
B3
B4
B5
B6
B7
B8
P1
P2
P3
S1
S2
S3
ENLARGED PLAN SHOWING STATION COMPOUND AREA AND BORE HOLE LOCATIONS
Scale :- 1:1000
PROPOSED ROAD REALIGNMENT
BROCKNAGH
CENTRE LINE OF EXISTING 220kV OVERHEAD LINE
Ordnance Survey Ireland License No EN 0023708-13
Copyright Ordnance Survey Ireland Government of Ireland
ESBI
BIRGRID
Laois-Kilkenny Reinforcement Project
COOLNABACKY 400kV STATION
SITE INVESTIGATION
LOCATION OF BORE HOLES, TRIAL PITS
PERCOLATION TESTS AND SOAKAWAY TESTS
Civil & Structural Engineering
ESB International
ESBI Energy Innovation
TC205733
A1
1:2500
PE493-D108-021-001-000

Soakaway Test

Soil Mechanics

Trial Pit No:	TPS2	Test No:	1	Date:	08/03/2012
Length (m):	1.50		Datum height:	0.00	m agl
Width (m):	1.30		Granular infill:	None	
Depth (m):	1.50				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.36		
1	0.37		
2	0.37		
5	0.37		
10	0.37		
30	0.37		
60	0.37		
105	0.37		
170	0.38		
250	0.38		
340	0.39		



Start water depth for analysis (mbgl):	0.36		
75% effective depth (mbgl):	0.65	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.93		
25% effective depth (mbgl):	1.22	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.50		

Volume outflow between 75% and 25% effective depth (m3):
Mean surface area of outflow (m^2): 5.14
(side area at 50% effective depth + base area)
Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate**

Remarks	Results processed following BRE 365 (2007).

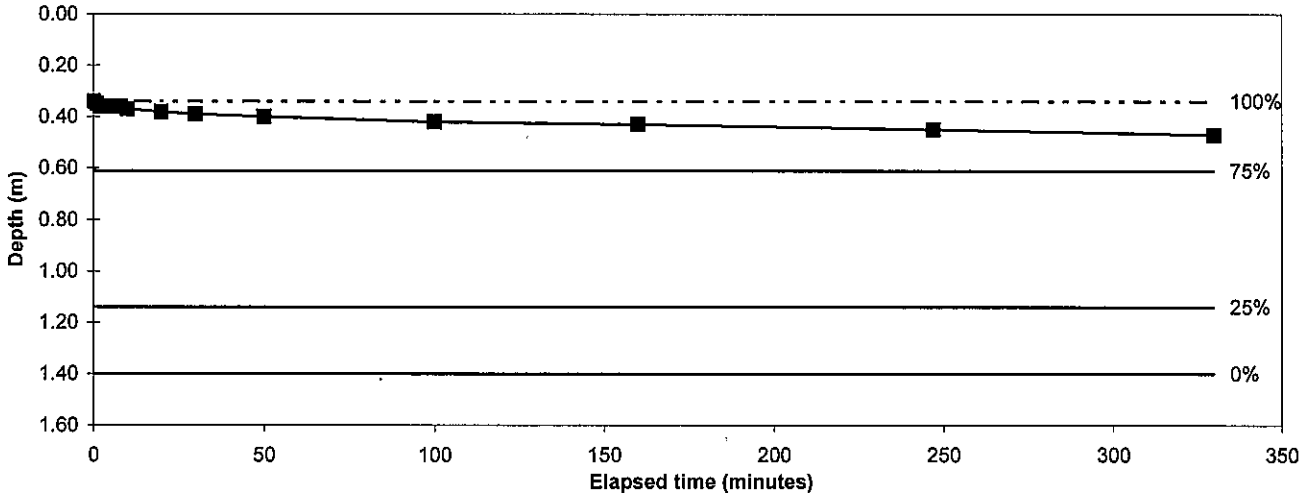
Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT	Figure
	Project No.	Y2012-12A	SKWY/TPS2/1
	Carried out for	EirGrid	Sheet 1 of 1

Soakaway Test

Soil Mechanics

Trial Pit No:	TPS3	Test No:	1	Date:	08/03/2012
Length (m):	1.60		Datum height:		0.00 m agl
Width (m):	1.30		Granular infill:		None
Depth (m):	1.40				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.34		
1	0.35		
2	0.36		
4	0.36		
6	0.36		
8	0.36		
10	0.37		
20	0.38		
30	0.39		
50	0.40		
100	0.42		
160	0.43		
247	0.45		
330	0.47		



Start water depth for analysis (mbgl):	0.34		
75% effective depth (mbgl):	0.61	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.87		
25% effective depth (mbgl):	1.14	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.40		

Volume outflow between 75% and 25% effective depth (m3):
Mean surface area of outflow (m^2): 5.15
(side area at 50% effective depth + base area)
Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate**

Remarks	Results processed following BRE 365 (2007).

Notes:	Project: LAOIS KILKENNY REINFORCEMENT PROJECT Project No.: Y2012-12A Carried out for: EirGrid	Figure **SKWY/TPS3/1** Sheet 1 of 1

Appendix C – Water Supply Calculations

Potable Water Demand in Proposed Development

Personnel Demand for Potable Water

Use	Demand (Litres)	Frequency per day	Potable Water Demand (litres)
WC Flush	6	4	24
WHB	1	4	4
Sink	0.6	4	2.4
Total demand for 1 PE			30.4

Annual Water demand (2 persons 2 days per wk)	6,323

Automatic Flush Water Demand

Use	Demand (Litres)	Frequency per week	Potable Water Demand (litres)
Auto WC Flush	6	2	12

Annual Automatic Flush demand from 2 no. WC's	1,248

Total Potable Water Demand Per Annum (litres)	7,571

Appendix D – Foul Water Calculations

Foul Water Volumes Generated in Proposed Development

Personnel Generated Foul Waste

Use	Loading (Litres)	Frequency per day	Foul Waste Generated (litres)
WC Flush	6	4	24
WHB	1	4	4
Sink	0.6	4	2.4
Total Foul Loading for 1 PE			30.4

Annual PE load (2 operatives for 2 days per wk)	6,323

Automatic Flush Generated Foull Waste

Use	Loading (Litres)	Frequency per week	Foul Waste Generated (litres)
Auto WC Flush	6	2	12

Annual Automatic Flush load from 2 no. WC's	1,248

Total Foul Loading Per Annum (litres)	**7,571**

Note: No allowance made for human consumption which would generally constitute a 10% reduction on the PE related foul loading.

Foul Holding Tank Capacity 10,000 litres

Tank Emptied once every 6 months

Capacity of Tank - routine emptying (litres)	**20,000**

Capacity >> Foul Water Generated

Appendix E – Site Suitability Assessment Report

SOIL CHARACTERISATION AND
SITE SUITABILITY ASSESSMENT REPORT
TE REF: 12/050TE

ESB NETWORKS
LAOIS-KILKENNY REINFORCEMENT PROJECT
COOLNABACKY 400KV STATION
COOLNABACKY
TIMAHOE
CO. LAOIS

IN ACCORDANCE WITH
EPA CODE OF PRACTICE
WASTEWATER TREATMENT AND DISPOSAL
SYSTEMS SERVING SINGLE HOUSES 2009

Traynor Environmental Ltd
Belturbet Business Park, Creeny, Belturbet
Co. Cavan
Tel: +353 49 9522236
Fax: +353 49 9522808
Web: www.traynorenvironmental.com

SITE CHARACTERISATION FORM FOR AN ON-SITE WASTEWATER TREATMENT SYSTEM

CONTENTS

1.0 GENERAL DETAILS (From planning application)

Company	*ESB Networks*

Address	**Site Location and Townland**
ESB Networks *c/o Geotech Specialists Ltd part of* *Environmental Scientifics Group* *Carewswood,* *Castlemartyr,* *County Cork,* *Ireland*	*ESB Networks* *Laois-Kilkenny Reinforcement Project* *Coolnabacky 400kv Station* *Coolnabacky* *Timahoe* *Co. Laois*

Telephone Number	*N/A*	**Fax Number**	*N/A*
Email	*N/A*		

Maximum No. of Employees	*6*	No. of double bedrooms	*N/A*	No. of Single Bedrooms	*N/A*

Proposed Water Supply	Mains		Private Well/Borehole	✓	Group Well/Borehole		

2.0 DESK STUDY

Soil Type	***Soil Association - 39*** *Greys 90% Grey brown Podzolics 10%*

Aquifer Category:	Regionally Important	*Rkd*	Locally Important		Poor				
Vulnerability	Extr		Hg	✓	Moderate		Low		High to Low		Unknown	

Bedrock Type	*DPBL - Dinantian Pure Unbedded Limestone*
Name of Public/Group Scheme Water Supply within 1km	*Local Group Water Scheme*

Groundwater Protection Scheme (Y/N)	*No*	**Source Protection Area**	SI	SO
Groundwater Protection Response:	*R2*[1]			

Presence of Significant sites (Archaeological, natural and historical):	*None identified or evident on the site.*
Past experience in the area:	*Variable percolation characteristics in the locality.*

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).*

R2[1]*: Acceptable subject to normal good practice (i.e. System selection, construction, operation and maintenance in accordance with EPA (2009). Site may be suitable for discharge to ground, if the minimum depths are met on the site and if there exists suitable percolation. As the soil type in the area is Gleys (75% of the land area), and as the area is mapped as High Vulnerability, surface water may be at risk around the site. Groundwater as a resource will be at risk if the minimum depths required are not achieved on the site, or if the percolation rate is too rapid. Older wells in the area may also be at risk, if the minimum separation distances are not adhered to. Groundwater and wells are therefore the main targets, following the desk study. Given the response and the aquifer type, the site is potentially suitable for a conventional septic tank system if the minimum depths required are met on the site, if the minimum separation distances can be met, and if the percolation rate is adequate. A regionally important bedrock aquifer will generally have a high permeability, rapid flow velocities and will provide little attenuation.*

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position	*Relatively Flat*

Slope	*Steep <1:5*		*Shallow 1.5 to 1.20*		*Relatively Flat*	✓

Surface features within a minimum of 250 metres (Distances to features should be noted in metres)

Houses	*There are no houses located within 100m of the proposed percolation area (ppa).*
Existing Land Uses	*Agricultural grazing.*
Vegetation Indicators	*Grass is the pre-dominant vegetation in the ppa. The absence of rushes in the ppa could indicate adequate percolation characteristics of the subsoil.*
Groundwater Flow Directions	*Northeastern direction.*
Ground Condition	*Ground conditions are best described as firm in the ppa and throughout the site.*
Site Boundaries	*Hedge and trees with drains located on all boundaries (North, East, West and South)*
Roads	*Agricultural laneway located >20m Southwest of the ppa.*
Outcrops (Bedrock and/or subsoil)	*None identified or evident in the vicinity.*
Surface water ponding	*No evidence of surface water ponding when examined on 21.03.12. It must be noted that weather conditions prior to the site assessment taking place was generally dry.*
Drainage Ditches	*Drainage ditches located along all boundaries. Drain levels at approximately 1m below ground level and approximately 1.20m wide.*

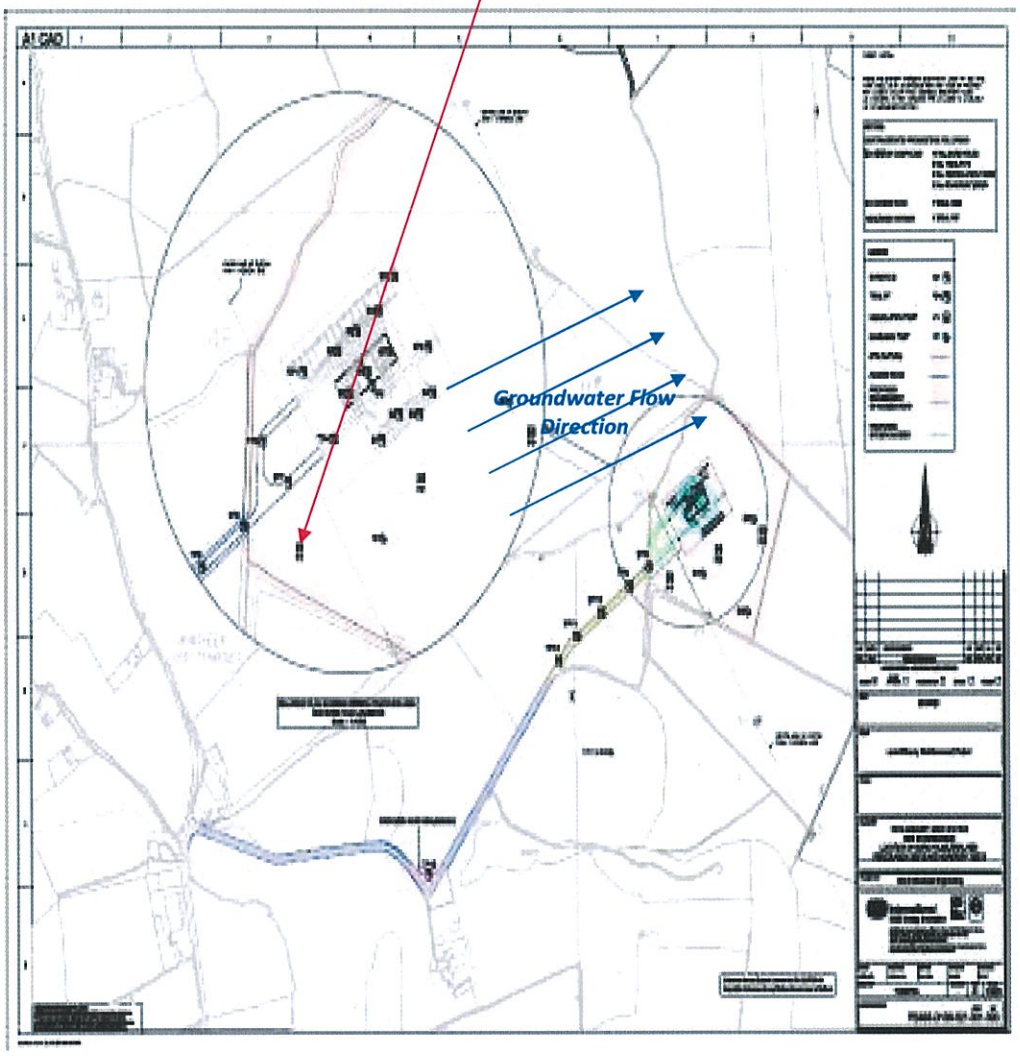
Beaches/Shellfish	*None identified or evident in the vicinity.*	**Areas/Wetlands**	*None identified or evident in the vicinity.*
Karst Features	*None identified or evident in the vicinity.*	**Watercourse/ streams**	*Drainage ditches as above.*
Lakes	*None identified or evident in the vicinity.*	**Springs/ Wells**	*None identified or evident in the vicinity.*

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 treatment system on the site.*

Following the desk study surface water was not thought not to be at risk. During the visual assessment the land here seems to be generally average drained in the location of the tested area. From this, the surface water does not seem to be a potential target, unless the soil in the proposed percolation area is saturated. Groundwater is still a target following the visual assessment, unless the minimum depths required are met on the site and there exists adequate percolation. Wells in use in the area are not considered to be at risk, as they are all well outside the minimum separation distances (Groundwater Protection Responses of GSI/EPA/DoELG).

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

SITE LAYOUT DRAWING SHOWING TEST HOLE LOCATIONS



3.2 Trial Hole

Should be a minimum 3m deep

Depth of Trial Hole	*3.00m*		
Depth from Ground Surface to bedrock (m) if Present	*None encountered*	**Depth from Ground Surface to Water Table (m) if Present**	*1.00m*
Depth of water ingress	*1.00m*	**Rock Type if Present**	*None encountered*
Date and Time of Excavation	*19.03.12* *08.00*	**Date and Time of Examination**	*21.03.12* *09.00*

	Depth of P & T Test	Soil/Subsoil Texture Classification	Plasticity and Dilatancy	Soil Structure	Density Compactness	Colour	Preferential Flowpaths
0.1m		*Silt/Clay*	*Ribbons 75mm 3 Threads*	*Blocky*	*Medium*	*Brown*	*None*
0.2m	*Depth of P Test*						
0.3m							
0.4m			*Ribbons*			*Brown -*	
0.5m	*Depth of T Test*	*CLAY*	*115mm 8 Threads*	*Sticky*	*High*	*Orange*	
0.6m							
0.7m							
0.8m		*Gravels/Clay*	*Ribbons 10mm 2 Threads*	*Blocky*	*Low*	*Grey Orange*	
0.9m							
1.0m							
1.1m							
1.2m							
1.3m		***Winter GWL***	***Winter GWL***	***Winter GWL***	***Winter GWL***	***Winter GWL***	***Winter GWL***
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: *According To The Flowchart For Describing Subsoil's based on BS5930:1999, the subsoil is best described as a Gravel/Clay. Good percolation characteristics of the subsoil exhibited in the trial hole (above the Winter Water Table Level of 1.00m)*

Likely T Value *<20.00 min /25mm*

*Note: Depth of percolation test holes should be indicated on log above (Enter P & T Depths as appropriate)

* See Appendix E for BS5930 Classification

** 3 samples to be tested on each horizon and results should be entered above for each horizon.

*** All signs of mottling should be recorded.

3.3a Percolation ("T" Test for Deep Subsoils and Water Table)

Step 1 Test Hole Preparation

Percolation Test Hole	***1***	***2***	***3***
Depth from ground surface to top of hole (mm) (A):	*200*	*200*	*200*
Depth from ground surface to base of hole (mm) (B):	*600*	*600*	*600*
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 Pre-soaking Started	*20.03.12*	*16.40*	*20.03.12*	*16.45*	*20.03.12*	*16.48*

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	***1***	***2***	***3***
Date of Test	*21.03.12*	*21.03.12*	*21.03.12*
Time Filled to 400mm	*09.00*	*09.05*	*09.10*
Time Water Level at 300mm	*09.33*	*09.40*	*09.50*
Time to drop 100mm (T_{100})	*33.00*	*35.00*	*40.00*
Average T_{100}			*36.00*

If T_{100} >300mins then T Value >90 – site unsuitable for discharge to ground
If $T_{100} \leq$ 210mins then go to Step 4
If $T_{100} \geq$ 210mins then go to Step 5

Step 4 Standard Method (where $T_{100} \leq 210$min)

Percolation Test Hole	1			2			3		
Fill No.	Start Time at 300mm	Finish Time at 200mm	Δt (min)	Start Time at 300mm	Finish Time at 200mm	Δt (min)	Start Time at 300mm	Finish Time at 200mm	Δt (min)
1	*09.34*	*10.15*	*41.00*	*09.41*	*10.29*	*48.00*	*09.51*	*10.41*	*50.00*
2	*10.16*	*11.08*	*52.00*	*10.30*	*11.31*	*61.00*	*10.42*	*11.48*	*66.00*
3	*11.09*	*12.17*	*68.00*	*11.32*	*12.51*	*79.00*	*11.49*	*13.24*	*95.00*
Average Δt			*53.67*			*62.67*			*70.33*
	Average Δt/4 = [Hole No. 1]		*13.42*	Average Δt/4 = [Hole No. 2]		*15.67*	Average Δt/4 = [Hole No. 2]		*17.58*

Result of Test : T *15.56* min/25mm

Comments
Excellent percolation characteristics of the subsoil

3.3b Percolation ("P" Test for Shallow Subsoils and 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) (B):	*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 Pre-soaking Started	*20.03.12*	*16.50*	*20.03.12*	*16.55*	*20.03.12*	*16.58*

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	*1*	*2*	*3*
Date of Test	*21.03.12*	*21.03.12*	*21.03.12*
Time Filled to 400mm	*09.15*	*09.20*	*09.25*
Time Water Level at 300mm	*10.39*	*10.48*	*10.59*
Time to drop 100mm (P_{100})	*84.00*	*88.00*	*94.00*
Average P_{100}			*88.66*

If P_{100} >300mins then P Value >90 – site unsuitable for discharge to ground
If $P_{100} \leq$ 210mins then go to Step 4
If $P_{100} \geq$ 210mins then go to Step 5

Step 4 Standard Method (where $P_{100} \leq 210$min)

Percolation Test Hole	1			2			3		
Fill No.	Start Time at 300mm	Finish Time at 200mm	Δt (min)	Start Time at 300mm	Finish Time at 200mm	Δt (min)	Start Time at 300mm	Finish Time at 200mm	Δt (min)
1	*10.40*	*12.14*	*94.00*	*10.49*	*12.26*	*97.00*	*11.00*	*12.42*	*102.00*
2	*12.15*	*14.03*	*108.00*	*12.27*	*14.17*	*110.00*	*12.43*	*14.39*	*116.00*
3	*14.04*	*16.10*	*126.00*	*14.18*	*16.27*	*129.00*	*14.40*	*16.54*	*134.00*
Average Δt			*109.33*			*112.00*			*117.33*
	Average Δt/4 = [Hole No. 1]		*27.33*	Average Δt/4 = [Hole No. 2]		*28.00*	Average Δt/4 = [Hole No. 3		*29.33*

Result of Test : P *28.22* min/25mm

Comments
Good percolation characteristics of the topsoil.

4.0 CONCLUSIONS of SITE CHARACTERISATION:

Not suitable for Development	☐

Suitable for		**Discharge Route**
1. Septic tank System (Septic tank and soil percolation system)	☐	*Groundwater*
2. Secondary Treatment System		
a. Septic tank and intermittent filter system and polishing unit	✓	
b. Package Wastewater Treatment system and polishing unit	✓	

5.0 RECOMMENDATION:

Propose to install	*The site is not suitable for a conventional septic tank and percolation area. Traynor Environmental recommends that an O' Reilly Oakstown package sewage treatment system or similar approved treatment system and a raised soil polishing filter constructed in accordance with EPA Guidelines 2009 is installed.*

And discharge to	*Groundwater*

Trench Invert Level (m)	*0.30m Above Ground Level (AGL)*

Site Specific Conditions (if any) e.g. special works, Site Improvement Works, Testing etc.
The tests showed that the site has a "T" value rating of 15.56min/25mm indicating excellent percolation characteristics of the subsoil. A "P" value rating of 28.22min/25mm was attained indicating excellent percolation characteristics of the topsoil. Bedrock level was not encountered in the trial hole; Groundwater was encountered in the trial hole at a depth of 1.00 BGL. *A purpose built soil polishing filter should be constructed to ensure that there is a minimum of 0.90m of suitable percolating material between the base of the lowest part of the soil polishing filter and groundwater level (1.00m) at all times. The distribution pipes used in this system will be smooth walled, have a diameter of 32mm, have 6mm holes drilled in them 300mm apart, and each pipe should be spaced parallel and 600mm apart. The distribution pipes will be bedded on 250mm depth of crushed stone (20 - 30 mm in size). Once the distribution pipes are in place they should be surrounded and covered to a depth of 150mm of crushed stone which should extend the full width of the soil polishing filter. Before the distribution pipes are backfilled with the topsoil the crushed stone should be covered with geotextile or similar permeable or durable materials. This is to prevent the stone being silted up with topsoil.* *Traynor Environmental Ltd also recommends that the soil polishing filter construction and the installation of the O' Reilly Oakstown Treatment System is overseen by a suitable qualified and accredited person*

6.0 TREATMENT SYSTEM DESIGN DETAILS

SYSTEM TYPE: Septic Tank System

Tank Capacity (m^2)	*N/A*	***Percolation Area***		***Mound Percolation Area***	
		No. of Trenches	*N/A*	*No. of Trenches*	*N/A*
		Length of Trenches (m)	*N/A*	*Length of Trenches (m)*	*N/A*
		Invert Level (m)	*N/A*	*Invert Level (m)*	*N/A*

SYSTEM TYPE: *O' Reilly Oakstown Treatment System*

Filter Systems

Media Type	**Area (m^2)**	**Deep of Filter (m)**	**Invert Level (m)**
Sand/Soil	*N/A*	*N/A*	*N/A*
Soil	*72m²*	*0.25m*	*0.30m AGL*
Constructed Wetland	*N/A*	*N/A*	*N/A*
Other	*N/A*	*N/A*	*N/A*

Package Treatment Systems

Type *O' Reilly Oakstown Treatment System*

Capacity PE *10*

Sizing of Primary Compartment *4* m^2

SYSTEM TYPE: *O' Reilly Oakstown Treatment System*

Polishing Filter: *Surface Area (m^2)*	*N/A*
or Gravity Fed:	
No. of Trenches	*N/A*
Length of Trenches (m)	*N/A*
Invert Level (m)	*N/A*

Package Treatment Systems: Capacity (PE)	*10*
Constructed Wetland: *Surface Area (m^2)*	*N/A*

DISCHARGE ROUTE:

Groundwater	✓	Hydraulic Loading Rate ($l/m^2.d$)	*210l/d*
Surface Water		Discharge Rate	*0.024l/s*

TREATMENT STANDARDS:

Treatment System Performance Standards (mg/l)	**BOD**	**SS**	**NH_3**	**Total N**	**Total P**
O'Reilly Oakstown Treatment System	*<20*	*<30*	*<10*	*5 - 10*	*12.5*

QUALITY ASSURANCE:

Installation & Commissioning	**On-going Maintenance**
Recommend to be overseen by plant supplier.	*Maintain and de-sludge annually*

7.0 SITE ASSESSOR DETAILS

Company:	*Traynor Environmental Ltd*				
Prefix:	*Mr.*	**First Name:**	*Nevin*	**Surname:**	*Traynor*
Address:	*Belturbet Business Park, Creeny, Belturbet, Co. Cavan.*				
Qualifications/Experience:	*BSc. Env, H.Dip I.T, Cert SHWW, EPA/FAS Cert.*				
Date of Report:	*28.03.12*				
Phone:	*049 9522236*	**Fax:**	*049 9522808*	**E-mail:**	*nevin@traynorenvironmental.com*
Indemnity Insurance Number:	*AGD/11/109*				

Signed:

Nevin Traynor

BSc. Env, H.Dip I.T, Cert SHWW, EPA/FAS Cert.

For Traynor Environmental Ltd

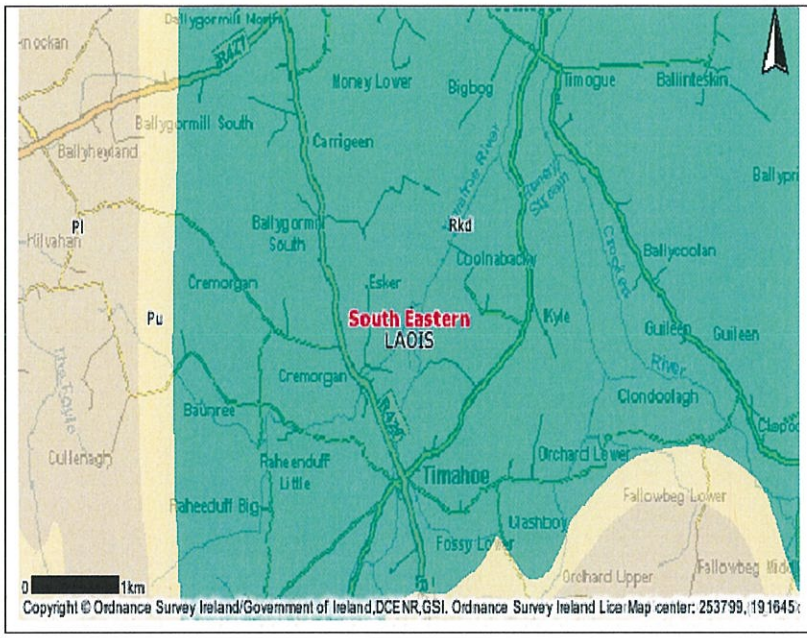
8.0 SITE PHOTOGRAPHS

Facing East From the Proposed Percolation Area	*Facing West From the Proposed Percolation Area*
	
Facing South From the Proposed Percolation Area	***Facing North From the Proposed Percolation Area***
	
Trial Hole Front View	***Trial Hole Side View***
	

Percolation ("T") Test 1	Percolation ("T") Test 2
	
Percolation ("T") Test 3	**Percolation ("P") Test 1**
	
Percolation ("P") Test 2	**Percolation ("P") Test 3**
	

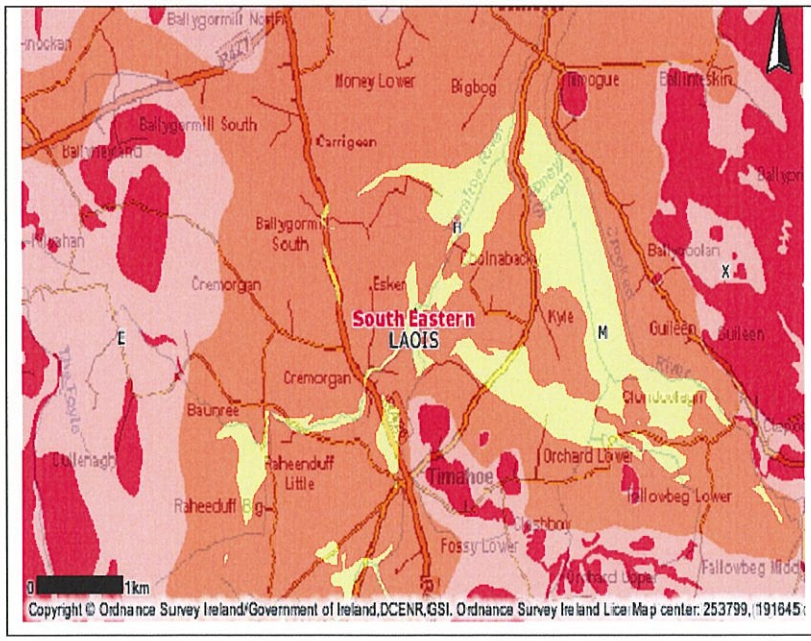
Maps Used As Part of the EPA Site Suitability Assessment

Groundwater/Aquifer Map



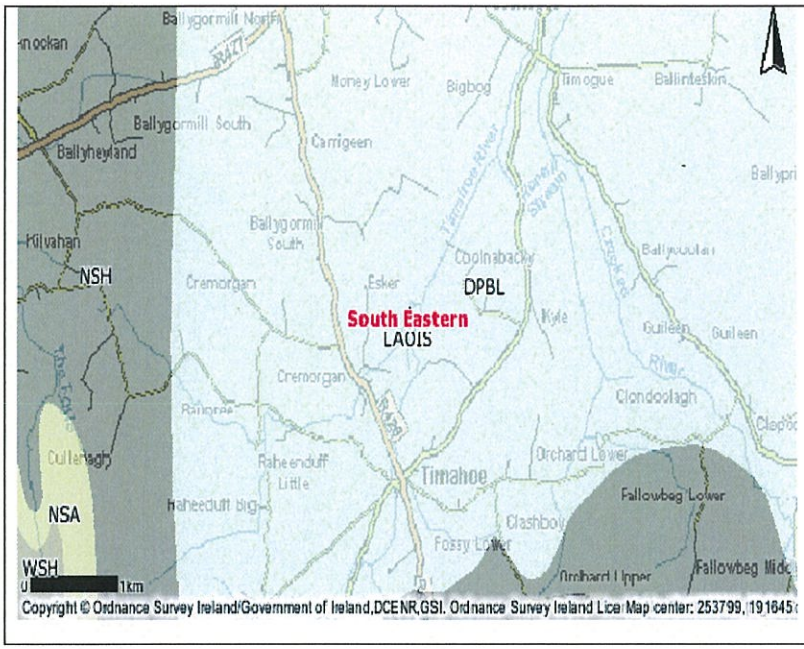
From the GSI Groundwater Aquifer Map Site is classified as Rkd Regionally important aquifer - .karstified (diffuse)

Vulnerability Map



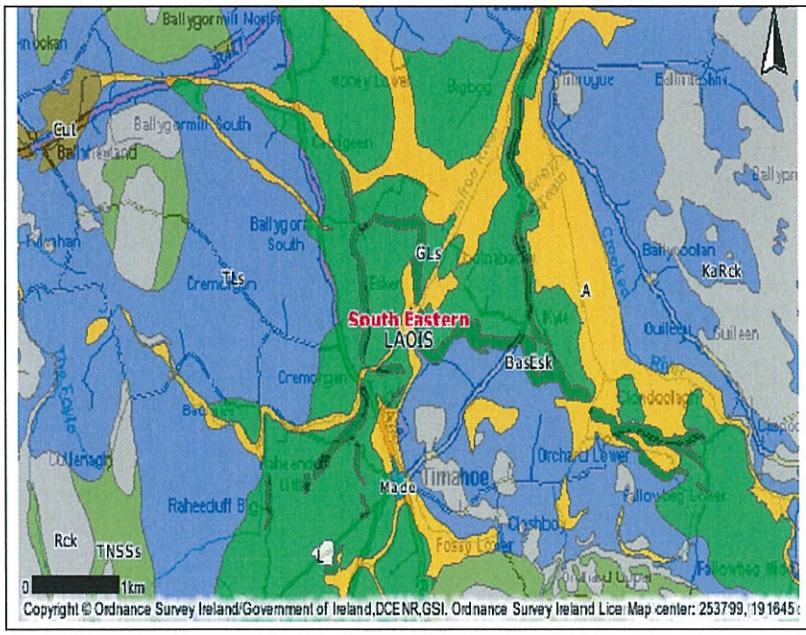
From the GSI Vulnerability Map Site is classified as High.

Bedrock Map



From the GSI Bedrock Map Site is classified as DPBL Dinantian Pure Unbedded Limestone

Teagasc Subsoil Map



From the Teagasc Subsoil GSI Map Site is classified as GLs Glacial Sands and gravels.

9.0 EPA/FAS CERTIFICATE

FETAC
Further Education and Training Awards Council
Comhairle na dTeastas Gairmiúil, Breisoideachais agus Oiliúna

National Skills Certificate

(FÁS)

Awarded to
Bronnta ar

Nevin Traynor

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

Site Suitability Assessment for On-Site

Wastewater Treatment Systems

Chief Executive, FETAC

F/NSC 003535

Griffiths & Armour

ENGINEERS IRELAND
VERIFICATION OF PROFESSIONAL INDEMNITY INSURANCE

Insured:	**Traynor Environmental Ltd**
Address:	**Belturbet Business Park Creeny Belturbet Co. Cavan**
Description of Business:	**Consulting Engineers**
Policy Number and Name/Address of Lead Insurer:	**A G Doré Syndicate 2526 at Lloyd's 4th Floor, 70 Gracechurch Street London EC3V 0XL United Kingdom Policy No: AGD/11/109**
Period of Insurance:	**12 July 2011 to 11 July 2012**
Renewal Date:	**12 July 2012**
Retroactive Date:	**None**
Limit of Indemnity any one claim:	**A sum not less than €1,000,000 (separate aggregate limits of indemnity for all claims in the period relating to • pollution or contamination • asbestos)**
Excess applying to each and every claim:	**€5,000**
Total amount of Excess amounts payable for all claims during any one period of insurance:	**€15,00**
Does cover include Joint Venture Projects?	**Yes**
Does cover include Sub-Consultants?	**Yes - Insured's liability**
Is there a Sub-Consultant's Warranty?	**None**
Are there any Restrictions/Limitations/Warranties in relation to the Policy connected with the Project or Brief presented by the Local Authority, Health Board, Vocational Educational Committee, Regional Technical College or other Public Body?	**None other than those which are standard to this class of insurance protection**
If so, could you provide details:	
Signed:	**For and on behalf of Griffiths & Armour Professional Risks** GROUP OFFICES Liverpool London Manchester Glasgow Dublin Guernsey
Date:	**13 July 2011**

The policy is subject to the insuring agreements, exclusions, conditions and declarations contained therein. The above is accurate at the date of signature. No obligation is imposed herein on the signatory to advise of any alteration.

Appendix F – Flood Risk Assessment Report

ESB International
ESBI Energy Innovation

Coolnabacky Substation

EIRGRID

Flood Risk Assessment

QG-000028-01-R02-001

ESBI Civil Building Environment
Stephen Court,
18/21 St Stephen's Green,
Dublin 2 Ireland
Tel: +353 (0)1 703 8000
Fax: +353 (0)1 7037186.
Web: www.esbi.ie

August 2012

File Reference:	
Client / Recipient:	EirGrid
Project Title:	Coolnabacky Substation
Report Title:	Coolnabacky Substation Flood Risk Assessment
Report No.:	QG-000028-01-R02-001
Rev. No.:	
Volume 1 of 1	

PREPARED: Ann Marie Downey ***TITLE: Professional Engineer***	***DATE: August 2012***
VERIFIED: Jim Fitzpatrick ***TITLE: Senior Consultant***	***DATE: August 2012***
APPROVED: Tommy Bree ***TITLE: CBE Technology Manager***	***DATE: August 2012***

Latest Revision Summary:

Contents

APPENDIX A: Extract from www.floodmaps.ie

Notes

1 Introduction

It is proposed to construct a 400kV High Voltage Substation in the townland of Coolnabacky approximately 2.5km North of Timahoe village and 9km west of Stradbally in County Laois.

This Flood Risk Assessment was prepared in accordance with *'The Planning System and Flood Risk Management - Guidelines for Planning Authorities'* issued by the Department of Environment, Heritage and Local Government in November 2009. Flood risk from fluvial, surface water and ground water sources has been assessed based on existing available information and a site visit in May 2012.

1.1 Scope

This assessment considers the following:

- The Department of Environment, Heritage and Local Government guideline document to Planning Authorities in relation to Flood Risk Management.
- Risk of flooding to the proposed Substation from flood flow from neighbouring watercourses.
- Risk of flooding due to direct rainfall.
- Risk of flooding from groundwater.
- Impact of presence of the Substation on the existing flood risk regime at its proposed site. The impacts addressed under this heading comprise:
    - The impact of surface water runoff from the sites on the flow regimes in neighbouring watercourses.
    - Loss of floodplain.
- Review of data on recorded historic floods.

2 Planning Guidelines

In November 2009 the Department of Environment, Heritage and Local Government issued a guideline document to Planning Authorities in relation to Flood Risk Management.

These Guidelines set out the policy on development and flood risk in Ireland and provide a framework for the integration of flood risk assessment into the planning process. The objective is to ensure that flood risk is taken into account at all stages in the planning process and as a result to:

- Avoid inappropriate development in areas at risk of flooding,
- Avoid new developments increasing flood risk elsewhere,
- Ensure effective management of residual risks for development permitted in floodplains.

The Guidelines set out a staged approach for the consideration of flood risk in relation to developments as follows:-

Stage 1: Flood risk identification – to identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans and Local Area Plans (LAP's) or a proposed development site that may warrant further investigation at the appropriate lower level plan or planning application levels;

Stage 2: Initial flood risk assessment – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of the detailed assessment should be scoped; and

Stage 3: Detailed flood risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

The Guidelines classify developments into three vulnerability classes based on the effects of flooding

(i) Highly vulnerable development,

(ii) Less vulnerable development and

(iii) Water Compatible development.

Essential infrastructure such as electricity substations is classed as highly vulnerable development.

The Guidelines classify Land areas within three flood zones based on the probability of flooding. Flood zones are defined as follows in the Guidelines:

- Zone A is at highest risk. In any one year, Zone A has a 1 in 100 year (1%) chance of flooding from rivers and a 1 in 200 year (1%) chance of flooding from the sea.
- Zone B is at moderate risk. The outer limit of Zone B is defined by the 1 in 1,000 year (or 0.1%) flood from rivers and the sea.
- Zone C is at low risk. In any one year, Zone C has less than 1 in 1,000 year (<0.1%) chance of flooding from rivers, estuaries or the sea.

In the identification of flood zones, no account should be taken of any flood relief walls or embankments.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Table 1: Matrix of Vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test (reproduced from Table 3.2 of Ref 1)

Table 1, which is reproduced from the guideline document to Planning Authorities in relation to Flood Risk Management states that essential infrastructure, including electricity substations should be located within Flood Zone C. Section 4 of this Flood Risk Assessment document will consider the Flood Zone assignment for the proposed site.

Table 1 refers to the use of a Justification Test under certain circumstances. In cases where there are insufficient sites available to locate a development in the appropriate low flood risk zone, the guideline documents allows for consideration of sites within flood risk zones. A Justification Test is then required to assess such proposals in the light of proper planning and sustainable development objectives.

This report considers the Flood Risk of the proposed substation in relation to Stages 1 and 2 of the staged approach outlined above.

3 Coolnabacky Site

The proposed site is approximately 2.5km north of Timahoe village and 9km west of Stradbally in Co. Laois within the townland of Coolnabacky. The site area is presently being used as agricultural land. The field in which the substation is planned is devoted to grassland and is surrounded by hedges and ditches some containing water. See Figure 1, Figure 2 and photo 1.

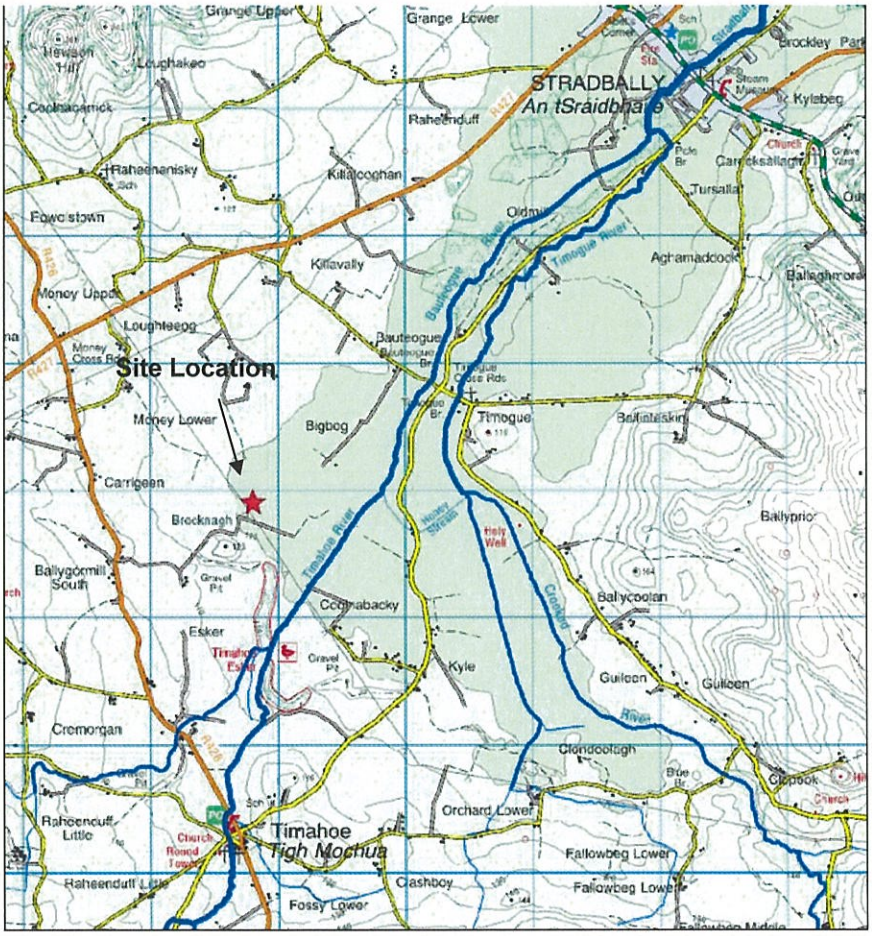


Figure 1: General Site Location (NTS)

Figure 2: Site Location on Orthophoto (NTS)

Photo 1: General site area showing grass field (facing westwards)

4 Flooding Risk

Flood Risk to the site is considered in relation to the following criteria:

- Available Predictive Flood Risk Mapping
- Fluvial Risk: Inundation from flow from neighbouring watercourses
- Pluvial Risk: Flooding due to direct rainfall
- History of Flooding
- Impact of presence of the Substation on the existing flood risk regime at its proposed site.

4.1 Review of OPW Flood Risk Mapping

"As part of Ireland's obligations under Directive 2007/60/EC (the "Floods Directive"), the office of public works (OPW) is currently engaged in the generation of new mapping which will provide predictive estimates of the extent of floodplains as part of its Catchment Flood Risk Assessment Management Studies (CFRAMS)". This programme is being undertaken on a River Basin District basis. The Coolnabacky site is located within the South Eastern River Basin District SERBD. Draft Flood Risk mapping from the CFRAM study is scheduled to be published in 2013.

A Preliminary Flood Risk Assessment (PFRA), a requirement of the EU "Floods" Directive, is being undertaken on a national basis. The objective of the PFRA is to identify areas where the risks associated with flooding might be significant and requiring future more detailed assessment. The more detailed assessment will be undertaken through the CFRAM Studies.

According to the OPW, the PFRA has been undertaken by:

- Reviewing records of historic floods
- An assessment to determine areas vulnerable to future flooding
- Consultation with relevant bodies (Local Authorities, Government departments and agencies)

This assessment considered flood risk from rivers, the sea and estuaries, direct rainfall and groundwater. Mapped output from the draft PFRA, with explanatory notes, is available for public consultation on the following Web site: http://www.cfram.ie/pfra/interactive-mapping/ Refer to Map 183 for Coolnabacky.

The draft mapping identifies the approximate extents of "the 'Indicative 1% AEP (100-yr)" and Extreme" Event zones. The proposed Coolnabacky site is located approximately 0.6km north-west of the left bank of the Timahoe River.

The proposed site lies outside the indicative 1% AEP (100-yr) and Extreme event zones.

The OPW note that the flood extent maps are based on broad-scale simple analyses and may not be accurate for specific locations.

The risk of fluvial flooding is discussed in further detail in Section 4.2 below.

4.2 Fluvial Flood Risk

4.2.1 Description of Site

The site is located in the catchment of the River Timahoe. The River Timahoe joins the River Stradbally just outside the town of Stradbally before entering the River Barrow north of Athy, Co. Kildare. The proposed site location is approximately 0.6km north-west of the Timahoe River and approximately 5km upstream from its confluence with the River Stradbally. The overall Timahoe catchment area upstream of the substation site is approximately 27 km². See Figure 3.

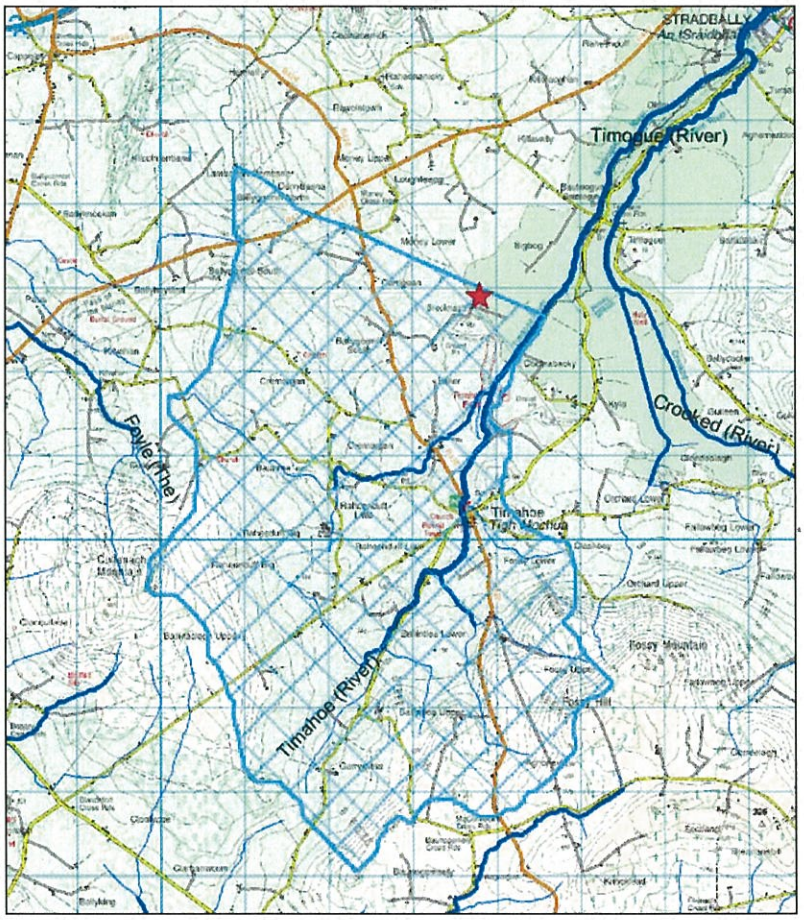


Figure 3: Proposed site showing estimated extent of Timahoe river catchment upstream of site (Light Blue Hatching)

The field within the station is to be sited is surrounded by drainage ditches on its north-west, north-east and south-east, boundaries which will eventually drain south-eastwards to the Timahoe River, a distance of approximately 0.6km. See Figure 4

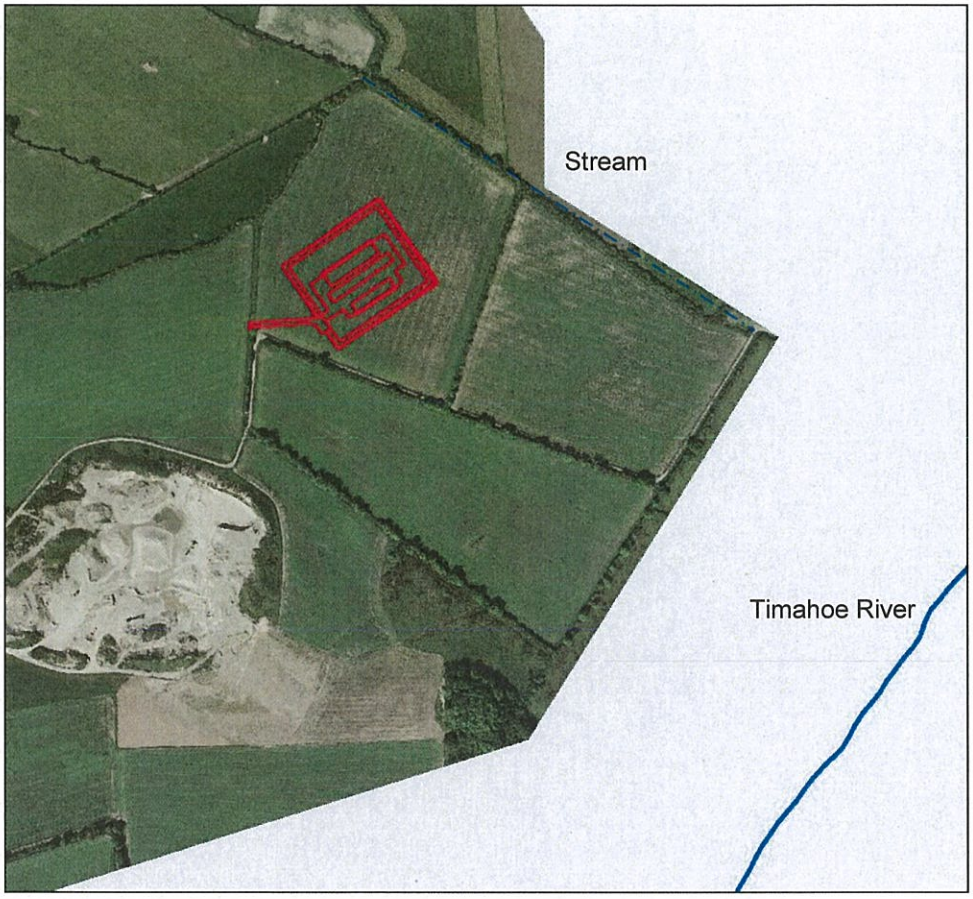


Figure 4: Proposed site showing the River Timahoe

Figure 5 overleaf illustrates the site location and surrounding drains and hedges. Current spot elevations are also shown. Site elevations vary between approximately 98.3mOD and 99.2 mOD. The proposed finished ground level is 99.5mOD.

The field drain running outside the north-east boundary of the field where the site is to be located is approximately 100m from the station. There is a hedge between the field and the drain.

The Timahoe River is included within the Barrow Drainage District and the surrounding lands were subject to arterial drainage. The field within the station is to be sited was not considered to have benefited from this drainage.

There are no active hydrometric gauges on the Timahoe River. Staff Gauge 14044 is sited on the Stradbally River at Stradbally, approximately 6km downstream of Coolnabacky.

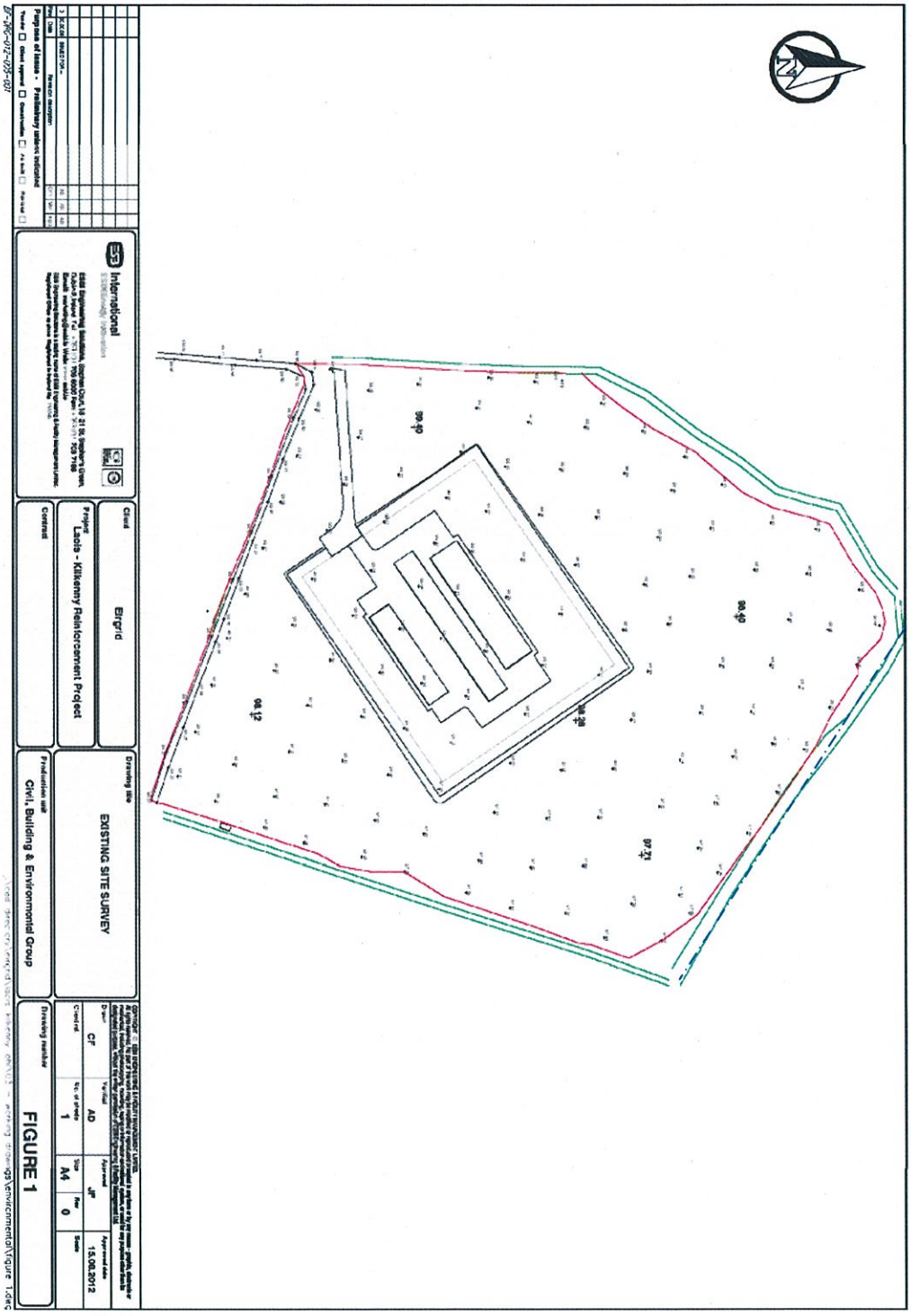


Figure 5: Site Elevation Information

Given the relative elevation of the site to the Timahoe River and that it is approximately 0.6km from the River, the risk of flooding to the substation is considered to be minimal. The risk of flooding from the field drainage network is considered to be minimal.

"It is considered that the site is located in a Flood Zone C as defined in section 2 above".

4.3 Pluvial Flood Risk

The proposed development will increase the impermeable area of the existing site and hence surface water runoff from the site will be increased. This can present an increased risk of pluvial flooding on site and downstream if not managed properly. Consideration needs to be given to the existing surface water runoff route and the drainage characteristics in order to develop an appropriate site drainage system and minimise impacts that increased discharge from the site may have.

Drainage on the site will mimic greenfield runoff characteristics. Sustainable Drainage Systems will be employed to achieve this. The site will be served by an adequate number of appropriately sized and spaced roof and road gullies to ensure that pluvial flooding will not be a problem on the site. Adequate falls in the drainage pipe network are achievable to provide self cleansing velocities and adequate flow capacity for runoff from the site. Sufficient and appropriately located access points to allow maintenance of the drainage network will be provided to further protect against pipe blockages.

The site surface water drainage system will be designed to best practice to provide protection from surface runoff (pluvial flooding) due to direct rainfall.

The drainage system design will reflect the latest rainfall-return period guidance from Met Éireann.

4.4 Groundwater Flood Risk

Groundwater can sometimes present a risk of flooding due to the fact that high groundwater levels can prevent surface water from infiltrating below ground level during extreme rainfall events. This can result in site flooding in the form of ponding.

Information on the site can be found in the report Factual Report on Ground Investigation, Report No. Y2012-12A, ESG 2012.

Based on findings in this report and the fact that there are no structures below ground level the likelihood of groundwater flooding affecting the sites in general is not significant.

4.5 Impact of Development on Current Flood Regime at Site

4.5.1 Impact of Site Surface Water Runoff

All surface runoff will be attenuated to Greenfield runoff rates through the use of flow control devices and attenuation ponds and will ultimately join the Timahoe River approximately 0.7km to the south-west.

There will be no foul discharges.

4.5.2 Loss of floodplain

The site is not located in a floodplain.

5 Historic floods

The review of historic flooding was undertaken using the Office of Public Works (OPW) Web site www.floodmaps.ie.

This Web site www.floodmaps.ie forms a record of all available flood records held by the OPW, all local authorities and other relevant state organisations such as the EPA and the Department of Environment Heritage and Local Government. As part of the data collection exercise, all area engineers in Laois County Council were interviewed and the Council made available its documentary records on past flood events. This Web site represents the current definitive database of historic flood information in this country.

The Web site has no record of flooding in the applicable area. (see Appendix A)

6 Climate Change

Predictions of increases in rainfall due to climate change are very uncertain, but in Autumn and Winter in mid-century it is expected to be of the order of 5 – 10% (http://www.c4i.ie/docs/IrelandinaWarmerWorld.pdf).

The SUDS drainage design can accommodate this increase.

7 Conclusions

There is a minimal risk of flooding to the Substation site at Coolnabacky, Co. Laois. It is reasonable to conclude that the site lies within Flood Zone C as defined by the guideline document to Planning Authorities in relation to Flood Risk Management.

The development will not increase the current flood risk in the catchment.

8 References

1. The Planning System and Flood Risk Management - Guidelines for Planning Authorities, Department of Environment, Heritage and Local Government, November 2009.

2. Factual Report on Ground Investigation, Report No. Y2012-12A, ESG 2012.

3. www.floodmaps.ie

4. http://www.cfram.ie/pfra/interactive-mapping/

Appendix A

Extract from
www.floodmaps.ie

OPW *National Flood Hazard Mapping*

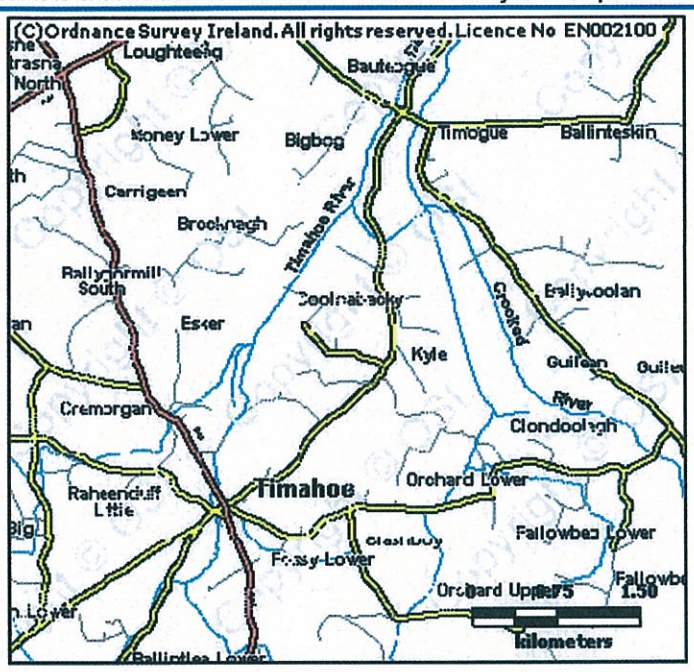
Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Laois

NGR: S 548 917



Map Scale 1:62,129

Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

0 Results

Appendix G – Drainage & Services Drawings List

All Drawings are located in Volume 1 of the Planning Pack

- PE610-D002-004-001 Road Drainage Plan Sheet 1 of 3
- PE610-D002-004-002 Road Drainage Plan Sheet 2 of 3
- PE610-D002-004-003 Road Drainage Plan Sheet 3 of 3
- PE610-D002-004-005 Site Drainage Layout
- PE610-D002-004-006 Compound Drainage Layout
- PE610-D002-004-007 Drainage Details Sheet 1 of 2
- PE610-D002-004-008 Drainage Details Sheet 2 of 2
- PE610-D002-004-009 Details of Drainage Ponds