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ESB Networks Historic Cable Fluid Losses: Preliminary Site Assessment

Location 12: Carrickmines – Poolbeg 220 kV – June 2015

Prepared for

ESB Networks
Engineering Major Projects
One Dublin Airport Central
Dublin Airport
Cloghran
Co. Dublin

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EXECUTIVE SUMMARY

This report presents a preliminary site assessment (PSA) of the potential environmental impacts associated with the historic loss of cable fluid from a section of underground cable located in Leopardstown, Co. Dublin. ESB records indicate that 11,965 litres of cable fluid (linear alkyl benzenes) leaked into the ground from the subject section of cable over a period of 26 months between April 2013 and June 2015. An earlier leak of cable fluid occurred at the same location between December 2010 and October 2012 – i.e. this earlier leak was repaired approximately six months before the subject leak is reported to have started.

The PSA was performed with reference to the EPA's 2013 publication "*Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites*". The EPA's guidance document outlines a staged and risk-based approach to contaminated land and groundwater assessment, with the PSA being the first stage in the process. By its nature the PSA stage is precautionary and conservative, aiming to identify those potential "pollutant linkages" where more detailed assessment is required.

Generally, more detailed assessment is only necessary where the assessed risk to a potential receptor is moderate, high or very high. However, in cases where the potential receptor is particularly sensitive, more detailed assessment may be recommended even if the assessed risk is low.

The findings of the PSA for the subject loss of cable fluid can be summarised as follows:

- The leak location is in a predominantly residential area adjacent to the intersection of Brewery Road and Leopardstown Avenue in south Co. Dublin;
- The topography in the vicinity of the leak location is relatively flat; ground elevations dip down slightly towards the north-east, generally along the line of Brewery Road.
- Surface water features close to the leak location include Stillorgan Reservoir, which is located up-gradient of the leak location and at a higher elevation, and Brewery Stream, which is located approximately 80m down-gradient of the leak location.
- Brewery Stream discharges to Dublin Bay in Blackrock approximately 3 km north-east of the leak location; this coastline is designated a Special Protection Area (SPA)[1] and a Special Area of Conservation (SAC)[2]. The status of Brewery Stream under the Water Framework Directive (WFD) classification system is "under review". There appears to be a culverted surface water drain running along the eastern side of Brewery Road that crosses the line of the subject cable and discharges to Brewery Stream;
- Based on available geological maps, the area of the leak location is underlain by silty clays with subordinate sands and gravels, below which is granite bedrock. Bedrock outcrop is indicated on maps immediately east of the leak location, indicating that soils in the area of the leak may be relatively thin. The groundwater body underlying area

[1] South Dublin Bay and River Tolka Estuary SPA – site code 004024

[2] South Dublin Bay SAC – site code 000210

of interest is classified as a "poor aquifer" from a productivity perspective. Its current WFD status is "good", and the associated risk classification is "not at risk" of achieving its WFD objectives;

- Brewery Stream, Dublin Bay close to the point where Brewery Stream discharges, ecosystems dependent on these water bodies and the bedrock aquifer in the granite bedrock, appear to be the key environmental receptors potentially at risk of impact from the leak of cable fluid from this location. The potential for cable fluid (or some of its constituent compounds) to permeate buried water mains and impact water quality in the water mains also needs to be considered; however, the low solubility of these compounds and the low rate of permeation are such that they are unlikely to impact water quality in the pipes. Whilst occupants of buildings in the vicinity of the leak could be considered to be potential receptors via vapour intrusion pathways, because of the expected low volatility of the linear alkyl benzenes, the risk of such receptors being impacted is probably low.

A preliminary risk assessment was completed that considered the potential risk posed by the subject leak on the identified potential receptors. The findings of this preliminary risk assessment are summarised in the following table:

Receptor	**Risk Category**	**Comment**
Brewery Stream, Dublin Bay & dependent ecosystems	Moderate	Medium/long term risk of pollution of Brewery Stream, which discharges to Dublin Bay (a SAC and a SPA), but it is uncertain that this will occur even over a longer period. This assumes there is a viable pathway for cable fluid migration between the cable trench and the inferred surface water drain along the east side of Brewery Road. There are understood to have been no reports to date of pollution of Brewery Stream or Dublin Bay linked to the subject loss of cable fluid.
Water mains, water supply	Low	Whilst the potential for organic compounds to permeate water mains is known (in particular plastic water pipes and the joints of other types of water pipes), the potential for linear alkyl benzenes to permeate water mains was not established during the PSA. The risk category assumes that cable fluid may be present as residual LNAPL in the water main trench and that there is potential for it to permeate water pipes, but not to the extent that it will impact water quality in the pipes.
Bedrock aquifer	Low	The bedrock is classified as a "poor aquifer". The GSI vulnerability rating is "extreme" indicating that overburden soils are thin. If cable fluid has entered the aquifer, the extent of any plume can be expected to be localised due to low productivity of the aquifer and the biodegradability of the cable fluid in groundwater.

Receptor	Risk Category	Comment
Occupants of buildings where there are potential confined spaces	Very low	There are no occupied buildings in the immediate vicinity of the leak location or the cable route close to the leak location. No health effects are anticipated.

More detailed assessment of the risk to water quality in Brewery Stream, and potentially Dublin Bay in the area where Brewery Stream discharges and ecosystems dependent on these water bodies, is required to refine the level of risk. Further investigation of the risk to water mains, the bedrock aquifer and occupants of nearby buildings is not considered necessary.

* * * * * * *

1 INTRODUCTION

1.1 Project Background

Geosyntec Consultants Ltd (Geosyntec) is pleased to present the Electricity Supply Board (ESB) this Preliminary Site Assessment (PSA), which relates to the potential environmental impacts associated with the historic loss of cable fluid from a section of underground cable located in Leopardstown, Co. Dublin. The alignment of the subject section of cable and the approximate location of the historic loss of cable fluid is illustrated in ESB Drawing Number QD-354120-01-D460-001-016-001 (Figure 1).

The PSA was completed in accordance with Geosyntec proposal reference 190607 dated June 2019, which was authorised by the ESB on 1st July 2019. The PSA was led by Mr Graham Webb, who is an environmental engineer with over 25 years' relevant experience, and Mr Jim Wragg, who is a contaminant hydrogeologist with over 30 years' relevant experience.

ESB Networks operates and maintains a network of High Voltage (HV) underground cables of over 1,600 km across Ireland, of which approximately 205 km (175 km operational) are insulated by a cable fluid. The majority of these fluid-filled cables are located in urban settings across Dublin city and Cork city. The cable fluid acts as an electrical insulator and aids the conduction of heat away from the conductor allowing the cable to be operated more efficiently. The cables are vulnerable to third party interference or damage, and over time, cables can develop leaks due to defects developing in the cable sheath and in joints and terminations. When such leaks occur, there is potential for pollution to arise.

In the case of the section of fluid-filled cable that is the subject of this PSA, ESB records indicate that 11,965 litres of cable fluid leaked into the ground from the cable over a period of 26 months between April 2013 and June 2015.

1.2 Objective and Scope of Work

The primary objective of the PSA was to complete a preliminary assessment of the potential types, locations, extent and significance of environmental impacts associated with the subject historic cable fluid loss. The PSA was performed with reference to the EPA's 2013 publication "*Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites*". This PSA report is based on the EPA's guideline template report for PSAs, which is linked to the 2013 guidance.

The EPA's 2013 guidance document outlines a staged approach to contaminated land and groundwater assessment, with the PSA being the first stage in the process. During the PSA stage, the guidance requires the assessor to identify environmental "receptors" - including groundwater and surface water bodes and flora and fauna dependent on them as well as people - who are potentially at risk from the source of contamination, and to qualitatively assess the risk to each environmental receptor by considering the viability of each source-pathway-receptor "pollutant linkage". Those pollutant linkages where there is considered to be a moderate or high risk of impact from the source of contamination, or where the receptor

is particularly sensitive, are identified through this process. These pollutant linkages are then carried forward to the next stage of the process during which more detailed assessment can be completed. Given the above, the PSA stage of the process is precautionary and conservative in nature.

Generally, more detailed assessment is only necessary where the assessed risk to a potential receptor is moderate, high or very high. However, in cases where the potential receptor is particularly sensitive, more detailed assessment may be recommended even if the assessed risk is low.

The PSA for the subject loss of cable fluid was based on a desk study of publicly available information and information provided by the ESB, a walkover survey of the immediate vicinity of the cable within approximately 200 metres of the location of the historic loss of cable fluid, and a reconnaissance of the surrounding area.

Information for the desk study element of the PSA was obtained from the following sources:

- Ordnance Survey Ireland (OSI) website (www.osi.ie): historic maps, historic aerial images, recent "street-view" map;
- Environmental Protection Agency (EPA) websites (www.epa.ie and www.catchments.ie): locations of EPA-licensed facilities, locations of Natura 2000 sites and National Heritage Areas (NHAs), information on groundwater and surface water quality, including Water Framework Directive (WFD) classifications;
- Geological Survey of Ireland (GSI) website (www.gsi.ie): overburden and bedrock geology, information on groundwater resources and groundwater vulnerability;
- Office of Public Works (OPW) website (www.opw.ie): flood risk;
- National Waste Collection Permit Office (NWCPO) website (www.nwcpo.ie): register of companies holding waste facility permits or certificates of registration issued by local authorities;
- ESB records outlining the location of the cable fluid loss, the volume of fluid lost and the period over which the fluid loss occurred;
- Safety Data Sheets (SDSs) provided by the ESB for the cable fluid understood to have been used in the subject cable at the time of the cable fluid loss.

The walkover survey and reconnaissance of the area surrounding the subject section of cable was completed by Mr Graham Webb of Geosyntec on 4th July 2019. A series of photographs taken at the time of the walkover survey and reconnaissance is included in Appendix A.

During the walkover survey and reconnaissance, information on the following aspects were recorded:

- The environmental setting, with regard to local topography, surface water drainage and the proximity of local surface water courses;

- Land use, in particular the proximity of residential properties and other potentially sensitive land uses close to the subject section of cable;
- The proximity of the subject section of cable to other below-ground infrastructure, such as water mains, gas mains and sewers;
- Distressed vegetation, which may be indicative of subsurface contamination.

Central to the PSA was the development of a preliminary Conceptual Site Model (CSM), which presents potential source-pathway-receptor (SPR) linkages identified during the PSA, and a preliminary assessment of the risk posed to identified human or environmental receptors from residual cable fluid potentially remaining in the vicinity of the subject section of cable.

2 DETAILS OF LOSS EVENT

2.1 Introduction

In the case of the section of fluid-filled cable that is the subject of this PSA, ESB records indicate that 11,965 litres of cable fluid leaked into the ground from the cable over a period of 26 months between April 2013 and June 2015. The type of fluid understood to have been present in the cable is identified in ESB records as a mixture of linear alkyl benzenes.

It is noted that an earlier leak of cable fluid occurred at the same location between December 2010 and October 2012 – i.e. this earlier leak was repaired approximately six months before the subject leak is understood to have started. This earlier leak is the subject of a separate PSA (as part of the same project). However, it is relevant to the subject PSA because it is reasonable to assume that residual cable fluid will have been in the subsurface in the vicinity of the leak location prior to it taking place. As such the potential impacts of the second leak event need to take account of the residual impacts from the first event.

2.2 Properties of Cable Fluid

The properties of the linear alkyl benzenes understood to have been used in the subject section of cable over the period of the leak, based on information contained within the Safety Data Sheets provided by ESB, are as follows:

- Boiling point: 280°C
- Flash point: >135°C
- Flammability: Non flammable
- Explosive properties: Not explosive
- Vapour pressure: <0.02 kPa at 20°C
- Density: 0.86 g/cm^3 at 20°C typical
- Solubility in water: Negligible
- Kinematic Viscosity: 4.2 mm^2/s typical

In their 2010 publication "*Classification of Hazardous and Non-Hazardous Substances in Groundwater*", the EPA classifies all petroleum hydrocarbon compounds listed in the document, including linear alkyl benzenes, as hazardous in groundwater. However, this is on the basis that they are former List I substances and it is stated in the document that these classifications are "under review". Based on the methodology outlined in the above-mentioned publication (which is based on the persistence, toxicity and potential to bioaccumulate of the substance in the environment) and publicly-available information on its properties, Geosyntec has concluded that linear alkyl benzenes should be classified as non-hazardous in groundwater.

2.3 Fate & Transport of Cable Fluid

The fate and transport of cable fluid entering the subsurface during and following the subject leak can be expected to be controlled by the following factors:

- The blend of linear alkyl benzene compounds that make up the cable fluid are less dense than water;
- The cable fluid has a low water solubility (< 1 mg/l);
- The compounds in the cable fluid are semi or non-volatile;
- The compounds present in the cable fluid can be expected to biodegrade but at rates that are controlled by the surface area of the fluid in the subsurface (i.e. in the form of a light non-aqueous phase liquid or LNAPL), its solubility where in contact with groundwater, the availability of electron acceptors and the presence of appropriate microbial populations.

Following creation of a breach in the cable structure, the conceptual model of the dispersion of the cable fluid into the subsurface at the subject location can be described as follows:

- As the cable fluid is less dense than water it will tend to migrate into the pore spaces in the sand bedding around the cable and downward under the force of gravity until it reaches either a water table or low permeability horizon, such as natural clay at the base of the cable trench;
- The cable fluid will tend to spread laterally whilst:
    - There is a driving head provided by leakage of further cable fluid;
    - There is a path of relatively low resistance, e.g. the sand bedding around the cable, potentially permeable fill material in other service trenches that the cable trench intersects, or permeable horizons in the overburden.

The migration potential of the cable fluid released to the subsurface as a result of the subject leak is discussed in more detail in Section 4.

3 SITE ENVIRONMENTAL SETTING

3.1 Proximity of Site to Designated Ecologically Sensitive Areas

The National Parks and Wildlife Service on-line mapping tool was consulted to check if the leak location lies close to any designated ecologically sensitive areas. Based on the information reviewed there are no Special Areas of Conservation (SACs - as per the Habitats Directive 92/43/EEC), National Heritage Areas (NHAs or proposed NHAs - as per the Wildlife Amendment Act, 2000) or a Special Protection Areas (SPAs - as per the Birds Directive 2009/147/EC) within a 2 km radius of the leak location.

It is noted that Brewery Stream, which flows close to the leak location, discharges into Dublin Bay adjacent to the Blackrock area. This coastal area of Dublin Bay is designated a SPA (South Dublin Bay and River Tolka Estuary SPA – site code 004024) and a SAC (South Dublin Bay SAC – site code 000210).

3.2 Surrounding Land Use & Field Observations

The subject leak location is in a residential area adjacent to Brewery Road in Leopardstown, Co. Dublin, at the intersection with Leopardstown Avenue. Immediately west of the leak location is a public open space at the entrance to a residential area. North-east of the leak location is the Leopardstown Inn, which is approximately 40m from the leak location at the closest point. The closest residential property is approximately 20m from the leak location.

The earliest historic map of the area available from the OSI's website is dated 1837 – 1842 (Appendix B) and shows that the leak location was greenfield land at that time. Brewery Road is shown on this map, running approximately north-south past the leak location.

The historic map dated 1888 – 1913 indicates that no further development has taken place over this period in the immediate vicinity of the leak location. However, the Stillorgan Reservoir is indicated on this map, located approximately 150 metres south-west of the leak location. On this map, an open drain is shown flowing north along the east side of Brewery Road, which appears to discharge into Brewery Stream approximately 80m north-east of the leak location.

The earliest aerial image available from OSI's website (other than 19th century historical maps) is dated 1995. This image indicates that in 1995, the road layout and the layout of commercial and residential buildings in the vicinity of the leak location was similar to that observed today.

Based on observations made during the walkover survey and reconnaissance of the area, land use in the vicinity of the leak location is predominantly residential, with an area of commercial land use north-east of the leak location. The residential buildings in the area appear to date from the mid-20th century and are mostly semi-detached bungalows or semi-detached two-storey houses. The streets in the area are likely to have been constructed in conjunction with the residential development of the area (Brewery Road being the exception).

In summary, land use in the vicinity of the leak location appears to have been predominantly agricultural until the mid-1900s when the area was developed predominantly for residential purposes.

Based on information from the EPA's website there are no facilities in the vicinity of the leak location that operate under an Industrial Emissions licence, an Integrated Pollution Control licence, or a Waste licence. According to the NWCPO's website there is one facility holding a Waste Facility Permit in the vicinity of the leak location. This facility is located approximately 1 km to the south-west in Sandyford (Greenking Composting - WFP DLR/16/01).

3.3 Topography & Surface Water

The leak location lies at an elevation of approximately 85 metres above Ordnance Datum. The topography in the vicinity of the leak location appears to be relatively flat, with ground elevations dipping down slightly from the south-west towards the north-east.

The nearest surface water body is the Stillorgan Reservoir which is located approximately 150 metres south-west of the leak location and has a total area of approximately 164,500 m^2. There is an earth embankment around the perimeter of the reservoir which is approximately 4 metres higher than the leak location; under normal circumstances the water level in the reservoir is higher than ground level at the leak location.

Additionally, Brewery Stream is indicated on Ordnance Survey maps of the area. It is indicated to be approximately 80 metres north-east and down topographic gradient of the leak location, flowing close to the eastern side of Brewery Road in a north-easterly direction, and eventually discharging to Dublin Bay. It appears that the open drain shown in the 1888-1913 historical OSI map along the eastern side of Brewery Road adjacent to the leak location may have been culverted during development of the area.

The status of Brewery Stream under the WFD classification system is currently "under review". It is listed as being under significant anthropogenic pressure.

The vicinity of the leak location is rated by the OPW as having a low-to-medium risk of fluvial flooding.

3.4 Geology & Hydrogeology

The bedrock geology underlying the leak location is mapped by the GSI as pale grey fine to coarse-grained granite of the Caledonian (Silurian - Devonian) age. Bedrock outcrop is indicated by the GSI immediately east of the leak location. The overburden deposits overlying the bedrock are indicated by the GSI to comprise glacial till comprising silty clays with subordinate sands and gravels.

The groundwater body (GWB) underlying the area of interest is known as the Kilcullen GWB. This GWB covers an area of approximately 642 km^2 extending across the southern portion of Dublin city, and the area south and south-west of Dublin from the coast towards the town of

Kilcullen in Co. Kildare. From a productivity perspective, the GSI classifies this GWB as a "poor aquifer". Such aquifers are generally unproductive except in local zones.

The EPA is responsible for classifying GWBs in Ireland in terms of water quality and their ability to meet objectives set out in the WFD. Based on the most recent round of EPA monitoring (2010 – 2015), the status of the Kilcullen GWB was categorised as "good" and it was categorised as "not at risk" with regard to achieving WFD objectives.

The vulnerability of the bedrock aquifer close to the leak location (from a water quality perspective) is classified by the GSI as "extreme", which suggests that bedrock is relatively shallow and that the otherwise protective overburden layer of glacial till may be thin or absent.

A search of the GSI's online database indicates that the nearest registered groundwater well to the leak location is approximately 1 km to the east. The well was drilled to a depth of 85 m with depth to bedrock indicated to be 7.6 m. The reported yield of the well is "moderate" at 54.5 m^3/d.

4 CONCEPTUAL SITE MODEL

4.1 Introduction

For the purposes of this PSA, it has been assumed that the top of the fluid filled cable is buried at a depth of 0.9 – 1.1m below ground level within a backfilled trench that is around 1.2m deep. The trench backfill is assumed to comprise a 0.35 m deep sand layer (0.85m below ground level) above which the trench is assumed to be filled with granular material.

For the purposes of the PSA, strata adjacent to and below the cable trench have been assumed to comprise either:

- Low permeability silty clay dominated glacial till; and/or,
- Granular fill materials associated with trench backfill for other underground services that intersect the route of the fluid filled cable; and/or,
- Granular fill materials associated with historical development in the surrounding area.

It has also been assumed that perched groundwater may periodically be present within the in-filled cable trench.

4.2 Source & Potential Migration Pathways

Based on the expected low permeability of overburden material in the vicinity of the leak location, cable fluid lost to ground can be expected to have spread laterally within the permeable sand bedding and possibly within the granular backfill within the cable trench. If the cable trench intersects more permeable material (e.g. deeper fill materials associated with

historical development, lenses of natural sands or gravels, or another in-filled services trench – including that around the river culvert), which is considered likely in the subject case, this could result in cable fluid migrating from the cable trench and along a different route or routes.

We have developed a series of indicative estimates for the subject leak location under different ground condition scenarios, with regard to the extent of cable fluid migration. These estimates have assumed that the cable is installed within a 0.35m thick sand bedding and surround layer in a trench 1.1m wide cut into low permeability clay soils (which can be expected at the subject location):

- In the case where (i) the sand bedding is dry, (ii) the cable fluid saturation reaches 40% of the residual saturation of the porosity in the sand bedding and (iii) the overlying granular back-fill material in the trench acts as a capillary break, the theoretical length of trench impacted by LNAPL migration is 388 m (955 m if the two leaks at this location are considered cumulatively). There appears to be a low point in the cable route close to the leak location, with ground elevations increasing slightly towards the west and very slightly towards the east. As such, the migration direction along the cable trench under this scenario may be expected to be predominantly eastwards along Leopardstown Avenue, with some potential for migration along the cable trench under the green space west of Brewery Road. There appears to be potential for the cable fluid to "pond" in the trench if it is the case that the leak location is a local low-point in the cable trench, with potential for a thicker LNAPL layer to develop locally in the trench than the assumed 0.2m;

  However, given that there are likely to be other below-ground services trenches that run parallel with Brewery Road that intercept the cable trench (particularly drains and sewers, which may be deeper than the subject cable), it appears likely that a proportion of the cable fluid will have migrated from the cable trench and along the line of these service trenches, generally towards the north/north-east. Given the relatively large volume of cable fluid lost to ground at the leak location, there is potential for cable fluid to have migrated for a considerable distance (i.e. tens of metres, potentially more) along such service trenches;
- In the event that the base of the trench contains perched water then this would lower the LNAPL saturation in the sand layer surrounding the cable. This could result in LNAPL migration through the granular back-fill material above the sand bedding layer. The thickness of LNAPL-saturated soils will likely be less under this scenario than that outlined above, but the cable fluid would tend to spread further. If a 40% residual cable fluid saturation is assumed in granular backfill material over a 0.2m thickness, this would lead to a theoretical length of trench impacted by cable fluid of 680m (1,670 m if the two leaks at this location are considered cumulatively). As for the first scenario, the LNAPL migration direction can be expected to be predominantly towards the east along Leopardstown Avenue, with the same potential for a thicker LNAPL layer to develop in the in-filled cable trench if it is the case that there is a low

point in the in-filled trench in the vicinity of the leak location. The same potential exists under this scenario for cable fluid to migrate from the cable trench into deeper services trenches running parallel with Brewery Road, and to migrate potentially for several tens of metres (potentially more) within these services trenches generally towards the north/north-east along the line of Brewery Road;

- A third scenario considered herein is where the cable trench near the leak point passes through a wider area of granular material of similar properties to those used to backfill the trench. Here a more radial spreading of the cable fluid could occur. If a 0.2m deep soil zone is impacted with a LNAPL saturation of 40% then the theoretical radius of cable fluid LNAPL impact away from the release point would be 15 metres (24 m if the two recorded leaks at this location are considered cumulatively). For the subject location, given that ground elevations dip down towards the north-northeast (generally along the line of Brewery Road) then this spread of cable fluid can be expected to be preferentially towards the north/north-east;
- The cable fluid may have some semi-volatile components (alkyl benzenes) and as such may have the potential to generate a modest vapour pressure. However, this may be attenuated by biodegradation processes in the shallow soils. In aerobic shallow soils and groundwater, degradation of alkyl benzenes is expected to be relatively quick (half-life in soil of 15 days[3]). Conversely, degradation is expected to be negligible in anaerobic conditions. Degradation products of alkyl benzenes include toluene and ethylbenzene, which have relatively high vapour pressures. However, these products would be expected to be only generated in small quantities and themselves tend to degrade quickly;
- Cable fluid has the potential to migrate from the source to underneath confined spaced receptors (such as building cellars), either in LNAPL form or via migration in the dissolved phase in groundwater flow following dissolution from the LNAPL. Vapours generated from the LNAPL or groundwater have the potential to migrate through soil gas in the unsaturated zone and via building defects into confined spaces, where they may be breathed in by building occupants, potentially causing toxic and/or nuisance effects.

In addition to the above scenarios, the following potential migration pathways were considered as part of the PSA but they were not carried forward to the preliminary risk assessment because the source-pathway-receptor (SPR) linkage was not considered viable:

- Soil and dust ingestion from near surface soils;
- Dermal contact with near surface soils;
- Inhalation of fugitive dust from near surface soils; and
- Ingestion of soils via consumption of vegetables grown in near surface soils.

[3] Energy cable saturant SDS – refer to Appendix C

4.3 Potential Receptors

With the above migration scenarios in mind, Brewery Stream, potentially Dublin Bay (a SAC and a SPA), ecosystems dependent on these water bodies, and the bedrock aquifer in the granite bedrock appear to be the key environmental receptors potentially at risk of impact from the leak of cable fluid from this location. The potential for cable fluid (or some of its constituent compounds) to permeate buried water mains and impact water quality in the water mains also needs to be considered; however, the low solubility of these compounds and the low rate of permeation are such that they are unlikely to impact water quality in the pipes.

Whilst occupants of buildings in the vicinity of the leak could be considered to be potential receptors via vapour intrusion pathways, because of the expected low volatility of the alkyl benzenes, the risk of such receptors being impacted is probably low.

Groundworks contractors performing future tasks in the vicinity of the leak location could also be considered potential receptors (via direct contact, inhalation and ingestion pathways). However, it has been assumed that the potential risks posed to future groundworks contractors would be adequately mitigated through effective health and safety planning and work control procedures at the time the works are being carried out. As a result, groundworks contractors have not been considered potential receptors in the preliminary risk assessment presented in the following section.

5 PRELIMINARY RISK ASSESSMENT

The key potential source-pathway-receptor (SPR) linkages associated with the subject loss of cable fluid are presented in this section, together with a preliminary assessment of the risk posed to the identified receptors. The preliminary risk assessment is based on the methodology outlined in CIRIA C552 (2001) "*Contaminated Land Risk Assessment – A Guide to Good Practice*". This methodology requires the classification of the magnitude of the **consequence** (severity) of a risk occurring, and the **probability** of a risk occurring. The risk assessment methodology is summarised in Tables 1 – 4 below.

The potential consequences of contamination risks occurring are classified in accordance with Table 1.

Table 1: Classification of Consequence

Classification	Definition of Consequence
Severe	• Short-term (acute) risk to human health likely to result in significant harm. • Short-term risk of pollution of sensitive water resource. • Catastrophic damage to buildings/property. • A short-term risk to a particular ecosystem, or organism forming part of such ecosystem.
Medium	• Chronic damage to human health. • Pollution of sensitive water resources. • A significant change in a particular ecosystem, or organism forming part of such ecosystem.
Mild	• Pollution of non-sensitive water resources. • Significant damage to crops, buildings, structures and services. • Damage to sensitive buildings/structures/services or the environment.
Minor	• Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. • Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.) • Easily repairable effects of damage to buildings, structures and services.

The probability of contamination risks occurring are classified in accordance with Table 2.

Table 2: Classification of Probability

Classification	Definition of Probability
High Likelihood	Circumstances are such that an event appears very likely in the short-term or almost inevitable in the long-term; or there is already evidence that such an event has occurred.
Likely	Circumstances are such that such an event is not inevitable, but is possible in the short-term and is likely over the long-term.
Low Likelihood	Circumstances are such that it is by no means certain that an event would occur even over a longer period, and it is less likely in the short-term.
Unlikely	Circumstances are such that it is improbable that an event would occur even in the very long-term.

For each viable SPR linkage, the potential risks are evaluated, as presented in Table 3.

Definitions of the risk categories, together with the investigatory and remedial actions that may be necessary in each case are presented in Table 4.

Table 3: Risk Matrix

		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate risk	Low risk
	Low likelihood	Moderate risk	Moderate risk	Low risk	Very low risk
	Unlikely	Low risk	Low risk	Very low risk	Very low risk

Table 4: Definition of Risk Categories and Likely Actions Required

Risk Category	Definition and likely actions required
Very high	There is a high probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe. If any harm were to occur, it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst be mild.
Very low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

The key potential SPR linkages associated with the subject loss of cable fluid are presented in Table 5 below, together with a preliminary assessment of the risk posed to the identified receptors in each case, in line with the above methodology.

Table 5: Preliminary Risk Assessment for Location 12

Source	Potential Pathway	Receptor	Consequence	Probability	Risk Category	Comment
Loss of linear alkyl benzenes over the period April 2013 to June 2015 (estimated 11,965 litres). This followed on from an earlier loss of an estimated 17,434 litres over the period December 2010 – October 2012 at the same location.	Predominantly lateral migration of cable fluid from the leak location along the cable trench, and/or through granular lenses within the overburden, followed by migration along other preferential pathways (e.g. other in-filled services trenches that intersect the cable trench).	Brewery Stream; Dublin Bay (a SAC & a SPA); Ecosystems dependent on these water bodies	Medium	Low	Moderate	Medium/long term risk of pollution of Brewery Stream (and potentially Dublin Bay close to the point where Brewery Stream discharges) but it is uncertain that this will occur even over a longer period. This assumes there is a viable pathway for cable fluid migration between the cable trench and the inferred surface water drain along the east side of Brewery Road. There are understood to have been no reports to date of pollution of Brewery Stream linked to the subject loss of cable fluid.
	Predominantly lateral migration of cable fluid from the leak location along the cable trench, and/or through granular lenses within the overburden, and subsequent migration into backfilled trenches containing water mains. Permeation of constituents of the cable fluid through the walls or joints of the water mains.	Water mains/ Water supply	Medium	Unlikely	Low	Whilst the potential for organic compounds to permeate water mains is known (in particular plastic water pipes and the joints of other types of water pipes), the potential for linear alkyl benzenes to permeate water mains was not established during the PSA. The risk category assumes that cable fluid may be present as residual LNAPL in the water main trench and that there is potential for it to permeate water pipes. However, the low solubility of linear alkyl benzenes and the expected low rate of permeation are such that they are unlikely to impact water quality in the pipes.

Table 5: Preliminary Risk Assessment for Location 12

Source	Potential Pathway	Receptor	Consequence	Probability	Risk Category	Comment
(as above)	Vertical migration of cable fluid via permeable lenses in the overburden and/or via granular material in in-filled services trenches to groundwater in the bedrock aquifer, followed by dissolution of cable fluid and generation of a dissolved-phase plume of alkyl benzenes in the bedrock aquifer.	Bedrock aquifer	Mild	Low	Low	The bedrock is classified as a "poor aquifer". Vulnerability is "extreme" indicating that overburden soils are thin. If cable fluid has entered the aquifer, the extent of any plume can be expected to be localised due to low productivity of the aquifer and the potential for the cable fluid to biodegrade relatively rapidly in groundwater.
	Predominantly lateral migration of cable fluid from the leak location along the cable trench, and/or through granular lenses within the overburden, followed by migration along other preferential pathways (e.g. other in-filled services trenches that intersect the cable trench). Release of vapour-phase alkyl benzenes and/or daughter products from the LNAPL (noting that there is limited potential for this to occur) and migration in the vapour phase into buildings.	Occupants of buildings where there are potential confined spaces	Minor	Low	Very low	There are no occupied buildings in the immediate vicinity of the leak location or the cable route close to the leak location. No health effects are anticipated.

6 CONCLUSIONS

The following conclusions have been drawn based on the information reviewed and observations made during this PSA:

- The leak location is in a predominantly residential area adjacent to the intersection of Brewery Road and Leopardstown Avenue in south Co. Dublin;
- The topography in the vicinity of the leak location is relatively flat; ground elevations dip down slightly from the south-west towards the north-east, generally along the line of Brewery Road;
- The key receptors potentially at risk of impact from the subject leak are considered to be Brewery Stream, potentially South Dublin Bay (which comprises two designated sites, the South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA) close to the discharge point of Brewery Stream, ecosystems dependent on these water bodies, the bedrock aquifer underlying the area, water mains in the vicinity of the leak location and occupants of nearby buildings with potential confined spaces;
- Following the preliminary risk assessment methodology outlined in CIRIA publication C552 (2001), the appropriate risk category for these potential receptors and the associated SPR linkages are:
    - Brewery Stream/Dublin Bay - Moderate
    - Water mains - Low
    - Bedrock aquifer - Low
    - Occupants of nearby buildings - Very low

More detailed assessment of the risk to water quality in Brewery Stream, Dublin Bay close to the discharge point of Brewery Stream and ecosystems dependent on these water bodies is required to refine the level of risk. Further investigation of the risk to water mains, the bedrock aquifer and occupants of nearby buildings is not considered necessary.

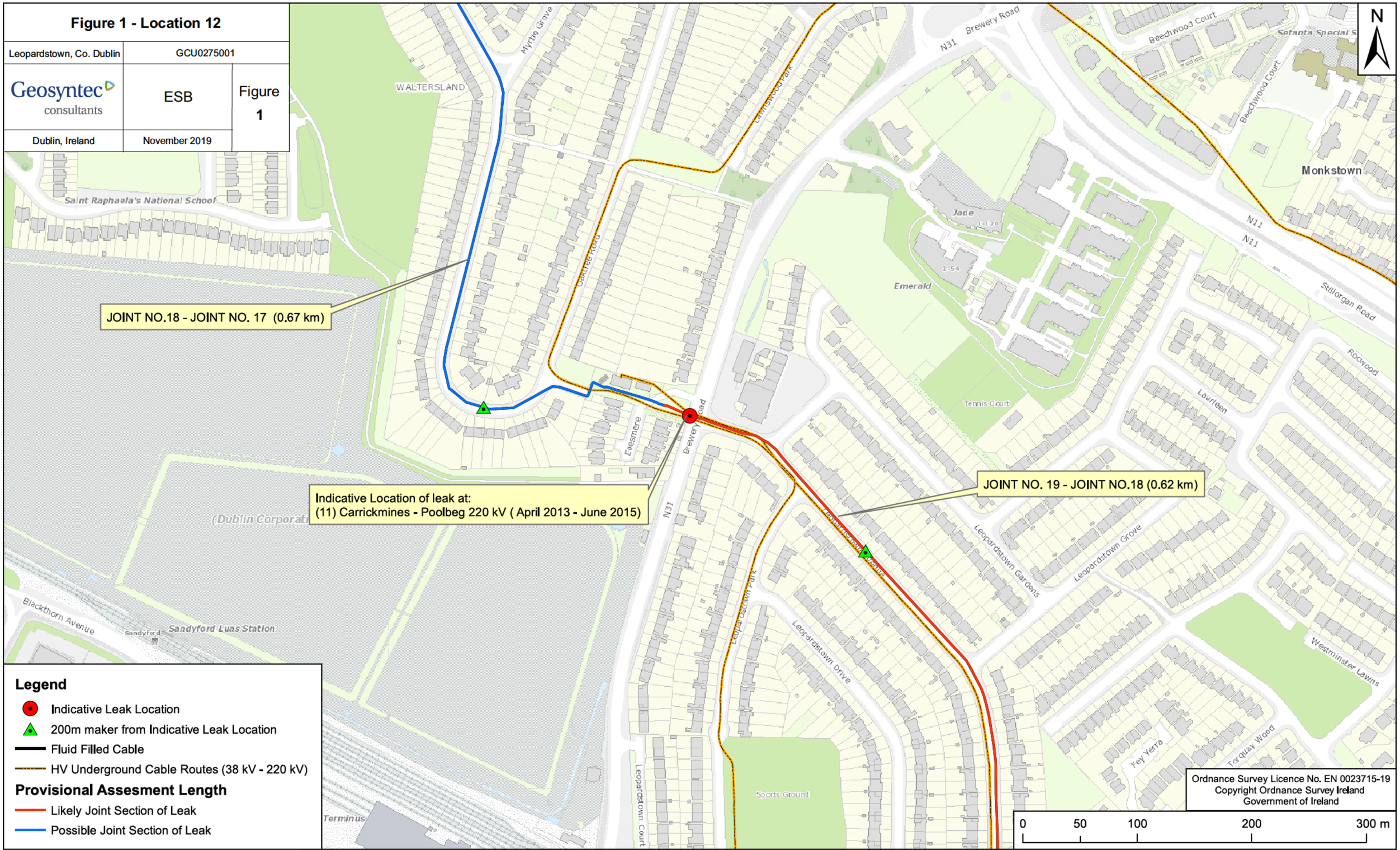
* * * * * * *

Geosyntec consultants

F I G U R E S

Figure 1 - Location 12

Leopardstown, Co. Dublin	GCU0275001	
Geosyntec consultants	ESB	Figure 1
Dublin, Ireland	November 2019	



Legend

- Indicative Leak Location
- 200m maker from Indicative Leak Location
- Fluid Filled Cable
- HV Underground Cable Routes (38 kV - 220 kV)

Provisional Assesment Length

- Likely Joint Section of Leak
- Possible Joint Section of Leak

0 50 100 200 300 m

REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
1	26/06/19	ADDITIONAL SPATIAL INFORMATION ADDED	T.O'R	T.O'R	J.F	A.M.C
0	26/06/19	REQUEST FOR PROPOSAL	T.O'R	T.O'R	J.F	A.M.C

CLIENT APPROVAL ☐ PLANNING ☐ TENDER ☐ CONSTRUCTION ☐ AS-BUILT ☐

ESB
Energy for generations
Engineering and Major Projects,
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Dublin Airport, Cloghran,
Co. Dublin, K67 XF72, Ireland.
Tel: 353 1 703 8000 Web: www.esb.ie
Engineering and Major Projects is a division of ESB.

CLIENT: ESB Networks

PRODUCTION UNIT: Civil & Environmental Engineering

PROJECT: P.R.A.

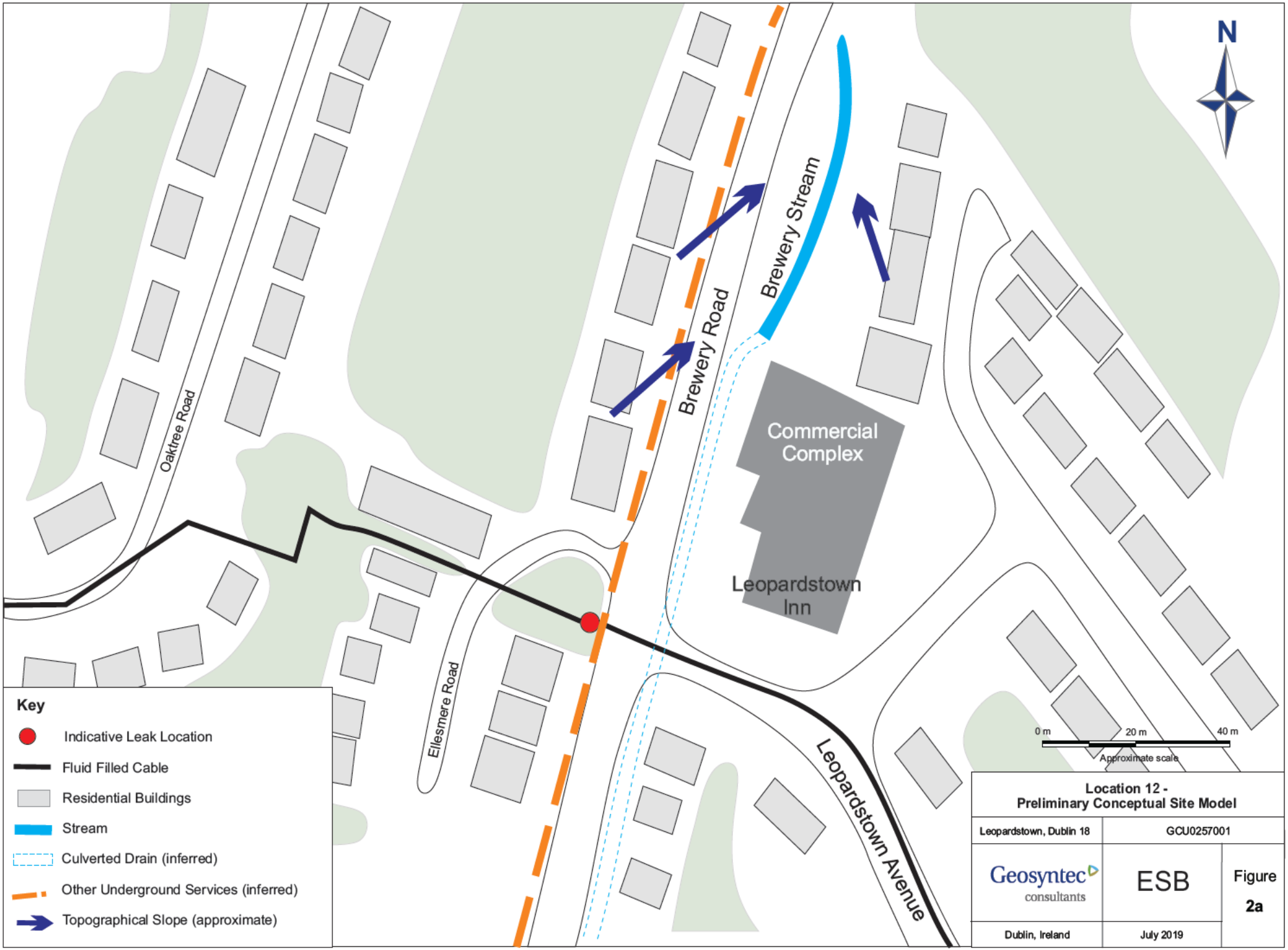
DRAWING TITLE: Indicative Cable Fluid Leakage Locations & Cable Sections (11) Carrickmines - Poolbeg 220 kV (April 2013 - June 2015)

CONTRACT

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
T.O'Rourke	T.O'Rourke	J. Fitzpatrick	A.M. Casey	26/06/2019

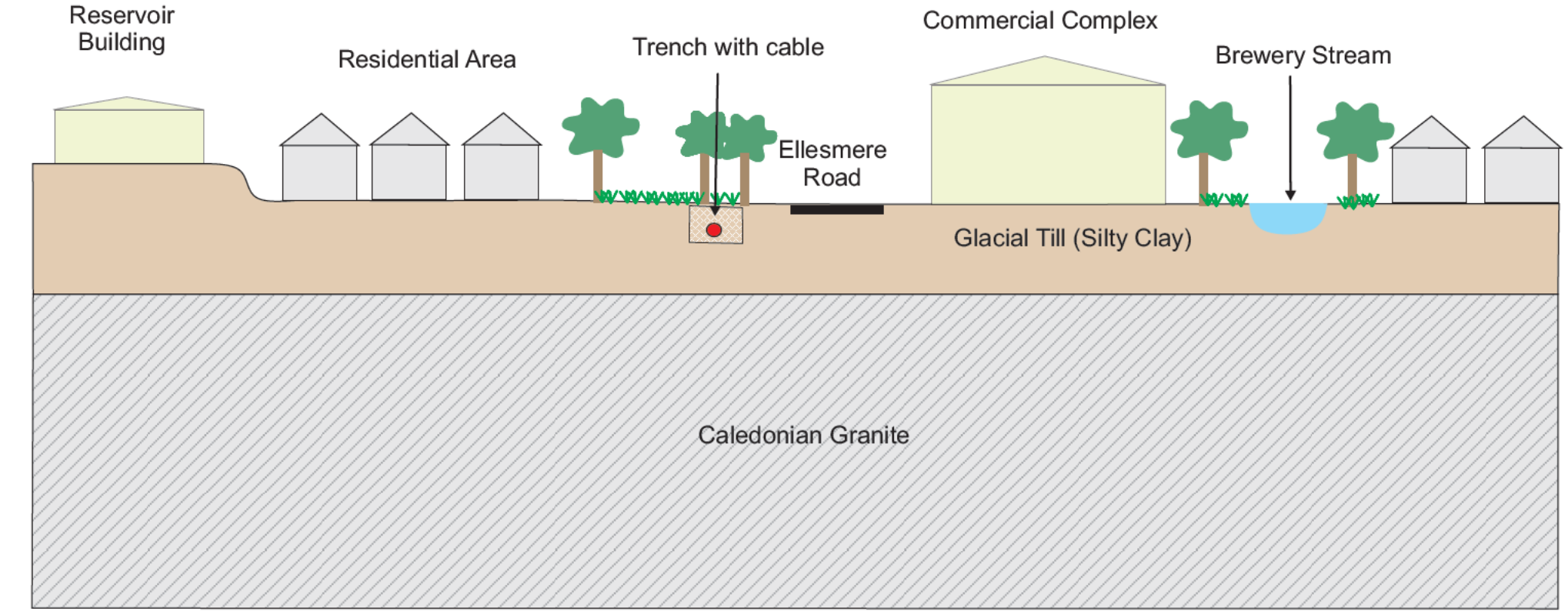
CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
00-00	1	1 of 1	A3	1:3,000

DRAWING NUMBER: QD-354120-01-D460-001-016-001



Location 12 - Preliminary Conceptual Site Model

Leopardstown, Dublin 18	GCU0257001	
Geosyntec consultants	ESB	Figure 2a
Dublin, Ireland	July 2019	



Location 12 - Preliminary Conceptual Site Model		
Leopardstown, Dublin 18	GCU0257001	
Geosyntec consultants	ESB	Figure 2b
Dublin, Ireland	July 2019	

Appendix A - Photolog

APPENDIX A

Photograph 1 – Leak location; west side of Brewery Road

Photograph 2 – Cable route west of leak location

Photograph 3 – View east along Leopardstown Avenue

Photograph 4 – Brewery Road looking north from Leopardstown Avenue

APPENDIX B


N
Site Location
0
30
60
Meters
Location 12, Historic 6 Inch Map (1837 - 1842)
Leopardstown, Co. Dublin
GCU0257001
Geosyntec consultants
ESB
Dublin, Ireland
July 2019
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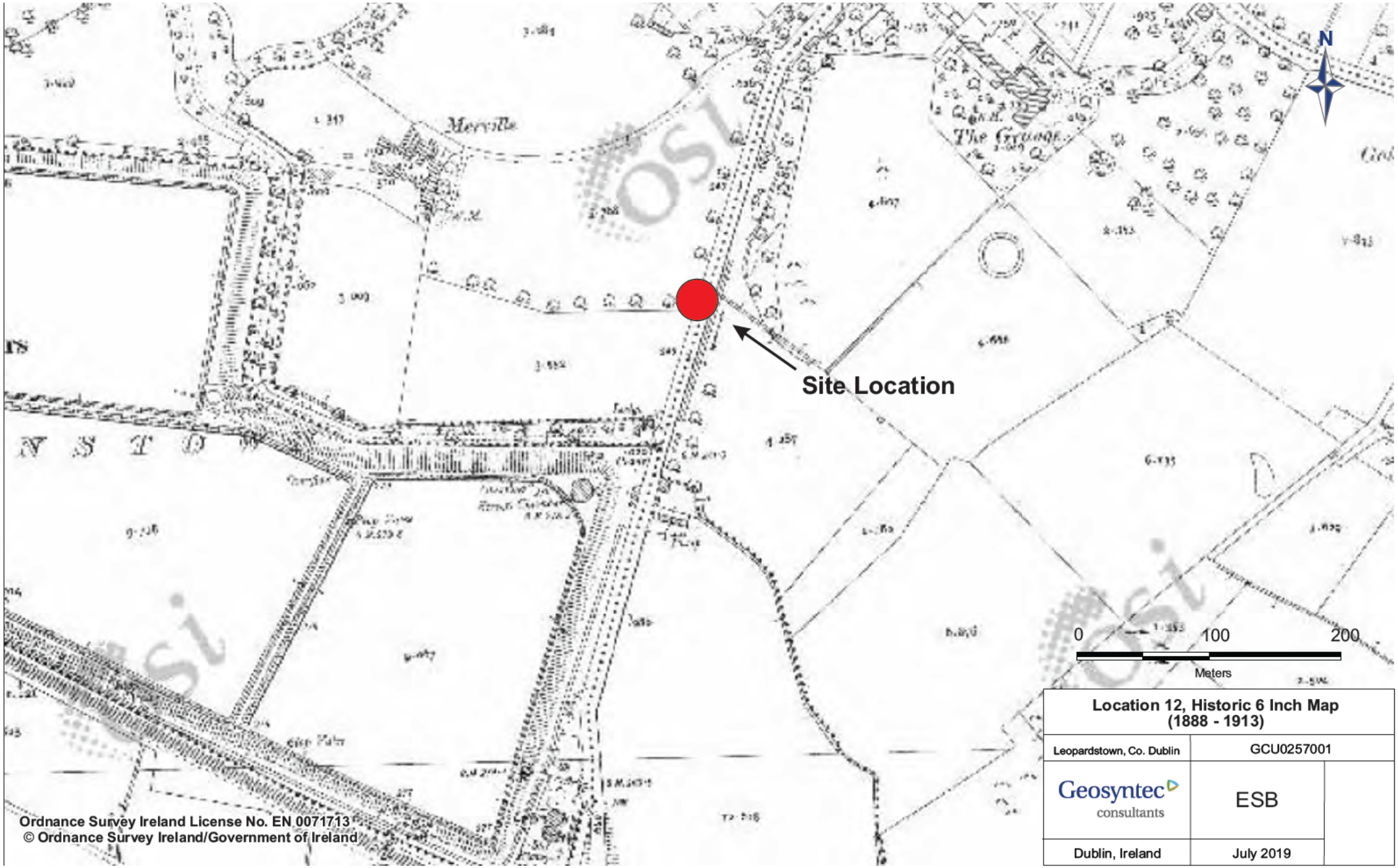

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Location 12, Historic 6 Inch Map (1888 - 1913)	
Leopardstown, Co. Dublin	GCU0257001
Geosyntec consultants	ESB
Dublin, Ireland	July 2019

Location 12, Aerial Map (2005 - 2012)	
Leopardstown, Co. Dublin	GCU0257001
Geosyntec consultants	ESB
Dublin, Ireland	July 2019

Appendix C – Safety Data Sheet for Cable Fluid

APPENDIX C

MATERIAL SAFETY DATA SHEET

1: IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY / UNDERTAKING

Product Name: T 3788

Application: Hollow-core Energy Cable Saturant

Company: H&R ESP Ltd.

Address: Matrix House
North 4th Street
Milton Keynes, MK9 1NJ
United Kingdom

Telephone: +44 (0)1908 351 111 Fax: +44 (0)1908 351122

2: COMPOSITION / INFORMATION ON INGREDIENTS

Composition: Low viscosity compound based on a blend of linear alkyl benzenes that have side alkyl chains of 10 – 13 carbon atoms in length.

Synonyms: Linear Alkyl Benzenes
Alkyl C10-C13, benzenes
Benzene, C10-13-alkyl-deriv.
Detergent Alkylate

Composition	EINECS number	CAS number	Symbol letters	Risk numbers	Concentration range
C10 – C13 Linear Alkyl Benzenes	267-051-0	67774-74-7	Not regulated		100%

All constituents of this product are listed in EINECS (European Inventory of Existing Commercial Chemical Substances) or ELINCS (European List of Notified Chemical Substances) or are exempt.

3: HAZARDS IDENTIFICATION

Classification of preparation: This product is not classified as a dangerous substance / preparation in accordance with The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP3).

Physical and Chemical Properties: Not classified as flammable, but will burn. Avoid contact with strong oxidisers.

Health Effects

Skin:	Contact with the skin may cause irritation. Prolonged or repeated skin contact may cause drying of the skin, progressing to dermatitis. Symptoms may include itching, discolouration, swelling and blistering.
Eyes:	Contact with the eyes may cause irritation. Symptoms may include reddening, swelling and impaired vision.
Ingestion:	Ingestion of small amounts may cause nausea and vomiting.
Inhalation:	Due to low volatility, this product should not present an inhalation hazard under ambient conditions. Exposure to vapour or mineral oil mists may irritate the mucous membranes and cause dizziness, headaches and nausea.

Environmental Effects

No specific hazards under normal use conditions.

4: FIRST AID MEASURES

Inhalation:	Remove from further exposure. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance and call a doctor. If breathing has stopped, administer artificial respiration.
Skin contact:	Remove contaminated clothing and wash affected skin with soap and water. If persistent irritation occurs, obtain medical attention. If high pressure injection injuries occur, obtain medical attention immediately.
Eye contact:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion:	Wash out mouth with water and obtain medical attention. DO NOT INDUCE VOMITING.

5: FIRE FIGHTING MEASURES

Suitable extinguishing media:	Carbon dioxide (CO_2), dry chemical, foam or water spray.
Unsuitable extinguishing media:	Do not use water jets.
Special exposure hazards:	Combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates and gases, including carbon monoxide, and unidentified organic and inorganic compounds.
Special protective equipment:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6: ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Spilt product presents a significant slip hazard. Remove any sources of heat.
Environmental Precautions:	Prevent from spreading or entering into drains, sewers and watercourses by using inert absorbent material or other appropriate barriers. Inform local authorities if this cannot be prevented.
Methods for cleaning up:	Absorb liquid with inert absorbent material. Sweep up and remove to a suitable, clearly marked container for disposal in accordance with local and national regulations

7: HANDLING AND STORAGE

Handling:	Do not eat, drink or smoke whilst using this product. To avoid the possibility of skin disorders repeated or prolonged contact with products of this type must be avoided. It is essential to maintain a high standard of personal hygiene.
Storage:	Store in a cool place away from sources of heat and out of direct sunlight to avoid pressure build up. Do not store near oxidisers.

Handling and Storage Materials and Coatings

Suitable:	Carbon steel, baked epoxy or Phenolic coatings, aluminium.
Unsuitable:	Natural rubber, Butyl rubber

8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Limits:	Not established.
Engineering control measures:	Use of local exhaust ventilation is recommended whenever this product is used in a confined space, is heated above ambient temperatures, or is agitated.
Hygiene measures:	Wash hands before eating, drinking, smoking and using the toilet. Gloves should be washed before being removed.
Respiratory Protection:	Normally not required if adequate ventilation is in place. Where concentrations in air may exceed the limits given in this section, it is recommended to use a half mask respirator to protect from over exposure by inhalation. Suitable filter material depends on the amount and type of chemicals being handled, but filter material suitable for organic vapours may be considered for use.
Hand Protection:	When handling this product it is recommended to wear chemical resistant gloves. Suggested materials for protective gloves include: PVC, Neoprene or similar.
Eye Protection:	Wear eye protection such as safety glasses, chemical goggles, or face shield if engineering controls or work practices are not adequate to prevent eye contact. Have suitable eye wash water available.

Skin Protection:	Wear impervious protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted.

9: PHYSICAL AND CHEMICAL PROPERTIES

General Information

Appearance:	Clear, colourless liquid
Odour:	Mild petroleum odour

Health, safety and environmental information

pH:	Not determined
Boiling point/range:	280°C
Flash point:	>135°C
Flammability:	Non flammable
Explosive properties:	Not explosive
Oxidising properties:	Not applicable
Vapour pressure at 20°C:	<0.02 kPa
Density:	0.86 g/cm^{-3} at 20°C typical
Solubility in water:	Insoluble
Kinematic Viscosity at 20°C:	4.0 – 4.5 cSt (4.0 – 4.5 mm^2/s) typical
Vapour density (Air=1):	>1
Evaporation rate:	Not determined

Other information

Pour point:	-60°C typical
Expansion coefficient:	0.0007 /°C typical
Neutralisation value:	0.03 mg KOH g^{-1} maximum

10: STABILITY AND REACTIVITY

Chemical stability:	This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure and will not polymerise.
Conditions to avoid:	Temperatures above 140°C
Materials to avoid:	Strong oxidising agents, such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, peroxides etc, as this may present an explosion hazard.
Hazardous decomposition products:	Carbon monoxide and irritant fumes may be generated if this product is burned in an enclosed space.

11: TOXICOLOGICAL INFORMATION

Basis for assessment:	Toxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the toxicology of similar products.
Acute toxicity:	Oral LD50 expected to be >5000 mg/kg (rat) Inhalation LC50/4hr expected to be >1.8 mg/l (rat) Dermal LD50 expected to be >2000 mg/kg (rabbit)
Corrosivity/irritation:	
Eye:	May be slightly irritant
Skin:	May be slightly irritant
Respiratory tract:	If mists are inhaled, slight irritation of the respiratory tract may occur
Skin sensitisation:	Not expected to be a skin sensitiser
Repeated-dose toxicity:	Prolonged and/or repeated contact may lead to irritation and possibly dermatitis, especially under conditions of poor personal hygiene.
Mutagenicity:	Not expected to be a mutagen.
Carcinogenicity:	Not expected to be a carcinogen.
Reproductive toxicity:	The preparation has not been assessed at all for this end-point, so its hazardous property in this regard is not known.

12: ECOLOGICAL INFORMATION

Basis for assessment:	Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.
Ecotoxicity:	Poorly soluble mixture. Product is not expected to be ecotoxic to fish/daphinia/algae, or sewage bacteria. This preparation is expected to be removed in a wastewater treatment facility
Mobility:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence and degradability:	Readily biodegradable. Soils degradation – half life approx. 15 days. Natural waters degradation – half life approx. 4 – 9 days.
Bioaccumulative potential:	May have the potential to bioaccumulate

13: DISPOSAL CONSIDERATIONS

Disposal must be in accordance with local and national legislation.

Unused Product:	Dispose of through an authorised waste contractor to a licensed site. May be incinerated.
Used/Contaminated Product:	Dispose of through an authorised waste contractor to a licensed site. May be incinerated.
Packaging:	Dispose of through an authorised waste contractor. May be steam cleaned and recycled.

14: TRANSPORT INFORMATION

This product is not classified as dangerous for transport.

15: REGULATORY INFORMATION

Classification/Symbol: Not Regulated

This preparation is not classified as Dangerous according to EU Directives

This safety data sheet is intended to assist in compliance with the following UK legislation:

- Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- Control of Substances Hazardous to Health Regulations 2002.
- Health and Safety at Work, etc. Act 1974.
- Environmental Protection Act 1990
- Environmental Protection (Duty of Care) Regs. 1991
- COSHH essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations

Further Guidance
The following guidance notes are available from HMSO or HSE.

Occupational exposure limits (EH 40). Effects of mineral oil on the skin (SHW 397).
Preventing dermatitis at work (INDG 233)
A step by step guide to COSHH assessment (HSG 97)
Assessing and managing risks at work from skin exposure to chemical agents (HSG 205)
The selection, use and maintenance of respiratory protective equipment: A practical guide (HSG 53)
Relevant EC Directives:

- Dangerous Substances Directive (DSD)
- Dangerous Preparations Directive (DPD)
- Safety Data Sheets Directive (SDSD)
- Health & Safety Framework Directive

16: OTHER INFORMATION

This data sheet was prepared in accordance with Commission Directive 2001/58/ECand SI 2002 No. 1689 (CHIP 3)

Key References:

- Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- The compilation of safety data sheets. Approved Code of Practice (third edition)
- Approved supply list (7th Edition). Information approved for the classification and labelling of substances and preparations dangerous for supply. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- Approved classification and labelling guide. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Guidance on regulations (Fifth edition).
- EH40/2005 Workplace Exposure Limits 2005
- COSHH essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations
- European Inventory of Existing Commercial Substances (EINECS)

The data and advice given apply when the product is sold for the stated application or applications. The product is not sold as suitable for any other application. Use of the product for applications other than as stated in this sheet may give rise to risks not mentioned in this sheet. You should not use the product other than for the stated application or applications without seeking advice from us.

If you have purchased the product for supply to a third party for use at work, it is your duty to take all necessary steps to secure that any person handling or using this product is provided with the information in this sheet.

If you are an employer, it is your duty to tell your employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

We believe, in good faith and to the best of our knowledge that the preceding information is accurate. However, we give no guarantee or warranty in this respect. The information provided herein may not be adequate for all individuals and/or all situations. The purchaser/user of the product remains responsible for storing, using or dealing with the product safely and in accordance with all applicable laws and regulations.

Material Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name : **Shell Diala Cable Oil**
Uses : Insulating oil.
Product Code : 001D8369

Manufacturer/Supplier : **Shell UK Oil Products Limited**
PO BOX 3
Ellesmere Port
CH65 4HB
United Kingdom

Telephone : +44 (0) 151-350-4000
Fax : +44 (0) 151-350-4000
Email Contact for MSDS : If you have any enquiries about the content of this MSDS please email lubricantSDS@shell.com

Emergency Telephone Number : +44-(0) 151-350-4595

2. HAZARDS IDENTIFICATION

EC Classification : Harmful.

Health Hazards : Repeated exposure may cause skin dryness or cracking. Harmful: may cause lung damage if swallowed.

Signs and Symptoms : If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Ingestion may result in nausea, vomiting and/or diarrhoea.

Safety Hazards : Not classified as flammable but will burn.
Environmental Hazards : Not classified as dangerous for the environment.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Preparation Description : Alkyl benzene.

Hazardous Components

Chemical Identity	CAS	EINECS	Symbol(s)	R-phrase(s)	Conc.
Benzene, C10-C13 alkyl derivitives	67774-74-7	267-051-0	Xn	R65; R66	90.00 - 100.00 %

Additional Information : Refer to chapter 16 for full text of EC R-phrases.

4. FIRST AID MEASURES

Inhalation	:	No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
Skin Contact	:	Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (37° C), shortness of breath, chest congestion or continued coughing or wheezing.
Advice to Physician	:	Treat symptomatically. Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Call a doctor or poison control center for guidance.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Unidentified organic and inorganic compounds.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use water in a jet.
Protective Equipment for Firefighters	:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe the relevant local and international regulations.

Protective measures	:	Avoid contact with skin and eyes. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Clean Up Methods	:	Slippery when spilt. Avoid accidents, clean up immediately. Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly.
Additional Advice	:	Local authorities should be advised if significant spillages

cannot be contained.

7. HANDLING AND STORAGE

General Precautions	:	Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
Handling	:	Avoid prolonged or repeated contact with skin. Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used.
Storage	:	Keep container tightly closed and in a cool, well-ventilated place. Use properly labelled and closeable containers. Storage Temperature: 0 - 50°C / 32 - 122°F The storage of this product may be subject to the Control of Pollution (Oil Storage) (England) Regulations. Further guidance maybe obtained from the local environmental agency office.
Recommended Materials	:	For containers or container linings, use mild steel or high density polyethylene.
Unsuitable Materials	:	PVC.
Additional Information	:	Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion. Exposure to this product should be reduced as low as reasonably practicable. Reference should be made to the Health and Safety Executive's publication "COSHH Essentials".

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

Exposure Controls	:	The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.
Personal Protective Equipment	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
Respiratory Protection	:	No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne

		concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)] meeting EN141.
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC, neoprene or nitrile rubber gloves. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.
Eye Protection	:	Wear safety glasses or full face shield if splashes are likely to occur. Approved to EU Standard EN166.
Protective Clothing	:	Skin protection not ordinarily required beyond standard issue work clothes. It is good practice to wear chemical resistant gloves.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Environmental Exposure Controls	:	Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Colourless. Liquid at room temperature.
Odour	:	Slight hydrocarbon.
pH	:	Not applicable.
Initial Boiling Point and Boiling Range	:	> 280 °C / 536 °F estimated value(s)
Pour point	:	< -60 °C / -76 °F Data not available
Flash point	:	Typical 140 °C / 284 °F (PMCC / ASTM D93)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V)
Auto-ignition temperature	:	> 320 °C / 608 °F
Vapour pressure	:	< 0.5 Pa at 20 °C / 68 °F (estimated value(s))
Density	:	Typical 857 kg/m3 at 20 °C / 68 °F
Water solubility	:	Negligible.
n-octanol/water partition coefficient (log Pow)	:	> 6 (based on information on similar products)
Kinematic viscosity	:	Typical 4.2 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	> 1 (estimated value(s))
Evaporation rate (nBuAc=1)	:	Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable.
Conditions to Avoid	:	Extremes of temperature and direct sunlight.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on data on the components and the toxicology of similar products.
Acute Oral Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rat Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Acute Dermal Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Not considered to be an inhalation hazard under normal conditions of use.
Skin Irritation	:	Expected to be slightly irritating. Repeated exposure may cause skin dryness or cracking.
Eye Irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Inhalation of vapours or mists may cause irritation.
Sensitisation	:	Not expected to be a skin sensitiser.
Repeated Dose Toxicity	:	Not expected to be a hazard.
Mutagenicity	:	Not considered a mutagenic hazard.
Carcinogenicity	:	Components are not known to be associated with carcinogenic effects.
Reproductive and Developmental Toxicity	:	Not expected to be a hazard.
Additional Information	:	Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible.

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity	:	Poorly soluble mixture. May cause physical fouling of aquatic organisms. Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l (to aquatic organisms) (LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract).
Mobility	:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence/degradability	:	Expected to be inherently biodegradable.
Bioaccumulation	:	Has the potential to bioaccumulate.
Other Adverse Effects	:	Product is a mixture of non-volatile components, which are not

expected to be released to air in any significant quantities. Not expected to have ozone depletion potential, photochemical ozone creation potential or global warming potential.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses.
Container Disposal	:	Dispose in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. EU Waste Disposal Code (EWC): 13 03 08 synthetic insulating and heat transmission oils. Classification of waste is always the responsibility of the end user. Hazardous Waste (England and Wales) Regulations 2005.

14. TRANSPORT INFORMATION

ADR
This material is not classified as dangerous under ADR regulations.

RID
This material is not classified as dangerous under RID regulations.

ADNR
This material is not classified as dangerous under ADNR regulations.

IMDG
This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply)
This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

EC Classification	:	Harmful.
EC Symbols	:	Xn Harmful.
EC Risk Phrases	:	R65 Harmful: may cause lung damage if swallowed. R66 Repeated exposure may cause skin dryness or cracking.
EC Safety Phrases	:	S62 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Chemical Inventory Status

EINECS	:	All components listed or polymer exempt.
TSCA	:	All components listed.
Classification triggering components	:	Contains alkyl benzene derivatives.
Other Information	:	Environmental Protection Act 1990 (as amended). Health and Safety at Work Act 1974. Consumers Protection Act 1987. Control of Pollution Act 1974. Environmental Act 1995. Factories Act 1961. Carriage of Dangerous Goods by Road and Rail (Classification, Packaging and Labelling) Regulations. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Control of Substances Hazardous to Health Regulations 1994 (as amended). Road Traffic (Carriage of Dangerous Substances in Packages) Regulations. Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations. Road Traffic (Carriage of Dangerous Substances in Road Tankers in Tank Containers) Regulations. Road Traffic (Training of Drivers of Vehicles Carrying Dangerous Goods) Regulations. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations. Health and Safety (First Aid) Regulations 1981. Personal Protective Equipment (EC Directive) Regulations 1992. Personal Protective Equipment at Work Regulations 1992.

16. OTHER INFORMATION

R-phrase(s)

R65	Harmful: may cause lung damage if swallowed.
R66	Repeated exposure may cause skin dryness or cracking.

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