RECEIVING ENVIRONMENT REPORT

AIR ENVIRONMENT

Site Location and Surrounding Land Use

The proposed licence extension area at Huntstown comprises the existing South Quarry, the lands immediately surrounding it and the haul routes leading to it within the Huntstown Quarry Complex. It straddles the townlands of Huntstown, Cappoge and Grange in North Co. Dublin and is located approximately 2.5 km north-west of Finglas and 1km west of the interchange between the N2 Dual Carriageway and the M50 Motorway.

The Central Quarry and construction materials production facilities extend across lands immediately to the north of the proposed licence extension area. The lands immediately to the south of it remain in use as agricultural grassland, as do the lands to the east of the South Quarry, beyond the eastern (by-product) backfill area. The lands to the west and north-west (beyond the proposed backfill and recovery area) comprise light industry and science and technology parks along the Cappagh Road (including Stadium Business Park, Huntstown Business Park and Millennium Business Park).

Study Area

The study area for the purposes of this air quality baseline report is taken to be the proposed licence extension area and everything within 500m thereof. For completeness, a number of more distant properties located downwind of the recovery area, along the R135 Regional Road (also known as the North Road) have also been included for impact assessment purposes. These properties are also potentially impacted by HGV traffic movements generated by ongoing (and future) backfilling and recovery activities. The proposed licence extension area is not subject to any statutory or non-statutory nature conservation designations and there are no such sites within a 2 km radius.

Baseline Study Methodology

Baseline Dust Monitoring

Dust monitoring undertaken at Huntstown is based on the 'Bergerhoff method' referred to in the TA Luft Air Quality Standard and forms the basis for assessing compliance with the 350mg/m^2/day emission limit set by the existing extractive planning permission ((Ref. FW12A/0022 and ABP PL06f.241693) and EPA waste licence (Ref. W0277-03).

The 'Bergerhoff' dust deposition gauge used in dust deposition surveys comprises a glass or plastic collection bottle with protective basket, mounted on a post and set at 1500mm above ground level. The input of atmospheric borne particulate material into the collection bottle takes place over a pre-determined measurement period (usually one month) by exposing it to the environment. The total dust collected in the bottle is expressed as deposition of total particulate matter (mg/m^2/day) arising from human activity in the surrounding area.

Sources of Information

A desk study was carried out to examine all relevant information relating to air quality conditions around the licenced site at Huntstown (and proposed extension area). Met Eireann, the National Meteorological Service, was consulted to obtain climate / weather data in respect of the local area (http://www.met.ie). The EPA website was also examined to obtain any relevant information on baseline air monitoring data around the site (http://www.epa.ie/air/quality/data/).

Information published on its website by the National Parks and Wildlife Service (NPWS) (http://webgis.npws.ie/npwsviewer/) in respect of designated ecological sites, protected habitats and species was also reviewed, together with Ordnance Survey maps and aerial photography (http://map.geohive.ie/mapviewer.html).

Field Survey / Monitoring

Dust deposition surveys were undertaken at and around the Huntstown quarry complex (including the licence extension area) for the full year period from January 2019 to December 2019 at existing dust monitoring locations, designated D1 to D6, and identified on Figure 7-1-3-2A. Dust monitoring stations are located as follows:

- D1 - adjacent to the site entrance;
- D2 – far northern limit of the existing licenced site area – at northern property boundary.
- D3 – north-west of the licence extension area – at south-western corner of the West Quarry;
- D4 – further north west of the licence extension area – near the property boundary along the Kilshane Road;
- D5 – immediately north of the licence extension area – within quarry complex;
- D6 – north of the licence extension area, at central infrastructure / production area.

The results of the dust deposition monitoring are presented in Table 7-1-3-2A below

Table 7-1-3-2A
Baseline Dust Deposition at Huntstown Quarry Complex

Date	D1	D2	D3	D4	D5	D6
	$mg/m^2/day$	$mg/m^2/day$	$mg/m^2/day$	$mg/m^2/day$	$mg/m^2/day$	$mg/m^2/day$
Jan-19	250	**449**	121	106	177	221
Feb-19	281	33	59	161	-	212
Mar-19	29	28	16	37	24	8
Apr-19	19	20	142	31	35	23
May-19	17	50	53	47	74	69
Jun-19	*510*	*391*	89	**864**	231	*763*
Jul-19	*457*	338	**1207**	309	*373*	327
Aug-19	145	277	127	141	317	16
Sep-19	134	328	**569**	238	**442**	102
Oct-19	22	79	64	34	54	39
Nov-19	48	75	51	26	67	25
Dec-19	146	124	80	228	118	59

As will be noted, several exceedances of the emission limit value (ELV) of 350mg/m2/day were recorded at the Huntstown quarry complex (from all existing site activities) over the course of the 2019. Of a total of 10 No. recorded exceedances from a dust monitoring dataset of 72 readings, 5 No. (identified in italics above) were recorded in the months of June and July and could be attributed

to the presence of increased amounts of non-mineral organic dust in dust sample jars (most likely from agricultural activity on surrounding lands). The remaining 5 No. exceedances (in bold above), (i.e. at locations D2, D3, D4 and D5) were all recorded at the Roadstone property boundary (not at sensitive receptor locations), principally in summer months.

Background Air Quality

The existing licenced site and proposed extension area lie in air quality Zone A. The closest air quality monitoring station to the quarry at Huntstown, and in a similar Zone A area, is located 2.1km away at Finglas (Mellowes Road). The monitoring stations continuously monitor concentrations of particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}). Recent annual mean concentrations monitored at Finglas (published on the EPA website[1]) are presented in Table 7-1-3-2B below.

Table 7-1-3-2B
Background PM_{10} Concentrations

Year	Annual Mean (µg/m³)	Number of Days >50µg/m³
2019	14	4

The data presented above indicates that PM_{10} concentrations monitored at the Finglas monitoring site are below the annual mean Air Quality Standard (AQS) of 40µg/m³ and comply with the requirement that a 24-hour mean of 50µg/m³ should not be exceeded more than 35 times in a calendar year.

Meteorology

Dispersion of Emissions

The most important climatological parameters governing the atmospheric dispersion of particles are as follows:

- wind direction determines the broad transport of the emission and the sector of the compass into which the emission is dispersed; and
- wind speed will affect ground level emissions by increasing the initial dilution of particles in the emission. It will also affect the potential for dust entrainment.

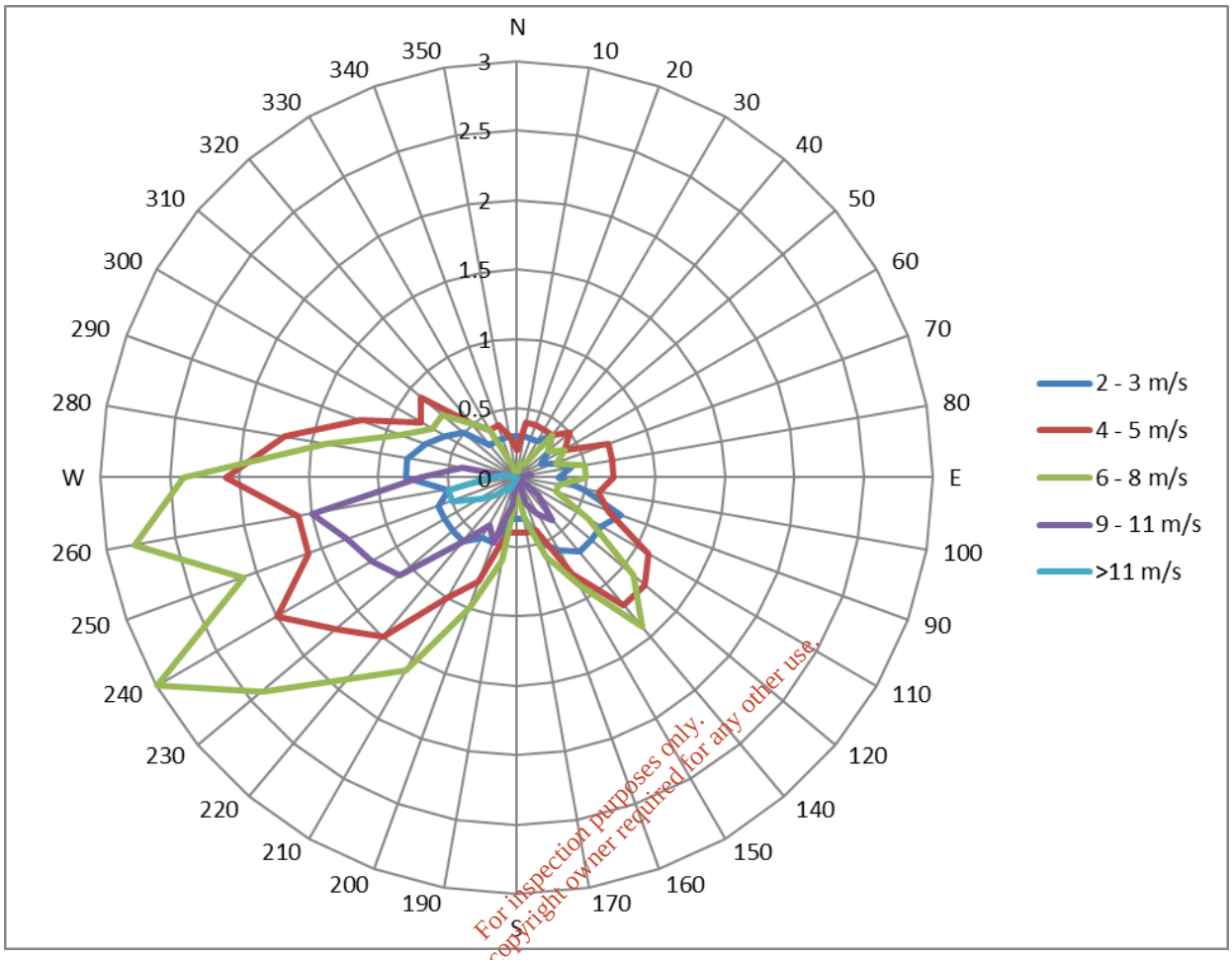
Rainfall is also an important climatological parameter in the generation of dust; sufficient amounts of rainfall can suppress dust at the source and eliminate the pathway to the receptor. According to Arup (1995)[2], rainfall greater than 0.2mm per day is sufficient to suppress dust emissions.

Local Wind Speed and Direction Data

The closest weather station with sufficient records of wind direction and wind speed considered representative of conditions experienced at the licenced site at Huntstown is Dublin Airport Meteorological Station. A windrose for the average conditions recorded at Dublin Airport over the ten-year period 2009-2018 is presented in the plot below. As can be seen, the predominant wind direction is from the south-western quadrant.

[1] Secure Archive for Environmental Research Data – http://erc.epa.ie/safer/.
[2] Arup Environmental, Ove Arup and Partners (1995) The Environmental Effects of Dust from Surface Mineral Workings, HMSO, London (ISBN 11 75 3186 3)

Windrose for Dublin Airport Meteorology Station



Rainfall Data

Relevant rainfall data applicable to the overall site has been obtained from the Irish Meteorological Service website for the Dublin Airport Meteorological Station (2009-2018), which is located approximately 6.5km east of the recovery area at the South Quarry.

The annual average days with rainfall greater than 0.2mm is 191 days per year. Natural dust suppression (from rainfall) is therefore considered to be effective for 52% of the year.

NOISE ENVIRONMENT

Study Area

The study area for the purposes of this noise baseline report is taken to be the proposed licence extension area and everything within 500m thereof. For completeness, a number of more distant properties located along (or accessed off) the R135 Regional Road which are impacted by HGV traffic movements generated by ongoing (and future) backfilling and recovery activities have also been included for noise impact assessment purposes.

There are 21 existing residences located in reasonable proximity to the future backfill and recovery operations at the South Quarry or to trafficked roads along the local road network. Eight of these properties are located along the R135 Regional Road, one is located beyond the eastern boundary of the recovery area (and eastern quarry boundary) and 12 to the south and south-west, along the Cappagh Road (L3080), refer to Figure 7-1-3-2A. The proposed licence extension area is not subject to any statutory or non-statutory nature conservation designations and there are no such sites within a 2km radius.

Baseline Study Methodology

Baseline Noise Monitoring

Environmental noise surveys were carried out to capture typical background noise levels at the noise-sensitive receptors closest to the proposed soil recovery facility at Huntstown. The methodology of the surveys and the results are set out below. The weather conditions during the survey periods were acceptable for noise monitoring, being generally dry, with little or no wind.

The baseline noise measurements were taken using a Larson Davis 831 Type 1 sound level meter. The sound level meter was calibrated before the measurements, and its calibration checked after, using a Larson Davis Cal200 field calibrator. No calibration drifts were found to have occurred during surveys. All noise equipment had been calibrated to a traceable standard by UKAS (United Kingdom Accreditation Service) accredited laboratories within 24 months preceding the surveys.

At the measurement positions, the following noise level indices were recorded:

- $L_{Aeq,T}$ is the A-weighted equivalent continuous noise level over the measurement period (T), and effectively represents an "average" value.
- $L_{A90,T}$ is the A-weighted noise level exceeded for 90% of the measurement period (T). This parameter is often used to describe the background noise.
- $L_{A10,T}$ is the A-weighted noise level exceeded for 10% of the measurement period (T). This parameter is often used to describe traffic noise.

All noise levels are recorded in 'A-weighted' decibels, dB(A). 'A-weighting' is the process by which noise levels are corrected to account for the non-linear frequency response of the human ear. All noise levels are quoted in dB(A) relative to a sound pressure of 20µPa.

Environmental noise surveys were undertaken by SLR Consulting Ireland staff at the noise sensitive receptors in the vicinity of the licence extension area on the 30th and 31st of March 2021. Noise measurements were undertaken over three, non-consecutive, 30-minute periods during the daytime period (07:00 to 19:00). The monitoring periods chosen are considered to give representative daytime noise levels at nearby noise sensitive locations.

It should be noted that the baseline noise survey was undertaken at a time when there were public health restrictions in place around movement and travel due to the Covid 19 pandemic and, as a

result, reported average ambient noise levels and background noise levels are likely to understate what they would otherwise be in normal circumstances.

During the surveys, the sound level meter was located in free-field conditions (i.e. at least 3.5m from the nearest vertical reflecting surface, with the microphone approximately 1.5m above ground level), with the meter set to 'Fast'-time weighting.

Sources of Information

A desk study was carried out to examine all relevant information relating to noise conditions around the backfilling and recovery area at the South Quarry including:

- the NWPS website in relation to sites that are charged with the conservation of a range of habitats and species in study area; and
- Ordnance Survey maps and aerial photography.

Knowledge of recent development was also considered when site-specific noise baseline surveys were being planned for the purposes of this EIAR.

Existing Noise Conditions

The noise monitoring locations which form the basis of this baseline noise study, shown in plan in Figure 7-1-3-2A, comprise the following:

- BN1 to the east of the backfill / recovery area, south of the quarry entrance;
- BN2 to the north-east of the backfill / recovery area, north of the quarry entrance;
- BN3 to the west of the backfill / recovery area;
- BN4 to the south of the backfill / recovery area;
- BN5 to the south-west of the backfill / recovery area.

The baseline noise monitoring locations listed above are considered representative of the nearest noise sensitive locations (receptors) likely to be most impacted by the backfill and recovery activities at the South Quarry, identified on Figure 7-1-3-2A. These are described below[3]:

- Location BN1 is considered representative of residential properties located to the east of the recovery / backfill area, along the R135 Regional Road (also known as the North Road);
- Location BN2 is considered representative of residential properties located north of the entrance to the quarry complex and to the north-east of the recovery / backfill area;
- Location BN3 is considered representative of the commercial properties located to the west of the recovery / backfill area;
- Location BN4 is considered representative of the residential properties (at Cappagh Cottages), located to the south of the recovery / backfill area;
- Location BN5 is considered representative of the residential properties located to the south-west of the recovery / backfill area.

Baseline noise measurements for the residential property located within an agricultural landholding immediately east of the South Quarry and set back some distance from the R135 Regional Road (i.e. property R9 shown on Figure 7-1-3-2A) were provided separately by Roadstone. Noise monitoring data obtained at nearby monitoring location N2, located at the eastern quarry / property boundary, for the quarry / waste facility compliance monitoring programme in September 2020 are taken to be representative of baseline noise levels for this specific property.

[3] Note that noise levels were not taken at the exact locations of the noise sensitive properties as no access was made onto privately owned land. Monitoring was carried out adjacent to / in close proximity of these properties.

Noise monitoring results for the baseline survey are provided in Table 7-1-3-2C below. Logarithmic average L_{Aeq} values are provided in Table 7-1-3-2D thereafter.

Table 7-1-3-2C
Summary of Measured Noise Levels at Huntstown , Free Field dB

Location	Receptors	Period	Date	Time	$L_{Aeq,T}$	L_{A10}	L_{A90}
BN1	R5 to R8	Daytime	30/03/21	13:12	65	65	59
			30/03/21	14:34	60	62	57
			30/03/21	15:51	60	61	57
BN2	R1 to R4	Daytime	30/03/21	13:56	73	77	58
			30/03/21	15:14	71	75	55
			30/03/21	16:29	68	71	56
BN3	Millennium Business PK	Daytime	31/03/21	9:22	64	67	55
			31/03/21	11:29	64	68	54
			31/03/21	14:49	64	67	56
BN4	R10 Group R11	Daytime	31/03/21	10:03	62	67	47
			31/03/21	12:08	62	68	47
			31/03/21	13:30	65	67	49
BN5	R12	Daytime	31/03/21	10:45	74	78	49
			31/03/21	12:47	75	79	50
			31/03/21	14:10	74	78	55
N2 (Roadstone)	R9	Daytime	10/09/20	14.10	51	54	47
			10/09/20	14.40	53	55	48
			10/09/20	15.10	54	49	47

Table 7-1-3-2D
Summary of Measured Noise Levels at Huntstown, Free Field dB (Average Values)

Location	Receptors	Period	L_{AeqAVG}
BN1	R5 to R8	Daytime	62
BN2	R1 to R4	Daytime	71
BN3	Millennium Business PK	Daytime	64
BN4	R10, Group R11	Daytime	63
BN5	R12	Daytime	74
N2	R9	Daytime	53

In the course of the baseline noise monitoring undertaken around Huntstown, the key observation in respect of the surrounding noise environment was that the recorded noise levels were dominated by road traffic noise on the adjoining local roads and M50. There was also limited noise contribution from aircraft movements in/out of Dublin Airport. It should be noted that aircraft movement were considerably reduced at the time of the baseline / reference surveys due to the impact of Covid-19 restrictions on international air travel.

On the basis of the data presented above, it is concluded that all the noise monitoring locations may be designated as 'all other areas' in accordance with standards set out in the EPA's NG4 guidance document (*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*).

WATER

Study Area

For the purposes of this water baseline report, the study area is taken to comprise the proposed waste licence extension area and the surrounding area extending up to 5km radius around it.

Baseline Study Methodology

The methodology used for the baseline report follows the guidelines and advice notes provided by the Environmental Protection Agency (EPA) on environmental impact assessments and the IGI's guidance on Geology in Environmental Impact Statements.

Existing information on the geology, hydrogeology and hydrological features of the Huntstown area and its surrounds was collated and evaluated. Monitoring data, including discharge quality data, discharge quantity data, groundwater quality results and groundwater level monitoring was assessed.

The methodology involved in the assessment of the hydrology and hydrogeology in the area around Huntstown South Quarry is summarised as follows:

- a desk study, in which existing data and relevant regional data sources for the area were examined;
- a field visit, in which key aspects of the local hydrology and hydrogeology at the quarry and surrounding area were identified and assessed;
- a review of monitoring data provided by Roadstone, including groundwater quality, groundwater levels, discharge quality and discharge flow volumes; and
- analysis of the information gathered.

Sources of Information

The following sources of information have been consulted in order to investigate and define the hydrogeology and hydrology of lands surrounding the proposed recovery area at the South Quarry:

- The EPA website (www.epa.ie);
- The Geological Survey Ireland (GSI) website (www.gsi.ie);
- Details of Groundwater Protection Schemes (at www.gsi.ie); and
- Water Maps and Water Framework Directive online mapping (www.catchments.ie).

Surface Water Environment

Local Hydrology: Surface Water Bodies

Huntstown South Quarry is located immediately inside the Tolka River catchment. Much of the existing licenced site area (comprising the North Quarry and West Quarry) is located in the Ward River catchment immediately to the north.

Local Hydrology: Quality

The closest surface water body to the South Quarry is the Finglas Stream, which runs along the eastern boundary of the South Quarry and the Roadstone landholding. The Finglas Stream is a tributary of the River Tolka. The closest surface water quality monitoring point along the River Tolka is located at Glasnevin, approximately 4.5km south-east of the quarry and results indicate that at this location the river has a Q-value rating of Q3, indicating it to be of poor status.

Local Hydrology: Flow

Treated discharge from the South Quarry is discharged off-site to the headwaters of the Finglas Stream, at the discharge point shown in Figure 7-1-3-2A (designated 'W3' by existing Local Authority discharge licence). At the discharge point, almost the entire flow in the stream comprises discharge from the South Quarry. With no other significant inputs of flow, the Finglas Stream is reliant on discharge of water from the quarry to provide baseflow at the top of its catchment. In the absence of any discharge, it is likely that this watercourse would periodically run dry, except during periods of heavy or prolonged rainfall. There are no hydrometric stations along the stream in the vicinity of, or immediately downstream of, Huntstown South Quarry.

Discharge Volumes

Surface water at the Huntstown South Quarry is discharged from pumps located on the quarry floor. Details of recorded discharge volumes for 2020 were presented previously in Attachment 7-1-3-1 (Compliance Report) while a summary is presented in Table 7-1-3-2E below. As can be seen, the maximum recorded discharge volume from the South Quarry in 2020 was 9,740m^3/day.

The current licensed discharge licence limit for the South Quarry is 7,300m^3/d, and the majority of daily discharge rates are below this limit. The discharge rate in the South Quarry typically ranged between 4,000m^3/d and 6,000m^3/d over the course of 2020. Notably, the discharge rate range after August 2020 was reasonably consistent between 4,900m^3/d and 5,300m^3/d. Historical discharge records show that discharge volumes prior to 2020 were more variable, but these are now actively attenuated and limited to 7,300m^3/day.

Table 7-1-3-2E
Summary Groundwater Discharge Volumes (2018 and 2020)

Date	Maximum (m^3/d)	Minimum (m^3/d)	Average (m^3/d)
South Quarry 2018	9,770	156	4,660
South Quarry 2020	9,740	0	5,194

Surface Water Quality

Surface water quality has been monitored in compliance with the requirements of the existing discharge licence for the South Quarry (Ref. No. WPW/F/075). The results of water quality

monitoring required by the existing discharge licence at the discharge point (designated 'W3') for the calendar years 2019 and 2020 were presented previously in Attachment 7-1-3-1 (Compliance Report). More detailed surface water quality test results are presented in the Appendix 7-G of the Environmental Impact Assessment Report (EIAR) which accompanies this licence review application.

Water quality test results are generally within the licence limit warning value for the discharge. Very occasional exceedances of ammoniacal nitrogen and suspended solids were reported. None of the exceedances were persistent, and where exceedances did occur the parameter was within the licence limit during the next monitoring round.

Flooding

The Office of Public Works (OPW) website (www.floodmaps.ie) indicates that there is a record of one historic flood event in the vicinity of Huntstown, at Kilshane Cross in November 2002. This flood was attributed to '*run-off from adjacent grasslands*' and was not attributable to quarrying or production activities at Huntstown Quarry.

Surface water run-off and discharges from the Huntstown Quarry complex are managed on a continual basis so as not to increase the risk of flooding in the surrounding area. An assessment which was previously undertaken to assess the channel carrying capacity of the Finglas Stream (in support of the discharge licence application) demonstrated that the existing channel had sufficient capacity to transmit the off-site discharge.

Ground Environment

Land-Use

The proposed backfilling / soil waste recovery activities at Huntstown South Quarry will be entirely confined within the existing development footprint, on the western side of the quarry, and will not result in any increased land take or a change in existing land-use for any surrounding land.

In the long term, once the quarry has been backfilled to its original (pre-extraction) ground level, the land will be restored to grassland or other agricultural use, at least initially, and will thereby provide additional land resource and contribute to potential productive land use within the local area.

Soils and Subsoils

The EPA website publishes soils and subsoils maps created by the Teagasc Spatial Analysis Unit in collaboration with the Geological Survey of Ireland. These maps indicate that the proposed licence extension area at Huntstown and the surrounding area is / was typically underlain by deep basic mineral soils with variable drainage characteristics – from poorly drained to well drained. The parent material for these soils is the underlying glacial till derived from limestone which extends across much of the North Dublin region.

Much of the soil cover across this area was previously removed to facilitate the extraction of rock at the South Quarry and was placed in perimeter screening berms around the Roadstone property boundary.

Bedrock Geology

The soil and subsoil deposits at the proposed licence extension area at Huntstown and in the area immediately surrounding it are underlain by bedrock of several lower Carboniferous Formations. Regional geological maps indicate that four bedrock formations occur across the Huntstown Quarry complex, and that those across the South Quarry footprint comprise the Malahide (Boston Hill) Formation, as well as Waulsortian Formation, refer to Chapter 6 of the EIAR which accompanies this licence review application.

The bedrock formations are typically described as follows:

- Malahide (Boston Hill) Formation: rather uniform, thick successions of nodular diffusely bedded, argillaceous fossiliferous limestones (and their dolomitised equivalents) and subordinate thin shales (improved understanding means that the Boston Hill formation is now recognised to be part of the Malahide Formation);
- Waulsortian Limestone: a mainly pale grey biomicrite;
- The Tober Colleen Formation: a very gradationally interbedded calcareous mudstone and very argillaceous micrite. It overlies, and fills in the gaps between depressions of the Waulsortian Limestones;
- The Malahide Formation: at its top, is described as a fossiliferous limestone and shale with some oolites and sandstone, biomicrites and biosparites.

Groundwater Environment

Aquifer Characteristics

The overall quarry complex at Huntstown straddles the Dublin Groundwater Body (GWB) and the Swords GWB. The boundary between the two groundwater bodies is inferred to run through the middle of the quarry complex. The southern part of the quarry complex (including the South Quarry and proposed waste licence extension area) is located within the Dublin GWB.

The quarries at Huntstown have significant groundwater abstraction from both the Swords and Dublin GWBs. There are no major abstractions for groundwater supply from the Dublin GWB. Although the source protection area for a wellfield at Dunboyne extends marginally into the Dublin GWB, this protection zone is 8.5 km west and upgradient of the Huntstown Quarry complex. There are no groundwater supply source protection areas identified within the Swords GWB.

As noted previously, the predominant bedrock at Huntstown is limestone. As is typical of Irish bedrock, groundwater flow through the limestone formations is controlled by secondary fissure permeability. The bulk permeability of the limestone formations is relatively high, with groundwater storage and movement mainly constrained to the upper, weathered horizons of each unit and to discontinuities (such as joints, fractures and faults).

Bedrock aquifer maps published on the GSI website indicate that the South Quarry area comprises the Malahide (Boston Hill) Formation, as well as Waulsortian Formation. Both the Waulsortian and Malahide (Boston Hill) Formations are classified as Locally Important Aquifers (LI), i.e., Bedrock which is Moderately Productive only in Local Zones.

Groundwater Vulnerability

The subsoil deposits that overlie the bedrock at Huntstown tend to be relatively thin but play an important role in groundwater recharge. Where there are glacial till subsoils present there will be reduced groundwater recharge to the underlying bedrock due to the lower permeability of the till. Where glacial till subsoils are absent around the South Quarry, recharge will be directly to the underlying bedrock.

Groundwater vulnerability maps published on the GSI website indicate that the South Quarry is located within an area indicated to be of medium to extreme groundwater vulnerability status. The groundwater vulnerability reflects the exposed nature of the quarry area as a result of thin subsoil cover and/or absence thereof. Future backfilling of the existing quarry will provide an enhanced degree of groundwater protection, as the backfilled soils can be expected to have a relatively low permeability and will be of significant thickness (>3m) upon completion of backfilling to original ground level.

The Department of the Environment and Local Government (DoELG) / EPA / GSI has developed a scheme (*Groundwater Protection Response Matrix for Landfills*) to assess potential landfill sites on the basis of groundwater vulnerability and aquifer status. It should be noted however that this scheme has largely been developed for new non-hazardous landfills (i.e., receiving a waste stream of municipal solid wastes, and commercial and industrial wastes). It is therefore not a directly applicable tool for assessment of inert soil and stone recovery facilities such as that at Huntstown.

Nevertheless, these classifications have been compared against the matrix for non-hazardous landfills which indicates that the site setting falls within a response category of R2[2], which is described as being '*acceptable subject to guidance outlined in the EPA Landfill Design Manual or conditions of a waste licence*'.

Water Management

The quarry excavations at Huntstown have intersected the groundwater table and have lowered it around the periphery with excavation of each bench. Minor groundwater inflows to each of the quarries drain to the quarry floor, where they are contained.

As the South Quarry, surface water run-off and dewatered groundwater collects in a sump at a low point on the floor of the South Quarry. It is pumped from the sump to the top of the quarry and falls under gravity thereafter to a number of existing settlement ponds running in series. The treated surface water run-off then flows north-east along a pipe and is discharged to a drainage channel which runs eastwards through the Roadstone landholding for approximately 500m. Thereafter it passes through a hydrocarbon interceptor and is discharged off-site to the headwaters of the Finglas Stream (in accordance with the discharge permit issued by Fingal County Council, Ref. WPW/F/075).The pump on the quarry floor is floating in a collection sump and any pumping / discharge from it is automated via a float level switch.

Karst Features

A review of the GSI karst database (www.gsi.ie) indicates that there are no karst landforms or features within 5 km of the Huntstown Quarry complex.

Rainfall and Climate

The Average Annual Rainfall (AAR) in the area around Huntstown is c. 773 mm/yr for the 30-year period 1991-2020 (Met Eireann, 2021). The monthly average rainfall values for 1991-2020 are shown in Table 7-1-3-2F below.

Table 7-1-3-2F
Monthly Rainfall Averages (mm) 1991-2020 for Huntstown

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AAR
62	52	52	55	57	64	62	74	62	79	83	72	773

Rainfall values for one-hour and two-day storm events of 5-year return period intensity are 16mm and 59.6mm respectively.

Groundwater Recharge

Groundwater recharge around the Huntstown quarries has been assessed by the GSI in accordance with guidelines published by the Irish Working Group on Groundwater (WGGW, 2005). The effective rainfall in this area is assessed as 380mm/yr and the maximum groundwater recharge capacity is indicated to be 200mm/yr (www.gsi.ie).

The Water Framework Directive's Working Group on Groundwater (2005) has suggested that a reasonable 'cap' on recharge to locally important aquifers would be between 150mm/year and 200mm/year and that any incident rainfall in excess of this will be rejected as run-off. The bulk of this groundwater recharge would be likely to occur between late October and early March.

Groundwater Monitoring

At the present time, there are 11 No. groundwater monitoring wells installed around the Huntstown Quarry complex. Of these 3 No., designated GW6A, GW8 and GW9, are located in the vicinity of the South Quarry, refer to Figure7-1-3-2B. As can be seen, borehole GW6A is located in the South Quarry itself, borehole GW8 is located above and behind the western quarry face, and borehole GW9 is located above and behind the north-eastern face. Borehole GW6A had to be re-drilled recently (in March 2021, as GW06B), after the groundwater monitoring borehole had become inaccessible. Groundwater monitoring well construction details are provided in Table 7-1-3-2G below.

Table 7-1-3-2G
South Quarry Groundwater Monitoring Wells

Date	GW06A	GW06B	GW08	GW09
GL Elevation (mOD) (during drilling)	31.02	81.62	90.68	78.64
Depth (m bgl)	40	100	120	120
Toe Level (mOD)	-8.98	-18.38	-29.32	-41.35

The groundwater level elevation recorded at the three boreholes around the South Quarry are quite different. The ground and aquifer conditions at each borehole are described in brief below.

Borehole GW06A is developed entirely in limestone. Water strikes were encountered at 29.5mOD (1.50 m bgl) and 8.0mOD (23 m bgl).

The recent drilling of the replacement well for GW06A (identified as GW06B) encountered Made (Filled) Ground and boulder clay to approximately 74.8mOD (6.8m bgl). Weathered limestone is recorded to approximately 73.1mOD (8.5mbgl) and strong limestone bedrock is recorded thereafter to 45.1mOD (36.5m bgl). The competent limestone rock was underlain by a zone of more weathered limestone with clay infill to 20.6mOD (61m bgl). Competent limestone bedrock was again encountered beneath this zone to -18.4mOD (100m bgl). There were no water strikes reported during well drilling / installation.

Borehole GW08 is mainly developed in limestone. Overburden is present in the form of boulder clay to 84.6mOD (6.1m bgl), with gravel and muck thereafter to 81.6mOD (9.1m bgl). Weathered rock is encountered from 81.6mOD (9.1m bgl) to 75.5mOD (15.2m bgl), and some 'brown weathered rock' from 41.9mOD (48.8m bgl) to 29.8mOD (60.9m bgl). Water strikes were encountered at 37.7mOD (53m bgl) and 32.7mOD (58m bgl), within the section identified as 'brown weathered rock'.

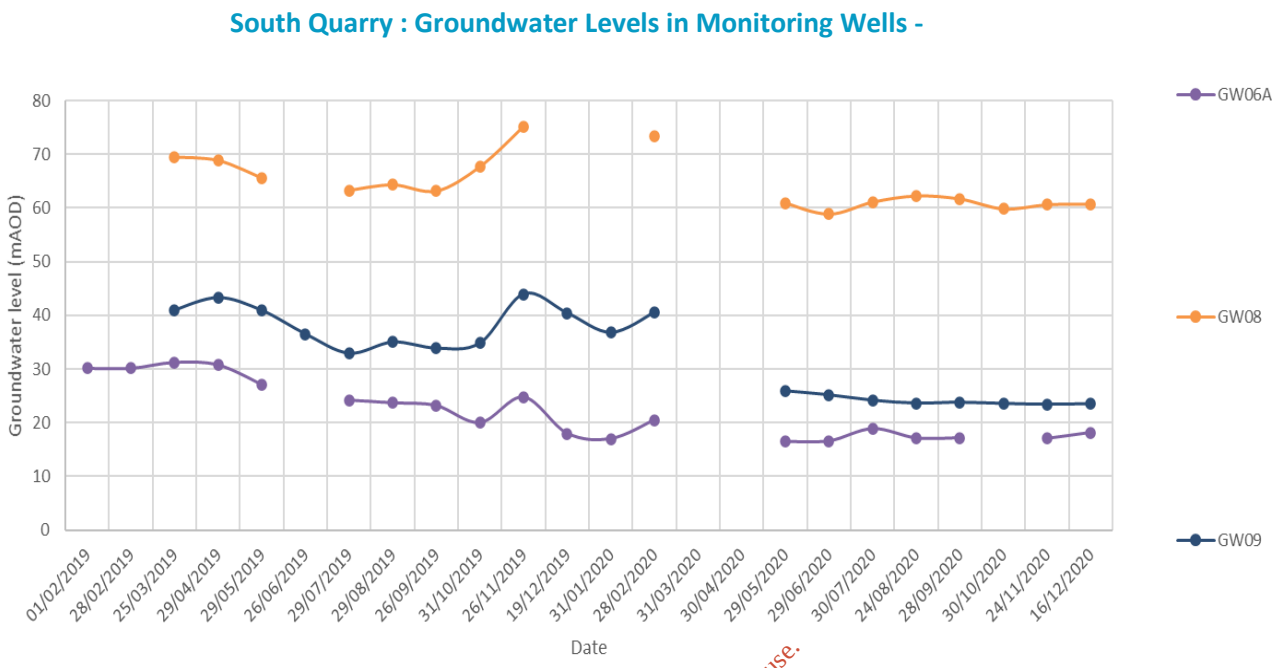
Borehole GW09 is mainly developed in limestone. Overburden is present in the form of clay and broken rock to 73.15mOD (5.5m bgl). A 'broken brown crevice' is encountered from 41.45mOD (37.2m bgl) to 40.85mOD (37.8m bgl), and 'brown rock with crevices' from 10.05 mOD (68.7m bgl) to -28.05mOD (106.7m bgl). No water strikes were reported during drilling of borehole GW09.

Groundwater Levels and Flow

Except for a short period in April and May 2020 (when stringent Covid restriction were in place), water levels have been monitored on a monthly basis at the South Quarry by SLR Consulting since January 2019. Detailed results are presented in Table 7-1-3-2H below and in a summary plot as a function of time thereafter.

Table 7-1-3-2H
Groundwater Levels

Date	GW06A	GW08	GW09	GW06A	GW08	GW09
	m bgl			mOD		
01/02/2019	0.9	Not yet drilled		30.12	Not yet drilled	
28/02/2019	0.9			30.12		
25/03/2019	-0.21	21.24	37.69	31.23	69.44	40.96
29/04/2019	0.25	21.86	35.37	30.77	68.82	43.28
29/05/2019	3.93	25.14	37.76	27.09	65.54	40.89
26/06/2019	Dry	Pumping	42.15	Dry	Pumping	
29/07/2019	6.83	27.42	45.73	24.19	63.26	32.92
29/08/2019	7.35	26.39	43.64	23.67	64.29	35.01
26/09/2019	7.86	27.54	44.78	23.16	63.14	33.87
31/10/2019	11.05	23	43.81	19.97	67.68	34.84
26/11/2019	6.27	19.5	34.69	24.75	75.18	43.96
19/12/2019	13.06	Pumping	38.24	17.96	Pumping	40.41
31/01/2020	14.06	Inaccessible	41.86	16.96	Inaccessible	36.79
28/02/2020	10.5	17.39	38.07	20.52	73.29	40.58
31/03/2020	Covid Restrictions					
30/04/2020	Covid Restrictions					
29/05/2020	14.57	29.79	52.71	16.45	60.89	25.94
29/06/2020	14.48	31.86	53.47	16.54	58.82	25.18
30/07/2020	12.17	29.62	54.47	18.85	61.06	24.18
24/08/2020	13.93	28.47	55.01	17.09	62.21	23.64
28/09/2020	13.89	29.03	54.85	17.13	61.65	23.80
30/10/2020	Inaccessible	30.89	55.07	Inaccessible	59.79	23.58
24/11/2020	14	30.1	55.21	17.02	60.58	23.44
16/12/2020	12.89	30.01	55.13	18.13	60.67	23.52



The recorded variation in groundwater levels over the two-year monitoring period between January 2019 and December 2020 ranges from 14.8m at GW06A to 20.5m at GW09. Groundwater elevations are observed to be highly variable around the South Quarry, ranging from an upper limit of 75.2mOD at GW08 to 16.45mOD at GW06A. The groundwater level at the recent redrill of GW06A (i.e. GW06B) was recorded at approximately 80m bgl directly following drilling (at a reduced level of approximately 1.6mOD).

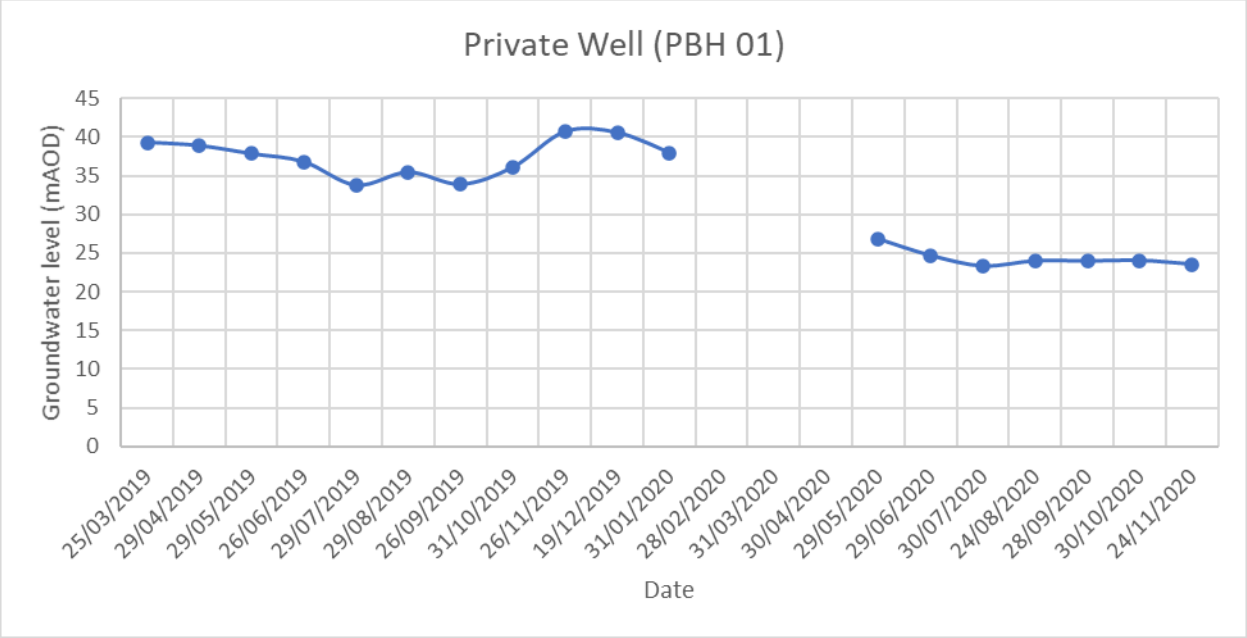
Existing dewatering operations at Huntstown have lowered groundwater levels around the Huntstown quarry complex and have locally altered the regional groundwater flow regime in the aquifers, diverting groundwater toward sumps on quarry floors. Groundwater levels in monitoring wells are most likely controlled by both distance from quarry voids, the presence of water bearing fractures and variations in bedrock geology.

Surrounding Groundwater Levels

There is one private well (PBH-01) located in the area immediately adjoining the South Quarry, less than 250m from the eastern property boundary, as indicated on Figure 7-1-3-2B. Monthly groundwater level monitoring has been undertaken at this location since 2019.

This private well supplies water to the neighbouring property for domestic and agricultural purposes and water levels are plotted as a function of time in the plot below. Note that due to Covid-19 restrictions, groundwater levels were not recorded during the months of March and April 2020.

Private Well PBH1 Groundwater Levels



Groundwater Quality

Groundwater monitoring boreholes GW6A, GW8, and GW9 around the South Quarry were monitored for baseline groundwater quality on 26th June 2020 and 28th September 2020. The baseline groundwater quality testing is based on an extensive suite of quarterly parameters, with additional parameters tested for annually (A):

- physical parameters (pH and conductivity);
- dissolved organic carbon;
- anions (chloride, fluoride, sulphate, sulphide);
- nutrients (ammoniacal nitrogen as N and NH_3, nitrate as NO_3, orthophosphate as PO_4,
- cyanide free and total (A);
- metals (antimony, arsenic, barium, boron, cadmium, chromium, chromium hexavalent, copper, iron, lead, mercury, nickel, selenium, vanadium, zinc);
- phenols (A);
- speciated Total Petroleum Hydrocarbons (TPHs);
- Polyaromatic Hydrocarbons (PAHs);
- Polychlorinated Biphenol (PCBs);
- Semi-Volatile Organic Compounds (SVOCs) (A);
- Volatile Organic Compounds (VOCs) (A); and
- pesticides/herbicides (A).

The results are compared against several assessment criteria: specifically, those set out in S.I. No 366 of 2016 (Groundwater Regulations), S.I. No 122 of 2014 (Drinking Water Regulations) and EPA's Interim Guideline Values (IGVs). The results are summarised in Table 7-1-3-2I below and presented in detailed in spreadsheet format in Appendix 7-E of the EIAR which accompanies this licence review application.

Table 7-1-3-2I
Baseline Groundwater Quality at Huntstown South Quarry (June and September 2020)

Parameter	Units	GW6A		GW8		GW9	
		June 2020	Sept 2020	June 2020	Sept 2020	June 2020	Sept 2020
Physical Properties							
Conductivity @ 20 °C	mS/cm	1.09	1.08	0.627	0.652	0.879	0.946
pH	pH Units	7.21	7.3	7.46	7.35	7.46	7.57
Carbon							
Carbon, Organic (diss.filt)	mg/l	<3	<3	5.67	5.55	<3	<3
Ions							
Ammoniacal Nitrogen as N	mg/l	0.0853	0.108	**0.527**	**0.662**	0.0788	0.0495
Chloride	mg/l	27.9	29.4	31.1	30.2	30.9	30.7
Cyanide, Free (low level)	µg/l	<2.5	-	<2.5	-	<2.5	-
Cyanide, Total (low level)	µg/l	<5	-	<5	-	<5	-
Fluoride	mg/l	0.548	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrate as NO3	mg/l	2.6	<0.3	0.752	<0.3	<0.3	1.17
Phosphate (Ortho as PO4)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulphate	mg/l	**370**	**370**	46.7	53.1	**222**	**221**
Sulphide	mg/l	0.0451	<0.01	0.0238	<0.01	<0.01	<0.01
Filtered (Dissolved) Metals							
Antimony (diss.filt)	µg/l	**18.5**	2.1	<1	<1	1.55	1.35
Arsenic (diss.filt)	µg/l	3.33	6.65	1.27	0.55	1.33	1.3
Barium (diss.filt)	µg/l	17.3	14.5	**144**	**130**	55.9	91.2
Boron (diss.filt)	µg/l	27.6	28.8	27.1	28.7	19.2	23.1
Cadmium (diss.filt)	µg/l	<0.08	<0.08	<0.08	<0.08	0.0941	<0.08
Chromium (diss.filt)	µg/l	<1	<1	<1	<1	<1	<1
Chromium, Hexavalent	mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Copper (diss.filt)	µg/l	0.381	<0.3	1.35	0.928	1.82	1.35
Iron (diss.filt)	mg/l	0.0248	**0.377**	**0.389**	<0.019	<0.019	0.0427
Lead (diss.filt)	µg/l	0.786	0.539	0.756	<0.2	0.264	0.523
Mercury (diss.filt)	µg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel (diss.filt)	µg/l	9.91	5.93	6.21	6.33	5.02	3.19
Selenium (diss.filt)	µg/l	<1	<1	<1	<1	1.26	2.54
Vanadium (diss.filt)	µg/l	<1	<1	<1	<1	<1	<1
Zinc (diss.filt)	µg/l	73.2	43.7	49.3	10.4	**132**	**137**
Total Petroleum Hydrocarbons (TPH CWG)							
Total EPH (C6-C40) (aq)	µg/l	**104**	<100	<100	<100	**160**	**237**

Parameter	Units	GW6A		GW8		GW9	
		June 2020	Sept 2020	June 2020	Sept 2020	June 2020	Sept 2020
Polyaromatic Hydrocarbons (PAHs)							
Fluoranthene (aq)	µg/l	<0.005	<0.0009	<0.005	<0.0009	0.00591	<0.0009
Naphthalene (aq)	µg/l	<0.01	<0.01	0.0146	<0.01	0.0283	0.0325
Phenanthrene (aq)	µg/l	<0.005	<0.005	<0.005	<0.005	0.0149	0.0176
Pyrene (aq)	µg/l	<0.005	<0.005	<0.005	<0.005	0.00872	<0.01
Bold: concentration in excess of assessment criteria							

All phenols, PCBs, SVOCs, VOCs, and pesticides / herbicides were below detection limit. Most parameters reported concentrations at less than the assessment criteria. Nitrate concentrations are low and conductivity is below the threshold value of 1875µs/cm. Although hydrocarbons are recorded in samples, they are only present at relatively low concentrations above detection limit. PAHs were also detected at low concentrations above detection limit on occasion (for fluoranthene, naphthalene, phenanthrene and pyrene).

Borehole GW6A exceeded assessment criteria for sulphate, antimony, iron and total EPH (C6-C40). Borehole GW8 exceeded assessment criteria for ammoniacal nitrogen, barium, and iron. Borehole GW9 exceeded assessment criteria for sulphate, zinc and total EPH (C6-C40) and exceeded the detection limit for phenanthrene and pyrene (PAHs).

Ongoing groundwater monitoring is being carried and will confirm any trends in groundwater quality at and around the South Quarry.

Separately, monthly groundwater monitoring undertaken by Roadstone for ongoing extractive operations at the South Quarry indicates that ammoniacal nitrogen was elevated on a number of occasions in 2020, particularly at borehole GW08. Coliforms were also elevated, which is indicative of likely agricultural impact on groundwater. Sulphate was elevated, and conductivity occasionally elevated. While TPH was recorded above detection limits on occasion, it was not persistent and was present at only relatively low concentration.

Groundwater Abstractions : Use and Quality

The GSI national well database records indicate that there are 12 wells or drill holes within 1 km of the Huntstown Quarry complex. Of these, only 2 wells appear to be used for groundwater abstraction: one is developed in the Waulsortian Limestone Formation at a location approximately 1km to the south of the South Quarry while the other, also developed in Waulsortian Formation, is located approximately 1.8km to the west.

Much of the potable water demand in Huntstown and the surrounding area is satisfied by a Local Authority mains supply. At the quarry itself, water for the concrete plant, aggregate washing and processing is sourced from the sump on the floor of the South Quarry.

Under Ireland's obligations for the Water Framework Directive, the status of groundwater bodies nationally has been assessed (www.wfdireland.ie), on the basis of both their quality and availability. The Dublin GWB is classified as being of Good overall status, however it is classified as being 'at risk' of losing its current 'Good' status as a result of urban development pressures. The Swords GWB is also classified as being of 'Good' overall status and is identified as being 'probably not at risk' of losing its current 'Good' status.

KILSHANE KENNELS
CAPPAGH ROAD
NORTHWEST BUSINESS PARK
MITCHELSTOWN HOUSE
JAVA REPUBLIC
NORTHWEST BUSINESS PARK
J&D FURNITURE
MILLENIUM BUSINESS PARK
HUNTSTOWN BUSINESS PARK
ROSEMOUNT BUSINESS PARK
NATIONAL TRUCK RENTAL
HARVEY NORMAN WAREHOUSE
STADIUM BUSINESS PARK
PREMIER BUSINESS PARK
STABLES
VIRIDIAN POWER STATION
(NOT OWNED BY ROADSTONE LIMITED)
ENERGIA AD PLANT
(NOT OWNED BY ROADSTONE LIMITED)
RAVENSWOOD HOUSING
DOGS TRUST IRELAND
BEECH VISTA GARDEN CENTRE
VETERINARY CLINIC
ESB 220 Kv STATION
D1
D2
D3
D4
D5
D6
W3
BN1
BN2
BN3
BN4
BN5
R

0 100 200 300 400m 600 800 1000
Metres 1:10,000

NOTES

1. EXTRACT FROM 1:2,500 ORDNANCE SURVEY DIGITAL SHEET NO'S. 3062-A, 3062-B, 3062-C, 3062-D, 3063-A, 3063-C, 3130-A & 3130-B.

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

LEGEND

- ROADSTONE LIMITED LAND INTEREST **(C. 171.8 HA)**
- AMENDED WASTE LICENCE AREA (COMPRISING EXISTING LICENCE AREA AND PROPOSED EXTENSION) **(C. 77.5 HA)**
- PROPOSED EXTENSION TO CURRENT WASTE LICENCE AREA
- N2 DUAL CARRIAGEWAY
- R135 REGIONAL ROAD (NORTH ROAD)
- LOCAL ROAD
- M50 MOTORWAY
- R — LOCATION OF NEAREST RESIDENCES
- BN1 — BASELINE NOISE SURVEY MONITORING LOCATIONS
- D1 — DUST MONITORING LOCATION
- W2 — SURFACE WATER MONITORING LOCATION

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ROADSTONE LIMITED
WASTE LICENCE REVIEW APPLICATION
HUNTSTOWN WASTE RECOVERY FACILITY
NORTH ROAD, FINGLAS, DUBLIN 11
LOCAL RECEPTORS

FIGURE 7-1-3-2A

Scale: 1:10,000 @ A3
Date: DECEMBER 2021

0180.00313.FIG 7-1-3-2A.Local Receptors.dwg

N

GW07

GW04

GW03

GW05

GW02A

GW01A

GW09

GW08

PBH-1

GW06A

GW06B

NORTHERN QUARRY FILL AREA

STOCKPILING AREA

CENTRAL QUARRY RECOVERY FACILITY

EXTRACTION AREA

SOUTHERN QUARRY FILL AREA

EXTRACTION AREA

BLOCK YARD

VIRIDIAN POWER STATION
(NOT OWNED BY ROADSTONE LIMITED)

ENERGIA AD PLANT
(NOT OWNED BY ROADSTONE LIMITED)

Water Settlement Ponds

High Voltage Powerlines

COLDWINTERS

KILDONAN

0 100 200 300 400m 600 800 1000

Metres 1:8,000

LOCATION	EASTING	NORTHING
GW01A	211888	241152
GW02A	211253	241235
GW03	211273	241772
GW04	210461	241915
GW05	210268	241372
GW06A	210859	240482
GW06B	211149	240353
GW07	211111	242094
GW08	210508	240632
GW09	211375	240944
PBH-1	211593	240625

NOTES

1. EXTRACT FROM 1:2,500 ORDNANCE SURVEY DIGITAL SHEET **NO'S. 3062-A, 3062-B, 3062-C, 3062-D, 3063-A, 3063-C, 3130-A & 3130-B**.

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

3. SURVEY COMPLETED ON 22ND FEBRUARY 2021 BY ASM IRELAND TO ITM AND MALIN HEAD DATUM

LEGEND

- ROADSTONE LIMITED LAND INTEREST **(C. 171.8 HA)**
- AMENDED WASTE LICENCE AREA (COMPRISING EXISTING LICENCE AREA AND PROPOSED EXTENSION) **(C. 77.5 HA)**
- PROPOSED EXTENSION TO CURRENT WASTE LICENCE AREA
- N2 DUAL CARRIAGEWAY
- R135 REGIONAL ROAD (NORTH ROAD)
- LOCAL ROAD
- M50 MOTORWAY
- ON-SITE GROUNDWATER MONITORING WELL LOCATIONS
- PRIVATE WELLS

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ROADSTONE LIMITED

WASTE LICENCE REVIEW APPLICATION

HUNTSTOWN WASTE RECOVERY FACILITY
NORTH ROAD, FINGLAS, DUBLIN 11

SITE LAYOUT AND GROUNDWATER MONITORING LOCATIONS

FIGURE 7-1-3-2B

Scale: 1:8,000 @ A3

Date: DECEMBER 2021

0180.00313.FIG 7-1-3-2B.Site Layout and Groundwater Monitoring Locations.dwg