HYDROGEOLOGICAL IMPACT ASSESSMENT

for

A PROPOSED SHD RESIDENTIAL DEVELOPMENT SITE AT SANTRY AVENUE, SANTRY, CO. DUBLIN

Technical Report Prepared For

Dwyer Nolan Developments Ltd

Technical Report Prepared By

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Our Reference

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1.0 INTRODUCTION

1.1 Background

AWN have been requested by Dwyer Nolan Developments Ltd to carry out a Hydrogeological Impact Assessment for a development of residential units located at the junction of Santry Avenue and Swords Road, Santry, Dublin 9.

Dwyer Nolan Developments Ltd. intend to apply to An Bord Pleanála for permission for a strategic housing development. The development site is bounded to the north by Santry Avenue, to the east by Swords Road, to the south by the permitted Santry Place development (granted under Dublin City Council Ref's. 2713/17 & 2737/19), and to the west by the Santry Avenue Industrial Estate.

1.2 Hydrogeological Impact Assessment Objectives

A Hydrogeological Impact Assessment (HIA) was undertaken for the proposed new development on Santry, Dublin 9, following the methodology given in Basement Development Guidance (2019, now withdrawn) and Basement Development Policy documents published by the Dublin City Council.

The Basement Development Policy document explains the historical context which created the need for a new policy to be put in place. It also presents existing Planning and Legislative background relating to the matter and describes the implementation process of this new policy.

The Basement Development Guidance document presents a methodology where the impact of basement on the surrounding ground and groundwater is assessed on a site specific basis. This policy sets out the requirements to complete this risk-based impact assessment with regard to hydrology, hydrogeology and land stability.

The HIA was undertaken to assess the likely impact on the existing water regime during and post construction of a basement within the proposed development. The objective is to ensure that the basement development:

- Protects and enhances where possible the groundwater quality, quantity and classification;
- Provides evidence that the construction of the basement shall not place groundwater at undue risk;
- Provides evidence that the structural stability of adjoining or neighbouring buildings and land areas are not put at risk;
- Provides a management plan for any demolition works and for the construction of the basement;
- Does not have an adverse effect on existing patterns of surface water drainage;
- Shall not significantly impact on groundwater or surface water flows to the extent that this is likely to increase the risk of flooding;
- Ensures appropriate handling and dealing with waste removal;
- Conserves and where possible enhances the biodiversity value of the site;
- Generally complies with the relevant regulations such as the Basement Development Policy and the Basement Development Guidance.

1.3 General Qualifications and Conditions of Use

The subject report is intended to be an accurate and unbiased account of what the potential impacts of constructing a basement within the proposed residential development. It has been compiled based on information from the following sources:

- Ordnance Survey Ireland - aerial photographs and historical mapping;
- Geological Survey of Ireland (GSI) - on-line mapping, Geo-hazard Database, Geological Heritage Sites & Sites of Special Scientific Interest, Bedrock Memoirs and 1: 100,000 mapping;
- Teagasc soil and subsoil database;
- Environmental Protection Agency (EPA) – website mapping and database information;
- The Irish Meteorological Service –rainfall data and river/estuary levels;
- Strategic Flood Risk Assessment (SFRA) - Dublin City Development Plan, 2016–2022;
- Relevant Eastern Catchment Flood Risk Assessment and Management (CFRAM) Flood Reports;
- Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites, Eastern Regional Fisheries Board (ERFB);
- Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001);
- Water Framework Directive (2000/60/EC);
- The Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C502);

The assessment also relies on information regarding design provided by Dwyer Nolan Developments as follows:

- Foundation Appraisal Report. Swords Road, Santry Phase 2 (DBFL, 2021);
- Ground Investigation Report. Development in Santry (GII, 2019);
- Construction and Environmental Management Plan (CEMP). Mixed Use Development at Heiton Buckley, Santry Avenue, Dublin 9 (DBFL, 2021)
- Various plans of the project.

This report is based on the above information and prepared for the purpose of making a submission to the planning authority on this particular site only. The impacts categorised above are based on the judgement and experience of the Engineers & hydrogeologist carrying out the assessment, and may be based on information or documentation supplied by others.

Moreover, the report is intended for the sole use of Dwyer Nolan Developments and their elected agents and advisors and, further, solely for the purpose for which it was originally commissioned. It may not be assigned or copied to third parties or relied upon by third parties.

This report was prepared by Marcelo Allende (BEng), and Teri Hayes (BSc MSc PGeol EurGeol). Marcelo is a Water Resources Engineer with over 15 years of experience in environmental consultancy and water resources studies. Marcelo is an Environmental Consultant with AWN Consulting, a member of the International

Association of Hydrogeologists (Irish Group) and a member of Engineers Ireland (MIEI). Teri is a hydrogeologist with over 25 years of experience in water resource management and impact assessment. She has a Masters in Hydrogeology and is a former President of the Irish Group of the Association of Hydrogeologists (IAH) and has provided advisory services on water related environmental and planning issues to both public and private sector bodies. She is qualified as a competent person as recognised by the EPA in relation to contaminated land assessment (IGI Register of competent persons www.igi.ie). Her specialist area of expertise is water resource management eco-hydrogeology, hydrological assessment and environmental impact assessment.

2.0 ASSESSMENT OF HYDROLOGICAL AND HYDROGEOLOGICAL BASELINE AND GROUNDWATER BODY STATUS

A reliable Conceptual Site Model (CSM) requires an understanding of the existing hydrological and hydrogeological setting. This is described below for the proposed development site and surrounding hydrological and hydrogeological environs.

2.1 Existing Site Conditions

The proposed development is located on lands at the junction of Santry Avenue and Swords Road, Santry, Dublin 9 on a site area of 1.5ha (refer to Insert 2.1 below). The site is bounded to the north by Santry Avenue, to the east by Swords Road, to the south by the permitted Santry Place development (Ref.s 2713/17 & 2737/19) and to the west by the Santry Avenue Industrial Estate. The brownfield site is currently Heiton Buckly Building Suppliers. The site is relatively flat.

Insert 2.1 *Development Site Location*

2.1.1 Existing Ground Conditions

A ground investigation was carried out for the adjoining development at Santry Place by GII, in January 2019 and was included as reference for the Foundation Assessment undertaken by DBFL. This investigation included the following:

- 3 no. trial pit to a maximum depth of 3.1 mbgl;
- 3 no. cable percussion boreholes to a maximum depth of 1o mbgl;
- 1 no. rotary core boreholes to a maximum of 9.7 mbgl;
- Geotechnical and environmental laboratory testing.

This report is included as part of Appendix A. Given the homogeneity of the area in terms of geology and the absence of structural geological elements (such as faults, as can be seen in sections below) this investigation is considered to be representative of the subject site.

Location of site investigations is presented in the Insert 2.2 below.

Insert 2.2 *Location of Site Investigations (in blue) (Source: DBFL, 2021)*

The stratification encountered at the adjacent site is as follows:

- Surfacing: Reinforce concrete up to 0.3 mbgl;
- Fill: Granular fill were encountered beneath the concrete to a depth of 0.4-1.0 mbgl;
- Made Ground: Made ground deposits (described as sandy gravelly Clay with occasional cobbles and contained rare fragments of plastic and plywood) were encountered beneath the Fill material to a variable depths between 0.7-3.4 mbgl;
- Cohesive Deposits: Deposits described as low permeability stiff sandy gravelly Clay were encountered beneath the Made Ground up to depths of 10 mbgl.
- The depth of bedrock head was not proven during the site investigation, with the maximum exploration to 10 mbgl.

This stratification is consistent with the groundwater vulnerability considered by the GSI at the site (refer to section 2.1.2 below)

Groundwater strikes associated with perched water within the overburden was encountered in only 1 no. of the exploratory boreholes at 5.5 mbgl (measured in February 2019, i.e., during wet and winter/ spring conditions).

Soil samples were selected from the exploratory holes for a range of environmental testing, including Waste Acceptance Criteria (WAC), pH and sulphate. Results show no evidence of contamination, as samples meet all WAC criteria for inert soils.

2.1.2 Geological and Hydrogeological Setting

Mapping from the Geological Society of Ireland (GSI maps, http://www.gsi.ie accessed on 16-06-2021) indicates the bedrock underlying the site is part of the Lucan Formation (code CDLUCN) and made up of dark limestone and shale (Calp). The lithological description comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded, and interbedded dark-grey calcar. The beds are predominantly fine-grained distal turbidites in the north Dublin Basin. The formation is intermittently exposed on the coast between Rush and Drumanagh Head. The formation ranges from 300m to 800m in thickness.

The GSI also classifies the principal aquifer types in Ireland as:

- Lk - Locally Important Aquifer - Karstified
- Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Pu - Poor Aquifer - Bedrock which is Generally Unproductive
- Rkd - Regionally Important Aquifer (karstified diffuse)

Presently, from the GSI (2021) National Bedrock Aquifer Map, the GSI classifies the bedrock aquifer beneath the subject site as a ‘Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones’. The proposed development is within the ‘Dublin’ groundwater body and is classified as ‘Poorly productive bedrock’. The most recent WFD groundwater status for this water body (2013-2018) is ‘Good’ with a current WFD risk score ‘Under Review’.

Aquifer vulnerability is a term used to represent the intrinsic geological and hydrological characteristics that determine the ease with which groundwater may be contaminated generally by human activities. The GSI (2021) guidance presently classifies the bedrock aquifer vulnerability in the region of the subject site as ‘Low’ which indicates a general thick overburden depth potential of >10m, indicating good protection of the underlying aquifer by low permeability subsoil. This desk study data was confirmed by the site investigations undertaken at the adjacent site which shows the overburden has depths greater than 10.0mbgl before reaching the bedrock. The aquifer vulnerability class in the region of the site is presented as Insert 2.2 below.

Insert 2.2 *Groundwater Vulnerability Map (source: GSI, 2021)*

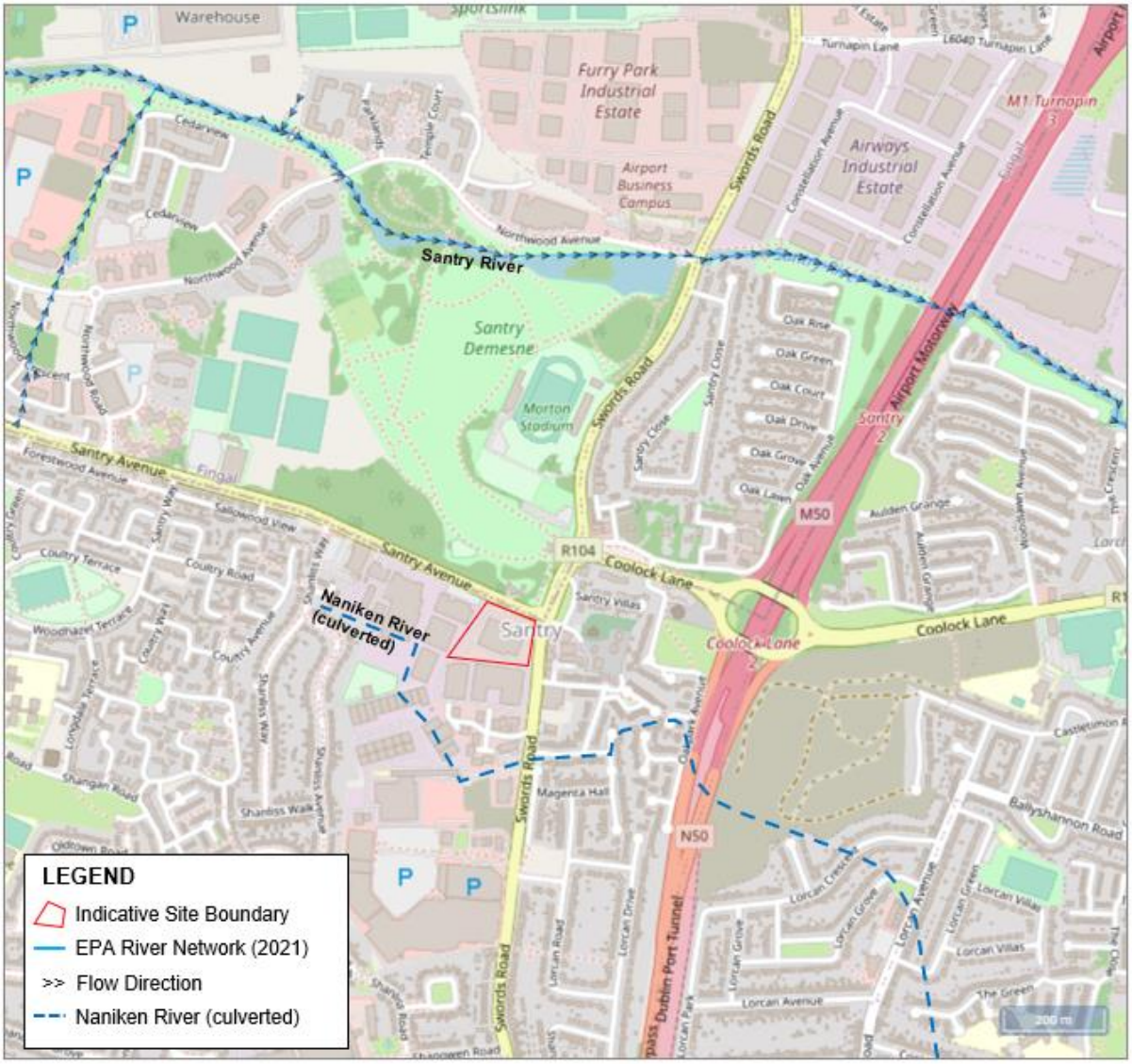
The GSI/ Teagasc (2021) mapping database of the quaternary sediments in the area of the subject site indicates the principal subsoil type in the residential area comprises Till derived from limestones (TLs), which is also consistent with the adjacent site investigations undertaken.

With regard to static groundwater level, there is no current available information. However, the GII site investigation at the adjacent site encountered groundwater strike at 5.5 mbgl in 1 no. borehole (winter measurement). It is noted this is a perched water level within made ground. No dewatering of the water table within bedrock is required for the proposed development.

2.1.2 Hydrological Setting

The proposed development site lies within the Liffey and Dublin Bay Catchment (Hydrometric Area 09) and Mayne River sub-catchment (WFD name: Mayne_SC_010, Id 09_17; EPA, 2021).

There are no watercourses at the site or in the immediate vicinity of the site. According to the EPA river network (EPA maps, https://gis.epa.ie/EPAMaps/ accessed on 16-06-2021), the nearest watercourse to the site is the Santry River which resides c. 680 m to the north of the site (refer to insert 2.3 below). The Dublin Bay coastal waterbody is the nearest water receptor and is located c. 7.4 Km southeast of the proposed development.



Insert 2.3 *Hydrological Map (source: EPA, 2021. The Rivers of Dublin, Sweeney, 2017)*

According to the OSi maps (https://www.floodinfo.ie/map/floodmaps/ accessed on 16-06-2021), the site is located within Flood Zone C (i.e., where the probability of flooding from rivers is less than 0.1% or 1 in 1000 years – probability of fluvial flooding is low risk). No historic flooding was identified at the site or surrounding area with the exception of a single event in 1965 recorded c.250m to the south of the site. This event is associated with the Naniken River system which currently flows culverted in this area.

3.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Dwyer Nolan Developments Ltd. intend to apply to An Bord Pleanála for permission for a strategic housing development, on a site of c. 1.5 hectares, located at the junction of Santry Avenue and Swords Road, Santry, Dublin 9. The development site is bounded to the north by Santry Avenue, to the east by Swords Road, to the west by Santry Avenue Industrial Estate, and to the south by the permitted Santry Place development (granted under Dublin City Council Ref's. 2713/17 & 2737/19).

The proposed development provides for 350 no. apartments, comprised of 113 no. 1 bed, 218 no. 2 bed, & 19 no. 3 bed dwellings, in 4 no. seven to fourteen storey buildings, over basement level, with 5 no. retail / commercial units and a community use unit located at ground floor level facing onto Santry Avenue and Swords Road. A one storey residential amenity unit, facing onto Santry Avenue, is also provided for between Blocks A & D.

The development consists of the following:

- Demolition of the existing buildings on site (measuring c. 4,196.8m^2).
- Construction of 350 no. 1, 2, & 3 bed apartments, retail / commercial and community uses in 4 no. buildings that are subdivided into Blocks A-G as follows:
    - Block A is a 7 to 14 storey block consisting of 59 no. apartments comprised of 26 no. 1 bed & 33 no. 2 bed dwellings, with 2 no. commercial/retail units located on the ground floor (c. 132.4m2 & 173m2 respectively). Adjoining same is Block B, which is a 7 storey block consisting of 38 no. apartments comprised of 6 no. 1 bed, 20 no. 2 bed, & 12 no. 3 bed dwellings, with 2 no. commercial/retail units located on the ground floor (c. 162.3m2 & 130.4m2 respectively). Refuse storage areas are also provided for at ground floor level.
    - Block C is a 7 storey block consisting of 55 no. apartments comprised of 13 no. 1 bed & 42 no. 2 bed dwellings. Refuse storage areas are provided for at ground floor level. Adjoining same is Block D which is a 7 to 10 storey block consisting of 51 no. apartments comprised of 25 no. 1 bed, 19 no. 2 bed, & 7 no. 3 bed dwellings, with 1 no. commercial unit / café located on the ground floor (c. 163.3m2). A refuse storage area is also provided for at ground floor level.
    - Block E is a 7 to 10 storey block consisting of 58 no. apartments comprised of 10 no. 1 bed & 48 no. 2 bed dwellings, with 1 no. community use unit located on the ground floor (c. 188.1m2). A refuse storage area, substation, & switchroom are also provided for at ground floor level. Adjoining same is Block F which is a 7 storey block consisting of 55 no. apartments comprised of 13 no. 1 bed & 42 no. 2 bed dwellings. A refuse storage area & bicycle storage area are also provided for at ground floor level.
    - Block G is a 7 storey block consisting of 34 no. apartments comprised of 20 no. 1 bed & 14 no. 2 bed dwellings. A refuse storage area & bicycle storage area are also provided for at ground floor level.
- Construction of a 1 storey residential amenity unit (c. 187.9m2) located between Blocks A & D.
- Construction of basement level car parking (c.5,470.8m2) accommodating 173 no. car parking spaces & 719 no. bicycle parking spaces. Internal access to the basement level is provided from the cores of Blocks A, B, C, D, E, & F. External vehicular access to the basement level is from the south, between Blocks B & C. 36 no. car parking spaces & 58 no. bicycle parking spaces are also provided for within the site at surface level.
- Public open space of c. 1,915m2 is provided for between Blocks C, D, E, & F. Communal open space of c. 3,122m2 provided for between (i) Blocks E, F, & G, (ii) Blocks A, B, C, & D, and (iii) in the form of roof gardens located on Blocks A, C, & F and the proposed residential amenity use unit. The development includes for hard and soft landscaping & boundary treatments.

Private open spaces are provided as terraces at ground floor level of each block and balconies at all upper levels.

Vehicular access to the development will be via 2 no. existing / permitted access points: (i) on Santry Avenue in the north-west of the site (ii) off Swords Road in the south-east of the site, as permitted under the adjoining Santry Place development (Ref. 2713/17).

The development includes for all associated site development works above and below ground, bin & bicycle storage, plant (M&E), sub-stations, public lighting, servicing, signage, surface water attenuation facilities etc.

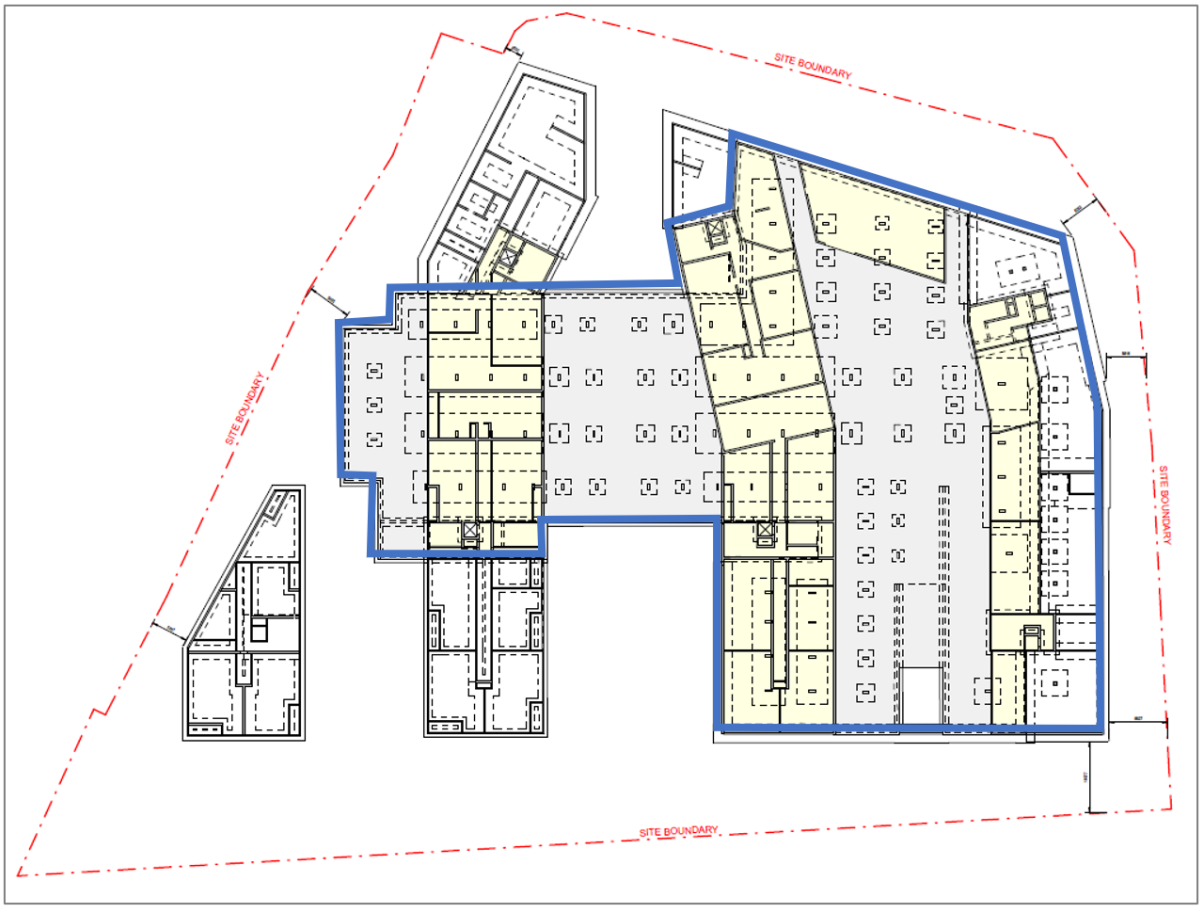
The basement for the proposed development will be founded at a formation level of approx. 4.5 mbgl.

Given the geotechnical characteristics of the cohesive deposits at the subject site (refer to DBFL, 2021) conventional strip and pad foundations are considered suitable for walls and columns for all blocks up to 14 storeys in height. Circulation cores are proposed to be founded on raft foundations as these cores provide stability to the overall scheme and as a result will attract higher load.

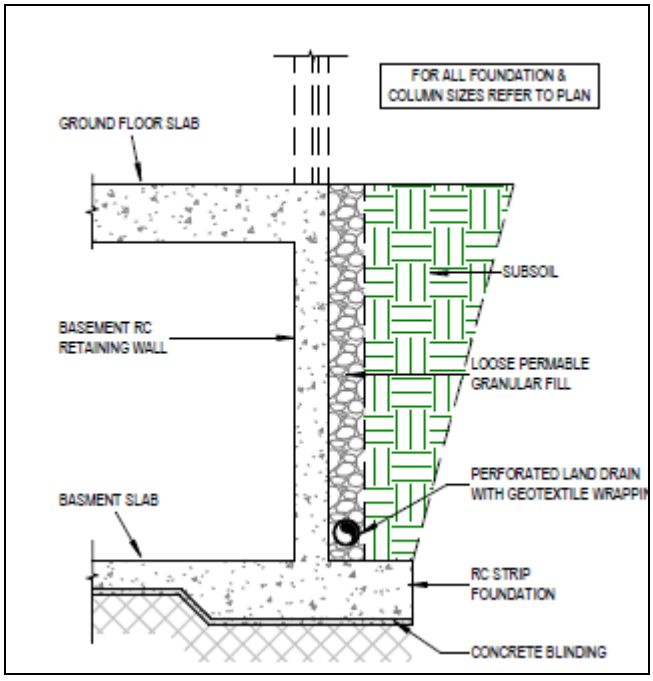
The ground conditions and allowable bearing capacity was verified using the ground investigation report carried out by IGSL on the nearby Coolock lane development (refer to DBFL, 2021). A piling solution was not considered due to the relatively shallow depth of the stiff cohesive deposits.

Given the location of the basement within the site and the space between the basement perimeter and the site boundary, a 45 degree batter is achievable to form the basement excavation.

It is also recommended that extensive ground investigations are carried out on the proposed site (including a combination of trial pits, boreholes and dynamic probes), before more detailed project design takes place. Refer to Insert 3.1 below for the basement plan and Insert 3.2 for a projected basement section.



Insert 3.1 *Outlined Basement Plan (blue polygon) (source: DBFL, 2021)*



Insert 3.2 *Typical Basement Section (source: DBFL, 2021)*

3.1 CONSTRUCTION WORK PROGRAMME

The approximate basement Construction Sequence is outlines below:

i. Demolition Works

The existing buildings on the site will be demolished as part of the planning application. Demolition will be completed by the appointed contractor in accordance with the relevant standards and guidelines. Contaminated materials used in the existing buildings will be identified and disposed of by a specialised contractor. Demolition will be carried out as described below to permit basement construction without undermining or causing loss of support to adjacent structures.

ii. Basement Construction

A full site investigation will be carried out prior to construction commencing. A specialist ground works contractor will be appointed to carry out the excavation and any rock breaking works that may be required. The appointed specialist contractor will carry out a full risk assessment prior to the commencement of work.

A ground works operation will be carried out in order to ensure that material removed from the ground is taken away at regular intervals in order to reduce the amount of material that will be stored on site. Excavated material will be reused on site where possible subject to the WAC analysis.

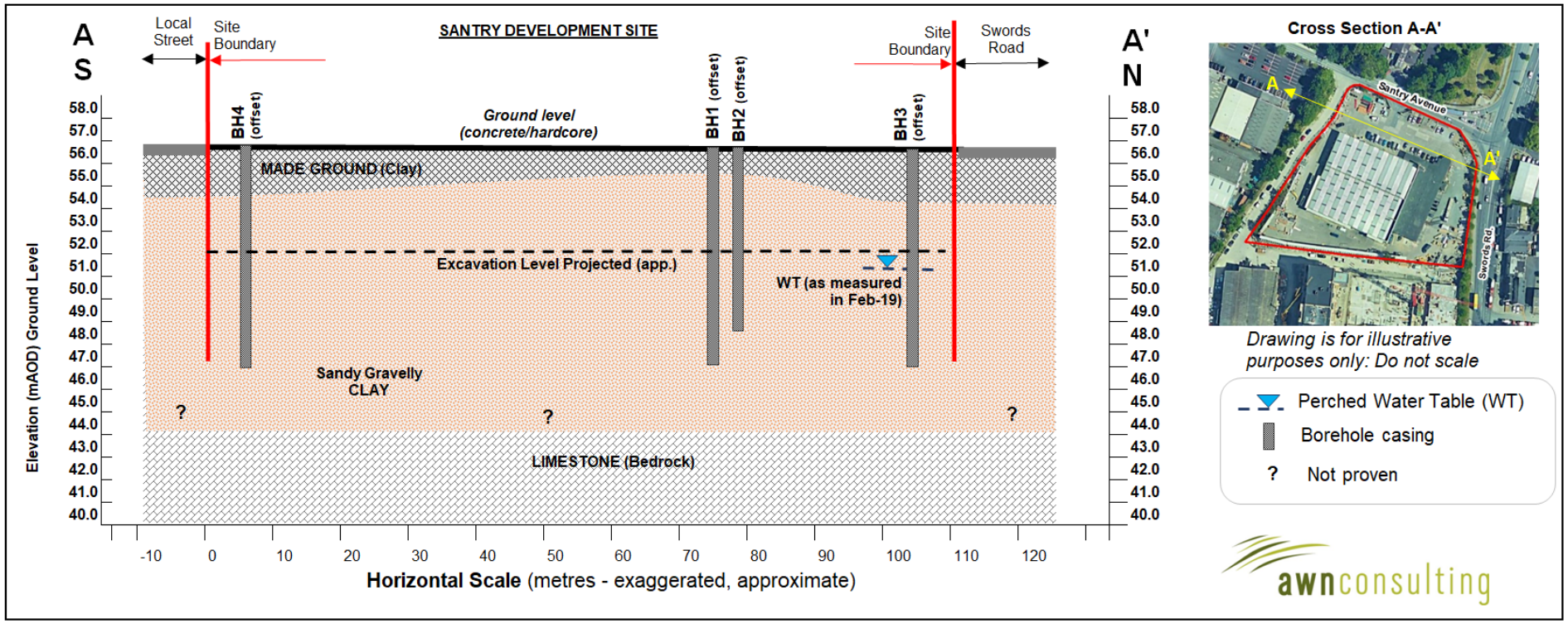
Localised sump pumps will be installed to remove the water through settlement tanks and after appropriate treatment into the local drainage network infrastructure for discharge. On completion of the excavation works to the formation level of the basement slab, this will be blinded to the final design levels. Any below ground services will be installed and tested below the basement slab. Prior to construction of the foundations and suspended slab at the lower basement level, a proprietary basement tanking system and water bar will be installed at all construction joints. A typical basement slab construction is as follows:

- Trim & grade to slab formation with suitable well compacted capping material.
- Cast mass concrete blinding to form a surface for applying waterproof membrane and tanking.
- Apply continuous waterproof tanking material and seal all laps (and along perimeter of secant wall/slab junction).
- Install slab reinforcement to slab area (including any columns and wall starters) Formwork to perimeter and any box-outs necessary (around raking props).
- Clean & inspect slab pour prior to concrete operations.
- *Note: The placement of large volumes of concrete such as the deep foundations will be carried out by a mobile or static concrete pump. The above process will repeat until the foundation raft is constructed.*

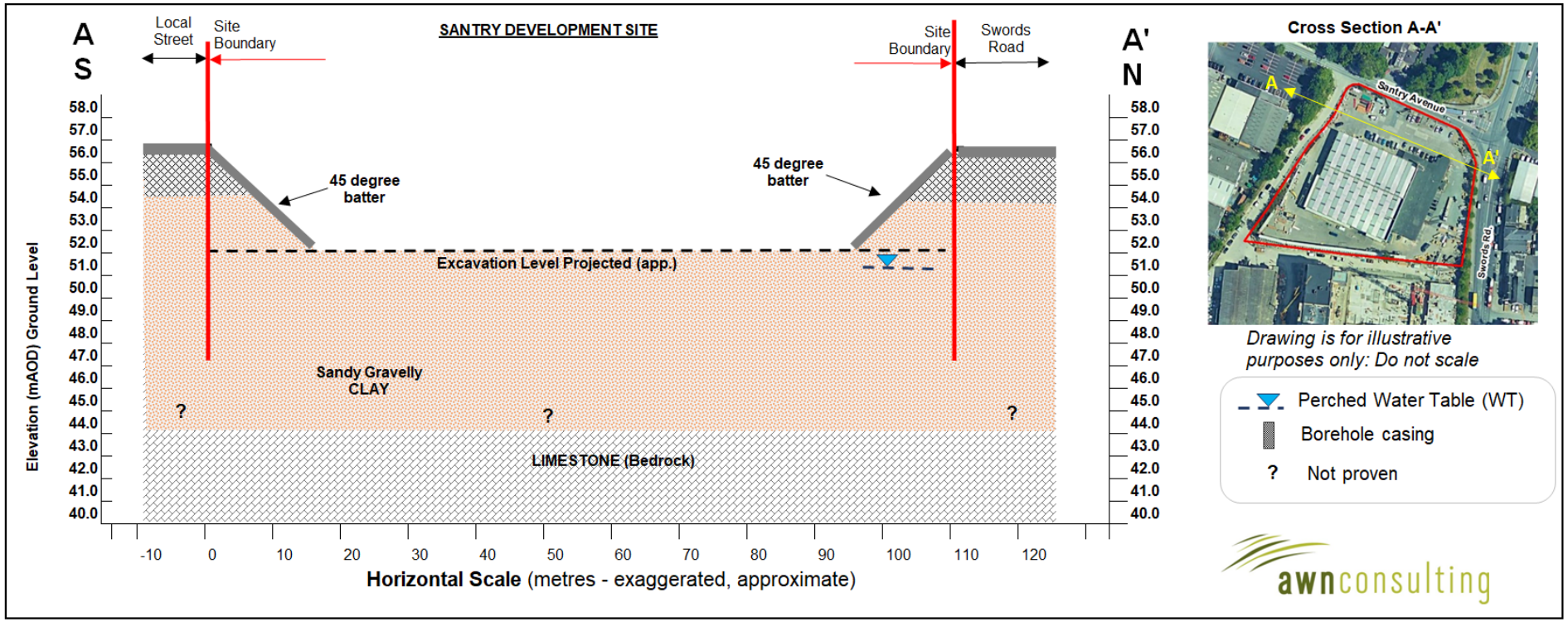
When a sufficient area of basement slab is constructed the vertical elements will be constructed to allow the upper level; basement slabs to be constructed.

4.0 CONCEPTUAL GROUND MODEL

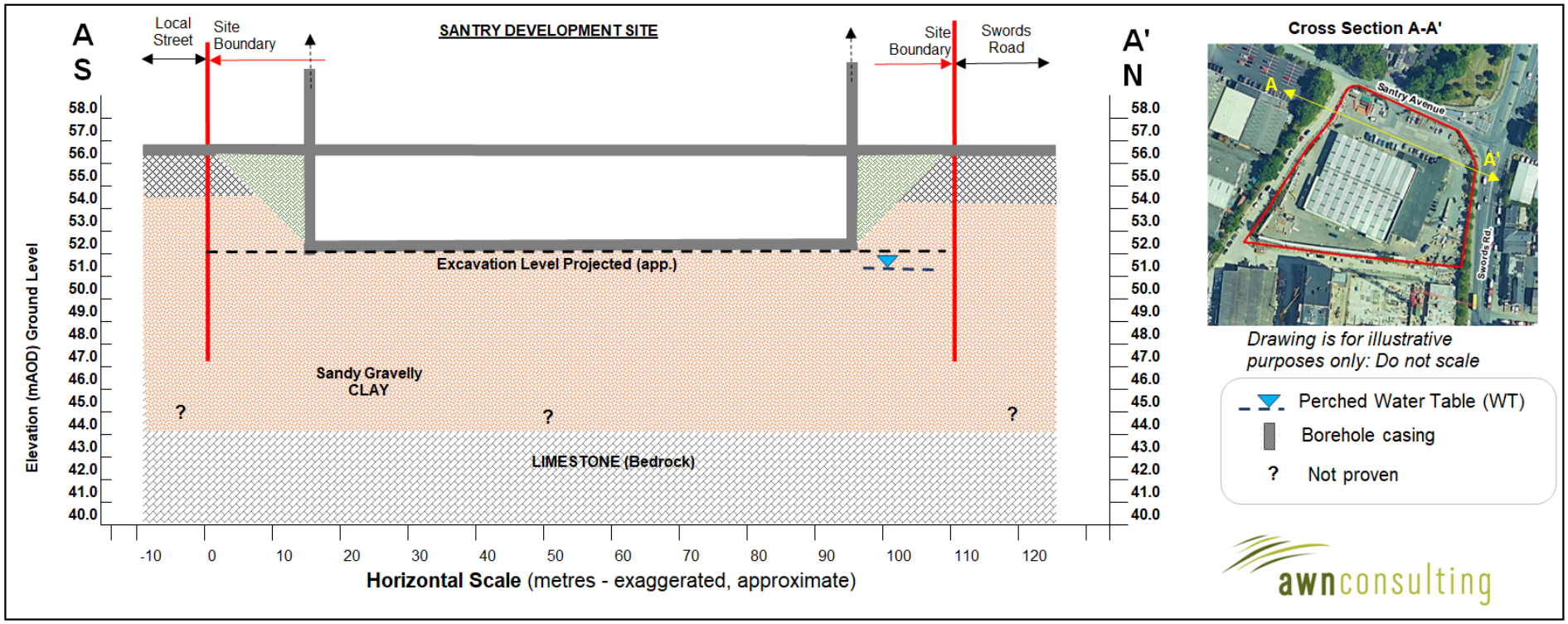
Based on the existing site conditions and the description of the proposed development, conceptual cross sections for the current situation, the construction phase and operation phase are shown in Inserts 4.1 to 4.3 below.



Insert 4.1 *Conceptual Cross Section A-A' for current situation*



Insert 4.2 *Conceptual Cross Section A-A' during Construction Phase*



Insert 4.3 *Conceptual Cross Section A-A' during Operation Phase*

5.0 POTENTIAL IMPACTS

There is no expected long term impact on groundwater levels surrounding the proposed site due to the nature of the hydrogeological environment and the shallow depth of the basement. Local shallow groundwater within overburden (Made ground and cohesive deposits – low permeability sandy gravelly Clay) will be intercepted (refer to Conceptual Ground Model above) by the basement retaining wall but following basement construction groundwater will migrate around the structure with no overall change in the groundwater and surface water regime.

During construction, a very localised impact may occur during early stages of excavation until the 45 degree batters are in place. Once these are installed into the low permeability clay (made ground and cohesive deposits), any horizontal flow from the water bearing gravel layer will be cut off and minimal inflows from the base of construction (along with any collected rainwater) will occur until the floor is constructed. Considering a water table at 5.5mbgl interpreted from ground investigations at the adjacent site, no drawdown of perched water would be required at the site as the level for foundations is projected at a depth of c. 4.5mbgl. However, in the event that perched water is encountered during excavation works, based on the construction design and average hydraulic conductivity for this type of overburden, the zone of influence would be expected to be within or close to the 45 degree batters and the basement retaining walls i.e. close to the site boundary during construction with full recovery post construction.

The regional water table within bedrock will not be affected by the planned basement construction. The effect on the shallow water table will at most be temporary. The basement is estimated to be completed within approximately 12-16 weeks.

Since the site is currently hardstand (Heiton Buckly Building Suppliers), the proposed development will not result in the increase in hardstanding area. Therefore, groundwater recharge and groundwater regime will not be affected.

The proposed basement construction, which would involve c. 4.5 m deep excavations has the potential to cause minor ground movements inside and outside the excavated area as a result of changes in vertical load on the ground. The construction sequence outlined in Section 3.1 of this report was developed to control any potential movement to within acceptable limits.

There is no source- pathway- receptor hydrogeological connection between the subject site and Dublin Bay through the Dublin aquifer as vertical migration to the underlying limestone bedrock is minimised due to the thickness of overburden (‘Low’ vulnerability) present at the site providing a high level of aquifer protection from any potential source. Therefore, no likely impact on the status of the aquifer is expected due to natural attenuation within overburden and reducing potential for off site migration.

6.0 POTENTIAL MITIGATION MEASURES

The following mitigation measures will be included in the design to protect water quality:

Any minor ingress of groundwater and collected rainfall in the excavation will be pumped out during construction. It is proposed that the water be discharged via the existing stormwater sewer network. The use of slit traps and an oil interceptor (if required) will be adopted if monitoring indicates the requirements for the same with no silt or contaminated water permitted to discharge to the sewer.

Site investigation has not identified any significant water bearing gravels within the basement footprint. However, if water bearing gravels encountered then the design should facilitate discharge around the basement structure.

To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within temporary bunded areas; these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container.

Where feasible all ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

In addition, monitoring of groundwater levels pre, during and post construction of basement works and monitoring of vibration and noise during the installation of 45 degree batters will complement the measures described above. Where groundwater is encountered, a minimum of 3 no. boreholes with standpipes it is suggested to install in order to measure these levels and their seasonal fluctuation.

A Construction and Environmental Management Plan (CEMP) undertaken by DBFL is included as part of the planning application (refer to Appendix B). A more detailed plan will be provided after the contractor is appointed. At that stage the contractors' detailed strategy during construction, including management of any collected water will be provided.

7.0 CONTINUOUS SITE INVESTIGATION

The site investigation comprises several stages. This included the pre-construction phase, during construction and post construction investigation.

7.1 Pre-Construction Stage

A desk study was carried out on the basis of a review of existing data sources such as the Geological Survey Ireland (GSI) and Environmental Protection Agency (EPA) websites. Results of this investigation were showed in the previous Section 2.0.

On the basis of this investigation, an interpretation is provided of the detailed site soil and geology and hydrogeology, of the geotechnical properties of the ground and an engineering and hydrogeological interpretation of the implications of the ground conditions in the previous Section 2.0. This interpretation was based on ground investigations for the adjacent site undertaken in 2019.

As such, it is necessary to install at least 3 no. boreholes with standpipes to carry out groundwater monitoring prior to commencing construction works.

6.2 Construction Stage

Due to the potential for minor ground movements during excavation works, at locations where movements are of critical importance, appropriate instrumentation will be installed and the wall and ground movements monitored accordingly. The predictions of ground movement based on the ground movement analysis should be checked by monitoring the basement wall. The monitoring will include the installation of inclinometers in the basement retaining wall elements so the pattern of wall behaviour can be reviewed with predicted values. From this understanding, the designer will carry out back analysis of the observed (monitored) wall behaviour and recalibrate the analytical model in terms of the excavation geometry and the behaviour of the ground and the structural elements with appropriate modifications or contingencies applied as required.

It is recommended that movement monitoring should be undertaken with surveying points set up prior to commencement of the works and readings be undertaken at weekly intervals. It is recommended that trigger values for monitoring are based on the predicted ground movements to ensure conservatism and that they are agreed under the Party Wall Act. In cases where vibration from construction methods could potentially damage sensitive neighbouring buildings and structures vibration monitors are to be installed. The precise monitoring strategy will be developed at a later stage and it will be subject to discussions and agreements with the owners of the adjacent properties and structures. Contingency measures will be implemented if movements of the adjacent structures exceed predefined trigger levels. Both contingency measures and trigger levels will need to be developed within a future monitoring specification for the works.

Based on ground water monitoring on the adjacent site, it is considered that there is a low risk of inflow during construction works. However, three groundwater monitoring wells are proposed outside of the basement footprint. Water level data collection will be undertaken before during and after construction.

8.0 CONCLUSIONS

The proposed basement will have no long term impact on water levels in the overburden or underlying aquifer and no impact on the current water body status. The bedrock water table will not be affected by the excavation works. Temporary dewatering of the perched water table within the clayey deposits to facilitate excavation works is expected to be minor and it will have a temporary local impact only.

The basement will need to be fully waterproofed to ensure no groundwater enters the finished basement. Site investigation has not identified any significant water bearing gravels within the basement footprint. However, if water bearing gravels encountered then the design should facilitate discharge around the basement structure.

Management of any collected rainwater and any groundwater seepage during basement excavations will be pumped to existing sewers (following appropriate treatment) in agreement with the regulatory authority.

By providing a 45 degree batter system there are no concerns regarding slope stability and horizontal movement can be easily limited to industry acceptable limited by careful detailed design.

Overall, the impact on the environment as a result of the proposed basement development in the area is predicted to be **long term-imperceptible and neutral**, provided mitigation measures above described are implemented.

APPENDIX A

Foundation Appraisal Report. DBFL, May 2021

Project

Swords Road, Santry Phase 2

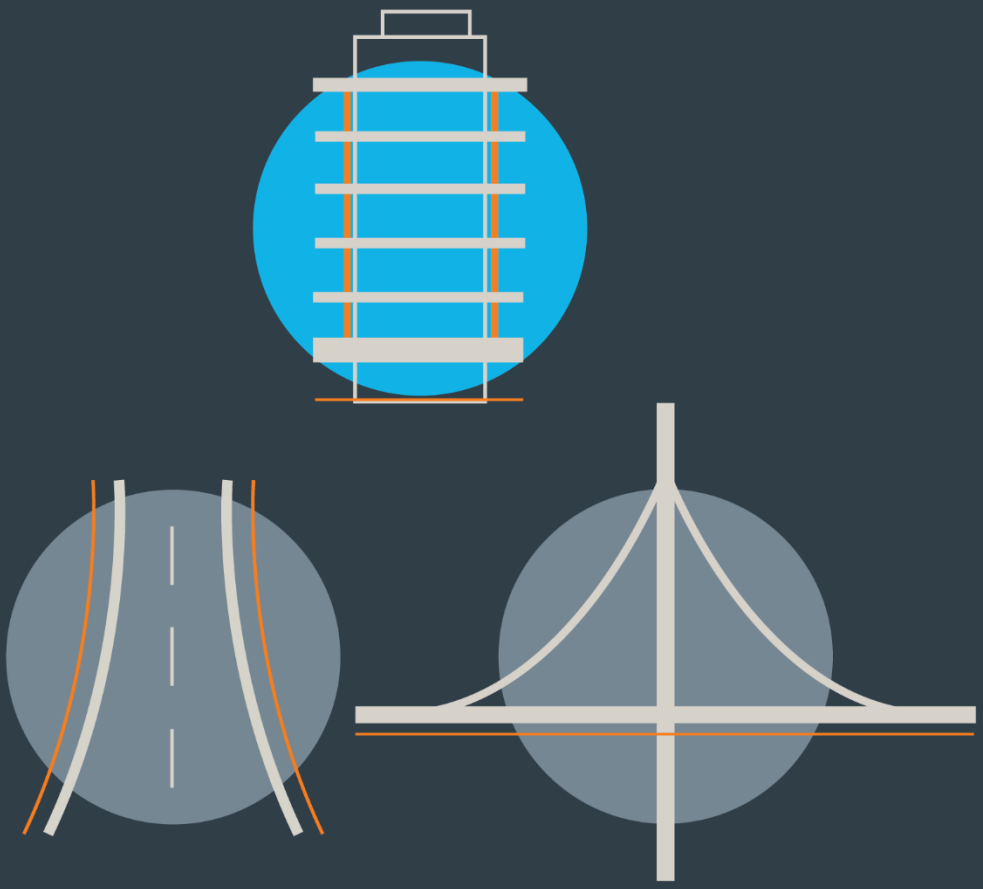
Report Title

Foundation Appraisal

Client

Dwyer Nolan Developments

STRUCTURES



DBFL CONSULTING ENGINEERS

May 2021

Project Number: 200060

Report Ref: 200060-DBFL-XX-XX-RP-S-1000

Author: Kevin Coughlan

Date: 20th May 2021

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Revision	Issue Date	Description	Prepared	Reviewed	Approved
P01	31.05.2021	First Issue	KDC	CFD	CFD

CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Summary

This report is intended to accompany the DBFL structural layouts of basement and ground floor level of the proposed mixed-use development, on the Swords Road, Santry. These drawings are presented in Appendix A of this report. The choice of conventional strip footings and pad foundations is presented and the reason for the selection of this foundation configuration.

1.2 Proposed Development

Permission is sought for the demolition of the existing buildings on site (4,196.8m^2). Vehicular access to the proposed development will be via two proposed access points: (i) on Santry Avenue and (ii) off Swords Road, and as permitted under the adjoining development at Santry Place.

The total proposed development consists of 113 no. 1 bed units, 218 no. 2 bed units & 19 no. 3 bed units, all in 7 no. blocks. The proposed development also provides for 5 no. commercial / retail units at ground floor level facing onto Santry Avenue and Swords Road. The development provides a community use hub unit (206m^2) at ground floor level of Block E and a residential amenity unit (203.5m^2) at ground floor level located between Blocks A and D.

Car parking is to be provided in the form of ground parking and basement car parks. Blocks A, B, C, D, E & F are located above the proposed basements, accommodating 173 no. car parking spaces and 358 no. cycle parking spaces.

1.3 Site Location

The proposed development is located on lands at the junction of Santry Avenue and Swords Road, Santry, Dublin 9 on a site area of 1.5ha, as shown in Figure 1.1. The site is bounded to the north by Santry Avenue, to the east by Swords Road, to the south by the permitted Santry Place development (Ref.s 2713/17 & 2737/19) and to the west by the Santry Avenue Industrial Estate. The site is relatively flat.

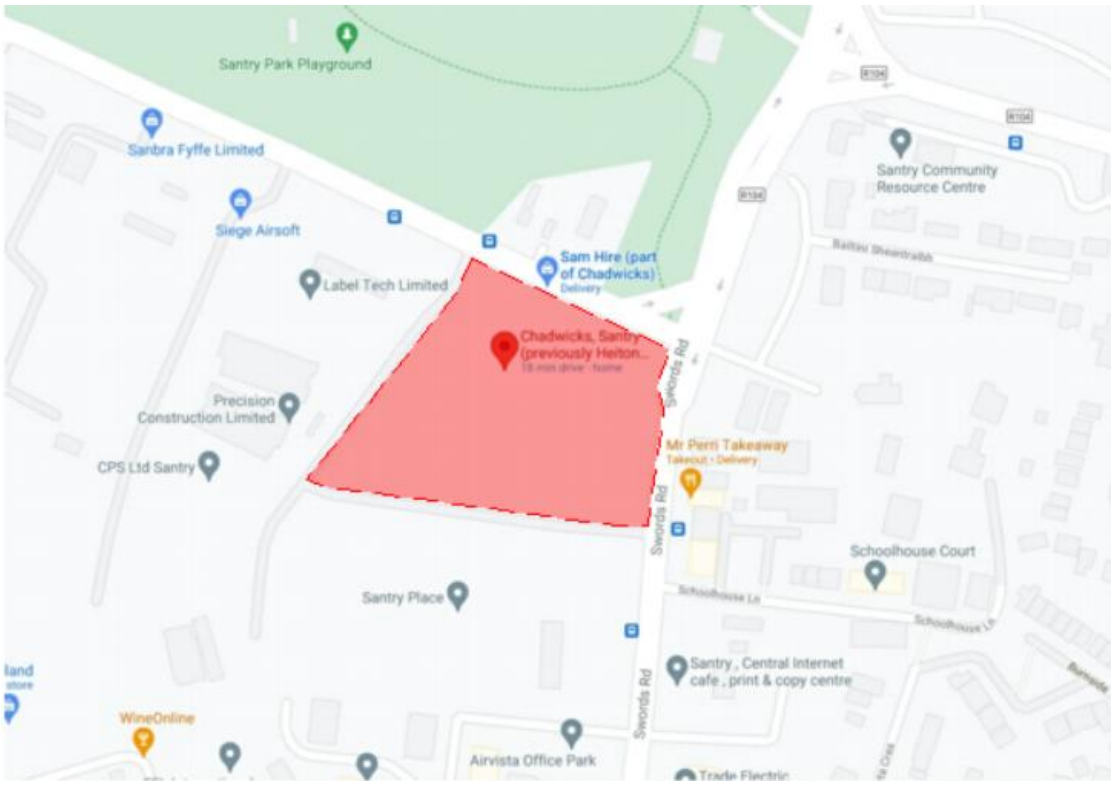


Figure 1.1 Site location

2.0 Information Gathering

2.1 Scope of Information

A desk study of the geotechnical conditions was carried out using information available of investigations carried out on nearby and adjacent sites. Information was collated from the following sources:

- Ground Investigations Ireland (GII) site investigation carried out on the adjacent Santry Place site. The investigation was carried out on the request of DBFL, who were appointed by Dwyer Nolan as Structural Engineers for the development.
- IGSL site investigation carried out on the nearby Coolock Lane Development, Santry. The investigation was carried out on behalf of Barry & Partners Consulting Engineers. This report is publicly available via the Geological Survey Ireland (GSI) online map portal; (https:/dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228).

No ground investigations have been carried out on the proposed site at the time of writing this report. However, the proposed development is located between the sites, where these investigations were carried out, as shown in Figure 2.1 below. Due to the uniformity of ground conditions described in the 2 No. reports, it is envisaged that the ground conditions on the proposed site will be consistent with Santry Place and Coolock Lane. However, it is recommended that extensive ground investigations are carried out to confirm the ground conditions prior to carrying out any detailed design. This ground investigation should include a combination of trial pits, boreholes, and dynamic probes.

Figure 2.1 Location of ground investigations

2.2 Geotechnical Site Investigation – Santry Place Development

A ground investigation was carried out for the adjoining development at Santry Place by GII, in January 2019. The findings of this investigation are summarised below. Please refer to GII report presented in Appendix B at the back of this report for the detailed findings.

2.2.1 Ground Conditions Encountered

The following is an extract from the GII report describing the ground conditions encountered on the Santry Place site:

"The sequence of strata encountered were consistent across the site and are generally comprised;

- *Surfacing*
- *Fill*
- *Made Ground*
- *Cohesive Deposits*

***SURFACING**: Reinforced concrete surfacing was encountered in all the exploratory holes and was present to a maximum depth of 0.3m BGL.*

***FILL**: Granular fill deposits were encountered beneath the concrete surfacing and was present to a relatively consistent depth of between 0.4m and 1.0m BGL. These deposits were described generally as Grey brown slightly clayey slightly sandy angular Gravel with rare angular cobbles.*

***MADE GROUND**: Made Ground deposits were encountered beneath the Fill material and was present to a relatively variable depths of between 0.70m and 3.40m BGL. These deposits were described generally as dark brown grey slightly sandy gravelly Clay with occasional cobbles and contained rare fragments of plastic and plywood.*

***COHESIVE DEPOSITS**: Cohesive deposits were encountered beneath the Made Ground and were described typically as brown slightly sandy slightly gravelly CLAY with occasional cobbles and boulders overlying a stiff dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and boulders. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 1.50m BGL in the majority of the exploratory holes. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs."*

2.2.2 Foundations

GII recommended an allowable bearing capacity of 150kN/m^2 for conventional strip or pad footings founded on the stiff cohesive deposits at a depth of 2.0m below ground level (BGL).

As the basement in the proposed development will be founded at a formation level of approx. 4.5m BGL, DBFL requested GII to review the allowable bearing capacity at the lower formation. On further correspondence between DBFL and GII, dated 19th April 2021, GII recommended an allowable bearing capacity of 250-300kN/m^2 for conventional strip footings at 4.5m BGL.

2.2.3 Excavations

GII noted that temporary excavations in the cohesive deposits will only remain stable for a limited time only and will need temporary propping or appropriate battering if the excavation is to permit man entry. Excavations in the made ground or the soft cohesive deposits will also require appropriate battering.

2.2.4 Groundwater

No standpipes were installed during the GII investigation, however water strikes were noted on the borehole log of BH3 at a depth of 5.5m, rising to 4.2m BGL in 20mins. There is no further groundwater information available.

2.3 Geotechnical Site Investigation – Coolock Lane Development

IGSL carried out a site investigation of nearby lands as part of a proposed residential / community centre development at Coolock Lane, Santry, in August 2002. The site is located within 150m of the proposed development. The IGSL report is appended to the back of this report. Refer to Appendix C.

2.3.1 Ground Conditions Encountered

The following is an extract from the IGSL report describing the ground conditions encountered on the Santry Place site:

"The boreholes have revealed similar ground conditions with deposits of topsoil and made ground extending to depths of between 1.00 and 2.20m underlain by a firm to stiff brown gravelly clay. This stratum was in turn underlain by a hard black gravelly clay and the boreholes were all terminated on obstructions within these gravelly clays at depths of between 5.50 and 6.50m."

2.3.2 Foundations

The following is an extract from the IGSL report in which the recommended allowable bearing capacities are presented:

"Where conventional foundations are placed on the firm to stiff brown gravelly clays at depths of approx. 1.00m an allowable bearing pressure of the order of 100 - 125 kN /M2 can be utilised. Where greater loads than these are required then foundations will have to be transferred to the underlying black gravelly clays where an allowable bearing pressure of the order 275 - 300 kN /M2 can be utilised."

2.3.3 Groundwater

No information on groundwater was presented in the IGSL report.

3.0 Discussion of Results

3.1 Choice of Foundations

Given the stiff cohesive deposits and allowable bearing capacity of 150kN/m^2 noted in the GII report along with the increased allowable bearing capacity of 250-300kN/m^2 noted in the correspondence between DBFL and GII in April 2021, conventional strip and pad foundations are considered suitable for walls and columns for all blocks up to 14 storeys in height. Circulation cores are proposed to be founded on raft foundations as these cores provide stability to the overall scheme and as a result will attract higher load.

The ground conditions and allowable bearing capacity was verified using the ground investigation report carried out by IGSL on the nearby Coolock lane development, accessed via the GSI online map portal.

Although a piling solution was considered for the taller blocks, it was not considered necessary due to the relatively shallow depth of the stiff cohesive deposits.

3.2 Stability of Excavations

Given the location of the basement within the site and the space between the basement perimeter and the site boundary, a 45 degree batter is achievable to form the basement excavation. Alternative retention systems, such as sheet piles or contiguous piling were also considered but deemed unnecessary. A keyplan of the proposed development and proximity to the boundary line is presented in Appendix D, at the back of this report.

3.3 Further Investigations

The findings and recommendations expressed in this report are solely based on information available to DBFL at the time of writing this report. No responsibility can be held by DBFL for conditions which have not been identified. Recommendations made in this report are indicative only and liability cannot be accepted for their accuracy.

It is also recommended that extensive ground investigations are caried out on the proposed site (including a combination of trial pits, boreholes and dynamic probes), before more detailed project design takes place.

APPENDIX A

General Layout Drawings

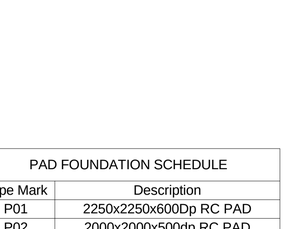
NOTE:

SIZING/POSITIONING OF STRUCTURAL ELEMENT SHOWN, INCLUDING FOUNDATIONS, ARE PRELIMINARY ONLY AND ARE SUBJECT TO CHANGE BASED ON FURTHER GEOTECHNICAL IN-SITU TESTING AND AT DETAILED DESIGN PHASE

PAD FOUNDATION SCHEDULE	
Type Mark	Description
P01	2250x2250x600Dp RC PAD
P02	2000x2000x500dp RC PAD
P03	2500x2500x600dp RC PAD
P04	2750x2750x750Dp RC PAD
P05	3250x3250x750dp RC PAD
P06	3000x3000x750dp RC PAD
P07	1700x1700x450dp RC PAD
P08	7500X7500x1875dp RC PAD
P09	5500x5500x1450dp RC PAD
P10	3750x3750x950dp RC PAD

STRIP FOUNDATION SCHEDULE	
Type Mark	Description
SF1	1250x450 Dp RC STRIP FOOTING
SF2	1750x450 Dp RC STRIP FOOTING
SF3	2500x650 Dp RC STRIP FOOTING
SF4	2750x750 Dp RC STRIP FOOTING
SF5	3250x850 Dp RC STRIP FOOTING
SF6	3000x450 Dp RC STRIP FOOTING
SF7	3600x450 Dp RC STRIP FOOTING
SF8	2250x450 Dp RC STRIP FOOTING
SF9	4250x450 Dp RC STRIP FOOTING
SF10	1500x450 Dp RC STRIP FOOTING
SF11	2000x450 Dp RC STRIP FOOTING
SF12	2700x450 Dp RC STRIP FOOTING
SF14	3450x450 Dp RC STRIP FOOTING

COLUMN SCHEDULE	
REF	DESCRIPTION
C01	300x900 RC COLUMN
C02	450Sq RC COLUMN



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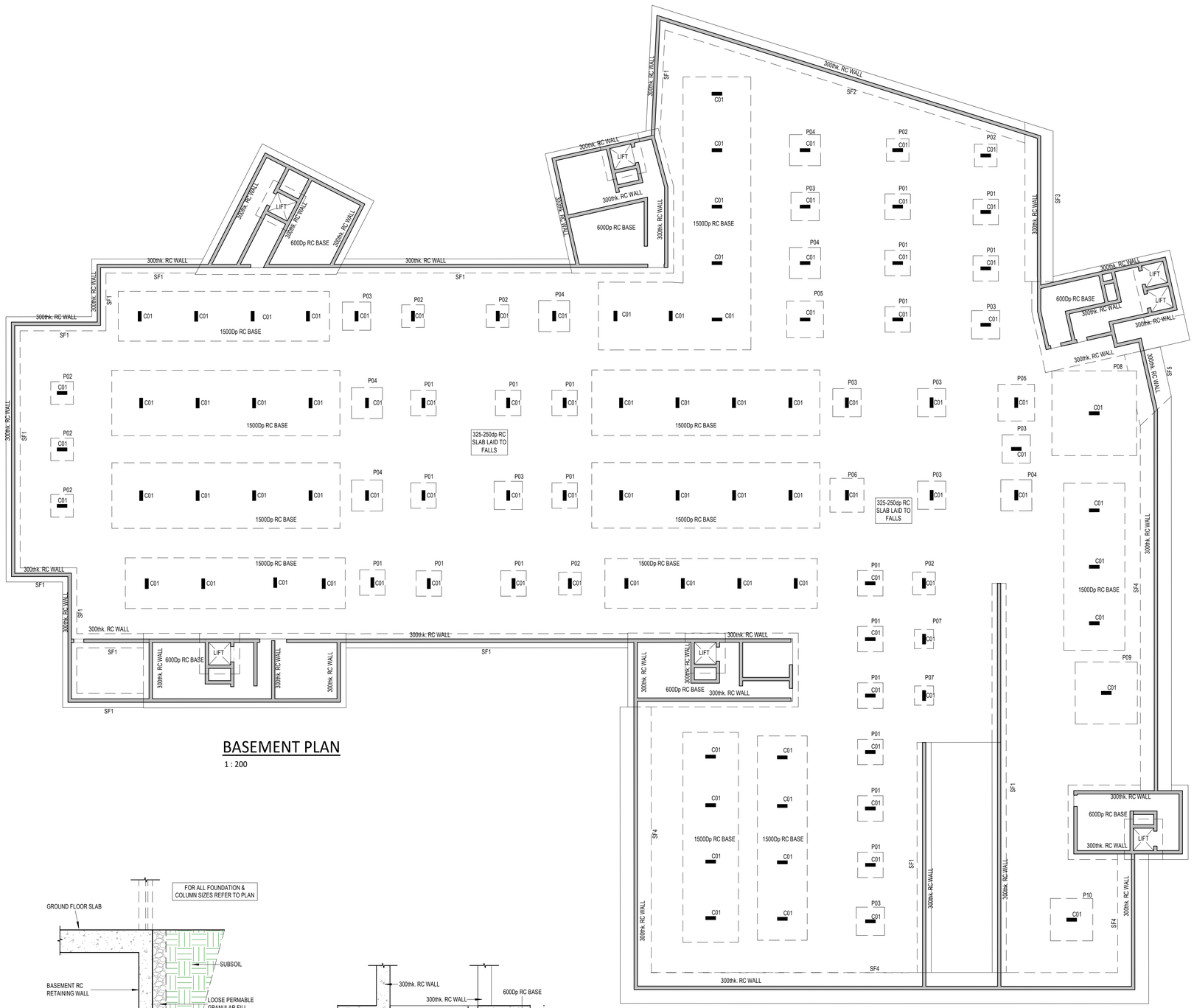

BASEMENT PLAN

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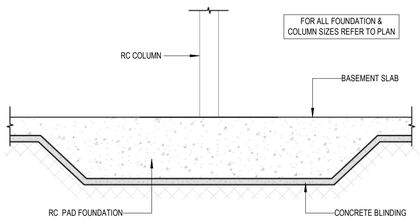

TYP. PAD FOUNDATION SECTION

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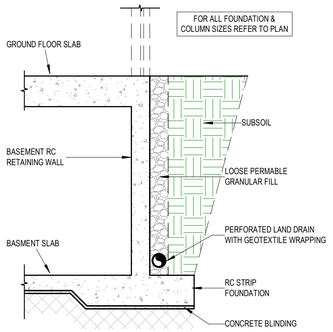

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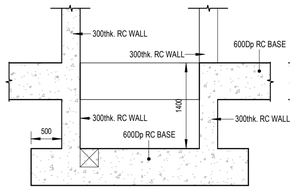

TYP. LIFTPIT SECTION

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REV	date	description		by	chkd.
client approval		A -Approved			
		B - Approved with comments			
		C - Do not use			
suitability	FOR INFORMATION	issue purpose	PLANNING		

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project ref.

PROPOSED REDIDENTAL DEVELOPMENT AT SWORDS RD, SANTRY, PHASE 2

drawing title

BASEMENT PLAN

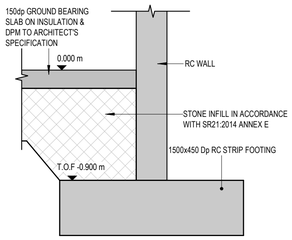
client

DWYER NOLAN DEVELEOPMENTS

designed by	author	scale:	sheet size
KDC	GD	AS SHOWN	A1

drawing no. 200060-DBFL-XX-B1-DR-S-1001

revision P01



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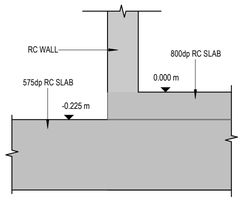

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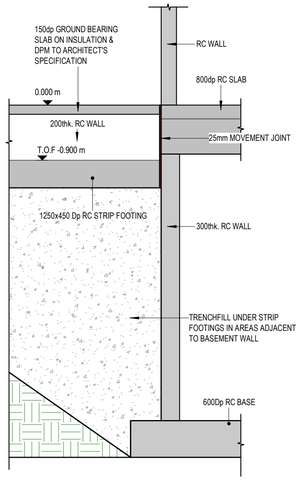

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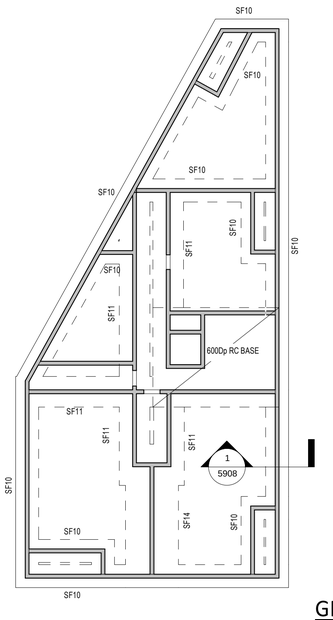

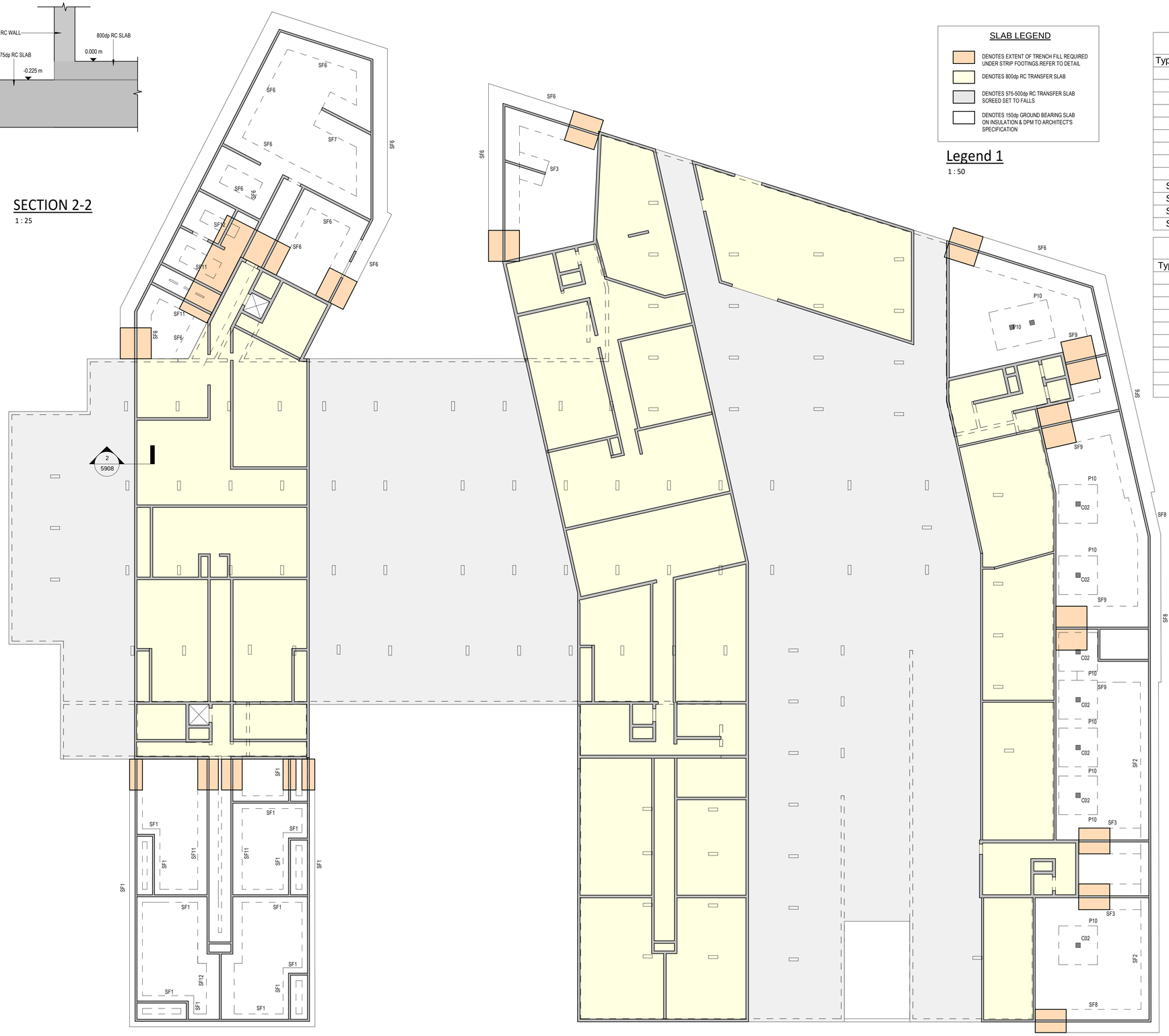

GROUND FLOOR PLAN
1 : 200

SLAB LEGEND

- DENOTES EXTENT OF TRENCH FILL REQUIRED UNDER STRIP FOOTINGS REFER TO DETAIL
- DENOTES 800dp RC TRANSFER SLAB
- DENOTES 575-500dp RC TRANSFER SLAB SCREED SET TO FALLS
- DENOTES 150dp GROUND BEARING SLAB ON INSULATION & DPM TO ARCHITECT'S SPECIFICATION

Legend 1
1 : 50

STRIP FOUNDATION SCHEDULE

Type Mark	Description
SF1	1250x450 Dp RC STRIP FOOTING
SF2	1750x450 Dp RC STRIP FOOTING
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SF12	2700x450 Dp RC STRIP FOOTING
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P09	5500x5500x1450dp RC PAD
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REV	date	description	by	chkd.
P01	31-05-2021	ISSUED FOR INFORMATION	GD	KDC

client approval
A -Approved
B - Approved with comments
C - Do not use

suitability: FOR INFORMATION
issue purpose: PLANNING

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project ref.
PROPOSED REDIDENTAL DEVELOPMENT AT SWORDS RD, SANTRY, PHASE 2

drawing title
GROUND FLOOR PLAN

client
DWYER NOLAN DEVELEOPMENTS

designed by	author	scale:	sheet size
KDC	GD	AS SHOWN	A1

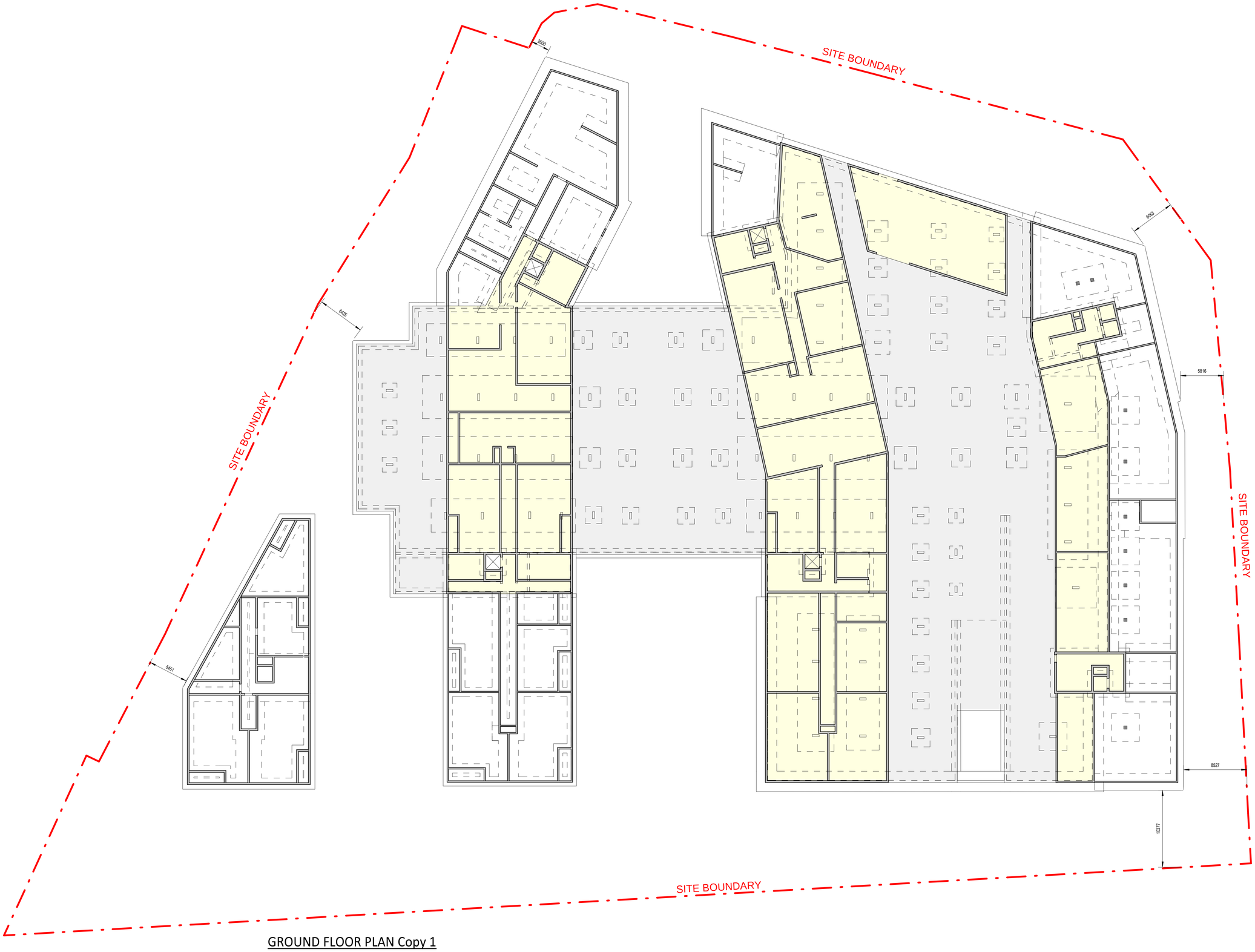
drawing no.: 200060-DBFL-XX-00-DR-S-1002
revision: P01

APPENDIX D

Key plan and Site Boundary

NOTE:

SIZING/POSITIONING OF STRUCTURAL ELEMENT SHOWN, INCLUDING FOUNDATIONS, ARE PRELIMINARY ONLY AND ARE SUBJECT TO CHANGE BASED ON FURTHER GEOTECHNICAL IN-SITU TESTING AND AT DETAILED DESIGN PHASE



GROUND FLOOR PLAN Copy 1

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REV	date	description	by	chkd.
P01	24-05-2021	ISSUED FOR INFORMATION	GD	KDC

client approval: A - Approved; B - Approved with comments; C - Do not use

suitability: FOR INFORMATION

issue purpose: PLANNING

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project ref.
PROPOSED REDIDENTAL DEVELOPMENT AT SWORDS RD, SANTRY, PHASE 2

drawing title
KEYPLAN AND SITE BOUNDARY

client
DWYER NOLAN DEVELEOPMENTS

designed by	author	scale:	sheet size
KDC	GD	AS SHOWN	A1

drawing no.: 200060-DBFL-XX-XX-DR-S-1000

revision: P01

APPENDIX B

Construction and Environmental Management Plan. DBFL May 2021

INFRASTRUCTURE

Project

Mixed Use Development at Heiton Buckley,

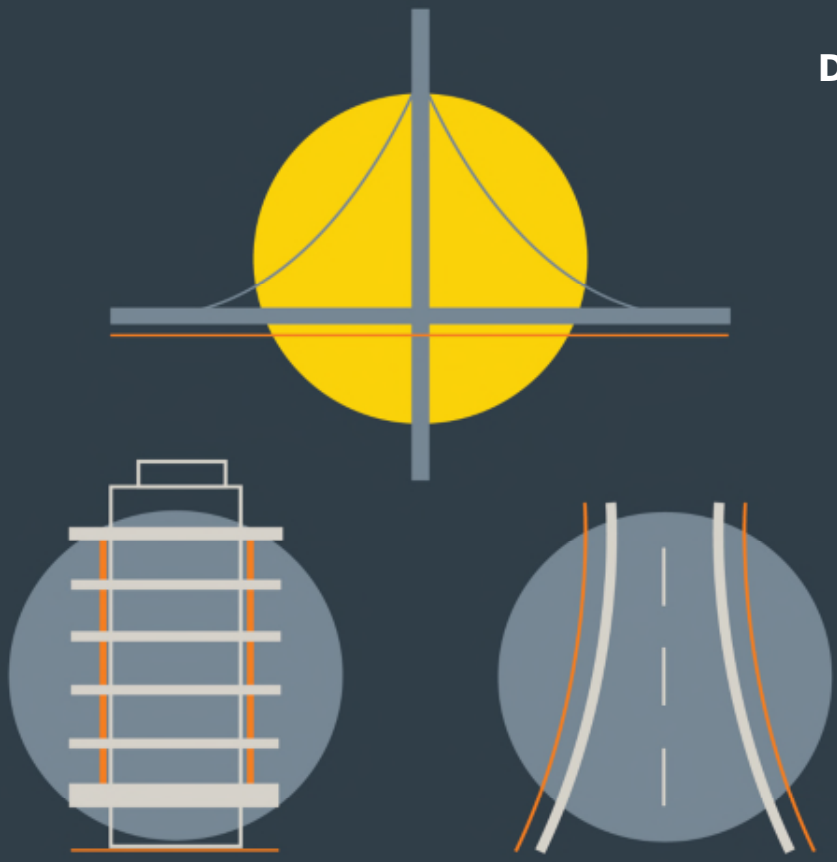
Santry Avenue, Dublin 9

Report Title

Construction and Environmental Management Plan (CEMP)

Client

Dwyer Nolan Ltd



May 2021

DBFL CONSULTING ENGINEERS

Project Title:	Mixed Use Development at Heiton Buckley, Santry Avenue, Dublin 9		
Document Title:	Construction and Environmental Management Plan (CEMP)		
File Ref:	200060-DBFL-XX-XX-RP-C-0003	rev:	P01

Rev.	Status	Date	Description	Prepared	Reviewed	Approved
P01.01	S2 - For Information	14/05/21	CEMP	Daniel Hodnett	Laura McLoughlin	Ben Mong

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TABLE OF CONTENTS

1 INTRODUCTION

This Construction & Environmental Management Plan (CEMP) is for the proposed works associated with the construction of a mixed-use development at Santry Avenue, Dublin 9. The brownfield site is currently Heiton Buckly Building Suppliers.

This CEMP addresses noise and vibration, traffic management, working hours, pollution control, dust control, road cleaning, compound / public health facilities and staff parking, all associated with the construction works.

2 PROPOSED DEVELOPMENT

Dwyer Nolan Developments Ltd. intend to apply for planning permission for a mixed-use development on lands at the junction of Santry Avenue and Swords Road, Santry, Dublin 9. The proposed development provides for 350 no. dwellings comprised of 1, 2 & 3 bed apartments, accommodated in 7 no. blocks, all on a site area of 1.5ha. The site is bounded to the north by Santry Avenue, to the east by Swords Road, to the south by the permitted Santry Place development (Ref. 2713/17 & 2737/19) and to the west by the Santry Avenue Industrial Estate.

Permission is sought for the demolition of the existing buildings on site (4,196.8m2). Vehicular access to the proposed development will be via two proposed access points: (i) on Santry Avenue and (ii) off Swords Road, and as permitted under the adjoining development at Santry Place (put planning ref in here).

The total proposed development consists of 113 no. 1 bed units, 218 no. 2 bed units & 19 no. 3 bed units, all in 7 no. blocks. The proposed development also provides for 5 no. commercial / retail units at ground floor level facing onto Santry Avenue and Swords Road. The development provides a community use hub unit (206m2) at ground floor level of Block E and a residential amenity unit (203.5m2) at ground floor level located between Blocks A and D.

- Block A is a 14 storey block containing 59 no. units (26 x 1 bed units & 33 x 2 bed units), and 2 no. commercial units measuring 132.3m2 and 173m2 respectively at ground floor level.
- Block B is a 7 storey block containing 38 no. units (7 x 1 bed units 20 x 2 bed units & 12 x 3 bed units) and 2 no. commercial units measuring 168.7m2 and 130.4m2 respectively.
- Block C is a 7 storey block containing 55 no. units (13 x 1 bed units & 42 x 2 bed units), including a general storage unit measuring 20m2 and a bicycle storage unit measuring 27.3m2.
- Block D is a 10 storey block accommodating 51 no. apartments (25 x 1 bed units, 19 x 2 bed units & 7 x 3 bed units), including a commercial unit / café, 193.5m2 at ground floor level.
- Block E is a 10 storey block containing 58 no. units (10 x 1 bed units & 48 x 2 bed units), including a community use unit, 206m2, switchroom (15m2), substation (15.5m2) and a general storage room 19.6m2 at ground floor level.
- Block F is a 7 storey block containing 55 no. units (13 x 1 bed units & 42 x 2 bed units), with a ground floor refuse area (23.9m2) and bicycle storage unit (19.4m2).
- Block G is a 7 storey building containing 34 no. units (20 x 1 bed units & 14 x 2 bed units), with a refuse unit (12m2) and bicycle storage unit (16m2).

The proposed development provides for open spaces (2,190m2), hard and soft landscaping & boundary treatments. Private open spaces are provided as terraces at ground floor level of each block and balconies at all upper levels.

Car parking is to be provided in the form of ground parking and basement car parks. Blocks A, B, C, D, E & F are located above the proposed basements, accommodating 173 no. car parking spaces and 358 no. cycle parking spaces. There are an additional 40 no. surface car parking spaces also proposed (including 2 no. car club spaces).

The proposed development also provides for all associated site development works above and below ground, bin & bicycle storage, plant (M&E), sub-stations, public lighting, servicing, signage and surface water attenuation facilities.

Figure 1.1 – Site Location, Santry Avenue, Dublin 9 (Extract Google Maps)

3 COMPOUND FACILITIES/PARKING

The compound shall be entirely within the site boundaries. Site accommodation to be provided will include suitable washing / dry room facilities for construction staff, canteen, sanitary facilities, first aid room, office accommodation etc. Access to the compound will be security controlled and all site visitors will be required to sign in on arrival and sign out on departure.

The compound shall be constructed using a clean permeable stone finish and will be enclosed with security fencing. A permeable hardstand area will be provided for staff parking and these areas will be separate from designated machinery / plant parking.

A material storage zone will also be provided in the compound area. This storage zone will include material recycling areas and facilities.

A series of ‘way finding’ signage will be provided to route staff / deliveries into the site and to designated compound / construction areas.

On completion of the works all construction materials, debris, temporary hardstands etc. from the site compound will be removed off site and the site compound area reinstated in full on completion of the works.

The proposed site compound arrangement and layout is subject to further review and approval following main contractor appointment. The contractor will implement specific measures including appointing a staff member to monitor those arriving to site and where they park their vehicles.

4 TRAFFIC MANAGEMENT & ACCESS

As part of Construction Stage Safety Plan for the works, prior to commencement of development and following receipt of a grant of planning permission, a Traffic Management Plan (TMP) will be prepared in accordance with the principles outlined below and shall comply at all times with the requirements of:

- Chapter 8 of the Department of the Environment Traffic Signs Manual, current edition, published by The Stationery Office, and available from the Government Publications Office, Sun Alliance House, Molesworth Street, Dublin 2;
- Guidance for the Control and Management of Traffic at Road Works (June 2010) prepared by the Local Government Management Services Board;
- Any additional requirements detailed in the Design Manual for Roads and Bridges & Design Manual for Urban Roads & Streets (DMURS)

The site will be accessed from the existing site entrance on Santry Avenue to the northeast of the site, this is the current access to neighbouring development site (Planning Ref: 2713/17 & 2737/19) to the south. Traffic volumes are not anticipated to be significant and turning movements into the site shall be accommodated without delay. Warning signage will be provided for pedestrians and other road users on all approaches in accordance with Chapter 8 of the Traffic Signs Manual and the Contractor's Traffic Management Plan.

All construction activities will be governed by a Construction Traffic Management Plan (CTMP), the final details of which will be agreed with Dublin City Council prior to the commencement of construction activities on site. The principal objective of the CTMP is to ensure that the impacts of all building activities generated during the construction phase upon the public (off-site), visitors to the subject site (on-site) and internal (on-site) workers environments, are fully considered and proactively managed/programmed thereby ensuring that safety is maintained at all times, disruption is minimised and undertaken within a controlled hazard free/minimised environment.

During the general excavation of the foundations and basement there will be additional HGV movements to and from the site. All suitable material will be used for construction and fill activities where possible and appropriate. All spoil material will be removed to a registered landfill site.

In addition to the traffic generated by the movement of subsoil to and from the site, there will be traffic generated from deliveries of construction materials and equipment. It should be pointed out that construction traffic generated during the development works tends to be during off-peak hours. Such trips would generally be spread out over the full working day and are unlikely to be higher than the peak hour predicted for the operational stage.

Construction traffic will consist of the following categories:

- Private vehicles owned and driven by site construction staff and by full time supervisory staff. On-site employees will generally arrive before 07:30, thus avoiding the morning peak hour traffic. These employees will generally depart after 18:00. It should be noted that a large proportion of construction workers would arrive in shared transport. The site is readily accessible by public transport with Dublin Bus route 171 serving Santry Avenue and Dublin Bus routes 16, 16D, 33,41,41B,41C and 41D serving Swords Road within walking distance.
- Excavation plant and dumper trucks involved in site development works and material delivery vehicles for the following: granular fill materials, concrete pipes, manholes, reinforcement steel, ready-mix concrete and mortar, concrete blocks, miscellaneous building materials, etc.

Deliveries would arrive at a steady rate during the course of the day. It is estimated that peak delivery rates would be in the region of 1 - 2 deliveries per hour throughout the day.

In the absence of a final construction programme it is difficult to assess the exact impact during the construction period. Nevertheless; the following estimates have been made in respect of the construction period impacts:

- Appropriate on-site and compounding will be provided to prevent overflow onto the local network. Parking in nearby residential estates shall be strictly prohibited.
- It is likely that some numbers of the construction team will be brought to/from the site in vans/minibuses, which will serve to reduce the trip generation potential.
- During the period of excavation and disposal off site, it is likely that up to 2 no. truck trips per hour (on average) will be generated by vehicles removing unsuitable spoil from the site to allow for the construction of the development and for the removal of demolition waste.
- The site offices and compound will be located within the site boundary.

4.1 Reductive/Mitigation Measures

Traffic Management during Construction: -

A Traffic Management Plan will be prepared prior to the commencement of construction work on site. This plan will be prepared in consultation with Dublin City Council in order to agree on traffic management and monitoring. Measures are outlined below:

- During the pre-construction phase, the site will be securely fenced off from adjacent properties, public footpaths and roads.
- The surrounding road network will be signed to define the access and egress routes for the development.

- The traffic generated by the construction phase of the development will be strictly controlled in order to minimise the impact of this traffic on the surrounding road network.
- All road works will be adequately signposted and enclosed to ensure the safety of all road users and construction personnel.
- All employees and visitor's vehicle parking demands will be accommodated on-site.
- A programme of street cleaning of Santry Avenue will be implemented.
- With the exception of large concrete pours, deliveries will be avoided where possible during peak school hours i.e. 8.30am – 9.00am, 1.15pm – 1.45pm and 2.45pm – 3.15pm.

5 Road Cleaning/ Wheel Washing

Provision will be made for the cleaning by road sweeper etc. of all access routes to and from the site during the course of the works. Road cleaning shall be undertaken as required during the completion of the works.

A wheel wash facility will also be provided on site to clean site traffic leaving the site when conditions require. Wastewater generated at this washing facility will be suitably treated on site and all settled silts disposed offsite to licensed landfill.

All road sweeping vacuum vehicles will be emptied off site at a suitably licensed facility.

6 Working Hours

For the duration of the proposed infrastructure works it is envisaged that the maximum working hours shall be 07:00 to 19:30 Monday to Friday (excluding bank holidays) and 08:00 to 14:00 Saturdays, subject to the restrictions imposed by the local authorities. No working will be allowed on Sundays and Public Holidays, unless express permission is obtained from the Local Authority.

7 Construction Methodology

7.1 Demolition

The brownfield site is currently Heiton Buckly Building Suppliers. The existing buildings on the site will be demolished as part of the planning application. Demolition will be completed by the appointed contractor in accordance with the relevant standards and guidelines. Contaminated materials used in the existing buildings will be identified and disposed of by a specialised contractor. Details of the proposed demolition plan will be confirmed prior to commencement of development upon receipt of a grant of permission.

7.2 Protection of Adjacent Areas

Work areas will be segregated from the adjacent public areas for the extent of the project by means of a suitable hoarding fence. All hoardings will be designed by a competent Structural Engineer to resist wind loads.

All materials being hoisted by crane or other means will be controlled using guide ropes where possible.

7.3 Site clearance, Excavation and Rock Breaking

A full site investigation will be carried out prior to construction commencing.

A specialist ground works contractor will be appointed to carry out the excavation and any rock breaking works that may be required. The appointed specialist contractor will carry out a full risk assessment prior to the commencement of work.

A ground works operation will be carried out in order to ensure that material removed from the ground is taken away at regular intervals in order to reduce the amount of material that will be stored on site. Excavated material will be reused on site where possible subject to the WAC analysis.

Refer to Chapter 6 of the Environmental Impact Assessment Report (EIAR) - Land, Soils and Geology for further details. This can be found under a separate heading.

7.4 Material Hoisting

It is envisaged that tower cranes will be erected to hoist materials on site in the construction of apartments and/or commercial units. The cranes will be erected within the building envelope. The cranes will be designed by a specialist to free stand full height without the need to be connected to another structure.

The crane will be founded on a concrete base foundation. The size of the base will be dependent on the ground conditions encountered. It is intended that the tower crane will be erected and dismantled by a mobile crane from within the site boundary.

Careful consideration will be given to the recruitment of suitably qualified crane drivers and banksmen.

7.5 Waste Management Plan

A detailed waste management plan will be agreed with Dublin City Council, prior to commencement of development upon receipt of a grant of permission and put in place in order to improve waste management on site, increase segregation and minimise construction waste costs. Waste arising from the site will be considered in relation to the waste management hierarchy of prevention, reduce, reuse, recycle, energy recovery and disposal.

8 NOISE & VIBRATION

The construction of the project will involve the use of noise generating construction plant. There will also be an increase in noise relating to delivery of materials to site. It is intended that noise from the construction phase of the development will be kept to a minimum in accordance with:

- "BS 5228: Noise Control on Construction on Open Sites".
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA, 2014).
- Safety, Health and Welfare at Work (General Application) Regulations 2007, Part 5 - Noise and Vibration.

The proposed development shall comply with these documents during all phases of construction. Unless absolutely necessary, construction work will be performed within the hours indicated in the relevant planning permission and any works outside this time frame shall be agreed with Dublin City Council in advance.

The noise limits to be applied for the duration of the infrastructure works are those specified in the B Category of BS 5228. BS5228-1:2009+A1:2014 gives several examples of acceptable limits for construction or demolition noise, the most simplistic being based upon the exceedance of fixed noise limits.

The following noise limits will be applied:

- Daytime (07:00 – 19:00hrs): 70dB(A) for residential properties
- Evening (19:00 – 23:00hrs): 60dB(A) for residential properties

All works on site shall comply with BS 5228-2009 which gives detailed guidance on the control of noise and vibration from construction activities. In general, the contractor shall implement the following mitigation measures during the proposed infrastructure works:

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal haul roads well maintained and avoid steep gradients.
- Minimise drop height of materials.
- Start-up plant sequentially rather than all together

More specifically the Contractor shall ensure that:

- Regular and effective maintenance by trained personnel is carried out to reduce noise and / or vibration from plant and machinery.
- The selection of construction plant with low potential for generating noise.
- The siting of noisy construction plant as far from neighbouring properties as possible.

- The erection of temporary barriers around items such as generators or compressors if required.
- Any and all ancillary plant shall be positioned so as to cause minimal noise disturbance.
- Where construction activities are required in close proximity to neighbouring noise sensitive properties, a solid hoarding of approximately 2.5m in height should be erected to provide a degree of acoustic screening to the lower storeys.
- An acoustically screened area should be provided on the site specifically for noisy operations such as grinding and cutting metal.
- A site representative responsible for matters relating to noise and vibration will be appointed prior to construction on site.
- Hours are limited during which site activities likely to create high levels of noise and vibration are carried out.

A site representative responsible for matters relating to noise and vibration will be appointed prior to construction on site. The noise liaison officer should be appointed and charged with the responsibility of keeping people informed of progress and by setting down procedures for dealing with complaints.

A noise and vibration monitoring specialist will be appointed to periodically carry out independent monitoring of noise and vibration during random intervals and at sensitive locations for comparison with limits and background levels. It is proposed that noise and vibration levels be maintained below those outlined above as part of these infrastructure works.

All vehicles and mechanical plant used for the purpose of the Works shall be fitted with effective exhaust silencers and shall be maintained in good and efficient working order. In addition, all diesel engine powered plant shall be fitted with effective air intake silencers. All compressors shall be “sound reduced” models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use. All ancillary pneumatic percussive tools shall be fitted with mufflers or silences of the type recommended by the manufacturers, and where commercially available, dampened tools and accessories shall be used.

All ancillary plant, such as generators and pumps, shall be positioned so as to cause minimum noise disturbance. If operating outside the normal working week acoustic enclosures shall be provided.

Local screening should be provided for stationary plant such as generators and compressors.

Notwithstanding the above, the developer shall comply with any requirements set out in the Codes of Practice from the Drainage Division, the Roads, Streets & Traffic Department and the Noise & Air Pollution Section.

Refer to Chapter 9 of the Environmental Impact Assessment Report (EIAR) found under a separate heading.

9 SEDIMENT AND WATER POLLUTION CONTROL PLAN

All works carried out as part of these infrastructure works will comply with all Statutory Legislation including the Local Government (Water Pollution) acts, 1977 and 1990 and the contractor will co-operate in-full with the Environmental Section of Dublin City Council.

As part of the overall construction methodology, the following issues will be addressed and have been identified as being of particular risk and/or concern to pollution.

- Sediment & Erosion- Similar to the above, any sedimentation and erosion due to direct surface water runoff generated onsite during the construction phase needs to be prevented. To prevent this from occurring surface water discharge from the site will be managed and controlled for the duration of the construction works until the permanently attenuated surface water drainage system of the proposed site is complete. A temporary positive drainage system shall be installed prior to the commencement of the construction works to collect surface water runoff from the site during construction. This temporary surface water management facility will throttle runoff and allow suspended solids to be settled out and removed before being discharged in a controlled manner to the agreed outfall. By directing the surface water from the construction works through this temporary positive drainage system will ensure:

o Site disturbance is at a minimum.

o Sediment control is implemented

o Potential for erosion is minimised.

o Sediment-contaminated water leaving the site is prevented.

Such measures shall be agreed as part of the site's discharge licence.

- Discharge Licences – It will not be permitted to discharge into any newly constructed storm water systems without adhering to the conditions of the discharge licence and agreeing the same with the Site Manager and Local Authority Area Engineer.
- Over Ground Oil / Diesel Storage – Only approved storage system for oil / diesel within the site will be permitted, (i.e. all oil / diesel storage to be located within a designated area placed contained within constructed bunded areas e.g. placed on 150mm concrete slab with the perimeter constructed with 225mm solid blockwork rendered internally). The bunded area will accommodate the relevant oil / diesel storage capacity in case of accidental spillage. Any accidental spillages will be dealt with immediately on site however minor by containment /removal form site. Any significant storage of hydrocarbons is not envisaged as construction vehicles will be refuelled off site.
- Concrete Washout – The washing out of concrete trucks on site will not be permitted as they are a potential source of high alkalinity in waterbodies. Consequently, it is a requirement that all concrete truck washout takes place back in the ready-mix depot.

- Disposal of Wastewater off Site – The Site Management Team will maintain a record of all receipts for the removal of toilet or interceptor waste off site to ensure its disposal in a traceable manner. These will be available for inspection by the Environment Section of Dublin City Council at all times.
- Road Sweepers / Cleaning – The cleaning of public roads in and around the subject site will be undertaken to reduce environmental impacts.

Refer to Chapter 7 – Water, of the Environmental Impact Assessment Report (EIAR) under a separate heading.

10 BIODIVERSITY PROTECTION MEASURES

All site clearance and landscaping works will comply with current legislative requirements and best practice. All retained trees that are within or close to the proposed development will be protected in accordance with the requirements of British Standard BS5837:2012 'Trees in Relation to Design, Demolition and Construction – Recommendations', with protective fencing being installed around all trees to be retained, prior to commencement of development. The planting plans and landscaping proposals will ensure that no invasive species are introduced, either deliberately or inadvertently, to the site.

Refer to Chapter 5 – Biodiversity, of the Environmental Impact Assessment Report (EIAR) under a separate heading.

11 DRAINAGE WORKS

It is proposed to construct drainage infrastructure in accordance with the plans shown on DBFL drawings 200060-DBFL-SW-ST-DR-C-1011-Suface Water Layout and 200060-DBFL-FW-ST-DR-C-1021-Foul Water Layout.

The drainage infrastructure will be constructed and protected through the following measures:

- Hoarding or fencing to be provided to cordon-off completed infrastructure works: As is standard practice on construction sites, elements of works may be completed on a phased basis. As works are completed and handed over within each phase, this area will be enclosed with hoarding or fencing offset a safe distance from the line of the existing infrastructure and no further excavation works will be allowed within this area unless agreed with site management.
- Contractor to produce as-built construction records of drainage infrastructure: These records will be submitted to the engineer for approval in advance of handover. The as-built records will be reviewed and will need to be approved by the engineer before practical completion can be certified. The as-built records (drawings, manhole cards, material approvals, correspondence, etc.) will be used by site personnel as a working record of where drainage infrastructure is located and its status. The locations of these will be recorded on the as-built and will be marked out on the ground in advance of any works commencing in later stages. This methodology will be formally incorporated into a method statement to be completed by the groundworks sub-contractor before excavations commence.
- Marker tape to be provided on top of sewers running through live areas of site: As part of the methodology laying of drainage pipes, drainage works will have marker tape placed at a depth of 300mm above the pipe to warn the excavator and banksman of the service below. It is noted that the placing of marker tape over drainage lines is not a standard construction detail. However, the vulnerability of live drainage infrastructure serving a previous phase of development is noted and these measures will form part of the works.
- Site personnel to be informed of works already completed: As part of the Safe System of Work Plan (SSWP), site personnel will be made aware of the drainage lines which are in operation. A site-specific method statement will be required in all cases where it is deemed that there is a risk of damaging such services. Those involved in direct management and supervision of site-based excavations require relevant competencies to deliver safety standards on site. They will have health and safety training in order to design safe systems of work that are appropriate to specific site conditions. They will need to prepare clear and simple safety method statements that can be used and understood by site workers. Ongoing checks will be carried out to ensure that appropriate equipment has been provided and is being used correctly.

- Monitoring of excavation and prevention of undermining of infrastructure: Special care will be taken when digging above or close to the lines of services. The locations of these will be marked out on the ground in advance of any excavation being undertaken. In addition, careful consideration will be taken to ensure that any buildings and infrastructure serving areas outside the development site are not undermined by excavation works. The general principles outlined in the Health and Safety Authority document: 'Code of Practice for Avoiding Danger from Underground Services' will be followed to ensure the safety of workers and to minimise the risk of damage to any existing pipelines or buildings.
- Water quality control of discharges to drainage network: As detailed within the previous section, groundwater needs to be protected from sedimentation and erosion due to direct surface water runoff generated onsite during the construction phase. This includes preventing any sediment laden water from entering the surface water outfalls. To prevent this from occurring surface water discharge from the site will be managed and controlled for the duration of the construction works until the permanently attenuated surface water drainage system of the proposed site is complete. Any manholes will need to be securely covered and gullies fitted with a geotextile filter to allow protection of the surface water within the pipe.
- Protection of services from breakage or crushing: Where drainage infrastructure serving areas outside of the development are located within the development site, the drainage infrastructure will have to be protected from breaking or crushing. Consideration will be given to areas where heavy plant is going to be tracked across the existing drainage infrastructure. This may require construction of temporary protective concrete slabs to bridge across the existing lines where haul roads are required.

12 DUST CONTROL

It is probable that the construction activities on site will generate some dust emissions which would be in addition to any dust generated by the activities in the vicinity of the proposed development, including traffic flows. The extent of dust generation under construction activities being carried out is dependent on environmental factors such as rainfall, wind speed and wind direction.

The objective is to ensure that dust does not impact significantly at nearby receptors. Therefore, a dust management plan (DMP) will be formulated for the site upon receipt of planning permission which will address the following:

- Specify a site policy on dust
- Identify site management of dust
- Develop documented systems for managing site practices and implementing management controls
- Outline how the DMP can be assessed

Dust samples will be collected on a monthly basis as a minimum. Sampling data, results and limits (as outlined in the Environmental Protection Agency Guidelines, Environmental Management in Extractive Industry Non-Scheduled Minerals) are to be outlined and supplied to DBFL Consulting Engineers in a tabular format.

Site Management

The siting of construction activities and storage piles will consider the location of sensitive receptors and prevailing wind conditions to minimise the potential dust nuisance. Site management will include the ability to respond to adverse weather conditions by either restricting operations on site or using effective control measure in a timely manner before potential for nuisance occurs.

- During working hours, the site agent or another competent appointed member of staff shall monitor dust control methods;
- A register shall be kept on site logging all correspondence and telephone / verbal complaints regarding construction activities outlining remedial actions if any;
- A site representative responsible for matters relating to dust management will be appointed prior to construction on site. The site representative responsible for dust management shall ensure that dust management procedures are followed and ensure monitoring and assessment of same;

- **Dust control measures**

- Apply a speed limit of at least 20km/hr for on-site vehicles
- Provide water bowsers during periods of dry weather to ensure unpaved areas are kept moist. Spray exposed site haul roads during dry and / or windy weather.
- Ensure paved roads are kept clean and free of mud and other materials. Sweep hard surface roads, inside and outside the site, to ensure roads are kept clear of debris, soil or other material.
- Restrict un-surfaced roads to essential site traffic.
- Provide water bowsers during periods of high winds and dry weather conditions to ensure moisture content is high to increase the stability of the soil.
- During the proposed infrastructure works the following mitigation measures shall be implemented to minimise dust emissions:
    - Construction techniques shall minimise dust release into the air.
    - Protect overburden material from exposure to wind by storing the material in sheltered regions of the site.
    - Regular watering of stockpiles during dry and windy periods.
    - Locate any stockpiles away from sensitive receptors, (i.e. receptors sensitive to dust release).
    - Provide tarpaulins over all unacceptable excavated materials being carted off site.
- Control vehicle speeds and impose speed restrictions, (speed can mobilise dust). The wheels of all vehicles leaving the construction site will be washed to ensure that dirt and dust is not transferred onto the public roadway.
- During dry spells and if deemed necessary monitoring of dust levels shall be carried out using the Bergerhoff Method i.e. analysis of dust collecting jars left on-site (German Standard VDI 2119, 1972). Results will be compared to the TA Luft guidelines (TA Luft, 1972). Should an exceedance of the TA Luft limit occur, additional mitigation measures, for example more regular spraying of water, shall be implemented.
- The excavating machines will be cleaned on a daily basis to ensure no excess grease and dust is left on the machine. This will be carried out at low level below the height of the hoarding to prevent any mud coming in contact with the public.

13 CONCLUSION

This Construction and Environmental Management Plan addresses construction activities on site that may result in noise, air quality, water quality, biodiversity or waste management issues, should the plan not be put in place and implemented.

These include procedures for monitoring and tracking construction activities and ensuring construction personnel are trained and educated as necessary. The Construction & Environmental Management Plan should be reviewed as the construction phase progresses to accommodate any changes in activities on site.

This CEMP has been carried out prior to construction stage and as such will be reviewed again prior to works commencing on site and incorporated into the Contractor's Site Safety Plan and Construction Traffic Management Plan (CTMP). The contents of the Site Safety Plan and the CTMP should then be reviewed and updated as the construction phase progresses to accommodate any changes in activities on site.