GeoDyne

Geotechnical &
Environmental
Consultants

Phase 2 Balmoral Way
Holbeach

Remediation Strategy & Verification Plan
For
Ashwood Homes

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Project No: D41012		**Date: 13th July 2022**	
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Comments			

1.0 INTRODUCTION

1.1 Introduction

GeoDyne Limited has been appointed by the Client, Ashwood Homes, to prepare a revised Remediation Strategy and Verification Plan relating to the site at Phase 2 Balmoral Way, Holbeach. A site location plan (Figure No. D41012/R1) is included in Appendix I.

The Remediation Strategy and Verification Plan has been prepared taking due consideration of the following reports and the comments received from the Local Authority:

- GeoDyne Limited report *'Phase 2 Balmoral Way, Holbeach – Combined Phase I Desk Study and Phase II Exploratory Investigation'*, produced for Ashwood Homes, reference D41012, dated 28th April 2021.
- GeoDyne Limited letter report *'Phase 2 Balmoral Way, Holbeach – Further Soil Sampling & Hotspot Delineation Works'*, produced for Ashwood Homes, reference D41012, dated 22nd April 2022.

This Remediation Strategy and Verification Plan should be read in conjunction with, and does not replace a detailed review of, the foregoing reports.

1.2 Project Understanding

We understand that it is proposed to develop the site with low-rise residential properties incorporating private gardens, public open space and associated infrastructure, as shown on the plan containing the proposed layout included within Appendix II. The site is proposed to comprise Phase 2 of Ashwood Homes' development site where Phase 1 of the development has recently been completed to the south-west of the study site.

As part of the proposed development works, it is proposed to raise site levels for flood risk and drainage purposes and plans showing the existing and proposed levels, including isopachyte drawings are also presented within Appendix II.

Where the proposed site end-use is not consistent with our current understanding, it would be necessary to review our Remediation Strategy and Verification Plan to ensure it continues to apply.

1.3 Project Overview

This Remediation Strategy and Verification Plan has been produced to assist with the planning process, and has been specifically written to address Condition 3, as referenced within the list of planning conditions relating to the site: South Holland District Council reference H09-0613-21 dated 1st March 2022, forwarded to ourselves by the Client.

Condition 3 states the following:

'The development hereby permitted shall not be commenced until a written method statement detailing the remediation strategy for land contamination and/or pollution of controlled waters affecting the site and a timetable for their completion has been submitted to, and approved in writing by, the Local Planning Authority (LPA). This shall include details of the proposed verification plan including compliance criteria and monitoring details.

No deviation shall be made from this scheme without the express written agreement of the LPA. If during redevelopment contamination not previously considered is identified, then the LPA shall be notified immediately and no further work shall be carried out until a method statement detailing a scheme for dealing with the suspected contamination has been submitted to and agreed in writing by the LPA.'

Condition 4 of the planning conditions relates to the requirement for the preparation of a verification report following completion of the works set out Remediation Strategy.

We understand that our Combined Phase I Desk Study and Phase II Exploratory Investigation report (referenced in Section 1.1) has been submitted to South Holland District Council as part of the planning consultation process.

The 'Online Comment' provided by the Local Authority Environmental Protection Officer (Sue Armour) states the following:

'I have reviewed GeoDyne reports 'Land to East of Chaffinch Way, Holbeach - 9 Plots Combined Phase I Desk Study and Phase II Exploratory Investigation Project No: D41012' dated 27th April 2021 and 'Phase 2 Balmoral Way, Holbeach Combined Phase I Desk Study and Phase II Exploratory Investigation Project No: D41012 ' dated 28th April 2021 and request that both parts ii-iv of the standard land contamination condition and the construction management plan condition be applied at this location.

Please pass on the following comments to the applicant to assist with the discharge of the condition in due course.

Regarding 'Land to East of Chaffinch Way' I agree than remedial action is required, and a remediation method statement should be prepared and submitted for this area prior to the commencement of any work on site.

Regarding 'Phase 2 Balmoral Way' I make the following comments:

- *I agree that further site investigation is required in the area of the identified hydrocarbon contamination and consider that delineation needs to be undertaken prior to the preparation of a remediation method statement.*

- *Sampling and testing of the made ground soil was limited, and it cannot be considered well characterised. I understand that it is physically and aesthetically unsuitable for retention in the near surface soils, and presume that this is the reason that further analysis was not undertaken. Asbestos was identified in one sample however the full extent of this contamination cannot be estimated from the sampling undertaken. The report suggests that retention and capping could be a suitable remedial solution at this location, with a physical 'no dig' barrier and warning membrane. If this is to be the case, this does pose a limit on the future use of the residential garden areas with only 600mm of growing medium proposed. I would therefore request that removal of permitted development rights is considered at this location, and that future occupants are formally made aware of the restrictions on the gardens use (e.g. implications for ponds etc.)*

- *Given the presence of asbestos, I request that our standard construction management plan condition is attached and that it includes the recommendations made in the prior for monitoring etc. during relevant works.*

- *I am concerned that the report mentions the soil stockpiles in the north western corner only briefly. No description, sampling or analysis was undertaken of these stockpiles, and no comments made about their ultimate destination. It is my understanding, following a conversation with the site manager of the phase 1 development back in 2019, that this is the deep made ground material removed from the southern part of the phase 1 development that was chemically and physically unsuitable for retention in a domestic setting. The applicant should also take advice as to the current legal status of this material, and if the CL:AIRE DoW CoP could apply if they propose to reuse it. The remediation method statement should be clear regarding the fate of these soils and the steps to be taken to prevent soil mixing with the made ground soil that exists on site.*

- *The remediation method statement must be prepared and agreed before the commencement of work on site, including any enabling works.'*

With regard to the Local Authority Environmental Protection Officer's comments on the stockpiles in the north-western portion of the site, we have been informed by Ashwood Homes that these soils are to be removed from site and we noted that this process had already commenced during our recent site visit. The stockpiled soils being removed were situated in the far north-western portion of the site where existing Made Ground is noted to be present below ground level and this has previously been found to contain asbestos. It is considered that any mixing of existing soils is not likely to be a significant issue as this area of the site requires remediation (i.e. provision of an engineered capping layer and detailed within the Combined Report) and the stockpiled soils are being removed. In view of this, we understand that no further actions in relation to these soils would therefore be required.

In addition to the above, we also understand that the previous version of this Remediation Strategy and Verification Plan document (dated 22nd April 2022) and the letter report regarding further soil sampling and hotspot delineation works (referenced in Section 1.1) have also been submitted to South Holland District Council as part of the planning consultation process. The 'Online Comment' provided by the Local Authority Environmental Protection Officer (Sue Armour) on 15th June 2022 states the following:

"I have reviewed the letter report dated 22/4/22 'Re: Phase 2 Balmoral Way, Holbeach - Further Soil Sampling & Hotspot Delineation Works' and 'Phase 2 Balmoral Way Holbeach Remediation Strategy & Verification Plan' ref D41012 dated 22/4/22 and request clarification on the following points: Regarding the TPH contamination - 1. How was the extent determined/ how will this be managed on site - was this visually based on changes to the made ground soils or staining/odour? There were no logs of the trial trenches or photos which may have helped make this clearer. 2. On what basis, and at what stage, will a decision on the need (or not) for a gas proof membrane in those plots (1-3?) affected by the TPH contamination, be made? Generally once construction starts, there is no time for a decision like this to be made, agreed, installed/ verified etc. 3. How big is the proposed excavation? At what point would it be proposed to increase the number of validation samples? 4. Where will the site won materials be sourced from for backfill? Will they be from zone 3 exclusively? Regarding zone 2 (Lead) - 5. How was the extent determined/ how will this be managed on site - was this visually based on changes to the made ground soils? There were no logs of the trial trenches or photos which may have helped make this clearer. 6. Given that there are buried structures at 1.8m depth, will some of the area need to be excavated in order to actually build? If so, is it proposed to replace the excavated soil back in place? 7. The RMS must specify if the break layer will be 'no dig' or a membrane. Please confirm. Further details are required eg thickness and make up of the no dig layer/ which membrane is to be used. Regarding zone 1 - 8. The RMS must specify if the break layer will be no dig or a membrane. Please confirm and provide further details as per 7 above. 9. How will future occupiers be made aware? 10. I see from the landscaping plan that there are several trees planned for the POS - what is the plan for those areas?"

A response to the above comments was subsequently prepared by GeoDyne and submitted to the Local Authority and the comments and proposals agreed within an email from the Environmental Protection Officer (Sue Armour) to Ashwood Homes dated 27th June 2022. **This Remediation Strategy and Verification Plan has therefore been revised to incorporate the agreed proposals and requirements.**

We have produced this Remediation Strategy and Verification Plan based on our current understanding of the Clients preferences with respect to remediation, to provide the Site Manager with a document for control of the remediation and validation works at the site.

1.4 Details of Remediation Strategy

This Remediation Strategy and Verification Plan details the necessary remediation and validation measures required at the site and represents a stand-alone report to act as a working document for use by the Contractor carrying out the remediation works; the Client including the construction phase Site Manager; and the Supervising Engineer in order to control / manage the remediation activities and the validation works.

The responsibilities of the Supervising Engineer (GeoDyne) are restricted to monitoring the works of the Contractor in terms of compliance with this Remediation Strategy and Verification Plan, carrying out validation testing, liaison with Regulators and reporting.

The Supervising Engineer has no responsibility for the direct instruction of the Contractor, or measurement and administration of the contract. The Supervising Engineer will report to the Client who will issue all instructions to the Contractor.

This document also states the level of inspection and Clean-Up Goals / Site Acceptance Criteria considered appropriate by GeoDyne, which are to be agreed with the Local Authority Environmental Protection Officer.

1.5 Limitations

This report has been produced specifically to address remediation and validation issues at the site. For a detailed review of the sites history, geology and environmental setting, and recommendations relating to all other matters, reference should be made to the previous Combined Report detailed in Section 1.1. The recommendations made in this report are limited to those that can be made based on the findings of the investigation works previously undertaken at the site. Where comments are made based on information obtained from third parties, GeoDyne Limited assumes that all third party information is true and correct. No independent action has been undertaken to validate the findings of third parties unless specifically stated.

The Remediation Strategy and Verification Plan has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of its issue.

GeoDyne Limited has prepared this report for the sole use and reliance of the Client, Ashwood Homes, in accordance with our standard Conditions & Limitations provided in Appendix VII. This report may not be used or relied upon by any unauthorised third party without the explicit written agreement of GeoDyne Limited. Reliance may not be placed on our report until all invoices associated with the project have been paid.

2.0 SITE SUMMARY

2.1 Site Description

The site comprises an irregular shaped parcel of land located to the east of Balmoral Way and Chaffinch Way between Battlefields Lane South and Foxes Low Road in the north-east of Holbeach, Lincolnshire. The site covers an area of approximately 3.2 hectares.

At the time of our site works (February 2021 and March 2022), the site could be divided into two distinct areas which are shown on the annotated site plan within Appendix III of this report (Figure No. D41012/R2). The areas comprise the north-western area and the south-eastern area which were both sensibly level.

The south-eastern area comprised a field and disused overgrown glasshouse (which has recently been removed). The field was sown with tulips at the time of the original site works, and partially overgrown in some areas. There were two small disused above ground fuel storage tanks and a large apparent circular water tank located close to the glasshouse (both of which have recently been removed). An open drain was present along the north eastern site boundary.

The north-western area was previously used as a construction compound for the Phase 1 development with vehicle parking areas, welfare cabins and building material storage (all of which have now been removed). Stockpiles of soils were also present, covering a large portion of the area and these were being removed at the time of our site visit in March 2022.

The site was generally surrounded by further agricultural fields. Phase 1 of the Balmoral Way development was present to the south-west of the site, along with the town of Holbeach. The A17 road was present to the north of the site, running in an east to west direction. An area of apparent former demolished buildings (associated with historical nursery / horticultural and agricultural activities) was situated to the south of the site.

2.2 Summary of Site History

Based on the reviewed historical maps as part of the previous desk study, the site was undeveloped until the 1960s, when the site was indicated to comprise a ‘Nursery’ with a glasshouse and a small building with adjacent tanks. The 1980s maps show the glasshouse and the building with tanks had been demolished / removed and a new glasshouse had been constructed (to the west), with an adjacent water tank. The remainder of the site has mainly comprised cultivated fields, with the far north-western portion of the site containing a contractor compound and more recently as a construction site compound associated with an adjacent housing development site. During the original site walkover, two small disused above ground tanks were situated to the south of the greenhouse building and were presumably used for heating oil. Both of these tanks have recently been removed, along with the glasshouse.

2.3 Summary of Geological & Environmental Setting

A full description of the sites geological and environmental setting has been provided in the previous report and the salient issues are summarised in Table 1.

TABLE 1 – SUMMARY OF GEOLOGICAL & ENVIRONMENTAL SETTING	
Geology	The entire site and immediate surrounding area are indicated to be underlain by superficial drift deposits comprising Tidal Flat Deposits which are typically described as marine alluvium comprising salt marsh, tidal creek and river deposits (i.e. sandy silt, sand and clay). Beneath the drift deposits across the entirety of the site, bedrock of the Ampthill Clay Formation comprising Mudstone is indicated to be present.
Hydrogeology	The superficial deposits (i.e. Tidal Flat Deposits) and the underlying bedrock (i.e. Ampthill Clay Formation) are classified as 'Unproductive Strata'. The site is not shown to lie within a Source Protection Zone (SPZ), as designated by the Environment Agency. There are no recorded licensed water abstractions situated within 250m of the site.
Hydrology	The nearest surface water feature is indicated to be present on site. This relates to the drain along the north eastern site boundary.

2.4 Summary of Ground Conditions

Made Ground

Made Ground was encountered within 15 No. of the exploratory holes advanced at the site.

In the north-western area of the site, the Made Ground generally comprised silt or sandy gravel with inclusions of brick, concrete, macadam, limestone and plastic fragments (along with minor inclusions of other man-made materials) to depths of between 0.10m and 1.05m begl.

In the south-eastern portion of the site, Made Ground was mainly encountered in the southern / south-western portion close to the disused glasshouse and the adjacent former small storage tanks, the area of the former building (with adjacent tanks shown on the historical maps) and in the overgrown area. The Made Ground in these areas generally comprised topsoil over silt with brick, concrete and occasionally glass fragments to depths of between 0.80m and 1.20m begl.

Topsoil

Topsoil was encountered at the surface within the central portion of the site, to depths of between 0.25m and 0.40m begl. The average thickness of the Topsoil was approximately 0.35m begl.

Natural Strata

Beneath the Topsoil and Made Ground, the Natural Strata beneath the site typically comprised firm sandy SILT, which became softer and more sandy with depth. The soils are considered to be typically representative of Tidal Flat Deposits, which are indicated by geological publications to underlie the site.

Visual & Olfactory Evidence of Soil Contamination

Hydrocarbon odours were noted within the Natural Strata in TP20 and WS3. These locations were in close proximity to the small disused above ground storage tanks at the site.

Ashy soils were noted within the Made Ground in TP6 and TP16 and rare clinker was noted within some of the Made Ground topsoil materials.

2.5 Contamination Assessment Findings

Human Health

Contamination testing was carried out on selected samples of the Topsoil, Made Ground and the underlying Natural Strata. On the basis of the chemical contamination assessment undertaken, the Topsoil situated in the agricultural field in the south-eastern area of the site may be considered to be uncontaminated for the proposed residential with plant uptake end-use (i.e. in relation to human health).

The results of the contamination assessment undertaken as part of the Combined Phase I Desk Study and Phase II Exploratory Investigation revealed the presence of asbestos fibres within the shallow Made Ground in the north-western area of the site. In addition, an elevated concentration of lead above Tier 1 human health screening criteria was encountered within the Made Ground in the central southern portion of the site (TP16) based on a residential with plant uptake end-use. Subsequent delineation works have recently been carried out which included a series of trial pits and trenches to determine the extent of the lead impacted Made Ground soils (as detailed in the report listed in Section 1.1).

As part of the delineation exercise carried out in the area of TP20 and WS3, the extent of the hydrocarbon impacted soils was determined by inspections of the soils encountered within the trial pits and trenches for visual and olfactory evidence of hydrocarbon impaction, together with the results of the laboratory testing.

The soils were noted to exhibit generally slight hydrocarbon odours with some grey staining visible where hydrocarbon impaction was noted. Based on the observations made on site, it appeared that hydrocarbon impacted soils were encountered from near surface around the location of the former tanks and this had extended to depths of up to 2.30m below existing ground level (begl) locally. It was noted that the hydrocarbon impacted soils extended laterally from the tank area within a relatively restricted band at depths of around 1.50m to 2.00m begl (i.e. around where water would typically be encountered).

With regard to the lead concentration encountered in TP16, the extent of the lead impacted soils was determined by inspections of the soils encountered within the trial pits and trenches, together with the results of the laboratory testing. Made Ground was encountered which included fragments of metal, together with ash and clinker in some of the samples. The lead concentrations recorded are considered likely to be attributable to fragments of metal recorded within the Made Ground which appears to be associated with a former building in this location (as indicated on the historical maps).

For the majority of the area in question, the extent of the lead impacted area was determined by the change between Made Ground encountered at surface and the presence of Natural soils at surface in adjacent / surrounding areas (i.e. within TP16C, TP16D and TP16E) and this was typically supported by laboratory testing. In TP16G, some Made Ground was also encountered, however, the lead concentration was low (33mg/kg) and this laboratory result was used to delineate the extent of the lead impacted soils.

The Made Ground encountered within the north-western and central southern areas of the site were found to be aesthetically and compositionally undesirable in both areas, with inclusions of clinker, ash and man-made materials including brick, concrete, timber, metal and plastic. The presence of macadam within the Made Ground in a number of the exploratory hole locations is likely to locally potentially contain notable contaminant concentrations which would typically be associated with macadam. In view of this, if the Made Ground soils containing macadam are to be retained at surface at the site, it is recommended that remedial actions would be required in gardens and soft landscaped areas for human health protection purposes.

The Natural Strata is generally uncontaminated with the exception of localised elevated TPH concentrations in the vicinity of the former above ground storage tanks in the central southern / south-eastern portion of the site. Subsequent delineation works have recently been carried out which included a series of trial pits and trenches to determine the extent of the hydrocarbon impacted Made Ground soils (as detailed in the report listed in Section 1.1).

Controlled Waters

In general, low contaminant concentrations have been revealed by the majority of the laboratory testing carried out in the specific areas assessed as part of these works. However, localised elevated concentrations of TPH have been recorded in the vicinity of the former disused above ground tanks in the central southern portion of the site (around TP20 and WS3). Localised elevated concentrations of lead have also been encountered to the north-east of the former tanks in an area of Made Ground containing metal and ash and clinker at the location of a former building.

The environmental sensitivity of the site is considered to be relatively low as the aquifer status of the underlying groundwater has been classified as Unproductive Strata, with no abstractions or Source Protection Zones within 250m of the site. The closest surface watercourse is indicated to be number of open drains along the northern and eastern site boundaries, with the closest situated approximately 130m from the location of the disused tanks.

In view of the generally low sensitivity of the groundwater, the limited extent of the TPH and lead impacted soils and the distances to the nearest surface watercourse, the potential significant risks posed to Controlled Waters by the findings of the laboratory analysis undertaken are considered to be low. This includes the lead concentrations recorded which are considered likely to be attributable to fragments of metal recorded within the Made Ground which appears to be associated with a former building. In addition, it is also considered that given the extent of hydrocarbon impacted soils have been defined by the delineation works and the distances to the site boundaries, the potential risk of off-site migration in relation to neighbouring properties is considered to be very low.

2.6 Summary of Ground Gas Assessment

On the basis of the ground gas monitoring undertaken in conjunction within the previous contamination assessment, the site was classified within our Combined Phase I & II Report as Characteristic Situation 'CS1' in accordance with BS 8485:2015 *'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'*, based on the concentrations of methane and carbon dioxide encountered.

No gas protection measures relating to carbon dioxide or methane are considered to be required for the proposed new dwellings to be constructed at the site. However, it should be noted that hydrocarbon impacted soils have been encountered in the immediate vicinity of the above ground fuel storage tanks around borehole WS3 and trial pit TP20. In view of this, it is therefore proposed to install gas protection measures within plots situated in the immediate vicinity of the area of hydrocarbon impaction as a precautionary measure.

The gas protection measures are only anticipated to be required to mitigate against the potential ingress of nuisance odours, rather than protecting future residents from harmful hydrocarbon vapours / volatiles as these are expected to be removed to below Tier 1 human health assessment criteria (hence not requiring further remediation from a human health protection perspective). Based on the findings / observations during the delineation works carried out and the proposed site layout, only Plot 2 may require a gas resistant membrane as a precautionary measure – as indicated on Figure D41012/R3 Revision A. However, Ashwood Homes propose to incorporate gas resistant membranes within Plots 1 to 3 as a precautionary measure.

3.0 CONCEPTUAL SITE MODEL

3.1 Introduction

GeoDyne's revised conceptual site model (CSM) of possible CPR pollutant linkages based on the findings of the Phase II Exploratory Investigation works and the further soil sampling and delineation works (detailed in the reports listed in Section 1.1) is provided in Table 2.

In preparing this CSM, it has been assumed that construction personnel involved with the redevelopment of the site (typically short term (acute) exposure) will adopt all necessary personal protective equipment (PPE and RPE etc.) and conform to all appropriate health and safety requirements, including their site-specific Risk Assessments and Method Statements (RAMS). Site workers have therefore not been included within the following table, as the adoption of these appropriate mitigation measures will result in an overall low risk of exposure to the CPR linkages identified.

TABLE 2 – REVISED RISK ASSESSMENT SUMMARY TABLE							
Potential Contaminant Source [C]	**Potential Pathway(s) [P]**	**Potential Receptor [R]**	**Probability of CPR Linkage**	**Consequence of CPR Linkage**	**Risk Level**	**Comments / Justification**	**Residual Risk After Remedial / Mitigation Measures**
Near Surface Soils (including Made Ground)	Direct contact, ingestion or inhalation of fugitive dust	End users	Likely	Medium	Moderate	Exploratory works have revealed the presence of lead and asbestos within the Made Ground at the site. Elevated TPH concentrations have been identified within the Natural Strata in the vicinity of the former above ground storage tanks. The Made Ground at the site are considered visually and compositionally undesirable with inclusions of concrete, brick and localised ash / clinker, along with macadam fragments. End users may come into contact with the in-situ soils if exposed at surface. **Remedial / mitigation measures required in the areas where asbestos and lead contaminated Made Ground and hydrocarbon impacted soils have been encountered.**	Low
	Plant uptake	End users	Likely	Medium	Moderate	Exploratory works have revealed the presence of lead within the Made Ground in the south eastern area of the site. Elevated TPH concentrations have been identified within the Natural Strata in the vicinity of the former above ground storage tanks. **Remedial / mitigation measures required in the areas where asbestos and lead contaminated Made Ground and hydrocarbon impacted soils have been encountered.**	Low
	Vertical and lateral migration	Neighbouring properties	Unlikely	Medium	Low	Elevated TPH concentrations have been identified within the Natural Strata in the vicinity of the former above ground storage tanks. The further soil sampling and delineation works have indicated that the area of hydrocarbon impacted soils is limited in extent, therefore the potential for off-site migration towards neighbouring properties is considered to be low.	Low – as per 'Risk Level'. No remedial / mitigation measures required.

TABLE 2 – REVISED RISK ASSESSMENT SUMMARY TABLE							
Potential Contaminant Source [C]	**Potential Pathway(s) [P]**	**Potential Receptor [R]**	**Probability of CPR Linkage**	**Consequence of CPR Linkage**	**Risk Level**	**Comments / Justification**	**Residual Risk After Remedial / Mitigation Measures**
	Leaching of Contaminants through unsaturated zone and/or vertical and lateral migration	Controlled Waters	Unlikely	Medium	Low	Exploratory works have revealed the presence of lead within the Made Ground in the central southern / south-eastern area of the site. Elevated TPH concentrations have been identified within the Natural Strata in the vicinity of the former above ground storage tanks in the central southern portion. Given the generally low sensitivity of the groundwater, the limited extent of the TPH and lead impacted soils and the distances to the nearest surface watercourse, the potential significant risks posed to Controlled Waters by the findings of the laboratory analysis undertaken are considered to be low.	Low – as per 'Risk Level'. No remedial / mitigation measures required.
	Direct contact or contact with vapours	Plastic buildings products (i.e. water supply pipes) and buried concrete	Low likelihood	Medium	Moderate / Low	Made Ground was encountered in the north-western and central southern / south-eastern areas of the site. Localised elevated TPH concentrations have been identified within the Natural Strata in the vicinity of the former above ground storage tanks which may pose a risk to plastic water supply pipes. Possible protection of potable water supply pipes may be required locally if laid in hydrocarbon impacted soils. Design Class DS-1/ACEC Class AC-1. (BRE Spec. Digest 1:2005). **Remedial / mitigation measures are proposed in the area where hydrocarbon impacted soils have been encountered with the potential aim of mitigating the requirement for the protection of potable water supply pipes.**	Low
	Vertical and lateral migration of ground gases to indoor air	End users of new buildings (asphyxiation) or new buildings (damage via explosion)	Unlikely	Medium	Low	Based on the ground gas monitoring undertaken, the site may be classified as Characteristic Situation 'CS1' in accordance with BS8485:2015+A1:2019. However, **it is proposed to install gas protection measures within Plots 1 to 3 situated in the immediate vicinity of the area of hydrocarbon impaction as a precautionary measure to mitigate against the potential ingress of nuisance odours.** .	Low – as per 'Risk Level'. No remedial / mitigation measures required.

3.2 Requirement for Remediation

Taking account the findings of the contamination assessment works undertaken for the site (as detailed within the previous reports listed in Section 1.1), together with the CSM, the following remedial measures are recommended at the site:

a) Inspections of the ground and validation sampling following remediation of the hydrocarbon impacted soils in the vicinity of the former above ground storage tanks (in the area of TP20 and WS3). Such remedial works may involve excavation and off-site removal of contaminated soils or alternatively treatment of the hydrocarbon impacted soils / waters; and potentially the provision of a remedial capping layer (comprising subsoil and topsoil) to proposed gardens / soft landscaping in the localised affected areas.

b) Provision of a remedial capping layer (comprising subsoil and topsoil) to proposed gardens / soft landscaping in areas where Made Ground soils are present within Zones 1 and 2 at the site (see the Remediation Zoning Plan [Figure No. D41012/R3 Revision A], presented in Appendix IV).

   Prior to placement of any remedial capping and based on the potential presence of asbestos within the Made Ground in Zone 1, it is recommended that a capping layer includes the placement of either a hard-to-dig gravel layer or a geotextile membrane separation / warning layer at the base of the capping layer overlain by suitable thicknesses of topsoil and subsoil (to become an engineered capping layer).

   For plots situated in Zone 3 shown on the Remediation Zoning Plan [Figure No. D41012/R3 Revision A], the provision of a remedial capping layer is not considered to be necessary within gardens and soft landscaped areas. In Zone 3, provision of chemically suitable topsoil (and possibly subsoil) is proposed to be re-used (or imported if required) and placed within proposed gardens and soft landscaped areas as a growing medium.

c) Provision of gas protection measures to Plots 1 to 3 only situated in the vicinity of the hydrocarbon impacted soils.

Should any visual or olfactory evidence of potential contamination be discovered during the site preparation / construction works, the works should be suspended until the surrounding soils can be inspected and assessed by a suitably experienced Engineer.

In addition to the above, the following actions are also considered to be required as part of the site preparation / development works:

<u>Protection of Water Supply Pipes</u>

As part of the proposed development of the site, appropriate protected water supply pipes may be required at the site due to the anticipated retention of some localised residual hydrocarbon impacted soils following source removal works. Liaison with the utility company should be carried out to determine their requirements in this regard.

<u>Buried Concrete</u>

An appropriate concrete mix should be adopted in accordance with BRE Special Digest 1:2005 for all buried concrete in contact with the Drift Deposits. For information on the requirements and the previous findings of the investigation works carried out at the site, reference should be made to the report listed in Section 1.1.

3.3 Remediation Objectives

The remediation objectives detailed in this Remediation Strategy (Section 4.0) are required in order to break the significant contaminant linkages identified in the above CSM and any identified following the outcome of further investigation and assessment works.

Hydrocarbon Impacted Soil

The objective of the remediation of the hydrocarbon contaminated soil from within the vicinity of the former above ground tanks (item (a)) will break the following plausible pollutant linkages:

Contaminant Source		**Pathway**		**Receptor**
Contaminated Soils	⇒	Direct contact Direct ingestion Ingestion of home-grown produce Inhalation of fugitive dust and vapours Plant uptake Plastic buildings products (i.e. water supply pipes)	⇒	End Users (Residents & Site Visitors)

Remedial Capping Layer

The remediation objective of the proposed encapsulation of the Made Ground in gardens and soft landscaped areas (item (b)) is to break the following plausible pollutant linkage:

Contaminant Source		**Pathway**		**Receptor**
Contaminated Soils	⇒	Direct contact Direct ingestion Ingestion of home-grown produce Inhalation of fugitive dust and vapours Plant uptake	⇒	End Users (Residents & Site Visitors)

Gas Protection Measures

The remediation objective of the proposed gas protection measures (item (c)) to be installed as a precautionary measure within localised plots is to break the following plausible pollutant linkage:

Contaminant Source		**Pathway**		**Receptor**
Ground gases (including hydrocarbon odours / vapours)	⇒	Vertical and lateral migration	⇒	Site Users & Building Envelope

4.0 REMEDIATION STRATEGY & VERIFICATION PLAN

4.1 Introduction

In accordance with the findings of our previous works at the site and our understanding of the development proposals, the following remedial strategy is considered appropriate for the site from a human health protection perspective.

Remediation and validation works are to be undertaken in accordance with the following guidance documents prepared by the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG):

- *'Verification Requirements for Cover Systems – Technical Guidance for Developers, Landowners and Consultants'*, Version 3.4 – November 2017.
- *'Verification Requirements for Gas Protection Systems – Technical Guidance for Developers, Landowners and Consultants'*, Version 1.1 – December 2016.

4.2 Pre-Start Site Meeting

Once the Client has selected their preferred Contractor(s), it is recommended that a pre-start meeting is arranged between the Site Manager and GeoDyne (as a minimum), to outline the remedial requirements during the construction phase of the development.

4.3 Proposed Methodology for Removal of Hydrocarbon Contaminated Soils Including Around TP20 and WS3

The main potentially applicable remediation options include:

- Removal of the hydrocarbon impacted soil and disposal off-site to a suitably permitted landfill or soil treatment centre.

- Treatment of the hydrocarbon impacted soil by one of the following options:
  - Bioremediation – in situ or ex situ.
  - Chemical treatment – in situ or ex situ.

Ashwood Homes propose to excavate and dispose of the hydrocarbon contaminated soils off-site at a suitably permitted waste management facility.

Should the Client wish to explore alternative remediation options in greater detail, we would recommend that the advice of specialist remediation Contractors is sought and the feasibility of such remediation / treatment options be ascertained Should a form of on-site remediation / treatment be proposed, the relevant Regulators (i.e. Local Authority and the Environment Agency) should be informed and a further method statement prepared to outline the methodology to be adopted and its justification for use.

Where excavation and off-site removal works are adopted at the site, prior to commencement of excavation, the Contractor shall determine the location of and ensure protection of all existing underground services to be retained at the site.

Where hydrocarbon impacted soils are identified, these should then be excavated and loaded directly (where possible) into waiting road lorries or suitably lined skips for disposal at a suitably permitted waste management facility. The Contractor shall take all necessary measures during excavation and loading into lorries or skips to prevent cross contamination from any spillages or leakages of contaminants onto the adjacent uncontaminated Made Ground and Natural Strata.

It may be necessary to temporarily stockpile contaminated soils prior to removal from site due to possible access restrictions. If this is required, contaminated soils shall be placed onto suitable polythene sheeting to prevent cross contamination from occurring.

Based on the observations made on site during the previous delineation works, together with the findings of the laboratory results, the approximate lateral extent of the hydrocarbon impacted soils to be remediated are shown on Figure No. D41012/R4 Revision A in Appendix V. The hydrocarbon impacted soils requiring removal should be chased out both laterally and vertically, as appropriate and as far as practically possible. The positions of each of the sampling points from the delineation works were surveyed and these are proposed to be set out prior to the future excavation works to determine the location for remediation purposes.

The excavation works are considered likely to be achievable in an open excavation (with battering of the sides as appropriate). If this is not the case, the excavation works may require simple trench supports to be installed and sheet piling is not considered to be feasible from an economic perspective.

Groundwater (including perched) is likely to be encountered within the resultant excavation, which may require pumping and removal to facilitate excavation and removal of the hydrocarbon impacted soils.

The removal of the hydrocarbon contaminated soils shall be carried out under the direction and to the satisfaction of the Supervising Engineer.

Validation sampling and analysis will be undertaken adopting the following procedure:

- Following removal of hydrocarbon contaminated soils, a minimum of one sample will be obtained from the base and from each side of the excavation (resulting in a minimum of 5 No. additional validation samples). The results of the previous laboratory testing of 8 No. samples obtained during the delineation of the surveyed edge of the area containing hydrocarbon impacted soils (including from sample references TPH2 and TPH4 to TPH10 inclusive which contained very low TPH concentrations) are also proposed to be utilised as part of the validation exercise, in conjunction with the additional 5 No. validation samples.
- The samples will be commissioned for speciated total petroleum hydrocarbon analysis (i.e. TPH by CWG method in the same manner as during the previous site investigation works).
- The individual sample concentrations will be compared to the GACs provided in Table 3 on the next page or alternatively site-specific remedial targets / Clean-Up Goals (CUGs) if derived as part of the further assessment works carried out at the site.
- If the results of the validation analysis indicate that the concentrations of the determinands are less than the respective GAC (or CUGs), the lateral or vertical extent of the excavation (as appropriate) shall be deemed acceptable. However, where any exceedances of the GAC are recorded during the validation testing, then further removal of hydrocarbon impacted soils would be necessary followed by subsequent validation sampling and analysis until successful removal of the hydrocarbon impacted soils is achieved (or carry out further detailed investigation / risk assessment works including the derivation of specific CUGs, if feasible).
- Photographic records of the source removal and validation works will be obtained by GeoDyne for inclusion within the validation report(s).

Table 3 below details the generic assessment criteria (GAC) for human health, against which the laboratory results from the validation samples should be initially compared to.

TABLE 3 – TPH & BTEX ASSESSMENT CRITERIA HUMAN HEALTH AND WATER SUPPLY PIPES	
Determinand	**Tier 1 GAC (mg/kg)**
Speciated TPH & BTEX	
Aliphatic C5-C6	42 S4UL
Aliphatic C6-C8	100 S4UL
Aliphatic C8-C10	27 S4UL
Aliphatic C10-C12	130 S4UL
Aliphatic C12-C16	1100 S4UL
Aliphatic C16-C35	65000 S4UL
Aromatic C5-C7	70 S4UL
Aromatic C7-C8	130 S4UL
Aromatic C8-C10	34 S4UL
Aromatic C10-C12	74 S4UL
Aromatic C12-C16	140 S4UL
Aromatic C16-C21	260 S4UL
Aromatic C21-C35	1100 S4UL
Benzene	0.087 S4UL
Toluene	130 S4UL
Ethyl Benzene	47 S4UL
m / p Xylene	56 S4UL
o Xylene	60 S4UL
Water Supply Pipe Threshold Values	
BTEX + MTBE	0.1 AW
Mineral Oil C11-20	10 AW
Mineral Oil C21-C40	500 AW

Key

S4UL – LQM/CIEH S4ULs for Human Health Risk Assessment, 2015 (based on a SOM content of 1%). Copyright Land Quality Management Limited reproduced with permission; publication number S4UL3026.
Assessment criteria values derived from S4UL values assume 1% SOM in the first instance (where appropriate, S4UL values for 2.5% or 6% SOM may be considered for the assessment of soils).
AW – Values taken from Pipe Selection Table within Anglian Water guidance document *'Investigation for developers about contaminated land and ground condition assessment'*, which is reproduced from UKWIR publication *'Guidance for the selection of water supply pipes to be used in Brownfield sites'*, (2010).

It should be noted that if the Anglian Water threshold values listed within Table 3 are exceeded (but the concentrations are below the respective Tier 1 GACs), then the Client could potentially choose to install protected water supply pipe work (or alternatively carry out further removal works).

4.4 Backfilling of Excavation

Following removal of the hydrocarbon contaminated soils (where necessary) to the satisfaction of the Supervising Engineer, the resultant excavation will require backfilling with chemically and geotechnically suitable soils / materials. It would be proposed to use uncontaminated site-won excavation arisings (such as from drainage excavations) from Zone 3 (i.e. the agricultural field area) which would only comprise Natural as dug soils.

The material should be placed to a suitable engineered specification (if necessary), with due regard to the proposed use of the study area of the site. It is understood that suitable site-won materials may be utilised to infill the excavation void. The Contractor should ensure that the material proposed for use as void infill is geotechnically suitable.

Should there be a requirement for the importation of soils to the site (including for void infill) the methodology detailed in Section 4.5.5 should be adopted.

Due to the requirement to undertake validation testing of the excavation sides and base, it will be necessary to either leave the excavation open for the duration of the testing exercise (in case the soil test results significantly fail the derived CUGs, thereby resulting in the requirement for further soil removal) or potentially loosely backfill the resultant void (in which case the material may require re-excavation in due course, either to remove further contaminated soils or to infill the excavation in a controlled manner). Some backfilling of the remedial excavations may be required to prevent the possibility of substantial collapse during the validation testing period.

If it becomes necessary to infill the excavations (or part of) due to health and safety or stability reasons, there is a risk that where the testing reveals that unacceptable levels of hydrocarbon contamination remain within the excavation, the infill materials are likely to become cross contaminated and therefore be subject to remediation. This would be explored by laboratory testing as and when necessary and any confirmed cross contaminated soil may require off-site removal.

It is recommended that appropriate health and safety measures (such as Heras fencing and signage etc.) be provided around open excavations until the validation process has been successfully completed. Furthermore, it may be necessary to batter the excavation sides for health and safety reasons, the requirement for this should be determined by the contractor undertaking the soil removal works.

4.5 Ground Gas Issues

On the basis of the ground gas monitoring undertaken in conjunction within the previous contamination assessment, the site was classified within our Combined Phase I & II Report as Characteristic Situation ‘CS1’. No gas protection measures relating to carbon dioxide or methane are considered to be required for the proposed new dwellings to be constructed at the site.

It should be noted, however, that hydrocarbon impacted soils have been encountered in the immediate vicinity of the above ground fuel storage tanks around borehole WS3 and trial pit TP20. In view of this, it is therefore proposed to install gas protection measures within plots situated in the immediate vicinity of the area of hydrocarbon impaction as a precautionary measure.

The gas protection measures are only anticipated to be required to mitigate against the potential ingress of nuisance odours, rather than protecting future residents from harmful hydrocarbon vapours / volatiles as these are expected to be removed to below Tier 1 human health assessment criteria (hence not requiring further remediation from a human health protection perspective). Based on the findings / observations during the delineation works carried out and the proposed site layout, only Plot 2 may require a gas resistant membrane as a precautionary measure – as indicated on Figure D41012/R3 Revision A. However, Ashwood Homes propose to incorporate gas resistant membranes within Plots 1 to 3 as a precautionary measure.

Appropriate precautions should therefore be included within the design of the proposed buildings to accommodate the installation of a gas resistant membrane to each of Plots 1 to 3.

4.6 Ground Gas Protection Measures

The following mitigation measures are considered appropriate for the site to achieve the required level of protection to dwellings:

- Provision of a well installed and verified low permeability proprietary gas resistant membrane.
- The membrane should have proven resistance to potential hydrocarbon vapours and nuisance odours from the localised hydrocarbon impacted soils.
- The membrane should be suitably lapped and sealed and should be extended across wall cavities and lapped with cavity trays to effectively exclude ground gases / hydrocarbon vapours and nuisance odours from the footprint of the proposed buildings. The membrane should be inspected by a third party in accordance with the requirements of CIRIA C735.
- The membrane must be suitably robust to withstand the construction process and should be suitably protected following installation and inspection to minimise damage during construction.
- Service penetrations through the membrane should be kept to a minimum and should be suitably sealed to the membrane. Where the service penetrations (typically 150mm pipes) are to be used as ducting for smaller service pipes (e.g. water, electricity or gas supply etc.) an appropriate method of sealing the smaller pipes within the ducting should be adopted (such as closed cell expanding foam), to minimise the risk of the ducting acting as a conduit for ground gases to enter the dwellings.

The floor slab design of the proposed plots will also incorporate sub-floor ventilation (primarily for damp protection purposes) which should also serve to dilute and disperse potential hydrocarbon odours and vapours from the subfloor void space.

It is recommended that advice should be sought from a membrane manufacturer and installer with regards to the specification of an appropriate membrane.

Where the proposed dwellings are to benefit from a Buildmark warranty (i.e. NHBC, or similar) we would recommend liaison with the warranty provider with respect to the precautionary ground gas protection measures to ensure that the proposals fully satisfy their requirements.

4.7 Ground Gas Protection Measures Verification

The proposed gas resistant membrane should be installed, inspected and validated by a third party in accordance with the requirements of CIRIA C735 *'Good practice on the testing and verification of protection systems for buildings against hazardous ground gas'* (2014).

We would recommend that the membrane specified for the proposed buildings is installed by a suitably qualified specialist contractor in a quality controlled / quality assured (QA/QC) manner. Verification of the membrane should include a third party visual inspection of the installed membrane, as a minimum.

Once the design of ground gas precautions and floor slab for the site have been finalised, a site-specific Verification Plan prepared in accordance with CIRIA guidance may be required to assist with verification of the gas protection measures. This document would include the following:

- Technical data relating to the membrane to be installed at the site.
- Drawings showing the proposed membrane installation details, inclusive of how membrane penetrations (i.e. service pipes etc.), door entries, party walls and corners will be sealed.
- Any correspondence with the Local Authority which relates to ground gas protection.
- Method statement for the installation of the membrane, prepared by the membrane installers.

Following installation, the ground gas protection measures should be visually inspected (as far as practicable) to ensure they are in accordance with the appropriate installation drawings and that the membranes are suitably installed and free from damage and defects.

The inspections should be carried out by GeoDyne in accordance with good practice and should include the following as a minimum:

- Obtain photographic records of the membrane during the installation process.
- Visual inspection of the joints / welds in the membrane to assess the continuity of the membrane throughout the structure. Integrity testing should be undertaken, as appropriate.
- Visual inspection of the seals around penetrations through the membranes (i.e. service pipes, stanchions etc.).
- Records of all materials used on site will be obtained during our inspection.
- Records of any deviation from the 'Construction' drawings and photographic evidence of any changes to the installation detail will be obtained.
- Records of any non-compliances (i.e. punctures / tears to the membrane, defective joints / seals etc.) and corrective action taken to rectify the defective areas will be obtained.

Following satisfactory installation of the membrane and satisfactory repair to any defective / damaged areas of the membrane, the membrane will be considered to 'Pass' the verification process. Validation report(s) relating to the membrane installation may be prepared for Plots 1 to 3 following completion of the installation works. Validation works should be undertaken at the earliest opportunity following installation, to minimise the potential for delays in construction etc.

The Client should note that following inspection by GeoDyne, the membranes should be appropriately protected during construction to minimise damage. The protection may comprise the provision of loose laid boarding over the membrane, or implementation of an exclusion zone preventing other Contractors access into the plots / structures prior to pouring of the floor. Any damage to the membrane will compromise the efficacy of the membrane and should be appropriately repaired.

The foregoing strategy is also recommended for any third party responsible for validation works of the proposed residential buildings.

4.8 Remedial Capping Layer

4.8.1 Summary of Capping Requirements

The Made Ground materials where present at the site (see the Remediation Zoning Plan – Figure No. D41012/R3 Revision A presented in Appendix IV) are considered to be unsuitable for retention or re-use at surface within proposed gardens and areas of soft landscaping due to the presence of asbestos within the shallow Made Ground soils in the north-western portion of the site and lead concentrations above Tier 1 human health generic assessment criteria based on a proposed residential with plant uptake end-use (i.e. in relation to human health) in the central southern / south-eastern portion of the site. On this basis, provision of a remedial capping is required within all proposed gardens and areas of soft landscaping within Zones 1 and 2 where Made Ground soils are retained in the area of the plots.

Based on the proposed layout, a remedial capping layer is to be placed in gardens and soft landscaped areas around the following plots:

- Zone 1: Plots 7 to 24, 35 and 36 in the western portion of the site.
- Zone 2: Plots 67 to 70 in the central southern / south-eastern portion.

With regard to the lead impacted soils, the positions of each of the sampling points from the previous lead delineation works were surveyed and these were used to position the location of the lead impacted area in relation to the proposed layout. This indicated that the area of lead impacted soils is situated within the area of proposed Plots 68 to 70, therefore remedial measures would be required in each of these plots. However, to make management of this issue easier on site, the extent of the area requiring remedial measures (i.e. the placement of capping in gardens) was extended to the north / north-east to include Plot 67 (which extended beyond the area of TP16G), as indicated on Figure No. D41012/R3 Revision A.

It is not proposed to excavate or relocate the Made Ground soils from the area of lead impacted soils. These are proposed to remain in-situ and be encapsulated by the recommended capping layer within gardens.

Ashwood Homes propose to retain the remnant structures in the vicinity of the lead impacted soils in-situ and advance the pile foundations through this area. It is therefore intended that the lead impacted soils will remain in-situ and be encapsulated by the capping layer within gardens.

It should be noted that the soils containing elevated TPH carbon fractions above Tier 1 human health generic assessment criteria in the central southern / south-eastern portion of the site are proposed to be removed from site as part of the remediation works.

For plots situated in Zone 3 shown on the Remediation Zoning Plan (Figure No. D41012/R3 Revision A), the provision of a remedial capping layer is not considered to be necessary within gardens and soft landscaped areas as the existing topsoil and subsoil in the central portion of the site is considered chemically suitable for re-use within the proposed development based on the contamination assessment works carried out.

Following removal of the hydrocarbon impacted soils, specific remedial measures are considered not necessary within areas of proposed hardstanding at the site (i.e. external permanent hardstanding areas and beneath the floor slabs to the proposed buildings) as the contaminants will be encapsulated from future end users.

4.8.2 Capping Thickness

It will be necessary to adopt a remediation strategy for the site to afford an appropriate level of protection to human health (future end users) by providing a remedial capping to the Made Ground within the proposed gardens and areas of soft landscaping (see the Remediation Zoning Plan Figure D41012/R3 Revision A within Appendix IV). Prior to placement of any remedial capping soils (i.e. topsoil and subsoil) and based on the potential presence of asbestos within the Made Ground, it is recommended that an appropriate separation and warning layer is placed at the base of the capping soils within Zone 1 (to become an engineered capping layer).

The engineered capping layer in Zone 1 may comprise either a hard-to-dig gravel layer or a geotextile membrane overlain by suitable thicknesses of topsoil and subsoil. Where a geotextile membrane is selected, it is recommended that a suitable geotextile product which can withstand the rigours of the construction / installation process is utilised (such as a suitable Terram or Ekotex product or similar) to ensure the integrity of the geotextile membrane. Ashwood Homes propose to use a geotextile membrane within the engineered capping layer and not a no-dig / hard-to-dig gravel layer. The geotextile membrane is proposed to comprise a Terram 1000 (or similar approved). A copy of the specification should be provided to the Local Authority for approval prior to its first use.

A geotextile membrane is not required to be incorporated as part of the remedial capping layer within Zone 2.

The recommended remedial capping thicknesses are detailed in Table 4 and are subject to Local Authority approval.

TABLE 4 – REMEDIAL CAPPING PROPOSALS				
Land Use	**Geotextile Membrane Yes/No**	**Subsoil (m)**	**Topsoil (m)**	**Total (m)**
Zone 1				
Private Gardens	Yes	0.45	0.15	0.60
Communal Soft Landscape	Yes	0.15	0.15	0.30
Public Open Space	Yes	0.15	0.15	0.30
Zone 2				
Private Gardens	No	0.45	0.15	0.60
Communal Soft Landscape	No	0.15	0.15	0.30
Public Open Space	No	0.15	0.15	0.30

Where applicable, the capping soil may comprise entirely of topsoil if preferred. It may be necessary to increase the thicknesses of topsoil / growing medium likely to be required around tree roots and to suit the planting regime, subject to confirmation by an arborist. The reader is also referred to Section 4.8.3 regarding proposed site level changes.

Prior to placement of any remedial capping soils, the formation level should be visually inspected prior to placement. Any potentially sharp deleterious material (i.e. oversized fragments of brick and concrete etc.) at formation level should be removed.

Please note that, subject to finished levels at the site, it may be necessary to locally reduce levels within gardens / soft landscape (i.e. remove some of the existing Made Ground) to accommodate an appropriate thickness of remedial capping.

4.8.3 Proposed Site Levels

As part of the proposed development works, it is proposed to raise site levels to varying degrees across the site for flood risk and drainage purposes and plans showing the existing and proposed levels, including isopachyte drawings are presented within Appendix II. A summary of the proposed changes in site levels in Zones 1 and 2 where remedial capping is required in gardens and soft landscaped areas is provided below.

TABLE 5 – SUMMARY OF PROPOSED SITE LEVELS			
Plot Number	**Approximate Existing Ground Level (m AOD)**	**Proposed External Ground Level (m AOD)**	**Approximate Site Level Increase (m)**
Zone 1			
7	3.30	4.40	1.10
8	3.35	4.35	1.00
9	3.35	4.40	1.05
10	3.20	4.45	1.25
11	3.25	4.45	1.20
12	3.20	4.35	1.15
13	3.30	4.45	1.15
14	3.30	4.35	1.05
15	3.30	4.35	1.05
16	3.30	4.30	1.00
17	3.30	4.30	1.00
18	2.80	4.00	1.20
19	2.80	4.00	1.20
20	2.80	4.00	1.20

TABLE 5 – SUMMARY OF PROPOSED SITE LEVELS			
Plot Number	**Approximate Existing Ground Level (m AOD)**	**Proposed External Ground Level (m AOD)**	**Approximate Site Level Increase (m)**
21	3.30	4.25	0.95
22	3.25	4.30	1.05
23	3.20	4.30	1.10
24	2.85	4.20	1.35
35	2.80	4.15	1.35
36	2.80	4.05	1.25
Zone 2			
67	3.60	3.80	0.20
68	3.60	3.80	0.20
69	3.60	3.60	0.00
70	3.60	3.60	0.00

In summary, site levels in Zone 1 are proposed to be raised by approximately 1.10m on average in order to achieve the proposed finished levels. In gardens and soft landscaped areas, the proposed site level increase would allow the incorporation of the proposed capping layer (up to 0.60m thickness), with a further 0.50m thickness of soils (on average) to be placed beneath.

Given the proposed site level increases, the Made Ground soils within Zone 1 (where asbestos has been identified) are therefore proposed to be retained at an increased depth, i.e. below a depth of 1.10m on average which would incorporate the proposed capping layer. The proposed site level increases would therefore achieve a greater depth of soils between the retained Made Ground and future end users at surface and this would also be beneficial for such other implications as ponds in gardens and around the root ball of proposed trees.

It should also be noted that the Local Authority Environmental Protection Officer has previously requested to the Planners that removal of permitted development rights is considered at this site (i.e. for plots constructed in areas where Made Ground potentially containing asbestos is to be retained), and that future occupants are formally made aware of the restrictions on the gardens use (e.g. implications for ponds etc.). Given that further details are now available on the proposed site levels and the noted increases across the site since the Local Authority made these comments, it is recommended that further comments (including confirmation / clarification of their requirements) should be obtained from the Local Authority in this regard prior to the sale of properties.

In Zone 2, the proposed site levels are similar to existing levels, therefore it would be necessary to locally reduce levels within the gardens / soft landscape of Plots 67 to 70 (i.e. remove some of the existing Made Ground) to accommodate the required appropriate thickness of remedial capping.

For Zone 3, based on the proposed site level drawings presented within Appendix II, site levels are generally proposed to be raised by in excess of 0.50m or more than 1.00m over large parts of the area, with some other smaller areas only being increased by less than 0.50m and localised areas of cut / reduction in ground levels.

4.8.4 Remedial Capping Materials and Imported Soils

Existing Topsoil and Subsoil

Based on the contamination assessment works carried out to date, the existing topsoil and subsoil in the central portion of the site is considered chemically suitable for re-use within the proposed development, including as capping soils (where required in Zones 1 and 2 shown on the Remediation Zoning Plan, Figure No. D41012/R3 Revision A) and as a growing medium within other areas (within Zone 3 of the Remediation Zoning Plan, Figure No. D41012/R3 Revision A).

We would recommend that the Topsoil is stripped and appropriately stockpiled in approximate 1,000m^3 volumes during the redevelopment. The Topsoil can then be placed at a suitable thickness in proposed soft landscaped areas to act as a growing medium.

The physical suitability of these soils should be assessed and determined on site by the developer.

The majority of the Natural Strata encountered at shallow depth at the site may be regarded as suitable for re-use within proposed gardens or areas of soft landscape as subsoil (to raise levels, as appropriate) or for landscaping / capping on alternative developments (subject to regulatory approval and the production of any necessary plans or permits) where surplus arisings are generated from the site, excluding the localised area of hydrocarbon impacted soils within the central southern / south-eastern part of the site.

Where it is proposed to re-use the natural topsoil and Natural Strata, suitable control measures should be implemented to segregate the overlying contaminated Made Ground soils.

Imported Topsoil / Subsoil

Where there is a requirement to import soils to the site, including to raise site levels, it will be necessary to test the soils proposed to imported at source to ensure they are suitably uncontaminated / clean (prior to importation) in accordance with CLEA / generic guidance. Given the presence of suitable topsoil within the agricultural field area, it is considered unlikely to require the importation of topsoil to the site. However, if during development there is a requirement to import topsoil (and subsoil), then the above requirements would also apply.

It will be necessary to test any imported topsoil and subsoil (including to raise site levels) at source to ensure it is suitably clean (prior to importation) in accordance with CLEA/generic guidance. The topsoil and subsoil should also conform to BS3882: 2015 '*Specification for topsoil*', with respect to the presence of foreign objects, and ideally nutrient levels etc.

The Site Acceptance Criteria (SAC) for the donor soils are detailed in Table 6 (Section 4.8.6). The results of the chemical analysis on topsoil and / or subsoil proposed for importation should be forwarded to the Local Authority (Environmental Health Officer) for approval (prior to importation).

4.8.5 Validation Protocol

Proposed Gardens and Soft Landscaped Areas

The recommended remediation protocol for use by the Site Manager and an Engineer (in the form of a decision tree), which defines the key stages of the remediation and validation processes areas is presented in Appendix VI.

Inspections of the remediation works will be undertaken on a rolling basis as necessary. Validation works in Zones 1 and 2 will include:

- Obtaining photographic records to demonstrate compliance with the Remediation Strategy.
- Before placement of the capping soils, carry out an inspection of the formation layer by the Site Manager / Client prior to placement of the geotextile membrane in Zone 1. Any potentially sharp deleterious material (i.e. glass shards, brick fragments etc.) at formation level which may puncture the underside of the geotextile membrane should be removed prior to placement.
- Provision of confirmation of the placement of the geotextile membrane following placement in Zone 1. The product specification sheet for the geotextile membrane shall be provided for inclusion within the validation report.
- Review of laboratory test certificates / soil analysis results for imported topsoil prior to importation to site and undertake potential additional chemical analysis (as appropriate). Laboratory test certificates are to be supplied to the Environmental Protection Officer at the Local Authority for comment / approval prior to the importation of donor soils to site. This will include tables summarising the assessment of the laboratory test results to the SAC. This information will be included within the validation report.
- Inspection of validation holes within garden areas and soft landscaped areas to verify the thickness of remedial capping soils placed. Validation holes are typically advanced using a spade / auger (or alternatively carefully mechanically excavated) to validate that an appropriate thickness of remedial capping has been placed.
- Validation testing for the remedial capping thickness should be:
  - Rear Gardens - 1 No. hole per plot.
  - Front Gardens - 1 No. hole per every two plots.
  - Other soft landscaping - 1 No. hole per area.
- Preparation of a validation report to confirm that the remediation objectives (as set out in the Remediation Strategy) have been met.

We would note that based on the proposed site layout shown on the drawing in Appendix II, the front gardens to the majority of plots are limited in size; furthermore, these gardens are likely to incorporate shallow buried services. It is considered that any gravel surround to the buried services and concrete haunching to edging stones (to drives, footpaths etc.) would act as a hard to dig layer within the completed gardens. Therefore, it may not be possible to achieve the full recommended depth of remedial capping in front gardens. However, the remedial capping layer provided should be as thick as practicable for the front garden areas.

4.8.6 Site Acceptance Criteria

It will be necessary for the Local Authority Environmental Protection Officer to review the suggested Site Acceptance Criteria (SAC) detailed in Table 6, which would be used when assessing the suitability of any materials proposed for importation (i.e. topsoil and subsoil, together with soils to be used to raise site levels, as appropriate etc.).

The SAC in Table 6 have been derived for a residential end-use with home grown produce (i.e. private gardens).

The following SAC are proposed for assessment of the laboratory results relating to the topsoil (and subsoil) proposed to be imported to site:

TABLE 6 – PROPOSED SITE ACCEPTANCE CRITERIA (RESIDENTIAL END-USE WITH PLANT UPTAKE)	
Determinand	**Tier 1 SAC (mg/kg)**
Metals	
Arsenic	37 S4UL
Cadmium	11 S4UL
Chromium III	910 S4UL
Chromium VI	6 S4UL
Lead	200 C4SL
Inorganic Mercury	40 S4UL
Selenium	250 S4UL
Nickel	130 S4UL
Copper	2400 S4UL
Zinc	3700 S4UL
PAHs	
Acenaphthene	210 S4UL
Acenaphthylene	170 S4UL
Anthracene	2400 S4UL
Benz(a)anthracene	7.2 S4UL
Benzo(a)pyrene	2.2 S4UL
Benzo(b)fluoranthene	2.6 S4UL
Benzo(ghi)perylene	320 S4UL
Benzo(k)fluoranthene	77 S4UL
Chrysene	15 S4UL
Dibenzo(ah)anthracene	0.24 S4UL
Fluoranthene	280 S4UL
Fluorene	170 S4UL
Indeno(123-cd)pyrene	27 S4UL
Naphthalene	2.3 S4UL
Phenanthrene	95 S4UL
Pyrene	620 S4UL
Asbestos	
Asbestos	Absence

Key
S4UL – CIEH/LQM Suitable 4 Use Levels (2015). Copyright Land Quality Management Limited. All rights reserved.
C4SL - value for Lead taken from DEFRA publication SP1010.

Note
SAC values for metals derived from S4UL values assume 6% Soil Organic Matter.
SAC values for PAHs derived from S4UL values assume 1% SOM in the first instance (where appropriate, S4UL values for 2.5% or 6% SOM may be considered for the assessment of donor soils).

Topsoil and subsoil samples should be tested at the donor site for the metals, PAHs and asbestos detailed in the above table (this may be undertaken by a Consultant under instruction from the Client or directly by the Supplier).

Please note that where donor materials are sourced from an unknown or potentially contaminated source (i.e. 'brownfield' sites) it may also be necessary to test the materials for additional determinands (i.e. speciated Total Petroleum Hydrocarbons, pesticides etc.), as well having the appropriate permits in place to allow transport of the material.

4.8.7 Pre-Importation Testing Methodology

In accordance with the requirements of the YALPAG document for a greenfield source, it is recommended that the donor topsoil / subsoil should be sampled and analysed at a minimum density of 1 No. sample per 250m^3 or 3 No. samples per source site / stockpile (whichever is the greater) to ensure that the results are representative and provide sufficient confidence that the soils will be acceptable in the proposed residential context.

If soils are proposed to be imported from an unknown or potentially contaminated source, then an increased testing frequency of a minimum of 1 No. sample per 100m^3 or 6 No. samples per source (whichever is the greater) would be necessary, along with laboratory analysis for additional determinands to those contained in Table 6 (depending upon the source).

In the first instance, the results of the testing will be compared directly to the SAC (Table 6). If the individual values are less than the SAC the source shall be considered suitable for use at the site.

If the individual values are greater than the SAC, the supervising Engineer may elect to calculate the 95th percentile Upper Confidence Level (UCL) Mean Value of the topsoil samples, which would then be compared to the appropriate SAC to determine whether the soil is 'clean' and suitable for use at the site. Similarly, it may be appropriate to adjust the Tier 1 SAC to account for the Soil Organic Matter (SOM) before reviewing results.

Should the UCL Mean Value of the topsoil / subsoil samples be in excess of the SAC, further samples may be obtained to enlarge the dataset prior to reassessment and a final decision being reached. Alternatively, the Client may elect to reject the donor site and select an alternative donor site.

4.9 Segregation of Materials

It is imperative that any 'clean' materials (i.e. any imported chemically suitable materials, e.g. topsoil and subsoil) are kept separate from localised 'contaminated' arisings generated at the site (including retained Made Ground materials).

Any cross contamination may result in the necessity to remove all affected materials from the site. Appropriate measures should therefore be adopted by the chosen Contractor.

These measures should include the following:

- The Contractor shall take all necessary measures during excavation works in areas of Made Ground (such as for foundation and drainage / sewer excavations), together with such activities as loading soils into lorries or skips during the removal of contaminated soils, to prevent any spillages of contaminants onto the adjacent ground in order to prevent the cross contamination of the surrounding soils.
- All vehicles are to be appropriately sheeted and 'clean', prior to leaving site. The Contractor shall take all reasonable and applicable measures to prevent the escape of material during transportation.
- It may be necessary to temporarily stockpile contaminated soils prior to removal from site, although this is considered unlikely at this site. If circumstances arise where temporarily stockpiling is required, contaminated soils should be placed onto suitable polythene sheeting to prevent cross contamination from occurring. Depending upon the requirements of the asbestos risk assessment, other measures such as dampening down and covering of stockpiled soils are also likely to be required.

- During the importation (if required) and placement of the remedial capping soils, all capping soils shall be placed directly onto the geotextile membrane layer in gardens and areas of proposed soft landscaping. If required, imported soils should be temporarily stockpiled onto suitable polythene sheeting (if suitable surface hardstanding is not present) to prevent cross contamination with the existing Made Ground (noted to contain lead and asbestos, where relevant) occurring prior to placement.

4.10 Off-Site Disposal & Waste Classification

The chemical testing regime for off-site disposal (if required) is different to the chemical testing required to assess the suitability of the soils for retention on site and the risks to human health. Therefore, a separate contamination assessment may be required to classify the soils for off-site disposal with testing criteria to assess whether the soil is hazardous, non-hazardous or inert waste.

The receiving landfill may require additional specialist laboratory testing to further characterise the material proposed for disposal against Waste Acceptance Criteria (WAC). We would recommend early consultation between the Contractor and the receiving landfill to determine any specific laboratory testing requirements. These may potentially include bespoke WAC leachate testing.

Individuals / companies removing soils from the site are bound by a **duty of care**; as such this should only be undertaken by an **authorised person**. All waste movements should be accompanied by a **waste transfer note and Environment Agency waste consignment notes**.

4.11 Utilities

Prior to development of the site, we would recommend that a copy of this report and the previous reports listed in Section 1.1 are supplied to utility companies, and that their recommendations relating to appropriate supply pipes are adhered to. Due to the anticipated retention of some hydrocarbon impacted soils locally, protected supply pipes may locally be required (depending upon the outcome of the validation testing following proposed source removal works).

4.12 Licences, Permits, Registrations, Plans & Approvals

The Contractor / Developer is responsible for, and must ensure that, all necessary licenses, permits, plans, registrations and approvals are in place prior to commencing with the earthworks at the site.

These will include any Materials Management Plans (MMPs), Site Waste Management Plans (SWMPs) and/or Environmental Permits / Exemptions as necessary to enable the completion of the proposed works.

4.13 Unforeseen Circumstances

Any areas of potentially contaminated soils encountered during site construction works must be brought to the attention of GeoDyne, to ensure that our recommendations continue to apply. Any potentially contaminated soils should be left in-situ and subjected to further assessment, to potentially include further chemical testing and risk assessment.

The following procedure should be adhered to if any areas of previously unidentified suspected contamination are encountered during the redevelopment of the site:

i. Suspected contaminated material will remain in-situ.
ii. GeoDyne to be notified, and will inform the Local Authority.

iii. GeoDyne will undertake a visual assessment of the possible contamination, followed by appropriate sampling / testing.
iv. If necessary, contamination will then be treated or removed from site and the Environmental Protection Officer informed accordingly. All necessary remediation works should be validated by testing in accordance with an approved strategy.

4.14 Construction Workers

It is recommended that construction personnel involved with direct contact with the soils at the site use appropriate PPE equipment together with hygiene facilities in accordance with general health and safety guidelines.

Appropriate consideration (by a suitably trained qualified professional) should be given to health and safety procedures for personnel working in asbestos contaminated soils. This may include consideration of the dust / fibre suppression, airborne asbestos fibre monitoring and provision of suitable respiratory protective equipment (RPE). The requirement for RPE and other protective measures should be confirmed following the outcome of a risk assessment relating to asbestos, as discussed in Section 4.12.

A copy of all reports relating to the site should be included in the site health and safety file, and site workers should be made fully aware of the sites setting.

4.15 Sites Affected by Asbestos

The CIRIA C733 document *'Asbestos in soil and made ground: a guide to understanding and managing risks'* (2014) recommends that remediation measures undertaken in sites affected by asbestos should be undertaken to a CAR (Control of Asbestos Regulations 2012) compliant risk assessment in order to protect site staff and members of the public.

The remediation of sites affected by asbestos may involve licensable work, notified non-licensable work or simply non-licensable work. The CAR risk assessment for the site should be site-specific and must cover all aspects of remediation involving asbestos. The contractor should satisfy themselves as to whether the soils at the site require a notification or licence to be in place prior to working with the soils.

The main risk associated with soils containing asbestos is the release of airborne fibres resulting from excavation, earth movements and primarily vehicle movements around the site (particularly during dry weather), the severity of which will depend upon the amounts and types of asbestos present (i.e. chrysotile).

Good site awareness, site management, asbestos-specific mitigation measures and training will reduce worker exposure to airborne dust and fibres. In order to avoid subsequent civil liabilities, mitigation measures need to prevent exposure of neighbouring residents and public to levels, which may be deemed significant in the future.

The CAR risk assessment in conjunction with the Client Health and Safety procedures will define the mitigation measures required at the site. Mitigation measures to avoid the spread of asbestos fibres may include some or all of the following:

- Damping down of surfaces and stockpiles of demolition/crushed materials.
- Management of stockpiles and soil movements.
- Hand picking of visible Asbestos Containing Material (ACM) from the site surface or stockpiles.
- Segregated areas.
- Potentially wheel washes, road wetting and road cleaning (as appropriate).

- Monitoring around the sites perimeter for airborne asbestos dust particles would ensure and confirm good site management of the asbestos risk and further protect site workers and members of the public. The Local Authority Environmental Protection Officer has requested for monitoring to be undertaken during the relevant works.

Where asbestos containing soil is present at non-domestic premises the Control of Asbestos Regulations 2012 requires adequate documentation to ensure the inadvertent exposure to asbestos can be prevented and exposures during subsequent planned disturbance of soils can be controlled and managed. With regard to the asbestos containing materials to be retained beneath shared drives / car parking areas (likely to be regarded as non-domestic premises), it is recommended that the potential presence of encapsulated asbestos containing materials be documented in an asbestos management plan and supplied to the appropriate parties (such as for further maintenance activities).

It should also be noted that the Local Authority Environmental Protection Officer has previously requested to the Planners that removal of permitted development rights is considered at this site (i.e. for plots constructed in areas where Made Ground potentially containing asbestos is to be retained), and that future occupants are formally made aware of the restrictions on the gardens use (e.g. implications for ponds etc.). Given that further details are now available on the proposed site levels and the noted increases across the site since the Local Authority made these comments, it is recommended that further comments (including confirmation / clarification of their requirements) should be obtained from the Local Authority in this regard prior to the sale of properties.

4.16 Site Managers Site Diary

It is the responsibility of the Site Manager to keep a site diary to record the progress of remediation works. This should include, but not be limited to:

- Photographic and written records of remediation works, with specific attention paid to unforeseen circumstances.
- Records of any remedial measures that cannot be dug up / sampled and validated at a later date.
- Records of all movements of waste materials, including consignment notes etc.

4.17 Communication

We would recommend that regular communication is maintained between GeoDyne and the Site Manager throughout the development / remediation works.

It will be the responsibility of the Site Manager to inform GeoDyne when it is proposed to remove the hydrocarbon contaminated soils for inspection and validation works.

4.18 Statutory Consultation

We would recommend that a copy of our Remediation Strategy and Verification Plan is issued to the Local Authority Environmental Protection Officer for review / comment and approval, at the earliest opportunity, prior to commencing with any remedial activity.

Where the proposed dwellings are to benefit from a buildmark warranty (i.e. NHBC, or similar) the warranty provider will require written approval of the Remediation Strategy and Verification Plan from the Local Authority in order to satisfy their Land Quality Conditions.

5.0 CONCLUSIONS

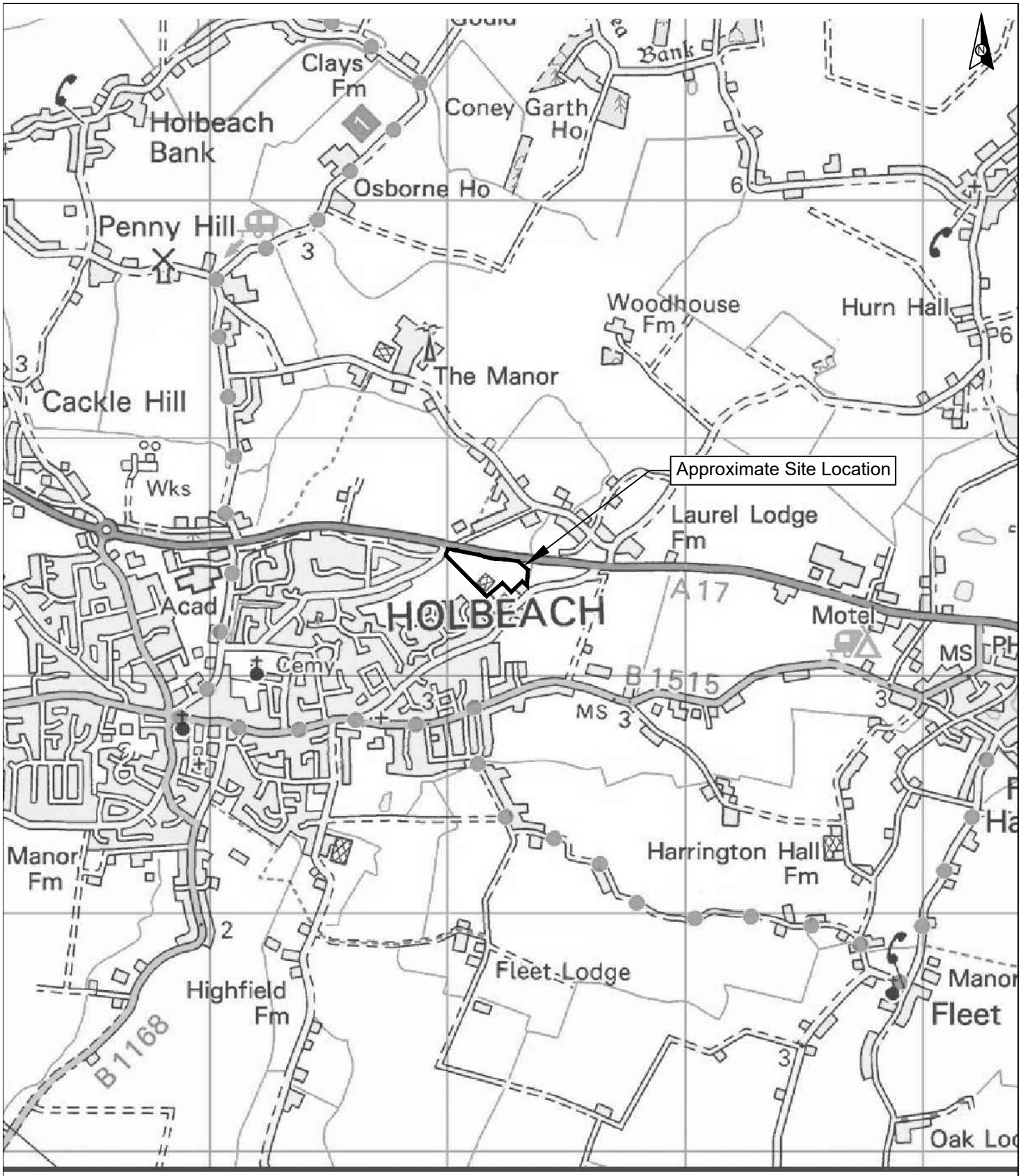
To the best of our knowledge, this Remediation Strategy and Verification Plan has been prepared to be compliant with the requirements of the Local Authority Planning Department and the Environmental Protection Officer.

Written approval of this report should be obtained from the Local Authority Environmental Protection Officer prior to implementation of the recommendations.

This Remediation Strategy and Verification Plan presents methodologies and procedures which, when implemented, are considered to be appropriate to enable the future development of the site without creating unacceptable risk to end-users.

APPENDIX I

Site Location Plan
(Figure No. D41012/R1)



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Project No.	D41012	Drawn By	SJ
Client	Ashwood Homes	Checked By	DB
		Approved By	PK
Project	Phase 2 Balmoral Way Holbeach	Scale	NTS
		Date Drawn	21/04/2022
Title	Site Location Plan	Revision	
		Figure No.	D41012/R1

GeoDyne
Nottingham 0115 962 0001
Derby 01332 290 798
info@geodyne.co.uk
www.geodyne.co.uk

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APPENDIX II

Proposed Site Layout and Site Level Plans

N

W E

S

Drain

BUND

BUND

Easement 30

PUBLIC OPEN SPACE

Pedestrian Access

PUMP STATION

PUBLIC OPEN SPACE

Line of acoustic fence

9M IDB EASEMENT

ANGLIAN WATER EASEMENT

Drain

Drain

House Type Schedule - Rented				
House Type	Sqft	Storeys	Beds	No of
★ A538	538	2	1b 2p	2
★ A732	732	2	2b 4p	3
★ A902	902	2	3b 6p	1
			Total	6

House Type Schedule - Shared Ownership				
House Type	Sqft	Storeys	Beds	No of
✶ A732	732	2	2b 4p	2
✶ A902	902	2	3b 6p	1
			Total	3

House Type Schedule - Open Market				
House Type	Sqft	Storeys	Beds	No of
A538	538	2	1b 2p	2
Dee	732	2	2b 4p	13
Aire	902	2	3b 5p	14
Avon	910	2	3b 5p	6
Coronation	932	2	3b 5p	4
Lock	1079	2	3b 5p	3
Mere	1080	2	3b 5p	9
Rutland	1099	2	3b 5p	3
Ribble-V	1283	2	4b 7p	6
Severn	1345	2	4b 6p	2
Harren	1396	2	4b 6p	2
			Total	72

Plot Schedule	
Plot No	House Type
1	RUTLAND
2	CORONATION
3	CORONATION
4	SEVERN
5	LOCK
6	RIBBLE-V
7	HARREN
8	RIBBLE-V
9	RUTLAND
10	AIRE
11	AIRE
12	RIBBLE-V
13	RIBBLE-V
14	AIRE
15	MERE
16	AIRE
17	MERE
18	DEE
19	DEE
20	DEE
21	MERE
22	CORONATION
23	CORONATION
24	RIBBLE-V
25	HARREN
26	SEVERN
27	MERE
28	AIRE
29	AIRE
30	AIRE
31	MERE
32	AIRE
33	MERE
34	RIBBLE-V
35	LOCK
36	LOCK
37 ★	A732

★ RENTED
✶ SHARED OWNERSHIP

Plot Schedule	
Plot No	House Type
38 ✶	A732(DEE)
39	AVON
40	AVON
41	AVON
42	AVON
43	RUTLAND
44	MERE
45	AIRE
46	DEE
47 ✶	A732(DEE)
48 ★	A732
49 ★	A732
50 ★	A538
51 ★	A538
52 ✶	A902(AIRE)
53 ★	A902
54	DEE
55	DEE
56	DEE
57	DEE
58	AVON
59	AVON
60	DEE
61	A538
62	A538
63	AIRE
64	AIRE
65	DEE
66	DEE
67	AIRE
68	AIRE
69	AIRE
70	MERE
71	MERE
72	DEE
73	DEE

★ RENTED
✶ SHARED OWNERSHIP

REV	DATE	DESCRIPTION
N	14.02.2022	PLOTS 74-81 REMOVED, RED LINE REDUCED, NENE RENAMED AS RUTLAND
M	22.11.2021	PLOTS 48 TO 53 REPLANNED, BIN COLLECTION POINT SIZES INCREASED
L	08.09.2021	PLOTS 37 & 38 CHANGED TO 2 BEDS, LINK ROAD REMOVED
K	31.08.2021	AFFORDABLE MIX UPDATED
J	13.08.2021	BIN COLLECTION POINTS REVISED PLOT 5 & 22-23, FUTURE ACCESS TO ADJACENT DEVELOPMENT INDICATED
H	19.07.2021	UPDATED FOLLOWING PLANNING COMMENTS
G	24.06.2021	SCHEDULE UPDATED
F	22.06.2021	AFFORDABLE MIX UPDATED
E	18.06.2021	1 BED AFFORDABLE HOUSE SIZE INCREASED
D	04.06.2021	PLOT 81 CHANGED TO RICHMOND
C	01.06.2021	PLOT NUMBERS REDUCED TO 81
B	25.05.2021	ADDITIONAL 9 PLOTS ADDED
A	18.05.2021	PLOT 1 GARAGE AMENDED

I:\Administration\02 Technical\14 Company Logo\Ashwood Homes Logo.jpg

1 Goodison Road, Lincs Gateway Business Park,
Spalding, Lincs, PE12 6FY **T: 01406 490590**

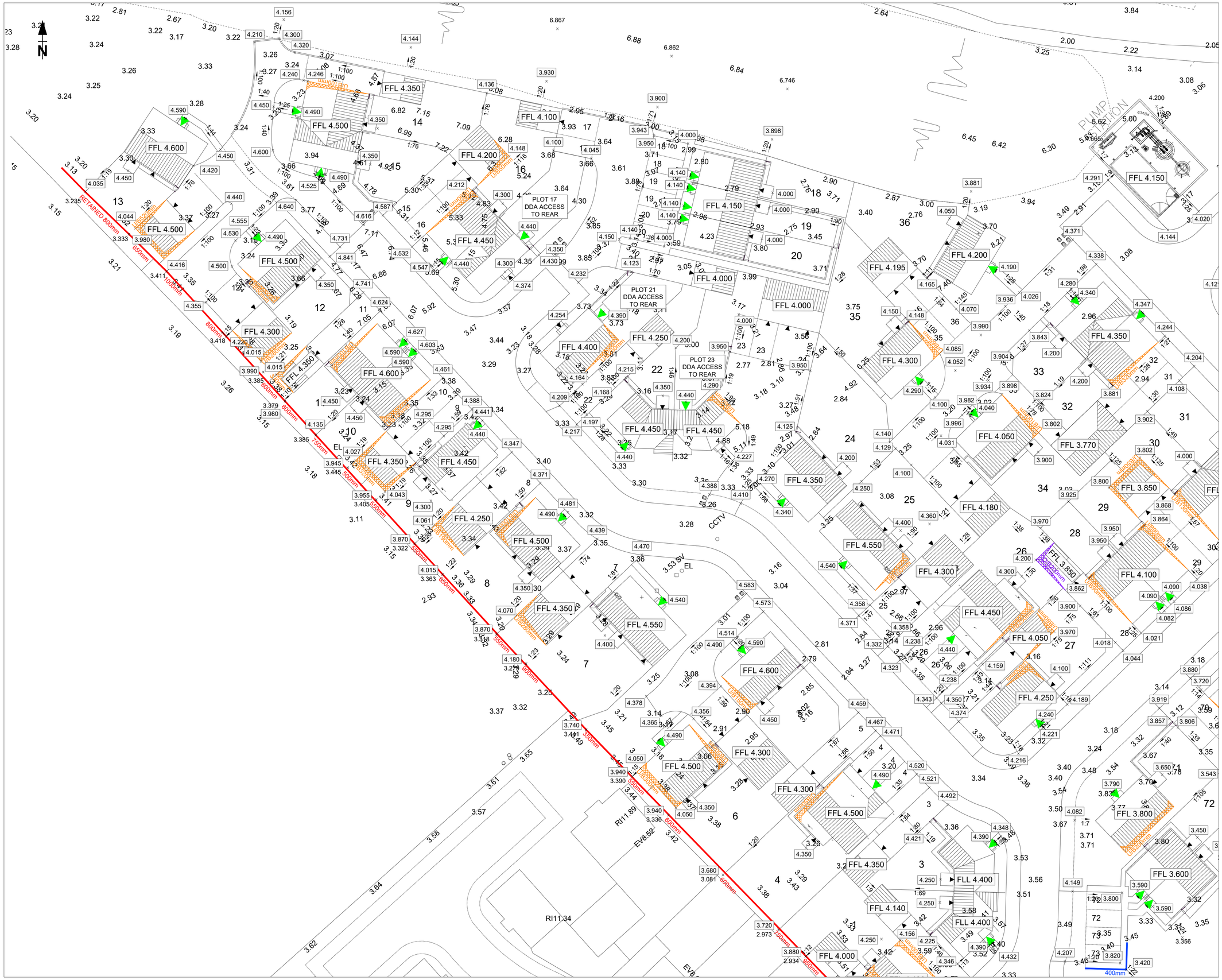
PROJECT:
PROPOSED RESIDENTIAL DEVELOPMENT AT LAND EAST OF CHAFFINCH WAY HOLBEACH

DRAWING TITLE:
SITE PLAN

SCALE: 1:500 @ A1 | DATE: 20.04.2022

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DRAWING No:
75 - SL - 01



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NOTES:

1. RETAINING STRUCTURES GENERAL PRINCIPLES

GRAVEL BOARD	MAX 350m	NOT SUITABLE AGAINST DRIVES, NEVER IN FRONT GARDENS
FLAG ON EDGE	0-500mm	MAX 225mm AGAINST DRIVES
WALL	225-200mm	AGAINST DRIVES,
	500-600mm	
	600mm +	SEPARATE DETAIL

2. LOG RETAINING WALLS MAY BE CONSIDERED IN LOCATIONS OTHER THEN IN BETWEEN PLOTS AND WILL BE ANNOTATED SEPARATELY.
3. THE LAYOUT WILL INDICATE THE MAXIMUM RETAINED HEIGHT ANY WALL SHALL STEP DOWN IN TYPE AND SCALE AS DETERMINED ON SITE.

KEY:

109.328	EXISTING SURVEY LEVEL
128.503 ×	PROPOSED SPOT LEVEL
FFL 129.07	PROPOSED FINISHED FLOOR LEVEL
U/B350mm	AREA OF UNDER BUILD
O/B350mm	AREA OF OVER BUILD
3S	STEPS - NUMBER SHOWN
▼	DDA ACCESS POINT

RETAINING STRUCTURE

- GRAVEL BOARD (GB)
- FLAG ON EDGE (FOB)
- RETAINING WALL (RW)

(DIMENSIONS SHOWN ON LOWER SIDE)

REV	DATE	NAME	CHECK	NOTE
C1	14/04/22	AJS	CR	CONSTRUCTION ISSUE

DRAWING STATUS:

CONSTRUCTION

CLIENT

ASHWOOD HOMES LTD

PROJECT

BALMORAL WAY PHASE 2

DRAWING TITLE

EXTERNAL WORKS SHEET 1

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AJS	CR	CR

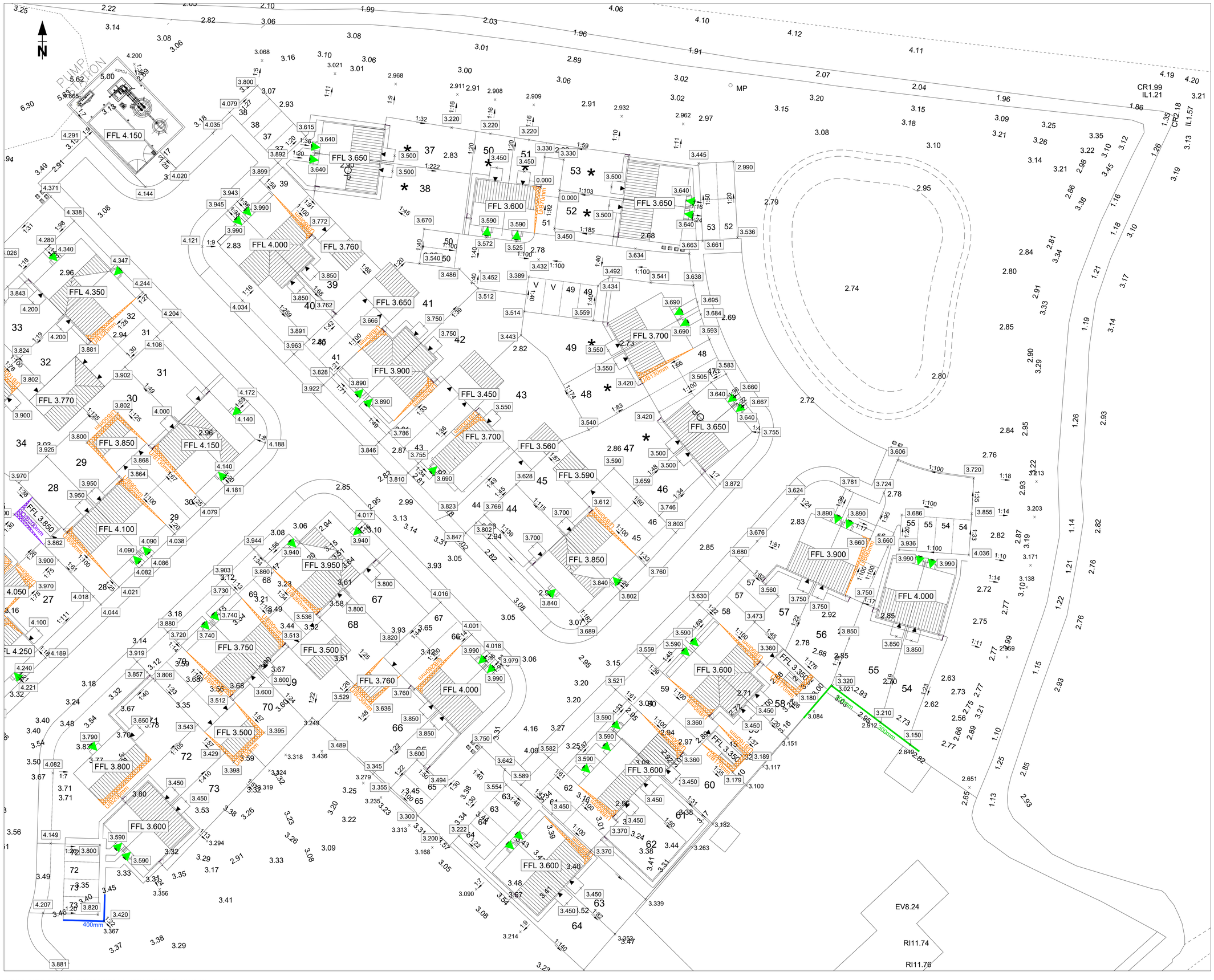
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DRAWING No.: AHL-1534-01-EW-001

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RETAINING STRUCTURE

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- FLAG ON EDGE (FOB)
- RETAINING WALL (RW)

(DIMENSIONS SHOWN ON LOWER SIDE)

REV	DATE	NAME	CHECK	NOTE
C1	14/04/22	AJS	CR	CONSTRUCTION ISSUE

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BALMORAL WAY PHASE 2

DRAWING TITLE

EXTERNAL WORKS
SHEET 2

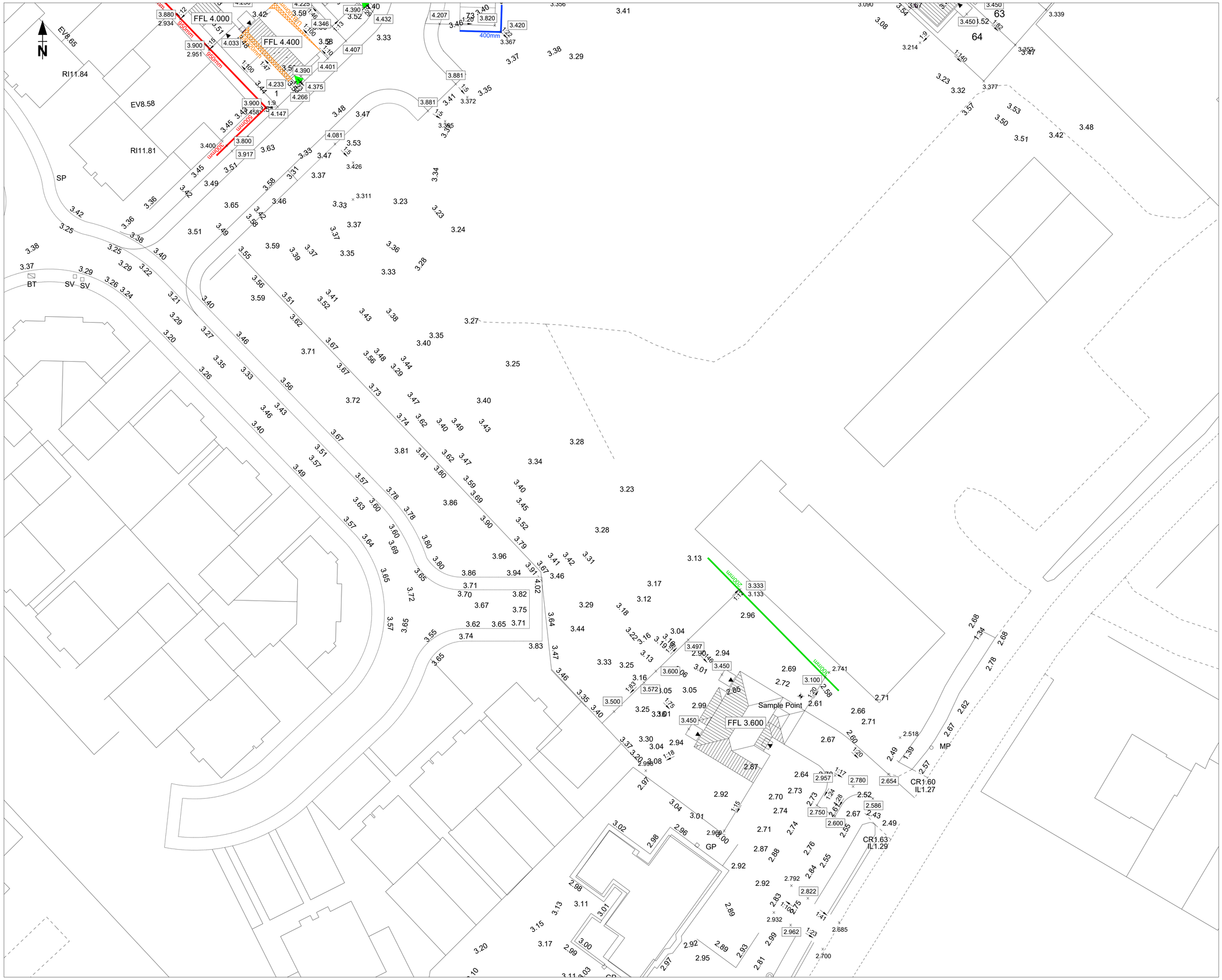
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- FLAG ON EDGE (FOB)
- RETAINING WALL (RW)

(DIMENSIONS SHOWN ON LOWER SIDE)

REV	DATE	NAME	CHECK	NOTE
C1	14/04/22	AJS	CR	CONSTRUCTION ISSUE

DRAWING STATUS:

CONSTRUCTION

CLIENT

ASHWOOD HOMES LTD

PROJECT

BALMORAL WAY PHASE 2

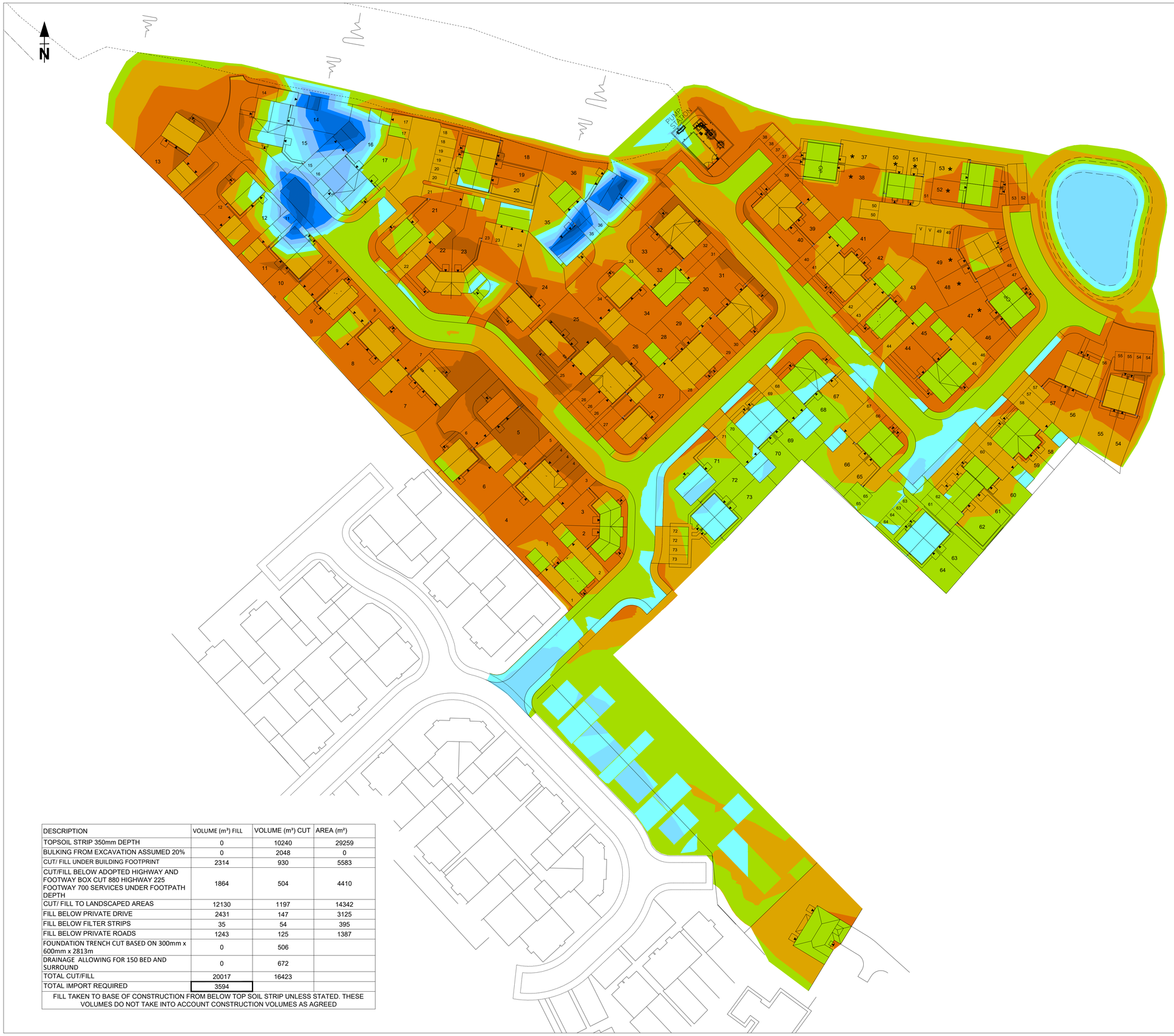
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EXTERNAL WORKS
SHEET 3

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AJS	CR	CR

DATE	SCALE @ A1
30 July 2021	1:250

DRAWING No.	REVISION No.
AHL-1534-01-EW-003	C1



DESCRIPTION	VOLUME (m³) FILL	VOLUME (m³) CUT	AREA (m²)
TOPSOIL STRIP 350mm DEPTH	0	10240	29259
BULKING FROM EXCAVATION ASSUMED 20%	0	2048	0
CUT/ FILL UNDER BUILDING FOOTPRINT	2314	930	5583
CUT/FILL BELOW ADOPTED HIGHWAY AND FOOTWAY BOX CUT 880 HIGHWAY 225 FOOTWAY 700 SERVICES UNDER FOOTPATH DEPTH	1864	504	4410
CUT/ FILL TO LANDSCAPED AREAS	12130	1197	14342
FILL BELOW PRIVATE DRIVE	2431	147	3125
FILL BELOW FILTER STRIPS	35	54	395
FILL BELOW PRIVATE ROADS	1243	125	1387
FOUNDATION TRENCH CUT BASED ON 300mm x 600mm x 2813m	0	506	
DRAINAGE ALLOWING FOR 150 BED AND SURROUND	0	672	
TOTAL CUT/FILL	20017	16423	
TOTAL IMPORT REQUIRED	3594		
FILL TAKEN TO BASE OF CONSTRUCTION FROM BELOW TOP SOIL STRIP UNLESS STATED. THESE VOLUMES DO NOT TAKE INTO ACCOUNT CONSTRUCTION VOLUMES AS AGREED			

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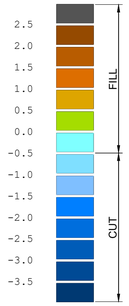
NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METERS UNLESS OTHERWISE STATED.

DEPTHS SHOWN FROM BASE OF TOP SOIL STRIP TO BASE OF CONSTRUCTION FORMATION AND FINISHED EXTERNAL LEVELS IN OPEN SPACES.

KEY:

HEIGHT RANGES



CONSTRUCTION DEPTHS:

FOOTWAY / SERVICE STRIPS	700mm
FOOTWAYS	225mm
CARRIAGEWAYS	880mm
PRIVATE DRIVES	250mm
PRIVATE ROADS	250mm

REV	DATE	NAME	CHECK	NOTE
C1	26/04/22	AJS	CR	CONSTRUCTION ISSUE

DRAWING STATUS:

CONSTRUCTION

CLIENT

ASHWOOD HOMES

PROJECT

BALMORAL WAY PHASE 2

DRAWING TITLE

ISOPACHYTE
BETWEEN TOPSOIL STRIP AND BASE OF CONSTRUCTION

DRAWN	CHECKED	APPROVED
AJS	CR	CR

DATE: 31 January 2022

SCALE @ A1: 1:500

DRAWING No.: AHL-1534-01-EW-004

REVISION No.: C1



DESCRIPTION	VOLUME (m³) FILL	VOLUME (m³) CUT	AREA (m²)
TOPSOIL STRIP 350mm DEPTH	0	10240	29259
BULKING FROM EXCAVATION ASSUMED 20%	0	2048	0
CUT/ FILL UNDER BUILDING FOOTPRINT	2314	930	5583
CUT/FILL BELOW ADOPTED HIGHWAY AND FOOTWAY BOX CUT 880 HIGHWAY 225 FOOTWAY 700 SERVICES UNDER FOOTPATH DEPTH	1864	504	4410
CUT/ FILL TO LANDSCAPED AREAS	12130	1197	14342
FILL BELOW PRIVATE DRIVE	2431	147	3125
FILL BELOW FILTER STRIPS	35	54	395
FILL BELOW PRIVATE ROADS	1243	125	1387
FOUNDATION TRENCH CUT BASED ON 300mm x 600mm x 2813m	0	506	
DRAINAGE ALLOWING FOR 150 BED AND SURROUND	0	672	
TOTAL CUT/FILL	20017	16423	
TOTAL IMPORT REQUIRED	3594		
FILL TAKEN TO BASE OF CONSTRUCTION FROM BELOW TOP SOIL STRIP UNLESS STATED. THESE VOLUMES DO NOT TAKE INTO ACCOUNT CONSTRUCTION VOLUMES AS AGREED			

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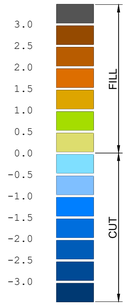
NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL MEASUREMENTS ARE IN METERS UNLESS OTHERWISE STATED.

DEPTHS SHOWN FROM BASE OF TOP SOIL STRIP TO EXTERNAL LEVELS.

KEY:

HEIGHT RANGES



CONSTRUCTION DEPTHS:

FOOTWAY / SERVICE STRIPS	700mm
FOOTWAYS	225mm
CARRIAGEWAYS	880mm
PRIVATE DRIVES	250mm
PRIVATE ROADS	250mm

REV	DATE	NAME	CHECK	NOTE
C1	26/04/22	AJS	CR	CONSTRUCTION ISSUE

DRAWING STATUS:

CONSTRUCTION

CLIENT

ASHWOOD HOMES

PROJECT

BALMORAL WAY PHASE 2

DRAWING TITLE

ISOPACHYTE
BETWEEN TOPSOIL STRIP AND FINISHED EXTERNAL LEVELS

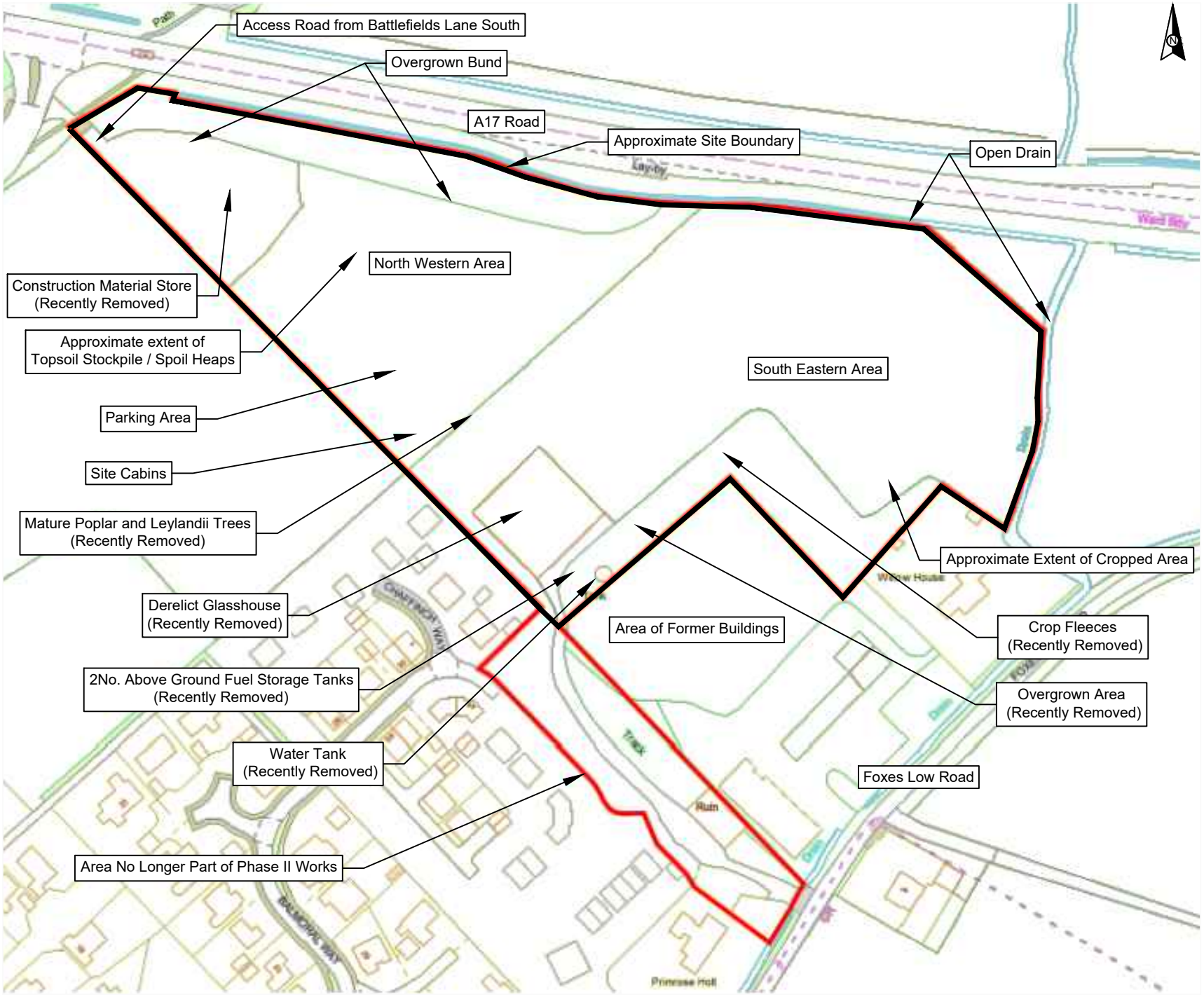
DRAWN	CHECKED	APPROVED
AJS	CR	CR

DATE	SCALE @ A1
02 Feburary 2022	1:500

DRAWING No.	REVISION No.
AHL-1534-01-EW-005	C1

APPENDIX III

Annotated Site Plan
(Figure No. D41012/R2)



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Project No.	D41012
Client	Ashwood Homes
Project	Phase 2 Balmoral Way Holbeach
Title	Annotated Site Plan
Drawn By	SJ
Checked By	DB
Approved By	PK
Scale	NTS
Date Drawn	21/04/2022
Revision	
Figure No.	D41012/R2

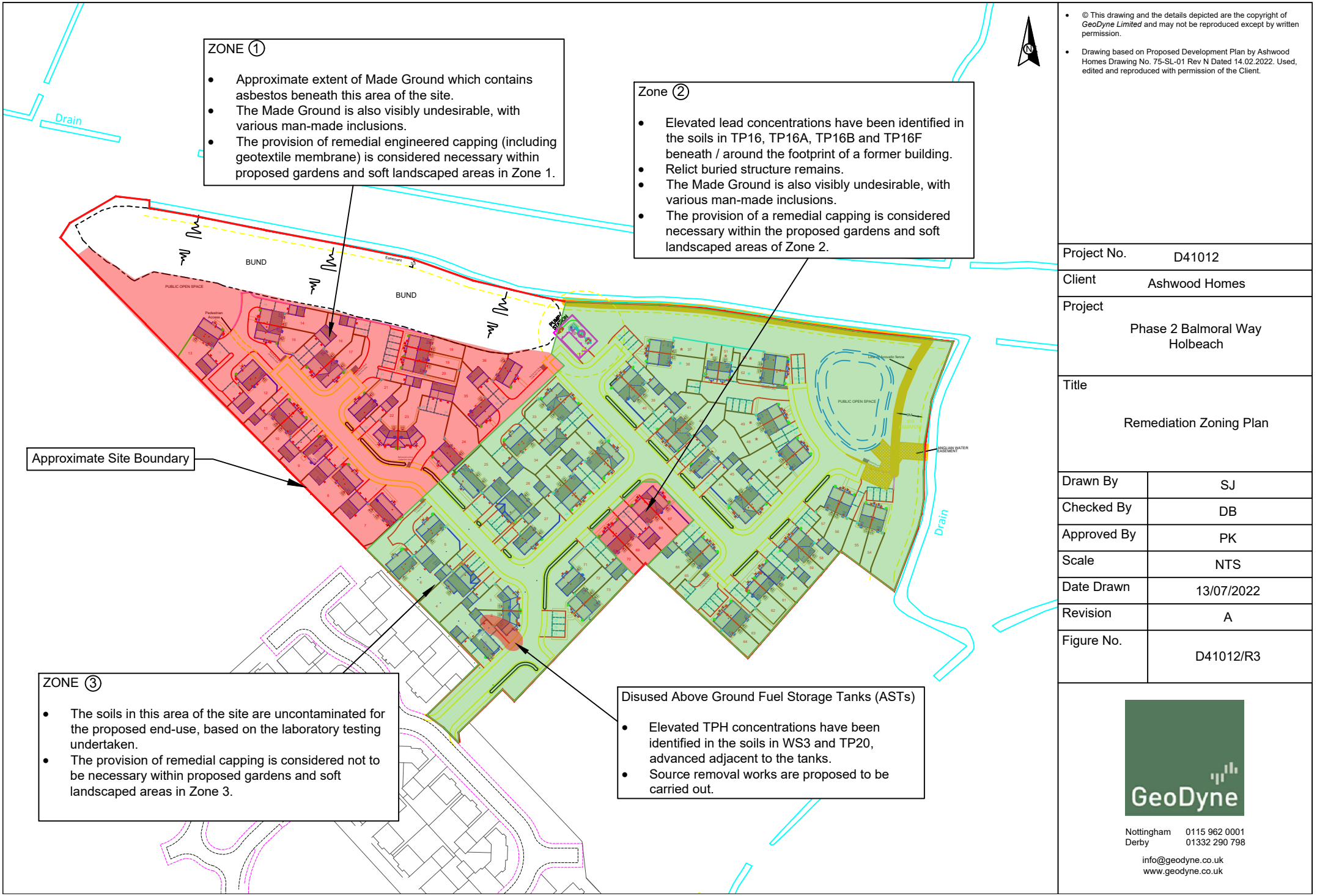
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APPENDIX IV

Remediation Zoning Plan
(Figure No. D41012/R3 Revision A)



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Project No.	D41012
Client	Ashwood Homes
Project	Phase 2 Balmoral Way Holbeach
Title	Remediation Zoning Plan
Drawn By	SJ
Checked By	DB
Approved By	PK
Scale	NTS
Date Drawn	13/07/2022
Revision	A
Figure No.	D41012/R3

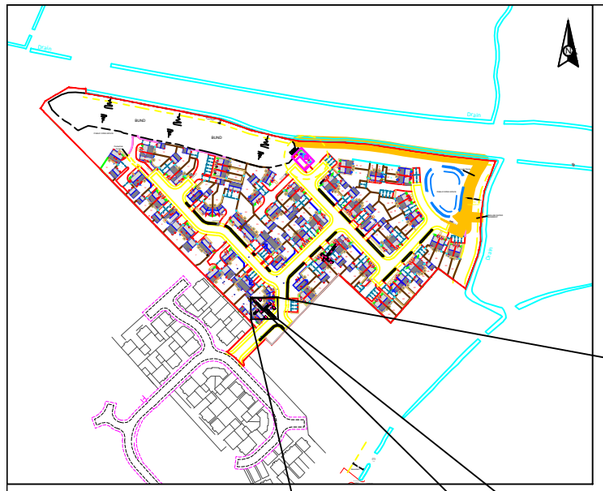
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APPENDIX V

Plan Showing Approximate Extent of Hydrocarbon Impacted Soils to be Remediated (Figure No. D41012/R4 Revision A)

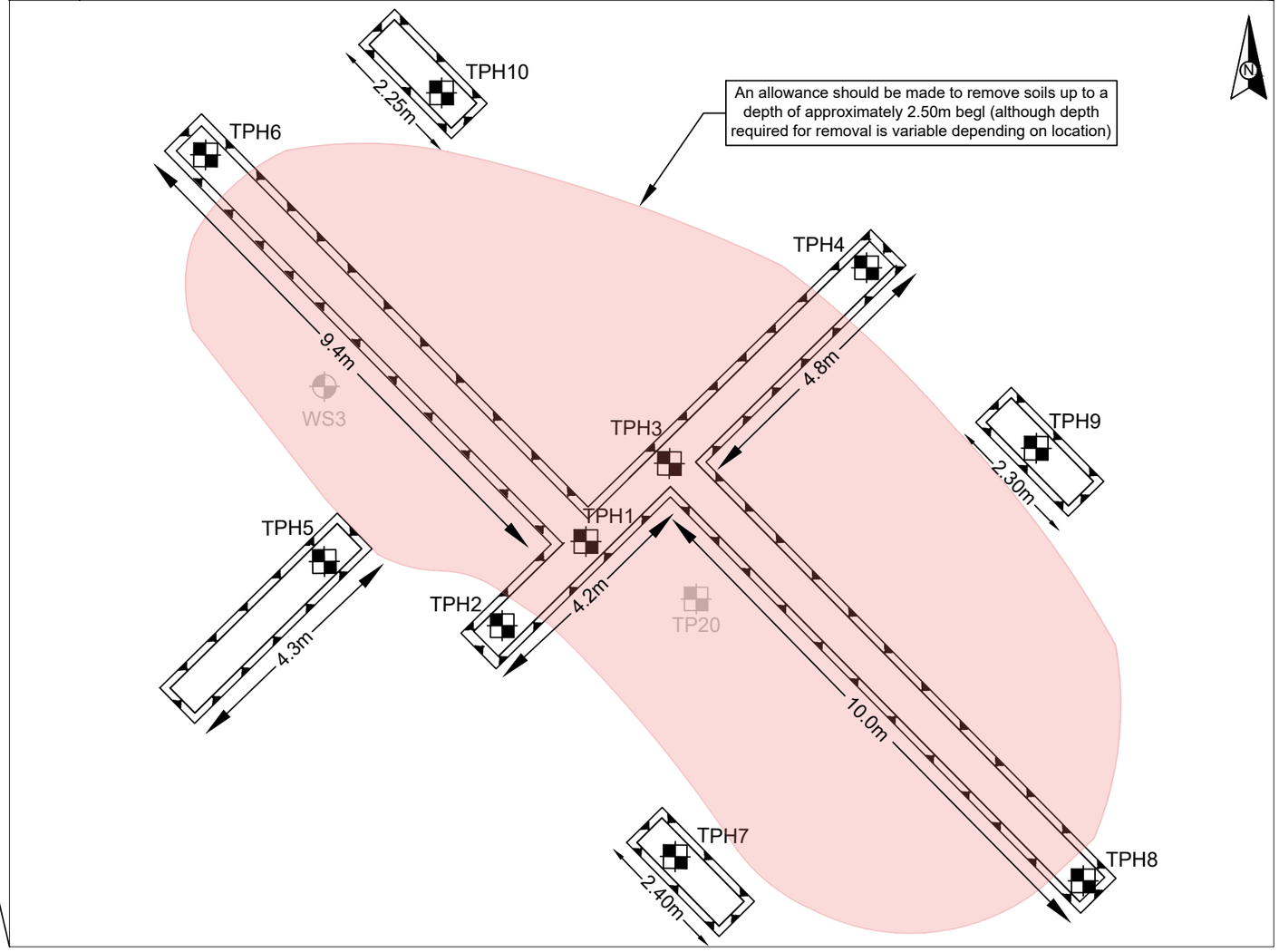


KEY

- Window Sample Borehole (Advanced February 2021)
- Trial Pit (Advanced February 2021)
- Sample Location
- Approximate Extent of Trial Pits and Trenches
- TPH Impacted Soils to be Remediated

NB: All locations shown are approximate

Sample Ref.	Depth	Sample Type	PID Reading
TPH1	1.50m	Natural sandy SILT with grey staining and a slight hydrocarbon odour	32.9ppm
TPH2	1.50m	Natural sandy SILT (No hydrocarbon odours or staining)	0ppm
TPH3	2.30m	Natural sandy SILT with grey staining and a slight hydrocarbon odour	42.6ppm
TPH4	1.50m	Natural sandy SILT (No hydrocarbon odours or staining)	0ppm
TPH5	1.50m	Natural sandy SILT (No hydrocarbon odours or staining)	0ppm
TPH6	2.00m	Natural sandy SILT (No hydrocarbon odours or staining)	0ppm
TPH7	1.50m	Natural sandy SILT (No hydrocarbon odours or staining)	0ppm
TPH8	2.00m	Natural sandy SILT (No hydrocarbon odours or staining)	0ppm
TPH9	1.80m	Natural sandy SILT (No hydrocarbon odours or staining)	0ppm
TPH10	1.70m	Natural sandy SILT (No hydrocarbon odours or staining)	0ppm



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Project No.	D41012
Client	Ashwood Homes
Project	Phase 2 Balmoral Way Holbeach
Title	Plan Showing Approximate Extent of Hydrocarbon Impacted Soils to be Remediated
Drawn By	SJ
Checked By	DB
Approved By	PK
Scale	NTS
Date Drawn	21/04/2022
Revision	A
Figure No.	D41012/R4

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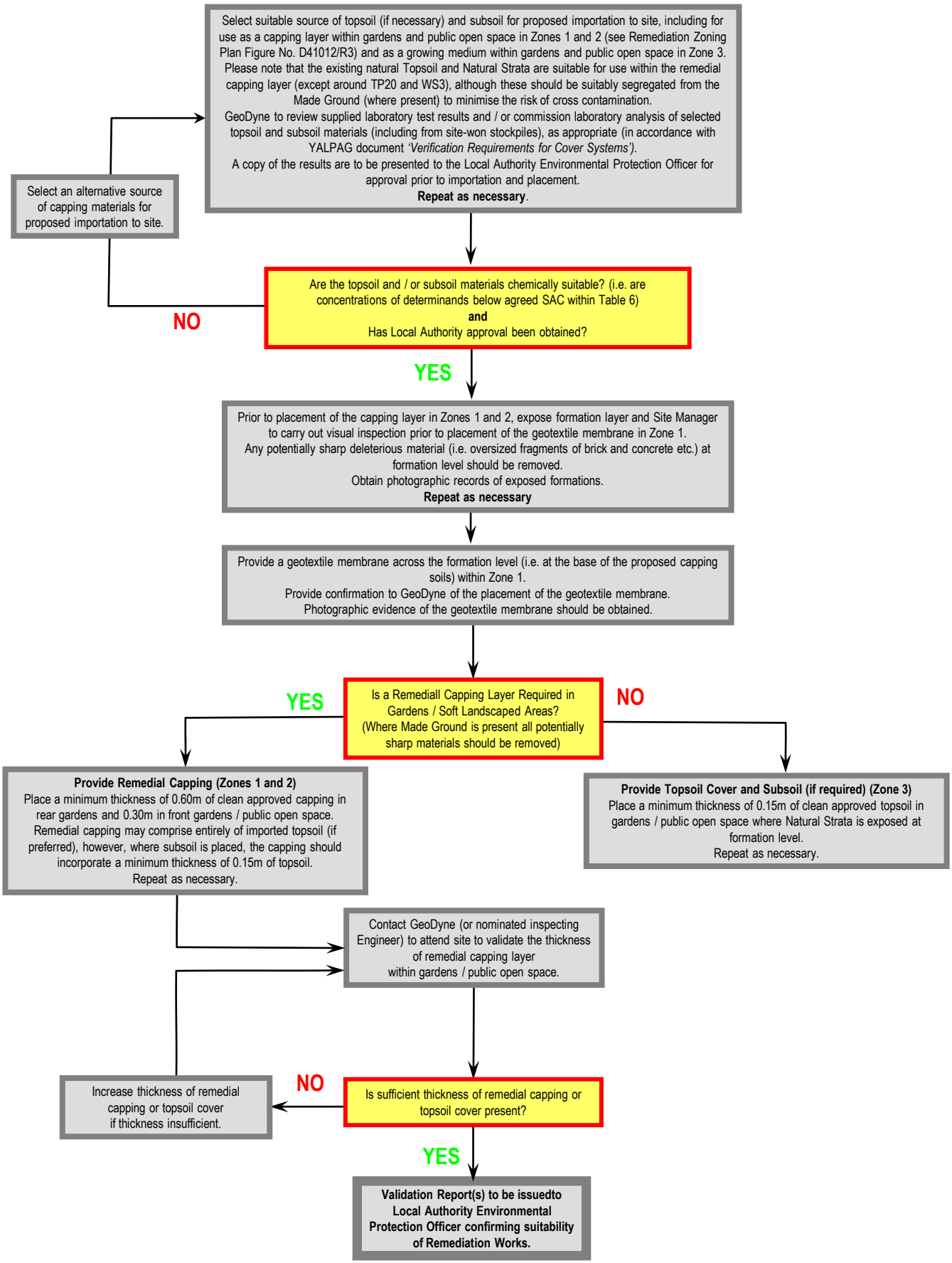
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APPENDIX VI

Remediation Validation Protocol

Client	Ashwood Homes
Project No.	D41012
Site	Phase 2 Balmoral Way, Holbeach
Date	July 2022
Comments	**Remediation Validation Protocol – Proposed Gardens and Soft Landscaped Areas**



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APPENDIX VII

Conditions & Limitations

Conditions & Limitations

Phase I Desk Studies

1. Works undertaken to provide the basis of the Phase I Desk Study report comprise a review of information available from a number of sources/parties (potentially also including the Client) together with a walk over of the site (where applicable and included within the quotation). The opinions given in the Phase I Desk Study are based on the information available from third parties/sources that has been obtained within the available timeframe. GeoDyne Limited assumes all third party information to be true and correct and therefore cannot accept liability for the accuracy of such information supplied.

2. Should additional information become available that may affect the comments and opinions made within the Phase I Desk Study, GeoDyne Limited reserves the right to review such information and make modifications to comments/opinions as appropriate.

3. It should be borne in mind that a Phase I Desk Study collates available information to generate a conceptual model of the site. The actual geotechnical and environmental considerations can only be fully quantified by intrusive investigation works to confirm the accuracy of the conceptual site model.

Phase II Intrusive Investigations

1. Our quotation assumes that access to the site will be arranged by others at no cost to ourselves.

2. We have assumed that free access is available throughout to the entire site and that works can be undertaken during a single mobilisation. Where restricted access is encountered, or where additional unscheduled mobilisations are required, additional costs may be incurred to the client.

3. We have assumed that all available information relating to buried services will be supplied by the Client at no cost to ourselves. No responsibility will be accepted for damage to underground services that have not been brought to our prior attention by the Client.

4. All excavations/boreholes will be backfilled with compacted arisings upon completion, with any excess arisings left proud of ground levels. Excess arisings will not be removed from the site unless specifically requested by the Client. Where we are requested to remove excess arisings, all associated costs will be passed to the Client.

5. We will attempt to leave the site in a clean and tidy state, however, it must be understood that some disturbance of the site is unavoidable during intrusive works.

6. Exploratory holes are positioned approximately on site by GeoDyne Limited. Should the client require precise locations of all exploratory points, additional fees will be incurred. It must be borne in mind that backfilled trial pits can create ‘soft spots’, therefore, should the Client wish to designate ‘no dig’ zones, for example under the footprint of proposed structures, these must be brought to our attention prior to commencement of works.

7. Groundwater observations relate to conditions encountered at the time of investigation. It must be understood that groundwater levels may vary as a result of recent climatic conditions or seasonal variation.

8. Trial pits and boreholes examine only a small proportion of the total site area. No liability can be accepted for conditions not revealed in exploratory holes, particularly between positions. All extrapolations of available data are given in good faith.

Payment

1 Payment terms are strictly 28 days from the invoice date.

2 Prior to commencement of works, we require receipt of formal written instruction from the party accepting full financial responsibility for the work. In the absence of such an instruction, we would expect the instructing Consulting Engineers/Architects to accept full financial responsibility for the works.

3 Receipt of instruction to commence work shall be taken as acceptance and compliance of the foregoing conditions.

Liability

1. GeoDyne Limited offer £5,000,000.00 Professional Indemnity Insurance (in aggregate over the year). This shall be the limit of our liability for works undertaken. No individual liability shall be implied to, or accepted by, any employee for works undertaken for and on the behalf of GeoDyne Limited.