Proposed Amendment No. 8

Building Height & Density Review,

including Related & Ancillary Amendments

(Urban Design, Green Infrastructure, Amended Appendix E Tufa Springs Mitigation Requirements, New Appendix H Indicative Street Sections showing Proposed Maximum Building Heights and New Appendix I Guidance with regard to Sunlight and Daylight Assessment of Proposed Developments).

To

Cherrywood Planning Scheme 2014

(as amended)

May 2021

(including Modifications/Material Alterations, approved on 25th April 2023 and came into effect as and from 6th July 2023)

PROPOSED AMENDMENTS TO THE CHERRYWOOD PLANNING SCHEME

Proposed Amendment No. 8 to the Cherrywood Planning Scheme seeks to increase the Building Heights in Cherrywood at certain locations. This review of the building heights was carried out in response to SPPR 3 (Part B) of the Urban Development and Building Heights Guidelines for Planning Authorities, December 2018 which requires the following:

SPPR 3 (Part B) requires the following:

> *'It is a specific planning policy requirement that where;*
>
> *(B) In the case of an adopted Planning Scheme the Development Agency in conjunction with the relevant planning authority (where different) shall, upon the coming into force of these guidelines, undertake a review of the Planning Scheme, utilising the relevant mechanisms as set out in the Planning and Development Act 2000 (as amended) to ensure that the criteria above are fully reflected in the Planning Scheme. In particular the Government policy that building heights be generally increased in appropriate urban locations shall be articulated in any amendment(s) to the Planning Scheme.*

With regard to this Amendment, Cherrywood Development Agency Project Team (DAPT) commissioned the following consultants to advise and assist in the preparation of this amendment.

- **Loci Consultants.** Loci specialise in urban design and placemaking and were commissioned to carry out an independent review of the building heights in the Cherrywood Planning Scheme area and prepare a Background Technical Report Document outlining the findings of this review. This document accompanies this Amendment submission to An Bord Pleanála.

- **CSC (Chris Shackleton Consulting). CSC specialise in Skylight/Daylight and Sunlight assessment and** were commissioned to carryout out aa Skylight, Daylight and Sunlight Assessment on the Town Centre and the impact that an increase in height would have on the Town Centre sites. A copy of the CSC , Cherrywood Town Centre Building Height Review, Skylight, Sunlight and Shadow Analysis Report accompanies this amendment.

- **JBA Consulting:** The Hydrogeology Section of JBA was commissioned to review Appendix E of the Planning Scheme which refers to Hydrogeology in the Cherrywood Planning Scheme area, particularly with regard to Tufa Spring No. 5. JBA carried out extensive site investigations on behalf of the DAPT on the catchment area of Tufa Spring No. 5 in Spring 2019. As a result of the findings of these site investigations updates have been made to Appendix E of the Planning Scheme which relates to Hydrogeology in the Planning Scheme area with particular reference to 2 No. Tufa Spring formations. A copy of the JBA Report outlining the findings of these site investigations, dated May 2019, accompanies this amendment and forms the basis of the proposed amendments and updates to Appendix E and the associated specific objectives of the Cherrywood Planning Scheme.

It was also considered an appropriate time to carry out a review of the residential densities in the approved Planning Scheme on the residential zoned sites having regard to the Apartment Guidelines introduced in 2015 and 2018. These Guidelines resulted in a reduced gross and net apartment size from that which had been utilised in the original Planning Scheme. This increase in density has been applied primarily to Res 3 and Res 4 sites noting that these sites will consist of primarily apartment

type development. The Town and Village Centres already received an uplift in dwelling numbers under Amendment 1-4 approved by An Bord Pleanála. It is noted that the maximum number of dwellings proposed in the Planning Scheme is now circa 10,500, which is considered to be the maximum number of new homes the proposed physical and social infrastructure proposed for the Planning Scheme area, can sustainably support.

This current document outlines the proposed amendments to the Planning Scheme. For clarity, this amendment document takes account of **Amendment No. 7 of the Cherrywood Planning Scheme 2014 (as amended) -Beckett Road Re-alignment and Ancillary Amendments as approved by An Bord Pleanála on the 14th of April 2021, ABP Case Number: ABP-308753-20.**

New text, including changes to the Tables in the Approved Planning Scheme on foot of this amendment are indicated in red text. Text to be deleted on foot of this amendment from the Approved Planning Scheme document is indicated with a ~~strikethrough~~.

For the purposes of including variations or modifications, further additions to the text of the proposed Amendment, as applicable, and text in the adopted Cherrywood SDZ Planning Scheme, 2014, as amended, Written Statement (latest version April 2021) are identified through the use of (bold underlined) **blue print**.

For ease of reference the proposed amendments to the Approved Planning Scheme are detailed in order of page number in the Approved Planning Scheme document. The existing maps, figures and tables are also included alongside the proposed amended maps, figures and tables for ease of reference.

The following changes are proposed to the Approved Planning Scheme.

Note: Reference to the page numbers in this document have being amended from the original sub-mission to An Bord Pleanála due to the Beckett Road Re-alignment and Ancillary amendments (Amendment No. 7) having being approved by the Bord in the interim on the 14th April 2021.

CHAPTER 1: PLANNING SCHEME

No changes

CHAPTER 2: PROPOSED DEVELOPMENT IN CHERRYWOOD

PAGE 13

Proposed Amended Table 2.2 Overall Development Quantum Range

Development Type	(A) Min Quantum	(B) Max Quantum	(C) Development Permitted/Constructed Feb 2012	D=(B-C) Balance Max Future Quantum
Town Centre Sq.m	286,894	362,909	7,247	355,662
Village Centre Sq.m	41,855	~~61,625~~ 71,925	--	~~61,625~~ 71,925
High Intensity Employment Sq.m	267,550	350,000	96,000	254,000
Commercial Uses Sq.m	65,000*	--	--	77,000*
Residential	Circa 6,255	Circa ~~8,786~~ 10,500	Circa 600 units	Circa 9,906
Education	4 Primary 2 Post Primary	4 Primary 2 Post Primary	--	4 Primary 2 Post Primary
Class One HA	27	~~29.7~~ 32.5	--	~~29.7~~ 32.5

Proposed Amended Table 2.3 Town and Village Centre Development Quantum Ranges.

	Net Site Area HA	Min/Mx Gross Retail Floor Space Sq.m	Min/Max Gross Residential Floor Space Sq.m	Min/Max High Intensity Employment Gross Sq.m	Min/Max Non-Retail Uses Net Sq.m	Community Sq.m
Cherrywood Town Centre	16.1	34,394/40,909	120,000/150,000	82,800/109,000	47,500/ 60,000	2,200/3,000
Tully	1.2	4,000/6,060	12,000/~~18,000~~ 19,500	750/1,000	750/1,000	250/500
Lehaunstown	0.9	1,515/3,790	9,000/ ~~12,000~~ 14,800	700/1,000	700/1,000	250/500
Priorsland	0.9	1,290/2,275	9,000/ ~~12,000~~ 18,000	700/1000	700/1000	250/500
MAX TOTALS	**19.1 HA**	**41,199/53,034SQ.M**	**150,000/~~192,000~~ 202,300**	**84,950/112,000SQ.M**	**49,650/ 63,000 sq.m**	**2,950/ 4,500 sq.m**

PAGE 14

Proposed Amended Table 2.4: Town and Village Centre Plot Ratio Ranges

	Min Plot Ratio	Max Plot Ratio
Cherrywood Town Centre	1:1.7	1:2.3
Tully	1:1.5	~~1:2.2~~ 1:2.3
Lehaunstown	1:1.4	~~1:2~~ 1:2.3
Priorsland	1:1.3	~~1:2~~ 1:2.5

PAGE 14

Proposed Amended Section 2.7.2

Section 2.7.2 Residential Density Range and Housing Mix

Having regard to the principles set out in Section 1.7 the maximum number of residential units envisaged by this Scheme is circa ~~8,786~~ 10,500 units. As of February 2012, circa. 600 residential units had been developed within the Scheme area. A maximum of circa ~~1,600~~ 2,160 residential units are to be located in the Town Centre and the three Village Centres. The total quantum of residential land under the Planning Scheme is 76 ha net, which can support up to ~~6,136~~ 7,747 dwellings.

PAGE 15

Proposed Amended Table 2.9 Residential Development Density Ranges and Development Yield.

Density Type	Land Area HA	% Split	Min Density Range*	Max Density Range*	Min Units	Max Units
Res 1	3.9	5%	35	~~50~~ 55	137	~~195~~ 215
Res 2	44.5	58.5%	45	~~70~~ 75	2,003	~~3,073~~ 3,338
Res 3	21.8	28.5%	65	~~100~~ 145	1,417	~~2,130~~ 3,161
Res 4	5.9	8%	85	~~125~~ 175	502	~~738~~ 1,033
Mixed Use Areas	N/a	N/a	N/a	N/a	Circa 1,596	Circa ~~2,050~~ 2,160
Developed to date	N/a	N/a	N/a	N/a	600	600
TOTALS	**76**	**100%**	**-**	**-**	**Circa 6,255**	**Circa ~~8,786~~ 10,500**

Insert the following additional paragraph as a sixth and final paragraph under Table 2.9 Residential Development Density Ranges and Development Yield (on page 15 of the Cherrywood Planning Scheme document),

'The current number of dwelling units that have been completed within the Planning Scheme area on Res 1, 2, 3 and 4 lands from the date of the adoption of the Planning Scheme in April 2014 to 17 October 2022, is 210 no. dwelling units. A further circa 369 no. dwelling units are under active construction.

The total number of permitted dwellings units across all the Res 1, Res, 2, Res 3 and Res 4 lands is 1,212 no. dwellings to date, as of October 2022.

It is relevant that 1,508 no. dwelling units have been permitted in the Town Centre, 431 no. of which have been completed and a further 520 no. are under construction, as of October 2022.'

PAGE 15

Section 2.7.4 Part V Provisions

Delete the following text from Specific Objective PD 6

All residential development, including those in the mixed-use areas of the Town Centre and the Village Centre will fulfil the social and affordable requirements of Part V of the Planning and Development Act 2000 as amended. ~~The Dún Laoghaire-Rathdown County Development Plan 2010-2016 has a 20% requirement for social and affordable housing.~~ At all times the requirements of the current County Development Plan and Housing Strategies will also apply to residential development in the Planning Scheme.

PAGE 15

Section 2.7.5 Existing Residential Dwelling Houses

Add the following text to amend a typo under this section.

There are a number of existing dwelling houses within the Strategic Development Zone and Planning Scheme boundary. These homes are located in Development Areas 4 and 6b in the Scheme. The Planning Authority will consider planning applications for extensions or improvements to existing dwellings that are not considered likely to impact negatively on the development potential of adjoining sites or the provision of infrastructure within the Scheme. Such applications will be assessed in accordance with the current County Development Plan and will not be subject to the phasing and sequencing of infrastructure set out in the Planning Scheme.

PAGE 15

Section 2.8 Urban Form

Insert the following text in red under Section 2.8 Urban Form

Distinctiveness: That the place has recognisable features so that people can describe where they live and form an emotional attachment to the place.

That the layout makes the most of the opportunities presented by existing features on sites such as buildings, landform, archaeological and ecological features, and that the proposal also successfully exploits views into and out of the site.

Page 16

Insert the following after Public Realm

Design: A well-designed place contributes to local distinctiveness and identity. Developments shall fully consider the site's context, the layout – the pattern of streets, landscape and spaces, the movement network and the arrangement of development blocks, the form, scale, design, materials and details of buildings and landscape.

PAGE 16

Amend Specific Objectives PD 7 to PD 15 as follows:

PD 7 Design Statement

The Planning Scheme seeks to ~~To~~ promote the development of each area as a distinct and legible new neighbourhood with an individual character achieved through~~,~~ ~~concept, design style~~ ~~and use of materials.~~ the full consideration of the site's context, development layout, street pattern, landscaping, open space, movement network as well as the arrangement of development blocks (form, scale, height, design, materials) and the detailing of buildings and landscaping.

In this regard a design statement referring to the character of the specific development area shall be submitted with each application. This shall have regard to the unique character of each Development Area as set out in Chapter 6 and shall set out a baseline understanding of the local context and an analysis of local character and identity noting Section 2.8 Urban Form and specific objectives PD 8-PD 29. Refer also to Section 2.9.1 **Criteria for assessing Building Height in the Planning Scheme.**

The Design Statement shall demonstrate and not be limited to:

- How the development enhances the surroundings.
- How the development connects with its surroundings whether visually, historically, or physically in terms of permeability.
- How the development responds to the characteristics of the site and any features (natural, historical or otherwise) on site.
- How the identity of the development is one that is attractive and distinctive.
- That the development consists of a coherent built form.
- Accessibility and ease of movement.
- Enhances and optimises nature.
- The provision of public spaces that are safe, social and inclusive.
- The provision of appropriate uses and integration of those uses.

PD 8 Distinctive Neighbourhoods

Each individual neighbourhood will be locally distinct, created by the design, detailing and materials of buildings and landscape and by including ~~with~~ individual features ~~including~~ such as public art and civic landmarks to form its character. It should incorporate focal points utilising views in and out of the area as identified in Section 2.11.

PD 9 Principal Frontages and Streetscape

To provide for principal frontages in each development plot to define strong streetscape elements, turn corners on public roads, and enclose and overlook amenity open space areas and green routes. These are identified on Map 2.4 and are indicative in length to allow for sufficient flexibility in breakages and access points.

Streets shall be a focus of activity, creating active frontages with street accesses into buildings animating the public realm. They shall be designed as places, not just for cars but as a distinct component of the public realm and amenity. Home zones shall form part of the design where appropriate to create shared areas.

PD 10 Layout

To require the layout of residential areas ~~to~~ and block form to create an appropriate network of streets and spaces and maximise pedestrian and cyclist permeability with clear, legible, safe, attractive and direct routes for pedestrians and cyclists along anticipated desire lines, with safe edge treatment, clear sight lines at eye level and an appropriate level of passive supervision.

PD 11 Inclusivity and Innovative Building Typologies

To ensure that innovative building typologies are used throughout Cherrywood for life long living and that address issues of car parking, private open space, and the need for high quality residential amenity. To ensure that these buildings have a greater engagement with the varying road and green way layout.

PD 12 Sustainability, Microclimate and Sunlight/Daylight/Shadow Analysis

To ensure a sustainable built form with best practice sustainable design, construction methods and materials, which has regard to solar effect, wind tunnelling prevention and microclimate. Adaptable residential building design, which is responsive to changing ethnical /economic and social conditions, is generally encouraged.

Applicants are referred to Appendix I of the Planning Scheme which provides guidance on what is required in Sunlight and Daylight assessments submitted as part of planning applications for new developments.

~~**PD 13**~~

~~To ensure that frontage widths of individual buildings and massing allow for their successful integration into the streetscapes.~~

PD 13 Massing and Scale

Development shall ensure that the scale and proportions of buildings enhance streetscapes and create appropriately scaled spaces and streets between them. Breaks shall be provided so as to allow for pedestrian permeability, penetration of sunlight and daylight and an optimum micro-climate. Long monolithic facades shall be avoided.

PD 14 Materials and Detailing

To ensure that a distinctiveness of materials is used at various scales, and the detailing of those materials allows ~~allowing~~ for a coherent and high-quality built environment, with an individual palette to identify each neighbourhood. High quality finishes are to be used in the public realm, including external elevational treatment to buildings, structures and public open space. The materials shall be:

- Appropriate to the scale, form and appearance of the building and its surroundings.
- Attractive and durable.
- Contribute to visual appeal and local distinctiveness.

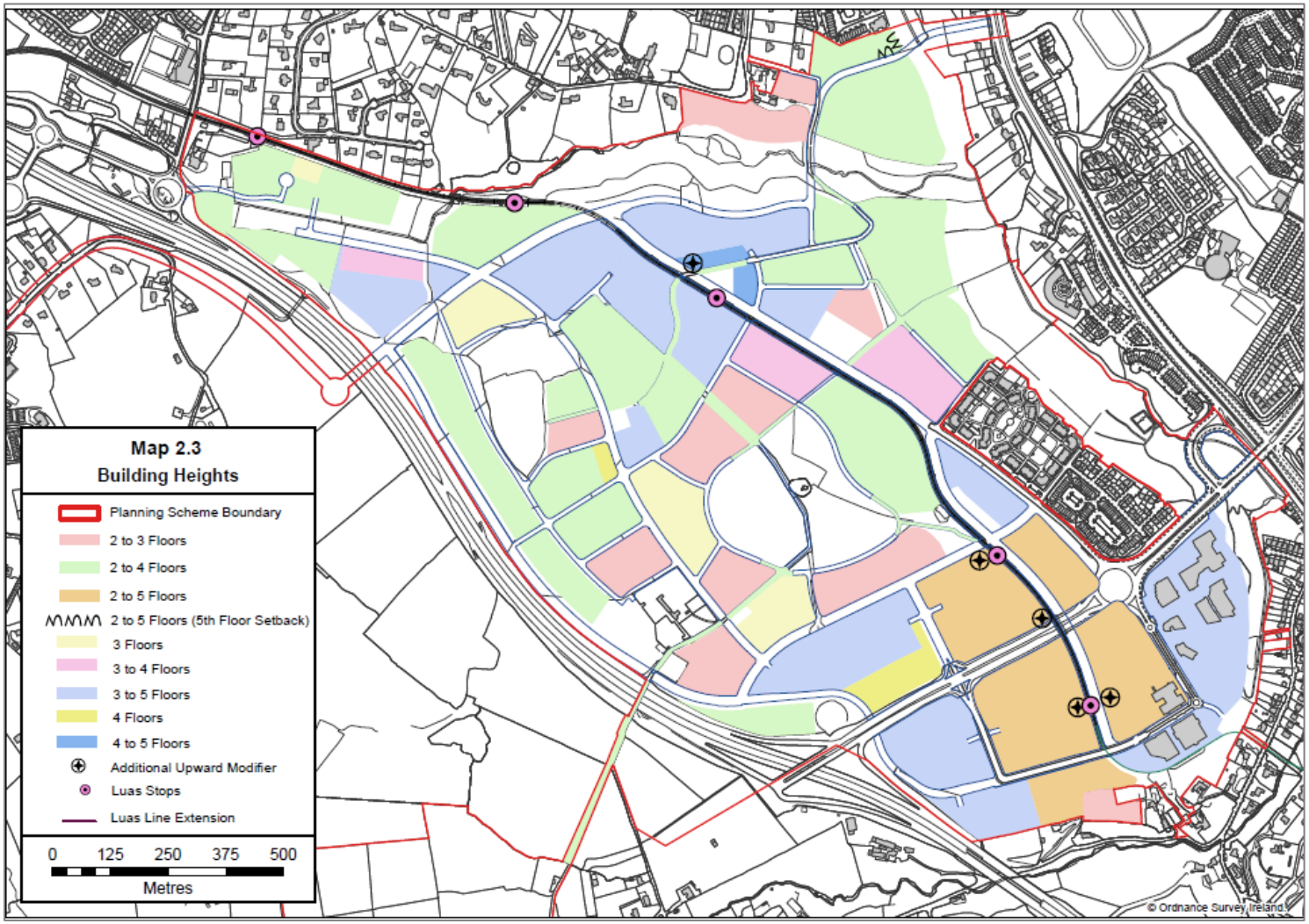
A material and finishes palette guide will be required post-adoption of the Planning Scheme.

PD 15 Ancillary Structures

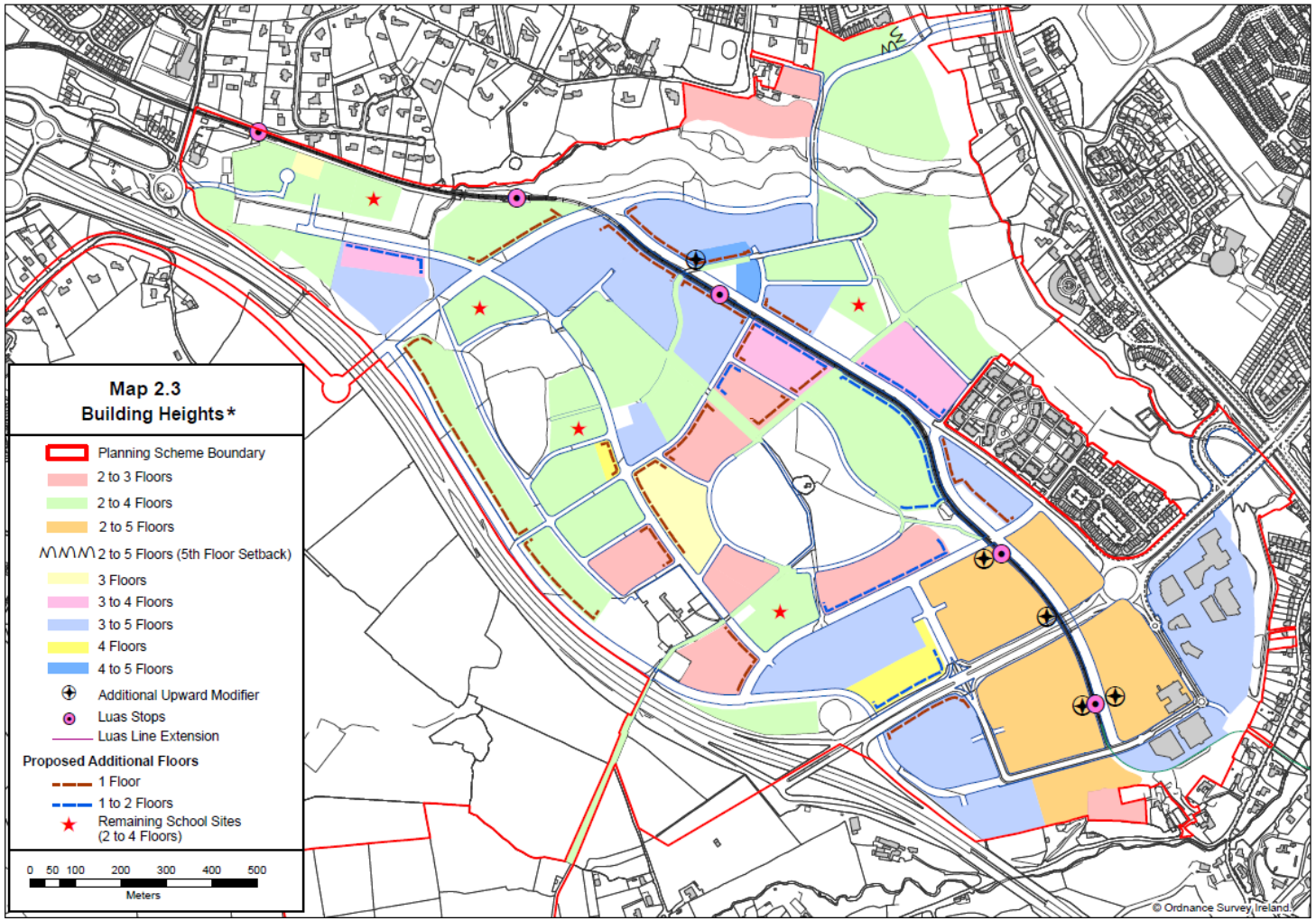
To promote the strategic design and appropriate location of bin-stores, service boxes, ESB substations and similar ancillary provision, including meter boxes, into the curtilage of developments or as positive design features that enhance the local streetscape and do not register as visual clutter. Applicants are advised to consider ESB Networks requirements with regard to safety, design, location etc. of ESB stations early during the design process of their development.

PAGE 16 **Amend Map 2.3 Building Heights**

Approved Map 2.3 Building Heights



Proposed Amended Map 2.3 Building Heights



*Subject to proposals clearly demonstrating that they address all of the Criteria for Assessing Building Height under Section 2.9.1 of the Planning Scheme

PAGE 18

Insert the following text into Section 2.8.2 Skyline.

2.8.2 Skyline

Due to the undulating landscape, the skyline will be an important feature in Cherrywood, when viewed both externally and internally within Cherrywood from existing and future neighbouring developments. Regard must be given to roof profiles, roofing materials and visual interest in the preparation of planning applications. Applications will be required to demonstrate how this is addressed.

Amend Specific Objective PD 19 as follows:

PD 19 Services on roofs, including lift and stair over runs, ventilation and smoke shafts, photovoltaic cells and other plant and services will be so designed and sited ~~covered and designed~~ so as not to be visually prominent. In this regard:

- Where possible, structures shall be set back from the building edge.
- Natural ventilation of buildings will be promoted.
- Roof structures shall be appropriately screened.
- Materials of structures and screening shall be of a high quality and light in colour.
- All structures on roofs shall be limited in number and size and avoided where possible.

Amend Section 2.9 Building Heights as follows:

2.9 Building Heights

The topography of Cherrywood is widely varying throughout with 3 Valleys and the high point at Tully Church. Building height in Cherrywood will respect and reflect the local topography, the location and context of the site, scale and use of adjoining buildings and the microclimate it creates. Building height shall contribute towards, urban legibility and visual diversity.

~~In the Town Centre and Village Centres, additional height, , is acceptable to provide legibility and clarity to make these areas distinctive. taller buildings, can also be acceptable local landmark and feature buildings to articulate important locations such as Luas stops and at entrance points to the Town Centre, as outlined in Table 2.11 and Map 2.3.~~

~~The ground level of the Town Centre will alter across the Town Centre lands so as to join at grade with the Luas Line. The new ground level will be the level from which building heights will be determined in the Town Centre (see Chapter 6). Where a building addresses two streets building height will be measured from the higher street.~~

It is an objective of the Planning Scheme (Specific Objective PD21) to ensure that Cherrywood is developed in accordance with height limits as set out in Map 2.3 Building Height subject to the building making a positive contribution to the built form, to the criteria in Section 2.9.1 and the Specific Objectives in the Planning Scheme.

For clarity the following shall apply:

- The ground level of the Town Centre will alter across the Town Centre lands so as to join at grade with the Luas Line. The new ground level will be the level from which building heights will be determined in the Town Centre (see Chapter 6). Where a building addresses two streets within the Town Centre, building height will be measured from the higher street.

- A residential floor when measured externally can be up to 3.4m in general, and up to 4.5m when measured externally for ground floor units within Res 3 and Res 4 areas. A floor height of all other uses is 4.5m.

- The maximum height is measured externally from the ground floor to the building shoulder height/external wall height and excludes parapets, safety railings/walls/balustrades, green roofs, photovoltaics, lift overruns and plant, noting that the latter should be kept to a minimum and all to be of a reasonable height to be agreed with the Planning Authority.

- Architectural features which stand above the main maximum building height as set out on Map 2.3 Building Heights, will be considered where it is demonstrated that they enhance the building quality, contribute to urban legibility and allow for variance in roof design or add distinctiveness to a building. These elements shall not include floor area and are purely for architectural expression. All development proposals will need to demonstrate that protected views and prospects are retained in accordance with Section 2.11 of the Planning Scheme in this regard.

Add a 4th bullet point to Section 2.9 Building Heights as follows:

- **For the Commercial Plots, in instances where buildings do not follow the normal pattern of floors/storeys, consideration may be given to such uses based on the equivalent building height in metres. This relates specifically to the Commercial Uses (CU) plots only. In such instances, the Applicant shall set out a rationale for same having regard to the nature of the uses. The onus shall be on the Applicant to adequately detail the rationale and to demonstrate that visually the proposal will not have an undue overbearing impact, and/or to introduce design elements to reduce the appearance of the resultant massing and scale.**

Delete Table 2.11 Building Heights and associated footnote.

Insert New Section 2.9.1 Criteria for Assessing Building Height in the Planning Scheme Area.

2.9.1 Criteria for Assessing Building Height in the Planning Scheme Area.

Applicants are required to submit a Design Statement (See also Specific Objective PD 7) as part of their planning application. The Design Statement shall demonstrate to the satisfaction of the Planning Authority that the proposed building heights have addressed the criteria below and are in accordance with the building height range for the application site as set out on Map 2.3.

Proposals seeking to increase building height on a site in accordance with Map 2.3 by way of an amendment planning application to an existing permission shall clearly demonstrate that the proposed additional height has been considered as an integral and holistic part of the overall redesign of the building/development and enhances both the development and the surrounding area.

The Design Statement shall demonstrate how the proposal addresses the following criteria;

- Where a planning application seeks to utilise the proposed additional floors as set out on Map 2.3, this provision shall apply to the identified street or space frontage only. The extent of the additional floor/s shall be limited in depth and should extend no more than circa

20 metres back from the frontage (as normally defined by the front building line). This shall be clearly demonstrated in the design statement and the drawings submitted.

- All planning applications shall demonstrate the protection of the designated views and prospects in the Cherrywood Planning Scheme. This may require careful positioning and/or articulation or disaggregation of additional floors.

- Demonstrate how the proposal includes appropriate articulation of the roof form and roofscape. This may include disaggregation of additional floors, variation in building/floor heights, and limiting the extent of additional floors along frontages.

To insert a new bullet point into Section 2.9.1 as Bullet Point 4

- **All planning applications shall demonstrate how the proposal achieves an appropriate balance between height and scale, contributes to variety in design, incorporates an element of finer grain at the street level and prominent elevations, and includes design elements to safeguard against monolithic and monotonous buildings. Proposals shall demonstrate visual variety across a plot where appropriate, neighbouring plots or development areas and also along the streetscape frontage.**

- Demonstrate that the proposal results in appropriate street proportions and enclosure. This will need to be supported by detailed street and block sections and studies.

- Demonstrates appropriate continuity and enclosure of public space. This will need to be supported by detailed street and block sections and studies, and an assessment of the impact on microclimate and sun lighting and daylighting. Refer to Appendix I, **Guidance with regard to Sunlight and Daylight Assessment of Proposed Developments** in this regard.

- Demonstrate appropriate continuity and enclosure of private and semi-private amenity and courtyard spaces. This will need to be supported by detailed block sections and studies, and an assessment of the impact on microclimate and sun lighting and daylighting. Refer to Appendix I, **Guidance with regard to Sunlight and Daylight Assessment of Proposed Developments** in this regard.

- Demonstrate appropriate regard to the amenity of neighbouring properties and / or sites in terms of shadow impact, overbearing or other amenity consideration, including development which falls outside but is located along the Planning Scheme Boundary.

- Demonstrate that the proposed heights are a clear and additional contribution to the design quality of the proposal, in terms of design rationale and execution, quality and durability of materials and attention to, and execution of, detailing.

- Proposal shall demonstrate maximisation of adaptable and sustainable unit typologies– for example, by maximising passive solar access through the use of dual aspect residential units, ensuring potential for passive ventilation, etc.

- All proposals shall demonstrate that they shall enhance or not detract from sensitive sites including inter alia protected structures, national monuments, archaeological sites, natural habitats, protected treelines and hedgerows and tufa springs.

- Demonstrate that proposals along the Luas line have regard to the Light Rail Environment -Technical Guidelines for Development, December 2020, Transport Infrastructure Ireland. The stated purpose of these Guidelines is to ensure that the operational safety and efficiency of the light rail are maintained while improvements in accessibility, permeability and interfaces with the public realm where possible are facilitated.

- Sites within the protection zone of Tufa Spring No. 5, as identified under Appendix E of the Planning Scheme, or within proximity of Tufa Spring No. 11, are required to demonstrate through site investigations as outlined under Appendix E, and the Ecology Report submitted as part of a planning application that proposed developments on these sites will not cause significant impacts on the Tufa Springs. The consideration of the Tufa Springs may impact the overall design of a development proposal.

- Additional height as set out on Map 2.3 of the Planning Scheme shall only be acceptable where the applicant has clearly demonstrated to the satisfaction of the Planning Authority that these additional floors would not impact adversely on meeting the above criteria.

Amend Specific Objective PD 21 as follows:

PD 21 To allow building height within the range of storeys identified and set out on Map 2.3 subject to Section 2.9.1 Criteria for Assessing Building Height in the Planning Scheme. These heights have been informed by the characteristics of each site and are the maximum permissible on each development plot.

PD 22 Local landmark and feature building elements ~~over the stated building heights~~ are acceptable at important locations, where they contribute to the visual amenity, civic importance and legibility of the area. These buildings are identified by the use of upward modifiers ~~in Table 2.11~~ and act as focal points or gateways, emphasising hierarchy and urban activity in the Town and Village Centre~~s~~ and public transport nodes, at locations identified in Map 2.3. Upward modifiers are defined as a local increase in height, of an 'element' of a building, up to additional 3 storeys in the Town Centre and up to 2 additional storeys in the Village Centre. Such structures shall be slender in appearance so as to serve their function as a local landmark.

Amend Specific Objectives PD 23 as follows:

PD 23 It is an objective to encourage the use of 'adaptable' ground floor residential units with a greater internal floor to ceiling heights of up to 4.5 metres, in Village Centres, along the Grand Parade and adjacent to Cherrywood Town Centre where increased overall building heights are proposed.

CHAPTER 3: CULTURAL AND BUILT HERITAGE

No changes.

CHAPTER 4: PHYSICAL INFRASTRUCTURE

No changes.

CHAPTER 5: GREEN INFRASTRUCTURE

PAGE 53: Amend Table 5.1: Main Classification of Open Space

Typology	Classification	Planned provision	Approx Size	Description
Natural Green Space		Druid's Glen	circa 6.5ha	River Valley
		Lehaunstown Valley	circa 18ha	River Valley
		Linear Park	circa 5ha	Valley
		Druid's Glen Buffer	circa 2.5ha	Ecological buffer to Druid's Glen
		Sub-total	**circa 32ha**	
Amenity Open Space, Class 1	Class 1 Park	Tully Park	circa 9ha	High profile, high quality and distinctive flagship park
	Class 1 Park	Beckett Park	circa 5ha	Major local park that provides for a range of needs for a number of neighbourhoods.
	Class 1 Park	Parade Green	circa 1ha	Small local park that provides for the needs of the local neighbourhood.
	Class 1 Park	Priorsland Park	circa 1ha	Small local park that provides for the needs of the local neighbourhood.
	Outdoor Sports	Synthetic sports pitch	circa 1.5ha	Outdoor synthetic sports pitch with ancillary facilities
	Outdoor Sports	Ticknick Park	circa ~~12.2~~ 15ha	Grassed sports pitches with ancillary facilities
	Amenity Open Space, Class 1 (sub-total)		**circa ~~29.7~~ 32.5 ha**	
Amenity Open Space, Class 2	Pocket Park	Lehaunstown Lane (3nr	qualitative	3 small parks (circa 0.2ha) associated with adjacent residential areas.
	Pocket Park	Tufa Springs	qualitative	Public open space associated with Tufa Springs.
	Neighbourhood Plaza	Lehaunstown Village Green	circa 0.2ha	Small, formal open space associated with Lehaunstown Village centre
	Neighbourhood Plaza	Tully Village Green	circa 0.2ha	Small, formal open space associated with Tully Village centre.
	Neighbourhood Plaza	By Luas tunnel	qualitative	Small civic open space over Luas tunnel
	Pocket Park	Cairn/Wedge Tomb	circa 0.7ha	Small civic open space which provides a setting for the Cairn/Wedge Tomb Site
	Play Facilities		qualitative	Communal open space within residential areas
	Community Garden		qualitative	Communal open space within residential areas.
	Civic Space	Town Centre Links	To be agreed as per Urban Form Development Framework	Civic space within Cherrywood Town Centre
Greenways		Lehaunstown Lane	n/a	Pedestrian/ cycle link, habitat link
		Tully Park link	n/a	Pedestrian/ cycle link between Town Centre and Tully Park, habitat link
		Beckett Park link	n/a	Pedestrian/ cycle link from Lehaunstown Lane to Beckett Park via Tully Village, habitat link
Green Corridors	SuDS	M50 green corridor		Landscaped area
	SuDS	Swales		Landscaped area
	SuDS	Priorsland flood containment		Landscaped area

Amend Section 5.2.1 Components of the Cherrywood Way

The total area of planned and incidental green infrastructure (not including infrastructural SuDS provision) equates to circa ~~3~~ 2.3 ha. per 1,000 planned maximum residential population (circa ~~23,722~~ 26,000) . It is noted that approximately half of this provision is not suitable for recreational usage because of topography, biodiversity, sustainable drainage, flooding and other environmental considerations. The amount of planned amenity open space (Class 1 and Class 2 open space) is equivalent to circa ~~1.4~~ 1.25ha / 1,000 planned residential population (circa ~~23,722~~ 26,000) (see Map 5.1). This includes the open space provision shared by schools.

Page 60

GI 61

Ensure the protection of calcareous (tufa) springs and the area surrounding them by having no ~~net effect~~ significant impact on the hydrogeological and other physical conditions on which these springs rely. Any Planning Application that is located within the hydrogeological catchment of these areas as outlined in the protection zone map of the Hydrogeological Study in Appendix E will have to be accompanied by evidence of how this will be achieved. Collection of hydrogeological data may be required ~~in some cases~~ to prove that there will be no ~~effect~~ significant impact on these features.

CHAPTER 6: DEVELOPMENT AREAS

Section 6.1 Development Area 1: Lehaunstown

PAGE 66:

Change Name DA 9 to DA9(a) and DA9 (b) Split this Objective into 2 parts with a new Part DA 9(b)

DA 9 (a)

Prior to a planning application being submitted on the Res 4 plot in Development Area 1 Lehaunstown or Res 3 plot in Development Area 4 Domville, both located on the southern side of the Grand Parade, the land owner shall enter into a discussion with the Local Authority to explore the potential of relocating the Travellers Accommodation site in the Res 4 plot to the Res 3 plot.

Insert Specific Objective DA 9 (b)

With regard to the same Res 4 Plot, the applicant shall follow the Hydrogeology Guidance outlined in Appendix E of the Planning Scheme with regard to the design of proposed development on sites within the catchment sensitivity zone of Tufa Spring No. 5 in order to protect the hydrology source, as detailed in Chapter 5 Green Infrastructure (see GI30 and Appendix E).

The layout and design of proposed developments on sites identified as been within the protection zone of the Tufa Springs, as indicated in Appendix E of the Planning Scheme , shall be informed by site investigations , as outlined in Appendix E, which are to be carried out in advance of the preliminary design of any proposals for these sites. Proposals on these sites shall demonstrate that they will have no significant impact on Tufa Spring No. 5 and shall be accompanied by an ecology report demonstrating the same.

PAGE 66

Amend Table 6.1.1 Sub-headings Lehaunstown Village Centre and Residential Development.

Amendments in red text. Deleted text in ~~strikethrough.~~

LEHAUNSTOWN VILLAGE CENTRE		
Total Village Centre Lands HA		**0.9**
RETAIL SQ.M		
	Min	**Max**
	Net/Gross	**Net/Gross**
1 no. Supermarket	600/905	1,500/2,274
Local Retail	200/305	500/758
Retail Services	200/305	500/758
Total Retail Quantum Village Centre	**Min Net/Gross**	**Max Net Gross**
	1,000/1,515	2,500/3,790
RESIDENTIAL VILLAGE CENTRE		
Residential Dwelling Units	**Min**	**Max**
	Circa 95	Circa ~~130~~ 160
Gross Residential Floor Area Sq.m	**Min**	**Max**
	Circa 9,000	Circa ~~12,000~~ 14,800
NON-RESIDENTIAL USES		
Non-Retail Uses	**Min**	**Max**
	700	1,000
High Intensity Employment	**Min**	**Max**
	700	1,000
Community Facilities	**Min**	**Max**
	250	500
Total Non-Residential Floor Area Sq.m	**Min**	**Max**
	1,650	2,500
TOTAL FLOORSPACE QUANTUM LEHAUNSTOWN VILLAGE CENTRE SQ.M	**Min**	**Max**
	12,165	**~~18,290~~** **21,090**
Plot Ratio	**Min**	**Max**
	1:1.4	~~1:2~~ 1:2.3
Site Coverage	**Min**	**Max**
	40%	60%
Building Height in Storeys	**Min**	**Max**
	4	~~5~~ 6

RESIDENTIAL DEVELOPMENT		
Total Residential Lands HA	**17.7**	
	Land Area HA	**Density Range**
Res 1	0	~~35-50~~ 35-55
Res 2	6.4	~~45-70~~ 45-75
Res 3	6.9	~~65-100~~ 65-145
Res 4	4.4	~~85-125~~ 85-175
No. of Dwellings on Residential Lands	**Min**	**Max**
	1,112	~~1,818~~ 2,251
Overall Residential Density	**Min**	**Max**
	63 per ha	~~95 per ha~~ 127 per ha
Building Height in Storeys	2	~~5~~ 6
No. of Dwellings in Village Centre	**Min**	**Max**
	95	~~130~~ 160
TOTAL NO. OF RESIDENTIAL DWELLINGS	**Min**	**Max**
	Circa 1,207	Circa ~~1,818~~ Circa 2,411

Section 6.2: Development Area 2: Cherrywood

PAGE 70

Amend Table 6.2.1: Sub-heading Residential Development in Development Area 2 Cherrywood

Amendments in red text. Deleted text in ~~strikethrough.~~

Proposed Amended Table 6.2.1: Sub-heading Residential Development

RESIDENTIAL DEVELOPMENT		
Total Residential Lands HA	**4**	
	Land Area HA	**Density Range**
Res 1	0	~~35-50~~ 35-55
Res 2	2.5	~~45-70~~ 45-75
Res 3	0	~~65-100~~ 65-145
Res 4	1.5	~~85-125~~ 85-175
No. of Dwellings on Residential Lands	**Min**	**Max**
	240	~~363~~ 450
Overall Residential Density	**Min**	**Max**
	60 per ha	~~91 per ha~~ 113 per ha
Building Height in Storeys	2	~~5~~ 6
No. of Dwellings in Town Centre	**Min**	**Max**
	Circa 1,276	Circa 1,600
TOTAL NO. OF RESIDENTIAL DWELLINGS	**Min**	**Max**
	Circa 1,516	Circa ~~1,963~~ Circa 2,050

Section 6.3 Development Area 3: Priorsland

PAGE 73

Amend Table 6.3.1: Development Type and Quantum for Development Area 3 Priorsland, Sub-Headings Priorsland Village Centre and Residential Development.

Amendments in red text. Deleted text in ~~strikethrough.~~

PRIORSLAND VILLAGE CENTRE		
Total Village Centre Lands HA		**0.9**
RETAIL SQ.M		
	Min	**Max**
	Net/Gross	**Net/Gross**
1 no. Supermarket	550/834	900/1,365
Local Retail	150/228	300/455
Retail Services	150/228	300/455
Total Retail Quantum Village Centre	**Min Net/Gross**	**Max Net Gross**
	850/1,290	1,500/2,275
RESIDENTIAL VILLAGE CENTRE		
Residential Dwelling Units	**Min**	**Max**
	Circa 95	~~Circa 130~~ Circa 200
Gross Residential Floor Area Sq.m	**Min**	**Max**
	Circa 9,000	Circa ~~12,000~~ 18,000
NON-RESIDENTIAL USES		
Non-Retail Uses	**Min**	**Max**
	700	1,000
High Intensity Employment	**Min**	**Max**
	700	1,000
Community Facilities	**Min**	**Max**
	250	500
Total Non-Residential Floor Area Sq.m	**Min**	**Max**
	1,650	2,500
TOTAL FLOORSPACE QUANTUM PRIORSLAND VILLAGE CENTRE SQ.M	**Min**	**Max**
	11,940	~~**16,775**~~ **22,775**
Plot Ratio	**Min**	**Max**
	1:1.4	~~1:2~~ 1:2.5
Site Coverage	**Min**	**Max**
	40%	60%
Building Height in Storeys	**Min**	**Max**
	3	~~4~~ 6

RESIDENTIAL DEVELOPMENT		
Total Residential Lands HA	**9.2**	
	Land Area HA	**Density Range**
Res 1	0	~~35-50~~ 35-55
Res 2	4.5	~~45-70~~ 45-75
Res 3	4.7	~~65-100~~ 65-145
Res 4	0	~~85-125~~ 85-175
No. of Dwellings on Residential Lands	**Min** Circa 508	**Max** ~~785~~ Circa 1019
Overall Residential Density	**Min** 55 per ha	**Max** ~~85 per ha~~ 111 per ha
Building Height in Storeys	2	~~5~~ 6
No. of Dwellings in Village Centre	**Min** Circa 95	**Max** ~~Circa 130~~ Circa 200
TOTAL NO. OF RESIDENTIAL DWELLINGS	**Min** Circa 603	**Max** ~~Circa 915~~ Circa 1,219

Section 6.4 Development Area 4: Domville

PAGE 74

Amend Approved Objective DA 30 as follows:

DA 30

a) To provide a Class 2 open space pocket park in close proximity to the Springs and to follow the Hydrogeology Guidance outlined in Appendix E of the Planning Scheme with regard to the design of proposed development on sites within the catchment sensitivity zone of Tufa Spring No. 5 in order to protect the hydrology source, as detailed in Chapter 5 Green Infrastructure (see GI30 and Appendix E).

b) The layout and design of proposed developments on sites identified as been within the protection zone of the Tufa Spring No. 5, as indicated in Appendix E of the Planning Scheme , shall be informed by site investigations , as outlined in Appendix E, which are to be carried out in advance, by the applicant, of the preliminary design of any proposals for these sites. Proposals on these sites shall demonstrate that they will have no significant impact on Tufa Spring No. 5 and shall be accompanied by an ecological report demonstrating the same.

PAGE 75

Amend table 6.4.1: Development Type and Quantum for Development Area 4 Domville Sub-Heading Residential Development.

Please note there was a typographical error in this Table in the Approved Planning Scheme stating that the max height in this area was 4 storeys when it is actually 5 as indicated on one of the Res 3 sites on Map 2.3; Building Heights, of the Planning Scheme document.

Amendments in red text. Deleted text in ~~strikethrough.~~

RESIDENTIAL DEVELOPMENT		
Total Residential Lands HA	**12**	
	Land Area HA	**Density Range**
Res 1	0	~~35-50~~ 35-55
Res 2	6.4	~~45-70~~ 45-75
Res 3	5.6	~~65-100~~ 65-145
Res 4	0	~~85-125~~ 85-175
No. of Dwellings on Residential Lands	**Min**	**Max**
	Circa 652	~~1,008~~ Circa 1,292
Overall Residential Density	**Min**	**Max**
	54 per ha	~~84 per ha~~ 108 per ha
Building Height in Storeys	2	~~4~~ 6
Residential Dwellings Constructed February 2012	**Min**	**Max**
	600	
TOTAL NO. OF RESIDENTIAL DWELLINGS	**Min**	**Max**
	Circa 1,252	~~1,608~~ Circa 1,892

Section 6.5 Development Area 5: Druid's Glen

PAGE 77

Amend table 6.5.1: Development Type and Quantum for Development Area 5 Druid's Glen, Sub-Heading Residential Development.

RESIDENTIAL DEVELOPMENT		
Total Residential Lands HA	**8.5**	
	Land Area HA	**Density Range**
Res 1	2.6	~~35-50~~ 35-55
Res 2	5.9	~~45-70~~ 45-75
Res 3	0	~~65-100~~ 65-145
Res 4	0	~~85-125~~ 85-175
No. of Dwellings on Residential Lands	**Min**	**Max**
	Circa 357	~~543~~ Circa 586
Overall Residential Density	**Min**	**Max**
	42 per ha	~~64 per ha~~ 69 per ha
Building Height in Storeys	2	4
TOTAL NO. OF RESIDENTIAL DWELLINGS	**Min**	**Max**
	Circa 357	~~543~~ Circa 586

Section 6.6: Development Area 6 Bride's Glen

Insert New Specific Objective **DA 40 (b)** on PAGE 78

A building of appropriate scale, massing, design and quality should be located at the interface of the Town Centre, Brides Glen Square, the Luas line and Green Linear Park, south of the Brides Glen Square on HIE2 lands, to provide a visual focal point at these key public realm and civic spaces.

***There is an allowance of a transfer of 3,000 sqm of floorspace between HIE 1 and HIE 2 whilst maintaining the overall area permissible in HIE 1 & HIE 2 combined (Refer to Table 6.6.1). (This transfer between the HIE 1 and HIE 2 plots is subject to the agreement between the HIE 1 and HIE 2 landowners)**

PAGE 79

To take account of proposed physical infrastructure lands not utilised for the approved Regional Pond 5A system in Development Area 6 :

Amend as follows,

Table 6.6.1: Development Type and Quantum for Development Area 6 Bride's Glen, Sub-Heading Residential Development.

RESIDENTIAL DEVELOPMENT		
Total Residential Lands HA	~~**2.2**~~ 2.5	
	Land Area HA	**Density Range**
Res 1	0.7	~~35-50~~ 35-55
Res 2	~~1.5~~ **1.8 ***	~~45-70~~ 45-75
TOTAL NO. OF RESIDENTIAL DWELLINGS	**Min**	**Max**
	~~Circa 93~~ **Circa 106**	~~140 Circa 151~~ **174**

***Includes an allowance of circa 0.3ha of land zoned Physical Infrastructure but that may not be utilised for the Regional Pond 5A system, and which may be used for residential development.**

Section 6.7: Development Area 7 Macnebury

PAGE 81

Proposed Amended table 6.7.1: Development Type and Quantum for Development Area 7 Macnebury, Sub-Headings, Non-Residential Development, Commercial Uses and Residential Development.

NON-RESIDENTIAL DEVELOPMENT	
HIGH INTENSITY EMPLOYMENT	
High Intensity Employment Lands HA	4.95
Max Quantum Sq.m	74,000
BREAKDOWN FOR SITE HIE 4	
Area HA	3.4
Max Quantum Sq.m	58,000
Plot Ratio	**Max**
	1: 1.7
Building Height in Storeys	**Max**
	~~5~~ 6
BREAKDOWN FOR SITE HIE 5	
Area HA	1.55
Max Quantum Sq.m	19,000
Plot Ratio	**Max**
	1:1.2
Building Height in Storeys	**Max**
	~~4~~ 6

Commercial Uses		
Commercial Uses Lands HA	2.9	
Min Quantum Sq.m	29,000	
Site CU 2		
Area HA	1.6	
Min Quantum Sq.m	16,000	
Min Plot Ratio	Min	
	1:1	
Building Height in Storeys	**Min**	**Max**
	2	~~4~~ 5
Site CU 3		
Area HA	1.3	
Min Quantum Sq.m	13,000	
Min Plot Ratio	**Min**	
	1:1	
Building Height in Storeys	**Min**	**Max**
	2	~~3~~ 4

RESIDENTIAL DEVELOPMENT		
Total Residential Lands	**5.5**	
	Land Area HA	**Density Range**
Res 1	0	~~35-50~~ 35-55
Res 2	1.8	~~45-70~~ 45-75
Res 3	4.6	~~65-100~~ 65-145
Res 4	0	~~85-125~~ 85-175
No. of Dwellings on Residential Lands	**Min**	**Max**
	380	~~494~~ 802
Overall residential Density	**Min**	**Max**
	69 per ha	~~93~~ 146 per ha
Building Height in Storeys	**Min**	**Max**
	2	5
TOTAL NO. OF RESIDENTIAL DWELLINGS	**Min**	**Max**
	~~321~~ 380	~~494~~ 802

Section 6.8 Development Area 8: Tully

PAGE 83 AND PAGE 84

Insert New DA 48 (b)

With regard to the built form of the Tully Village Centre, urban scale and variation in building height shall contribute to a well-designed, high quality development, with elements of fine grain. Extensive monolithic blocks should be avoided, and in this regard, the design shall incorporate a roofscape and building form that presents with visual and architectural variety, including for example, set-backs, breaks in form, sections which emphasise verticality, and roofscape articulation. The built form shall reflect the civic nature of a village centre as a focal point for the neighbourhood.

Insert New DA 57 a and b

a) The applicant shall follow the Hydrogeology Guidance outlined in Appendix E of the Planning Scheme with regard to the design of proposed development on sites within the catchment sensitivity zone of Tufa Spring No. 5 in order to protect the hydrology source, as detailed in Chapter 5 Green Infrastructure (Refer to GI30 and Appendix E).

b) The layout and design of proposed developments on sites identified as been within the protection zone of the Tufa Springs, as indicated in Appendix E of the Planning Scheme , shall be informed by site investigations , as outlined in Appendix E, which are to be carried out, by the applicant, in advance of the preliminary design of any proposals for these sites. Proposals on these sites shall demonstrate that they will have no significant impact on Tufa Spring No. 5 and shall be accompanied by an ecological report demonstrating the same.

Proposed Amendments to Table 6.8.1: Development Type and Quantum for Development Area 8 Tully, Sub-Headings, Tully Village Centre, Non-Residential Development Commercial Use and Residential Development.

Tully Village Centre		
Total Village Centre Lands HA		**1.2**
RETAIL SQ.M		
	Min	**Max**
	Net/Gross	**Net/Gross**
1 no. Supermarket	1,750/2,652	2,500/3,789
Local Retail	445/674	750/1,136
Retail Services	445/674	750/1,136
Total Retail Quantum Village Centre	**Min Net/Gross**	**Max Net Gross**
	2,640/4,000	4,000/6,060
RESIDENTIAL VILLAGE CENTRE		
Residential Dwelling Units	**Min**	**Max**
	Circa 130	~~Circa 190~~ Circa 200
Gross Residential Floor Area Sq.m	**Min**	**Max**
	12,000	~~18,000~~ 19,500
NON-RESIDENTIAL USES		
Non-Retail Uses	**Min**	**Max**
	750	1,000
High Intensity Employment	**Min**	**Max**
	750	1,000
Community Facilities	**Min**	**Max**
	250	500
Total Non-Residential Floor Area Sq.m	**Min**	**Max**
	1,750	2,500
TOTAL FLOORSPACE QUANTUM TULLY VILLAGE CENTRE SQ.M	**Min**	**Max**
	17,750	~~**26,560**~~ **28,060**
Plot Ratio	**Min**	**Max**
	1:1.5	~~1:2.2~~ 1:2.3
Site Coverage	**Min**	**Max**
	40%	**60%**
Building Height in Storeys	**Min**	**Max**
	3	**5**

NON-RESIDENTIAL DEVELOPMENT		
COMMERCIAL USES **Breakdown for Site CU 1**		
Site Area HA	3.6	
Min Quantum	36,000	
Min Plot Ratio	1:1	
Height Storeys	**Min**	**Max**
	2	~~4~~ 5

RESIDENTIAL DEVELOPMENT		
Total Residential Lands	**16.1**	
	Land Area	**Density Range**
Res 1	0.6	~~35-50~~ 35-55
Res 2	15.5	~~45-70~~ 45-75
Res 3	0	~~65-100~~ 65-145
Res 4	0	~~85-125~~ 85-175
No. of Dwellings on Residential Lands	**Min** 719	**Max** ~~1,115~~ 1,196
Overall residential Density	**Min** 45 per ha	**Max** ~~69 per ha~~ 74 per ha
Building Height in Storeys	**Min** 2	**Max** ~~4~~ 5
No. of Dwellings in Tully Village Centre	**Min** Circa 130	**Max** ~~Circa 190~~ Circa 200
TOTAL NO. OF RESIDENTIAL DWELLINGS	**Min** Circa 849	**Max** ~~Circa 1,305~~ Circa 1,396

CHAPTER 7: SEQUENCING AND PHASING

~~**No Changes**~~

Insert Text to Section 7.4 of the Planning Scheme as follows :

"The Local Authority will also undertake a plan led review of the Town Centre and Environs having regard to the overall Vision and Principles for Cherrywood and appropriate Government policy, to ensure that the Town Centre functions as a vibrant, mixed use sustainable District Centre at the heart of Cherrywood. This review will seek to ensure an appropriate mix, quantum and phasing of uses to secure a balance of employment, commercial, retail, residential, community and social uses. It is an objective of the Council to use its best endeavours to undertake this plan lead review within twelve months from the date that the proposed Amendment No. 8 comes into effect."

APPENDICES

PAGE 111

Amend Appendix E: Phase 1 Hydrogeology Assessment of the Cherrywood SDZ.

Rename Appendix E as follows:

Appendix E: Tufa Springs Mitigation Requirements

Insert Annex A: ORIGINAL Appendix E (attached as part of this amendment).

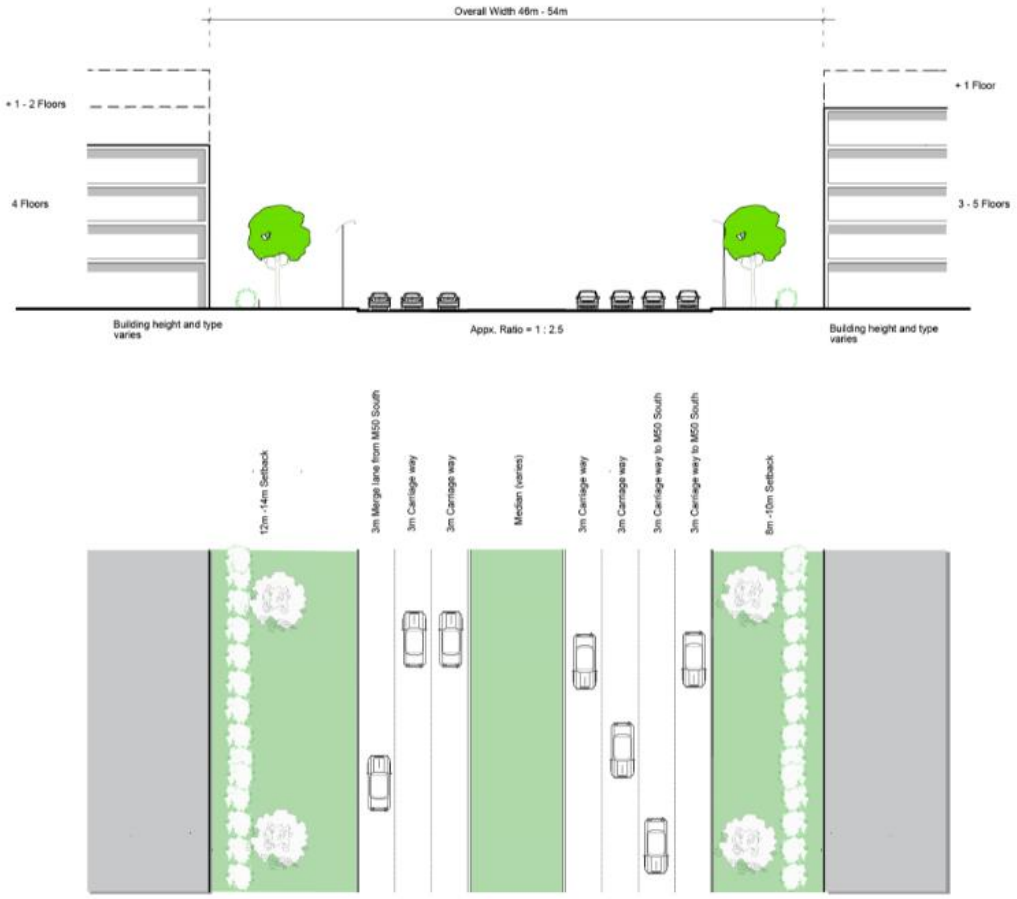
Insert Annex B: JBA Catchment Study (attached as part of this amendment).

Insert New Appendix H at the end of the Cherrywood Planning Scheme Document.

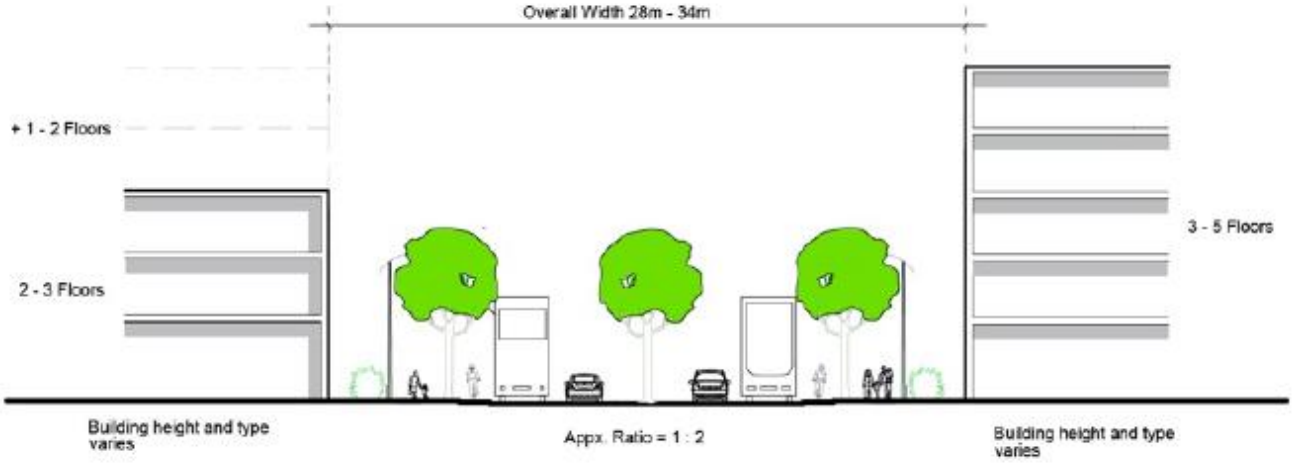
Appendix H: Indicative Street Sections showing Proposed Maximum Building Heights.

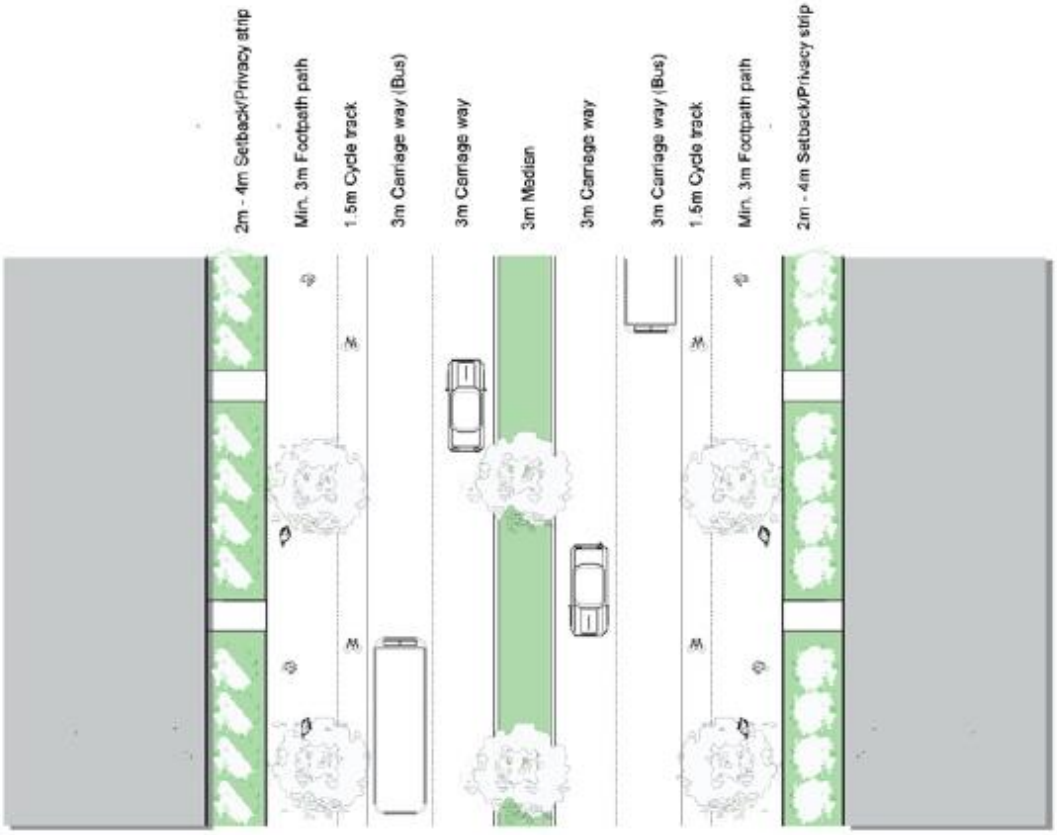
Section 1: Indicative Cross Section of Wyattville Link Road

(North East of the Lehaunstown Interchange)

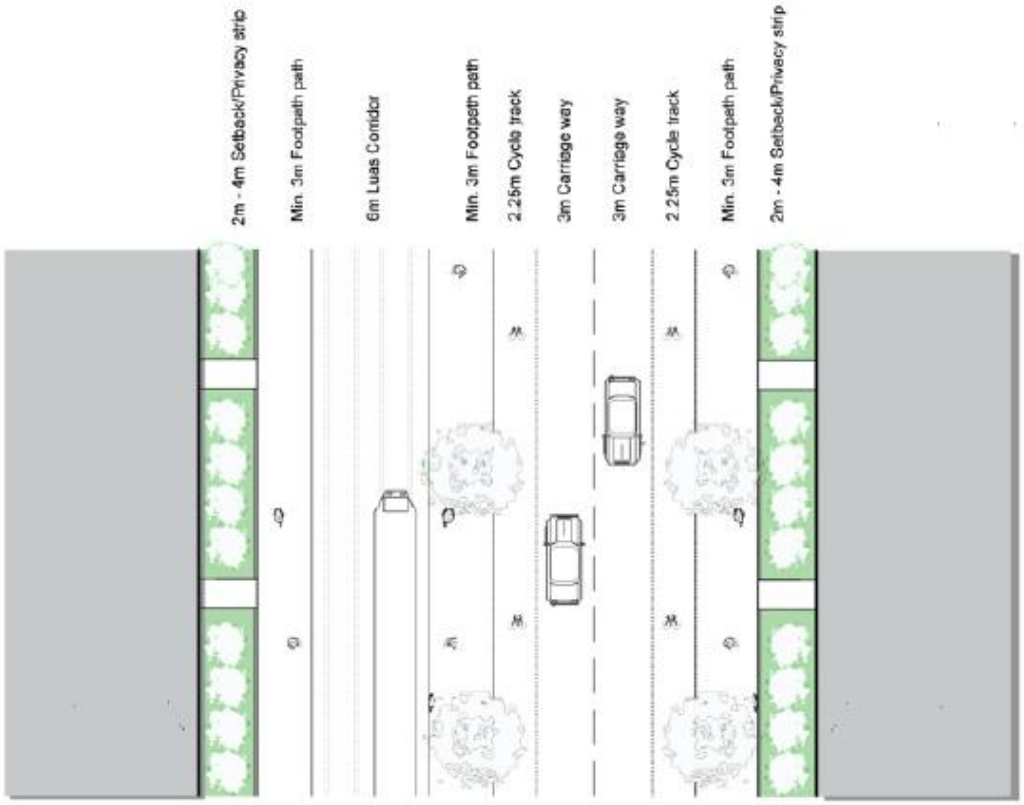


Section 2: Indicative Cross Section of Bishops Street

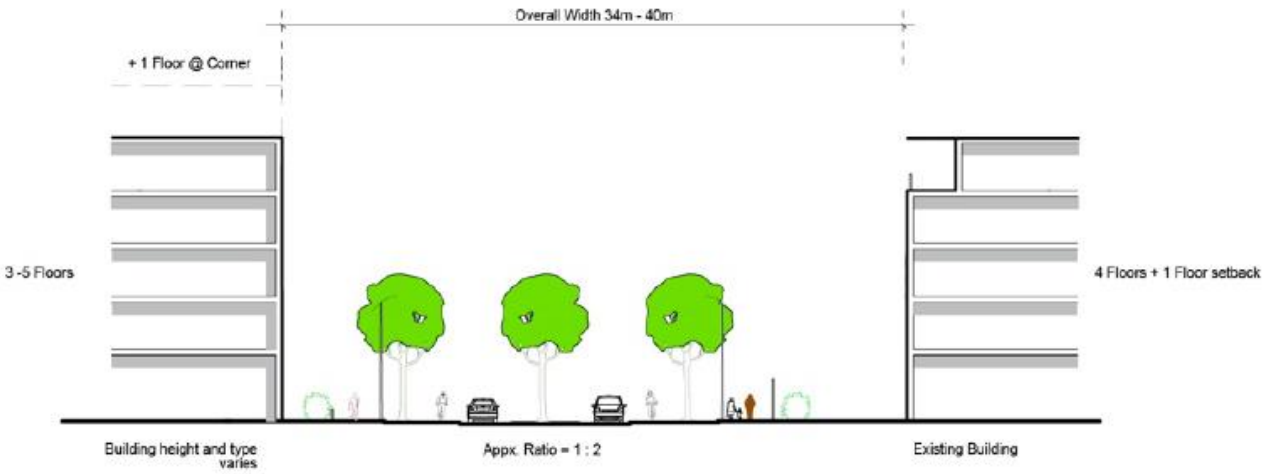


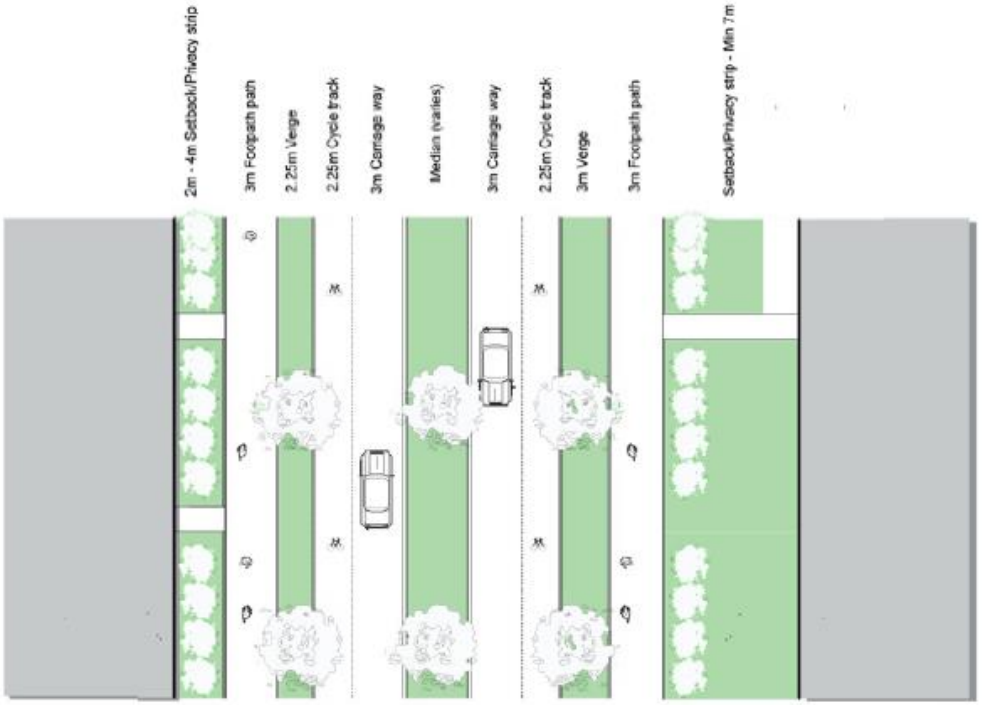


Section 3A: Indicative Cross Section of Grand Parade (South of Junction B)



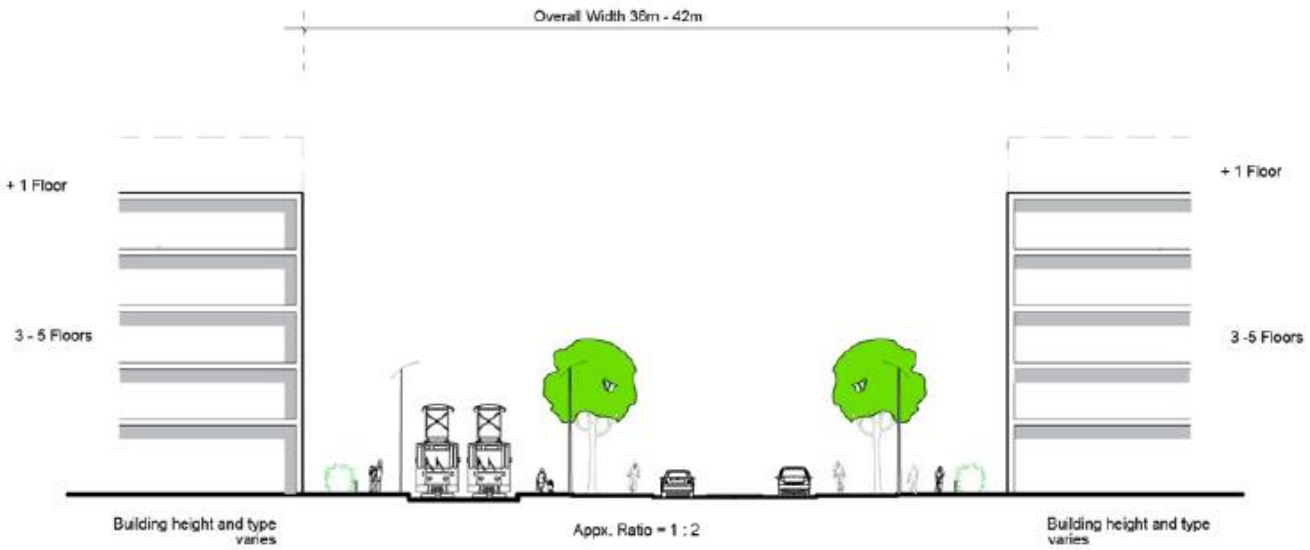
Section 3B: Indicative Cross Section of Tullyvale Road (South of Junction B)

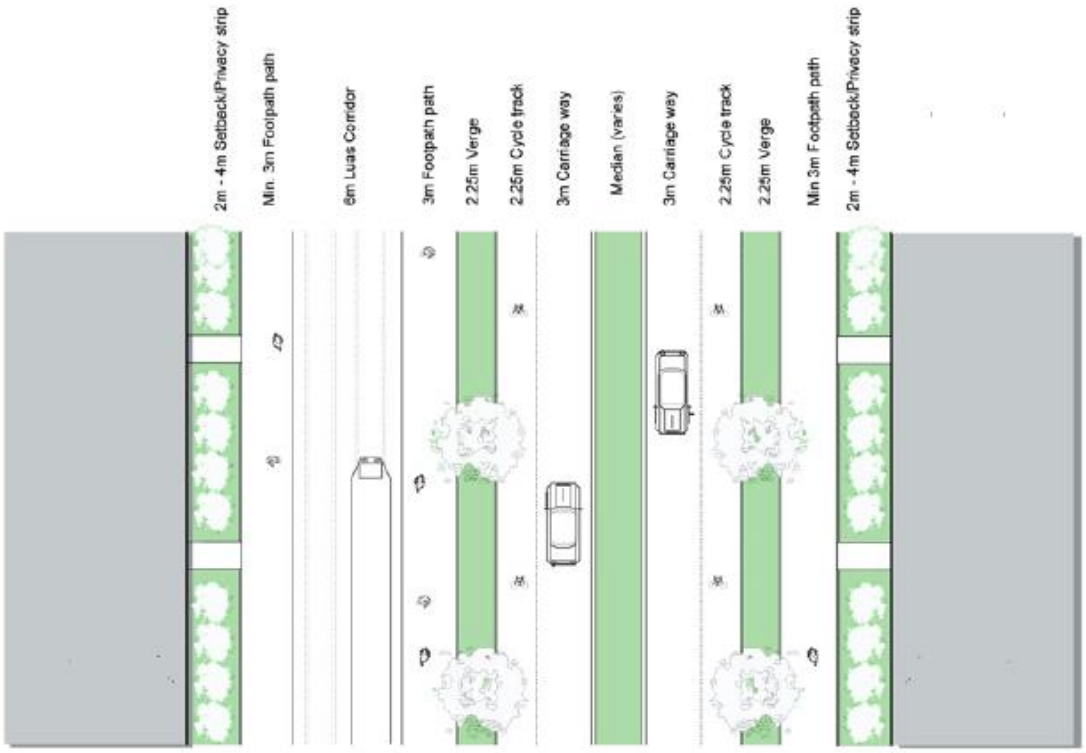




Section 4A: Indicative Cross Section of Grand Parade

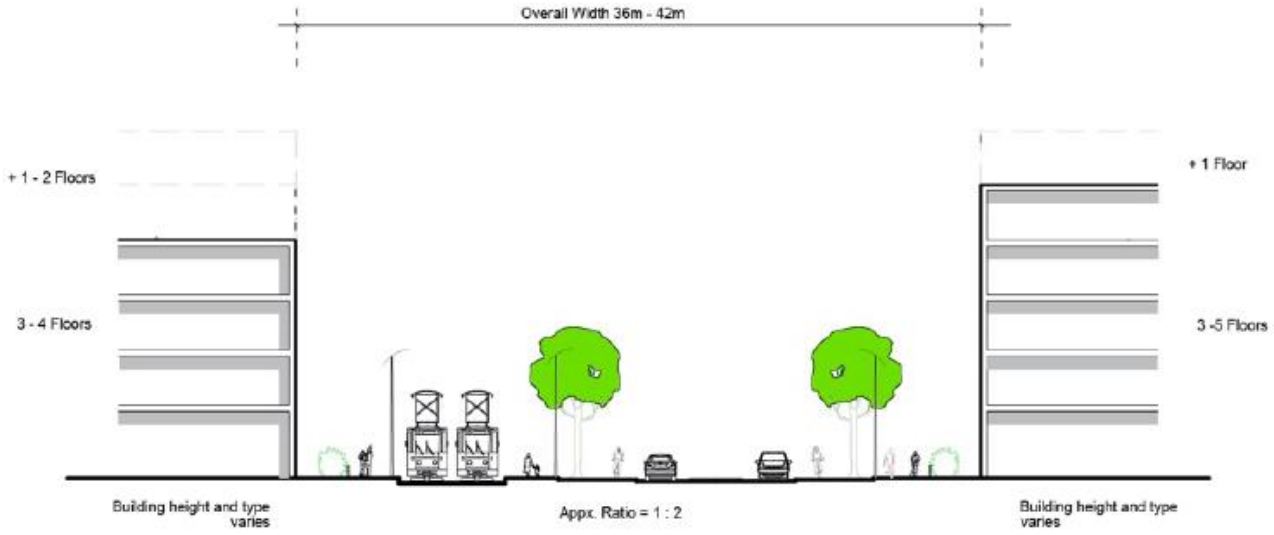
(North of Lehannstown Village)

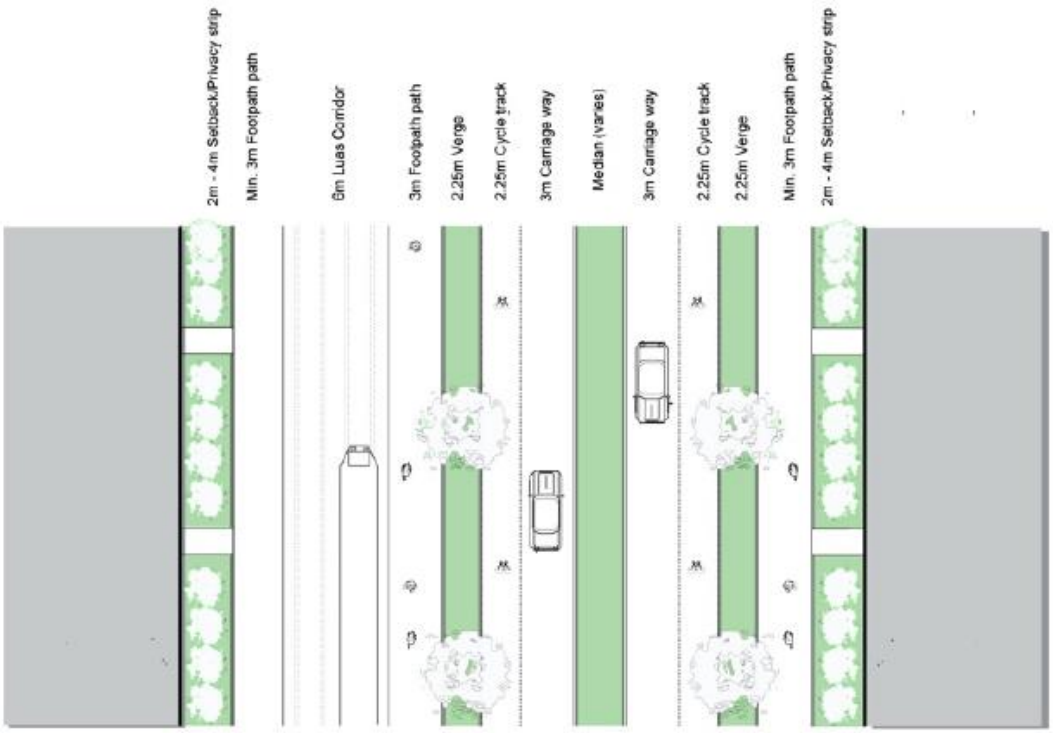




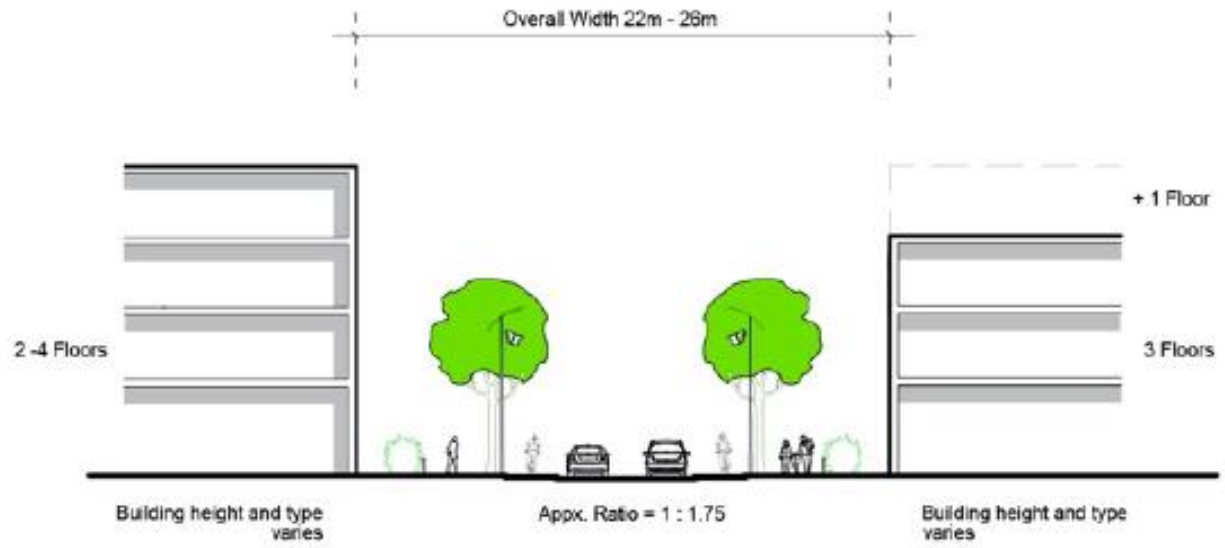
Section 4B: Indicative Cross Section of Grand Parade

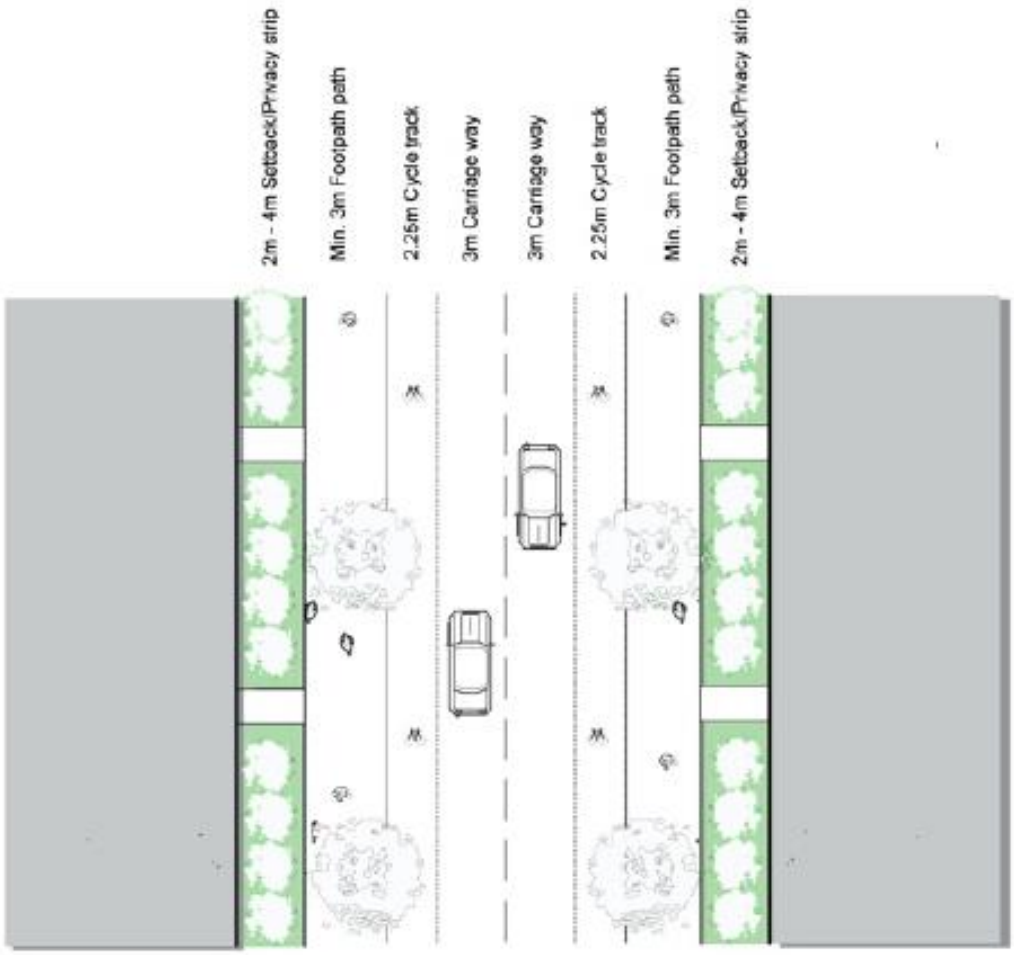
(South of Lehaunstown Village)





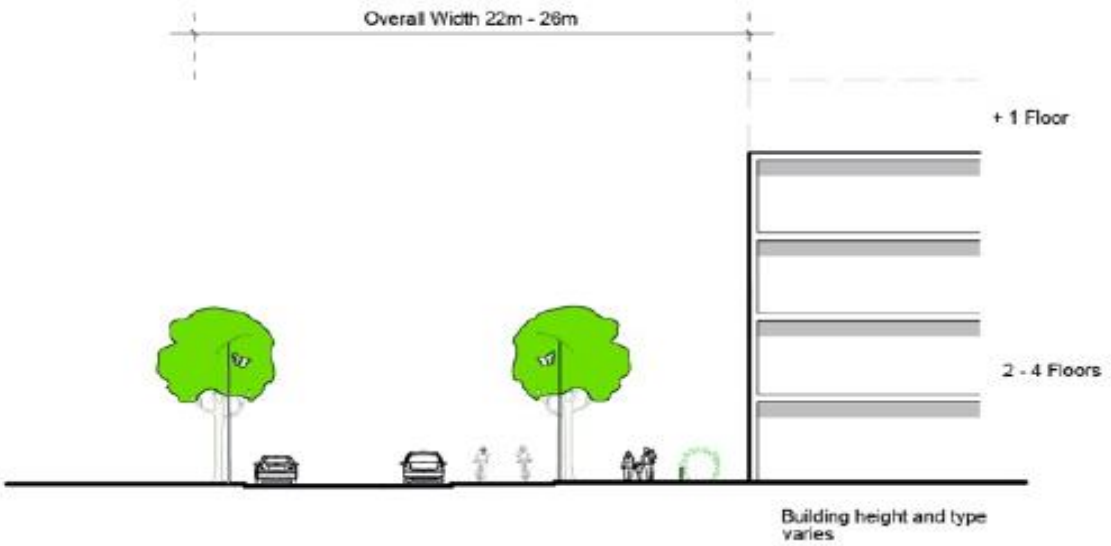
Section 5: Indicative Cross Section of Castle Street

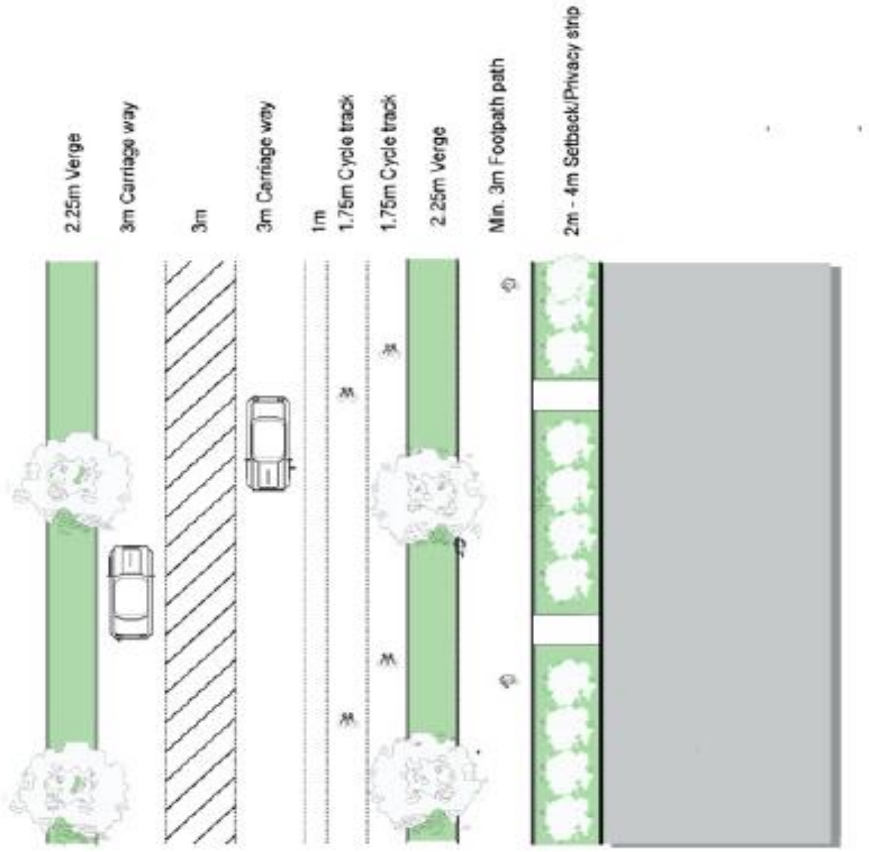




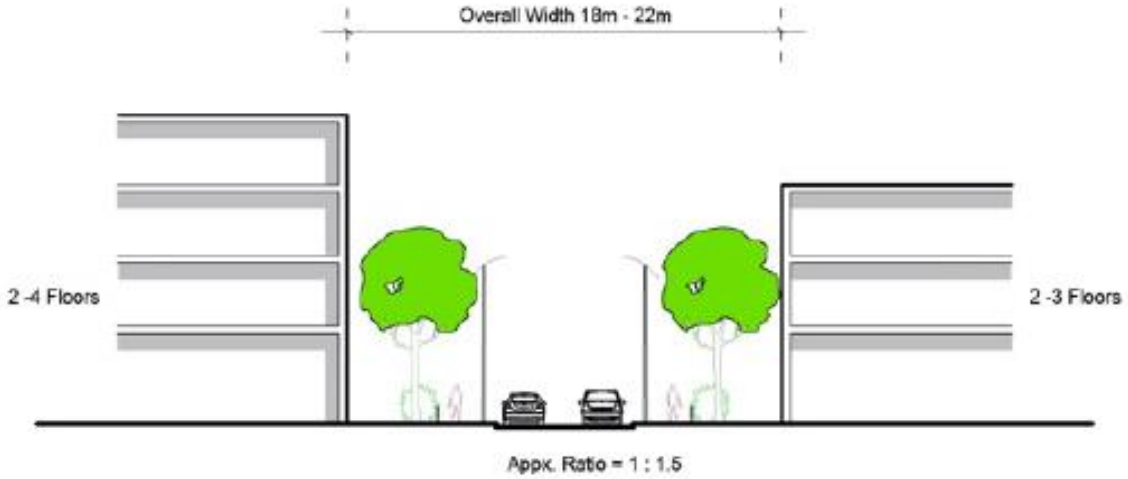
Section 6: Indicative Cross Section of Beckett Road

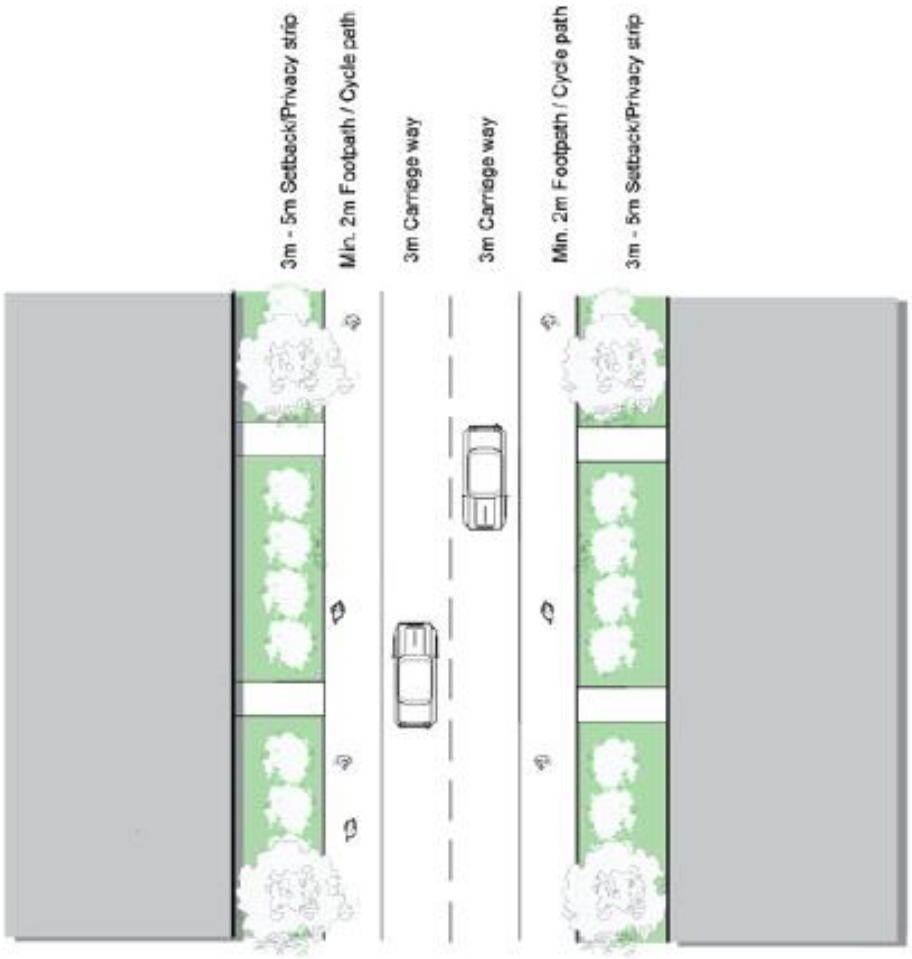
In Appendix H : Indicative Street Sections showing Proposed Maximum Building Heights, on page 38**,** for the drawing for Section 6: Indicative Cross Section of Beckett Road, change the wording **'2m-4m Setback/Privacy Strip to '2m-4m Physical Infrastructure zone', and shade light grey**.





Section 7: Indicative Cross Section of Local Neighbourhood Street





Insert New Appendix I Guidance with regard to Sunlight and Daylight Assessment of Proposed Developments at the end of the Cherrywood Planning Scheme Document.

Appendix I

Guidance with regard to Sunlight and Daylight Assessment of Proposed Developments

~~Proposals for development should include technical assessments in accordance with BR209 Site Layout Planning for Daylight & Sunlight A Guide to Good Practice Second Edition 2011 and BS 8206-2: 2008 Lighting for Buildings Part 2: Code of Practice for Daylighting. Assessments should include the following:~~

~~With regard to neighbouring developments:~~

- ~~Shadow Impact/ Sunlight levels on private gardens, balconies, communal and public spaces to the 2hr on the 21st March test.~~
- ~~Impact on habitable windows Skylight – Vertical Sky Component (VSC) test.~~
- ~~Impact on living room windows Sunlight – Annual and Winter Probable Sunlight Hours (APSH & WPSH) tests.~~

~~With regard to the proposed development itself:~~

- ~~Sunlight levels on private gardens, balconies, communal and public spaces to the 2hr on the 21st March test.~~
- ~~Light distribution within habitable rooms – Average Daylight Factor (ADF) levels with particular regard to units at the ground and lower floor levels and at corner locations.~~
- ~~Sunlight availability for living room windows – Annual and Winter Annual Probable Sunlight Hours (APSH & WPSH) tests.~~

Delete the following text :

~~Proposals for development should include technical assessments in accordance with BR209 Site Lay-out Planning for Daylight & Sunlight A Guide to Good Practice Second Edition 2011 and BS 8206-2: 2008 Lighting for Buildings Part 2: Code of Practice for Daylighting. Assessments should include the following:~~

~~With regard to neighbouring developments:~~
~~• Shadow Impact/ Sunlight levels on private gardens, balconies, communal and public spaces to the 2hr on the 21st March test.~~

~~• Impact on habitable windows Skylight – Vertical Sky Component (VSC) test.~~

~~• Impact on living room windows Sunlight – Annual and Winter Probable Sunlight Hours (APSH & WPSH) tests.~~

~~With regard to the proposed development itself:~~
~~• Sunlight levels on private gardens, balconies, communal and public spaces to the 2hr on the 21st March test.~~

~~• Light distribution within habitable rooms – Average Daylight Factor (ADF) levels with particular regard to units at the ground and lower floor levels and at corner locations.~~

~~• Sunlight availability for living room windows – Annual and Winter Annual Probable Sunlight Hours (APSH & WPSH) tests.~~

And replace with the following text :

Proposals for development should include technical assessments in accordance with BR209 Site Layout Planning for Daylight & Sunlight A Guide to Good Practice Third Edition – 2022 and the Irish Standard IS EN 17037:2018 which differs from BS EN 17037.

The above should be used to frame their technical assessments in relation to light under the headings of:

- **Impact on Neighbours**
- **Development Performance**

The tests required are detailed in the guidelines.

There is cognisance of the fact that IS EN 17037 does not currently include a localising National Annex. An Applicant may wish to additionally provide results in terms of the BS EN 17037 National Annex NA and should support this with commentary for consideration.

The above documents replace the now withdrawn BR209 Site Layout Planning for Daylight & Sunlight A Guide to Good Practice Second Edition – 2011 and the also withdrawn BS 8206- 2: 2008 Lighting for Buildings Part 2: Code of Practice for Daylighting.

Appendix E: Tufa Springs Mitigation Requirements

1 Introduction

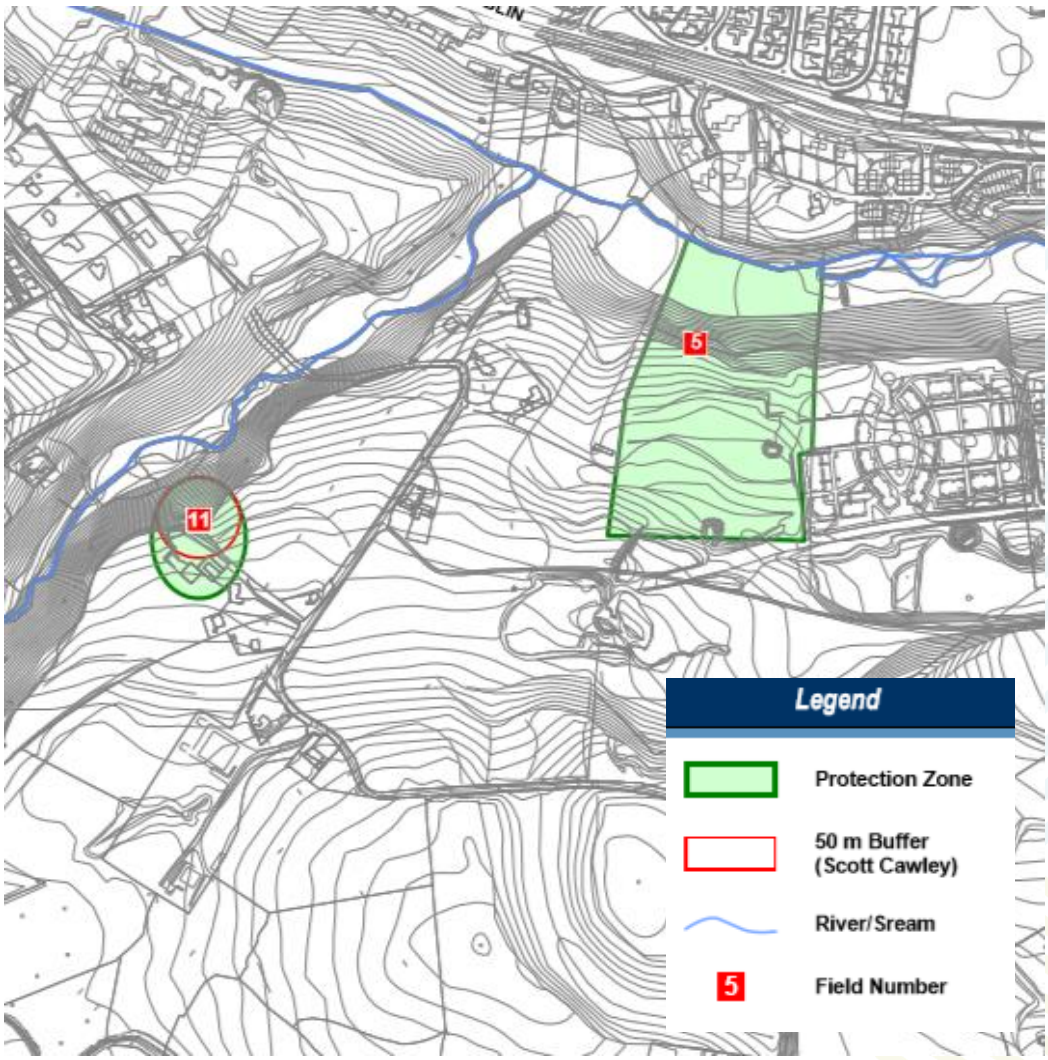
In September 2011, RPS produced a Phase 1 Hydrogeological Assessment of the Cherrywood Strategic Development Zone (SDZ) area (see Annex A-Original Appendix E) with a view to identifying potential sensitive tufa spring groundwater receptors that could be impacted by future development in the area.

The objectives of this study were to:

- Broaden the understanding of the tufa springs in the area;
- Highlight potential risks on the tufa springs;
- Recommend solutions and mitigation measures that may be needed to avoid negative impacts on the tufa springs.

This study identified two protection zone in which further assessment and mitigation measures would be required (see Figure 1-1).

Figure 1-1: RPS Protection Zones



Through an iterative site investigation and hydrogeological assessment processes, the understanding of mechanisms that support Tufa Spring No. 5 has increased and so the requirements of the Protection Zone associated Protection Zone require updating.

Please note the advice regarding the Protection Zone 11, remains as the original Appendix (see Annex A).

2 Current Understanding of the Hydrogeology of Tufa Spring 5

Since 2016, JBA Consulting have been commissioned by DLRCC to provide ongoing hydrogeological advice regarding the protection of the tufa spring. A range of further information has been made available to improve the understanding of the hydrogeological systems since 2011 including site investigations for particular developments within the Cherrywood Planning Scheme area.

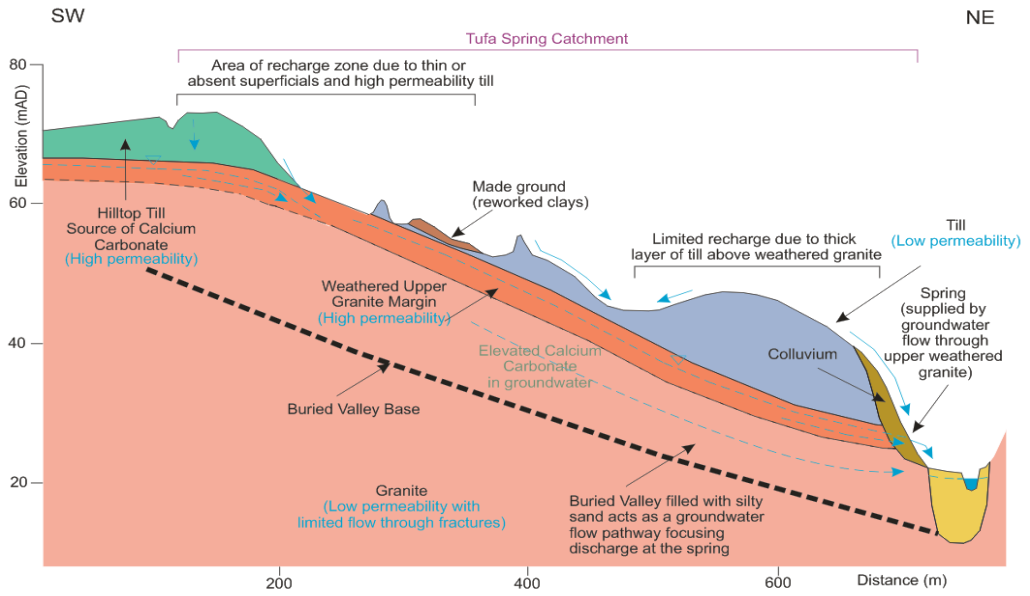
The current understanding of the hydrogeological system supporting Tufa Spring 5 is detailed in the JBA Catchment Study (see Annex B -JBA Catchment Study) and summarised in the Box below.

Box 1 - Tufa Spring Conceptualisation

The current hydrogeological conceptual model of the tufa spring has been developed from two reports previously produced by JBA Consulting and the additional site investigation data summarised in the section above. It has the following features:

- The tufa springs form and discharge where a buried valley filled with silty sand intersects with the valley side.
- The upper weathered margin of the granite bedrock which is observed in previous site investigations acts as a relatively high permeability layer which discharges groundwater to the buried valley from the surrounding area.
- The recharge is likely to be derived from an area of thinner/absent till which overlies the bedrock and higher permeability till deposits in the upper catchment. These high permeability tills are also likely to also be a key source of calcium carbonate for the spring.
- Recharge in the area immediately uphill of the spring is limited by a thick layer of low permeability till.

The updated conceptual site model is shown in figure below.



3 Potential Impacts and Catchment Sensitivity Zone

The JBA Catchment Study has divided the catchment into zones (see **Figure 3-1** below). These are based on the underlying geology and how the spring is supported by these areas.

For each Zone, there are two Potential Impact Classes described in **Table 3-1**.

Any proposed development should not significantly change the nature or area of the catchment of the spring, through divergence of surface or groundwater away from the catchment.

To note, Tufa Spring No. 5 is a mature developed tufa formation which is a priority EU Annex Habitat which is considered important at county level.

Table 3-1:Potential Impact Classes

Potential Impact Classes	Possible Mechanism	Spatial Locations Where Impact is Most Likely to Occur
Alteration of Recharge Characteristics	Reducing the permeability of the ground and infiltration of surface water through construction of extensive areas of hardstanding. Installation of drainage systems which change the spring catchment or lead to reduced recharge within the catchment.	Where groundwater recharge rates are likely to be higher, i.e. areas where till is relatively thin (or absent), or of relatively high permeability.
Alteration of Groundwater Flow Paths	Physical barriers to groundwater flow (secant piled walls, deep foundations for undercroft parking etc.) could be built through the upper weathered margin or buried valley. Deep permanent excavation below the local water table, or installation of deep service conduits.	In the lower part of the spring catchment, where till is thick, this impact mechanism is only likely to only occur with deeper excavations. Where till is thin or absent or higher permeability development works could have the potential to alter flow paths. It has been assumed that groundwater flow paths in the lower catchment will not be significantly affected by excavations and physical barriers in the upper catchment, i.e. all except very large excavations in the upper catchment will not change the groundwater catchment of the spring

In addition to the impact mechanisms identified above, direct damage to the spring could occur with developments close to the spring.

Figure 3-1: Catchment Sensitivity Classification

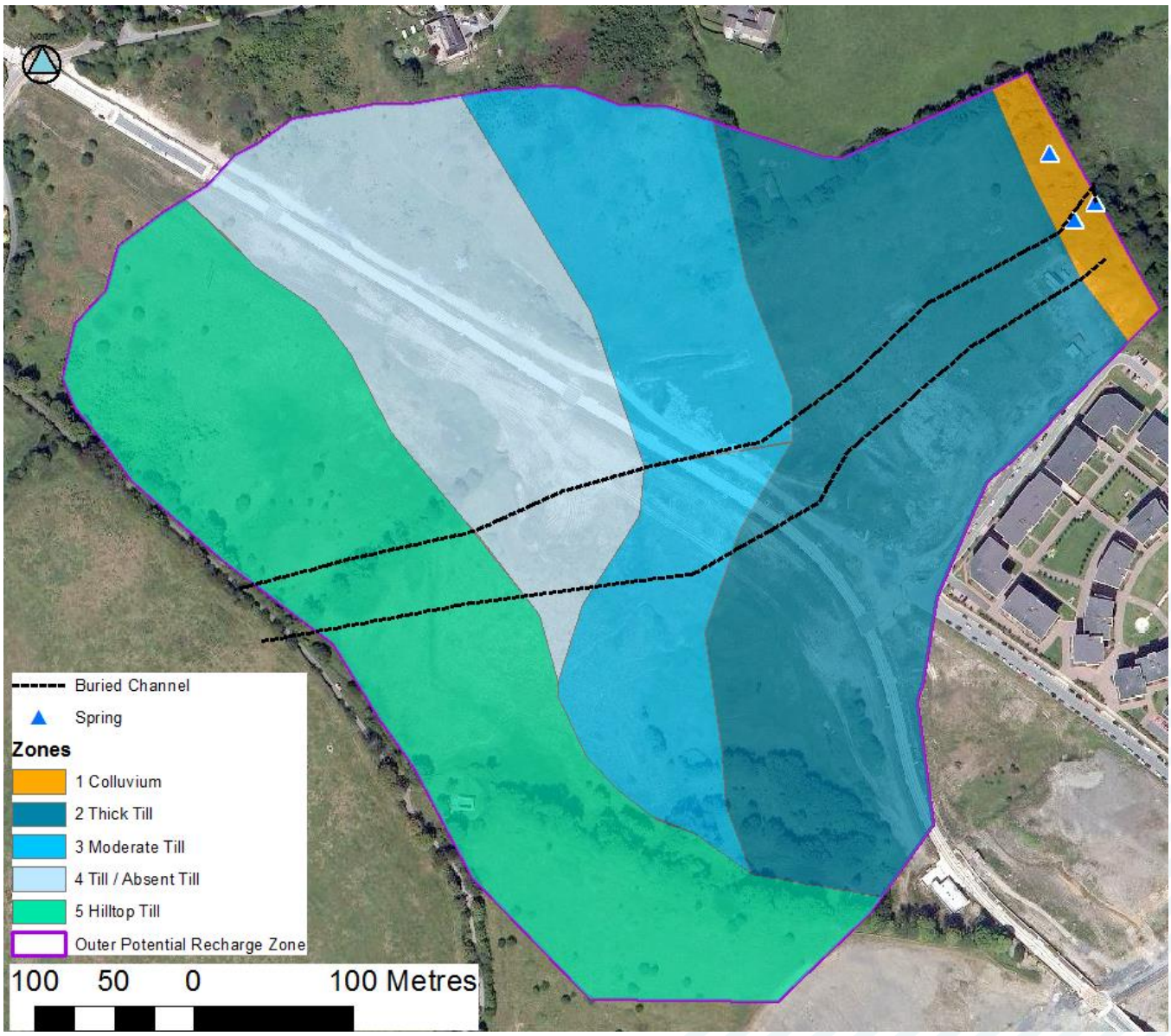


Table 3-2 provides a description of the potential development related impacts that could arise within each zone, and the outline recommended mitigation actions.

The last row of **Table 3-2** takes into account large scale development works such as extensive and deep excavations (more than 2.5m deep) which could fundamentally alter the groundwater system and therefore the future status of the springs.

Such work**, anywhere within the Precautionary Spring Catchment** as defined in **Figure 3-1**, should be supported by a hydrogeological risk assessment and an appropriate level of site investigation**.**

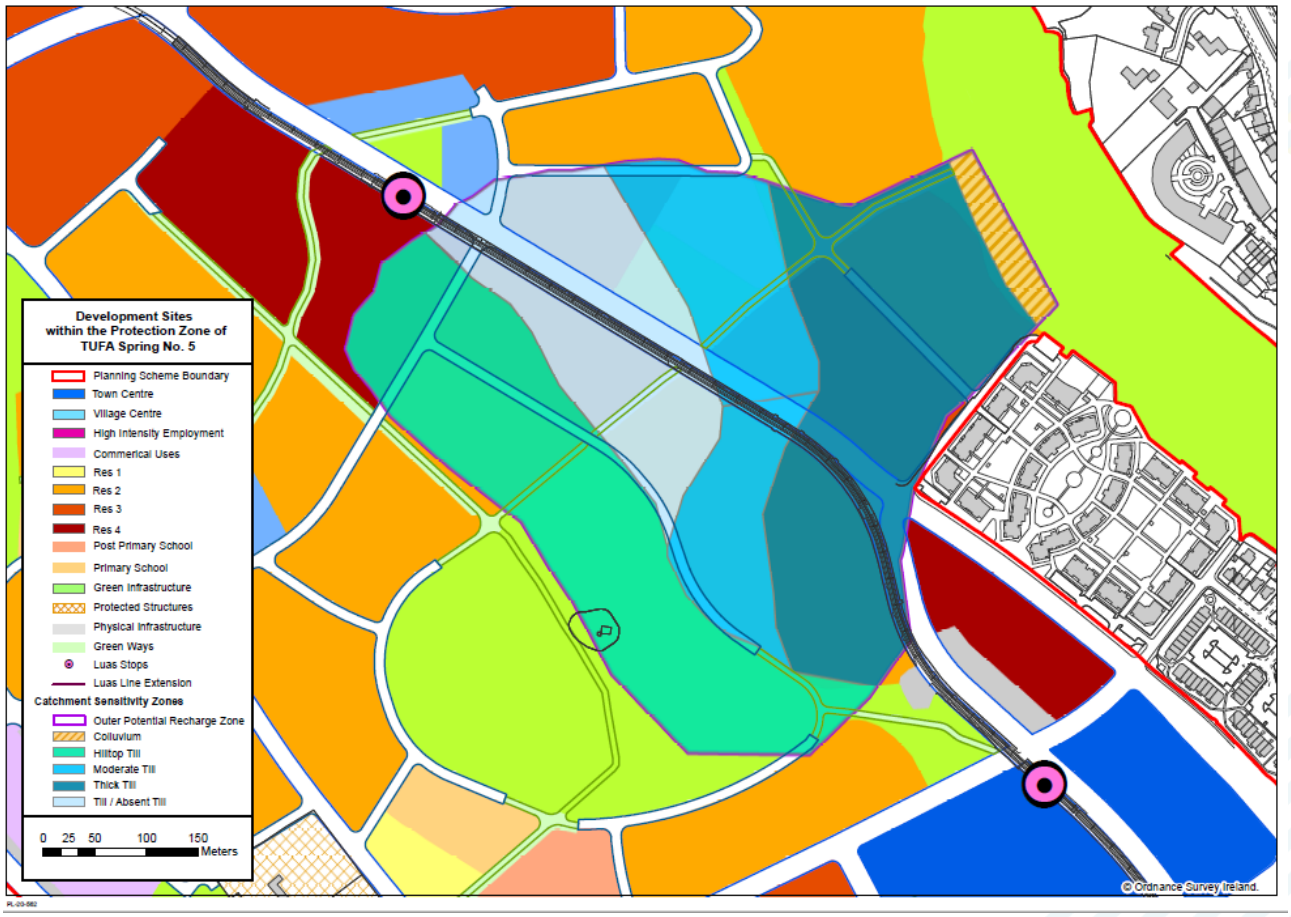
In certain zones, excavations less than 2.5m could be undertaken without further excavations, as they would occur entirely in low permeability till deposits.

Table 3-2: Sensitivity Zone Classification

Zone	Recharge Impact Potential	Flow Impact Potential
1 - Colluvium	Zone 1 represents the slope where spring flow occurs and should be avoided in all cases	
2 – Thick Till	Unlikely – No further analysis is likely to be required.	Unlikely - No further analysis is likely to be required. Note area may be more suitable for deeper excavations further analysis would be required.
3 – Moderate Till	Unlikely – No further analysis is likely to be required	Unlikely - No further analysis is likely to be required
4 Till / Absent	Likely – Areas of proposed hardstanding and other low permeability cover will require further analysis to establish the extent of impact on recharge to the spring. Where areas can be shown to have a significant layer of low permeability till no further analysis would be required.	Likely – Excavations that are expected to reach the gravel (weathered bedrock) and bedrock layers would require further analysis to establish the extent of impact on the groundwater flow to the spring.
5 Hilltop Till	Likely – Areas of proposed hardstanding and other low permeability cover will require further analysis to establish the extent of impact on recharge to the spring.	Likely – Excavations that are expected to reach saturated deposits would require further analysis to establish the extent of impact on the groundwater flow to the spring.
All Zones	Large scale excavations (>2.5m deep) - further analysis requirement	

The following map shows the Catchment Sensitivity Classification Zone overlaid over Map 2.2: Scale of Density taken from the Planning Scheme.

Figure 3-2: Catchment Sensitivity Classification Overlaid with Map 2.2: Scale of Density taken from the Planning Scheme.



4 Analysis Requirements

While **Table 3-2** above outlines what type of impact mechanism could occur in each zone and where further analysis is required, this section provides an initial framework which may lead to the requirement of further analysis to be carried out on site by the applicant.

Guidance on this process is outlined under Table 4-1 below. These assessments shall be carried out prior to the design of the layout of the proposed design on site and prior to any pre-planning workshops been carried out with the DAPT or the Planning Authority.

The process is an iterative one and should not be deemed to be complete until the Hydrogeological Analysis carried out by the applicant indicates that their proposed development:

- will not significantly impact on the Tufa Springs, noting that Tufa Spring No. 5 is a mature developed tufa formation which is a priority EU Annex Habitat which is considered important at county level and has been given a High Rating under the Draft National Level Assessment been carried out by NPWS (2020, in draft).
- and that sufficient evidence has been provided to inform the Ecological Impact Assessment accompanying any proposed development/planning application on the development sites within the protection zone shown in Figure 3-1, that the proposal will not cause significant impacts on the Tufa Spring.

Prior to the lodgement of a planning application on any of the sites within the protection zone of the Tufa Spring as identified on Figure 3-1, the applicant will need to demonstrate that they have carried out the following:

- Engaged and suitably qualified Hydrogeologist.
- Prepared an Ecological Impact Assessment prepared by the Applicant supported by a Hydrogeological Analysis carried out by a suitably qualified Hydrogeologist in consultation with a suitably qualified Tufa Spring Ecologist.
- Must ensure that the proposed development will pose no significant impact on the Tufa Springs.

All works within the catchment will require assessment. The scale of the work required to prove no significant effects on the tufa spring will be dependent on a number of factors:

- The scale and nature of the works.
- The location within the catchment and the role that location plays in supporting the spring.
- The rounds of iterative investigations required to provide a robust hydrogeological baseline understanding of the area.
- The scale and nature of the measures required to mitigate impacts.

Small works, such as the installation of paths on the existing ground surface, which shed runoff to the surrounding ground may only require a screening assessment.

Larger scale works such as sub terrain carparks which partly lie beneath the water table may need to be supported by a Hydrogeological Risk Assessment support by a groundwater model which has been developed by several rounds of Site Investigation.

Table 4-1 below provides a framework of the stages potentially required. The conclusions of the assessment process carried out by the applicant/developer will need to be presented to and agreed with DLRCC. It is recommended that this is done as part of the pre-application consultation process and the design of the development should be based on the results of these assessments. This will aid the process when a development on site is lodged as a formal planning application.

Table 4-1 – Framework of Studies Required

Stage	Activity	Consider if Enough Information has been gathered
1	**Screening assessment** Are there activities that might affect the tufa springs through changes in recharge or groundwater flow pattern?	If there is no potential source of impact no further assessment required If potential impacts continue to stage 2
2	Develop initial hydrogeological conceptual model based on available data	
3	Review nature of the development	
4	Review mitigation measures available Outline Hydrogeological Impact assessment	If no feasible impact linkage identified, no further assessment is required (only valid if conservative assumptions are made) If potential impacts are possible continue to stage 5
5	Design and conduct site investigation to improve conceptual model Depending on the mitigation measures require this may include ongoing monitoring to capture the range of groundwater conditions the site experiences, or quantitative (e.g. modelling) assessments.	
6	Develop the conceptual model, mitigation measures and risk assessment further Support the risk assessment with quantitative assessment if appropriate	If impact linkages can be demonstrated to lead to no significant impacts, no further assessment is required. If this is not possible repeat Stages 5 and 6 until no significant impacts can be demonstrated

The Environment Agency (2007), Hydrogeological impact appraisal for dewatering abstractions, although developed for and specifically for dewatering activities, provides further useful guidance on the iterative process which should underlie the assessment process and the tiers of evidence that can support a hydrogeological risk assessment.

https://www.gov.uk/government/publications/hydrogeological-impact-appraisal-for-dewatering-abstractions

4.1 Screening

All proposals within the catchment should be screened by the applicant to assess

- whether they include activities which could cause the impact mechanism detailed in **Table 3-1**.
- Assess whether those activities are appropriate to the zone.

If at the screening stage activities are identified that could potentially impact the spring, further assessment will be required as outlined in Table 4-1.

4.2 Further Assessment

If potential impacts are identified, developments will only be permitted where it can be demonstrated by the applicant that these can be successfully mitigated against.

This should be presented in the form of a hydrogeological risk assessment which can form the basis of the technical information to inform the Ecological Impact Assessment of the scheme.

The information contained within the hydrogeological risk assessment should reflect the sensitivity of the location and the scale of the works being undertaken, and the significance of the impact mechanism that may be affected. Depending on the initial finding of the hydrogeological risk assessment and design constraints, the process may be iterative, and may require a number of rounds of investigation.

Where the Hydrogeological Risk Assessment concludes that impact mechanisms can be eliminated through the design of the scheme[1], mitigation measures developed will need to be supported by additional quantitative assessments which show that the functions of the existing hydrogeological system will be replicated.

[1] Example of elimination - the depth of excavations are reduced to no change groundwater flood patterns

Annex A -Original Appendix E

Annex B - JBA Catchment Study Tufa Spring No. 5

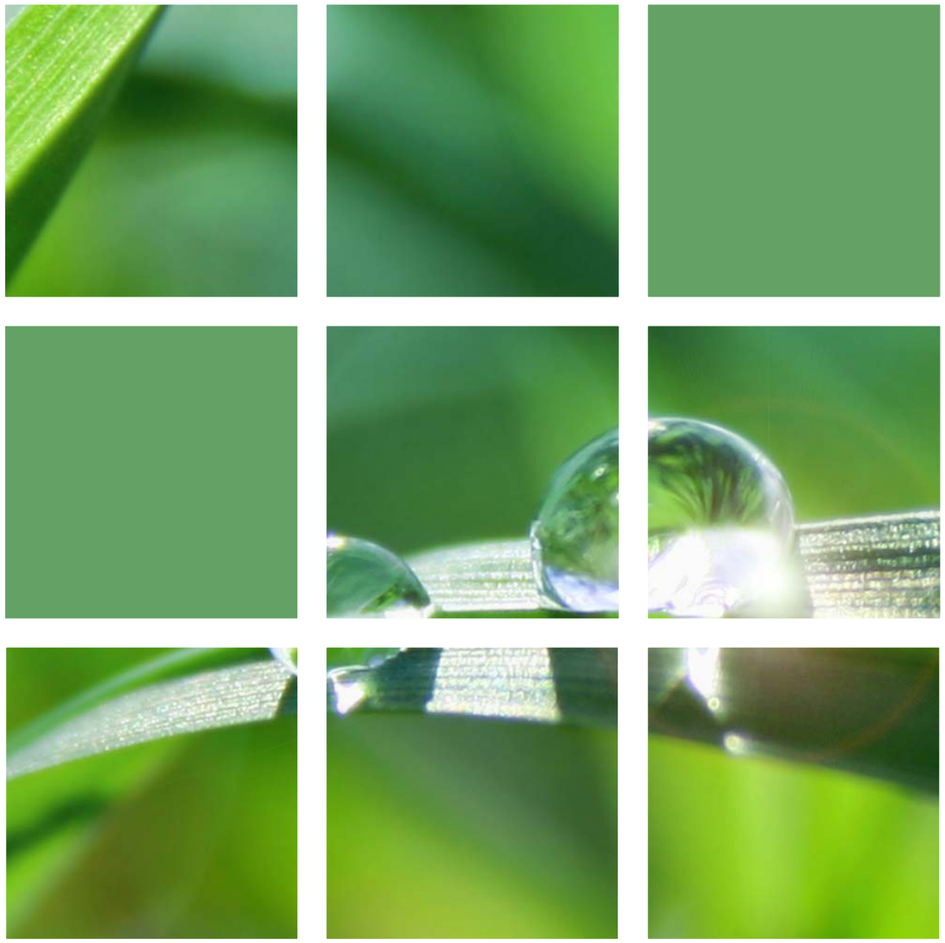
CHERRYWOOD
PLANNING SCHEME

Appendix E: Phase 1 Hydrogeology Assessment of the Cherrywood SDZ

RPS

Cherrywood Hydrogeology

Phase I Hydrogeology Assessment of the Cherrywood SDZ



September 2011

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TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

1 INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

RPS were requested by Dún Laoghaire Rathdown County Council to conduct a Phase 1 Hydrogeological Assessment of the Cherrywood Strategic Development Zone (SDZ) area with a view to identifying potential sensitive groundwater receptors that could be impacted by future development in the area. As part of the ecological studies undertaken for the Cherrywood SDZ area, a number of tuffa spring formations have been identified.

The objectives of this study were to:

- Broaden the understanding of the tuffa springs in the area;
- Highlight potential risks on the tuffa springs; and
- Recommend solutions and mitigation measures that may be needed to avoid negative impacts on the tuffa springs.

1.2 TUFFA FORMATION & PROJECT APPRECIATION

Tuffa is a deposit of calcium carbonate that has deposited at the source of a spring emergence. Groundwater percolating through the soil and aquifer material can dissolve calcium from the parent material and precipitate calcium carbonate where groundwater emerges at the spring source. The chemical reactions are similar to those that cause the formation of stalagmites and stalactites in cave systems.

The significance of tuffa springs formation in relation to the Strategic Development Zone (SDZ) for Cherrywood is that where such springs occur, land development within the catchment area that feeds the tuffa spring can potentially impact these springs. The existing baseline conditions (tuffa spring) are being supported by an existing hydrological cycle whereby rainfall infiltrates the subsoil and discharges at spring emergences. When land developments block or reduce the amount of rainfall that can infiltrate the groundwater system, there can be a direct impact on the amount of groundwater recharge and an indirect down gradient impact on the tuffa springs.

2 METHODOLOGY

In order to provide a preliminary assessment of the tuffa springs and the potential impact of the planned development in the area, RPS conducted a Phase 1 Hydrogeological Assessment of the Cherrywood SDZ using the following methodology:

- Review of the Geological Survey of Ireland (GSI) bedrock, quaternary and groundwater information available;
- Desk top review of soil, geology and water sections of relevant Environmental Impact Statement (EIS) for the area (e.g. LUAS, M50 Scheme);
- Review of relevant and available geotechnical investigations conducted in the area; and
- Preliminary site walkover with the ecology team that had identified the location of the tuffa springs.

3 REVIEW OF EXISTING INFORMATION

3.1 HISTORICAL GEOLOGICAL MAPPING

The Geological Survey of Ireland's (GSI) historical field sheets for the area identify the study area as Limestone Drift with Granite bedrock exposure and drift around Carrickmines and Brennanstown House.

3.2 QUATERNARY & BEDROCK MAPPING

The GSI have identified the bedrock (**Figure 1**) underlying the site as comprising of Granite with a gradation between pale grey fine to coarse grained granite (Stratigraphic code Nt2e) in the west, to Granite with microcline phenocrysts (Stratigraphic code Nt2p) in the east. The bedrock is classified by the GSI to be a Poor Aquifer bedrock (Pl), which is generally unproductive, except for local zones.

The GSI's subsoil Quaternary mapping for the area indicates that Granite Till (TGr) underlies the majority of the study area in the central part of the site with localised areas of bedrock outcrop (Rck) along the M50 and to the west of the M50 (**Figure 2**). Limestone Till (TLs) is mapped in the eastern part of the study area that coincides with the observed locations of tuffa springs (refer to **Section 4.2**) with Alluvium around the Loughlinstown River.

3.3 RELEVANT EIA IN THE STUDY AREA

The LUAS Line B1 Sandyford Industrial Estate to Cherrywood EIS, specifically Area 5 Volume 2 Ballyogan Wood to Bride's Glen, crosses through the study area. The soil and water sections of this EIS refer to a generally low permeability subsoil (descried as glacial till) overlying weathered granite bedrock. The weathered granite bedrock was noted to provide private groundwater abstractions at the time in the Laughanstown area that were due to be replaced by public mains water.

4 WALKOVER OBSERVATIONS

4.1 GENERAL OBSERVATIONS

A site walkover survey was completed on 9 June 2011 in the accompaniment of Mr Paul Scott of Scott Cawley. Weather conditions on the day were dry with sunshine and there was antecedent rainfall on the two days prior to the walkover (3.1mm and 2.7mm recorded at Dublin Airport).

Soil and rock outcrop were observed at several locations during the walkover. Subsoils in the centre of the study area were well exposed from the earth works that have been completed and significant calcareous carbonate source material was evident in the abundant limestone gravel and cobbles observed, which would provide source material to support tuffa spring formation. Granite bedrock was observed at several locations along the river valley running east west to the south of Brennanstown road and granite shallow subsoils were also observed along these locations. Granite parent material in the soil will not provide source material to support tuffa spring formation.

Figure 3 illustrates the locations of the observations made during the site walkover and **Table 1** provides a description of observations made during the walkover.

4.2 TUFFA SPRINGS

Tuffa spring formations were observed at several locations across the study area and can be subdivided into the following broad categories:

Immature recently formed tuffa as the result of recent earthworks exposing shallow perched groundwater tables and spring/seepage along new embankments. Several examples were evident along the northeast - southwest trending embankment to the northwest of the Wyatville Link Road (location 1 on **Figure 3**). Photographs 1 and 2 (**Appendix A**) illustrate this in close up and from a distance.

Mature, high quality tuffa springs with active groundwater flow and calcareous carbonate precipitation with associated plant communities. Two large examples were present on the southwestern flank of the river valley to the southwest of the N11 (location 5 on **Figure 3**) and illustrated in Photographs 3 and 4 (**Appendix A**).

Lower quality tuffa spring formations were located along small drainage channels (with the associated plant communities less dominant). An example occurs at spring seepage to the south of Brennanstown Road on the southern slope of the river valley (location 11 on **Figure 3**) and illustrated in Photograph 5 (**Appendix A**). A rare species of mollusc was also identified by Scott Cawley at location 11.

A complete description of notable field observations is contained in **Table 1** with locations illustrated in **Figure 3**. In summary, a small number of localised high quality tuffa spring formations were observed on the southwestern flank of the river valley to the southwest of the N11 (location 5 on **Figure 3**). The spring flows observed to be feeding one of these deposits was located approximately 1/4 way down the slope embankment, indicating a relatively shallow perched groundwater discharge at this location.

Tuffa spring formations were not widespread across the remainder of the SDZ, with localised recent immature examples present along recently excavated areas (location 1) and lower quality formations at one location in the northwest of the study area (location 11).

The absence of extensive tuffa spring formations along the southwest side of the river valley indicates that the groundwater flow systems supporting these formations are relatively limited in aerial extent. Photograph 6 (Appendix A) illustrates the nature of a well drained slope without any spring emergence 100m to the northwest of the large tuffa springs observed at location 5.

The mature tuffa spring formations observed at location 5 (**Figure 3**) are the only maturely developed tuffa formations within the limits of the SDZ. RPS also understands from Scott Cawley that the tuffa spring formations at location 5 correspond to an EC Habitats Directive Annex I habitat. These factors combined ensure that location 5 will be most important for the proposed SDZ in terms of the impacts of the development on the hydrogeology - ecology interaction of the area.

The more immature tuffa formations identified around the site are insufficiently developed at this time to be considered an issue of high hydrogeological protection, with the exception of location 11. Location 11 has been identified by Scott Cawley as an ecologically sensitive area within the SDZ and as such the hydrogeological impacts of the SDZ development on this site will also be important to consider.

Table 1. Field Observations

Map Location	Observation	Groundwater	Tuffa Spring Sensitivity/Priority Rating
1	Recently formed tuffa springs at base of excavations on the edge of cleared land. Position approximately 4m below natural ground level. Additional tuffa spring formations along sloped embankment created by excavations for development site approximately 2-3m below natural ground level	Seepage and standing water	Moderate
2	Ditch cutting with calcareous and granite source parent material in silty subsoil	Dry	Low
3	Limestone dominated subsoil exposed across development site with dark grey limestone gravel and cobbles within a silty subsoil matrix.	Dry	Low
4	Calcareous moss and orchids at the top of steep sloped bank.	Damp ground	Moderate
5	Large tuffa spring (approx. 15m wide x 2-3m length) with active spring flow and tuffa formation around vegetation. Second suspected tuffa formation heavily overgrown 50-100m north of first formation.	Spring emergence approximately ¼ way from the top of the slope. Saturated soils in the base of the slope.	High
6	Dry grass land slope	Dry	Low
7	Sandy subsoil visible along river floodplain. Adjacent slope embankments dry with no observable spring /seepage discharges	Dry	Low
8	Minor seepage at top of slope, possible marl formation	Seepage	Low
9	Steep embankment to river, dry, with weathered granite bedrock and shallow granite subsoil above bedrock.	Dry	Low
10	Slope with dry soil exposure, granite subsoil.	Dry	Low
11	Spring emergence amongst boulders at top of slope. Concrete water holding tank adjacent. Minor tuffa spring formation along runoff stream from spring 10-15m long by 2-3 m wide. Rare molluscs were identified by Scott Cawley.	Spring	Moderate - High
12	Well drained land, granite subsoil exposed in excavation.	Dry	Low
13	Dry slopes with granite weathered subsoil exposed along base adjacent to river.	Dry	Low

5 PRELIMINARY CONCEPTUAL HYDROGEOLOGICAL MODEL

Based on the information reviewed and the site walkover conducted, the preliminary conceptual hydrogeological model for the site can be described as follows:

- Localised shallow groundwater flow is expected to be within the more permeable zones within the subsoil across the SDZ;
- The limestone parent material (e.g. gravel, cobbles and boulders) with the subsoil is the primary source material for the calcium carbonate to be dissolved by infiltrating rain water;
- Groundwater flow paths are expected to be relatively short (100's m in length) within the subsoil material as evidenced by the relatively high levels of discharge along the embankments of drainage channels and associated tuffa spring formations;
- Groundwater flow within the shallow granite bedrock is not considered to be a critical component supporting tuffa spring formations as groundwater will not be enriched with calcium bicarbonate from the granite rock; and
- Overall groundwater flow directions are expected to follow the local topography with the predominant regional flow direction to the east towards the river valley. Shallower local groundwater flow directions will mirror local variations in the topography and discharge to streams and shallow springs where the geological conditions are favourable (e.g. localised more permeable sand and gravel lenses and bodies within the overburden.

6 POTENTIAL IMPACTS AND MITIGATION

6.1 POTENTIAL IMPACTS FROM THE SDZ

The hydrogeology below the study area has been outlined in **Section 5** of this report. Under current conditions, effective rainfall recharges shallow groundwater in the subsoil and weathered bedrock below the study area. Groundwater within the study area flows towards sloped embankments, where it discharges as a spring or seepage, or to the rivers/streams where it discharges as baseflow. The development of the SDZ has the potential to alter the hydrogeology in several ways that are discussed below:

- The creation of artificial drainage below significant areas of the SDZ has the potential to divert rainwater from groundwater recharge to storm runoff, thereby reducing groundwater recharge. This would reduce the volume of groundwater discharging to the observed tuffa springs and river systems.
- Excavation of soils for landscaping purposes has the potential to reduce the nature of subsoil aquifers below the SDZ lands and create spring discharge of groundwater where excavations proceed below the shallow perched groundwater or the groundwater table.

6.2 MITIGATION MEASURES FOR SDZ DESIGN

Several mitigation measures should be considered during the design stage for sensitive areas within the SDZ in order to minimise the potential impacts to the tuffa springs.

1. A Sustainable Urban Drainage Systems (SUDS) design philosophy should be employed for the SDZ;
2. The construction of hard standing areas should be minimised in the catchments immediately up gradient of the high quality tuffa springs (e.g. location 5) in order to minimise the potential for disruption to recharge in these areas.;
3. Artificial recharge systems should be considered where possible in sensitive areas, specifically up gradient from high quality tuffa spring (e.g. location 5) discharges in order to maintain the overall hydrological balance if development cannot be avoided in these areas; and
4. Landscape proposals should be considered in relation to the position of the groundwater table below the site so as to avoid possible interference with natural groundwater flow directions to sensitive receptors such as the high quality tuffa springs (e.g. location 5).

7 CONCLUSIONS & RECOMMENDATIONS

7.1 CONCLUSIONS

In summary, localised areas of tuffa spring formation have been observed within the SDZ. These appear to be supported by relatively shallow groundwater flow systems within permeable zones of the subsoil. The limestone parent material within the subsoil is acting as the source of the calcium carbonate. Tuffa spring formation is limited to where this is present and where there is a groundwater flow and discharge such as at localised slope banks. As these are relatively high up the embankments it suggests the presence of shallow perched groundwater flow systems that are not laterally extensive. The catchment areas feeding these tuffa springs are sensitive to future land changes that create impermeable surfaces, which will reduce groundwater recharge and ultimately discharge to these localised tuffa springs.

The most significant of these tuffa spring formations has been located to the southwest of the N11 on the south-western flank of the river valley, (location 5 on **Figure 3**). A low quality tuffa spring formation which is ecologically significant was also observed high on the northwest sloping boundary of the SDZ. (location 11 on **Figure 3**). These two tuffa spring formations will be dealt with in the recommendations below.

7.2 RECOMMENDATIONS

A number of high level recommendations have been made in relation to potential mitigation principles for the SDZ design (e.g. avoidance of sensitive areas, use of SUDS systems and possible use of artificial recharge). In line with the avoidance principle two spereate protection zones have been developed to encompass the tuffa spring formations at location 5 and location 11 and the most likely catchment areas that feed the individual tuffa formations.

The protection zone (**Figure 4)** relevant to location 5 extends to the southwest and upgradient of the tuffa formation to where the land rises again out of a topographical dip approximately 25m/30m in that southwesterly direction. To the northwest the protection zone extends to the boundary line of neighbouring agricultural land where a drainage ditch has been dug. The southeast boundary of the protection zone is the previously developed land. The proposed protection zone covers an area of 380m by 230m. With further field investigations the protection zone may be refined and more accurately delineated.

The protection zone (**Figure 4**) relevant to location 11 coincides largely with the 50m buffer zone recommended by Scott Cawley. The protection zone has been extended 50m past the recommended buffer zone to the west of the tuffa spring formation, giving a 100m protection zone in this direction to allow for a conservative estimate in the length of the flow path to the tuffa spring. Topographic contours suggest that flows from the east are unlikely to be contributing to the tuffa spring at location 11.

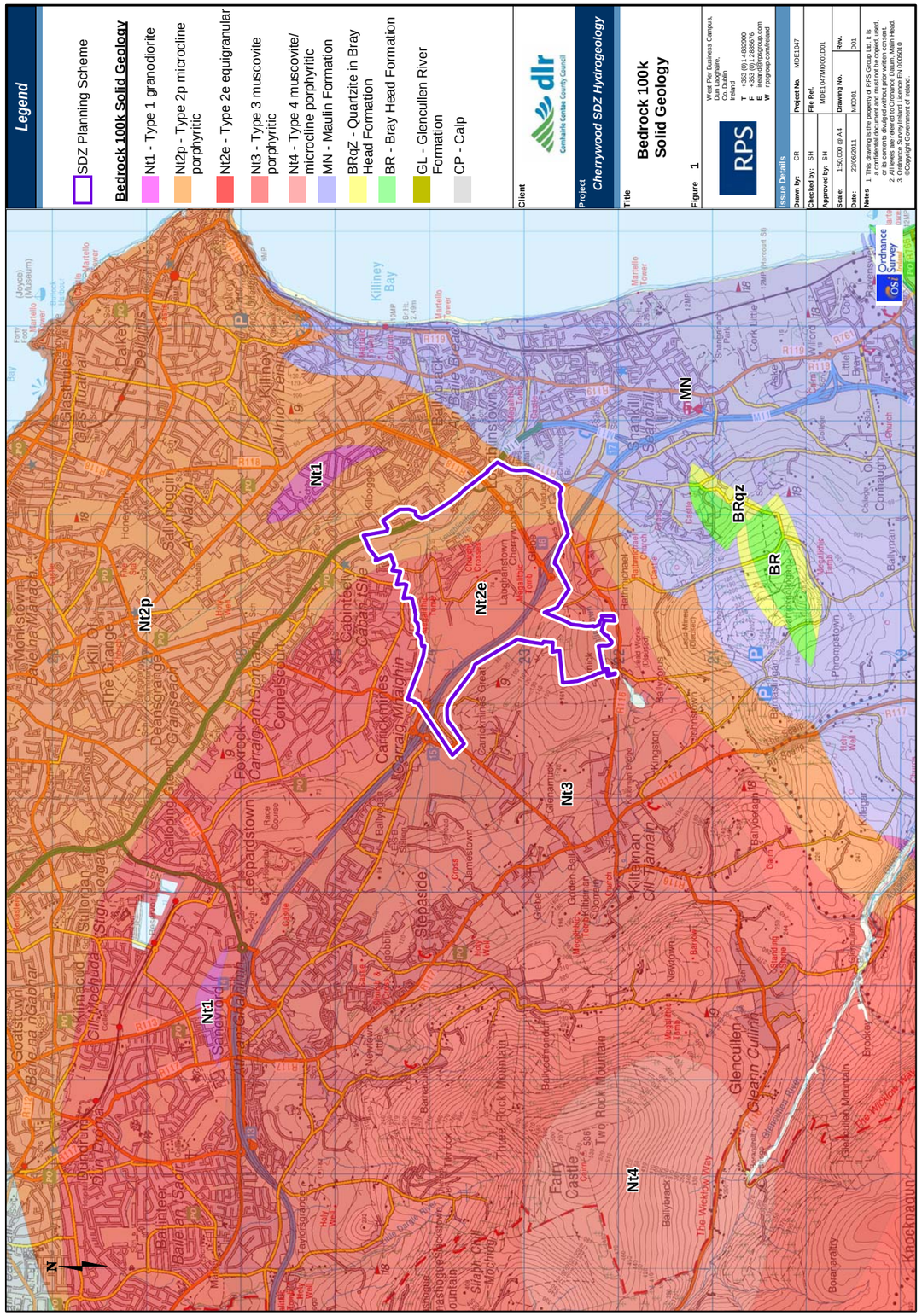
If avoidance of the sensitive catchment at location 5 is not possible, a targeted hydrogeological site investigation is recommended so that the hydrogeological system can be more completely evaluated and a baseline monitoring programme can be established on which to predict potential development impacts more completely. A targeted hydrogeological investigation would also help to refine the extent of the protection zone. Ideally this should include:

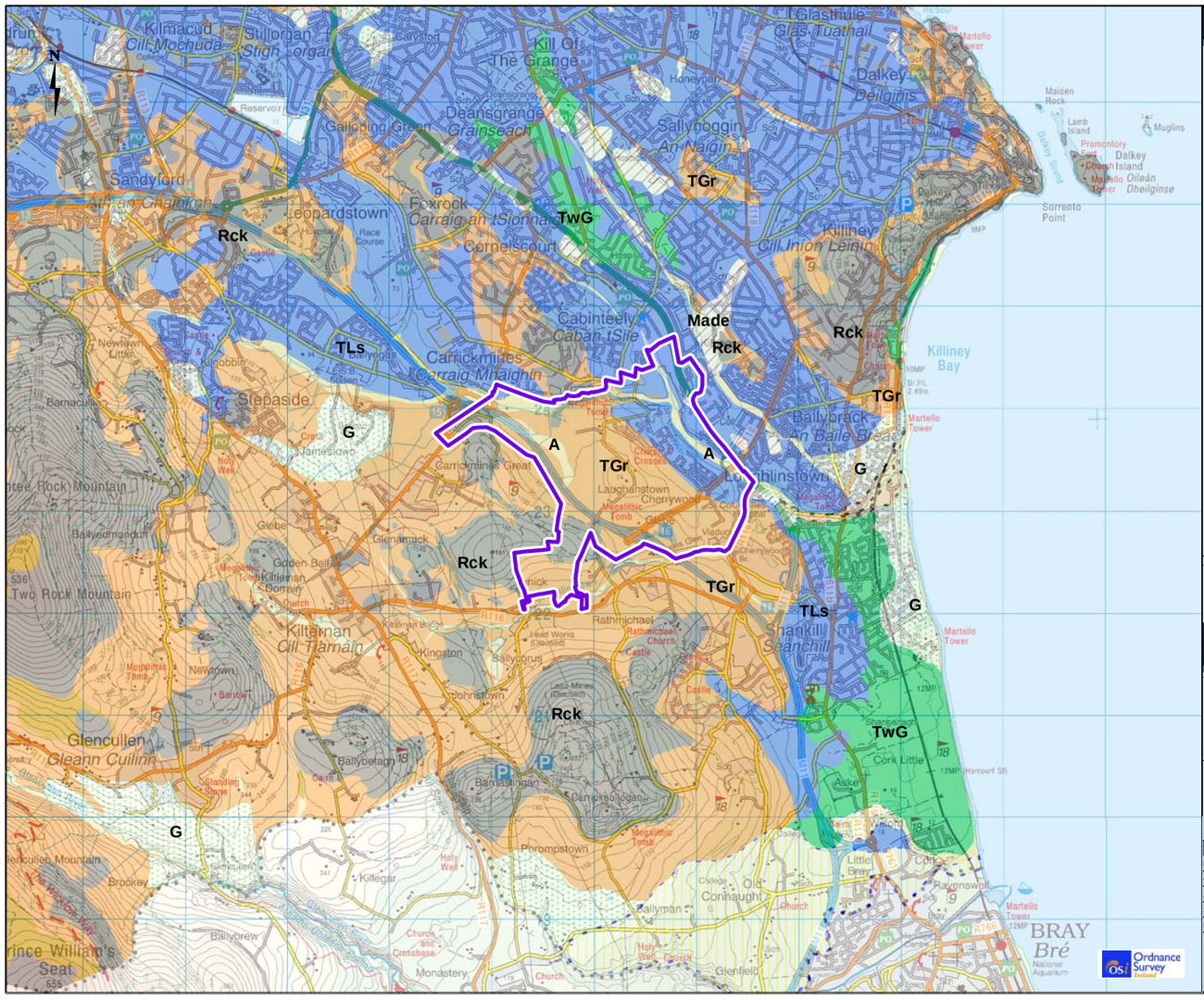
- Trial pit excavation to a nominal depth of 2.5m – 3m at approximately 15 locations across the designated protection area to more accurately assess subsoil geology in the catchment.
- Installation of a groundwater monitoring borehole network upslope of the spring emergence. 4 wells minimum, 6/7m deep or to a depth of 3m below the water table, located directly above and to either side of the spring emergence using a shell and auger drilling rig.

- Groundwater levels to be monitored in all boreholes over 12 month period using data loggers.
- Groundwater quality to be assessed in boreholes closest to the tuffa formation and at the spring emergence, (bi-monthly). Samples to be tested for major ions. – Ca, Na, CO_3, Cl, Mg, N
- Calculation of the mass water balance for the sensitive catchments above the tuffa springs to assess the overall impacts from future land use development changes in the catchment area.

APPENDIX A

PROJECT FIGURES




N
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G
Kilmacud
Stillorgan
Kill Of The Grange
Deansgrange
Sandyford
Leopardstown
Foxrock
Cornelscourt
Dalkey
Killiney
Sallynoggin
Glasthule
Cabinteely
Carrickmines
Stepaside
Ballybrack
Loughlinstown
Killiney Bay
Two Rock Mountain
Kilternan
Glencullen
Johnstown
Cherrywood
Rathmichael
Shankill
Ballycorus
Newtown
Ballyedmonduff
Glenamuck
Golden Ball
Jamestown
Laughanstown
Carrickmines Great
Sorrento Point
Maiden Rock
Dalkey Island
Muglins
Martello Tower
Megalithic Tomb
Holy Well
Church & Crosses
Viaduct
Cherrywood Br
Lead Works (Disused)
Castle
Barnaslingan
Carrickgollogan
Phrompstown
Killegar
Brookey
Ballybrew
Ballyman
Old Conaught
Cork Little
Ravenswell
Aske
Monastery
Glenfield
BRAY
Bré
National Aquarium
Ordnance Survey Ireland
Legend
SDZ Planning Scheme
Quarternary Geology
Ag - Alluvium (sandy)
As - Alluvium (silty)
G- Sands & Gravels (undifferentiated)
GLs- Limestone Sands & Gravels (undifferentiated)
Made - Made Ground
Mbs - Beach Sand
Pt - Peat
Rck - Bedrock at surface
TGr - Granite Till
TLs - Limestone Till (carboniferous)
TwG - Till with gravel (undifferentiated)
W - Water
Client
dlr
Comhairle Contae County Council
Project
Cherrywood SDZ Hydrogeology
Title
Quarternary Geology
Figure 2
RPS
West Pier Business Campus,
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File Ref. MDE1047MI0002D01
Scale: 1:50,000 @ A4
Drawing No. MI0002
Rev. D01
Date: 23/06/2011
Notes
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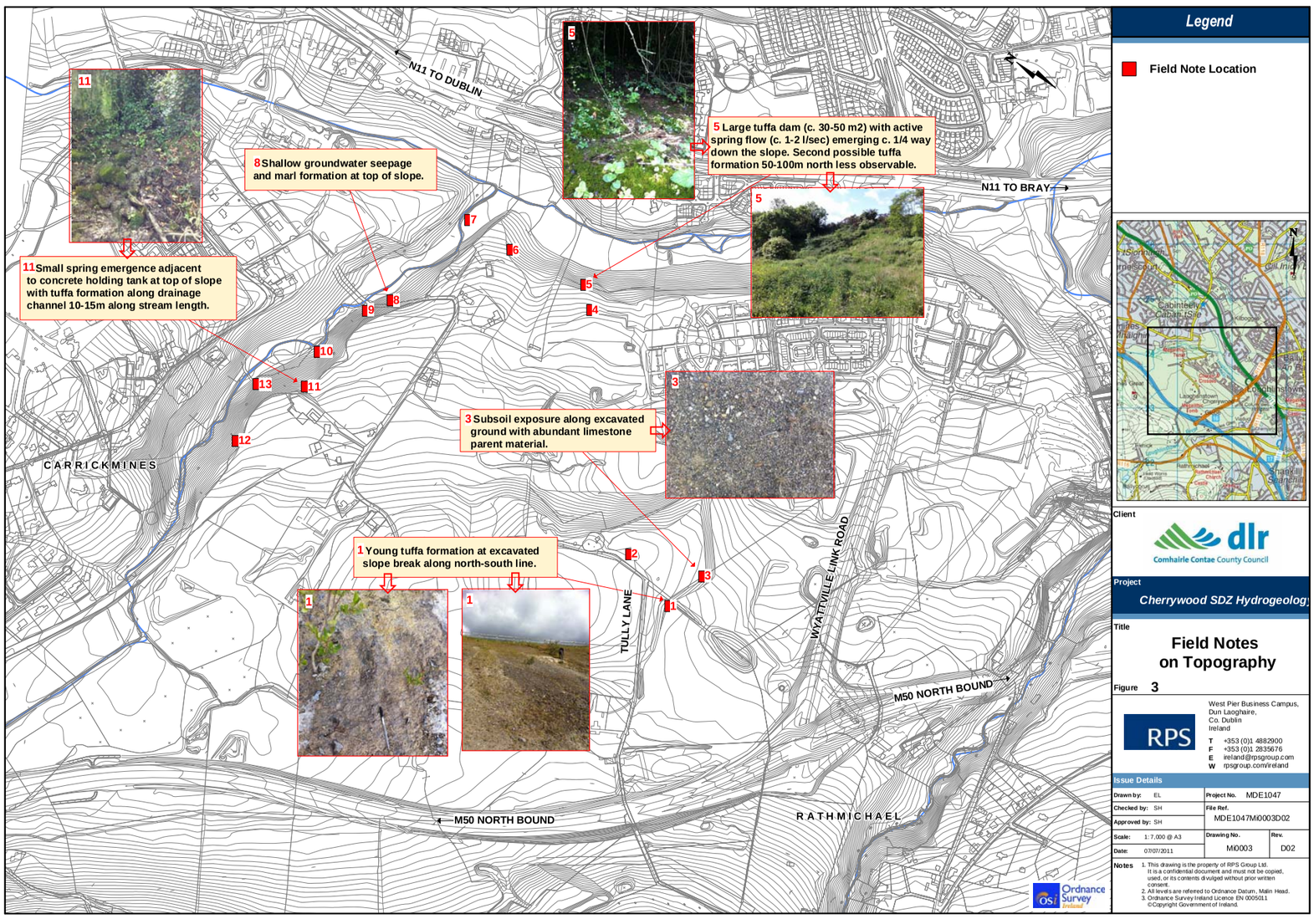
11
11 Small spring emergence adjacent to concrete holding tank at top of slope with tuffa formation along drainage channel 10-15m along stream length.
8 Shallow groundwater seepage and marl formation at top of slope.
5
5 Large tuffa dam (c. 30-50 m2) with active spring flow (c. 1-2 l/sec) emerging c. 1/4 way down the slope. Second possible tuffa formation 50-100m north less observable.
5
3
3 Subsoil exposure along excavated ground with abundant limestone parent material.
1 Young tuffa formation at excavated slope break along north-south line.
1
1
N11 TO DUBLIN
N11 TO BRAY
M50 NORTH BOUND
M50 NORTH BOUND
CARRICKMINES
RATHMICHAEL
TULLY LANE
WYATTVILLE LINK ROAD
11
10
13
12
9
8
7
6
5
4
3
2
1
Legend
Field Note Location
Client
dlr
Comhairle Contae County Council
Project
Cherrywood SDZ Hydrogeology
Title
Field Notes on Topography
Figure 3
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Issue Details
Drawn by: EL
Project No. MDE1047
Checked by: SH
Approved by: SH
File Ref. MDE1047MI0003D02
Scale: 1:7,000 @ A3
Drawing No. MI0003
Rev. D02
Date: 07/07/2011
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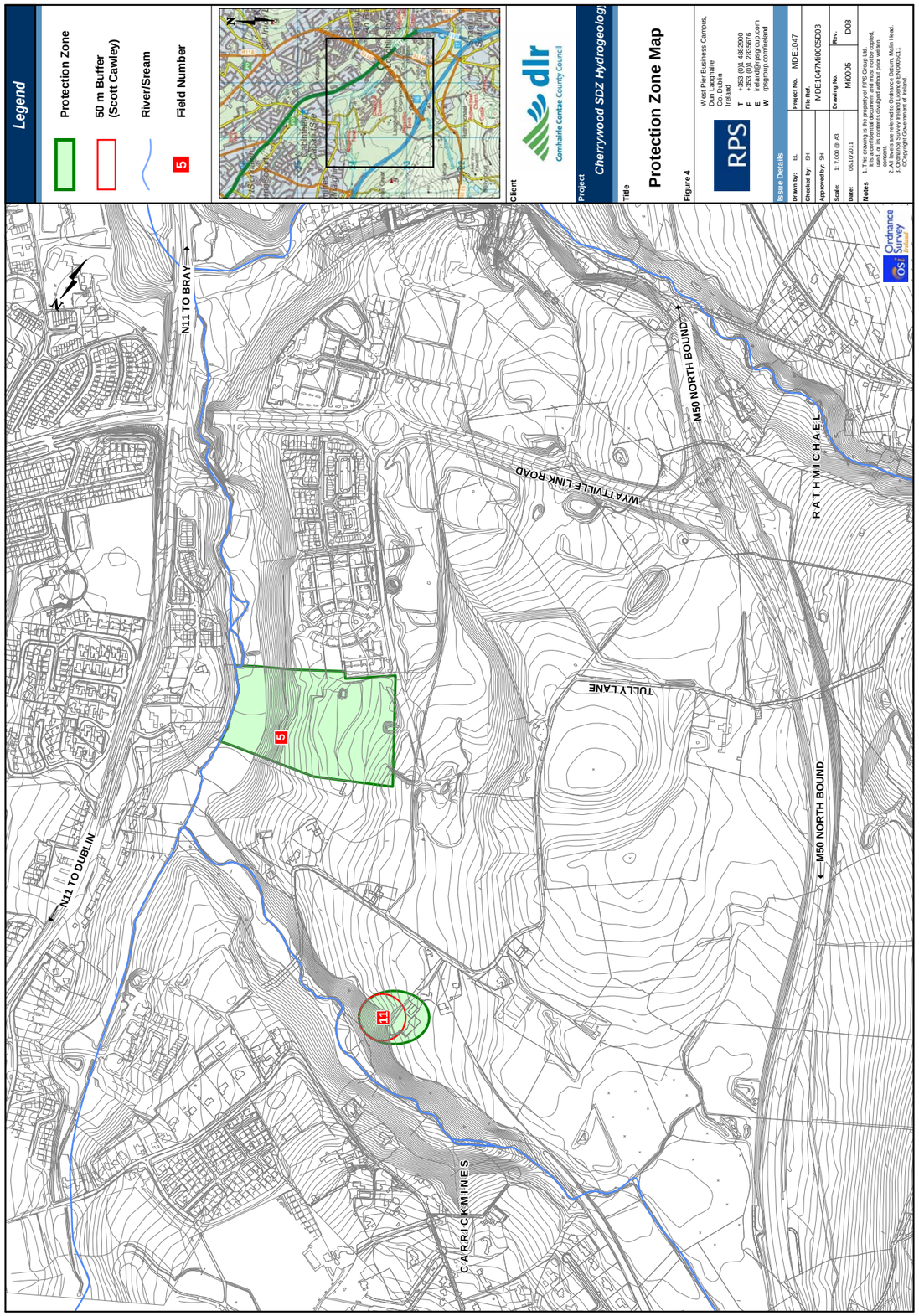


APPENDIX B

PROJECT PHOTOGRAPHS

Photograph 1 – Close up view of new tuffa formation observed along slope break (ref Location 1 on Figure 3).

Photograph 2 – View of new tuffa formation (where person is standing) observed from a distance along slope break (ref Location 1 on Figure 3).

Photograph 3 – Close up of tuffa (orange material surrounded by moss) and spring located along southwest bank of valley at location 5 (refer to Figure 3).

Photograph 4 – Distant view of tuffa spring (heavily overgrown area to the left of trees) located along southwest bank of valley at location 5 (refer to Figure 3).

Photograph 5 –Tuffa formation along drainage stream from spring emergence at location 11. Concrete water holding tank visible at top left corner of image.

Photograph 6 – Dry well drained land without spring or tuffa emergence along western bank of River valley, refer to location 6 on Figure 3.

NOTE TO FILE

2018s1302
Dún Laoghaire - Rathdown
County Council
May 2019
Alex Jones BSc MSc CGeol
Tufa Catchment Study

1 Introduction

This interim note summarises the updated assessment of a catchment study to spatially assess areas that may be important in supporting a sensitive groundwater fed tufa spring bounding the Cherrywood Strategic Development Zone. An initial catchment study was presented in 2018 on behalf of the County Council. This update is based on additional intrusive site investigations carried out by developers and by JBA in the catchment.

This note summarises provides an update of our understanding of the functioning of the spring, which was presented in three previous reports prepared by JBA Consulting. It has the following structure:

- Presentation of most recent additional site investigation data (completed in early Spring 2019) involving excavation of trial pits and advancing groundwater monitoring boreholes,
- An update of the existing hydrogeological Conceptual Model of the Tufa Spring,
- Identification of potential impact mechanisms that could affect the future integrity of the tufa spring,
- Further baseline assessment of the catchment supporting the tufa spring,
- Spatial zoning of the catchment to identify:
    - The hydrogeological role of catchment zones in supporting the spring,
    - Potential impact mechanisms that might affect the spring in each zone,
    - The broad nature of mitigation measures required in each zone.

2 Data Sets

The following datasets were available for review for this report.

Table 2-1: Data Sources

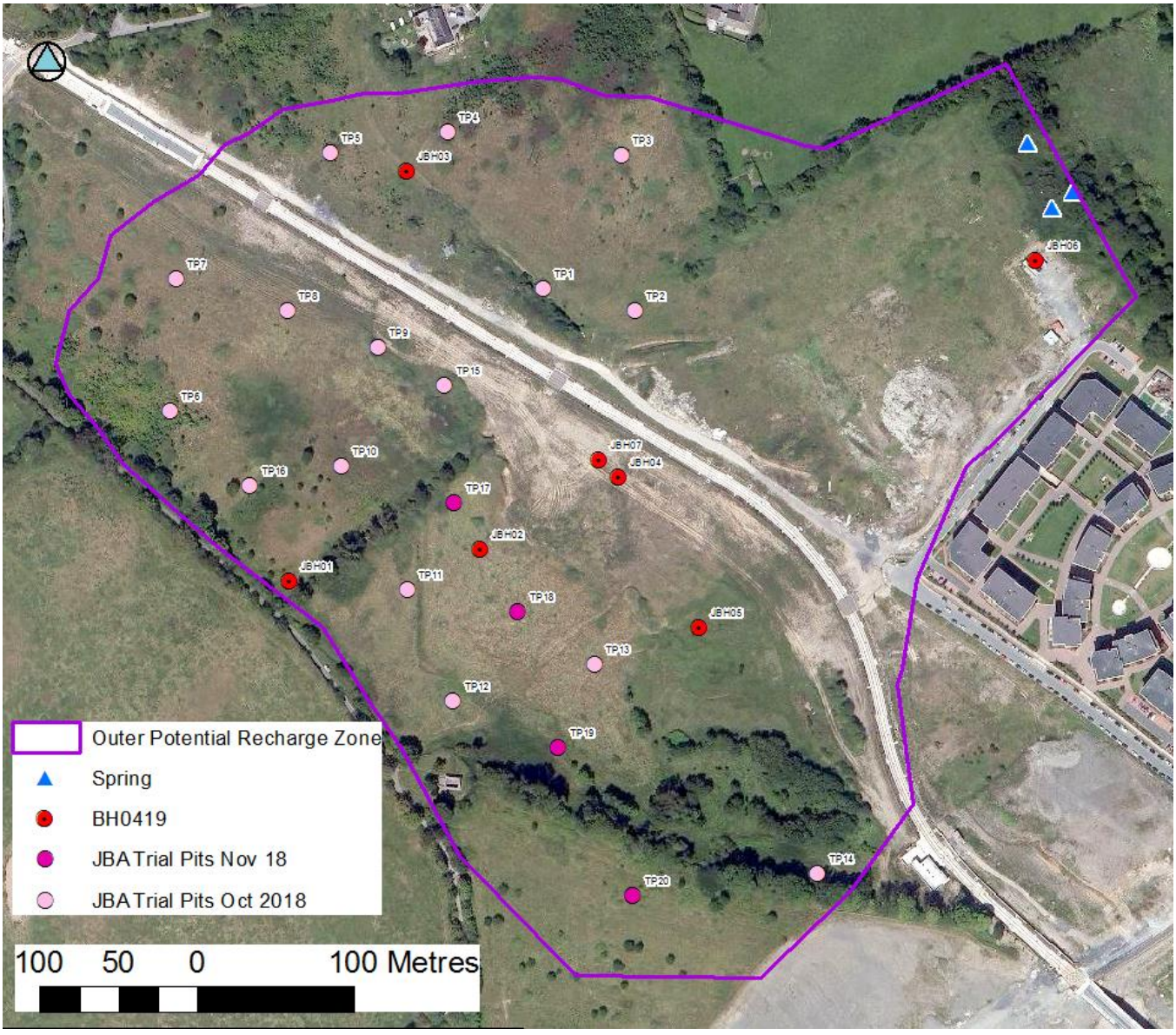
Area	Source
Topo-graphy	LIDAR
Historic Maps	25 inch 1888-1913 6 inch 1837- 1842 Available at http://map.geohive.ie/mapviewer.html
Site Investigation	GSI National Geotechnical Borehole Database – Report Numbers 1461, 2589, and 6043 Available at http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 Site Investigation Ltd – 2001 – Four Borehole logs covering development to the south. Ground Investigation Ireland Ltd – 2017 – 9 boreholes, 14 Trial Pits on land immediately uphill of Tufa Spring. Ground Investigation Ireland Ltd – 2017 – Site at Domville, Cherrywood, Dublin 18 – Site Investigation Report. JBA Trial Pitting 2018– See Appendix A. Causeway Geotech, April 2019, Cherrywood Ground Investigation – See Appendix B.
Aerial Photograp	Geohive 2000, 2005 and Latest Aerial Photographs available at http://map.geohive.ie/mapviewer.html

hy	Google Earth
Reports	Stephen Buss Environmental Consulting, September 2016, Hydrological Monitoring of Tufa Spring at Cherrywood. RPS, September 2011, Phase 1 Hydrogeological Assessment of the Cherrywood SDZ. Engineering Planning Report for a Proposed Residential Development at Domville, Cherrywood, Dublin 18 for William Neville & Sons – Muir Associates Ltd. JBA Consulting, July 2018, Review of Response to CFI (Planning Reference DZ17A/0714)
Thesis	MD Lyons (2015), The Flora and Conservation Status of Petrifying Springs in Ireland.

3 New Intrusive Site Investigation Information

Additional site investigations has been conducted in 2019 under the supervision of JBA to provide additional characterisation of ground and groundwater conditions within the spring catchment (See Trial Pit logs in Appendix A and Causeway Geotech 2019 in Appendix B). The locations of new investigation points are shown in the figure below and the supporting documents are provided in the appendices of this note.

Figure 3-1: Exploratory Locations



The site investigation identified three significant findings that have been used to update the conceptual model. These are discussed below.

3.1 Hilltop Till

Trial Pitting has identified a distinct type of deposit on the top of the hill, across the south and western area of the spring catchment (see Figure 3-3). The trial pits in this area identified a relatively thick sequence of

superficial deposits which included deposits sands and gravels from 1 to 5m thick. These deposits are not seen elsewhere in the catchment and are likely to be a source of the carbonate and much of the recharge that the tufa is dependent upon. The nature of these deposits is collaborated by RPS 2011 observations (see Figure 3 3) which also identified limestone rich till and tufa formations on a cut slope on the same hill to the south east of the study area. Additional water chemistry data for groundwater found within these deposits is discussed in Section 3.3

Figure 3-2: Detail from RPS 2011

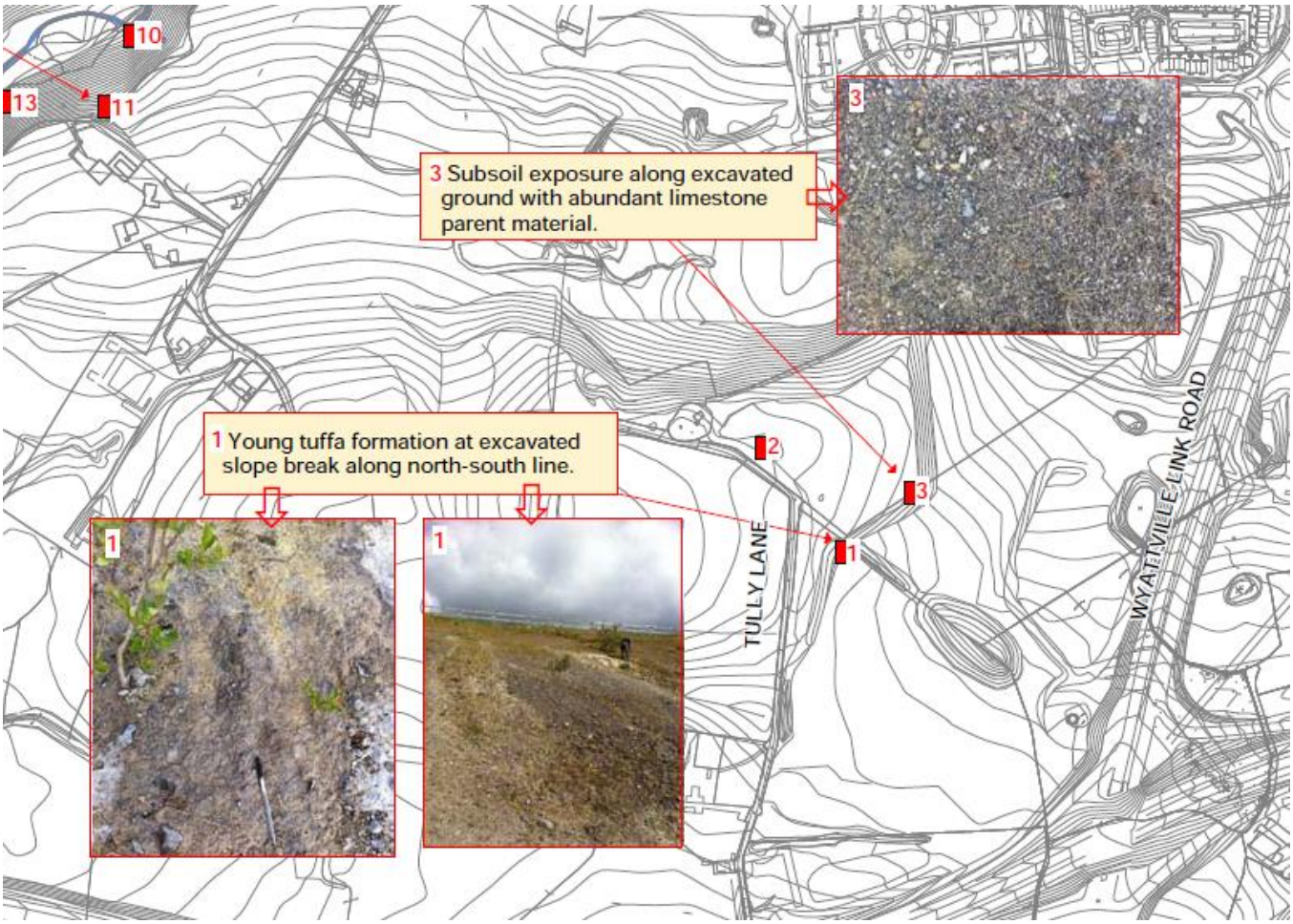
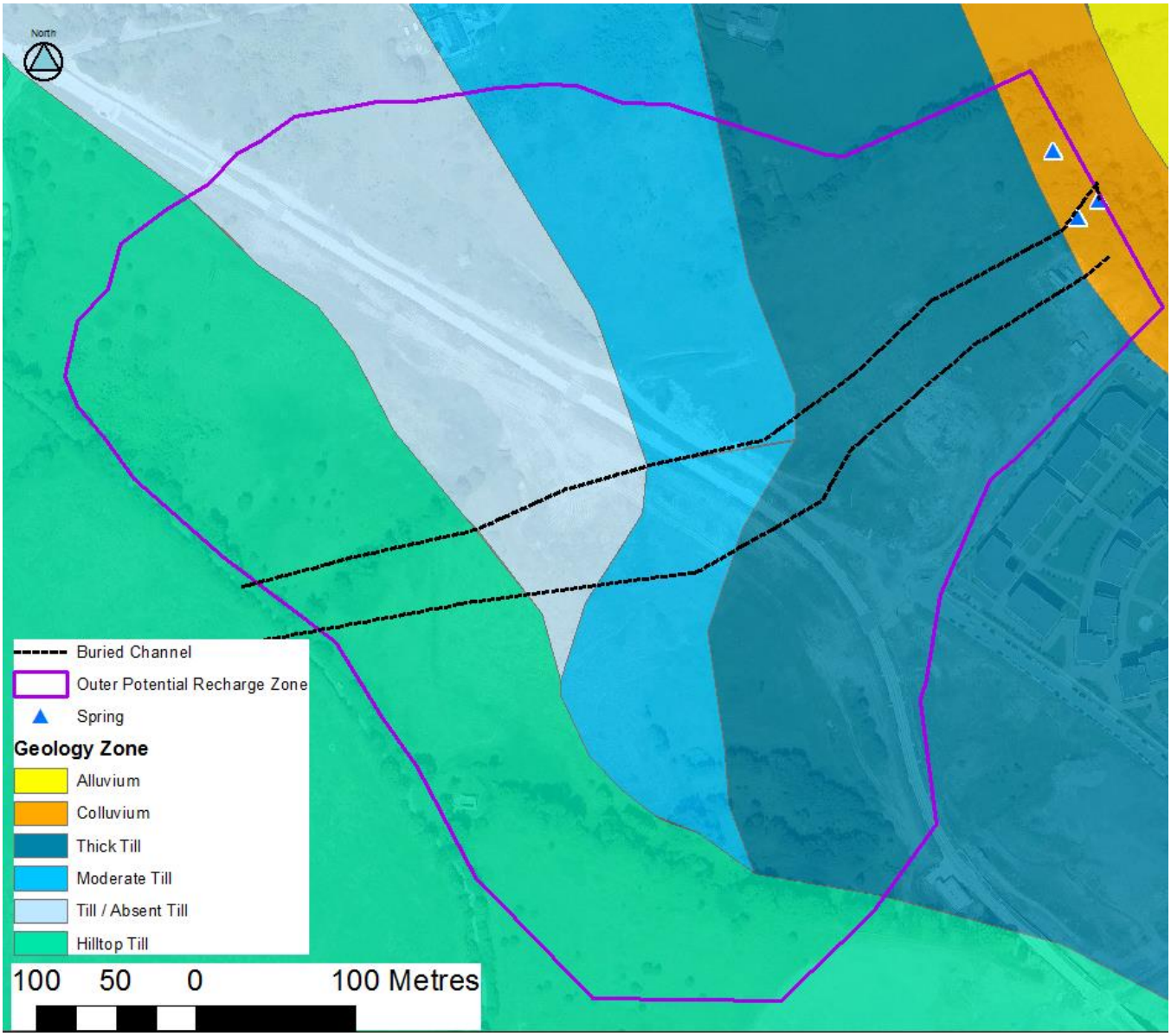


Figure 3-3: Broad Geological Classification Zones



3.2 Buried Valley

Four of the new boreholes identified a thick layer of greyish white silty sand at their base. Similar deposits at depth had not been identified in previous site investigations.

Table 3-1: Identified Buried Valley Deposits Summary

Borehole	Thickness of Silty Sand Deposits
JBH01	10m+
JBH02	6m+
JBH04	14m+
JBH06	10m+

Review of the surround site investigation information suggests that these deposits fill a steep sided buried valley cut into the granite bedrock surface. The approximate line of the buried valley is shown in Figure 3-3. For example, JBH07 and 04 are approximately 16 metres apart, bedrock at JBH07 is found at 3.2mbgl, whereas the base of JBH04 at 16mgl does not find the bedrock. This indicates the this buried valley has steep sides with at least a 1 in 1 slope. It may be a relatively narrow feature, which would explain why previous site investigations did not identify it.

Identifying the buried valley is important for updating our understanding of the location of the tufa spring. In effect, the buried valley may act as a conduit for groundwater flow focusing discharge at the spring. This may also explain why the neighbouring slopes have no groundwater discharge. However, there is a 200m gap between identify the buried valley deposits at JBH4 and at JBH6 (above the spring). Further site investigation would be recommended to try to identify the line of it through this area, possibly with the aid of non-intrusive investigation techniques such as geophysics.

3.3 Water Chemistry Results

Groundwater chemistry results suggest that that the soils found at hill top till act as a key source of calcium carbonate. Analysis indicates that, using field and laboratory measurements of pH, to calculate the Calcium Carbonate Saturation Index leads to varying results. Depending on the method of calculation, the results show groundwater lies at or close to supersaturated with respect to Calcium Carbonate in the majority of samples (see Table 3-2). This includes JBH01 showing Calcium Carbonate is present in the groundwater system in high concentrations from the top of the catchment.

Table 3-2: CaCO3 Saturation Index[1]

Sample ID		JBH - 1	JBH - 2	JBH - 3	JBH - 4	JBH - 5	JBH - 6	JBH - 7	Spring
17/04/2019	Field	0.37	0.17	0.12	0.11	0.51	0.48	0.43	N/A
	Lab	0.15	-0.48	-0.31	-0.31	0.13	0.08	-0.11	
14/04/2019	Field	0.12	-0.72	-0.53	-0.47	-0.26	-0.18	-0.53	-0.088
	Lab	0.14	0.08	-0.06	0.24	0.23	0.08	0.16	0.35

Table 3-3 presents water quality measurements at Cherrywood and the range of water quality results presented in Lyon (2015). Lyon (2015) sampled 115 tufa springs across Ireland and presents the mean, medium, minimum and maximum concentrations of a range of parameters. The table shows the parameters at Cherrywood are within the range of the Lyon samples, notably with generally high Calcium and Alkalinity

[1] The Saturation Index (SI) is a method of determining whether water will deposit calcium carbonate or maintain it in solution. Values greater than 0 are supersaturated.

levels and lower nitrate levels.

Table 3-3: Water Quality Parameters at Domville vs Parameters at other Tufa Springs (mg/l)

Sample ID	JBH - 1	JBH - 2	JBH - 3	JBH - 4	JBH - 5	JBH - 6	JBH - 7	Spring	JBA Mean	Lyon Mean	Lyon Median	Lyon Min	Lyon Max
Dissolved Calcium	108.5	133.7	124.6	100	125.2	133.2	138.3		123.4	87.8	84.5	19.08	181.22
	113	91.8	126.2	104.3	133.4	138.4	136.6	168.9	129.8				
Dissolved Magnesium #	10.3	15.4	6.3	17.6	8.7	12.3	14.7		12.2	10.11	8.15	0.22	30.56
	11.1	7.5	6	14.9	6.7	11.7	13.7	9.6	10.35				
Dissolved Potassium #	3.6	1.9	0.9	1.5	3.2	1.5	1.3		2.0	1.75	0.91	0.14	10.4
	3.3	1.4	0.9	1	0.9	1.4	1.1	1.1	1.1				
Dissolved Sodium #	26.5	15.1	12.8	13.7	14.8	16.7	15.3		16.4	15.52	8.97	5.1	82.31
	26.7	13.5	12.3	10.9	12	15.9	14.2	14.7	13.85				
Sulphate as SO4 #	22.1	34	36.3	29.2	38.7	62.7	40.6		37.7	14.27	8.28	0.06	96.25
	23.4	29.3	32.8	22.7	46.4	59.2	39.5	104.3	36.15				
Chloride #	50.5	23.5	25.6	17.1	21.8	28.3	15.4		26.0	24.16	14.61	6.98	131.89
	23.4	29.3	32.8	22.7	46.4	59.2	39.5	104.3	36.15				
Nitrate as N #	5.39	2.55	1.62	0.37	0.65	0.94	1.35		1.8	5.09	1.56	<0.07	44.05
	5.26	2.72	1.31	0.8	0.97	0.6	1.45	1.54	1.38				
Total Alkalinity as CaCO3	420	258	328	317	361	455	391		361.4	293.7	292.8	109.1	609.2
	600	335	333	330	624	431	414	353	383.5				
pH	7.62	7.43	7.36	7.47	7.51	7.54	7.5		7.5	7.88	7.97	7	8.47
	7.37	7.61	7.36	7.78	7.37	7.36	7.5	7.63	7.435				

Note
1) Two results are presents for each location on site. The upper is from the 17/04/2019 monitoring round and the lower is from the 14/04/2019.
2) No sample was taken from the spring in the first round.

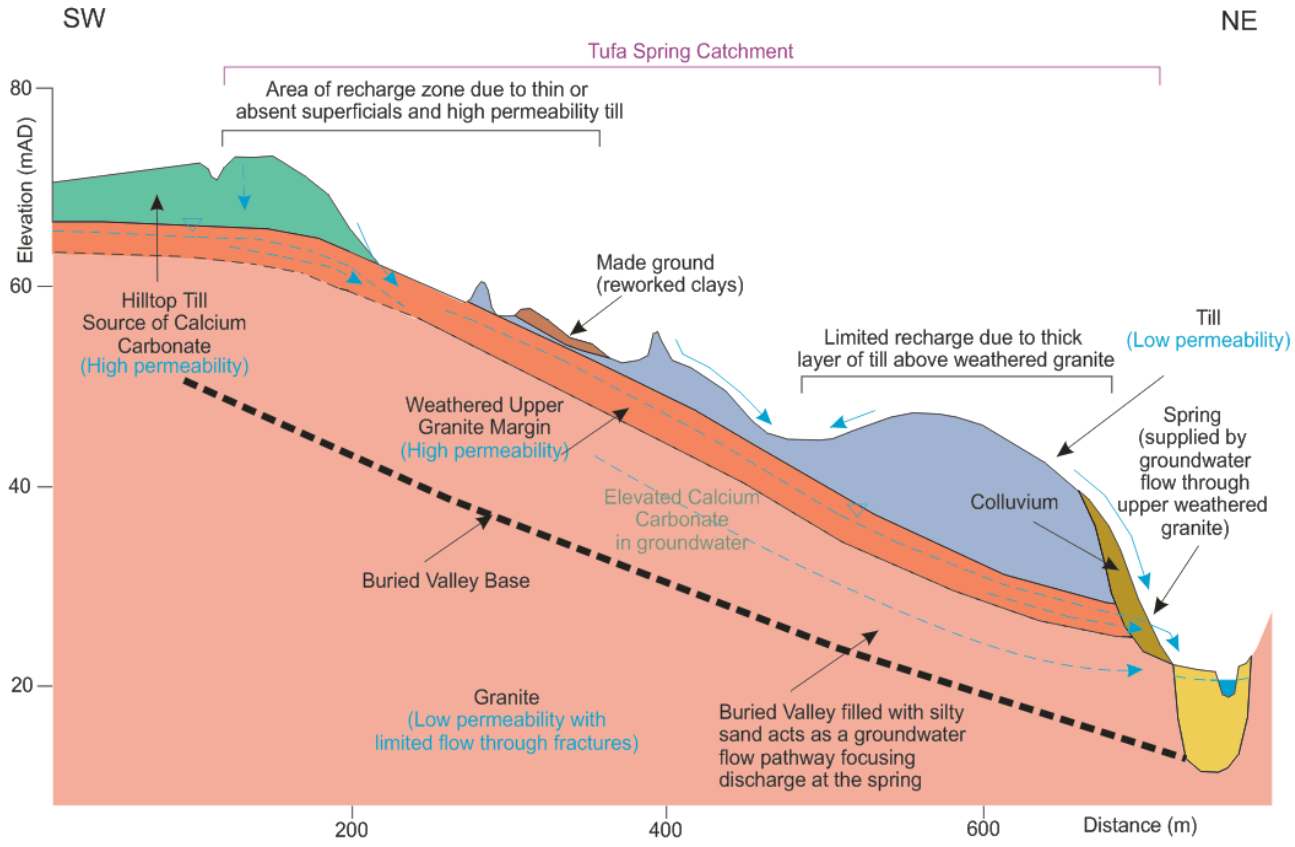
4 Updated Hydrogeological Conceptual Model

The current hydrogeological conceptual model of the tufa spring has been developed from two reports previously produced by JBA Consulting and the additional site investigation data summarised in the section above. It has the following features:

- The tufa springs form and discharge where a buried valley filled with silty sand intersects with the valley side.
- The upper weathered margin of the granite bedrock which is observed in previous site investigations acts as a relatively high permeability layer which discharges groundwater to the buried valley from the surrounding area.
- The recharge is likely to be derived from an area of thinner/absent till which overlies the bedrock and higher permeability till deposits in the upper catchment. These high permeability tills are also likely to also be a key source of calcium carbonate for the spring.
- Recharge in the area immediately uphill of the spring is limited by a thick layer of low permeability till.

The updated conceptual site model is shown in Figure 4-1.

Figure 4-1: Conceptual Model



4.1 Potential Impact Mechanisms

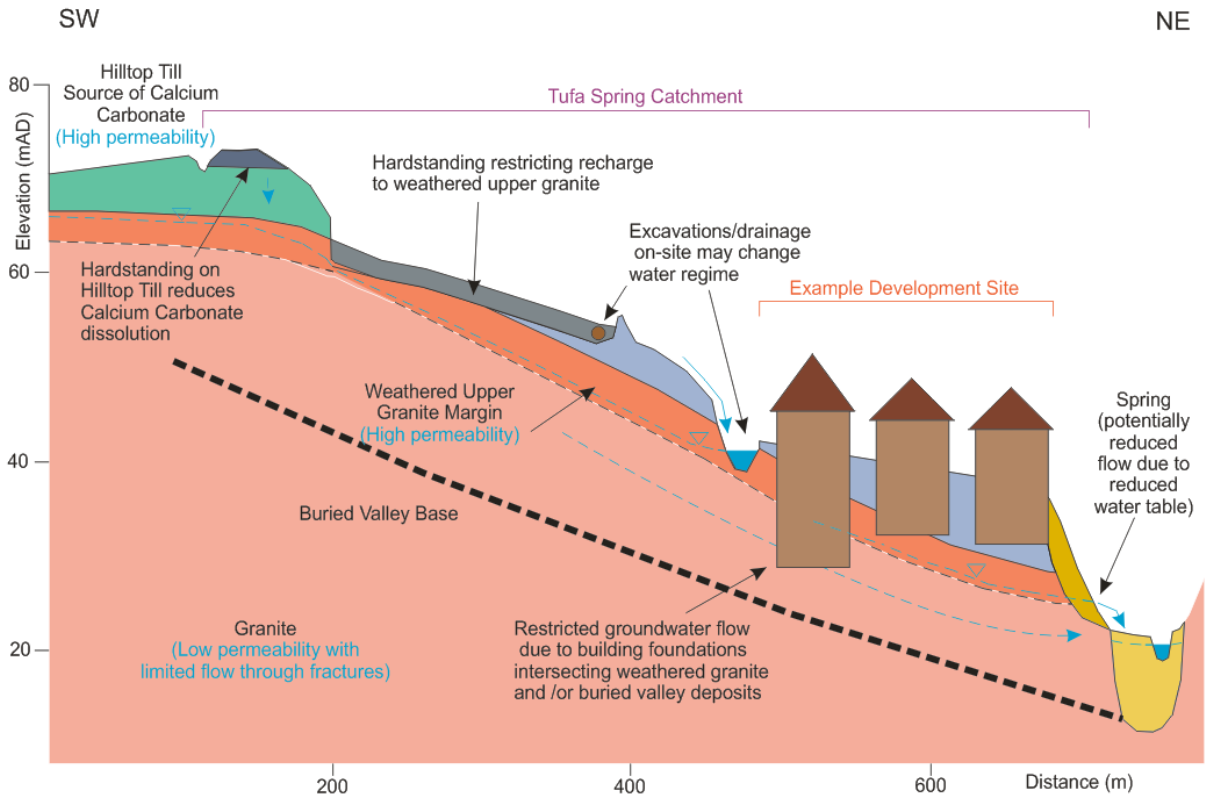
The potential impact mechanisms caused by future development can be divided into three broad categories (see table below). These are based on three key elements of the groundwater conceptual model which explains the functioning of the tufa spring.

Table 4-1: Potential Impact Mechanisms

Tufa Spring Support Element	Impact Mechanism
The water recharge zone	Reducing the permeability of the ground e.g. through construction of hardstanding over recharge area. Installation of drainage systems which divert surface water and alter the spring catchment.
Flow of water through the relatively high permeability tills, buried valley deposits and weathered upper margin of the granite bedrock.	Physical barriers to impede or divert groundwater flow (e.g. contiguous piling, foundations etc.) . Excavation below the local water table leading to a change inflow patterns, or installation of services below the water table which act as conduits for groundwater flow.
Direct Damage	Direct physical damage could occur to the tufa formation. This could lead to a change in the flow across the tufa, and the distribution of habitats on the formation.

These impact mechanisms are shown in the impact conceptual model in Figure 4-2.

Figure 4-2: Impact Conceptual Model



5 Catchment Baseline Analysis

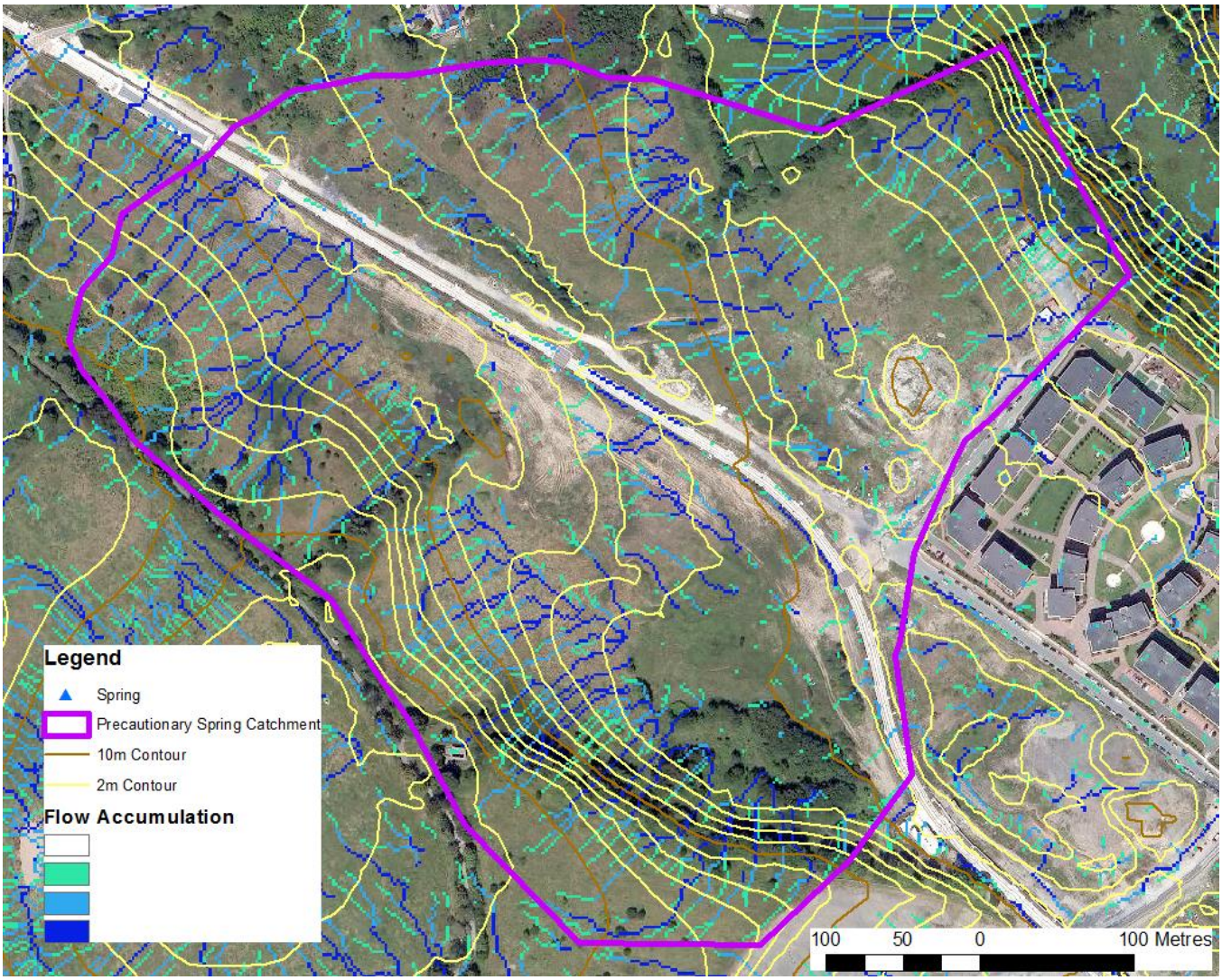
This section outlines several key elements of the analysis undertaken on the tufa catchment to identify areas which may potentially be sensitive to future development.

5.1 Precautionary Catchment Area

A Precautionary Catchment Area is shown in Figure 5-1. It is likely to be slightly larger than the true spring groundwater catchment and its extent has been defined based on the following:

- ArcGIS flow accumulation analysis to identify watersheds and main overland flow paths.
- Recharge calculations (in SBEC 2016), which suggest the catchment should be circa 28ha to account for the flow at the spring.
- The catchment excludes the existing development immediately to the south, which appears not to have affected the spring.

Figure 5-1: Precautionary Catchment Area



5.2 Intrusive Investigation Review

Data from six intrusive site investigation reports (see Table 2-1) were available for review. Appendix A presents a summary of the exploratory locations, identifying the nature and thickness of the superficial and bedrock geology. Two summary figures are presented below showing the estimated base of the superficial soils and depth to granite bedrock. Figure 5-2 shows a general slope to the top of the granite in line within general topography from west to east. The contours show the line of the buried valley west of the Luas Line and near the spring. Between those area, the site investigation locations have not identified the buried valley.

Figure 5-2: Base of Till/ Top of Granite mAD

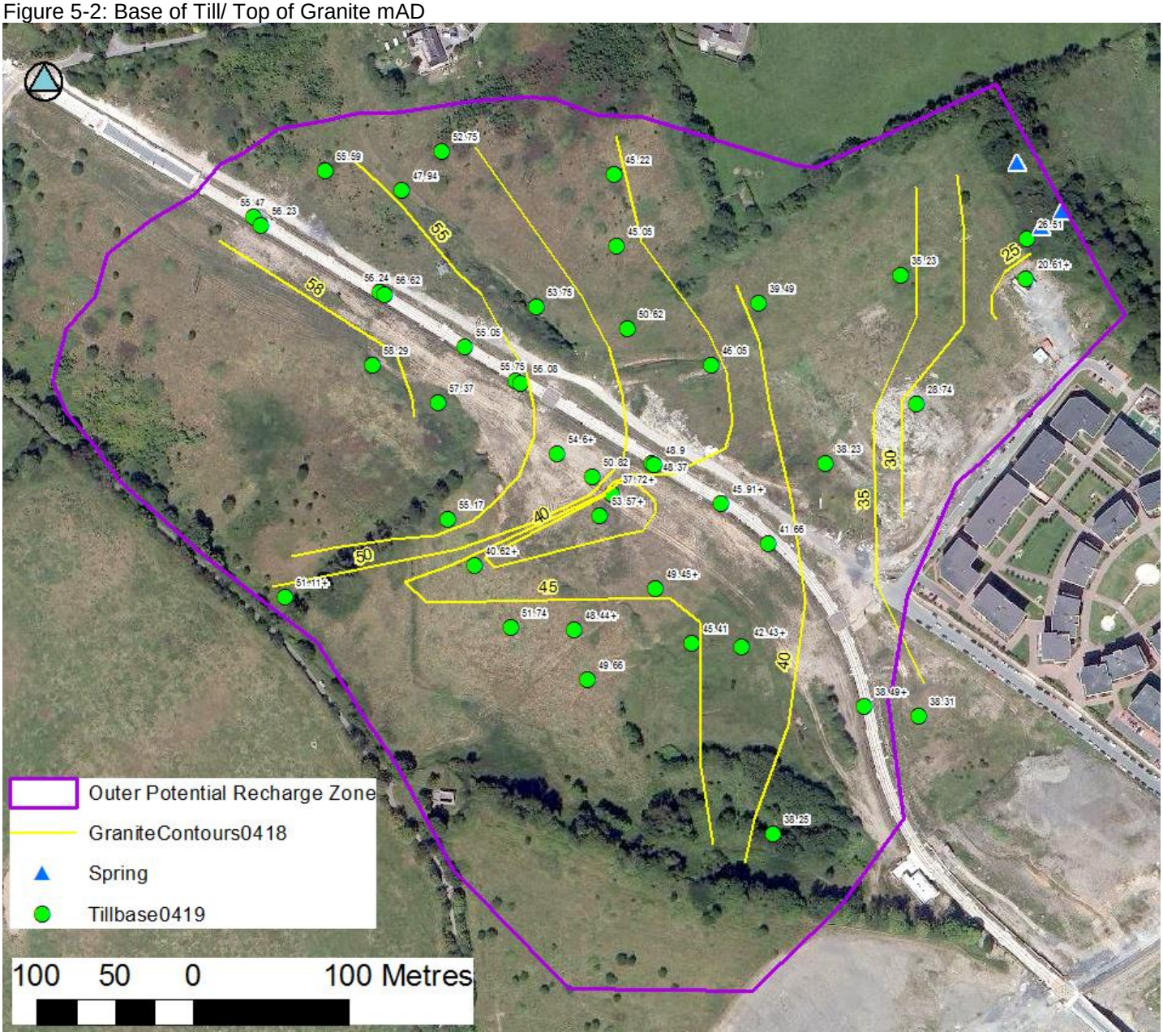


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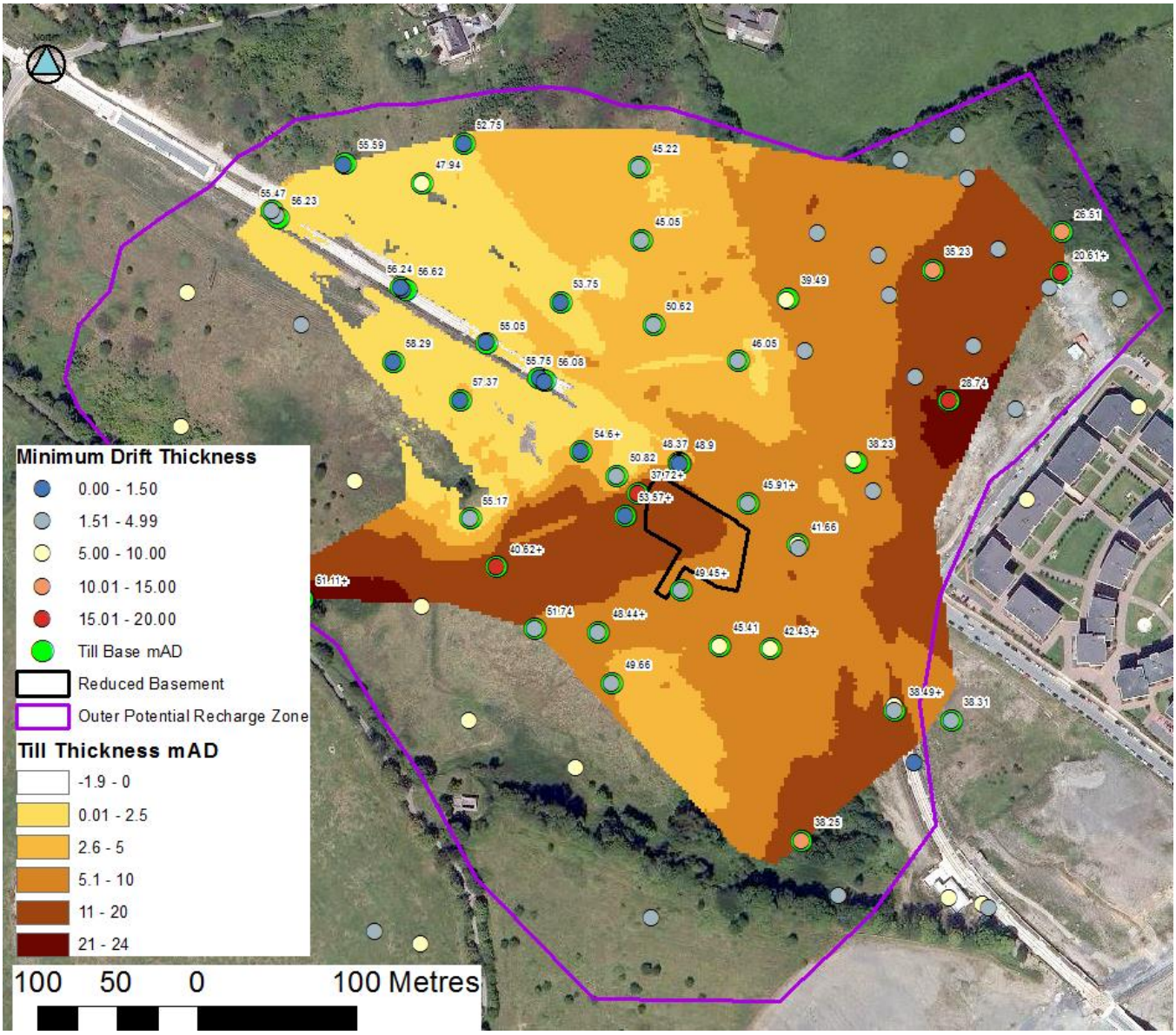
Figure 5-3: Depth to Weathered Bedrock



5.3 General Geological Classification

A review of available SI data (including that recently collected in 2018/2019), published geological mapping and topography data has been used to produce a broad classification of the geology of the catchment. This is shown in Figure 5-4 and a stratigraphic cross section is shown in Figure 5-5. There are the following classes:

- Alluvium – occupying the valley floor below the spring,
- Colluvium – till material that has migrated down the steep hill through gravity,
- Thick Till – an area of thick till (up to 17m thick) which forms a plateau above the tufa spring,
- Moderate Till – an area of moderately (approximately 2.5-5m) thick till which represents a wedging

out of the thick till in the central area of the conjectured spring catchment area,

- Thin/absent Till – above the thick till plateau as the surrounding ground slopes upwards in the west of the catchment area. The overlying till wedges out on this slope so the bedrock lies close to the surface..This is classified as till less that circa 2.5m thick
- Hilltop Till – at the top of the catchment in the west is a plateau area underlain with till with a relatively high sand and gravel content.
- The approximate line of the buried valley identified during the most recent investigations is indicated with by dashed lines. This buried valley is filled with silty and sand rich deposits.

The entire area is underlain by granite bedrock with a weathered upper surface.

Figure 5-4: Broad Geological Classification Zones

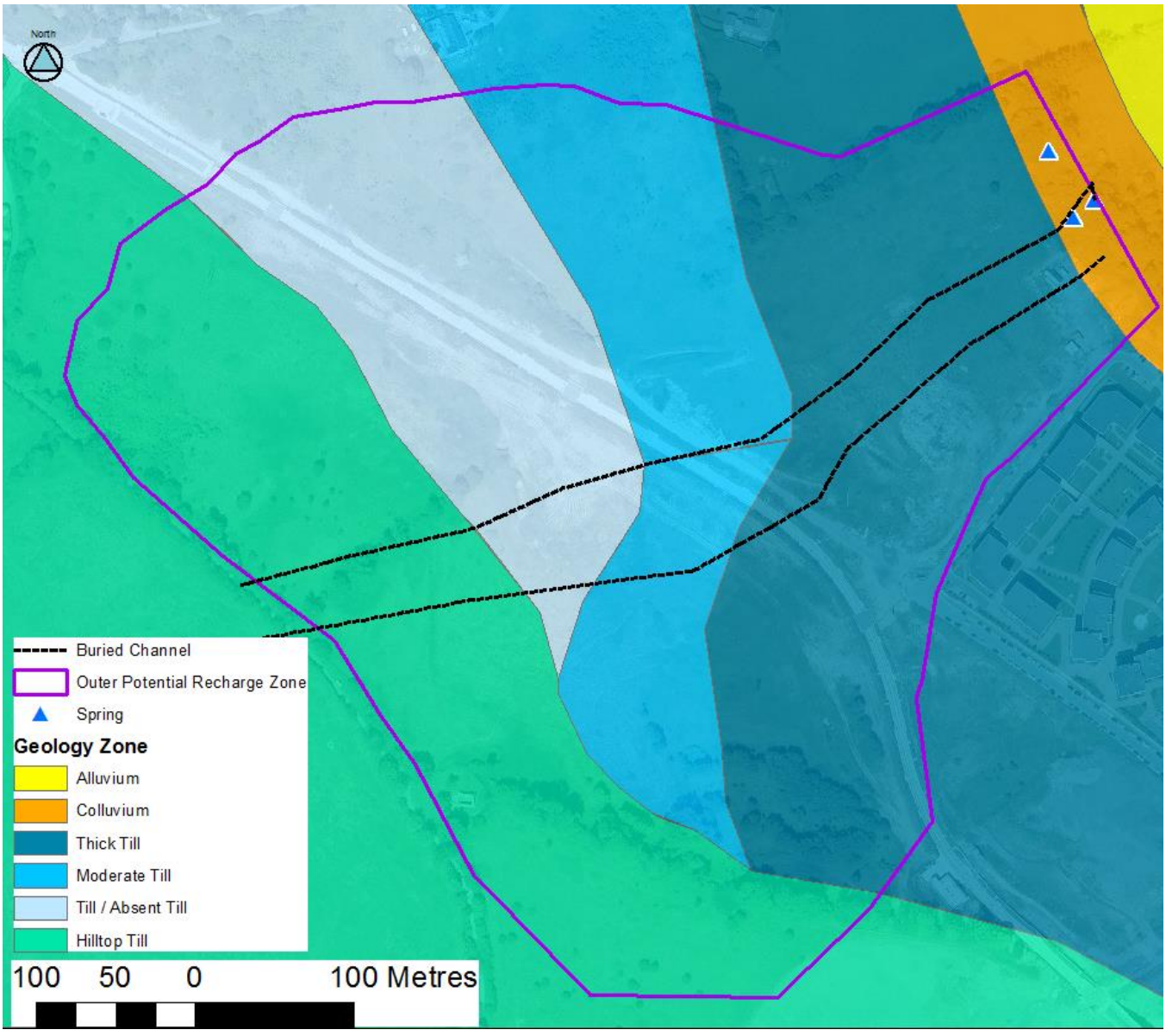
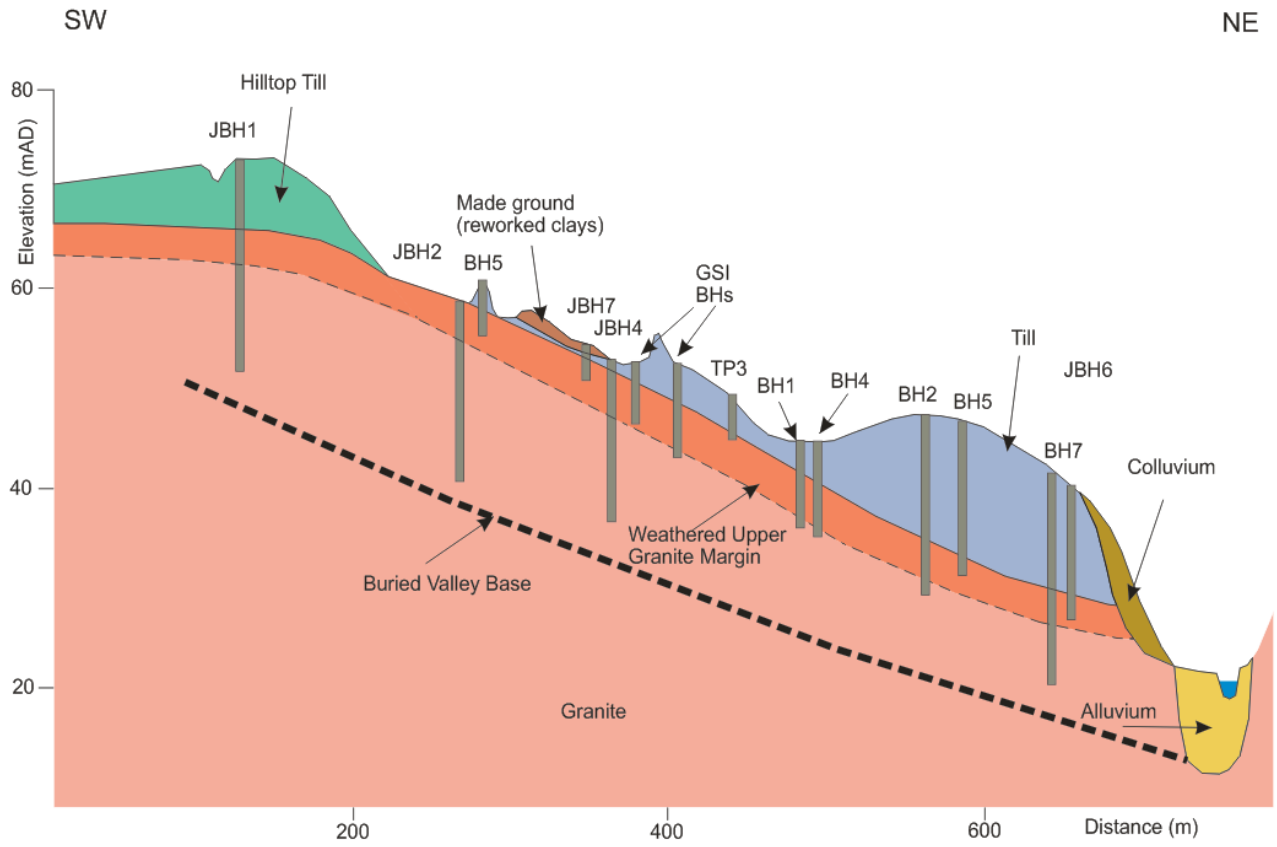


Figure 5-5: Stratigraphic Cross Section



5.4 Identifying Reworked Ground

An analysis of the SI information, LIDAR, Historic Mapping and Aerial photographs have been used to identify areas of reworked, or made ground. This includes areas of cutting and stockpiling. They are shown in Figure 5-6 and described in Table 5-1.

Figure 5-6: Reworked Ground

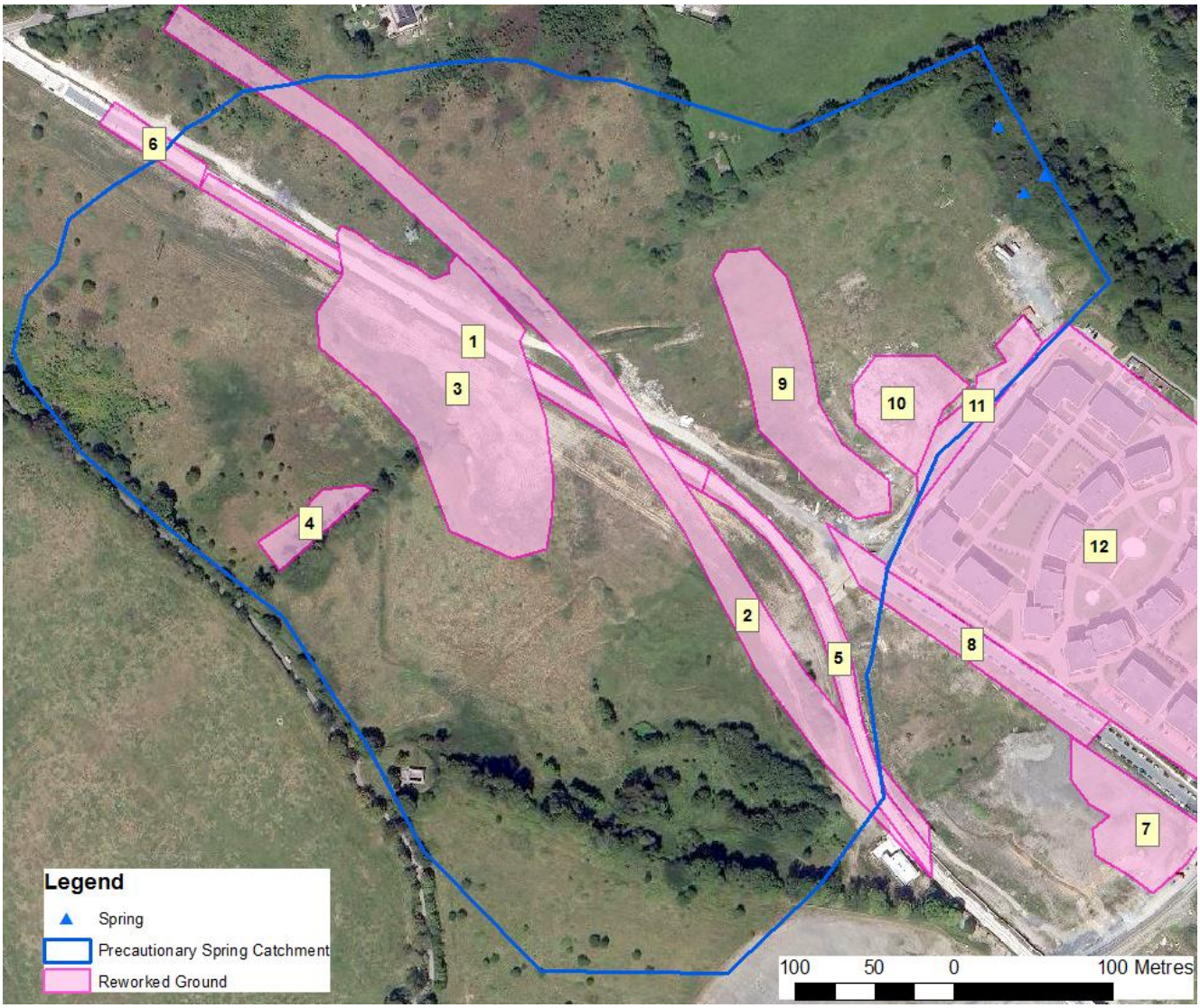


Table 5-1: Reworked Ground Descriptions

Number	Description
1	Railway line – cut section
2	Historic line of railway line
3	Area of earth stockpile (Domville SI, LIDAR and aerial photographs)
4	Historic gravel pit – 1837-42 map
5	Railway line – raised section
6	Railway line – limited cut
7	Earth stockpile
8	Road

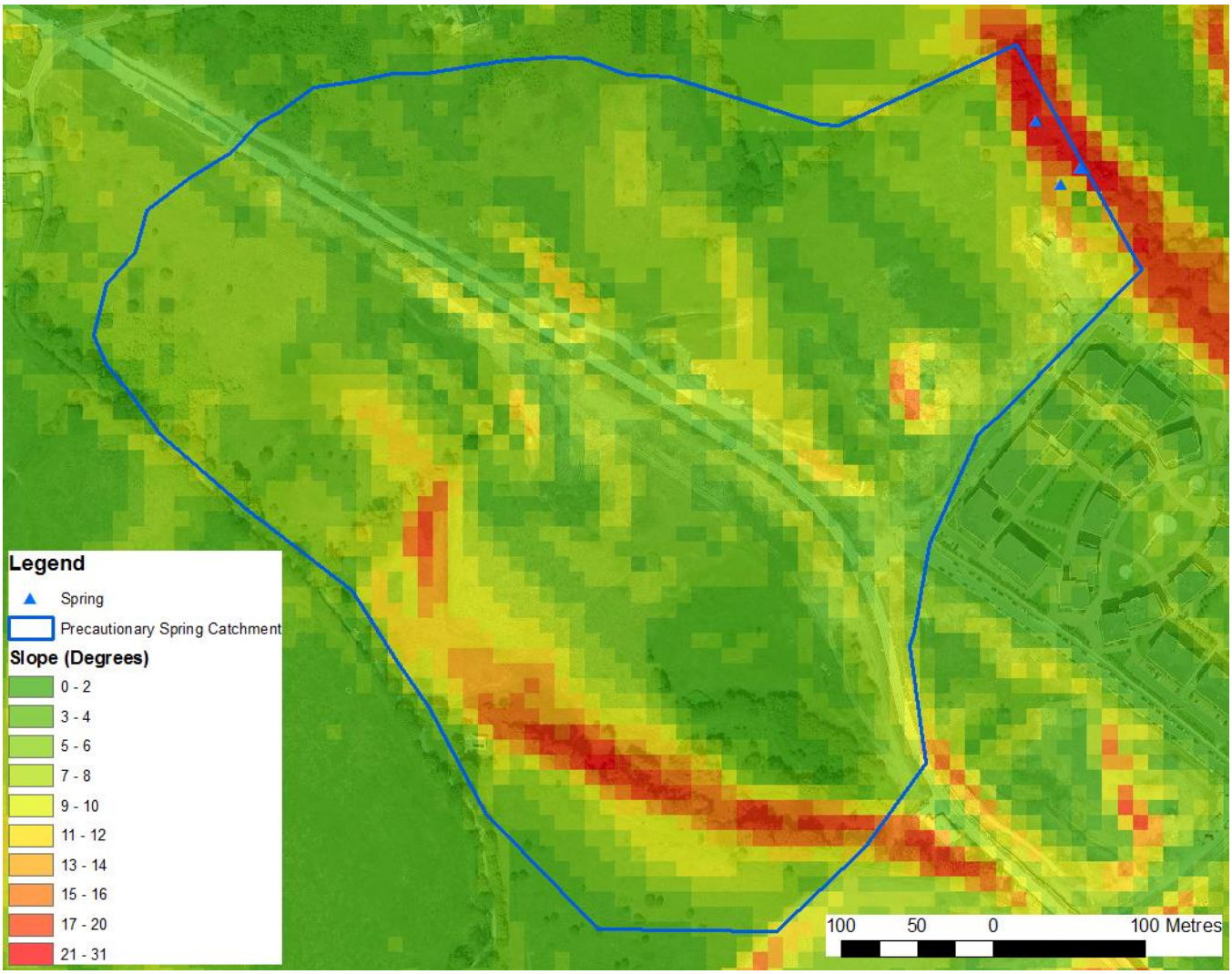
9	Thin area of made ground (SI)
10	Earth Stockpile (LIDAR and aerial photograph)
11	Section cut and levelled (LIDAR)
12	Flats

5.5 Slope and Topography Analysis

Figure 5-7 presents an analysis of slope angle across the catchment using ArcGIS analysis (of 10m aggregated version of the LIDAR data to remove "noise" of microtopographical features). It shows the following:

- The floodplain below the springs,
- The steep slope on which the springs lie,
- The plateau above the spring,
- The gentle slope further up the hill,
- The steep slope at the top of the catchment in the south, and,
- The hill top plateau.

Figure 5-7: Slope Analysis



6 Catchment Sensitivity Zone Classification

This section presents an updated catchment sensitivity zone classification scheme. The zones into which the catchment have previously been sub-divided are shown in Figure 6-1. Table 6-2 provides a description of the potential development related impacts that could arise within each zone, and the outline recommended mitigation actions. These are based on an assessment of the superficial geology coverage proven by site investigation and shown in Figure 5-4, the slope analysis provided in Figure 5-7 and the relative distances from the spring..

The following provides a short summary of development impact classes. However, it does not take into account large scale development works such as extensive and deep excavations (more that 2.5m deep) which could fundamentally alter the groundwater system and therefore the future status of the springs. **Such work, anywhere within the Precautionary Spring Catchment as defined above, should be supported by a hydrogeological risk assessment and an appropriate level of site investigation**. In certain zones, excavations less than 2.5m could be undertaken without further excavations, as they would occur entirely in low permeability till deposits. For each area, there are two Potential Impact Classes described in Table 6-1. Any proposed development should not significantly change the nature or area of the catchment of the spring, through divergence of surface or groundwater away from the catchment.

Table 6-1:Potential Impact Classes

Potential Impact Classes	Possible Mechanism	Spatial Locations Where Impact is Most Likely to Occur
Alteration of Recharge Characteristics	Reducing the permeability of the ground and infiltration of surface water through construction of extensive areas of hardstanding. Installation of drainage systems which change the spring catchment, or lead to reduced recharge within the catchment.	Where groundwater recharge rates are likely to be higher, i.e. areas where till is relatively thin (or absent), or of relatively high permeability.
Alteration of Groundwater Flow Paths	Physical barriers to groundwater flow (secant piled walls, deep foundations for undercroft parking etc.) could be built through the upper weathered margin or buried valley. Deep permanent excavation below the local water table, or installation of deep service conduits.	In the lower part of the spring catchment, where till is thick, this impact mechanism is only likely to only occur with deeper excavations. Where till is thin or absent or higher permeability development works could have the potential to alter flow paths. It has been assumed that groundwater flow paths in the lower catchment will not be significantly affected by excavations and physical barriers in the upper catchment, i.e. all except very large excavations in the upper catchment will not change the groundwater catchment of the spring

Table 4-1 identifies a third impact mechanism relating to changing groundwater chemistry (close to the spring. This impact mechanism is more likely to occur only in the vicinity of the springs in Zone 1.

Figure 6-1: Catchment Sensitivity Classification

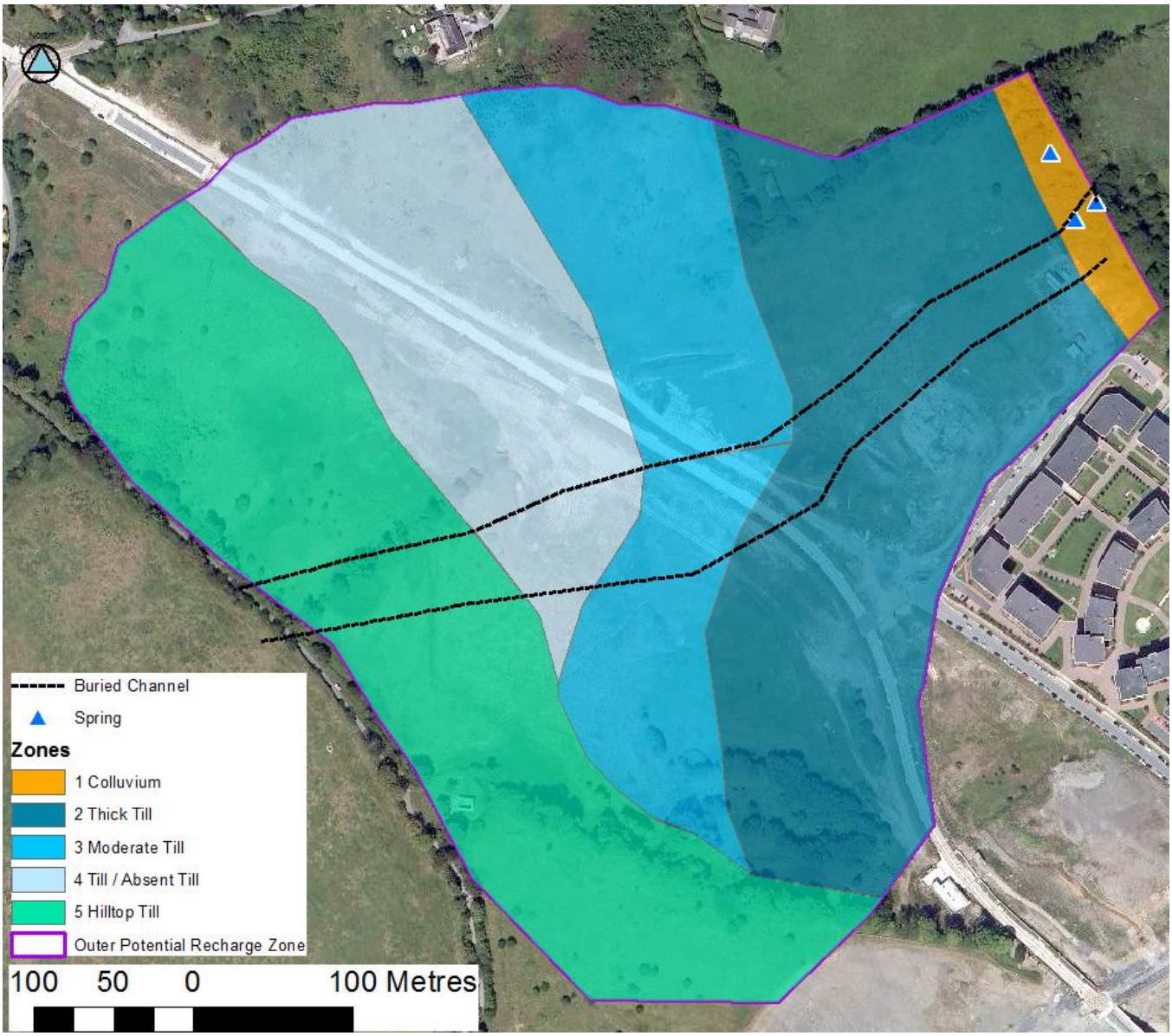


Table 6-2: Sensitivity Zone Classification

Zone	Recharge Impact Potential	Flow Impact Potential
1 - Colluvium	Zone 1 represents the slope where spring flow occurs and should be avoided in all cases	
2 – Thick Till	Unlikely – No further analysis is likely to be required.	Unlikely - No further analysis is likely to be required. Note area may be more suitable for deeper excavations further analysis would be required.

3 – Moderate Till	Unlikely – No further analysis is likely to be required	Unlikely - No further analysis is likely to be required
4 Till / Absent	Likely – Areas of proposed hardstanding and other low permeability cover will require further analysis to establish the extent of impact on recharge to the spring. Where areas can be shown to have a significant layer of low permeability till no further analysis would be required.	Likely – Excavations that are expected to reach the gravel (weathered bedrock) and bedrock layers would require further analysis to establish the extent of impact on the groundwater flow to the spring.
5 Hilltop Till	Likely – Areas of proposed hardstanding and other low permeability cover will require further analysis to establish the extent of impact on recharge to the spring.	Likely – Excavations that are expected to reach saturated deposits would require further analysis to establish the extent of impact on the groundwater flow to the spring.

7 Domville Review

This section provides an interim summary on the proposals for basement areas below Blocks C, D and F as part of planning reference DZ17A/0714 in the light of the recent GI findings.

7.1 Updated Hydrogeological Conceptual Model

Figure 7-1 presents the location of the basement with regards to the Sensitivity Zones (from Figure 6-1) and Figure 7-2 presents a cross section through the basement. The following should be noted:

- The basement lies within the footprint of the buried valley which has been identified during the most recent round of ground investigation.
    - The GI has shown that this buried valley feature is infilled with deposits containing silty sands, which are likely to acts as a key groundwater flow path to the tufa spring,
    - The thickness of these deposits were shown to be at least 16m deep at JBH04,
    - The lateral extent of the buried valley is not well constrained, especially its southern boundary, though it appears that it is relatively steep sided.
- Recent monitoring of static groundwater levels (see Table 7-1 and Figure 7-2) indicates that groundwater levels in the north of the basement are slightly higher than the basement floor which lies at a proposed elevation of 49.37mAD. This is within the footprint of the buried valley. In the south, groundwater levels fall below the base of the basement.

Figure 7-1: Sensitivity Zones and the Basement

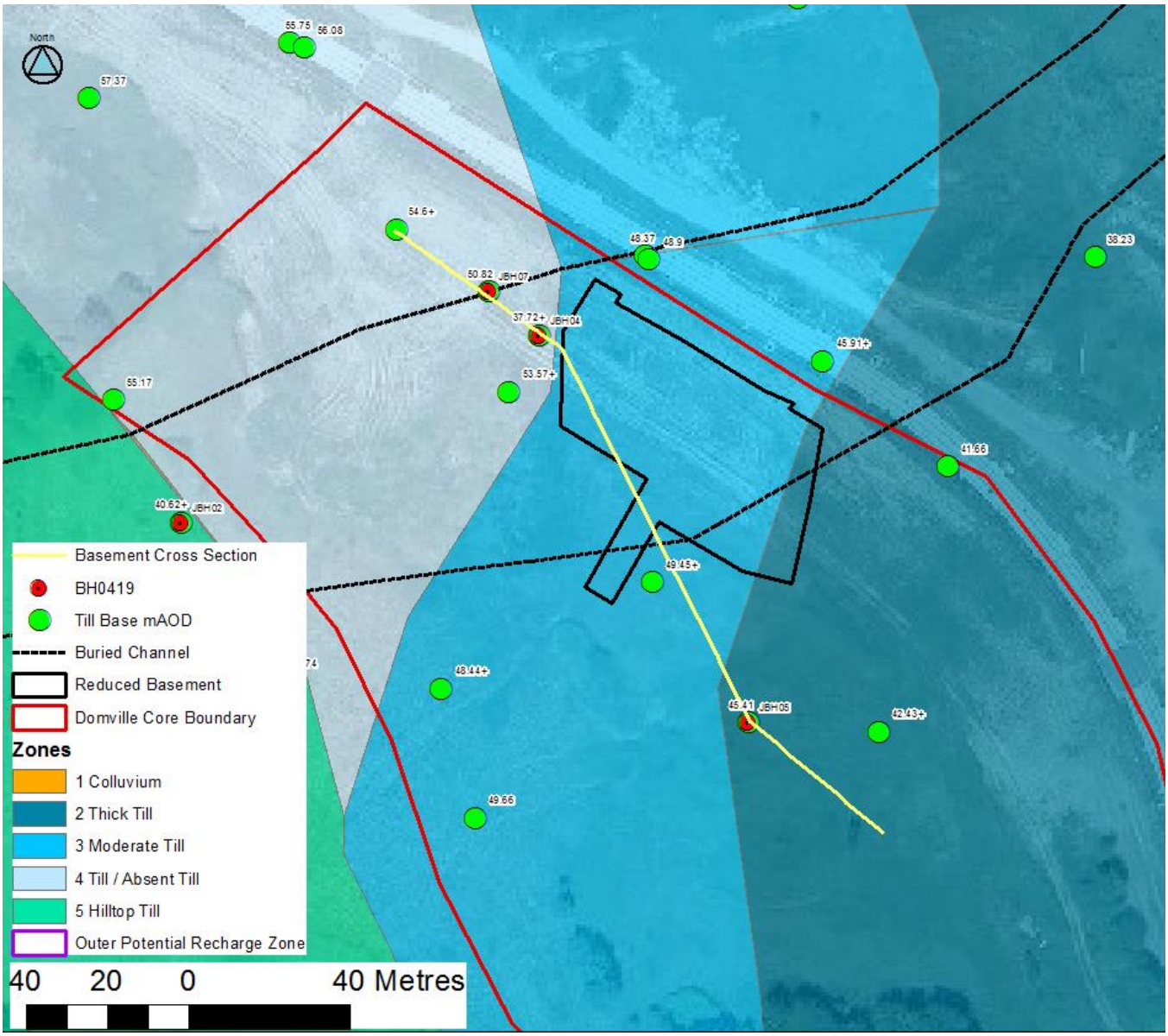


Figure 7-2: Hydrogeological Cross Section of the Basement

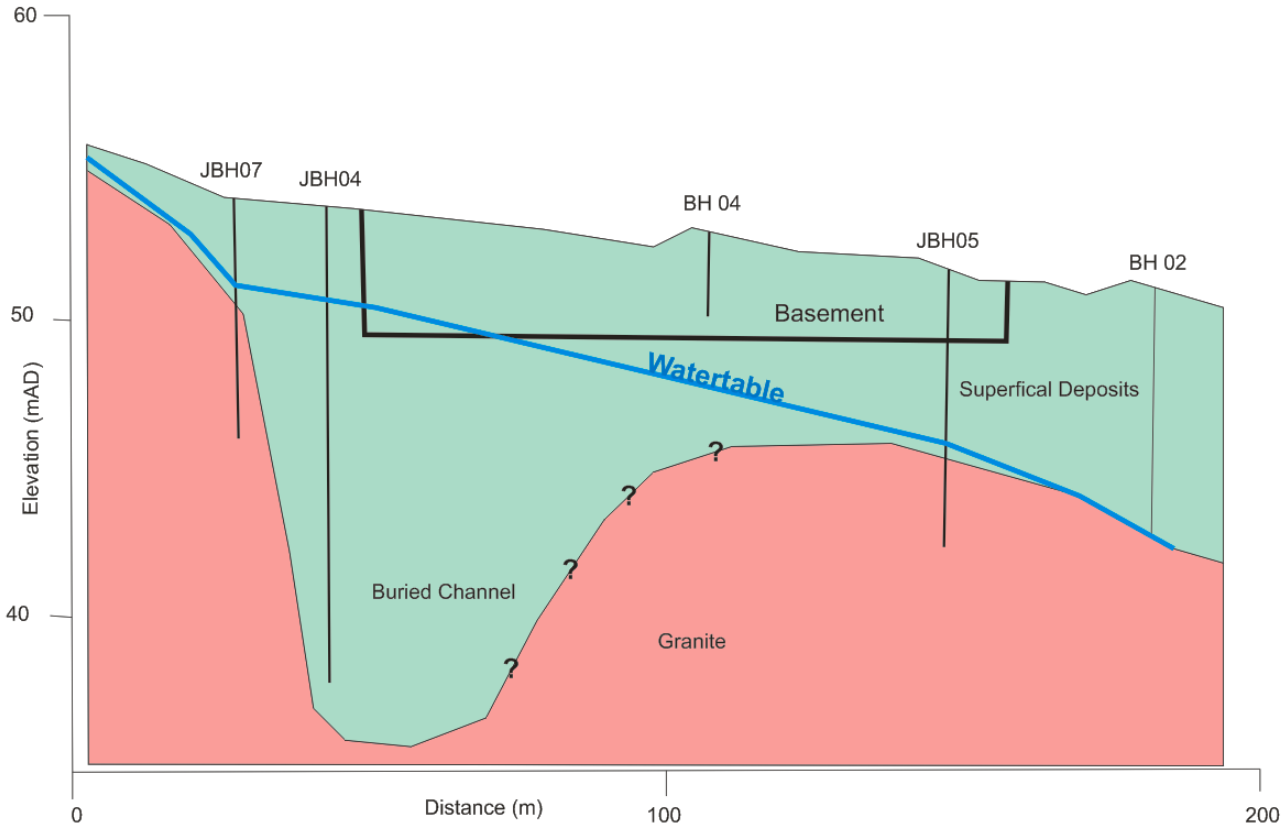


Table 7-1: Groundwater Water Level Monitoring

Sample ID	JBH - 2	JBH - 4	JBH - 5	JBH - 7
Water Level mbgl	4.2	2.98	5.75	2.44
	4.82	3.14	5.91	2.84
Water level mAD	52.22	50.74	45.16	51.58
	51.6	50.58	45	7.47
Note 1) Two results are presents for each location on site. The upper is from the 17/04/2019 monitoring round and the lower is from the 14/04/2019.				

7.2 Impact Assessment Update

The table below presents the impact assessment that was competed prior to the most recent round of ground investigation (JBA July 2018) presented in Appendix A. It presents a series of potential outcomes based on what further site investigation might identify. The text highlighted in yellow are our opinion on the most likely outcomes based upon a review of existing and recent GI data.

Table 7-2: Previous Impact Assessment (JBA July 2018)

Area	Technical Conclusion
Reduced Basement during operation	The proposed new basement is all at one level – 49.37mAD. In the previous design the eastern half of the basement dropped to 45.83mAD. This reduced basement probably removes the potential for the artesian excavation impact to occur, however aquifer interaction impact is still a potential risk. There is only one borehole in the footprint of the new basement, and it shows the basement floor would be close to the top of the weather upper margin of the granite. The decision tree (Appendix B) shows the potential results of an SI, but this can be summarised as: 1. No interaction with the aquifer – no impact. 2. Interaction with the aquifer (the basement cuts into the aquifer supplying the spring) – but the aquifer is shown to be thick below the basement, so groundwater can travel underneath the basement and won't be significantly affected – no impact. 3. Interaction with the aquifer – the basement blocks groundwater flow – but water flows around the basement to the north and the south and so the supply to the spring won't change – no impact. 4. Interaction with the aquifer – the basement blocks groundwater flow and it diverts groundwater in a new direction, so the catchment of the spring is reduced – significant impact. There is only one potential outcome with a pre-mitigation significant impact, however the chance of this occurring is low, and there should be design mitigation options available (e.g. underlying the basement with a high permeability gravel layer.
Reduced Basement during construction	Construction impacts have the potential to be more significant than the long-term effects of the basement, as it could include moderate periods of dewatering activity which could reduce flows to spring. There are ways to mitigate the impact to an acceptable level which may include: - Constructing during a dry period (i.e. outside of winter/early spring) when dewatering of the groundwater body may not be required. - Constructing during extremely wet periods when flows at the spring a strong, and dewatering is unlikely to dry the spring out. - Inject pumped water back into the aquifer at a suitable downgradient location.

Groundwater monitoring data suggests that the local water table is at a similar level to the basement along its western edge. There therefore may be localised modification of groundwater flow paths around this section of the basement. However, recent GI data also indicates the presence of a deep buried valley which is likely to provide significant recharge to the spring and there is in effect a significant thickness of aquifer below the basement which will continue to provide recharge.

During construction water level monitoring indicates that part of the excavation could require dewatering. This is based on one monitoring round in April, where groundwater levels are normally expected to be somewhere nearest to their seasonal highpoint. Options to avoid possible dewatering impacts during construction are presented in Table 7-2.

APPENDIX A – TRIAL PITS

SITE INVESTIGATION LOGS

JBA Project Code	2018s1298
Contract	Domville Catchment Site Investigation
Client	Dun Laoghaire Rathdown County Council
Day, Date and Time	09/10/18
Author	D Casey
Reviewer / Sign-off	A Jones
Subject	Tufa Spring Catchment Trial Pits

Equipment & Methods JCB Backhoe	Pit No TP1		Ground level (mAOD) N/A		Date 09/10/18
Logged by: D Casey	GRID REFERENCE				

Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Dark Brown Sandy SILT Sub round gravels	0-0.3					
Brown Silty CLAY Dry, Fine	0.3-0.4					
Weathered Granite Bedrock	0.4-05					
Bedrock	0.5+					
END AT	0.5					

Notes

SITE INVESTIGATION LOGS

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Reviewer / Sign-off	A Jones
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Equipment & Methods JCB Backhoe	Pit No TP2		Ground level (mAOD) N/A		Date 09/10/18
Logged by: D Casey	GRID REFERENCE				

Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Dark Brown Topsoil Sandy Silty CLAY Dry Loose	0-0.2					
Brown Silty CLAY Dry, sticky,Some sub-round gravels	0.2 – 2.3					
Weathered Granite Bedrock						
Granite Bedrock	+2.35					
END AT	2.35					
Notes						

SITE INVESTIGATION LOGS

JBA Project Code	2018s1298
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Equipment & Methods JCB Backhoe	Pit No TP3		Ground level (mAOD) N/A		Date 09/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Light Brown Clayey Silt Topsoil Loose, soft	0-0.3					
Very Light Brown Clayey Silt Dry, Loose Sub-round gravels	0.3 - 0.5					
Brown Silty CLAY Dry Some subangular gravels	0.5-1.5					
Dark Brown silty CLAY Sticky, slightly moist Sub-angular gravels	1.5-2.8					
Weathered Bedrock	2.8-2.9					
END AT	2.9					
Notes						

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Reviewer / Sign-off	A Jones
Subject	Tufa Spring Catchment Trial Pits

Equipment & Methods JCB Backhoe	Pit No TP4		Ground level (mAOD) N/A		Date 09/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Light Brown Clayey Silt Topsoil	0-0.1					
Brown Silty CLAY Sub-angular Gravels Dry, crumbly Texture	0.1 – 1.25 Becoming dark brown after 0.6					
Broken Bedrock Dry	1.25 – 1.7					
Bedrock	1.7					
END AT	1.7					
Notes						

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Equipment & Methods JCB Backhoe	Pit No TP5		Ground level (mAOD) N/A			Date 09/10/18
\	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Brown Sandy Silt Topsoil	0 - 0.25					
Brown Silty CLAY Dry, loose Sub-angular Gravels Sub-round gravels	0.25 – 1.2					
Broken Bedrock Silty clay Sub-round /angular cobbles	1.2-2.8					
Fracture Bedrock Sandy Silty CLAY Sub-round cobbles, Gravels Dry	2.8-3.5					
Bedrock	3.5					
END AT						
Notes Groundwater encountered at 3.5mbgl, slow seepage.						

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Equipment & Methods JCB Backhoe	Pit No TP6		Ground level (mAOD) N/A		Date 09/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Dark Brown Silty Clay SAND topsoil Dry, Loose	0-0.1					
Dark Brown Sandy Clayey Silt Dry, Round gravels	0.1-0.6					
Dark Brown Silty Sand Loose, dry Sub-round gravels	0.6-1.3					
Brown SAND Dry, loose, round/sub round gravels	1.3-2.4					
Dark Brown Sandy SILT Dry, Loose Round – sub-round gravels	2.4-2.6					
Dark Brown Silty Clay Fine Sticky, dry Sub round gravels	2.6-2.9					
Reddish Sandy CLAY	2.9-4.3					
Light Brown CLAY Sticky, dry, Firm	4.3-5					
END AT	5					
Notes						

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Subject	Tufa Spring Catchment Trial Pits

Equipment & Methods JCB Backhoe	Pit No TP7		Ground level (mAOD) N/A			Date 09/10/18
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Dark Brown SILT	0-0.1					
Dark Brown Sandy SILT Dry, loose cobbly Sub angular Gravels	0.1-0.8					
Becoming Dark Brown very Silty CLAY Dry, Sticky Sub-angular Gravels	0.8-2					
Brown / Light Grey Very Silty CLAY Dry, loose Sub-angular gravels	2-5					
END AT						
Notes						

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Reviewer / Sign-off	A Jones
Subject	Tufa Spring Catchment Trial Pits

Equipment & Methods JCB Backhoe	Pit No TP8		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Sandy SILT Topsoil	0-0.2					
Brown Sandy Clay SILT Dry, Loose Some sub-angular Gravels	0.2-1.7					
Dark Brown Silty CLAY Dry, sticky Sub angular gravels	1.7-2.0					
Dark Brown Silty Clayey GRAVELs Round – subround gravels Round- subround cobbles	2.0-2.9					
END AT	2.9					
Notes						

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Equipment & Methods JCB Backhoe	Pit No TP9		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Dark Brown Sandy Silt Topsoil	0-0.2					
Brown Clayey SLIT Dry, loose Course Sub-angular gravels	0.2-1.4					
Weather Bedrock	1.3-1.4					
Bedrock	1.4					
END AT	1.4					
Notes						

SITE INVESTIGATION LOGS

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Equipment & Methods JCB Backhoe	Pit No TP10		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Brown Sandy Silt Topsoil	0-0.2					
Brown-sandy Silty CLAY Dry Sub-round gravel	0.2-1.2					
Brown Silty Clayey GRAVELS Sub-round and sub-angular gravels	1.2-2.1					
Pale Yellow SANDS Round cobbles	2.1-2.4					
Brown Very Silty CLAY Firm, sticky, dry Sub-round gravels	2.4-3.1					
Silty CLAY	3.1-4.8					
Light Brown CLAY Fine Dry No gravel	4.8-5					
END AT	5					
Notes: Bedrock not met, no groundwater strikes						

Equipment & Methods JCB Backhoe	Pit No TP11		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Dark Brown Sandy SILT Topsoil	0 - 0.2					
Dark Brown Sandy Silty CLAY Dry Loose Sub-round gravels	0.2 – 0.8					
Light Brown CLAY Moist, loose No Gravels	0.8-2.3					
Dark Brown Silty clay GRAVELS Sub angular gravel Firm, moist, sticky Course	2.3-3.8					
Brown Silty Sand Course Sub-round / round gravels	3.8-5.3					
Large Cobbles and Boulders	5.3-5.7					
END AT	5.7					
Notes Bedrock not met, no groundwater strikes						

Equipment & Methods JCB Backhoe	Pit No TP12		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Dark Brown Sandy Silt Topsoil Dry Loose	0-0.2					
Dark Brown Clayey SILT Dry, course, loose, subangular gravels	0.2-0.8					
Light Brown Silty CLAY Dry, loose, subangular gravel	0.8-1					
Light Brown Silty Sand Dry soft Waterstrike at 3.5	1-4.9					
Dark Brown Silty clayey GRAVEL Sub-round gravels/cobble Angular gravel (shale)	4.9-5					
END AT	5					
Notes						

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Equipment & Methods JCB Backhoe	Pit No TP13		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Brown Sandy Silt Topsoil Dry, loose, course	0-0.2					
Brown Clayey SILT Dry, loose, course, subround, sub-angular gravels	0.2-2.2					
Sandy Clayey GRAVEL Dry Loose, course subround gravels	2.2-2.4					
Broken Bedrock, large cobbles and boulders	2.4-2.5					
Bedrock	2.5					
END AT	2.5					
Notes						

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Equipment & Methods JCB Backhoe	Pit No TP14		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Dark Brown Sandy SILT Topsoil Dry, loose	0-0.2					
Brown Sandy SILT Dry loose, Course sub-angular – sub-round gravels	0.2-1.2					
Brown Sandy Silty GRAVELS Dry, loose Course sub angular, sub round gravels and cobbles	1.2-2.4					
Brown Clayey Silty, GRAVELS Dry, loose Course sub-round cobbles Sub-angular gravels	2.4-4.6					
END AT	4.6					
Notes						

Equipment & Methods JCB Backhoe	Pit No TP15		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Brown Sandy SILT Topsoil Loose, Dry, Course	0-0.2					
MADE GROUND - Brown Silty clayey GRAVEL Sub-round, sub angular stones and cobble	0.2 – 1.1					
MADE GROUND - Brown, Silty CLAY with some brown black colouration and pieces of wooden branches	1.1-2.8					
Bedrock	2.8					
END AT	2.8					
Notes						

Equipment & Methods JCB Backhoe	Pit No TP16		Ground level (mAOD) N/A		Date 10/10/18	
Logged by: D Casey	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Brown Sandy Silt Topsoil Course Dry	0-0.2					
Brown, Clayey SILT Dry, loose, course Sub-angular gravels	0.2-0.8					
Light Yellow Silty SAND Dry, course, loose No gravel	0.8-1.4					
Grey Sandy CLAY Dry sticky soft No Gravels	1.4-3.4					
Light Brown / reddish Silty Sand, course, loose, dry	3.4-4.8					
Grey Course SANDS Dry	4.8-5.1					
Cobble and Boulders	5.1					
END AT						
Notes						

SITE INVESTIGATION LOGS

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Reviewer / Sign-off	A Jones
Subject	Tufa Spring Catchment Trial Pits

Equipment & Methods JCB Backhoe	Pit No TP17		Ground level (mAOD) N/A		Date 8/11/2018	
Logged by: H Moore	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
TOPSOIL	0-0.4					
Brown Gravelly Silty SAND Increasing gravel /boulder content with depth	0.4-2.7					
Granite Bedrock	2.7					
END AT						
Notes						

Equipment & Methods JCB Backhoe	Pit No TP18		Ground level (mAOD) N/A		Date 8/11/2018	
Logged by: H Moore	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
Fine Sandy TOPSOIL	0-0.5					
Red Brown Slightly Gravelly, Slightly cobbly SILT	0.5-1.3					
Reb Brown Slightly Gravelly, Slightly Cobbly, Silty SAND	1.3-3.5					
Cobbly Sandy GRAVEL (weathered bedrock)	3.5-5					
END AT	5.5					
Notes						

Equipment & Methods JCB Backhoe	Pit No TP19		Ground level (mAOD) N/A		Date 8/11/2018	
Logged by: H Moore	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
TOPSOIL	0-0.4					
Light Brown Gravelly Sandy CLAY	0.4-2.3					
Clayey Cobbly Gravelly SAND	2.3-4.2					
Clayey Gravelly SAND	4.2-5					
END AT	5					
Notes – gravels granitic in nature						

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Reviewer / Sign-off	A Jones
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Equipment & Methods JCB Backhoe	Pit No TP20		Ground level (mAOD) N/A		Date 8/11/2018	
Logged by: H Moore	GRID REFERENCE					
Description	Level BGL	Reduced level	Lithology	Samples/tests		Notes
				Depth	No	
TOPSOIL	0-0.4					
Brown Gravelly CLAY	0.4-0.6					
Slightly Gravelly Slightly Cobbly SILTY CLAY	0.6-1.3					
Clayey Sandy Cobbly GRAVEL	1.3-2					
Silty Clayey Gravelly COBBLES	2-2.5					
Clayey Boulders GRAVEL	2.5-4.6					
END AT	4.6					
Notes – high proportion of limestone material						

APPENDIX B - SITE INVESTIGATION

Cherrywood – Ground Investigation

Client:	Dún Laoghaire – Rathdown County Council
Client's Representative:	JBA Consulting
Report No.:	19-0148
Date:	April 2019
Status:	Final for Issue

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CONTENTS

APPENDICES

Document Control Sheet

Report No.:		19-0148			
Project Title:		Cherrywood			
Client:		Dún Laoghaire – Rathdown County Council			
Client's Representative:		JBA Consulting			
Revision:	A00	**Status:**	Final for issue	**Issue Date:**	15 April 2019
Prepared by:		**Reviewed by:**		**Approved by:**	
 Sean Ross BSc MSc		 Matthew Gilbert MEarthSci FGS		 Darren O'Mahony BSc MSc MIEI	

The works were conducted in accordance with:

British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler)
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler)
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
LB	Large bulk disturbed sample
D	Small disturbed sample
C	Core sub-sample (displayed in the Field Records column on the logs)
L	Liner sample from dynamic sampled borehole
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (c)	Standard penetration test using 60 degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
▽	Water strike: initial depth of strike
▼	Water strike: depth water rose to
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum).

Cherrywood

1 AUTHORITY

On the instructions of JBA Consulting Engineers, ("the Client's Representative"), acting on the behalf of Dún Laoghaire – Rathdown County Council ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical information for input to the development of the site, as part of the larger Cherrywood development.

This report details the work carried out on site; it contains a description of the site, the works undertaken and the exploratory hole logs.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included boreholes, soil sampling, and the preparation of a factual report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted on a currently undeveloped site in Cherrywood, south Dublin. The site is located either side of the Luas tracks in between the Laughanstown and Cherrywood stations. The site is currently agricultural fields on the south of the Luas tracks, while the north section of the site is unused and contains a large amount of construction and demolition waste. The site varies in topography with a c.20m fall across the site from south to north.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 12th March and the 3rd April 2019, comprised:

- three light cable percussion boreholes,
- seven boreholes by rotary drilling methods, four of which were conducted as follow-ons to the cable percussion holes; and
- a standpipe installation in seven boreholes.

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Boreholes

A total of seven boreholes were put down in a minimum diameter of 150mm through soils and rock strata to their completion depths by a combination of methods, including light cable percussion boring by a Dando 2500 rig, and rotary drilling by a Hanjin 8D tracked rotary drilling rig.

The borehole logs state the methodology and plant used for each location, as well as the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

Appendix B presents the borehole logs.

4.2.1 Boreholes by combined percussion boring and rotary follow-on drilling

Four boreholes (JBH01, JBH02, JBH05 and JBH06) were put down by a combination of light cable percussion boring and rotary follow-on drilling techniques. Cable percussion boreholes were advanced to their scheduled depths, after which rotary percussive methods were employed to advance the borehole to their scheduled completion depths, or to bedrock, where rotary coring was undertaken. Symmetrix cased full-hole drilling was used during the rotary percussion sections.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk bag) samples were taken within the strata encountered by the cable percussion rig.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Where coring was carried out within bedrock strata, conventional coring methods were used with a metric T2-101 core barrel, which produced core of nominal 84mm diameter, and was placed in triple channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.2.2 Rotary drilled boreholes

Three boreholes (JBH03, JBH04 and JBH07) were put to their completion by rotary drilling techniques only. The boreholes were completed using a Hanjin 8D tracked rotary drilling rig

Symmetrix-cased full hole rotary percussive drilling techniques were employed to advance the boreholes to bedrock, after which rotary coring was employed to recover core samples of the bedrock. JBH04 did not encounter bedrock, and rotary percussive drilling was used to put the borehole to completion.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Where coring was carried out within bedrock strata, the core was extracted in up to 1.5m lengths using a metric T2-101 core barrel, which produced core of nominal 84mm diameter, and was placed in triple channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in JBH01 – JBH07.

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

4.4 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish National Grid) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

4.5 Groundwater and ground gas monitoring

Following completion of site works, groundwater was conducted on one round. Ground water monitoring was carried out using a water interface probe.

5 GROUND CONDITIONS

5.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Glacial Till. These deposits are underlain by Type 2e and 2p Leinster Granite.

5.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Topsoil:** encountered in JBH01 – JBH03 and JBH05 with a thickness of 100 – 300mm.
- **Made Ground (fill):** reworked sandy gravelly clay/silty sand encountered in JBH06 and JBH07 ranging in thickness from 100 – 500mm.
- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.

- **Fluvioglacial deposits/weathered granite:** typically, grey/brown silty sands and gravels with cobbles of granite encountered across all holes down to 20mbgl in JBH01 and JBH06.

- **Bedrock (Granite):** Rockhead was encountered at depths ranging from 5.50m in JBH05 to 6.80m in JBH03.

5.3 Groundwater

Groundwater was encountered during percussion boring and rotary drilling through soil and rock as water strikes as shown in Table 1 below.

Table 1: Groundwater strikes encountered during the ground investigation

GI Ref.	Water level (mbgl)	Comments
BH02	11.20	Rose to 10.00mbgl after 5mins
BH02	14.00	No rise after 5 mins
BH03	1.50	Seepage
BH04	11.00	Seepage
BH06	2.70	Rose to 2.00m after 20mins
BH06	9.20	Rose to 6.00m after 10mins

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was not noted during drilling at any of the other borehole locations. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any/additional groundwater strikes and the possibility of encountering groundwater during excavation works should not be ruled out.

It should be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

Subsequent groundwater monitoring of the standpipe installations recorded water levels as shown in Table 2.

Table 2: Groundwater monitoring

GI Ref	Water level (mbgl)
	12/04/2019
JBH01	11.78
JBH02	10.02
JBH03	1.13
JBH04	2.88
JBH05	5.37
JBH06	4.50
JBH07	2.00

Seasonal variation in groundwater levels should also be factored into design considerations, and continued monitoring of the seven installed standpipes will give an indication of the seasonal variation in groundwater level.

6 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS EN ISO 14689-1:2018: Geotechnical investigation and testing. Identification and classification of rock. Identification and description.

CAUSEWAY GEOTECH

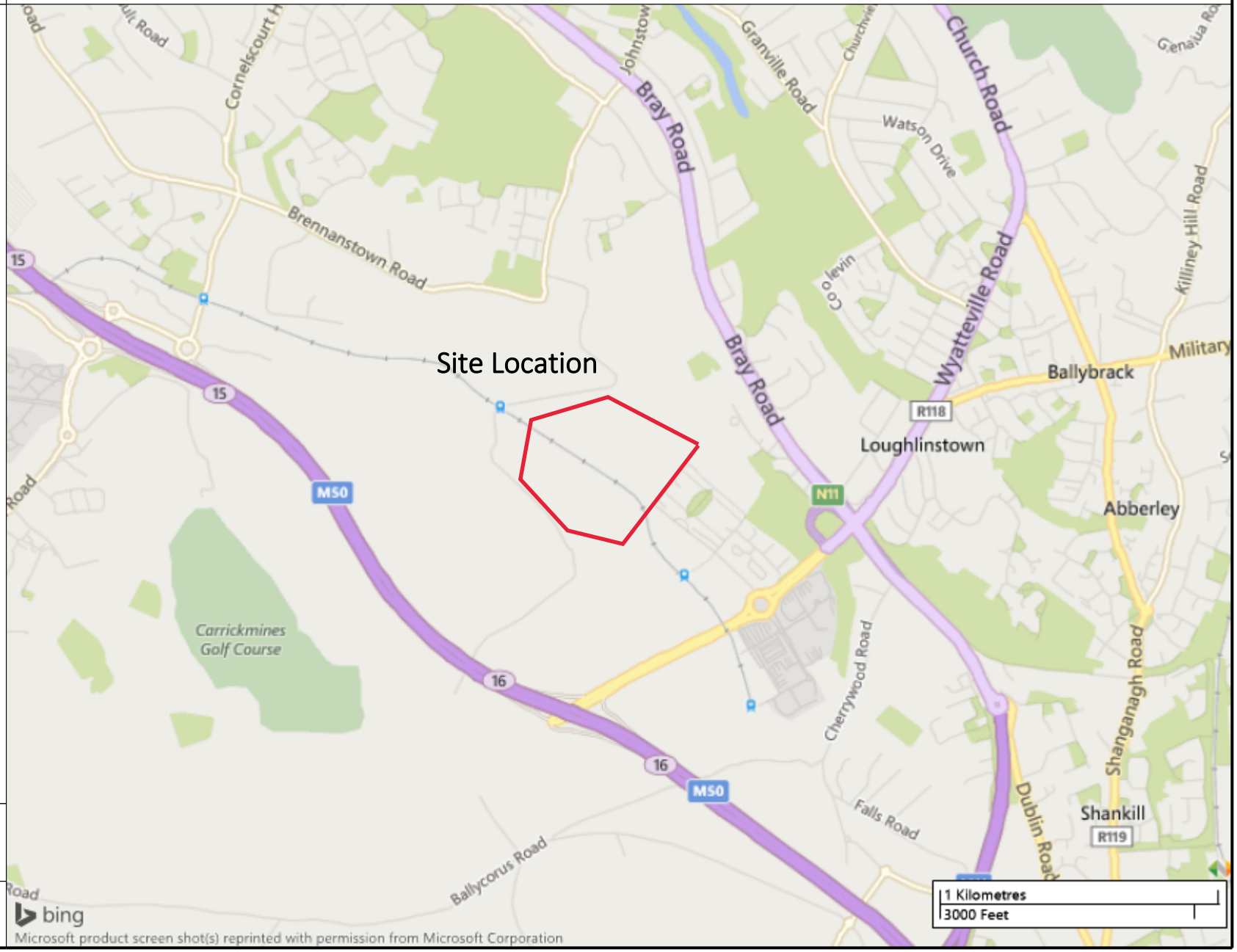
APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLANS

CAUSEWAY GEOTECH

Project No.:	19-0148	**Client:**	Dun Laoghaire - Rathdown County Council
Project Name:	Cherrywood, Co. Dublin	**Client's Representative:**	JBA Consulting

Legend Key



Title:
Site Location Plan

Last Revised:	**Scale:**
08/04/2019	1:20000

CAUSEWAY GEOTECH

Project No.:	19-0148	**Client:**	Dun Laoghaire - Rathdown County Council
Project Name:	Cherrywood, Co. Dublin	**Client's Representative:**	JBA Consulting

Legend Key

- Locations By Type - CP+RC
- Locations By Type - RO
- Locations By Type - RO + RC

Title:

Site Location Plan

Last Revised:	**Scale:**
09/04/2019	1:5000

CAUSEWAY GEOTECH

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Drilling	Dando 2500 Hanjin 8D	0.00 7.50	7.50 20.00

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH01

Coordinates: 323288.68 E 223523.89 N

Client: Dun Laoghaire - Rathdown County Council

Sheet 1 of 2

Client's Representative: JBA Consulting

Scale: 1:50

Driller: RN+KW

Ground Level: 71.11 mOD

Dates: 12/03/2019 - 26/03/2019

Logger: SR+

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(0.20)		TOPSOIL
0.20 - 1.00	B1				70.91	0.20		Soft brown sandy CLAY. Sand is fine.
1.00 - 2.00	B2							
						(2.80)		
2.00 - 3.50	B3							
					68.11	3.00		Brown clayey fine to coarse SAND.
						(0.50)		
3.50 - 4.50	B4				67.61	3.50		Grey gravelly silty fine to coarse SAND. Gravel is subrounded fine to coarse of mixed lithologies.
4.50 - 5.50	B5					(2.00)		
5.50 - 7.00	B6				65.61	5.50		Greyish brown fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of mixed lithologies with occasional cobbles. Cobbles are subrounded of mixed lithologies predominantly granite.
						(1.50)		
7.00 - 7.50	B7				64.11	7.00		Firm brown sandy gravelly CLAY with occasional cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies.
						(0.50)		
					63.61	7.50		Brown sandy gravelly CLAY with occasional cobbles. (Driller's description).
						(2.50)		
					61.11	10.00		Light brown gravelly fine to coarse SAND. (Driller's description).
						(0.50)		

Water

Backfill

Remarks

Hand dug inspection pit excavated to 1.20m.

No noticeable groundwater strikes encountered.

Terminated at scheduled depth.

Core Barrel

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
7.50	7.50	01:00

Flush Type

Water

Water Added

From (m)	To (m)
3.50	7.50
11.50	20.00

Casing Details

To (m)	Diam (mm)
20.00	200

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Drilling	Dando 2500 Hanjin 8D	0.00 7.50	7.50 20.00

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH01

Coordinates: 323288.68 E 223523.89 N

Client: Dun Laoghaire - Rathdown County Council

Client's Representative: JBA Consulting

Ground Level: 71.11 mOD

Dates: 12/03/2019 - 26/03/2019

Sheet 2 of 2

Scale: 1:50

Driller: RN+KW

Logger: SR+

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
					60.61	10.50		Light brown gravelly fine to coarse SAND. (Driller's description).
								Light grey gravelly silty fine to coarse SAND. (Driller's description).
								At 11.50m: Coring attempted but no recovery.
13.00						(9.50)		
								At 16.50m: Coring attempted but no recovery.
18.00								
		20.00	Dry	26-03-2019	51.11	20.00		End of Borehole at 20.00m

Water

Backfill

10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5

Remarks

Hand dug inspection pit excavated to 1.20m.

No noticeable groundwater strikes encountered.

Terminated at scheduled depth.

Core Barrel

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
7.50	7.50	01:00

Flush Type

Water

Water Added

From (m)	To (m)
3.50	7.50
11.50	20.00

Casing Details

To (m)	Diam (mm)
20.00	200

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Drilling	Dando 2500 Hanjin 8D	0.00 10.00	10.00 16.00

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH02

Coordinates: 323410.41 E 223544.13 N

Client: Dun Laoghaire - Rathdown County Council

Sheet 1 of 2

Client's Representative: JBA Consulting

Scale: 1:50

Driller: RN+KW

Ground Level: 56.42 mOD

Dates: 13/03/2019 - 03/04/2019

Logger: SR+

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.20 - 1.00	B1				56.22	(0.20) 0.20		TOPSOIL
								Soft brown sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subrounded of mixed lithologies.
1.00 - 2.00	B2					(1.80)		
2.00 - 3.00	B3				54.42	2.00		Brown sandy clayey subangular to subrounded fine to medium GRAVEL of mixed lithologies. Sand is fine to coarse.
3.00 - 4.00	B4					(2.00)		
4.00 - 5.00	B5				52.42	4.00		Brown gravelly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
5.00 - 6.00	B6					(3.00)		
6.00 - 7.00	B7							
7.00 - 8.00	B8	7.00 7.00	6.00 6.10	13-03-2019 14-03-2019	49.42	7.00		Firm brown sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravels are subrounded fine to coarse of mixed lithologies. Cobbles are subrounded of mixed lithologies predominantly granite.
8.00 - 9.00	B9					(3.00)		
9.00 - 10.00	B10							
				14-03-2019	46.42	10.00		Brown sandy gravelly CLAY. (Drillers' description).
	TCR	SCR	RQD	FI				

Water

Backfill

Remarks

Hand dug inspection pit excavated to 1.20m.

Terminated at scheduled depth.

Core Barrel

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
11.20		5	10.00
14.00		2	14.00

Chiselling Details

From (m)	To (m)	Time (hh:mm)
10.00	10.00	01:00

Flush Type

Water

Water Added

From (m)	To (m)
2.00	10.00

Casing Details

To (m)	Diam (mm)
20.00	200

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
19-0148	Cherrywood, Co. Dublin	JBH02
Coordinates:	**Client:**	Sheet 2 of 2
323410.41 E	Dun Laoghaire - Rathdown County Council	
223544.13 N	**Client's Representative:** JBA Consulting	**Scale:** 1:50
Ground Level:	**Dates:**	**Driller:** RN +KW
56.42 mOD	13/03/2019 - 03/04/2019	**Logger:** SR+

Method	Plant Used	Top	Base
Cable Percussion Rotary Drilling	Dando 2500 Hanjin 8D	0.00 10.00	10.00 16.00

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
							(1.20)		Brown sandy gravelly CLAY. (Drillers' description).
					Water strike at 11.20	45.22	11.20		Brown gravelly clayey fine to coarse SAND. (Driller's description).
							(2.80)		
					Water strike at 14.00	42.42	14.00		Light brownish grey gravelly fine to coarse SAND. (Driller's description)
							(2.00)		
						40.42	16.00		End of Borehole at 16.00m
	TCR	SCR	RQD	FI					

Water

Backfill

10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5

Remarks
Hand dug inspection pit excavated to 1.20m.

Terminated at scheduled depth.

Core Barrel

Flush Type
Water

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
11.20		5	10.00
14.00		2	14.00

Water Added

From (m)	To (m)
2.00	10.00

Casing Details

To (m)	Diam (mm)
20.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
10.00	10.00	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Hanjin 8D	0.00	6.80
Rotary Coring	Hanjin 8D	6.80	9.80

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH03

Coordinates: 323363.69 E 223785.37 N

Client: Dun Laoghaire - Rathdown County Council

Sheet 1 of 1

Client's Representative: JBA Consulting

Scale: 1:50

Driller: KW

Ground Level: 54.74 mOD

Dates: 22/03/2019 - 25/03/2019

Logger: RS

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
					54.44	(0.30) 0.30		TOPSOIL
						(1.20)		Firm brown sandy gravelly CLAY with cobbles. (Driller's description).
				Water Strike at 1.50m	53.24	1.50		Light greyish brown fine to coarse SAND with cobbles of granite. (Driller's description)
		5.50	3.00	22-03-2019				
		5.50	3.00	25-03-2019				
						(5.30)		
					47.94	6.80		Medium strong white phaneritic GRANITE. Partially to moderately weathered. Discontinuities: 1. 60 degree fracture closely spaced (45/85/350) planar, rough, open, orange staining present on surface. 2. 80 - 90 degree joint, probably medium spaced, planar, rough, open, orange staining present on most surfaces.
7.80	100 71 56							
	100 56 40		6			(3.00)		
8.80				25-03-2019				
	100 65 48							
9.80					44.94	9.80		End of Borehole at 9.80m
	TCR SCR RQD		FI					

Water: Backfill

Remarks

Hand dug inspection pit excavated to 1.20m.

Terminated at scheduled depth.

Core Barrel

T2-101

Flush Type

Water

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.50	1.50	10	1.50

Water Added

From (m)	To (m)
6.80	9.80

Casing Details

To (m)	Diam (mm)
6.80	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Hanjin 8D	0.00	16.00

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH04

Coordinates: 323498.90 E 223590.29 N

Client: Dun Laoghaire - Rathdown County Council

Client's Representative: JBA Consulting

Ground Level: 53.72 mOD

Dates: 27/03/2019 - 02/04/2019

Sheet 1 of 2

Scale: 1:50

Driller: KW

Logger: KW

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(0.50)		MADE GROUND: Stiff brown sandy gravelly CLAY. (Driller's description).
					53.22	0.50		Brown sandy gravelly CLAY with occasional cobbles. (Driller's description).
						(1.60)		
					51.62	2.10		Light greyish white very silty fine to coarse SAND. (Driller's description).
								At 4.0m: Coring attempted but no recovery
						(13.90)		

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

Remarks

Hand dug inspection pit excavated to 1.20m.

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
11.00		10	11.00

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
16.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Hanjin 8D	0.00	16.00

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH04

Coordinates: 323498.90 E 223590.29 N

Client: Dun Laoghaire - Rathdown County Council

Sheet 2 of 2

Client's Representative: JBA Consulting

Scale: 1:50

Ground Level: 53.72 mOD

Dates: 27/03/2019 - 02/04/2019

Driller: KW

Logger: KW

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
				Water strike at 11.0				Light greyish white very silty fine to coarse SAND. (Driller's description).
								At 14.5m: Coring attempted but no recovery
					37.72	16.00		End of Borehole at 16.00m

Water

Backfill

10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5

Remarks

Hand dug inspection pit excavated to 1.20m.

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
16.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2500	0.00	5.50
Rotary Coring	Hanjin 8D	5.50	8.50

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH05

Coordinates: 323550.72 E, 223494.60 N

Client: Dun Laoghaire - Rathdown County Council

Sheet 1 of 1

Client's Representative: JBA Consulting

Scale: 1:50

Driller: RN+KW

Ground Level: 50.91 mOD

Dates: 19/03/2019 - 02/04/2019

Logger: SR+RS

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.20 - 1.20	B1				50.71	(0.20) 0.20		TOPSOIL
								Soft dark brown sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subrounded of mixed lithologies.
1.20 - 2.00	B2					(1.80)		
2.00 - 2.50	B3				48.91	2.00		Soft grey sandy slightly gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subrounded and of mixed lithologies. Cobbles are subrounded of mixed lithologies predominantly granite.
2.50 - 4.00	B4				48.41	(0.50) 2.50		Light brown gravelly fine to coarse SAND with occasional cobbles. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
						(1.50)		
4.00 - 5.00	B5				46.91	4.00		Firm dark brown sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subrounded of mixed lithologies predominantly granite.
						(1.00)		
5.00 - 6.50	B6				45.91	5.00		Firm brownish grey sandy very gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of granite. Cobbles are subrounded of granite.
						(0.50)		
					45.41	5.50		Medium strong white phaneritic GRANITE. Partially to moderately weathered.
	100 57 53							Discontinuities:
6.50								1. 0 to 30 degree, horizontal to sub-horizontal fractures, medium spaced (60/300/680) undulating, rough, open (2-3mm) with an orange/brown staining present on surfaces.
	100 67 20					(3.00)		*6.00m to 7.40m: 80 degree sub-vertical joint, undulating, rough, open with an orange staining penetrating up to 25mm.*
7.50								
	100 80 80							
8.50					42.41	8.50		End of Borehole at 8.50m
	TCR SCR RQD FI							

Water: 9

Backfill

Remarks

Hand dug inspection pit excavated to 1.20m.

No noticeable groundwater strikes encountered.

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)
5.50	8.50

Casing Details

To (m)	Diam (mm)
6.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.50	6.50	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Drilling	Dando 2500 Hanjin 8D	0.00 5.50	5.50 20.00

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH06

Coordinates: 323765.35 E 223728.71 N

Client: Dun Laoghaire - Rathdown County Council

Sheet 1 of 2

Client's Representative: JBA Consulting

Scale: 1:50

Driller: RN+KW

Ground Level: 40.61 mOD

Dates: 20/03/2019 - 21/03/2019

Logger: SR+

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
0.10 - 1.20	B1				40.51	(0.10) 0.10		MADE GROUND: Brownish grey sandy gravelly CLAY with fragments of red brock and concrete. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
						(1.90)		Soft brown gravelly CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subrounded of mixed lithologies. .
1.20 - 2.00	B2							
2.00 - 2.50	B3				38.61	2.00		
						(0.50)		Soft grey slightly gravelly silty CLAY with occasional cobbles. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subrounded of mixed lithologies. .
2.50 - 3.50	B4			Water strike at 2.70m	38.11	2.50		Firm brown sandy gravelly CLAY with rare cobbles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded of mixed lithologies predominantly granite.
3.50 - 4.50	B5					(2.00)		
					36.11	4.50		No recovery, pushing boulder
						(1.00)		
					35.11	5.50		Grey very sandy subangular fine to coarse GRAVEL with some cobbles. (Driller's description).
						(1.80)		
					33.31	7.30		Brown very silty fine to coarse SAND. (Driller's description).
						(0.70)		
					32.61	8.00		Brownish grey sandy gravelly CLAY with some cobbles. (Driller's description).
						(1.20)		
				Water strike at 9.20m	31.41	9.20		Light grey fine to coarse SAND. (Driller's description).
						(0.60)		
					30.81	9.80		Light brown fine to medium SAND. (Driller's description)
	TCR	SCR	RQD	FI				

Water: Backfill

Remarks

Hand dug inspection pit excavated to 1.20m.

Terminated at scheduled depth.

Core Barrel

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.70	2.70	20	2.00
9.20	9.20	10	6.00

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.50	5.50	01:00

Flush Type

Water

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
17.50	200

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion Rotary Drilling	Dando 2500 Hanjin 8D	0.00 5.50	5.50 20.00

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH06

Coordinates: 323765.35 E 223728.71 N

Client: Dun Laoghaire - Rathdown County Council

Sheet 2 of 2

Client's Representative: JBA Consulting

Scale: 1:50

Driller: RN +KW

Ground Level: 40.61 mOD

Dates: 20/03/2019 - 21/03/2019

Logger: SR+

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
							(4.00)		Light brown fine to medium SAND. (Driller's description)		
						26.81	13.80		Yellowish brown fine to coarse SAND. (Drillers description).		
						20.61	20.00		End of Borehole at 20.00m		

10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5 20.0 20.5

Remarks

Hand dug inspection pit excavated to 1.20m.

Terminated at scheduled depth.

Core Barrel

Flush Type Water

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.70	2.70	20	2.00
9.20	9.20	10	6.00

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
17.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
4.50	5.50	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Hanjin 8D	0.00	1.00
Rotary Coring	Hanjin 8D	1.00	7.70

Project No.: 19-0148

Project Name: Cherrywood, Co. Dublin

Borehole No.: JBH07

Coordinates: 323486.26 E 223601.09 N

Client: Dun Laoghaire - Rathdown County Council

Sheet 1 of 1

Client's Representative: JBA Consulting

Scale: 1:50

Driller: KW

Ground Level: 54.02 mOD

Dates: 27/03/2019 - 27/03/2019

Logger: RS

Depth (m)	Sample / Tests		Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
							(0.50)		MADE GROUND: Brown silty SAND with cobbles. (Driller's description).
						53.52	0.50		
							(0.30)		Brown sandy gravelly CLAY with occasional cobbles. (Driller's description)
						53.22	0.80		
	45	0	0				(1.00)		White slightly gravelly COBBLES of granite. Gravel is subangular coarse of granite (Weathered bedrock).
1.80						52.22	1.80		
	0	0	0	NI			(1.40)		Greyish white silty fine to medium SAND. (Driller's description).
3.20						50.82	3.20		
	33	9	9				(1.70)		Weak white phaneritic GRANITE. Distinctly weathered to destructured. No discernable discontinuity sets
4.70						49.12	4.90		
	88	64	44						Weak cream phaneritic GRANITE. Moderately weathered. Discontinuities: 1. 45 degree joints, probably medium spaced, planar, rough open with a slight orange staining on surface.
6.20				8			(2.80)		
	67	31	18						
7.70						46.32	7.70		End of Borehole at 7.70m
	TCR	SCR	RQD	FI					

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0

Remarks

Hand dug inspection pit excavated to 1.20m.

No noticeable groundwater strikes encountered.

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)
1.00	7.70

Casing Details

To (m)	Diam (mm)
1.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

APPENDIX C

CORE PHOTOGRAPHS

BH03 Box 1 6.80 – 9.80m

BH05 Box 1 5.5 – 8.50m

BH07 Box 1 1.00 – 6.20m

BH07 Box 2 6.20 – 7.70m

APPENDIX C – WATER QUALITY DATA

Appendix C1 – Lab Results

Exova Jones Environmental

Registered Office: Exova Environmental UK Limited, 10 Lower Grosvenor Place, London, SW1W 0EN. Reg No. 11371415

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Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

JBA Consulting
17 Laureston Crescent
Tower
Co. Cork
Ireland

Attention :	Declan Egan
Date :	26th April, 2019
Your reference :	Cherrywood
Our reference :	Test Report 19/6410 Batch 1
Location :	
Date samples received :	18th April, 2019
Status :	Final report
Issue :	1

Seven samples were received for analysis on 18th April, 2019 of which seven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Paul Boden BSc
Senior Project Manager

Client Name: JBA Consulting
Reference: Cherrywood
Location:
Contact: Declan Egan
JE Job No.: 19/6410

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

J E Sample No.	1-9	10-18	19-27	28-36	37-45	46-54	55-63				LOD/LOR	Units	Method No.
Sample ID	JBH - 1	JBH - 2	JBH - 3	JBH - 4	JBH - 5	JBH - 6	JBH - 7						
Depth													
COC No / misc													
Containers	V H HN HCL N Z P	V H HN HCL N Z P	V H HN HCL N Z P	V H HN HCL N Z P	V H HN HCL N Z P	V H HN HCL N Z P	V H HN HCL N Z P						
Sample Date	17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019	17/04/2019						
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water						
Batch Number	1	1	1	1	1	1	1						
Date of Receipt	18/04/2019	18/04/2019	18/04/2019	18/04/2019	18/04/2019	18/04/2019	18/04/2019						
Dissolved Calcium #	108.5	133.7	124.6	100.0	125.2	133.2	138.3				<0.2	mg/l	TM30/PM14
Dissolved Magnesium #	10.3	15.4	6.3	17.6	8.7	12.3	14.7				<0.1	mg/l	TM30/PM14
Dissolved Potassium #	3.6	1.9	0.9	1.5	3.2	1.5	1.3				<0.1	mg/l	TM30/PM14
Dissolved Sodium #	26.5	15.1	12.8	13.7	14.8	16.7	15.3				<0.1	mg/l	TM30/PM14
Total Hardness Dissolved (as CaCO3)	315	399	338	324	350	385	407				<1	mg/l	TM30/PM14
Sulphate as SO4 #	22.1	34.0	36.3	29.2	38.7	62.7	40.6				<0.5	mg/l	TM38/PM0
Chloride #	50.5	23.5	25.6	17.1	21.8	28.3	15.4				<0.3	mg/l	TM38/PM0
Nitrate as N #	5.39	2.55	1.62	0.37	0.65	0.94	1.35				<0.05	mg/l	TM38/PM0
Nitrite as N #	0.097	<0.006	<0.006	0.023	<0.006	<0.006	<0.006				<0.006	mg/l	TM38/PM0
Ortho Phosphate as P #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	0.20	0.03	<0.03	<0.03	0.04	0.05	0.10				<0.03	mg/l	TM38/PM0
Dissolved Carbon Dioxide	62415	88306	105841 ++	88583	61581	86680	142139 ++				<1	ug/l	TM25/PM0
Total Alkalinity as CaCO3 #	420	258	328	317	361	455	391				<1	mg/l	TM75/PM0
Carbonate Alkalinity as CaCO3	<1	<1	<1	<1	<1	<1	<1				<1	mg/l	TM75/PM0
Electrical Conductivity @25C #	718	314	388	548	732	543	383				<2	uS/cm	TM76/PM0
pH #	7.62	7.43	7.36	7.47	7.51	7.54	7.50				<0.01	pH units	TM73/PM0

Please see attached notes for all abbreviations and acronyms

Client Name: JBA Consulting
Reference: Cherrywood
Location:
Contact: Declan Egan

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
No deviating sample report results for job 19/6410						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 19/6410

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 19/6410

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM25	Determintaion of Dissolved Methane, Ethane and Ethene by Headspace GC-FID	PM0	No preparation is required.				
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM14	Analysis of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for dissolved metals and acidified if required.				
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM14	Analysis of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for dissolved metals and acidified if required.	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM75	Modified US EPA method 310.1. Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.				
TM75	Modified US EPA method 310.1. Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.	Yes			
TM76	Modified US EPA method 120.1. Determination of Specific Conductance by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			

Exova Jones Environmental

Registered Office: Exova Environmental UK Limited, 10 Lower Grosvenor Place, London, SW1W 0EN. Reg No. 11371415

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JBA Consulting
17 Laureston Crescent
Tower
Co. Cork
Ireland

Attention :	David Casey
Date :	24th May, 2019
Your reference :	2018s1298
Our reference :	Test Report 19/7960 Batch 1
Location :	Cherrywood
Date samples received :	16th May, 2019
Status :	Final report
Issue :	1

Eight samples were received for analysis on 16th May, 2019 of which eight were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Paul Boden BSc
Senior Project Manager

Client Name: JBA Consulting
Reference: 2018s1298
Location: Cherrywood
Contact: David Casey
JE Job No.: 19/7960

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24			LOD/LOR	Units	Method No.
Sample ID	JBH-1	JBH-2	JBH-3	JBH-4	JBH-5	JBH-6	JBH-7	Spring					
Depth													
COC No / misc													
Containers	H HN P	H HN P	H HN P	H HN P	H HN P	H HN P	H HN P	H HN P					
Sample Date	14/05/2019	14/05/2019	14/05/2019	14/05/2019	14/05/2019	14/05/2019	14/05/2019	14/05/2019					
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	16/05/2019	16/05/2019	16/05/2019	16/05/2019	16/05/2019	16/05/2019	16/05/2019	16/05/2019					
Dissolved Calcium #	113.0	91.8	126.2	104.3	133.4	138.4	136.6	168.9			<0.2	mg/l	TM30/PM14
Dissolved Magnesium #	11.1	7.5	6.0	14.9	6.7	11.7	13.7	9.6			<0.1	mg/l	TM30/PM14
Dissolved Potassium #	3.3	1.4	0.9	1.0	0.9	1.4	1.1	1.1			<0.1	mg/l	TM30/PM14
Dissolved Sodium #	26.7	13.5	12.3	10.9	12.0	15.9	14.2	14.7			<0.1	mg/l	TM30/PM14
Total Hardness Dissolved (as CaCO3)	329	261	341	323	362	395	399	463			<1	mg/l	TM30/PM14
Sulphate as SO4 #	23.4	29.3	32.8	22.7	46.4	59.2	39.5	104.3			<0.5	mg/l	TM38/PM0
Chloride #	53.1	22.5	25.4	15.6	21.0	30.4	15.7	23.1			<0.3	mg/l	TM38/PM0
Nitrate as N #	5.26	2.72	1.31	0.80	0.97	0.60	1.45	1.54			<0.05	mg/l	TM38/PM0
Nitrite as N #	0.050	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006			<0.006	mg/l	TM38/PM0
Ortho Phosphate as P #	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03			<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as N #	0.16	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03			<0.03	mg/l	TM38/PM0
Dissolved Carbon Dioxide	62852	71578	111272++	74812	121192++	110303++	153596++	94046			<1	ug/l	TM25/PM0
Total Alkalinity as CaCO3 #	600	335	333	330	624	431	414	353			<1	mg/l	TM75/PM0
Carbonate Alkalinity as CaCO3	<1	<1	<1	<1	<1	<1	<1	<1			<1	mg/l	TM75/PM0
Electrical Conductivity @25C #	731	630	719	654	743	788	837	930			<2	uS/cm	TM76/PM0
pH #	7.37	7.61	7.36	7.78	7.37	7.36	7.50	7.63			<0.01	pH units	TM73/PM0

Please see attached notes for all abbreviations and acronyms

Client Name: JBA Consulting
Reference: 2018s1298
Location: Cherrywood
Contact: David Casey

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
No deviating sample report results for job 19/7960						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 19/7960

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 19/7960

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM25	Determintaion of Dissolved Methane, Ethane and Ethene by Headspace GC-FID	PM0	No preparation is required.				
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM14	Analysis of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for dissolved metals and acidified if required.				
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM14	Analysis of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for dissolved metals and acidified if required.	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM75	Modified US EPA method 310.1. Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.				
TM75	Modified US EPA method 310.1. Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.	Yes			
TM76	Modified US EPA method 120.1. Determination of Specific Conductance by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			

Appendix C2 – Field and Calculated Results

Field Measurements 17/04/2019

Sample ID	JBH - 1	JBH - 2	JBH - 3	JBH - 4	JBH - 5	JBH - 6	JBH - 7
Water Level mbgl	11.99	4.2	1.32	2.98	5.75	4.84	2.44
Ground Level mAD	71.11	56.42	54.74	53.72	50.91	40.61	54.02
Water level mAD	59.12	52.22	53.42	50.74	45.16	35.77	51.58
Well Depth m	17.06	14.65	9.88	15.68	7.69	20.4	7.47
Temp	11	11.8	10.5	11.5	10.8	11.4	10.2
pH	7.4	6.78	6.93	7.05	7.13	7.17	7.02
pHmv	-35.1	0	-8.5	-15.3	-20	-21.9	-13.5
EC	680.2	481	640	588.9	674	743	751
ORPmv	81	99.3	116.6	71.4	81.7	117.8	88.2
Colour	Brown tint	Brown tint	Brownish	Brown tint	Milky brown	Brownish	Milky brown
Odour	None	None	None	None	None	None	

Field Measurements 14/05/2019

Well No.	JBH-1	JBH-2	JBH-3	JBH-4	JBH-5	JBH-6	JBH-7	Spring
Water level mbgl	12.07	4.82	1.30	3.14	5.91	5.17	2.84	
Water level mAD	59.04	51.6	53.44	50.58	45	35.44	51.18	
Well Depth (mbgl)	17.06	14.65	9.88	15.68	7.69	20.40	7.47	
Temp	10.6	11.2	10.9	10.7	10.8	11.3	10.8	11.2
pH	7.35	6.81	6.89	7.07	6.88	7.1	6.81	7.19
Redox	-34.5	-3.3	-8	-18	-7.4	-19.6	-6.1	-24.9
EC	759	550.5	671	619.7	707	751	795	891
ORPmv	7.5	51	82.1	77.1	74.5	74.7	79	77.2
Colour	Brownish	Brownish	Brownish	Brownish	Brownish	Brownish	Brownish	Clear
Odour	None	None	None	None	None	None	None	None