

# Cherrywood Green Routes Network

Hydrogeological and Hydrological Risk Assessment

Dún Laoghaire-Rathdown County Council

Project number: PR-402643 PR-402643\_ACM\_RP\_ENV\_001 (Hydro Risk Assessment)

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# 1. Introduction

AECOM has been appointed by Dún Laoghaire-Rathdown County Council (DLRCC, 'the Client') with this proposal for a Hydrogeological and Hydrological Risk Assessment pertaining to the proposed Cherrywood Greenway ('the site').

In May 2010 Cherrywood was designated a Strategic Development Zone (SDZ) by the Government. The lands are approximately 16km south east from Dublin City Centre, 8km south of Dun Laoghaire, 3km from coastline and 4km from the Dublin Mountains. The bulk of the lands lie between the M50 and the N11 (which has a Quality Bus Corridor to the City Centre). The areas are served by 5 Luas stops along the Green Line.

The Cherrywood Green Routes Network aims to provide a cycling and pedestrian network within the Cherrywood SDZ. This will include greenways, traffic-free cycle and pedestrian links, and the associated cycle and pedestrian infrastructure to support and improve these routes.

## 1.1 **Objective**

This Hydrogeological and Hydrological Risk Assessment considers the potential impact to water quality in Killiney Bay resulting from the construction and operation of the Cherrywood Green Routes Network. Impacts are assessed through the development of a Conceptual Site Model (CSM) and impacts are considered in the absence of mitigation.

# 2. Baseline Environment

# 2.1 Information Sources

The following sources of information were consulted as part of the desk study:

- Geological Survey of Ireland (GSI) Public Viewer Maps (<u>www.gsi.ie</u>);
- Ordnance Survey of Ireland (OSI) historical maps (<u>www.geohive.ie</u>);
- Online planning records, including site layout and drainage maps (www.dlrcoco.ie);
- Environmental Protection Agency (EPA) mapping website (gis.epa.ie/EPAMaps/);
- Design drawings.

### 2.2 Site Location and Setting

The site is located in Cherrywood within the area of Dún Laoghaire-Rathdown, Co. Dublin. It is located to the west of the N11 and to the northeast of the M50.

The proposed route generally follows the western side of the Loughlinstown River North' (labelled on EPA maps as 'Carrickmines Stream') from northwest to southeast. the route forks in the north, with one section of route following the Carrickmines River (also labelled on EPA maps as 'Carrickmines Stream') to the west and another following St. Bride's Stream (EPA name: 'Cabinteely Stream') to the north. At the centre of the route, two crossings of the Loughlinstown River North are proposed, with a short section of the route on the east of the river. To the southeast, the route departs from the Carrickmines Stream and heads south, along the line of the Loughlinstown River South (EPA name: 'Shanganagh'), crossing a small tributary of the river.

A site plan is presented as Figure 1. Figure A below shows names of route sections as they are referenced in this report:

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# 2.3 Existing Site Conditions

The current site conditions along the route can be summarised as follows:

- Druids Glen: predominantly woodland;
- Carrickmines River Valley: green space, including grassland and woodland;
- Tudor Homes: green space, alongside a planned residential development;
- Lehaunstown Valley (North): green space with grassland, hedgerows and trees;
- Lehaunstown Valley (South): grassland, with existing paths that may be re-used;
- Bray Link Road: existing pathway that runs below the R118;
- Cherrywood Business Park: grassland with existing paths;
- Bride's Glen Valley: forms part of construction site;
- Bride's Glen Link Road: woodland and residential access roads.

### 2.4 Site History

A review of publicly-available online mapping indicates the site has been undeveloped historically, and has mainly been occupied by grassland and woodland up to the commencement of the Cherrywood development.

# 2.5 Topography

The route generally follows the line of the Loughlinstown River, generally at between approximately 20m and 30m above Ordnance Datum (AOD). The route rises to where it finishes at the R118 in the south, at a level of approximately 48m AOD (Bride's Glen Valley). It also rises to the west along Druid's Glen, to a high point of approx. 60m AOD.

# 2.6 Geology

#### 2.6.1 Surficial Geology

According to the Geological Survey of Ireland (GSI) website, quaternary sediments beneath the site are characterised by alluvium to the north, and Tills derived from limestone and granite to the south, as shown in Figure 2.

According to the GSI website, a number of geotechnical boreholes have been drilled in the vicinity of the site, associated with road and drainage schemes. Borehole logs and soil descriptions along the R118 crossing the site indicate sandy gravelly clays and silts to depths exceeding 8.0m below ground level (bgl). The surficial deposits were found to be thinner to the north of the site, with a borehole close to the confluence of St. Bride's Stream and Carrickmines River encountering bedrock at 3.6m bgl.

#### 2.6.2 Bedrock Geology

According to the GSI website (GSI, 1:100,000 map) the bedrock geology below the site is 'Granite with microcline phenocrysts', of the formation 'Type 2p microcline porphyritic (Northern and Upper Liffey Valley Plutons)'. A section to the west near Lehaunstown Road is underlain by 'Pale grey fine to coarse-grained granite' of the 'Type 2e equigranular (Northern and Upper Liffey Valley Plutons)' formation. The bedrock geology is presented in Figure 3.

## 2.7 Hydrogeology

#### 2.7.1 Aquifer Classification

The GSI has classified the granitic bedrock underlying the site as a 'Poor' aquifer, which is generally unproductive except for local zones.

#### 2.7.2 Groundwater Vulnerability

The aquifer vulnerability varies along the length of the Proposed Development, as shown in Figure 4.

To the south, the groundwater vulnerability is low, due to thicker surficial sediments, but with areas to the north classified as having moderate, high and extreme vulnerability. In two locations to the north and west, the groundwater vulnerability is classified as 'rock at or near surface or karst'. A summary of groundwater vulnerability under each of the route sections is as follows:

- Druids Glen: Extreme/Rock at or near surface or karst;
- Carrickmines River Valley: Extreme/Rock at or near surface or karst;
- Tudor Homes: High/Extreme;
- Lehaunstown Valley (North): Moderate/High/Extreme;
- Lehaunstown Valley (South): Low/Moderate;
- Bray Link Road: Low;
- Cherrywood Business Park: Low;
- Bride's Glen Valley: Low/Moderate;
- Bride's Glen Link Road: Low.

#### 2.7.3 Groundwater Flow

Groundwater is inferred to flow towards the nearest surface water feature for each section of the Proposed Development and generally towards the east towards the Loughlinstown River.

### 2.7.4 Groundwater Quality

The EPA has classified the status of groundwater body beneath the site under the Water Framework Directive (WFD) 2013-18, as 'good'.

#### 2.7.5 Groundwater Wells

According to GSI records, there is one groundwater well within a 1.0 km radius of the site. It is located approximately 500m to the west of the Proposed Development. The well was drilled in 1994 to a depth of 61.3 m. The use of well is recorded as 'unknown'. Yield from this well is classified as 'good'. Yield is declared as 220 m<sup>3</sup>/day with a capacity of the well of 26.7 m<sup>3</sup>/day. It must be noted that the presence of other private wells within a 1 km radius of the site cannot be ruled out as these wells are not always recorded on the GSI Mapping system.

The site is not located within a groundwater Source Protection Area.

#### 2.7.6 Groundwater Springs

Based on a review of publicly available information, a number of tufa-forming springs are present along the proposed route. Mapping produced in a 2011 report<sup>1</sup> identifies springs at the locations shown in Figure B.



The springs marked number 5 in Figure B are described as "mature, high quality tufa springs" and a protection zone was recommended in their vicinity. The remaining springs were classed as immature or lower quality, although a protection zone was recommended around the spring marked as number 11 in Figure B, due to its ecological significance.

The report recommended the following as mitigation measures for the SDZ design:

- A SUDS design philosophy to be employed for the SDZ;
- The construction of hardstanding areas to be minimised in the catchments immediately upgradient of the high quality tufa springs (e.g. location 5) in order to minimise the potential for disruption to recharge in these areas;

<sup>&</sup>lt;sup>1</sup> Phase1 Hydrogeology Assessment of the Cherrywood SDZ. RPS (2011)

- Artificial recharge systems to be considered where possible in sensitive areas, specifically up gradient from high quality tufa spring (e.g. location 5) discharges in order to maintain the overall hydrological balance if development cannot be avoided in these areas;
- Landscape proposals to 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 tufa springs (e.g. location 5); and
- It was recommended a targeted hydrogeological site investigation be undertaken in the protection area at location 5, if this area could not be avoided in the design.

# 2.8 Hydrology

#### 2.8.1 Surface Water Features

The site's setting in relation to surface water features is shown in Figure 5. The site lies within the Carrickmines Stream (Loughlinstown River) and Shanganagh River sub-basins, in the Dargle sub-catchment of the Ovoca[sic]-Vartry WFD Catchment.

As described in Section 2.2, the cycleway generally follows the route of the Loughlinstown River North (IE\_EA\_10S010600), with sections to the north (Tudor Homes) and west (Carrickmines River Valley and Druids Glen) running along two of its tributaries, St Bride's Stream (IE\_EA\_10C040350) and Carrickmines River (IE\_EA\_10C040350), respectively. The Loughlinstown River North flows from north to south and enters the Shanganagh River (IE\_EA\_10S010600) approximately 400m downstream of the route, at which point the Loughlinstown River South (IE\_EA\_10S010600) also joins. The Shanganagh River flows into Killiney Bay approximately 1.6km east of the proposed route, adjacent to the Shanganagh Waste Water Treatment Plant.

The proposed route will cross the Carrickmines River with a proposed bridge at the southern end of the Tudor Homes section, and the Loughlinstown River North at an existing bridge within the Cherrywood Business Park section. Within the Lehaunstown Valley (South) section, an existing bridge over the Loughlinstown River North is to be used. The Druids Glen and Carrickmines River Valley route sections are also separated by an existing bridge over the stream.

#### 2.8.2 Surface Water Quality

Based on EPA mapping data, the water quality of the surface water features has been assessed as follows:

- Loughlinstown River North: 'moderate' immediately upstream of R118;
- Shanganagh River: 'poor' at confluence with Loughlinstown River North and South, approx. 200m east of site; 'moderate' approx. 1km downstream of site; and 'poor' approx. 1.3km downstream of site, adjacent to the Shanganagh Waste Water Treatment Plant;
- Killiney Bay: 'unpolluted'.

Water monitoring under the Water Framework Directive (WFD) indicates the WFD 2013-2018 status of the Carrickmines River, Loughlinstown River, St. Bride's Stream and Shanganagh River is 'moderate'. The WFD status of Killiney Bay is listed as 'high'.

Under the WFD, St. Bride's Stream, Carrickmines River and Loughlinstown River North upstream of the R118 are listed as 'at risk' of failing to meet objectives, while the Loughlinstown River North downstream of the R118, the Loughlinstown River South, the Shanganagh River and Killiney Bay are listed as 'not at risk'.

### 2.8.3 Existing Drainage

As the majority of the proposed development route consists of grassland and woodland, most surface water drainage is directly to land.

# 2.9 Protected Areas

According to the EPA online mapping tool, Loughlinstown Woods 200m to the east, is a proposed Natural Heritage Area (pNHA).

# 3. Characteristics of the Proposed Development

# 3.1 Construction

The construction of the Proposed Development will entail the upgrade of existing paths, the construction of new cycle and walking routes and the construction of a bridge.

The proposed bound surface pavement construction will be as shown in Figure C below, pending final detailed design, and will consist of:

- 20 mm thin surface course
- 55 mm base course
- 150mm Clause 804 subbase (machine laid)
- Geotextile layer (where necessary)
- Capping (where necessary)

Kerbs or other edge restraint are not proposed for this greenway. It is proposed instead to extend the subbase to 300mm beyond the surface course on each side, with the base course extending 150mm beyond the surface course, as is shown in Figure C. The requirements for geotextiles and capping will be dependent on the ground conditions along the proposed route. This will be determined at a later design stage and will give added stability where the ground conditions are sub-par.

It is proposed that the greenway is machine laid, as this gives a more even surface and better drainage than using a hand laid approach.



The Druids Glen route section will comprise a pedestrian route, constructed by the laying of a geocellular web confinement system.

The new proposed bridge will likely be of steel construction, with concrete abutments.

A number of sections of the route will require a process of cut and fill to attain appropriate gradients for the greenway, with the two largest areas of earthworks shown in Figure D below. These sections will be reprofiled for the purpose of providing a suitable gradient for the route. It is not anticipated that the cut and fill will have a significant impact on the groundwater or surface water regime, based on the proposed changes to topography.

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In addition, a potential 'green wall' is proposed to the west of the section of cut shown in Figure D (b).

# 3.2 Proposed Drainage

It is proposed to provide over-the-edge drainage along the proposed cycle route. The greenway should be higher than the proposed ground level by 20mm to stop back flow of the surface water runoff from a flat grassed verge.

It is proposed to provide a consistent crossfall throughout the design of 2%. It is proposed that the crossfall is developed from one side of the greenway to the other, i.e. that a crown line isn't provided in the middle of the greenway. It is proposed that the greenway crossfall is directed towards the inside of a bend to prevent negative crossfall, which could pose a hazard to cyclists.

The grassed verge will also be lower than the proposed cycleway to ensure that no back flow occurs from the proposed grass verge back onto the cycleway. However, the verge gradient will not be more than 10% in gradient so that errant cyclists are not destabilised if they stray from the cycleway.

The proposal will cross a section of calcareous spring habitat in Druids Glen (location 11 in Figure B). The spring in the Druids Glen is a tufa cascade which crosses the Druids Glen pathway before continuing downstream to the Carrickmines

Stream. The spring source is located up-slope in the Druids Glen valley and will not be affected by the proposed development. The crossing of the spring will be elevated by boardwalk to avoid impeding the flow of calcium-rich water downslope.

Drainage will be provided to the proposed green wall and it is not anticipated this will have a significant impact on the existing surface water run-off.

# 4. Conceptual Site Model

Based on the findings of the study completed herein, a Conceptual Site Model (CSM) has been developed identifying potential contaminant sources, contaminant migration pathways and potential receptors with reference to BS10175-2011 + A2 2017 and CIRIA Document C552: 'Contaminated Land Risk assessment - A Guide to Good Practice' (2001).

In the context of land contamination, there are three essential elements to any risk:

- A **source** a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters;
- A **receptor** in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body; and
- A pathway a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant-pathway-receptor is described as a pollutant linkage. The preliminary CSM was developed to describe viable source-pathway-receptor linkages for the site.

#### 4.1 Potential Sources

#### 4.1.1 Construction Phase

#### 4.1.1.1 Storage and Use of Fuel

During the construction phase, machinery will be present on site that requires refuelling. In the absence of mitigation, there exists the potential for a fuel spill to occur from an area of storage or during refuelling.

#### 4.1.1.2 Construction Materials

The cycle route will be covered with a surface layer of asphalt/tarmac. In addition, concrete will be used in, for example, the construction of abutments for the proposed bridge. In the absence of mitigation measures, tarmac and concrete may be able to enter surface waters, leading to contamination and, in the case of concrete, potential impacts to surface water pH.

#### 4.1.2 **Operational Phase**

#### 4.1.2.1 Increased Run-off

Where previously-grassed areas are to be covered with hardstanding and where cut and fill is being undertaken, there will be a potential for increased surface water run-off to nearby surface water features. Such run-off may contain silt, which would increase sediment loading in surface water features.

### 4.2 **Potential Pathways**

The following pathways have been considered:

- Direct run-off of contaminants into adjacent surface water features (Carrickmines River, St. Bride's Stream, Loughlinstown River North, Loughlinstown River South)
- Surface water on site could enter into the granite bedrock, particularly in the northwest of the site where bedrock is recorded as at/near the surface. However, the bedrock aquifer is classified as 'Poor' and therefore significant lateral migration of water through the bedrock to other receptors is considered unlikely;

- There is a hydrological linkage from surface water to Killiney Bay through the Shanganagh River and its tributaries which run adjacent to the site.
- Where cut and fill are proposed, there is potential for increased infiltration to groundwater.

### 4.3 **Potential Receptors**

The bedrock aquifer is classified as 'Poor' and is therefore is not considered to be a potentially sensitive receptor.

The key receptor identified is Killiney Bay, approx. 1.6km downstream of the route. The Carrickmines River, St. Bride's Stream, Loughlinstown River North, Loughlinstown River South and Shanganagh River are also considered to be surface water receptors.

The existing tufa springs identified at locations 5 and 11 in Figure B are considered to be potential receptors. However, based on the proposed design, significant changes to the flow regime are not anticipated.

As noted in Section 3.2 above, a boardwalk will be provided over the spring at location 11.

Significant earthworks are not proposed within the protection zone of the springs at location 5 and the infrastructure passing through comprises a simple cycle path downgradient of the springs. This path is not considered to have a significant impact on the drainage of the catchment area, and therefore no targeted site investigation is considered necessary.

The CSM is presented in Table 1 below.

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#### Table 1. Conceptual Site Model

| Source  | Pathway   | Receptor  | Potential Risk | Discussion  |
|---|---|---|----------------|---|
| Construction Pha  | ise   |   |                |   |
| Leak from storage<br>of fuel / refuelling<br>of construction<br>machinery       | Direct run-off into Carrickmines River, St.<br>Bride's Stream, Loughlinstown River<br>North and Loughlinstown River South;<br>and migration downstream into<br>Shanganagh River               | Carrickmines River, St.<br>Bride's Stream,<br>Loughlinstown River North,<br>Loughlinstown River South<br>and Shanganagh River | Low            | In the absence of mitigation measures, there exists the potential for a fuel spill<br>during construction works to impact the surface water features adjacent to the site.<br>This may lead to an impact to water quality in the nearby surface water features.<br>Given the likely size of such a spill, impacts are considered to be temporary in<br>nature and minor in scale. |
|   | Direct run-off into Carrickmines River, St.<br>Bride's Stream, Loughlinstown River<br>North and/or Loughlinstown River South,<br>followed by migration downstream<br>through Shanganagh River | Killiney Bay  | No Risk        | In the event of a spill to one of the surface water features adjacent to the site, there is considered to be no potential for impacts to water quality in Killiney Bay. This is based on the likely size of any spill and attenuation and dilution processes in the surface waters downstream of the Proposed Development.  |
| Construction<br>materials,<br>including   | Direct run-off into Carrickmines River, St.<br>Bride's Stream, Loughlinstown River<br>North and Loughlinstown River South;  | Carrickmines River, St.<br>Bride's Stream,<br>Loughlinstown River North,  | Low            | In the absence of mitigation measures, there exists the potential for construction materials to fall into the surface water features adjacent to the site, especially where works are over/adjacent to water (bridge).  |
| tarmacadam,<br>concrete and<br>cement   | and migration downstream into<br>Shanganagh River   | Loughlinstown River South<br>and Shanganagh River   |                | There may be an impact to the water quality of surface water features adjacent to the site. However, given the likely size of such a spill, impacts are considered to be localised and temporary in nature.   |
|   | Direct run-off into Carrickmines River, St.<br>Bride's Stream, Loughlinstown River<br>North and/or Loughlinstown River South,<br>followed by migration downstream<br>through Shanganagh River | Killiney Bay  | No Risk        | In the event of a loss of cement/concrete or asphalt/tarmacadam to one of the surface water features adjacent to the site, there is considered to be no potential for impacts to water quality in Killiney Bay. This is based on the likely size of any spill, and attenuation and dilution processes in the surface waters downstream of the Proposed Development.               |
| Operational Phas  | e   |   |                |   |
| Increased run-off<br>from paved areas<br>with potential for<br>suspended solids | Direct run-off into Carrickmines River, St.<br>Bride's Stream, Loughlinstown River<br>North and Loughlinstown River South;<br>and migration downstream into<br>Shanganagh River               | Carrickmines River, St.<br>Bride's Stream,<br>Loughlinstown River North,<br>Loughlinstown River South<br>and Shanganagh River | Imperceptible  | In certain areas of the route, existing uncovered ground will be covered in hardstanding. This may slightly reduce surface water infiltration to ground, leading to increased flows to surface water features. These flows may carry suspended solids. However, based on the limited width of the proposed cycle route, the increase in run-off is likely to be imperceptible.    |
|   | Direct run-off into Carrickmines River, St.<br>Bride's Stream, Loughlinstown River<br>North and/or Loughlinstown River South,<br>followed by migration downstream<br>through Shanganagh River | Killiney Bay  | No Risk        | As stated above, any impact to surface water features adjacent to the site is likely to be imperceptible. On this basis, given the attenuation and dilution processes downstream, there is considered to be no potential for impact to Killiney Bay.  |

# 5. Cumulative Impacts

There are a number of permitted developments in the vicinity of the site, associated with the Cherrywood SDZ. A summary of notable applications is presented below:

- DZ15A/0758: Permission granted in 2016 for the development of roads and infrastructure as part of Phase 1 of the Cherrywood SDZ. These works include drainage infrastructure, including attenuation ponds;
- D15A/0385: Beech Park residential development, which was granted permission following appeal in 2018;
- DZ17A/0122 / DZ18A\_1104: Office blocks ('F-blocks') on the south of the SDZ;
- DZ17A/0731: Permission was granted in 2018 for an office development on the southwest of the SDZ;
- DZ17A/0862: Permission was granted in 2018 for the development of a town centre;
- DZ18A/0208: A residential development to the north of the scheme ('Tudors Homes') was granted permission in 2020;
- DZ18A/0854: Permission was granted for the installation of three attenuation ponds (Ponds 5A) at the south of the site;
- DZ19A/0255: Permission was granted in 2019 for the development of Cherrywood Business Park;
- DZ19A/0597: Permission was granted in 2020 for a residential development within the Cherrywood SDZ;
- DZ20A/0052: DZ21A/0785: Permission was granted in 2021 for a mixed use development within the Cherrywood SDZ;
- DZ20A/0399: Permission was granted in 2021 for a residential development within the Cherrywood SDZ;
- DZ21A/0334: Permission was granted in 2021 for a residential development within the Cherrywood SDZ;
- DZ21A/0664: Permission was granted in 2021 for a residential development within the Cherrywood SDZ;
- DZ21A/0785: Permission was granted in 2021 for a mixed use development within the Cherrywood SDZ;
- DZ21A/0932: Permission was granted in 2021 for a residential development within the Cherrywood SDZ

It is considered most likely that the Proposed Development will commence in 2022. While there is the potential for some overlap of other schemes with the Proposed Development, the above schemes have all been designed with a consideration for surface water drainage and are not considered likely to represent significant risks to the local hydrology. Planning approved developments within the Cherrywood SDZ will be phased.

Therefore, there is not considered to be any significant potential for cumulative impacts to the water quality in Killiney Bay during the Proposed Development.

# 6. Conclusions

A CSM has been prepared based on a desktop review of the site and surrounding area. Based on this CSM, plausible source-pathway-receptor linkages have been assessed assuming an absence of any mitigation measures.

Based on the findings of the CSM, it is concluded there is no potential for impacts to water quality at the outfall of the Shanganagh River to Killiney Bay from the Proposed Development.

It is noted that mitigation measures have been included in the construction design and will be implemented during the construction programme of the proposed development. These specific measures will provide further protection to the receiving soil and water environments. However, the protection of water quality in Killiney Bay is in no way reliant on these measures.

# **Figures**

- Figure 1 Site Plan
- Figure 2 Quaternary Sediments
- Figure 3 Bedrock Geology
- Figure 4 Groundwater Vulnerability
- Figure 5 Surface Water Features





|  |                          | MENDMENT      |  |  |  |
|--|--------------------------|---------------|--|--|--|
| Cycle Route  |                          |               |  |  |  |
| -  |                          |               |  |  |  |
| GGr, Grave   | ls derived               | from          |  |  |  |
| GLs, Grave   | els derived              | from          |  |  |  |
| IrSTLs, Iris   | h Sea Till               |               |  |  |  |
| Rck, Bedro   | ck outcrop               | o or          |  |  |  |
| TGr, Till de   | rived from               |               |  |  |  |
| TLs, Till de   | rived from               |               |  |  |  |
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| Discipline   | MENTAL                   |               |  |  |  |
| Project Title:<br>CHERRYWOOD GREENWAY  |                          |               |  |  |  |
| Drawing Title:   |                          |               |  |  |  |
| QUATERNARY SEDIMENTS   |                          |               |  |  |  |
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| Drawing No:<br>FIGURE 2  |                          | Rev:<br>O     |  |  |  |



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| 101                     | LEGEN   | D  |  |  |
| . m=23                  |   | Cycle Rou  | ıte  |  |
|                         | Bedro   | ck   |  |  |
| de f                    | T   | Гуре 1   |  |  |
| na fé                   | ۲<br>ا  | Гуре 3 ті  | uscovite   |  |
| A.                      | p t   | oorphyriti   | С  |  |
|                         | <b>T</b>  | Гуре 2е  |  |  |
|                         | ۲ ۲   | Гуре 2р n  | nicrocline   | Э  |
|                         | p k   | oorphyriti   | с  |  |
|                         |   | Maulin   |  |  |
| No. of Concession, Name |   |  |  |  |
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| 8.0                     | Discipline  |  |  |  |
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| 1.3                     | В   | BEDROCK  | GEOLOG   | θY   |
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|                         |   | 2  |  | Rev:   |
|                         | FIGURE  | 5  |  | 10   |

| Cycle Route<br>Bedrock   |
|--|
| Type 1   |
| Type 3 muscovite   |
| porphyritic  |
| Туре 2е  |
| Type 2p microcline   |
| porphyritic  |
| Maulin   |
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| The The CHERRYWOOD GREENWAY  |
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| vrawing i ne:  |
| BEDROCK GEOLOGY  |
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| FIGURE 3   |
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| LEGEND  |                     |
| Cycle Route   |                     |
| Watercourses  |                     |
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| Project Title:  |                     |
| CHERRYWOOD GREENWAY   |                     |
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| Drawing Title:  |                     |
|   |                     |
| SURFACE WATER FEATURES  |                     |
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| Drawing No: Rev:<br>FIGURE 5 0  |                     |
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![](_page_20_Picture_2.jpeg)