9 SOILS, GEOLOGY AND HYDROGEOLOGY

9.1 Introduction

This chapter of the EIAR describes the soils, geology and hydrogeology in the existing environment along the River Poddle and its catchment. The catchment of the River Poddle is urbanised, interspersed by open space and parkland, particularly close to the river. This chapter presents an assessment of the potential impacts on the soils, geology, and hydrogeology of the area arising from the proposed development and to propose measures to mitigate against these impacts.

9.2 Statement of Authority

This chapter has been prepared by Richard Church formerly of Nicholas O'Dwyer Ltd. Richard holds a Bachelor's degree in Geophysical Sciences and a Master's degree in Hydrogeology with over 25 years' experience in engineering and environmental consultancy in the water services industry in Ireland, UK and internationally.

9.3 Methodology

This chapter presents the findings of a desktop study of available soil, geology and hydrogeology data from published sources from the GSI, EPA and OPW. The analysis incorporates aquifer characteristics and vulnerability, soils, subsoils and quaternary sediments, the geological setting, groundwater well locations, along with geological and Ordnance Survey mapping.

This assessment has been prepared in accordance with the following guidelines:

- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, 2017)
- Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (Institute of Geologists of Ireland, 2013).

In keeping with these guidelines, this assessment has been undertaken in consultation with the requirements and guidelines of the Geological Survey of Ireland (GSI) concerning the soils, geology and groundwater environment.

9.4 Existing Environmental Conditions

This section describes the existing environment in terms of the current geology underlying the site on a regional and local scale as well as its interaction with the groundwater regime at the site. On this basis, the potential impacts of the development were identified, as were the measures required to mitigate against any negative impacts on the soils, geology and groundwater environment.

9.4.1 Development Proposals

The proposed development consists of flood alleviation works along and adjacent to the River Poddle on sites totalling 12ha, along with associated ancillary and temporary works.

9.4.2 Characteristics of the Proposed Development

The proposed works extend from the upper reaches of the River Poddle at Tymon North in Tallaght to Saint Teresa's Gardens in Merchant's Quay, Dublin. A detailed description of

the proposed works is contained in **Chapter 5** and illustrated in **Volume 3** of the EIAR. A brief description is summarised as follows:

There are three areas where more substantial works are proposed in green spaces and parks including Tymon North and Tymon Park in Tallaght where the main flood storage embankment is to be constructed and an Integrated Constructed Wetland (ICW) is also planned; at Whitehall/Wainsfort Manor Crescent in Terenure where a channel re-alignment is proposed; and at Ravensdale Park in Kimmage where flood walls are to be constructed to provide flood protection and storage.

Proposed ancillary works and associated development includes drainage channel clearance and removal of trees where required for the works; rehabilitating or installing culvert screens in locations as required; installing flap valves in all culverts draining to the River; rehabilitating or replacing manholes; biodiversity enhancements including installation of floating nesting platforms in Tymon Lake, Tymon Park, Tallaght; and landscape mitigation and restoration at Tymon Park, Tallaght, Whitehall Park, Terenure, and Ravensdale Park and St. Martin's Drive, Kimmage including public realm improvements, replacement footbridges, biodiversity enhancements and tree planting and landscaping.

Temporary works include establishing a main construction compound in Tymon Park with access off Limekiln Road, which will be in operation for the entire duration of the works; and temporary works / set down areas at Wainsfort Manor Crescent, Ravensdale Park and St. Martin's Drive, which will be in use for the duration of the works to be carried out in these locations. Other temporary works include temporary stockpiling of excavated earth in Tymon Park; temporary channel crossings at Tymon North and Tymon Park, and channel diversions at Tymon Park and Whitehall Park to enable the works along the River channel to be carried out.

9.4.3 The Existing Environment

9.4.3.1 Soils, Subsoils and Quaternary Sediments

Natural soils and subsoils are limited in the northern half of the catchment due to the urbanisation of the catchment. Much of the soil cover is classified by Teagasc as Made Ground. The till derived soils are classified as mineral and poorly drained. Mapping of soils within the catchment is presented in **Figure 9-1**.

The Quaternary sediments overlying the bedrock through the catchment are principally till derived from limestone, this is generally thin <5m. Some river derived sediments and gravels have been identified in Tymon Park to the west of the M50. Local areas of bedrock at surface are present in the catchment from Kimmage to Harold's Cross. Mapping of Quaternary sediments is presented in **Figure 9-2**.

9.4.3.2 Geological Setting

Reference to GSI web mapping[1] indicates that the catchment is underlain by the Lucan Formation of Lower Dinantian Limestones (known as 'Calp'). The formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones,

[1] Geological Survey of Ireland, web mapping, http://spatial.dcenr.gov.ie/GeologicalSurvey/Groundwater/index.html [accessed 31/05/19].

sometimes graded, and interbedded dark-grey calcareous limestone. There are no regional faults mapped within the catchment.

9.4.3.3 Aquifer Characteristics

The bedrock is classified by GSI as a Locally Important (LI) Aquifer where the bedrock aquifer is moderately productive but only in local zones. A map of the bedrock aquifers is presented in **Figure 9-3**.

9.4.3.4 Groundwater Wells

The GSI groundwater database reports two wells which were drilled in 1992 close to Kimmage Cross Roads for industrial purposes. These were drilled to 150m depth and report moderate to excellent well yields (45-818 m^3/d). The bedrock in the area was intercepted at a depth of 2m. Two wells drilled in Crumlin and Drimnagh into the same bedrock report similar yields.

9.4.3.5 Groundwater Vulnerability and Recharge

As a result of the low permeability nature of the bedrock aquifer the potential recharge within the catchment is limited and a recharge coefficient of 20% is given to the area. The bedrock aquifer has a classification of High to Extreme vulnerability due to the thin subsoils and the limited soil depth. A map of the groundwater vulnerability is presented in **Figure 9-4**.

9.4.3.6 Geological Heritage

The Irish Geological Heritage (IGH) Programme identifies and selects a complete range of sites that represent Ireland's geological heritage under sixteen themes ranging from Karst features to Hydrogeology. The IGH Programme is a partnership between the GSI and the National Parks and Wildlife Service (NPWS) and sites identified as important for conservation are conserved as Natural Heritage Areas (NHA). Datasets are now available online detailing sites of geological heritage. There are no sites of geological heritage within the catchment.

9.4.3.7 Water Framework Directive Status

Under the Water Framework Directive (WFD), the key water quality objective is that all water bodies achieve or retain '*Good*' status by 2015. The Groundwater Body has been classified as having '*Good*' status and has a risk score of '*Not at Risk*'. There are no Drinking Water Protected Areas defined within the catchment.

9.4.3.8 Historic Map Review

A review of the historic 6" mapping for the area identifies a number of potential impacts from historic use of groundwater and bedrock within the catchment. A number of historic mills were located in the Kimmage area and a mill pond is located close to Kimmage Crossroads. This pond could be in hydraulic continuity with the underlying groundwater indicating shallow groundwater depths in the area. A number of old quarries are located to the north of Kimmage Crossroads which must have been backfilled with material at some point. An old quarry also exists in the park to the east of Mount Argus View.

9.4.3.9 Groundwater Flood Risk Assessment

The bedrock aquifer within the catchment has a low storage capacity for groundwater. Boreholes and surface water ponds indicate that groundwater levels are shallow (typically <5m depth). The soils mapping indicates that there are areas of poorly drained soils within the catchment and significant areas of 'made ground' which are also likely to be poorly draining. Therefore, additional groundwater recharge to the catchment could result in localised groundwater flooding, particularly in basements or excavated areas. This is likely to be during periods of high groundwater levels, typically during later winter months and early spring.

There are no recorded incidents directly and solely attributable to groundwater flooding within the catchment, and due to the size and particularly width of the catchment it may be difficult to distinguish a groundwater flood event from a river flood event.

It is considered that the principal risk of flooding by groundwater relates to poorly draining soils and subsoils preventing infiltration to groundwater from high rainfall events. The risk from direct groundwater flooding is considered to be low.

9.5 Potential Impacts

9.5.1 Construction Impacts

The following potential impacts have been identified during the construction phase.

9.5.1.1 Bedrock Exposure and Removal

In localised areas the upper weathered bedrock may be partially and permanently removed during the construction for wall foundations. The competent bedrock will be exposed for a short period during the construction phase prior to foundation pouring. The impact associated with the removal of weathered bedrock is considered to be a neutral permanent minor impact.

9.5.1.2 Hydrocarbon Leakage/Spillage

Possible contamination of soil and subsoil, by leakage or spillage from machinery and associated equipment, may occur during the construction phase. An accidental hydrocarbon spillage would have a negative short-medium term moderate impact on surface water quality at, and down-gradient of the development sites.

9.5.1.3 Foundation Pouring

The spillage of cement material poses a potential risk to surface and groundwater. During the construction phase this risk may be realised during the construction of buildings and the washing of equipment if due caution is not taken in pouring the concrete. The entry of cement washwater into the surface water drainage network would have a negative short-term moderate impact on surface water quality.

9.5.1.4 Groundwater Flow Paths

The removal of soils and subsoils and the replacement by embankment and walls could result in localised diversion of groundwater flow. However, due to the low permeability nature of the underlying aquifer it is expected that this change would be very local and limited and have an imperceptible impact.

Some limited dewatering of excavations may be required, which may involve pumping groundwater. This water could potentially become contaminated and will be tested prior to discharge.

9.5.2 Operational Impacts

There is not expected to be any further impacts on the bedrock or aquifer environment during the operational phase.

9.6 Mitigation Measures

9.6.1 Overview

Construction activities have the potential to cause minor adverse impacts to the geology and hydrogeology of the site. A number of planned mitigation measures, detailed below, will reduce these impacts. Many of the mitigation measures below are based on Construction Industry Research and Information Association, UK (CIRIA) technical guidance on water pollution control and on current accepted best practice.

9.6.2 Construction Phase

9.6.2.1 Soils

Any soil imported to site will be subject to assessment by a suitably qualified Ecologist to identify invasive alien species present. Any soils stored on site will be seeded and periodically topped. Such stores will be subject to on-going monitoring.

If invasive plant species are present at any of the sites, machinery and equipment including footwear and tools will be cleaned appropriately (as per species requirements) between infested sites.

An estimated 5,000m^3 of material is to be excavated for the works in Tymon Park. The excess material from the excavation works will be used as bulk fill, embankments or landscaping where possible. It is estimated that 50% of the material will be required for the embankments and landscaping and the remainder will be taken off site for disposal at an agreed licensed area. All material removed from site will be disposed of in accordance with relevant waste management legislation.

The top layer of soil (approximately 200m depth) contains valuable ecological material that will be saved separately from subsoils and will be used to reinstate the parks and green areas and allow for natural restoration and establishment of plants. Stockpiles of this material are to be stored in banks no more than 1m high.

All materials excavated from the works areas will be stockpiled as close to the area where they are to be re used in landscape restoration in order to minimise on-site haulage and double handling. Areas for material storage have been assigned in consideration of sensitive habitats and ecological features and use of the parks and green spaces in the Scheme. Stockpiles of other material will be formed no more than 2m in height and will be sealed using the back of an excavator bucket or tracked upon by a tracked excavator to ensure the stockpile does not become saturated and therefore difficult to handle when being reinstated into the works. All stockpiles will be clearly defined, fenced and signed to ensure no cross contamination with other materials to be stockpiled.

9.6.2.2 Bedrock and Groundwater

The contractor shall be obliged to ensure no deleterious discharges are released from the sites to the River Poddle during excavation de-watering, testing or washing activities. Throughout the period of works the contractor shall also take account of relevant legislation and best practice guidance including but not limited to the following:

- C532 Control of water pollution from construction sites: guidance for consultants and contractors;
- C648 Control of water pollution from linear construction projects;
- SP156 Control of water pollution from construction sites – guide to good practice.

The contractor's construction method statements shall also indicate how management, monitoring, interception, removal and/or treatment of silt run-off will prevent contamination of ground or surface waters by mobilisation of soil particles.

The contractor's methodology statement should be reviewed and approved by a suitably qualified geotechnical engineer prior to site operations.

Excavations will be backfilled as soon as possible to prevent any infiltration of potentially polluting compounds to the subsurface and the aquifer.

Prior to the storage of any potentially polluting material on site, the site manager will be responsible for ensuring that a material safety data sheet for each product is available for inspection. A copy of all relevant material safety data sheets will be available at storage locations as well as the site office.

The majority of new material brought to site will be used immediately or will be stored within the site boundary. Other materials such as asphalt or concrete will be brought directly to the construction site when required and immediately placed.

All potentially polluting materials will be stored in bunded areas, the capacity of which will be 110% of the total volume of liquid to be stored. Any machinery refuelling that takes place on site will be carried out by competent personnel, preferably at a single designated location within the temporary site compound, otherwise a bowser will be used to refuel machinery working onsite. Spill kits will be stored at the machinery refuelling areas. The spill kits will comprise suitable absorbent material, refuse bags, *etc*. to allow for the appropriate clean-up and storage of contaminated material in the event of a spillage or leak occurring.

The washing of any plant equipment will be carried out in designated areas to prevent potentially polluting material from contaminating aquifers and soils/subsoils.

There will be no discharge of effluent to groundwater during the construction phase. All wastewater from the construction facilities will be stored for removal off site for disposal and treatment.

Any potentially contaminated groundwater that may be pumped from excavations will be tested and discharged appropriately.

All machinery will be inspected at the start of each work shift for signs of leaking hydrocarbons. Parking areas will be inspected on a daily basis for evidence of hydrocarbons leaking from machinery. Spills will be cleaned up and corrective action will be taken to prevent future spills.

9.6.3 Operational Phase

During the operational phase of the development, all materials required for the maintenance of the sites will be stored according to good practice and in areas either off-site or in bunded areas with impermeable floors. A programme of inspection and maintenance of the site drainage will ensure that any damage, blockages, *etc*. are identified and remedied.

9.7 Residual Impacts

If the mitigation measures detailed above are implemented it is expected that there will be no residual impacts on soils, groundwater and the underlying geology as a result of the construction or operation of the proposed development.

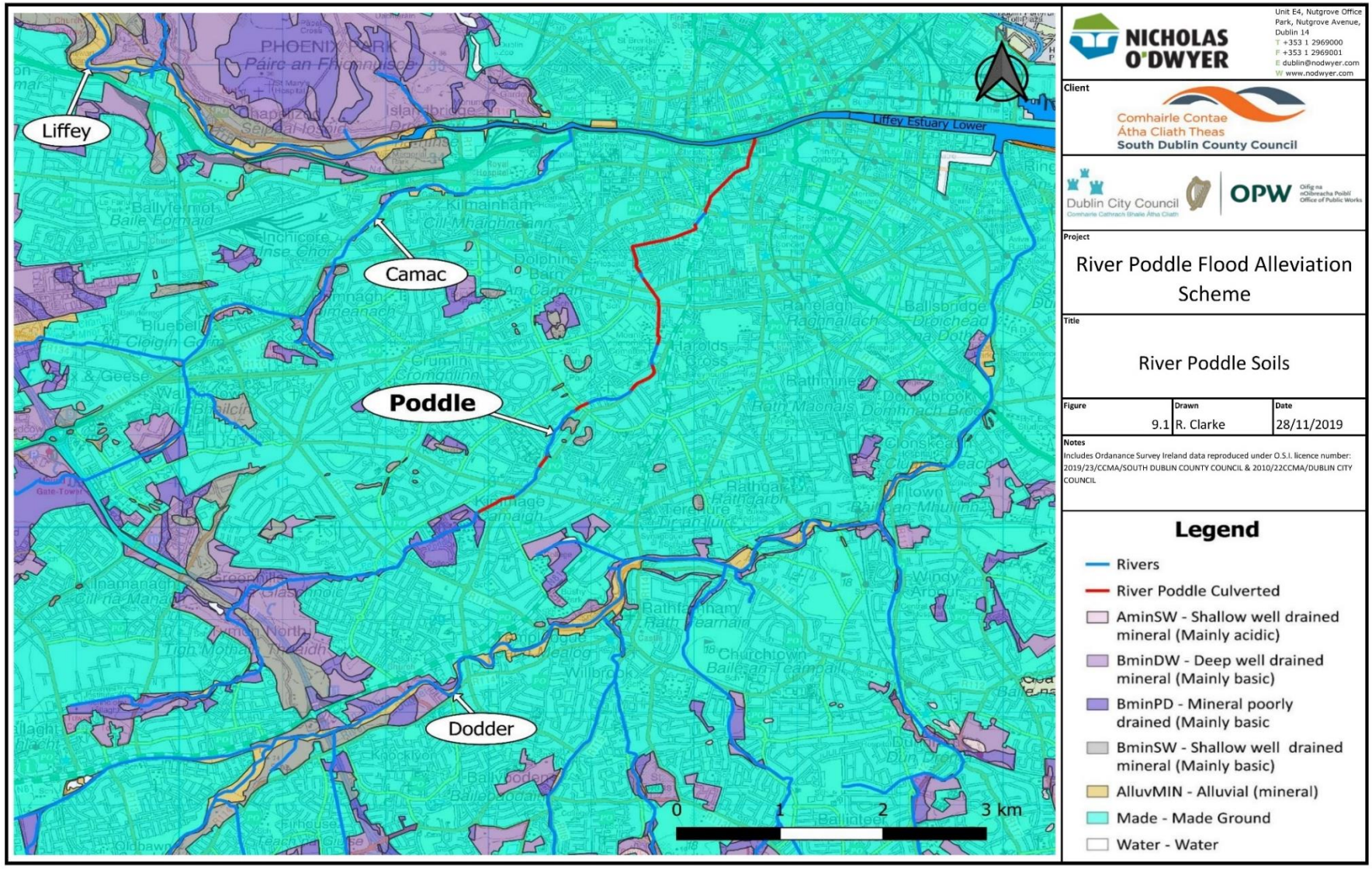

Figure 9-1. Soils in the surrounding areas of the River Poddle.

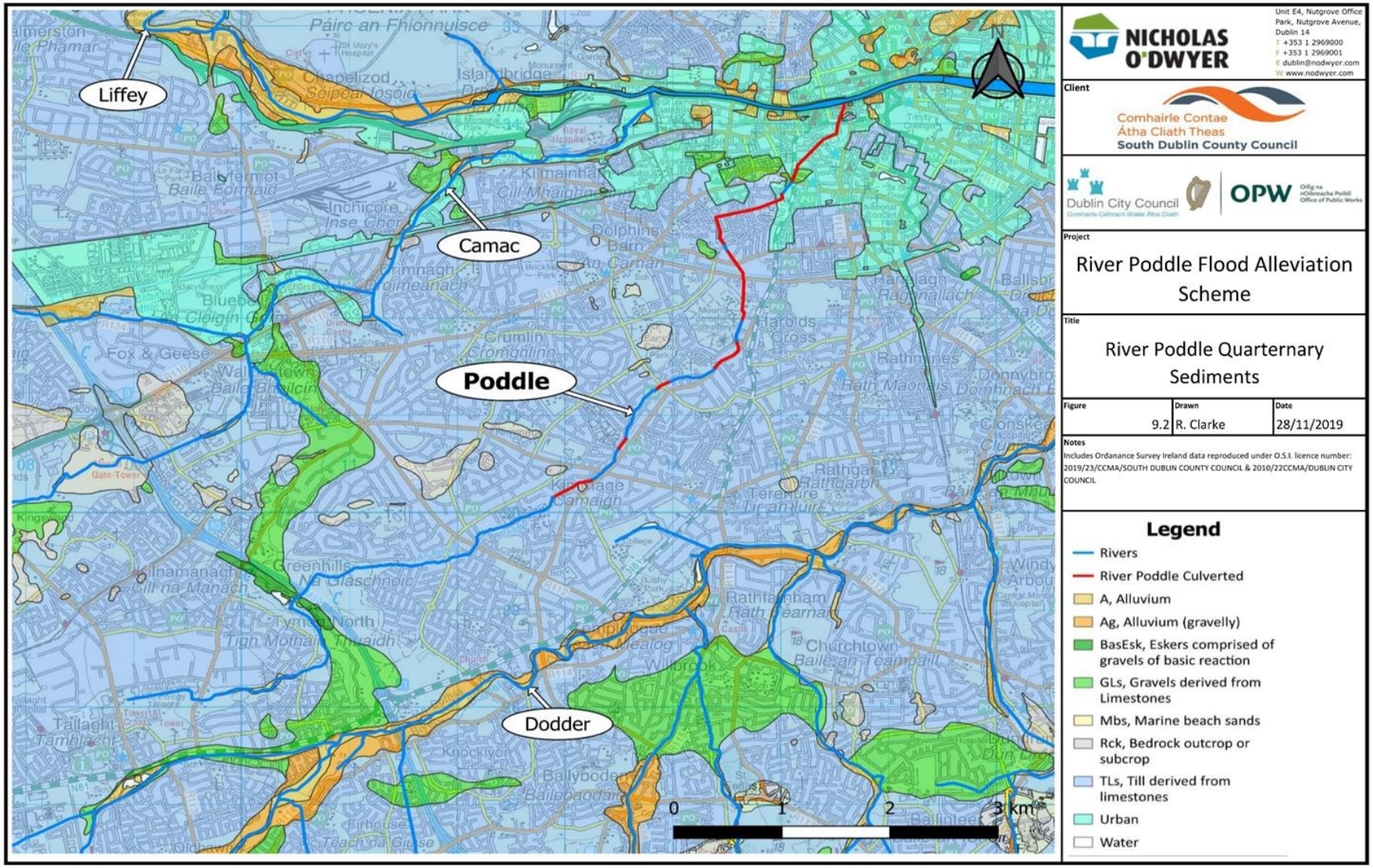

Figure 9-2. River Poddle Quarternary Sediments.

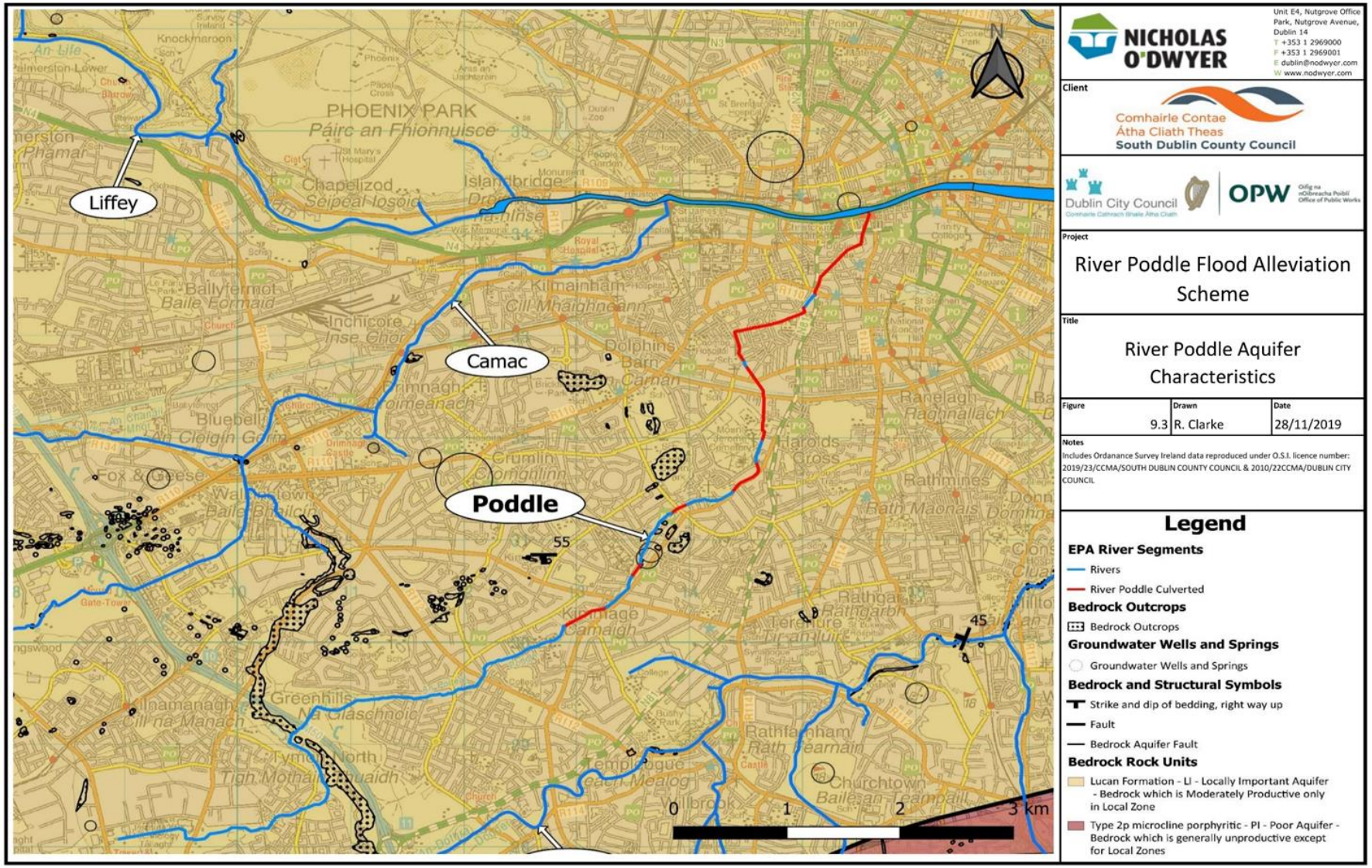

Figure 9-3. River Poddle Flood Alleviation Scheme Characteristics

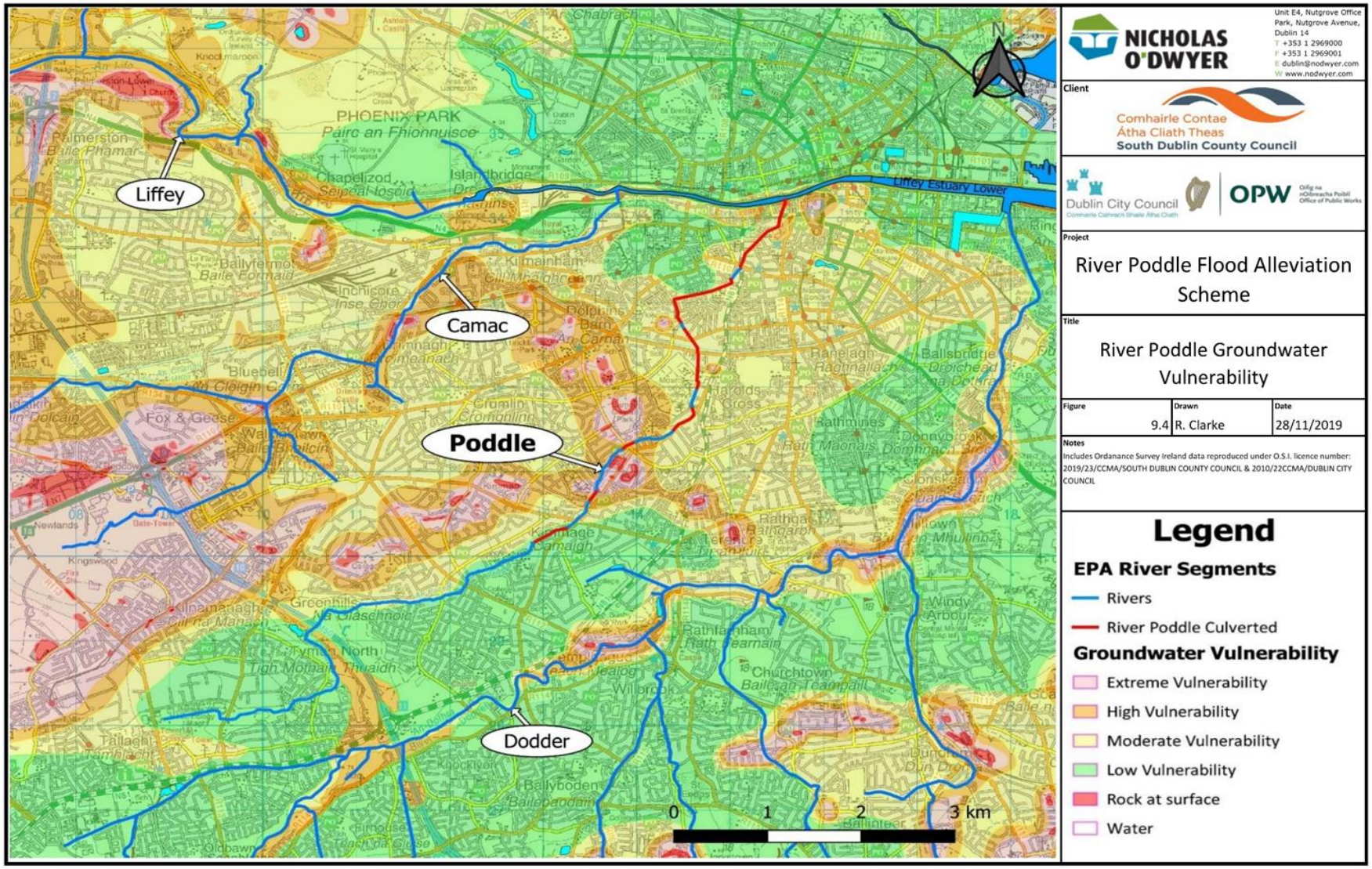

Figure 9-4. River Poddle Groundwater Vulnerability.