Flood Consequences Assessment Plot 1

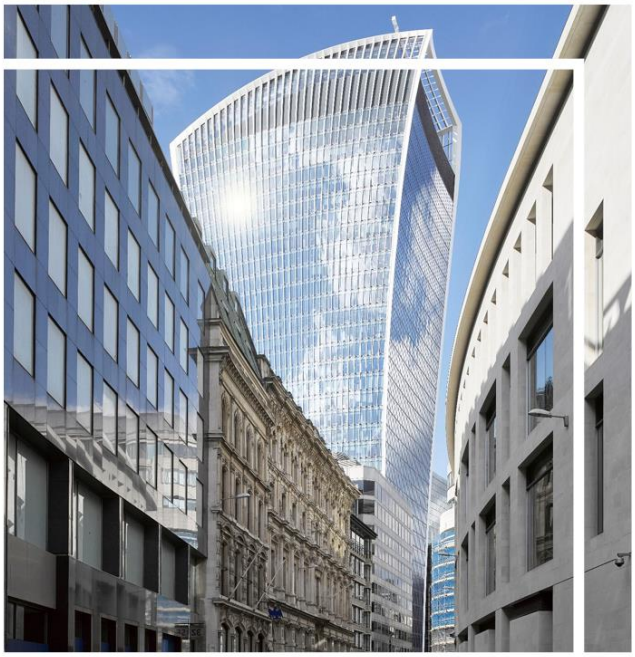
Cardiff Peninsula Plot 1

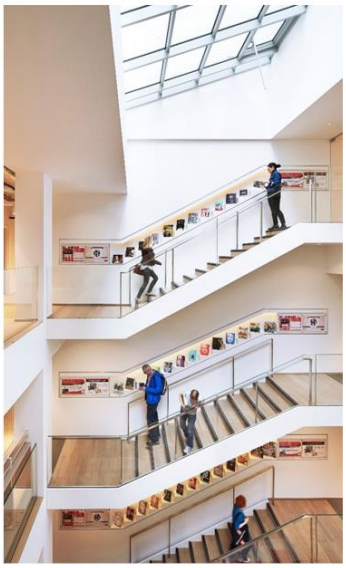
Orion Land & Leisure Ltd

24 June 2024

CPM-HIL-1A-0000-RP-E-PL-1001

Issue P01





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Approver:	P BOND
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HM Office:

Shackleton House
Hays Galleria
4 Battlebridge Lane
London
SE1 2HP

T: +44 (0)20 7940 8888
hilsonmoran.com
@HilsonMoran
hilson_moran
Hilson Moran

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Contents

Executive Summary

Hilson Moran has been commissioned by Orion Land & Leisure Ltd to undertake a Flood Consequences Assessment (FCA), appropriate to the nature and scale of the proposed development for Plot 1, Cardiff Peninsula, Cardiff.

Currently, the site is a car park for the various sporting facilities located within the area. The vast majority of the site is composed of hard surfaces, however, some vegetation in the form of a rough area is found on the southeastern corner towards the waterfront. Plot 1 proposals comprise a 4/5-story tall apartment (Building A), with approximately 77 new residential units along with associated parking and amenity spaces. The ground floor comprises senior living accommodation as well as a laundry, refuge, plant areas as well as a residential lounge area. The total GIA is 5872m^2.

This document highlights all the possible sources of flooding that may affect the area, including fluvial, pluvial, ground, and reservoir flooding. Currently, the site lies within a Flood Zone 3 (High Risk) for fluvial sources (River and Seas), meaning that there is a 1 in 100 chance or greater (1% Annual Exceedance Probability) of the site flooding from river sources or a 1 in 200 (0.5% AEP) of flooding from sea/coastal sources. The flood risk indicated from the maps is due to the proximity to a major watercourse (River Ely) and being affected by tidal influences from the Severn Estuary, affecting the water levels within the bay. A data request from Natural Resources Wales (NRW) was conducted and Product 5/6 data with the latest available information was provided on 15/02/2024. From the data provided, it was demonstrated that the highest modelled flood level expected within the site is **8.62m AOD.** This is from the 1 in 100 fluvial extreme tidal (T200) scenario plus climate change (CC). The flood maps also highlighted that the site location is affected by pluvial sources, mainly concentrated within the centre of the site. Upon further review, the “ponding” displayed within the flood maps is created because the maps do not take account of the on-site drainage, currently within the site. The ponding is caused by the drainage regime in the carpark which is designed to concentrate flows within its centre (acting as a basin). Then the flows enter slots drains found in the centre of the area and are conveyed off-site via highway drains underneath the carpark. Other sources of flood risk such as reservoir flooding have been assessed but these have also been deemed low, due to the strict monitoring and maintenance conducted by NRW.

The Welsh Technical Advice Note 15 (TAN15) states that all developments must be designed to be flood-free during a fluvial 1% Annual Exceedance Probability (AEP) or 0.5% AEP for coastal flooding. Consultation with NRW on 07/03/2024 stipulated that the entire development boundary ground level is required to be above the fluvial flood levels of 8.62m AOD, in order to demonstrate compliance with the TAN15 requirements.

It is intended that site-wide, the ground levels will be modified to be above **8.62m AOD** and the finished floor levels (FFL) of the building to be set no lower than **8.92m AOD**, providing a 300mm additional “freeboard” for ground floor sleeping accommodations. Therefore, this development will comply with the TAN15 in terms of flood risk.

1. Introduction

1.1. Background

Hilson Moran has been commissioned by Orion Land & Leisure Ltd to undertake a Flood Consequences Assessment (FCA), appropriate to the nature and scale of the Proposed Development at Plot 1, Cardiff Peninsula, Cardiff, hereafter referred to as the 'Proposed Development' or 'Application Site'. The Application Site is located in the administrative area of Cardiff Council (CC) (National Grid Reference 318500 172500), as identified in **Figure 1.1**.

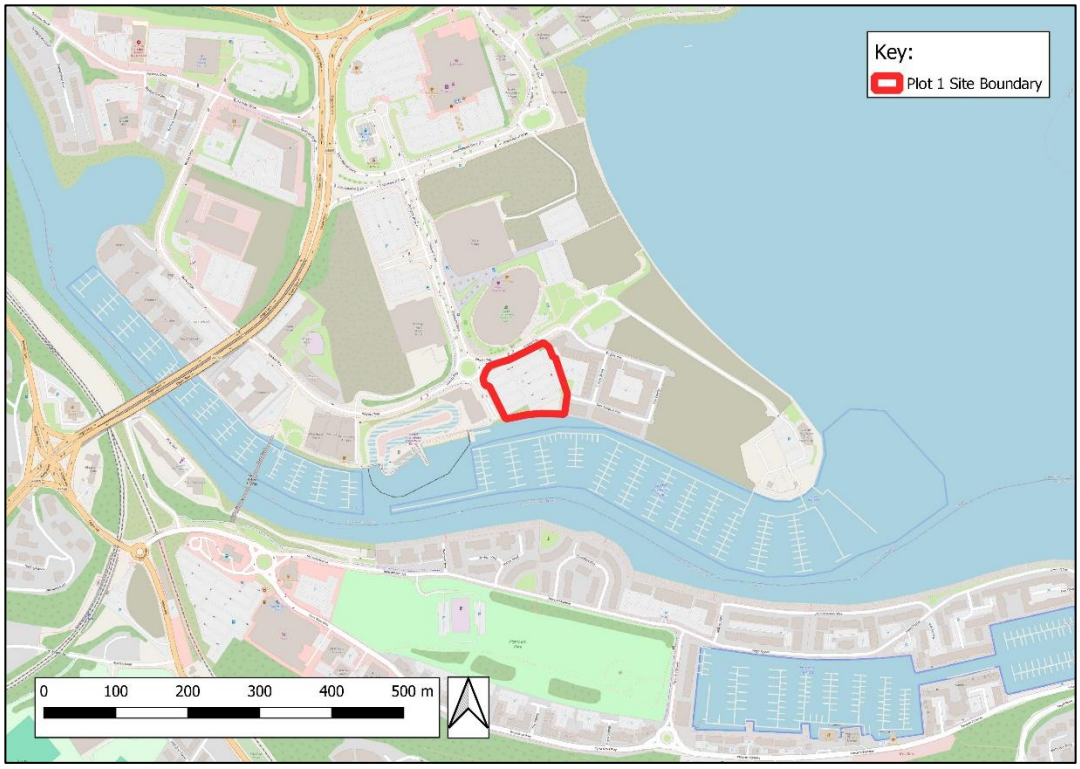

Figure 1.1 Site Boundary (OpenStreetMap 2024)

The plan is to redevelop an area of approximately 0.85 ha. Currently, this site is used for car parking. The redevelopment will consist of building a 4/5-storey tall apartment (Building A) which will contain approximately 77 new residential units, as well as 40 residential parking. The development will also introduce soft landscaping, which will help with the visual enhancements of the land by introducing green spaces and tree planting within the site, as well as contributing to the housing demand within the City of Cardiff, which under the Future Wales Policy requires delivery of 24,000 houses between 2021-2036 (1,600 p/a).[i]

1.2. Purpose of the Report

The purpose of the FCA is to provide formal support for the planning application of the Proposed Development at Plot 1.

1.3. Scope of the Assessment

This document comprises a full FCA, using relevant information and up-to-date methodologies available to support the planning application for the Proposed Development.

1.4. Structure

The remainder of this document describes the legislative context of flood risk in Wales, confirms the flood risk of the proposals from all forms of flooding, presents mitigation and enhancements for the identified risk, and closes with a summary and conclusions.

Relevant appendices are included at the end of the report.

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2. Policy Framework and Regulation

2.1. Planning Policy

2.1.1. National

Planning Policy Wales (PPW)[ii] sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental, and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Wellbeing of Future Generations (Wales) Act 2015 and other key legislation, and resultant duties such as the Socio-economic Duty.

TAN 15 provides technical guidance that supplements the policies set out in PPW in relation to flooding and coastal erosion and sets out the framework of assessing flood risks within Wales. It also provides advice on the consequences of the risks and adapting to and living with flood risk.

Chapter 6 of the TAN 15 - "Nature of development or land use", sets out the guidelines on the types of infrastructure with their respective flood risk vulnerability classification. There are 3 classes that the development can fall under, refer to Table 2.1 for further details.

Table 2.1 Nature of Development or Land Use (Chapter 6 – TAN 15)

Development Category	Types
Highly vulnerable development	All residential premises (including hotels, Gypsy and Traveller sites, caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and power stations, chemical plants and waste disposal sites). Emergency services. (e.g. fire stations, police stations). Emergency flood shelters.
Less vulnerable development	Car parks. General industrial (e.g. commercial and retail development). Public buildings (excluding those identified as emergency shelters). Places of worship.

Development Category	Types
	Cemeteries. Equipped play areas. Renewable energy generation facilities.
Water compatible development	Marinas and essential works are required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

2.1.2. Local

Local Planning policy is provided by the Lead Local Flood Authority (LLFA) Cardiff Council's Local Flood Risk Management Strategy[iii].

2.2. Legislation

2.2.1. Building Regulations Part H: Drainage and Waste Disposal (2010)

Building Regulations Approved Document Part H3 provides guidance on the hierarchy of options for surface water removal from a development site. The document states that, where feasible, the first choice for surface water removal should be to discharge such waters to an adequate soakaway or infiltration system. If this is not reasonably practicable, then discharge should be to a watercourse, with discharge to an existing sewer being the least favoured option. Infiltration techniques should therefore be applied wherever they are feasible.

Building Regulation H3 stipulates that "...[Infiltration devices should not be built] *where the presence of any contamination in the run-off could result in the pollution of a groundwater source or resource*". This is reaffirmed in the SuDS Manual[iv], which states that "*in areas containing contaminated soils or contaminated groundwater, soakaways are not acceptable*".

2.2.2. Water Industry Act (1991)

Legislation covering connection to a public sewer is contained in Section 106 to Section 109 of the Water Industry Act 1991 (the Act). Section 106 of the Act provides that the owner or occupier of any premises may have their drains or private sewer connected to the public sewers of the sewerage undertaker.

In accordance with the Act, the following types of connection may (subject to approval) be made to the public sewerage system. The type of connection you make will depend on the sewerage system in the area of the required connection.

1) Foul water into a foul sewer (*e.g*. from toilets, sinks, showers, and baths);
2) Surface water into a surface water sewer (*e.g*. roof and paved area drainage);
3) Foul and surface water into a combined water sewer (both a. and b. above); and,
4) Other types of connections may be permitted in exceptional circumstances, but they would be considered at the time of application.

2.2.3. Environmental Protection Act (1990)

Part II of the Environmental Protection Act 1990 states that "*contaminated land is any land which appears to be in such a condition, by reason of substances in, on or under the land, that:*

- *significant harm is being caused or there is a significant possibility of such harm being caused; or,*
- *pollution of controlled waters is being or is likely to be caused*".

2.2.4. Flood and Water Management Act (2010) - Wales

The Act states that construction work that has drainage implications may not be commenced unless a drainage system for the work has been approved by an approving body (unitary authority/ County Council).

In determining an application for approval, the approving body must "*grant it, if satisfied that the drainage system if constructed as proposed will comply with national standards for sustainable drainage; or refuse it if not satisfied*".

The Act therefore removes the automatic right to connect to the public sewer if the proposed drainage strategy does not fully consider the feasibility of sustainable drainage systems (SuDS).

As part of the provisions of the Act, Llywodraeth Cymru (The Welsh Government) has set a statutory standard for designing, constructing, operating, and maintaining SuDS[v].

Reducing the impact of surface water runoff from the development on flood risk associated with the receiving water body is based on limiting the peak runoff rate and runoff volume for extreme events. The 1:100 year return period rainfall event is the criterion normally used.

For controlling runoff rates at the development:

- *"Aiming to replicate greenfield runoff rates for extreme events helps ensure that the flood risk associated with the receiving watercourse/sewer is not increased by the development."*
- *"For previously developed sites, site runoff rates should be reduced to the greenfield rates wherever possible. Because the critical duration for the attenuation storage system for the proposed development will be much longer than the storm duration used for sizing pipework for the previously developed site, there is a risk that by allowing previously developed runoff rates to occur (for a much longer duration) receiving watercourse damage and flood risk could be made considerably worse. Thus, betterment of at least 30% should be considered as a minimum requirement (this will need to be established and agreed with the drainage approving body) and strong consideration should still be given to controlling volumes of runoff to greenfield equivalents."*

Runoff volume control at the development:

- *Where possible, the volume of runoff from the site (or development) area should not exceed the volume of runoff from the equivalent area in its natural undeveloped or "greenfield" state (for the same rainfall event).*

Where controlling runoff to greenfield volumes is considered unachievable, then the runoff volume should be reduced as much as possible and any additional volume should be stored and released at a low rate that will not increase downstream flood risk (normally 2 l/s/ha is considered an appropriate rate) using either of the following approaches:

1) The additional runoff volume (i.e. the difference between the predicted development runoff volume and the estimated greenfield runoff volume, often called Long-Term Storage) should be discharged from the site at a rate of 2 l/s/ha or less, while still allowing greenfield runoff peak flow rates to be applied for the greenfield runoff volume.
2) All the runoff from the site for the 1:100 year event should be discharged at either a rate of 2 l/s/ha or the average annual peak flow rate (i.e. the mean annual flood, QBAR), whichever is the greater.
3) For previously developed sites, the surface water management system should be designed so the volume of surface water runoff discharged from the site for the 1:100 year, 6 hour event is kept as close to greenfield conditions as possible.

Please refer to AKT II's Detailed Drainage Strategy Report for further details regarding surface water management of the proposed development.

2.2.5. Environment (Wales) Act 2016

This policy will see the establishment of the Flood and Coastal Erosion Committee which will provide advice to the Welsh Ministers on flooding from all sources and coastal erosion across Wales.

The Act aims to provide benefits for local communities equally, by encouraging decision makers to consider the economic, social, and environmental impacts of decisions on current and future generations. It intends to create a resilient natural environment, so our natural resources can provide clean water, good air quality, climate regulation, and crop pollination.

2.2.6. The Well-being of Future Generations (Wales) Act 2015

The Act gives a legally binding common purpose, the seven well-being goals for national government, local government, local health boards, and other specified public bodies. One of the wellbeing frameworks includes "*Reducing flood risk to homes and businesses".*

3. Proposed Development

3.1. Location

The area of the site is approx. 0.85 ha and is located at the southern side of Cardiff Bay. To the west of the site is the Cardiff International White-Water Centre and directly adjacent to the east are residential developments (Dan Donovan and Francis Street). South of the site is Cardiff Bay, located immediately north of the site is the local highway (Empire Way).

3.2. Proposal

The proposals include for:

'Senior living accommodation with associated car parking, cycle parking, and landscaping.'

Plot 1 comprises a 4 to 5-story tall apartment (Building A) with 77 new residential units. The ground floor includes for senior living accommodation as well as a laundry, refuge, plant areas, and a residential lounge area. The total GIA of the building measures to 5872m$^{2.}$ The remaining site area comprises vehicle access, residential parking, vehicle drop-off areas, residential amenity spaces, as well as a hardstanding area for fire services. The western section of the site will introduce a dedicated greenspace that measures 900 m^2. Tree planting will also be featured throughout the development. The overall size of Plot 1 measures 0.85 ha (Figure 3.1).

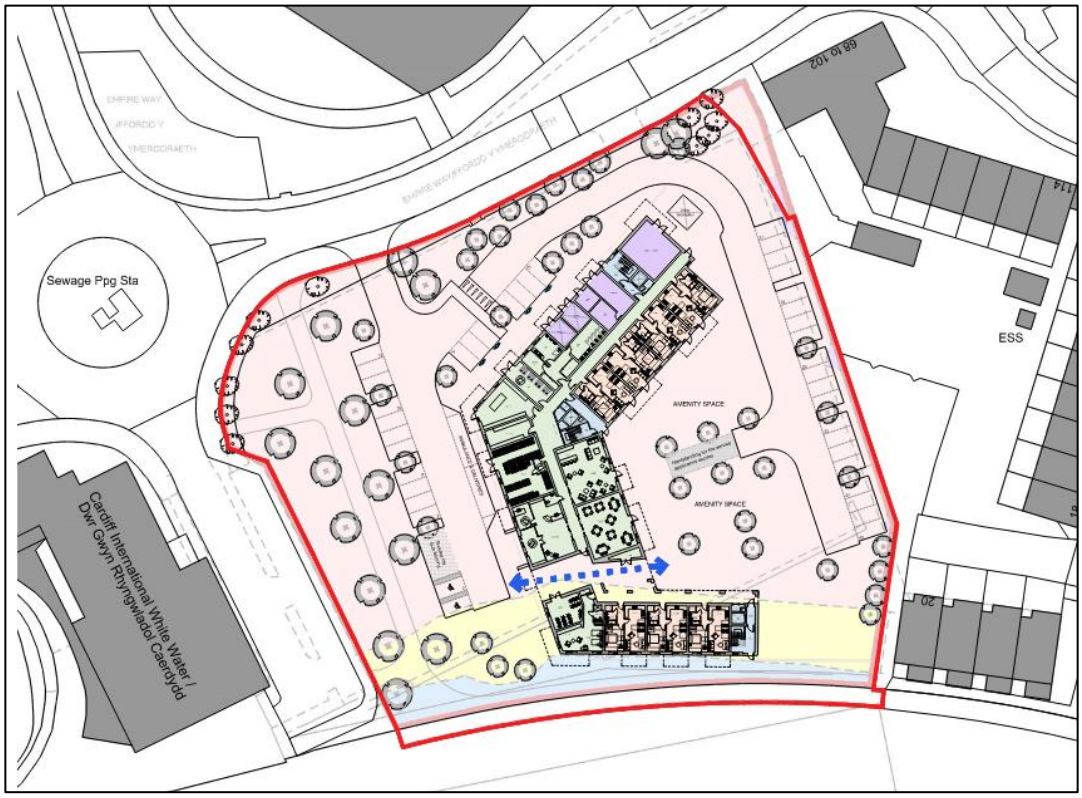


Figure 3.1 Proposed Development at Plot 1.

4. Baseline Conditions

4.1. Existing Site

The existing site is located on the southern side of Cardiff Bay, the surrounding area is fairly well developed with many large-scale sporting facilities the area including the International Pool, White Water Rafting facilities, whilst the waterfront is a Marina for the local Yacht Club (Cardiff Bay Yacht Club). This area of the bay is located behind the Cardiff Bay Barrage. Currently, the site of the proposed development is used as a car park for the various sporting facilities located within the area. The southeastern corner of the site has a rough vegetated area towards the waterfront, but the vast majority of the site is composed of hard surfaces. The site is classified as a brownfield site.

4.2. Site Walkover

A site walkover was conducted by Hilson Moran on 07/02/2024, to provide a better understanding of the current conditions of the area for Plot 1, along with the other plots within the Cardiff Bay development area. During the visit the conditions were overcast, and evidence of surface water ponding was found throughout parts of the site including within some of the car parks. Refer to Appendix A for the site visit photos.

4.3. Topography

The general topography of the site is relatively flat with no distinctive topographical features. Contours generated from a Digital Terrain Model (DTM), indicate that the site has a slight depression at the centre of the carpark. Generally, the site slopes towards the waterfront (Figure 4.1).

Figure 4.1 General topography of the area

A topographic survey was conducted at the site in Nov 2023. This measured that the lowest area of the site was in the south, comprising the site at the vegetated (rough) area before the waterfront measuring around 7.60m AOD.

The highest region of the site is located by the carpark entrance on the north joining to Empire Way and measures around 8.46 – 8.56 m AOD. The survey echoes the terrain model, showing that the regional low within the middle sections of the carpark has the shallowest levels, and measures around 7.92 – 7.99m AOD. A slot drain is located within the shallow area of the car park, allowing the flows from the site to drain into and towards the public surface water sewers at the highway. Refer to Appendix B for the full details.

4.4. Geology and Soils

The British Geological Survey's (BGS) Geology of Britain viewer provides an understanding of the geological formations throughout Great Britain[vi]. A review of the information at the 1:50,000 scale mapping identifies that the bedrock of the entire area consists of the Mercia Mudstone Group, which is a sedimentary bedrock formation formed during the early Triassic. Superficial Quaternary deposits are also present as sedimentary clays and sands (Tidal Flat Deposits).

With reference to the National Soil Resources Institute (NSRI) Soilscape[vii] the soil within the site is entirely comprised of freely draining floodplain soils. However, during the site

visit, it was noted that the ground was largely made of imported “Made Ground” aggregates (refer to the Appendix A).

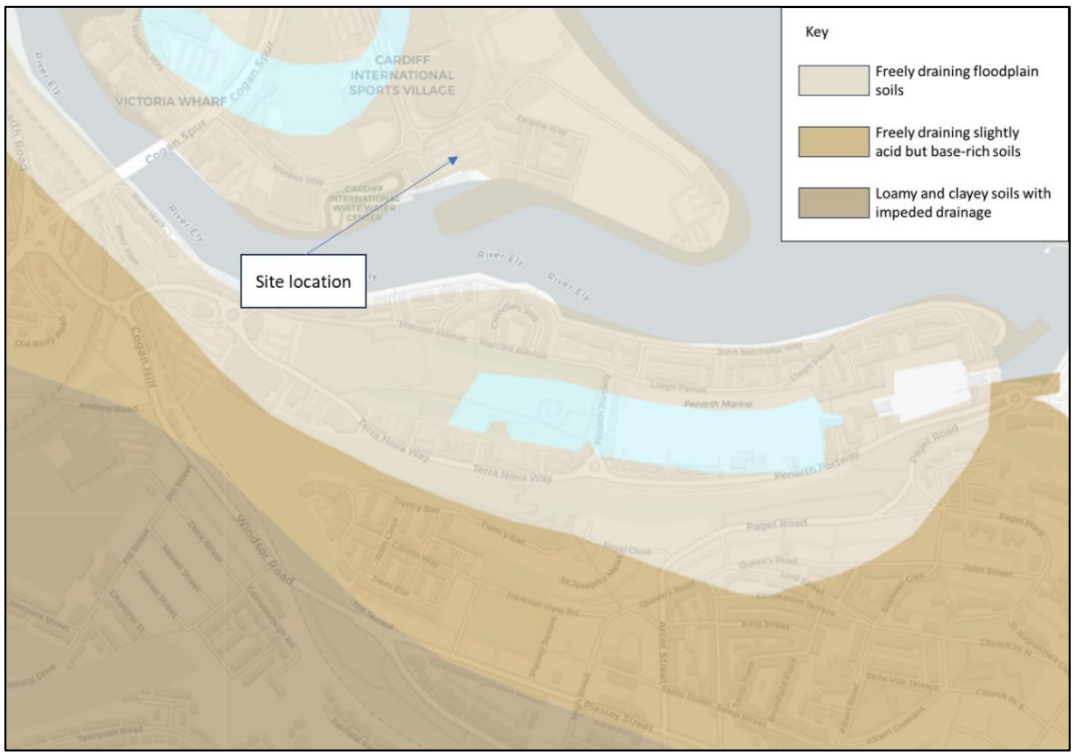


Figure 4.2 NSRI Soilscape – Soil types within the surrounding Cardiff Bay Area.

4.4.1. Source Protection Zones

Source Protection Zones (SPZs) are defined as areas that contain groundwater that is used to supply drinking water and are protected by the NRW. This includes wells, boreholes, and springs.

Datamaps Wales indicates that the site is not within a SPZ, with the closest area being around 28km west of Cardiff by Penllyn (Figure 4.3).

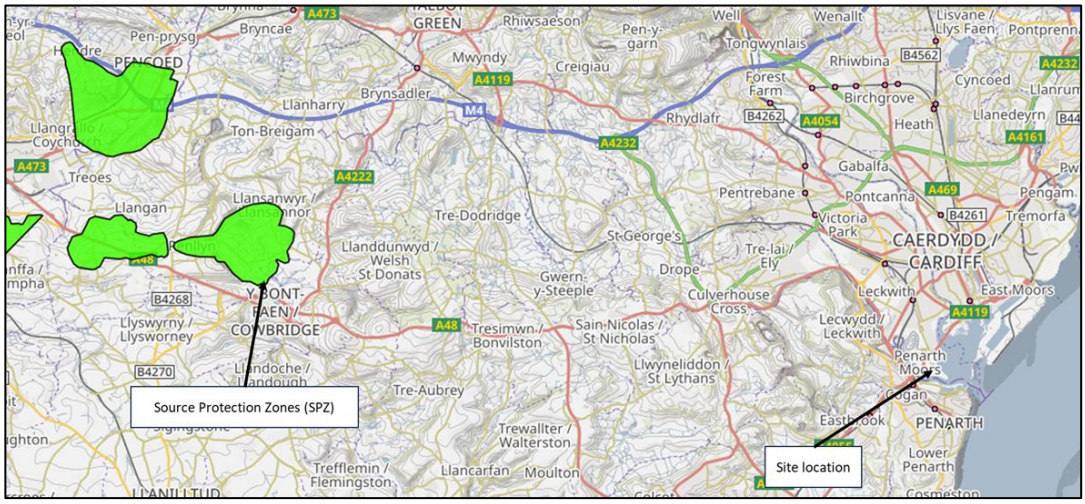


Figure 4.3 Nearest SPZ in relation to the Application Site.

4.5. Hydrology

4.5.1. Information Sources

In determining the hydrological conditions across the site and environs, reference has been made to several sources. In particular, information has been brought together from:

- The NRW's Flood Map internet resource;
- Local Flood Risk Management Strategy; and,
- Preliminary Flood Risk Assessment[viii].

4.5.2. Historic Flood Information

Historical flood data has been gathered from key stakeholders within Cardiff. The resulting data has been used to produce a historical flood map, identifying places with known flooding incidents (Figure 4.4). The Preliminary Flood Risk Assessment (PFRA) has recorded over 1000 historical flooding incidents within the study area. Table 4.1 breaks down the type of infrastructure that has been affected by flooding in Cardiff.

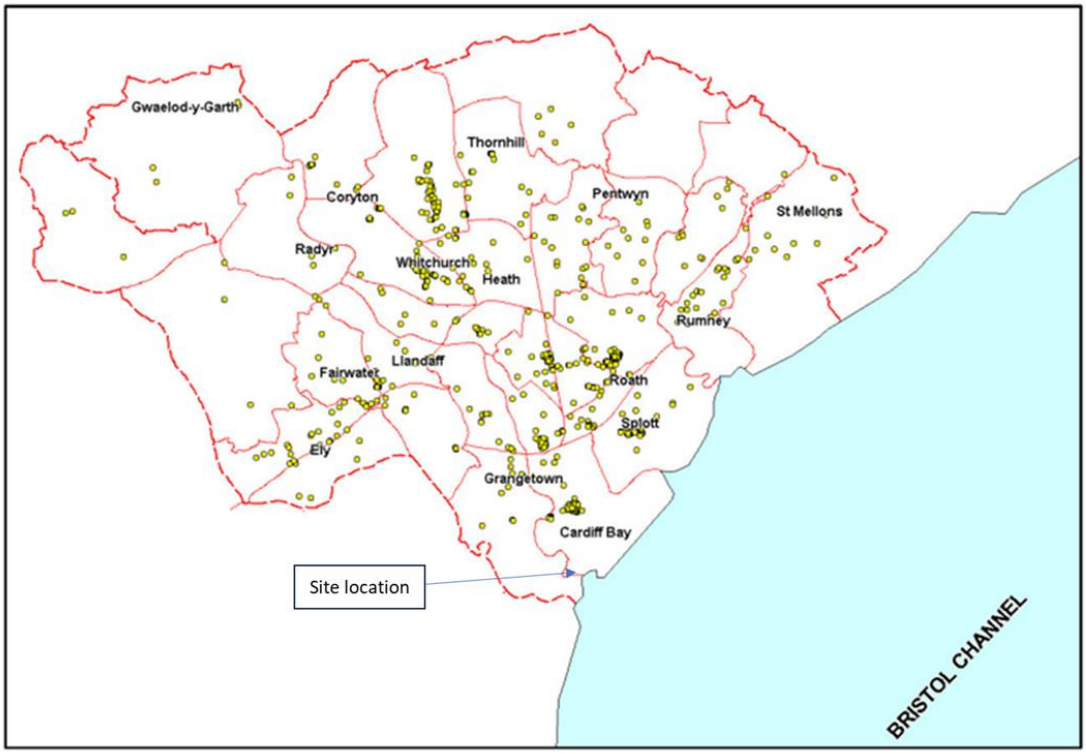


Figure 4.4 PFRA Map of the location of all the historical flood events from all sources within the Cardiff City Area (yellow dots).

The summary map demonstrates that at the time of producing the map, no flooding incidents have been recorded in the proposals site.

Table 4.4.1 PFRA Summary of all Historical Flooding Records within Cardiff

Receptor Type	
Residential Properties	341
Critical Services (schools)	9
Non- Residential Properties	156
Open areas (gardens, parks, roads, etc)	583

4.5.3. Sewer Records

Sewer records of the surrounding area indicate that the nearest public sewers are located at Empire Way, with the closest foul manhole (MH) labelled as F2, which connects to a 375mm ⌀ foul sewer and flows in a southwest direction before entering a pumping station located further down the road by Watkiss Way (Figure 4.5).

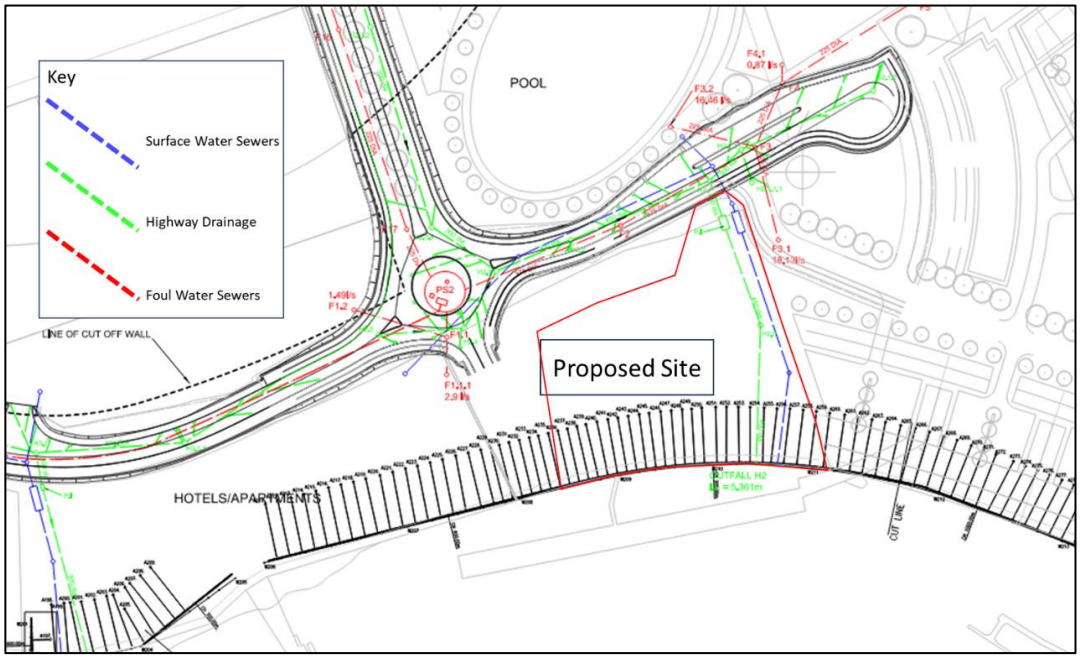


Figure 4.5 Drainage at the northern boundary

A Drainage and Architect Layout plan provided by AKT II indicates that the surface water in the area is drained by 2 sets of sewers across the site, located on the eastern edge of the site boundary. Both sets take flows upstream of the site with one set being dedicated to draining surface water from the highways (Empire Way) and the other taking runoff from the nearby buildings, including flows from the International Pool and Gym. Both surface water sewers (SW) connect to the site via junction manholes (MH) H2.1 (Highway) and MH.2a (SW). The Highway Drains then connect to a 450mm⌀ pipe draining southwards along the site to a 525mm⌀ outfall "H2" (IL 5.36m), whilst the surface water drains connect to a 750mm pipe running adjacent, discharging from a 750mm⌀ outfall "S2" (IL 4.61m). The carpark drainage is located in the centre of the site (by the depression) in the form of the slot drain, which runs along the length of the carpark and takes flows from across the car park surface. The slot drains connect to a 300mm ⌀ SW pipe, with an east-west flow direction, that connects to the highway drain, which then outfalls into the bay.

4.5.4. Surface Waters

The site is located near several bodies of water all connecting to the Cardiff Bay, before connecting to the Severn Estuary and ultimately to the Bristol Channel. Cardiff Bay itself is an estuary area, with the River Ely being immediately south of the site and the River Taff north of the spit.

4.5.5. Fluvial Flooding

Fluvial flooding occurs when water levels exceed the banks of the watercourse (rivers, lakes, sea) causing it to overflow into the surrounding areas. This can be caused by excessive rainfall snowmelts or coastal surges.

According to the NRW maps for planning which are digital flood maps that monitor the potential of flood extents (assuming that no defences are in place}, the entire site is located within a fluvial Flood Zone 3 (for both river and coastal risk). This means that there is a 1 in 100 chance or greater (1% Annual Exceedance Probability) of the site flooding from river sources or a 1 in 200 (0.5% AEP) of flooding from sea/coastal sources (Appendix C). The flood risk highlighted is due to the site's close proximity to a major watercourse (River Ely) and being affected by tidal influences from the Severn Estuary, affecting the water levels within the bay. The levels of flooding in the Flood and Coastal Erosion Maps, which take into account the local flood defences and flood management schemes, downgrade the risk level of the site from "High" risk down to "Low" from flooding from the Sea, reducing the chances of flooding at a given year to be between 0.1% and 0.5% (AEP). Fluvial Flood extent is limited to the southern perimeter of the site, where there is the rough area, and thus currently the carpark area is not affected by fluvial flooding. The surface water drainage within the site has been greyed out and is under review, so it is unclear if this is an accurate representation. The long-term flood map shows significant improvements in risk, due to an acknowledgement that this area of Cardiff Bay is actively managed by defences, together with the drainage within the site (Figure 4.6).

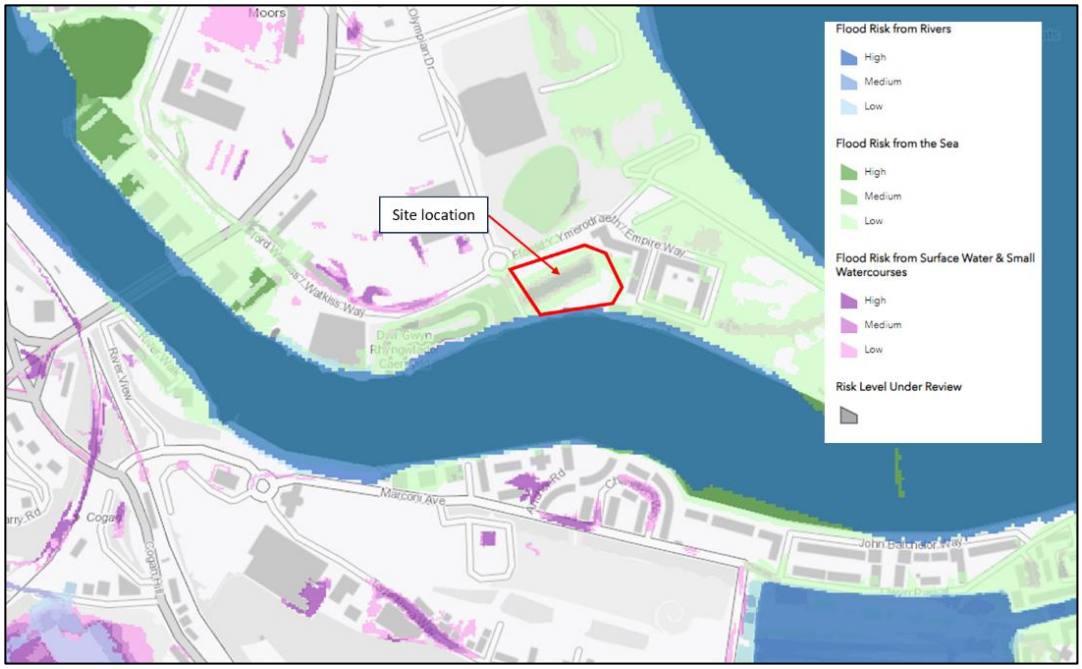


Figure 4.6 NRW – Flood and Coastal Erosion Risk Map

Typically, within areas that have been designated as a Flood Zone 3, development is restricted to water-compatible, essential infrastructures and less vulnerable uses (refer to Chapter 2.1.1 of this report for more information regarding the building classification of the proposals). However, this site benefits from coastal and river flood defences and has been identified in the Development Advice Map to be a Zone C1, which is in an area that has significant infrastructure including flood defences and is within the TAN15 Defended Zones (Figure 4.7).

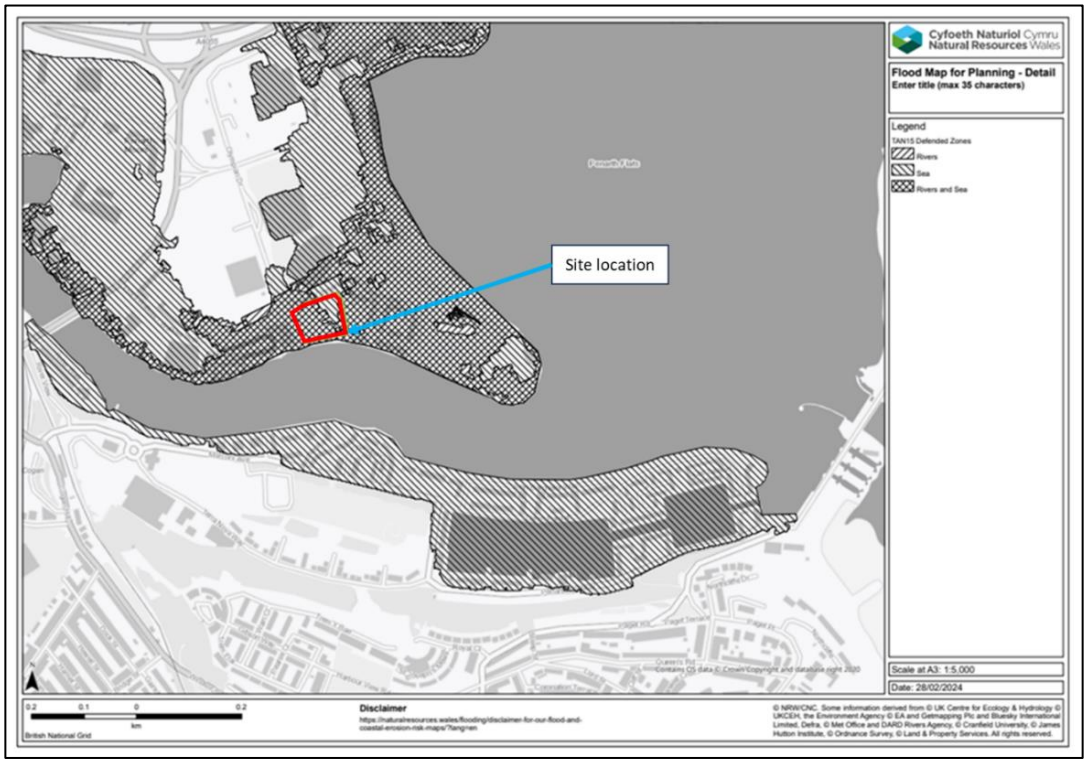


Figure 4.7 NRW – Maps for planning TAN15 Defended Zones

The TAN15 Defended Zones are regions where there are known flood risk management infrastructure that provides a minimum standard protection for both the 1 in 100 (plus climate change) for rivers and a 1 in 200 (plus climate change) minimum protection from the sea. These zones are updated every 2 to 3 years and the defences are reassessed. If the NRW deems that the standards of the flood defences in the area have dropped below the threshold they will remove the area from the defended zone on the map and reclassify the area.

The defences that the site benefits from include the Cardiff Bay barrage, which forms a significant section of the coastal defence system and helps to reduce the risk of tidal flooding. The River Ely also benefits from flood management programs such as an upstream tree catcher at Wroughton Place (approx. 5.5 km upstream from the site) which aims to prevent blockages of bridges downstream by capturing large debris upstream. It is modelled to protect roughly 490 proprieties within the catchment from fluvial flooding during a 1 in 100 annual event[ix].

A Flood Data enquiry was submitted to NRW, which was able to provide Product 6 data for Taff and Ely on 15/02/2024. Spot levels within the site were created to provide potential flood levels and depth of flooding at a given return period. A total of 13 node points within the site were used for this exercise (Figure 4.8).

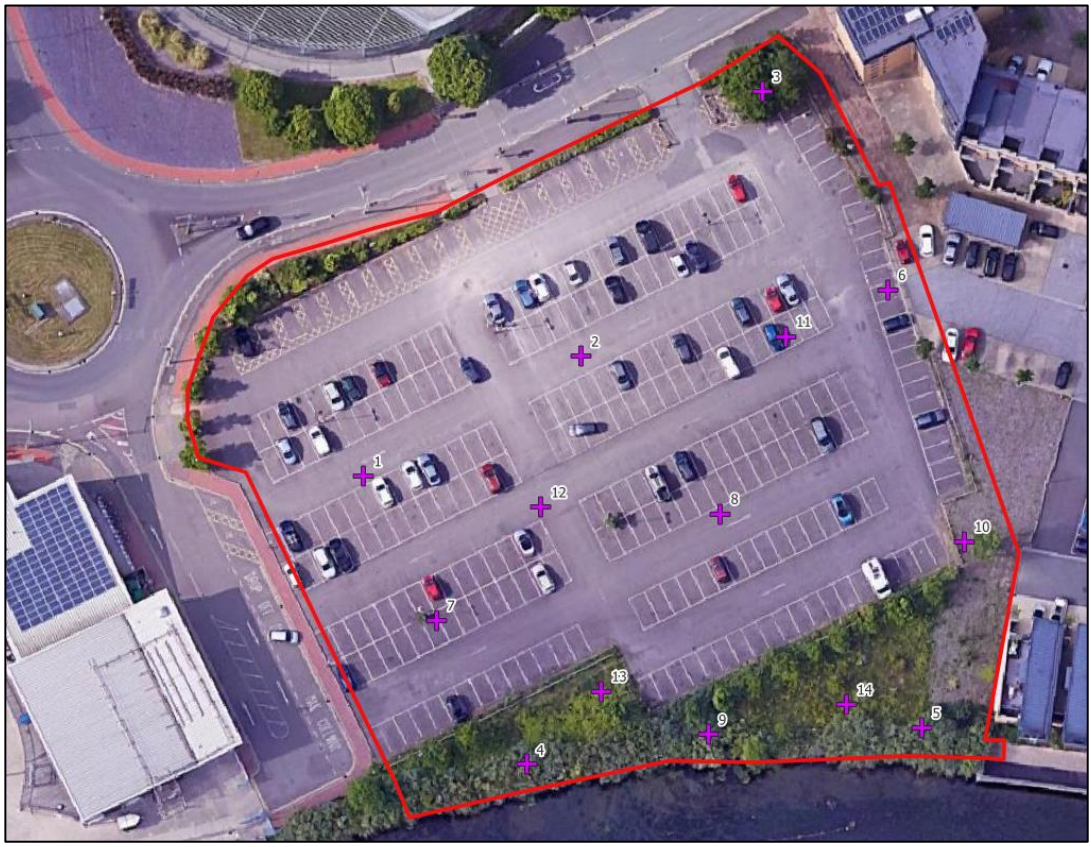


Figure 4.8 Node points used within the Application Site

Within the data package, both the defended and undefended scenarios were supplied for the Taff and Ely, along with results from the coastal T200 model for Cardiff Bay. Climate Change (CC) allowances scenarios for the river model were also provided with the Upper-End estimates (+70%) and the Central Estimates (+25%), for the Severn catchment.[x]

The following tables show the relative flood depths modelled at the above node points in mAOD:

Table 4.2 Modelled Fluvial Flood Levels during 1% Annual Exceed Probability (mAOD)

Node point	1% AEP	1% AEP +20% CC	1% AEP +70% CC	1% AEP Undefended
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	6.68	7.73	7.83	6.63
5	6.67	7.73	7.83	6.63
6	-	-	-	-
7	-	-	7.83	-

Node point	1% AEP	1% AEP +20% CC	1% AEP +70% CC	1% AEP Undefended
8	-	7.6	7.81	-
9	6.67	7.73	7.83	6.63
10	-	-	7.81	-
11	-	-	-	-
12	-	-	7.8	-
13	-	7.72	7.83	-
14	6.672	7.73	7.83	6.63

The default fluvial model takes account of the tidal influences from the bay and applies the mean high-water spring (MHWS) tidal curve throughout the scenarios. The "extreme tidal" modelling scenario was supplied within the Product 6 data, which is derived from the T0200 model and applies a 1 in 200-year tidal level in addition to the 1 in 100 fluvial (riverine). An additional climate change scenario was also modelled for this and the results are shown in Table 4.3.

Table 4.3 Flood levels (mAOD) from the extreme tidal model (T0200)

Node point	1% + 0.5% AEP (Coastal)	1% CC +0.5% CC AEP (Coastal)
1	7.95	8.62
2	7.92	8.62
3	7.92	8.62
4	7.98	8.62
5	7.98	8.62
6	7.92	8.62
7	7.98	8.62
8	7.97	8.62
9	7.98	8.62
10	7.97	8.62
11	7.92	8.62
12	7.96	8.62
13	7.98	8.62
14	7.98	8.62

Within Chapter 11 of TAN 15 ("*Acceptability of flood consequences*"), all developments must be designed to be flood-free during the 1% AEP river flood or a 0.5% AEP for sea, plus additional climate change over the lifetime of the development. However, some flood tolerance is allowed during "extreme" (0.1% AEP) flood events, with the exception of emergency services, which will required to be flood free during these events. TAN 15 states that residential buildings (Highly Vulnerable development) are permitted a tolerable maximum depth of flooding of up to 600 mm during the 0.1% AEP event. Table 4.4 shows the flood levels at the node points during extreme flood events.

Table 4.4 Modelled Fluvial Flood Levels during extreme flood events 0.1% AEP (mAOD)

Node point	0.1% AEP (1 in1000 year)	0.1% AEP (Undefended)	0.1% + 0.5% AEP (Coastal)
1	-	-	8.42
2	-	-	8.42
3	-	-	8.42
4	6.93	6.81	8.42
5	6.93	6.81	8.42
6	-	-	8.42
7	-	-	8.42
8	-	-	8.42
9	6.93	6.81	8.42
10	-	-	8.42
11	-	-	8.42
12	-	-	8.42
13	-	-	8.42
14	6.93	6.81	8.42

4.5.6. Surface Water (Pluvial)

Surface water flooding occurs when intense, often short-duration, precipitation events are unable to enter a drainage system due to blockages, breakages in water pipes, or where the drainage capacity has been exceeded. This type of flooding is usually short-lived, associated with heavy precipitation events, and highly localised. The surface run-off will tend to flow toward low spots where it collects. Flooding can occur both to land or property which lies in the flow path of the water or to property situated in the low spot where the water finally collects. The effects of climate change are predicted to increase the frequency of heavy downpours, therefore, increasing the number of events that exceed the capacity of the sewer system.

The combination of surface water flooding and urban drainage issues can cause some localised areas of combined fluvial and urban flooding.

The Flood Map for planning also indicates that the majority of the central part of the site is within Flood Zone 3 from surface water flooding (chances of flooding from this source is greater than 1 in 100 (1% AEP) in a given year). From the site visit, there was evidence of surface water ponding found within parts of the carpark, along with isolated areas of the rough areas and depressions found within the roads (Refer to Appendix A).

The flooding indicated by the Map seems to be isolated and concentrated within the centre of the site. This surface water ponding is likely due to the Map picking up the depression feature within the middle of the carpark and not taking account of beneficial impacts of the local drainage system. In reality, this topographic low is used to convey surface water flows from the car park into the highway drains, via the slot drain running across the centre of the site.

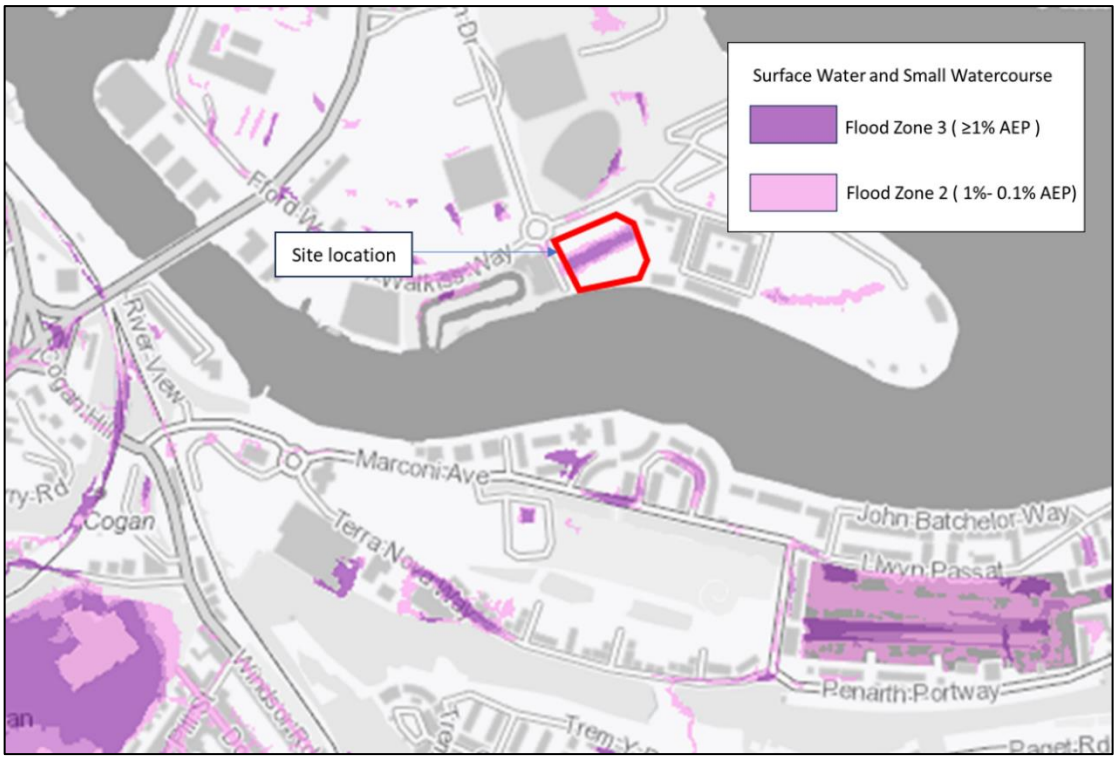


Figure 4.9 Map for planning illustrating pluvial flood extent.

4.5.7. Groundwater

Flooding from groundwater can happen when the water within the soils and/or rock rises to the surface. Water can seep through to the surfaces, whilst basements and cellars are particularly vulnerable to this source of flooding. Low-lying areas are particularly susceptible.

Within Cardiff, groundwater is understood to be relatively deep and flooding from this source has not been a common issue since the Cardiff Bay Barrage was built[xi].

4.5.8. Reservoir and Artificial Waterbodies

A reservoir is a large natural or artificial lake that is designed to collect and store water. Flooding from reservoirs is extremely unlikely. An area is considered at risk if peoples' lives could be threatened in the event of a dam or reservoir failure.

The Flood Map indicates that a significant area of Cardiff (including the entire Cardiff Bay area) could be affected by flooding from reservoirs, with areas downstream of the River Taff most affected. The two major watercourses adjacent to Cardiff Bay, namely the River Ely and River Taff, both have major reservoirs upstream of the catchment (the Pontsticill Reservoir and Llwyn-on Reservoir respectively). Both are roughly 40 km north of the site. TAN 15 states that flood risk from reservoirs is managed by NRW and within Wales the reservoirs are maintained to very high standards. In the UK in general, there has not been a loss of life from reservoir flooding since 1925. All large reservoirs within the UK are inspected and supervised by reservoir panel engineers and it has been stressed that businesses and homes within a "*reservoir inundation area*" should not be concerned.

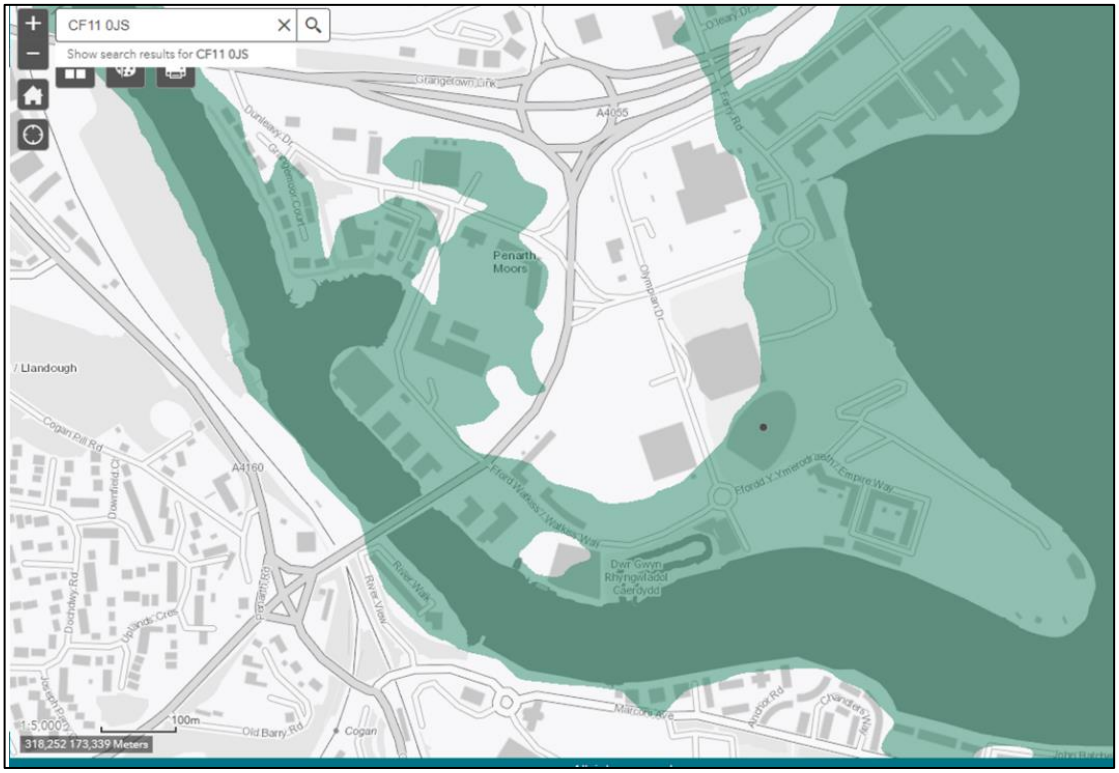


Figure 4.10 Map for planning illustrating reservoir flood risk extent.

4.6. Conclusions

The above desk study highlights all of the potential sources of flooding that may affect Plot 1 of International Sports Village, Cardiff. The Flood Map for planning has identified the site location in Flood Zone 3 for fluvial flooding, being affected by both fluvial (via the River Ely) and coastal sources. However, the area does benefit from extensive flood defences such as the Cardiff Bay Barrage, and has been classified as an area within the TAN15 Defence Zone, which provides minimum standard protection for both the 1 in 100 (plus climate change) for rivers and a 1 in 200 (+CC) for coastal flooding. Flood modelling demonstrates that the highest flood level expected during a 1 in 100 year (1%AEP) event within the site is **8.62m AOD** (site-wide), which was produced from the extreme tidal model T0200 plus additional climate change.

Surface water maps have highlighted that surface water flooding is concentrated within the centre of the site however, this is due to the basin feature found within the carpark and the model not taking account of the areas slot drains, which will take the surface water flows from the site and discharge the flow into the bay.

Other flooding sources (such as groundwater and reservoirs) have also been assessed and are deemed as low. The Flood Maps indicates that the site is within an area that can be affected by reservoir flooding, however, reservoirs are managed at the highest standards in Wales and the UK, and flooding from this source is deemed unlikely.

5. Mitigation & Enhancements

5.1. Background

The application site measures 0.83 ha and is currently used as a public car park and classified as a brownfield site.

The planned proposal is to change and redevelop this area into 76 apartments split between 5 stories, along with 42 surface carparks. The masterplan shows that the use of the ground floor will be mixed. This includes a residential lounge area, communal kitchen, plant area, laundry area, and finally 6 residential 1-bed apartments (refer to Appendix D).

The change from car park to residential accommodation will result in a reclassification of the development category from a "Less Vulnerable development" (which includes car parks and commercial and retail development) into a "Highly vulnerable development" (which includes all residential premises such as apartments and hotels). All such development under the TAN15 policy must be flood-free during the 1% AEP for river flooding and 0.5% AEP for coastal flooding, plus an allowance for climate change over the lifetime of the building.

During extreme flood events (i.e. 1 in 1000, 0.1% AEP) then some flood tolerance may be allowed. For Highly Vulnerable development this will be a Maximum depth of flooding of 600mm (0.6m).

Table 5.1 - TAN15 Vulnerability of different land uses

Development Category	Types
Emergency services	Hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots, and buildings are used to provide emergency shelter in times of flood.
Highly vulnerable development	All residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centers), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites.
Less vulnerable development	General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks, mineral extraction sites, and associated processing facilities, excluding waste disposal sites.

5.2. Assessment of Impact

5.2.1. General Design Considerations

For new development, there is a general expectation that a drainage system should be adequate, particularly for drains created by development subject to Building Regulations. Adequate performance will usually be achieved if the drainage system:

- Conveys the flow via a suitable network or treatment systems to a suitable outfall (a soakaway, a watercourse, surface water, or combined sewer).
- Minimises the risk of blockage or leakage with good access for clearing blockages and any necessary maintenance.
- Has sufficient capacity to carry or retain the expected flow at any point in the system and so does not increase the vulnerability of the development to flooding.
- Provides drainage from roofs or paved areas to an adequately and suitably designed drainage system.
- Where necessary is adequately ventilated such that foul air does not enter buildings. It should be noted that:
    - The priority for discharge of rainwater is first to an adequate soakaway or infiltration system, if that is not reasonably practicable then to a watercourse, the last option is to a sewer; and
    - Discharges into the ground (where permitted) should be distributed sufficiently so that the foundations of buildings or structures are not damaged.

5.2.2. Flood Resilience Measures

As described in Section 5.1, within the vicinity of the proposed development there is potential risk from flooding from both coastal and riverine sources.

Consultation with the NRW was conducted on 08/03/2024. This consultation was to clarify NRW's position on the development's ground levels and finishing floor levels (FFL), in relation to the modelled fluvial flood levels, and if there is a requirement for additional freeboard to be compliant with the TAN15 "acceptability of flood consequences". NRW commented that *"There is no FFL freeboard required as long as the site is above the 1 in 100 years plus climate change flood level (or 1 in 200 years plus CC if at tidal risk)".*

NRW also stated that their definition of development is the whole area within the "redline boundary" (including the external areas). As such it is intended that the development ground levels should be set to a minimum of **8.62m AOD**.

The proposed application will contain sleeping accommodation at the ground floor, and therefore the FFL of the proposed building will be set above the predicted undefended future flood levels of 1 in 200-year flood event+ CC. For best practice, a nominal 300 mm additional freeboard is recommended for the FFLs and thus the sleeping accommodation should be higher than **8.92m AOD**, to maintain external dry access and egress routes during evacuation.

For pluvial (surface water) flood resilience measures, please refer to the AKT II, Sustainable Urban Drainage Report, which accompanies this FCA.

5.2.3. Flood Warnings

In the event of flooding within Cardiff, the NRW provides live warnings and alerts on their website (refer to https://naturalresources.wales/flooding/check-flood-warnings/?lang=en), which also provides information on the flood risk outlook for Wales for the next five days.

Alternatively, NRW provides a 24-hour phone service 0345 988 1188 (Flood line) which includes direct operator advice & frequently updated flood warning information. It is intended that the site owners would subscribe to the NRW's Flood Warning Service, which will produce live flood warnings and alerts.

5.2.4. Safe Access & Egress

TAN15 states that safe access and escape routes for emergency services to and from the development during a flood event should be identified. In the unlikely case of flooding, if instructed to evacuate by the emergency service, the shortest route from the building and away from Flood Zone 3 is to travel 155m northeast along to Olympian Drive. However, this route may require transversing through a flooded area before being able to enter dry grounds (Figure 5.1) and would only be attempted if instructed by the emergency services.

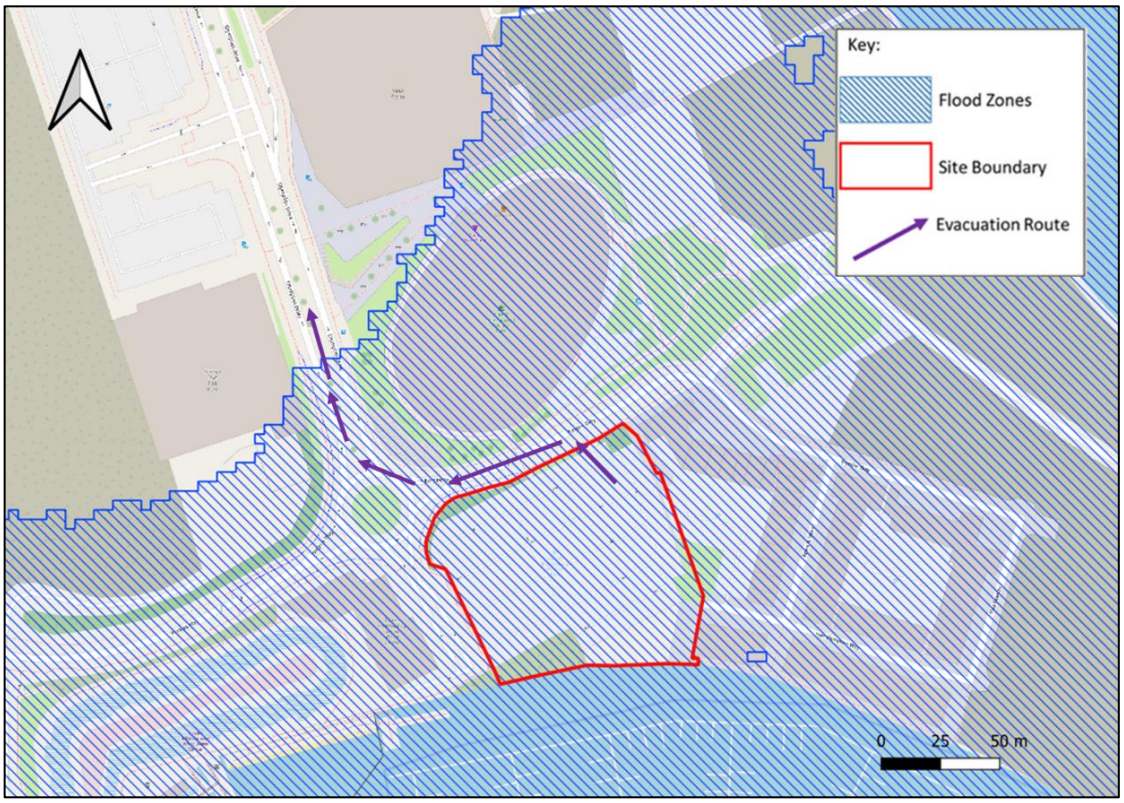


Figure 5.1 Proposed shortest evacuation route from the site away from the flood zones

If evacuation is not deemed possible and/or if the residents have been instructed to stay within the premises by the emergency services, an organised exodus of the ground floor areas to higher floors within the building should be conducted. It should be assumed that due to the effects of floodwaters, all electrically powered lifts within the development would

either not be functioning, or have the potential to stop functioning during use, leaving people trapped between floors. For this reason, all "Invacuation" routes to the 1st floors and above should be by means of stairs. It is recommended that the plans take account of factors such as a communal refuge area on these higher floors enabling shelter for the residents until the flood subsides. Consequently, communal access to the staircases should be provided to allow people from ground levels to escape to higher floors in the event of a flood. Equipment to transport people with restricted mobility such as evacuation chairs should also be a part of the Invacuation strategy.

All evacuation routes will be clearly signed with legible with pictorial signs, permitting them to be understood by those with visual impairment, difficulty in reading, or diverse ethnical backgrounds. All staff, including those with impaired hearing, sight, or mobility, will be thoroughly trained in flood response and evacuation procedures by means of regular exercises. Additional aid should be given to those with disabilities during exercises and real flooding events, should they occur.

Multi-agency plans activated at the time of the event may include the provision of public transport to aid rapid evacuation. Attention must be given to advice provided by the emergency services at the time of the incident. Nevertheless, a catastrophic failure of coastal flood defences may not permit sufficient warning time to be given to facilitate a safe evacuation from the premises. The decision on whether to evacuate would be given at the time by the emergency services. Such warnings are issued by local radio, supplemented by direct dial telephone systems and other local systems as appropriate.

5.2.5. Flood Resilient Construction

In addition to the above, as a precautionary measure against extreme coastal and future groundwater flooding, building specific flood resistant measures will be included in the scheme (in line with the UK Government's "*Improving the Flood Performance of New Buildings: Flood Resilient Construction*" guidance), *i.e.*:

- No air bricks within the floor slab construction;
- External walls/windows capable of withstanding a hydrostatic head up to 600 mm;
- Use of building materials that are effective for a 'water exclusion strategy' including engineering bricks, cement-based materials including water retaining concrete and dense stone; and
- The provision of non-return valves in the drainage system to prevent back-flow of diluted sewage, should local surface water flooding be associated with surcharging of the combined sewer system.

5.3. Justification for Development

Section 10 of TAN15, outlines the justification for developments within different flood risk zones. Since the site is within a TAN 15 Defended Zone, the following justification will be required to be met to consider planning permission. Table 5.2 summaries the conditions set by TAN15 and how the proposed development can meet these requirements. Consequently, if guidance and recommendations within this FCA are followed for the development, then the justification for this use is acceptable.

Table 5.2 TAN15- Section 10, justification for developments summary

Conditions for TAN15 Defended Zones	Justifications
Its location meets the definition of previously developed land; **AND**	Currently, the site is used as a carpark and classified as a brownfield site, therefore it meets the definition of a previously developed land.
The potential consequences of a flooding event for a particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of the TAN (Acceptability of flood consequences).	Information regarding the potential sources of flooding has been identified within **Chapter 4** of this report. Within **Chapter 5**, flood risk resilience measures and finishing floor levels should be set above the 1% AEP for rivers and 0.5 AEP for Sea, along with additional climate change factors, this is identified as 8.62m AOD.

6. Summary & Conclusion

Hilson Moran has been commissioned by Orion Land and Leisure Limited to undertake a Flood Consequences Assessment (FCA), appropriate to the nature and scale of the Proposed Development at Plot 1, Cardiff Peninsula, Cardiff.

Currently, the site is used as a public car park for the sporting facilities located within the area. The vast majority of the site comprises hard surfaces, however, some vegetation in the form of a rough area is found on the southeastern corner towards the waterfront. Plot 1 comprises a 4/5-story tall apartment (Building A) with approximately 77 new senior living residential units along with associated parking and amenity spaces in the rest of the development. The ground floor comprises senior living accommodation as well as a laundry, refuge, plant areas as well as a residential lounge area. The total plan area of the apartment measures approximately 5872m^2.

This document highlights all the possible sources of flooding that may affect the area, including fluvial, pluvial, ground, and reservoir flooding. Currently, the site is within a Flood Zone 3 for fluvial sources (River and Seas), meaning that there is a 1 in 100 chance or greater (1% Annual Exceedance Probability) of the site flooding from river sources or a 1 in 200 (0.5% AEP) of flooding from sea/coastal sources. The flood risk indicated from the maps is due to the proximity of a major watercourse (River Ely) and being affected by tidal influences from the Severn Estuary, affecting the water levels within the bay.

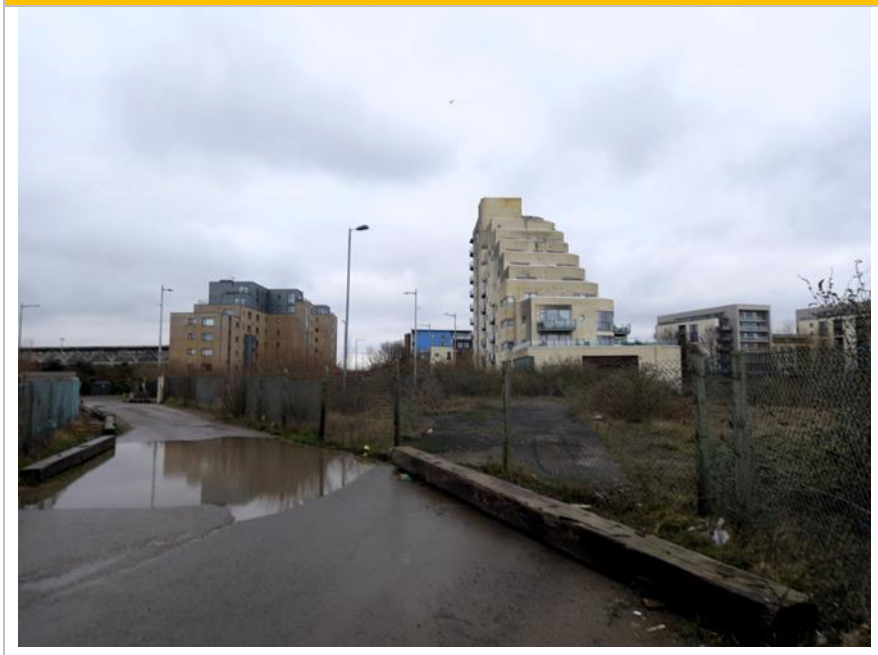
A data request from NRW was conducted and Product 5/6 data with the latest available information was provided on 15/02/2024. From the data provided it was demonstrated that the highest modelled flood level expected within the site will be **8.62m AOD.** This is from the 1 in100 fluvial extreme tidal (T200) scenario plus climate change. The Flood Map also highlights that the site location is affected by pluvial sources, mainly concentrated within the centre of the site. Upon further review, the “ponding” displayed within the Flood Map results from the inability of the Map to take account of the current on-site drainage system. The “ponding” is caused by the drainage design in the carpark which is concentrates flows to the centre of the car park (acting as a basin). In reality, flow then enters slots drains found in the centre of the area and is then conveyed off-site via highway drains underneath the carpark. Other sources of flood risk such as reservoir flooding have been assessed but these have also been deemed low due to the strict monitoring and maintenance conducted by the NRW in Wales.

TAN15 states that all developments must be designed to be flood-free during a fluvial 1% Annual Exceedance Probability (AEP) or 0.5% AEP for coastal flooding. Consultation with the NRW on 07/03/2024 stated that the entire development boundary ground level is required to be above the fluvial flood levels of **8.62m AOD**, which will be required to demonstrate compliance with TAN15.

It is intended that site-wide, the ground levels will be above **8.62m AOD** and that the FFL of the building will be set to **8.92m AOD.** This will provide a 300mm additional freeboard for the ground floor sleeping accommodations. Therefore, this development will comply fully with the TAN15 in terms of flood risk.

Appendix A- Site Photos

Site Photos	Descriptions
	Crushed aggregates are commonly found within the “rough” areas.
	Some surface water ponding was found within the grass area next to the carpark.

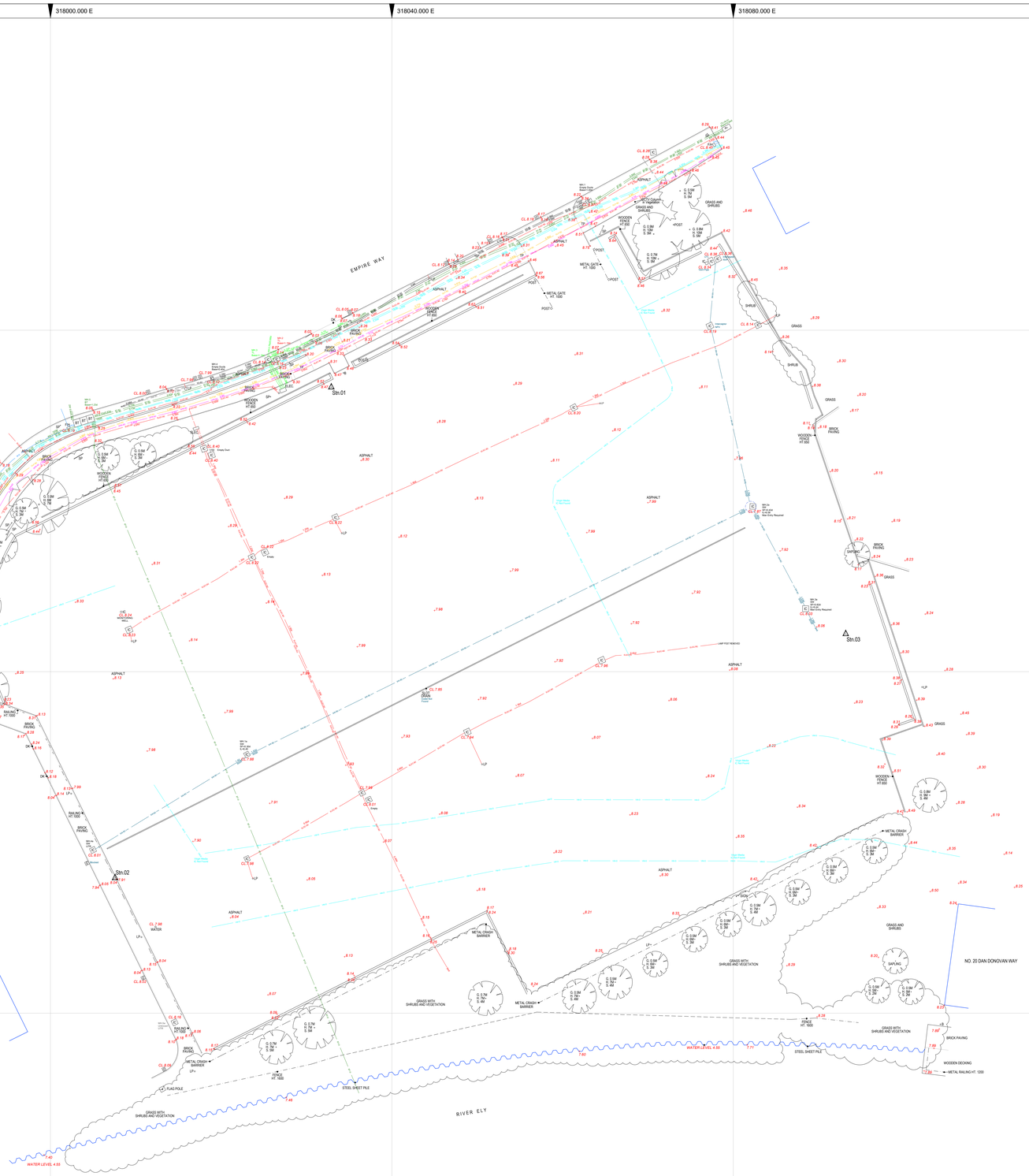
Site Photos	Descriptions
	Surface water found within low spots on the bay.
	Onlooking Cardiff Bay

Site Photos	Descriptions
	Surface water ponding found within the carpark area is likely from SW drainage blockages.
	Walkway separating the waterfront from the existing buildings the raised area.

Appendix B – Topographic Site Survey

317960.000 E | 318000.000 E | 318040.000 E | 318080.000 E | 318120.000 E

172900.000 N | 172860.000 N | 172820.000 N | 172780.000 N



Notes:

Utilities may continue outside of the survey area. Any paint marks outside of the area are for investigative purposes only and may not represent the full extent of the sub-surface utilities.

Only sub-surface utility information is provided. Above ground utility information may be shown where it assists with positional referencing.

Where logic indicates a utility exists but which cannot be positively confirmed with the technology, an assumed route (AR) is recorded.

ClearView Surveys does not procure statutory or private source utility information (Unless requested at time of order) as part of its detection service nor does it record any such information in a utility survey unless otherwise requested. Statutory plans should be consulted to supplement this survey.

Vertical & Horizontal Position - Vertical position (depth) is indicative to the top of the utility/feature and is recorded as DTS (depth to top of service) and should not be taken as exact. Where depth information from the technology is unclear, depth is not shown. Drains may have been detected using threading and the depth indicated could be between the top and the bottom of the drain. Horizontal position is indicative to the centre of the utility/feature and should not be taken as exact.

Warranty - Biodegradable paints are used to mark-out the position of the utilities. Before long paint markings may become illegible depending on ground, weather and traffic conditions. No warranty is given in respect of the durability of the paint markings and that they are a complete representation of the sub-surface utilities therefore this drawing should be used as the primary reference for the survey results.

This drawing does not provide an absolute representation of the sub-surface. Utilities have been detected using non-invasive technologies only and the performance can be adversely affected by ground, weather and site conditions outside of ClearView Surveys control therefore some utilities may be undetectable. While ClearView Surveys uses reasonable endeavours to detect all utilities, it does not warrant that 100% detection will be achieved and that approximate depth penetration of the technologies will be greater than two metres.

Sewer and manhole details shown on this drawing have been obtained by observation and measurement from the surface and as such cannot be guaranteed. Where precise sewer details will be critical to the project design ClearView Surveys would recommend that entry into the chamber be undertaken using a specialist team, appropriately qualified for confined space entry. These teams can be supplied on request.

Irrespective of the information provided by a utility survey and statutory plans, excavation work should be undertaken with extreme caution and in accordance with HSE Guidelines - HSG47 Avoiding Danger from Underground Services

Additional Notes:

1. The correct identification of the utility types can not be 100% guaranteed, therefore these should be independently verified prior to use in any design or building works.
2. All pipe diameters and levels are assumed to be correct, but due to non entry of the inspection chambers, these should be verified before any works commence.
3. All utility depths are in metres.
4. All pipe/duct sizes are in millimetres.
5. Information provided should not be altered. It should not be used for any purpose other than for which it was intended and should not be issued to other parties without prior agreement from ClearView Surveys.
6. All dimensions should be checked on site before any fabrication,construction or excavation.

ABBREVIATIONS

Ø	Diameter (mm)	NPV	No Pipes Visible
(AR)	Assumed Route	OL	Outlet Level
BD	Back Drop Depth	ONV	Outlet Not Visible
BDL	Back Drop Level	PIG	Pipe In Ground
BH	Borehole	RWP	Rain Water Pipe
CD	Chamber Depth	SA	Soakaway
CID	Cable In Ground	SD	Sump Depth
CL	Cover Level	SFD	Soffit Depth
CP	Catch Pit	SFL	Soffit Level
d	Depth (m)	SIL	Silt Level
DP	Down Pipe	SL	Sump Level
ext	End Of Trace	SV	Stop Valve
FW	Foul Water	SVP	Soil Vent Pipe
HV	High Voltage	SW	Surface Water
IBDL	Internal Back Drop	UTR	Unable To Raise
ID	Invert Depth	UTS	Unable To Survey
IL	Invert Level	UTT	Unable To Trace
KI	Kerb Inlet	VP	Vent Pipe
LV	Low Voltage	WL	Water Level
NFI	No Further Information	WP	Waste Pipe

UTILITY KEY

FW >	Foul Drainage
SW >	Storm Drainage
W	Water
G	Gas
E	Electric
T	BT
	Duct (Empty)
GPR	Linear Radar Feature
TS	Traffic Signal
U	Unidentified
VM	Virgin Media

PAS 128:2022 QUALITY LEVELS

QL-D Asset added from records
QL-C Asset added from site reconnaissance
QL-B4 Asset shown as assumed route
QL-B3P Same as "B3" including GPR data post-processing
QL-B3 Asset located horizontally by one technique only
QL-B2P Same as "B2" including GPR data post-processing
QL-B2 Asset located horizontally and vertically by one technique only
QL-B1P Same as "B1" including GPR data post-processing
QL-B1 Asset located horizontally and vertically by multiple techniques
QL-A Asset located by physical verification

Where details are recorded at inspection covers such as depths, pipes sizes, numbers of ducts etc. these are classified as QL-A

DATE	REVISIONS

CONTROL SURVEY STATIONS

SURVEY ORIENTATED TO ORDNANCE SURVEY GRID USING STATIC GPS OBSERVATION OF SURVEY CONTROL STATION 01 USING A MINIMUM 2 HOUR OBSERVATION PERIOD. BASE AND ROVER MEASUREMENTS TO SURROUNDING CONTROL POINTS WERE OBSERVED. OSTN15 USED. SURVEY LEVELS RELATED TO ORDNANCE SURVEY DATUM USING STATIC GPS OBSERVATION OF SURVEY CONTROL STATION 01. OSTN15 USED

STATION	EASTING (M)	NORTHING (M)	LEVEL (M)
STN01	318032.905	172893.322	8.457
STN02	318007.569	172835.852	8.036
STN03	318093.169	172864.432	8.124

ABBREVIATIONS (WHERE APPLICABLE)

A/C	AIR CONDITIONING	N/A	NO ACCESS
B	BOLLARD	O/H	OVERHEAD
BOE	BRICK ON EDGE COPING	RAD	RADIATOR
BT	BRITISH TELECOM COVER	RL	ROOF LIGHT
CATV	CABLE TV COVER	RS	ROAD SIGN
CF	CEILING FALL	RSJ	ROLLED STEEL JOIST
CL	COVER LEVEL	RSS	ROLLED STEEL STANCHION
CONC	CONCRETE FINISH	RWP	RAIN WATER PIPE
CPD	CUPBOARD	SAR	SLOPING ASPHALT ROOF
CPT	CARPET FLOOR FINISH	S/C	STRUCTURAL CEILING
CPS	CONCRETE PAVING SLABS	SGR	SLOPING GLASS ROOF
DK	DROP KERB	SP	SIGN POST
DP	DOWN PIPE	SSR	SLOPING SLATE ROOF
ER	EARTH ROD	STR	SLOPING TILED ROOF
EVCP	EV CHARGING POINT	SVP	SOIL & VENT PIPE
FAR	FLAT ASPHALT ROOF	TCB	TRAFFIC CONTROL BOX
FB	FLOWER BED	TL	TRAFFIC LIGHT
F/C	FALSE CEILING	T/P	TACTILE PAVING
FH	FIRE HYDRANT	U	URINAL
FHR	FIRE HOSE REEL	VP	VENT PIPE
G	GULLY	WC	TOILET
GM	GAS METER	WHB	WASH HAND BASIN
GPO	TELECOM COVER	WMV	WATER METER VALVE
GV	GAS VALVE	WSC	WATER STOP COCK
HT	HEIGHT	WT	WATER TANK
IC	INSPECTION COVER		
LL	LOW LEVEL		
LP	LAMP POST		

LEGEND (WHERE APPLICABLE)

- - - - - -	LINE INDICATES OVERHEAD OR HIDDEN DETAIL
——— ———	INDICATES CENTRE OF STEEL, RAILING OR FENCES
C. 0000	CILL HEIGHT TO OPENING FROM FINISHED FLOOR LEVEL
SP. 0000	SPRING HEIGHT TO ARCH FROM CILL LEVEL
H. 0000	HEAD HEIGHT TO OPENING FROM CILL LEVEL
+ 10.00	CROSS INDICATES POSITION OF LEVEL
DL 10.00	INDICATES POSITION OF DEDUCED LEVEL
(0000)	INDICATES RELEVANT CEILING, BEAM OR SOFFIT HEIGHT
	EXISTING TREE (SPREAD & HEIGHTS - NEAREST METRE) G. GIRTH H. HEIGHT S. SPREAD

PLEASE NOTE (WHERE APPLICABLE)

1. THE ACCURACY OF THIS SURVEY DRAWING IS DEPENDENT UPON THE SCALE AT WHICH IT IS PRODUCED. USERS SHOULD NOT RE-SCALE THIS DRAWING WITHOUT WRITTEN CONSENT.
2. WHILST ALL REASONABLE CARE HAS BEEN TAKEN IN LOCATING THE UNDERGROUND SERVICES SHOWN ON THIS DRAWING, THE COMPLETENESS OR THE ACCURACY OF THE INFORMATION CANNOT BE GUARANTEED. USERS SHOULD SATISFY THEMSELVES WITH REGARD TO THE TYPE, SIZE AND ROUTE OF SERVICES BEFORE CONNECTIONS ARE AUTHORISED.
3. THE ABILITY TO SCALE FROM THIS SURVEY DRAWING IS DEPENDENT ON THE STABILITY OF THE DRAWING MATERIAL. USERS SHOULD VERIFY, BY THE SCALE OF THE SURVEY GRID, THE ACCURACY OF THE DRAWING MATERIAL PRIOR TO SCALING DIMENSIONAL INFORMATION.

ORDNANCE SURVEY RELATED MARK

TRAVERSE CONTROL STATION 01

VALUE = 8.457m

TITLE
PLOT 1 - SITE PLAN

PROJECT
THE PENINSULA, CARDIFF CF11

CLIENT
RADCLIFFES

SCALE	DRAWN	DATE	DRAWING	REVISION
1:200@A0	S.W	NOV 2023	10509/01	

Michael Gallie
THE STANDARD OF MEASUREMENT
166B Tower Bridge Road, LONDON SE1 3LZ
T:0333-240-1211 T:020-7394-1111
survey@michaelgallie.co.uk www.michaelgallie.co.uk

NORTH

Appendix C – NRW Maps for Planning

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Enter title (max 35 characters)

Legend

Sea

Flood Zone 3

Flood Zone 2

Scale at A3: 1:5,000

Date: 28/02/2024

0.2 0.1 0 0.2

km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Enter title (max 35 characters)

Legend

Surface Water and Small Watercourses

- Flood Zone 3
- Flood Zone 2

Scale at A3: 1:5,000

Date: 28/02/2024

0.2 0.1 0 0.2

km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Enter title (max 35 characters)

Legend

Rivers

- Flood Zone 3
- Flood Zone 2

Scale at A3: 1:5,000

Date: 28/02/2024

0.2 0.1 0 0.2

km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Detail

Enter title (max 35 characters)

Legend

TAN15 Defended Zones

- Rivers
- Sea
- Rivers and Sea

Scale at A3: 1:5,000

Date: 28/02/2024

0.2 0.1 0 0.2
km

British National Grid

Disclaimer

https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en

Appendix D - Proposed Master Plan

0 1 2 3 4 5m 10 15 20
Scale 1:200

NORTH

EMPIRE WAY / FFORDD Y YMERODRAETH

Sewage Ppg Sta

PUBLIC LANDSCAPED OPEN SPACE

Cardiff International White Water / Dwr Gwyn Rhyngwladol Caerdydd

2 BED
2 BED
Stair
2 BED
1 BED
1 BED
2 BED

KITCHEN
LAUNDRY + MSS
STAFF & GUESTS
Cpd
Stair
Lift
REFUSE
RESIDENTS LOUNGE/BISTRO
ENTRANCE

AMENITY SPACE
AMENITY SPACE

1 BED
1 BED
Cpd
Lift
Stair
1 BED
1 BED
2 BED
Stair
1 BED
1 BED

68 to 102
114
116 to 130
2
ESS
FRANCIS STREET
18
20
11
15
19
32

A223. A224. A225. A226. A228. A229. A230. A231. A232. A233. A234. A235. A236. A237. A238. A240. A241. A242. A244. A245. A246. A247. A248. A249. A250. A251. A252. A253. A254. A255. A256. A257. A258. A259. A260. A261. A262. A263. A264. A265. A266. A267. A268.

CH 900.00m

CH 800.00m

CH LINE

Rev.	Date	Detail
Status	DRAFT ISSUE	

ASCOT DESIGN
Timeless architecture
Ascot Design Ltd, Berkshire House 39-51 High Street, Ascot, Berkshire, SL5 7HY
Tel: 01344 299330 Fax: 01344 299331 Email: info@ascotdesign.com
www.ascotdesign.com

Client: Orion Land and Leisure Ltd

Project Title: CARDIFF PENINSULA - PLOT 1

DRAWING Title: DRAFT GROUND FLOOR SITE LAYOUT

Scale	Date	Drawn
1:200 @ A0	JAN '24	-

DRAWING No.	Rev.
23 - J4303 - 01	-

Appendix E - NRW Product 6 data

The modelled tidal depths (m) for the 0.5% and 0.1% AEP (T0200)

Node point	1 in 200 (0.5% AEP)	1 in 1000 (0.1% AEP)
1	0.353	0.55
2	0.486	0.68
3	0.476	0.67
4	2.67	2.51
5	2.44	0.698
6	0.5	0.765
7	0.567	0.765
8	0.649	0.846
9	2.79	2.98
10	0.684	0.882
11	0.476	0.67
12	0.538	0.74
13	0.512	0.731
14	1.27	1.47

The modelled tidal depths (m) for the 1% AEP, climate change scenarios, and undefended scenario

Node point	1% AEP	1% AEP+20% CC	1% AEP+70% CC	1% AEP (undefended)
1	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	1.31	2.17	2.279	1.55
5	0.888	1.82	2.05	1.18
6	N/A	N/A	N/A	N/A
7	N/A	N/A	0.169	N/A
8	N/A	N/A	N/A	N/A
9	1.27	2.29	2.393	1.22
10	N/A	N/A	0.284	N/A
11	N/A	N/A	N/A	N/A
12	N/A	N/A	0.16	N/A
13	N/A	0.001	0.118	N/A
14	0.313	0.81	0.88	0.8

References

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[vi] British Geological Survey - Geoindex internet website: https://mapapps2.bgs.ac.uk/geoindex/home.html

[vii] Cranfield Soil and Agrifood Institute- Soilscapes website: https://www.landis.org.uk/soilscapes/

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