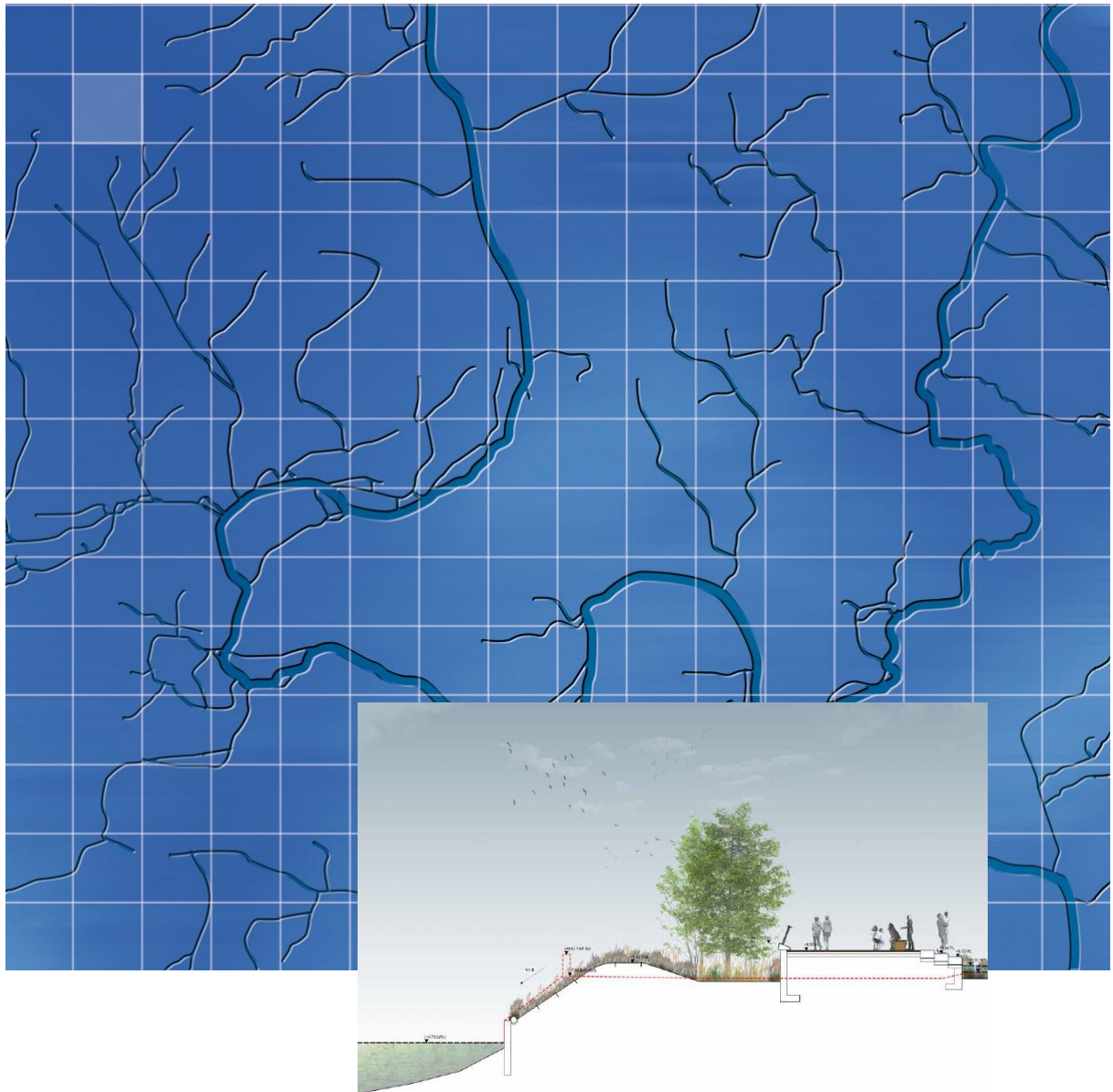


Rightacres Property Co. Ltd.

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Central Quay WFD Assessment



WHS

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For and on behalf of Wallingford HydroSolutions Ltd.

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1 Introduction

Wallingford HydroSolutions Ltd (WHS) has been commissioned by Rightacres Property Co. Ltd. to complete a Water Framework Directive (WFD) Assessment for embankment improvement works required as part of the proposed Central Quay redevelopment site in central Cardiff (the embankment works are hereafter referred to as the Project). Specifically relevant to this WFD assessment are the improvements to the concrete embankment of the River Taff and the existing flood wall on the western edge of the site, which are subject to a Marine Licence application.

The wider redevelopment is being undertaken in phases at the former Brains Brewery site and will comprise residential units, commercial units, shared spaces and landscaping.

The aim of this report is to identify the relevant WFD water bodies located within the vicinity of the site and to assess if the Project is compliant with the objectives of the WFD for the identified areas. This report supports an application for a Marine Licence to undertake the embankment works.

2 Methodology

2.1 Legislation

The legislative framework for the WFD comprises the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The regulations seek to protect and enhance the ecological and chemical health of rivers, lakes, estuaries, coastal waters and groundwaters. The aim of the WFD is for all water bodies to achieve “good status” by 2027. Water bodies are assessed within River Basin Management Plans which allow the water body to be managed as a natural geographical and hydrological unit.

Each river basin has a River Basin Management Plan (RBMP) which sets out the current status for each water body within the river basin. The RBMP also sets out the objectives required to achieve good status by 2027 in terms of ecological, chemical and protected areas. The status of each water body is reassessed in Wales every year under 6 year cycles with interim updates every 3 years as part of WFD cycles. The first cycle ended in 2015 and the second cycle in 2021. Cycle 3 (2021-2027) classifications were published in 2021 and have been used for this assessment. For those water bodies which did not achieve good status the target date was extended to either 2021 (cycle 2) or 2027 (cycle 3).

Ecological, chemical and groundwater status (where applicable) are assessed based on several distinct quality elements. To achieve good ecological status or potential, good chemical status or good groundwater status each element must be assessed as having a good status or better. If a single element is below the threshold for good status, then the waterbody’s status cannot be classed as good.

2.1.1 Surface Water Criteria

Surface water bodies can have an overall status classed as high, good, moderate, poor or bad status, which is determined by a water body’s ecological status and chemical status. The same classifications as above apply to the ecological status, which is assessed based on the following.

- Biological quality – fish, benthic invertebrates, aquatic flora.
- Hydromorphological quality – riverbank structure, continuity of channel or substrate of the river bed.

- Physico-chemical quality – temperature, oxygenation and nutrient conditions.

The chemical status is classed as either good or fail. It is based on specific water pollutants detailed in the Environmental Quality Standards Directive¹.

2.1.2 Groundwater Criteria

Groundwater bodies have an overall status which is assessed according to their “quantitative” and “chemical” status. The chemical status is assessed based on different elements than for surface water bodies. Quantitative status is related to the availability of the groundwater resource and ensuring that it is not reduced by the long-term annual average rate of abstraction.

2.2 Guidance and Methodology

The Environment Agency have published guidance on completing WFD assessments for estuarine and coastal waters² which is also considered best practice in Wales. This guidance has been taken into consideration for the completion of this assessment. The following approach has been taken:

- **Screening:** Identify and record current waterbody status, future objectives and any activities within the vicinity of the water body which may influence the status of the water body.
- **Scoping:** For each WFD element, identify where the proposed development may affect the current or achievable status.
- **Assessment and mitigation:** Identify the extent to which the development will influence (positively or negatively) the WFD elements. Identify where further actions can be incorporated into the development to mitigate any negative effects of the development.

3 Project Description

The Project site is located at Central Quay in the centre of Cardiff (NGR: ST18067567) at the site of the former Brains Brewery. The wider redevelopment is being undertaken in phases and will comprise residential units, commercial units, shared spaces and landscaping. As part of the redevelopment, works are required to the existing concrete embankment and flood wall on the banks of the River Taff. To undertake these embankment works, Rightacres have been informed by the Marine Management Organisation (MMO) that a Marine Licence is required. The subject of the Marine Licence is limited to the works described below and does not incorporate the wider redevelopment site. Therefore, this WFD assessment is also based on the below Project.

The entire western boundary of the Central Quay site is formed by the River Taff. The top of the existing 300 m section of riverbank is delineated by a 1.2 m high masonry flood defence wall which is owned and operated by NRW. On the outside of which the riverbank comprises a steeply sloping concrete revetment situated on top of a sheet pile wall that drops to the riverbed (Figure 1). Parts of the concrete revetment have become vegetated over time, but the vast majority remains a visibly aged concrete face.

¹ Environment Agency (2016) Environmental Quality Standards Directive (EQSD) list for WFD assessments <https://www.gov.uk/government/publications/list-of-chemicals-for-water-framework-directive-assessments/environmental-quality-standards-directive-eqsd-list-for-wfd-assessments>

² Environment Agency (2016) Water Framework Directive assessment: estuarine and coastal waters. Available via: <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>



Figure 1: Existing embankment and flood wall

The Project proposes to remove the existing 1.2 m high flood wall and the concrete embankment, replacing it with a vegetated slope at a shallower angle, a 'river walk' for pedestrian access and a new flood wall (at the same height) further into the wider redevelopment site. Figure 2 shows a diagram of the proposed cross section while Figure 3 shows an engineered cross sectional drawing.

It is proposed that the new vegetated bank will continue down the entire length of the wider redevelopment site however it may be provided in stages in line with the phased approach of the wider redevelopment site. No changes are proposed to the existing sheet pile wall.

A series of Sustainable Drainage Systems (SuDS) have been incorporated into the design of the wider redevelopment site which include a surface water management system, bioretention (rain gardens), tree pits, riverside attenuation basis and water features. It is proposed for surface water to be discharged to the River Taff via suitable treatment stages, such that the water would comply with relevant discharge licences.

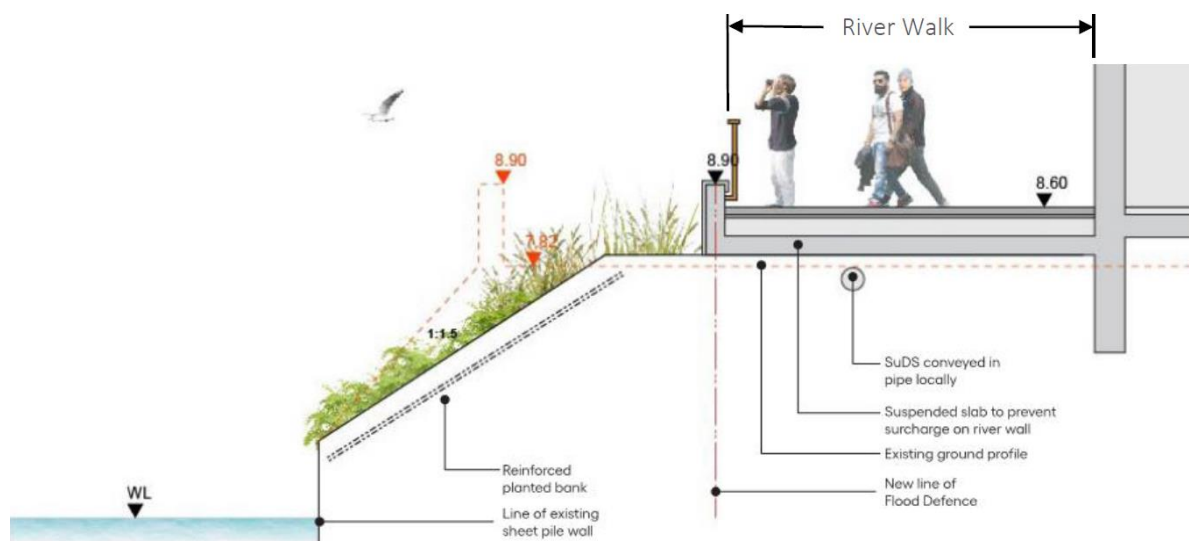


Figure 2: Cross section diagram of the embankment works

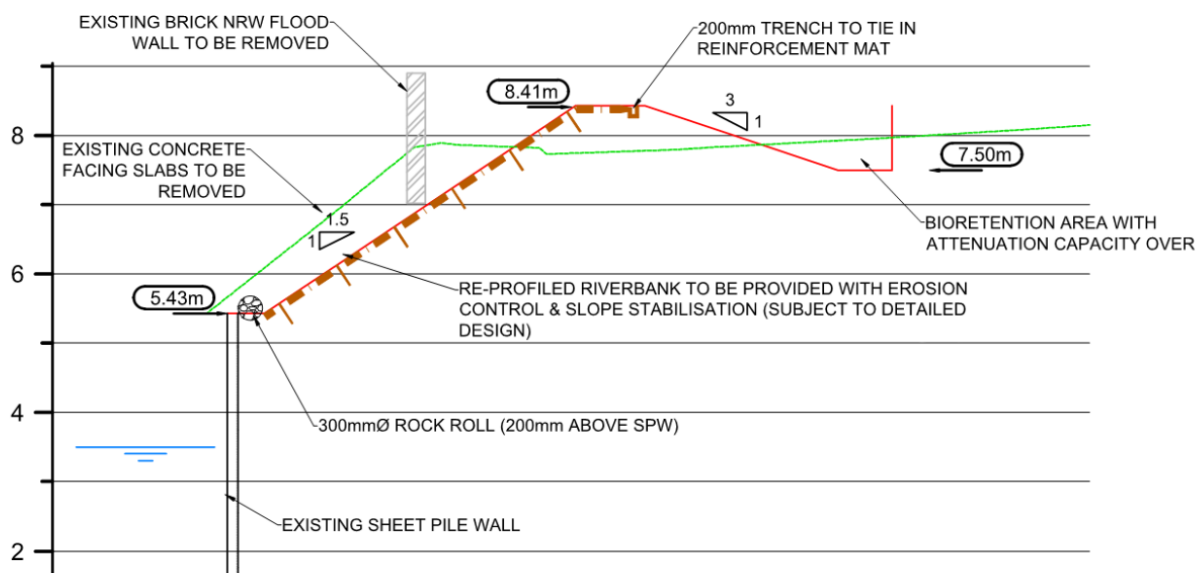


Figure 3: Engineered cross section

The use of geo-engineering systems has been considered for the slope reinforcement which will enable the greening-up of the riverbank slope whilst preventing soil erosion that might be caused by the river and surface water runoff. This is to include application of soil erosion reinforcement matting and a natural hydraulically applied mulch which is to be seeded to include native planting species. An assessment of the proposed slope has indicated that an approach to maintaining long term stabilisation is required. This is to include adding a confining face of 0.5 m – 1.0 m of engineered fill combined with a proprietary strengthening geocellular/grid system. A single continuous pre-filled roll of rock which can be vegetated is also being considered to tie in slope with the back of the existing sheet piled wall that is to remain. The seeding of the slope will provide a greening-up of the river bank and enhanced biodiversity.

4 WFD Screening

The site is located within the Severn River Basin District which incorporates water bodies in England and Wales. This section identifies the WFD surface water and groundwater bodies located adjacent to the site as determined by the surrounding topography. The land use of the site and surrounding area is predominantly urban as it is located within the centre of Cardiff. The nature of the surrounding area is likely to contribute to a reduction in water quality of the water bodies through road/hardstanding run off into the water.

4.1 Surface Water Body Catchment

The site drains into the Taff confluence Rhondda R to Castle Street (water body ID: GB109057027270). This water body is approximately 27 km in length with a catchment area of approximately 63 km². Appendix 1 shows the location of the water body relative to the site and Appendix 2 shows the catchment for this water body. Overall, the water body is classified as Moderate and is classed as a heavily modified water body (HMWB). Table 4-1 shows the WFD details of this surface water body indicating its status and objectives. Full details are provided in Appendix 3.

Table 4-1: WFD Water Body Characteristics for Taff confluence Rhondda R to Castle Str Water Body³

WFD Indicator	Cycle 2 Interim (2018) Classification	Cycle 3 (2021) Classification	Objectives
Overall Status	Moderate	Moderate	Moderate by 2027
Ecological	Moderate	Moderate	Moderate by 2027
Chemical	Fail	Moderate	Moderate by 2027

The 2021 data show an improving picture for the chemical classification, with the 2018 interim data showing a Fail for this category. It has been identified that the reasons for this water body not achieving good status include physical modifications creating barriers to fish migration, and unknown activities relating to concentrations of Benzo (b) and (k) Fluoranthene, Benzo(a)pyrene and Fluoranthene which are pending investigation.

4.2 Groundwater Body

The site lies within the SE Valleys Southern Devonian Old Red Sandstone & Triassic Mercia Mudstone Ground Water Body which covers a total area of 2,690 km². The water body currently has an overall status of good which is consistent with the 2015 data (latest available data for groundwater bodies). The classifications of this water body are shown in Table 4-2.

Table 4-2: SE Valleys Southern Devonian Old Red Sandstone & Triassic Mercia Mudstone Ground Water Body characteristics

WFD Indicator	Current Status/Information	Objective
Overall Status	Good	Good by 2027
Quantitative	Good	Good by 2027
Chemical	Good	Good by 2027

³ Data available for download from: <https://waterwatchwales.naturalresourceswales.gov.uk/en/>

4.3 Severn River Basin Management Plan

The site is located within the Severn River Basin Management Plan (RBMP), which covers over 21,000 km² and lies across both England and Wales. It is divided into 10 catchments, the catchments are characterised by mainly agriculture and forestry. The RBMP outlines water management issues and objectives with the aim of protecting and enhancing the water environment.

The environmental objectives of the WFD are⁴:

- 'to prevent deterioration of the status of surface waters and groundwater;
- to achieve objectives and standards for protected areas;
- to aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status;
- to reverse any significant and sustained upward trends in pollutant concentrations in groundwater;
- the cessation of discharges, emissions and losses of priority hazardous substances into surface waters; and
- progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants.'

4.4 Designated sites

There are no statutory designated Special Protection Areas (SPA), Special Areas of Conservation (SAC), Ramsar or Sites of Special Scientific Interest (SSSI) within 2 km of the Project site. The River Taff flows into Cardiff Bay approximately 1.5 km downstream of the Project site. Cardiff bay itself is not designated, however the seaward side of the Cardiff Bay Barrage forms part of the Sever Estuary which is designated as a SSSI, SAC and SPA (located approximately 3.5 km downstream from the Project site).

The Severn Estuary SSSI, SAC and SPA is designated for the presence of Annex I habitats including estuaries, mudflats and sandflats, Atlantic salt meadows, sandbanks and reefs. The site is also designated for the following species: sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, twaite shad *Alosa fallax*, bewick's swan *Cygnus columbianus bewickii*, greater white-fronted goose *Anser albinfrons albinfrons*, dunlin *Calidris alpina alpina*, common redshank *Tringa tetanus*, common shelduck *Tadorna tadorna* and gadwall *Anas strepera*.

The objectives of the designated site are to ensure that the integrity of the site is maintained or restored as appropriate. Ensuring that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring;

- the extent and distribution of qualifying natural habitats and habitats of qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the population of qualifying species; and
- the distribution of qualifying species within the site.

⁴ Department for Environment, Food and Rural Affairs, Welsh Government, Natural Resources Wales and Environment Agency (2015) Part 1: Severn river basin district management plan.

5 WFD Scoping

This section sets out the scoping exercise of the WFD Assessment. It follows the layout set out within the Environment Agency guidance². It assesses whether the Project is likely to impact the WFD water body in relation to its ecological or chemical status. If it is identified that an impact could occur, an impact assessment is required to be undertaken (Section 6).

5.1 Hydromorphology

Consider if your activity:	Yes	No	Hydromorphology risk issue(s)
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status	-	Impact assessment not required	The works would change the profile of the embankment and would move the flood wall. The works however would re-vegetate the bank above the existing sheet pile wall (with appropriate erosion control) and would not change the existing sheet pile wall. As this section of the River Taff is considered a HMWB, the works would therefore not result in any changes to the existing flow regime or tidal patterns of the water body.
Could significantly impact the hydromorphology of any water body	-	Impact assessment not required	
Is in a water body that is heavily modified for the same use as your activity	-	Impact assessment not required	The water body is heavily modified however the works required as part of this Project wouldn't result in any additional modifications to the natural bank form.

5.2 Biology

5.2.1 Habitats

The Environment Agency guidance document sets out sensitive habitats present in the UK coastal/estuarine waters. None of these habitats are present within the Project site.

5.2.2 Fish

Consider if your activity:	Yes	No	Biology fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	-	Go to next section	The works associated with the Project would not take place within the wetted perimeter of the River Taff and therefore would not affect the movement of fish within the estuarine waters. The works would also not result in excessive noise or release chemicals into the water. The mitigation measures presented in section 3 should ensure that no pollutants enter the water body through discharge. Mitigation
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)	-	Impact assessment not required	

Consider if your activity:	Yes	No	Biology fish risk issue(s)
Could cause entrainment or impingement of fish	-	Impact assessment not required	presented in Section 6 would also reduce the risk of pollution during construction. As such, there would be no impact on fish during construction or operation of the Project.

5.3 Water Quality

5.3.1 Phytoplankton Status

Consider if your activity:	Yes	No	Water quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	Requires impact assessment	-	The works are likely to take longer than 14 days and would take place in very close proximity to the water body.
Is in a water body with a phytoplankton status of moderate, poor or bad	-	Impact assessment not required	Phytoplankton is not a driving element of this water body.
Is in a water body with a history of harmful algae	-	Impact assessment not required	No known history of harmful algae.

5.3.2 Risk of Pollution

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	-	Impact assessment not required	No chemicals listed on the EQSD list would be used during construction.
It disturbs sediment with contaminants above Cefas Action Level 1	-	Impact assessment not required	The works will not disturb any sediments.

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	-	Impact assessment not required	No chemicals listed on the EQSD list would be discharged as a result of the Project.

5.4 WFD Protected Areas

Consider if your activity is:	Yes	No	Water quality risk issue(s)
Within 2km of any WFD protected area	-	Impact assessment not required	The Project site is not located within 2 km of a WFD protected site. The nearest protected site is the Severn Estuary approximately 3.5 km downstream. The Project works are minor and would not necessitate an increase in the 2 km buffer.

5.5 Invasive Non-Native Species (INNS)

Consider if your activity could:	Yes	No	Water quality risk issue(s)
Introduce or spread INNS	-	Impact assessment not required	No INNS have been identified within the Project site and as such the Project works are not likely to result in the spread of INNS.

5.6 Summary

The above scoping exercise has indicated there is no need to complete an impact assessment in relation to hydromorphology, biology, WFD protected areas or INNS. An impact assessment is required to assess the water quality effects of the works in relation to phytoplankton. The impact assessment and suggested mitigation is provided in Section 6 of this report.

6 Impact Assessment

As the Project works are located adjacent to the water body there is a chance that pollution in the form of construction materials/spillages or sediment laden runoff, could enter the watercourse. The design of the vegetated embankment and flood wall has measures embedded to reduce pollution, such as the use of a geocellular confinement layer and erosion matting. In addition, the wider Central Quay development has utilised SuDS designs to ensure the discharge of water to the water body would be treated prior to discharge (in line with any discharge consents imposed).

During construction mitigation measures will be put in place to prevent the pollution of the water body. A Risk Assessment Methodology Statement (RAMS) and Method Statement will be produced and agreed prior to construction to implement measures. These measures will follow the methods

set out in the GPP5 Works and Maintenance in or near Water⁵ guidance document and will include (but not limited to):

- minimising the time of exposed bare ground by vegetating quickly and exposing areas in stages;
- use of silt fencing at the bottom of slopes;
- diverting clean water away from construction areas;
- plant and wheel washing;
- preventing water from entering excavations; and
- storage of concrete or cement in an impermeable designated area and 10 m away from the water body.

In addition, the following measures will also be implemented:

- works will take place during summer months and will avoid periods of heavy rainfall;
- all works will be undertaken using land based plant such as long reach excavators;
- the riverside walkway and permanent wall (reprovision of flood wall) will be constructed when the buildings of the wider redevelopment site are being built, with temporary flood barriers erected within the site to maintain the level throughout the course of construction; and
- a modular floating pontoon system will be set up and lowered into the river in sections by an excavator and connected together to provide a platform approximately 30 m long. The pontoon will be equipped with fence panel edge protection and held in place by fixing to the existing sheet pile wall.

The methodology for removal of the existing embankment and construction of the new embankment will follow the general steps outlined below. These steps will be included within the Method Statement.

- An excavator will reduce the ground behind the wall and pull the wall into the excavation, i.e. away from the watercourse, and dispose.
- The excavator will then undermine the concrete embankment in sections and pull the debris into the site and away from the watercourse.
- The embankment will then be reprofiled and erosion control measures installed.
- This sequence will be repeated along the length of the embankment.

With the implementation of the above measures, together with the embedded mitigation measures set out as part of the design (as described in Section 3), it is not likely that pollution would enter the

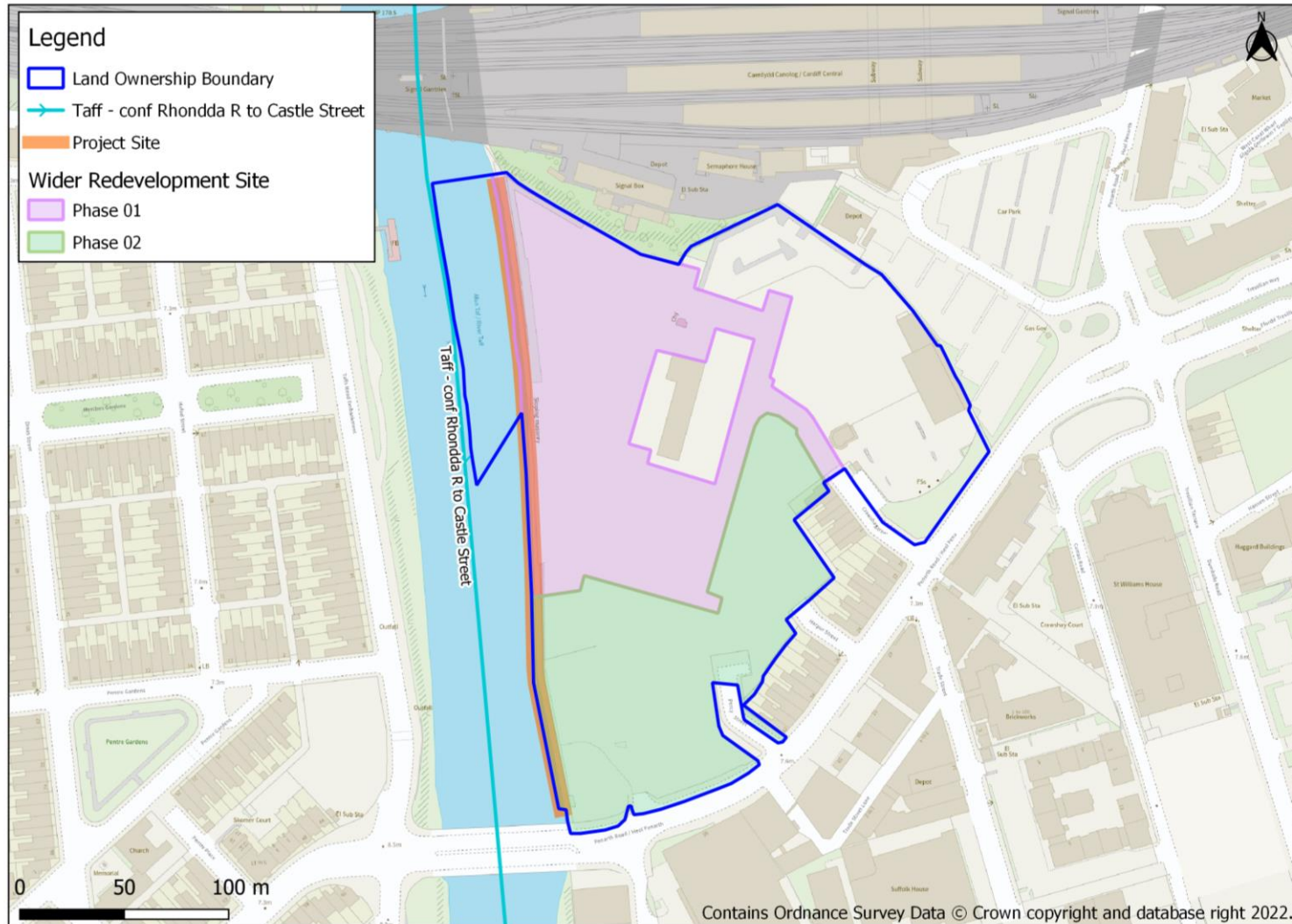
⁵ Natural Resources Wales (NRW), Northern Ireland Environment Agency (NIEA) and Scottish Environment Protection Agency (SEPA) (2018) Guidance for Pollution Prevention. Works and maintenance in or near water: GPP5

water body during construction or operation. Therefore, the Project would not cause deterioration of the water body and would not prevent water body from reaching its objectives.

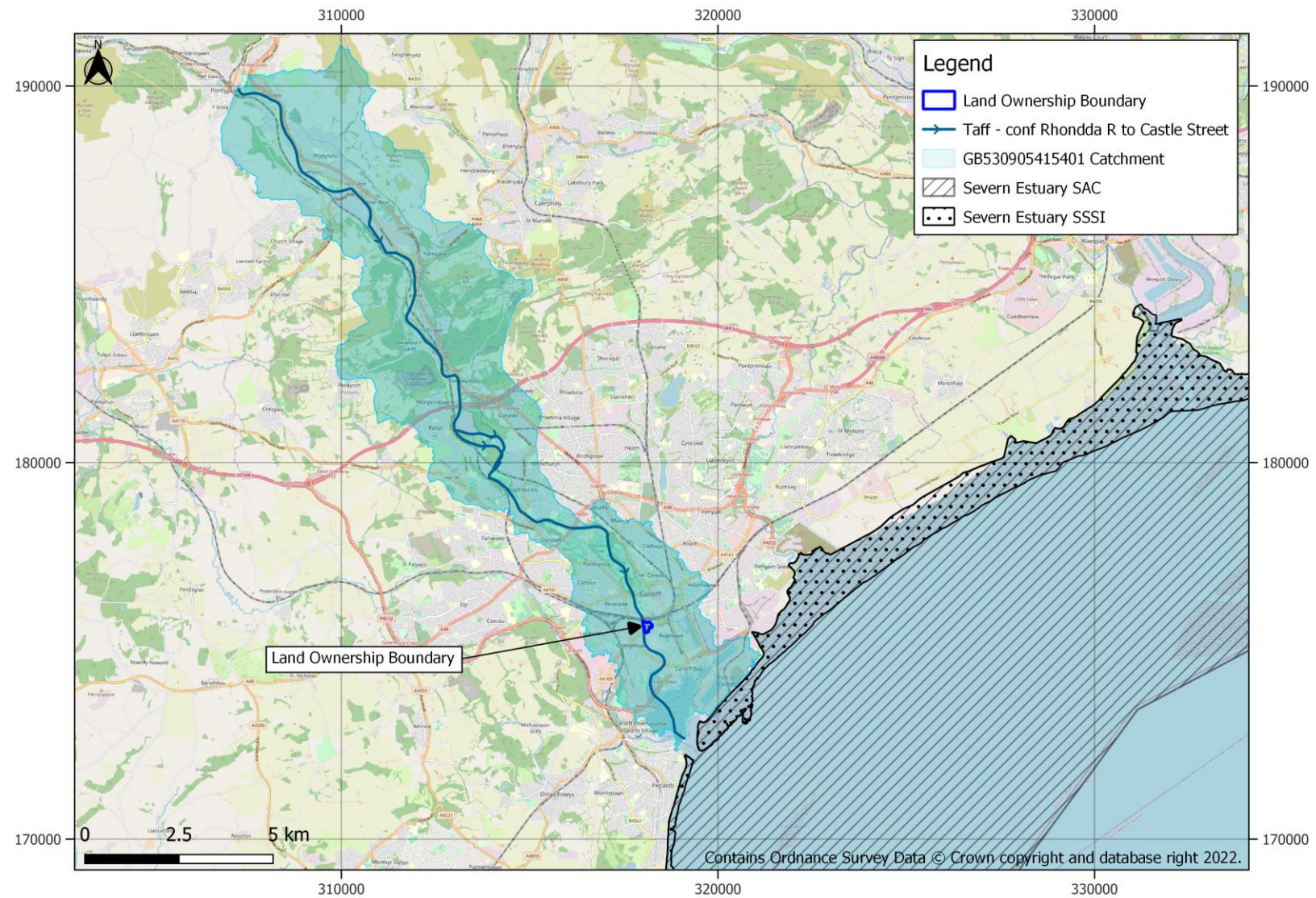
7 Conclusions

The Project includes works to the concrete embankment and flood wall adjacent to the River Taff. As a result, there is the possibility of pollution of the Taff confluence Rhondda R to Castle Street (water body ID: GB109057027270) water body during construction. With the implementation of embedded mitigation together with the construction mitigation, the Project would not cause deterioration of the water body and would not prevent the water body from reaching its objectives.

Appendix 1



Appendix 2



Appendix 3

WFD Indicator	Cycle 2 Interim (2018)	Cycle 3 (2021)
Overall Status	Moderate	Moderate
Ecological	Moderate	Moderate
Driving ecological quality element	Mitigation measures assessment	PAH and mitigation measures assessment
Ecological - Biology	Good	Good
AWIC	High	-
Invertebrates	High	High
Macrophyte and phytobenthos	Good	High
Macro sub	Good	High
Diatom Sub	Good	High
Ammonia	High	High
BOD (biological oxygen demand)	High	High
Dissolved oxygen	High	High
pH	High	High
Phosphate	Good	High
Temperature	High	Good
Ecological - hydromorphology	Not High	Not High
Hydrological regime	Not High	Not High
Chemical	Fail	Moderate
Specific pollutants		High
Arsenic	High	High
Copper	High	High
Iron	High	High
Zinc	High	High
Manganese	High	High
Phenol	-	High
Priority hazardous substances	Moderate	Moderate
Anthracene	-	High
Endosulfan	-	High
Benzo and flouranthene	Moderate	
Cadmium	High	High
Hexachlorocyclohexane	High	High
Nonyphenol	-	High
Priority substances	High	High
Atrazine	High	High
Flourthene	Moderate	-
Lead	High	High
Napthalene	-	High
Nickel	High	High
Octylphen	-	High
Pentachlorophenol	-	High
Trichlorobenzenes	High	High
Trichloromethane	High	High

WFD Indicator	Cycle 2 Interim (2018)	Cycle 3 (2021)
Alachlor	-	High
Benzene	-	High
Dichlometh	-	High
Dichlorvos	-	High
Chemical other	High	High
Aldrin, Dieldrin, Endrin & Isodrin	High	High
Carbon Tetrachloride	High	High
DDT total	High	High
Para DDT	High	High
Tetrachloroethylene	High	High
Trichloroethylene	High	High