

Pioneer 2 - Flood Consequences Assessment

Version 3

March 2024

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Contract

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This report describes work commissioned by Sundeep Reddy, on behalf of Protium Green Solutions Ltd, by an instruction dated 15th August 2023. Charlotte Lickman of JBA Consulting carried out this work.

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Abbreviations

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
FMfP	Flood Map for Planning
FRAW	Flood Risk Assessment Wales
LIDAR	Light Detection and Ranging
NRW	Natural Resources Wales
TUFLOW	Two-dimensional Unsteady FLOW (hydraulic model)

1 Introduction

1.1 Terms of Reference

JBA Consulting (JBA) were commissioned by Sundeep Reddy of Protium Green Solutions Ltd to undertake a Flood Consequences Assessment (FCA) to support a planning application for the development of a Hydrogen Production Facility at Heolcae'r-Bont, Margam.

1.2 FCA Requirements

This FCA follows Welsh Government guidance on development and flood risk as set out in Technical Advice Note 15: Development and Flood Risk (TAN-15). Where appropriate, the following aspects of flood risk should be addressed in all planning applications over their expected lifetime.

- The likely mechanisms of flooding
- The likely source of flooding
- The depths of flooding through the site
- The speed on inundation of the site
- The rate of rise of flood water through the site
- Velocities of flood water across the site
- Overland flow routes
- The effect of access and egress and infrastructure, for example, public sewer outfalls, combined sewer outflows, surface water sewers and effluent discharge pipes from wastewater treatment works.
- The impacts of the development in terms of flood risk on neighbouring properties and elsewhere on the floodplain.

2 Site Description

2.1 Site Summary

The proposed 0.09 ha development site is located in Margam, Port Talbot, as shown in Figure 2-1. The site is located within the boundary of Western Bio Energy power station. The proposed area of development currently exists as a concrete block and is therefore brownfield in nature.

The development site is situated to the west of the M4 J38. The site is bound to the east by an existing building and car parking associated with the Western Bio Energy power station as well as an access road to the site. Immediately to the north is a small, wooded area, beyond which is Margam Green Energy Plant. To the west is further concreted land associated with the site, beyond which is greenfield land. Further to the west is the South Wales main line railway and significant industrial development of Tata Steel Port Talbot, which extends towards the Bristol Channel.

Table 2-1 summarises the key characteristics of the site.

Table 2-1 Site summary

Site name	Western Bio Energy
Site area	0.09ha
Existing land use	Brownfield - concrete base
Purpose of development	Hydrogen Production Facility
OS NGR	SS 79027 86219
Local Planning Authorities	Neath Port Talbot County Borough Council
Lead Local Flood Authority	Neath Port Talbot County Borough Council

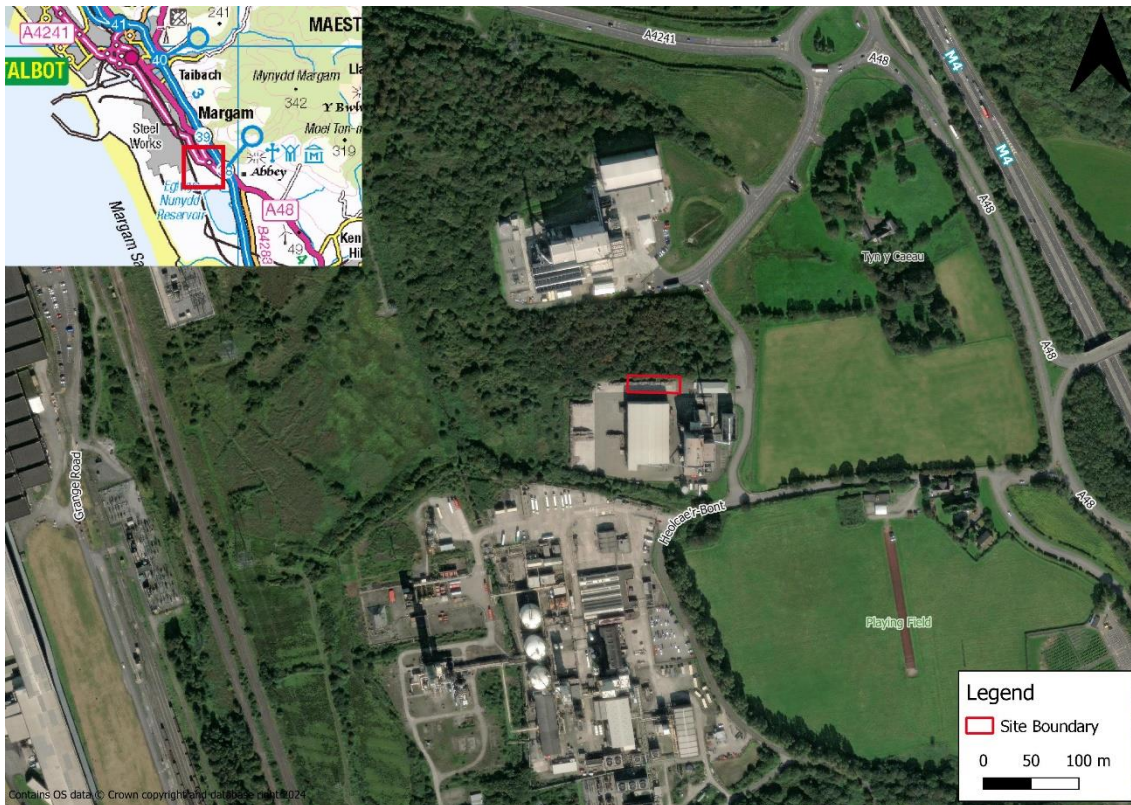


Figure 2-1 Site Location

2.2 Watercourses

No watercourses cross the proposed development site. Figure 2-2 shows that to the west of the site is a complex network of ordinary watercourses (predominantly ditches). Approximately 700m to the south of the site is Eglwys Nynydd Reservoir, and 2KM to the west is the Bristol Channel.

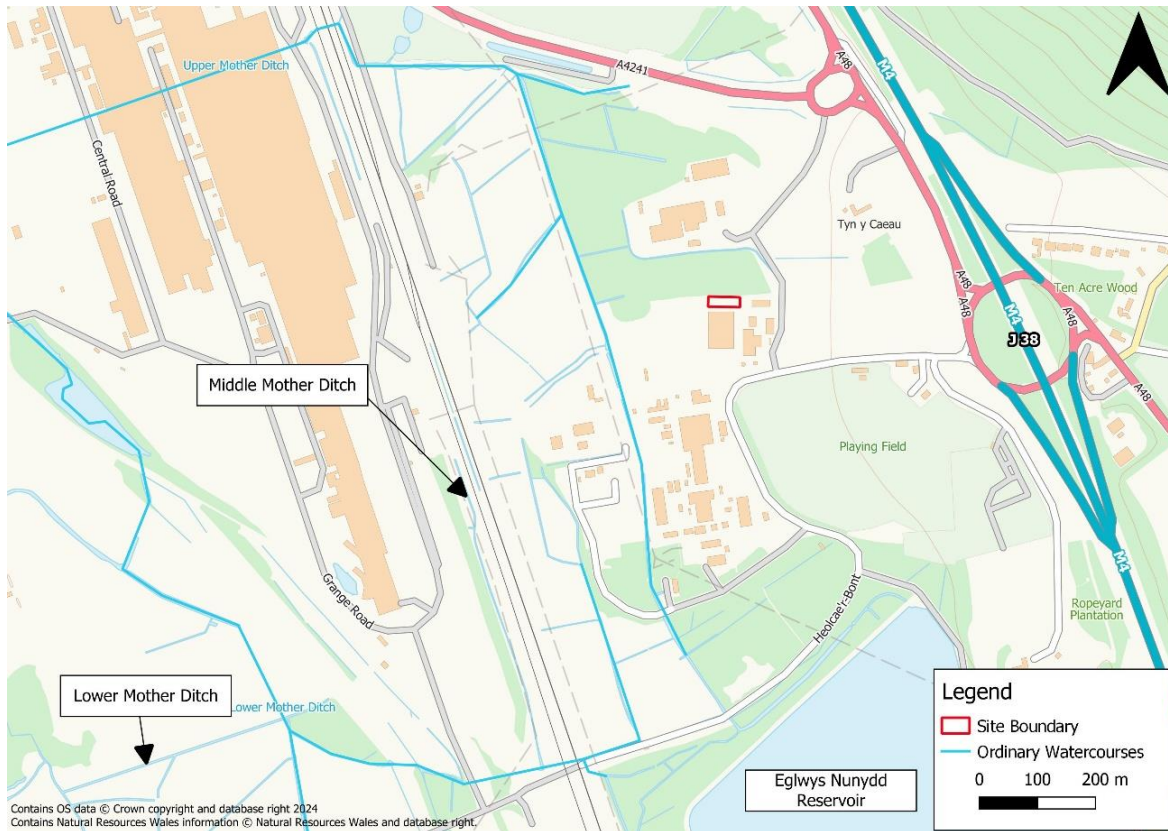


Figure 2-2 Nearby Watercourses

2.3 Site Topography

Figure 2-3 shows Natural Resources Wales (NRW) Light Detection and Ranging (LiDAR) data which provides an illustration of the site topography. A topographic survey of the site is not available for use at the time of writing.

Based on the available LiDAR data and known information about the current use of the proposed site, it is anticipated that the higher elevations shown, of up to 12.05mAOD, are representative of stored material on site, which has not been filtered out during the LiDAR survey, rather than the true ground levels. As such, actual ground levels are anticipated to be generally flat, with indicative ground levels obtained from the LiDAR data shown to be lowest in the north-west of the site at approximately 6.28mAOD, and highest in the south-east at approximately 7.37mAOD.

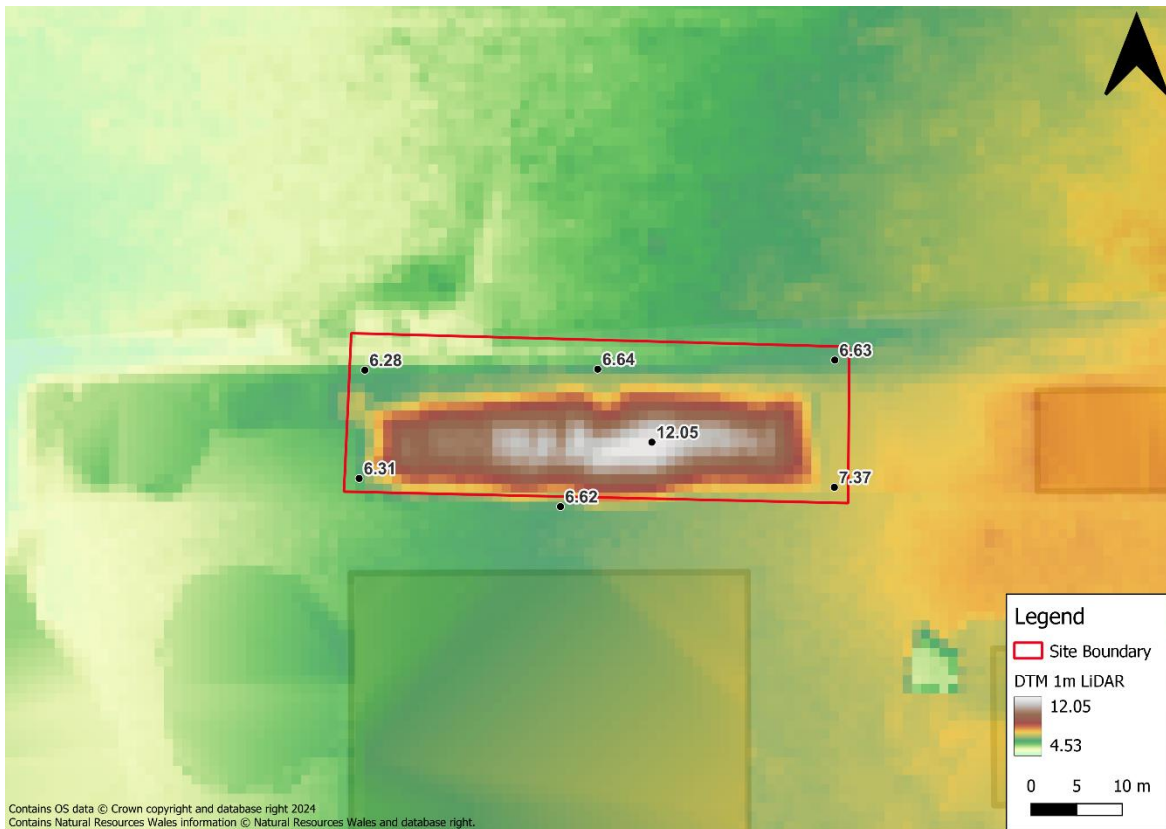


Figure 2-3 1m LiDAR DTM

2.4 Soils and Geology

The geology of the site has been assessed using the British Geological Survey (BGS) GeoIndex¹. The bedrock is shown to be South Wales Middle Coal Measures formation - mudstone, sandstone, and siltstone. The superficial geology is formed of Glaciofluvial Deposits, Devensian - sand and gravel.

The soils on site have been assessed on the Cranfield University Soilscape viewer² and are shown to be freely draining slightly acid loamy soils.

2.5 Development Proposal

It is proposed to develop the site for a Hydrogen Production Facility. This incorporates an electrolyser system and a compressor system with associated components including:

- ISO Container containing the electrolyser equipment, control and monitoring equipment, water treatment and hydrogen gas purification units.
- Hydrogen and Oxygen Vent Stacks.
- ISO Container housing the electrical switch gear.
- Transformer Building.

¹ <https://mapapps2.bgs.ac.uk/geoindex/home.html>

² <https://www.landis.org.uk/soilscales/>

- Compressors and associated buffer tank (within Containers)
- 2 No. Air Cooled Condenser Units
- 2-3 No Tube trailer refilling bays
- Material consumable storage areas.
- A Private Wire connection to the WBE substation.
- Pipework/Pipebridge connecting the HPF to the HTTFS
- Fencing and pedestrian entrances/exit

An extract of the development proposal is as shown in below in Figure 2-4 and contained in full in Appendix A.

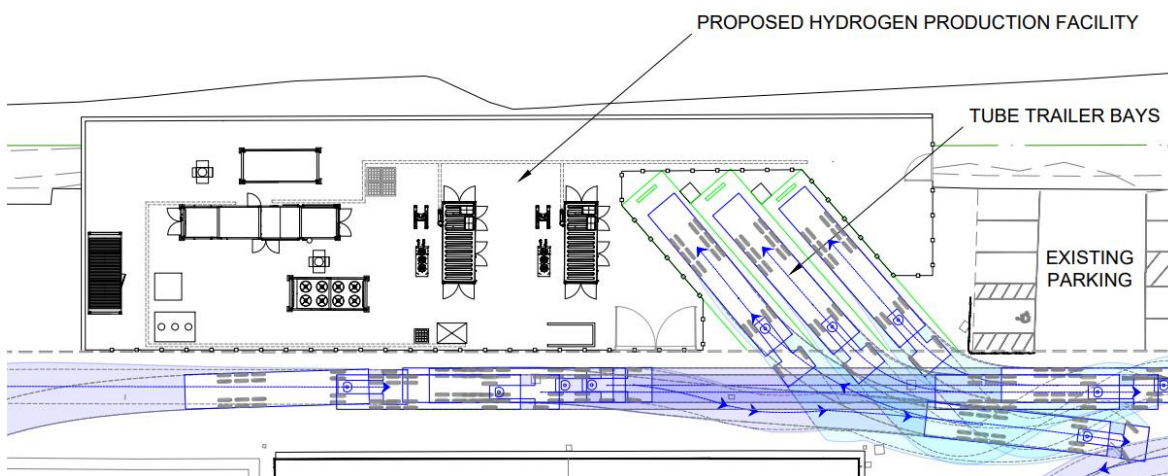


Figure 2-4 Extract of Development Proposal Plan (ref: Project Heart, North Pad WBE Margam, Protium Green Solutions Ltd)

3 Planning Policy and Flood Risk

3.1 Planning Context

Planning Policy Wales (PPW) 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. These policies have the aim that all development in Wales is sustainable and improves the social, economic, environmental and cultural wellbeing of Wales as set out in the Wellbeing of Future Generations Act 2015.

TAN-15, introduced by the Welsh Government in 2004, provides technical guidance relating to development planning and flood risk in Wales. The initial requirements of TAN-15 are to identify the vulnerability classification(s) and flood zones relevant to the proposed development, and to apply this information to the application of the justification tests.

An update for TAN-15 was released in October 2021. However, Welsh Government have since suspended this, and it is not currently known when the new TAN-15 will be published in its final form and implemented. Although the new TAN-15 is not a material consideration, Welsh Government and NRW advise that some consideration is given to the draft Flood Map for Planning (FMfP) as best available information. Therefore, where a site is located in a FMfP flood risk zone it is recommended that an FCA is carried out.

As a result of the above, both the DAM and the FMfP are considered as part of this FCA, although only the current TAN-15 has been applied to assessment.

3.2 Vulnerability Classification

TAN-15 assigns one of three flood risk vulnerability classifications to a development, as shown in Table 3-1.

The proposed development is for a Hydrogen Production Facility, which is deemed to be vulnerable industrial development. Consequently, the development is classified as Highly Vulnerable.

Table 3-1 Development categories as defined by TAN-15

Development category	Types
Emergency services	Hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood.

Development category	Types
Highly vulnerable development	All residential properties (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), 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.

3.3 Lifetime of development

The Welsh Government latest technical guidance for climate change states:

"When considering new development proposals, Technical Advice Note 15: Development, Flooding and Coastal Erosion (TAN-15) states that it is necessary to take account of the potential impacts of climate change over the lifetime of development. A rule of thumb is that residential development has a lifetime of 100 years while a lifetime of 75 years is assumed for all other developments."

As the proposals are for industrial development, a 75-year lifetime of development has been considered in this assessment.

3.4 Development Advice Map Classification

The DAM zone classification is used to trigger different planning actions based on a precautionary assessment of flood risk. The proposed development site is predominantly located within Zone A, as shown in Figure 3-1. Zone A is defined as areas considered to be at little or no risk of fluvial or tidal/coastal flooding. Zone B encroaches into part of the west of the site. Zone B is defined as areas known to have been flooded in the past evidenced by sedimentary deposits. Zone B is not a flood extent but is derived from the British Geological Survey (BGS) drift geology maps.

Zone B of the DAM is used as part of a precautionary approach to indicate where site levels should be checked against the extreme 0.1% Annual Exceedance Probability (AEP) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further. When TAN-15 was published in 2004 this 'check' was often important as flood mapping was in its infancy and errors and data limitations were common. This 'check' is rarely necessary now and the updated TAN-15 does away with this zone.

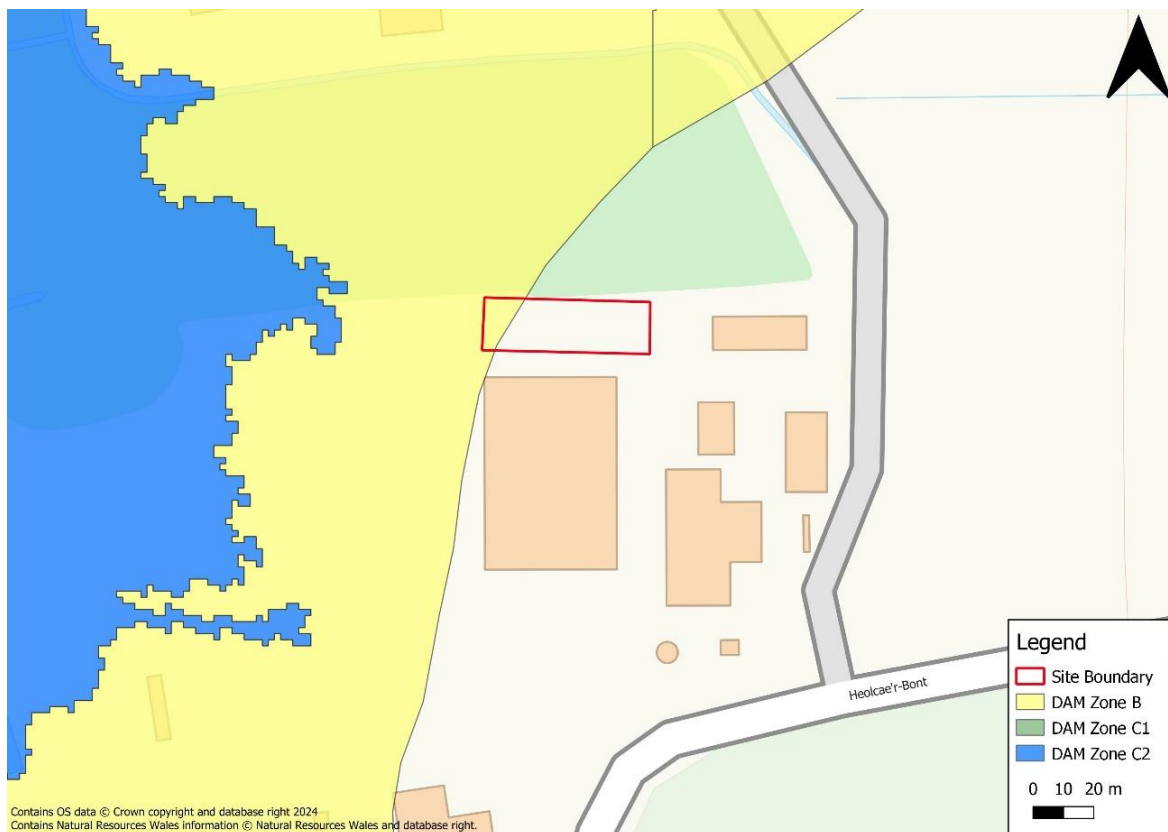


Figure 3-1 Development Advice Map

3.5 Flood Map for Planning

The Flood Map for Planning is used to trigger different planning actions in support of the new forthcoming TAN-15. Although the new TAN-15 is not a material consideration, the new Flood Map for Planning is useful in that it shows the flood risk allowing for climate change over a 100-year lifetime of development.

3.5.1 Flood Map for Planning - Rivers

The proposed development is located within Flood Zone 1 of the Flood Map for Planning for Rivers, as shown in Figure 3-2. Flood Zone 1 shows areas which have a less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.



Figure 3-2 Flood Map for Planning - Rivers

3.5.2 Flood Map for Planning - Sea

The proposed development is located within Flood Zone 1 of the FMfP for Sea, as shown in Figure 3-3. This means the site has a less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.



Figure 3-3 Flood Map for Planning - Sea

3.5.3 Flood Map for Planning - Surface Water and Small Watercourses

The proposed development is located within Flood Zone 1 of the Flood Map for Planning for Surface Water and Small Watercourses, as shown in Figure 3-4. This means that the site has a less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.



Figure 3-4 Flood Map for Planning - Surface Water and Small Watercourses

3.6 Justification Test and TAN-15

TAN-15 requires the application of the Justification Test for sites located within Zone C of the DAM. As the proposed development site is located in Zone A and Zone B, the Justification Test is not required. An assessment of flood risk at the site is assessed against the Acceptability Criteria for a comprehensive assessment of flood risk.

4 Flood Risk Assessment

This section assesses the risk to the proposed development site from all sources of flooding, the risk of increased flooding to others, and how flood risk can be managed. Information is taken from publicly available data sources.

JBA Consulting have recently completed updated detailed fluvial and tidal hydraulic modelling of the Margam area as part of a Flood Map Challenge (HCB-JBAU-XX-XX-RP-0001-S3-P02-Margam FMC Model Report), building on the original Capita URS 2015 1D-2D linked ESTRY-TUFLOW Margam model. The results of the Flood Map Challenge were approved by NRW in August 2023 and implemented into the Flood Map for Planning in the November 2023 update. These model updates were completed in discussion with NRW and have considered both fluvial and tidal risk. No updates to the model have been made since the submission of the Flood Map Challenge. A summary of the model updates for the Flood Map Challenge is as follows:

- Updated hydrology inflows and downstream boundary conditions (to reflect the updated UK Coastal Flood Boundary dataset released in 2018), reviewed and approved by NRW prior to inclusion within the updated model. Climate change estimates have been updated in line with NRW guidance.
- Update to the latest TUFLOW executable (at the time of the model update - 2020-10-AF).
- Update to the representation of bridge units within the 1D model extent to reflect updates to best practice and modelling efficiencies since the initial model build.
- Collection and inclusion of updated river channel survey collected in 2022 by JBA Consulting.
- Improved schematisation of the Ty Du reservoir.
- Updated topographical data across the model extent using OS MasterMap and LiDAR updates available since the initial model build.

The results from JBA's updated modelling, and the latest Flood Map for Planning have therefore been used to inform this FCA.

4.1 Review of Existing Flood Risk Data

The latest available information on flood risk at the site, published as Flood Risk Assessment Wales by NRW, is summarised in Table 4-1 below.

Table 4-1 Flood Risk Summary

Source of Flooding	Onsite Presence	Description
Flood Risk from Rivers	✗	The site is at very low risk of fluvial flooding
Flood Risk from the Sea	✗	The site is at very low risk of tidal flooding

Source of Flooding	Onsite Presence	Description
Flood Risk from Surface Water and Small Watercourses	✗	The site is at very low risk of flooding from surface water and small watercourses
Flood Risk from Groundwater	✗	The site is at very low risk of flooding from groundwater
Flood Risk from Reservoirs	✓	The site is at low risk of flooding from reservoirs
Flood Risk from Sewers	✗	The site is at low risk of flooding from sewers

4.2 Historical Flooding

NRW's map of recorded flood extents does not show any evidence of historic flooding on the site. Neath Port Talbot's Preliminary Flood Risk Assessment³ and Flood Risk Management Strategy⁴ identified no other historical flooding records at the site.

4.3 Flood Risk from Rivers

NRW's Flood Risk Assessment Wales (FRAW) Flood Risk from Rivers mapping indicates that the site is at very low risk of fluvial flooding, as shown in Figure 4-1. This means that there is a less than 0.1% AEP chance of fluvial flooding in any given year.

³ [npt.gov.uk/media/4629/pfra_report_2011.pdf?v=20171123145433](https://www.npt.gov.uk/media/4629/pfra_report_2011.pdf?v=20171123145433)

⁴

https://www.npt.gov.uk/media/4930/lfrms_npt_local_flood_risk_management_strategy.pdf?v=20170627002244

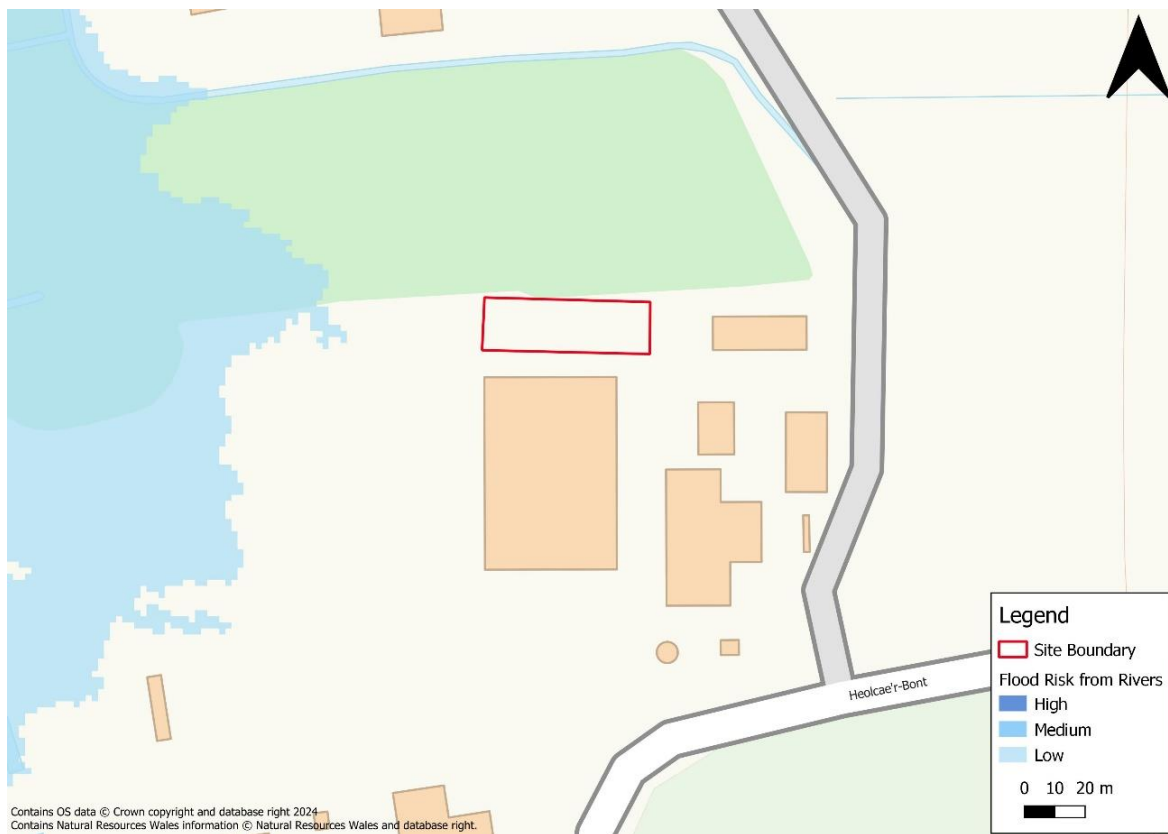


Figure 4-1 FRAW Flood Risk from Rivers

The NRW FRAW mapping does not consider the application of climate change. The conclusion of a very low risk of fluvial flooding is supported by the Flood Map for Planning, and the updated Margam Model.

Figure 4-2 presents the predicted flood extent during the 0.1% AEP fluvial event. The proposed development site is predicted to remain flood free during this event.

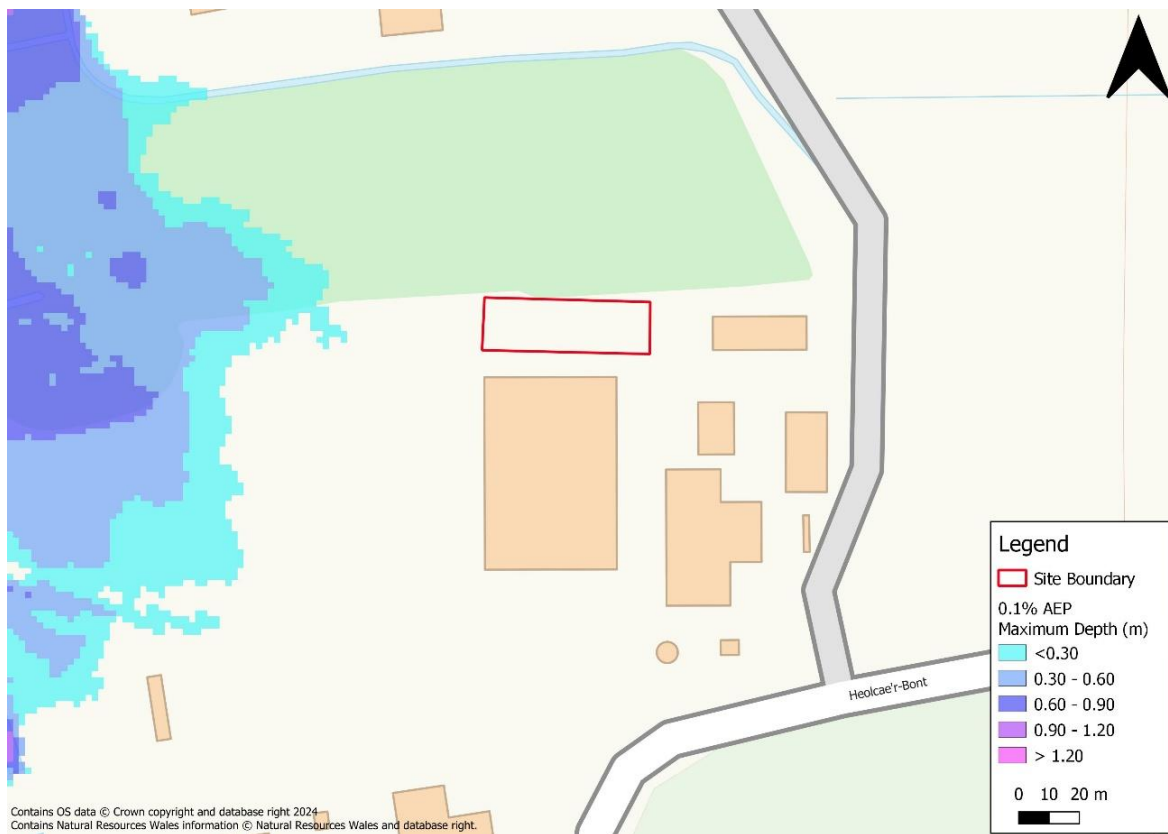


Figure 4-2 0.1% AEP fluvial event

4.4 Flood Risk from the Sea

Figure 4-3 shows NRW's FRAW Flood Risk from the Sea mapping which indicates that the site is located outside of the mapped flood event, therefore is at very low risk of tidal flooding. As a result, there is less than a 0.1% AEP chance of tidal flooding in any given year.



Figure 4-3 FRAW Flood Risk from the Sea

The conclusion of a very low risk of fluvial flooding is supported by the Flood Map for Planning, and the updated Margam Model.

Figure 4-4 presents the predicted flood extent during the 0.1% AEP plus climate change tidal event. The proposed development site is predicted to remain flood free during this event.

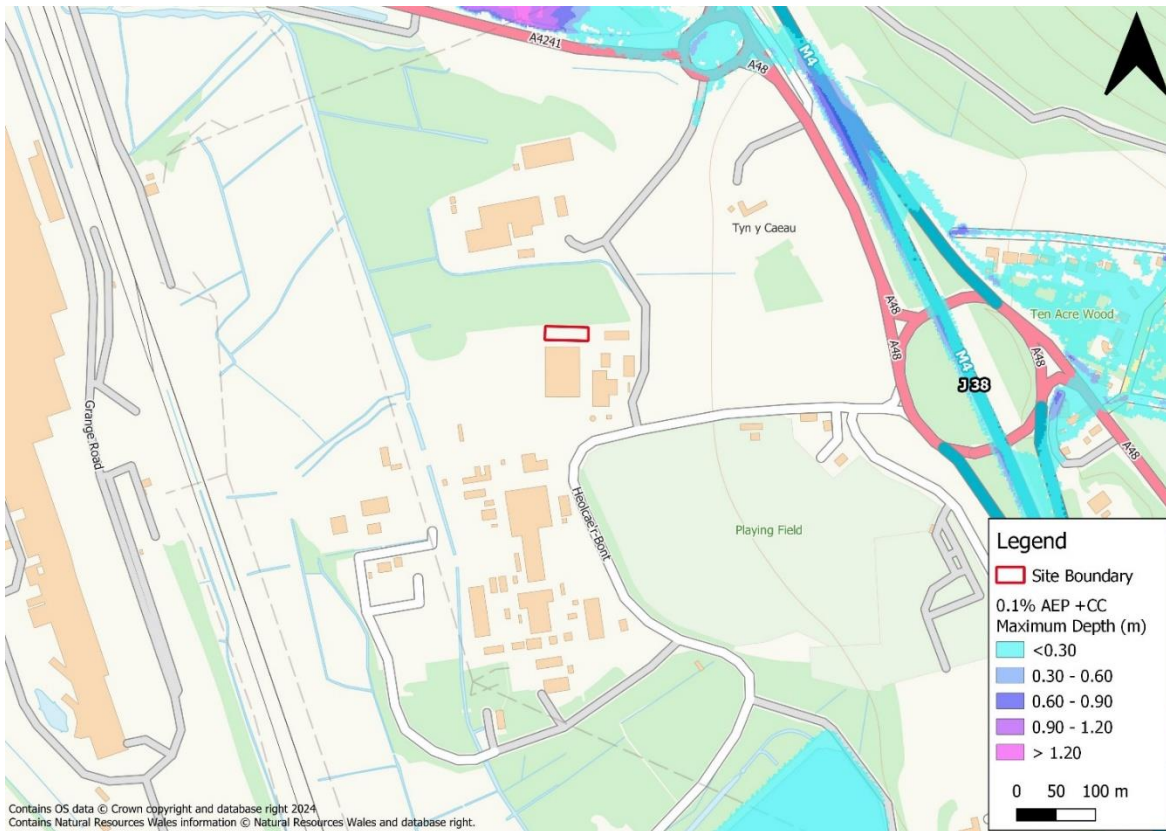


Figure 4-4 0.1% AEP +CC tidal event

4.5 Flood Risk from Surface Water and Small Watercourses

NRW's FRAW Surface Water and Small Watercourses map shows that the site is at very low risk of flooding from this source, as shown in Figure 4-5. This means that there is a less than 0.1% AEP chance of flooding in any given year from surface water and small watercourses.

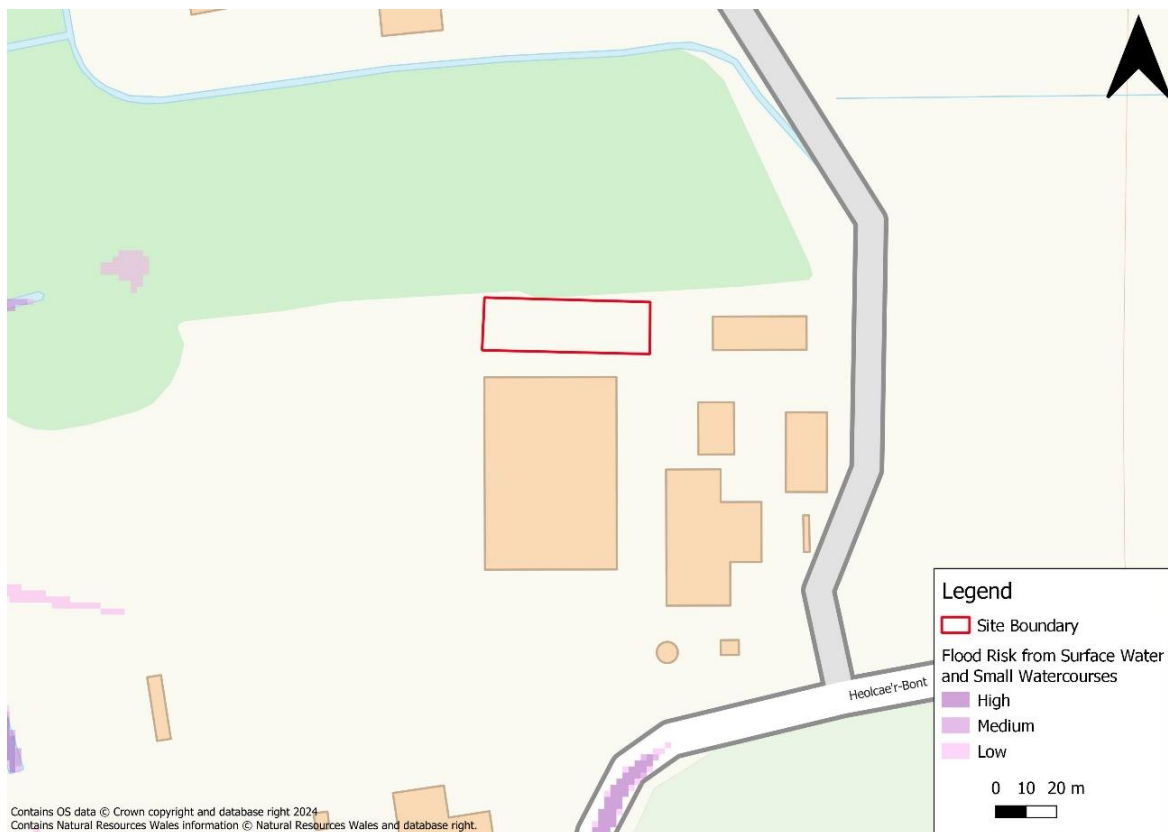


Figure 4-5 FRAW Flood Risk from Surface Water and Small Watercourses

4.6 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months, and can damage property. The risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

Neath Port Talbot's Local Flood Risk Management Strategy states that *"Historically, there are no specific areas of groundwater flooding recorded in the Neath Port Talbot area."* Therefore, the risk of groundwater flooding to the proposed development site is considered to be very low.

4.7 Flood Risk from Reservoirs

Figure 4-6 indicates that the site is at risk of flooding from failure of the Eglwys Nnunydd Reservoir, located approximately 670m to the south of the proposed development site.

All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in Wales, NRW ensures that reservoirs are inspected regularly, and essential safety work is carried out. The regulatory nature of reservoir management means that the probability of a failure at a statutory reservoir is very low. It is therefore concluded, given the probability and consequences of such an event, that the risk at the proposed development site as a result of reservoir failure is low.

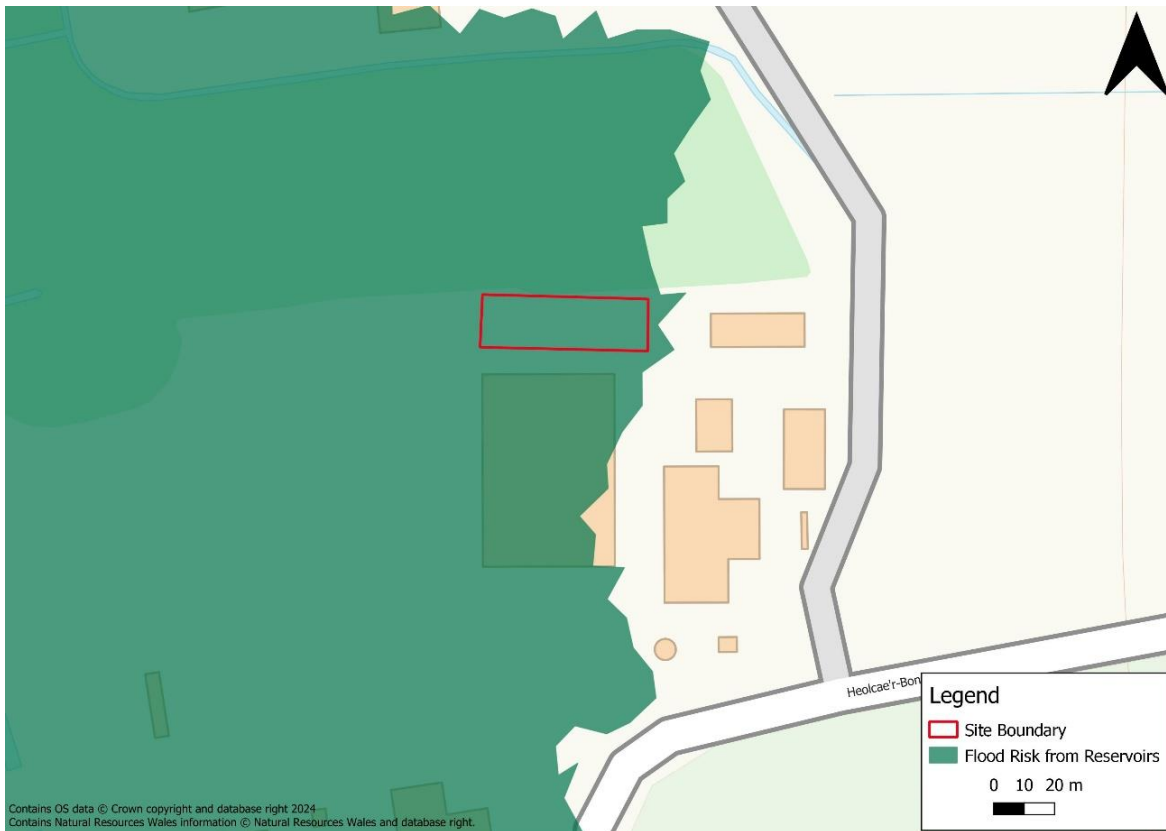


Figure 4-6 FRAW Flood Risk from Reservoirs

4.8 Flood Risk from Sewers

Neath Port Talbot's Flood Risk Management Strategy states that 340 sewer flooding incidents have been recorded by the relevant water company; however the location of these sewers are unknown. There is no known flood history of sewer flooding at the site, and therefore the risk of sewer flooding is considered to be low.

5 Assessment of Acceptability Criteria

Table 5-1 assesses the proposed development against the acceptability requirements by TAN-15 (2004) to be met. Although the Acceptability Criteria is not strictly required for this development under TAN-15, an assessment has been included for completeness and as a precautionary approach to flood risk.

Table 5-1 Acceptability Criteria for TAN-15

TAN-15 Justification Criteria	Comments	Achieved?
Developer is required to demonstrate that the site is designed to be flood free for the lifetime [Ref: TAN-15 A1.5] of development for a 1 in 100 (1%) chance (fluvial) or a 1 in 200 (0.5%) chance (tidal) flood event including an allowance for climate change in accordance with TAN-15 Table A1.14.	Fluvial The proposed development is predicted to be flood free in the 1% AEP plus climate change event. Tidal The development is proposed to be flood free in the 0.5% AEP event plus climate change.	✓
The development should be designed so that in an extreme (1 in 1000) event there would be less than 600mm of water on access roads and within the property.	Fluvial The proposed development is predicted to be flood free in the 0.1% AEP event. Tidal The development is proposed to be flood free in the 0.1% AEP event plus climate change.	✓
No flooding elsewhere	Predicted flood extents for all sources do not encroach into the proposed development site, and there is no known change in ground level as a result of the development. Therefore, third party detriment is unlikely as a result of the development.	✓
Flood defences must be shown by the developer to be structurally adequate particularly under extreme overtopping conditions (i.e. that flood with a 1 in 1000 chance of occurring in any given year).	N/A - The proposed development is not served by flood defences.	✓
The developer must ensure that future occupiers of development are aware of the flooding risks and consequences.	The developers shall provide future occupiers with information on flood risk in the form of this report.	✓

TAN-15 Justification Criteria	Comments	Achieved?
Effective flood warnings are provided at the site.	N/A - The proposed development site is flood free in all conditions therefore flood alerts and warnings are not relevant.	✓
Escape/evacuation routes are shown by the developer to be operational under all conditions.	N/A - The proposed development site is flood free in all conditions.	✓
The development is designed by the developer to allow the occupier of the facility for rapid movement of goods/possessions to areas away from flood waters.	Flood free access and egress for the site can be obtained from the east of the site via the A48 and M4.	✓
Development is designed to minimise structural damage during a flood event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of a flood.	N/A - The proposed development is flood free in all conditions.	✓

6 Conclusions

JBA Consulting were commissioned by Protium Green Solutions Ltd in August 2023 to prepare a Flood Consequences Assessment (FCA) to support a planning application for a Hydrogen Production Facility in Port Talbot, South Wales.

The existing site is brownfield in nature and exists as a concrete slab at Western Bio Energy power station. Development proposals for the site are for a Hydrogen Production Facility with associated components.

NRW LiDAR data indicates that the site is relatively flat, with approximate ground levels lowest in the north-west of the site at approximately 6.28mAOD, and highest in the south-east at approximately 7.37mAOD.

The development is classified under TAN-15 as 'Highly Vulnerable' development.

The site is predominantly located in DAM Zone A, with part of the west of the site shown to be located within Zone B on the DAM map. The Flood Map for Planning suggests the site is located within Zone 1 for Rivers, and Surface Water and Small Watercourses, and Zone 1 for the Sea.

NRW's FRAW mapping indicates that the development site has a very low risk of flooding from Rivers, the Sea, and Surface Water and Small Watercourses. The site is at low risk of flooding from Reservoirs.

JBA's recently updated detailed fluvial and tidal hydraulic model of the Margam area was used to investigate fluvial and tidal risk at the proposed development site.

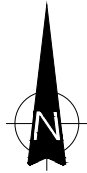
The proposed development site is flood free during the fluvial 1% AEP plus climate change and 0.1% AEP event. It also remains flood free during the tidal 0.5% AEP event and the 0.1% AEP event with allowances for climate change.

The Justification Test is not applicable at the site is located in DAM Zone A and B.

This FCA has demonstrated that all requirements of TAN-15, including the Acceptability Criteria, have been satisfied.

Consequently, it is concluded that on the grounds of flood risk, the proposed development meets the requirements set out in TAN-15 and the aims of Planning Policy Wales.

A Development Proposal



PROPOSED HYDROGEN PRODUCTION FACILITY

TUBE TRAILER BAYS

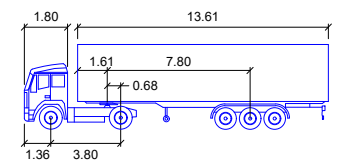
EXISTING PARKING

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KEY



Artic

Tractor Width : 2.55 meters
Trailer Width : 2.55
Tractor Track : 2.55
Trailer Track : 2.55
Lock to Lock Time : 6.0
Steering Angle : 42.7
Articulating Angle : 70.0

REV	DESCRIPTION	DATE	BY

CLIENT

PROTIUM



4245 Park Approach, Thorpe Park, Leeds. LS15 9GB. 0113 264 9960

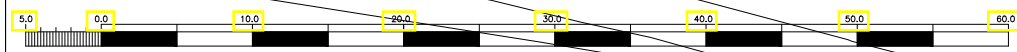
JOB TITLE

MARGRAM HYDROGEN
PRODUCTION FACILITY

DRAWING TITLE

SWEPT PATH ANALYSIS

DRAWN	DATE	APPROVED	DATE
S.T	11/4/2024	F.W	11/4/2024
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