

Report

Flood Consequence Assessment

Newport BESS

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1 Introduction

Sweco UK has been appointed by Field Energy Limited to undertake an update to this Flood Consequence Assessment (FCA) to inform the design of the site located to the South of Traston Road, NP19 4RD.

This report has been prepared for the sole use of Field Energy Limited and the contents should not be relied upon by others without the express written authority of Sweco. If any unauthorised third party makes use of this report they do so at their own risk and Sweco owes them no duty of care or skill.

The site is shown on the National Resource Wales (NRW) Flood map for planning (see Figure 1) to lie in the Medium Risk Flood Zone 1 for tidal flooding. The Medium Risk Flood Zone is the area described as having between a 0.5% (200 year) and 3.3% (30 year) annual probability of tidal flooding. All land uses are appropriate in this flood zone.

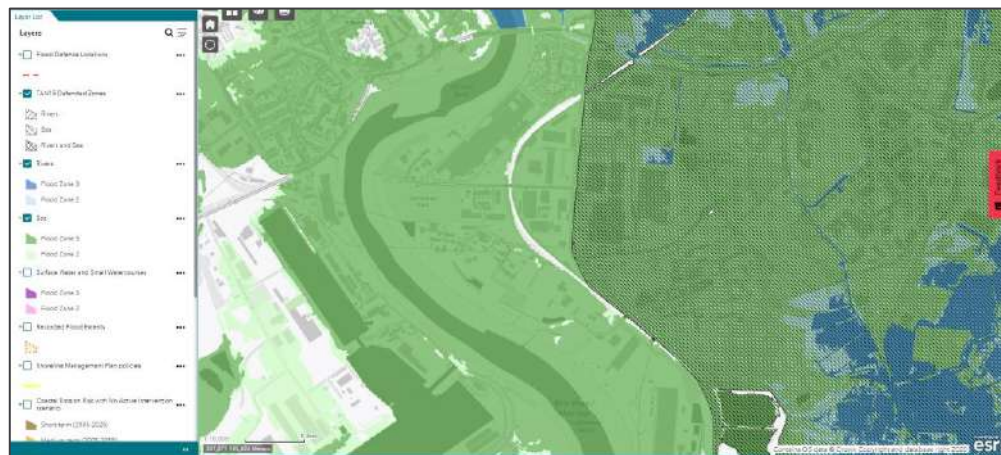


Figure 1 - NRW Flood map for planning

The latest Technical Advice Note (TAN) 15 Development Advice Map shows the site to lie in flood zone C1, land considered to be at risk of flooding but is served by significant flood infrastructure. The site is in a TAN15 Defended Zone and commercial developments are classified as Less Vulnerable, which is permitted in Zone C1 following a satisfactory completion of the justification test and acceptability of consequences.



Figure 2 – TAN 15 Development Advice Map

This report includes commentary on the surface water drainage strategy for the site which sets out how the proposals should not increase off-site flood risk. The report discusses the use of Sustainable Drainage Systems (SuDS) at the site for the attenuation and removal of pollutants prior to discharge from the site.

2 Existing Conditions and Site Access

2.1 Existing Conditions

- 2.1.1 The site is located to the south of Traston Road, Newport. A site location plan is located in Figure 1 of this report.
- 2.1.2 The site is approximately a total size of 0.7ha and comprises approximately 28% of a larger site which is made up of a combination of previously developed BOC depot and Greenfield land.
- 2.1.3 The north of the larger site is bound by Traston Road; to the north west is a power generation facility. All other directions are bounded by undeveloped areas. The Battery site is located within the south western corner of the larger site.

2.2 Proposed Development

- 2.2.1 Field Energy is proposing to develop the site with a commercial scale battery storage and associated infrastructure.
- 2.2.2 This report has been updated following a revision of the proposals, which includes the minor amendments listed below:
 - Changes to the arrangement/layout of equipment platforms;
 - The construction of new harmonic filter equipment (principally changing the size of the control room);
 - The introduction of water tanks beneath the welfare building;
 - Minor extension of fencing (approx. 40 metres of new fencing to close a previous gap);
 - Emergency warning beacons have been added to the PCS;
 - The access barrier has been removed in favour of a gate;
 - An extension of one of the building platforms; and
 - Increased height of CCTV post lighting and some new CCTV posts (non-lit).
- 2.2.3 The access to the proposed development will be from Traston Road to the north.

2.3 Policy Context

- 2.3.1 TAN 15 (2004) is the planning guidance used in Wales to assess flood risk. A requirement of TAN 15 is that developers making planning applications on sites that are potentially at risk from flooding should consult with Natural Resources Wales and produce a Flood Consequence Assessment (FCA) to support their proposals.
- 2.3.2 This report sets out how the development compares by reference to Section 5, 6 & 7 and Appendix 1 of TAN 15.
- 2.3.3 A new version of TAN 15 was due to come into effect in 2023, however this has been suspended pending further consultation.
- 2.3.4 This application is assessed against the requirements of TAN 15 at this current time of application but with reference to the anticipated 2023 version.

3 Requirements of the Flood Consequence Assessment

3.1 Proposed Development

- 3.1.1 TAN 15 – Development and Flood Risk, Appendix 1 Section A1.17 sets out the requirements of a Flood Consequence Assessment.
- 3.1.2 The TAN 15 Appendix 1 Section A1.17 guidance specifies that the report shall contain the following:
- Location Plan – see section 4 of this report and Appendix A.
 - Level Plan – see section 5 and Appendix A
 - Details of existing flood alleviation measures – see section 6
 - Access/Evacuation Routes – Section 7
 - Source of flooding - see section 8
 - Flood Plain – see section 9
 - Structures influencing Local Hydraulics – see section 10
 - Flood Probabilities - see section 11
 - Cross Section of Proposed Site – see section 12
 - Sewer Hydraulics – see section 13
 - Flood Volume Displaced – see section 14
 - Impact of Displaced water – see section 15
 - Impact of Fluvial Morphology – see section 16
 - Climate Change Impacts – see section 17
 - Flood Defence Residual Risk Assessment – see section 18
 - Summary – see section 20
- 3.1.3 The following sections address each of the points referring to the relevant paragraph in TAN 15, Appendix 1E, paragraph A1.17
- 3.1.4 The proposed on-site drainage strategy is discussed in section 19 of this report.

4 Site Location (A1.17.1)

4.1 Site Location

- 4.1.1 The site is located south of Traston Road. The grid reference is ST 33123 85671. Refer to Figure 3 for location plan.



Figure 3 – Location Plan

- 4.1.2 The north of the site is bound by Traston Road; to the north west is a power generation facility. All other directions are bound by undeveloped areas, though the surrounding area is generally commercial/industrial in use.
- 4.1.3 The red line boundary of the site covers approximately 0.7ha.

5 Level Plan (A1.17.2)

5.1 Site Survey

- 5.1.1 A topographical survey of the site has been undertaken.
- 5.1.2 The site falls from south to north with levels ranging from approximately 7.5mAOD to 6.0mAOD. Traston Road to the north is elevated above the site's northern boundary of the application site with a level of approximately 7.0mAOD.
- 5.1.3 Levels where the battery site is to be constructed vary between 6.44mAOD and 7.5mAOD.

6 Existing Alleviation Measures (A1.17.3)

6.1 Flood Mitigation

- 6.1.1 The TAN 15 Development Advice Map (DAM) shows that the site is in Flood Zone C1, which is land at risk of flooding that is served by defence infrastructure.
- 6.1.2 A Product 4 data request has been made to Natural Resources Wales however this data is unavailable. See report section 8.1 below for more details on flood model data.
- 6.1.3 The site is identified as being within Flood Zone C1, and whilst this is not shown in the NRW mapping provided, site specific Flood Level data from the undefended model are higher than those in the defended model.
- 6.1.4 The defences that would affect the site specific Flood Level data are the Riverside tidal defences, which are in “Very Good” condition according to NRW. Refer to Appendix D.
- 6.1.5 As the site is within Flood Zone C1 a justification test is required.

6.2 Justification Test

- 6.2.1 TAN 15 indicates that development should be located away from C1 unless it can be justified.
- 6.2.2 As the UK electricity system continues to decarbonise, significant additional energy storage capacity is required in order to smooth out the variability of wind and solar renewable energy. On an increasingly constrained electricity network, grid capacity is the single biggest limiting factor for build out of energy storage assets. The Traston Road development site is located within 100m of the Western Power Distribution substation, one of the few substations in South Wales with spare capacity to connect a battery storage facility. The Traston Road development site was selected for this reason as it is the only viable site for construction in the immediate vicinity of the substation. The construction of the battery energy storage facility will assist in the UK’s journey to net zero carbon enabling surplus renewable energy to be stored and used in place of fossil fuel generation which would otherwise be required.
- 6.2.3 It is also to be partly constructed on previously developed land and the consequences of flood events are considered below with necessary mitigation provided.

7 Access/Evacuation Routes (A1.17.4)

7.1 Site Access Routes

- 7.1.1 The main vehicular and pedestrian access to the site will be from Traston Road to the north.
- 7.1.2 The TAN 15 Development Advice Map shows that the area immediately to the north of the site is classified as Zone C1 so access will also become affected in a severe storm event.
- 7.1.3 The site is not usually manned, in the event of flooding of the site it is not expected that there will be any people on site to evacuate, however if evacuation were needed then the route to a safe place would be east and north on Traston Road to Nash Road, then north on Nash Road to the A5 and then north-east on A5.



Figure 4 – Evacuation Route

- 7.1.4 Figure 4 shows the most suitable route to an area of Flood Zone A which is an area outside of the modelled flood extent, if this area is not flood free, by continuing along the A48, Flood Zone A can be reached.
- 7.1.5 The evacuation route is in a direction away from the source of the flooding.
- 7.1.6 As the site is commercial, the users are deemed as less vulnerable to flooding and suitable evacuation time should be available following the users signing up to NRW's early warning flood system.
- 7.1.7 The site will not usually be occupied but any the owners of the site should subscribe to all available NRW early warning systems and have the ability to remotely shut down all electrical equipment in order to protect the site in a severe storm event.

8 Sources of Flooding (A1.17.5)

8.1 Tidal Flooding

8.1.1 The proposed development site is located approximately 430m to the north east of the tidally influenced River Usk.

8.1.2 NRW was asked to provide Product 4 data for the site, however NRW confirmed that this is not available and that only Product 5 & 6 data is available. This was obtained for review and to inform this FCA.

8.1.3 The Caldicot and Wentlooge Coastal Modelling Summary Report (JBA, June 2016) contains flood data information relative to Newport and is therefore applicable to the site. Table 11-2 of the report provides updated tidal levels that are used to determine the tidal flooding at the site. The table confirms that for the Q200 tidal level there has been no increase in predicted tide height with the new flood modelling data.

8.1.4 As the Caldicot and Wentlooge Coastal Modelling Summary Report does not provide detailed site level flood information and Product 4 data is no longer available data was obtained from application 16/1140 for the adjacent site which also covers the site now being applied for. This data is included in Appendix D.

8.1.5 The defended model results (2011) for the site give flood levels of:

- Q200 2086 7.75mAOD
- Q200 2111 7.98mAOD
- Q1000 2086 7.94mAOD
- Q2100 2111 8.21mAOD

8.1.6 This data is still valid as the current modelled tidal levels in the Caldicot and Wentlooge Coastal Modelling Summary Report are the same as the 2012 report from which these flood levels were derived.

8.1.7 Current climate change allowances use a rise of 14.5mm per year up to 2116, there is no advice available beyond that date for likely sea level rise. It is not as simple as increasing the modelled on site levels by the climate change allowances as the mechanism by which water arrives at the site, i.e. breach, over-topping or a combination of the two, affects the rate of flow into the flood cell and therefore the predicted flood level.

8.1.8 As the application is related to a battery storage facility it is reasonable to assume that technology will improve the storage capacity of batteries and that the lifetime of the development will be less than 25 years. However, a design life of 75 years has been used for this assessment as noted in section 11.1 below.

8.2 Fluvial Flooding

- 8.2.1 The NRW Flood Map indicates that the site is situated within Zone 3, which is land within the 1 in 100 year undefended fluvial and 1 in 200 year undefended tidal flood area. Although this area is within the fluvial flood area, the main controlling influence is tidal which is outlined above.

8.3 Pluvial Flooding

- 8.3.1 The NRW Risk of Surface Water Flooding Map (Figure 5) shows that the site is at very low risk of pluvial flooding.

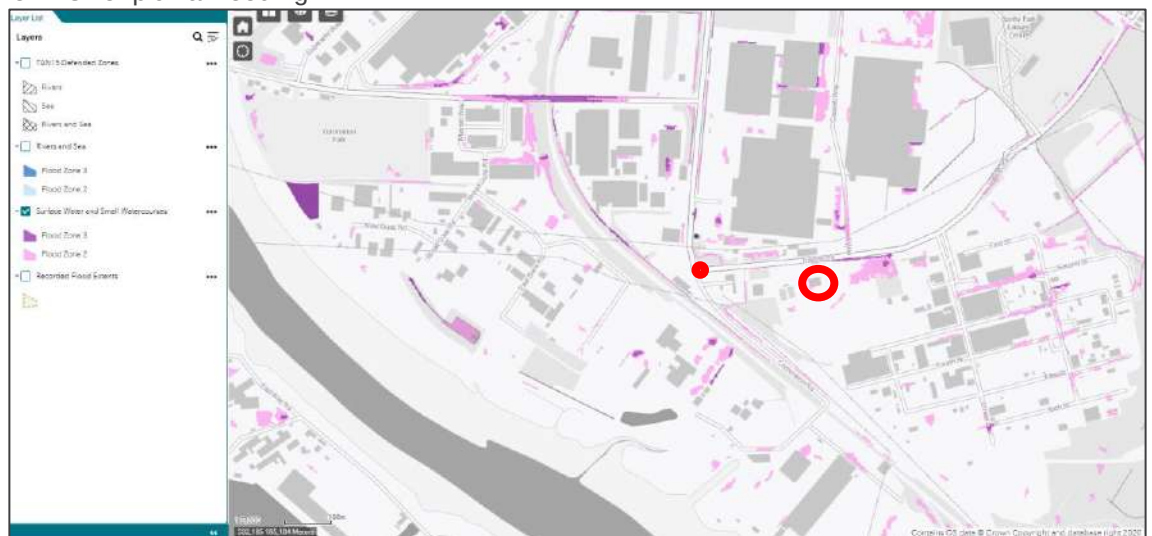


Figure 5 – NRW Risk of Surface Water Evacuation Route

8.4 Sewer Flooding

- 8.4.1 Refer to Section 13.

8.5 Groundwater Flooding

- 8.5.1 British Geology Survey (BGS) data indicates that the bedrock under the site is Mercia Mudstone Group. There are superficial Tidal Flat Deposits, made up of Clay and Silt, see Figures 6 and 7 for further details.

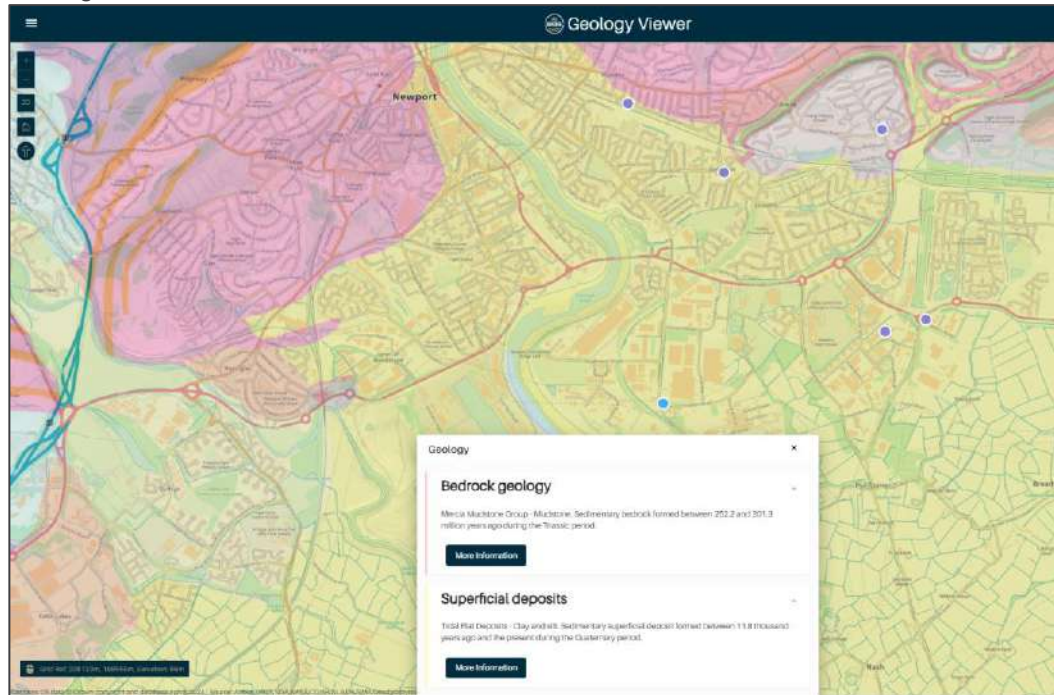


Figure 6 – BGS Geology Viewer

- 8.5.2 Groundwater flooding can occur when the water table rises and emerges above the ground level. There is no evidence of groundwater flooding risk within the site. Borehole logs (ST38NW112) near the site held by the BGS indicate that groundwater was not detected up to 8.25mbgl at some locations. Groundwater was encountered as indicated in the window sample logs but groundwater is likely to be confined to the peat lenses and the made ground. Any groundwater that did express at the site surface would simply drain away due to the local topography.

9 Flood Plain (A1.17.6)

9.1 Flood Plain Extent

- 9.1.1 The extent of the predicted 1% and 0.1% annual probability flood plain is indicated on the NRW Flood Map. Refer to Figure 1.
- 9.1.2 The site is wholly situated within NRW Flood Zone 3. As this area is considered a flood area any floodplain area that is lost by making ground and constructing buildings should be compensated via a detailed compensatory scheme.
- 9.1.3 The Q1000 + 75 year climate change level for the site can be calculated from the site flood levels in Section 8 plus an allowance of 14.5 mm/yr (assuming on site levels rise at same rate as tidal climate change allowances) which gives a level of 8.1 mAOD. Proposals for the scheme involve all buildings being constructed on stilts which raise the FFL above the flood level.
- 9.1.4 It is proposed to raise all structures to a level of 8.51mAOD which is significantly higher than predicted flood levels. This will provide mitigation against damage from flooding.
- 9.1.5 Proposals for the scheme involve all buildings being constructed on stilts which raise the FFL above the flood level. The stilts are of only modest cross-sectional area thus ensuring that any flood storage lost as a result of the development is negligible, therefore no flood compensation is required.
- 9.1.6 The welfare building is proposed to include tanks which will be below the raised floor level but suspended above nominal ground level. Given the level and volume of these tanks, negligible displacement of flood water storage is expected. This is detailed further in section 14.

10 Hydraulic Structures (A1.17.7)

10.1 Restrictions to Flow

- 10.1.1 There are no watercourses running through the site. There is a small drainage ditch that flows alongside Corporation Road to the south west of the application site. This watercourse is culverted under both Traston Road and the cycle track.
- 10.1.2 There is also a small drainage ditch located along the northern boundary of the application site between the application boundary and Traston Road. This drainage ditch is also culverted in locations.
- 10.1.3 There are no reported incidences of culvert flooding based on current rates and discharge from the site will mimic current Greenfield conditions, so risk will not be increased.

11 Flooding Probabilities (A1.17.8)

11.1 Flood Risk

- 11.1.1 The TAN 15 DAM indicates that the proposed site is located within Flood Zone C1, which is land that is benefitting from flood defences.
- 11.1.2 The design life of the site is 75 years so the flood level in 2097 from the NRW modelled data will be used to assess the effect of climate change.
- 11.1.3 For the Q200 storm event, a flood level of 7.75mAOD is modelled with a level of 7.91mAOD including climate change.
- 11.1.4 For the Q1000 storm event, a flood level of 7.94mAOD has been calculated in the model with a level of 8.1mAOD with an allowance for climate change.
- 11.1.5 The justification test has been carried out in Section 6.2 in line with TAN 15 and other appropriate mitigation measures have been provided in order to make the consequences of flooding within the site acceptable.

12 Cross Sections and Finished Levels (A1.17.9)

12.1 Proposed Site Levels

- 12.1.1 The development is a commercial scale battery scheme.
- 12.1.2 It is proposed that electrical equipment will be raised 600mm above the Q200 with an allowance for climate change level of 8.51mAOD.
- 12.1.3 All of the equipment at the site is proposed to be installed on stilts, above the flood level for the site.
- 12.1.4 The site operator has also confirmed that if a BESS site does become submerged, their electrical protection systems will operate to disconnect them from the sub-station.

13 Sewer Hydraulics (A1.17.11)

13.1 Sewer Flooding Reports

- 13.1.1 Newport City Council have confirmed that they hold no records of any sewer related flooding within the application site.
- 13.1.2 Newport City Council indicated that there are issues with highways drainage within Corporation Road caused by maintenance issues that are currently being monitored.
- 13.1.3 The Local Flood Risk Management Strategy produced for Newport City Council by Arup in 2014 does not highlight any issues regarding sewer flooding in this area.
- 13.1.4 Dwr Cymru Welsh Water have confirmed that there are no reported incidences of sewer flooding within the vicinity of the site.
- 13.1.5 A drainage strategy is included to ensure that the future risk of sewer flooding is not increased.

14 Flood Volume Displacement (A1.17.12)

14.1 Displacement of Water

- 14.1.1 As the site is situated within the flood zone, a flood storage compensatory scheme may be required in order to mitigate flood risk for the surrounding area.
- 14.1.2 The proposals include for the entirety of the development area to be constructed on stilts, minimising the displacement of flood water. Alongside this, the steel platforms that the equipment sits on are made from permeable mesh to allow rainwater to disperse through.
- 14.1.3 It is proposed that any loss of flood storage, which will be negligible as the stilts will not occupy any significant volume, is compensated as described in section 9. To summarise, compensation is not required due to the inclusion of stilts throughout the design.
- 14.1.4 The welfare buildings are proposed to include tanks which will be below the raised floor level but suspended above nominal ground level. Depending on the level and volume of these tanks, there could be some displacement of flood water storage.
- 14.1.5 The tanks are shown to be set at an invert level approximately equal to nominal ground level, which is assumed to be 7.00mAOD, approximately 1.5m below the finished floor level of the welfare building. There are two tanks with different profiles, a potable water storage tank (1,000L internal volume) and a wastewater storage tank (2,300L internal volume).
- 14.1.6 The potable water storage tank is 1.15m high so would only be fully submerged during any flood whose level exceeds 8.15mAOD. For the flood events given in section 11, the following submersion depths and volumes have been calculated and tabulated in Table 1.

Flood event	Flood level (mAOD)	Submersion depth (m)	Displaced volume (m ³)
Q200	7.75	0.75	0.652
Q200 + CC	7.91	0.91	0.791
Q1000	7.94	0.94	0.843
Q1000 + CC	8.10	1.10	0.956

Table 1 – Submersion depths and volumes for the potable water storage tank by flood event

- 14.1.7 The wastewater storage tank is 0.280m high so would only be fully submerged during any flood whose level exceeds 7.280mAOD. For the flood events given in section 11, the following submersion depths and volumes have been calculated and tabulated in Table 2.

Flood event	Flood level (mAOD)	Submersion depth (m)	Displaced volume (m3)
Q200	7.75	0.280	2.300
Q200 + CC	7.91	0.280	2.300
Q1000	7.94	0.280	2.300
Q1000 + CC	8.10	0.280	2.300

Table 2 – Submersion depths and volumes for the wastewater storage tank by flood event

- 14.1.8 The total flood plain volume displacement has been calculated and is summarised in Table 3. The volumes shown are insignificant and can be considered to have a negligible impact on the level of flood water in the local area during the events noted. Compensation of these volumes is therefore not considered to be necessary.

Flood event	Volume displaced by potable water tank (m3) see Table 1	Volume displaced by wastewater tank (m3) see Table 2	Aggregate displaced volume (m3)
Q200	0.652	2.300	2.952
Q200 + CC	0.791	2.300	3.091
Q1000	0.843	2.300	3.143
Q1000 + CC	0.956	2.300	3.256

Table 3 – Aggregate volumes displaced by the welfare facility tanks by flood event

15 Impact of Displaced Water (A1.17.13)

15.1 Offsite Flooding

- 15.1.1 Flood water displaced by the development will be negligible due to its construction on stilts, therefore a compensatory scheme will not be required.

16 Impact on Fluvial and Coastal Morphology (A.17.14)

- 16.1.1 As the site will continue to discharge at Greenfield rates to the watercourse, the impact on the fluvial morphology is not expected to change from current conditions.

17 Climate Change Impacts (A1.17.15)

- 17.1.1 The flood data provided by Natural Resources Wales allows for climate change through an increase in sea level.
- 17.1.2 An assessment of flood levels has been taken from 2091, which takes into account the change in sea level over the design life of the application site.
- 17.1.3 Storage estimates within MicroDrainage software allow a 40% increase in precipitation to allow for the changes in climate anticipated within the design life of the site.

18 Flood Defence and Residual Assessment (A1.17.16)

18.1 Flood Defence Assessment

18.1.1 The site is protected by the Riverside tidal defences.

18.1.2 NRW have indicated that the Riverside Defences are in condition 1, which are defences that are "Very Good" in condition.

19 Drainage Strategy for the Proposed Development

19.1 Surface Water

- 19.1.1 The surface water drainage strategy will be delivered in accordance with prevailing local and national planning policy. Currently, the most significant factors influencing the design of the drainage strategy are the Flood and Water Management Act 2010, Newport City Council's Flood Risk Management Strategy, the Interim Non-statutory Standards for Sustainable Drainage (SuDS) in Wales, Technical Advice Note 15 (TAN 15) and Planning Policy Wales (PPW).
- 19.1.2 This drainage strategy sets the guidelines for future detailed design, but more importantly, it demonstrates that a sustainable drainage solution is deliverable at this site, complying with all relevant planning and legislative criteria. The most important function of this drainage strategy is to demonstrate that the development will not increase flood risk elsewhere.
- 19.1.3 The method of surface water discharge is critical to ensuring that flood risk will not be increased elsewhere. TAN 15 guidance and Building Regulations dictate the hierarchy for discharge options. In order of preference these are:
- To the ground (infiltration);
 - To a surface water body;
 - To a surface water sewer, highway drain or another drainage system;
 - To a combined sewer;
- 19.1.4 Infiltration testing should be carried out prior to construction once other intrusive ground works are being undertaken. However, given that the site is underlain with clay it is not expected that infiltration drainage will be possible. The Ground Investigation already undertaken concluded *'In summary the Tidal Flat Deposits clay soil near surface features poor drainage characteristics and is practically impervious.'* A falling head test undertaken in a borehole (see Appendix E) shows that ground conditions are not suitable for infiltration drainage.
- 19.1.5 A drainage strategy utilising attenuation will be set out, however, if infiltration testing carried out to BRE365 reveals that infiltration drainage will be possible, further calculations should be carried out to ensure that the surface water drainage strategy is appropriate for the development.
- 19.1.6 There is an existing drainage ditch located along the south western boundary of the application site, which flows to the River Usk. A second ditch flows parallel with Traston Road and it is understood that all flows from the site would ultimately end up in this ditch. It is proposed that surface water from the site should discharge to this drainage ditch to mimic existing conditions.

19.2 19.2 Greenfield Runoff and Volume

- 19.2.1 It is proposed to discharge at the Qbar Greenfield rate up to the Q100 + 40% Climate change storm in order to provide betterment on existing conditions.
- 19.2.2 The run-off rates for the whole site have been calculated using ICP SuDS within MicroDrainage.

These calculations can be seen within Appendix C and are summarised below:

Event Frequency	Run off Rate (l/s)
Q1	2.2
Qbar	2.5
Q30	4.3
Q100	5.4

Table 4 – Greenfield Run-off

- 19.2.3 The proposed drainage solution would involve attenuation before discharging at the Qbar rate of 2.5l/s for all events up to the Q100 + 40% Climate Change event. By discharging at the Qbar rate rather than a staged discharge to mimic Greenfield conditions, betterment is provided. The Surface Water Drainage Strategy calculations can be seen in Appendix C.
- 19.2.4 The impermeable surfaces have been calculated as 0.486ha from the latest layout.
- 19.2.5 Newly published guidance confirms that the 1 in 100 year surface water runoff rate and storage for the 1 in 100 plus climate change (40%) will be suitable for the site, however, betterment can be provided by limiting to the Qbar rate and the flow control device is more simplistic.
- 19.2.6 A storage estimate of 441m³ has been calculated using Microdrainage. The C_v values for both summer and winter storms have been set as 1.0 to assess the worst-case scenario.
- 19.2.7 It is proposed that the attenuation will be provided in sub-base storage within the site with a flow control device limiting flows before discharging to the drainage ditch. It is possible that the outfall may require pumping due to levels across the site.
- 19.2.8 The Surface Water Drainage Design has been approved by the Sustainable Drainage Approval Body (SAB), in line with the policy.

19.3 Compensatory Storage

- 19.3.1 The layout elevates all buildings etc to a level of 8.51mAOD so they are above the predicted maximum flood level. There will be a negligible loss of flood storage due to the stilts being below flood level. Mitigation/compensation is therefore not considered required.

19.4 Future Responsibility and Maintenance

- 19.4.1 There are a number of options for the adoption and maintenance of the SuDS features and drainage network, including SuDS features being owned and maintained by the developer with the maintenance activities undertaken by a 3rd party contractor.

20 Foul Drainage Strategy

20.1 Local Public Sewers

- 20.1.1 Building Regulations Approved Document H details guidance for drainage and waste disposal. It specifies that the priority hierarchy for the disposal of foul water is to;
- a) A public sewer, or, where that is not reasonably practicable;
 - b) A private sewer communicating with a public sewer, or, where that is not reasonably practicable;
 - c) Either a septic tank which has an appropriate form of secondary treatment or another wastewater treatment system; or, where that is not reasonably practicable;
 - d) A cesspool.
- 20.1.2 There is an existing foul sewer which runs from east to west along Traston Road.
- 20.1.3 No staff will be employed on the site permanently, and it is therefore anticipated that there will be no foul flows from the site.

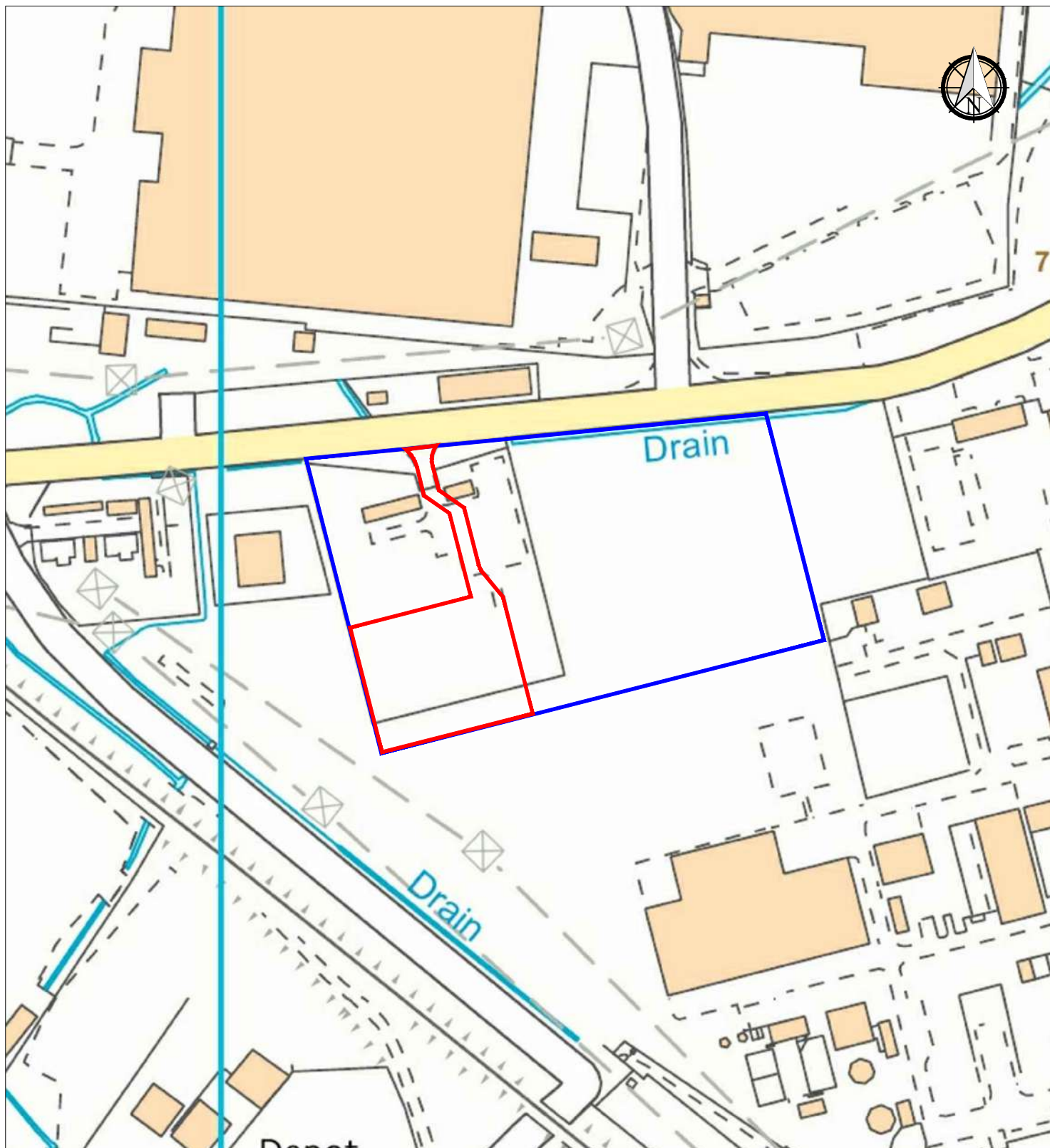
21 Conclusion and Recommendations

- 21.1.1 The latest TAN 15 Development Advice Map (DAM) for the area shows the site to be within Flood Zone C1 – land considered to be at risk of flooding but is served by significant flood infrastructure. Commercial developments are classified as Less Vulnerable, which is permitted in Zone C1 following a satisfactory completion of the justification test and acceptability of consequences.
- 21.1.2 The provision of this site is justifiable as it contributes key energy infrastructure which will support employment development by improving security of supply. It is also to be partly constructed on previously developed land and the consequences of flood events is considered below with necessary mitigation provided.
- 21.1.3 As the site is commercial, the users are deemed as less vulnerable to flooding and suitable evacuation time should be available following the users signing up to NRW's early warning flood system. There is to be no permanent presence on the site, however, the occupiers of the site should subscribe to all available NRW early warning systems and have the ability to remotely shut down all electrical equipment in order to protect the site in a severe storm event.
- 21.1.4 The Q1000 + 75 year climate change level for the site has been calculated as 8.1mAOD.
- 21.1.5 It is proposed that all equipment will be raised 600mm above the Q200 with an allowance for climate change level of 8.51mAOD. Floor levels of the buildings are elevated as the building is proposed to be constructed on stilts. The proposals would cause negligible flood storage displacement therefore no flood compensation is required.
- 21.1.6 There is an existing drainage ditch located along the south western boundary of the application site, which flows to the River Usk. There is also a ditch flowing parallel with Traston Road. The proposed drainage solution would involve attenuation before discharging at the Qbar rate of 2.5l/s for all events up to the Q100 + 40% Climate Change event.
- 21.1.7 A storage estimate of 441m³ has been calculated using MicroDrainage. It is proposed that the attenuation will be provided in sub-base storage within the site.
- 21.1.8 As the site is not to be manned, it is expected that there will be no foul connection required.
- 21.1.9 The site can be constructed with no detrimental flood risk effect on the surrounding area provided the measures set out above are put in place.

Appendix A – Location Plans

Ordnance Survey Plan

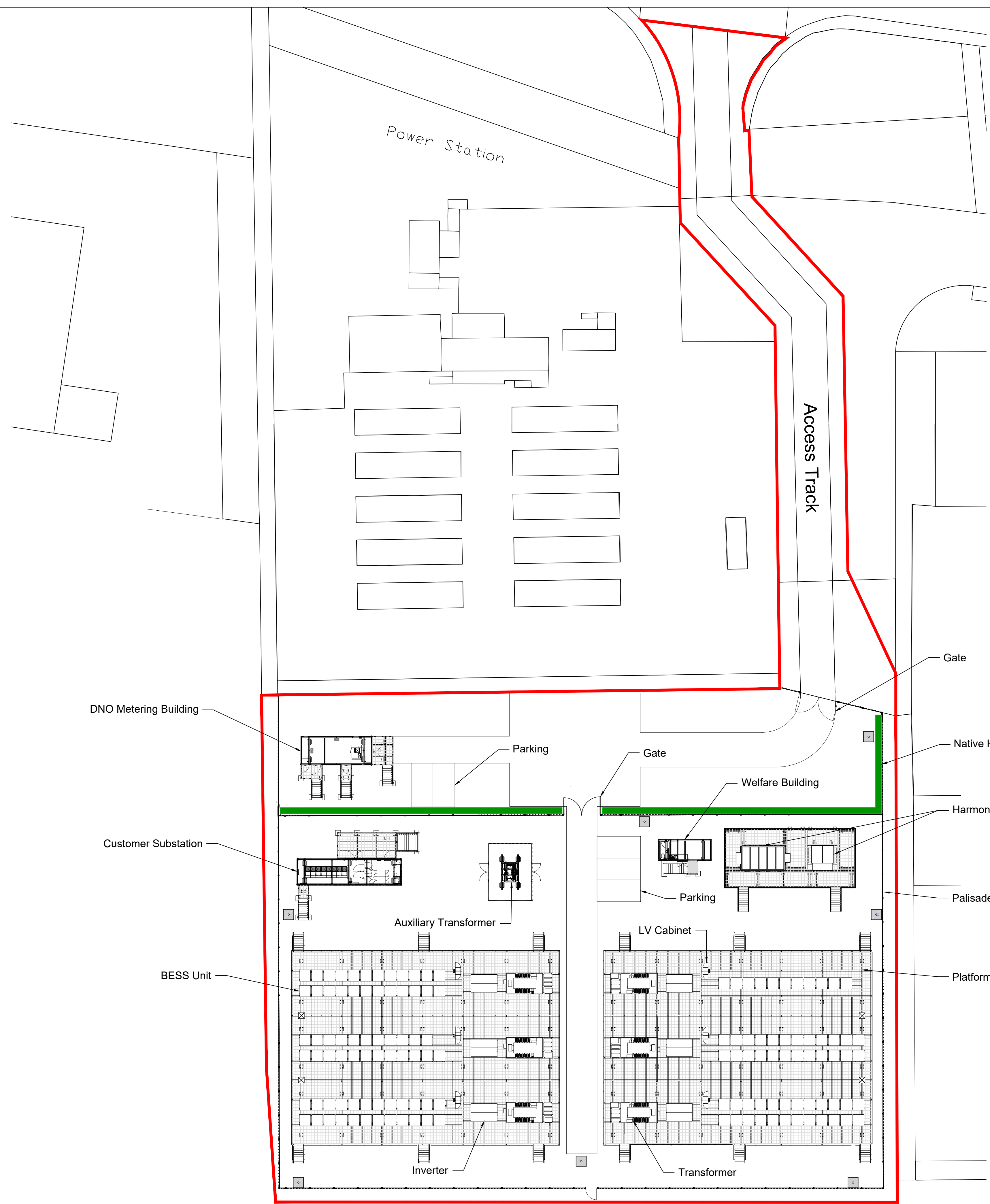
Topographical Survey



Traston Road, NP19 4RE	Key: Development Area (0.49Ha): Landowner's Property:	Scale: 1:2500 at A4	ukenergyreserve SUPPORTING A RENEWABLE FUTURE
		Drawing: [16033.101](Traston Road Batteries) Location Plan (Rev.1a)	6th Floor, Radcliffe House, Blenheim Court, Solihull, West Midlands, B91 2AA
		Date: 18/08/2016	Drawn By: ND
		Revision 1a	Reviewed By: DB
Description: Location Plan			Plan not to be used for construction

Appendix B – Site Plans

Field drawing –BTGBNEW01_001.1 - Site Layout Plan



- Drawing Notes:**
- All dimensions are shown in metres unless noted otherwise.
 - Do not scale from this drawing.
- Legend:**
- Planning Boundary
 - Fencing
 - Planting/Landscaping Area
 - Steel Platform
 - CCTV and Lighting Pole
 - CCTV Pole

REV	DATE	DESCRIPTION	BY	CHKD
02	15/11/2024	HARMONIC FILTER EQUIPMENT ADDED	WL	JH
01	07/11/2024	FENCING, BUILDING ACCESS PLATFORMS AND POSITION OF LV CABINETS AMENDED. CCTV COLUMNS AND EMERGENCY EXIT ADDED	WL	EW
0	24/03/2023	SITE LAYOUT PLAN - ORIGINAL	WL	RS



Field
Fora Montacute Yards
186 Shoreditch High Street
London
E1 6HU

PROJECT		NEWPORT			
TITLE		Site Layout Plan			
DISCIPLINE		PLANNING			
DRAWING STATUS		FOR PLANNING			
SCALE	DATE	DRAWN BY	CHECKED BY	APPROVED BY	
1:500 @A1	07/11/2024	WL	EW	AP	
PROJECT NO.		DRAWING NO.		REV.	
BTGBNEW01		001.1		01	

Appendix C – Drainage Strategy

Greenfield Calculations

Surface Water Attenuation Calculations

Sweco UK Limited		Page 1																								
Grove House Mansion Gate Drive Leeds LS7 4DN	65206973 BESS Traston Road Greenfield Run-off																									
Date 17/06/2022 11:21 File	Designed by JRC Checked by																									
Innovyze	Source Control 2020.1																									
<u>ICP SUDS Mean Annual Flood</u> Input <table><tr><td>Return Period (years)</td><td>1</td><td>Soil</td><td>0.400</td></tr><tr><td>Area (ha)</td><td>0.486</td><td>Urban</td><td>0.000</td></tr><tr><td>SAAR (mm)</td><td>983</td><td>Region Number</td><td>Region 9</td></tr></table> Results 1/s <table><tr><td>QBAR Rural</td><td>2.5</td></tr><tr><td>QBAR Urban</td><td>2.5</td></tr><tr><td>Q1 year</td><td>2.2</td></tr><tr><td>Q1 year</td><td>2.2</td></tr><tr><td>Q30 years</td><td>4.3</td></tr><tr><td>Q100 years</td><td>5.4</td></tr></table>			Return Period (years)	1	Soil	0.400	Area (ha)	0.486	Urban	0.000	SAAR (mm)	983	Region Number	Region 9	QBAR Rural	2.5	QBAR Urban	2.5	Q1 year	2.2	Q1 year	2.2	Q30 years	4.3	Q100 years	5.4
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Q30 years	4.3																									
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©1982-2020 Innovyze																										

Sweco UK Limited		Page 1																																																																																																																																																																																																																																																																																		
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Summary of Results for 100 year Return Period (+40%) Half Drain Time : 1473 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (1/s)</th><th>Max Control (1/s)</th><th>Max Outflow (1/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>6.643</td><td>0.143</td><td>0.0</td><td>2.5</td><td>2.5</td><td>131.8</td><td>O K</td></tr><tr><td>30 min Summer</td><td>6.689</td><td>0.189</td><td>0.0</td><td>2.5</td><td>2.5</td><td>186.7</td><td>O K</td></tr><tr><td>60 min Summer</td><td>6.739</td><td>0.239</td><td>0.0</td><td>2.5</td><td>2.5</td><td>246.9</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>6.790</td><td>0.290</td><td>0.0</td><td>2.5</td><td>2.5</td><td>308.6</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>6.818</td><td>0.318</td><td>0.0</td><td>2.5</td><td>2.5</td><td>341.8</td><td>Flood Risk</td></tr><tr><td>240 min 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Summer</td><td>6.873</td><td>0.373</td><td>0.0</td><td>2.5</td><td>2.5</td><td>407.6</td><td>Flood Risk</td></tr><tr><td>2880 min Summer</td><td>6.858</td><td>0.358</td><td>0.0</td><td>2.5</td><td>2.5</td><td>389.7</td><td>Flood Risk</td></tr><tr><td>4320 min Summer</td><td>6.830</td><td>0.330</td><td>0.0</td><td>2.5</td><td>2.5</td><td>355.8</td><td>Flood Risk</td></tr><tr><td>5760 min Summer</td><td>6.803</td><td>0.303</td><td>0.0</td><td>2.5</td><td>2.5</td><td>323.7</td><td>Flood Risk</td></tr><tr><td>7200 min Summer</td><td>6.777</td><td>0.277</td><td>0.0</td><td>2.5</td><td>2.5</td><td>292.5</td><td>Flood Risk</td></tr><tr><td>8640 min Summer</td><td>6.752</td><td>0.252</td><td>0.0</td><td>2.5</td><td>2.5</td><td>261.9</td><td>Flood Risk</td></tr><tr><td>10080 min Summer</td><td>6.727</td><td>0.227</td><td>0.0</td><td>2.5</td><td>2.5</td><td>232.9</td><td>Flood Risk</td></tr><tr><td>15 min 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Summer</td><td>10.901</td><td>0.0</td><td>421.2</td><td>606</td></tr><tr><td>720 min Summer</td><td>9.507</td><td>0.0</td><td>419.7</td><td>724</td></tr><tr><td>960 min Summer</td><td>7.652</td><td>0.0</td><td>416.7</td><td>962</td></tr><tr><td>1440 min Summer</td><td>5.622</td><td>0.0</td><td>410.9</td><td>1370</td></tr><tr><td>2160 min Summer</td><td>4.120</td><td>0.0</td><td>683.2</td><td>1708</td></tr><tr><td>2880 min Summer</td><td>3.300</td><td>0.0</td><td>725.7</td><td>2080</td></tr><tr><td>4320 min Summer</td><td>2.408</td><td>0.0</td><td>745.7</td><td>2900</td></tr><tr><td>5760 min Summer</td><td>1.929</td><td>0.0</td><td>826.3</td><td>3696</td></tr><tr><td>7200 min Summer</td><td>1.624</td><td>0.0</td><td>860.8</td><td>4536</td></tr><tr><td>8640 min Summer</td><td>1.412</td><td>0.0</td><td>888.8</td><td>5280</td></tr><tr><td>10080 min Summer</td><td>1.254</td><td>0.0</td><td>914.2</td><td>6056</td></tr><tr><td>15 min 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720 min Summer	9.507	0.0	419.7	724																																																																																																																																																																																																																																																																																
960 min Summer	7.652	0.0	416.7	962																																																																																																																																																																																																																																																																																
1440 min Summer	5.622	0.0	410.9	1370																																																																																																																																																																																																																																																																																
2160 min Summer	4.120	0.0	683.2	1708																																																																																																																																																																																																																																																																																
2880 min Summer	3.300	0.0	725.7	2080																																																																																																																																																																																																																																																																																
4320 min Summer	2.408	0.0	745.7	2900																																																																																																																																																																																																																																																																																
5760 min Summer	1.929	0.0	826.3	3696																																																																																																																																																																																																																																																																																
7200 min Summer	1.624	0.0	860.8	4536																																																																																																																																																																																																																																																																																
8640 min Summer	1.412	0.0	888.8	5280																																																																																																																																																																																																																																																																																
10080 min Summer	1.254	0.0	914.2	6056																																																																																																																																																																																																																																																																																
15 min Winter	127.500	0.0	134.7	26																																																																																																																																																																																																																																																																																
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Sweco UK Limited		Page 3
Grove House Mansion Gate Drive Leeds LS7 4DN	65206973 BESS Traston Road Surface Water Drainage	
Date 17/06/2022 11:39 File 65206973-XX-XX-T-C-0002...	Designed by JRC Checked by	
Innovyze	Source Control 2020.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.318	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.486

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	(ha)	From:	To:	(ha)
0	4	0.162	4	8	0.162
				8	12
					0.162

Sweco UK Limited		Page 4
Grove House Mansion Gate Drive Leeds LS7 4DN	65206973 BESS Traston Road Surface Water Drainage	
Date 17/06/2022 11:39 File 65206973-XX-XX-T-C-0002...	Designed by JRC Checked by	
Innovyze	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 7.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	60.0
Membrane Percolation (mm/hr)	1000	Length (m)	66.7
Max Percolation (l/s)	1111.7	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	6.500	Membrane Depth (m)	0

Pump Outflow Control

Invert Level (m) 6.500

Depth (m) Flow (l/s)

0.001	2.5000
-------	--------

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Appendix D – NRW Flood Data

ATI-10775a – Traston Road, Newport

E: 333149 N: 185720

1.0 Current Flood Map

Figure 1 shows the current Flood Map (version 201607) at this location. The Flood Map represents a combination of the undefended fluvial and tidal flood extents derived from a combination of detailed local modelled and nationally generalised modelled data.

The current Flood Map in this area is derived from the Newport SFRM Modelling – Update of Newport Tidal Model study v3.1 & v3.2 undertaken by JBA Consulting in December 2012 (*ref 5*).

More information on the Flood Map can be obtained from the Natural Resources Wales website <http://www.naturalresources.wales/floodriskmap>

2.0 Local Flood Risk Mapping Study

Model Summary

This study was commissioned to update the tidal flood model in the area. This study uses extreme tidal level predictions together with new LiDAR data and information on changes to landforms in the area (*ref 5*).

The baseline model includes the improved Riverside tidal defences completed in summer 2012.

The model was run for undefended and defended tidal flood events for 2011 and defended tidal events with climate change. The median river flow (QMED) is used for all events.

Changes in sea level used in the model are shown in **Table 1** (*ref 2*).

Table 1: Sea Level Rise (mm per year)

Assumed vertical land movement	1990-2025	2025-2055	2055-2085	2085-2115
-0.5	3.5	8.0	11.5	14.5

Results

The shape for the site has been used to query the elevation, depth, velocity and hazard grids to provide the results in **Tables 3, 5 and 7**. These results all relate to a base year of 2011.

To get water elevation results for 2016 and future years, model results have been interpolated, the results are shown in **Tables 4 and 6**.

The depth grids for the defended tidal 1 in 200 (2111) excluding confidence intervals and 1 in 200 (2111) including confidence intervals, are shown in **Figures 3 and 4**.

The hazard grid for the defended 1 in 200 year (2086) including confidence interval is shown in **Figure 5**.

Table 2: Legend for Hazard Grids

Flood Hazard Rating (HR)	Colour Code	Hazard to People Classification (<i>ref 6</i>)
Less than 0.75		Very low hazard – Caution
0.75 to 1.25		Danger for some – includes children, the elderly and the infirm
1.25 to 2.0		Danger for most – includes the general public
More than 2.0		Danger for all – includes the emergency services

Model Results - the Site

*Null values show that the site is flood free for that return period.

Table 3: Defended Model Results (2011)

Defended (excluding upper confidence interval)						
	1 in 200			1 in 1000		
	2011	2086	2111	2011	2086	2111
Model Grid Size (m)	5	5	5	5	5	5
Wet Cells	538	1052	1092	914	1092	1099
Elevation, mean (mAOD)	7.01	7.67	7.89	7.40	7.86	8.14
Elevation, max (mAOD)	7.07	7.75	7.98	7.47	7.94	8.21
Depth, mean (m)	0.32	0.72	0.92	0.54	0.89	1.16
Depth, max (m)	0.70	1.34	1.56	1.08	1.52	1.80
Velocity, mean (m/s)	0.19	0.42	0.52	0.43	0.51	0.58
Velocity, max (m/s)	1.87	1.33	1.56	1.62	1.53	1.65
Hazard, mean	0.96	1.56	1.81	1.29	1.77	2.11
Hazard, max	1.70	2.20	2.49	1.80	2.44	2.89

Table 4: Defended Interpolated Results (2016)

Defended (excluding upper confidence interval)						
	1 in 200			1 in 1000		
	2016	2091	2116	2016	2091	2116
Elevation, max (mAOD)	7.08	7.82	8.05	7.49	8.01	8.28

Table 5: Defended Model Results (2011)

Defended (including upper confidence interval)				
	1 in 200			1 in 1000
	2011	2086	2111	2011
Model Grid Size (m)	5	5	5	5
Wet Cells	975	1092	1104	1088
Elevation, mean (mAOD)	7.48	7.91	8.20	7.83
Elevation, max (mAOD)	7.55	7.99	8.26	7.91
Depth, mean (m)	0.58	0.94	1.21	0.86
Depth, max (m)	1.15	1.58	1.85	1.49
Velocity, mean (m/s)	0.36	0.53	0.59	0.50
Velocity, max (m/s)	2.10	1.64	1.65	1.64
Hazard, mean	1.37	1.84	2.18	1.73
Hazard, max	2.18	2.51	2.99	2.39

Table 6: Defended Interpolated Results (2016)

Defended (including upper confidence interval)				
	1 in 200			1 in 1000
	2016	2091	2116	2016
Elevation, max (mAOD)	7.57	8.07	8.34	7.93

Table 7: Undefended Model Results (2011)

Undefended (2011)		
	1 in 200	1 in 1000
Model Grid Size (m)	5	5
Wet Cells	1041	1088
Elevation, mean (mAOD)	7.60	7.77
Elevation, max (mAOD)	7.69	7.86
Depth, mean (m)	0.67	0.80
Depth, max (m)	1.28	1.45
Velocity, mean (m/s)	0.42	0.49
Velocity, max (m/s)	1.30	1.45
Hazard, mean	1.50	1.68
Hazard, max	2.17	2.42

Model Results – Emergency Access to Site

No access route was provided.

3.0 Additional Information

Figure 2 shows the approximate outline from the December 1981 event on the Usk.

The local authority may be able to provide information on issues such as localised flooding from sewers, drains and culverts.

4.0 References

1. Tidal Flood Mapping Study (Penarth and Chepstow), Study report Issue 1, Atkins July 2008
2. Department for Environment, Food and Rural Affairs, 2011. *Technical Report Design sea levels*. R&D Report SC060064. Defra/Environment Agency
3. Flood and Coastal Defence Appraisal Guidance: FCDPAG3 Economic Appraisal. Supplementary Note to Operating Authorities – Climate Change Impacts; October 2006; Department for Environment, Food and Rural Affairs.
4. Using the national coastal flood boundary data for England and Wales, Environment Agency Operational Instruction 490_11, Issued 4/2/2011
5. Newport SFRM Modelling: Update of Newport Tidal Model v3.2, JBA, December 2012.

6. Supplementary note on flood hazard ratings and thresholds for development planning and control purpose, May 2008

5.0 Notes

Undefended scenarios are provided as being a possible worst case scenario in the event of defence failure. They are used as the basis of the Flood Map.

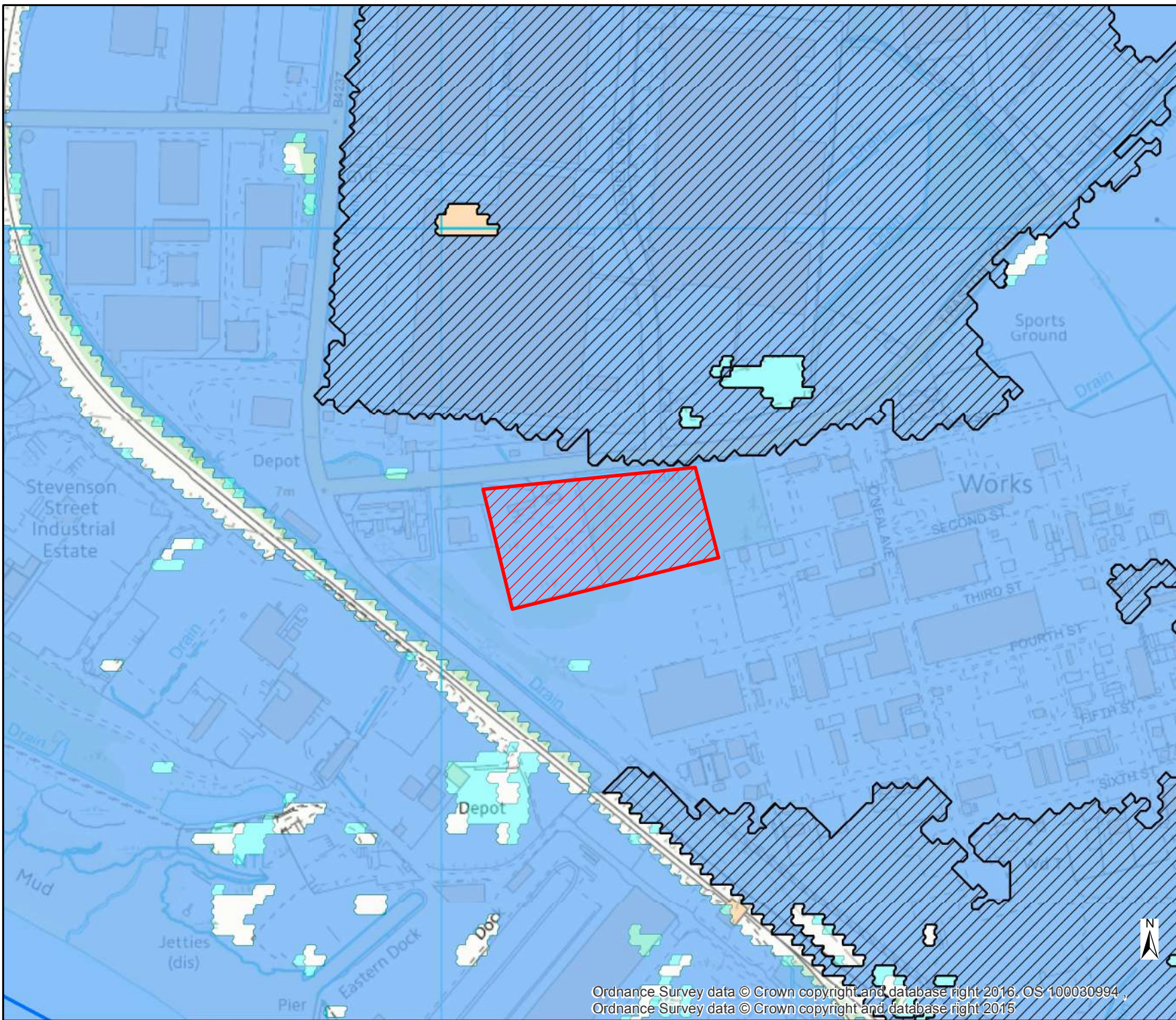
The scope of the model is the mapping of flood risk, it is not intended for detailed design. The model should be considered as the starting point for more detailed modelling, commensurate with the consequences of flooding at the site of interest.

NRW models are available under licence agreement for the purpose of further development. Contact Natural Resources Wales Data Distribution team for details of terms, conditions and pricing.

If the data is used in support of an FCA, please include the reference number.

Please refer to NRW standard terms and conditions.

Flood Risk Analysis
04/08/2016



Legend

- Site Location
- Flood Zone 3 (1 in 100 year undefended fluvial and 1 in 200 year undefended tidal extents)
- Flood Zone 2 (1 in 1000 year undefended fluvial and tidal extents)
- Areas benefiting from defences
- Defences
- Flood Storage Area
- Main Rivers

Cyfoeth Naturiol Cymru
Natural Resources Wales

Project

Traston Road, Newport,
NP19 4RD
(Ref: ATI-10775a)

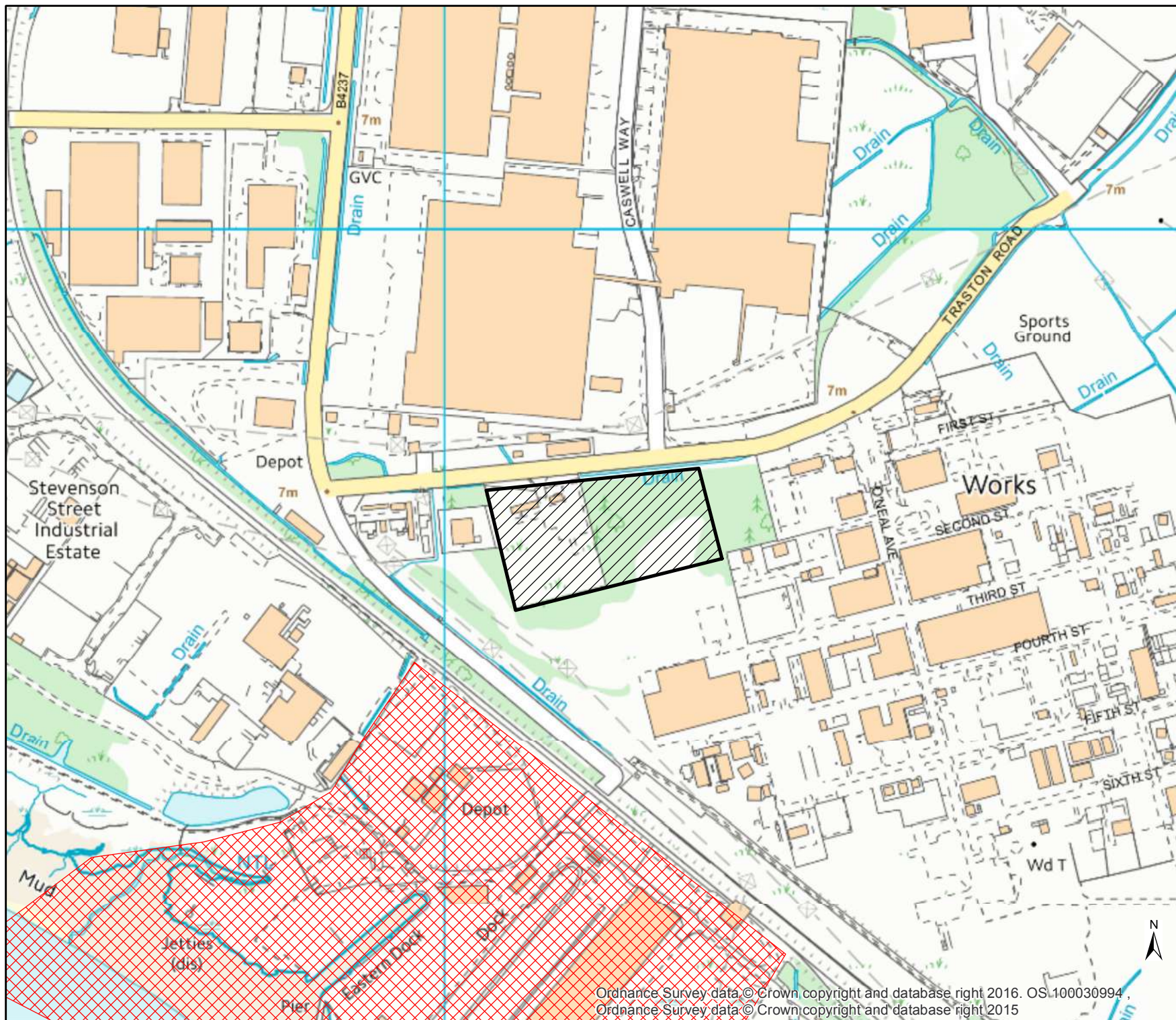
Drawing

Figure 1:
Current Floodmap
[v201607]

Date

4th August 2016

Scale 1:5,000



Legend

-  Site Location
-  Approximate extent of historical flooding

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Project

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NP19 4RD
(Ref: ATI-10775a)

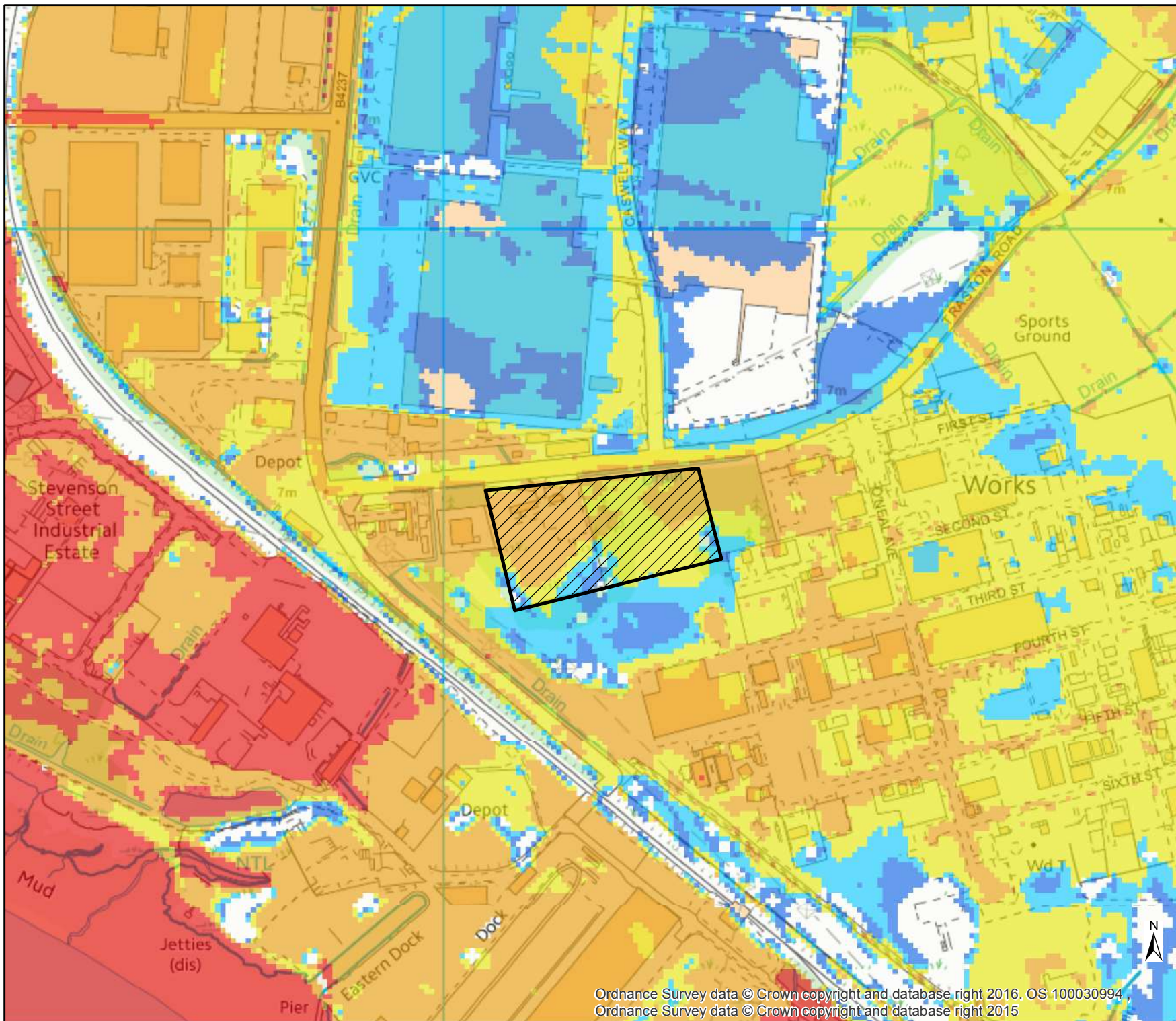
Drawing

Figure 2:
Historic Floodmap (v4)

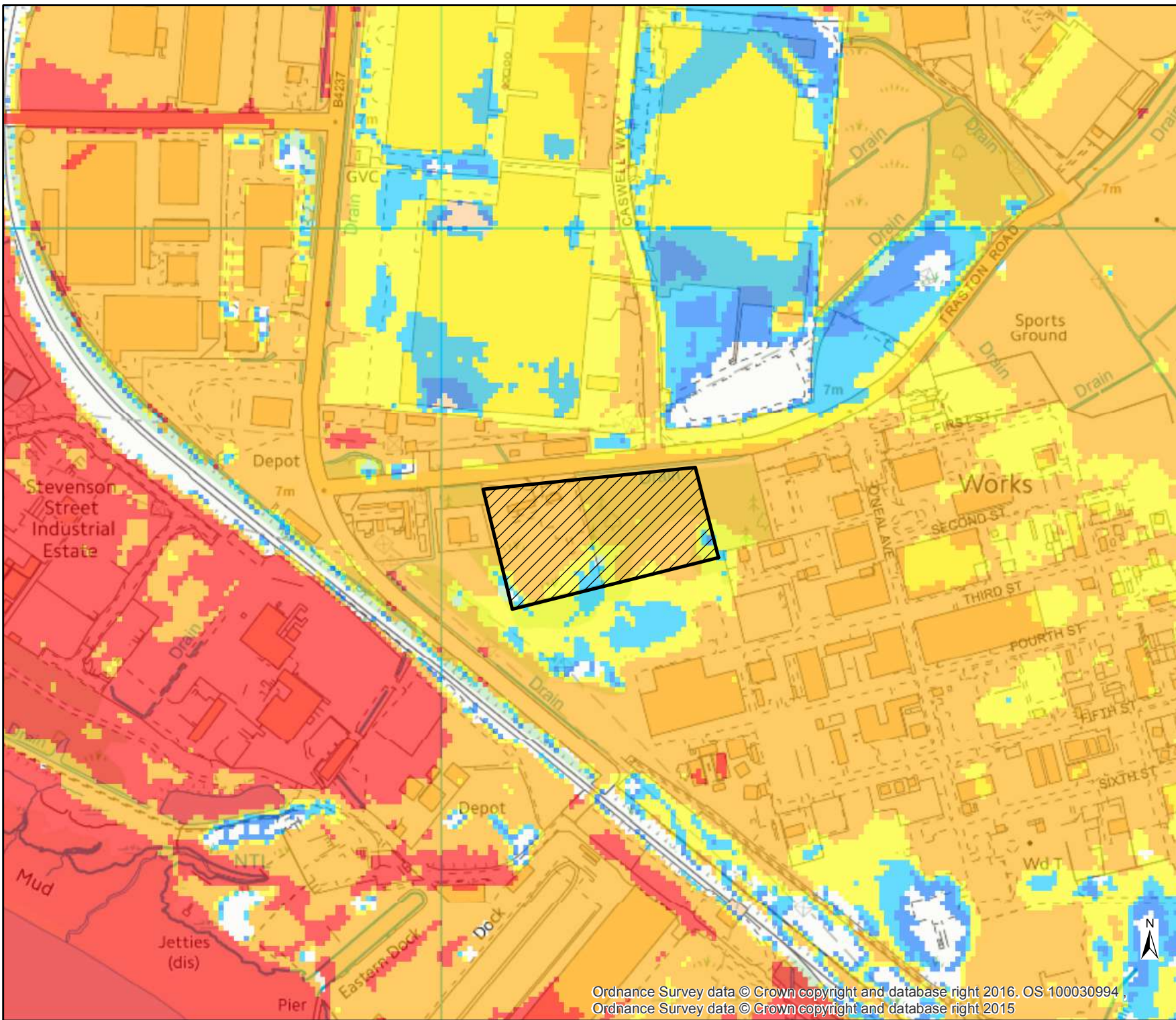
Date

4th August 2016

Scale 1:5,000



Legend Site Location Flood Depth (m) 0.0 - 0.3 >0.3 >0.6 >1.0 >2.0	
Cyfoeth Naturiol Cymru Natural Resources Wales	
Project Traston Road, Newport, NP19 4RD (Ref: ATI-10775a)	
Drawing Figure 3: Depth Grid for 0.5% AEP (1 in 200) year event - defended excluding upper confidence intervals (2111)	
Date 4th August 2016	
Scale 1:5,000	



Legend

Site Location

Flood Depth (m)

0.0 - 0.3

>0.3

>0.6

>1.0

>2.0

Cyfoeth Naturiol Cymru
Natural Resources Wales

Project

Traston Road, Newport,
NP19 4RD
(Ref: ATI-10775a)

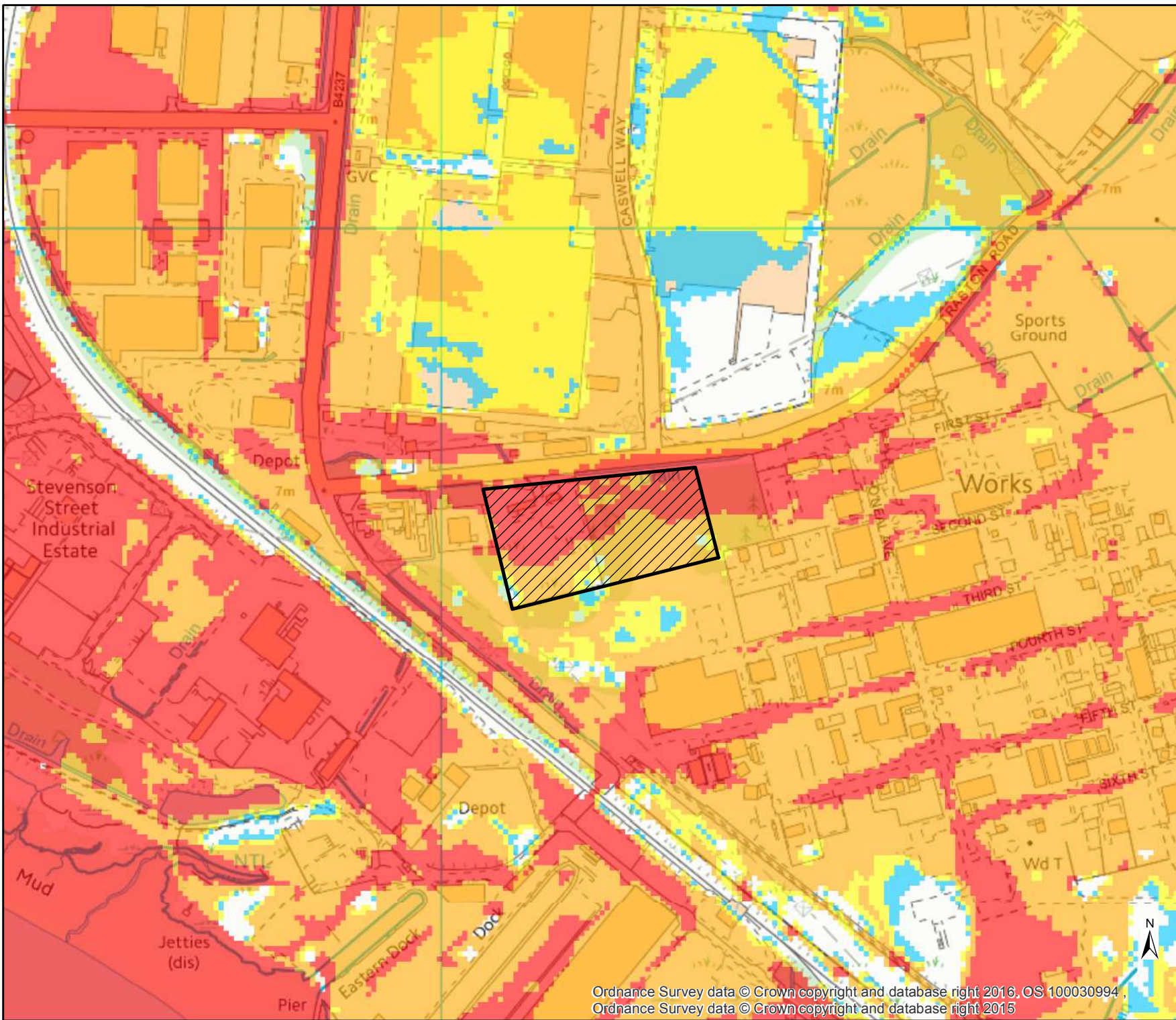
Drawing

Figure 4:
Depth Grid for 0.5% AEP
(1 in 200) year event -
defended including upper
confidence intervals (2111)

Date

4th August 2016

Scale 1:5,000



Legend

 Site Location

Flood Hazard

 < 0.75

 0.75 - 1.25

 1.25 - 2.00

 > 2.0

 **Cyfoeth Naturiol Cymru**
Natural Resources Wales

Project

Traston Road, Newport,
NP19 4RD
(Ref: ATI-10775a)

Drawing

Figure 5:
Hazard Grid for 0.5% AEP
(1 in 200) year event -
defended including upper
confidence intervals (2086)

Date

4th August 2016

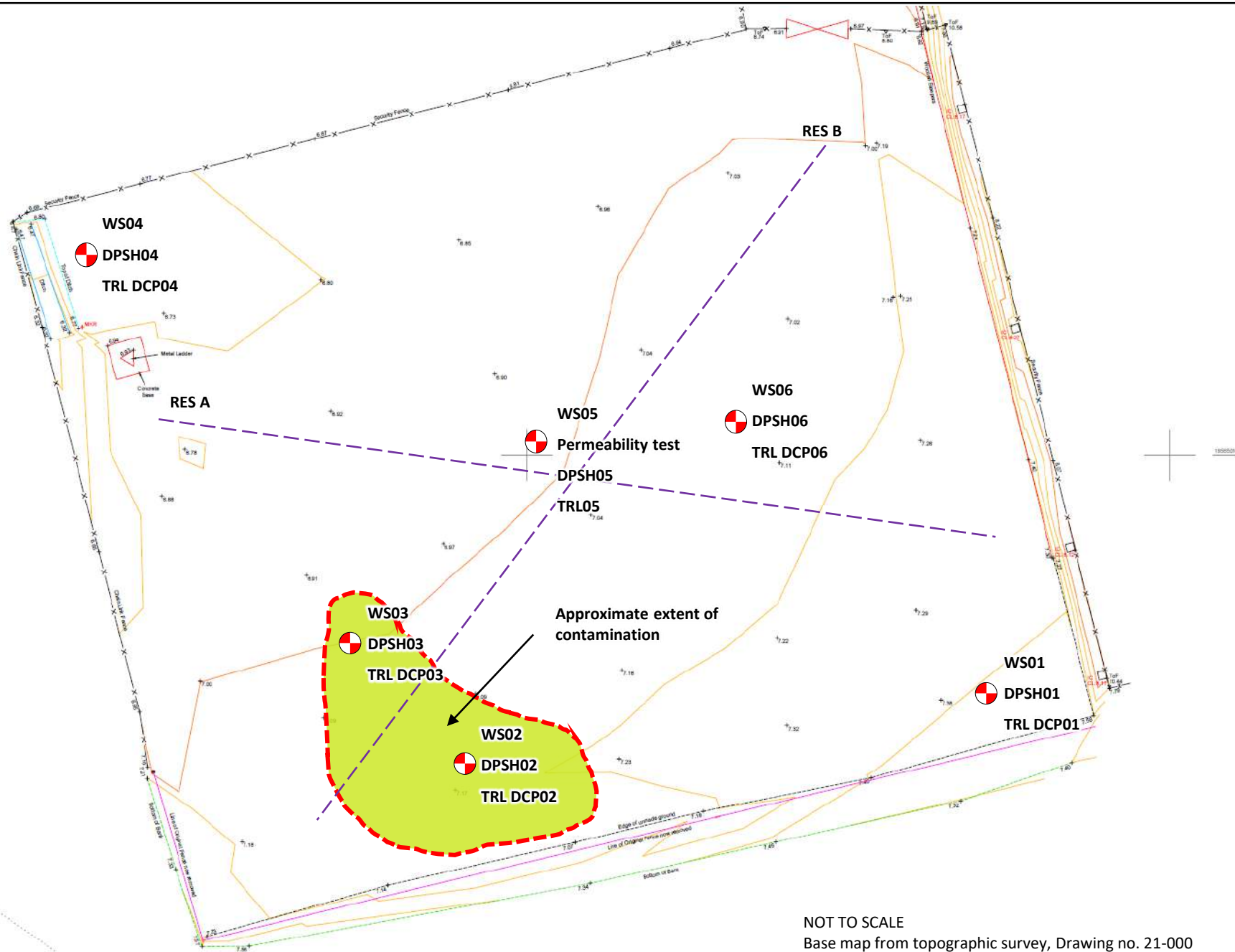
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Appendix E – Ground Investigation

South West Geotechnical – Exploratory Hole Location Plan

Bore Hole Logs

Falling Head Test



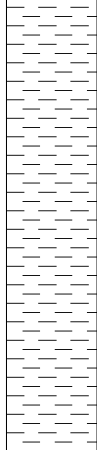
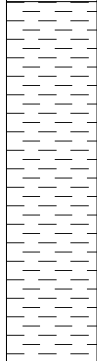
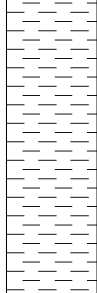
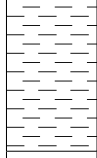
 Exploratory hole location

 **Soil resistivity survey
(Wenner array)**

Newport BESS

Exploratory Hole Location Plan



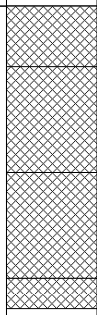
				Borehole Log				Borehole No. WS01 Sheet 1 of 1	
Project Name: Newport BESS				Project No. 14109		Co-ords: 333131E - 185633N		Hole Type WS	
Location: South Wales						Level:		Scale 1:25	
Client: Anesco						Dates: 19/05/2022		Logged By SS	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30			MADE GROUND: Hardstanding comprising dark brown grey and black locally clayey Sand and Gravel. Gravel is fine to coarse angular to sub-angular imported materials. Contains red brick, fabric, concrete and timber. Geotextile membrane at base. Firm grey and brown slightly gravelly slightly sandy slightly silty CLAY. Contains black specks. TIDAL FLAT DEPOSITS.	1
		0.80		HVP=90					
		1.00	D						
		1.00	SPT	N=7 (1,3/3,1,1,2)					
		1.80		HVP=60	1.80				2
		2.00	D						
		2.00	SPT	N=12 (3,3/2,3,3,4)					
		2.80		HVP=27					3
		3.00	SPT	N=5 (2,1/1,2,1,1)					
		3.50	D						4
4.00	SPT	N=3 (1,1/1,0,1,1)							
				4.45			End of Borehole at 4.450m	5	
Remarks 1) Groundwater encountered at 3.00m, rising to 1.00m in 20 minutes. 2) Dynamic probe to 10.0m. 3) Install: GL-1.00m plain pipe and bentonite, 1.00-2.00m slotted and gravel, gas tap and flush cover at surface.									

				Borehole Log				Borehole No. WS02 Sheet 1 of 1	
Project Name: Newport BESS				Project No. 14109		Co-ords:		Hole Type WS	
Location: South Wales				Level:		Scale 1:25		Logged By SS	
Client: Anesco				Dates: 19/05/2022					

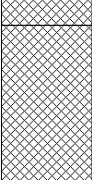
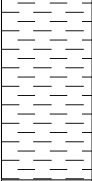
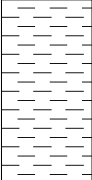
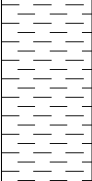
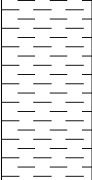
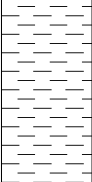
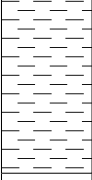
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.90	ES		0.50		MADE GROUND: Hardstanding comprising dark brown grey and black locally clayey Sand and Gravel. Gravel is fine to coarse angular to sub-angular imported materials. Contains red brick, fabric, concrete and timber. Geotextile membrane at base.		
					1.00		MADE GROUND: Fill comprising spongy yellow slightly gravelly sandy fibrous material. Gravel is fine to coarse imported materials. Contains orange round granules <1mm. Strong solvent odour.		
							End of Borehole at 1.000m	1	
								2	
								3	
								4	
								5	

Remarks
 1) Groundwater not encountered. 2) Permeability test not undertaken due to contamination. 3) Backfilled with arisings.



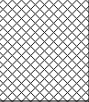
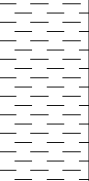
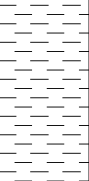
				Borehole Log				Borehole No. WS03 Sheet 1 of 1	
Project Name: Newport BESS				Project No. 14109		Co-ords: 333083E - 185639N		Hole Type WS	
Location: South Wales				Level:		Scale 1:25			
Client: Anesco				Dates: 19/05/2022		Logged By SS			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Hardstanding comprising dark brown grey and black locally clayey Sand and Gravel. Gravel is fine to coarse angular to sub-angular imported materials. Contains red brick, fabric, concrete and timber. Geotextile membrane at base.	
				0.55		MADE GROUND: Reworked natural materials comprising grey and brown slightly gravelly slightly sandy slightly silty CLAY.			
				0.90		MADE GROUND: Fill comprising spongey yellow slightly gravelly sandy fibrous material. Gravel is fine to coarse imported materials. Contains orange round granules <1mm. Strong solvent odour.			
				1.00		MADE GROUND: Reworked natural materials comprising grey and brown slightly gravelly slightly sandy slightly silty CLAY. End of Borehole at 1.000m			
Remarks 1) Groundwater encountered at 1.00m, rising to 0.60m in 20 minutes. 2) Permeability test not undertaken due to contamination. 3) Dynamic probe to 10.0m. 4) Backfilled with arisings.									
									

					Borehole Log			Borehole No. WS04 Sheet 1 of 1	
Project Name: Newport BESS					Project No. 14109		Co-ords: 333068E - 185668N		Hole Type WS
Location: South Wales					Level:		Scale 1:25		Logged By SS
Client: Anesco					Dates: 19/05/2022				

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Hardstanding comprising light grey Gravel. Gravel is coarse angular to sub-angular concrete with medium cobble content.	1
					0.65			MADE GROUND: Reworked natural materials comprising grey and brown slightly gravelly slightly sandy slightly silty CLAY.	
		1.00	SPT	N=7 (2,1/1,1,2,3)	1.50			Firm grey and brown slightly gravelly slightly sandy slightly silty CLAY. TIDAL FLAT DEPOSITS.	2
		1.50 1.50	D	HVP=93				Very soft grey and brown slightly gravelly slightly sandy slightly silty CLAY. TIDAL FLAT DEPOSITS.	
		2.00	SPT	N=3 (0,1/0,1,1,1)					3
		2.50 2.50	D	HVP=31					
		3.00	SPT	N=0 (0,0/0,0,0,0)					4
		3.50		HVP=23					
		4.00	SPT	N=0 (0,0/0,0,0,0)					5
					4.45			End of Borehole at 4.450m	

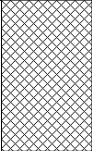
Remarks
 1) Groundwater encountered at 2.50m. 2) Dynamic probe to 10.0m. 3) Install: GL-1.00m plain pipe and bentonite, 1.00-3.00m slotted and gravel, gas tap and flush cover at surface.



				Borehole Log			Borehole No. WS05 Sheet 1 of 1			
Project Name: Newport BESS				Project No. 14109		Co-ords: 333099E - 185660N		Hole Type WS		
Location: South Wales				Level:		Scale 1:25		Logged By SS		
Client: Anesco				Dates: 19/05/2022						
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.10	ES		0.35			MADE GROUND: Hardstanding comprising dark brown grey and black locally clayey Sand and Gravel. Gravel is fine to coarse angular to sub-angular imported materials. Contains red brick, fabric, concrete and timber. Geotextile membrane at base.	1 2 3 4 5	
		0.40	ES					0.55		MADE GROUND: Reworked natural materials comprising grey and brown slightly gravelly slightly sandy slightly silty CLAY.
		0.80		HVP=83						Firm grey and brown slightly gravelly slightly sandy slightly silty CLAY. Contains black specks. TIDAL FLAT DEPOSITS.
		1.00	D SPT	N=5 (0,1/1,2,1,1)	1.20			Soft to very soft grey and brown slightly gravelly slightly sandy slightly silty CLAY. Contains black specks. TIDAL FLAT DEPOSITS.		
		1.00								
		1.50		HVP=40			(1.40m) 10mm thickness lens of fibrous PEAT			
		1.80		HVP=37			(1.80m) 10mm thickness lens of fibrous PEAT			
		2.00	D SPT	N=4 (0,0/1,1,1,1)						(2.00m) very soft
		2.00								
		2.50		HVP=31						
		2.80		HVP=30						
		3.00	SPT	N=2 (0,0/0,0,1,1)						
				3.45			End of Borehole at 3.450m			

Remarks

1) Groundwater encountered at 1.95m. 2) Permeability test undertaken at 1.00m. 3) Dynamic probe to 10.0m. 4) Backfilled with arisings.


				Borehole Log				Borehole No. WS06 Sheet 1 of 1	
Project Name: Newport BESS				Project No. 14109		Co-ords: 333116E - 185666N		Hole Type WS	
Location: South Wales						Level:		Scale 1:25	
Client: Anesco						Dates: 19/05/2022		Logged By SS	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.50			MADE GROUND: Hardstanding comprising dark brown grey and black locally clayey Sand and Gravel. Gravel is fine to coarse angular to sub-angular imported materials. Contains red brick, fabric, concrete and timber. Geotextile membrane at base.	
		0.80		HVP=105					
		1.00	SPT	N=13 (1,1/2,3,3,5)					1
		1.10	D						
		1.50		HVP=106					
		1.80		HVP=78					
		2.00	SPT	N=1 (0,0/0,0,0,1)	2.00				2
		2.30	D						
		2.50		HVP=26					
		2.80		HVP=30					
		3.00	SPT	N=0 (0,0/0,0,0,0)				3	
					3.45				
								End of Borehole at 3.450m	
									4
									5

Remarks

1) Groundwater encountered at 3.00m, rising to 1.00m in 20 minutes. 2) Dynamic probe to 10.0m. 3) Backfilled with arisings.





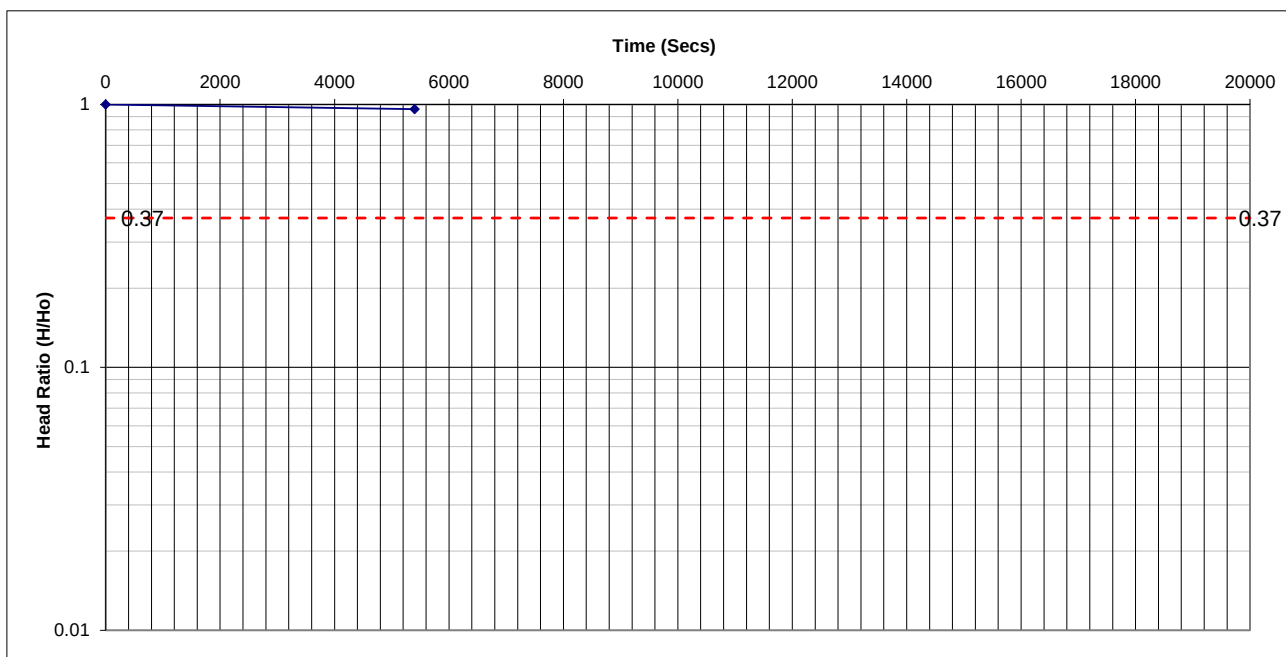
Falling Head Permeability Test

Newport BESS

Job No. 13959

Ref BS 5930 (1999), Clause 25.4.6.1, Method 1 b (general approach)

Date	Test 1		Level (mbgl)	H (m)	%	BH No.		WS03
	Δ time (min)	Time (Secs)				Depth of hole		
28.04.22	0	0	0	1	1	Depth of casing	1 m	
	90	5400	0.04	0.96	0.96	Water used	n/a l	
						Hole diameter	87 mm	
						Length of Test	1 m	
						Groundwater level	1 mbgl (Assumed)	



$$k = \frac{A}{F(t_2 - t_1)} \log e \frac{H_1}{H_2} = 2.24E-08 \text{ m/s} *$$
$$F = \frac{2 \pi L}{\log e \left[\left(\frac{L}{D} \right) + \sqrt{1 + \left(\frac{L}{D} \right)^2} \right]} = \frac{6.283185307}{\log e 23.03192} = 2.003004$$

D	0.087 m
A	0.005945 m ²
L	1 m
t ₁	0.01 s
t ₂	5400 s
H ₁	1 m
H ₂	0.96 m

*Permeability estimated, water level did not reduce to 0.37% in accordance with BS