



Herbert Road, Newport

Flood Consequences Assessment

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Flood Consequences Assessment

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Comments

Issue B - FCA updated following additional hydraulic modelling of proposals and a subsequent meeting with the Natural Resources Wales in March 2013

Issue C – References to 'EA' removed and updated to 'NRW'

Issue D – FCA updated following NRW guidance received on 4th November 2013 from the Flood Risk Analysis Team

Issue E- Minor amendments to FCA RE no. of dwellings and access/egress details.

Issue F-FCA updated to consider 100 year lifetime of development, and consideration of the extant planning permission on the Site

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Much of the information presented in this report is based on topographical survey information provided by others. That information has neither been checked nor verified by Waterman Transport & Development Ltd.

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1. INTRODUCTION

Land at Herbert Road, Newport (henceforth referred to as “the Site”) is allocated for residential purposes in the adopted Unitary Development Plan for 169 dwellings.

The Welsh Government’s Planning Policy Wales (PPW) provides the planning policy framework under which Local Planning Authorities (LPAs) must prepare their Local Development Plans (LDPs). The LDP has to encourage developments that are economically, socially and environmentally sustainable. PPW is supplemented by a number of Technical Advice Notes (TANs), including TAN 15: Development and Flood Risk. The Assembly’s TAN 15 Development Advice Map shows that the Site lies entirely within Flood Risk Zone C1. The risk designations indicated in TAN 15 require that a Flood Consequences Assessment (FCA) be carried out in support of a planning application.

In November 2012, Waterman Transport and Development Ltd. were commissioned to undertake a study into the hydrological issues affecting the Site, having particular regard to the planning recommendations of TAN 15.

Following submission of the FCA to Natural Resources Wales in November 2013, new guidance from the Welsh Government demanded that new development is assessed for a lifetime of 100 years. The following report therefore assesses the flood risk at the Herbert Road Site assuming a 100 year design life.

2. THE SITE

2.1 Site Description

The Site is located in Newport, South Wales at approximate National Grid Reference 331718E 189369N. The Site is located approximately 1km north east of Newport town centre on the east bank of the River Usk between the Newport to Hereford railway line and the River Usk. A location plan is included as Figure 1 below, with the Site boundary indicated by the red dotted line. The Site Plan indicates that the Site is bounded to the north by the new community Glan Usk Primary School; to the east by the railway line; and to the south by a mixed residential and commercial area. The Site is approximately 3.9 hectares (9.7 acres), and includes a narrow strip adjacent to the river which connects the Site to Collier Street which is located to the south. The east bank of the River Usk is located immediately adjacent to the Site and forms the western boundary.

The Site has previously been developed and is now vacant, having been allocated for housing development in the Newport UDP adopted in 2006. It is understood that an extant Planning Permission exists for the Site, which states that *'the site shall be raised to a level of 9.8 metres Above Ordnance Datum with the finished floor levels of all development set 600mm above the 9.8 metres standard...'* (Notice of Decision: Replacement Primary School, All Weather Pitch, Soft and Hard Play Areas and Residential Development; Glebelands, St Julians, Newport; App. No.: 00/0768)

A topographical survey of the Site indicates that the existing ground levels in the north east portion of the Site are at around 6.9m AOD and rise to the east to approx. 7.4m AOD. The Site is located (at least in part) on a former industrial /domestic landfill site. This is reflected in the topography of the main part of the Site which varies between 7.0m AOD and 8.0m AOD. The ground running immediately adjacent to the River Usk along the western boundary of the Site is generally higher, with levels rising from 9.0m AOD in the north to approx. 10.0mAOD halfway along the Site, before dropping to 9.5m AOD at the southern extent. A copy of the topographical survey is included in Appendix A herewith.

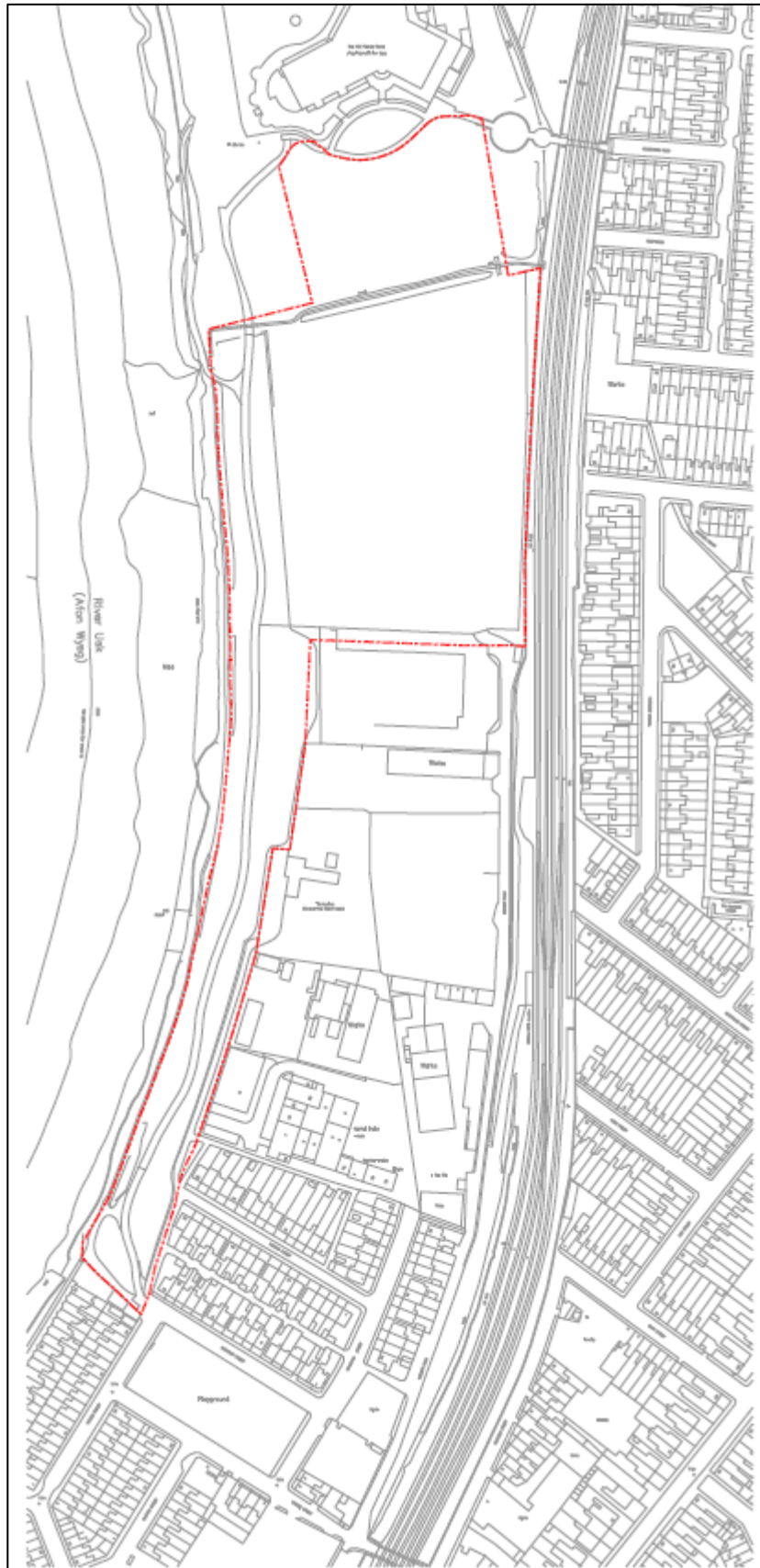


Figure 1: Site Location Plan

2.2 Proposed Development

It is proposed to construct 250 no. dwellings within the Site, which will comprise a mixture of flats and houses. Vehicular access to the Site will be via a new dedicated access route along the narrow strip of land running from the Site to Collier Street. A proposed Site layout plan is included in Appendix B herewith.

2.3 TAN15 Development Advice Map

The proposed development comprises residential development. TAN 15 identifies these proposed uses as being 'more vulnerable' development in terms of flood risk. The bulk of the Site is shown to lie entirely within TAN 15 Zone C1 by the Welsh Government Development Advice Maps, included in Appendix C herewith. This designates this part of the Site as being served by significant infrastructure including defences. There are also some areas within the Site which lie within Zone A i.e. considered to be at little or no risk of fluvial or coastal/tidal flooding.

The Welsh Government's TAN15 DAM is intended to be used alongside Planning Policy Wales and TAN 15 to direct new development in respect to flood risk. Together, they form a precautionary framework to guide planning decisions.

The maps are based on Natural Resources Wales's (NRW) extreme flood outlines (Zone C) and the British Geological Survey drift data (Zone B).

Zone B data was originally published in 2004; Zone C data has since been revised in 2009. However, Natural Resources Wales have since updated their Floodmap using more detailed hydraulic modelling so that the risk designation shown by the DAM may be out of date.

2.4 Flood Maps

The NRW Floodmap, included in Appendix D herewith, shows the current Flood Map (version 201211) for the proposed Site and confirms that the southern portion of the Site is located within Flood Zones 2 and 3. A small area to the north is shown to be outside of the extreme flood outlines in Flood Zone 1. The NRW Flood Map represents a combination of the undefended fluvial and tidal flood extents for Newport as derived from the Newport SFRM Modelling- Update of Newport Tidal Model Study v3.1 (Dec 2011).

The risk designations highlighted above require that a Flood Consequences Assessment be carried out in support of the proposed development.

2.5 Historical Flooding

There are no known records of flooding at the proposed development site.

3. FLUVIAL FLOOD RISK

3.1 Fluvial Regime

The Site is located within the lower catchment of the River Usk. This major watercourse rises in the mountains of Mid Wales and flows in a southerly direction through several major urban areas including Monmouth and the eastern valley towns to outfall into the Severn Estuary at Newport.

To the north of Newport the River Usk meanders as it flows along the river valley of relatively flat gradient. At Newport the natural geological features channel the river between the high ground occupied by Allt yr yn (near Newport Civic Centre) to the west of the river and Summerhill to the east. Downstream of this channel restriction the river again meanders across formerly estuarine mud flats to the Estuary. The former mud flats extend along the coast to Caldicot in the east.

Given the high fluvial flows and relatively flat channel slopes the River Usk regime tends to be very sensitive to flooding and as such NRW have carried out a considerable amount of analytical work on the regime. Careful consideration has been given to the flooding risks in urban areas within the catchment and particular attention has been given to Newport where there is also the potential from tidal flooding.

3.2 Natural Resources Wales Hydraulic Model

NRW has recently completed a detailed hydraulic modelling study for Newport using a hydrodynamic 1d/2d ESTRY-TUFLOW model. The modelling exercise assessed the flood risk from the River Usk and major tributaries, and included the major flood defences as well as the newly constructed East Bank defence along the River Usk. The model outputs were subsequently used to inform the Floodmap, a copy of which is included as Figure 1 in Appendix D herewith.

It can be seen that the proposed Site is located within Flood Zone 1 and outside of Flood Zones 2 and 3. It is therefore concluded that the Site will remain unaffected by floodwaters during the extreme fluvial flood in the River Usk.

3.3 Ordinary Watercourse

A small drainage ditch is seen to flow through the proposed Site. Scrutiny of OS contour data and map data indicates that the ditch drains a small area of approx. 0.45km² and drains the area to the north of the Site encompassing the 'Glebelands' and the new Glan Usk School site. The ditch flows adjacent to the railway line for a short distance along the eastern boundary of the Site, before making a 90° turn to flow due west across the Site and discharging into the River Usk.

Due to the limited catchment area, any flows within the channel are considered to be relatively small and of insufficient magnitude to significantly impact on the Site.

4. TIDAL FLOOD RISK

4.1 Tidal Regime

The City of Newport is located in the upper part of the Severn Estuary. The coastal geomorphology of the Bristol Channel and Severn Estuary encourages the development of high tidal ranges. Tidal water is constricted as it propagates up the Estuary and as such, the tidal range is greater with distance up the Estuary.

In this case, the coastal fringe to the south and south east of Newport is potentially at risk from tidal flooding in the event of a high return period tide.

Flood defences in the Newport area vary in form and protection level but generally the defences on the west bank of the river are of a higher protection level than on the east.

With regard to the defences in the vicinity of the proposed development site, Figure 1 in Appendix D details the location of formal NRW maintained raised defences along the River Usk. It can be seen that the formal defence on the left bank of the River Usk ends at the downstream boundary of the proposed Site, adjacent to Courtney Street. However, there is a raised embankment with a formed pathway on top that runs along the left bank of the River Usk from the southern extent of the proposed Site to beyond the M4 Motorway Bridge and the Glebelands Park to the north. The topographic survey data indicates that the crest level of this embankment is approximately 9.5mAOD at the downstream extent. This rises to approx. 10.3mAOD for a short section before returning to levels of generally 9.3-9.5mAOD. The lowest section of the bank is located at the outfall of the small drainage ditch to the River Usk where ground levels are ~9.1m AOD.

4.2 Natural Resources Wales Hydraulic Model

The current NRW Flood Map in this area is derived from the Newport SFRM Modelling- Update of Newport Tidal Model Study v3.1, which is based on a hydrodynamic 1d/2d ESTRY-TUFLOW model completed in December 2011. This modelling study incorporated the latest extreme tidal level prediction datasets and included the major flood defences as well as the newly constructed East Bank defence along the River Usk. The finalised model was run for the defended and undefended tidal flood events as well as the defended scenario with climate change. QMED was applied to the fluvial inflows for all model runs. The model outputs were subsequently used to inform the Flood Map.

In addition to the data supplied by NRW and following a meeting between WTD and NRW in March 2013, the NRW Flood Risk Analysis Team has considered the development proposals in line with interim guidance relating to the application of the Upper Bound Confidence Limits to tidal scenarios. With specific reference to the NRW Data Request (Ref Q3_133, dated 14th Nov 2012) and the June 2013 FCA Report (Issue C), the scenarios recommended for assessing tidal flood risk for new developments are as follows:

- T200 plus allowance for climate change (DESIGN EVENT)
- T1000 (present-day) (DESIGN EVENT)
- T200 plus allowance for climate change plus Upper Confidence Limit (SENSITIVITY EVENT)

Based on these recommendations, the NRW model was purchased and re-run for the relevant scenarios in **2114**. This assumes a Lifetime of Development of 100 years in line with the latest guidance from Newport City Council. The appropriate values were added to the inflow hydrograph to account for the anticipated sea-level rise. Using the current guidance on sea level rise provided by DEFRA (detailed in Appendix D), this equates to 1.05m of sea level rise on the peak levels used for the modelled 2011

scenario. It is noted that the calculated tide level for the 0.5% APE in 2114 is approx. 9.545m AOD, compared to 8.82m AOD calculated for the 0.1% APE in 2014. In this case, the critical threshold of flooding will be that arising from the 0.5% APE in 2114.

The model outputs provide detailed flood level and depth data for the existing scenario. The model results are shown in Drawing No. CIV13980-C-SA-90-1001-A02, included in Appendix E herewith. The model outputs indicate that the Site is affected during the 0.5% probability tidal events in 2114 in the **DEFENDED** scenario (with upper confidence interval applied). Peak water levels within the River Usk channel adjacent to the Site are circa 9.92m AOD. Scrutiny of the topographic survey data indicates that the raised embankment along the left bank of the River Usk at this location ranges between 10.38m AOD and 9.12m AOD. Floodwaters initially enter the Site via the un-flapped culvert that conveys the ordinary watercourse through the Site and under the raised Usk embankment. However, floodwaters also spill into the Site from the north-west corner during the onset of the second (peak) tidal cycle. Peak flood depths of circa 2.0m are predicted for the main part of the Site.

4.3 Undefended scenario

As part of the flood mapping exercise, NRW also considered the undefended scenario. The 0.5% APE and 0.1% APE undefended scenario results are detailed in Table 3 in Appendix D. It should be noted that the undefended scenarios were run solely for the purposes of flood mapping rather than for planning purposes, so these levels do not include the confidence intervals (which would need to be added for planning purposes). Furthermore, the model was not run for future undefended scenarios. It can be seen that the water surface elevations for the undefended events remain consistent across the Site at around 8.62m AOD and 8.93m AOD for the 0.5% and 0.1% probability events respectively.

The mechanism of flooding in the undefended scenario is primarily from floodwaters spilling out of bank over the left bank of the River Usk to the south of the Site. An overland flow path subsequently develops and floodwaters gravitate towards the north and inundate the proposed Site. Flood depths peak at 1.96m and 2.27m for the 0.5% APE and 0.1% APE respectively. Topographic survey data indicates that the average ground level at the Site is around 7.3m AOD; therefore, general flood depths across the Site in the undefended scenario exceed 1m. Velocities are low for both undefended scenarios (~0.3m/s) indicating that floodwaters will pond in the area of lower ground between the River Usk and the railway line.

4.4 Proposed Development

NRW have confirmed that it is required to apply the calculated Confidence Limits to the extreme tide levels as part of sensitivity testing to assess compliance with Table A1.14 of TAN15 for the proposed development.

Application of the Upper Confidence Limit value of 0.4m to the base tidal curve gives an extreme tide level of 9.945m AOD). The Upper Confidence Limit is not applied to the 0.1% APE (Tidal).

The extant Planning Permission for the Site proposes to raise ground levels to 9.8m AOD, with slab levels to be set 600mm above this level at 10.4m AOD. However, this degree of ground-raising is not necessary, and as part of the updated proposals, it is proposed to raise Site levels to circa 9.8m AOD, with building slabs set at 9.95m AOD.

The topographic survey data indicates that the extreme tide level will exceed the levels along the left bank of the River Usk. Raising the slab levels to 9.95m AOD ensures that the internal levels of the proposed buildings remain unaffected by the extreme tidal levels. Furthermore, roads will be set at circa 9.5m AOD

to provide both a conveyance route and flood storage for flood waters through the Site during the extreme flood events.

Raising the lowest parts of the Site to a level of circa 9.8m AOD raises an area of approx. 2.5ha out of the 0.5% APE floodplain. Furthermore, raising the Site limits the conveyance route for floodwaters spilling into the Site from the north western corner. Setting the slab levels of the proposed buildings at 9.95m AOD ensures that the proposed buildings will remain flood-free during the 0.5% APE in 2114 with the Upper Confidence Interval applied. This will ensure that the Site satisfies Table A1.14 for the 0.5% probability tide event. The results of the model simulation are presented in Drawing No. CIV13980-C-SA-90-1003-A02, included in Appendix E herewith.

In order to avoid flood water bypassing the existing flood defences, via the un-flapped culvert on the ordinary watercourse, this culvert is to be replaced with a flap valved 2.5m diameter culvert (in lieu of the existing 2m diameter culvert).

4.5 Peak Tide Levels, Confidence Intervals and Third Party Effects

In order to provide an appropriate assessment of flood risk at the Site of interest, this FCA has presented the model output based on the predicted extreme tide level for the 0.5% APE in 2114. This scenario used the 'base' peak tide level estimates as supplied by NRW, with the appropriate increments added to account for anticipated sea level rise.

It is a requirement of TAN15 that the impact of the proposed development on third party flooding is assessed as part of a detailed FCA.

Modelling has shown that the proposed buildings will remain unaffected by floodwaters during the 0.5% APE (2114). It is also concluded that the proposed buildings will remain unaffected during the 0.1% APE (2014). However, when assessing the potential third-party impact, the extant consented scheme is used as the 'baseline' scenario. This provides an assessment of the impact that the new layout will have on flood levels compared to the consented scheme.

The latest design layout proposes to set Site levels at 9.8m AOD, with the road infrastructure some 350mm lower at levels of 9.8-9.45m AOD. Building slab levels will be set at 9.95m AOD. Clearly this is lower than the consented scheme, which proposes to set the Site at 9.8m AOD, and the building slabs at 10.4m AOD. The latest proposed layout involves a lesser degree of ground-raising, which will result in a smaller impact on the existing flow regime than that of the consented scheme. As a result, the third-party impacts of the new layout proposals will be less significant than that from the consented scheme. The model has been re-run for the Consented Scheme (0.5% APE in 2114 with upper confidence interval) and the outputs are compared to the results for the Proposed Scheme. Drawing No. CIV13980-C-SA-90-2001-A01 illustrates the impact of the Proposed Scheme; it is clear that it provides a widespread betterment of circa 30mm for a large area to the east of the River Usk when compared to the Consented Scheme. Therefore, it is concluded that the latest development proposals do not adversely affect third party land and actually provide a betterment.

4.5.1 Ordinary Watercourse

It is noted in the initial design layout that the existing ordinary watercourse that flows from east to west through the Site will be retained. It is intended to enhance the ditch to provide a wildlife/ecology buffer zone and activity walks, which will link in with the adjacent play area and green open space. The conveyance capacity of the existing channel will not be changed, and the proposed raised plateau will ensure that the new dwellings will not be affected by this minor watercourse.

Furthermore, the low-lying area that is proposed next to the ordinary watercourse is likely to provide attenuation for floodwater in the watercourse when the outfall to the river is tide locked. Adequate consideration will need to be made in the detailed design of the development proposals to avoid any potential impact resulting from the loss of floodplain connectivity/storage for floodwaters associated with this ordinary watercourse.

5. OTHER SOURCES OF POTENTIAL FLOODING

5.1 Pluvial Flooding

Pluvial flooding is defined as flooding that results from rainfall-generated overland flow, before the runoff enters any watercourse or sewer. It is usually associated with high intensity rainfall events (typically >30mm/h) but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or has low permeability resulting in overland flow and ponding within depressions in the topography. Urban pluvial flooding arises from high intensity 'extreme' rainfall events. In such situations, urban underground sewerage/drainage systems and surface watercourses may be overwhelmed.

Although the Site has previously been developed and is classified as brownfield, it is now vacant and much of the ground comprises of overgrown vegetation with some areas of hard-standing. The main part of the Site is characterised by lower ground levels of approx. 7.2mAOD, with three raised areas or 'mounds' of higher ground ranging between 7.6-7.8mAOD. Furthermore, the Site is constrained by higher ground to the east and west by the raised embankment and railway line respectively. There is potential for a high intensity storm to generate areas of standing water within the existing Site where there are depressions in the topography, however following the construction of the development plateau and a formalised drainage system, the risks associated with pluvial flooding will be negligible.

5.2 Groundwater Flooding

Flooding from groundwater occurs when the ground water table reaches the surface and creates overland flow. Groundwater flooding is generally associated with porous rocks eg. sands, gravels, and limestone.

The Head of Public Protection within Newport City Council reports that the site overlies a minor sandstone aquifer. In addition, it is understood that the area is characterised by a perched water table.

Following the construction of the development plateau, the risks associated with groundwater flooding will be negligible.

5.3 Surface Water / Combined Drainage

Another potential source of flooding could be resultant of a blockage or lack of capacity in the existing drainage system. In this case, overland flooding may initiate and in doing so has potential to flood highways and properties that lie within its flow path.

The existing sewerage system comprises a network of surface water and combined sewers. According to DCWW records, a combined sewer (1800mm diameter) runs in a northerly direction along the western boundary of the proposed Site. This pipe then joins with a larger combined sewer of 2100mm diameter flowing from the north east, which subsequently crosses the River Usk and ultimately conveys flows into the Sewerage Treatment works at Uskmouth.

Should the capacity of the existing public sewerage system be exceeded then there is potential for outflow to occur at the associated manholes. Due to the presence of the raised embankment along the western boundary of the Site, any resultant flow will be channelled eastwards and into the Site.

Due to the depth of the aforementioned sewers this is considered to be unlikely however the design of the on-site highway infrastructure should none the less consider this potential risk and ensure that future properties are elevated in comparison with the on-site highways.

Sewerage plans in the vicinity of the Site are included in Appendix G herewith.

6. FLOOD CONSEQUENCES ASSESSMENT

6.1 Planning Policy Requirements

TAN 15 identifies Residential Development as being ‘highly vulnerable’ development in terms of flood risk. The proposed development site is located in an area that has been designated to be in risk category Zone C1. The Zone C1 designation denotes “areas served by significant flood defence infrastructure, including flood defences”. The NRW Flood Map indicates the Site is at risk of flooding during an extreme tidal event. This flood risk designation requires that a Flood Consequences Assessment is required in accordance with Sections 6 and 7 and Appendix 1 of TAN 15 to address any potential flood risk issues.

As a first step in the Assessment, it is necessary to establish the justification for development in Zone C areas. Section 6 of TAN 15 requires that development will only be justified if *‘its location is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement, or its location is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region.’*

In October 2000 outline planning permission was granted for the construction of a replacement primary school with ancillary play areas, together with the proposed residential development on the site located at the ‘Glebelands’. These proposals include the raising of Site levels to 9.8m AOD, with building slabs to be set at 10.4m AOD. The principle of this development has, therefore, already been accepted and the details under consideration have been the subject of extensive consultations and discussion.

The proposed Site is located within the ‘Glebelands’ site H(5), which is designated as a main source of housing land within the Newport Deposit Plan 2011-2026. It is detailed in the Deposit Plan that the Glebelands Site has ‘existing commitments for residential development’. The replacement primary school has now been constructed. This planning consent has been implemented by virtue of the construction of the primary school.

Section 6 of TAN 15 requires that development will only be justified if *‘it concurs with the aims of Planning Policy Wales (PPW) and meets the definition of previously developed land’* and *‘the potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in Section 5 and 7 and Appendix 1 found to be acceptable’*. The Site is classed as previously developed land in PPW. Furthermore, the Newport Deposit Plan recognises that the Site is at risk of flooding during an extreme flood event and highlights that the Site will need to be raised so as to ‘ensure adequate flood risk management levels are achieved’. Extant Planning Permission permits the Site to be raised to 9.8m AOD with building slabs set at 10.4m AOD.

Newport City Council have provided their initial comments regarding the proposals as part of a screening opinion for residential development. They highlight that *‘a large part of the site lies within a defended floodplain (C1) as identified in the Welsh Government’s Development Advice Maps. It will be necessary to show that the effects of tidal flooding can be acceptably managed on the site. If land raising is proposed the impact of flood water displacement and run-off effects should be taken into account.’*

6.2 Potential Flooding Mechanisms

NRW have provided a copy of the Flood map based on their most up to date flood risk modelling of the River Usk at Newport (included in Appendix D herewith). It is evident that the existing Site is marginally affected by the 0.5% tidal event, and significantly affected during a 0.1% probability tidal flood event in the present day (which was then 2011) in the **defended** scenario. It is noted that these levels include the upper confidence intervals for the predicted peak tide levels.

Following agreement with NRW, the scenarios recommended for assessing tidal flood risk for new developments are as follows:

- T200 plus allowance for climate change (DESIGN EVENT)
- T1000 (present-day) (DESIGN EVENT)
- T200 plus allowance for climate change plus Upper Confidence Limit (SENSITIVITY EVENT)

It is a requirement that any proposed development remains compliant with TAN15 criteria for the lifetime of the development. In this case, a design life of 100 years has been considered for the proposed residential development. In order to provide a robust and conservative assessment of flood risk for the proposed Site, the modelled scenarios have been run with the application of the upper confidence interval as a worst case scenario. The 0.5% probability tidal event in 2114 is shown to be the critical mechanism of flooding to the proposed Site. Drawing No. 13980-C-SA-90-1003-A02 in Appendix E illustrates the peak flood levels at the Site for the defended scenario for the 0.5% probability event in 2114. It can be seen that the proposed buildings remain unaffected by floodwaters during this scenario. Raising the Site to ~9.8m AOD and the FFLs to 9.95 AOD ensures that the criteria of Table A1.14 are satisfied and the Site can be developed at TAN15 compliant thresholds even in this very conservative scenario.

Furthermore, when the proposed scenario is compared to the consented scenario, it is shown that the proposed scenario provides a large area of betterment of circa 30mm when compared to the consented scheme. Therefore, the proposals do not adversely affect third party land and/or property and are compliant with TAN15.

6.3 Disposal of Surface Water

As part of a Flood Consequences Assessment, TAN 15 requires that consideration be given to any potential for flooding from surface water emanating from the proposed development site to minimise the risk of flooding to the Site, and to ensure the development does not increase the risk or magnitude of flooding to other parties.

It is understood that the site's existing land drainage system currently drains to the drainage ditch in the north of the site that subsequently discharges into the River Usk. A plan of the existing sewerage system is shown in Appendix G included herewith.

TAN 15 requires all new developments to consider, and where possible incorporate, the use of Sustainable Urban Drainage Systems (SuDS) to effectively dispose of surface water emanating from the Site. Due to the nature of the ground beneath the existing Site, it is unlikely that the use of soakaways will be appropriate for the development proposals, and therefore other SuDS options should be considered.

The next most desired method of surface water disposal is by means of a discharge to a watercourse. The nearest connection would be to the ditch that runs through the Site and then discharges into the River Usk, which lies immediately to the west of the Site.

The development proposals will result in an increase in impermeable areas across the Site, and therefore an increase in the rate of surface water runoff. In this case, however it is proposed to discharge at an unrestricted rate to tidally affected waters of the ordinary watercourse/River Usk.

6.4 Emergency Access

The emergency access/egress route to/from the proposed development site should also be reviewed in the light of the TAN 15 requirements, in respect of the maximum depth and velocity of floodwaters, so that access may be achieved in emergencies. For residential developments, TAN 15 stipulates that the maximum depth of floodwater over the defined route during a 0.1% probability flood event should be 600mm and that the maximum velocity should be 0.3m/s.

During the 0.5% APE with the Upper Confidence Interval applied to the peak tide level estimate, flood depths are seen to exceed the maximum criteria beyond the southern Site boundary, with Morgan Street, Collier Street and Courtney Street being affected by flood depths 1m+.

Notwithstanding the above, a flood-free route from the proposed site is available during the first and second modelled tidal cycles. It is possible to access and egress the Site from the North through the Glan Usk School grounds. This would allow residents, once alerted to the extreme tidal levels, to make their way off the Site onto Bank Street. Flood waters are shown to flow through the School Site during the third tidal cycle, with flood waters generally not exceeding 0.6m and associated velocities of circa 0.2m/s. Whilst this is compliant with the maximum flood depths and velocities recommended within TAN15, it is noted that this area is also only affected for a short period of 2 hours. Therefore, the safest course of action during an extreme flood event would be to remain on-site and wait for floodwaters to recede before attempting to gain access to/from the Site. The preceding two tidal cycles would act as a warning for a potential extreme tidal event, and would allow residents to take appropriate action. With approx. 12 hours between each tidal peak, there is sufficient time to make arrangements if necessary.

However, it should be noted that tidal flood events are highly predictable and as such, residents should be encouraged to sign up to the NRW flood warning service. Residents should have sufficient time to evacuate the premises if necessary. Furthermore, since the development is to be raised above the 0.5% probability tidal level, then the plateau itself would also provide an appropriate point of containment for residents if necessary until the floodwaters had subsided.

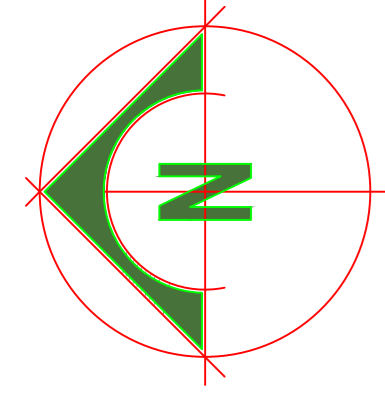
7. SUMMARY ASSESSMENT

- The existing Site is unaffected by the 1.0% and 0.1% annual probability fluvial flood events in the River Usk.
- The existing Site is shown to be affected by tidal flooding during the 0.5% probability tidal event in 2114 in the **DEFENDED** scenario, with the Upper Confidence Interval applied.
- It is proposed to raise the Site to around 9.8m AOD, with FFLs set at 9.95m AOD. This will ensure that the development remains dry during even the most conservative estimation of the 0.5% probability tidal event in 2114 and therefore is compliant with TAN15.
- There is no third party detriment as a result of the proposed development when compared to the consented scheme for the Herbert Road Site.
- The proposed development site is not likely to be affected by pluvial and groundwater flooding.
- The development proposals will increase the coverage of impermeable surfaces with a resultant increase in surface water runoff. As the use of soakaways is not likely to be feasible then surface water emanating from the proposed development should discharge to the land drainage ditch in the northern half of the site. Discussions regarding the rate of surface water discharge should be advanced with Newport CC during the detailed design process.
- The NRW model output data indicates that whilst Emergency Access/Egress within the Site remains compliant and with the guidance within TAN15, the main access/egress route off-site to the south of the development will experience flood depths in excess of 600mm.
- Alternative safe emergency access and egress is available from the Site from the North via the Glan Usk School Site. The proposed buildings remain flood-free throughout all modelled scenarios; and therefore it is recommended that residents remain on-site until the floodwaters recede.

APPENDICES

A. TOPOGRAPHIC SURVEY

B. PROPOSED SITE LAYOUT



PLOT SCHEDULE

799 HOUSE TYPE, 3 PERSON 3 BEDROOM	-	30
910 HOUSE TYPE, 3 PERSON 3 BEDROOM	-	28
877 HOUSE TYPE, 3 PERSON 3 BEDROOM	-	28
666 HOUSE TYPE, 4 PERSON 2 BEDROOM	-	30
797YAN HOUSE TYPE, 5 PERSON 3 BEDROOM	-	14
916S11 HOUSE TYPE, 4 PERSON 2 BEDROOM	-	8
892CON HOUSE TYPE, 4 PERSON 2 BEDROOM	-	2
FLATS, 2 PERSON 1 BEDROOM FLAT TYPE	-	7
FLATS, 3 PERSON 2 BEDROOM FLAT TYPE	-	51
FLATS, 3 PERSON 2 BEDROOM ELDERLY FLAT TYPE	-	6
FLATS, 2 PERSON 1 BEDROOM FLAT TYPE	-	6
FLATS, 3 PERSON 2 BEDROOM FLAT TYPE	-	6
FLATS, 3 PERSON 2 BEDROOM ELDERLY FLAT TYPE	-	12
FLATS, 3 PERSON 2 BEDROOM FLAT TYPE	-	20
TOTAL	-	249

PRELIMINARY

Client

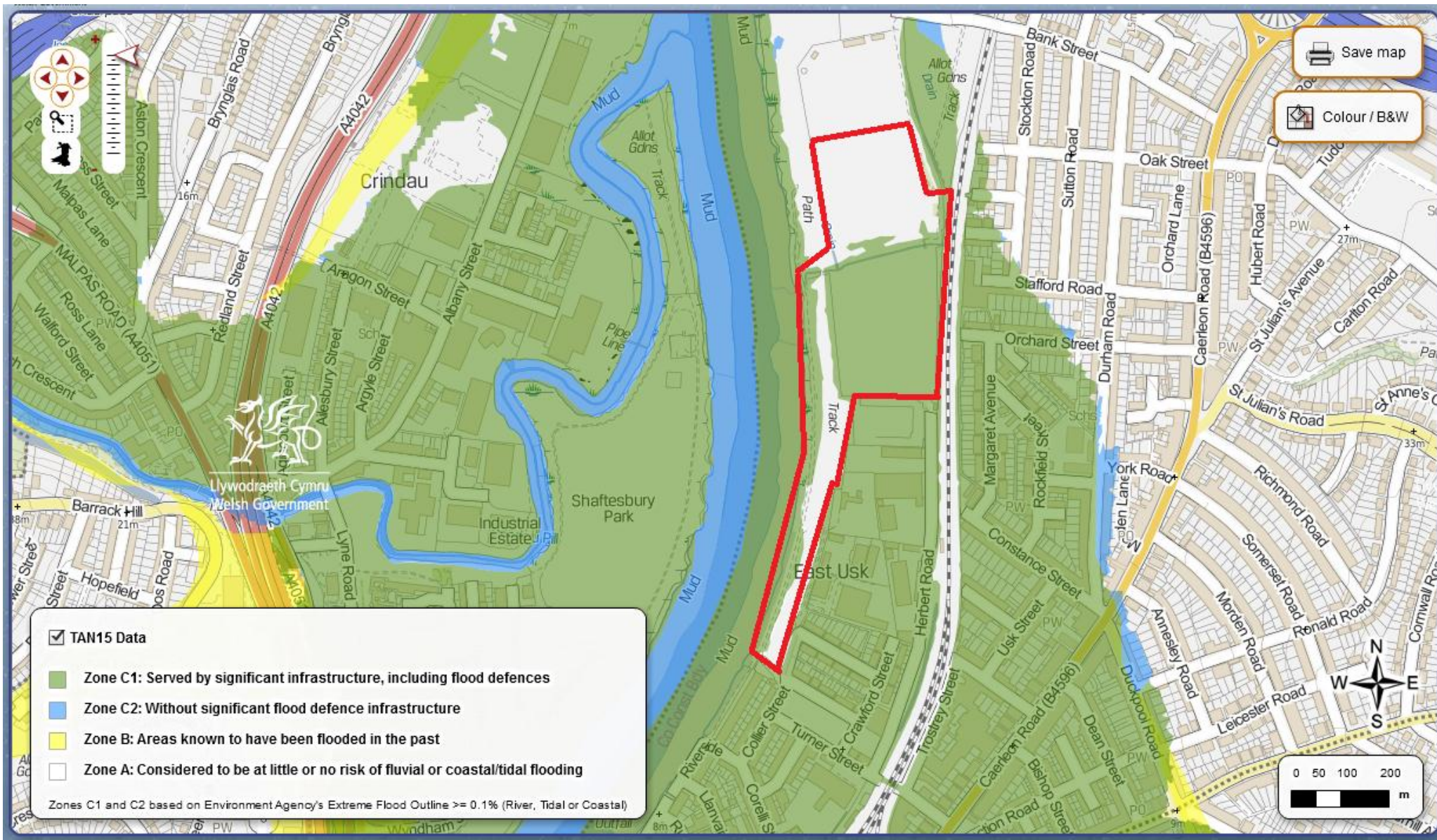
Contract
Development at Herbert Road
NEWPORT

Description
PROPOSED SITE
LAYOUT

Scale 1:500 @ A0	Date Nov '12
Dwg No. SW49 (04) 01	Revision



C. TAN15 DEVELOPMENT ADVICE MAP



D. NRW DATA

Q3_133 – Herbert Road, Newport

E 331718 N 189369

1.0 Current Flood Map

Figure 1 shows the current Flood Map (version 201211) 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 undertaken by JBA Consulting in December 2011 (*ref 5*).

More information on our Flood Map can be obtained from our website www.environment-agency.gov.uk

2.0 Local Flood Risk Mapping Study

Model Summary

The results summarised below are taken from the Newport SFRM Modelling – Update of Newport Tidal Model v3.1 study. This study was commissioned to update the tidal flood model in the area. This study incorporates extreme tidal level prediction datasets together with new LiDAR data and information on changes to landforms in the area.

The baseline model also includes the improved Riverside tidal defences, which were completed in June 2012.

The final design model was run for defended and undefended tidal flood events (including defended with climate change) whilst QMED is used for fluvial inflows for all design runs.

Results:

The results from this study relate purely to tidal levels in the river Usk. The section 3.0 – ‘Extreme Sea Levels & Climate Change Guidance’ and associated tables below, relate to tidal levels from the Severn Estuary.

The red polygon shown in the figures has been used to query the height, depth and velocity grids to provide the results in Table 1, 2 and 3. These represent the current day (2011) defended and undefended levels.

Example depth grids for the defended tidal 1 in 200 and 1 in 1000 year event, including upper confidence limit, are reproduced in **Figures 4 and 5**.

Table 1: Defended Level Data

Defended (2011)		
	1 in 200	1 in 1000
Model Grid Size (m)	5	5
Wet Cells	37	92
Elevation, mean (mAOD)	8.62	8.94
Elevation, max (mAOD)	8.63	8.95
Depth, mean (m)	0.16	0.12
Depth, max (m)	0.64	0.75
Velocity, mean (m/s)	0.02	0.01
Velocity, max (m/s)	0.20	0.31

Table 2: Defended with Climate Change Level Data

Defended (including upper confidence interval)					
	1 in 200 (2011)	1 in 1000 (2011)	1 in 200 (2061)	1 in 200 (2086)	1 in 200 (2111)
Model Grid Size (m)	5	5	5	5	5
Wet Cells	205	1477	1291	1788	1873
Elevation, mean (mAOD)	8.15	9.05	8.46	9.49	9.87
Elevation, max (mAOD)	9.05	9.48	9.36	9.59	9.89
Depth, mean (m)	0.09	1.05	0.58	1.27	1.57
Depth, max (m)	0.85	2.26	1.49	2.81	3.21
Velocity, mean (m/s)	0.10	0.43	0.42	0.43	0.58
Velocity, max (m/s)	1.24	4.25	4.60	4.88	5.04

Table 3: undefended Level Data

Undefended (2011)		
	1 in 200	1 in 1000
Model Grid Size (m)	5	5
Wet Cells	1460	1555
Elevation, mean (mAOD)	8.62	8.93
Elevation, max (mAOD)	8.63	8.93
Depth, mean (m)	1.06	1.30
Depth, max (m)	1.96	2.27
Velocity, mean (m/s)	0.31	0.32
Velocity, max (m/s)	2.24	2.25

3.0 Extreme Sea Levels & Climate Change Guidance

In February 2011, new extreme sea levels were derived for England and Wales (*ref 4*), which supersede previous estimates for the Caldicot and Wentlooge Levels. These levels were derived using a tidal model calibrated to UK tidal gauge data. The model output is provided for node locations spaced at approximately 2km. 95% confidence bounds for these values were also derived using the confidence intervals for each node location. The extreme sea levels comprise still water level including storm surge, however they do not account for local wave action. The baseline estimations are for the year 2008, so climate change is calculated relative to this year, for example add 10.5mm for the year 2011.

Extreme sea levels for the node points closest to the site location are included in **Table 4**. The node locations are shown in **Figure 7**

Table 4 Extreme sea levels for adjacent nodes

Node	Easting	Northing	T25	T50	T75	T100	T200	T1000
396	333517	182371	8.11	8.23	8.30	8.35	8.48	8.79
398	331070	182628	8.04	8.16	8.23	8.28	8.41	8.72

To provide the estimate of extreme sea levels for the site (**Table 5**), levels were interpolated from the adjacent nodes.

Table 5 Extreme sea levels interpolated between adjacent nodes

Site	Easting	Northing	T25	T50	T75	T100	T200	T1000
Site	332170	183294	8.06	8.18	8.25	8.30	8.43	8.74
95% Confidence (+/-)			0.20	0.20	0.30	0.30	0.40	0.60

The current guidance on climate change from DEFRA is as follows:

Table 6 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

The calculated future extreme sea levels are shown in **Table 7**. Adopting a precautionary approach as advised by Agency guidance (*ref 4*), these levels include the upper level 95% confidence bound.

Table 7 Extreme sea levels for the site (including 95% Confidence Bound)

Year	Sea level rise(m)	Extreme Event Sea Level (mAOD)					
		T25	T50	T75	T100	T200	T1000
2012	0.014	8.3	8.4	8.6	8.6	8.8	9.4
2062	0.380	8.6	8.8	8.9	9.0	9.2	9.7
2087	0.674	8.9	9.1	9.2	9.3	9.5	10.0
2112	1.036	9.3	9.4	9.6	9.6	9.9	10.4

Extreme sea levels provided as part of this project are accurate to one decimal place (Table 7). Two decimal places have been provided to show the gradual change between nodes seen in the model, however, this does not imply greater accuracy.

4.0 Additional Information

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

Figure 3 shows an approximate outline of the extent of fluvial flooding from December 1981.

5.0 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 v3.1, JBA, December 2011.

6.0 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.

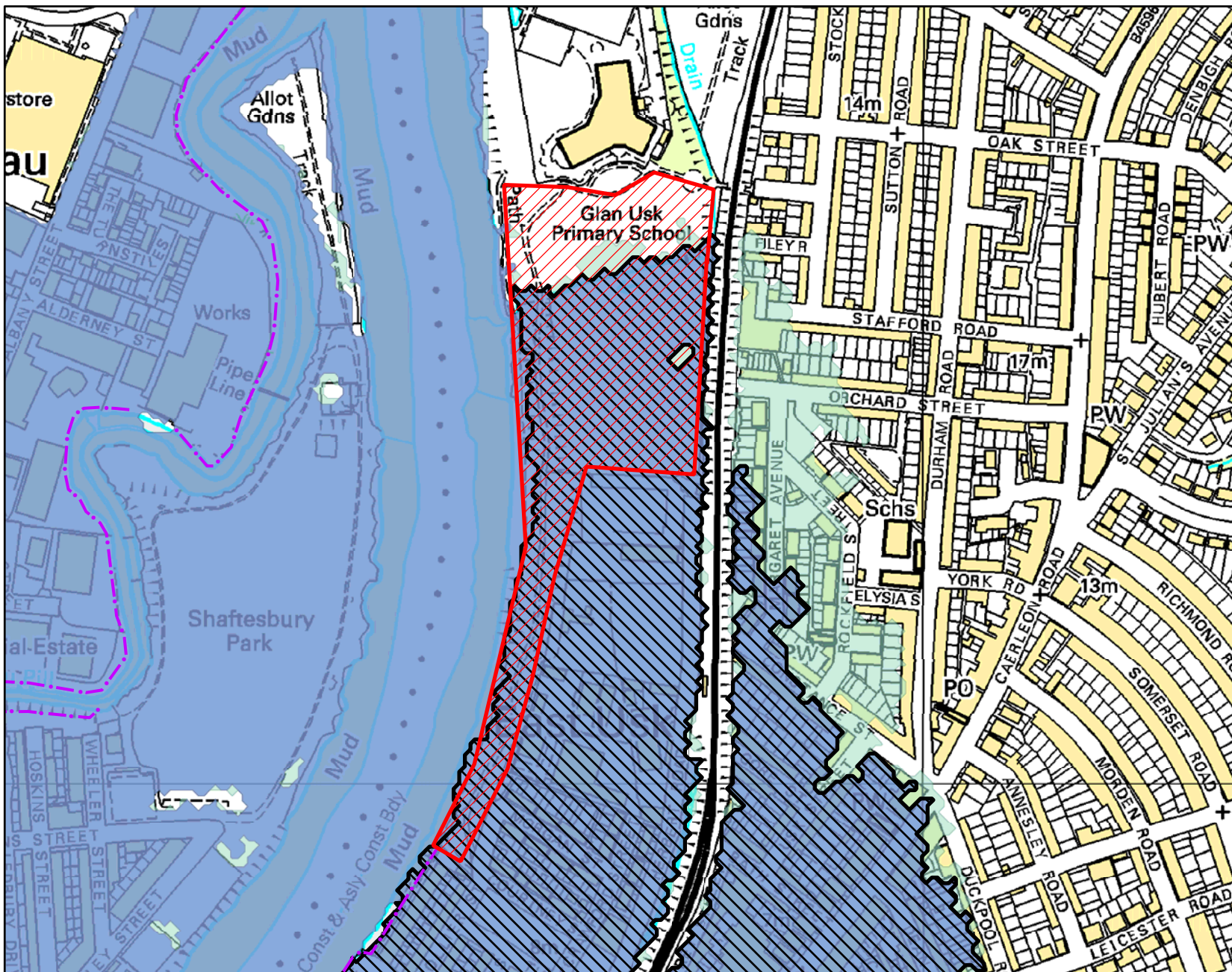
EA models are available under licence agreement for the purpose of further development. Contact EA Wales External Relations for details of terms, conditions and pricing.

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

Please refer to EA standard terms and conditions

Flood Risk Analysis
14/11/2012

Basic FCA Map for Herbert Street , Newport - created 13 November 2012 [Ref: Q3_133]



Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Scale 1:5,000



Legend






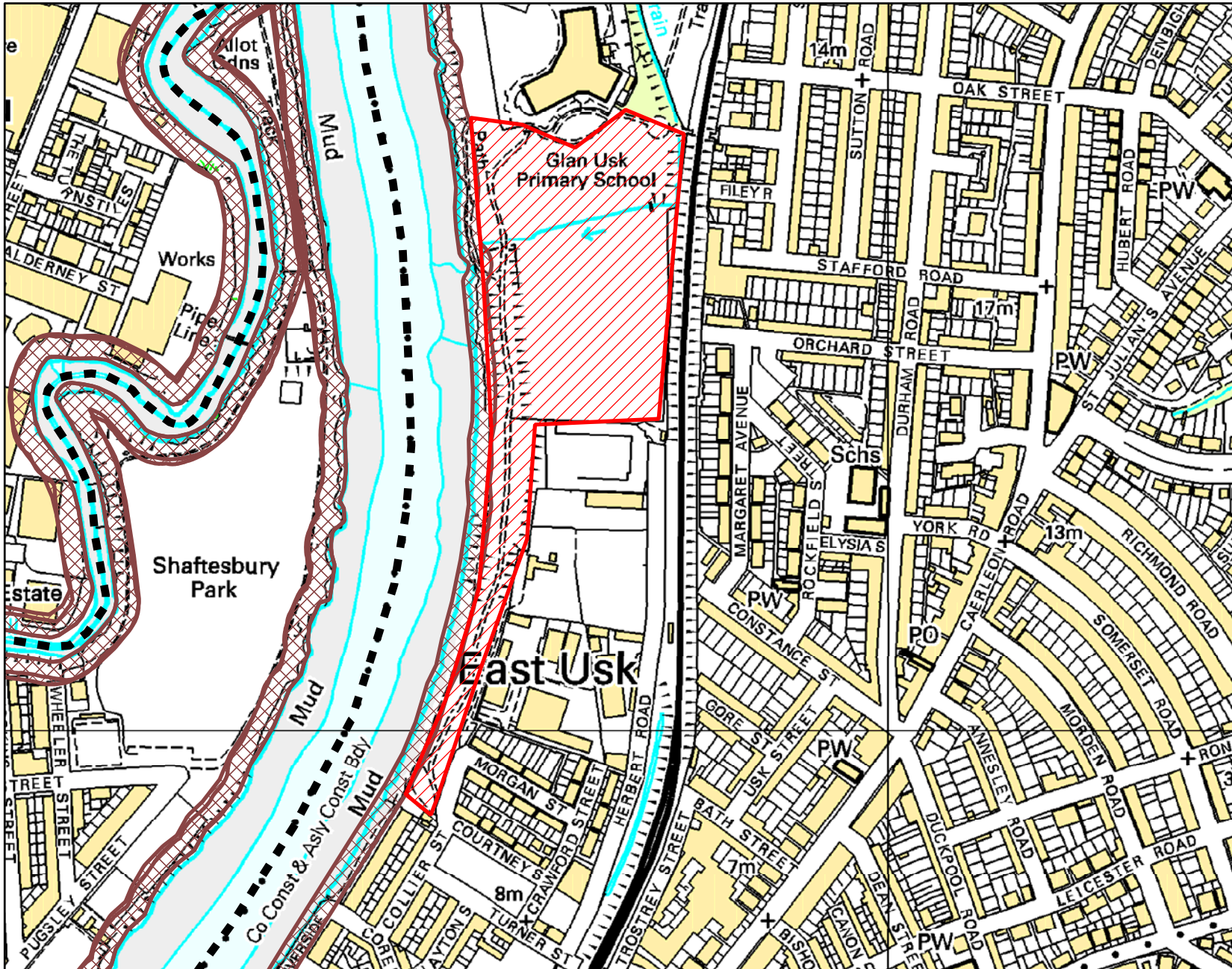
-  Site Location
-  Flood Zone 3 (1 in 100 year undefended fluvial and 1 in 200 year undefended tidal extents)
-  Flood Zone 2 (1 in 1000 year undefended fluvial and tidal extents)
-  Areas benefiting from defences
-  Defences

Figure 1

Current Flood Map (V201211)

Basic FCA Map for Herbert Road , Newport - created 13 November 2012 [Ref: Q3_133]




Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Scale 1:5,000



Legend

 Site Location

 Statutory Main River


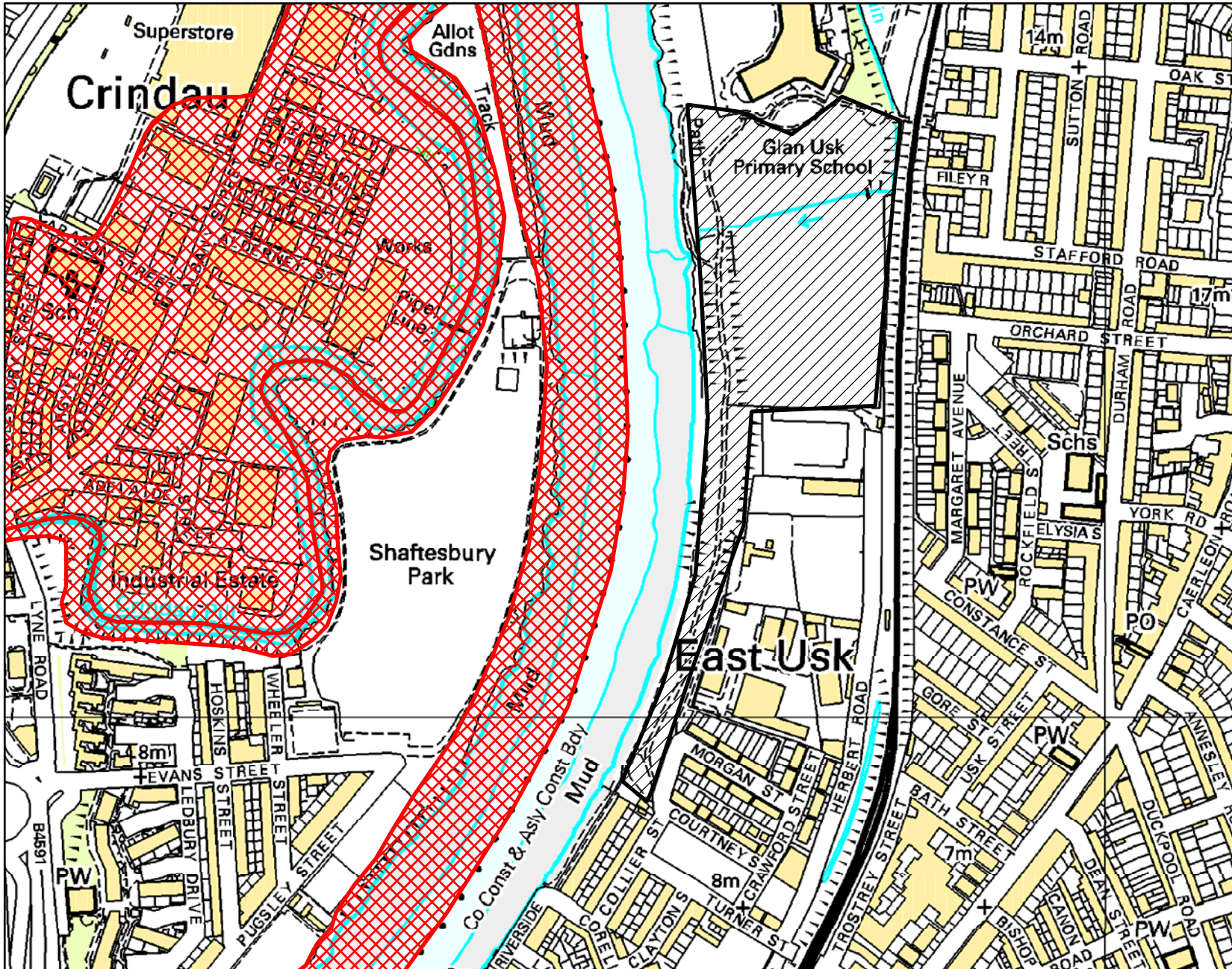
 Bank Top E-Planning Tool
(comprising: 20m buffer
around the Main River network,
River Bank features & around
the mean high water level for
estuaries wider than 40m)

Figure 2

Statutory Main Rivers

Basic FCA Map for Herbert Road , Newport - created 13 November 2012 [Ref: Q3_133]



Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Scale 1:5,000



Legend



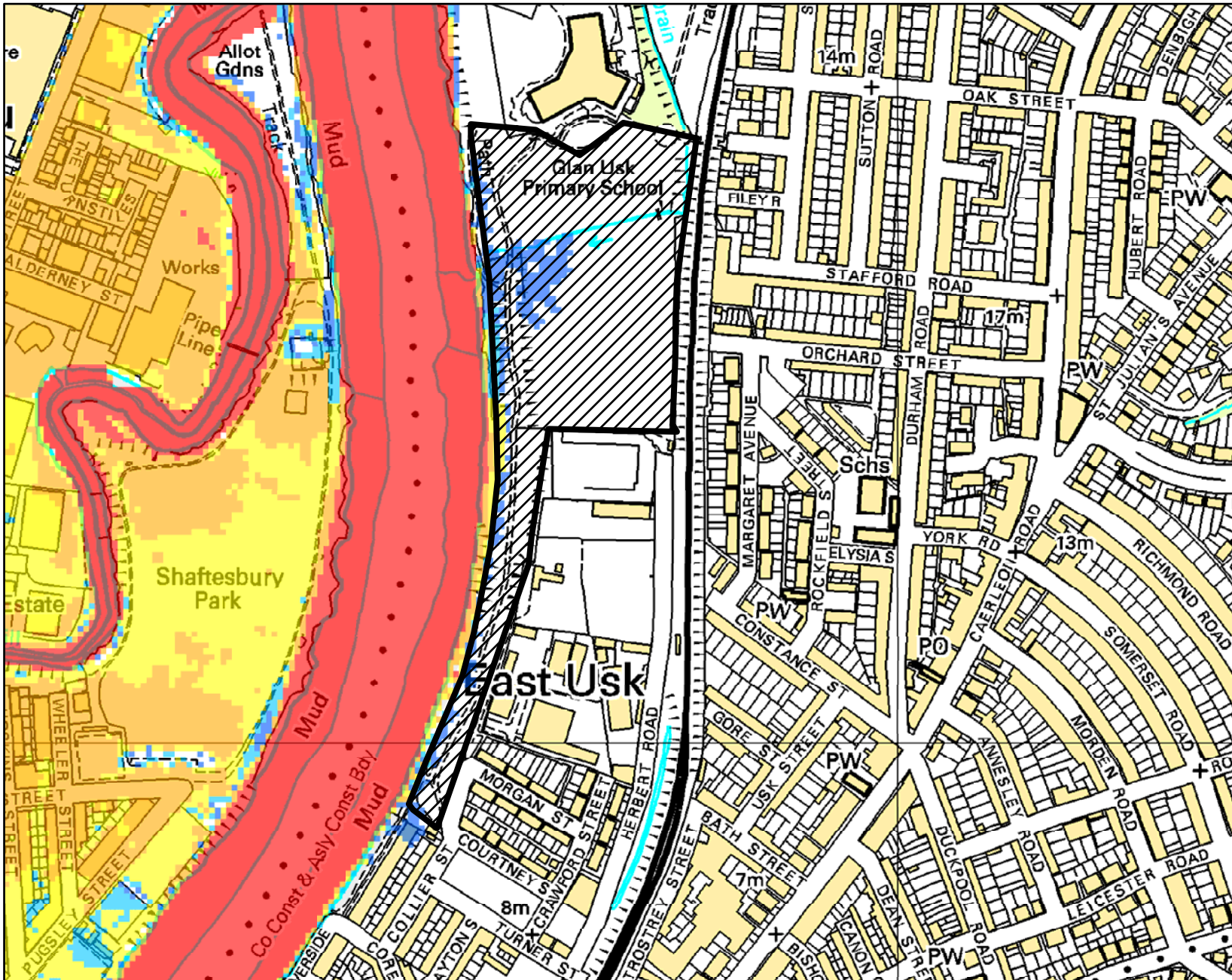
-  Site Location
-  Approximate extent of historical flooding

Figure 3

Historic Flood Map (v4)

Basic FCA Map for Herbert Road, Newport - created 13 November 2012 [Ref: Q3_133]



Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Scale 1:5,000



Legend

Site Location

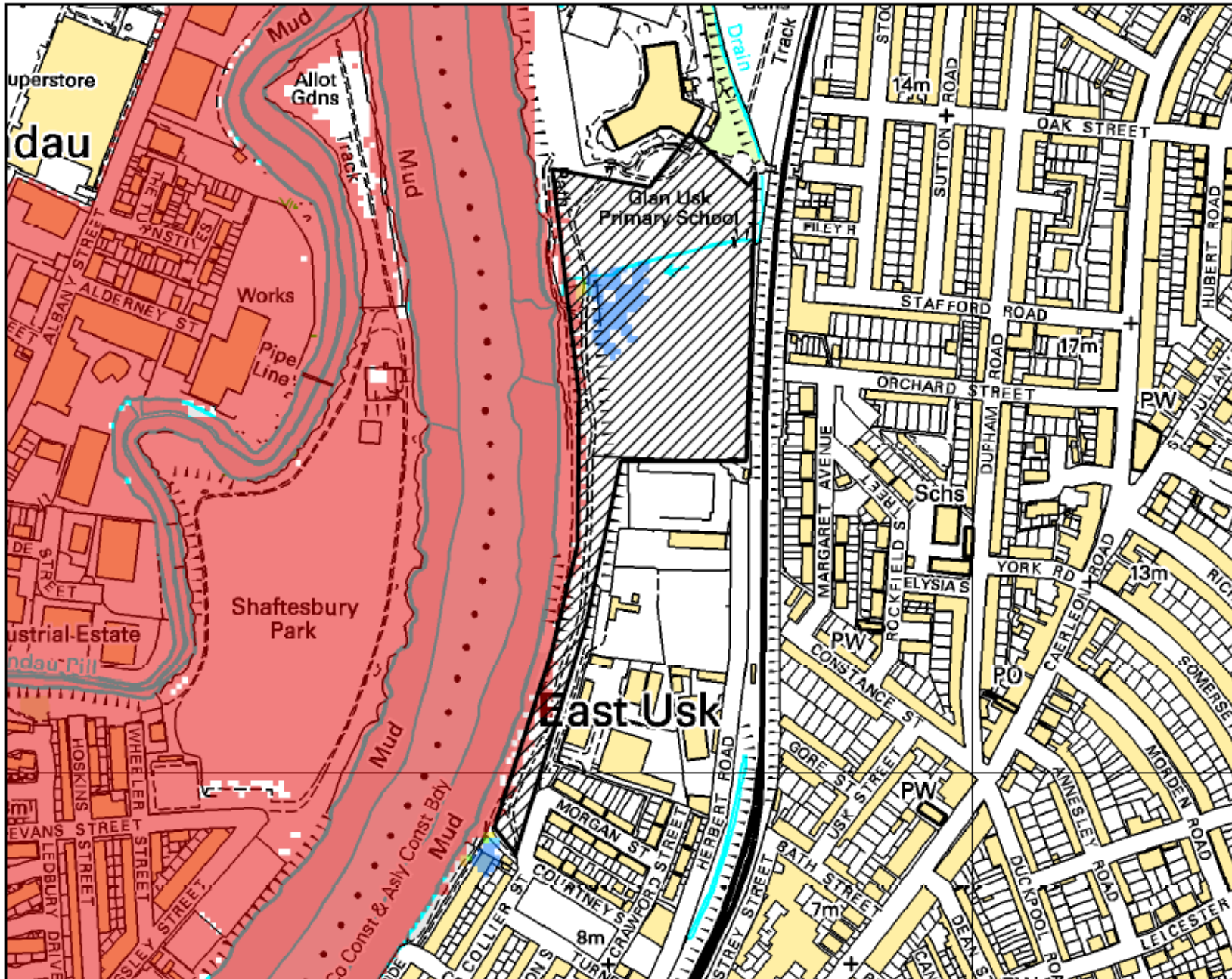
Flood Depth (m)


- 0.0 - 0.3
- >0.3
- >0.6
- >1.0
- >2.0


Figure 4

Depth Grid for 0.5% AEP
(1 in 200) year tidal event -
defended including upper
confidence limit (2011)


Basic FCA Map for Herbert Road, Newport - created 21 November 2012 [Ref: Q3_133a]




Asiantaeth yr Amgylchedd Cymru
Environment Agency Wales

Scale 1:5,000
 

Legend

-  Site Location

Water Surface Elevation (mAOD)







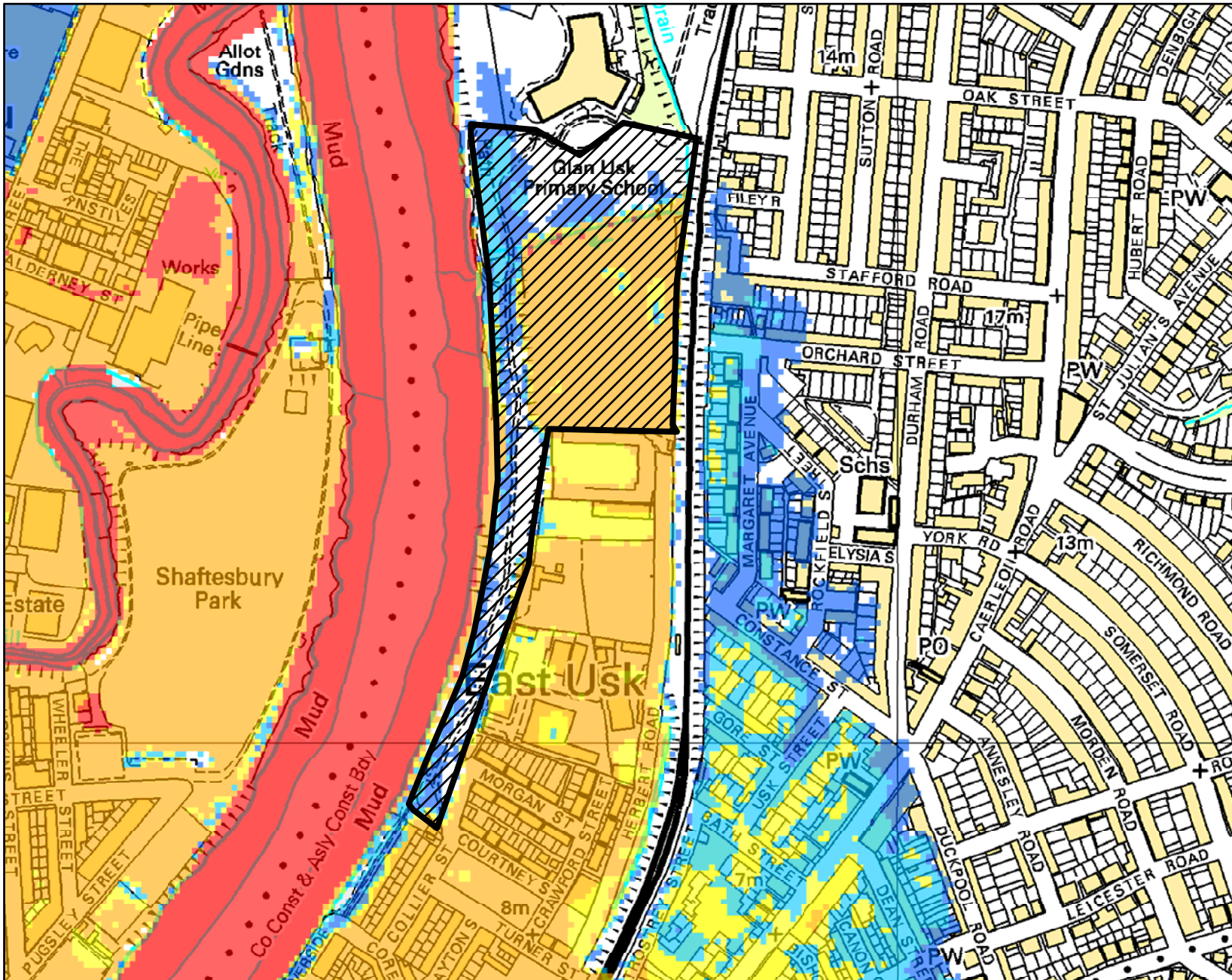
-  <8.0
-  8.00 - 8.25
-  8.25 - 8.50
-  8.50 - 8.75
-  8.75 - 9.00
-  >9.00

Figure 4b
 Elevation Grid for 0.5% AEP (1 in 200) year tidal event - defended including upper confidence limit (2011)

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Basic FCA Map for Herbert Road, Newport - created 13 November 2012 [Ref: Q3_133]



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Amgylchedd Cymru
Environment
Agency Wales

Scale 1:5,000



Legend

 Site Location

Flood Depth (m)






-  0.0 - 0.3
-  >0.3
-  >0.6
-  >1.0
-  >2.0

Figure 5

Depth Grid for 0.1% AEP
(1 in 1000) year tidal event -
defended including upper
confidence limit (2011)

Basic FCA Map for Herbert Road, Newport - created 21 November 2012 [Ref: Q3_133a]



Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Scale 1:5,000





Legend


 Site Location


Water Surface Elevation (mAOD)

 <8.0

 8.00 - 8.25

 8.25 - 8.50

 8.50 - 8.75

 8.75 - 9.00


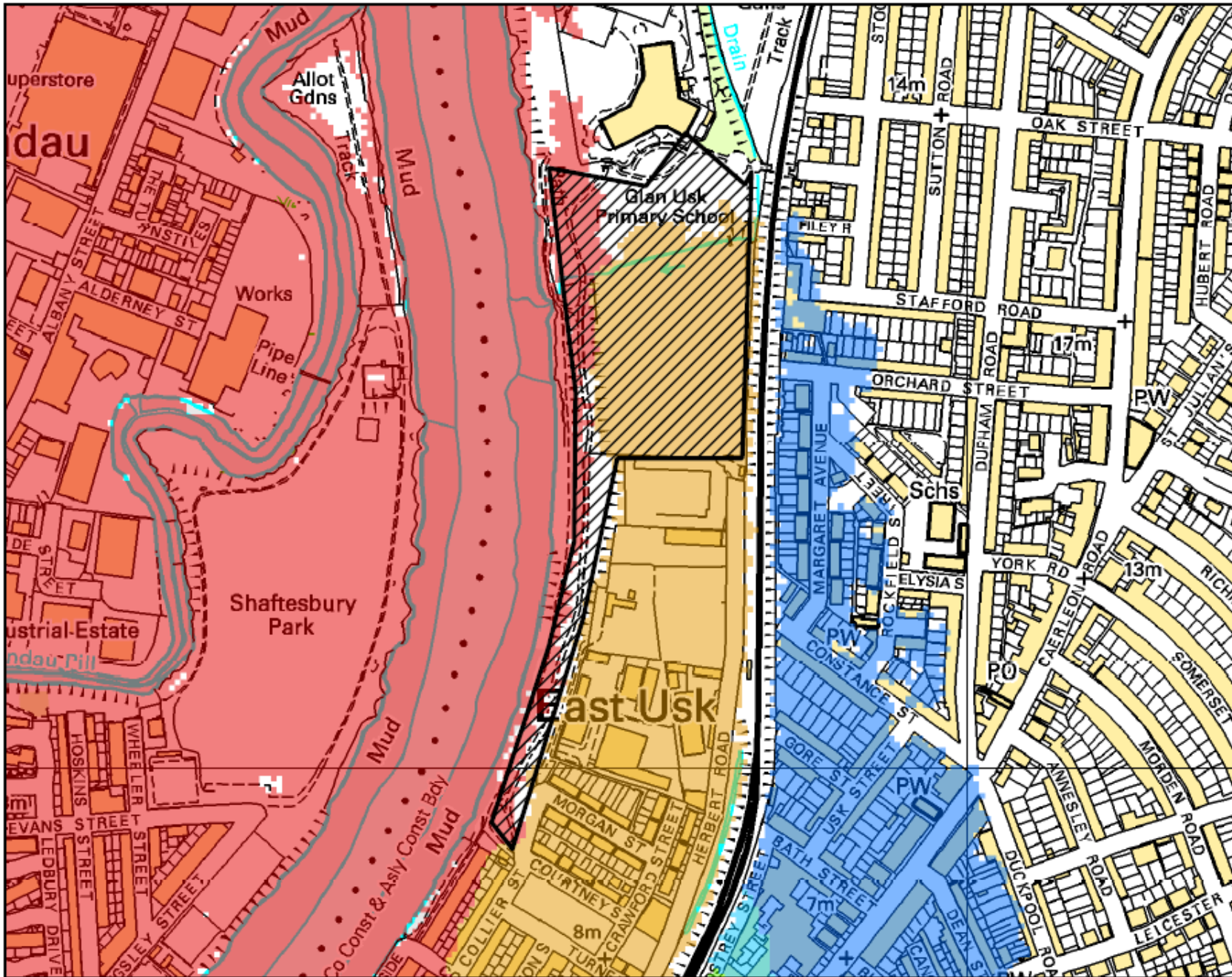
 >9.00

Figure 5b

Elevation Grid for
0.1% AEP (1 in 1000)
year tidal event - defended
including upper confidence limit
(2011)



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Basic FCA Map for Herbert Road, Newport - created 21 November 2012 [Ref: Q3_133a]



Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Scale 1:5,000



Legend

 Site Location

Flood Depth (m)






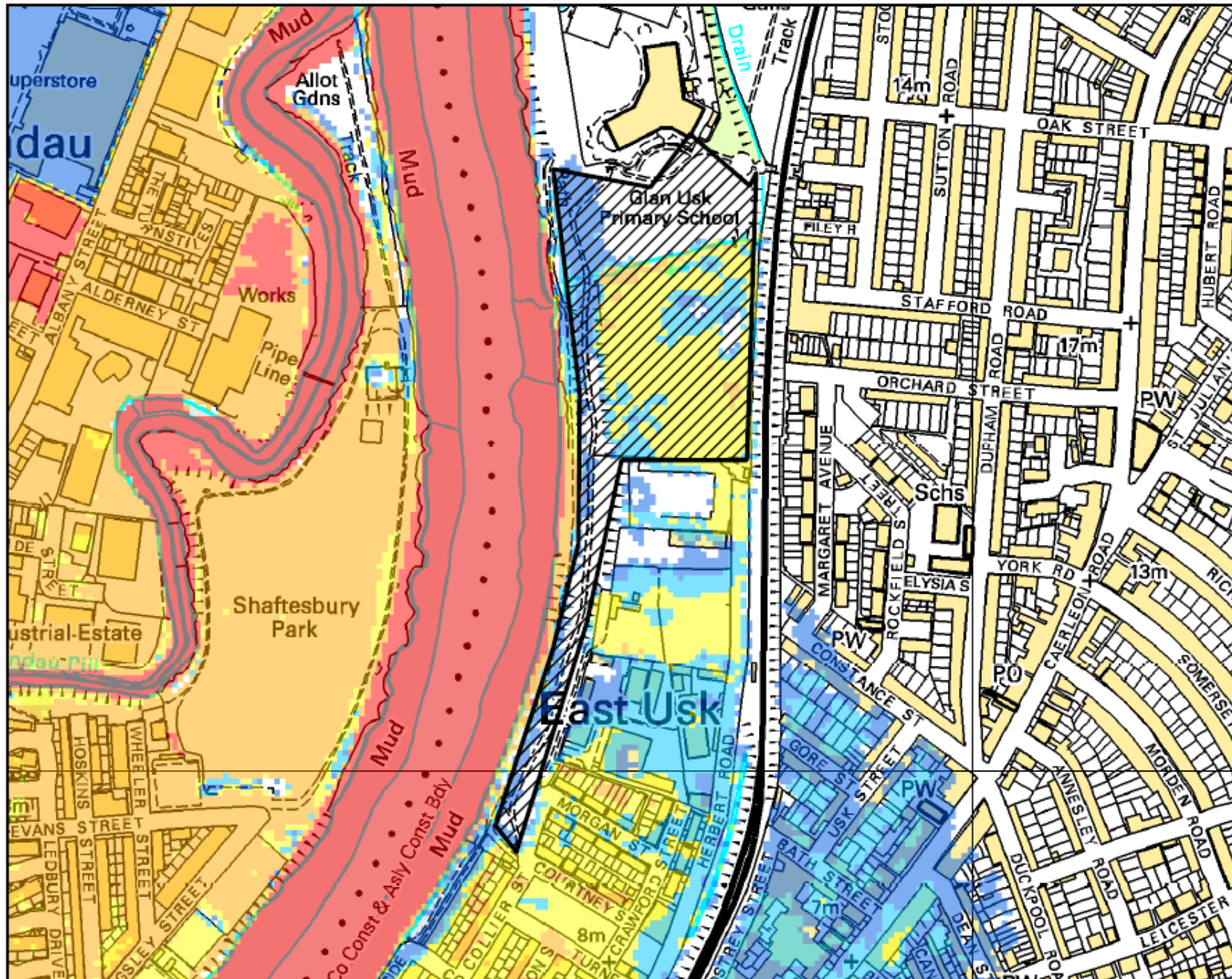
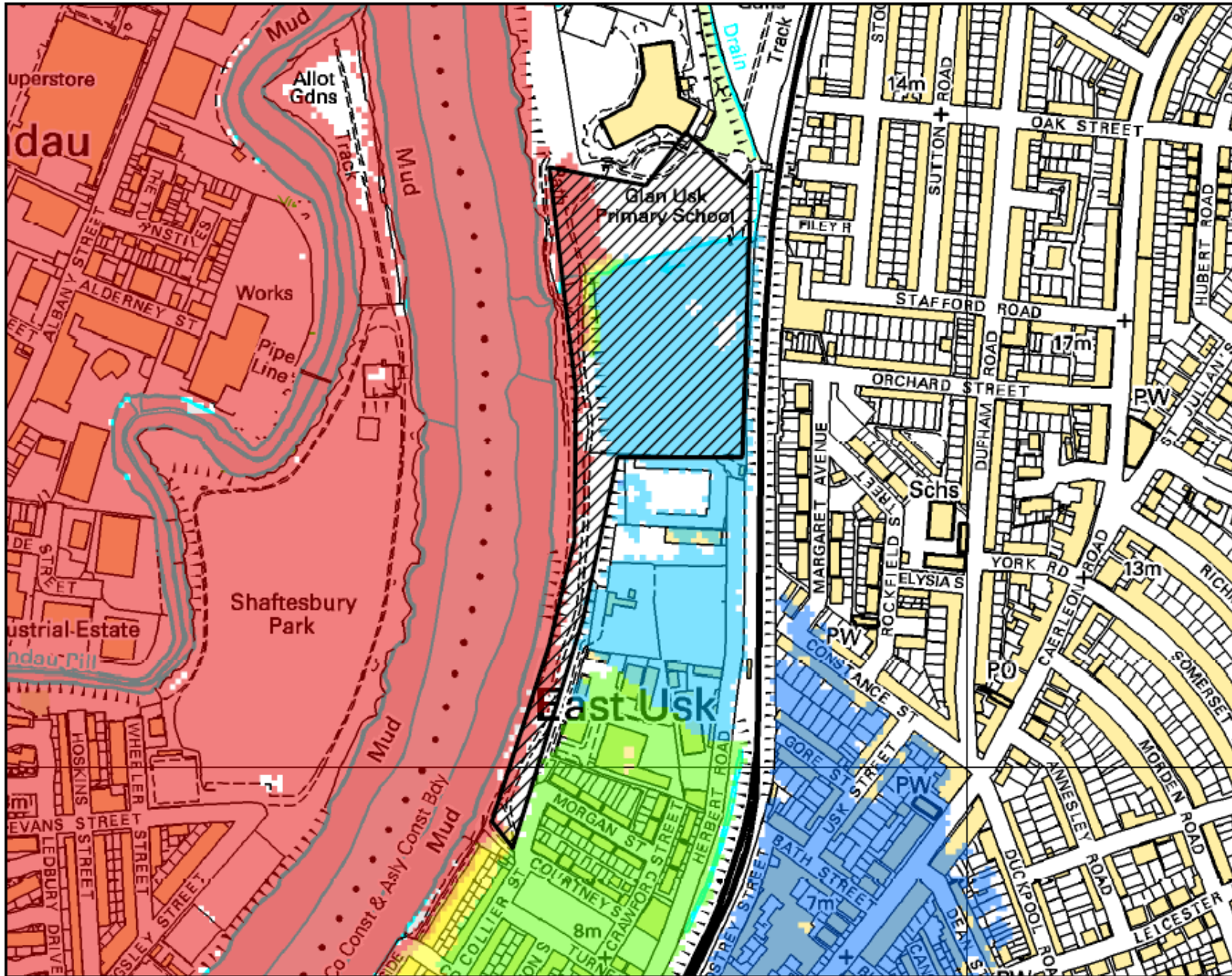
-  0.0 - 0.3
-  >0.3
-  >0.6
-  >1.0
-  >2.0

Figure 6

Depth Grid for
0.5% AEP (1 in 200)
year tidal event - defended
including upper confidence limit
(2061)



Basic FCA Map for Herbert Road, Newport - created 21 November 2012 [Ref: Q3_133a]



Scale 1:5,000




Legend


 Site Location


Water Surface Elevation (mAOD)

 <8.0

 8.00 - 8.25

 8.25 - 8.50

 8.50 - 8.75

 8.75 - 9.00


 >9.00

Figure 6b

Elevation Grid for
0.5% AEP (1 in 200)
year tidal event - defended
including upper confidence limit
(2061)

Basic FCA Map for Herbert Road, Newport - created 13 November 2012 [Ref: Q3_133]



Asiantaeth yr
Amgylchedd Cymru
Environment
Agency Wales

Scale: 1:60,000



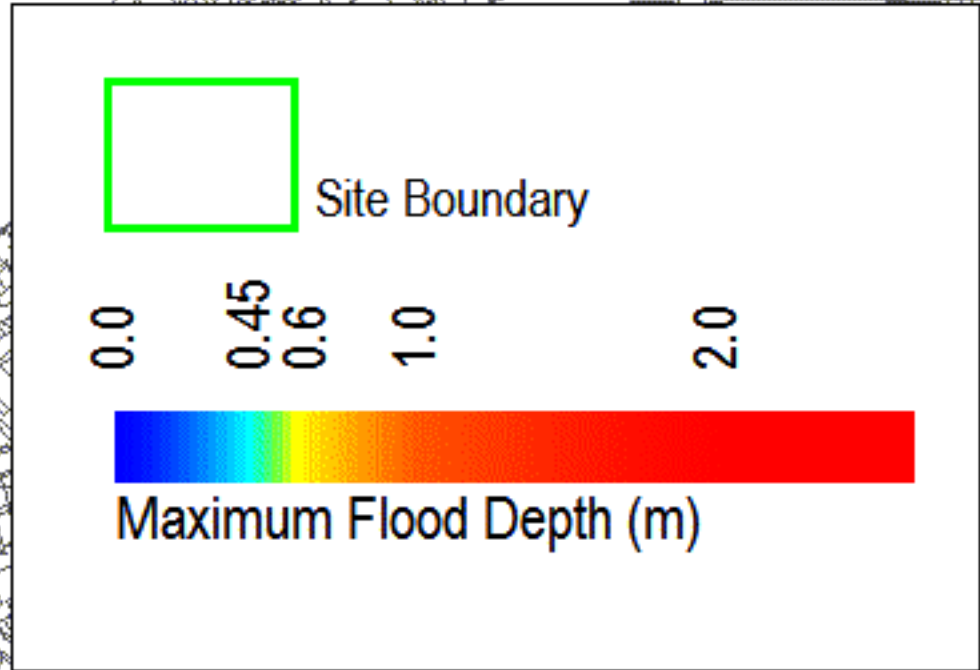
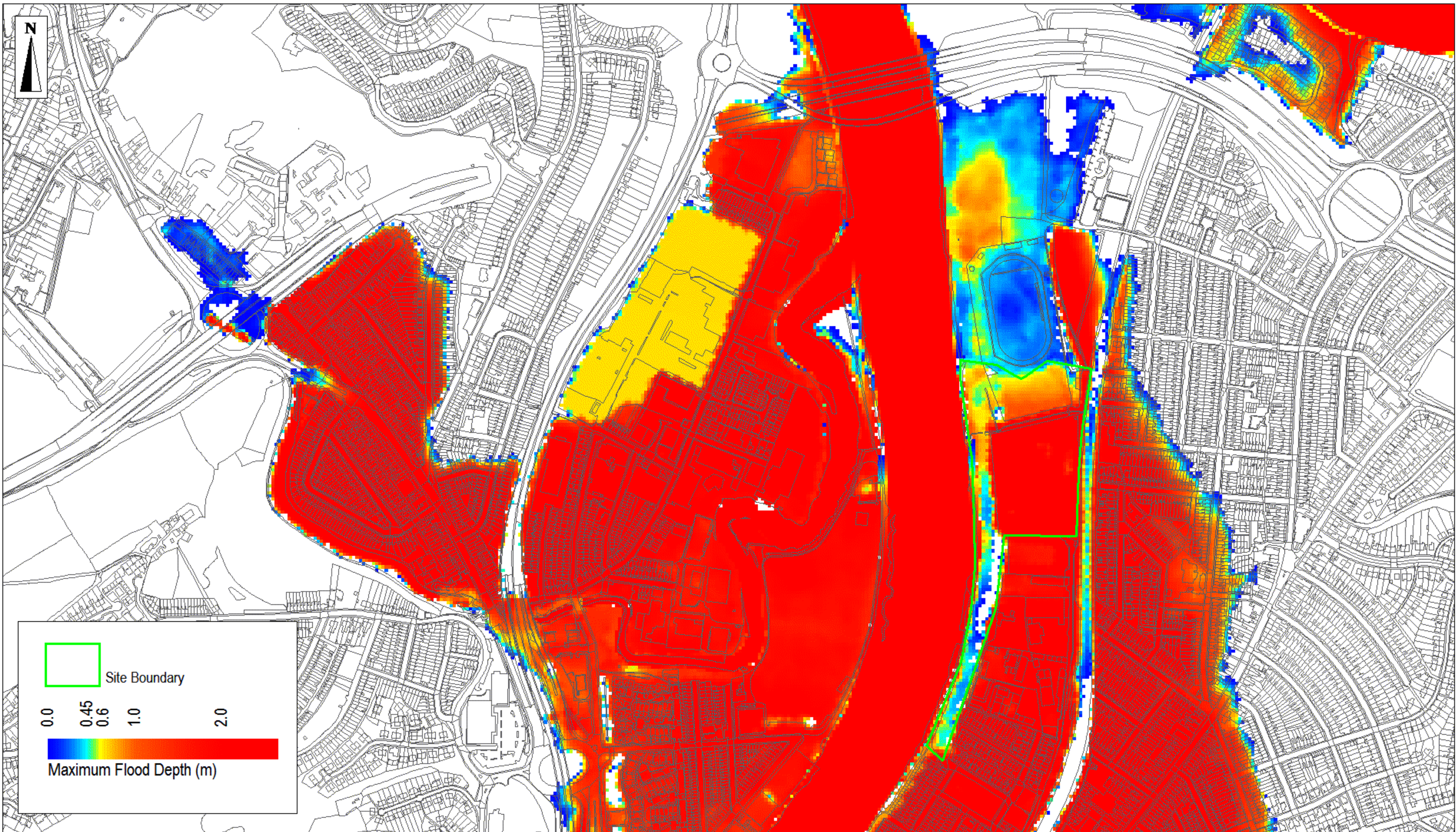
Legend

-  Site Location
-  Sea Level Node Location
-  Projected Sea Level

Figure 7

Extreme Sea Level
Node Locations

E. MODEL RESULTS- EXISTING SCENARIO



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Rev	Date	Description	By
A02	11.03.14	Model outputs for 100 year design life	LC
A01	07.11.13	FIRST ISSUE	LC
Amendments			

GENERAL NOTES

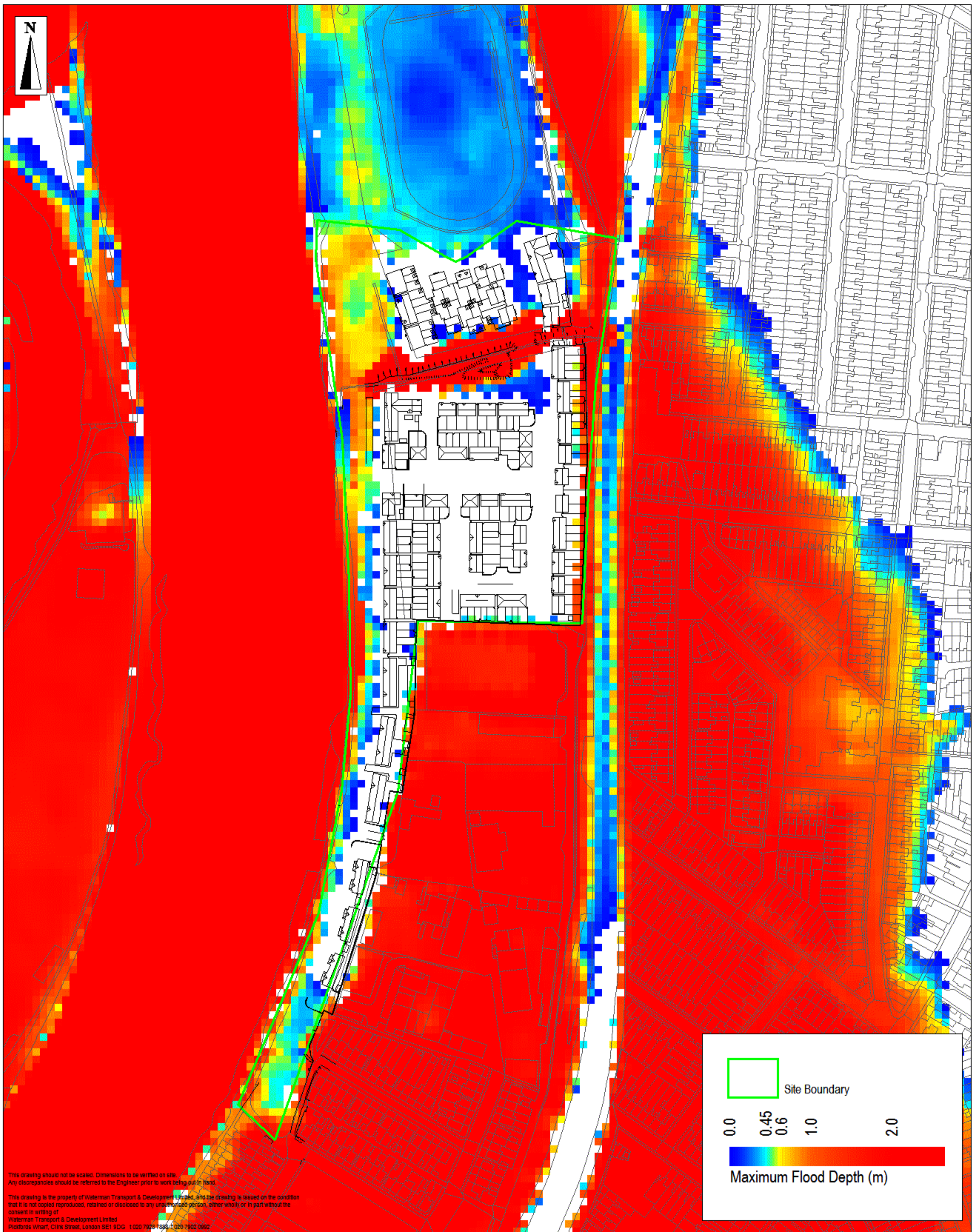
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		Title PEAK FLOOD DEPTHS (m), 0.5% APE, 2114 WITH UPPER CONFIDENCE INTERVAL EXISTING SCENARIO	
Client GREENHILL CONSTRUCTION		Drawing status INFORMATION	

Designed by LC		Checked by LC		Project No CIV13980	
Drawn by LC		Date MAR 2014		Computer File No NTS	
Scale @ A0 <small>work to figured dimensions only</small>		Publisher C		Zone SA	
Category 90		Number 1001		Revision A02	

Project HERBERT ROAD, NEWPORT		Drawing status INFORMATION	
Title PEAK FLOOD DEPTHS (m), 0.5% APE, 2114 WITH UPPER CONFIDENCE INTERVAL EXISTING SCENARIO		Project No CIV13980	
Client GREENHILL CONSTRUCTION		Computer File No NTS	
Publisher C		Zone SA	
Category 90		Number 1001	
Revision A02			


Project HERBERT ROAD, NEWPORT		Drawing status INFORMATION	
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Revision A02			

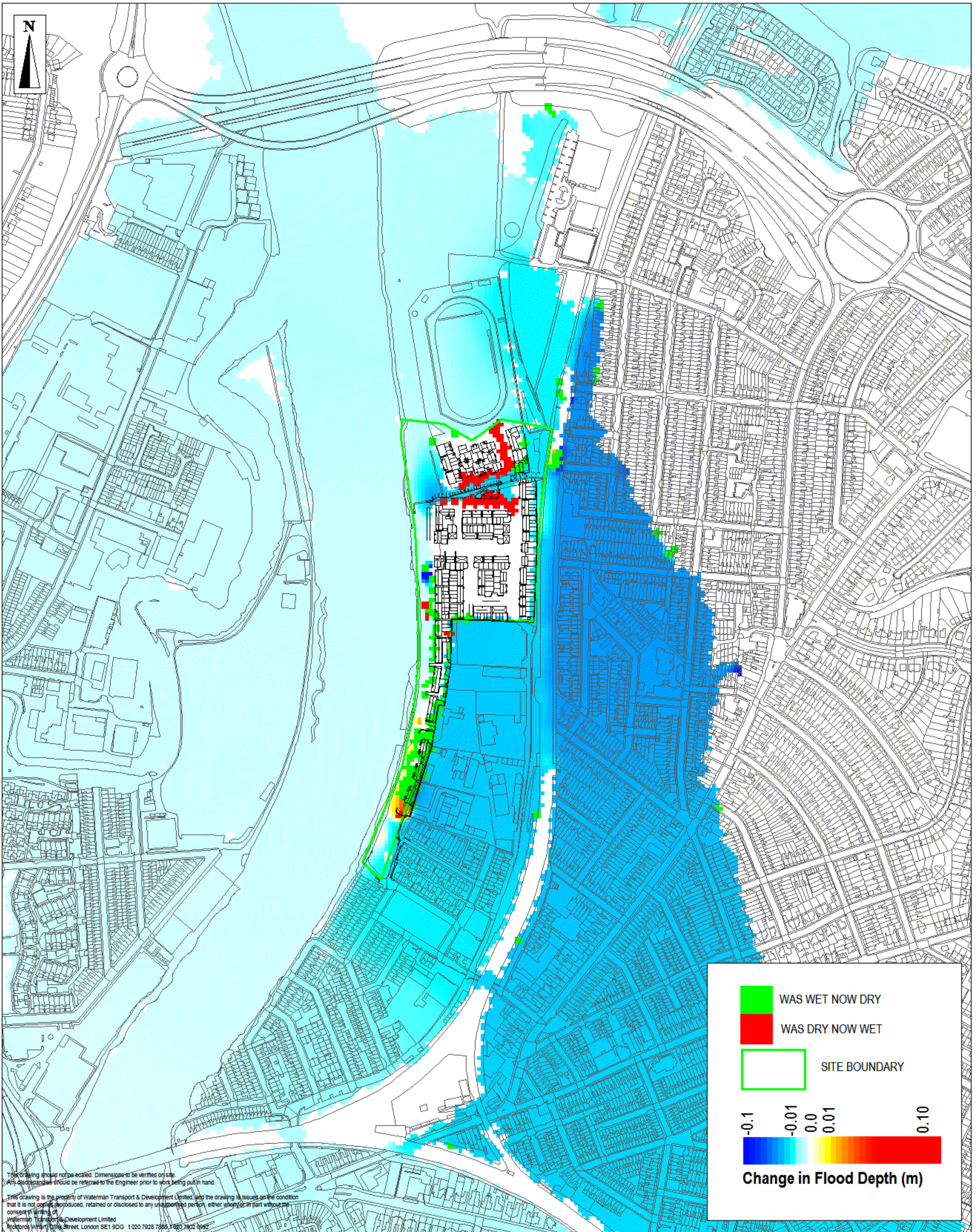
F. MODEL RESULTS- PROPOSED SCENARIO



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 Transport & Development 38 Cathedral Road Cardiff CF11 9LL 1 020 7926 7926 1 020 7902 0992 info@waterman-group.co.uk www.waterman-group.com	Project HERBERT ROAD, NEWPORT		Drawing name INFORMATION					
	Title PEAK FLOOD DEPTH (M) 0.5% APE WITH UPPER CONFIDENCE INTERVAL, 2114 PROPOSED SCENARIO		Designed by LC Checked by LC		Project No CV13980			
Rev Date Description By A02 14.03.14 Model outputs for 100 year design life LC A01 07.11.13 FIRST ISSUE LC		Client GREENHILL CONSTRUCTION		Scale 1:100 NTS <small>(work to figured dimensions only)</small>		Conquer File No		
Amendments				Publisher C	Zone SA	Category 90	Number 1003	Revision A02



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38 Cathedral Road, Cardiff CF11 9LL
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mail@waterman-group.co.uk www.waterman-group.com

Project	LC	LC	LC
Rev	Date	Description	By
A01	14.03.14	FIRST ISSUE	LC
Amendments			

HERBERT ROAD, NEWPORT

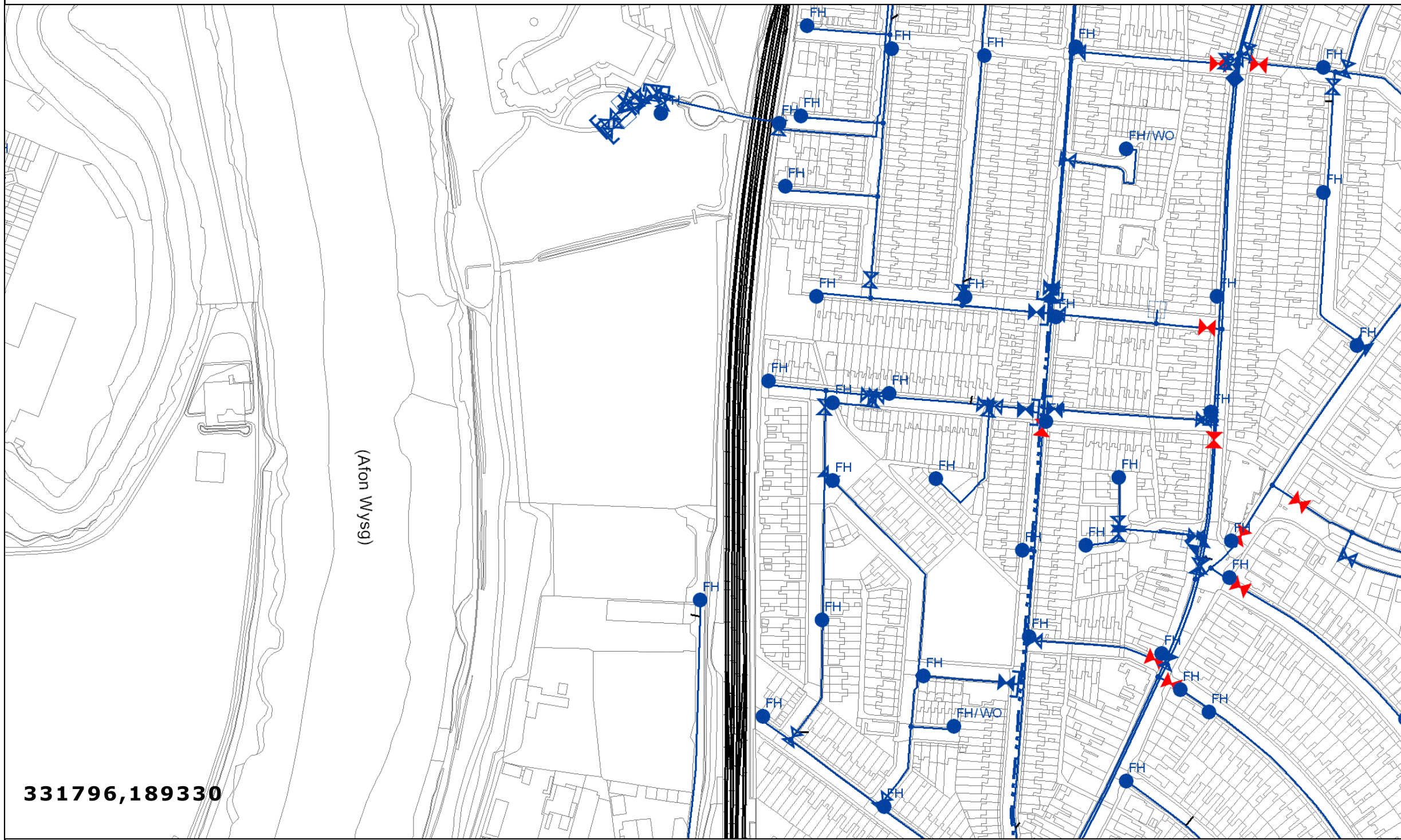
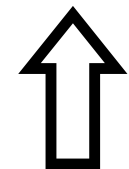
COMPARISON OF THE PEAK FLOOD DEPTH (M) BETWEEN THE PROPOSED SCENARIO AND THE CONSENTED SCENARIO
0.5% APE WITH UPPER CONFIDENCE INTERVAL,
2114


Client: GREENHILL CONSTRUCTION

INFORMATION				
Designed by	LC	Checked by	Project No CV13980	
Drawn by	LC	Date	MARCH 2014	
Scale	NTS <small>work to figured dimensions only</small>			
Publisher	Zone	Category	Number	Revision
C	SA	90	2001	A01

G. DCWW SEWER RECORDS

HerbertRd_Water



- LEGEND**
- Clean Water**
-  Sluice Val
 -  Air Val, SINGLE
 -  Tap
 -  Pressure Reducing Valve
 -  Meter
 -  BULK Meter
 -  FH
 -  Cap
 -  Existing Main
 -  NON COMPANY
- Sewerage External**
-  Foul
 -  Surface Water
 -  Combined
 -  Rising Main
 -  Private
 -  Treatment Works
 -  Pumping Station
 -  Special Purpose
 -  Unknown End
 -  Change, Combined Overflow
 -  Outfall, FOUL
 -  Lamp Hole, Foul
 -  Private Sewer Transfer
 -  Lateral Drain
 -  Inspection Chamber

331796,189330

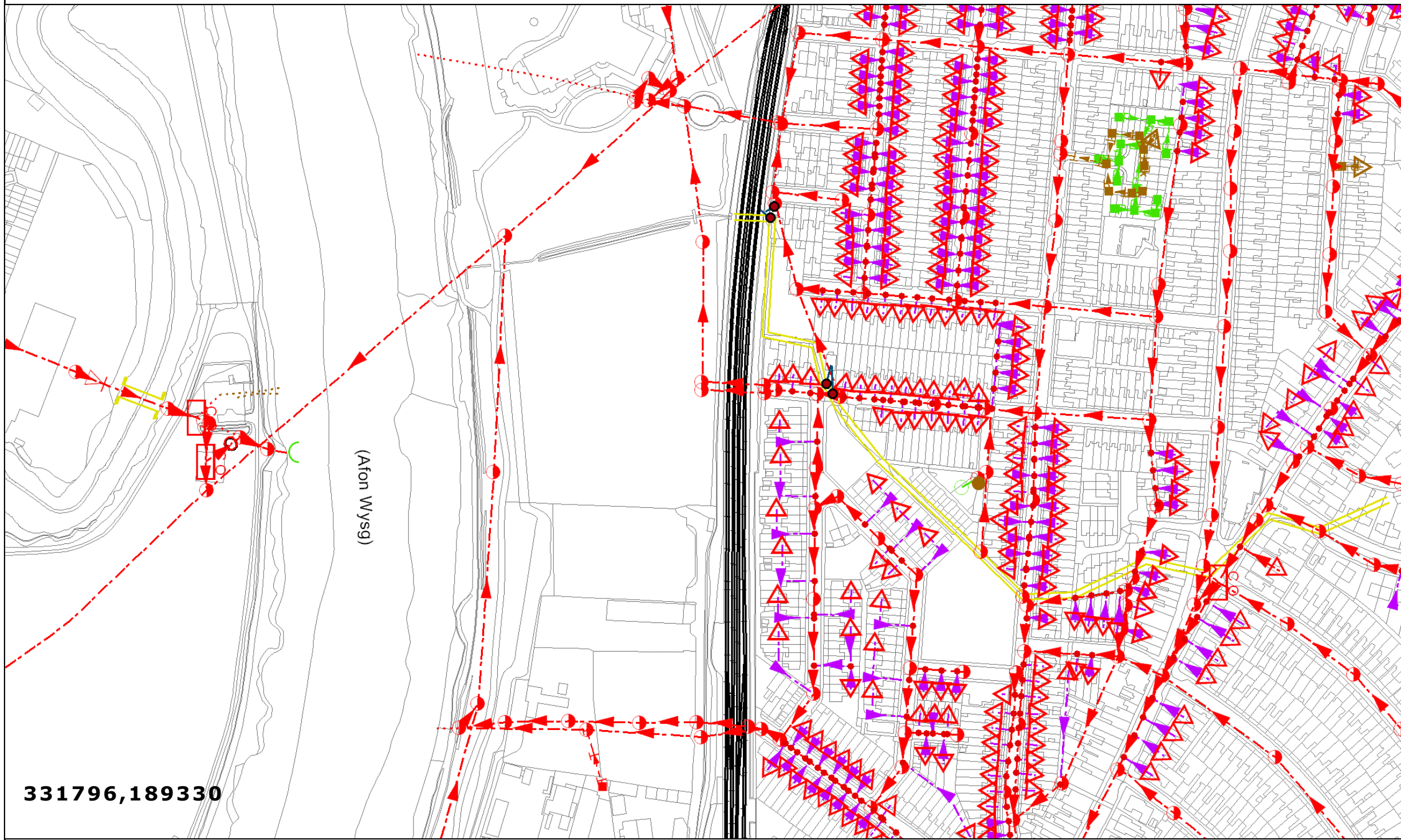
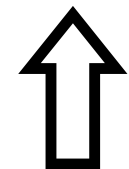
Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. The information which is supplied hereby by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 based upon the best information available and in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a drain sewer or disposal main laid before 1 September 1989, or if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE

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HerbertRd_Sewerage



- LEGEND**
- Clean Water**
 - Sluice Val
 - Air Val, SINGLE
 - Tap
 - Pressure Reducing Valve
 - Meter
 - BULK Meter
 - FH
 - Cap
 - Existing Main
 - NON COMPANY
 - Sewerage External**
 - Foul
 - Surface Water
 - Combined
 - Rising Main
 - Private
 - Treatment Works
 - Pumping Station
 - Special Purpose
 - Unknown End
 - Change, Combined Overflow
 - Outfall, FOUL
 - Lamp Hole, Foul
 - Private Sewer Transfer
 - Lateral Drain
 - Inspection Chamber

331796,189330

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