South Wales Metro
Task Order 28-I - Taffs Well Depot Outline Planning
Flooding Consequences Assessment

March 2018
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<table>
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Contents

Executive summary 1

1 Project Description & Scope of Works 3
  1.1 Scope of this Report 4
  1.2 Site location and description 5
  1.3 Proposed development 7

2 Sources of information and consultations 9
  2.1 Planning Policy Wales and Technical Advice Note 15 9
      2.1.1 Development Advice Zones 9
      2.1.2 Development category 10
      2.1.3 Justifying the location of development 10
      2.1.4 Assessing flooding consequences 10
      2.1.5 Surface water management 11
  2.2 Local planning policy and guidance 11
      2.2.1 Rhondda Cynon Taf Strategic Flood Consequence Assessment (SFCA) 11
  2.3 Information obtained from the Lead Local Flood Authority (LLFA) 12
      2.3.1 Rhondda Cynon Taf Local Flood Risk Management Strategy (LFRMS) and Flood Risk Management Plan (FRMP) 12
      2.3.2 Request for information for the site 12
  2.4 Natural Resources Wales 13
      2.4.1 Preliminary pre-application enquiry 13
      2.4.2 “Product 4” data 13

3 Assessment of the suitability of the site for development 14
  3.1 Development advice zone 14
  3.2 Justifying the location of development 14

4 Assessment of flood risk and flooding consequences 15
  4.1 Flooding history 15
  4.2 Flooding from the sea 15
  4.3 Flooding from rivers 15
  4.4 Flooding from ordinary watercourses 15
  4.5 Flooding from surface water 16
      4.5.1 Information from Rhondda Cynon Taf County Borough Council (LLFA) 16
      4.5.2 Information from NRW 17
  4.6 Flooding from sewers and drains 19
  4.7 Flooding from groundwater 19
4.8 Flooding from artificial sources
4.9 Access and egress during a flood event

5 Flood mitigation measures
5.1 Surface water management and disposal
  5.1.1 Surface water disposal options
  5.1.2 Control of the rate and volume of surface water run-off
  5.1.3 Sustainable Drainage Systems (SuDS)
5.2 Mitigating risk due to contamination of flood waters
5.3 Flood Management Plan
5.4 Structural integrity and flood resilience
5.5 Residual risk

6 Summary and conclusions

Appendices

A. Red Line Boundary plan
B. Development Master Plans
C. Natural Resources Wales preliminary Application Advice
D. Other Correspondence with NRW
E. Correspondence with Lead Local Flood Authority
F. Preliminary surface water run-off and attenuation storage calculations
G. Topographic Survey
H. DCWW Drainage and Water Enquiry response reference
   2016/3/318742/352229 dated 17 March 2016
I. DCWW public sewer record plan
Executive summary

The entire site falls within development advice zone A. All categories of development use are appropriate at this location, and the TAN 15 justification test is not applicable.

There are no constraints relating to river or coastal flooding.

The site is identified by the LLFA as being in an area that is at a high risk of surface water flooding. The development should seek to reduce the likelihood and impact of internal flooding, consider the mobilisation of vehicles during flood conditions, and make allowance for the impacts of climate change.

Records indicate that surface water run-off from the site currently drains to a public combined sewer.

Surface water runoff from the development may be safely managed by means of a carefully considered surface water drainage system such that the development is not at risk of flooding from surface water run-off from within the site and does not increase the risk of such flooding elsewhere.

Subject to obtaining the relevant permissions and consents, it is expected that surface water can be discharged to a watercourse and/or a public sewer.

A full assessment of the SuDS techniques suitable for the proposed development, including an assessment of the correct number of treatment stages in the surface water management train, should be undertaken in accordance with the SuDS Manual 2015 (CIRIA Report C753).

It is estimated that, as part of this system, a surface water attenuation storage volume of between 4,000m³ and 6,500m³ is likely to be required.

SuDS should be considered in the design of the drainage system and implemented wherever they will be effective.

The site is also located within an area that could be flooded if either Pontsticill (Taf Fechan) or Beacons Reservoir was to fail and release the water that it holds.

A safe and dry access and egress route will be available to and from most parts of the site, during most flood events. Most on-site parking areas will not be affected by flooding. However, it will likely not be practicable to evacuate all road vehicles or railway rolling stock in advance of a flood event.

Construction and maintenance contractors should be made aware of the flood risk to the site and reasonably practicable measures taken to mitigate that risk.

A Flood Management Plan should be produced and implemented so that site occupiers are aware of the risks and potential consequences, and know what to do in the event of a flood or a forecast flood.

Buildings and other site infrastructure should be designed and constructed to be resilient to the predicted level of surface water flooding.

Subject to implementation of the mitigation measures set out within this report and summarised above, it is considered that the flood risk and consequences for the proposed development are
acceptable and there is no reason from a flood risk standpoint for the proposed development not to proceed.
1 Project Description & Scope of Works

Mott MacDonald has been commissioned by Transport for Wales (TfW) to provide planning and technical support during the current procurement phase for the next ‘Wales and Borders Rail Service’ which will include the development of the South Wales Metro Phase 2, focusing specifically on the Core Valley Lines (CVL). This programme of works, funded by the Welsh and UK Governments and the European Commission, will transform the rail network involving extensive investment in new rolling stock, stations and associated infrastructure. It will deliver a step change in the public transport offer bringing about improved connectivity between the CVL and Cardiff and providing a much needed modern, reliable and efficient public transport system.

As part of the investment required to transform the rail network, additional depot and stabling facilities are required to accommodate the new fleet of rolling stock. As such, Welsh Government undertook a comprehensive site search process to find suitable and available land. This has resulted in Welsh Government acquiring the former ‘Forgemasters’ building and associated land at Garth Works Industrial Estate in Taffs Well. The whole site area, including the associated works to Taffs Well Station, extends to some 5.4 hectares and is shown on drawing number 367590-28I-XX-DR-C-0005.

In order to ensure early delivery of investment for the CVL and minimise risk to the preferred bidder (who will be named the Operator and Development Partner (ODP) once the procurement process is concluded, Welsh Government and TfW are seeking to secure outline planning permission for the depot and associated works.

In order to accommodate the specific operational requirements of the preferred ODP, the planning permission needs to have flexibility and as such, a ‘Hybrid’ Planning Application for the depot and associated works is being sought from Rhondda Cynon Taf County Borough Council as the Local Planning Authority. The hybrid planning application will seek full planning permission for the demolition of the existing buildings within the industrial estate and outline planning permission for construction of the depot and associated works. This approach provides flexibility for TfW in allowing demolition and site clearance works to commence in advance of works for the main depot and then the detailed design of the depot and associated works being dealt with through a Reserved Matters Planning Application. It is anticipated however, that the outline element of the planning permission for the depot and associated works will be subject to maximum parameters in terms of built floorspace, car parking and general alignment of highway infrastructure. These parameters and principles will then need to be reflected in the preferred ODP’s detailed design solution through any Reserved Matters application.

An indicative masterplan (Drawings 367590-28I-XX-DR-C-0002 and 0003) of the Taffs Well Depot has been prepared which indicates the construction of the following:

- A new rolling stock depot comprising of:
  - Multiple stabling lines.
  - A maintenance workshop with offices above.
  - A rolling stock washing facility.
  - A sand replenishment plant.
  - A delivery track where rolling stock will be delivered on HGVs and lifted onto the depot tracks.
  - A substation.
Staff parking and increased park and ride spaces.

- Associated works will include:
  - Local highways and rail infrastructure improvements.
  - A new footbridge over Taffs Well Station.
  - Extension to the existing Taffs Well Station western platform.
  - Improvements to the National Cycle Network (Taffs Trail).

The key parameters are listed below:

- Whole site area is 5.4 hectares. This includes all land within the red line boundary (Drawing number 367590-28I-XX-DR-C-0004) which includes the associated works at and around Taffs Well Station.
- Developable site area is 3.6 hectares. This is the main depot site between the A470 and Ffordd Bleddyn, as shown on drawing 367590-28I-XX-DR-C-0005.
- Total approximate floor space will be as below:
  - 3770m² of workshop floor space.
  - 2372m² of office floor space over two floors.
  - 400m² and 100m² of storage buildings floor space.
  - Combined this comes to a total of approximately 6642m².
- The tallest building is the maintenance workshop with offices above at 13.5m tall, smaller than the existing 15m tall Forgemasters building.
- The design of the depot allows for different types and sizes of rolling stock and power options including electric and diesel.

The full development description for the project is as follows:

- Hybrid Planning Application for the construction of the Taffs Well Depot on land at the Garth Works Industrial Estate in Taffs Well.
- Part A: Full planning application for the demolition and site clearance works associated with existing buildings and structures on the Garth Works Industrial Estate.
- Part B: Outline planning application with all matters reserved for the construction of the Taffs Well Depot including: multiple stabling lines; a maintenance workshop with offices above; a rolling stock washing facility; a sand replenishment plant; a delivery track; a substation; staff parking and increased park and ride spaces; highways and rail infrastructure improvements; modifications to Taffs Well Station and landscaping.

1.1 Scope of this Report

Transport for Wales (TfW) commissioned Mott MacDonald to undertake a Flooding Consequences Assessment (FCA) to accompany a hybrid planning application for the proposed Taffs Well Depot scheme. The hybrid planning application seeks full planning permission for the demolition of the existing site buildings, and outline planning permission with all matters reserved (except access) for the ODP rolling stock depot.

The FCA was undertaken in consultation with Natural Resources Wales and Rhondda Cynon Taf County Borough Council, the Lead Local Flood Authority (LLFA). The FCA includes consideration of flood risk posed to and by the proposed development, as required by Planning Policy Wales (PPW) and other local planning guidance. The scope of the FCA comprised an
assessment of existing readily available information, including consideration of the predicted effects of climate change over the lifetime of the development.

The detail and technical complexity of the assessment reflects the current stage and objectives of the development process.

The information and recommendations presented within this assessment are dependent upon the accuracy and reliability of the information, correspondence and data available to Mott MacDonald, at the time of the assessment. Any party developing detailed design should not rely on assumptions made in this report but should satisfy themselves in that regard.

Mott MacDonald has followed accepted procedure in providing the services but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions Mott MacDonald takes no liability for, and gives no warranty against, actual flooding of any property (client’s or third party) or the consequences of flooding in relation to the performance of the service. The FCA has been prepared for the purposes of supporting this hybrid planning application only.

Our assessment of the effects of climate change is based on the recommendations from Natural Resources Wales in place at the time of the study. These recommendations may change in the future increasing the extent of predicted effects and we would recommend that you seek further advice should this occur during the lifetime of the project.

1.2 Site location and description

The site is located approximately nine kilometres north-west of Cardiff City Centre, at Cardiff Road, Taff’s Well, Rhondda Cynon Taf, CF15 7PE. The National Grid Reference at the centre of the site is ST 12550 83270. A site location plan is included as Figure 1.
A red line boundary drawing illustrating the extent of the planning application, is included in Appendix A.

An aerial view of the site location, showing the approximate planning application boundary, is included as Figure 2.
The site lies between the A470 and the A4054 Cardiff Road, and in close proximity to the M4 motorway. To the west of the site, beyond the A4054 and residential development, lies the River Taff, which flows in a north-west to south-east direction at this location. To the east of the site, beyond the A470, the land rises steeply and is covered with established woodland (Forest Fawr). There is also a short length of open watercourse to the east of the site, in a narrow strip of land between the site boundary and the A470.

The site covers a total area of approximately 3.6 hectares and is relatively flat.

The eastern part of the site comprises an elliptical shaped area of land currently occupied by industrial development, and an overflow car park for the Taffs Well railway station located opposite. The existing ground levels in this area of the site vary between approximately 33.4m AOD and approximately 34.4m AOD.

The Cardiff and Merthyr railway line and existing Taffs Well railway station and car park currently occupy the west of the site. The existing ground levels in the car park and around the station area vary between approximately 34.5m AOD and approximately 35.8m AOD.

The aforementioned eastern and western parts of the site are dissected by an unnamed road, providing access to both from the A4054.

The site is predominantly covered in impermeable surfacing comprising roads, car parks, building roofs and floor slabs, associated with the multiple industrial and commercial buildings currently occupying the site.

1.3 Proposed development

Master plans of the proposed development are included in Appendix B.

The current Masterplan and proposals are indicative only.
In summary, the proposal comprises the following:

- Demolition of existing buildings and redevelopment of the eastern part of the site into the Taffs Well Depot for the South Wales Metro, comprising; stabling and maintenance facilities for rolling stock, associated workshop and offices, car parking, and an electrical substation.
- Relocation of platforms and footbridge at the existing Taffs Well station and reconfiguration of the station's access and parking areas.
- Construction of new rail links to connect the Taffs Well Depot with the Cardiff and Merthyr railway line.
- Construction of elevated sections of access road, to bridge over the new rail links to the depot and maintain road access between the site and the A4054.
2 Sources of information and consultations

Mott MacDonald reviewed or utilised the following sources of information to produce this FCA:

- Planning Policy Wales (PPW) and Technical Advice Note 15 (TAN 15).
- Consultation with Natural Resources Wales.
- Consultation with Rhondda Cynon Taf County Borough Council, in its capacity as LLFA.
- Topographic survey (dated April 2010) by Davies’s Chartered Land Surveyors.
- Geo-environmental Desk Study 367590-WTD-CAR-28I-02 (Mott MacDonald, August 2017).
- Outline Planning drawings comprising Red Line Boundary plan, Ground Level Master Plan, and Upper Level Master Plan.
- Dwr Cymru Welsh Water Drainage and Water Enquiry response reference 2016/3/318742/352229, including extracts from the Public Sewer Map and the Public Water Map (dated 17/03/2016)
- Dwr Cymru Welsh Water public sewer record plan (undated)

2.1 Planning Policy Wales and Technical Advice Note 15

Planning Policy Wales (PPW) and Technical Advice Note 15 (TAN 15) on Development and Flood Risk, provide a framework and technical guidance for assessing the flood risks posed to and by a development.

2.1.1 Development Advice Zones

Figure 1 of TAN 15 defines three development advice zones (A, B and C), which are summarised in Table 2.1. The figure also attributes different planning actions for each of the zones.
### Table 2.1: Development Advice Zone Classification

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<th>Zone</th>
<th>Sub-Zone</th>
<th>Description of Zone</th>
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<tr>
<td>A</td>
<td></td>
<td>Considered to be at little or no risk of fluvial or tidal/coastal flooding</td>
<td>Used to indicate that justification test is not applicable and no need to consider flood risk further.</td>
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<tr>
<td>B</td>
<td></td>
<td>Areas know to have been flooded in the past evidenced by sedimentary deposits</td>
<td>Used as part of precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further.</td>
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<tr>
<td>C</td>
<td></td>
<td>Based Environment Agency / NRW extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)</td>
<td>Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences.</td>
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<tr>
<td>C1</td>
<td></td>
<td>Areas of the floodplain which are developed and served by significant infrastructure, including flood defences</td>
<td>Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.</td>
</tr>
<tr>
<td>C2</td>
<td></td>
<td>Areas of the floodplain without significant flood defence infrastructure</td>
<td>Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.</td>
</tr>
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Source: Planning Policy Wales Technical Advice Note 15 (TAN 15)

#### 2.1.2 Development category

Section 5 of TAN 15 states “particular flooding consequences may not be acceptable for particular types of development … the precautionary framework identifies the vulnerability of different land uses to flooding”.

TAN 15 divides types of development into the following three categories: emergency services, highly vulnerable development, and less vulnerable development.

Figure 5 of TAN 15 identifies general industrial development, transport and utilities infrastructure and car parks, as “less vulnerable development”.

#### 2.1.3 Justifying the location of development

The overarching aim of TAN15 is to ensure that new development is “directed away from zone C and towards suitable land in zone A, otherwise to zone B, where river or coastal flooding will be less of an issue”.

Furthermore, Section 6 of TAN 15 states that “highly vulnerable development … in zone C2 should not be permitted”, and that all other new development should only be permitted within zones C1 and C2 if determined by the planning authority to be justified in that location.

The suitability of the site for development is addressed in section 3.

#### 2.1.4 Assessing flooding consequences

Appendix 1.2 of TAN 15 states that the prime objective of an assessment of flooding consequences is to develop a full appreciation of:

- “The consequences of flooding on the development.”
- “The consequences of the development on flood risk elsewhere within the catchment for a range of potential flooding scenarios up to that flood having a probability of 0.1%.”
“The assessment can be used to establish whether appropriate mitigation measures can be incorporated within the design of the development to ensure that development minimises risk to life, damage to property and disruption to people, etc.”

Appendix 2 of TAN 15 recognises that flood consequences will change over time as result of climate change.

2.1.5 Surface water management

Section 8 of TAN 15 defines the surface water requirements for new developments, as follows:

- Surface water run-off from new developments should be managed so that the development does not increase the risk of flooding elsewhere.
- Sustainable Drainage Systems (SuDS) should be implemented, wherever they will be effective, in all new development proposals, irrespective of the Development Advice Zone in which they are located.
- The aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for redevelopment to reduce run-off where possible.

Consideration must also be given to maintaining the effectiveness of any drainage systems.

2.2 Local planning policy and guidance

2.2.1 Rhondda Cynon Taf Strategic Flood Consequence Assessment (SFCA)

The overall purpose of the SFCA is to inform the Local Development Plan (LDP) and provide realistic approaches to managing the risk of flooding.

The objectives of the SFCA were to:

- identify past major flood events and the associated source of flooding;
- identify potential sources of flooding in Flood Zone C2 (the extreme or 1 in 1000 year return period flood outline) as identified on the Development Advice Maps;
- refine or improve the accuracy of the Development Advice Maps and extreme flood outline where required;
- identify other sources of flooding that may present concern;
- appraise existing flood defence infrastructure; and
- undertake a broad level assessment of flood consequences where the LPA still has a requirement to allocate land for development within flood risk areas.

The SFCA is divided into two parts, as follows.

1. Strategic Site Analysis, comprising assessment of all sources of flood risk to eight strategic sites plus Treforest Industrial Estate.
2. Wider Site Analysis, of smaller potential “candidate” development sites identified across the study area, to be assessed against:
   a. The critical drainage areas in relation to the wider development sites, highlighting the drainage problem areas; and
   b. The potential flood risk from artificial sources (canals and reservoirs) to the wider sites.

The SFCA concludes that site specific FCAs will be needed to accompany any planning applications for development sites within areas affected by ‘priority culverts’, “to inform the
Environment Agency and the LPA of the flood risk and ensure that development only continues if the flood risk is manageable in line with policy requirements”. The scope of the FCA should be discussed with the Environment Agency (now Natural Resources Wales) and guidance is laid out in Appendix 1 of TAN 15 but, in general terms, it would include more detailed analysis of:

- Flood probability;
- Flood depth;
- Flood velocity;
- Rate of onset of flooding.

Furthermore, the following would need to be considered in relation to site specific proposals, to allow informed decisions to be made regarding the safety of the development:

- Access/egress routes;
- Residual risks of flooding
- Effects of climate change on the site;
- Management of surface water through SUDS;
- Incorporation of suitable flood resilient construction techniques.

2.3 Information obtained from the Lead Local Flood Authority (LLFA)

2.3.1 Rhondda Cynon Taf Local Flood Risk Management Strategy (LFRMS) and Flood Risk Management Plan (FRMP)

Rhondda Cynon Taf County Borough Council (RCTCBC), as the LLFA, has statutory responsibility for managing the flood risk from local sources, namely surface runoff, groundwater and ordinary watercourses.

The Flood and Water Management Act 2010 (FWMA) requires the LLFA to produce a LFRMS and a FRMP for its area.

The LFRMS sets out the following four core objectives with regard to the management of flood risk in the RCTCBC administrative area.

1. Utilise a risk based approach to managing flood risk, recognising that drainage and structural defences may not always be the most appropriate solution.
2. Develop a greater strategic understanding of flood risk from all sources within RCT and at a wider catchment scale.
3. Raise community awareness of, and actively engage communities in the response to flood risk.
4. Use local planning policy to ensure that no new flood risk is created and where possible, opportunities to reduce flood risk are taken.

The FRMP was not found on the LLFA’s website and was not provided by the LLFA as part of consultation for this FCA.

2.3.2 Request for information for the site

RCTCBC, as Lead Local Flood Authority (LLFA), was contacted and requested to provide relevant information and advice to inform the FCA.

The LLFA response is included in Appendix E.
In summary, the response from RCTCBC stated the following:

- The site is located in an area that is at a high risk of surface water flooding, and any development proposal should seek to reduce the likelihood and impact of “internal flooding and mobilisation of vehicles during spate conditions; including the impacts of climate change.”
- The FCA should identify recommendations to mitigate local flood risk

RCTCBC referred to the Long Term Flood Risk maps on the Natural Resources Wales website, as a source of “visual flood maps” to aid in the identification of flood risk.

RCTCBC also noted the presence of an “Ordinary watercourse” (i.e. non-Main River) in the proximity of the site location and stated that “any modification to an Ordinary watercourse is likely to require Ordinary watercourse Consent prior to construction” and that such consent “sits outside of the remit of a planning application”. The Council stated that these consents cannot be granted retrospectively.

2.4 Natural Resources Wales

2.4.1 Preliminary pre-application enquiry

A pre-application enquiry was made with Natural Resources Wales (NRW) and their response is included in Appendix C.

In relation to flood risk and management of surface water, NRW provided the following advice.

“The site lies within Zone A of the Development Advice Maps (DAM) contained within Technical Advice Note 15 Development and Flood Risk (July 2004). TAN15 advises that for development located in Zone A the justification test is not applicable and surface water requirements apply. The acceptability criteria is for no increase in flooding elsewhere to occur as a result of the development. We note it is for the Local Authority’s Land Drainage Department to comment on the suitability of these proposals”.

2.4.2 “Product 4” data

In addition to the pre-application advice NRW was requested to provide existing available information relevant to the site, including the following:

- Flood modelling data.
- Details of flood history.
- Confirmation as to whether the site lies in a critical drainage area.
- Details regarding the primary source of flood risk to the site and whether the site benefits from any flood defences.

In response NRW confirmed that the site falls outside the flood zone and that NRW holds no modelled data relevant to the site. NRW also provided details of flood defences in the nearby area, but noted that these do not provide direct benefits for the site.

The NRW response is included in Appendix D.
3 Assessment of the suitability of the site for development

3.1 Development advice zone

The TAN 15 Development Advice Map (DAM) indicates the extents of the development advice zones for areas in Wales. The DAM indicates that the entire site falls within development advice zone A.

Figure 3: Extract from Development Advice Map


3.2 Justifying the location of development

TAN 15 states that new development should be directed away from zone C and towards suitable land in zone A, otherwise to zone B.

In accordance with TAN 15, for development advice zone A the justification test is not applicable and all categories of development use are appropriate. There are no constraints relating to river or coastal flooding. However, the surface water requirements set out in TAN 15 must be met to avoid increasing flood risk elsewhere.

In any event, due to the nature of the development proposal there will be very few if any alternative sites that are both suitable and available.
4 Assessment of flood risk and flooding consequences

4.1 Flooding history
The LFRMS records that there are many (thousands) of recorded instances of flooding within Rhondda Cynon Taf County Borough, and classifies these into types of flooding but does not identify the locations of the flood events. However, in response to our enquiries the council did not identify any recorded instances of flooding having affected the site.

The Historic Flood Map provided on NRW's Long Term Flood Risk online map does not indicate any record of historic flooding at this site. Similarly, in response to our enquiries NRW did not identify any recorded instances of flooding having affected the site.

The SFCA does not indicate any historic flooding at the site.

4.2 Flooding from the sea
The site is in development advice zone A and therefore, in accordance with TAN 15 Figure 1, it is considered to be at little or no risk of tidal/coastal flooding and there is no need to consider this source of flood risk further.

4.3 Flooding from rivers
The site is in development advice zone A and therefore, in accordance with TAN 15 Figure 1, it is considered to be at little or no risk of flooding from rivers and there is no need to consider this source of flood risk further.

4.4 Flooding from ordinary watercourses
Notwithstanding the above, inspection of NRW online map sources (refer to Figure 4) indicates that several ordinary watercourses (notably the Nant y Brynau and Nant Llywydd, both tributaries to the River Taff) flow towards the site from the adjacent hillside to the east.

The confluence of the Nant y Brynau and Nant Llywydd is located approximately 600m to the north-east of the site, near Ty Rhiw Farm. Immediately downstream the Nant y Brynau is then culverted beneath the Taff Trail cycle path (which follows the route of a dismantled railway). Downstream of this culvert, the Nant y Brynau flows down the hillside in an east-west direction. Along this part of its route, the Nant y Brynau is culverted three times: the first at Cemetery Road, then at a second dismantled railway (now used as an access road), and finally beneath Parish Road. At the point where the Nant y Brynau meets the A470, it turns through 90 degrees to flow in a southerly direction, adjacent to the southbound carriageway of the A470, before entering a culvert approximately 50m north of the site where the A470 meets the dismantled railway.

As noted in section 1.2, there is a short length of open watercourse in a narrow strip of land between the eastern site boundary and the northbound carriageway of the A470. It is likely that this is a continuation of the Nant y Brynau.

The NRW Long Term Flood Risk maps do not identify any flood zones or flood extents for the Nant y Brynau and Nant Llywydd, and it is assumed that these watercourses have not been
modelled by NRW. The absence of flood extents on the NRW maps does not mean that these watercourses do not pose a flood risk that should be considered in this FCA.

Figure 4: Extract from NRW Long Term Flood Risk map, showing watercourses local to the site

4.5 Flooding from surface water

4.5.1 Information from Rhondda Cynon Taf County Borough Council (LLFA)

4.5.1.1 LLFA consultation

The LLFA consultation response identifies that the site is in an area that is “at a high risk of surface water flooding and any development proposal should look to reduce the likelihood and impact of internal flooding…”.

4.5.1.2 Information from SFCA

The main focus of the SFCA was on eight strategic sites plus Treforest Industrial Estate, none of which are in Taff’s Well.

A Wider Site Analysis of smaller potential “candidate” development sites was also undertaken. This identified 48 communities and towns as potentially at risk of flooding from critical drainage issues. One of these towns is Taff’s Well, which was identified as having two ‘priority culverts’, representing critical drainage ‘hotspots’. These so-called ‘priority culverts’ are culverts with known blockage and / or flooding issues and which therefore require regular maintenance to ensure that they operate as efficiently as possible.
The precise location of the ‘priority culverts’ is not identified in the SFCA. The ‘priority culverts’ identified in Taff’s Well are stated as being located at “GARTH VIEW GIAN Y IIYN” and “TYRHIW RD”.

From inspection of maps of Taff’s Well, the first of these would appear to be in the Glan y Llyn area, a residential area in the north of Taff’s Well. This is not in close proximity to the site.

The second ‘priority culvert’ would appear to be located in the vicinity of the Ty Rhiw Farm and housing estate, on the Nant y Brynau upstream of the site. Although in close proximity to the site, any blockage and/or flooding issues at this culvert are likely to be localised and not impact on access to, nor operation of, the site.

In addition to the priority culverts, RCTCBC identified other culverts which are considered to pose the greatest flood risk in the event of blockage. None of these culverts are located in Taff’s Well.

4.5.2 Information from NRW

4.5.2.1 NRW consultation response

Direct consultation with NRW did not identify any specific surface water flooding risks.

4.5.2.2 NRW online Long Term Flood Risk map

The NRW Long Term Flood Risk online map (reproduced in Figure 5) indicate that most of the elliptical shaped part of the site, where the depot itself is to be located, is at a ‘high’ risk of flooding from surface water (where ‘high’ risk means areas that each year have a chance of flooding of greater than 1 in 30 (3.3%)).

A similar but slightly larger area is shown to be at a ‘low’ risk of flooding from surface water, where ‘low’ risk means areas that each year have a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%).
Interrogation of the interactive map indicates that within the area of the site shown to be at ‘high’ risk of surface water flooding:

- The flooded depth is shown to be mostly in the range 0.30m to 0.90m.
- The velocity of flood water is shown to be mostly less than 0.25m/s, with the velocity in some small isolated areas shown to be greater than 0.25m/s.
- The flood hazard is shown to vary, mostly between ‘danger for some’ and ‘danger for all’, with some smaller areas shown as ‘low’ hazard and one smaller isolated area shown as ‘danger for all’.

Interrogation of the interactive map also reveals that, within the area of the site shown to be at ‘low’ risk of surface water flooding:

- The flooded depth is shown to be mostly in the range 0.30m to 0.90m, with some small isolated areas shown to have flooded depths of greater than 0.90m.
- The velocity of flood water is shown to be mostly less than 0.25m/s, with the velocity in some areas shown to be greater than 0.25m/s.
- The flood hazard is shown to vary; for most of the flooded area it is ‘danger for most’, there are some areas of ‘danger for some’ and ‘danger for most’, with some smaller areas shown as ‘low’ hazard.

The source of this surface water flood risk appears to be associated with the Nant y Brynau. Land along the Nant y Brynau upstream of the site is also shown to be at ‘high risk of surface...
water flooding’, most notably the adjacent industrial area and allotments to the north of the A470, and the A470 carriageway itself.

However, the maps do not take into consideration existing positive drainage networks. The site is already fully developed, with almost all of its area covered with impermeable surfacing. A site walkover undertaken by Mott MacDonald to inform a Geo-Environment Desk Study report (August 2017) for the same site, identified gullies indicative of an existing positive drainage network. Therefore, it may be expected that this risk is not as great as that suggested by the NRW Long Term Flood Risk online map.

The size of the site and proportion of impermeable surfacing means that it has potential to generate significant rates and volumes of surface water run off which would pose a flood risk to the site and surrounding land if not mitigated.

Proposed mitigation measures for surface water flooding are discussed in section 5.

4.6 Flooding from sewers and drains
Flooding from sewers and drains is typically caused by blockages or hydraulic overload.

The LLFA, RCTCBC, did not provide any information on flooding from sewers and drains to inform this report.

The sewerage undertaker Dwr Cymru Welsh Water (DCWW) was not contacted directly as part of this assessment.

A DCWW Drainage and Water Enquiry response reference 2016/3/318742/352229 dated 17 March 2016, which relates to the eastern part of the site only, was provided by TfW and is included in Appendix H. The response states that:

- “records indicate that foul water from the property drains to a public sewer”;
- “records indicate that surface water from the property does drain to a public sewer”; and
- “The property is not recorded as being at risk of internal flooding due to overloaded public sewers. It is…..possible that a property may be at risk of internal flooding due to an overloaded public sewer which the sewerage undertaker is not aware of.”

It is reasonable to expect that the risk and consequences of flooding from sewers and drains can be mitigated by means of industry standard methods e.g. by designing constructing and maintaining sewers and drainage systems in line with current standards and best practice, and by setting the finished floor levels within the building above the surrounding ground levels.

4.7 Flooding from groundwater
Groundwater flooding occurs when water levels in the ground rise above surface levels. It is most likely to occur in areas underlain by permeable rocks, called aquifers.

The LLFA, RCTCBC, did not provide any information on groundwater flooding to inform this report.

We have not found any record of groundwater flooding in the vicinity of the site.

It is considered that, relative to other potential sources of flooding, the risk of flooding from groundwater at this location is low and it is reasonable to expect that it can be mitigated by means of industry standard methods without excessive cost or time implications e.g. by setting the finished floor levels within buildings above the surrounding ground levels.
4.8 Flooding from artificial sources

The SFCA considers the risk of flooding from artificial sources such as canals or reservoirs, where the body of water is contained above ground, and failure of the supporting structure will result in the release of large volumes of water. Taff’s Well is not identified in the SFCA as a town or community potentially at risk of flooding from these artificial sources.

The NRW Long Term Flood Risk online map (reproduced in Figure 6: NRW Long Term Flood Risk Map – Reservoir Flood Risk) indicates that the site could be flooded if either the Pontsticill (Taf Fechan) Reservoir or the Beacons Reservoir were to fail and release the water they hold.

In the unlikely event that a reservoir dam failed, a large volume of water would escape at once and flooding could happen with little or no warning.

Interrogation of the interactive maps reveals that, in the event of a reservoir dam failure, the predicted depth of flooding on site is between 0.3m and 2.0m. The predicted velocity of flood water for almost all parts of the site is up to 0.5m/s; however, in some small areas it is predicted to be between 0.5m/s and 2.0m/s.

The NRW website states that this is a worst-case scenario, that reservoir flooding is extremely unlikely to happen, and it is unlikely that any actual flood would be this large. Both Pontsticill Reservoir and Beacons Reservoir are some 20 miles to the north of Taff’s Well.

NRW advice to those that live or work in an area at risk of reservoir flooding is to plan in advance what they would do in an emergency. It may be necessary to evacuate immediately, and therefore those at risk should consider where they would go to safety, and be ready to follow the advice of emergency services.

Figure 6: Extract from NRW Long Term Flood Risk Map – Reservoir Flood Risk

4.9 Access and egress during a flood event

Sections 4.1 to 4.8 have demonstrated that the site could be flooded by surface water run-off associated with the Nant y Brynau watercourse, or the failure of a reservoir dam. Both of these sources of flooding originate from the north.

In either case it may be necessary to evacuate the site either during or, preferably, before, a flood event. It may also be necessary for emergency services to access the site during a flood event.

In the case of surface water flooding the most direct route out of the flooded area will be to exit toward the south via the existing unnamed road that dissect the site, and then onto the A4054 Cardiff Road in either direction. This route is approximately 250m long from the ground-level vehicular exit from both the depot site itself and the Taffs Well railway station (see Ground Level Master Plan included in Appendix B), to the junction with Cardiff Road.

In the case of reservoir flooding the most direct route out of the flooded area will again be to exit toward the south via the existing unnamed road that dissect the site, then turning left onto the A4054 Cardiff Road and then left again onto Cemetery Road which lies outside of the area predicted to flood.

As part of the development, the access road that dissect the site and links it to the A4054 Cardiff Road will be elevated to bridge over the rail links between the depot and the Cardiff-Merthyr railway line (see Upper Level Master Plan included in Appendix B).

Most of the car parking in the depot site (approximately 150 spaces for depot staff and visitors, and approximately 60 spaces for the public) will also be elevated above ground (with stabling for rolling stock beneath), and will therefore be above the predicted flood levels for reservoir and surface water flooding. However, ground level staff car parking areas within the depot site and at the adjacent remodelled Taffs Well railway station, will be within the areas predicted to flood. In the case of the railway station parking, there will be no additional spaces compared with existing. In the case of ground level staff car parking areas, there will be no additional spaces compared with the existing previously developed scenario.

Pedestrians on the ground-level of the depot site, including those working in the workshops and offices, should be able to ascend to the upper-levels of the office buildings or to parking areas, both of which are predicted not to flood. These will provide safe refuge or, in the case of the parking, a safe egress route if needed.
5 Flood mitigation measures

The assessment of flood risk in section 4 concludes that flooding from surface water and reservoir sources poses the biggest risk to the development.

Based on the information currently available and reviewed as part of this assessment, the following flood mitigation and management measures will be required for the development to proceed.

5.1 Surface water management and disposal

The site and any development on it is at risk of flooding from surface water, as identified by the consultation responses and document review, and assessed in section 4.5 of this report.

The development will generate significant rates and volumes of surface water run-off, which could increase the flood risk to the site and surrounding areas of land if suitable mitigation measures are not implemented.

Section 8 of TAN 15 deals with surface water run-off from new development, and its requirements are listed in section 2.1.5 of this report. In summary: development should not increase the risk of flooding elsewhere; Sustainable Drainage Systems (SuDS) should be implemented wherever they will be effective; and redevelopment should reduce run-off where possible.

In order to meet the requirements of TAN 15 a surface water management and disposal system that meets current standards will need to be designed, constructed and maintained, taking consideration of the following issues and constraints. The design and specification of the surface water management system should follow the principles outlined below, and this may be secured by a suitably worded planning condition.

5.1.1 Surface water disposal options

The surface water runoff from the development should be managed in accordance with the hierarchy of disposal options set out in Building Regulations 2000 (Part H – Requirement H3). This states that rainwater should be discharged to one of the following, listed in order of priority:

1. “an adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable

2. a watercourse; or, where that is not reasonably practicable

3. a sewer.”

5.1.1.1 Discharge to a soakaway

In order for disposal of surface water to a watercourse or sewer to be acceptable to the environmental regulator or sewerage undertaker, it is necessary to demonstrate that disposal via soakaway or infiltration system is not reasonably practicable.

The Wallingford Winter Rain Acceptance Potential Map, which is used in the estimation of greenfield runoff, indicates that the site is located in an area with a SOIL class of 3. This is described as “relatively impermeable soils in boulder and sedimentary clays, and in alluvium,
especially in eastern England”, “permeable soils with shallow ground-water in low lying areas”, and/or “mixed areas of permeable and impermeable soils, in approximately equal proportions”.

The site is low-lying on the valley floor, near to the River Taff main river, and is previously developed with virtually all of the site area currently occupied by buildings or otherwise covered with impermeable surfacing.

A geo-environmental desk study undertaken by Mott MacDonald in parallel with this FCA, and dated August 2017, identified the following site characteristics.

- The bedrock is overlain by superficial sand and gravel deposits, encountered at depths ranging from 0.4m to 18.5m. Overlying the natural ground is Made Ground up to 3.3m in thickness, likely due to the extensive historic industrial land use (predominantly iron works, metal forge) identified on-site.
- Potentially contaminative features identified during a site walkover include: the external storage of gas tanks on-site; leaked fuel oil from vehicles; auto repair and automotive recovery activity; metal works and forge; and likely fuel tanks (above ground and underground) on site.
- The results of leachate and groundwater quality testing indicate a risk to controlled waters from metals, sulphate, sulphide, cyanide, and benzo(a)pyrene.
- Risk to surface water bodies arises from the leaching and transport mechanism of water infiltrating potentially contaminated material, and migrating towards nearby surface water bodies. Risk to groundwater arises from already leached and transported contaminants within the ground, vertically migrating to the saturated zone.

Building Regulations 2000 (Part H) sets out that infiltration devices including soakaways should not be built within 5m of a road or building, in ground where the water table reaches the bottom of the device at any time of the year, and where the presence of any contamination in the runoff could result in pollution of groundwater source or resource.

Based on the information currently available and taking into account the potential for infiltration of surface water to the ground to mobilise existing sources of contamination, it is considered likely that the disposal of surface water via soakaway or infiltration system is not reasonably practicable at this site.

5.1.1.2 Discharge to a watercourse

If conditions are not appropriate for soakaway or infiltration drainage, then the practicability of discharging to a watercourse would need to be investigated.

The existence of an open watercourse adjacent to the eastern boundary of the site indicates that it should be reasonably practicable to discharge at least some of the run-off to a watercourse.

Observations from the site walkover undertaken to inform the Geo-environmental Desk Study confirmed the existence of positive drainage systems, and it is likely that these discharge locally either to watercourses or sewers.

It should be reasonably practicable to re-use existing surface water connections and outfalls, be they to watercourses or public sewers. The existing surface water drainage infrastructure should be investigated to establish the location, size, level, capacity, and condition of existing outfalls.
Therefore, a reasonably practicable solution for the disposal of surface water from the development is available.

5.1.1.3 Discharge to a sewer

In order to discharge surface water to a sewer it would be necessary to demonstrate to the sewerage undertaker (in this case Dwr Cymru Welsh Water) that disposal of some or all surface water via infiltration to ground and via discharge to a watercourse, is not reasonably practicable.

The DCWW Drainage and Water Enquiry response included in Appendix H indicates that surface water from the site currently drains to a public sewer. As such there is a precedent for discharging surface water to the public sewer and an existing connection to the sewer which could be re-used for the proposed development, if necessary.

This may aid any case for continuing to discharge surface water to the sewer following the redevelopment, subject to limitations on the peak rate of discharge.

The DCWW public sewer record plan is included in Appendix I. The record indicates that an existing 1200mm diameter combined sewer runs beneath the car park of the Taffs Well railway station in the western part of the site, flowing in a north-south direction.

The record plan also shows that there are two smaller (300mm and 225mm diameter) combined sewers running alongside the eastern site boundary, approximately on the route of the A470, flowing in a north-south direction. There is an existing 225mm diameter connection from the site, to the adjacent 225mm combined sewer.

5.1.2 Control of the rate and volume of surface water run-off

The surface water runoff should be managed on-site so that, for specific design events, the discharge volumes and peak discharge rates do not exceed those of the existing situation, and therefore do not result in an increase to flood risk elsewhere.

Preliminary calculations of rainfall runoff and attenuation storage volume estimates, are included in Appendix F.

The “greenfield” (undeveloped) mean annual peak flow ($Q_{BAR}$) is estimated to be 33.7 litres/second for the whole site area and 26.7 litres/second for the net (positively drained) site area. If discharges are controlled to these greenfield rates, it is estimated that a total attenuation storage volume of around 6,500m$^3$ may be required.

However, the site is not “greenfield” but previously developed, with virtually all of the site area currently occupied by buildings or otherwise covered in impermeable surfacing. TAN 15 acknowledges that for such sites, redevelopment should reduce run-off where possible compared with the current conditions.

For the current (previously developed) site conditions the mean annual peak flow ($Q_{BAR}$) is estimated to be 73.4 litres/second for the whole site area and 58.2 litres/second for the net (positively drained) site area. If discharges are controlled to these previously developed rates, it is estimated that a total attenuation storage volume of around 4,000m$^3$ may be required.

If the cumulative discharge rate is controlled such that a reduction of 30% is achieved compared with the current ‘previously developed’ scenario, then it is estimated that a total attenuation storage volume of around 5,000m$^3$ may be required.

If the above estimates of attenuation storage volume include an allowance for climate change over the life of the development (assumed to be 100 years), of +30% for peak rainfall intensity.
This allowance reflects Environment Agency Wales document “Guidance on Surface Water Run-off (Wales only)” dated 25 November 2011. NRW confirmed in April 2017 that this document remains current; however, it is understood that Welsh Government intends to issue updated climate change guidance in the near future and therefore the climate change allowance and the associated storage volumes may increase.

No allowance for urban creep was made in the calculations as the site is already virtually covered with impermeable surfacing and the opportunity for further ‘urban creep’ is very limited and considered unlikely to occur.

Subject to discussion and agreement with the relevant regulatory and permitting authorities, in order that the discharge volumes and peak discharge rates do not exceed those of the existing situation and considering the aspiration of TAN 15 is to reduce run-off where possible, it is anticipated that the total storage volume required is likely to be in the range 4,000m\(^3\) to 6,500m\(^3\).

5.1.3 Sustainable Drainage Systems (SuDS)

The aims of SuDS are to reduce the quantity of surface water run-off; improve the quality of surface water run-off; and provide an amenity value to the proposed development. SuDS seek to mimic natural drainage systems and retain water on or near to the site, when and where rain falls. SuDS offer significant advantages over conventional drainage systems in relation to flood risk by reducing the quantity of surface water runoff from a site and the speed at which it reaches water courses, promoting groundwater recharge, and improving water quality and amenity.

In accordance with the aims of TAN 15 and current best practice, SuDS should be implemented wherever they will be effective in the new development proposals.

A full assessment of the SuDS techniques suitable for the proposed development, including an assessment of the correct number of treatment stages in the surface water management train, should be undertaken in accordance with the SuDS Manual 2015 (CIRIA Report C753). This will ensure that appropriate SuDS are utilised wherever they will be effective, as required by TAN 15.

Shallow depths of groundwater, low permeability and/or the presence of contamination are likely to preclude disposal of surface water runoff via infiltration to the ground. The presence of groundwater may also limit the maximum depth of excavation of some below-ground SuDS. In this case, surface level devices such as swales (for conveyance and storage) and tanked pervious paving (for treatment and attenuation storage) may prove to be most appropriate, complemented by buried tanked storage appropriate for site loading conditions (e.g. reinforced concrete box culverts).

Buried tanked storage is likely to be the most efficient way of providing the necessary storage volume using the minimum plan area.

Clear arrangements will be made for on-going maintenance of SuDS systems used. The SuDS will be designed to ensure that the maintenance and operation requirements are economically proportionate. This may be secured by means of a suitably worded planning condition.

5.2 Mitigating risk due to contamination of flood waters

The consequences of flooding may be increased during construction due to there being an increased number of people on site together with construction plant and materials. However, given the temporary nature and relatively short time period for construction (in relation to the...
operational lifetime of the development), the likelihood of a flood event inundating the site during construction is low.

Construction and maintenance contractors should be made aware of the flood risk to the site and reasonably practicable measures taken to mitigate that risk.

It is recommended that contractors prepare and implement a Flood Management Plan to cater for periods when the site is un-manned.

There is a risk of pollution of flood waters caused by construction material present on site, petroleum and oil from plant as well as disturbance of the soil surface. In order to limit pollution risk, construction material and equipment/tools could be stored in on-site containment units which could be secured in order to limit flood water contamination. Construction operations and site activities should be planned in order to minimise the storage of materials and stockpiling of soils on site. Where reasonably practicable, materials should not be delivered until such time as they are ready to be incorporated into the works.

The proposed development will also result in a risk of pollution from materials and products (e.g. fuel) stored or used on site during the operational phase.

5.3 Flood Management Plan

Developers should ensure that future occupiers of the development are aware of the flooding risks and consequences.

A Flood Management Plan including site shut-down and evacuation procedures should be produced and implemented so that site occupiers are aware of the risks and potential consequences, and know what to do in the event of a flood or a forecast flood.

Procedures, roles, responsibilities, and triggers for evacuating the site should be clearly set out in the Flood Management Plan.

The Plan should make provision for site users with impaired mobility, and identify safe refuge in case any users are not able to evacuate the site in the event of a flood.

The Flood Management Plan together with site operational procedures will need to include measures to mitigate the risk of materials causing pollution if inundated by flood water.

5.4 Structural integrity and flood resilience

TAN 15 guidance is for development to be designed to minimise structural damage during a flooding event and to be flood proofed to enable it to be returned to its prime use quickly in the aftermath of the flood.

It is therefore recommended that the buildings and other site infrastructure are designed and constructed to be resilient to the potential level of flooding predicted from surface water and the Nant y Brynau watercourse.

Flood resilient measures appropriate to the development will need to be identified. Typically these might include include air brick covers, use of water-resistant construction materials, raised sockets and electrical systems.

Where practicable all mechanical and electrical equipment including the proposed electrical substation and all critical equipment should be stored or located above the predicted flood level. Operational plant if practicable should be elevated above the flood level using structural frames or plinths.
5.5 Residual risk

It is not practicable to control or prevent surface water run-off from adjacent land, or flooding from watercourses upstream of the site, from entering the site.

The risk of surface water flooding is linked to the risk of flooding from the Nant y Brynau ordinary watercourse. However, for the reasons set out in Section 4.5.2.2, it may be expected that this risk is not as great as that suggested by the NRW Long Term Flood Risk online map.

The potential consequences of flooding of the site could include disruption to regional rail services, and contamination of floodwater due to the nature of the site use (materials stored and used at the depot).

Therefore, it is recommended that the developer gives consideration to undertaking further work (e.g. hydraulic modelling and mapping of the Nant y Brynau watercourse) in order to better understand the flood risk to the site from this source and be better able to manage it. This knowledge can then be used to inform the preparation of a Flood Management Plan as recommended above.

As discussed in Section 4.9, a safe and dry access and egress route will be available to and from most parts of the site, during most flood events. Also, most on-site parking areas will not be affected by flooding.

The ground level parking areas within the depot site and at the adjacent Taffs Well railway station, will be within the areas predicted to flood. Staff working on site would be able to move their vehicles in the event of a flood, but the owners of vehicles parked at the station, or staff that have parked at the depot but are working on the rail network, will not be able to move the vehicles from the affected area in the event of a forecast or actual flood. However, this would be an improvement on the existing situation as the number of ground-level parking spaces will be reduced following redevelopment.

Similarly, in the case of rolling stock stabled within the depot, it would not be practicable to move these vehicles from the affected area in the event of a forecast or actual flood. The site operator should be made aware of this risk and it should be addressed in the site Flood Management Plan.

The assessment of attenuation storage volumes that may be required is based on the climate change allowances from Natural Resources Wales in place at the time of the study. These allowances may change in the future, increasing the extent of predicted effects and the storage volumes required.
6 Summary and conclusions

The TAN 15 Development Advice Map (DAM) indicates that the entire site falls within development advice zone A. All categories of development use are appropriate at this location, and the TAN 15 justification test is not applicable.

There are no constraints relating to river or coastal flooding.

The Surface water requirements set out in TAN 15 must be met, and the acceptability criteria is for no increase in flooding elsewhere to occur as a result of the development.

The site is identified by the LLFA as being in an area that is at a high risk of surface water flooding. The development should seek to reduce the likelihood and impact of internal flooding, consider the mobilisation of vehicles during flood conditions, and make allowance for the impacts of climate change.

The available sources of information indicate that the site is at risk of surface water flooding to a depth of between 0.30m and 0.90m, and a velocity generally less than 0.25m/s, with the associated flood hazard varying mostly between ‘danger for some’ and ‘danger for all’.

However, these sources do not take into consideration existing positive drainage networks and it may be expected that the actual risk is not as great as that suggested.

The development will generate significant rates and volumes of surface water run-off, which could increase the flood risk to the site and surrounding areas of land if suitable mitigation measures are not implemented.

Surface water runoff from the development may be safely managed by means of a carefully considered surface water drainage system designed, constructed and maintained in accordance with the principles and strategy set out in Section 5.1 of this report, such that the development is not at risk of flooding from surface water run-off from within the site and does not increase the risk of such flooding elsewhere.

Currently, surface water run-off from the site is discharged to an adjacent public combined sewer. The existing surface water drainage infrastructure should be investigated to establish the location, size, level, capacity, and condition of existing outfalls.

A full assessment of the SuDS techniques suitable for the proposed development, including an assessment of the correct number of treatment stages in the surface water management train, should be undertaken in accordance with the SuDS Manual 2015 (CIRIA Report C753).

It is estimated that, as part of this system, a surface water attenuation storage volume of around 5000m$^3$ may be required.

SuDS should be considered in the design of the drainage system and implemented wherever they will be effective. It is anticipated that, due to the nature of the development and spatial constraints, buried tanked storage is likely to be the most practicable way of providing some or most of the necessary storage volume.

The site is also located within an area that could be flooded if either Pontsticill (Taf Fechan) or Beacons Reservoir were to fail and release the water that they hold. The flood water associated with such an event if it were to occur, is predicted to reach up to 2.0m in depth and up to 2.0m/s velocity.
A safe and dry access and egress route will be available to and from most parts of the site, during most flood events. Most on-site parking areas will not be affected by flooding. However, it will not be practicable to evacuate all road or rail vehicles in advance of a flood event.

Construction and maintenance contractors should be made aware of the flood risk to the site and reasonably practicable measures taken to mitigate that risk.

A Flood Management Plan should be produced and implemented so that site occupiers are aware of the risks and potential consequences, and know what to do in the event of a flood or a forecast flood.

Buildings and other site infrastructure should be designed and constructed to be resilient to the predicted level of surface water flooding.

Subject to implementation of the mitigation measures set out within this report and summarised above, it is considered that the flood risk and consequences for the proposed development are acceptable and there is no reason from a flood risk standpoint for the development not to proceed.

The risk of surface water flooding is linked to the risk of flooding from the Nant y Brynau ordinary watercourse. It is recommended that the developer considers undertaking further work (e.g. hydraulic modelling and mapping of the Nant y Brynau watercourse) to better understand and quantify the flood risk to the site from this source and be better able to manage it.
Appendices

A. Red Line Boundary plan 31
B. Development Master Plans 32
C. Natural Resources Wales preliminary Application Advice 33
D. Other Correspondence with NRW 34
E. Correspondence with Lead Local Flood Authority 35
F. Preliminary surface water run-off and attenuation storage calculations 36
G. Topographic Survey 37
I. DCWW public sewer record plan 39
A. Red Line Boundary plan
B. Development Master Plans
C. Natural Resources Wales preliminary Application Advice
24 August 2017

Annwyl Syr/Madam / Dear Sir/Madam

PRELIMINARY PRE-APPLICATION ADVICE
PROPOSED RAILWAY DEPOT AT TAFF’S WELL, CARDIFF

Thank you for your enquiry dated 08 August 2017

We have considered your enquiry in relation to our Development Planning checklist. We advise that the following matters are relevant to your site / proposed development and suggest you consider these further prior to the submission of any planning application:

Flood Risk and Surface Water
The site lies within Zone A of the Development Advice Maps (DAM) contained within Technical Advice Note 15 Development and Flood Risk (July 2004). TAN15 advises that for development located in Zone A the justification test is not applicable and surface water requirements apply. The acceptability criteria is for no increase in flooding elsewhere to occur as a result of the development. We note it is for the Local Authority’s Land Drainage Department to comment on the suitability of these proposals.

Contamination
Due to the previous use of the site, there is potential for land contamination. We refer you to our website for further advice.

European Protected Species (EPS)
Our records show there may be protected species in the vicinity of the site; bats and otter. We advise liaison with the LPA ecologist to discuss and agree the scope of any surveys that may be required.

We refer you to our website for further advice.

Foul Water
We refer you to Welsh Office Circular 10/99 on non-mains drainage, and specifically paragraphs 3 and 4 which stresses that the first presumption must be to provide a system
of foul drainage discharging into a public sewer. We note the proposed development is in a publicly sewered area.

We refer you to our website for further advice.

**Protected Sites**
The site lies within 120m of Cardiff Beech Wood SAC, Garth Woods SSSI and Castell Coch Woodlands and Road Section SSSI.

We refer you to our website for further advice.

Please note the view expressed in this letter is a response to a pre-planning enquiry only. We trust these comments will prove helpful but they should not set a precedent for any future Natural Resources Wales’ response to any formal application for planning permission or other legal consent. Such applications shall be assessed on the information submitted and regulations of relevance at that time. The details contained in this letter are based on the information available to date.

If you have any queries on the above please do not hesitate to contact us.

Yn gywir / Yours faithfully

**Helen Griffiths**
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**Ein diben yw sicrhau bod adnoddau naturiol Cymru yn cael eu cynnal, eu gwella a’u defnyddio yn gynaliadwy, yn awr ac yn y dyfodol.**

**Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.**
D. Other Correspondence with NRW
Hi Sarah

This data is provided under the attached Standard Notice.

Regards

Kathy

Eich Enw/Your name: Kathleen Banner
Teitl Swydd/Job Title: Swyddog Cysylltiadau Allanol/ External Relations Officer
Teitl eich tim/Title of your team: Cysylltiadau Allanol/External Relations
Cyfoeth Naturiol Cymru/Natural Resources Wales
Ffon/Tel: 03000 653568 or Ganolfan Gwasanaethau Cwsmeriad/Customer Services Centre - 03000 653568
E-bost/E-mail: datadistribution@naturalresourceswales.gov.uk
Gwefan/Website: www.cyfoethnaturiolcymru.gov.uk/www.naturalresourceswales.gov.uk

Dwy’n gweitho Dydd Mawrth, Dydd Mercher a Dydd Iau
Please note I work on a Tuesday, Wednesday and Thursday

Ein diben yw sicrhau bod adnoddau naturiol Cymru yn cael eu cynnal, eu gwella a’u defnyddio yn gynaliadwy, yn awr ac yn y dyfodol.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.

Ewch i / Browse our Data Services webpage

---

Hello Sarah

From the plan you provided outlining the site boundary, this site falls outside the flood zone so we have no modelled data relevant to the site.

Please find attached details of the defences in the nearby area. However note that these do not provide direct benefit to the above site.

Regards
Dwy’n gweitho Dydd Mawrth, Dydd Mercher a Dydd Iau
Please note I work on a Tuesday, Wednesday and Thursday

Ein diben yw sicrhau bod adnoddau naturiol Cymru yn cael eu cynnal, eu gwella a’u defnyddio yn gynaliadwy, yn awr ac yn y dyfodol.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.

Ewch i / Browse our Data Services webpage

---

From: Perera, Sarah L [mailto:Sarah.Perera@mottmac.com]
Sent: 08 August 2017 09:18
To: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Subject: RE: ATI 13202a - Flood Product - Taffs Well, Cardiff, CF15 7YF - ST 12593 83205

Good morning Kathy,

Apologies for the delay in response, I have been on leave the past few weeks.

Please find attached the red line boundary plan for the site.

Can you provide the following information, similar to that of EA “Product 4” data (if available):

- Flood modelling data, including levels, depths and velocities for the site, and for the following events: 1 in 5, 1 in 20, 1 in 30, 1 in 100, 1 in 100+CC and 1 in 1000.
- Any flood history for the site or surrounding area.
- Confirmation as to whether the site lies in a critical drainage area.
- Details regarding the primary source of flood risk to the site and whether the site is benefiting from any flood defences.

If you have any questions, or require any further information please do not hesitate to contact me.

Kind regards,

Sarah

Sarah Perera
Graduate Civil Engineer

D +44 (0)29 2047 8970 T +44 (0)29 2046 7800 F +44 (0)29 2047 1888
sarah.perera@mottmac.com
E. Correspondence with Lead Local Flood Authority
Good afternoon Sarah

From the change of the site boundary I would not offer any further advice in relation to the flood risk that what has previously been provided.

Regards,

Owen Griffiths MSc BSc (Hons)

Uwch Beiriannydd (Llifogydd a Thomenn Glo – Rheoli Risg) / Senior Engineer (Floods and Tips Risk Management)
Rheoli Risg Llifogydd / Flood Risk Management
Gyngor Bwrdeistref Sirol Rhondda Cynon Taf / Rhondda Cynon Taf County Borough Council
Tŷ Sardis, Sardis Road, Pontypridd CF37 1DU

Ffon / Tel:       01443 490425
E-bost / E-mail: Owen.Griffiths@rctcbc.gov.uk

Good afternoon Owen,

Thank you for your email below dated 10 July 2017. I apologies for the delayed response, I have been on leave the past few weeks.

On my return I have been made aware we have a new red line boundary plan for the proposed development which I have attached. Would there be any further information you can provide us with regards to my initial email dated 30 June 2017? We also have a detailed master plan of the site should that be required.

Kind regards,

Sarah

Sarah Perera
Graduate Civil Engineer

D +44 (0)29 2047 8970 T +44 (0)29 2046 7800 F +44 (0)29 2047 1888
sarah.perera@mottmac.com
Good afternoon Sarah,

In regards to the above request it would be for the producer of the FCA to identify recommendations to mitigate the local flood risk.

In terms of the site I would note that the area is at a high risk of surface water flooding and any development proposal should look to reduce the likelihood and impact of internal flooding and mobilisation of vehicles during spate conditions; including the impacts of climate change.

I would refer you to Natural Resources Wales Long Term Flood Risk portion of their website as it provides visual flood maps to aid in the identification of flood risk at site.


I would also note the presence of an Ordinary watercourse in the proximately of the site location and would remind the developer that any modification to an Ordinary watercourse is likely to require Ordinary watercourse Consent prior to construction (not retrospectively granted) which sits outside of the remit of a planning application.


Regards,

Owen Griffiths MSc BSc (Hons)

Uwch Beiriannydd (Llifogydd a Thomenni Glo – Rheoli Risg) / Senior Engineer (Floods and Tips Risk Management)
Rheoli Risg Llifogydd / Flood Risk Management
Gyngor Brwdeistref Sirol Rhondda Cynon Taf / Rhondda Cynon Taf County Borough Council
Tŷ Sardis, Sardis Road, Pontypridd CF37 1DU

Ffon / Tel: 01443 490425
E-bost / E-mail: Owen.Griffiths@rctcbc.gov.uk
We are currently carrying out a Flood Consequence Assessment for a site at (CF15 7YF).

Please see an indicative sketch attached. Grid reference: ST 12593 83205

We require the following pre application advice:
- Site flood data for the production of a Flood Consequence Assessment
- Recommendations/Comments on the proposal for the site.

If you require any payment, further information or wish to discuss any of the above, please do not hesitate to contact myself.

Kind regards,

Sarah

Sarah Perera
Graduate Civil Engineer

D +44 (0)29 2047 8970  T +44 (0)29 2046 7800  F +44 (0)29 2047 1888
sarah.perera@mottmac.com

We welcome correspondence in Welsh and corresponding with us in Welsh will not lead to a delay. Let us know your language choice if Welsh or bilingual

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We welcome correspondence in Welsh and corresponding with us in Welsh will not lead to a delay. Let us know your language choice if Welsh or bilingual
Mae'r neges ar gyfer y person / pobl enwedig yn unig. Gall gynhwys gwybodaeth bersonol, sensitif neu gyfrinachol. Os nad chi yw'r person a enwyd (neu os nad oes gyda chi'r awdurdod i'w derbyn ar ran y person a enwyd) chewch chi ddim ei chopïo neu'i defnyddio, neu'i datgelu i berson arall. Os ydych chi wedi derbyn y neges ar gam, rhowch wybod i'r sawl sy wedi anfon y neges ar unwaith. Mae'n bosibl y bydd holl negeseuon, gan gynhwys negeseuon GCSX, yn cael eu cofnodi a/neu fonitro unol â'r ddeddfwriaeth berthnasol. I ddarllen yr ymwadiad llawn, ewch i http://www.rctcbc.gov.uk/CY/Help/TermsOfUse.aspx

We welcome correspondence in Welsh and corresponding with us in Welsh will not lead to a delay. Let us know your language choice if Welsh or bilingual

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F. Preliminary surface water run-off and attenuation storage calculations
### Calculation cover sheet

**Project Title:** South Wales Metro - Taffs Well Depot  
**Project No:** 367590

**File No:**  
**No. of Sheets:** 4 + 7 App.

**Section:** Flood Risk Assessment  
**Subject:** Outline Drainage Strategy

**Calc No:** 1

**Project Manager:** GJ Last  
**Designer:** SL Perera

**Design Phase:**  
- A - Concept or preliminary  
- C - Design verification  
- B - Analysis and detailed design  
- D - Other (specify)

**Computer Applications Used:**

<table>
<thead>
<tr>
<th>Application</th>
<th>Title</th>
<th>Version Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWG TrueView</td>
<td>uksuds.com Greenfield runoff rate estimation tool</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td>uksuds.com Surface water storage volume estimation tool</td>
<td></td>
</tr>
</tbody>
</table>

**Scopes for Checking Manual and Computer Generated Calculations:**

Level 2: principle, method, assumptions, design criteria and minimum 20% arithmetic check.

<table>
<thead>
<tr>
<th>Sheets Checked</th>
<th>Calculations by</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rev A</td>
<td>SLP</td>
<td>Name:</td>
</tr>
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<td></td>
<td></td>
<td>Signature:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Date: 28/09/2017</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Name: NMP</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Date: 29/09/2017</td>
</tr>
</tbody>
</table>

*If an Excel spreadsheet or other computer file has been checked and has not been attached, enter the name, date and full file path or PiMS location of the file that was checked. (PiMS nickname or short link from Properties – General could also be useful.)*

#### a) Basic Design Information or Source and Reference:


The supporting information on the HR Wallingford website provides an in-depth explanation of the methodology that is adopted by the tool (accessed: 31/08/2017, available at: [http://www.uksuds.com/help-support/frequently-asked-questions](http://www.uksuds.com/help-support/frequently-asked-questions)).

The following drawings included in Annex A:
- A.1 – 367590-MMD-28I-XX-DR-C-0002,
- A.2 – 367590-MMD-28I-XX-DR-C-0003, and
- A.3 – 367590-MMD-28I-XX-DR-C-0004.

#### b) Identify documents/technical records where output will be used:

‘Flood Risk Assessment and Drainage Strategy – South West Metro Taff’s Well Depot’ (Document Ref: 367590-WTD-CAR-28I-05)

---

**Approved by Project Manager:**  
**Signature:** .................................................................  
**Date:** .................................................................

**Print name:** .................................................................  
**Distribution:** Original to project file
Introduction

Transport for Wales proposes the construction of a new depot at Taffs Well Station, Cardiff Road, Mid Glamorgan, CF15 7PE, hereinafter referred to as “the site”. The site consists of a brownfield area of approximately 5.8 hectares (ha). The proposed development will include the demolition of the existing buildings and infrastructure, and the construction of 8 new buildings, a new railway bridge and installation of new railway tracks. This calculation is based on the information indicated by the following drawings included in Annex A:

- 367590-MMD-28I-XX-DR-C-0002 Rev P01,
- 367590-MMD-28I-XX-DR-C-0003 Rev P01, and
- 367590-MMD-28I-XX-DR-C-0004 Rev P01.

Methodology

Estimate the peak surface water runoff rate and storage volume requirement for the development using the HR Wallingford Ltd online ‘Surface Water Storage Requirements for Sites’ tool.

- Estimate the greenfield runoff rate for the catchment.
- Estimate the storage requirement for the proposed development with runoff from impermeable areas limited to the greenfield runoff rate.

Information and Assumptions

The following information has been obtained from various sources:

- OS Open Data, Contains Ordnance Survey data © Crown copyright and database right 2017 [https://www.ordnancesurvey.co.uk/opendatadownload/products.html]:
  - The site has a total area of approximately 5.8 hectares (ha).
- The proposed development will feature approximately 8 new buildings to house workshops, offices, storage, a substation and staff parking, as well as wash, sand and delivery track facilities. 214 parking spaces (62 public car parking spaces, 152 staff/visitor parking spaces), a new bridge over the railway track as well as numerous new railway tracks are to be installed as part of the proposed development.
  - This tool was used to estimate the greenfield runoff rates of the site.
- HR Wallingford Ltd online ‘Surface water storage volume estimation’ tool (available [http://www.uksuds.com/drainage-calculation-tools/surface-water-storage]):
  - This tool was used to estimate the storage volume requirement of the site. (Default values were used for all input variables not listed in Table 1 of this calculation).

The following assumptions have been made:

- Due to the lack of information on whether the ground conditions on site are suitable for discharging surface water via soakaways/infiltration. It has therefore been assumed that disposal via soakaways/infiltration will not be achievable. Likewise, controlled discharge of surface water directly into the River Taff is unlikely to be feasible due to the A4054 (Cardiff Road) providing an obstacle between the site and the River Taff, therefore in line the hierarchy of options set out in the SuDS Manual the next preferred approach will be disposal via the controlled discharge of surface water into a surface water sewer highway drain or another drainage system.

Ref: The SuDS Manual (C753), p41
The Ground Level Master Plan shows some areas of landscaping to be introduced to the site, however they will be treated as impermeable areas throughout this calculation so that a ‘worst case’ runoff is considered.

The difference in the footprint between the Red-line Boundary Plan and the area of proposed development on the Ground Level Master Plan is assumed to be greenfield area which will be assumed to be “significantly public open space” for the surface water storage volume estimation.

### Estimation of Greenfield Runoff Rates

Several methods are available to use in order to estimate greenfield runoff rates, e.g. Statistical FEH Model, IH 124 Method, ReFH Hydrograph Method, etc. However, these methods are limited by the catchment area of the site which they are estimating.

The Institute of Hydrology (IH) 124 Method is based on a range of data and measured flows across small rural catchments. However, these catchments are not small relative to typical developments as these are defined as having areas less than 25km². The IH advises that the method should not be applied to catchments which are smaller than 50ha.

The Design Manual for Roads and Bridges (DMRB) (Vol 4, Section 2, Part 1, HA 106/04) recommends the use of the IH 124 Method for catchments greater than 40ha, and the Agricultural Development and Advisory Service (ADAS) Method for catchments which are equal to or less than 40ha. However, the ADAS Method is based on limited data that was obtained from studying land drains, and is strongly advised against (Preliminary Rainfall Runoff Management for Developments, R&D Technical Report W5-074/A/TR/1/E). For this reason, a regression equation is typically used to adapt the IH 124 Method so that it is applicable for catchments smaller than 50ha.

Where developments are smaller than 50ha, the analysis for determining greenfield runoff rates should assume a catchment of 50ha and linearly interpolate the flow rate value based on the ratio of the size of the development. This modified IH 124 Method is known as the Interim Code of Practice (ICP) SuDS Method, and is considered appropriate for the purposes of this estimation.

### Methodology:

1. Determine the Soil Type (SOIL) for the site:

   ![Extract from Wallingford Procedure Winter Rain Acceptance Potential (WRAP) Map](Ref: WRAP Map)

   The site is located in an area of “relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England”, “permeable soils with shallow ground-water in low lying areas”, and/or “mixed areas of permeable and impermeable soils, in approximately equal proportions” (WRAP Class 3 Wallingford Procedure Winter Rain Acceptance Potential (WRAP) Map).

   

   **SOIL = 3**
2. Determine the Areas (A) to be positively drained (measured from drawings attached in Annex A using AutoCAD software):

\[ A = 4.6\text{ha} \quad (A_{50} = 50\text{ha}) \]


\[ \text{SAAR4170} = 1,277\text{mm} \]

4. Determine the Standard Percentage Runoff (SPR):

<table>
<thead>
<tr>
<th>SOIL</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPR</td>
<td>0.10</td>
<td>0.30</td>
<td>0.37</td>
<td>0.47</td>
<td>0.53</td>
</tr>
</tbody>
</table>

Extract from IH FSSR 16

\[ \text{SPR} = 0.37 \quad \text{(for SOIL} = 3) \]

5. Determine the 50ha Catchment Mean Annual Peak Flow (Q_{BAR(50)}):

\[ Q_{BAR(50)} = 1.08 \times (A_{50}) \times 0.01^{0.89} \times \text{SAAR4170}^{1.17} \times \text{SPRHOST}^{2.17} \]

\[ Q_{BAR(50)} = 290.2\text{l/s} \]

6. Determine the Catchment Mean Annual Peak Flows (Q_{BAR(rural)}):

\[ Q_{BAR(rural)} = Q_{BAR(50)} \times (A \div 50) \]

\[ Q_{BAR(rural)} = 26.7\text{l/s} \]

**Estimation of Surface Water Storage Volume**

The first part of this calculation was undertaken using the HR Wallingford Ltd online ‘Surface Water Storage Requirements for Sites’ tool (available at: http://www.uksuds.com/drainage-calculation-tools/surface-water-storage). According to the HR Wallingford Ltd website, this tool provides an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with best practice in the SuDS Manual and the SuDS Standards in England, Wales and Northern Ireland.

The online estimation tool provides estimates for storage volumes using three estimation methods ‘FEH’, ‘IH124’ and ‘ReFH2’ estimation methods. Chapter 24 of the CIRIA SuDS Manual (2015) indicates that the ‘FEH ReFH2’, ‘FEH statistical method’ and ‘IH124’ estimation methods are all appropriate for the estimation of the peak runoff rate for a greenfield site. ‘IH124’ has been used in this assessment.

The supporting information on the HR Wallingford website provides an in-depth explanation of the methodology that is adopted by the tool. This information can be accessed on their website here: http://www.uksuds.com/help-support/frequently-asked-questions.
Table 1 summarises the values input into the ‘Surface water storage estimation’ tool. Default values from the map click were used for all variables not listed below.

**Table 1: Site Characteristics and Design Criteria**

<table>
<thead>
<tr>
<th>Site Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ‘site’ area (ha)</td>
<td>5.8</td>
</tr>
<tr>
<td>Significantly “public open space” (ha)</td>
<td>1.2</td>
</tr>
<tr>
<td>Impermeable area (ha)</td>
<td>4.6</td>
</tr>
</tbody>
</table>

**Design Criteria** (as per recommendations described in [http://www.uksuds.com/help-support/frequently-asked-questions](http://www.uksuds.com/help-support/frequently-asked-questions))

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change allowance factor</td>
<td>1.3 (i.e. +30%)</td>
</tr>
<tr>
<td>Urban creep allowance factor</td>
<td>1.0 (i.e. no allowance, as there is no opportunity for urban creep on this site)</td>
</tr>
</tbody>
</table>

The ‘Surface water storage volume estimation’ tool generates a report containing the results for the chosen estimation method, in this case ‘IH124’. Three calculations were undertaken; one to estimate the greenfield storage requirement, one to estimate the brownfield storage requirements (i.e. based on the existing previously developed site), and one to estimate the storage requirements for a 30% betterment (i.e. reduction on the rate of discharge) of the existing previously developed site.

The brownfield storage requirements were estimated using a SOIL factor of 5, and subsequently an SPR of 0.53. This approach was followed based on recommendations set out in the SuDS Manual.

The 30% betterment storage requirements were calculated by reducing the Qbar value obtained from the brownfield storage calculation by 30%.

The results are summarised in Table 2 below, and the report for each respective calculation is included in Annex B.

**Table 2: Runoff Rates and Storage Volume Estimates**

<table>
<thead>
<tr>
<th></th>
<th>Greenfield site scenario</th>
<th>Brownfield site scenario (i.e. previously developed)</th>
<th>30% Betterment compared with existing (previously developed) site scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qbar total site area (l/s)</td>
<td>33.67</td>
<td>73.43</td>
<td>51.4</td>
</tr>
<tr>
<td>Estimated runoff rate (l/s) (1 in 1 year)</td>
<td>23.5</td>
<td>51.3</td>
<td>35.9</td>
</tr>
<tr>
<td>Estimated runoff rate (l/s) (1 in 100 years)</td>
<td>58.2</td>
<td>127</td>
<td>88.9</td>
</tr>
<tr>
<td>Estimated total storage requirement (m³)</td>
<td>6530</td>
<td>3783</td>
<td>5040</td>
</tr>
</tbody>
</table>

**Conclusion**

The estimated total surface water storage requirements for the proposed development on the existing brownfield site is approximately 3783m². It is noted that these indicative estimates include interception, attenuation, long term, and treatment storage, further details of which will be confirmed at detailed design of any surface water drainage network.
This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance “Preliminary rainfall runoff management for developments”, W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Cria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

### Methodology

**IH124**

### Site characteristics

| Total site area (ha) | 4.6 |  

### Methodology

<table>
<thead>
<tr>
<th>Qbar estimation method</th>
<th>Calculate from SPR and SAAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPR estimation method</td>
<td>Calculate from SOIL type</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOIL type</th>
<th>Default</th>
<th>Edited</th>
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<tr>
<td>3</td>
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<table>
<thead>
<tr>
<th>HOST class</th>
<th>---</th>
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<tr>
<td></td>
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<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>SPR/SPRHOST</th>
<th>0.37</th>
<th>0.37</th>
</tr>
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</table>

### Hydrological characteristics

<table>
<thead>
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<tbody>
<tr>
<td>1277</td>
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<table>
<thead>
<tr>
<th>Hydrological region</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Growth curve factor: 1 year</th>
<th>0.88</th>
<th>0.88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth curve factor: 30 year</td>
<td>1.78</td>
<td>1.78</td>
</tr>
<tr>
<td>Growth curve factor: 100 year</td>
<td>2.18</td>
<td>2.18</td>
</tr>
</tbody>
</table>

### Notes:

1. Is $Q_{\text{BAR}} < 2.0 \text{ l/s/ha}$?

2. Are flow rates $< 5.0 \text{ l/s}$?

3. Is $\text{SPR/SPRHOST} \leq 0.3$?

### Greenfield runoff rates

<table>
<thead>
<tr>
<th>Qbar (l/s)</th>
<th>Default</th>
<th>Edited</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.7</td>
<td>26.7</td>
<td></td>
</tr>
</tbody>
</table>

| 1 in 1 year (l/s) | 23.5 | 23.5 |
| 1 in 30 years (l/s) | 47.53 | 47.53 |
| 1 in 100 years (l/s) | 58.21 | 58.21 |
This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance “Preliminary rainfall runoff management for developments”, WS-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

### Site characteristics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total site area (ha)</td>
<td>5.8</td>
</tr>
<tr>
<td>Significant public open space (ha)</td>
<td>1.2</td>
</tr>
<tr>
<td>Area positively drained (ha)</td>
<td>4.6</td>
</tr>
<tr>
<td>Pervious area contribution (%)</td>
<td>30</td>
</tr>
<tr>
<td>Impermeable area (ha)</td>
<td>4.6</td>
</tr>
<tr>
<td>Percentage of drained area that is impermeable (%)</td>
<td>100</td>
</tr>
<tr>
<td>Impervious area drained via infiltration (ha)</td>
<td>0</td>
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<tr>
<td>Return period for infiltration system design (year)</td>
<td>10</td>
</tr>
<tr>
<td>Impervious area drained to rainwater harvesting systems (ha)</td>
<td>0</td>
</tr>
<tr>
<td>Return period for rainwater harvesting system design (year)</td>
<td>10</td>
</tr>
<tr>
<td>Compliance factor for rainwater harvesting system design (%)</td>
<td>66</td>
</tr>
<tr>
<td>Net site area for storage volume design (ha)</td>
<td>4.6</td>
</tr>
<tr>
<td>Net impermeable area for storage volume design (ha)</td>
<td>4.6</td>
</tr>
</tbody>
</table>

* Where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50 % of the ‘area positively drained’, the ‘net site area’ and the estimates of Qbar and other flow rates will have been reduced accordingly.

### Methodology

<table>
<thead>
<tr>
<th>Methodology</th>
<th>IH124</th>
</tr>
</thead>
</table>

### Design criteria

<table>
<thead>
<tr>
<th>Volume control approach</th>
<th>Use long term storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default</td>
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<tr>
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<td>Urban creep allowance factor</td>
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<td>Interception rainfall depth (mm)</td>
<td>5</td>
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<tr>
<td>Minimum flow rate (l/s)</td>
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<table>
<thead>
<tr>
<th>Qbar estimation method</th>
<th>SPR estimation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculate from SPR and SAAR</td>
<td>Calculate from SOIL type</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Qbar total site area (l/s)</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>33.67</td>
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</table>

### Hydrology

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>SAAR (mm)</td>
<td>1277</td>
</tr>
<tr>
<td>M5-60 Rainfall Depth (mm)</td>
<td>20</td>
</tr>
<tr>
<td>'r' Ratio M5-60/M5-2 day</td>
<td>0.2</td>
</tr>
<tr>
<td>Rainfall 100 yrs 6 hrs</td>
<td>82</td>
</tr>
<tr>
<td>Rainfall 100 yrs 12 hrs</td>
<td>119.48</td>
</tr>
<tr>
<td>FEH/FSR conversion factor</td>
<td>1.16</td>
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### Site coordinates

<table>
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<tr>
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<tbody>
<tr>
<td>Latitude</td>
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<tr>
<td>Longitude</td>
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### Site discharge rates

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<thead>
<tr>
<th>Metric</th>
<th>Default</th>
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<tbody>
<tr>
<td>Qbar total site area (l/s)</td>
<td>33.67</td>
<td>33.67</td>
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<tr>
<td>Qbar net site area (l/s)</td>
<td>26.7</td>
<td>26.7</td>
</tr>
<tr>
<td>1 in 1 year (l/s)</td>
<td>23.5</td>
<td>23.5</td>
</tr>
<tr>
<td>1 in 30 years (l/s)</td>
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<td>47.5</td>
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<tr>
<td>1 in 100 years (l/s)</td>
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### Estimated storage volumes

<table>
<thead>
<tr>
<th>Metric</th>
<th>Default</th>
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</thead>
<tbody>
<tr>
<td>Interception storage (m³)</td>
<td>184</td>
<td>184</td>
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<tr>
<td>Attenuation storage (m³)</td>
<td>4724</td>
<td>4724</td>
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<tr>
<td>Long term storage (m³)</td>
<td>1622</td>
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<tr>
<td>Treatment storage (m³)</td>
<td>552</td>
<td>552</td>
</tr>
<tr>
<td>Total storage (excluding treatment) (m³)</td>
<td>6530</td>
<td>6530</td>
</tr>
</tbody>
</table>

This report was produced using the Storage estimation tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.
This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", WS-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

### Site characteristics

<table>
<thead>
<tr>
<th>Site characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total site area (ha)</td>
<td>5.8</td>
</tr>
<tr>
<td>Significant public open space (ha)</td>
<td>1.2</td>
</tr>
<tr>
<td>Area positively drained (ha)</td>
<td>4.6</td>
</tr>
<tr>
<td>Pervious area contribution (%)</td>
<td>30</td>
</tr>
<tr>
<td>Impermeable area (ha)</td>
<td>4.6</td>
</tr>
<tr>
<td>Percentage of drained area that is impermeable (%)</td>
<td>100</td>
</tr>
<tr>
<td>Impervious area drained via infiltration (ha)</td>
<td>0</td>
</tr>
<tr>
<td>Return period for infiltration system design (year)</td>
<td>10</td>
</tr>
<tr>
<td>Impervious area drained to rainwater harvesting systems (ha)</td>
<td>0</td>
</tr>
<tr>
<td>Return period for rainwater harvesting system design (year)</td>
<td>10</td>
</tr>
<tr>
<td>Compliance factor for rainwater harvesting system design (%)</td>
<td>66</td>
</tr>
<tr>
<td>Net site area for storage volume design (ha)</td>
<td>4.6</td>
</tr>
<tr>
<td>Net impermeable area for storage volume design (ha)</td>
<td>4.6</td>
</tr>
</tbody>
</table>

*Where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Qbar and other flow rates will have been reduced accordingly.*

### Methodology

<table>
<thead>
<tr>
<th>IH124</th>
</tr>
</thead>
</table>

### Design criteria

#### Volume control approach

<table>
<thead>
<tr>
<th>Use long term storage</th>
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<tbody>
<tr>
<td>Climate change allowance factor</td>
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<td>1.0</td>
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<td>5</td>
</tr>
<tr>
<td>Minimum flow rate (l/s)</td>
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#### Qbar estimation method

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</thead>
<tbody>
<tr>
<td>Calculate from SPR and SAAR</td>
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#### SPR estimation method

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Calculate from SOIL type</td>
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</table>

#### Qbar total site area (l/s)

<table>
<thead>
<tr>
<th>Default</th>
<th>Edited</th>
</tr>
</thead>
<tbody>
<tr>
<td>73.43</td>
<td></td>
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#### SOIL type

<table>
<thead>
<tr>
<th>Default</th>
<th>Edited</th>
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#### HOST class

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#### SPR

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<tbody>
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### Hydrology

#### SAAR (mm)

<table>
<thead>
<tr>
<th>Default</th>
<th>Edited</th>
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</thead>
<tbody>
<tr>
<td>1277</td>
<td></td>
</tr>
</tbody>
</table>

#### M5-60 Rainfall Depth (mm)

<table>
<thead>
<tr>
<th>Default</th>
<th>Edited</th>
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</thead>
<tbody>
<tr>
<td>20</td>
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</table>

#### 'r' Ratio M5-60/M5-2 day

<table>
<thead>
<tr>
<th>Default</th>
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</thead>
<tbody>
<tr>
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#### Rainfall 100 yrs 6 hrs

<table>
<thead>
<tr>
<th>Default</th>
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<tbody>
<tr>
<td>82</td>
<td></td>
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#### Rainfall 100 yrs 12 hrs

<table>
<thead>
<tr>
<th>Default</th>
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<tbody>
<tr>
<td>119.48</td>
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#### FEH/FSR conversion factor

<table>
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<tr>
<th>Default</th>
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<tbody>
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<td>1.16</td>
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</tr>
</tbody>
</table>

### Site discharge rates

<table>
<thead>
<tr>
<th>Default</th>
<th>Edited</th>
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<tbody>
<tr>
<td>Qbar total site area (l/s)</td>
<td>73.43</td>
</tr>
<tr>
<td>Qbar net site area (l/s)</td>
<td>58.24</td>
</tr>
<tr>
<td>1 in 1 year (l/s)</td>
<td>51.3</td>
</tr>
<tr>
<td>1 in 30 years (l/s)</td>
<td>103.7</td>
</tr>
<tr>
<td>1 in 100 years (l/s)</td>
<td>127</td>
</tr>
</tbody>
</table>

### Estimated storage volumes

<table>
<thead>
<tr>
<th>Default</th>
<th>Edited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interception storage (m³)</td>
<td>184</td>
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<tr>
<td>Attenuation storage (m³)</td>
<td>2580</td>
</tr>
<tr>
<td>Long term storage (m³)</td>
<td>1018</td>
</tr>
<tr>
<td>Treatment storage (m³)</td>
<td>552</td>
</tr>
<tr>
<td>Total storage (excluding treatment) (m³)</td>
<td>3783</td>
</tr>
</tbody>
</table>
This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance “Preliminary rainfall runoff management for developments”, WS-074A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

### Methodology

**IH124**

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</tr>
<tr>
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</tr>
<tr>
<td>Interception rainfall depth (mm)</td>
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<tr>
<td>Minimum flow rate (l/s)</td>
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#### Qbar estimation method

<table>
<thead>
<tr>
<th>Specify Qbar manually</th>
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#### SPR estimation method

<table>
<thead>
<tr>
<th>Calculate from SOIL type</th>
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</thead>
<tbody>
<tr>
<td><strong>Default</strong></td>
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<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Qbar total site area (l/s)</td>
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### Hydrology

<table>
<thead>
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<tr>
<td>FEH/FSR conversion factor</td>
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</tr>
<tr>
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<td>Growth curve factor: 10 year</td>
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<td>Growth curve factor: 30 year</td>
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<tr>
<td>Growth curve factor: 100 year</td>
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### Site discharge rates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<th>Value</th>
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</thead>
<tbody>
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<td></td>
</tr>
<tr>
<td>Qbar net site area (l/s)</td>
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<td>40.77</td>
<td></td>
</tr>
<tr>
<td>1 in 1 year (l/s)</td>
<td>51.3</td>
<td>35.9</td>
<td></td>
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<tr>
<td>1 in 30 years (l/s)</td>
<td>103.7</td>
<td>72.6</td>
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<tr>
<td>1 in 100 years (l/s)</td>
<td>127</td>
<td>88.9</td>
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<table>
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<tr>
<th>Parameter</th>
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<tbody>
<tr>
<td>Interception storage (m³)</td>
<td>2580</td>
</tr>
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<td>3783</td>
</tr>
<tr>
<td>Long term storage (m³)</td>
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</tr>
</tbody>
</table>
G. Topographic Survey
H. DCWW Drainage and Water Enquiry
response reference 2016/3/318742/352229
dated 17 March 2016
Drainage and Water Enquiry

Responses as required by the Home Information Pack Regulations

| The information contained within this report refers to the Existing property at: | S W FORGEMASTERS LTD
GARTH WORKS
TAFFS WELL
CF15 7YF |
| --- | --- |

| Search report produced by: | Dŵr Cymru Welsh Water
P.O. Box 3146
Linea
Fortran Road
Cardiff
CF30 0EH
Telephone No. – 0800 917 2652 |

[www.dwrcymru.com](http://www.dwrcymru.com)
[www.dwrcymrusearches.com](http://www.dwrcymrusearches.com)
enquiries@dwrcymru.com

Water supply - Call 0800 052 0130
Sewerage services - Call 0800 085 3968 |

<table>
<thead>
<tr>
<th>Our reference:</th>
<th>2016/3/318742/352229</th>
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<table>
<thead>
<tr>
<th>Your reference:</th>
<th>998948</th>
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</thead>
</table>

The following records were referenced in compiling this search report

- Customer Account System
- Asset Information System
- Water Quality Database

Any enquiries relating to this report should be addressed to our Customer Support Searches Team at the above address. Please quote one of the above references.

NEW LEGAL REQUIREMENT
IF THIS SEARCH RELATES TO A RECENTLY BUILT PROPERTY, NEW WELSH GOVERNMENT LEGISLATION EFFECTIVE FROM 1ST OCTOBER 2012 REQUIRES THAT ANY SEWERS AND LATERAL DRAINS SERVING THE PROPERTY MUST BE SUBJECT TO A SECTION 104 ADOPTION AGREEMENT WITH DWR CYMRU WELSH WATER.
Q 1  Interpretation of Drainage and Water Enquiry
Response  
Appendix 1 contains definitions of terms and expressions identified within this report.
Informative  
Not Applicable.

Q 2  Enquiries and Responses
Response  
1. The records were searched by Hannah-May Thomas who has no nor not likely to have, any personal or business relationship with any person involved in the sale of the property.
2. This search report was prepared by Hannah-May Thomas who have no nor not likely to have any personal or business relationship with any person involved in the sale of the property.
Informative  
For the Residential Drainage & Water Search Complaint Procedure please see Appendix 6.

Q 3  Where relevant, please include a copy of an extract from the public sewer map.
Response  
A copy of an extract from the public sewer map is included in which the location of the property is identified.
Informative  
Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991. The company is not responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only. Sewers indicated on the extract of the public sewer map as being subject to an agreement under section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended that these details are checked with the developer, if any. Assets other than public sewers may be shown on the copy extract, for information only. The presence of a public sewer located within the boundary of the property may restrict further development within it. The sewerage undertaker has a statutory right of access to carry out work on its assets, subject to notice. This may result in employees of the sewerage undertaker or its contractors needing to enter the property to carry out works.

Q 4  Does foul water from the property drain to a public sewer?
Response  
Records indicate that foul water from the property drains to a public sewer.
Informative  
Water companies are not responsible for any private drains and sewers that connect the property to the public sewerage system, and do not hold details of these. The property owner will normally have sole responsibility for private drains serving the property and may have shared responsibility, with other users, if the property is served by a private sewer which also serves other properties. These may pass through land outside of the control of the sell and the buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal. If foul water does not drain to the public sewerage system the property may have private facilities in the form of a cesspit, septic tank or other type of treatment plant.

Q 5  Does surface water from the property drain to a public sewer?
Response  
Records indicate that surface water from the property does drain to a public sewer.
Informative  
Sewerage undertakers are not responsible for private drains and sewers that connect the property to the public sewerage system and do not hold details of these. The property owner will normally have sole responsibility for private drains serving the property and may have shared responsibility with other users, if the property is served by a private sewer which also serves other properties. These may pass through land outside of the control of the
seller and the buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal. In some cases, sewerage undertakers' records do not distinguish between foul and surface water connections to the public sewerage system. If on inspection the buyer finds that the property is not connected for surface water drainage, the property may be eligible for a rebate of the surface water drainage charge. Details can be obtained from the sewerage undertaker. If surface water does not drain to the public sewerage system the property may have private facilities in the form of a soakaway or private connection to a watercourse.

Q 6 Are any sewers or lateral drains serving or which are proposed to serve the property the subject of an existing adoption agreement or an application for such an agreement?

Response The property is part of an established development and is not subject to an adoption agreement.

Informative This enquiry is of interest to purchasers of new homes who will want to know whether or not the property will be linked to a public sewer. Where the property is part of a very recent or ongoing development and the sewers are not the subject of an adoption application, buyers should consult with the developer to ascertain the extent of private drains and sewers for which they will hold maintenance and renewal liabilities. Final adoption is subject to the developer complying with the terms of the adoption agreement under Section 104 of the Water Industry Act 1991.

Q 7 Does the public sewer map indicate any public sewer, disposal main or lateral drain within the boundaries of the property?

Response The public sewer map included indicates that there is a public sewer, disposal main or lateral drain within the boundaries of the property. However, from 1st October 2011 there may be additional public sewers, disposal mains or lateral drains which are not recorded on the public sewer map. For further information please contact Dwr Cymru Welsh Water on Tel: 0800 917 2652

Informative The boundary of the property has been determined by reference to the Ordnance Survey record. The presence of a public sewer running within the boundary of the property may restrict further development. The company has a statutory right of access to carry out work on its assets, subject to notice. This may result in employees of the company or its contractors needing to enter the property to carry out work. Sewers indicated on the extract of the public sewer map as being subject to an agreement under section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended that these details be checked with the developer, if any. Assets other than public sewers may be shown on the copy extract, for information only.

Q 8 Does the public sewer map indicate any public sewer within 30.48 metres (100 feet) of any buildings within the property?

Response The public sewer map included indicates that there is a public sewer within 30.48 metres (100 feet) of a building within the property.

Informative The presence of a public sewer within 30.48 metres (100 feet) of the building(s) within the property can result in the local authority requiring a property to be connected to the public sewer. The measure is estimated from the Ordnance Survey record, between the building(s) within the boundary of the property and the nearest public sewer. Sewers indicated on the extract of the public sewer map as being subject to an agreement under section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended that these details are checked with the developer. Assets other than public sewers may be shown on the copy extract, for information only. If the public sewer map indicates that there is a public sewer or lateral drain located within the development site, dependant on the actual plot layout(s), these sewers may be within 30.48
meters (100 feet) of a proposed building. It is recommended that investigations are made into the drainage arrangements of the property as the owner may be liable for repairs to the drainage system.

Q 9  Has a sewerage undertaker approved or been consulted about any plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain?

Response  There are no records in relation to any approval or consultation about plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain. However, the sewerage undertaker might not be aware of a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain.

Informative  Buildings or extensions erected over a sewer in contravention of building controls may have to be removed or altered. From the 1st October 2011 private sewers, disposal mains and lateral drains transferred into public ownership and the sewerage undertaker may not have approved or been consulted about plans to erect a building or extension on the property over or in the vicinity of these.

Q 10  Where relevant, please include a copy of an extract from the map of waterworks.

Response  A copy of an extract of the map of waterworks is included, showing water mains, resource mains or discharge pipes in the vicinity of the property.

Informative  The "water mains" in this context are those which are vested in and maintainable by the water company under statute. The purchaser should carry out a physical inspection of the property. Assets other than public water mains may be shown on the plan, for information only. Water undertakers are not responsible for private supply pipes connecting the property to the public water main and do not hold details of these. These may pass through land outside of the control of the seller, or may be shared with adjacent properties. The buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.

The presence of a public water main located within the boundary of the property may restrict further development within it. Water undertakers have rights of access to carry out work on their assets, subject to notice (except in the event of an emergency). This may result in employees of the water undertaker or its contractors needing to enter the property to carry out work.

Q 11  Is any water main or service pipe serving or which is proposed to serve the property the subject of an existing adoption agreement or an application for such an agreement?

Response  Records confirm that water mains or service pipes serving the property are not the subject of an existing adoption agreement or an application for such an agreement.

Informative  This enquiry is of interest to purchasers of new homes who will want to know whether or not the property will be linked to the mains water supply.

Q 12  Who are the sewerage and water undertakers for the area?

Response  The sewerage undertaker is Dwr Cymru Cyfyngedig, Pentwyn Road, Nelson, Treharris, CF46 6LY and the water undertaker is Dwr Cymru Cyfyngedig, Pentwyn Road, Nelson, Treharris, CF46 6LY.

Informative  Not applicable.

Q 13  Is the property connected to mains water supply?

Response  Records indicate that the property is connected to mains water supply.
Informative Details of private supplies are not kept by the water undertaker. The situation regarding sources of supply and supply arrangements should be checked with the current owner of the property and a physical inspection should be carried out.

Q 14 Are there any water mains, resource mains or discharge pipes within the boundaries of the property?
Response The map of waterworks indicates that there are water mains, resource mains or discharge pipes within the boundaries of the property.
Informative The boundary of the property has been determined by reference to the Ordnance Survey record. The presence of a public water main within the boundary of the property may restrict further development within it. Water companies have statutory rights of access to carry out work on their assets, subject to notice (except in the event of an emergency). This may result in employees of the company or its contractors needing to enter the property to carry out work. If the map of waterworks indicates that there is a public water main drain located within the development site, dependant on the actual plot layout(s), protection measures and/or diversion of these water mains may be required and agreed with the water undertaker.

Q 15 What is the current basis for charging for sewerage and water services at the property?
Response The charges are based on actual volumes of water measured through a water meter ("metered supply").
Informative Water and sewerage undertakers' full charges are set out in their charges schemes which are available from the company free of charge upon request. It is policy to meter all new water connections - this would result in charges being levied according to the measured tariff. The water undertaker may install a meter at the premises where a buyer makes a change of use of the property. The Water Industry Act 1991 Section 150, The Water Resale Order 2001 provides protection for people who buy their water or sewerage services from a person or company instead of directly from a water or sewerage company. Details are available from the Office of Water Services (OFWAT) at www.ofwat.gov.uk

Q 16 Will the basis for charging for sewerage and water services at the property change as a consequence of a change of occupation?
Response There will be no change in the current charging arrangements as a consequence of a change of occupation.
Informative Water and sewerage undertakers' full charges are set out in their charges schemes which are available from the company free of charge upon request. It is policy to meter all new water connections this would result in charges being levied according to the measured tariff. The water undertaker may install a meter at the premises where a buyer makes a change of use of the property.

Q 17 Is a surface water drainage charge payable?
Response Records confirm that a surface water drainage charge is payable for the property at the rate of £1.3079 p/m³ for Households and £1.3024 p/m³ for Non-Households of water used for each financial year.
Informative Where surface water from a property does not drain to the public sewerage system no surface water drainage charges are payable. Where surface water charges are payable but upon inspection the buyer finds that the property is not connected to the public sewerage system, the property may be eligible for a rebate of the surface water drainage charge. Details can be
obtained from the sewerage undertaker. The charge for unmeasured surface water drainage for 2015-2016 is £50. The charge for measured surface water drainage is included in the volumetric rate charged for measured sewerage and is therefore dependant upon the volume used by each customer. For 2015-2016, if the premises is connected for surface water the sewerage volumetric rate will be £1.6763 p/m³ for Households and £1.6681 p/m³ for Non-Households. If the premises is not connected then the sewerage volumetric rate will be £1.3238 p/m³ for Households and £1.3156 p/m³ for Non-Households. Where the enquiry relates to a plot of land or development site, it is recommended that the charging proposals are checked with the developer.

Q 18  Please include details of the location of any water meter serving the property.

Response  Records indicate that the property is served by a water meter, which is located within the dwelling-house which is or forms part of the property.

Informative Where the property is not served by a meter and the customer wishes to consider this method of charging they should contact the appropriate water company. Where the enquiry relates to a plot of land or development site, it is recommended that the charging proposals are checked with the developer.

Q 19  Who bills the property for sewerage services?

Response  The property is billed for sewerage services by Dwr Cymru Cyfyngedig, PO Box 690, Cardiff, CF3 5WL, Tel: 0800 052 0145, Internet: www.Dwrcymru.com.

Informative Where the enquiry relates to a plot of land or development site, it is recommended that the charging proposals are checked with the developer.

Q 20  Who bills the property for water services?

Response  The property is billed for water services by Dwr Cymru Cyfyngedig, PO Box 690, Cardiff, CF3 5WL. Tel: 0800 052 0145, website: www.Dwrcymru.com.

Informative This is the water undertaker to notify the change of occupant to, on completion of sale. Where the enquiry relates to a plot of land or development site, it is recommended that the charging proposals are checked with the developer.

Q 21  Is the dwelling-house which is or forms part of the property at risk of internal flooding due to overloaded public sewers?

Response  The property is not recorded as being at risk of internal flooding due to overloaded public sewers. From the 1st October 2011 private sewers, disposal mains and lateral drains were transferred into public ownership. It is therefore possible that a property may be at risk of internal flooding due to an overloaded public sewer which the sewerage undertaker is not aware of. For further information it is recommended that enquiries are made of the vendor.

Informative A sewer is "overloaded" when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.

"Internal flooding" from public sewers is defined as flooding which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.

"At Risk" properties are those that the water company is required to include in the Regulatory Register that is reported annually to the Director General of Water Services. These are defined as properties that have suffered or are likely to suffer internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company's reporting procedure.
Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the at Risk register. Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company. Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991. It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter. The Purchaser should also make enquiries with the seller. Where the enquiry relates to a plot of land or development site, the sewerage undertaker is not obliged to hold records of flooding.

Q 22 Is the property at risk of receiving low water pressure or flow?  
Response Records confirm that the property is not recorded on a register kept by the water undertaker as being at risk of receiving low water pressure or flow.

Informative The boundary of the property has been determined by reference to the Ordnance Survey record. "Low water pressure" means water pressure below the regulatory reference level which is the minimum pressure when demand on the system is not abnormal. Water undertakers are required to include in the Regulatory Register that is reported annually to the Director General of Water Services, properties receiving pressure below the reference level, provided that allowable exclusions do not apply (i.e. events which can cause pressure to temporarily fall below the reference level). The reference level of service is a flow of 9 litres/minute at a pressure of 10 metres head on the customer's side of the main stop tap. The reference level of service must be applied on the customer's side of a meter or any other company fittings that are on the customers side of the main stop tap. The reference level applies to a single property. Where more than one property is served by a common service pipe, the flow assumed in the reference level must be appropriately increased to take account of the total number of properties served. For two properties, a flow of 18 litres/minute at a pressure of 10 metres head on the customer's side of the main stop tap is appropriate. For three or more properties the appropriate flow should be calculated from the standard loadings provided in BS6700 or Institute of Plumbing handbook. Allowable exclusions: The water undertaker is required to include in the Regulatory Register properties receiving pressure below the reference level, provided that allowable exclusions listed below do not apply. Abnormal demand: This exclusion is intended to cover abnormal peaks in demand and not the daily, weekly or monthly peaks in demand which are normally expected. Water undertakers should exclude from the reported DG2 figures properties which are affected by low pressure only on those days with the highest peak demands. During the report year water undertakers may exclude, for each property, up to five days of low pressure caused by peak demand. Planned maintenance: Water undertakers should not report under DG2 low pressures caused by planned maintenance. It is not intended that companies identify the number of properties affected in each instance. However, water undertakers must maintain sufficiently accurate records to verify that low pressure incidents that are excluded from DG2 because of planned maintenance are actually caused by maintenance. One-off incidents: This exclusion covers a number of causes of low pressure; mains bursts; failures of company equipment (such as PRVs or booster pumps); firefighting; and action by a third party. However, if problems of this type affect a property frequently, they cannot be classed as one-off events and further investigation will be required before they can be excluded. Low pressure incidents of short duration: Properties affected by low pressures which only occur for a short period, and for which there is evidence that incidents of a longer duration would not occur during the course of the year, may be excluded from the reported DG2 figures. The buyer should also make enquiries with the seller.
Q 23  Please include details of a water quality analysis made by the water undertaker for the water supply zone in respect of the most recent calendar year.

Response  The analysis records confirmed that tests failed to meet the standards of the 2000 Regulations or the 2001 Regulations in relation to another substance or substances, and these details are included in the attached report.

Informative  Drinking water quality in England and Wales is regulated by the Government through the Drinking Water Inspectorate (DWI). Drinking Water Supplies are of a very high standard and the legal requirements are set out in the Water Supply (Water Quality) Regulations 2001 (Wales).

Last year Dwr Cymru Welsh Water carried out over 100,000 water quality tests of which 99.9% showed that the drinking water produced by Welsh Water met the required standards.

Each Water Quality Zone covers a population of up to 100,000, sampling address are generated on a random basis. Distribution sampling is conducted to assess the quality of drinking water throughout Dwr Cymru Welsh Water's distribution network and not as an indicator of the condition of an individual property. Therefore Dwr Cymru Welsh Water will not disclose the sampled address.

If you have specific concerns regarding an individual property relating to water quality (e.g. Lead) then we would suggest you instruct your surveyor accordingly.

Some standards relate to the appearance of the water rather than to health. Where a standard has been set for health reasons, this is normally based on a lifetime exposure and there is a wide margin of safety. It should also be noted that most failures are of short duration and are satisfactory on resample.

All exceedences of the regulatory standard are reported to the Drinking Water Inspectorate along with details of any remedial work undertaken.

Q 24  Please include details of any departures authorised by the Secretary of State under Part 6 of the 2000 Regulations from the provisions of Part 3 of those Regulations; or authorised by the National Assembly for Wales under Part 6 of the 2001 Regulations from the provisions of Part 3 of those Regulations.

Response  There are no such authorised departures for the water supply zone

Informative  Authorised departures are not permitted if the extent of the departure from the standard is likely to constitute a potential danger to human health.

Please contact your water undertaker if you require further information.

Q 25  Please state the distance from the property to the nearest boundary of the nearest sewage treatment works

Response  The nearest sewage treatment works is 3822.1m to the SW of the property. The name of the nearest sewage treatment works is Rhydlafar.

Informative  The nearest sewage treatment works will not always be the sewage treatment works serving the catchment within which the property is situated. The sewerage undertaker’s records were inspected to determine the nearest sewage treatment works. It should be noted therefore that there may be a private sewage treatment works closer than the one detailed above that have not been identified.
Appendix 1 - General Interpretation

1. In this Schedule-

"the 1991 Act" means the Water Industry Act 1991(a);

"the 2000 Regulations" means the Water Supply (Water Quality) Regulations 2000(b);

"the 2001 Regulations" means the Water Supply (Water Quality) Regulations 2001(c);

"adoption agreement" means an agreement made or to be made under section 51A(1) or 104(1) of the 1991 Act(d);

"bond" means a surety granted by a developer who is a party to an adoption agreement;

"bond waiver" means an agreement with a developer for the provision of a form of financial security as a substitute for a bond;

"calendar year" means the twelve months ending with 31st December;

"discharge pipe" means a pipe from which discharges are made or are to be made under section 165(1) of the 1991 Act;

"disposal main" means (subject to section 219(2) of the 1991 Act) any outfall pipe or other pipe which—
(a) is a pipe for the conveyance of effluent to or from any sewage disposal works, whether of a sewerage undertaker or of any other person; and
(b) is not a public sewer;

"drain" means (subject to section 219(2) of the 1991 Act) a drain used for the drainage of one building or of any buildings or yards appurtenant to buildings within the same curtilage;

"effluent" means any liquid, including particles of matter and other substances in suspension in the liquid;

"financial year" means the twelve months ending with 31st March;

"lateral drain" means—
(a) that part of a drain which runs from the curtilage of a building (or buildings or yards within the same curtilage) to the sewer with which the drain communicates or is to communicate; or
(b) (if different and the context so requires) the part of a drain identified in a declaration of vesting made under section 102 of the 1991 Act or in an agreement made under section 104 of that Act(e);

"licensed water supplier" means a company which is the holder for the time being of a water supply licence under section 17A(1) of the 1991 Act(f);

"maintenance period" means the period so specified in an adoption agreement as a period of time—
(a) from the date of issue of a certificate by a sewerage undertaker to the effect that a developer has built (or substantially built) a private sewer or lateral drain to that undertaker's satisfaction; and
(b) until the date that private sewer or lateral drain is vested in the sewerage undertaker;

"map of waterworks" means the map made available under section 198(3) of the 1991 Act(g) in relation to the information specified in subsection (1A);

"private sewer" means a pipe or pipes which drain foul or surface water, or both, from premises, and are not vested in a sewerage undertaker;

"public sewer" means, subject to section 106(1A) of the 1991 Act(h), a sewer for the time being vested in a sewerage undertaker in its capacity as such, whether vested in that undertaker—
(a) by virtue of a scheme under Schedule 2 to the Water Act 1989(i);
(b) by virtue of a scheme under Schedule 2 to the 1991 Act(j);
(c) under section 179 of the 1991 Act(k); or
(d) otherwise;

"public sewer map" means the map made available under section 199(5) of the 1991 Act(l);
"resource main" means (subject to section 219(2) of the 1991 Act) any pipe, not being a trunk main, which is or is to be used for the purpose of—
(a) conveying water from one source of supply to another, from a source of supply to a regulating reservoir or from a regulating reservoir to a source of supply; or
(b) giving or taking a supply of water in bulk;

"sewerage services" includes the collection and disposal of foul and surface water and any other services which are required to be provided by a sewerage undertaker for the purpose of carrying out its functions;

"sewerage undertaker" means the company appointed to be the sewerage undertaker under section 6(1) of the 1991 Act for the area in which the property is or will be situated;

"surface water" includes water from roofs and other impermeable surfaces within the curtilage of the property;

"water main" means (subject to section 219(2) of the 1991 Act) any pipe, not being a pipe for the time being vested in a person other than the water undertaker, which is used or to be used by a water undertaker or licensed water supplier for the purpose of making a general supply of water available to customers or potential customers of the undertaker or supplier, as distinct from for the purpose of providing a supply to particular customers;

"water meter" means any apparatus for measuring or showing the volume of water supplied to, or of effluent discharged from any premises;

"water supplier" means the company supplying water in the water supply zone, whether a water undertaker or licensed water supplier;

"water supply zones" in relation to a calendar year means the names and areas designated by a water undertaker within its area of supply that are to be its water supply zones for that year; and

"water undertaker" means the company appointed to be the water undertaker under section 6(1) of the 1991 Act for the area in which the property is or will be situated.

2. In this Schedule, references to a pipe, including references to a main, a drain or a sewer, shall include references to a tunnel or conduit which serves or is to serve as the pipe in question and to any accessories for the pipe.

Note:
(a) 1991 c. 56
(b) S.I. 2000/3184. These Regulations apply in relation to England.
(c) S.I. 2001/3911. These Regulations apply in relation to Wales.
(d) Section 51A is inserted by section 92(2) of the Water Act 2003 (c.37). Section 104(1) is amended by section 96(4) of that Act.
(e) To which there are various amendments made to sections 102 and 104 by section 96 of the Water Act 2003.
(f) Inserted by section 56 of and Schedule 4 to the Water Act 2003.
(g) Subsection (1A) is inserted by section 92(5) of the Water Act 2003.
(h) Section 106(1A) is inserted by section 99 of the Water Act 2003.
(i) 1989 c.15.
(j) To which there are various amendments made by section 101(1) of and Schedule 8 to the Water Act 2003.
(k) To which there are various amendments made by section 101(1) of and Schedule 8 to the Water Act 2003.
(l) Section 199 is amended by section 97(1) and (8) of the Water Act 2003.
### Definitions

- **Company** means Dwr Cymru Cyf who produces the Report.
- **Order** means any request completed by the Customer requesting the Report.
- **Report** means the drainage and/or water report prepared by The Company in respect of the Property.
- **Property** means the address or location supplied by the Customer in the Order.
- **Customer** means the person, company, firm or other legal body placing the Order, either on their own behalf as Client, or, as an agent for a Client.
- **Client** means the person, company or body who is the intended recipient of the Report with an actual or potential interest in the Property.
- **Purchaser** means the actual or potential purchaser of an interest in the Property including the mortgage lender.

### Agreement

1. The Company agrees to supply the Report to the Customer and to allow it to be provided to the Client and the Purchaser subject, in each case, to these terms. The scope and limitations of the Report are described in paragraph 2 of these terms. Where the Customer is acting as an agent for the Client then the Customer shall be responsible for bringing these terms to the attention of the Client.

1.1 The Customer, the Client and Purchaser agree that the placing of an Order for a Report and the subsequent provision of a copy of the Report to the Purchaser indicates their acceptance of these terms.

### The Report

2. Whilst The Company will use reasonable care and skill in producing the Report, it is provided to the Customer, the Client and Purchaser on the basis that they acknowledge and agree to the following:

2.1 The information contained in the Report change on a regular basis so The Company cannot be responsible to the Customer, the Client and Purchaser for any change in the information contained in the Report after the date on which the Report was first produced and sent to the Customer.

2.2 The Report does not give details about the actual state or condition of the Property nor should it be used or taken to indicate or exclude actual suitability or unsuitability of the Property for any particular purpose, or relied upon for determining saleability or unsuitability of the Property in relation to the intended occupation by third parties.

2.3 The information contained in the Report is based upon the accuracy of the address and plan supplied to the Company.

2.4 The Report provides information as to the location & connection of existing services and other information in relation to drainage and water enquiries and should not be relied upon for any other purpose. The Report may contain opinions or general advice to the Customer, the Client and Purchaser which The Company cannot ensure that any such opinion or general advice is accurate, complete or valid and accepts no liability therefore.

2.5 The position and depth of apparatus shown on any maps attached to the Report are approximate, and are furnished as a general guide only, and no warranty as to its correctness is given or implied. The exact positions and depths should be obtained by excavation trial holes and the maps must not be relied on in the event of excavation or other works made in the vicinity of The Company’s apparatus.

### Liability

3. The Company shall not be liable to the Customer, the Client and Purchaser for any failure defect or non-performance of its obligations arising from any failure of or defect in any machine, processing system or transmission link or anything beyond The Company’s reasonable control or the acts or omissions of any party for whom The Company are not responsible.

3.1 Where a report is requested for an address falling within a geographical area where two different Companies separately provide Water and Sewerage Services, then it shall be deemed that The Company and one or other of the Companies are responsible for the information given by that Company for reasons of accuracy of the information supplied. A Company supplying information which has been provided to it by another Company for the purposes outlined in this agreement will therefore not be liable in any way for the accuracy of that information and will supply that information as agent for the Company from which the information was obtained.

3.2 The Report is produced for use in relation to individual domestic property transactions and cannot be used for commercial developments of domestic properties or commercial properties for intended occupation by third parties.

3.3 The Company shall accept liability for death or personal injury arising from negligence but in any other case, the Company’s liability for negligence shall be limited to £5000.00. Such liability will be met by the Company or its insurers and the Company has and will maintain an appropriate contract of insurance.

### Copyright and Confidentiality

4. The Customer, the Client and Purchaser acknowledge that the Report is confidential and is intended for the personal use of the Client and Purchaser. The copyright and any other intellectual property rights in the Report shall remain the property of The Company. No intellectual or other property rights are transferred or licensed to the Customer except to the extent expressly provided.

4.1 The Customer or Client is entitled to make copies of the Report but may only copy the Ordnance Survey mapping or data contained in the, or attached to the Report, if they have an appropriate licence from the originating source of that mapping or data.

4.2 The Customer, the Client and Purchaser agree (in respect of both the original and any copies made) to respect and not to alter any trademark, copyright notice or other property marking which appears on the Report.

4.3 The maps contained in the Report are protected by Crown Copyright and must not be used for any purpose outside the context of the Report.

4.4 The Customer, the Client and Purchaser agree on a joint and several basis to indemnify The Company against any losses, costs, claims and damage suffered by The Company as a result of any breach by either of them of the terms of paragraphs 4.1 to 4.4 inclusive.

### Payment

5. Unless otherwise stated all prices are inclusive of VAT. The Customer shall pay for the price of the Report specified by The Company, without any set off, deduction or counterclaim. Unless the Customer or Client has an account with The Company for payment for Reports, The Company must receive payments for Reports in full before the Report is produced. For Customers or Clients with accounts, payment terms will be as agreed with The Company.

### General

6. If any provision of these terms is or becomes invalid or unenforceable, it will be taken to be removed from the rest of these terms to the extent that it is invalid or unenforceable. No other provision of these terms shall be affected.
6.1 These terms shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts.

6.2 Nothing in these terms and conditions shall in any way restrict the Customer, the Clients or the Purchasers statutory or any other rights of access to the information contained in the Report.

6.3 We may disclose personal data you provide about yourself, or your clients, to other companies within our group in accordance with Data Protection Act 1998 and other applicable laws. We will analyse and utilise any information we collect so that we are able to correctly administer, develop and improve our business and services.

6.4 The terms and conditions may be enforced by the Customer, the Client and Purchaser.
Appendix 3 - Extract of the Public Sewer Map for the area surrounding the property/plot [17/03/2016]

Dwr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only 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 in vicinity of the Company’s apparatus in any area. It must be understood that the furnishing of information is entirely without prejudice to the provisions of the New Roads and Street Works Act 1991 and the Company’s rights to be compensated for any damage to its apparatus. Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Appendix 4 - Extract of the Public Water Map for the area surrounding the property/plot [17/03/2016]

Dwr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and is intended as a means of assistance to its customers. It is a matter of checking the apparatus before any work in its vicinity is started.

Exacting Locations of all apparatus to be determined on site.

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Appendix 5 – Additional Information

Additional information related to response for Question 23

Drinking Water Compliance Summary for Cardiff (Ely / Radyr / Llandaff) (N511068)
From 1st January 2014 to 31st December 2014
The population for this zone is 57471

<table>
<thead>
<tr>
<th>Substance</th>
<th>Samples Taken</th>
<th>Exceedances</th>
<th>Compliance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL COLIFORMS(/100ML)</td>
<td>214</td>
<td>1</td>
<td>99.53</td>
</tr>
</tbody>
</table>
Appendix 6 – Residential Drainage & Water Search Complaint Procedure

The Law Society endorses the use of a residential drainage and water enquiry on all occasions where a property is
being sold. With our unique knowledge of the water industry, Dwr Cymru Welsh Water is best placed to identify any
risks relating to the location and ownership of public water mains and sewers within our operational area, before
property purchases are completed.

Should you wish to contact us about the service provided then our preferred method of dealing with your complaint
is by telephone during office hours, Monday – Friday 09.00am – 4.30pm, tel no. 0800 917 2652. We will always
aim to deal with your telephone complaint the first time you call us, however, if that isn’t possible, we will advise
you on how soon we can respond.

If you are not happy with our initial response, we will advise you to write to us at Dwr Cymru Welsh Water’s
Developer Services, P.O. Box 3146, Linea, Fortran Road, Cardiff, CF30 0EH or email us at
searches@dwr-cymru.com outlining the reasons for your complaint.

We will investigate and research the matter in detail and provide a written substantive response within 10 working
days of receipt of your written complaint.

If you remain dissatisfied with the response you have received, or the way your complaint was handled, you can
ask for a Director to carry out a formal review of you complaint. To do this, please contact Head of Customer
Relations, Dwr Cymru Welsh Water, P.O. Box 8, Nelson, CF46 6YH.

A response from a director will be sent within 10 working days. If we have fully reviewed your complaint and you
remain dissatisfied, you can refer your complaint to the Consumer Council for Water. This is an independent body
which represents customers’ interests and investigates complaints. Their address is Consumer Council for Water
Wales, Room 140 Caradog House, 1-6 St Andrews Place, Cardiff, CF10 3BE.

The water quality data in this report is for the entire water quality zone and not for any individual property.
I. DCWW public sewer record plan
Dwr Cymru
Welsh Water

Notes:

While every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material other than Asbestos Cement or Pitch Fibre may be found to be made of ductile iron or other non-asbestos materials. For all DCWW assets, it is advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation.

Dwr Cymru CYF gives the information on the position of its underground apparatus by way of general guidance only 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 excavation rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:
Map scale: 1:2,000
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