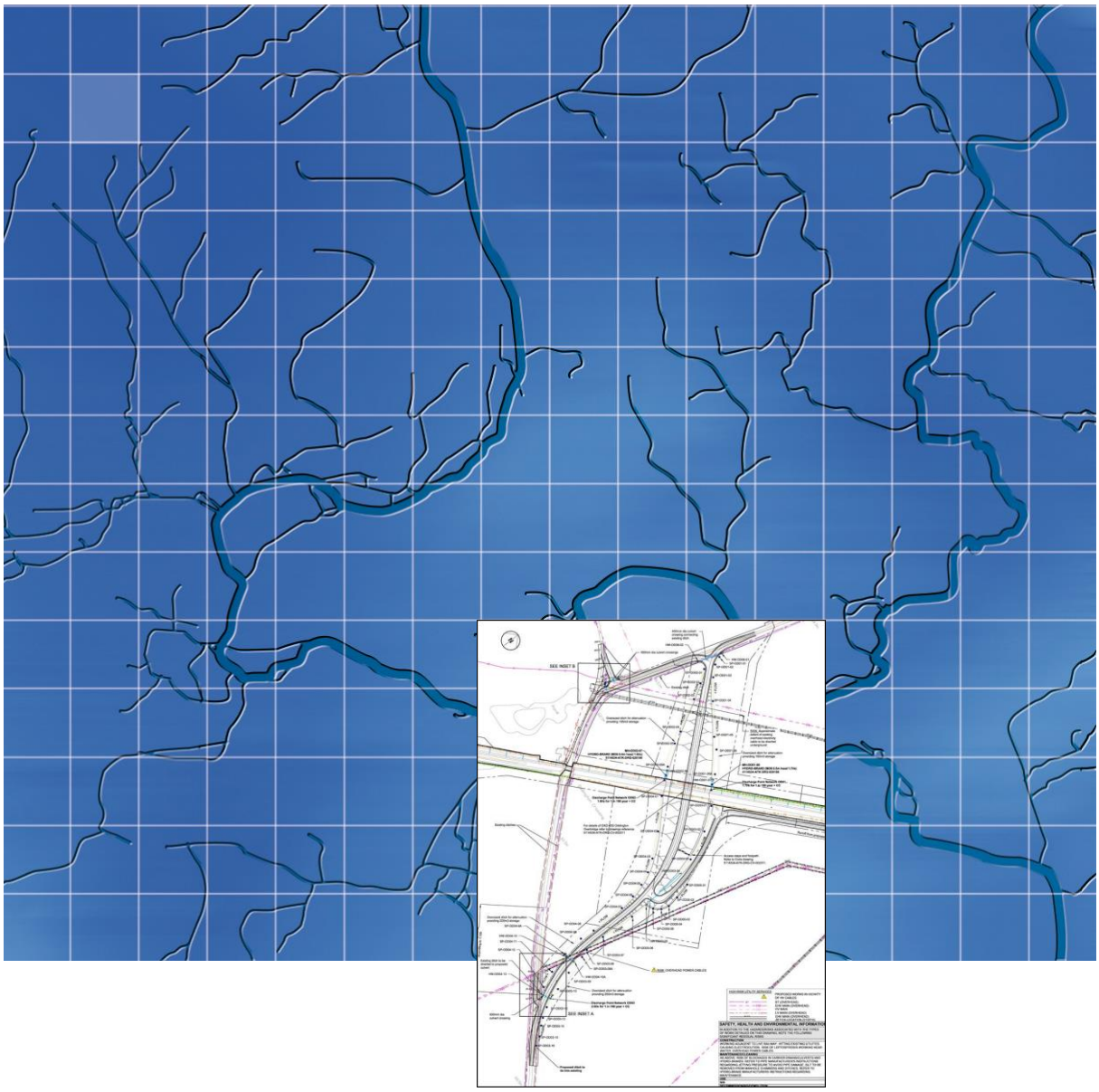
Chiltern Railways & Network Rail

January 2015

EWR P1 – SW Drainage Assessment (AP10)



Wallingford HydroSolutions Limited

Chiltern Railways & Network Rail

EWR P1 – SW Drainage Assessment (AP10)

Document issue details

WHS1160

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1.01	9th January 2015	Internal DRAFT	Cardiff
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For and on behalf of Wallingford HydroSolutions Ltd.

Prepared by Thomas Hughes

Approved by Paul Blackman
Position *Technical Director*

Date **14th January 2015**

This report has been produced in accordance with the WHS Quality Management system which is certified as meeting the requirements of ISO 9001:2008.

WHS

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Contents

1 Purpose

This document constitutes a surface water drainage assessment (SWDA), as required by Condition 13 of the Order under the Transport and Works Act 1992 (TWA) obtained by Network Rail for the construction of the East West Rail Phase 1 (EWR P1) project between Bicester and Oxford. This document also provides the information required by the National Planning Policy Framework (NPPF) and the associated requirements of PPS25, in considering the surface water drainage aspects of a Flood Risk Assessment for new development.

This surface water drainage assessment considers the requirements for the development of AP10 – Oddington Overbridge (Cherwell District Council Planning Ref: 14/00167/DISC)

Figure 1 shows the location of the Assessment Points in relation to the overall railway development.

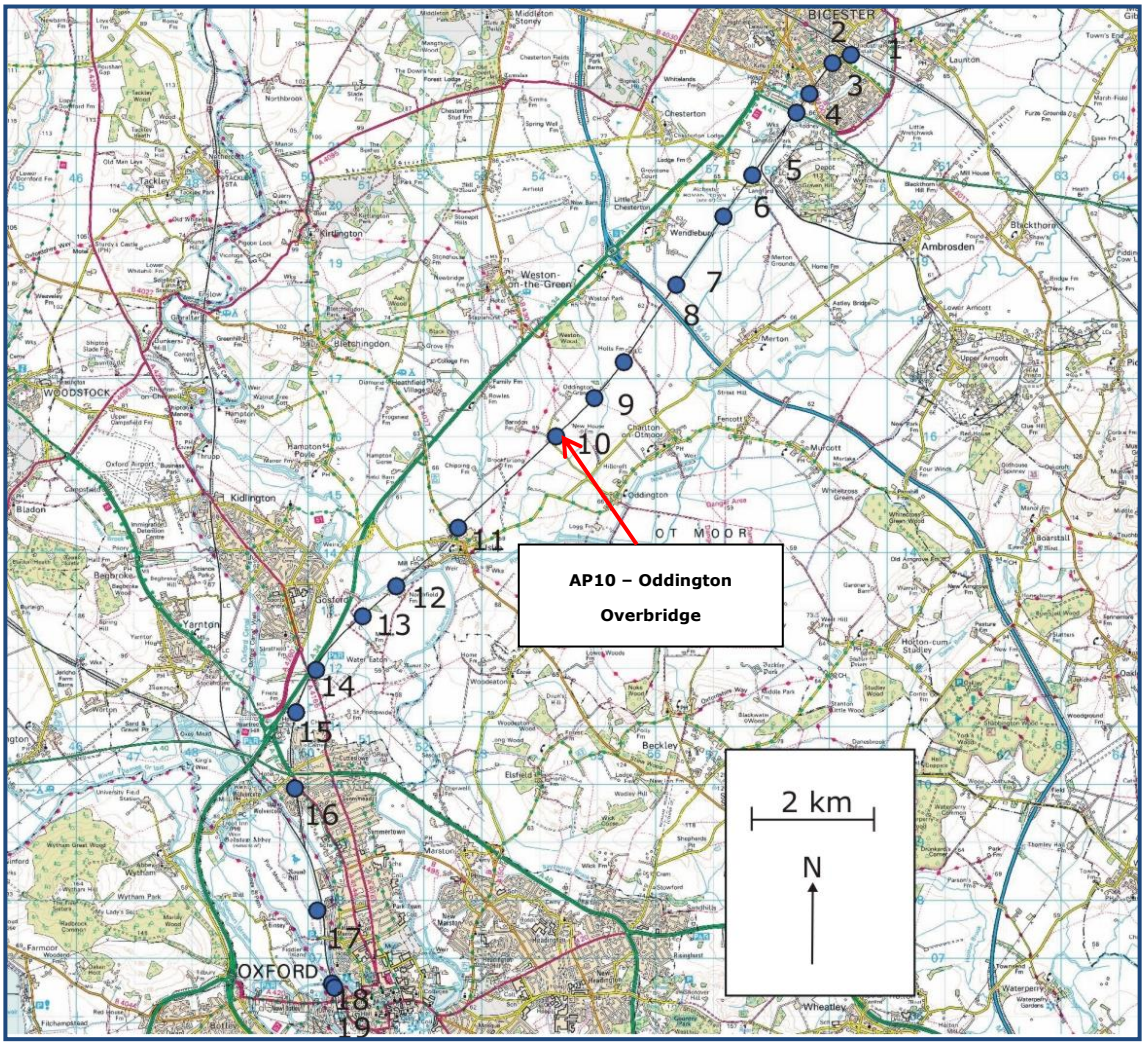

Figure 1 - Overview of the scheme with Assessment Points shown.

Condition 13 of the TWA Order requires that:

'No construction of any one of the following elements of development shall commence until a surface water drainage assessment and scheme for that element (as identified in the Level 2 Flood Risk Assessment Revised, July 2010 (Inquiry document CD/2.22), unless stated otherwise here) has been submitted to and approved in writing by the local planning authority, in consultation with the Environment Agency:

- *AP1 Bicester Chord.*
- *AP2 Tubbs Lane footbridge.*
- *AP3 Bicester Town station.*
- *AP4 A41 overbridge.*
- *AP6 Elm Tree Farm/Langford Lane Overbridge (modified to accord with the revised proposal shown on Revised Sheets 8b, 35 and 37 of the Deposited Plans and Sections (Inquiry Document CD/1.28).*
- *AP7 Merton footbridge.*
- *AP8 Holts Farm overbridge.*
- *AP9 Oddington Footbridge No 5.*
- *AP10 Oddington overbridge.*
- *AP11 Islip station in Phase 1.*
- *AP11 Islip station in Phase 2.*
- *AP13 Water Eaton No5 overbridge.*
- *AP14 Water Eaton Parkway.*
- *AP15 Gosford and Water Eaton Footbridge No 10.*
- *AP17 Banbury Road Sidings*
- *AP18 Sheepwash Bridge.*
- *AP19 Oxford station.*

The surface water drainage assessments shall follow the methodology set out in the Scope of Surface Water Drainage Assessment, July 2010, agreed by the Environment Agency. Each surface water drainage assessment shall demonstrate that surface water discharge rates and volumes from that element of the development will not increase flood risk, or taken together with other relevant works in the same catchment, can be maintained at or below the agreed limits, using sustainable drainage techniques. Development shall be in accordance with the approved surface water drainage assessment and scheme.'

Therefore the purpose of this document is to obtain approval of the local planning authority, in consultation with the Environment Agency (EA), for the surface water drainage assessment for AP10 Oddington Overbridge, thus discharging the requirements of Condition 13 of the TWA Order and meeting the surface water drainage requirements of NPPF/PPS25.

2 Proposed Development

2.1 Overview

EWR P1 is a major package of infrastructure investments including: the doubling of the line between Bicester town and Oxford North Junction; a new independent line being built between Oxford North Junction and Oxford station, using a disused track bed parallel to the existing railway; the existing stations at Bicester Town and Islip will be rebuilt, and a new station built at Water Eaton Parkway. The following section describes the proposed works at AP10 in more detail.

2.2 AP10 – Oddington Overbridge

A new overbridge and associated diversion of the existing roads are planned for the location shown in Figure 2, at Oddington Crossing, east of Barndon Farm. This replaces the existing level crossing on an unclassified road which is to be closed due to the increased line speed on the railway. The structure will comprise reinforced earth abutments with wingwalls.

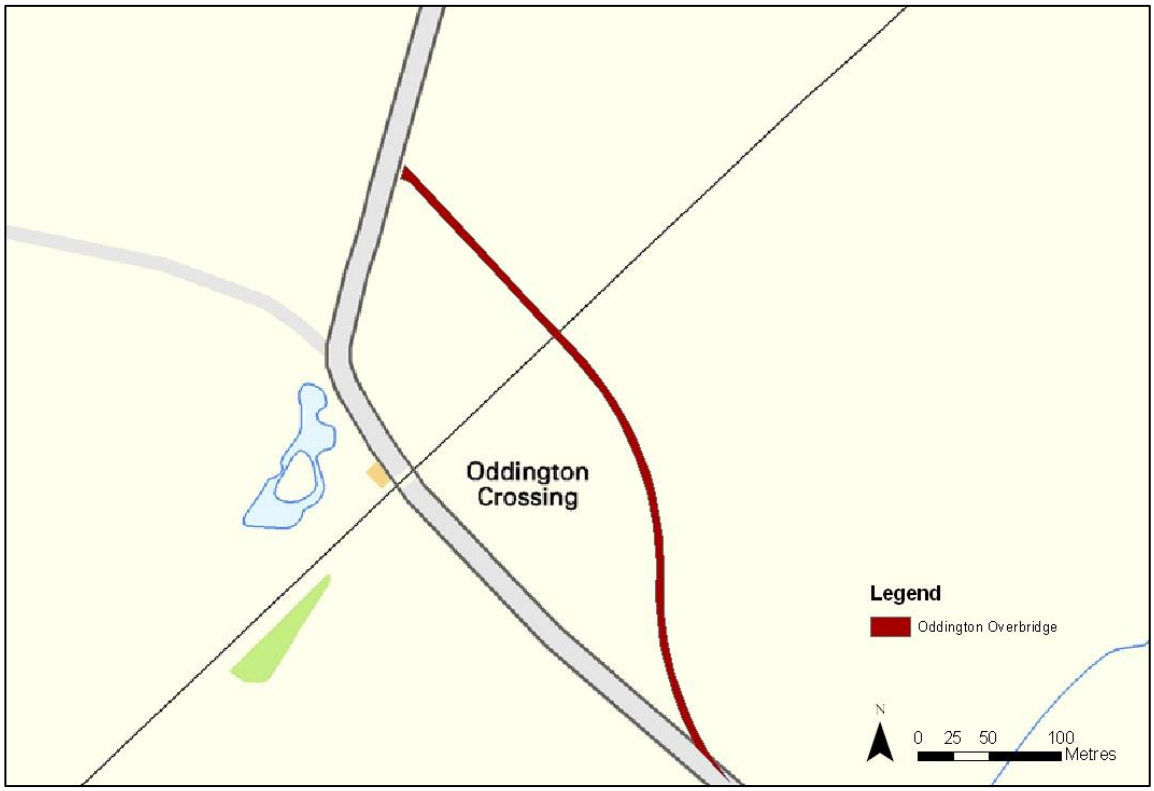

Figure 2 – AP10. Oddington Overbridge. Contains Ordnance Survey Data © Crown copyright and database right 2013

3 Management of Surface Water Runoff

3.1 Planning Requirements

It is a recognised development requirement that post-development the stormwater runoff rates discharged from any new development should not be greater than flows currently generated from the site, whether this be at greenfield or existing brownfield run-off rates. Exceptions generally only apply where it is not practical to achieve this due to the size of the hydraulic control unit. In this situation overcompensation at neighbouring sites will be provided to ensure that over the whole scheme surface water runoff is reduced. These commitments are in line with guidance set out in the NPPF, PPS25 and through discussions with the EA. The following sections describe the calculation procedure followed to obtain these rates.

3.2 Runoff Assessments

Pre-development (i.e greenfield or brownfield) peak surface water runoff rates have been calculated for the 1:1yr and 1:100yr events for AP10. Appendix 1 outlines the methodology used in the estimation of the peak surface water runoff rates. It should be noted that following discussions with the EA the trackside and road embankments are considered to be permeable hence can be assumed to generate runoff at the greenfield rate. The following sections present the data used and the results of the surface water runoff calculations.

3.2.1 Area Assessment

Table 1 details the areas of permeable and impermeable surfaces at AP10 pre- and post-development. The areas have been taken from the Atkins drainage design plans[1] for AP10 Oddington Overbridge prepared as part of the GRIP Stage 5 detailed design process (please see Appendix 2).

Table 1 – Surface types and areas at assessment points.

Assessment Point	Type	Existing Brownfield		Post Development		Increase in Impermeable area (ha)
		Impermeable extent (ha)	Permeable extent (ha)	Impermeable extent (ha)	Permeable extent (ha)	
AP10 Oddington Overbridge	**Greenfield**	0	0.413	0.27	0.143	0.27

3.2.2 Surface Water Runoff Rates

Greenfield runoff rates were calculated as described in Appendix 1. Greenfield runoff rates have been based on a total area of 0.413ha which comprises of the hard surfaced roadway and the permeable embankments, which Atkins has confirmed are both positively draining into the proposed surface water drainage system at Oddington, and are presented in Table 2 below.

[1] Atkins. East West Rail Phase 1 Drainage Designs. GRIP 5. (December. 2014)

Table 2 – Surface Water Runoff rates.

Return Period	Limiting Discharge rate (l/s)
1:1	1.41
1:100	5.31

It should be noted that the greenfield runoff rates calculated above are based on principles set out in the calculation procedures in the Flood Estimation Handbook (FEH) and IH124. These procedures use broad scale SOIL data to represent soil type at a development site. The SOIL type for Oddington is type 3 that represents soils with moderate permeability and would result in lower greenfield runoff rates being calculated. However, a detailed Ground Investigation (G.I) has since been undertaken by RSK in October 2014[2] (please see Appendix 3) and has confirmed that the underlying soils are clay. Therefore, based on observed site data the higher SOIL value of 4 has been adopted within the surface water runoff calculations presented in Table 2.

4 Design Statements & Commitments

As part of the EWR Phase 1 scheme five overbridges and several access tracks are proposed to facilitate the closing of a number of level crossings along the existing railway and to provide access to local communities. Atkins has prepared drainage designs for AP10 Oddington Overbridge as part of the GRIP 5[1] detailed drainage designs (please see Appendix 2). This design shows the general drainage arrangements proposed at each site to sustainably manage surface water. WHS has estimated the target discharge rates (see Table 2 in section 3.2.2 that need to be achieved at AP10 Oddington Overbridge to manage surface water. The following sections describe the drainage layout and SuDS components used to sustainably manage surface water runoff.

4.1 Target Discharge Rates

The drainage design for AP10 needs to ensure that discharge from site is limited to greenfield runoff rates (as per Table 2). However, the greenfield runoff rates for the lower return period events are very small (i.e less than 2l/s for the 1 in 1 year event). Through liaison with Gordon Hunt (Drainage Engineer) from Oxfordshire County Council (OCC) it has been agreed that limiting flows to such a small rate would result in a high risk of outfall blockage and associated maintenance issues and is considered to be impractical. Therefore the emphasis has been on controlling runoff for the larger return period events (i.e 1 in 100 year plus an allowance for climate change events), which are the more critical rainfall events when considering management of off-site flood risk.

4.2 AP10 – Oddington Overbridge Drainage Design

The proposed drainage infrastructure for AP10 Oddington Overbridge comprises of roadside drainage ditches that collect and convey surface water runoff generated by the road into several oversized drainage ditches that provide formal attenuation storage. To restrict surface water discharges to 5.31l/s a total attenuation storage volume provision of 515m^3 is provided for the 1 in 100 year (plus a 30% increase in rainfall intensity to account for climate change) rainfall event. The attenuation will be provided via three oversized drainage ditches at the toe of the road embankment with flows controlled using hydrobrake flow control devices as shown in Figure 3

[2] RSK. October 2014. East-West Rail, Oddington Road and Langford Lane. Factual Report: Soakaway Testing.

(please see Appendix 2 for full design details). Details of the proposed attenuation features are provided in the following bullet points;

- **Oversized Ditch A** - 105m^3 of attenuation storage volume will be provided within the oversized drainage ditch with a hydrobrake flow control device limiting discharge to 1.6l/s. This attenuation feature discharges into the existing railway track drainage system.

- **Oversized Ditch B** - 160m^3 of attenuation storage volume will be provided within the oversized drainage ditch with a hydrobrake flow control device limiting discharge to 1.7l/. This attenuation feature discharges into the existing railway track drainage system.

- **Oversized Ditch C** - 250m^3 of attenuation storage volume will be provided within the oversized drainage ditch with a hydrobrake flow control device limiting discharge to 2.0l/s. This attenuation feature discharges into an existing drainage ditch that runs adjacent to the existing road.

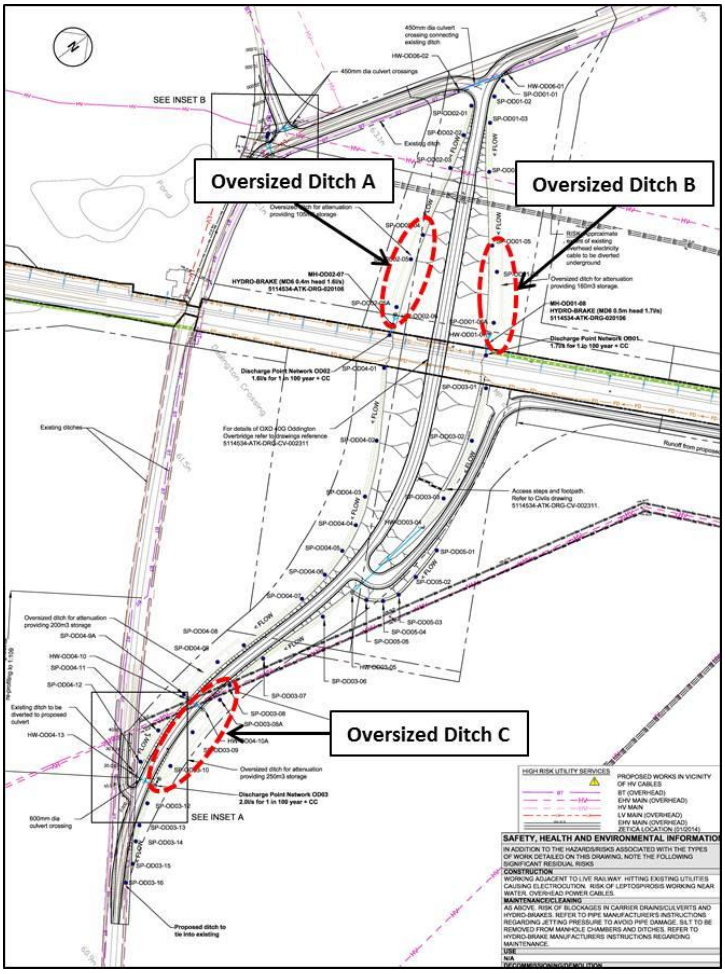

Figure 3 – Location Plan of Attenuation Features.

The potential to use Infiltration as a surface water disposal method was also considered at this site but discounted on the grounds of poor infiltration rates. A Ground Investigation was carried out by RSK[2] in which clay was encountered in all trial pits, which has a very poor permeability.

5 Conclusion

The proposed drainage arrangements at AP10 Oddington Overbridge will achieve the target discharge rates presented in Table 2. This will ensure that post-development runoff rates from this development are reduced to pre-development equivalents for the 1 in 100 year plus climate change event. We consider that the information provided in this surface water drainage assessment is sufficient to comply with Condition 13 of the TWA Order and the surface water drainage requirements of NPPF/PPS25.

Appendix 1 – Surface Runoff Calculations Methodology

1.1 Introduction

Guidance issued by DEFRA[3] states that post development the stormwater runoff discharges from urban developments should approximate to the site greenfield response over an extended range of storm frequencies of occurrence (return periods). However, it is accepted that drainage proposals may be measured against the existing drainage performance of the site (brownfield). In addition the peak rate of runoff into a watercourse should be no greater than the undeveloped rate of runoff, although similarly exceptions apply where it is not practical to achieve this. The guidance outlines methodologies for estimating storage volumes for stormwater control for development sites and also provides methodologies for the estimation of peak rates of runoff from greenfield sites.

For clarification, the greenfield rate refers to the volumes and peak flows associated with an undeveloped site whilst brownfield relates to a site which has been previously developed hence a proportion of the site is impermeable.

As part of the East West Rail Phase 1 development surface water runoff volumes for greenfield and brownfield conditions are required. In addition, peak runoff rates are also required for greenfield and brownfield conditions. Section 1.2 outlines the methodology for the estimation of the surface water runoff volumes whilst Section 1.3 outlines the methodology for estimating the peak runoff rates. Note that there is no guidance on estimating brownfield peak runoff rates, and the guidance states that greenfield runoff rates should be considered as indicative only due to the limitations of the methodologies.

1.2 Surface Water Runoff Methodology

The DEFRA guidance recommends the use of Institute of Hydrology Report 124 (IH124)[4] for estimating surface water runoff. However, recent research into flood design for small catchments[5] suggests that the FEH statistical method[6] and the Revitalised Flood Hydrograph (ReFH)[7] event-based method both outperform the older methods. The report states that these are applicable across the range of catchment sizes used in their development and that the continued recommendation of outdated methods such as IH124 and ADAS 345 is inappropriate. The research notes that there is little evidence to suggest that the accuracy of the FEH methods when applied to ungauged catchments is particularly scale dependent and recommends the use of current versions of the FEH statistical approach or the ReFH rainfall-runoff model except on highly permeable (BFIHOST > 0.65) or urbanised catchments (URBEXT2000>0.15) where the results of the ReFH model can be less reliable. The research recommends that for catchments smaller than 0.5 km^2 and plot scale, which is relevant for the development sites within the East West Rail Phase 1 development, runoff estimates should be derived from FEH methods applied to the nearest suitable catchment above 0.5 km^2 for which descriptors can be derived from the FEH CD-ROM and scaled down by the ratio of catchment areas.

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[3] Kellagher R, 2012, Preliminary rainfall runoff management for developments, DEFRA R&D Technical Report W5-074/A/TR/1 Revision E

[4] Marshall D, C, W. Bayliss, A, C,. Flood Estimation for small catchments. Institute of Hydrology Report 124.

[5] Environment Agency, 2012, Estimating flood peaks and hydrographs for small catchments: Phase 1, SC090031

[6] Robson, A.J. and Reed, D.W. (1999) Statistical procedures for flood frequency estimation. Volume 3 of the Flood Estimation Handbook. Centre for Ecology & Ecology.

[7] NERC (CEH). 2005. Revitalised FSR/FEH rainfall runoff method. Spreadsheet application version 1.4.http://www.ceh.ac.uk/feh2/SpreadsheetimplementationofReFH.html

Following the guidance, and taking into account this research, greenfield runoff hydrographs were calculated using 6.25 hour duration design rainfall events for the required return period event using a conjunction of the IH124 and ReFH rainfall runoff method.

IH124

Greenfield peak runoff rates have been calculated using the small catchment statistical method, IH124 methodology, in conjunction with the growth curves factors specified within the NERC Flood Studies Supplementary Reports 2[8] and 14[9]

A catchment area of 50 ha was assumed for each site with the results expressed as runoff rates per unit area to facilitate scaling to the development area. A key catchment descriptor within the method is the soil class(es) as defined by the Winter Rainfall Acceptance Potential (WRAP) map[10]. This is an extremely coarse map which is mapped at a scale of 1:625,000 and as such does not contain sufficient information for determining local soil and underlying substrate permeability. At design level the selection of appropriate soil class values would be informed by local soil maps coupled within infiltration tests. For the purposes of defining runoff rates for this assessment the soil permeability classes and substrate classes within the Hydrology of Soil Types (HOST) classification[11] were used to guide soil class selection. The HOST classification has replaced the WRAP map in all current flood estimation procedures.

ReFH

Given that there is no available flood event data on which to calibrate the ReFH model, the catchment descriptors for each site were obtained from the FEH CD ROM v3. The nearest 1km cell to each site was used to obtain the rainfall parameters required for the rainfall Depth Duration Frequency (DFF) ReFH model. Where this is not possible catchment scale parameters were obtained for the nearest small river reach.

The ReFH model was run using the 6.25 hour event for the 1 in 1 year, 1 in 30 year and 1in 100 year events. Allowances for climate change were made for the 1:100 year event by increasing the rainfall intensity by 30% in accordance with current Planning Policy Statement guidance[12]. Note that current DEFRA[13] guidance advises increasing rainfall intensities by 20% for 2080 and beyond, so the adopted values are conservative. A catchment area of 50 hectares was assumed and results are then scaled to the site level.

Development of final runoff rates

The ReFH and IH124 methodologies produce independent runoff rates for the given return periods. Current research into small catchments[14] indicates that more recent methodologies are generally more reliable that the older (IH124) methodologies. The differences between the peak runoff rates

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[8] Faulkner, D.S. 1999. Rainfall Frequency Estimation. Flood Estimation Handbook Vol. 2, Institute of Hydrology, Wallingford, UK.
[9] Institute of Hydrology,1983 Review of regional growth curves. Flood Studies Supplementary Report 14. Institute of Hydrology, Wallingford, UK
[10] Natural Environment Research Council, 1975. Flood Studies Report.
[11] Boorman, D. B., Hollis, J. M. and Lilly, A., Hydrology of soil types: a hydrologically-based classification of the soils of the United Kingdom. Institute of Hydrology Report 126.
[12] Communities and Local government (CLG), 2010, Planning Policy Statement 25.
[13] Kellagher R, 2012, Preliminary rainfall runoff management for developments, DEFRA R&D Technical Report W5-074/A/TR/1 Revision E
[14] Environment Agency, 2012, Estimating flood peaks and hydrographs for small catchments: Phase 1, SC090031.

were resolved by adjusting the BFIHOST or WRAP classes. For most of the sites the peak runoff from IH124 was rescaled to be similar to ReFH. Since ReFH is not considered as reliable in high permeability catchments (taken to be where the BFIHOST is greater than 0.6) in highly permeable catchments the IH124 estimates for peak runoff were given a greater weighting.

Calculation of current brownfield and potential post development runoff volumes

The assessment of current brownfield and potential post-development runoff volumes for each return period is conducted:

- by assuming a runoff coefficient of unity for impermeable areas;
- calculating a gross direct runoff volume by taking the product of the areal extent of the impermeable area and the corresponding rainfall event profile;
- calculating the equivalent greenfield runoff profile for the impermeable area by taking the product of the greenfield runoff hydrograph (expressed in units of runoff per unit area) and the impermeable areas, and estimating the net runoff volume for the impermeable area.

This nett runoff volume represents the runoff volume that has to be captured, and preferably infiltrated to maintain runoff at the greenfield rate. For the 1:100 year event the runoff calculations have included an overall increase in event rainfall depth of 30% for the impermeable runoff estimate to allow for climate change.

Surfaces assumed to be impermeable in this outline design level assessment include roofs, car parks, pavements, roads, bridge structures and platforms. As such this represents a worst case scenario as it ignores the detailed design potential for at-source mitigation.

1.3 Brownfield Peak Runoff

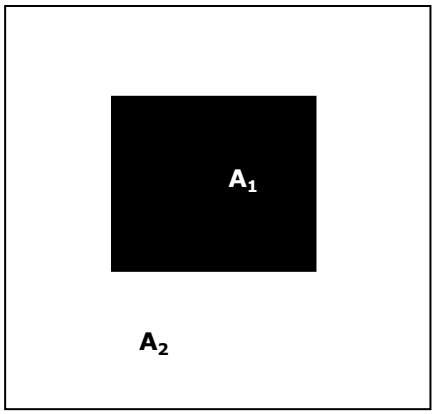
The greenfield peak runoff can be obtained from the IH124 and ReFH methodologies. However, DEFRA[15] do not provide guidance on producing peak runoff for brownfield sites. Whilst ideally runoff volumes and peak runoff should be returned to the greenfield level, it is accepted that this is not always possible. In these circumstances maintaining the current runoff or peak flows is acceptable hence brownfield peak runoff values are required.

It is widely accepted that increasing the impermeable extents within a catchment, or development site in this case, increases runoff volume and decrease the response time within the catchment[16].

The following methodology has been developed to calculate the Brownfield peak flow:

1) Consider a site to contain an impermeable surface of area A_1 (m^2) and permeable surface of area A_2 (m^2), as per diagram below

[15] Kellagher R, 2012, Preliminary rainfall runoff management for developments, DEFRA R&D Technical Report W5-074/A/TR/1 Revision E
[16] Chow V. T., Maidment D. R. and Mays L. W., 1988, Applied Hydrology, McGraw-Hill, New York, USA.



2) Calculations within ReFH assume that A_1 and A_2 are both greenfield hence we already have the design rainfall *P* (mm) and the greenfield runoff *Q* (mm) for the design hydrograph.

3) For a completely impermeable surface, A_1 and A_2 are impermeable, the following is proposed:

$$Q = 0.7 \times P + 0.3 \times Q$$

It is assumed that 70% of the rainfall becomes direct runoff. The value of 70% is used as this is generally recommended for use within the UK[17,18]. A proportion of the rainfall is also delayed through the system and this is reflected by adding 30% of the greenfield runoff.

The result is a hydrograph which has a faster time to peak, higher peak and greater total runoff than the greenfield hydrograph.

4) For a mixed impermeable/greenfield site these two components are combined according to the proportion of each within the development site.

$$Q = \left[\frac{A_2}{A_1 + A_2} \times Q\right] + \left[\frac{A_1}{A_1 + A_2} \times 0.7 \times P\right] + \left[\frac{A_1}{A_1 + A_2} \times 0.3 \times Q\right]$$

5) The peak flows can then be extracted from the hydrographs and rescaled to cumecs.

[17] Institute of Hydrology, 1999, Flood Estimation Handbook, Vols 1 – 5.
[18] Department of Environment/National Water Council, 1981, Design and analysis of Urban Storm Drainage:the Wallingford Procedure, National Water Council, UK.

An example is presented within Figure 1.

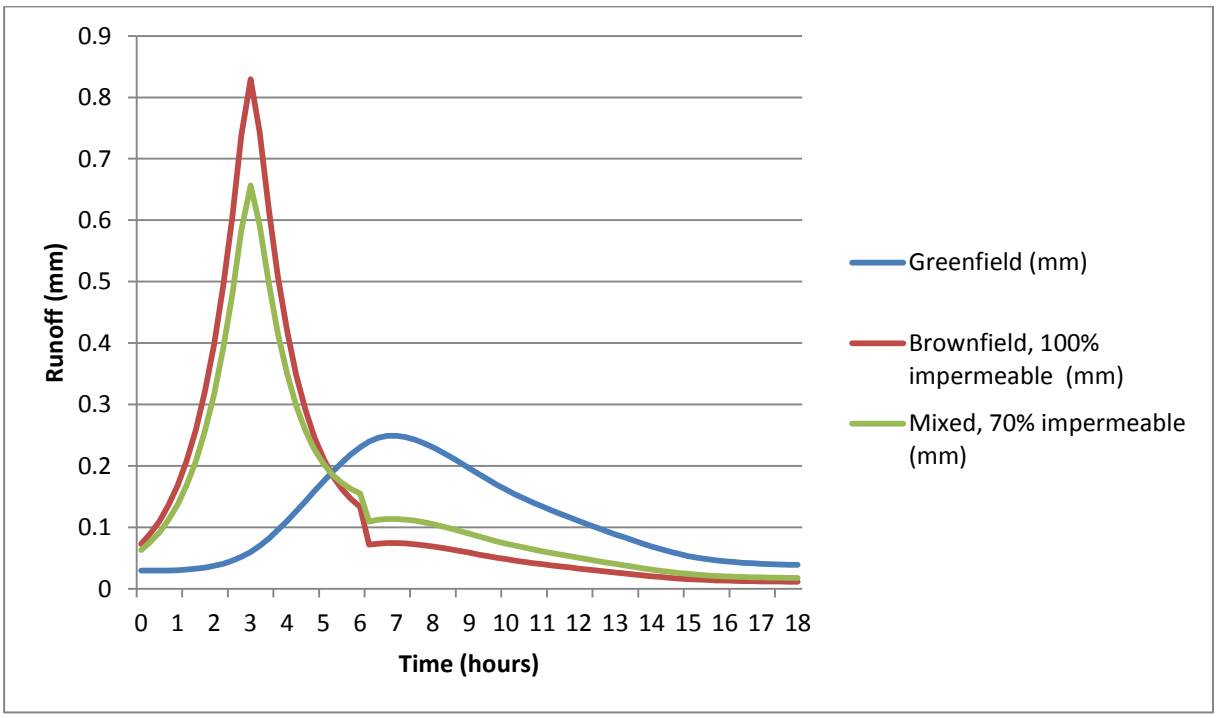


Figure 1 - Example Hydrograph for a Greenfield, 100% impermeable and 70% impermeable site.

1.4 Determining the development site area

For most sites the development site considered is the same as the footprint of the development thus the post development will be 100% impermeable. i.e. if a footbridge is being built then the footprint of the footbridge is considered to be the development site and the site is initially 100% greenfield and post development 100% impermeable.

Some sites are more complex, for example the development of Islip and Water Eaton Parkway Stations. The proposal indicates that the aim will be to retain the runoff associated with the existing site (or greenfield where possible) which means that agreement of the development site extent may affect the amount of flood storage which must be allowed for. In these cases the development site is considered to be the addition of the existing and proposed development site. Post development all sites will be 100% impermeable unless land at any of the sites is returned to greenfield which is unlikely. This is illustrated for Islip Station, Figure 2, where the development site is the combined area of existing and proposed developments.

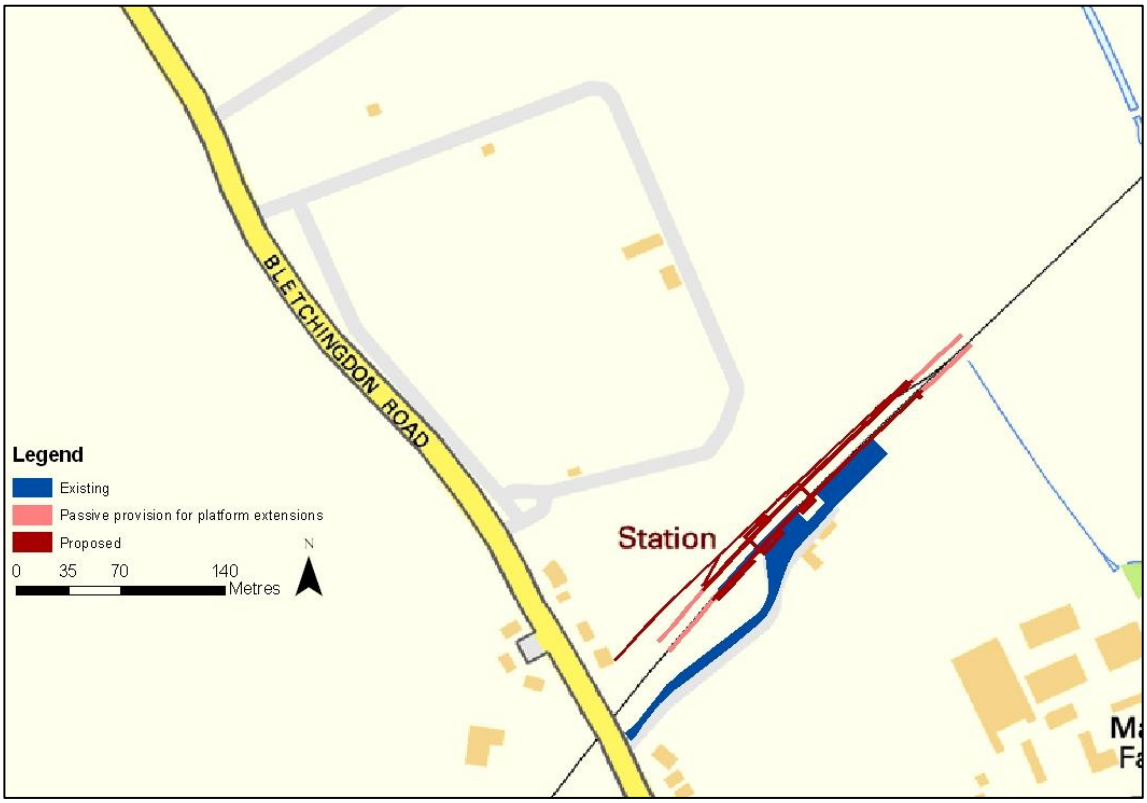
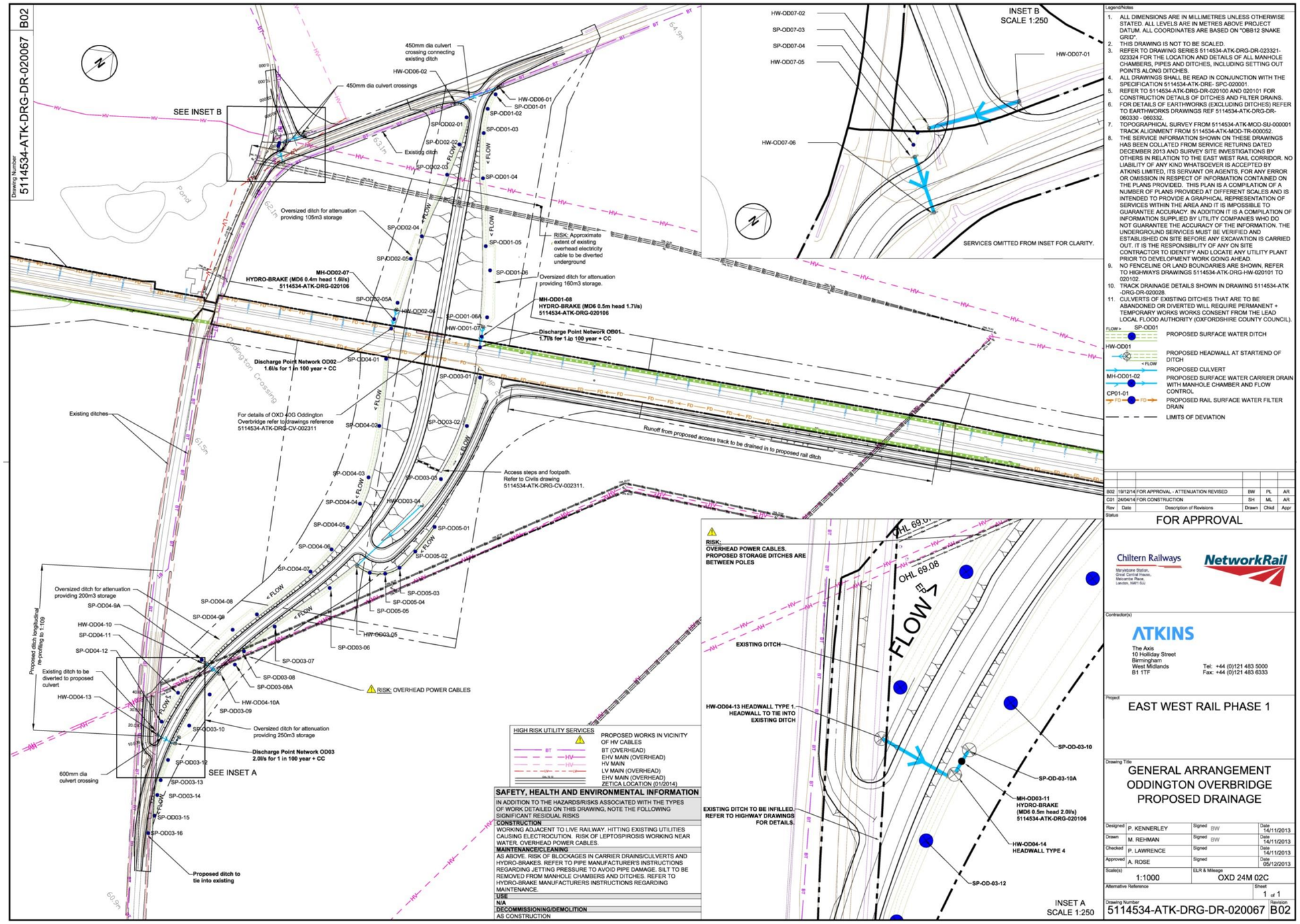


Figure 2 – Existing and post development site at Islip Station.

Appendix 2 – (AP10) Oddington Overbridge Drainage Design


Drawing Number 5114534-ATK-DRG-DR-020067 B02
SEE INSET B
SEE INSET A
INSET B SCALE 1:250
INSET A SCALE 1:250
SERVICES OMITTED FROM INSET FOR CLARITY.
450mm dia culvert crossing connecting existing ditch
450mm dia culvert crossings
Existing ditch
Oversized ditch for attenuation providing 105m3 storage
RISK: Approximate extent of existing overhead electricity cable to be diverted underground
Oversized ditch for attenuation providing 160m3 storage.
MH-OD02-07 HYDRO-BRAKE (MD6 0.4m head 1.6l/s) 5114534-ATK-DRG-020106
MH-OD01-08 HYDRO-BRAKE (MD6 0.5m head 1.7l/s) 5114534-ATK-DRG-020106
Discharge Point Network OD01 1.7l/s for 1 in 100 year + CC
Discharge Point Network OD02 1.6l/s for 1 in 100 year + CC
Existing ditches
For details of OXD 40G Oddington Overbridge refer to drawings reference 5114534-ATK-DRG-CV-002311
Runoff from proposed access track to be drained in to proposed rail ditch
Access steps and footpath. Refer to Civils drawing 5114534-ATK-DRG-CV-002311.
Oversized ditch for attenuation providing 200m3 storage
Existing ditch to be diverted to proposed culvert
600mm dia culvert crossing
Oversized ditch for attenuation providing 250m3 storage
Discharge Point Network OD03 2.0l/s for 1 in 100 year + CC
Proposed ditch to tie into existing
RISK: OVERHEAD POWER CABLES
Proposed ditch longitudinal re-profiling to 1:109
Pond
Drayton Crossing
RISK: OVERHEAD POWER CABLES. PROPOSED STORAGE DITCHES ARE BETWEEN POLES
EXISTING DITCH
HW-OD04-13 HEADWALL TYPE 1. HEADWALL TO TIE INTO EXISTING DITCH
EXISTING DITCH TO BE INFILLED. REFER TO HIGHWAY DRAWINGS FOR DETAILS.
MH-OD03-11 HYDRO-BRAKE (MD6 0.5m head 2.0l/s) 5114534-ATK-DRG-020106
HW-OD04-14 HEADWALL TYPE 4
OHL 69.08
FLOW
HIGH RISK UTILITY SERVICES
PROPOSED WORKS IN VICINITY OF HV CABLES
BT (OVERHEAD)
EHV MAIN (OVERHEAD)
HV MAIN
LV MAIN (OVERHEAD)
EHV MAIN (OVERHEAD)
ZETICA LOCATION (01/2014)
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
IN ADDITION TO THE HAZARDS/RISKS ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS
CONSTRUCTION
WORKING ADJACENT TO LIVE RAILWAY. HITTING EXISTING UTILITIES CAUSING ELECTROCUTION. RISK OF LEPTOSPIROSIS WORKING NEAR WATER. OVERHEAD POWER CABLES.
MAINTENANCE/CLEANING
AS ABOVE. RISK OF BLOCKAGES IN CARRIER DRAINS/CULVERTS AND HYDRO-BRAKES. REFER TO PIPE MANUFACTURER'S INSTRUCTIONS REGARDING JETTING PRESSURE TO AVOID PIPE DAMAGE. SILT TO BE REMOVED FROM MANHOLE CHAMBERS AND DITCHES. REFER TO HYDRO-BRAKE MANUFACTURERS INSTRUCTIONS REGARDING MAINTENANCE.
USE
N/A
DECOMMISSIONING/DEMOLITION
AS CONSTRUCTION
Legend/Notes
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED. ALL LEVELS ARE IN METRES ABOVE PROJECT DATUM. ALL COORDINATES ARE BASED ON "OBB12 SNAKE GRID".
2. THIS DRAWING IS NOT TO BE SCALED.
3. REFER TO DRAWING SERIES 5114534-ATK-DRG-DR-023321-023324 FOR THE LOCATION AND DETAILS OF ALL MANHOLE CHAMBERS, PIPES AND DITCHES, INCLUDING SETTING OUT POINTS ALONG DITCHES.
4. ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION 5114534-ATK-DRE- SPC-020001.
5. REFER TO 5114534-ATK-DRG-DR-020100 AND 020101 FOR CONSTRUCTION DETAILS OF DITCHES AND FILTER DRAINS.
6. FOR DETAILS OF EARTHWORKS (EXCLUDING DITCHES) REFER TO EARTHWORKS DRAWINGS REF 5114534-ATK-DRG-DR-060330 - 060332.
7. TOPOGRAPHICAL SURVEY FROM 5114534-ATK-MOD-SU-000001 TRACK ALIGNMENT FROM 5114534-ATK-MOD-TR-000052.
8. THE SERVICE INFORMATION SHOWN ON THESE DRAWINGS HAS BEEN COLLATED FROM SERVICE RETURNS DATED DECEMBER 2013 AND SURVEY SITE INVESTIGATIONS BY OTHERS IN RELATION TO THE EAST WEST RAIL CORRIDOR. NO LIABILITY OF ANY KIND WHATSOEVER IS ACCEPTED BY ATKINS LIMITED, ITS SERVANT OR AGENTS, FOR ANY ERROR OR OMISSION IN RESPECT OF INFORMATION CONTAINED ON THE PLANS PROVIDED. THIS PLAN IS A COMPILATION OF A NUMBER OF PLANS PROVIDED AT DIFFERENT SCALES AND IS INTENDED TO PROVIDE A GRAPHICAL REPRESENTATION OF SERVICES WITHIN THE AREA AND IT IS IMPOSSIBLE TO GUARANTEE ACCURACY. IN ADDITION IT IS A COMPILATION OF INFORMATION SUPPLIED BY UTILITY COMPANIES WHO DO NOT GUARANTEE THE ACCURACY OF THE INFORMATION. THE UNDERGROUND SERVICES MUST BE VERIFIED AND ESTABLISHED ON SITE BEFORE ANY EXCAVATION IS CARRIED OUT. IT IS THE RESPONSIBILITY OF ANY ON SITE CONTRACTOR TO IDENTIFY AND LOCATE ANY UTILITY PLANT PRIOR TO DEVELOPMENT WORK GOING AHEAD.
9. NO FENCELINE OR LAND BOUNDARIES ARE SHOWN, REFER TO HIGHWAYS DRAWINGS 5114534-ATK-DRG-HW-020101 TO 020102.
10. TRACK DRAINAGE DETAILS SHOWN IN DRAWING 5114534-ATK-DRG-DR-020028
11. CULVERTS OF EXISTING DITCHES THAT ARE TO BE ABANDONED OR DIVERTED WILL REQUIRE PERMANENT + TEMPORARY WORKS WORKS CONSENT FROM THE LEAD LOCAL FLOOD AUTHORITY (OXFORDSHIRE COUNTY COUNCIL).
SP-OD01 PROPOSED SURFACE WATER DITCH
HW-OD01 PROPOSED HEADWALL AT START/END OF DITCH
PROPOSED CULVERT
MH-OD01-02 PROPOSED SURFACE WATER CARRIER DRAIN WITH MANHOLE CHAMBER AND FLOW CONTROL
CP01-01 PROPOSED RAIL SURFACE WATER FILTER DRAIN
LIMITS OF DEVIATION
B02 19/12/14 FOR APPROVAL - ATTENUATION REVISED BW PL AR
C01 24/04/14 FOR CONSTRUCTION SH ML AR
Rev Date Description of Revisions Drawn Chkd Appr
Status FOR APPROVAL
Chiltern Railways
Marylebone Station, Great Central House, Melcombe Place, London, NW1 6JJ
NetworkRail
Contractor(s)
ATKINS
The Axis 10 Holliday Street Birmingham West Midlands B1 1TF
Tel: +44 (0)121 483 5000 Fax: +44 (0)121 483 6333
Project EAST WEST RAIL PHASE 1
Drawing Title GENERAL ARRANGEMENT ODDINGTON OVERBRIDGE PROPOSED DRAINAGE
Designed P. KENNERLEY Signed BW Date 14/11/2013
Drawn M. REHMAN Signed BW Date 14/11/2013
Checked P. LAWRENCE Signed Date 14/11/2013
Approved A. ROSE Signed Date 05/12/2013
Scale(s) 1:1000 ELR & Mileage OXD 24M 02C
Alternative Reference Sheet 1 of 1
Drawing Number 5114534-ATK-DRG-DR-020067 Revision B02

Appendix 3 – RSK: East-West Rail, Oddington Road and Langford Lane. Factual Report: Soakaway Testing.

Carillion Buckingham Joint Venture

East-West Rail, Oddington Road and Langford Lane

Factual Report: Soakaway Testing

312873-01 (00)

OCTOBER 2014

RSK

RSK GENERAL NOTES

Project No.: 312873-01(00)

Title: Factual Report: Soakaway Testing

Client: Carillion Buckingham Joint Venture

Date: 24th October 2014

Office: Abbey Park, Humber Road, Coventry, CV3 4AQ. Tel: 02476 505600

Status: Final

Author	Rowan Brown	**Technical and quality review**	Marc Dixon
Signature		Signature	
Date:	24th October 2014	Date:	24th October 2014
Project manager	Rowan Brown		
Signature			
Date:	24th October 2014		

CONTENTS

FIGURES

APPENDICES

1 INTRODUCTION

RSK Environment Limited (RSK) have been commissioned by Carillion Buckingham Joint Venture (the Client) to carry out a series of infiltration tests at Oddington Road and Langford Lane, as part of the East-West Rail project.

The investigation was carried out to the instructions of Atkins (the Engineer) on behalf of the Client. This report describes the work undertaken and presents the data obtained.

This report is subject to the RSK service constraints given in Appendix A.

1.1 Objective and scope of investigation

The objective of the investigation was to obtain information on the ground conditions and infiltration characteristics of the shallow soils, in relation to the design of proposed attenuation areas to be adopted for the discharge of surface run-off.

The project was carried out to an agreed brief as set out in RSK's variation (via email, dated 2nd October 2014). The scope of testing was as follows:

- Excavate trial holes to depths of 0.60m;
- Log the soils encountered; and
- Undertake soakage testing at each location to assess infiltration characteristics.

1.2 Presentation

A description of the procedures followed during the testing are presented within Section 3. The factual data obtained are presented within Appendix B of this report.

1.3 Limitations

The comments provided and the opinions expressed within this report are based on the ground conditions encountered during the intrusive investigation, and on the results of testing undertaken in-situ and in the laboratory. There may, however, be conditions pertaining to the site that have not been disclosed by the investigation; and therefore could not be taken into account. In particular, it should be noted that the thickness and quality of the made ground may be variable across the site. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects.

2 SITE INVESTIGATION PROCEDURE

The testing was undertaken in accordance with the instructions of the Client and the Designer of the investigation (Atkins) between 6th and 15th October 2014.

The techniques adopted for the intrusive investigation were chosen based on the aims of the investigation, and the access constraints for plant and equipment.

The sampling strategy was primarily focused on the characterisation of the shallow soils; in order to confirm the infiltration characteristics of the soils at a depth of 0.60m bgl, as instructed by the Designer.

The testing was undertaken at the locations identified by the Client on site, as specified by the Designer; and the locations were surveyed in by the Client on site.

Prior to breaking ground at each location, permits to works were completed by the Client to control risks associated with buried utility apparatus.

The investigation and the soil descriptions were carried out in accordance with 'BS 5930:1999. Code of Practice for Site Investigations' (BSI, 1999); and the testing was undertaken in accordance with Building Research Establishment (BRE) 365. Full exploratory hole records are presented in Appendix B.

Table 1 outlines the programme of testing undertaken, and the results of the tests are presented in full within Appendix B.

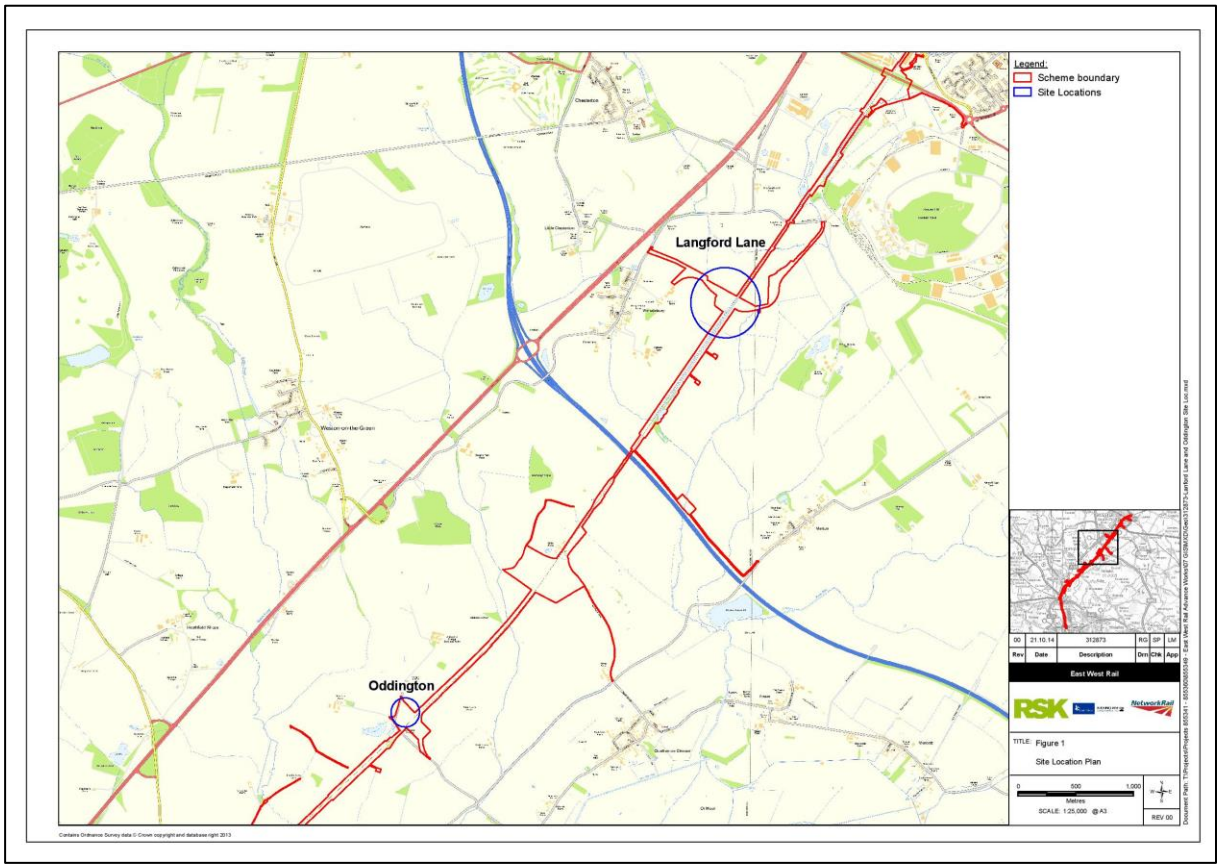
Table 1: Summary of infiltration testing programme

Site	Location	Test ref.	Result (m/s)
Oddington	SAO1	1	9.14×10^{-9}
	SAO2	1	NA
	SAO4	1	NA
	SAO5	1	NA
	SAO6	1	NA
Langford Lane	SAL5	1	6.66×10^{-6}
		2	8.91×10^{-6}
		3	1.02×10^{-5}
	SAL6	1	1.88×10^{-5}
		2	1.80×10^{-5}

Site	Location	Test ref.	Result (m/s)
		3	1.80×10^{-5}
	SAL7	1	1.36×10^{-3}
		2	2.31×10^{-5}
		3	3.70×10^{-5}
	SAL8	1	5.54×10^{-6}
		2	1.53×10^{-6}
		3	3.33×10^{-6}

FIGURES

Carillion Buckingham Joint Venture
East West Rail, Factual Report: Soakaway Testing
312873-01 (00)


Legend:
Scheme boundary
Site Locations
Langford Lane
Oddington
East West Rail
RSK
Network Rail
TITLE: Figure 1
Site Location Plan
SCALE: 1:25,000 @ A3
REV 00

APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Carillion Buckingham Joint Venture (the "client") in accordance with the terms of a contract between RSK and the "client", dated 3rd October 2014. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be** well advised to seek independent advice from a competent environmental consultant and/or lawyer.
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date hereof, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.
8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.

Carillion Buckingham Joint Venture
East West Rail, Factual Report: Soakaway Testing
312873-01 (00)

APPENDIX B
FIELD RECORDS

Carillion Buckingham Joint Venture
East West Rail, Factual Report: Soakaway Testing
312873-01 (00)

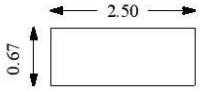
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
East West Rail	CBJV	SA01

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
312873	End: 07.10.14	---	---	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Grass over dark brown CLAY with many rootlets.	0.17	
						Stiff to firm orangish brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium quartzite, sandstone with occasional rootlets.	(0.47)	
						Trial pit terminated at 0.64m bgl.	0.64	

Plan (Not to Scale)



General Remarks

1. Location scanned with a CAT and Signal Generator prior to breaking ground. No services encountered.
2. Ground water not encountered.
3. Trial pit remained stabled during excavation.
4. Trial pit back filled upon completion.

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	Tracked excavator	LMoody	AGS

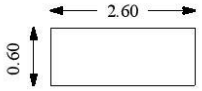
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
East West Rail	CBJV	SA02

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
312873	End: 07.10.14	---	---	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Grass over dark brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium quartzite.	0.20	
						Firm to stiff grey mottled orange slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse chalk with occasional sand pockets	(0.47)	
						Trial pit terminated at 0.67m bgl.	0.67	

Plan (Not to Scale)



General Remarks

1. Location scanned with a CAT and Signal Generator prior to breaking ground. No services encountered.
2. Ground water not encountered.
3. Trial pit remained stabled during excavation.
4. Trial pit back filled upon completion.

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	Tracked excavator	LMoody	

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 312873 EAST WEST RAIL.GPJ - v8_05 | 21/10/14 - 12:52 | LM.
RSK Environment Ltd, The Enterprise Centre, Coventry University Technology Park, Coventry, CV1 2TX. Tel: 02476 236014, Fax: 02476 236816, Web: www.rsk.co.uk.

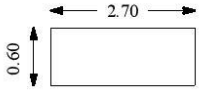
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
East West Rail	CBJV	SA03

Contract Ref:	Start: 07.10.14	Ground Level:	Co-ordinates:	Sheet:
312873	End: 07.10.14	---	---	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Dark grey angular medium to coarse granite and basalt GRAVEL. (ROAD STONE)	(0.40) 0.40	
						Trial pit terminated at 0.40m due to a high influx of water through the road stone.		

Plan (Not to Scale)



General Remarks

1. Location scanned with a CAT and Signal Generator prior to breaking ground. No services encountered.
2. Ground water not encountered.
3. Trial pit remained stabled during excavation.
4. Trial pit back filled upon completion.

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	Tracked excavator	LMoody	AGS

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Log TRIAL PIT LOG | 312873 EAST WEST RAIL.GPJ - v8_05 | 21/10/14 - 12:52 | LM.
RSK Environment Ltd, The Enterprise Centre, Coventry University Technology Park, Coventry, CV1 2TX. Tel: 02476 236014, Fax: 02476 236816, Web: www.rsk.co.uk.

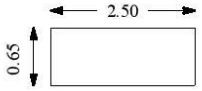
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
East West Rail	CBJV	SA04

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
312873	08.10.14	---	---	1 of 1
	End: 08.10.14			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Grass over dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse quartzite and occasional rootlets.	0.15	
						Firm orangish brown mottled grey CLAY with occasional rootlets.	(0.28)	
							0.43	
						Firm orangish brown very gravelly CLAY. Gravel is subangular to subrounded fine to medium quartzite, flint and sandstone.	0.45	
						Firm grey mottled orange CLAY.	0.70	
						Trial pit terminated at 0.70m bgl.		

Plan (Not to Scale)



General Remarks

1. Location scanned with a CAT and Signal Generator prior to breaking ground. No services encountered.
2. Ground water not encountered.
3. Trial pit remained stabled during excavation.
4. Trial pit back filled upon completion.

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	Tracked excavator	LMoody	

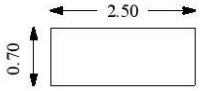
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
East West Rail	CBJV	SA05

Contract Ref:	Start: 08.10.14	Ground Level:	Co-ordinates:	Sheet:
312873	End: 08.10.14	---	---	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Dark brown gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse quartzite, metal sandstone, carpet, road stone and occasional rootlets.	0.25	
						Stiff to firm grey mottled orange slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium quartzite and occasional sand pockets.	(0.60)	
						Trial pit terminated at 0.85m bgl.	0.85	

Plan (Not to Scale)



General Remarks

1. Location scanned with a CAT and Signal Generator prior to breaking ground. No services encountered.
2. Ground water not encountered.
3. Trial pit remained stabled during excavation.
4. Trial pit back filled upon completion.

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	Tracked excavator	LMoody	

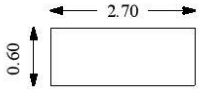
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
East West Rail	CBJV	SA06

Contract Ref:	Start:	Ground Level:	Co-ordinates:	Sheet:
312873	End: 08.10.14	---	---	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						Light brown slightly gravelly CLAY. Gravel is subangular fine to coarse sandstone, quartzite and road stone with occasional sand pockets.	(0.30) 0.30	
						Firm to stiff grey mottled orange slightly gravelly CLAY. Gravel is subangular to subrounded chalk with occasional sandy pockets.	(0.70) 1.00	
						Trial pit terminated at 1.00m bgl.		

Plan (Not to Scale)



General Remarks

1. Location scanned with a CAT and Signal Generator prior to breaking ground. No services encountered.
2. Ground water not encountered.
3. Trial pit remained stabled during excavation.
4. Trial pit back filled upon completion.

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	Tracked excavator	LMoody	AGS

FULL SCALE SOAKAWAY TEST

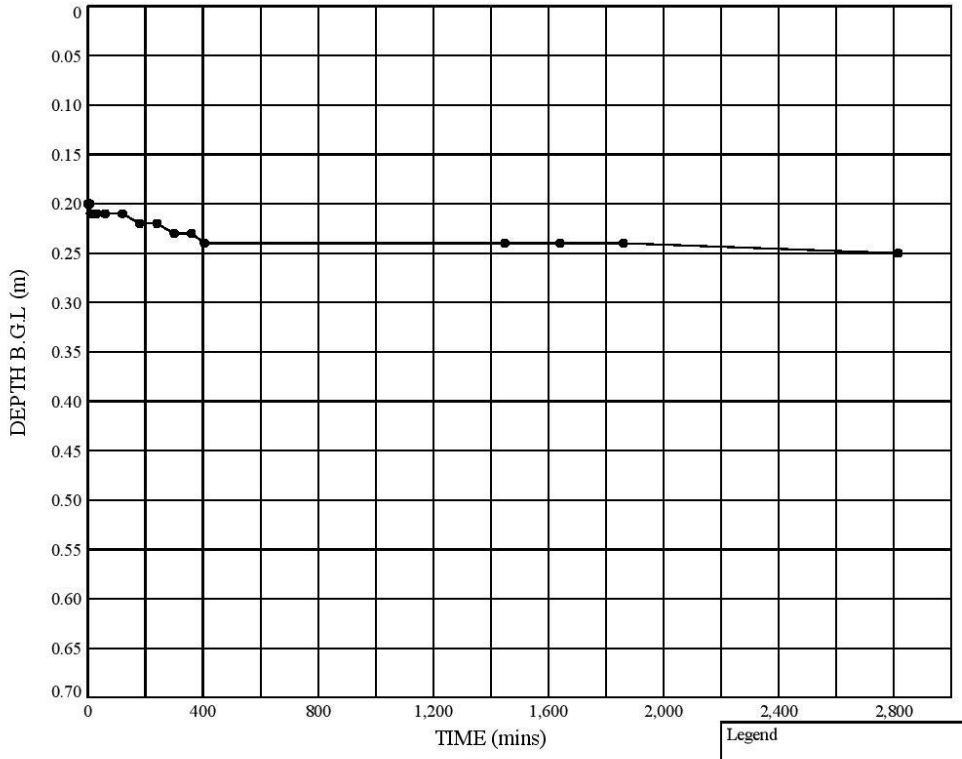
In accordance with BRE Digest 365

Soakaway Test - Position ID : **SA01**

Ground Level: ---

Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

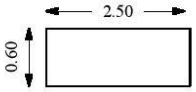
Pit start depth:	=	**0.64**	m
Pit final depth:	=	**0.64**	m
Effective depth, De	=	**0.44**	m
Effective storage volume, V_{p75-25}	=	**0.3300**	m^3
Surface area, a_{p50}	=	**2.8640**	m^2
Time, t_{p75-25}	=	**1260600**	secs
Infiltration rate, f	=	**$9.14x10^{-9}$**	m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

● Test 1 (07.10.14)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
Abbey Park
Humber Road
Coventry
CV3 4AQ

Compiled By	Date	Checked By	Date
	17/10/14		

Contract: **East West Rail**

Contract Ref: **312873**

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT | 312873 EAST WEST RAIL.GPJ - v8_05 | 17/10/14 - 16:15 | LM.

FULL SCALE SOAKAWAY TEST

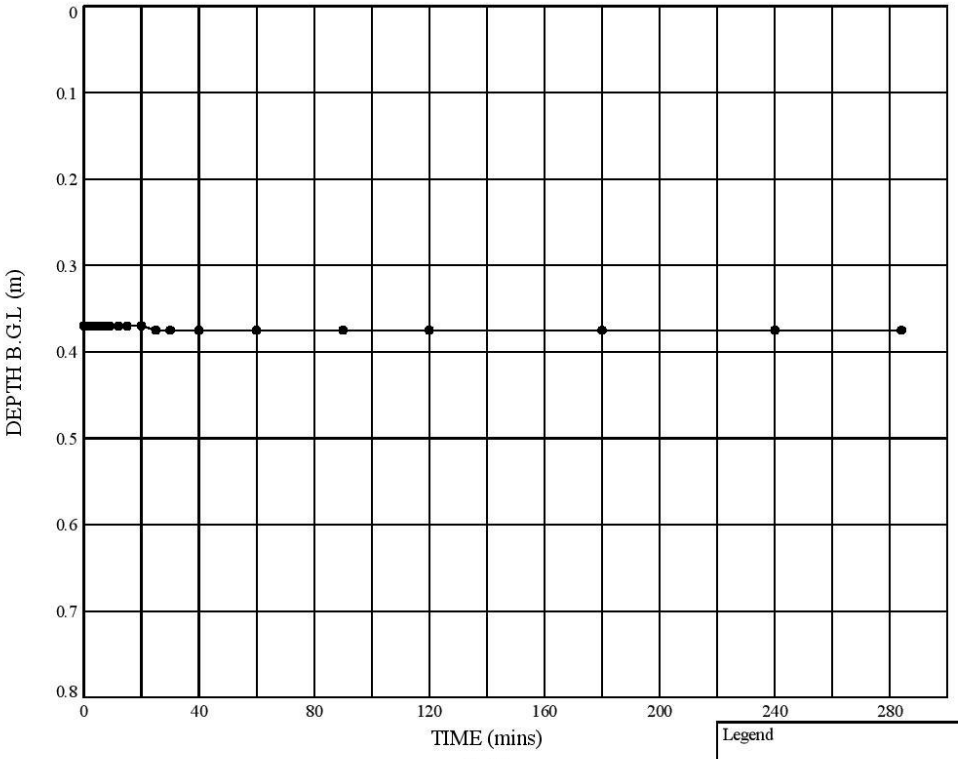
In accordance with BRE Digest 365

Soakaway Test - Position ID : **SA02**

Ground Level: ---

Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



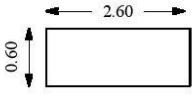
Pit start depth:	=	**0.77**	m
Pit final depth:	=	**0.77**	m
Effective depth, De	=	**0.40**	m
Effective storage volume, $V_{p75\text{-}25}$	=	**0.3120**	m^3
Surface area, a_{p50}	=	**2.8400**	m^2
Time, $t_{p75\text{-}25}$	=	**N/A**	secs
Infiltration rate, f	=	**N/A**	m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

Test 1 (07.10.14)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
Abbey Park
Humber Road
Coventry
CV3 4AQ

Compiled By	Date	Checked By	Date
	17/10/14		

Contract	Contract Ref:
East West Rail	**312873**

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT | 312873 EAST WEST RAIL.GPJ - v8_05 | 17/10/14 - 16:16 | LM

FULL SCALE SOAKAWAY TEST

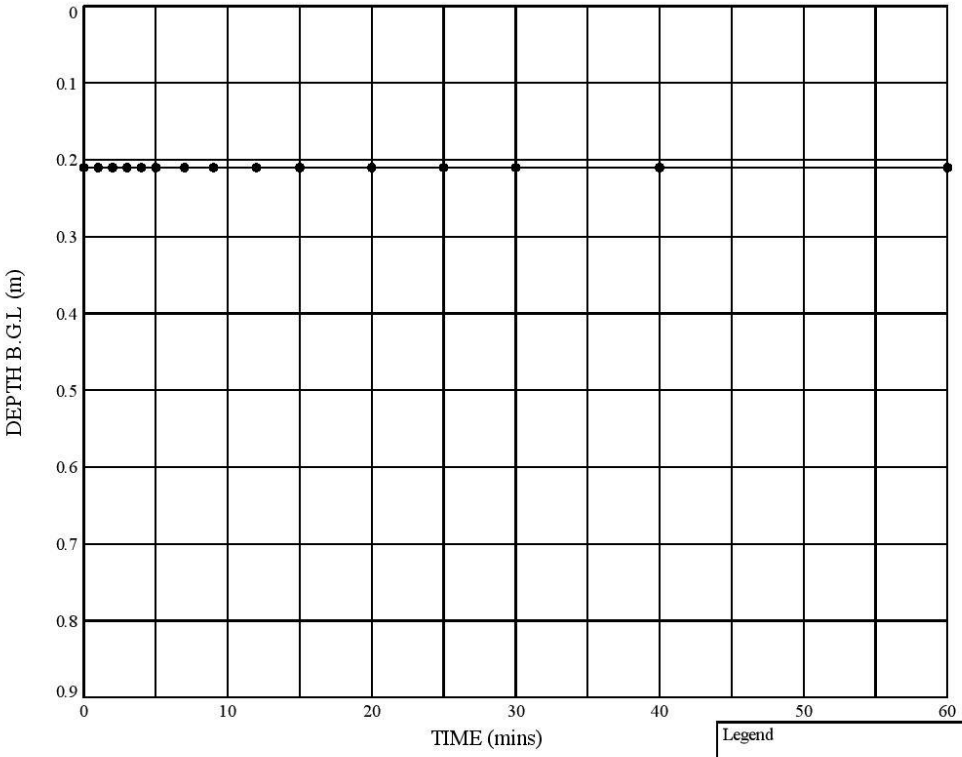
In accordance with BRE Digest 365

Soakaway Test - Position ID : **SA04**

Ground Level: ---

Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



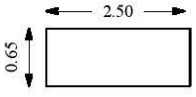
Pit start depth:	=	**0.83**	m
Pit final depth:	=	**0.85**	m
Effective depth, De	=	**0.62**	m
Effective storage volume, V_{p75-25}	=	**0.5038**	m^3
Surface area, a_{p50}	=	**3.5780**	m^2
Time, t_{p75-25}	=	**N/A**	secs
Infiltration rate, f	=	**N/A**	m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

Test 1 (09.10.14)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
Abbey Park
Humber Road
Coventry
CV3 4AQ

Compiled By	Date	Checked By	Date
	17/10/14		

Contract	Contract Ref:
East West Rail	**312873**

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT | 312873 EAST WEST RAIL.GPJ - v8_05 | 17/10/14 - 16:17 | LM

FULL SCALE SOAKAWAY TEST

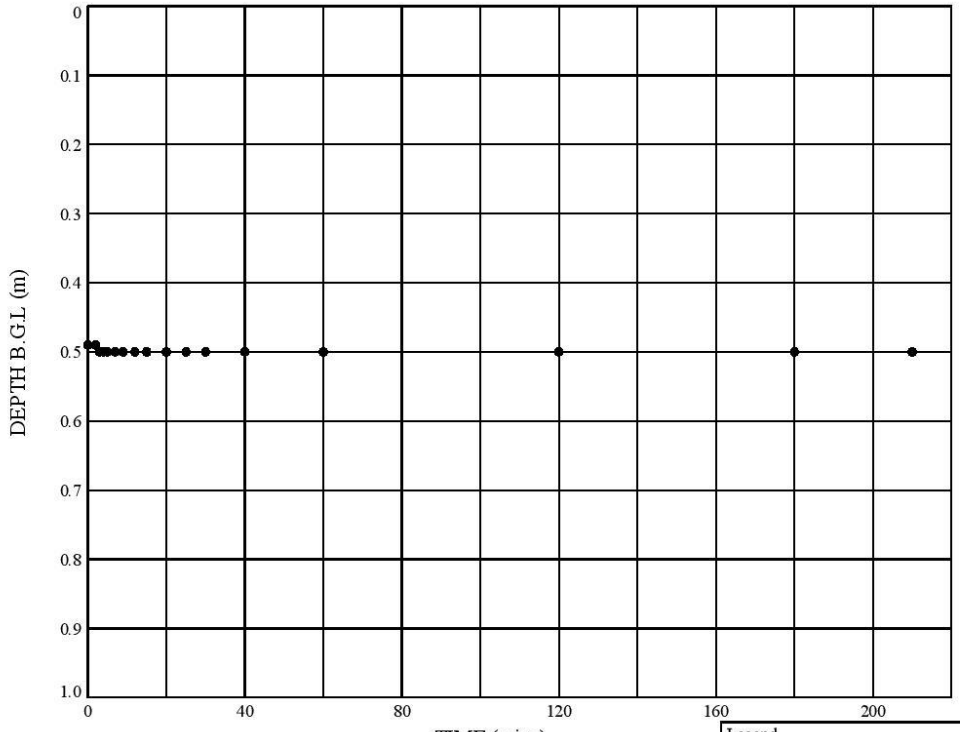
In accordance with BRE Digest 365

Soakaway Test - Position ID : **SA05**

Ground Level: ---

Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

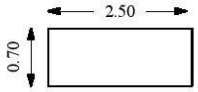
Pit start depth:	=	**0.49**	m
Pit final depth:	=	**0.88**	m
Effective depth, De	=	**0.39**	m
Effective storage volume, V_{p75-25}	=	**0.3410**	m^3
Surface area, a_{p50}	=	**2.9980**	m^2
Time, t_{p75-25}	=	**N/A**	secs
Infiltration rate, f	=	**N/A**	m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

● Test 1 (08.10.14)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
Abbey Park
Humber Road
Coventry
CV3 4AQ

Compiled By	Date	Checked By	Date
	17/10/14		

Contract: **East West Rail**

Contract Ref: **312873**

GINT_LIBRARY_V8_05.GLB Lib Version: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT | 312873 EAST WEST RAIL.GPJ - v8_05 | 17/10/14 - 16:17 | LM

FULL SCALE SOAKAWAY TEST

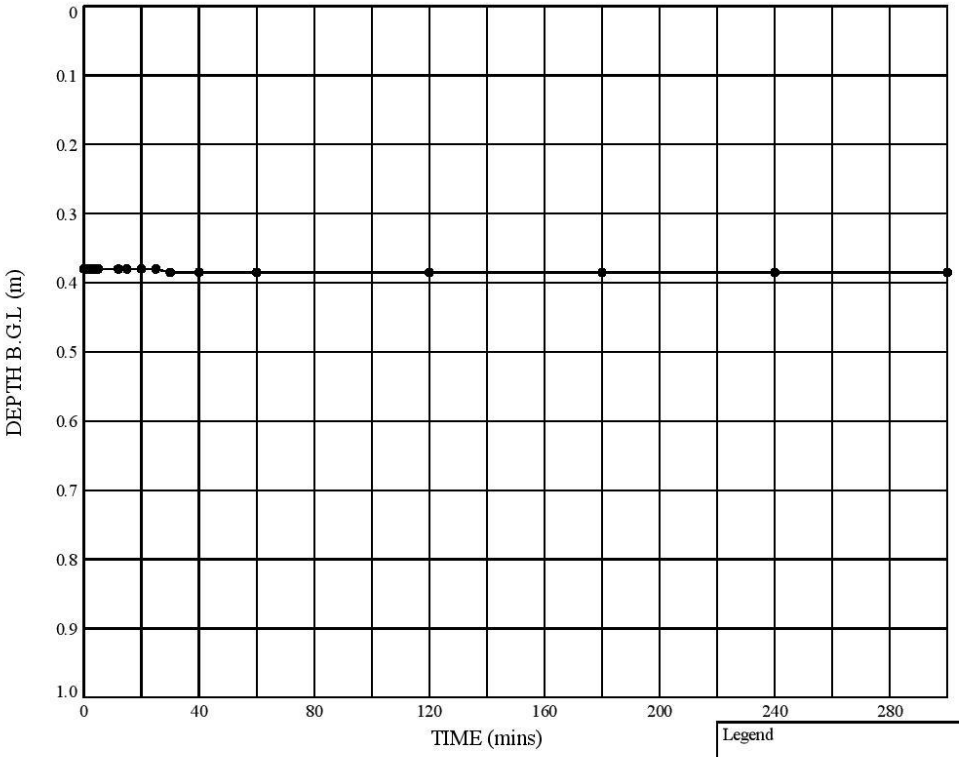
In accordance with BRE Digest 365

Soakaway Test - Position ID : **SA06**

Ground Level: ---

Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



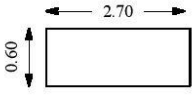
Pit start depth:	=	**0.92**	m
Pit final depth:	=	**0.92**	m
Effective depth, De	=	**0.54**	m
Effective storage volume, V_{p75-25}	=	**0.4374**	m^3
Surface area, a_{p50}	=	**3.4020**	m^2
Time, t_{p75-25}	=	**N/A**	secs
Infiltration rate, f	=	**N/A**	m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

Test 1 (08.10.14)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
Abbey Park
Humber Road
Coventry
CV3 4AQ

Compiled By	Date	Checked By	Date
	17/10/14		

Contract	Contract Ref:
East West Rail	**312873**

GINT_LIBRARY_V8_05.GLB LibVersion: v8_05 - Lib0004 PrjVersion: v8_05 - Core+Logs 0003 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT | 312873 EAST WEST RAIL.GPJ - v8_05 | 17/10/14 - 16:19 | LM