

# Land South of Gillingham, Dorset

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Welbeck Strategic Land

## Flood Risk Assessment



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### Flood Risk Assessment

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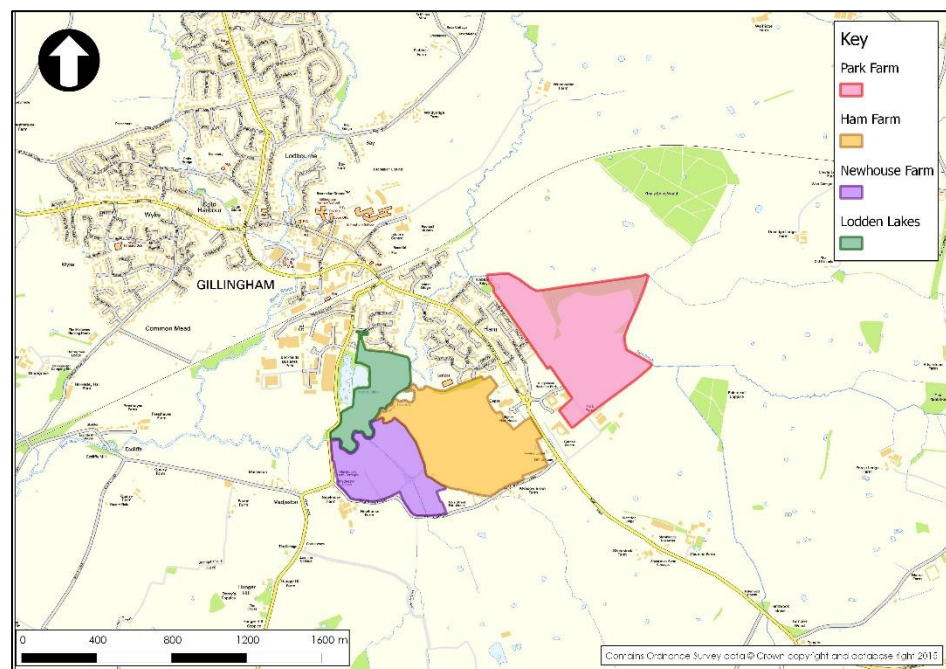
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# 1 Introduction

- 1.1 Awcock Ward Partnership (AWP) has been commissioned by Welbeck Strategic Land to prepare a Flood Risk Assessment (FRA) in support of an outline Planning Application for a mixed-use development on greenfield land to the south of Gillingham, Dorset.
- 1.2 The proposed development delivers the central area of the Gillingham Southern Extension Master Plan Framework (MPF) which comprises the sites of Newhouse Farm and Ham Farm. The mixed-use scheme includes residential development, local centre provision and a primary school extension, together with associated access roads, landscaping, drainage and engineering works.
- 1.3 The location of the proposed development is shown as Newhouse Farm and Ham Farm on Figure 1.1 below.

Figure 1.1 - Site Location – Wide Area



## National Planning Policy Framework

- 1.4 The National Planning Policy Framework (NPPF) and the Planning Practice Guidance were published by the Department for Communities and Local Government in March 2012 and March 2014 respectively.

- 1.5 The NPPF states that *"a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding"*.
- 1.6 The aim of a site-specific flood risk assessment is to demonstrate that *"the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall"*.
- 1.7 Furthermore, the site-specific flood risk assessment must *"assess the flood risk to and from a development site ... The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users"*, as required by the Planning Practice Guidance.

#### Structure and limitations of this FRA

- 1.8 This site-specific FRA has been written in line with the above Framework. It also includes a Surface Water Management Plan (SWMP) that indicates how the surface water runoff can be managed in such a way as not to increase the flood risk to the downstream catchment.
- 1.9 It is important to note that this FRA does not attempt to present a final design of the surface water drainage system. This will be left until the detailed design stage when further site investigation work can be undertaken and other systems can be evaluated. This evaluation will also need to include assessments due to health and safety, CDM etc.

#### Consultation

- 1.10 To scope out any site specific or catchment specific flood risk or drainage requirements we have engaged with various parties.
- 1.11 We liaised with Michael Holm, the Environment Agency's (EA) Sustainable Places Officer and Gary Cleaver, Dorset County

Council's (DCC) Flood Risk and Coastal Engineer, in the production of the MPF.

- 1.12 We have also met with Julie Hawkins, Gillingham Town Council's Planning Committee Clerk (and Community Flood Warden) to discuss existing flooding issues within the study area and existing SuDS schemes serving nearby developments within Gillingham.
- 1.13 Furthermore, a public consultation was held on the MPF which provided an opportunity for members of the public to review the proposals and share any thoughts or concerns relating to the existing site or the outline drainage strategy.
- 1.14 Since the initial planning submission, we have received initial consultation responses from both the Environment Agency (EA) and Dorset County Council (DCC), as Lead Local Flood Authority (LLFA). This FRA and the accompanying Surface Water Management Plan (SWMP) have been amended to reflect the comments received from both the EA and DCC. Further technical studies have also been completed and will be referenced within this report where appropriate.
- 1.15 The output of the above consultation process has helped to inform this FRA and the inherent SWMP.

#### Reference

- 1.16 This FRA has been prepared by reference to the following documents:
- National Planning Policy Framework (March 2012);
  - Planning Practice Guidance (March 2014);
  - Environment Agency (EA) Flood Warning Information Service;
  - CIRIA Guide 753 – The SuDS Manual (November 2015);
  - Gillingham Southern Extension Master Plan Framework (November 2015);
  - AWP Gillingham Southern Extension Flood Risk Assessment (August 2016);
  - Wessex Water (WW) Asset Records; and,
  - JBA Consulting Gillingham Modelling Extension (October 2018).

## 2 Existing Conditions

### Context

- 2.1 The proposed mixed-use development is located on greenfield land to the south of Gillingham, North Dorset, at national grid reference ST 816 255.

### Existing land uses

- 2.2 The site comprises undeveloped greenfield land of Newhouse Farm and Ham Farm, with established hedgerows forming boundaries within the site and at its perimeter.

### Surrounding land use

- 2.3 The site is bound to the north by the River Lodden and St Mary's Church of England primary school, with surrounding residential developments, to the east by Shaftesbury Road, to the south by Cole Street Lane and to the west by the B3092.

### Topographic survey

- 2.4 A topographic survey has been undertaken and indicates that the site predominantly falls towards the River Lodden at its northern boundary.
- 2.5 The site comprises a peak within Ham Farm and a shallow valley within Newhouse Farm. The base of the valley forms an ordinary watercourse which routes flows northwards, from Cole Street Lane and beyond, to the River Lodden.
- 2.6 An 'Existing Site Plan' has been prepared to set the context of the pre-development site and can be found as drawing 0456-XS-101, within Appendix A of this report.

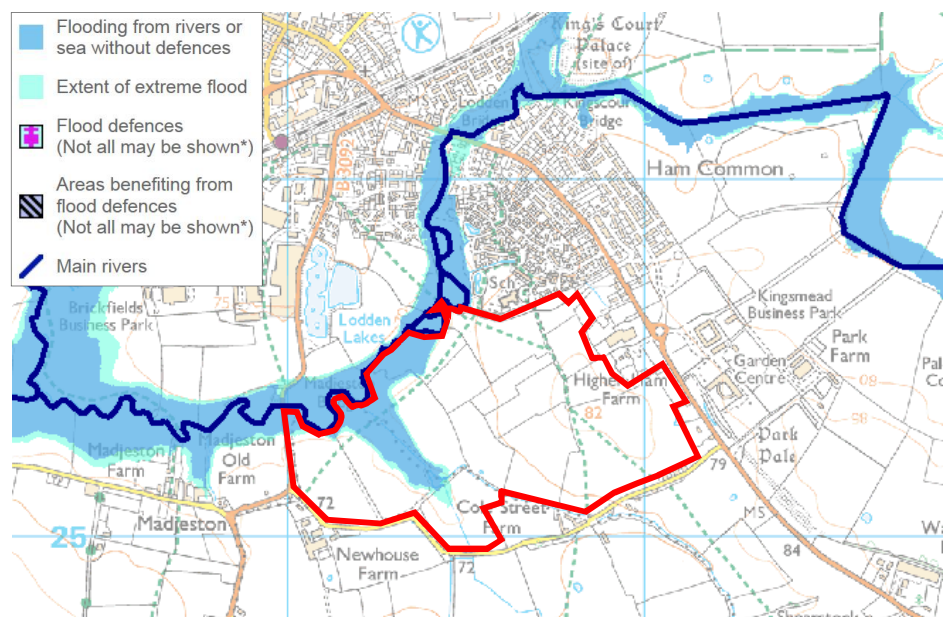
### Existing Flood Risk

- 2.7 The EA's 'Flood Warning Information Service' provides flood risk information and mapping throughout England.
- 2.8 An extract of the 'Flood Map for Planning' has been reproduced as Figure 2.1 and shows the majority of the site to be within 'Flood

Zone 1', as land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).

- 2.9 Where the site borders both the River Lodden and the existing ordinary watercourse, it falls within 'Flood Zone 2' and 'Flood Zone 3', however the proposed developable areas and any future SuDS attenuation will be kept within 'Flood Zone 1' as required by the NPPF. Furthermore, all new properties will demonstrate a minimum freeboard allowance of 600mm above the 100 year flood level, with allowance for climate change.

Figure 2.1 – Flood Map for Planning

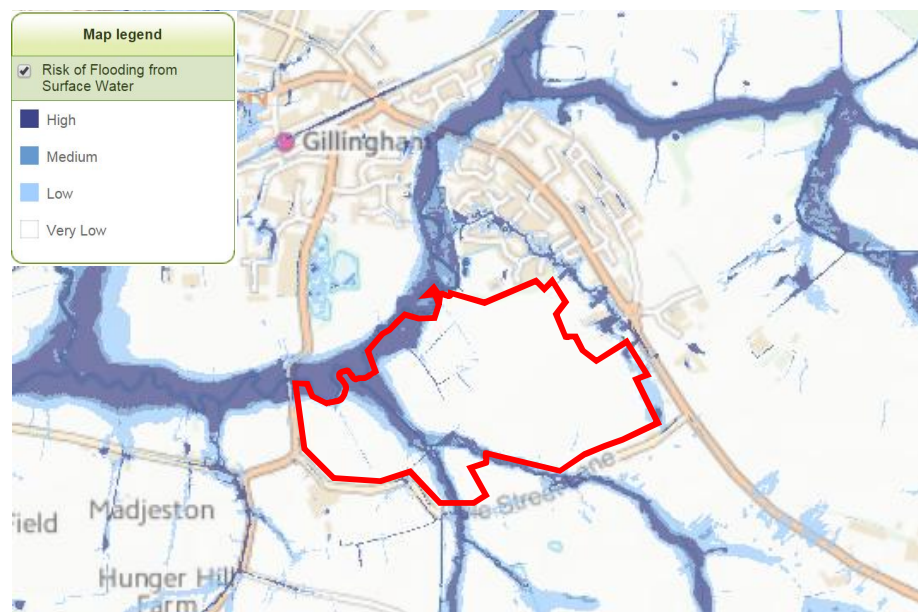


- 2.10 The EA Flood Zones for this site are based upon JFlow which is not suitable for use within site specific FRA's, accordingly the EA and DCC have advised that a bespoke assessment of the Flood Zones, including up-to-date hydraulic modelling (and hydrology) must be undertaken.
- 2.11 JBA Consulting have completed an updated Gillingham hydrology model, which includes a range of deliverables to enable a Flood Map Challenge. The updated 1% and 0.1% AEP outlines have been used for assessment within this FRA.
- 2.12 Review of the 1% AEP with 85% climate change flood extents from the JBA Consulting model has also been completed and confirms there is negligible difference from the 0.1% AEP flood event.



- 2.13 The JBA Consulting Gillingham Modelling Report can be found within Appendix H of this report with access to the respective appendices offered via a permanent online link, [available here](#).
- 2.14 An extract of the 'Flood Risk from Surface Water' mapping has been reproduced as Figure 2.2. This mapping is based on LIDAR data and indicates the typical conveyance routes of surface water runoff.
- 2.15 The mapping shows concentrated overland flows following the alignment of the existing ordinary watercourse, which routes through the site, from Cole Street Lane to the River Lodden. This reflects several concerns raised by residents of Cole Street Lane at the pre-application exhibition.
- 2.16 Concerns were raised over the capacity of the ordinary watercourse (namely the Sette Brook) which drains beyond Cole Street Lane and heads through the application site to the River Lodden. It is understood that during heavy rainfall runoff surcharges upstream and places existing properties at risk.
- 2.17 As with the fluvial flood zones, the developable area should be kept outside of land susceptible to flooding from surface water and the development as a whole must ensure that the existing risk of flooding is not increased due to the development.

Figure 2.2 – Flood Risk from Surface Water



### Historic flooding in Gillingham

- 2.18 We have liaised with Julie Hawkins, Gillingham Town Council's Planning Committee Clerk (and Community Flood Warden) over existing flooding issues in the study area however the mitigation measures (which include 10% betterment in peak flow) for the proposed development will actively reduce any downstream flooding.

### Existing Site Drainage

- 2.19 Following inspection of Wessex Water's asset record plans for this area, there do not appear to be any existing public sewers within the application boundary.
- 2.20 The existing drainage regime represents that of a typical greenfield site, with some surface water runoff soaking into the underlying strata and some following the natural topography of the site.
- 2.21 The majority of runoff generated by the existing site will be intercepted by local field ditches, which drain runoff to either the on-site ordinary watercourse or directly to the River Lodden.

### Ground conditions

- 2.22 A Ground Investigation which included BRE Digest 365 compliant soakaway testing was undertaken by Ruddlesden Geotechnical Ltd in August 2014.
- 2.23 The results of the testing can be found within Table 2.1 below, with extracts from the report included within Appendix B for completeness.

Table 2.1 – Soakaway Test Results

Test Ref.	Infiltration Rate (m/s)	Performance
TP8	N/A	Failed
TP12	N/A	Failed
TP22	N/A	Failed
TP25	N/A	Failed
TP30	N/A	Failed
TP44	N/A	Failed
TP49	N/A	Failed
TP58	N/A	Failed
TP60	N/A	Failed
TP62	N/A	Failed

- 2.1 The Ruddlesden Geotechnical Ltd report states *"The report concluded that *the ground has low permeability and is unsuitable for the use of soakaway drainage. Off-site discharge, possibly combined with on-site attenuation, is considered to be the most suitable drainage solution*".*

### 3 Development Proposals

#### Introduction

- 3.1 The proposed development delivers the central area of the Gillingham Southern Extension Master Plan Framework (MPF) which comprises the sites of Newhouse Farm and Ham Farm. The mixed-use scheme includes residential development, local centre provision and a primary school extension, together with associated access roads, landscaping, drainage and engineering works.

#### Vulnerability

- 3.2 In accordance with the Planning Practice Guidance, residential dwellings are considered to be “More Vulnerable”, however given the proposed developable areas are located outside of the 1% and 0.1% AEP flood extents, within ‘Flood Zone 1’ (as confirmed by the updated Gillingham model), Table 3 of the Planning Practice Guidance confirms this as being an appropriate form of development.

#### Sequential Test

- 3.3 The proposed developable areas are located within ‘Flood Zone 1’ and therefore passes the Sequential Test, as there are no competing sites with a lower flood risk classification.

#### Cross sections and finished levels

- 3.4 It is anticipated that the existing ground profile will be modified locally to reflect the requirements of the new development.
- 3.5 Any future level design should aim to minimise the extent of any re-profiling works and should look to retain existing catchment areas wherever possible.

#### Safe access and egress

- 3.6 The proposed development comprises three main vehicular access locations. The primary location is with the B3081 Shaftesbury Road to the east, which is entirely within Flood Zone 1 and offers safe access and egress.

3.7 The remaining vehicular access locations provide northbound and southbound connectivity with the B3092 New Road and fall within the fluvial floodplain of the River Lodden.

3.8 JBA's hydraulic modelling has been used to confirm the flood depths and velocities for the B3092 access locations during the 100 year (+40% climate change) and 1000 year flood events, with the outputs assessed against Figure 2.1 of FD2321/TR2 'Combinations of flood depth and velocity that cause danger to people'. The output of this exercise has been summarised within Tables 3.1 and 3.2 below.

Table 3.1 – B3092 Southbound Access Flood Hazard

Flood Event	Max. Flood Depth	Max. Velocity	Flood Hazard	Hazard Category
Q20*	N/A	N/A	N/A	N/A (No Hazard)
Q100+40CC	0.23 m	0.6 m/s	0.25	N/A (No Hazard)
Q1000	0.35 m	0.7 m/s	0.42	N/A (No Hazard)

\* Southbound access to B3092 New Road is outside of FZ3b

Table 3.2 – B3092 Northbound Access Flood Hazard

Flood Event	Max. Flood Depth	Max. Velocity	Flood Hazard	Hazard Category
Q20	0.35 m	1.1 m/s	0.56	N/A (No Hazard)
Q100+40CC	0.70 m	1.4 m/s	1.33	Class 1 (Danger for Some)
Q1000	0.83 m	1.5 m/s	1.66	Class 2 (Danger for Most)

3.9 The above confirms that the southbound access to the B3092 would remain operational in the 1000 year flood, whereas the northbound access presents a 'danger for some' in the 100 year (+40%) flood and 'danger for most' in the 1000 year flood.

3.10 To assess the flood hazard from Flood Zone 3b (functional floodplain) we have also obtained depth and velocities from the 20 year flood model. The output from this assessment confirms the northbound route on the B3092 New Road does not pose a flood hazard within the functional floodplain.

3.11 At the Reserved Matters stage the carriageway alignment which crosses the Sette Brook can be designed to ensure it is safe from flooding. This will ensure the full extents of development can utilise both the southbound access to New Road or the eastern access to Shaftesbury Road. Only the northbound access to New Road will present a danger during the 100 year and 1000 year flood events, however this is reflective of existing conditions and alternative routes will be available.

3.12 The relevant extracts and correspondence from JBA which confirm the above flood depths and velocities can be found within Appendix C.

#### Drainage strategy requirements

3.13 'CIRIA C753 – The SuDS Manual' advises that surface water disposal should be to be prioritised in the following order:

- Infiltration
- Discharge to surface waters
- Discharge to a surface water sewer, highway drain or other drainage system
- Discharge to a combined sewer

3.14 As required by the NPPF, the drainage strategy must demonstrate that the development will be safe throughout its lifetime, without increasing flood risk elsewhere, whilst also taking account of the impacts of climate change.

#### Outline drainage strategy

3.15 The results of the BRE Digest 365 soakaway testing have confirmed that the site is underlain by sub-soils which are unsuitable for the application of soakaway features. The Geotechnical Investigation report concludes *"the ground has low permeability and is unsuitable for the use of soakaway drainage. Off-site discharge, possibly combined with on-site attenuation, is considered to be the most suitable drainage solution"*.

3.16 Due to the above, the proposed drainage strategy will utilise an attenuated greenfield discharge, based on the following:

- Adoptable & non-adoptable underground pipework;

- Swales;
  - Attenuation Basins;
  - Flow control devices; and,
  - Exceedance Overland Measures.
- 3.17 The drawing included in Appendix D (reference 0456-PDL-101) shows a preliminary drainage layout for the site.
- 3.18 Details on the size of the attenuation features are given within the preliminary drainage layout drawing and have been summarised within the 'Surface Water Management Plan' (SWMP) section of this report.
- 3.19 The proposed drainage strategy has been prepared ahead of the release of Sewers for Adoption 8<sup>th</sup> Edition, however with an expected mid-2019 release, the Reserved Matters Application for any phase of development must take account of changes due to 8<sup>th</sup> Edition.

#### Climate change impacts

- 3.20 The NPPF requires that the impact of climate change be considered to minimise vulnerability and provide resilience. The NPPF and Planning Practice Guidance explain that an FRA should demonstrate how flood risk will be managed throughout the development's lifetime, taking climate change into account.
- 3.21 The Environment Agency, as the government's expert on flood risk, released the document 'Flood Risk Assessments: Climate Change Allowances Guidance' in February 2016.
- 3.22 Table 3.3 provides an extract detailing the predicted increase in peak rainfall intensity due to climate change over the next 100 years.

Table 3.3 – Peak rainfall intensity allowances (applicable across all of England)

Allowance category	Total potential change anticipated for (2015 to 2039)	Total potential change anticipated for (2040 to 2069)	Total potential change anticipated for (2070 to 2115)
Upper end (90 <sup>th</sup> Percentile)	10%	20%	40%

Central (50th Percentile)	5%	10%	20%
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- 3.23 The guidance states for peak rainfall intensity, Flood Risk Assessments should “assess both the central and upper end allowances to understand the range of impact”.
- 3.24 The on-site attenuation for this proposed development has been sized to offer flood protection for the development and its downstream catchment throughout its lifetime, with the upper end allowance of 40% being utilised to present a worst-case scenario.
- 3.25 The updated Gillingham model, prepared by JBA Consulting, includes the latest fluvial climate change allowances. The model confirms there is negligible difference between the 0.1% AEP flood event and the 1% AEP with 85% climate change.
- 3.26 The report can be found within Appendix H of this report.



## 4 Surface Water Management Plan

### Existing surface water runoff

- 4.1 The existing drainage regime for the site represents a typical greenfield site, with some surface water runoff soaking into the underlying strata and some following the natural topography of the site.
- 4.2 The MicroDrainage Source Control module has been used to assess the natural runoff rates for the existing site using the ICP SUDS method. This method is based on the IH 124 methodology, which is best practice for greenfield sites such as this.
- 4.3 To ensure the development will be safe throughout its lifetime and that it does not increase flood risk elsewhere, the drainage strategy will include appropriate mitigation measures, so that the pre-development greenfield runoff rates can be reduced by a minimum of 10%.
- 4.4 A copy of the assessment can be seen within Appendix E of this report, with the results summarised in Table 4.1 below.

Table 4.1 – Greenfield Runoff Rates

Return Period	Greenfield Runoff Rates (l/s)	Allowable Rates (10% Betterment)
2 year	177.8	160.0
30 year	457.3	411.6
100 year	643.7	579.3

### Proposed Surface Water Strategy

- 4.5 The surface water strategy for this site has been developed to respect the masterplan, accounting for runoff in up to the 100 year (+40% climate change) critical storm event.
- 4.6 The results of the BRE Digest 365 soakaway testing concluded that infiltration is not an appropriate method of surface water disposal for this site. Instead, on-site attenuation combined with off-site discharge is considered to be the most appropriate drainage solution.
- 4.7 Wherever possible, runoff generated by the proposed development should be conveyed via new swales, designed to convey development flows. The swales should include online

storage bays and check dams to allow for online attenuation, sedimentation and water quality enhancement.

- 4.8 Where swales cannot be accommodated runoff should instead be conveyed through private and adoptable storm networks.
- 4.9 The upstream reach of the ordinary watercourse within the site (namely the Sette Brook) should not be utilised for the discharge of development flows. This will offer some relief to the existing watercourse which naturally receives runoff from the site but is understood to experience regular flooding at Cole Street Lane.
- 4.10 All proposed storm conveyance systems will drain towards a series of downstream attenuation basins, located at the northern extent of each development parcel. Following a site visit with Julie Hawkins, Gillingham Town Council's Planning Committee Clerk (and Community Flood Warden), it is recommended that any future detention basin follow the below design code;
- Basins to be located outside of Flood Zones 2 and 3 (to ensure they are not impacted throughout the developments 100 year lifetime, with allowance for climate change).
  - The SWMP which accompanies this report sets the provisional size, area and location of proposed basins and is based on the current JBA flood modelling, development catchments and maximum basin depths of 1.0-1.2m. The final basin design must consider revised flood extents (due to impacts from future highway culverts or similar), together with measured drainage catchment areas and monitored groundwater levels which might influence the type and depth of construction.
  - Wherever possible, the basins should include permanently wet beds, below the level of the inlet and outlet structures. This will enhance the amenity and biodiversity of the local space.
  - Where permanently wet beds cannot be accommodated low-flow channels should be utilised, with capacity to convey the 1 year peak flow.
  - All basins must include minimum 300mm freeboard to reduce any residual risks from blockage or exceedance events.

- Basins earthworks should be no steeper than 1 in 3 and should include a 2.0m wide level bench at the top water level to provide safer access for maintenance.
  - Basins should form part of the landscape strategy, with planting at margins, on banks, and where appropriate, within the bed of the feature itself. All specified planting should be chosen with consideration for ease of maintenance.
  - The Basins should form part of the open-space strategy. They should be open and accessible.
- 4.11 The attenuation basins will provide the necessary attenuation and long-term storage volumes simultaneously. A lower outfall will be designed to initially discharge at no more than 2 l/s/ha. Once the long-term storage has been filled, a second outfall will engage, with the resulting total discharge restricted to the site's pre-development greenfield runoff rates, minus 10%, up to a maximum of the 100 year rate.
- 4.12 The peak rates of discharge will be managed by a series of hydraulic controls, with the restricted outflows being discharged to the River Lodden.
- 4.13 The proposed drainage strategy ensures the existing rate and volume of runoff entering the Sette Brook from the application site is reduced, offering a reduced flood risk to properties at Cole Street Lane.
- 4.14 Similarly, the peak rates of discharge to the River Lodden are being reduced by 10%. In addition, by safeguarding against the upper end allowances for climate change (40%), the development will offer further betterment to the River Lodden and its downstream catchment until such time as this level of climate change has been realised (estimated as 2119).

#### Long-term storage volume

- 4.15 The required long-term storage volume has been calculated utilising Equation 24.10 within CIRIA C753 'The SuDS Manual'.
- 4.16 A copy of the calculation sheet has been included in Appendix F of this report, with the result summarised by Table 4.2 below;

Table 4.2 – Long-Term Storage Volume

100 year +40% LTS Volume	1015 m <sup>3</sup> Total (or 57 m <sup>3</sup> per hectare of impermeable c'ment)
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## Attenuation storage volumes

- 4.17 The MicroDrainage Source Control module has been used to determine the combined 100 year +40% climate change Long-Term and basic attenuation requirements per hectare of impermeable catchment.
- 4.18 The output of this model can be seen within Appendix G of this report, with the result summarised in Table 4.3 below.

Table 4.3 – Long-Term &amp; Basic Attenuation Volumes

100 year +40% LTS & Att Volume	580 m <sup>3</sup> per hectare of impermeable c'ment)
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- 4.19 This volume has been prorated across all development parcels (labelled from west to east as Parcel's A to E) within the application boundary to establish the total site attenuation, as summarised by Table 4.4 below;

Table 4.4 – Total Site Attenuation Volume

Dev. Parcel Ref.	Gross Dev Area (ha)	Assumed % Imp.	Dev. Imp. Area (ha)	Highway Area (ha)	Total Imp. Area (ha)	Att. Req. (m <sup>3</sup> )
A	2.66	60%	1.60	0.63	2.22	1,300
B	1.71	60%	1.03	0.43	1.46	850
C	3.24	60%	1.94	0.20	2.14	1,250
D	11.43	60%	6.86	0.63 <i>Inc. School</i>	7.49	4,350
E	6.12	60%	3.67	0.62	4.29	2,500
Total	29.33	-	17.60	2.51	17.60	10,250

- 4.20 The drawing included within Appendix D (reference 0456-PDL-101) shows a preliminary drainage layout for the site.

## Exceedance events

- 4.21 During exceedance events, beyond the 100 year critical storm, surface water runoff will overflow from the aforementioned systems.

- 4.22 Overland flow will follow the topography of the site and where possible will route through green corridors or the proposed highway network, towards convenient holding points, such as areas of public open space, parking courts and the proposed attenuation features, where the freeboard allowances can be utilised.
- 4.23 At the Reserved Matters stage any natural valleys which are susceptible to surface water flooding should be re-profiled, or must otherwise incorporate appropriate exceedance pathways (i.e. green corridors or highway alignments), which aim to steer flows towards convenient holding points.

#### Maintenance

- 4.24 Any adoptable sewerage networks will be designed in accordance with Sewers for Adoption (SfA) and will be offered to WW for adoption.
- 4.25 Any storm drainage which solely serves the adopted highway will be offered to the highway authority for adoption.
- 4.26 Any private drainage will be designed in accordance with Building Regulations Part H and will become the responsibility of the respective homeowner, or where otherwise a 3<sup>rd</sup> party management company.

The operation and maintenance of any SuDS features must be undertaken in accordance with 'CIRIA C753 – The SUDS Manual, Chapter 32 – Operation and Maintenance'.

## 5 Miscellaneous Issues

### Construction issues

- 5.1 It is good practice to offer a Construction Environmental Management Plan (CEMP) to allow the construction and phasing of drainage works to be closely monitored. Prior to the commencement of construction, it is recommended the contractor produce a CEMP and agree it with the LLFA.
- 5.2 Any facilities for the storage of oils, fuels or chemicals need to be situated in suitable bunded bases that will be equivalent to at least the volume of the tank plus 10%.

### Residual flood risks

- 5.3 The proposed developable area has been located outside the 1% and 0.1% AEP flood extents, within 'Flood Zone 1', and is outside of any areas susceptible to flooding from surface water, on this basis there are no residual flood risks with regard to development within high risk flood zones.
- 5.4 The residual risk of blockage or failure of any key component within the proposed drainage strategy will be reduced through appropriate operation and maintenance procedures (in accordance with CIRIA C753 – The SUDS Manual, Chapter 32 – Operation and Maintenance').
- 5.5 At the reserved matters stage the residual risks from exceedance storms will be reduced through appropriate design of the external works and highway alignments. The design will aim to steer exceedance flows away from primary access and egress routes and towards convenient holding points.

### Health and safety

- 5.6 Until such time as the hazards relating to the site or location are known, we are unable to confirm that our recommendations will be acceptable in terms of safe buildability / maintainability.
- 5.7 Under the CDM Regulations, adequate information about the site must be provided by the client in order to allow the potential hazards to be reviewed by the designer, and avoidance / mitigation measures taken where reasonably practicable.

## 6 Mitigation, Conclusions and Recommendations

### Mitigation

- 6.1 The proposed development has been assessed in line with the NPPF, to allow the planning application to be progressed and to show that the development can be undertaken in an acceptable manner from a flood risk perspective.
- 6.2 This proposed development parcels are located within 'Flood Zone 1' and are outside of areas susceptible to flooding from surface water. This means the development is not at risk of flooding from fluvial sources in up to the 1 in 1000 year return period flood.
- 6.3 The proposals comprise three main vehicular access locations. The primary location with the B3081 Shaftesbury Road to the east is within Flood Zone 1 and offers safe access and egress for all people. The remaining vehicular access locations provide southbound and northbound connectivity with the B3092 New Road and fall within the fluvial floodplain of the River Lodden.
- 6.4 Only the northbound access to New Road will present a danger during the 100 year and 1000 year flood events, however this is reflective of existing conditions and alternative routes will be available, including the southbound access to New Road and eastern access to Shaftesbury Road.
- 6.5 The drainage strategy accounts for runoff from all storms up to the 100 year return period. This ensures the development will be safe throughout its lifetime, without increasing flood risk elsewhere, whilst also taking account of the impacts of climate change.
- 6.6 A ground investigation confirms that the ground conditions are unfavourable for the use of infiltration based drainage techniques. Instead, on-site attenuation combined with off-site discharge is considered to be the most appropriate drainage solution at this site.
- 6.7 The strategy promotes a SuDS train, which includes swales, above ground storage bays and detention basins all in accordance with industry best practice. These features will offer biodiversity and ecological benefits whilst also promoting water quality enhancement.

- 6.8 Any future attenuation basins should follow the design code promoted within the 'Proposed Surface Water Strategy' section of this report.
- 6.9 Long Term Storage will be utilised to mitigate the impacts of any increased volume of runoff caused by the development.
- 6.10 Surface water runoff generated by the site will be attenuated on site and discharged to the River Lodden at rates which offer 10% reduction on the pre-development greenfield scenario.
- 6.11 The strategy also safeguards against the upper end allowances for climate change (40%), which will provide further betterment until such time as this level of climate change has been realised (estimated as 2119).
- 6.12 As a result of the oversizing of the attenuation features outlined in 6.8 and 6.9 above, there will be a significant reduction in surface water runoff from the completed development when compared to the current scenario. As a result the flood risk to low lying downstream properties will be reduced in line with best practice.
- 6.13 Development flows must not discharge to upper reaches of the ordinary watercourse (Sette Brook) which passes through the site. This will offer some relief to the existing watercourse which naturally receives runoff from the site but is understood to experience regular flooding at Cole Street Lane.
- 6.14 Exceedance flows will route towards convenient holding points and away from dwellings and primary access routes. The proposed detention basins will include freeboard allowances which can be utilised to attenuate exceedance runoff.



## Conclusions

*This Flood Risk Assessment has been assessed in line with the NPPF. It is concluded that the development can be undertaken in a sustainable manner, whilst also reducing the flood risk to existing properties in the downstream catchment.*

*The FRA does not attempt to present a final design of the surface water system. Detailed design of the surface water network and inherent features will commence upon approval of the outline strategy and will include assessments due to further site investigations, health and safety, CDM*

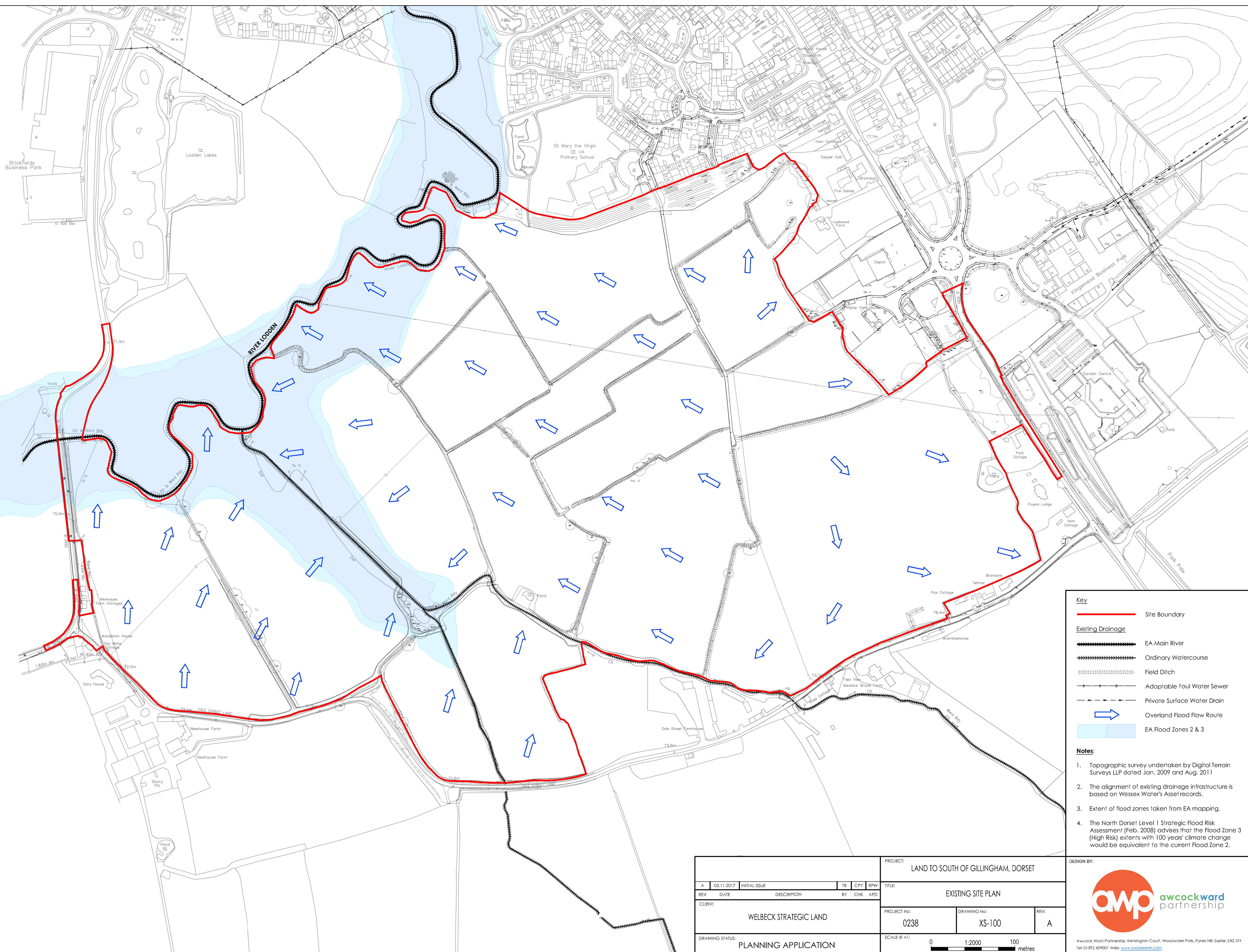
## Recommendations

- 6.15 As the development will be safe from flooding for its design life and will actively reduce flood risk to properties in the downstream catchment, it is recommended that the Lead Local Flood Authority advise the local planning authority that they have no objections to the proposed development.



## Appendix A Topographic Survey






**Key**

- Site Boundary
- Existing Drainage**
  - EA Main River
  - Ordinary Watercourse
  - Field Ditch
  - Adoptable Foul Water Sewer
  - Private Surface Water Drain
  - Overland Flood Flow Route
  - EA Flood Zones 2 & 3

**Notes:**

- Topographic survey undertaken by Digital Terrain Surveys LLP dated Jan. 2009 and Aug. 2011
- The alignment of existing drainage infrastructure is based on Wessex Water's Asset records.
- Extent of flood zones taken from EA mapping.
- The North Dorset Level 1 Strategic Flood Risk Assessment (Feb. 2008) advises that the Flood Zone 3 (High Risk) extents with 100 years' climate change would be equivalent to the current Flood Zone 2.

				PROJECT: LAND TO SOUTH OF GILLINGHAM, DORSET																			
A				03.11.2017		INITIAL ISSUE		TB		CPY		RPW		TITLE: EXISTING SITE PLAN									
REV				DATE				DESCRIPTION				BY				CHK		APD					
CLIENT:  WELBECK STRATEGIC LAND														PROJECT No:  0238				DRAWING No:  XS-100				REV:  A	
DRAWING STATUS:  PLANNING APPLICATION														SCALE @ A1:  0 1:2000 100 metres 									



Awcock Ward Partnership, Kersington Court, Woodwater Park, Pynes Hill, Exeter, EX2 5TY  
Tel: 01392 409007 Web: [www.awpexeter.com](http://www.awpexeter.com)





## Appendix B Ground Investigation Extracts

## EXECUTIVE SUMMARY

<b>Proposals</b>	It is proposed to develop land at South Gillingham for residential purposes.
<b>Site History</b>	Old Ordnance Survey maps showed the site has comprised many fields of varying sizes separated by hedgerows since first edition (1880s) maps. Orchards were present in the northeast of the site and a 'smithy' was present off-site to the southeast of the site from the late 1800s until the mid 1900s.
<b>Site Geology</b>	The British Geological Survey (BGS) map of the area indicates the site to be underlain by Late Jurassic Kimmeridge Clay Formation, overlain by Quaternary Head deposits across much of the site, particularly around the site's periphery, and also overlain by Quaternary Alluvium, adjacent to the stream and drainage channel.
<b>Ground Conditions Encountered</b>	63 (sixty-three) trial pits typically encountered ground conditions of topsoil, underlain by firm to stiff silty clay, with occasional softer horizons and beds of (loose to medium dense) clayey sandy gravel. Groundwater was encountered in approximately 20% of the trial pits.
<b>Foundations</b>	<p>The results of this investigation indicate that strip or trench-fill foundations are generally suitable to support the proposed structures.</p> <p>However, it is noted that the bearing capacity of the soils varies across the site. Similarly, the volume change potential of the soil varies across the site: although much of the site is underlain by clays of medium volume change potential, locally, soils of high and low volume change potential are also present.</p> <p>Prior to development, further, more intensive, investigation is recommended to confirm the bearing capacity and volume change potential of the soils in a particular area.</p>
<b>Concrete</b>	Elevated levels of soluble sulphate (exceeding 5,000mg/kg) have been recorded. Design Sulphate Class DS-4, Aggressive Chemical Environment for Concrete (ACEC) Class AC-4, is required for all buried concrete at this site.
<b>Roads</b>	From an assessment of the ground conditions encountered and laboratory testing results, a CBR value of 2% is recommended for road pavement design.
<b>Soakaways</b>	In-situ soakaway testing showed that the ground has a low permeability and is unsuitable for the use of soakaway drainage. Off-site discharge, possibly combined with on-site attenuation, is considered to be the most suitable drainage solution.



**In Accordance with BRE 365 "Soakaway Design"**

Job Title: South Gillingham Urban Expansion  
Job No.: 14114  
Client: South Gillingham Consortium  
Date: Jul-14

Test No. TP08

Length (m):	3.10
Width (m):	0.70
Depth (m):	2.60
Start Water Level (m):	1.00
Total Depth of Test	1.60

[illegible]

## Soakaway Test Results In Accordance with BRE 365 "Soakaway Design"

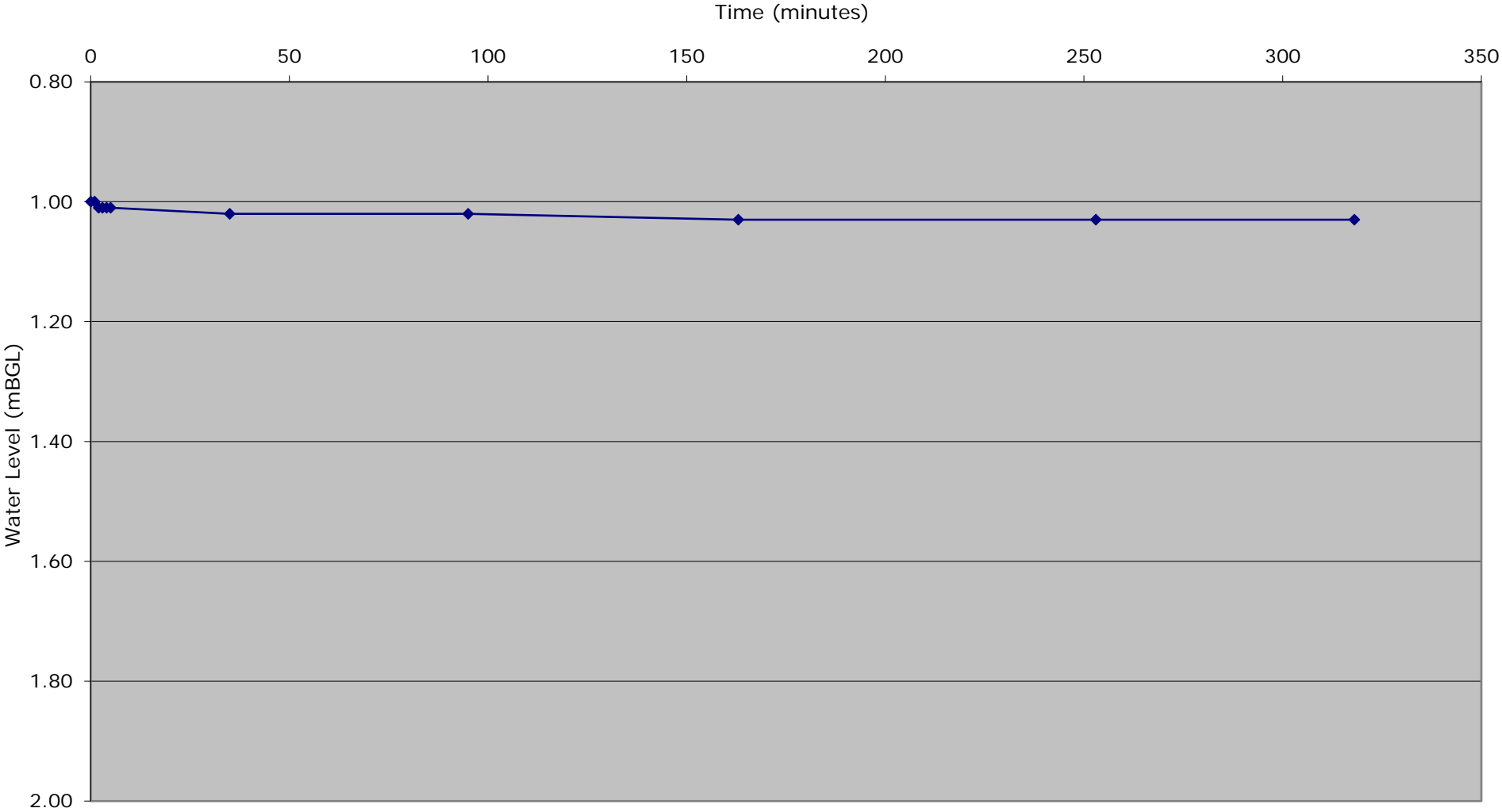
### Calculations

$$\begin{aligned} \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ \\ \text{Where} \\ V_{p75-25} &= \text{effective storage volume of water in the trial pit between 75\% and 25\% effective depth} \\ &= 3.10 \times 0.70 \times 0.80 \\ &= \underline{1.736 \text{ m}^3} \\ a_{p50} &= \text{internal surface area of the trial pit up to 50\% effective depth and including the base area} \\ &= 1.12 + 4.96 + 2.17 \\ &= \underline{8.25 \text{ m}^2} \\ t_{p75-25} &= \text{time for the water level to fall from 75\% to 25\% effective depth} \\ &\quad \begin{array}{l} 25\% \text{ effective depth} = 1.4 \\ 75\% \text{ effective depth} = 2.2 \end{array} \\ &= \text{ } - \text{ } \text{ mins} \\ &= 0 \text{ mins} \\ &= \underline{0 \text{ secs}} \\ \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ &= 1.736 / 8.25 \times 0 \\ &= \underline{\#DIV/0! \text{ m/s}} \end{aligned}$$

OTHER NOTES:



Soakaway Test Results - TP08





**In Accordance with BRE 365 "Soakaway Design"**

Test No. TP12

Length (m):	2.90
Width (m):	0.70
Depth (m):	2.50
Start Water Level (m):	0.98
Total Depth of Test	1.52

[illegible]

## Soakaway Test Results

### In Accordance with BRE 365 "Soakaway Design"

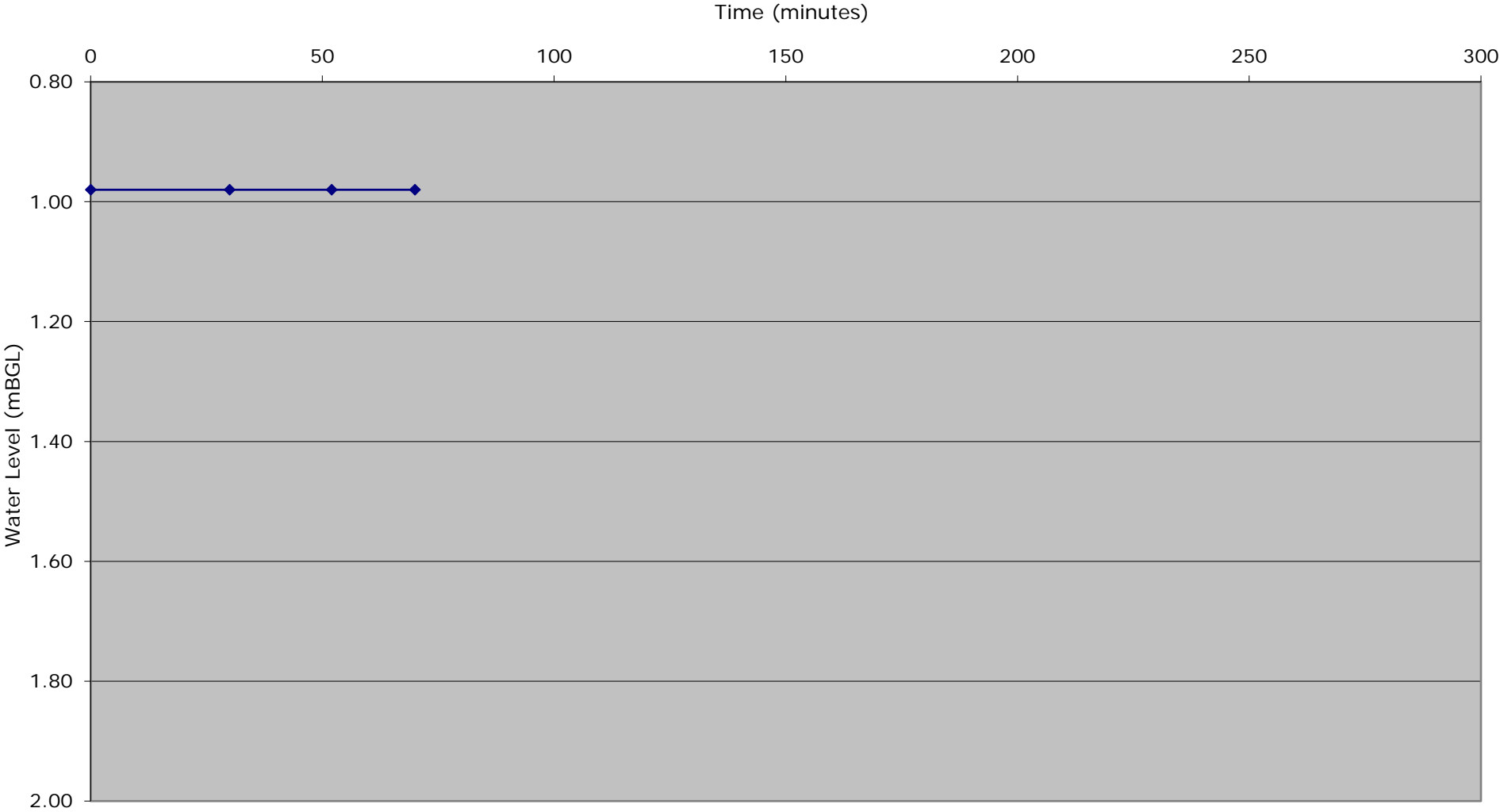
#### Calculations

$$\begin{aligned} \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ \\ \text{Where} \\ V_{p75-25} &= \text{effective storage volume of water in the trial pit between 75\% and 25\% effective depth} \\ &= 2.90 \times 0.70 \times 0.76 \\ &= \underline{1.5428 \text{ m}^3} \\ a_{p50} &= \text{internal surface area of the trial pit up to 50\% effective depth and including the base area} \\ &= 1.06 + 4.41 + 2.03 \\ &= \underline{7.502 \text{ m}^2} \\ t_{p75-25} &= \text{time for the water level to fall from 75\% to 25\% effective depth} \\ &\quad \begin{array}{l} 25\% \text{ effective depth} = 1.36 \\ 75\% \text{ effective depth} = 2.12 \end{array} \\ &= \text{ } - \text{ } \text{ mins} \\ &= 0 \text{ mins} \\ &= \underline{0 \text{ secs}} \\ \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ &= 1.5428 / 7.502 \times 0 \\ &= \underline{\#DIV/0! \text{ m/s}} \end{aligned}$$

OTHER NOTES:



Soakaway Test Results - TP12



**In Accordance with BRE 365 "Soakaway Design"**

Test No. TP22

Length (m):	2.80
Width (m):	0.70
Depth (m):	2.50
Start Water Level (m):	0.95
Total Depth of Test	1.55

[illegible]

## Soakaway Test Results In Accordance with BRE 365 "Soakaway Design"

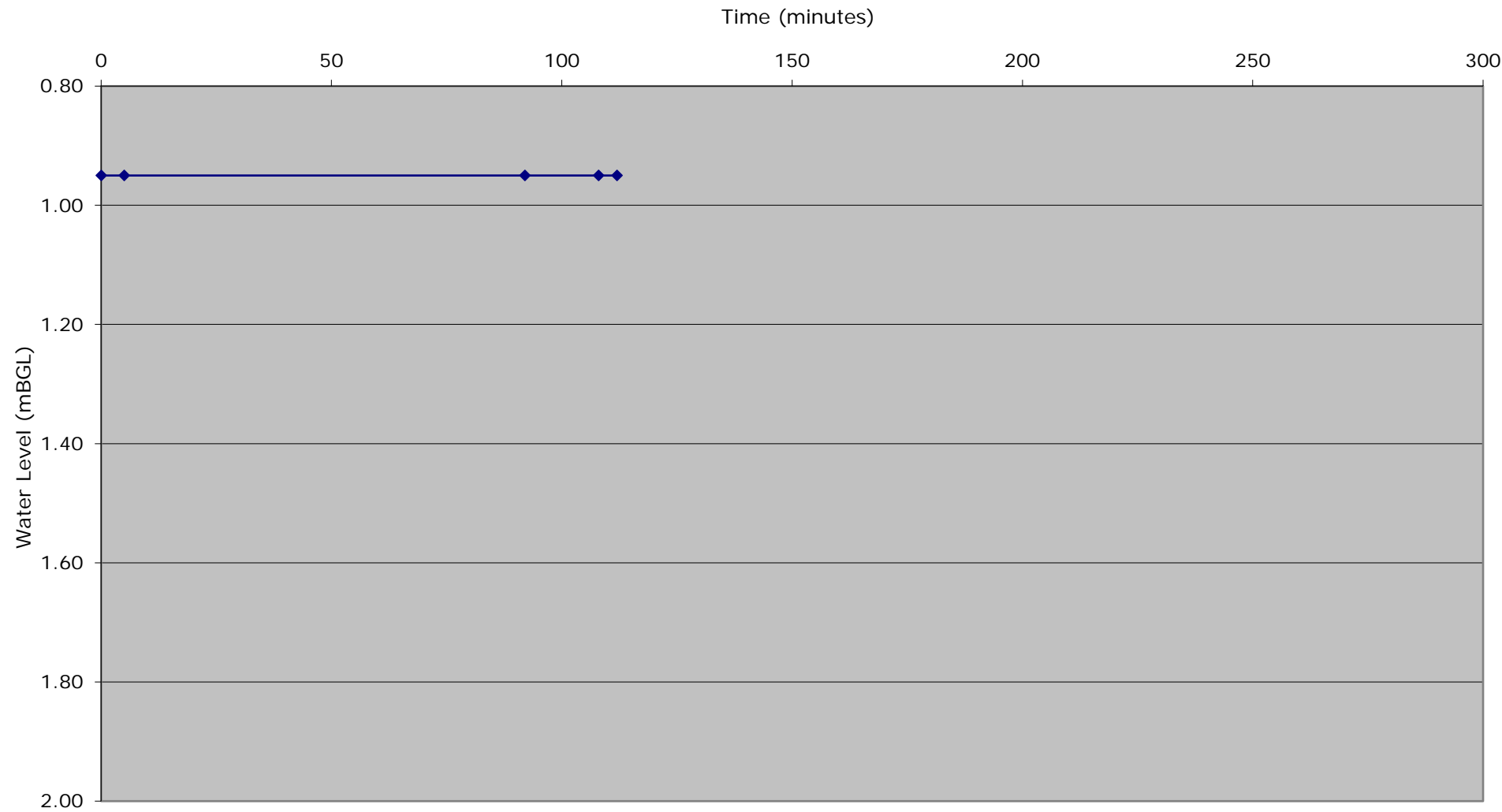
### Calculations

Soil Infiltration Rate (f)	=	$(V_{p75-25}) / (a_{p50} \times t_{p75-25})$
Where		
$V_{p75-25}$	=	effective storage volume of water in the trial pit between 75% and 25% effective depth
	=	$2.80 \times 0.70 \times 0.78$
	=	<u>1.519 m<sup>3</sup></u>
$a_{p50}$	=	internal surface area of the trial pit up to 50% effective depth and including the base area
	=	$1.09 + 4.34 + 1.96$
	=	<u>7.385 m<sup>2</sup></u>
$t_{p75-25}$	=	time for the water level to fall from 75% to 25% effective depth
		25% effective depth = 1.3375
		75% effective depth = 2.1125
	=	<span style="background-color: #e0ffff;">          </span> - <span style="background-color: #e0ffff;">          </span> mins
	=	0 mins
	=	<u>0 secs</u>
Soil Infiltration Rate (f)	=	$(V_{p75-25}) / (a_{p50} \times t_{p75-25})$
	=	$1.519 / 7.385 \times 0$
	=	<u>#DIV/0!</u> m/s

OTHER NOTES:



Soakaway Test Results - TP22



**In Accordance with BRE 365 "Soakaway Design"**

Test No. TP25

Length (m):	3.20
Width (m):	0.70
Depth (m):	2.60
Start Water Level (m):	0.93
Total Depth of Test	1.67

[illegible]

## Soakaway Test Results In Accordance with BRE 365 "Soakaway Design"

### Calculations

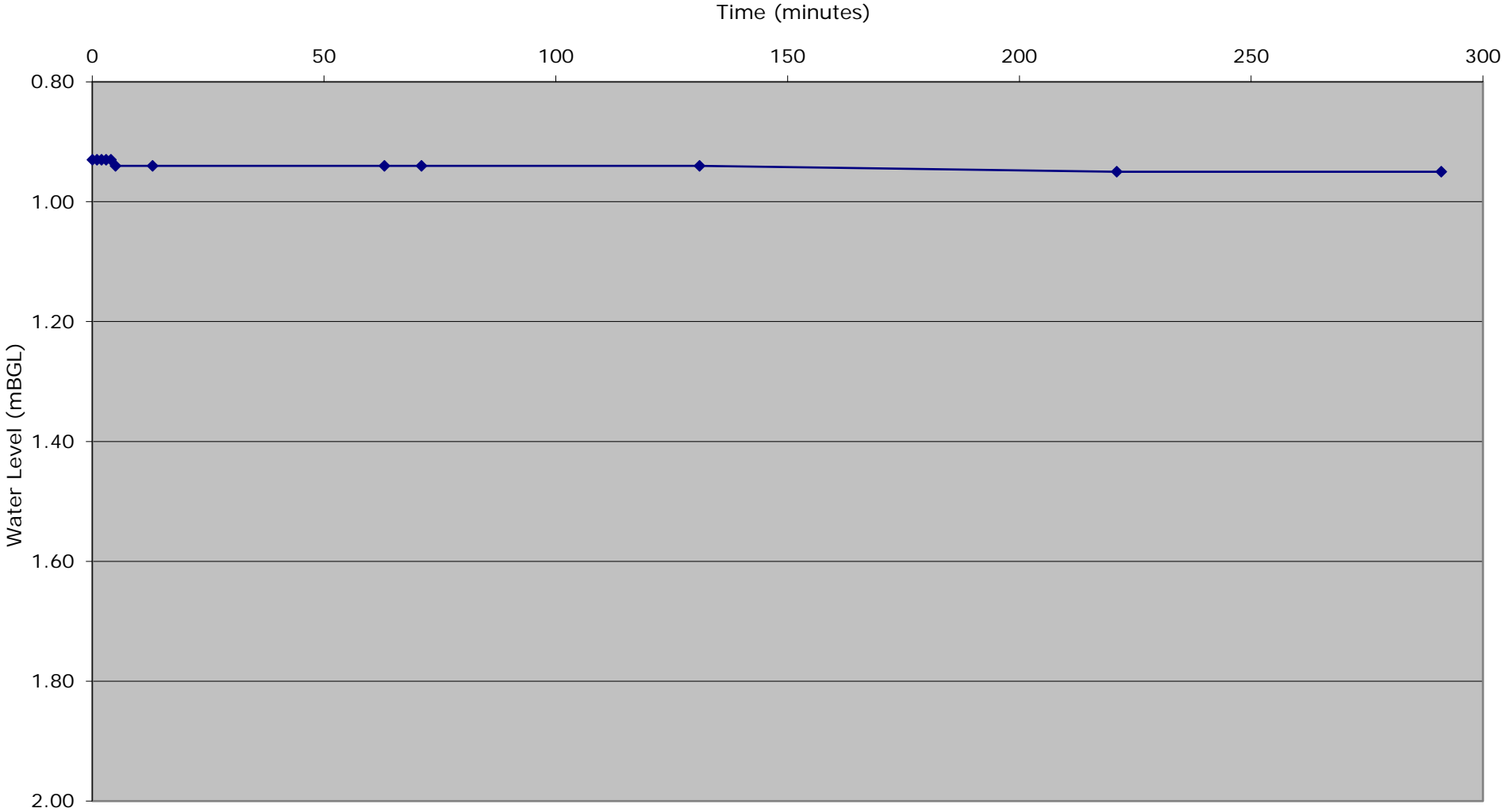
$$\begin{aligned} \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ \\ \text{Where} \\ V_{p75-25} &= \text{effective storage volume of water in the trial pit between 75\% and 25\% effective depth} \\ &= 3.20 \times 0.70 \times 0.84 \\ &= \underline{1.8704 \text{ m}^3} \\ a_{p50} &= \text{internal surface area of the trial pit up to 50\% effective depth and including the base area} \\ &= 1.17 + 5.34 + 2.24 \\ &= \underline{8.753 \text{ m}^2} \\ t_{p75-25} &= \text{time for the water level to fall from 75\% to 25\% effective depth} \\ &\quad \begin{array}{l} 25\% \text{ effective depth} = 1.3475 \\ 75\% \text{ effective depth} = 2.1825 \end{array} \\ &= \text{ } - \text{ } \text{ mins} \\ &= 0 \text{ mins} \\ &= \underline{0 \text{ secs}} \\ \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ &= 1.8704 / 8.753 \times 0 \\ &= \underline{\underline{\#DIV/0! \text{ m/s}}} \end{aligned}$$

OTHER NOTES:





Soakaway Test Results - TP25



**In Accordance with BRE 365 "Soakaway Design"**

Test No. TP30

Length (m):	2.60
Width (m):	0.70
Depth (m):	2.50
Start Water Level (m):	1.02
Total Depth of Test	1.48

[illegible]

## Soakaway Test Results In Accordance with BRE 365 "Soakaway Design"

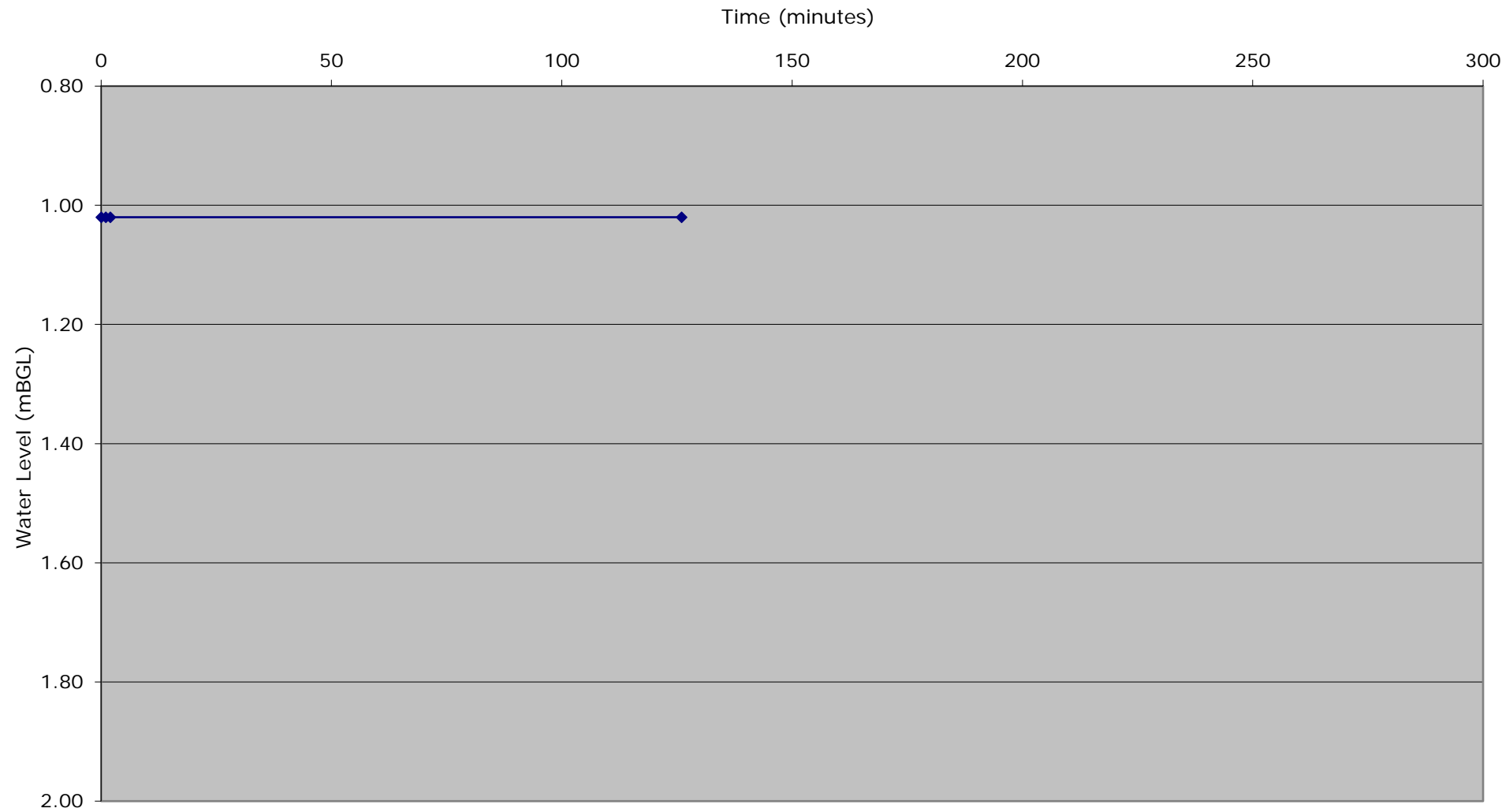
### Calculations

$$\begin{aligned} \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ \\ \text{Where} \\ V_{p75-25} &= \text{effective storage volume of water in the trial pit between 75\% and 25\% effective depth} \\ &= 2.60 \times 0.70 \times 0.74 \\ &= \underline{1.3468 \text{ m}^3} \\ a_{p50} &= \text{internal surface area of the trial pit up to 50\% effective depth and including the base area} \\ &= 1.04 + 3.85 + 1.82 \\ &= \underline{6.704 \text{ m}^2} \\ t_{p75-25} &= \text{time for the water level to fall from 75\% to 25\% effective depth} \\ &\quad \begin{array}{l} 25\% \text{ effective depth} = 1.39 \\ 75\% \text{ effective depth} = 2.13 \end{array} \\ &= \text{ } - \text{ } \text{ mins} \\ &= 0 \text{ mins} \\ &= \underline{0 \text{ secs}} \\ \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ &= 1.3468 / 6.704 \times 0 \\ &= \underline{\underline{\#DIV/0! \text{ m/s}}} \end{aligned}$$

OTHER NOTES:



Soakaway Test Results - TP30



**In Accordance with BRE 365 "Soakaway Design"**

Job Title: South Gillingham Urban Expansion  
Job No.: 14114  
Client: South Gillingham Consortium  
Date: Jul-14

Test No. TP44

Length (m):	3.10
Width (m):	0.70
Depth (m):	2.50
Start Water Level (m):	0.90
Total Depth of Test	1.60

[illegible]

## Soakaway Test Results

### In Accordance with BRE 365 "Soakaway Design"

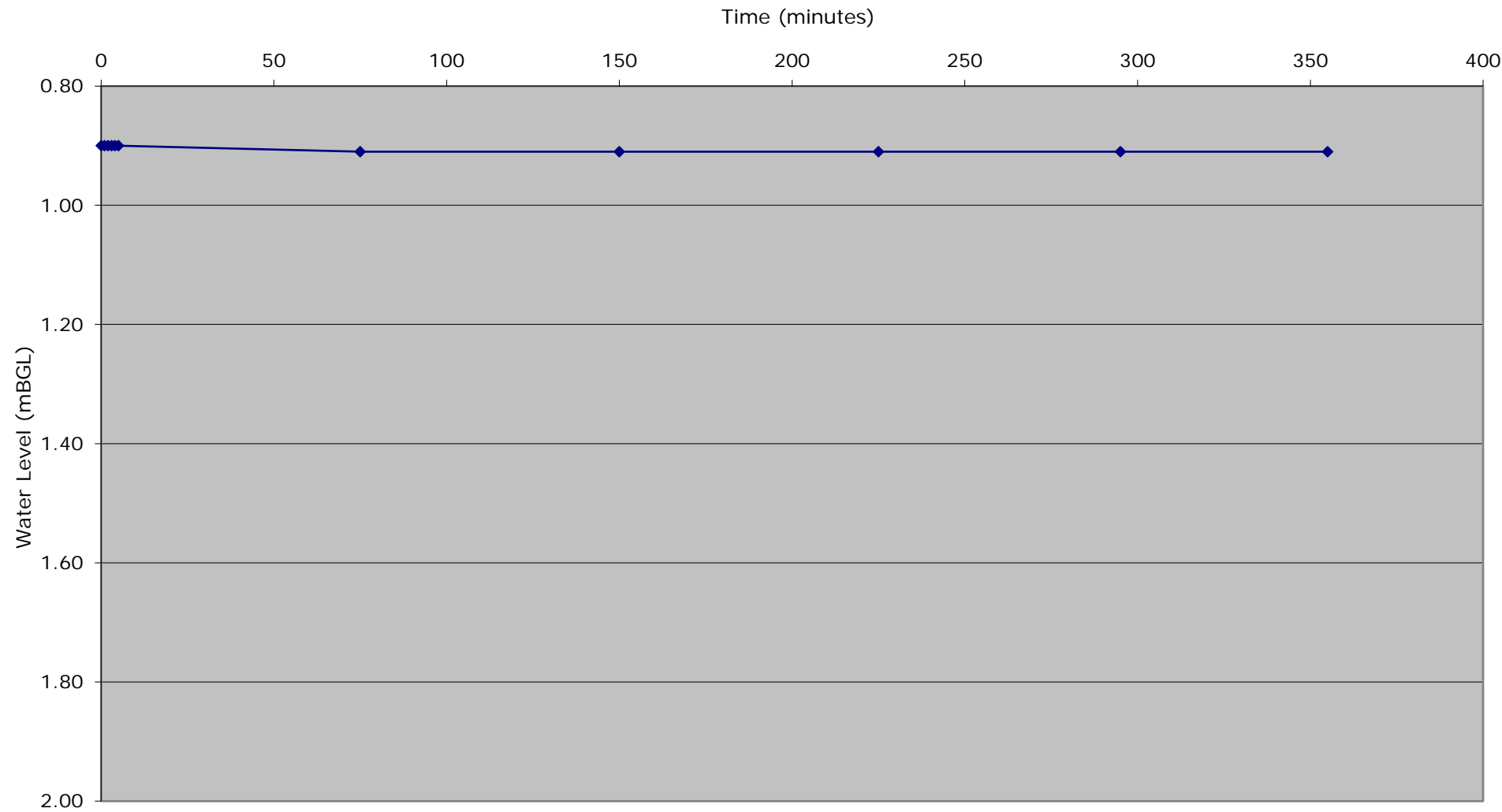
#### Calculations

$$\begin{aligned}
 \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\
 \\
 \text{Where} \\
 V_{p75-25} &= \text{effective storage volume of water in the trial pit between 75\% and 25\% effective depth} \\
 &= 3.10 \times 0.70 \times 0.80 \\
 &= \underline{1.736 \text{ m}^3} \\
 a_{p50} &= \text{internal surface area of the trial pit up to 50\% effective depth and including the base area} \\
 &= 1.12 + 4.96 + 2.17 \\
 &= \underline{8.25 \text{ m}^2} \\
 t_{p75-25} &= \text{time for the water level to fall from 75\% to 25\% effective depth} \\
 \begin{aligned}
 &25\% \text{ effective depth} = 1.3 \\
 &75\% \text{ effective depth} = 2.1
 \end{aligned} \\
 &= \text{ } - \text{ } \text{ mins} \\
 &= 0 \text{ mins} \\
 &= \underline{0 \text{ secs}} \\
 \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\
 &= 1.736 / 8.25 \times 0 \\
 &= \underline{\#DIV/0! \text{ m/s}}
 \end{aligned}$$

OTHER NOTES:



Soakaway Test Results - TP44



**In Accordance with BRE 365 "Soakaway Design"**

Job Title: South Gillingham Urban Expansion  
Job No.: 14114  
Client: South Gillingham Consortium  
Date: Jul-14

Test No. TP49

Length (m):	3.00
Width (m):	0.70
Depth (m):	2.60
Start Water Level (m):	0.99
Total Depth of Test	1.61

[illegible]



## Soakaway Test Results In Accordance with BRE 365 "Soakaway Design"

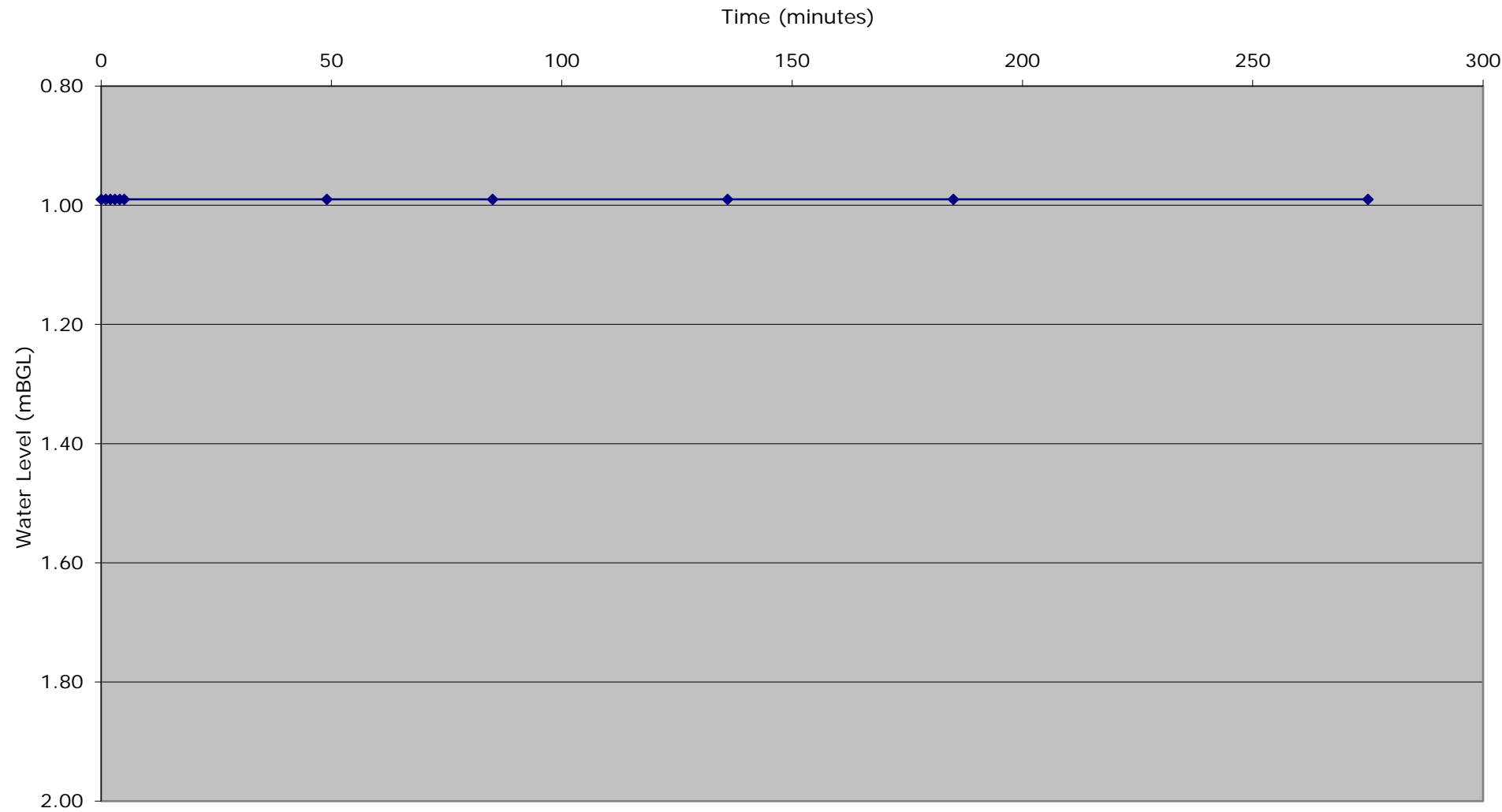
### Calculations

Soil Infiltration Rate (f)	=	$(V_{p75-25}) / (a_{p50} \times t_{p75-25})$
Where		
$V_{p75-25}$	=	effective storage volume of water in the trial pit between 75% and 25% effective depth
	=	$3.00 \times 0.70 \times 0.81$
	=	<u>1.6905 m<sup>3</sup></u>
$a_{p50}$	=	internal surface area of the trial pit up to 50% effective depth and including the base area
	=	$1.13 + 4.83 + 2.10$
	=	<u>8.057 m<sup>2</sup></u>
$t_{p75-25}$	=	time for the water level to fall from 75% to 25% effective depth
		25% effective depth = 1.3925
		75% effective depth = 2.1975
	=	<span style="background-color: #e0ffff;">          </span> - <span style="background-color: #e0ffff;">          </span> mins
	=	0 mins
	=	<u>0 secs</u>
Soil Infiltration Rate (f)	=	$(V_{p75-25}) / (a_{p50} \times t_{p75-25})$
	=	$1.6905 / 8.057 \times 0$
	=	<u>#DIV/0!</u> m/s

OTHER NOTES:



Soakaway Test Results - TP49



**In Accordance with BRE 365 "Soakaway Design"**

Job Title: South Gillingham Urban Expansion  
Job No.: 14114  
Client: South Gillingham Consortium  
Date: Jul-14

Test No. TP58

Length (m):	3.10
Width (m):	0.70
Depth (m):	2.60
Start Water Level (m):	1.00
Total Depth of Test	1.60

[illegible]

## Soakaway Test Results In Accordance with BRE 365 "Soakaway Design"

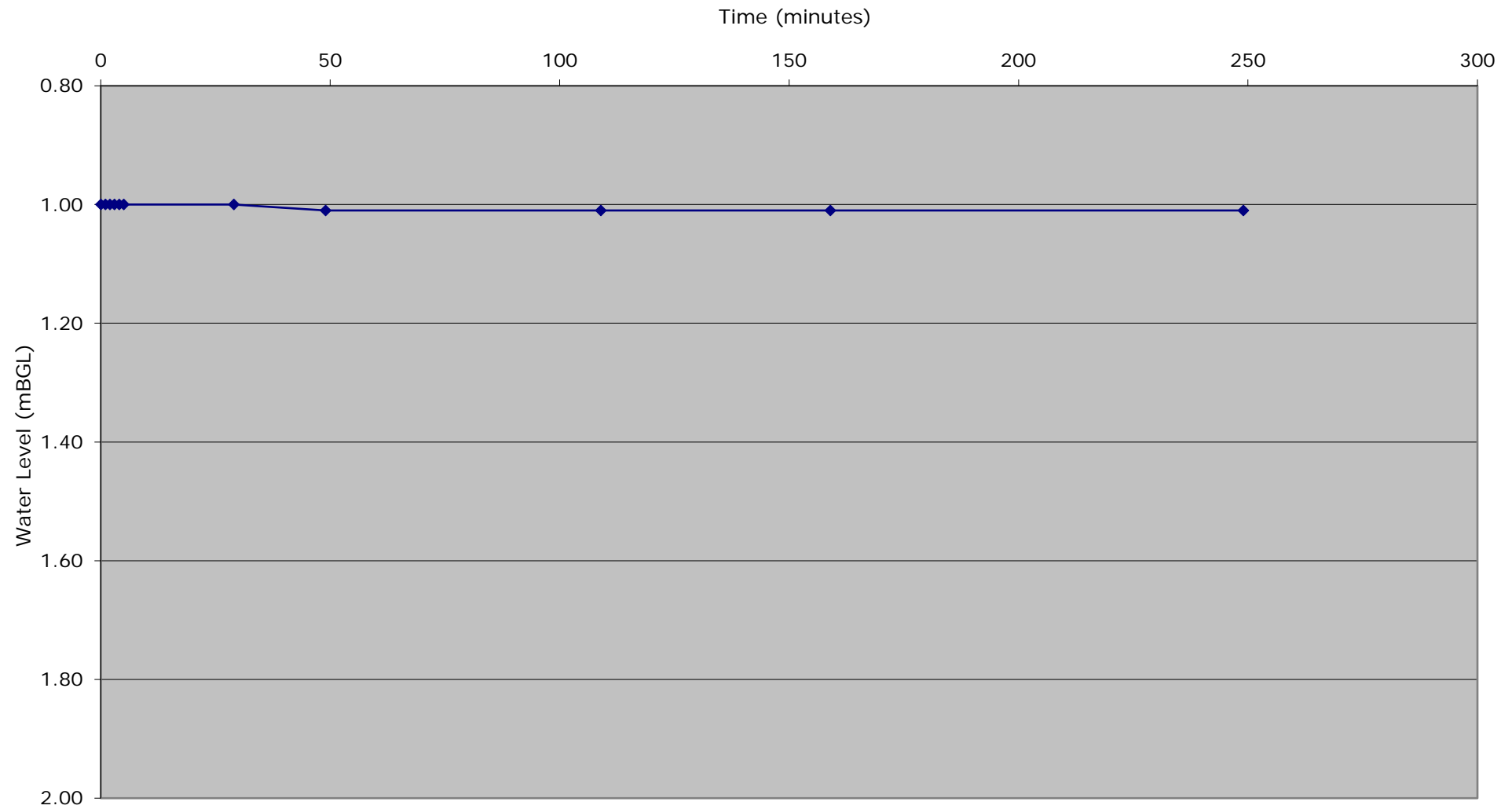
### Calculations

Soil Infiltration Rate (f)	=	$(V_{p75-25}) / (a_{p50} \times t_{p75-25})$
Where		
$V_{p75-25}$	=	effective storage volume of water in the trial pit between 75% and 25% effective depth
	=	$3.10 \times 0.70 \times 0.80$
	=	<u>1.736 m<sup>3</sup></u>
$a_{p50}$	=	internal surface area of the trial pit up to 50% effective depth and including the base area
	=	$1.12 + 4.96 + 2.17$
	=	<u>8.25 m<sup>2</sup></u>
$t_{p75-25}$	=	time for the water level to fall from 75% to 25% effective depth
		25% effective depth = 1.4
		75% effective depth = 2.2
	=	<span style="background-color: #e0ffff;">          </span> - <span style="background-color: #e0ffff;">          </span> mins
	=	0 mins
	=	<u>0 secs</u>
Soil Infiltration Rate (f)	=	$(V_{p75-25}) / (a_{p50} \times t_{p75-25})$
	=	$1.736 / 8.25 \times 0$
	=	<u>#DIV/0!</u> m/s

OTHER NOTES:



# Soakaway Test Results - TP49



**In Accordance with BRE 365 "Soakaway Design"**

Test No. TP60

Length (m):	2.40
Width (m):	0.70
Depth (m):	2.50
Start Water Level (m):	1.21
Total Depth of Test	1.29

[illegible]

## Soakaway Test Results In Accordance with BRE 365 "Soakaway Design"

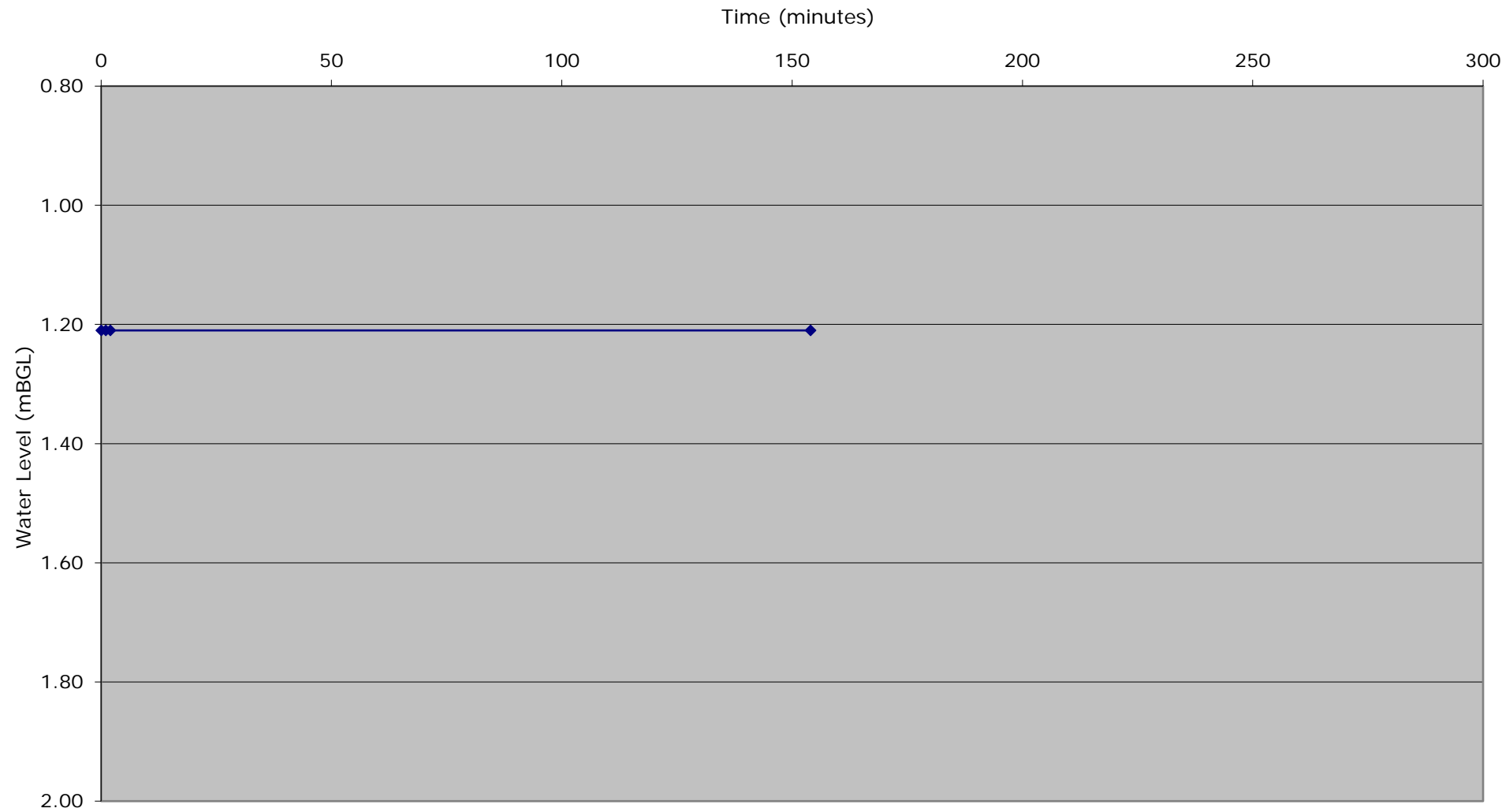
### Calculations

Soil Infiltration Rate (f)	=	$(V_{p75-25}) / (a_{p50} \times t_{p75-25})$
Where		
$V_{p75-25}$	=	effective storage volume of water in the trial pit between 75% and 25% effective depth
	=	$2.40 \times 0.70 \times 0.65$
	=	<u>1.0836 m<sup>3</sup></u>
$a_{p50}$	=	internal surface area of the trial pit up to 50% effective depth and including the base area
	=	$0.90 + 3.10 + 1.68$
	=	<u>5.679 m<sup>2</sup></u>
$t_{p75-25}$	=	time for the water level to fall from 75% to 25% effective depth
		25% effective depth = 1.5325
		75% effective depth = 2.1775
	=	<span style="background-color: #e0ffff;">          </span> - <span style="background-color: #e0ffff;">          </span> mins
	=	0 mins
	=	<u>0 secs</u>
Soil Infiltration Rate (f)	=	$(V_{p75-25}) / (a_{p50} \times t_{p75-25})$
	=	$1.0836 / 5.679 \times 0$
	=	<u>#DIV/0!</u> m/s

OTHER NOTES:



Soakaway Test Results - TP60





**In Accordance with BRE 365 "Soakaway Design"**

Job Title: South Gillingham Urban Expansion  
Job No.: 14114  
Client: South Gillingham Consortium  
Date: Jul-14

Test No. TP62

Length (m):	3.30
Width (m):	0.70
Depth (m):	2.50
Start Water Level (m):	0.94
Total Depth of Test	1.56

[illegible]

## Soakaway Test Results In Accordance with BRE 365 "Soakaway Design"

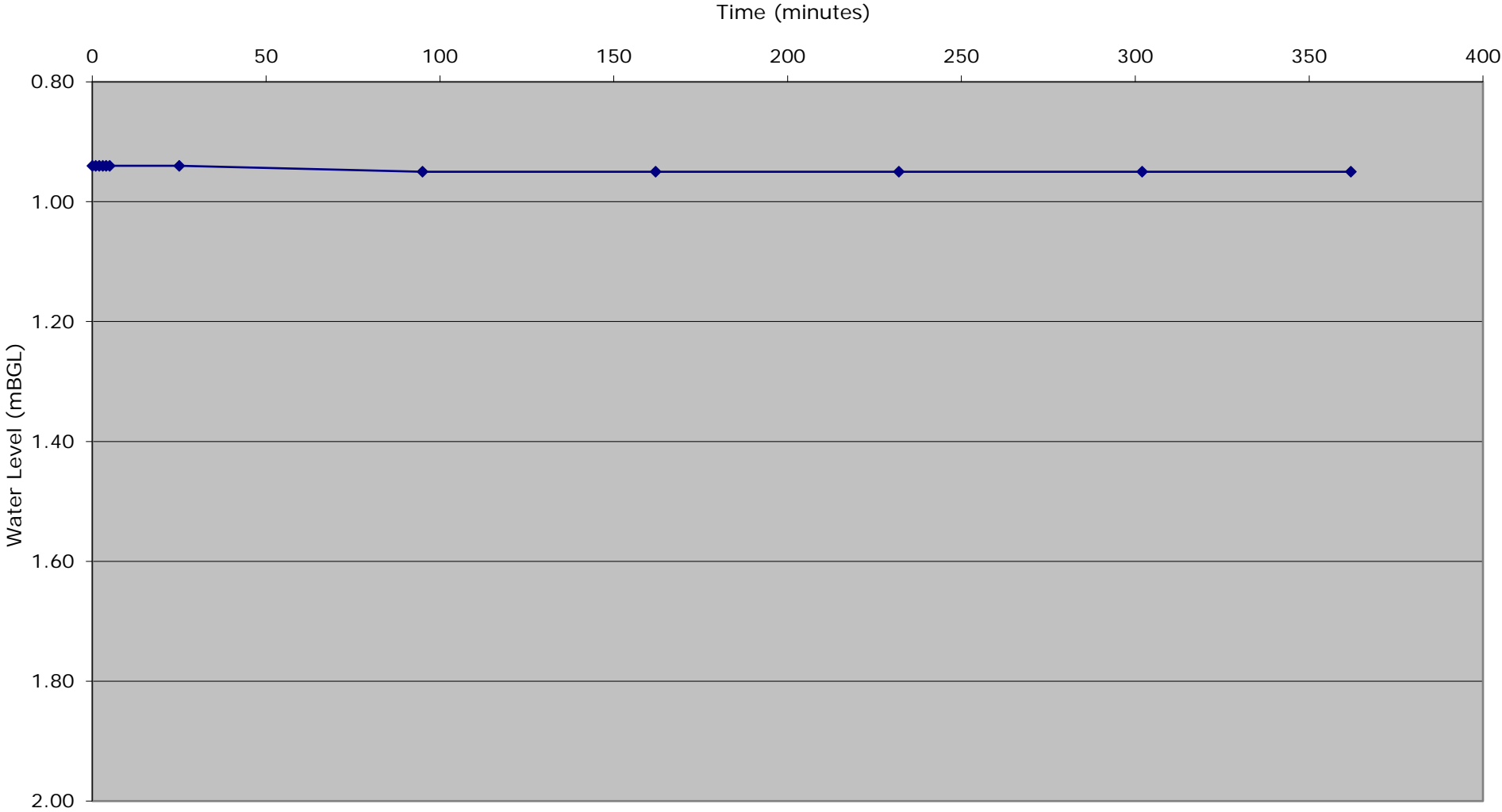
### Calculations

$$\begin{aligned} \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ \\ \text{Where} \\ V_{p75-25} &= \text{effective storage volume of water in the trial pit between 75\% and 25\% effective depth} \\ &= 3.30 \times 0.70 \times 0.78 \\ &= \underline{1.8018 \text{ m}^3} \\ a_{p50} &= \text{internal surface area of the trial pit up to 50\% effective depth and including the base area} \\ &= 1.09 + 5.15 + 2.31 \\ &= \underline{8.55 \text{ m}^2} \\ t_{p75-25} &= \text{time for the water level to fall from 75\% to 25\% effective depth} \\ &\quad \begin{array}{l} 25\% \text{ effective depth} = 1.33 \\ 75\% \text{ effective depth} = 2.11 \end{array} \\ &= \text{ } - \text{ } \text{ mins} \\ &= 0 \text{ mins} \\ &= \underline{0 \text{ secs}} \\ \text{Soil Infiltration Rate (f)} &= (V_{p75-25}) / (a_{p50} \times t_{p75-25}) \\ &= 1.8018 / 8.55 \times 0 \\ &= \underline{\#DIV/0! \text{ m/s}} \end{aligned}$$

OTHER NOTES:



Soakaway Test Results - TP62





# LEGEND:

 Trial Pit

## NOTES:

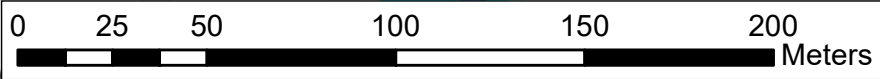
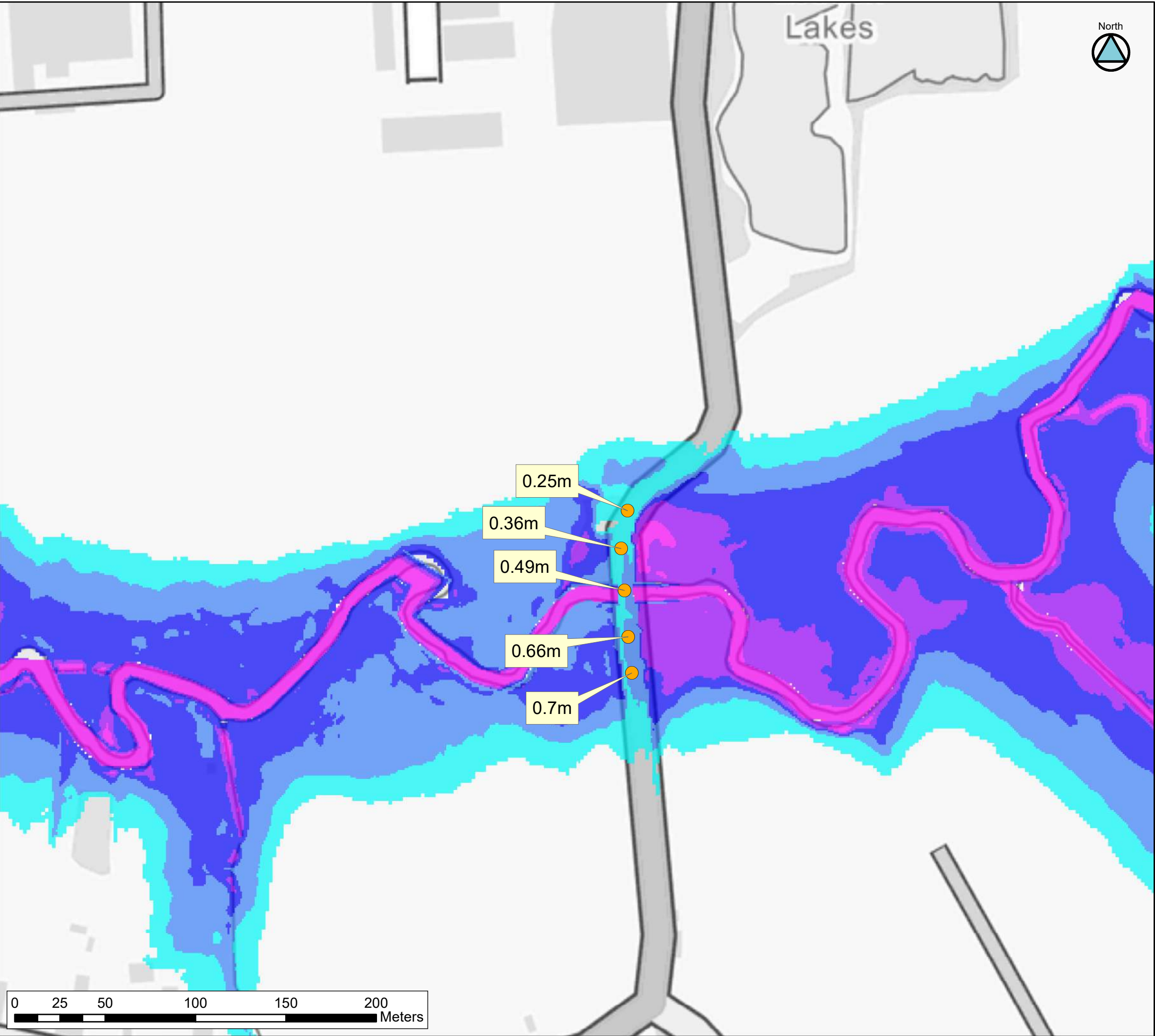
Drawn on plan supplied by client

Job Title:	SOUTH GILLINGHAM URBAN EXPANSION
Drawing Title:	TRIAL PIT LOCATION PLAN
Client:	SOUTH GILLINGHAM CONSORTIUM
 Ruddlesden geotechnical ltd The Stables 65 Langaton Lane Pinhoe Exeter EX1 3SP <a href="http://www.ruddlesden.co.uk">www.ruddlesden.co.uk</a>	
Dwg. No:	14114/02
Date:	JUL-14
Scale:	NTS



## Appendix C JBA Flood Depth & Velocity Extracts (Access on to B3092 New Road)





KEY

**Legend**

- B3092 - Point Inspection

**Depth (m)**

- 0 - 0.5m
- 0.5 - 1m
- 1 - 1.5m
- 1.5 - 2m
- 2m +

KEYPLAN

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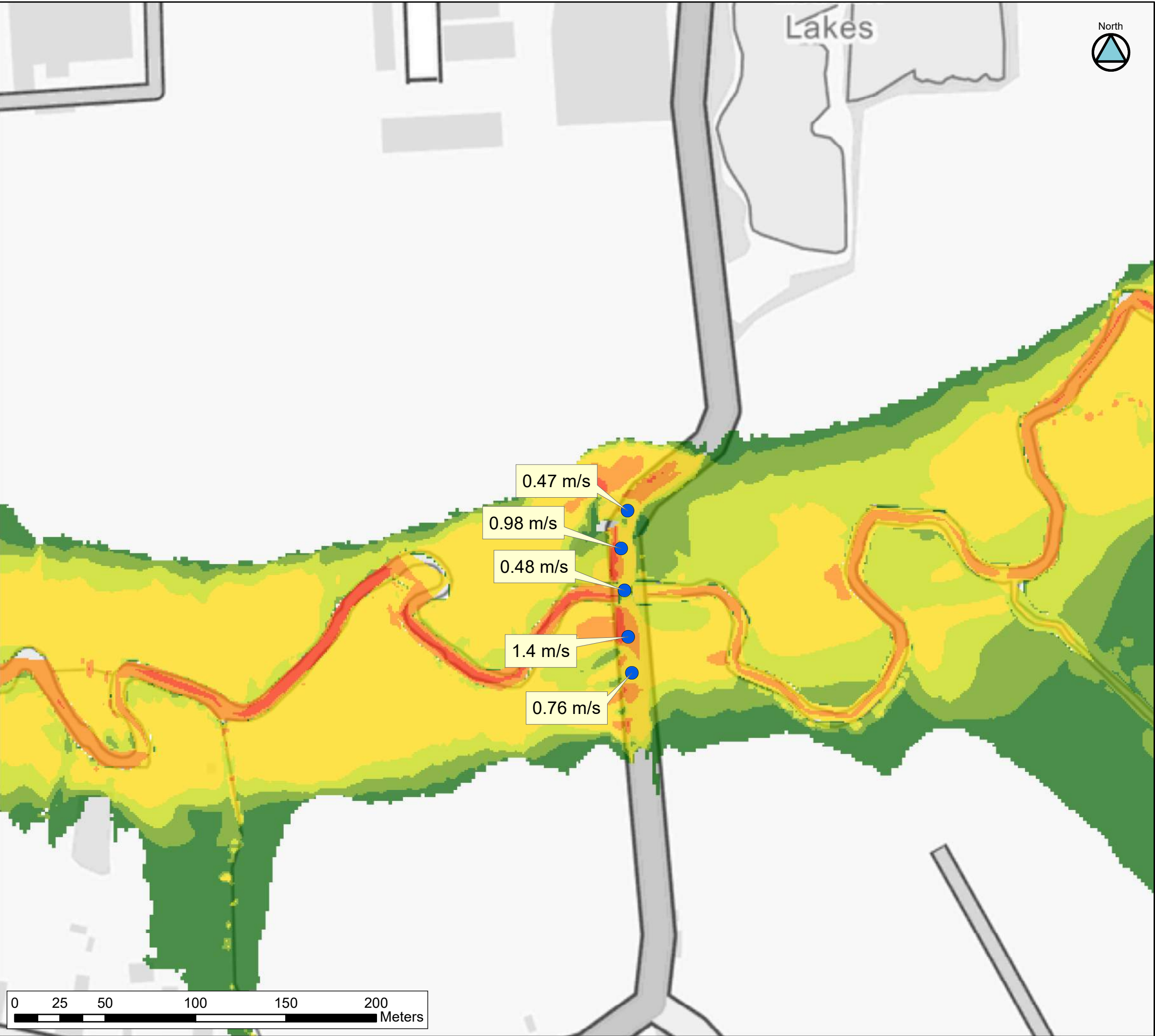
**Gillingham Southern Extension Modelling**  
1% AEP +40% climate change event  
New Rd Depth

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Scale: 1:2,000  Original @ A3	Drawn	PR	12/02/2019
	Checked		
	Approved		

Digital File Name: 2018s0439 - Gillingham 1% AEP +cc

Drawing 2018s0439_101	Sheet No.: 1 of 1	Rev.: A
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KEY

Legend

B3092 - Point Inspection

Velocity (m/s)

0 - 0.15

0.15 - 0.3

0.3 - 0.45

0.45 - 1

1 - 2

2 +

KEYPLAN

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Gillingham Southern  
Extension Modelling  
1% AEP +40% climate change event  
New Rd Velocity

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Scale: 1:2,000  
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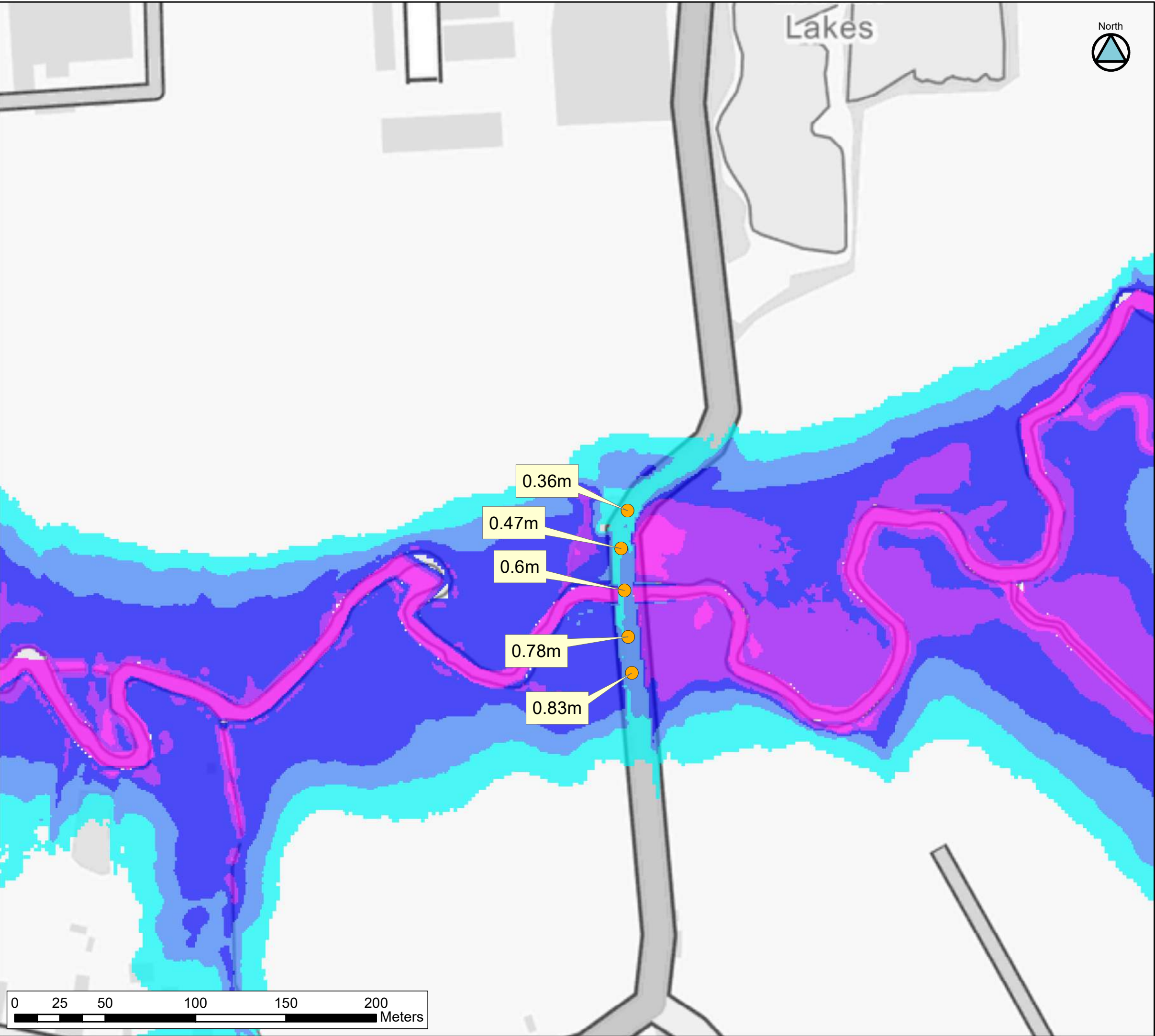
Digital File Name: 2018s0439 - Gillingham 1% AEP +cc

Drawing  
2018s0439\_103

Sheet No.:  
1 of 1

Rev.: A





KEY

Legend

●

B3092 - Point Inspection

Depth (m)

0 - 0.5m

0.5 - 1m

1 - 1.5m

1.5 - 2m

2m +

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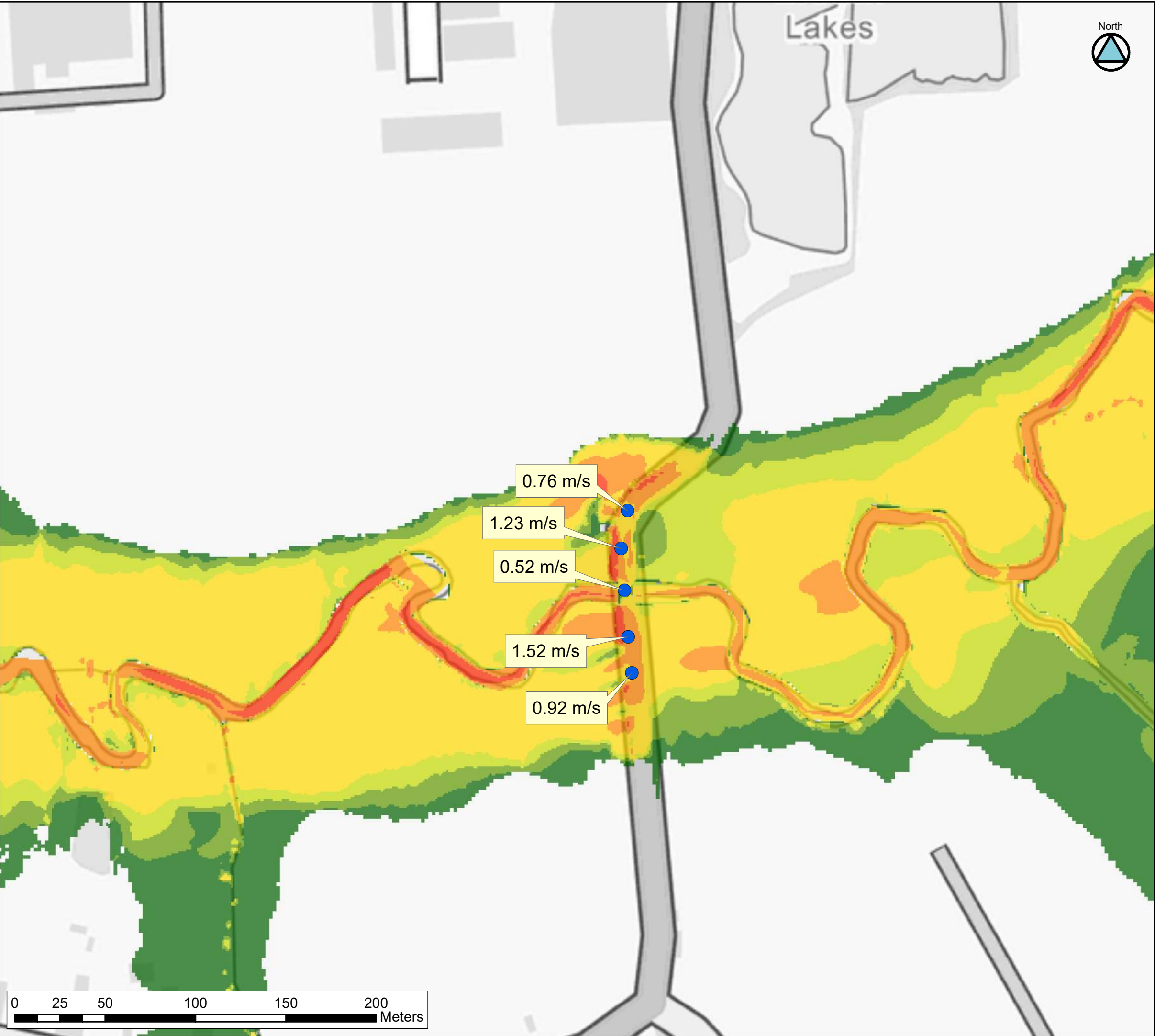
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Gillingham Southern  
Extension Modelling  
0.1% AEP event  
New Rd Depth

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Digital File Name: 2018s0439 - Gillingham 0.1% AEP			
Drawing 2018s0439_100		Sheet No.: 1 of 1	Rev.: A





KEY

Legend

B3092 - Point Inspection

Velocity (m/s)

0 - 0.15

0.15 - 0.3

0.3 - 0.45

0.45 - 1

1 - 2

2 +

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Gillingham Southern Extension Modelling

0.1% AEP event

New Rd Velocity

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Scale: 1:2,000  Original @ A3	Drawn	PR	12/02/2019
	Checked		
	Approved		
Digital File Name: 2018s0439 - Gillingham 0.1% AEP			
Drawing 2018s0439_102		Sheet No.: 1 of 1	Rev.: A

Chris Yalden

---

From: Paul Redbourne <Paul.Redbourne@jbaconsulting.com>  
Sent: 13 February 2019 10:38  
To: Chris Yalden  
Subject: RE: 2018s0439 - Gillingham Maps

Hi Chris,

For the point you have added please see below the following depths and velocities.

Q0100cc(40%) Depth – 0.23m  
Q1000 Depth – 0.35m  
Q0100cc(40%) Velocity – 0.6m/s  
Q1000 Velocity - 0.74m/s

I can add these to the maps if you need to present them to the EA but it will take a little time to pull together.

Could I also take this time to confirm we weren't successful on the Wellington flood modelling work we were asked to quote for a couple weeks back?

Regards,  
Paul

---

From: Chris Yalden <Chris.Yalden@awpexeter.com>  
Sent: 13 February 2019 10:14  
To: Paul Redbourne <Paul.Redbourne@jbaconsulting.com>  
Subject: RE: 2018s0439 - Gillingham Maps

Sorry - mark-up attached!

Chris Yalden  
Associate  
MICE, IEng



Kensington Court, Woodwater Park, Pynes Hill, Exeter EX2 5TY

office: 01392 409007  
direct dial: 01392 441066  
Mobile: 07843 107790  
email: [chris.yalden@awpexeter.com](mailto:chris.yalden@awpexeter.com)  
web: [www.awpexeter.com](http://www.awpexeter.com)

AWP is a regional engineering consultancy providing development planning and infrastructure services to developers and house builders across the south west.

---

From: Chris Yalden  
Sent: 13 February 2019 10:13  
To: 'Paul Redbourne' <[Paul.Redbourne@jbaconsulting.com](mailto:Paul.Redbourne@jbaconsulting.com)>  
Subject: RE: 2018s0439 - Gillingham Maps

Hi Paul,

Thank you for your email – this is exactly what we needed!

Would it be possible to provide one extra node/point just inside the southern edge of floodplain? (see attached mark-up)

You can note these in an email if easier.

Many thanks,

Chris Yalden  
Associate  
MICE, IEng



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AWP is a regional engineering consultancy providing development planning and infrastructure services to developers and house builders across the south west.

---

From: Paul Redbourne <[Paul.Redbourne@jbaconsulting.com](mailto:Paul.Redbourne@jbaconsulting.com)>  
Sent: 12 February 2019 16:53  
To: Chris Yalden <[Chris.Yalden@awpexeter.com](mailto:Chris.Yalden@awpexeter.com)>  
Subject: 2018s0439 - Gillingham Maps

Hi Chris,

Please find attached 4 maps, two showing flood depths at the New Rd bridge and two showing velocities for the 1% AEP event plus climate change (40%) and the 0.1% AEP event.

I can also provide similar maps for the Water Level and the Hazard classification but thought it best to see if you were happy with these first.

Let me know if this wasn't quite what you were after.

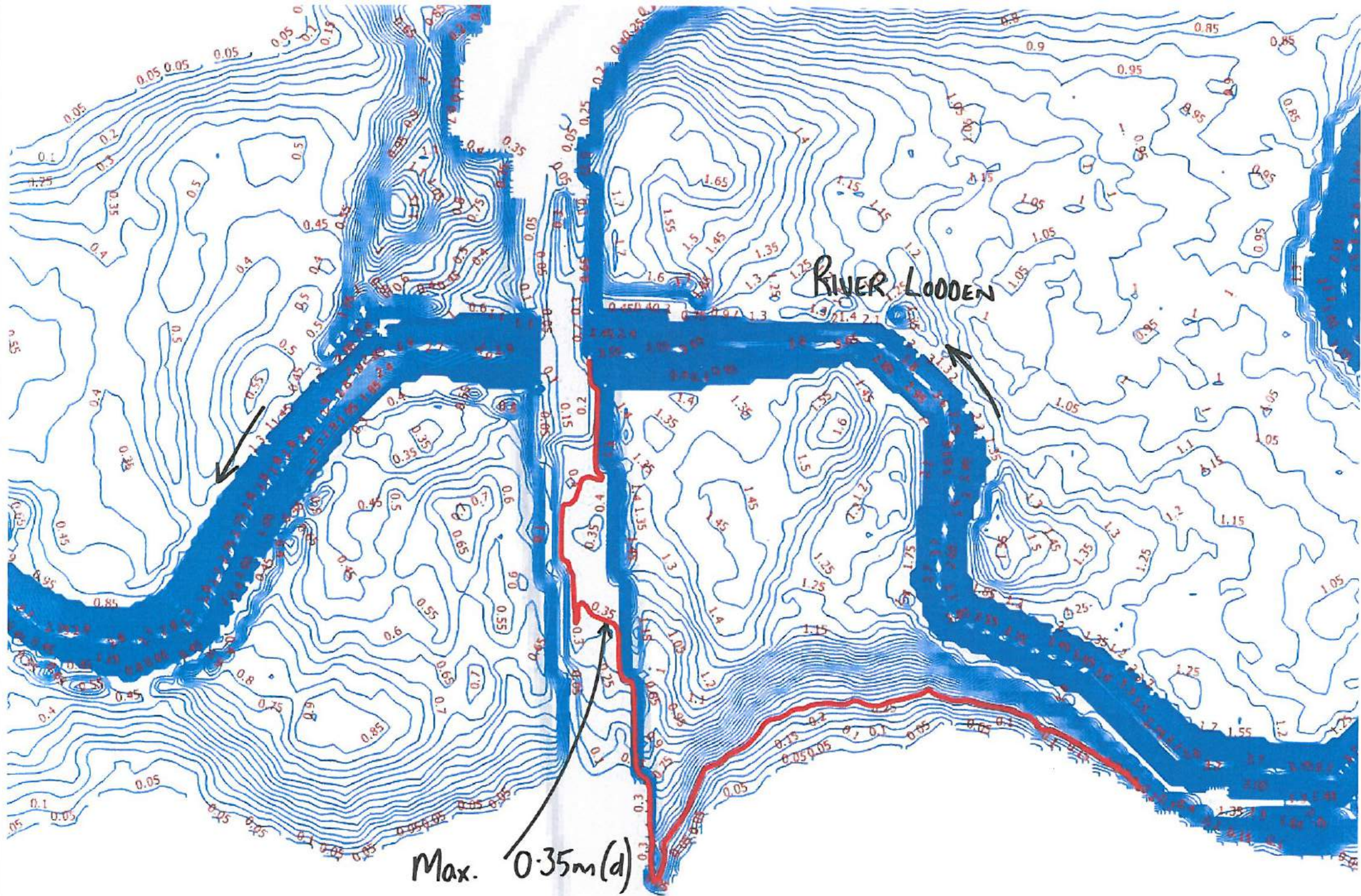
Regards,  
Paul

JBA Consulting, Kings Chambers, 8 High Street, Newport, South Wales, NP20 1FQ.  
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Q20 FZ3b

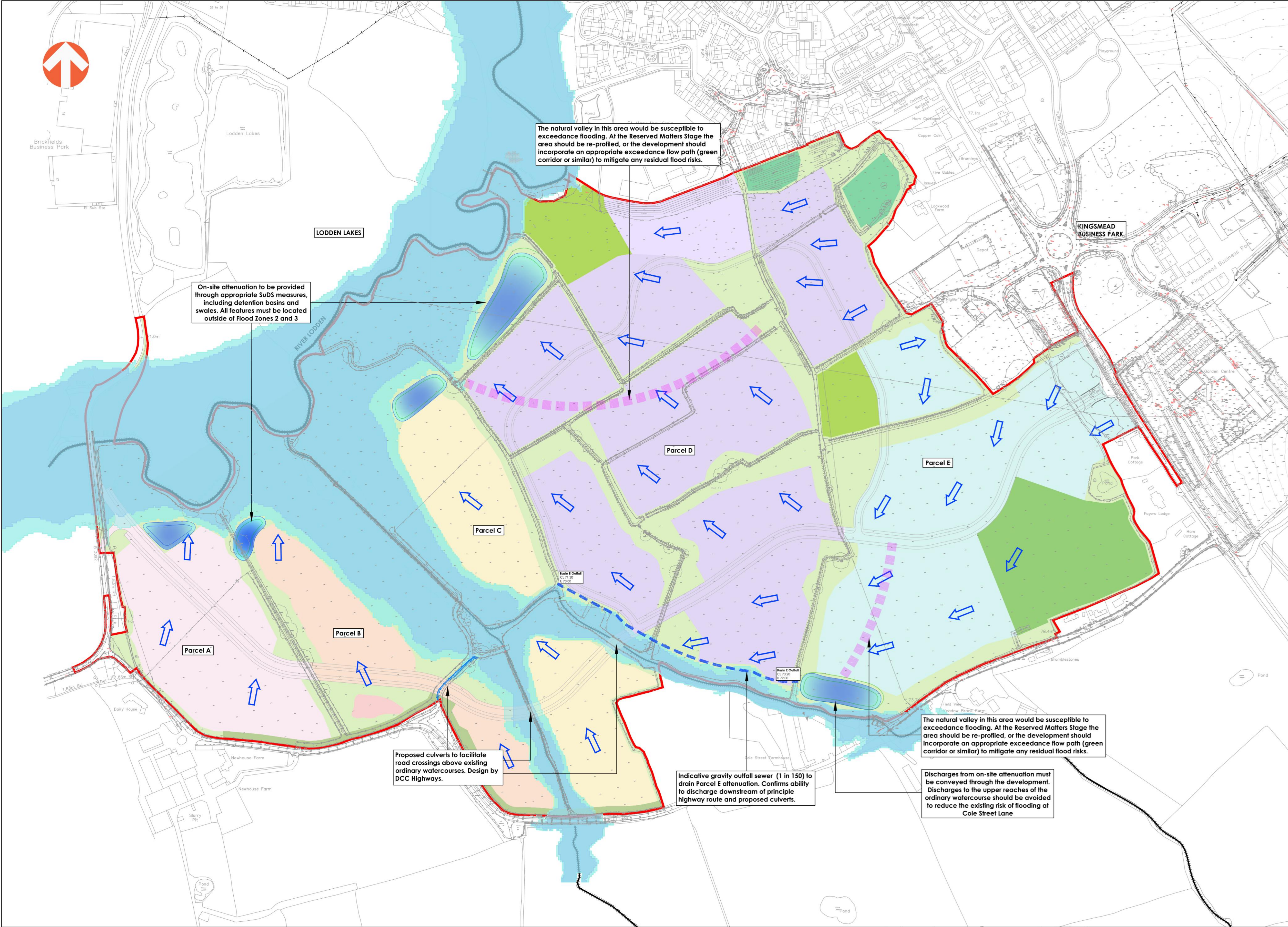






## Appendix D Preliminary Drainage Layout





**Key**

- Site Boundary
- Flood Zone 2
- Flood Zone 3
- Existing Drainage
  - River Loddon
  - Ordinary Watercourse
  - Field Ditch
- Proposed Drainage
  - Detention Basin
  - Overland Flood Flow route

**Pre-Development (Greenfield) Runoff**

The greenfield runoff rate has been assessed in accordance with the ICP SuDS method, which is based on the IH124, but for catchments of less than 50ha.

The greenfield rate has been assessed per 1ha of area and the future development will include 10% betterment as below.

Return Period	Greenfield Runoff	10% Betterment
2 year	4.9 l/s/ha	4.4 l/s/ha
30 year	12.5 l/s/ha	11.3 l/s/ha
100 year	17.6 l/s/ha	15.8 l/s/ha

**Attenuation Summary**

The attenuation requirements for each parcel of land has been calculated on the basis of an assumed 'percentage impermeable' of 60% and is sized to accommodate the 100 year attenuation storage and Long Term Storage simultaneously, with 40% allowance for climate change.

LTS Volume	57 m³/ha
LTS Rate	2 l/s/ha
Combined Att. & LTS Vol.	580 m³/ha

This volume has been prorated across all development parcels within the application boundary to establish the total site attenuation, as summarised below;

Parcel Ref.	100 yr +40% CC Vol.
Parcel A	1,300 m³
Parcel B	850 m³
Parcel C	1,250 m³
Parcel D	4,350 m³
Parcel E	2,500 m³
<b>TOTAL</b>	<b>10,250 m³</b>

- Notes**
  - The proposed developable area is located entirely within Flood Zone 1 - Low Risk and is therefore not at risk of flooding from fluvial sources in up to a 1 in 1000 year return period.
  - The proposed drainage strategy has been designed in accordance with the National Planning Policy Framework (NPPF) and the supplementary Planning Practice Guidance.
  - In-situ soakway testing was undertaken by Ruddesden Geotechnical Ltd in August 2014 and complied with the requirements of BRE Digest 365. The results of the soakway testing confirmed that the underlying ground conditions are unsuitable for the use of infiltration based drainage techniques.
  - The application site has been sub-divided from west to east into development parcels, labeled A to E. Runoff generated by each parcel will be attenuated to the pre-development greenfield runoff rates, with 10% betterment.
  - Any on-site attenuation will be sized to cater for the 100 year (+40% climate change) critical storm event and will incorporate Long Term Storage (LTS) to mitigate the impact of any increased volume of runoff. The LTS volume will be released as 2 l/s/ha, beyond which the total site discharge will be limited to the equivalent greenfield runoff rate, less 10%.
  - The blanket allowance of 40% for the predicted effects of climate change will offer further betterment until such time as this level of climate change has been realised (currently predicted as being 100 years).
  - The restricted runoff from the site will be steered towards the River Loddon. No discharges will be released to the upper reaches of the ordinary watercourse (Sette Brook).
  - During exceedance events, water will overlap the drainage systems and follow the natural topography of the site, towards the on-site attenuation features where any freeboard allowances will be utilised.
  - The Preliminary Drainage Layout does not attempt to present a final design of the proposed drainage systems. Detailed design of the systems and any inherent features will commence upon approval of the strategy and will include assessments due to site investigations, health and safety, CDM etc.
  - Any adoptable drainage networks will be designed in accordance with Sewers for Adoption and will be handed to the respective Water Authority for adoption.
  - Any new private drainage will be designed in accordance with Building Regulations Part H. The operation and maintenance of any on-plot drainage will be the responsibility of the respective homeowner, whilst any communal features will be the responsibility of a third party management company.
  - The maintenance of any SuDS features should be in accordance with the requirements of CIRIA C753 - The SuDS Manual.

E	13.02.2019	DRAINAGE NOTES ADDED	RJM	CPY	CPY	PROJECT:	GILLINGHAM SOUTHERN EXTENSION		
D	18.12.2018	UPDATED LAYOUT	TMR	CPY	RW				
C	14.12.2018	UPDATED LAYOUT	TMR	CPY	RW				
B	03.07.2017	UPDATED LAYOUT	PAB	CPY	RW	TITLE:	PRELIMINARY DRAINAGE LAYOUT NEWHOUSE & HAM FARM		
REV	DATE	DESCRIPTION	BY	CHK	APD				
CLIENT:									
WELLBECK STRATEGIC LAND						PROJECT No:	DRAWING No:	REV:	
						0456	PDL-102	E	
DRAWING STATUS:						SCALE @ A1:			
PLANNING APPLICATION						0 1:2000 100 metres			

DESIGN BY:

**awcockward**  
partnership

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Tel: 01392 409007 Web: [www.awpexeter.com](http://www.awpexeter.com)