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# Appendix H: Ground Conditions

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# South Wokingham Distributor Road Options Appraisal – Ground Conditions Technical Note

October 2013

## Introduction

This technical note provides a summary of the potential ground conditions constraints associated with the development of three aspects of the proposed South Wokingham Distributor Road scheme which comprise the following:

- Three proposed route options for the Proposed South Wokingham Distributor Road: Route Option A (including an Route Option A - Alternative Links A1, A2 and A3), Route Option B (including Route Option B Alternative Link B1) and Route Option C (including Route Option C Alternative Link C1);
- Six Local Study Areas where improved access across the railway is proposed; and
- Proposed improvements to Waterloo Road / Peacock Lane (Route D).

Figures A1a 'Overall Study Area and Environmental Constraints Plan' and A1b 'Aerial Photography View' present the three aspects of the scheme in relation to environmental designations and general context. Figure A5 specifically relates to the study area of the Waterloo Road / Peacock Lane improvements. Key geological features in relation to the Overall Study Area are identified on Figure A2.

These three aspects to the scheme are described in further detail below:

## Proposed South Wokingham Distributor Route Options

- Route Option A – Route Option A starts at the A321 Finchampstead Road at the junction with Oakley Drive. It runs approximately west to east, immediately south of the railway and ends just North of the railway line, approximately 300m east of the crossing of Waterloo Road. The proposed route will cross Emm Brook, Public Rights of Way 9 and 10, Easthampstead Road and Waterloo Road.
- Route Option B – Route Option B begins in the same location as Route Option A, on the A321 Finchampstead Road at the junction with Oakley Drive, and runs broadly east, diverting south round the existing detention pond. The route also ends in the same location as Route Option A, just north of the railway line, and crosses the Emm Brook, Public Rights of Way 9 and 10, Easthampstead Road and Waterloo Road.
- Route Option C – This route runs broadly west to east, south of Route Options A and B. It also begins in the same location, on the A321 Finchampstead Road at the junction with Oakley Drive. Route Option C ends north of the railway, in the same location as Route Options A, B and the alternatives. Route Option C crosses the Emm Brook east of Chapel Green, Public Rights of Way 9 and 10, Ludgrove School private access, Heathlands Road, Easthampstead Road and Waterloo Road.

## Alternative Alignments in relation to the Route Options

- Route Option A Alternative Link 1 – A link between Route Option B and Route Option A at Knoll Farm. This link provides an alternative route for Route Option A which does not require land from Knoll Farm.
- Route Option A Alternative Link 2 - Link between Route Option A and Route Option B to the west of the existing detention pond. This link provides an alternative route for Route Option A to the south of the detention pond which enables the Easthampstead Road junction to be located further south at the proposed Route Option B Easthampstead Road crossing.

- Route Option A Alternative Link 3 - Link between Route Option A and Route Option B. This link provides an alternative route from Route Option A passing through the existing detention pond to the proposed Route Option B Easthampstead Road crossing.
- Route Option B Alternative Link B1 –This link provides an alternative more southern and straight alignment for Route Option B east of Tesco which does not require land acquisition from Knoll Farm.
- Route Option C Alternative Link C1- Link between Route Option C to the south of the existing detention pond to Easthampstead Road, traveling down Easthampstead Road to re-join Route Option C. This link provides an alternative route for Route Option C to access Easthampstead Road which avoids the Ludgrove School private access and Heathlands Road crossings.

## Local Study Areas

Six local study areas (A to F) have also been considered within this note and are identified on Figure A1b.

Footbridges across the railway are proposed at each location. These are likely to have steps and lifts/ramps to provide disabled access. For the purpose of this assessment, at each local study area potential constraints within the highway boundary for minimum of 150m north of the railway and 150m radius south of the railway have been identified.

- Local Study Area A is centred over the A321 Finchampstead Road, over the roundabout intersection with Oakley Drive, and is approximately 140m long.
- Local Study Area B is centred at the Knoll Farm, to the south of Gipsy Lane, and is approximately 60m long.
- Local Study Area C is centred at an existing footbridge over the railway line, to the south of Gipsy Lane, to the east of Local Study Area B, and is approximately 60m long.
- Local Study Area D is centred on the Easthampstead Road Level Crossing, and is approximately 70m in length.
- Local Study Area E is centred over the Waterloo Road Level Crossing, and is approximately 80m in length.
- Local Study Area F is approximately 340m in length, at the point of the South Wokingham Distributor Road roadbridge over the railway line, from below to a point approximately 150m north of the railway line.

## Waterloo Road / Peacock Lane Proposed Improvements (Route D):

The proposed improvements commences on the corner of Waterloo Road, just north of the woodland parcel to the west, and continues east along Waterloo Road and Peacock Lane until its cessation approximately 300m east of Easthampstead Park. All works are due to be completed within the highway boundary with the exception of works at the junction between Waterloo Road, Old Wokingham Road and Peacock Lane, where some additional land would likely be needed to the south west.

## Definitions

Given the relative proximity of the proposed distributor road routes, six local study areas and improvements to Waterloo Road / Peacock Lane, which share some of the same existing baseline, they are herein collectively termed '**the overall study area**'. Where there are differences, they will be referred to as Route Option A, Route Option A Alternative Link A1, A2, or A3, Route Option B, Route Option B Alternative Link B1, Route Option C, Route Option C Alternative Link C1, Local Study Area (A – F) or Waterloo Road / Peacock Lane improvements respectively.

In relation to the four route options where they share the same existing baseline, they will herein be referred to as '**the Site**'.

The term '**Local Study Areas**' will be used to refer to the six areas where work is proposed to improve access across the railway.

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The advice presented within the summary of constraints at the end of this technical note must be considered both generic and preliminary at this stage and will need updating when more information becomes available regarding the likely infrastructure scenarios. For ease of reading, the constraints identified within this technical note are colour coded in relation to a 'traffic light system' according to their significance on the scheme. Below identifies the colour coding:

- **Red** – Constraint to Development.
- **Amber** – Constraint to Planning/Major Cost Implication
- **Green** – Manageable constraint through scheme adaptation/mitigation measures/surveys (some cost implications).

Text left in black is not considered to represent any form of constraint and provides background information and/or recommendations to further avoid environmental impacts and/or to enhance the existing environment.

## Methodology

This preliminary constraints assessment includes the following elements:

- Assessment of the 'sensitivity' of the site location through review of readily available site specific and published information;
- Assessment of the historical land uses on and surrounding the site;
- Review of other readily available site specific environmental information; and
- Review of the current information regarding the underlying soil and groundwater baseline conditions and provision of a preliminary assessment of likely geotechnical and geo-environmental (contamination) risks and initial overview of geotechnical constraints associated with the local ground conditions.

This appraisal has been undertaken with due regard to Contaminated Land Guidance documents issued by the Department for Environment, Food and Rural Affairs (and its predecessors) including CLR 11 Model Procedures for the Management of Land Contamination, the British Standards Institute (the BSI) and the Royal Institution of Chartered Surveyors (RICS). The methods used follow a risk-based approach, with the potential environmental risks assessed qualitatively using the 'source-pathway-receptor pollutant linkage' concept introduced in the Environmental Protection Act, 1990.

Consideration is given to the site's status under the Contaminated Land Regime implemented on the 1st April 2000 as Part IIA of the Environmental Protection Act 1990, and the actual or potential designation of the site as 'Contaminated Land' as defined in Section 78A(2). Unless specifically stated as relating to this definition, references to 'contamination' and 'contaminants' relate in general terms to the presence of potentially hazardous substances in, on or under the site.

This appraisal does not purport to be equivalent to a Preliminary Sources Study Report (PSSR) under Eurocode 7 (EC7).

This technical note is structured as follows:

- Introduction;
- Desk Study Results – Route Options;
- Desk Study Results – Local Study Areas;
- Desk Study - Waterloo Road / Peacock Lane Improvements;
- Summary of Environmental Sensitivity;
- Preliminary Environmental Conceptual Site Model; and
- Summary of Ground Conditions Constraints.

## Desk Study – Route Options

### Site Details

<b>Site Address</b>	Proposed South Wokingham Distributor Road routes, near Wokingham, Berkshire
<b>National Grid Reference (centre)</b>	Route Option A – 481775, 167836 Route Option A1 – 481469,167806 Route Option A2 – 481975,167769 Route Option A3 – 482136,167819 Route Option B – 481851,167707 Route Option B1– 481323,167690 Route Option C – 481873,167624 Route Option C1 – 482475,167646
<b>Site Location</b>	The proposed routes are located to the south of Wokingham. More specifically, each route is located to the east of the A321, south of the railway line and terminates to the west of the wooded area known as “Big Wood”.
<b>Current Site Use</b>	All the route options predominantly cross agricultural land. All options transect Emm Brook in the west and cross a number of drains within the east of the alignments.

### Historical Land Use

A study of available historical maps has been undertaken to identify any potentially contaminative former land uses on or immediately adjacent to, the route options. It is noted that the majority of the proposed routes have remained in agricultural use since the earliest maps reviewed. The following section provides a summary of this information.

Features	Approximate Reference	Grid	Dates
<b>Route Option A / A1 / A2 / A3</b>			
Railway Line (Staines, Wokingham and Reading Branch)	481266, 167937		Pre1876 – to date
Pumping station	480915, 167823		Pre 1900 – pre 1961
<i>Then</i> Unnamed buildings			Pre 1961 – pre 1971
<i>Then</i> Garage			Pre 1971 – pre 2006
<i>Then</i> superstore			Pre 2006 – to date
Easthampstead Road	482216, 167876		Pre 1876 - to date
Waterloo Road	483047, 167913		Pre 1876 - to date
Unnamed buildings	481313, 167900		Pre 1912 – pre 1971
<i>Then</i> The Knoll Farm			Pre 1971 – to date
<b>Route Option B / B1</b>			
Pumping station	480915, 167823		Pre 1900 – pre 1961
<i>Then</i> Unnamed buildings			Pre 1961 – pre 1971

Features	Approximate Reference	Grid	Dates
<i>Then</i> Garage			Pre 1971 – pre 2006
<i>Then</i> superstore			Pre 2006 – to date
Unnamed farm building	481113, 167772		Pre 2006 – to date
Easthampstead Road	482295, 167834		Pre 1876 - to date
Waterloo Road	483047, 167913		Pre 1876 - to date
Gravel Pit	482689, 167912		Pre 1900 – pre 1912
Woods Farm	482485, 167760		Pre 1876 – to date
Brittons Farm	482878, 167774		Pre 1876 – to date
<b>Route Option C / C1</b>			
Unnamed residential building	481245, 167521		Pre 1876 – pre 1900
<i>Then</i> Chapelgreen Farm			Pre 1900 – pre 1971
<i>Then</i> Chapel Green Cottages			Pre 1971 – to date
Pumping station	480915, 167823		Pre 1900 – pre 1961
<i>Then</i> Unnamed buildings			Pre 1961 – pre 1971
<i>Then</i> Garage			Pre 1971 – pre 2006
<i>Then</i> superstore			Pre 2006 – to date
Easthampstead Road	482389, 167742		Pre 1876 - to date
Waterloo Road	483129, 167864		Pre 1876 - to date
Lodge	482409, 167695		Pre 1900 – pre 1975
<i>Then</i> East Lodge			Pre 1975 - to date
Unnamed farm building	481113, 167772		Pre 2006 – to date
Woods Farm	482485, 167760		Pre 1876 – to date

## Regulatory Information

The following pertinent environmental data has been obtained from a summary of information databases reported in an Envirocheck Report (ref. 44305408\_1\_1), dated 19th February 2013.

Environmental Data	On-Site	Within 250m	Within 500m	Details
<b>Route Option A / A1 / A2 / A3</b>				
Discharge Consents	-	9	6	The closest consent is located 25m north of the route where Public Sewage: Storm Sewage Overflow is discharged into a freshwater stream/river.
Local Authority Pollution Prevention and Controls	-	2	1	The closest active control is located 170m northwest of the route at a

Environmental Data	On-Site	Within 250m	Within 500m	Details
				petrol filling station.
Pollution Incidents to Controlled Waters	-	5	3	The closest incident occurred 160m west of the route. Details of the incident have not been supplied but it is listed as a Category 3 - Minor Incident.
Ground and Surface Water Abstractions	-	3	-	There are three abstractions located 190m south of the route where surface water is abstracted for General Agriculture: Spray Irrigation – Direct.
Historical Landfill Sites	-	1	1	The closest historic landfill is located 80m north of the route where household waste from various dwellings was accepted. The last input date is unknown.
Licensed Waste Management Facilities (Locations) and Registered Waste Treatment or Disposal Sites	-	-	2	The closest facility is located 410m east of the route, where metal recycling is undertaken.
Explosive Sites	-	-	2	The closest explosives site is located 400m east of the route. No further details are provided.
Planning Hazardous Substance Consents	-	1	1	The closest consent is located 270m south of the route, where substances or preparation which creates extreme risks of explosion by shock, friction, fire or other sources of ignition are stored.
BGS Recorded Mineral Sites	-	1	-	There is one ceased recorded site located 80m south of the route where sand and gravel was extracted.
Man-Made Mining Cavities	-	1	-	There is one cavity located 200m north of the route where a brickworks shaft has been identified.
Fuel Station Entries	-	1	-	The closest open fuel station is located 155m west of the route.
<b>Route Option B / B1</b>				
Discharge Consents	-	9	7	The closest consent is located 85m north of the route where Trade Effluent Discharge-Site Drainage is discharged on to land (Lower Bagshot Beds)
Local Authority Pollution Prevention and Controls	-	1	1	The closest active control is located 70m north of the route at a petrol filling station.

Environmental Data	On-Site	Within 250m	Within 500m	Details
Pollution Incidents to Controlled Waters	-	6	6	The closest incident occurred 40m south of the route where general pollutants were released into an unknown water body. The incident is listed as a Category 3 - Minor Incident.
Ground and Surface Water Abstractions	-	1	1	There is one abstraction located 110m south of the route where groundwater is abstracted for Golf Courses: Spray Irrigation - Direct
Historical Landfill Sites	-	2	-	The closest closed historic landfill is located 85m north of the route where household waste from various dwellings is accepted. The last input date is unknown.
Licensed Waste Management Facilities (Locations) and Registered Waste Treatment or Disposal Sites	-	-	1	The closest facility is located 400m east of the route where metal recycling is undertaken.
Explosive Sites	-	-	2	The closest explosives site is located 370m east of the route. No further details are provided.
Planning Hazardous Substance Consents	-	1	-	The closest consent is located 215m south of the route where substances or preparation which creates extreme risks of explosion by shock, friction, fire or other sources of ignition are stored.
BGS Recorded Mineral Sites	-	1	-	There is one ceased recorded site located 100m north of the route where sand and gravel was extracted.
Man-Made Mining Cavities	-	1	-	There is one cavity located 230m north of the route where a brickworks shaft has been identified.
Fuel Station Entries	-	1	-	The closest open fuel station is located 75m north of the route.
<b>Route Option C / C1</b>				
Discharge Consents	-	11	4	The closest consent is located 10m west of the route where Sewage Discharges - Final/Treated Effluent - Not Water is discharged into a freshwater stream/river.
Local Authority Pollution Prevention and Controls	-	1	-	The closest active control is located 160m north of the route at a petrol filling station.

Environmental Data	On-Site	Within 250m	Within 500m	Details
Pollution Incidents to Controlled Waters	-	6	2	The closest incident occurred 150m west of the route; details of the incident have not been supplied. The incident is listed as a Category 3 - Minor Incident.
Ground and Surface Water Abstractions	-	3	-	There is one abstraction located 110m south of the route where groundwater is abstracted for Golf Courses: Spray Irrigation - Direct
Historical Landfill Sites	-	1	1	The closest historic landfill is located 110m north of the route where household waste from various dwellings was accepted. The last input date is unknown.
Licensed Waste Management Facilities (Locations) and Registered Waste Treatment or Disposal Sites	-	-	2	The closest facility is located 390m east of the route where metal recycling is undertaken.
Explosive Sites	-	-	2	The closest explosives site is located 360m east of the route. No further details are provided.
Planning Hazardous Substance Consents	-	1	-	The closest consent is located 200m south of the route where substances or preparation which creates extreme risks of explosion by shock, friction, fire or other sources of ignition are stored.
BGS Recorded Mineral Sites	-	-	1	There is one ceased recorded site located 310m north of the route where sand and gravel was extracted.
Man-Made Mining Cavities	-	1	-	There is one cavity located 280m north of the route where a brickworks shaft has been identified.
Fuel Station Entries	-	1	-	The closest open fuel station is located 170m northwest of the route.

## Environmental Setting

### Geology and Hydrogeology

The British Geological Survey (BGS) Sheet 268 and 269, Reading and Windsor respectively, scale 1:50,000 solid and drift edition, 2000 and 1999, indicates the following geological sequence to underlie the route options (in summary). The aquifer status across the Overall Study Area is presented on Figure 2 (terms used within the key are former classifications used by Environment Agency; these are in italics within the table):

Geological Unit	Location	Aquifer Status*
Alluvium	Present within western end of all the routes.	Secondary (A) <i>(Minor aquifer)</i>
Head Deposits	Localised zones located within the western to central portion of the routes.	Secondary (Undifferentiated) <i>(Minor and non-aquifer)</i>
River Terrace Deposits	Localised zones located within the central to eastern portion of Route Options A / A1 and C.	Secondary (A)
Bagshot Formation	Located within the central to western portion of Route Options A / A1 / A2, B / B1 and C.	Secondary (A)
London Clay Formation	Underlying all route options.	Unproductive
White Chalk Subgroup (Former Upper Chalk)	At depth.	Principal

Notes: \*As classified by the Environment Agency;

Based on available BGS logs within the surrounding area, groundwater was not encountered within a depth of 11m below ground level. The depth to ground water in the area is not known.

### Ground Stability Hazards

The following ground stability hazards have been identified by the BGS on-site:

Ground Stability Hazards	Hazard
Collapsible Ground	No hazard to very low
Compressible Ground	No hazard to moderate
Landslides	Very low
Running sand	No hazard to low
Shrinking or swelling clay	No hazard to low

### Groundwater Abstractions

There are no groundwater abstractions within 1km of the routes.

In accordance with the Environment Agency website, the proposed routes are not located within a designated Source Protection Zone (SPZ).

## Hydrology

The following surface water features are located within 500m of the routes:

Surface Water Feature	Distance (m)	Direction	Water Quality*
Ditches and land drains	Various distances both on-site and adjacent	Various	Unknown
Unnamed pond	100m from Route Option 3	West	Unknown
Unnamed pond	150m from Route Option 3	South	Unknown
Unnamed pond	100m from Route Option 1	North	Unknown
Unnamed ponds	From 30m of Route Option 3	South	Unknown
Emm Brook	On-site for all route options.	N/A	Current – Moderate ecological quality Expected 2015 Cycle – Moderate ecological quality Chemical quality has not yet been assessed

Notes: \* Environment Agency general quality assessment (GQA) river quality classification chemistry/biology

## Surface Water Abstractions

The following current licensed surface water abstractions have been identified within a 1km radius of the sites:

Use	Distance (m)	Direction
Other Industrial/Commercial/Public Services: Non-Evaporative Cooling	430m from Route Options B and 580m from Route Options A, B1 and C.	West
General Agriculture: Spray Irrigation (3 licenses held)	110m from Route Options C / C1, B and A2	South

## Flooding

The Environment Agency website indicates that the east and western areas of all route options are at risk from flooding from Emm Brook without flood defences. However, this does not purport to be making a flood risk assessment.

## Desk Study - Local Study Areas

### Site Details

Site Address	Proposed Local Study Areas, near Wokingham, Berkshire
<b>National Grid Reference (centre)</b>	Local Study Area A – 480885, 167866 Local Study Area B – 481296, 167931 Local Study Area C – 481436, 167892

	Local Study Area D – 482157, 167905 Local Study Area E – 482832, 168099 Local Study Area F – 483120, 168193
<b>Site Location</b>	Area A is located to the west of the main route options. Local Study Areas B - E are located to the north of the main route options (along the railway line) and Area F is located at the eastern end of the main routes.
<b>Current Site Use</b>	Local Study Area A – A321 (Finchampstead Road) and roundabout. Local Study Area B – Residential properties and agricultural land. Local Study Area C – Private gardens and agricultural land. Local Study Area D – Easthampstead Road. Local Study Area E – Waterloo Road. Local Study Area F – Railway line and agricultural land.

#### Historical Land Use

A study of available historical maps has been undertaken to identify any potentially contaminative former land uses on or immediately adjacent to the Local Study Areas. The following section provides a summary of this information.

Features	Approximate Reference	Grid	Dates
<b>Local Study Area A</b>			
Road	480885, 167866		Pre 1876 – pre 1900
<i>Then</i> Finchampsted Road			Pre 1900 – to date
Residential properties	481300, 167956		Pre 1912 – to date
Railway Line	480847, 167828		Pre 1876 – to date
<b>Local Study Area B</b>			
Railway Line	481266, 167937		Pre 1876 – to date
Gipsy Lane	481449, 167935		Pre 1976 – to date
The Knoll Farm	481312, 167884		Pre 1971 – to date
<b>Local Study Area C</b>			
Railway Line	481266, 167937		Pre 1876 – to date
Residential properties	481449, 167935		Pre 1971 - to date
Woods Farm	482445, 167750		Pre 1876 - to date
<b>Local Study Area D</b>			
Railway Line and Starlane Crossing	481266, 167937		Pre 1876 – to date
Residential properties	482151, 167935		Pre 1900 – to date
Easthampstead Road	482216, 167876		Pre 1876 - to date
<b>Local Study Area E</b>			

Railway Line and Waterloo Crossing	481266, 167937	Pre1876 – to date
Waterloo Road	483129, 167864	Pre 1876 - to date
<b>Local Study Area F</b>		
Railway Line	481266, 167937	Pre1876 – to date

## Regulatory Information

The following pertinent environmental data has been obtained from a summary of information databases reported in Envirocheck Report (ref. 44305408\_1\_1) dated 19th February 2013.

Environmental Data	On-Site	Within 250m	Within 500m	Details
<b>Local Study Area A</b>				
Discharge Consents	-	1	1	The closest consent is located 40m north of the study area where Sewage Discharges - Final/Treated Effluent is discharged into the Emm Brook.
Local Authority Pollution Prevention and Controls	-	1	1	The closest active control is located 25m north of the study area at a petrol filling station.
Pollution Incidents to Controlled Waters	2	3	6	There have been two incidents on-site. The details of each incident have not been supplied but both are listed as a Category 3 - Minor Incident.
Ground and Surface Water Abstractions	-	-	1	There is one abstraction located 330m west of the study area where surface water is abstracted for Other Industrial/Commercial/Public Services: Non-Evaporative Cooling.
Historical Landfill Sites	-	2	-	The closest historic landfill is located 100m north of the study area where household waste from various dwellings is accepted. The last input date is unknown.
Man-Made Mining Cavities	-	1	-	There is one cavity located 220m north of the study area where a brickworks shaft has been identified.
Fuel Station Entries	-	1	-	The closest open station is located 30m north of the study area.
<b>Local Study Area B</b>				
Discharge Consents	-	1	2	The closest consent is located 225m east of site where Sewage Discharges - Final/Treated Effluent is discharged into plateau gravels.
Local Authority Pollution Prevention and Controls	-	-	1	The closest active control is located 330m north of the study area at a petrol filling station.

Environmental Data	On-Site	Within 250m	Within 500m	Details
Pollution Incidents to Controlled Waters	-	-	4	The closest incident occurred 370m west of the study area, details on the incident has not been supplied. The incident is listed as a Category 3 - Minor Incident.
Historical Landfill Sites	-	1	-	The closest historic landfill is located 220m west of the study area where household waste from various dwellings is accepted. The last input date is unknown.
Man-Made Mining Cavities	-	1	-	There is one cavity located 225m northwest of the study area where a brickworks shaft has been identified.
Fuel Station Entries	-	-	1	The closest open station is located 330m west of the study area.
<b>Local Study Area C</b>				
Discharge Consents	-	1	2	The closest consent is located 95m east of study area where Sewage Discharges - Final/Treated Effluent is discharged into plateau gravels.
Local Authority Pollution Prevention and Controls	-	-	1	The closest active control is located 460m north of the study area at a petrol filling station.
Pollution Incidents to Controlled Waters	-	-	1	The closest incident occurred 310m southeast of the study area where oils were released into an unknown water body. The incident is listed as a Category 3 - Minor Incident.
Historical Landfill Sites	-	-	1	The closest historic landfill is located 350m west of the study area where household waste from various dwellings is accepted. The last input date is unknown.
Man-Made Mining Cavities	-	-	1	There is one cavity located 355m northwest of the study area where a brickworks shaft has been identified.
Fuel Station Entries	-	-	1	The closest open station is located 460m west of the study area.
<b>Local Study Area D</b>				
Discharge Consents	-	2	4	The closest consent is located 135m east of the study area where Public Sewage: Storm Sewage Overflow is discharged into Waterloo Road Stream.
Local Authority Pollution Prevention and Controls	-	1	-	The closest control is located 250m northeast of the site where dry cleaning is undertaken.
Pollution Incidents to Controlled Waters	-	2	1	The closest incident located 430m northeast of the study area where a natural pollutant

Environmental Data	On-Site	Within 250m	Within 500m	Details
				was released into an unknown water body. The incident is listed as a Category 3 - Minor Incident
Ground and Surface Water Abstractions	-	-	3	There are three abstractions located 380m south of the route where surface water is abstracted for General Agriculture: Spray Irrigation – Direct.
Planning Hazardous Substance Consents	-	-	1	The closest consent is located 190m south of the study area where substances or preparation which creates extreme risks of explosion by shock, friction, fire or other sources of ignition are stored.
BGS Recorded Mineral Sites	-	-	1	There is one ceased recorded site located 480m southeast of the study area where sand and gravel was extracted.
<b>Local Study Area E</b>				
Discharge Consents	-	-	1	The closest consent is located 500m west of the study area where Public Sewage: Storm Sewage Overflow is discharged into Waterloo Road Stream.
Local Authority Pollution Prevention and Controls	-	-	1	The closest control is located 450m northwest of the study area where dry cleaning is undertaken.
Pollution Incidents to Controlled Waters	-	1	1	The closest incident located 300m northwest of the study area where a natural pollutant was released into an unknown water body. The incident is listed as a Category 3 - Minor Incident
Planning Hazardous Substance Consents	-	-	1	The closest consent is located 460m south of the study area where substances or preparation which creates extreme risks of explosion by shock, friction, fire or other sources of ignition are stored.
BGS Recorded Mineral Sites	-	1	-	There is one ceased recorded site located 215m southwest of the study area where sand and gravel was extracted.
<b>Local Study Area F</b>				
Discharge Consents	-	-	3	The closest consent is located 370m south of the study area where Sewage Discharges - Final/Treated Effluent is discharged into a Tributary of the Emm Brook.
Licensed Waste Management Facilities (Locations) and Registered Waste Treatment or Disposal Sites	-	-	1	The closest facility is located 230m southeast of the study area where metal recycling is undertaken.
Explosive Sites	-	1	1	The closest explosives site is located 220m southeast of the study area. No further

Environmental Data	On-Site	Within 250m	Within 500m	Details
				details are provided.
Planning Hazardous Substance Consents	-	-	1	The closest consent is located 315m south of the study area where substances or preparation which creates extreme risks of explosion by shock, friction, fire or other sources of ignition are stored.

## Environmental Setting

### Geology and Hydrogeology

The British Geological Survey (BGS) Sheet 268 and 269, Reading and Windsor respectively, scale 1:50,000 solid and drift edition, 2000 and 1999, indicates the following geological sequence to underlie Local Study Areas (in summary). The aquifer status across the site is presented on Figure 2 (terms used within the key are former classifications used by Environment Agency, these are in italics within the table)::

Geological Unit	Location	Aquifer Status*
Alluvium	Local Study Area A.	Secondary (A) <i>(Minor Aquifer)</i>
Head Deposits	Local Study Area A.	Secondary (Undifferentiated) <i>(Minor and non-aquifer)</i>
Bagshot Formation	Local Study Areas B and C.	Secondary (A)
London Clay Formation	Underlying all sites.	Unproductive
White Chalk Subgroup (Former Upper Chalk)	At depth.	Principal

Notes: \*As classified by the Environment Agency;

Based on available BGS logs within the surrounding area, groundwater was not encountered within a depth of 11m below ground level. The depth to ground water in the area is not known..

### Ground Stability Hazards

The following ground stability hazards have been identified by the BGS on-site:

Ground Stability Hazards	Hazard
Collapsible Ground	No hazard to very low
Compressible Ground	No hazard to moderate
Landslides	Very low
Running sand	No hazard to low
Shrinking or swelling clay	No hazard to low

## Groundwater Abstractions

There are no groundwater abstractions within 1km of the Local Study Areas.

In accordance with the Environment Agency website the local study areas are not located within a designated Source Protection Zone (SPZ).

## Hydrology

The following surface water features are located within 500m of the Local Study Areas:

Surface Water Feature	Distance (m)	Direction	Water Quality*
<b>Local Study Area A</b>			
Ditches and land drain	Various distances	Various	Unknown
Unnamed pond	315	East	Unknown
Unnamed pond	210	Southeast	Unknown
Emm Brook	Adjacent	Northwest	Current – Moderate ecological quality Expected 2015 Cycle – Moderate ecological quality Chemical quality has not yet been assessed
<b>Local Study Area B</b>			
Emm Brook	160	South	Current – Moderate ecological quality Expected 2015 Cycle – Moderate ecological quality Chemical quality has not yet been assessed
Unnamed pond	60	South	Unknown
Unnamed pond	360	Southwest	Unknown
<b>Local Study Area C</b>			
Emm Brook	170	South	Current – Moderate ecological quality Expected 2015 Cycle – Moderate ecological quality Chemical quality has not yet been assessed
Unnamed pond	120	Southwest	Unknown
Unnamed pond	425	Southwest	Unknown
<b>Local Study Area D</b>			
Ditches and land drains	Various distances both on-site and adjacent	Various	Unknown
Unnamed pond	360	Northeast	Unknown

Surface Water Feature	Distance (m)	Direction	Water Quality*
<b>Local Study Area E</b>			
Ditches and land drain	Various distances	Various	Unknown
Unnamed pond	245	Northeast	Unknown
Emm Brook	295	West	Current – Moderate ecological quality Expected 2015 Cycle – Moderate ecological quality Chemical quality has not yet been assessed
<b>Local Study Area F</b>			
Ditches and land drains	Various distances both on-site and adjacent	Various	Unknown
Unnamed pond	440	South	Unknown

Notes: \* Environment Agency general quality assessment (GQA) river quality classification chemistry/biology

### Surface Water Abstractions

The following current licensed surface water abstractions have been identified within a 1km radius of the Local Study Areas:

Use	Distance (m)	Direction
Other Industrial/Commercial/Public Services: Non-Evaporative Cooling	330m from Local Study Area A	West

### Flooding

The Environment Agency website indicates that Local Study Area A is located in an area affected by flooding from Rivers or Sea without defences (Zone 3). However, this does not purport to be making a flood risk assessment.

## Route D - Waterloo Road / Peacock Lane Improvements

### Desk Study

#### Site Details

<b>Site Address</b>	Proposed improvements Waterloo Road/Peacock Lane, near Wokingham, Berkshire
<b>National Grid Reference (centre)</b>	Waterloo Road/Peacock Lane – 483756, 167926
<b>Site Location</b>	Waterloo Road/Peacock Lane is located to the east of the route options.
<b>Current Site Use</b>	The site currently comprises Waterloo Road and Peacock Lane.

## Historical Land Use

A study of available historical maps has been undertaken to identify any potentially contaminative former land uses on or immediately adjacent to the location of the Peacock Lane / Waterloo improvements. It is noted that the site has remained as a road since the earliest maps which were available for review. The following section provides a summary of this information.

Features	Approximate Reference	Grid	Dates
Unnamed Road <i>Then Waterloo Road</i>	483756, 167926		Pre 1876 – pre 1975 Pre 1975 – to date
Locks Farm <i>Then Locks House</i>	483317, 167732		Pre 1876 – pre 1912 Pre 1912 – to date
Big Wood House <i>Then unnamed buildings</i> <i>Then scrap yard</i>	483498, 168059		Pre 1975 – pre 2006 Pre 2006 – pre 2012 Pre 2012 – to date

## Regulatory Information

The following pertinent environmental data has been obtained from a summary of information databases reported in Envirocheck Report (ref. 44305408\_1\_1) dated 19th February 2013.

Environmental Data	On-Site	Within 250m	Within 500m	Details
Discharge Consents	-	3	2	The closest consent is located 45m south of the Peacock Lane / Waterloo improvements where Sewage Discharges - Final/Treated Effluent is released into Land and Tributary of Emm Brook.
Licensed Waste Management Facilities (Locations) and Registered Waste Treatment or Disposal Sites	-	2	-	A metal recycling site is located 70m north of the Peacock Lane / Waterloo improvements.
Explosive Sites	-	2	-	The closest active explosive site is located 50m north of the Peacock Lane / Waterloo improvements at Bigwood House/Bracknell Fireworks.
Planning Hazardous Substance Consents	-	1	-	There is one consent located adjacently west of the Peacock Lane / Waterloo improvements where explosive (substance or preparation which creates extreme risks of explosion by shock, friction, fire or other sources of ignition).

## Environmental Setting

### Geology and Hydrogeology

The British Geological Survey (BGS) Sheet 268 and 269, Reading and Windsor respectively, scale 1:50,000 solid and drift edition, 2000 and 1999, indicates the following geological sequence to underlie the Peacock Lane / Waterloo improvements (in summary). The aquifer status across the area is presented on Figure 2:

Geological Unit	Location	Aquifer Status*
London Clay Formation	Underlying the route.	Unproductive
White Chalk Subgroup (Former Upper Chalk)	At depth.	Principal

Notes: \*As classified by the Environment Agency;

Based on available BGS logs within the surrounding area, groundwater was not encountered within a depth of 11m below ground level. The depth to ground water in the area is not known.

### Ground Stability Hazards

The following ground stability hazards have been identified by the BGS in the area of the Peacock Lane / Waterloo improvements:

Ground Stability Hazards	Hazard
Running sand	Very low

### Groundwater Abstractions

There are no groundwater abstractions within 1km of the proposed Peacock Lane / Waterloo improvements.

In accordance with the Environment Agency website the proposed Peacock Lane / Waterloo improvements is not located within a designated Source Protection Zone (SPZ).

### Hydrology

The following surface water features are located within 500m of the proposed Peacock Lane / Waterloo improvements:

Surface Water Feature	Distance (m)	Direction	Water Quality*
Ditches and land drain	Various distances	Various	Unknown
Unnamed pond	Adjacent	South	Unknown
Unnamed pond	70	South	Unknown

Notes: \* Environment Agency general quality assessment (GQA) river quality classification chemistry/biology

### Surface Water Abstractions

There are no surface water abstractions within 1km of the proposed Peacock Lane / Waterloo improvements.

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## Flooding

The Environment Agency website indicates that the proposed Peacock Lane / Waterloo improvements is not located within an area which is affected by flooding from Rivers or Sea without defences, however, this does not purport to be making a flood risk assessment.

## Summary of Environmental Sensitivity

Overall, the setting of the Overall Study Area is considered to be of **moderate** sensitivity, for the following reasons:

- The presence of the unproductive London Clay Formation beneath the site (Low);
- The presence of potentially shallow and discontinuous groundwater within the superficial deposits (Moderate);
- Presence of the principal aquifer of the White Chalk and an associated source protection zone at depth (Moderate);
- Location of the Emm Brook, ponds and drains (Moderate);
- Presence of surface water abstractions within 500m for irrigation, agriculture and commercial purposes (Moderate);
- Potentially contaminative land uses within the surrounding areas including farms, historical landfill and transfer stations, petrol filling station, railway line, gravel pit and man-made cavity (Moderate to High).

## Preliminary Environmental Conceptual Site Model

The objectives of the pollutant linkage assessment process are to:

- Determine the potential sources of contamination (if present);
- Identify likely specific chemicals from potential sources noted above (if present);
- Identify possible contaminant migration pathways;
- Identify possible receptors (e.g. soil, groundwater, humans and third parties) which could be affected, including their relative potential sensitivity to contaminants given their nature of exposure; and
- Construct a conceptual site model which clarifies the mechanisms by which the site may present a risk, highlighting those sources of risk which will require further assessment and those which can be eliminated.

The conceptual model provides a description of three elements i.e.:

- The actual and probable nature, extent and location of contaminants, i.e. the SOURCE term;
- The potential existing and reasonably foreseeable future on-site and off-site RECEPTORS to contamination; and
- The likely migration PATHWAYS by which contaminants may reach such receptors.

Such information enables the development of plausible pollutant linkages between sources of contamination and receptors, and thus an estimation of the risks that may be present. The typical chemicals associated with the identified land uses have been referenced within DEFRA R&D Publication CLR8: Potential Contaminants for the Assessment of Land and this information has been used to inform our conceptual site model.

Based on the findings of the desk based assessments detailed above, it is considered that the following potential sources of contamination may be encountered as part of the scheme.

Potential Contaminant Sources	Associated Contaminants
Made Ground; Agricultural Land; Various Farms Gravel pit and man-made cavity Petrol Filling Station Historical landfill Railway Line	Metals and inorganics (including asbestos); Pesticides and herbicides; Total petroleum hydrocarbons (TPH); Polycyclic aromatic hydrocarbons (PAH); Ground gas and volatile vapours; Asbestos; and Phosphates, ammonia, sulphate and nitrates.

Pathways may include:

- Direct contact with contaminated soils and groundwater;
- Inhalation and ingestion of contaminated dust;
- Inhalation of volatile vapours and ground gases;
- Migration of contaminants into and through the groundwater; and
- Migration of ground gas and volatile vapours through the unsaturated zone;

Receptors include:

- Construction and maintenance workers
- Groundwater – shallow aquifers (River Terrace, Head Deposits, Alluvium deposits and the Bagshot Beds);
- Surface Water – Land drains, ponds and the Emm Brook; and
- Surrounding residents/properties.

## Summary of Ground Conditions Constraints

### Route Options

#### Route Option A / A1 / A2 / A3

Having evaluated the information gathered during the desk based study, as described in the previous sections; the following potential contamination risks should be given further consideration as part of the proposed Route Option A (including A1 / A2 / A3):

- Railway line;
- Knoll Farm;
- Historical landfill and gravel pit; and
- Petrol filling station.

The route of Route Option A (including A1 / A2 / A3) crosses several geological strata and other potential geotechnical constraints. It is considered that the key geotechnical constraints may include:

- **Soft and variable superficial Alluvium and Head Deposits.**

- Determination of suitable material and parameters for re-use in any areas of the road to be constructed in cut or on an embankment;
- Areas of variable Made Ground associated with the above environmental constraints and potential migration of ground gas/leachate from the historical landfill and gravel pit;
- Potential shallow groundwater within the Alluvium, Head Deposits, River Terrace Deposits and the Bagshot Beds;
- Potential measures required to mitigate the risk of flooding and possible need for flood compensation works; and
- Soft drift deposits associated with the Emm Brook crossing.

### Route Option B / B1

Having evaluated the information gathered during the desk based study as described in the previous sections; the following potential contamination risks should be given further consideration as part of the proposed Route Option B and B1:

- Various farms;
- Railway Line;
- Gravel pit; and,
- Petrol filling station.

The route of Route Option B (including B1) crosses several geological strata and other potential geotechnical constraints. It is considered that the key geotechnical constraints may include:

- Soft and variable superficial Alluvium and Head Deposits.
- Determination of suitable material and parameters for re-use in any areas of the road to be constructed in cut or on an embankment;
- Areas of variable Made Ground associated with the above environmental constraints and potential migration of ground gas/leachate from the historical landfill and gravel pit;
- Potential shallow groundwater within the Alluvium, Head Deposits, River Terrace Deposits and the Bagshot Beds;
- Potential measures required to mitigate the risk of flooding and possible need for flood compensation works; and
- Soft drift deposits associated with the Emm Brook crossing.

### Route Option C / C1

Having evaluated the information gathered during this desk based study as described in the previous sections, the following potential contamination risks should be given further consideration as part of the proposed Route Option C / C1:

- Railway Line;
- Chapel Green Farm and Woods Farm; and
- Petrol filling station.

The route of Route Option C (including C1) crosses several geological strata and other potential geotechnical constraints. It is considered that the key geotechnical constraints may include:

- Soft and variable superficial deposits including Alluvium, River Terrace Deposits and Head Deposits;
- Determination of suitable material and parameters for re-use in any areas of the road to be constructed in cut or on an embankment;

- 
- Areas of variable Made Ground associated with the above environmental constraints;
  - Potential shallow groundwater within superficial deposits and Bagshot Beds;
  - Potential measures required to mitigate the risk of flooding and possible need for flood compensation works; and
  - Soft drift deposits associated with the Emm Brook crossing.

## Local Study Areas

Having evaluated the information gathered during this desk based study as described in the previous sections; the following potential contamination risks should be given further consideration as part of the proposed works within the Local Study Areas:

- Railway Line;
- Petrol filling station;
- Various farms; and,
- Various roads.

The Local Study Areas cross several geological strata and other potential geotechnical constraints. It is considered that the key geotechnical constraints may include:

- Soft and variable superficial deposits including Alluvium, and Head Deposits;
- Determination of suitable material and parameters for re-use in any areas of the works to be constructed in cut or on an embankment;
- Areas of variable Made Ground associated with the above environmental constraints; and
- Potential shallow groundwater within superficial deposits and Bagshot Beds.

## Waterloo Road / Peacock Lane Improvements (Route D)

Having evaluated the information gathered during this desk based study as described in the previous sections; the following potential contamination risks should be given further consideration as part of the proposed improvements of Waterloo Road / Peacock Lane:

- Locks Farm.

It is considered that the key geotechnical constraints may include:

- Determination of suitable material and parameters for re-use in any areas of the improvements to be constructed in cut or on an embankment (if applicable);
- Areas of variable Made Ground associated with the above environmental constraints; and
- Potential shallow groundwater within superficial deposits and Made Ground.

## Recommendations

The following recommendations pertain to all three aspects of the scheme.

It is recommended that a Preliminary Sources Study Report (PSSR) is completed for the chosen option. It is considered that the PSSR will help inform the further recommended ground investigation for geotechnical purposes as well as flood considerations.

Following completion of the PSSR it is recommended that an intrusive site investigation is scoped to satisfy any planning and design requirements. The investigation should be designed to establish any potential geotechnical and environmental constraints with respect to ground, ground gas and groundwater conditions, which may

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represent potential constraints to the proposed road. In addition to the above, an assessment of any potential geotechnical considerations should be made that may affect or impact the proposed works.