Bracknell Forest Council

Environmental Impact Assessment

August 2016

Document Control

Issue	Date	Comments	Prepared By	Checked	Authorised
-	26/08/16	Original	PB	MB	OF

CONTENTS

1 BACKGROUND

In order to ensure that the authority can reduce its carbon footprint, a project affecting all of Bracknell Forests existing standard street lights by installing new lanterns incorporating modern Light Emitting Diodes (LEDs) and controlled by a central management system (CMS), has been initiated. The replacement will be over 2-3 years and will see a 66% reduction in power consumption after the installation phase, for those luminaires that have been replaced.

The street scene ranges from open countryside to conservation areas to urban environments and is lit by lanterns using a mixture of light sources including high and low pressure sodium, metal halide and fluorescent lanterns. In some areas, the existing lighting is not lit to any current standard.

The project has selected circa 13,000 lantern replacements (on existing columns with no scope to relocate columns) with LED lanterns and a Central CMS that will be able to control the lanterns. Each one will have a node and there will be approximately eight control transmitter base stations that will gather information from the lanterns and send data back to the control hub, allowing the maintenance team to manage the asset much more effectively.

The Heritage/Ornate style lanterns within the borough will not be included as part of the LED replacement scheme above. The council once decided and funds permitting will carry this work out at a later date as part of a separate project.

The work will be split into 10 phases to ensure that it is manageable. The first phase will be the main traffic routes through Bracknell. This is to ensure that works are completed quickly, for the main traffic routes, in order that traffic flows are not affected in different stages, subsequently, throughout the following phases. This also ensures that the most inefficient lanterns are replaced first, as there are generally higher wattage lanterns on these routes.

The project will:

- Standardise lighting across the road network (excluding heritage luminaires)
- Introduce a new era in street light maintenance and operation
- Improve visibility and ensure adequate lighting uniformity
- Reduce light spill into people's properties
- Reduce energy use and CO2 emissions
- Provide a remote central control and fault detection system to new lighting
- Provide a remote dimming and trimming (variable) lighting regime
- Improve lighting quality which may reduce the fear of crime, improve visibility of highway and footway people and transport modes, potentially improving public safety

Key elements of design are to:

- Provide good lighting uniformity
- Light safety critical conflict areas (road junctions and roundabouts) to the British Standard
- Where possible provide lighting design to the standard and identify departures where this has not been achieved.

This report presents a desk based study of the existing baseline, assessment of potential impacts and mitigation relating to the installation and operation of the LED replacement program in Bracknell. Should there be a specific local need, due to planning or other public comment to address individual locations, then these will be dealt with on a case by case basis.

The impact of a lighting installation can be quite severe if visual and environmental considerations are not made. Bracknell Forest Council endeavours to ensure that these are considered and in areas that are special requirements are needed, the equipment will be provided to compliment the environmental setting.

Minimising upward obtrusive light, and intrusive light is a key part of the lighting design. The use of better optical control is selected to ensure that these impacts are limited. A further overview occurs later in this report.

2 DESIGN METHODOLOGY

Ringway Jacobs Lighting Design will provide the lighting design and strategy for the project. The following principles will be used throughout the design process.

2.1 Maintainability

The designs will be created to ensure that the number of lantern types are minimised. The project consists of carrying out lantern replacement work on residential areas through to main traffic routes. Due to the variance in road types and their differing geometry there will be a likelihood of sixteen lantern types with eight varying wattages. The design team will do it's best to ensure that this does not increase further.

In a bid to reduce the number of lantern variants on the network the road lighting will be deemed acceptable, if the design can be met within a 10% tolerance of the required levels for the road. There will be a small energy compromise with this strategy but the maintainability will be much improved and any energy impact will be monitored.

2.2 Calculations

Calculations will be carried out for each and every individual road, which will include an assessment of lighting class for compliance with BS5489:2013.

For conflict areas, such as roundabouts for example, area calculations will be carried out and the location of the columns will also be verified to ensure that the calculations are accurate.

2.3 Large column spacing's

Where roads are non-compliant, then comparison calculations, using Lighting Reality Area software, will be carried out to ensure that useful light levels are maintained or improved

This means that where it is not always possible to get a compliant design, due to the inability to move columns or install new ones in new locations in this contract, where no standard was met previously, then the design team will ensure that the best solution will be provided and that levels are not worse than that already exists where possible.

Where possible, we would make use of photometric comparison grids to ensure that light projected on the highway is not worse than it was previously in areas where BS5489 where is not met.

2.4 Environment

The design will use the environmental maps and bat information supplied by the authority and their biodiversity officer/ planning team. Several layers have been produced that are to be loaded into the designs.

Any columns that are located within any one of the affected environmental designations such as the necessity to have reduced light near a column a shield will be used to minimise any obtrusive light.

3 INFORMATION FOR ASSESSMENT

Data has been taken from the council's asset management system and combined with its GIS data. Each location has an existing lighting point and all planning requirements e.g. conservation areas, listed surroundings are already in place.

The information that has been used is as follows:

1. The Councils own Inventory data and mapping tool (map not photograph based only)
    - Asset location and information
    - Unique Asset ID
    - Column ID
    - Column Height
    - Eastings / Northings (Location to determine spacing's)
    - Bracket Information / Post top / Side Entry
    - Concrete Column Locations
    - Existing Lantern Information – Type / Wattage
    - Environmental maps
    - Conservation Areas
    - Sites of Special Scientific Interest England – SSSIs
    - Special Areas of Conservation (England) - SACs
    - Special Protection Areas - SPAs
    - Local Wildlife Sites
    - Historic Parks / Gardens
    - Windsor Park
2. Web based street viewing tools such as Google maps, google earth and Bing
3. Liaison with the biodiversity officer to carry out a desk study of bat activity in the vicinity of the lit roads
4. Due to the size of the project a number of locations have been selected to carry out a comparative lighting design assessment of the existing network along with the proposed for the light presence.

4 METHOD OF ASSESSMENT

This section outlines where information has been supplied and the areas that the assessment covers and the reasons for assessing them.

4.1 The Equipment

Looking at the equipment it is important to assess what the impact of the technologies have to the environment. They can effect maintenance requirements and energy (covered in section below).

4.2 Energy and Carbon

Bracknell Forest Council aim to reduce their overall energy consumption and carbon emissions. Street Lighting has an impact on the environment through the consumption of the electricity. It is important to assess the consumption of energy to show the potential benefits of the proposed system of

4.3 Light presence

The Council recognises that lighting can provide many benefits and in some areas can help reduce crime and increase the perception of safety. When implementing the upgrade to the existing network, the local environment is taken into consideration. Elements such as pedestrian safety and lighting of crossings and local amenities are taken into consideration to ensure that the night time environment is enhanced and not reduced due to other factors such as light pollution.

It is important to ensure that the project will support the aims of the Authority's Sustainable Strategy which include:

- Thriving economy
- Safe communities
- Health and wellbeing
- Cohesive and strong communities
- Highway safety for road users

4.3.1 Obtrusive Light

Obtrusive light is light which falls outside the area to be illuminated which, because of its quantity, direction or colour causes annoyance, discomfort, distraction or reduces the ability to see. Obtrusive light is often referred to as light pollution, which can be defined as the adverse effect of artificial light. Obtrusive light can be subdivided into three main categories, sky glow, glare and light trespass.

The council shall ensure that considerations are made to reduce the impact of obtrusive light by:

- Reviewing the control of the type of light source
- Selecting luminaires that restrict the level of light emitted by the luminaire at high angles usually between 80 and 95 degrees.
- Special consideration will be given to the effect of lighting on adjacent areas used by other means of transport such as:
- Railways
- Transport interchanges
- Adjacent unlit traffic routes
- Car parks
- Environmental Zones (covered later)

4.3.1.1 Glare

For the traffic routes, the main measure of glare in a lighting design for traffic routes is threshold increment (TI). A luminaire with a poor glare rating can provide a good TI in the correct lighting layout arrangement. Glare is also affected by background lighting, so is reduced in an urban environment. All traffic routes will be designed using M class calculations, meaning that the TI is taken into account.

Glare is affected by the mounting angle for lantern on the column. It is important that when looking at glare ratings, they relate to the environment that is recommended in BS5489. Whilst some schemes try to reduce the impact to residents by introducing glare ratings. This can reduce spacing's and in many cases will not provide the best option for reducing light intrusion. In order to show that the levels of light intrusion are acceptable an assessment must be made to ensure that the correct level is used and whether light intrusion into properties can be limited using a lower glare rated lanterns or by using shields affixed to lanterns.

The following table shows the different criteria of the glare classes (values are in candela per thousand lumens).

Table 1 – Glare Classes

Glare class	G1	G2	G3	G4	G5	G6
Imax70	n/a	n/a	n/a	500	350	350
Imax80	200	150	100	100	100	100
Imax90	50	30	20	10	10	0
Imax95	-	-	-	0	0	0

4.3.1.2 Light Intrusion

Light intrusion is a key issue when designing and has become even more important since designing with LED's and white light sources as some residents find that they appear more intrusive. This project ensures that the designs are effective for roads and whilst reducing the impact on the residents.

Traffic routes will be classed as an E4 zone and will have a maximum limit of 5 lux going into a property window. For all other routes they will be classed as an E3 zone and therefore the design will work toward a maximum of 2 lux going into windows in residential areas. It must be noted that for traffic routes that go through residential areas if the road is to be illuminated effectively there are occasions where these levels are not achievable. Through the design process this will be monitored and the new lanterns in most cases will improve current levels of light intrusion as can be seen in the mitigation below.

Please see extract Table 2 from the ILP guidance for Reduction of Obtrusive Light showing the acceptable levels for Light Intrusion that will apply for the LED replacement scheme.

Table 2 – Environmental Classes

Environmental Zone	Sky Glow		Light Intrusion (into Windows)	Luminaire Intensity		Building Luminance
	ULR [Max %](1)		Eav [lux] (2)	I [candelas] (3)		Average
Pre- curfew	Pre- curfew	Post-curfew	Pre- curfew	Pre-curfew (4)	Post-curfew	L [cd/m2]
E3	5	10	2	10,000	1,000	10
E4	15	25	5	25,000	2,500	25

4.3.2 Potential Impacts around LED's

The review will also include an overview of the Public Health England a report entitled, 'Human responses to lighting based on LED lighting solutions'. The report concentrates on the impact of the optical radiation from LEDs on Human Health, and does not specifically cover the effects on flora or fauna.

It is not specific to street lighting; it also covers domestic and office class LED's so care should be taken not make assumptions on comments made on the other LED types.

The following areas will be looked at:

- Flicker
- Ocular Safety
- Hot spots / Glare
- Correlated Colour Temperature (CCT)

4.4 Local Community and Neighbours

4.4.1 Night working – Construction Phase only

Some of the work will require night working and impact and mitigation will be outlined in this report.

4.4.2 Public rights of way

There are many public rights-of-way that are lit with street lights. It is important to ensure that light levels are kept to the current levels or improved and that the useful light area is not reduced.

4.5 Land, Nature and Biodiversity

The highway network provides a wide variety of habitats for plants and animals, and it is our legal duty under the Natural Environment and Rural Communities Act 2006 to protect this environment when carrying out the work. Works are to be designed to provide a balance between maintaining a safe network for highway users, improving the visual amenity of the street scene and protecting the habitat.

There are a number of nature designations, landmarks and conservation areas and lighting has a potential impact on these areas. There is also a range of protected species that occur in the area, of particular concern for lighting are bats (see below).

To ensure that the correct considerations and mitigations are made we have worked with the planning and biodiversity officers.

4.5.1 Nature designations

In this assessment, we have identified the following nature designations:

- Special Protection Area (SPA) - land classified under EU Directive 79/409 on the Conservation of Wild Birds.
- A Special Area of Conservation (SAC) - land designated under EU Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora.
- Local Nature Reserve (LNR) - land declared under the National Parks and Access to the Countryside Act 1949 or Wildlife and Countryside Act (1981) as amended.
- Site of Special Scientific Interest (SSSI) - land notified as an SSSI under the Wildlife and Countryside Act (1981), as amended. SSSI are the finest sites for wildlife and natural features in England, supporting many characteristic, rare and endangered species, habitats and natural features.

- Local Wildlife Sites - These are non-statutory sites of significant value for the conservation of wildlife designated against set criteria by the Berkshire Local Nature Partnership in accordance with guidance from DEFRA. These sites are protected within the planning system.

4.5.2 Bats

All bat species and their roosts are protected under section 41 of the Conservation of Habitats and Species Regulations 2010. As a signatory to the Bonn Convention (Agreement on the Conservation of Bats in Europe) the UK is also required to protect their habitats. Therefore, the lighting scheme needs to avoid impacts on these species through sensitive design.

To identify potential impacts, a desk study was made to identify lighting columns within 25 metres of woodland, wetland, greenspace and bat records provided to the council by Thames Valley Environmental Records centre.

4.6 Conservation Areas

There are a number of conservation areas and it is important that there is not a negative change of appearance in conservation areas.

4.7 Listed Buildings

There are a number of listed building throughout the borough and it is important that any listed buildings appearance is not effected by the program.

4.8 Scheduled Ancient Monuments

Scheduling evolved specifically for sites of an archaeological character. It is our oldest form of heritage protection, dating from the 1882 Ancient Monuments Act, when a 'Schedule' of prehistoric sites deserving of state protection was first compiled.

There are a number of these Monuments and it is important to review if these will be effected by the project.

4.9 Waste

It is important to ensure that all waste generated is collected and disposed of in accordance with the Environmental Protection Act 1990.

The average household in the UK produces more than a tonne of waste every year. Put together, this comes to a total of 31 million tonnes per year, equivalent to the weight of three and a half million double-decker buses.

It is important to make a difference by recycling this reduces the need to use more natural resources. By reducing our waste we decrease the need for more landfill. By reusing more we can save money and reduce the need to consume and produce more waste.

4.10 Sustainability Statements – manufacturer and contractor

In order to ensure a fully sustainable project the main suppliers of the materials must also embrace the attitude of sustainability ensuring the following initiatives are at the core of their company:

- Well-being;
- Supporting Society

- Sustainable Planet
- Minimise waste
- Meet or exceed all the environmental legislation
- Demonstrate efficient use of energy and water
- Promote environmental awareness among their employees

5 BASELINE ASSESSMENT

In order to carry out an effective assessment it is important to identify the effect of the existing lighting.

As set out above this project is only replacing existing lighting units on a one for one basis we will not be adding new units as part of the project. This baseline assessment will be different to the norm due to the scale of the implementation whilst a review of the complete network has been undertaken, it is not possible to complete lighting designs for all the areas and therefore 20 locations have been selected for the section on light presence and for the Land and Biodiversity assessment 12 locations have been looked at to give a good comparative assessment.

The street scene ranges from open countryside to conservation areas to urban environments and is lit by lanterns using a mixture of light sources including high and low pressure sodium, metal halide and fluorescent lanterns. In some areas, the existing lighting is not lit to any current standard. Examples of the existing street scene can be seen below.

5.1 The Equipment

Bracknell Forest Council currently has an aging asset there are a high number of SOX lanterns which do not provide the same quality of light as newer technologies. There are also a number of SON lanterns that consume a high amount of energy and provide an average quality of light. Many of these lanterns still are utilising mechanical ballast and will not be able to be replaced in 2017 as part of the ***(EU) Regulation No 347/2010***, most of these lanterns have passed their life expectancy and use a high amount of energy. A summary of the types of lanterns can be seen below.

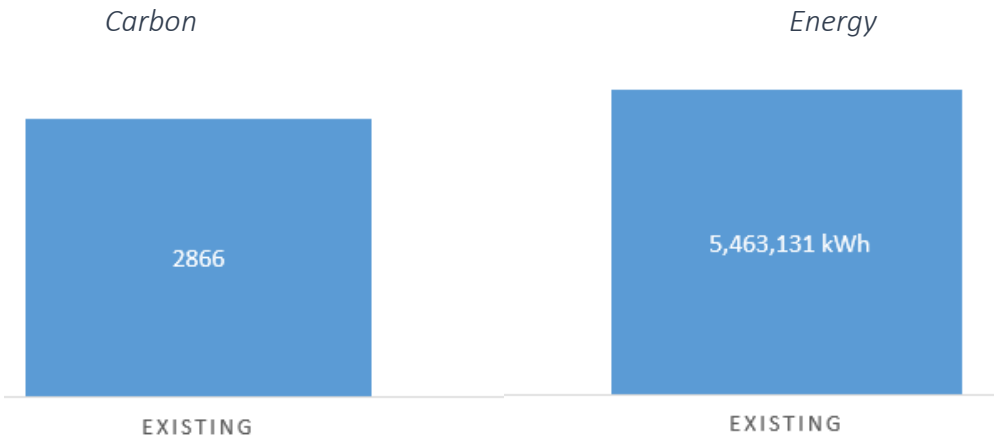
Table 3 – Existing Lamp Types

Lamp Type	Totals
35W CDM	31
70W CDM	213
150W CDM	26
45W COSMO	436
60W COSMO	129
60W GLS	59
50 SON	3,944
70 SON	1,050
100 SON	1,286
150 SON	1,198
250W SON	337
35 SOX	4,640
55W SOX	243
90W SOX	390
135 SOX	368
180W SOX	130
400W SON	15

5.2 Energy and Carbon

Currently the Authority has carbon footprint of the 2866 tonnes and is consuming 5,463 MWh per annum. This is a much larger consumption than that would be if using newer technology such as LED's.

Graph 1 – Energy Consumption



5.3 Light Presence

Many of the roads are lit with old luminaires that give out poor lighting and no colour rendition (unable to see colours). They are lit by luminaires using a mixture of light sources including high and low pressure sodium, metal halide and fluorescent lamps. In some areas, the existing lighting is not lit to any current standard.

Where the roads are lit they are providing light that reduces the fear of crime and the main roads and pedestrian crossing are lit to a good level of lighting which promotes safe road network.

5.3.1 Obtrusive Light

Many of the residential areas area lit by post top luminaires that emit light in all 360^0 directions. The light is also emitted above the horizontal.

5.3.1.1 Glare

The current lanterns are within the acceptable limits of glare, a snap shot of the glare ratings can be seen in Table 4.

Table 4 – Existing Lantern Snap Shot

Glare class	Philips SGS201 (FG P1)	Phillips SGS 252 GB	WRTL 2000 SDN	Phillips SGS201 PC	MA 90W SOX	Philips SGS253 (PC P1)
Imax70	408.0	601	182	375.9	286	532.9
Imax80	49.0	13	156	10.3	178	116.5
Imax90	3.0	1	108	2.1	53	6.3

5.3.1.2 Light Intrusion

It can be seen that lighting profile emitted the luminaires not are not only lighting the highway but lighting the resident's gardens and in some cases their houses as well.

From the initial assessment calculations (supporting information in *Appendix A*) it can be seen that there are a **13** roads that have houses that are effected by levels that are above the acceptable levels set out in ILP recommendations. On two roads there are **15** occasions where the levels are higher than the recommended level.

Table 5 – Existing Light Intrusion Assessment

Road Name	Traffic Route / Residential	Houses within 2 lux contour line	Houses within 5 lux contour line
PH1-004 Wokingham Road	Traffic Route	8	2
PH1-006 cx f3 Road	Traffic Route	9	0
PH1-015 Downshire Way	Traffic Route	17	0
PH1-016 Yorktown Road	Traffic Route	17	0
PH1-022 Sandhurst Road	Traffic Route	18	2
PH2-017 Alford Close	Residential	15	5
PH2-025 Perryhill Drive	Residential	2	0
PH2-029 Lake End Way	Residential	2	0
PH2-037 Edgecumbe Drive	Residential	0	0
PH2-053 Academy Place	Residential	5	3
PH3-003 Greenham Wood	Residential	3	0
PH3-010 Travelyan	Residential	1	0
PH3-024 Beedon Drive	Residential	2	0
PH3-034 The Green	Residential	0	0

PH3-043 Hopper Vale	Residential	15	5
PH4-032 Crowthorne Road	Residential	0	0
PH4-044 Wylam	Residential	0	0
PH4-052 Saffron Road	Residential	4	0
PH4-055 Oxenhope	Residential	2	0
PH4-062 Beech Glen	Residential	3	0

5.4 Local Community and Neighbourhoods

As can be seen in the light presence section the lighting is provided light that reduces the fear of crime and increases road safety be lighting conflict areas and the roads and footpaths.

5.4.1 Public rights of way

There are many public rights-of-way that are lit with street lighting it is important to ensure that light levels are kept to the current levels and not reduced for the useful light area.

5.5 Land, Nature and Biodiversity

5.5.1 Nature designations

1. There are a number of landmarks, statutory designations, nature reserves and conservation areas and these are summarised below further details can be found in *Appendix B*. There are nine **Local Nature Reserve (LNR)** that are in the vicinity of the existing lighting the designs.
2. There are 29 **Local Wildlife Sites** (LWS) near to existing lighting. These are designated by the Berkshire Local Partnership and recognised in planning policies.
3. There are 7 small **Sites of Special Scientific Interest** (SSSIs) and two large SSSIs (Windsor Forest and Great Park and Broadmoor to Baghot Woods and heaths.
4. Windsor Forest and Great Park is also designated as a **Special Area of Conservation** (SAC) which is the land designated under Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora
5. Bracknell Forest is also home to the Thames Basin Heaths which is designated as a **Special Protection Area** (SPA) which is the land classified under Directive 79/409 on the Conservation of Wild Birds.

Existing lighting is likely to have a range of effects on the designated areas, habitats and species that vary depending on the type of lighting and its proximity to habitats at each site. Light can alter plant growth and change activity patterns of species that affect the structure and composition of habitats. Light can impact on designated sites by altering the habitats or disturbing the species for which they are designated. This assessment is focused on whether the new LED lighting will increase or decrease the effect of lighting on biodiversity covered in Proposed Project.

5.5.2 Bats

Work with the biodiversity officer has revealed that an area of concern is the effect of lighting on biodiversity, particularly bats. A desk study has been conducted which identified **important bat areas** based on the presence of greenspaces, woodland and wetland habitats close to existing road light columns (*Appendix C*).

Lighting can negatively impact bats by creating a barrier to movement, removing available foraging habitat and becoming an artificial draw affecting species abundance and competition (Bat Conservation Trust, 2014 and Buglife, 2011). Current guidance indicates that lighting above 2 lux can affect bat foraging. There are 7 types of bat activity which consist of roosting, emergence, swarming, commuting, foraging, breeding and hibernation. The potential effect of lighting differs with the activity:

- Roosting/Emergence
- The selection of a roosting location depends on light level inside
- Leaving the roost depends on light level outside
- Commuting
- The choice of commuting route depends on light level
- Lines of light can block commuting routes
- Foraging
- Hunting insects attracted by light or avoiding light, depending on species as explained below.
- The effect of lighting differs between classes of bats. Bats can be grouped into 'fat-flying' such as Pipistrelles and slow flying such as Long-eared bats. The table below shows how there are different impacts depending on light source to different species

Table 6 – Summary of current evidence of the impacts of different light types on UK Bats

Light type	Species	Impact	Evidence
White LED	*Rhinolophus hipposideros* and *Myotis* spp.	Reduced activity and spatial avoidance of commuting routes	Stone *et al.*, 2012
Warm white LED	Unknown at present	Unknown - though likely to have less impact on light sensitive species than white light types	
Low pressure sodium	*Nyctalus noctula*	Increased activity and foraging	Rydell & Baagoe 1996
	Pipistrellus spp.	No significant increase in activity compared to dark areas	Blake *et al.*, 1994
High pressure sodium	*Rhinolophus hipposideros and Myotis* spp.	Reduced activity and spatial avoidance of commuting routes; delayed commuting time	Stone *et al.*, 2009; 2011
	Pipistrellus spp., *Nyctalus noctula, Eptesicus serotinus*	Increased activity and foraging	Rydell & Baagoe 1996
Compact fluorescent	Unknown at present	Unknown - though likely to have a similar impact on light sensitive species as other white light types	
Mercury vapor lamps	*P. pipistrellus and Pipistrellus* spp. *Eptesicus* spp.	Increased activity (Rydell (1991) recorded increased activity of *Eptescius nilssoni* (a species not present in the UK) at mercury vapor lamps in Sweden in spring April – May)	Haffner & Stutz 1985; Blake *et al.* 1994, Rydell & Racey 1995.

Source: Bats and Lighting – Overview of Current evidence and mitigation, *Edited by – Emma L Stone Bats and Lighting Research Project, University of Bristol* Marketing, PLA (UK) Group, May 2014

To assess the impact of lighting 12 sample areas have been looked at that are in the vicinity of 18 of the Designated sites which include the effect on seven important bat areas, shown in Table 8 (supporting calculations can be seen in *Appendix D*). Looking at the areas that are affected by the existing light it can be seen that more than 2 lux encroaches into these areas and it is best to minimise this. Currently there is no additional light control in these areas, for bat areas where tree line is higher than the columns the impact is significantly reduced. However, good light control should always be used and this highlights an opportunity to improve the current situation.

Table 7 – Existing Land, Nature and Biodiversity Lighting Assessment

Road Name	Environment Type	Effect Important bat area Yes / No	Tree Line Yes / No	Columns Higher than trees Yes / No	Areas within 2 lux contour line	Areas within 5 lux contour line
London Road	Local Nature Reserve (LNR) / Sites of Special Scientific Interest	Yes	Yes	No	6	5
Wokingham Road	Local Nature Reserve (LNR)	No	-	-	11	11
Crowthorne Road	Local Nature Reserve (LNR) / Local Wildlife Sites / Special Protection Area	Yes	Yes	No	11	11
Rackstraw Road	Sites of Special Scientific Interest / Special Protection Area	Yes	Yes	Yes	11	11
Marshall Road	Local Wildlife Sites / Sites of Special Scientific Interest	Yes	Yes	Yes	11 / 8	11 / 8
Forest Road	Local Wildlife Sites	Yes	Yes	No	2	0
Foresters Way	Special Protection Area	Yes	Yes	No	4	4
South Road	Historic registered parks and gardens	Yes	No	No	6	6
Copenhagen Walk	Special Area of Conservation	No	-	-	3	3
South Hill Road	Historic registered parks and gardens	No	-	-	9	9
Rectory Lane	Special Area of Conservation / Historic registered parks and gardens	No	-	-	14	14
Rainforest Walk	Special Area of Conservation	No	-	-	3	3

5.6 Conservation Area's

There are a number of conservation areas and there is a mix of heritage style lanterns that are in keeping with the surroundings and also there are a number of utilitarian lanterns that are also present and these will be highlighted and opportunity to provide further funding to upgrade these units to bespoke equipment shall be assessed.

5.7 Listed Buildings

All bespoke equipment on listed buildings shall remain, if any standard luminaires are on these buildings then listed building consent will still be required prior to any replacement.

5.8 Assessment of baseline (current effect)

Table 8 – Baseline Assessment

Issue	Current Impact / Risk Rating	Description	Comments
The Equipment	Existing Effect Negative Risk Rating 6	Most of the network is using old technology that do not meet the performance requirement of the EU directive to reduce carbon footprint.	Opportunity to lower energy and replace an aging asset
Energy and Carbon	Existing Effect Negative Risk Rating 6	Currently the existing lighting network is consuming lots of energy and is having a negative impact on the environment	Opportunity to lower energy
Obtrusive Light	Existing Effect Negative Risk Rating 5	There are only a small number of luminaires that have shields to limit obtrusive light. These units also have limited amount of control and there is a lot of spill light into property gardens and windows. In some cases much more than the permissible mount as per ILP guidance for Obtrusive Light It can be seen from the sample sites that there is are a number of houses that are impacted by higher levels of light than that is recommended by the ILP guidance	Opportunity to decrease obtrusive light
Public right of Ways	Existing Effect Neutral Risk Rating 4	Currently many of these are not lit to any standard, and in some situation are only there to provide guidance lighting.	Opportunity to provide more useful light on the PoW
Land, Nature and Biodiversity	Existing Effect Negative Risk Rating 6	There are a number of columns that are in the vicinity of environmental areas. No specialist light control has been used in these areas.	Better light control around these areas could reduce this impact
Bats	Existing Effect Negative Risk Rating 5	Many lanterns in bat areas these utilise a warm colour temperature however have not got additional light control	Better light control around these areas could reduce this impact
Conservation areas	Existing Effect Negative Risk Rating	There are a number of heritage style luminaires at that are in keeping with the environment but there are also a number of	Possible opportunity for finding funding

	5	utilitarian lanterns that in the areas	
Listed Buildings	Existing Effect Positive Risk Rating 2	Listed buildings generally have specialised equipment installed to keep the style in keeping with it heritage.	It is assumed that lanterns on listed building have been attached and approved through the listed building consent.
Waste disposal	Existing Effect Neutral Risk Rating 4	Ringway have a strict waste management plan and this will be completed before any works are carried out.	
Lamp Disposal	Existing Effect Neutral Risk Rating 4	Disposed with a WEEE regulated contractor	
Partner Sustainability Profile	Existing Effect Positive Risk Rating 3	Current contractor has an excellent sustainable profile, all other materials suppliers are varied so this has not been assessed in the baseline assessment	

6 IMPACT ASSESSMENT AND MITIGATIONS OF PROPOSED PROJECT

6.1 The Equipment

Bracknell Forest Council have ensured that the equipment is procured through reputable manufacturers that provide equipment that is sustainable and reliable. The project will combine two thriving technologies LED and CMS to provide a dynamic system. An overview of the technology can be seen below with further details in *Appendix E*.

6.1.1 LED Technology

LED) street lighting has been chosen as the preferred technology and has several advantages over the existing equipment:

LED Benefits	Emits no UV light unlike other sources such as Metal Halide sources and Fluorescent
	Assist in meeting environmental commitments reducing of carbon footprint
	Improves the quality of light whilst reducing the spill light
	Better light control reducing spill light into the environment
	Have long life from 10 – 20 years with a minimal maintenance

6.1.2 CMS

The Central Management System (CMS) provides effective management of the street lighting and lit furniture assets and can reduce routine scouting by instantly identifying faults with apparatus on the network.

CMS Benefits	Accurate reporting on power consumption
	Future proofing - upcoming new technology will integrate traffic systems for variable lighting profiles
	Daily reporting on faults for reactive maintenance reducing vehicle travel so further reducing carbon emissions
	Override switching for special events
	Remote Hosting by the CMS provider which will manage the Telecells
	Possible SMART metering (to be approved by NMO / Elexon)

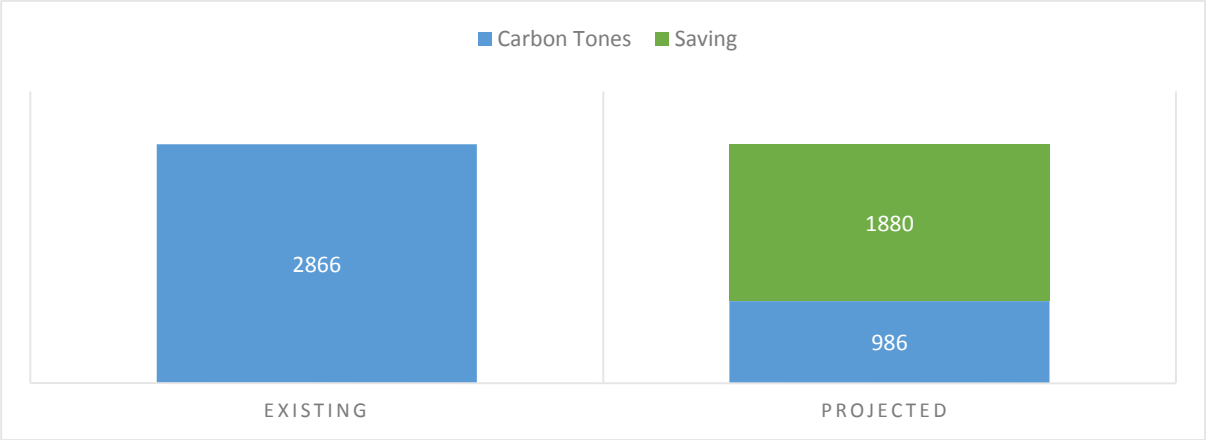
6.2 Energy and Carbon

The replacement of existing luminaires with LED lanterns can provide a significant reduction in power consumption and carbon emissions, whilst reducing the frequency of regular planned and reactive maintenance, reducing time on the network and CO2 emissions from the vehicles repairing the lanterns.

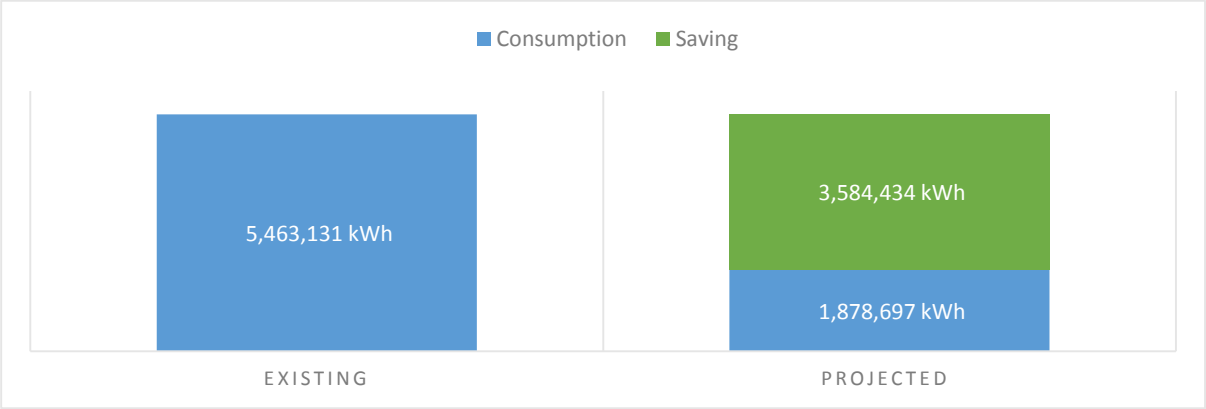
This scheme is set to reduce the carbon footprint of the 13,000 assets by 66% saving around 3,584 MWh per annum equating to an average carbon reduction per annum of 1880 tonnes once the project has been completed.

The LED replacement scheme will ensure power consumption and carbon emissions are significantly reduced whilst also providing a more sustainable environment.

Graph 2 – Carbon Savings



Graph 3 – Energy Savings



6.3 Light presence

The new system of street lighting will promote and maintain safety for all users of the highway the designs shall be carried out to the new British Standard and shall improve the quality of lighting in many of the areas which will have a positive impact on vulnerable user groups such as pedestrians, cyclists, the elderly or people with disabilities and children, the principal aim of which is to reduce night-time accidents.

6.3.1 Obtrusive Light

6.3.1.1 Glare

Unfortunately LED's do have a higher glare level at the 70^0 driver angle however when luminaires were selected to keep near as possible to the 500lm/Cd cut off for G4. There is one lantern being much more than this and this is due to the narrow optic putting light where is needed but pushing more light sideways which in turn increases the glare, this will mainly be used for footpaths so will limit effect on vehicle users.

The new lanterns have very good Imax 80 and above values which will help the reduction light pollution from other types of LED's.

Table 9 - Proposed Luminaire Glare Ratings

Glare class	DN11	DM10	R6	DX10	R5	R9
Imax70	650.5	511.3	382.7	519.4	445.4	106
Imax80	58.8	69.6	69.7	86.3	68.6	21.6
Imax90	0	0	0	0	0	0
Imax95	0	0	0	0	0	0

6.3.1.2 Light Intrusion

Looking at the calculations showing the 2 and 5 ISO lux contour show that the light intrusion is much improved from the original. Whereas **13** roads where adversely effected now only **four** roads where effected with a maximum of **7** houses on a road rather than **15**.

Although it can be seen that this is not eliminated the issue these units will incorporate shields which will further reduce the issue (currently we do not have the photometric data to assess this but can be done when available). This will only improve the situation.

Table 10 – Comparison of Light Intrusion

Road Name	Traffic Route / Residential	Existing		Proposed	
		Houses within 2 lux contour line	Houses within 5 lux contour line	Houses within 2 lux contour line	Houses within 5 lux contour line
PH1-004 Wokingham Road	Traffic Route	8	2	4	2
PH1-006 Bagshot Road	Traffic Route	9	0	0	0
PH1-015 Downshire Way	Traffic Route	17	0	2	0
PH1-016 Yorktown Road	Traffic Route	17	0	6	0
PH1-022 Sandhurst Road	Traffic Route	18	2	5	0
PH2-017 Alford Close	Residential	15	5	5	3
PH2-025 Perryhill Drive	Residential	2	0	0	0
PH2-029 Lake End Way	Residential	2	0	0	0
PH2-037 Edgecumbe Drive	Residential	0	0	0	0
PH2-053 Academy Place	Residential	5	3	3	0
PH3-003 Greenham Wood	Residential	3	0	0	0
PH3-010 Travelyan	Residential	1	0	0	0
PH3-024 Beedon Drive	Residential	2	0	0	0
PH3-034 The Green	Residential	0	0	0	0
PH3-043 Hopper Vale	Residential	15	5	7	2
PH4-032 Crowthorne Road	Residential	0	0	0	0
PH4-044 Wylam	Residential	0	0	0	0
PH4-052 Saffron Road	Residential	4	0	0	0
PH4-055 Oxenhope	Residential	2	0	0	0
PH4-062 Beech Glen	Residential	3	0	0	0

6.3.1.3 Mitigation

Design

It can clearly demonstrated that in the situations that have been tested there has been an improvement on the levels of light entering resident's windows.

Where possible the use of the DN optic will be minimised to ensure that glare levels in respect of a vehicle road user.

Installation Angle

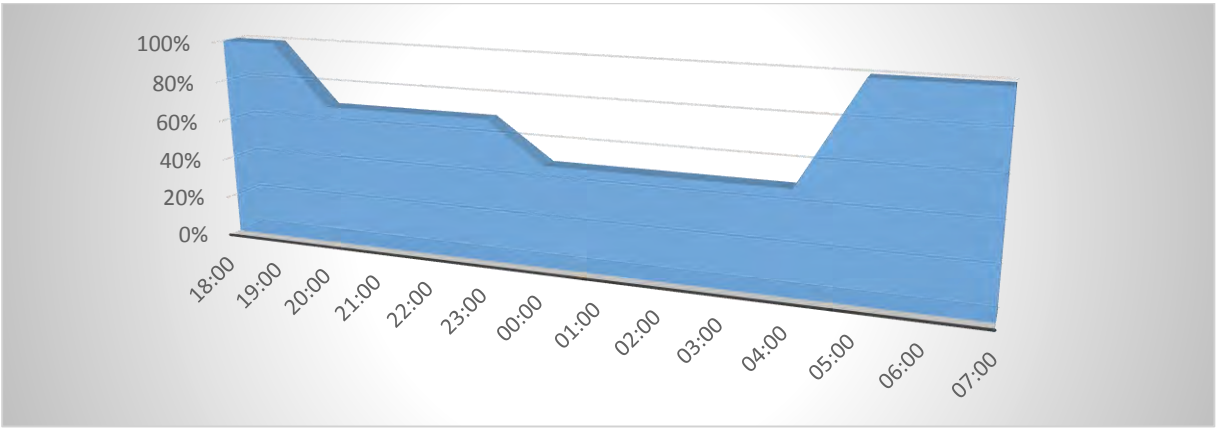
All lanterns will be installed at 0 degree tilt this will ensure that forward light into buildings is minimised.

Variable Lighting Strategy

A colour temperature of 4000K has been specified as this gives a good colour rendition and colour appearance. To ensure that residents are not affected unduly by the whiter light, a progressive variable lighting strategy has been used to ensure that enhanced lighting will be used during peak traffic flows. During the later hours of night the light levels will reduce by as much as half by midnight.

The variable lighting strategy will be as follows:

- Stage one - 100% light output between hours of darkness occurring between 05:00 – 20:00
- Stage two - Dim to 70% light output between 20:00 – 00:00
- Stage three - Dim to 50% light output between 00:00 – 05:00



Lighting Shields

The lanterns that have been selected for the project allow the use of two types of shields, one being an internal shield which is not visible but is the most effective and the other is an external shield fitting to the luminaire.

Throughout the design process if lighting levels are above the 2 lux level internal shields will be specified.

6.3.2 Potential Impacts around LED's

Public Health England have created a report entitled, 'Human responses to lighting based on LED lighting solutions'. The report concentrates on the impact of the optical radiation from LEDs on Human Health, and does not specifically cover the effects on flora or fauna.

It is not specific to street lighting; it also covers domestic and office class LED's so care should be taken not make assumptions on comments made on the other LED types.

6.3.2.1 Flicker

The LEDs used in street lighting lanterns were tested and demonstrated very low flicker, particularly when compared to office and domestic lighting. It states that for LED street lighting, it is possible for them to be flicker free. Flicker in higher levels has the potential to trigger seizures, migraines, headaches and may be visually uncomfortable or a persistent distraction.

Mitigation

Philips is a reputable manufacturer who have carried out a lot of research and product development to ensure that the LED Luminaires are flicker free, however there can be issues with the mains supply that can cause flicker and if this occurs then this will be investigated and resolved.

6.3.2.2 Ocular Safety

None of the street lanterns tested and measured for ultra-violet (UV), emitted UV radiation or more than negligible amounts of infrared radiation either. The LED light sources measured were not bright enough to cause retinal damage in normal use at reasonable distances. The assessments made do not cover the safety of street lights close up, however, at a distance of 2 m, reaching the exposure limit values for the Blue Light Hazard would require steady fixation for over 2½ hours (based on conservative calculations). Therefore, in normal use, at reasonable distances and through normal behaviour, none of the LEDs measured presented any optical radiation hazards as defined by international exposure guidelines, and developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Mitigation

This means that there will be no threat in most cases as the LEDs will be fitted at 5m mounting height and above the working plane: i.e. the ground. This is well above the 2m, 'reasonable distance' stated. This will also prove no threat to our operatives, as they should isolate before going aloft.

Where LED's are fitted within 2m of a window (in cases such as terraced houses with no frontage or on wall mounts). These luminaires will incorporate shields to minimise any issues.

6.3.2.3 Hot spots / Glare

It highlights that hot spots (which may result in temporary visual impairment) are prevalent for most street lighting LEDs, and it is advised that the luminaire's should be designed to minimise the impact of this.

Mitigation

Throughout the design process, considerations will be given to ensure the best light distribution is used for each road in relation to all of the criteria described above when selecting or specifying products. Further details can be seen in the obtrusive light section in this report.

6.3.2.4 Correlated Colour Temperature (CCT)

It states that the introduction of high CCT white light sources may give cause for concern, as increased levels of blue light exposure in the evening have been shown to cause melatonin suppression and subsequent phase delays in the melatonin cycle. This can interrupt circadian rhythms and in turn disrupts sleep.

It recommends that consideration be given to reducing the CCT of LED lighting to avoid potential adverse effects on melatonin production in the evening. It does not, however, recommend a threshold CCT that should not be exceeded in general lighting applications.

Mitigation

Whilst no CCT value is stated, the current preference within the industry in the UK is to avoid exceeding 4000 K. Using a colour temperature of 4000 K allows lighting levels to be reduced further under the

latest British standard BS5489:2013. In this standard it allows us to use an S/P ratio which because of the white light source allows the human eye to better differentiate between colours / objects and gives better visual guidance.

Due to this the compromise in increasing the colour temperature from 3000 K to 4000 K is offset by the further reduction in light levels. This combined with the better control of light to ensure that the light is lighting the required highway and not properties will ensure that in most cases spill light is reduced when compared to the original lighting installation.

It must be noted that if the colour temperature is 3000k an increase of energy from around 12-18% can be seen and this will have an impact on the carbon footprint

6.4 Local Community and Neighbours

As described in section above the light will provide a safe environment of residents and also reduce the light intrusion into people's properties.

6.4.1 Night working

Night working is essential for traffic sensitive areas such as roundabouts, junctions and routes with high volumes of traffic during peak hours. Night work will be carried out between the hours of 20:00 and 05:00. To ensure that residents that are affected are aware that the works will be carried out at night in advance, they will be informed in writing.

6.4.2 Public rights of way

Currently many of these are not lit to any standard, so to ensure that levels are improved, comparison calculations are carried out for every location that doesn't comply with a standard. This ensures that the levels of lighting are either the same or improved. In the initial calculations, it can be seen that lighting is improved in most cases, as the luminaires are more directional and distribute light further along footpaths rather than wasting light beyond the front and back of the paths.

6.5 Land, Nature and Biodiversity

Based on current guidance, to minimise the impact on biodiversity, the specification for the lighting should as far as possible:

- use restricted lighting hours or dim lighting
- reduce the light spill
- avoid wavelengths <500nm
- use shields to direct light
- use the lowest lighting level, 2 lux to avoid impacts on bats

The new lighting will have better intrinsic optical control this should decrease the area of unnecessarily lit space from the existing scenario.

As shown in the baseline assessment there are a number of areas affected and the comparison matrix of the 12 locations can demonstrate that there is better control of the light and should improve the current situation. The supporting lighting calculations can be seen in *Appendix D*.

Table 11 – Land, Nature and Biodiversity Lighting Assessment

					Proposed		
Road Name	Environment Type	Bats Yes / No	Tree Line Yes / No	Column Higher than trees Yes / No	Areas within 2 lux contour line	Areas within 5 lux contour line	Improved Yes / No
London Road	Local Nature Reserve (LNR) / Sites of Special Scientific Interest	Yes	Yes	No	6	5	Yes
Wokingham Road	Local Nature Reserve (LNR)	No	-	-	11	11	Yes
Crowthorne Road	Local Nature Reserve (LNR) / Local Wildlife Sites / Special Protection Area	Yes	Yes	No	10	1	Yes
Rackstraw Road	Sites of Special Scientific Interest / Special Protection Area	Yes	Yes	Yes	11	11	Yes
Marshall Road	Local Wildlife Sites / Sites of Special Scientific Interest	Yes	Yes	Yes	11 / 8	11 / 8	Yes
Forest Road	Local Wildlife Sites	Yes	Yes	No	0	0	Yes
Foresters Way	Special Protection Area	Yes	Yes	No	4	2	Yes
South Road	Historic registered parks and gardens	Yes	No	No	6	6	Yes
Copenhagen Walk	Special Area of Conservation	No	-	-	3	3	Yes
South Hill Road	Historic registered parks and gardens	No	-	-	9	9	Yes
Rectory Lane	Special Area of Conservation / Historic registered parks and gardens	No	-	-	14	14	Yes
Rainforest Walk	Special Area of Conservation	No	-	-	3	3	Yes

Mitigation

All designated sites and important bat areas have been mapped and will be loaded into the designs, any light column located within 25 metres of these sites will incorporate an internal shield to further reduce the impact of lighting thus improving these areas further in comparison of the existing installation.

As can be seen in Table 11 above there is already an improvement in light control from the existing baseline for biodiversity. The project also reduces the effect of lighting by:

- Using the variable lighting regime to reduce intensity to 70% and 50% during the night that will minimise effects on bat foraging and reduce other effects of lighting on biodiversity (see page 22).
- Changing the light type to an LED neutral white with no UV content that will reduce the attraction of insects.
- Reducing the light spill by selecting the best LED Directional light for each particular area giving maximum control, minimal light spill, no UV, maximum efficiency and all round sustainability.

A monitoring study is being carried out to assess the effect of new lighting on bats. The study has conducted surveys at sample sites before installation to establish existing bat activity. Once LED lighting has been installed, a follow-up survey will be conducted to identify what effect the new lighting has. If a negative affect is identified, then other measures can be used to reduce the effect of lighting such as dimming.

6.6 Conservation Area's

The project will ensure avoidance of detrimental environmental impact in terms of the visual appearance of lighting, both day and night.

Any bespoke equipment for these areas will remain and not be converted in the first stage of the LED replacement. Any environmental consideration will be taken at the stage when it is decided to replace these.

Where there are standard style lanterns in these areas, they will be highlighted for potential investment. For bespoke equipment, where this is not possible, the new LED lantern type will be used.

6.7 Listed Buildings

There are a number of listed building throughout the borough and it is important that any listed buildings appearance is not effected by the program.

The new lighting will only replace standard functional luminaires, this means that heritage style lighting will not be replaced. If it is then decided it requires to LED, then only the internal equipment will be changed to keep the appearance in keeping with the area of the listed buildings providing the idea works optically.

If standard equipment is on a listed building then care will be taken during the installation process to ensure that the integrity of the wall is not affected.

6.8 Scheduled Ancient Monuments

Although Bracknell Forest is home to a number of scheduled ancient monuments such as the Tumulus, none of these will be affected by the replacement program.

6.9 Waste

Due to the nature of the types of lanterns that are being replaced they are life expired lanterns and need to be replaced so will not be reused in the majority of cases. The lamps that will be disposed contain harmful substances to the environment.

Mitigation

Waste generated is collected and disposed of in accordance with the Environmental Protection Act 1990. All Recycling and disposal of redundant equipment including lamps will be treated in accordance with the Waste Electrical & Electronic Equipment (WEEE) regulations, RoHS directive, the contractors COSHH assessments and recycled in accordance with Ringway's Waste Management Plan.

Lanterns are being recycled in accordance with WEEE regulations by Lumicom. Waste records will be maintained by the project team for audit purposes.

Where lanterns can be re-used for maintenance activities then where possible these will be kept in the stores and set aside for re-use.

General precautions

1. Separate different types of waste into separate bays, skips or containers.
2. COSHH skip will be used to make sure that all used containers of substances are put in it. Do not mix with general waste.
3. Securely bag or bundle lightweight waste to prevent it being scattered by the wind.

Fire

1. Avoid the accumulation of combustible material could provide the fuel for a large fire.
2. Dispose of combustible waste in the skips or bins provided as soon as practical after you create it.
3. Don't dispose of used LPG cylinders or aerosol cans with general waste.
4. The burning of waste materials is banned for this project – "don't light bonfires and don't light fires in skips".

6.10 Sustainability Statements

For further information please see *Appendix F*.

6.10.1 Lantern Manufacturer - Philips

Philips is a technology company that strives to improve people's lives and make the world healthier and more sustainable through innovation. They drive sustainable innovation by considering both the social needs of people and the ecological capacity of the planet.

By 2050, there will be nine billion people on the planet - all wanting a high quality of life that must be achieved within the limitations of the Earth's resources. Their goal is to improve the lives people. Meeting people's needs through technology means re-imagining the way we live. It means developing new approaches to healthcare that promote prevention rather than simply treating illness; a focus on energy-efficiency and innovations that are more intuitive, effective, affordable and accessible.

6.10.2 CMS Manufacturer - Telensa

Telensa accepts responsibility for the impacts its operations have on both the local and global environment and is committed to reducing them.

The key points of the strategy to achieve this are:

- Minimise waste by evaluating operations and ensuring they are as efficient as possible.
- Promote recycling both internally and among its customers and suppliers.
- Develop, source and promote a product range to minimise the environmental impacts of both production and distribution.
- Meet or exceed all the environmental legislation that relates to itself as a company.
- Demonstrate efficient use of energy and water through direct monitoring of usage coupled with a consistent improvement programme to achieve measurable reductions.
- Train, educate and inform their employees about environmental issues that may affect their work.
- Support and encourage staff to develop a green approach to travelling to and from the office.

- Promote environmental awareness among their employees and encourage them to work in an environmentally responsible manner.

Telensa is committed to maintaining the highest standards of environment and sustainability responsibility in its business activities.

6.10.3 The Principle Contractor - Ringway

At Ringway, sustainability is encompassed within the way we work. We believe that to be a truly sustainable business is to be the preferred partner to do business with. Sustainability is seen in all that we do, as it is also in our vision statement.

Ringway has a commitment to adopting best environmental practice within our operations and reducing our impact on the natural resources for the benefit of future generations.

Ringway's employees have a responsibility to safeguard the environment and use resources efficiently and effectively. Our key drivers to achieve sustainability from our actions fall under our mantra – 'Reduce, Reuse and recycle'.

Reduce

We reduce the impact of our operations on our community and the environment, by carefully planning and managing our business to minimise waste, disruption and harm.

Re-use

We promote re-use of all resources and materials wherever practicable.

Recycle

We seek to recycle all waste materials that are an integral part of our day-to-day operations via conventional means and innovative processes.

6.10.3.1 Core Sustainability Drivers for Ringway

- Waste
- Water
- Carbon & Energy
- Materials

For further information please see *Appendix G*.

6.11 Impact Assessment Summary

There are a number of issues that have been highlighting in this document and these can be summarised along with the mitigations as follows.

Table 12 – Impact Scoring

Issue	Current Impact / Risk Rating	Mitigation / Comment	New Impact / Risk Rating
The Equipment	Impact Negative Risk Rating 6	The LED will provide lower maintenance regime equipment and a better quality of light.	Impact Positive Risk Rating 2
Energy and Carbon	Impact Negative Risk Rating 6	The main reason for the LED conversion is to reduce the power consumption of Bracknell Forest's street lighting.	Impact Positive Risk Rating 2
Obtrusive Light	Impact Negative Risk Rating 5	Low lighting levels with enhanced lighting through peak traffic flows All lanterns will be set at 0 degrees to minimise forward light Where back shields are already in place these will also be incorporated into the lantern Not every situation will be improved but from the initial assessment calculations, it can be seen that it is likely that in most cases there will be an improvement in the reduction of obtrusive light.	Impact Positive Risk Rating 2
Potential Impacts around LED's		Philips is a reputable manufacturer who have carried out a lot of research and product development to ensure that the LED Luminaires are flicker free Where LED's are fitted within 2m of a window (in cases such as terraced houses with no frontage or on wall mounts). These luminaires will incorporate shields to minimise any issues. Whilst no CCT value is stated, the current preference within the industry in the UK is to avoid exceeding 4000K. Using a colour temperature of 4000K allows lighting levels to be reduced further under the latest British standard BS5489:2013.	Impact Neutral Risk Rating 4
Night Working	Impact Negative Risk Rating 5	All residents that are affected will be informed prior to works being carried out. Unfortunately this cannot be mitigated as this is essential activity to mitigate the disruption on the network.	Impact Negative Risk Rating 5
Public right of Ways	Impact Neutral Risk Rating	Currently many of these are not lit to any standard, so to ensure that levels are improved, comparison calculations are carried	Impact Positive Risk Rating

	4	out for every location that doesn't comply with a standard. This ensures that the levels of lighting are either the same or improved. In the initial calculations, it can be seen that lighting is improved in most cases, as the luminaires are more directional and distribute light further along footpaths rather than wasting light beyond the front and back of the paths.	3
Land, Nature and Biodiversity	Impact Negative Risk Rating 6	All areas have been mapped and will be loaded into the designs, any light located in the vicinity will incorporate an internal shield.	Impact Positive Risk Rating 2
Bats	Impact Negative Risk Rating 5	In all important bat areas, luminaires will incorporate a shield. The LED luminaires have a better control of light, so this will also improve the impact from the existing installations. Monitoring group will ensure that any effects are assessed throughout the project.	Impact Positive Risk Rating 3
Conservation areas	Impact Negative Risk Rating 5	Heritage lanterns will not be converted, areas with standard luminaries will be replaced but also highlighted to the client for an opportunity to fund bespoke equipment.	Impact Neutral Risk Rating 4
Listed Buildings	Impact Positive Risk Rating 2	The new lighting will only replace standard functional luminaires, this means that heritage style lighting will not be replaced. If it is then decided it requires to LED, then only the internal equipment will be changed to keep the appearance in keeping with the area of the listed buildings providing the idea works optically. If standard equipment is on a listed building then care will be taken during the installation process to ensure that the integrity of the wall is not affected.	Not Changed
Waste disposal	Impact Neutral Risk Rating 4	Ringway have a strict waste management plan and this will be completed before any works are carried out. Lower number of visits will be required post installation phase.	Impact Positive Risk Rating 2
Lamp Disposal	Impact Neutral Risk Rating 4	New units will be replaced less often, however PCB are used and careful recycling of these parts will be important.	Not Changed
Partner Sustainability Profile	Impact Positive Risk Rating 3	The three main partners for this project have excellent sustainable profile.	Impact Positive Risk Rating 2

6.12 Conclusion

It can be seen from the review that the project will have a positive impact to Bracknell Forest's road lighting network and will deliver tangible benefits to the borough and the public. The overall environmental impact of the project will be a significant improvement in the street scene, carbon footprint and energy costs.

The latest health research into LED found no evidence that that LED street lighting specifically has any additional health and wellbeing effects beyond that found for artificial lighting in general.

This is a relatively new form of lighting and the environmental impacts and the public experiences / concerns will be monitored and considered at each subsequent phase. Where unforeseen issues arise these will be assessed and mitigations implemented, this is a live process and regular reviews throughout the design and construction phases will be carried out.

7 BILBIOGRAPHY

ILP (2013) PLG04 Guidance on Undertaking Environmental Lighting Impact Assessments [online] Available at: https://www.theilp.org.uk/documents/plg04-guidance-on-undertaking-environmental-light-impact-assess/

ILE, (2006) Street Lighting Invest to Save [online] Available at: https://www.theilp.org.uk/documents/street-lighting-invest-to-save/

UK Roads Liaison Group (2012) A Street Lighting Policy Framework [online] Available at: http://www.ukroadsliaisongroup.org/en/utilities/document-summary.cfm?docid=25D6CD1C-7305-4490-84CBE03EE120A817

ILP, (2016) PLG08 - Guidance on the Application of Adaptive Lighting within the Public Realm professionals [online] Available at: https://www.theilp.org.uk/documents/plg08-guidance-on-appl-of-adaptive-lighting-within-public-realm/

Power Data Associates, (2015) CRC Energy Efficiency Scheme [online] Available at: https://www.theilp.org.uk/documents/guide-to-the-crc-energy-efficiency-scheme-and-unmetered-supplies/

ILP, (2011) Guidance notes for the Reduction of Obtrusive Light [online] Available at: https://www.theilp.org.uk/documents/obtrusive-light/

ILP, (2012) Guidance on current and forth coming legislation within the lighting sector [online] Available at: https://www.theilp.org.uk/documents/guidance-on-current-and-forthcoming-2012/

Public Health England, (2016) Human responses to lighting based on LED lighting solutions [online] Available at: https://fonteva-customer-media-secure.s3.amazonaws.com/00D8E0000008w4FUAQ/HRLBL%20b.pdf?AWSAccessKeyId=AKIAIXKKC2UMFWOOMTEQ&Expires=1474373299&Signature=zRuVVVbKmloj2Dklprti2Banwl4%3D

Bat Conservation Trust, (2009) - Bats and Lighting in the UK– Bats and the Built Environment Series [online] Available at: http://www.bats.org.uk/data/files/bats_and_lighting_in_the_uk__final_version_version_3_may_09.pdf

The London Naturalist, (2012) No. 91, 2012 69 - Bats and lighting — six years on [online] Available at:

http://www.furesfen.co.uk/batsandlightingreviewalisonfurelnhspages69-88.pdf

Bat Conservation Trust, (2014) Interim Guidance: Artificial lighting and wildlife - Recommendations to help minimise the impact of artificial lighting [online] Available at: http://www.bats.org.uk/pages/bats_and_lighting.html

Buglife (2011) A Review of the Impact of Artificial Light on Invertebrates [online] Available at:

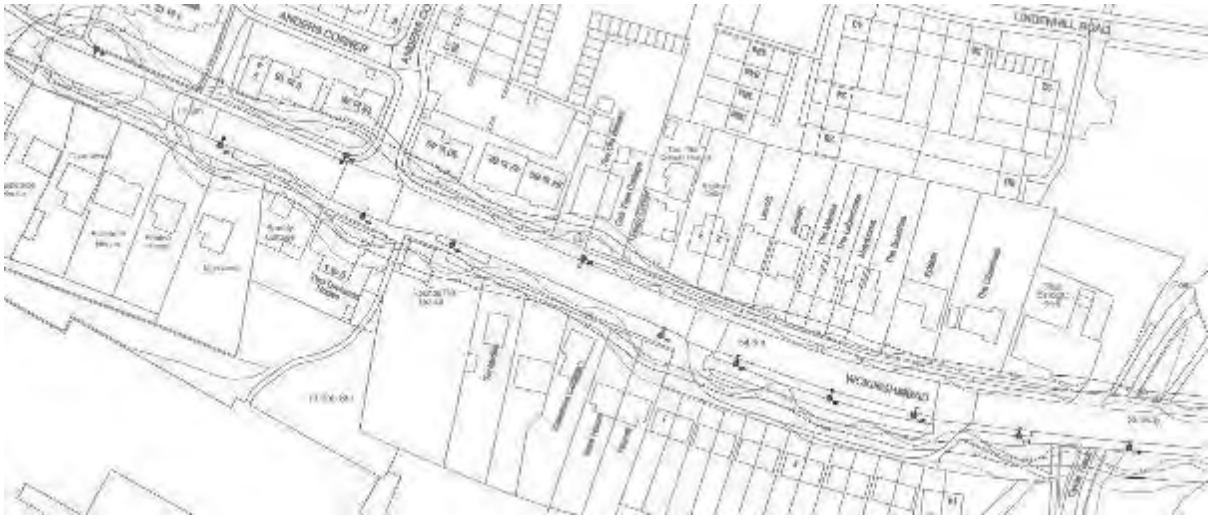
https://www.theilp.org.uk/documents/a-review-of-the-impact-of-artificial-light-on-invertebrates/

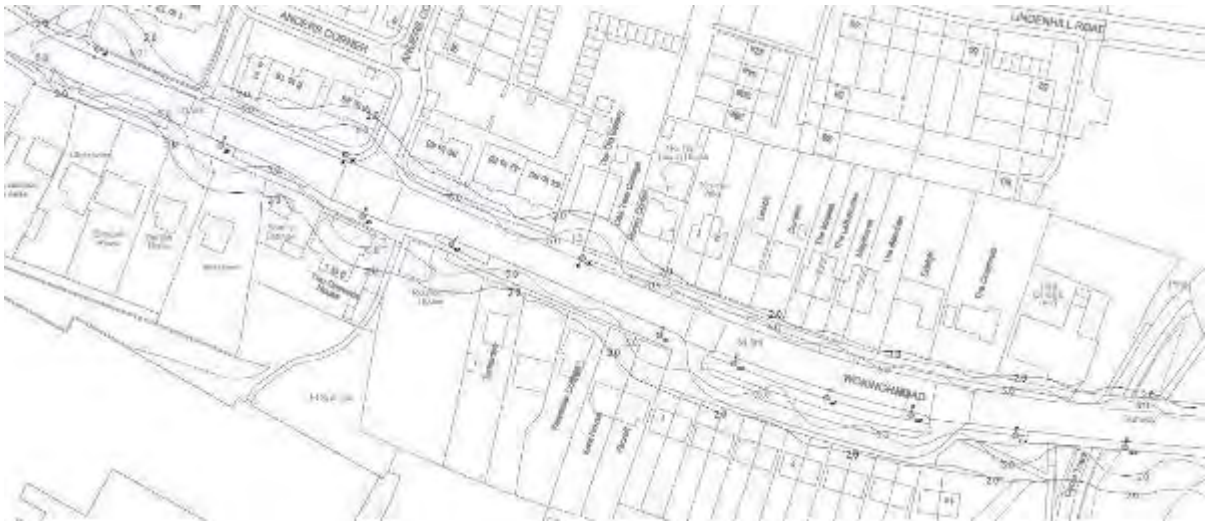
Department for Communities and Local Government (2012) National Planning Policy Framework [online] Available at: (NPPF) http://planningguidance.communities.gov.uk/

8 APPENDICIES

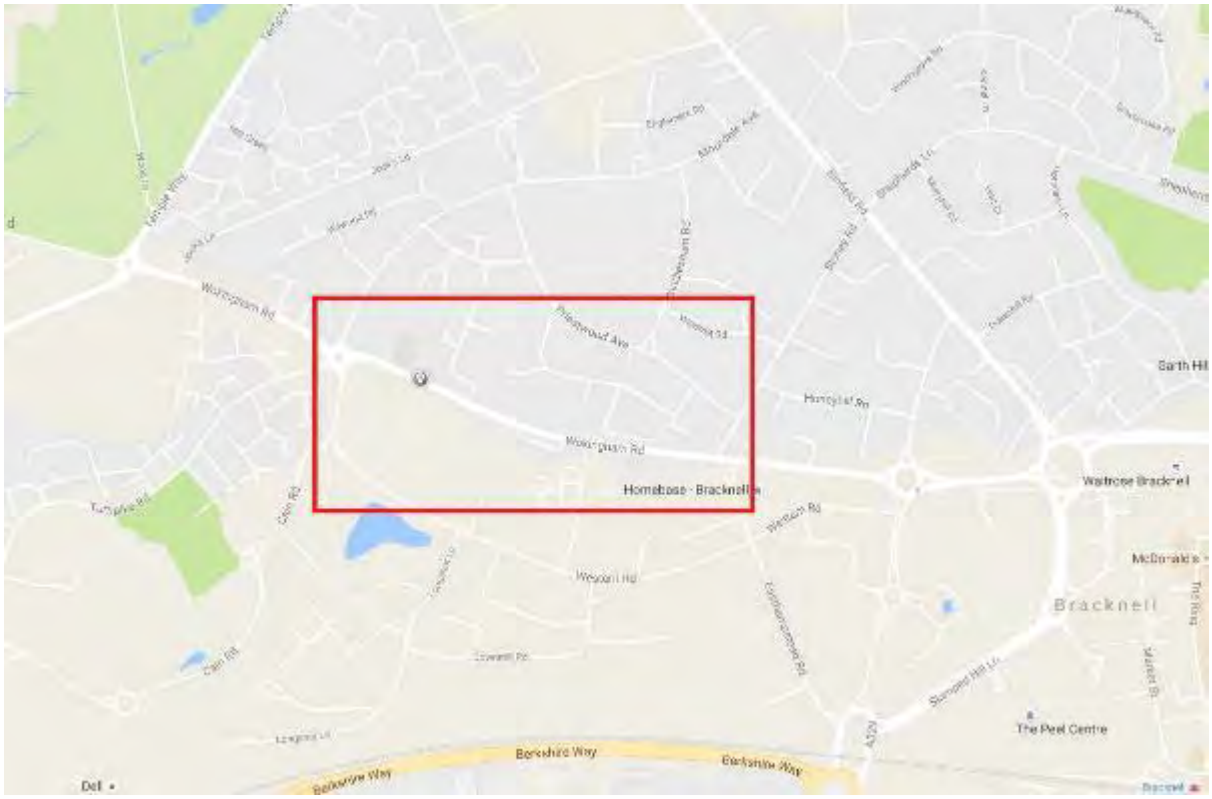
8.1 Appendix A – Light Intrusion Assessment

PH1-004 Wokingham Road





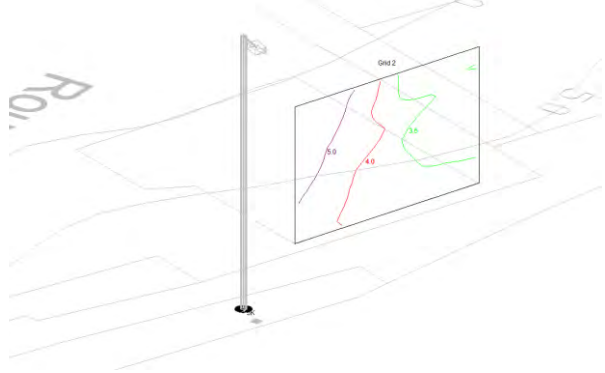
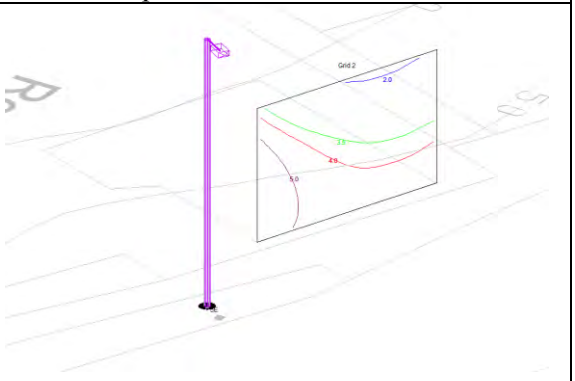
Location:

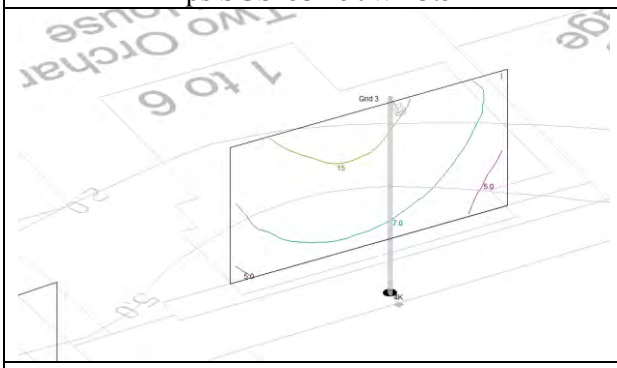
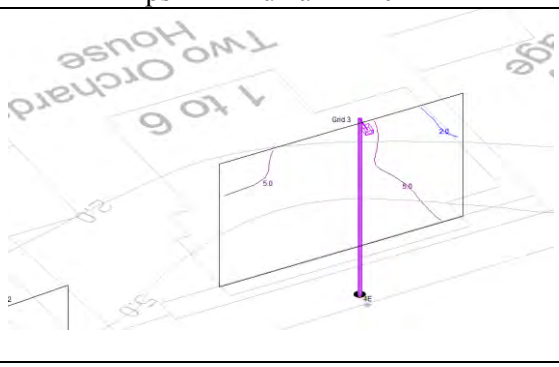

Homebase - Bracknell
Bracknell
Waitrose Bracknell
The Peel Centre
Berkshire Way
Dell

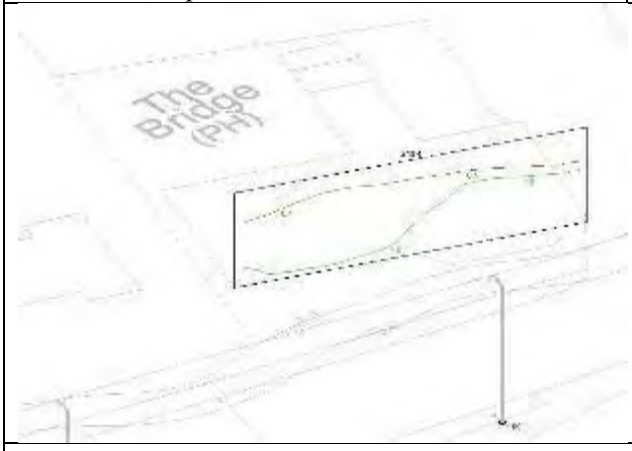
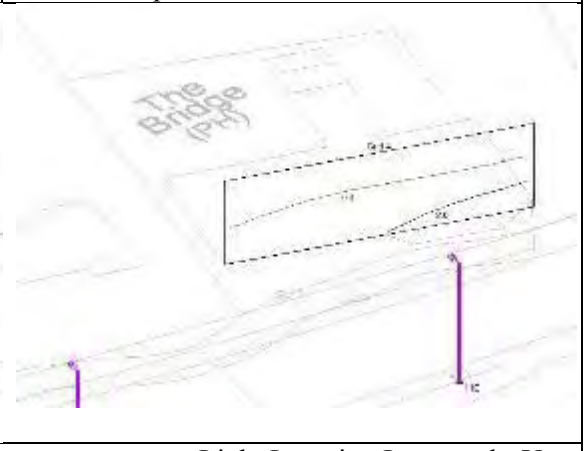
View of the Rd

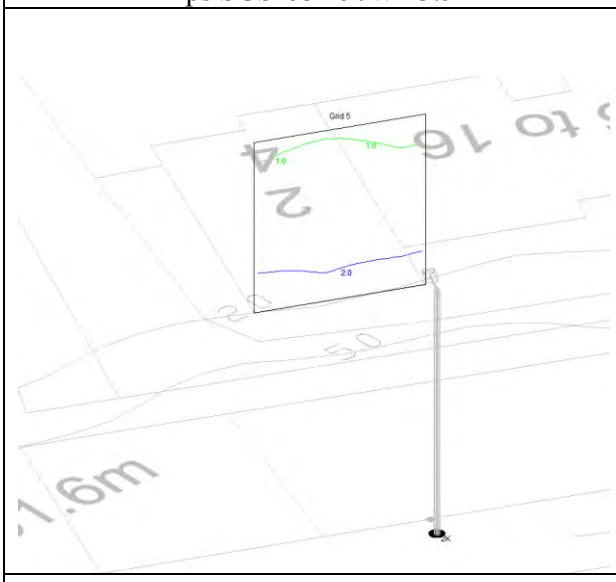
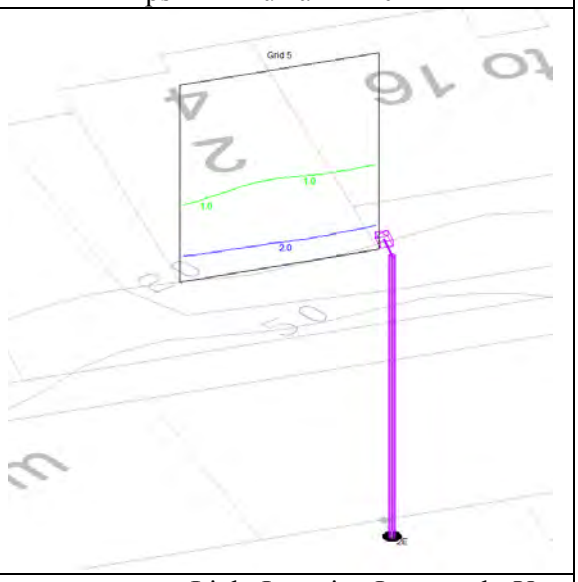
Picture 1

Picture 2

Roundle Hill House	
Philips SGS253 150W 13.5klm	Philips Mini Luma DM10 12klm
	
Light Intrusion Improved - Yes	

Two Orchards House	
Philips SGS253 150W 13.5klm	Philips Mini Luma DM10 12klm
	
Light Intrusion Improved - Yes	

The Bridge	
Philips SGS253 150W 13.5klm	Philips Mini Luma DM10 12klm
	
Light Intrusion Improved - Yes	

Building no 2-4	
Philips SGS253 150W 13.5klm	Philips Mini Luma DM10 12klm
	
Light Intrusion Improved - Yes	

PH1-006 Bagshot Road

Comparison

Existing

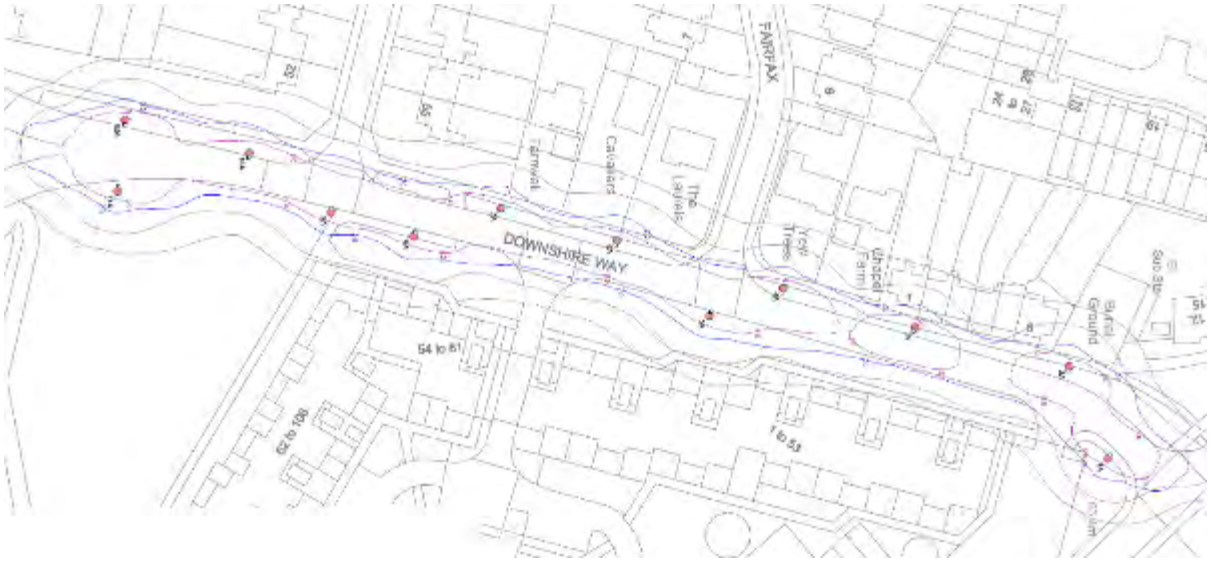
Location:

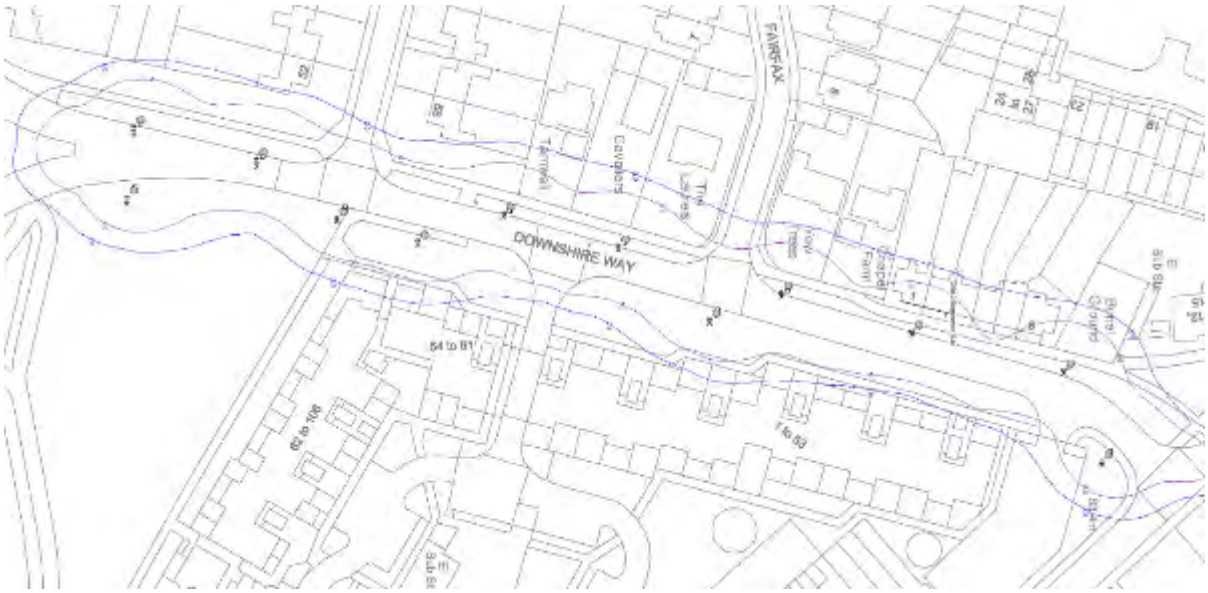
View of the Rd:

Picture 1:

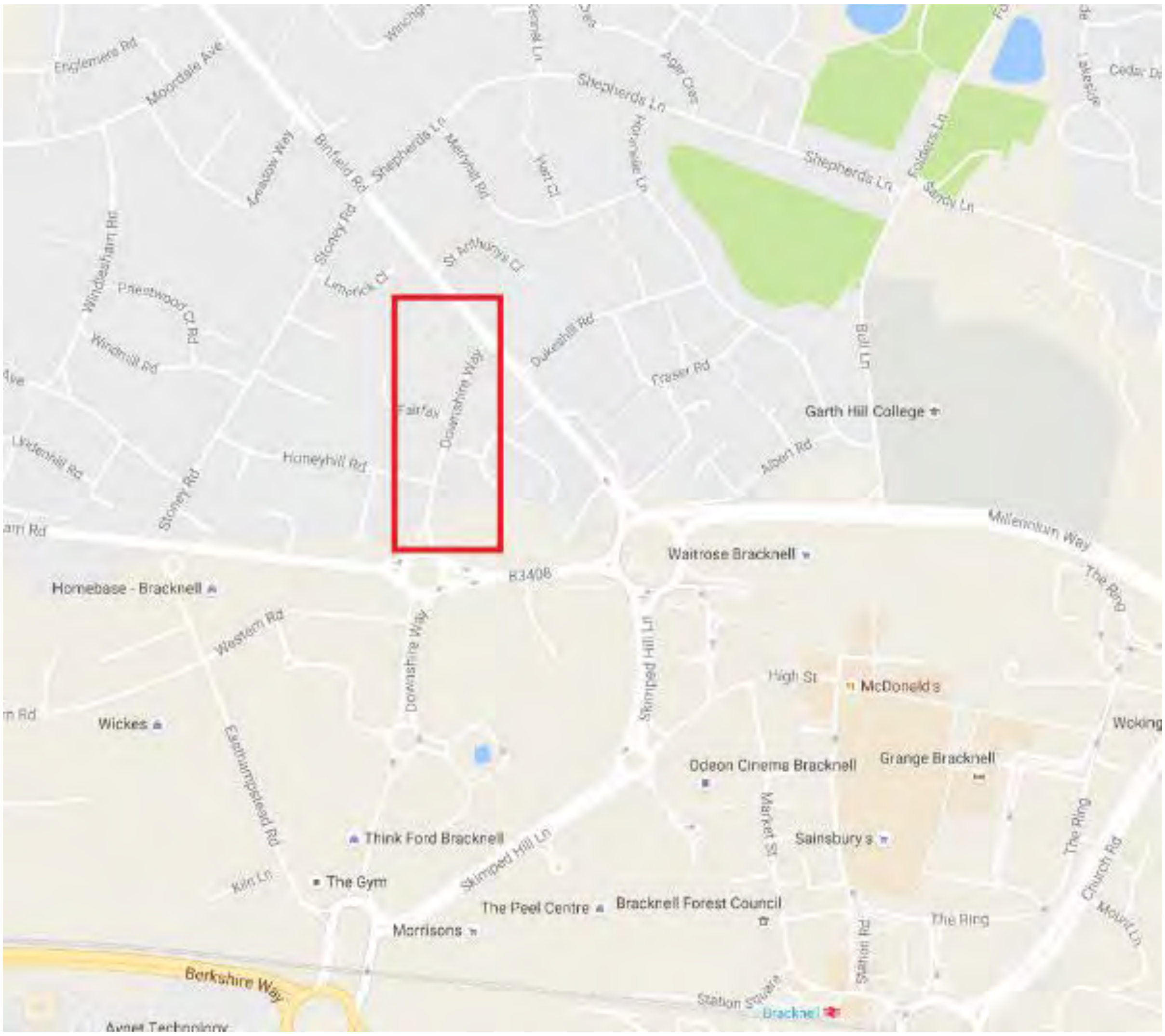
Picture 2

PH1-015 Downshire Way





Location:

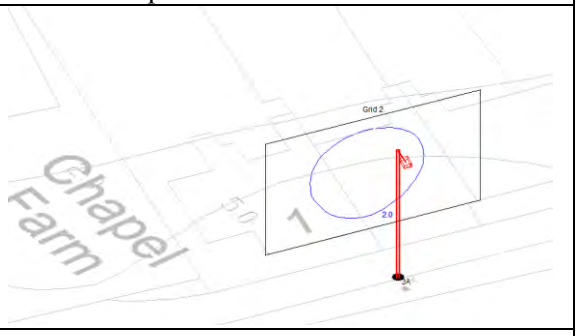


Moordale Ave
Shepherds Ln
Binfield Rd
Stoney Rd
Windlesham Rd
Honeyhill Rd
Fairfax
Downshire Way
Dukeshill Rd
Fraser Rd
Garth Hill College
Albert Rd
Bull Ln
Sandy Ln
Millennium Way
Waitrose Bracknell
B3408
Homebase - Bracknell
Western Rd
Wickes
Skimped Hill Ln
High St
McDonald's
Odeon Cinema Bracknell
Grange Bracknell
Market St
Sainsbury's
Easthampstead Rd
Think Ford Bracknell
The Gym
The Peel Centre
Bracknell Forest Council
Morrisons
The Ring
Church Rd
Berkshire Way
Station Rd
Bracknell

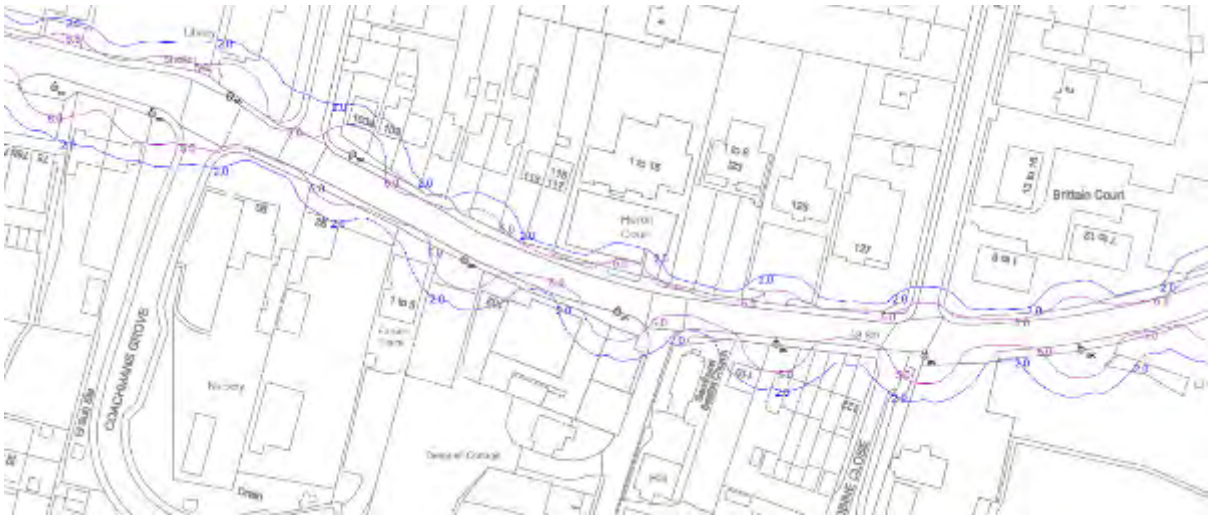
View of the road:

Picture 1:

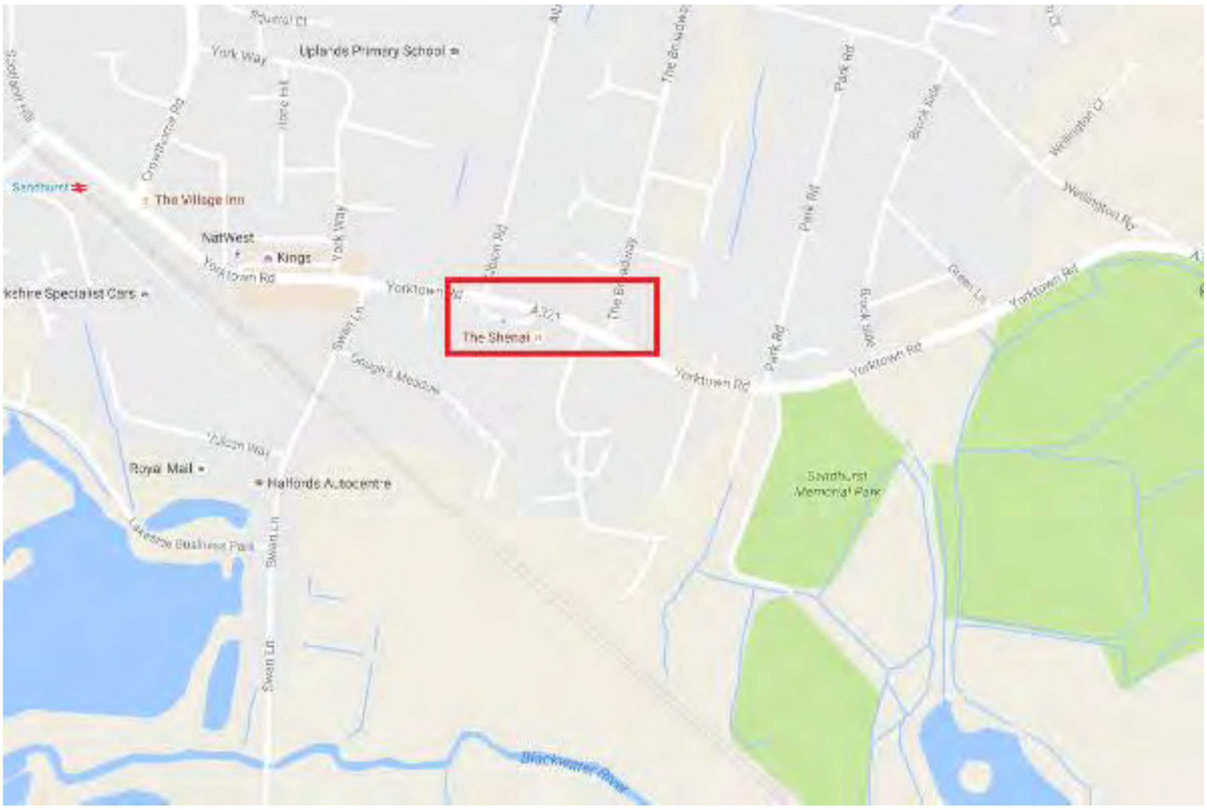
Picture 2:

House No 1-6	
Philips SGS253 150W 13.5klm	Philips Micro Luma DN11 6klm
	
Light Intrusion Improved - Yes	

PH1-016 Yorktown Road



Location:

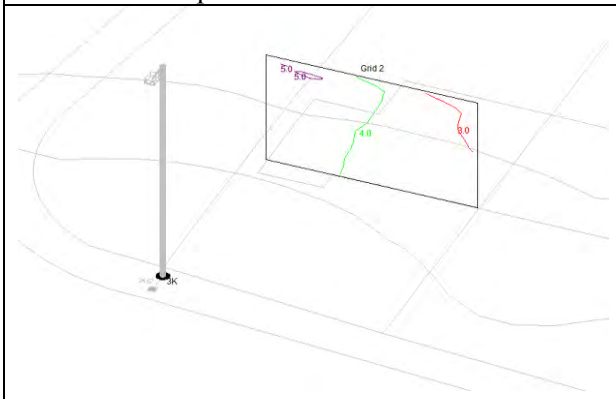
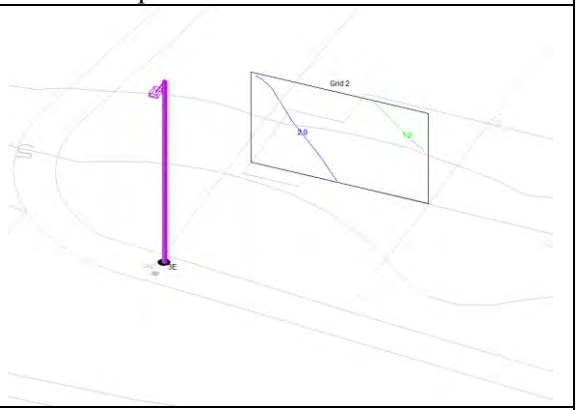


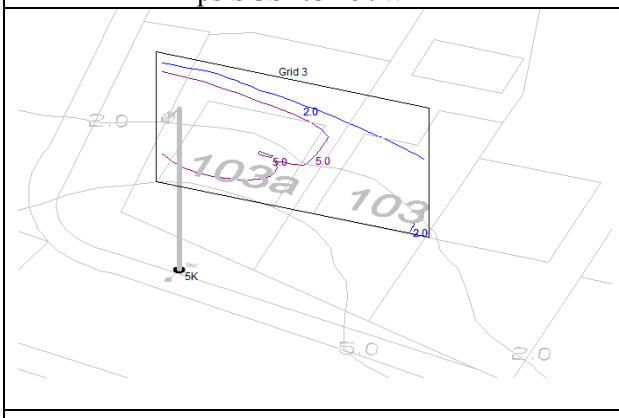
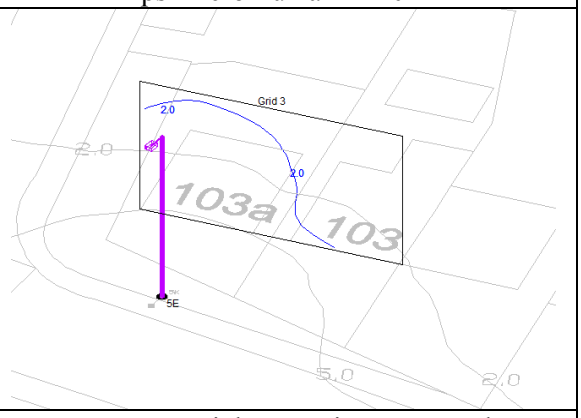
Uplands Primary School
York Way
The Village Inn
NatWest
Kings
Yorktown Rd
Swan Ln
Yorktown Rd
A321
The Shenai
The Broadway
Park Rd
Wellington Rd
Royal Mail
Halfords Autocentre
Swan Ln
Sandhurst Memorial Park
Blackwater River

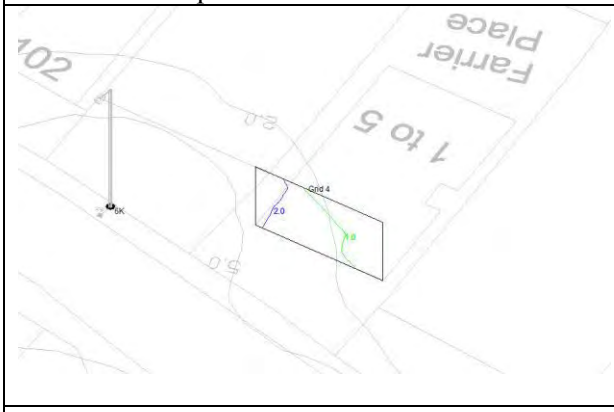
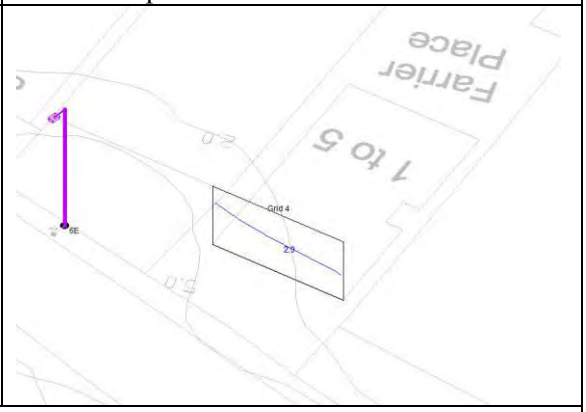
View of the road:

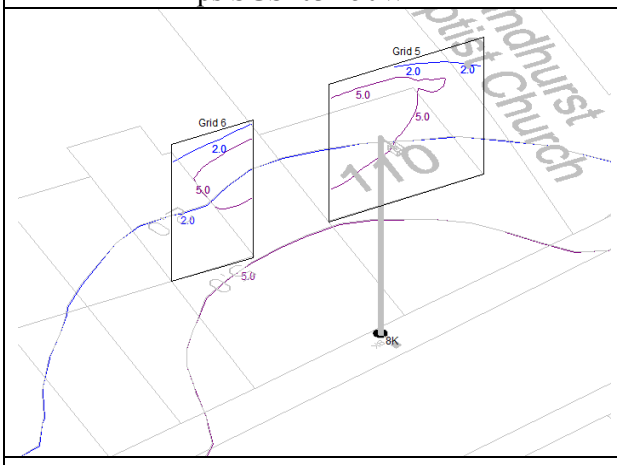
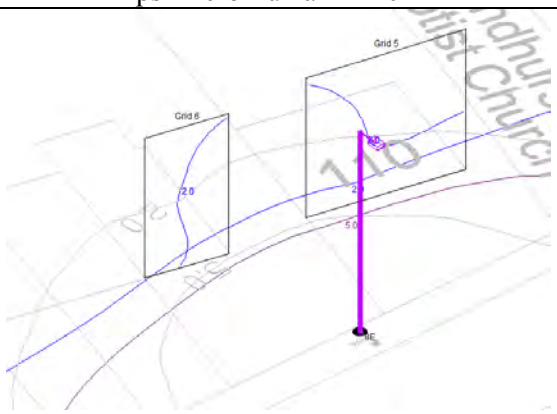
Picture 1:

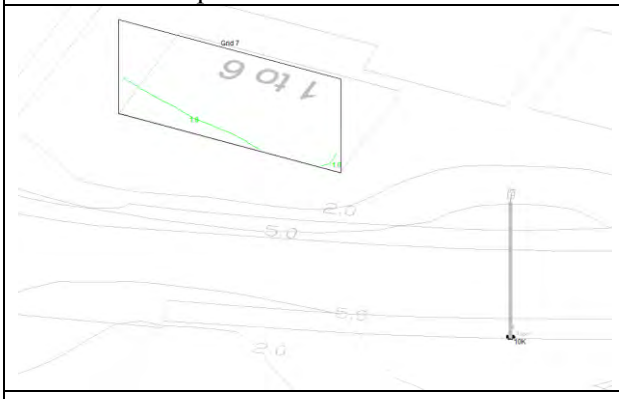
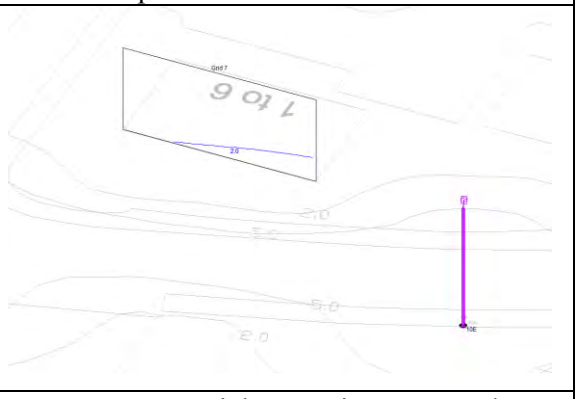
Picture 2:

House near Coachmans grove junction	
Philips SGS203 150W 14klm	Philips Micro Luma DM10 12klm
	
Light Intrusion Improved - Yes	

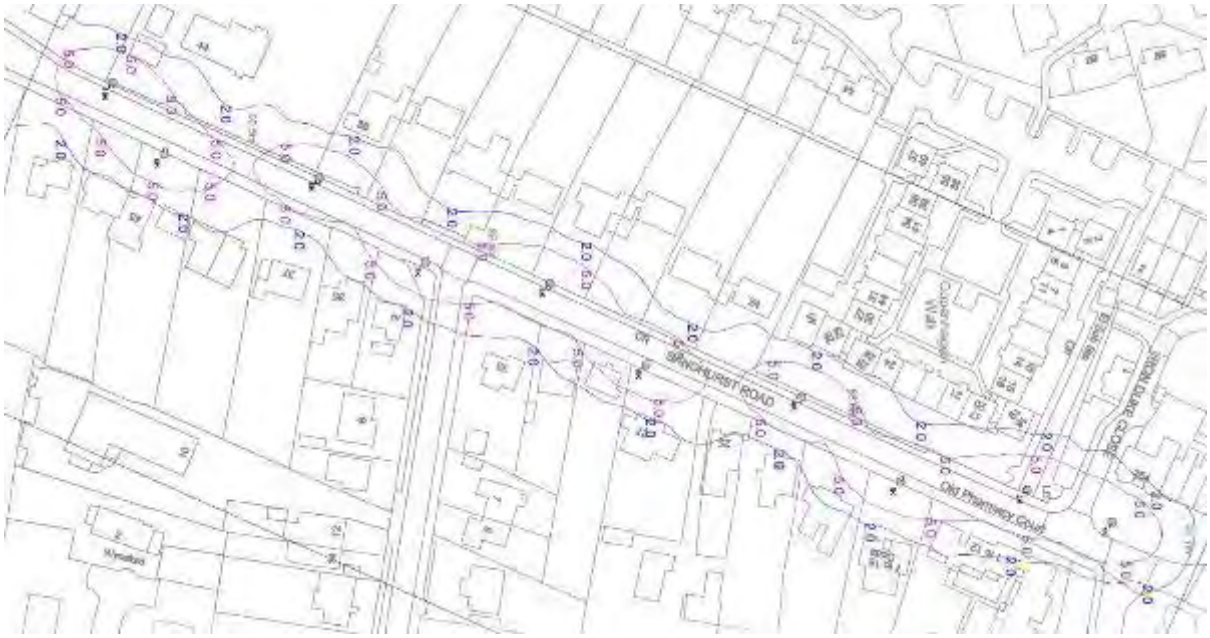
House No 103-103a	
Philips SGS203 150W 14klm	Philips Micro Luma DM10 12klm
	
Light Intrusion Improved - Yes	

House No 1-5 (Farrier Place)	
Philips SGS203 150W 14klm	Philips Micro Luma DM10 12klm
	
Light Intrusion Improved - Yes	

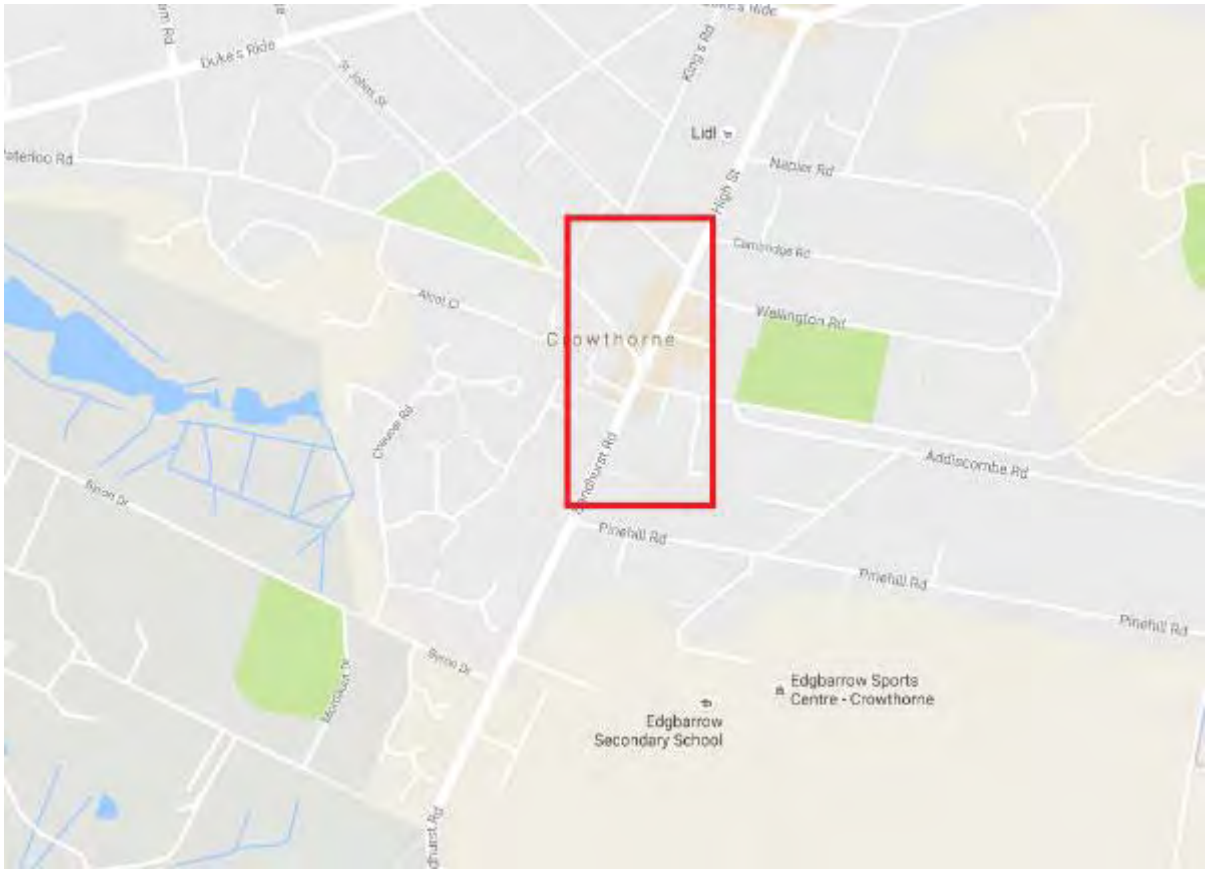
House No 110	
Philips SGS203 150W 14klm	Philips Micro Luma DM10 12klm
	
Light Intrusion Improved - Yes	

House No 1 to 6	
Philips SGS203 150W 14klm	Philips Micro Luma DM10 12klm
	
Light Intrusion Improved - No	

PH1-022 Sandhurst Road



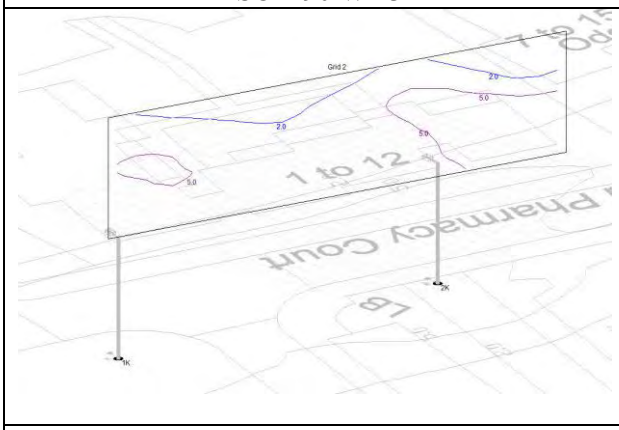
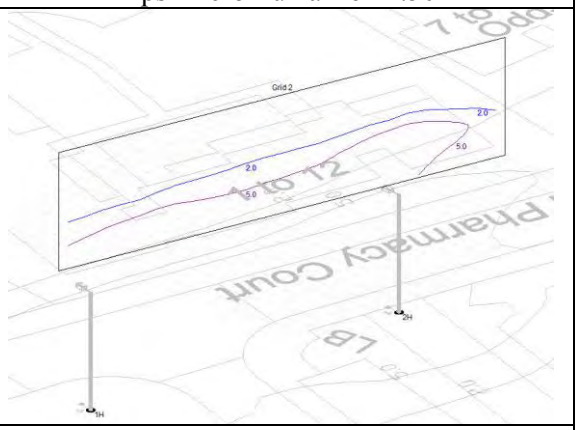
Location:

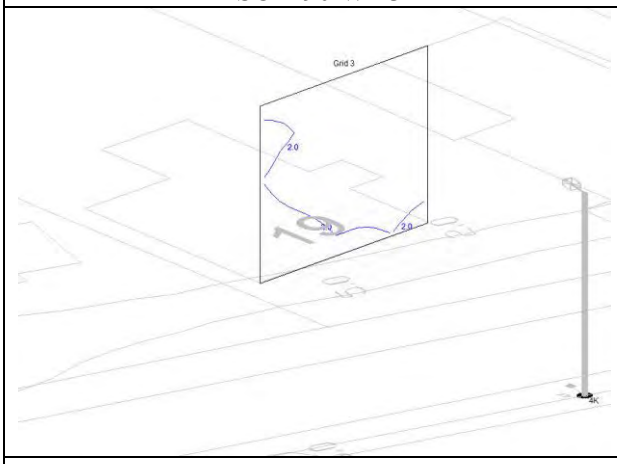
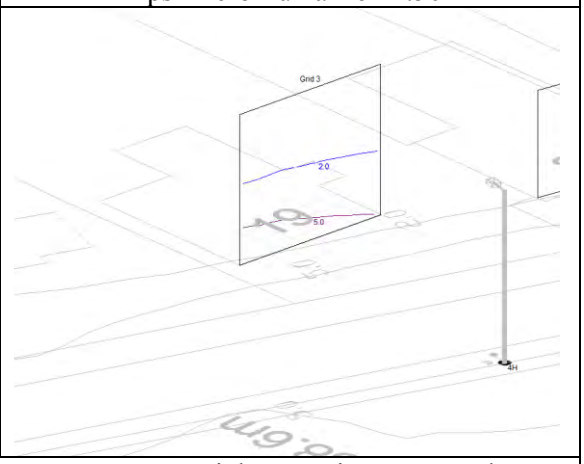

Lidl
Napier Rd
Cambridge Rd
Wellington Rd
Addiscombe Rd
Pinehill Rd
Pinehill Rd
Pinehill Rd
Crowthorne
Edgbarrow Sports Centre - Crowthorne
Edgbarrow Secondary School

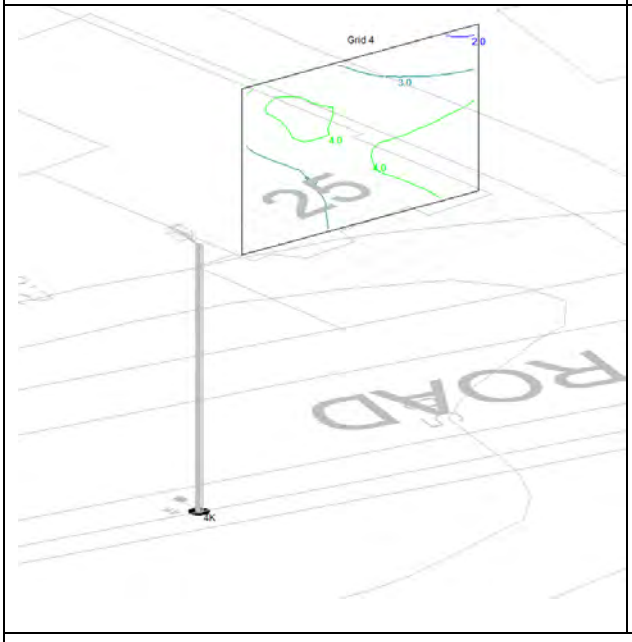
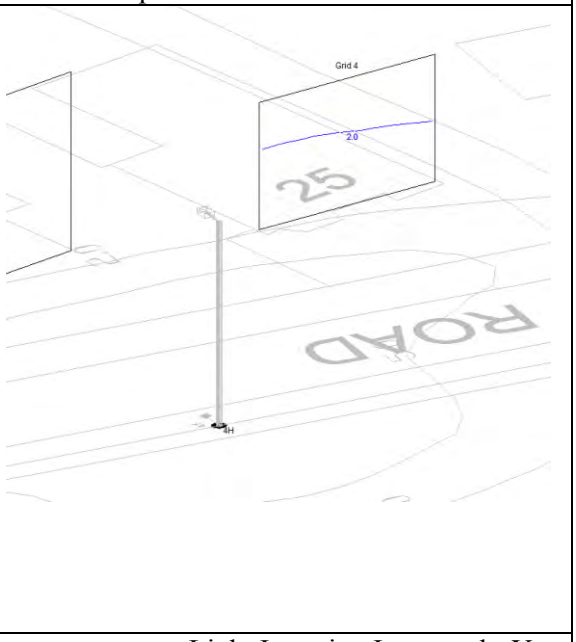
View of the road:

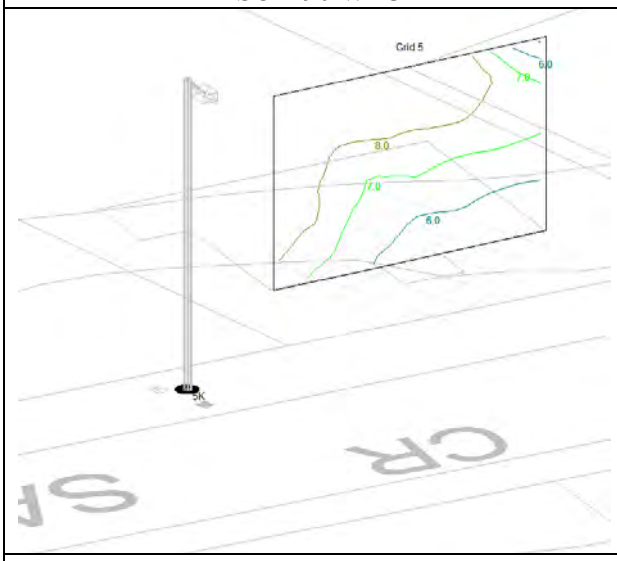
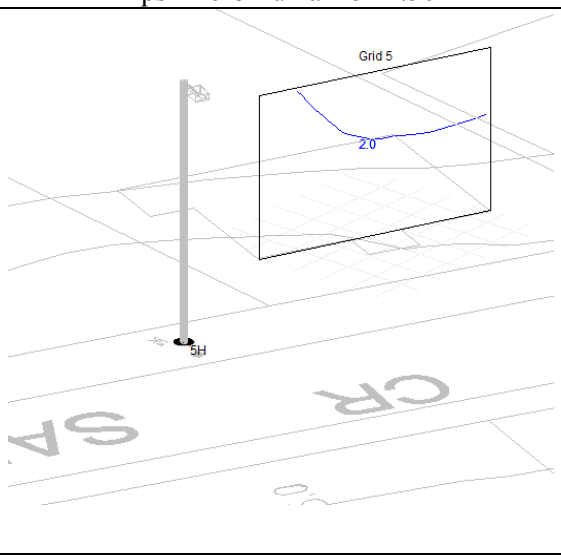
Picture 1:

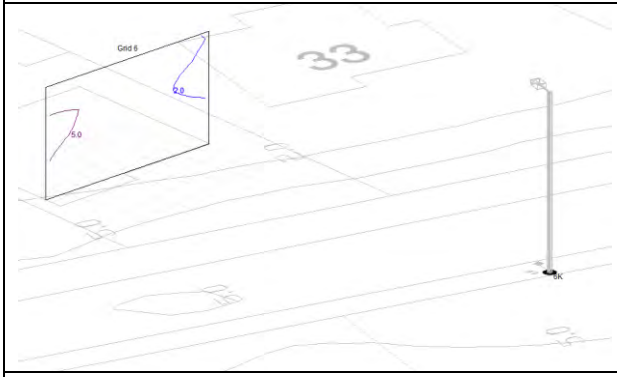
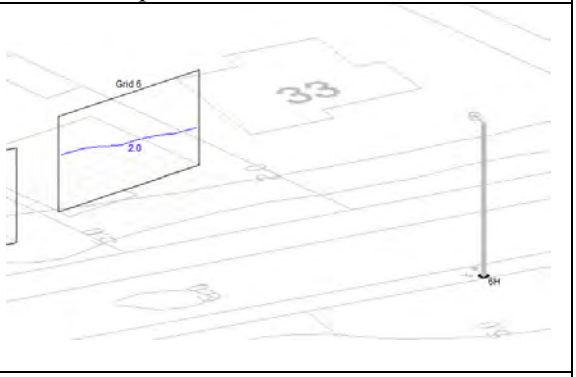
Picture 2:

House No 1 to 12	
MA SOX 90 W 13klm	Philips Micro Luma R6 11.50klm
	
Light Intrusion Improved - Yes	

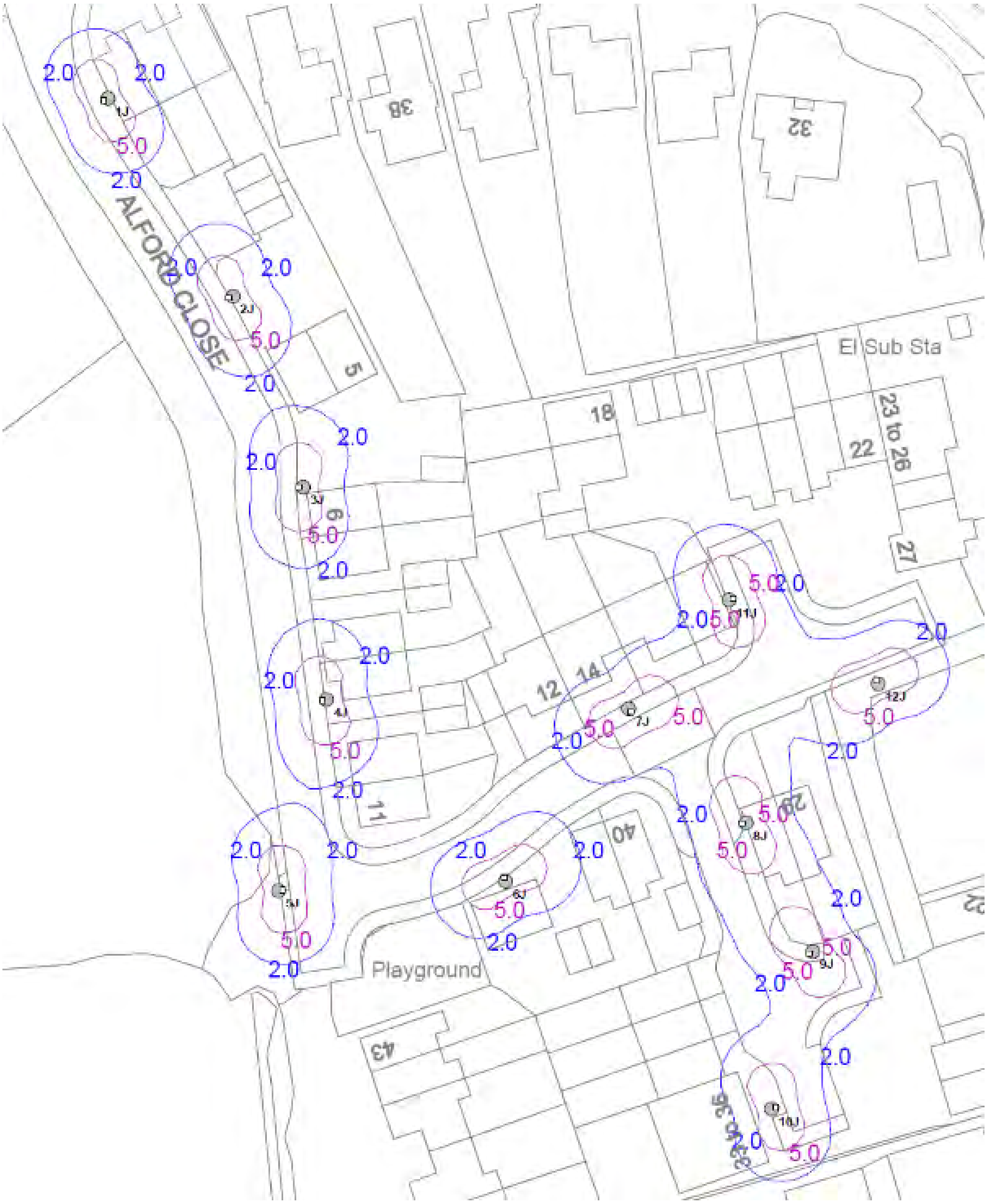
House No 19	
MA SOX 90 W 13klm	Philips Micro Luma R6 11.50klm
	
Light Intrusion Improved - Yes	

House No 25	
MA SOX 90 W 13klm	Philips Micro Luma R6 11.50klm
	
Light Intrusion Improved - Yes	

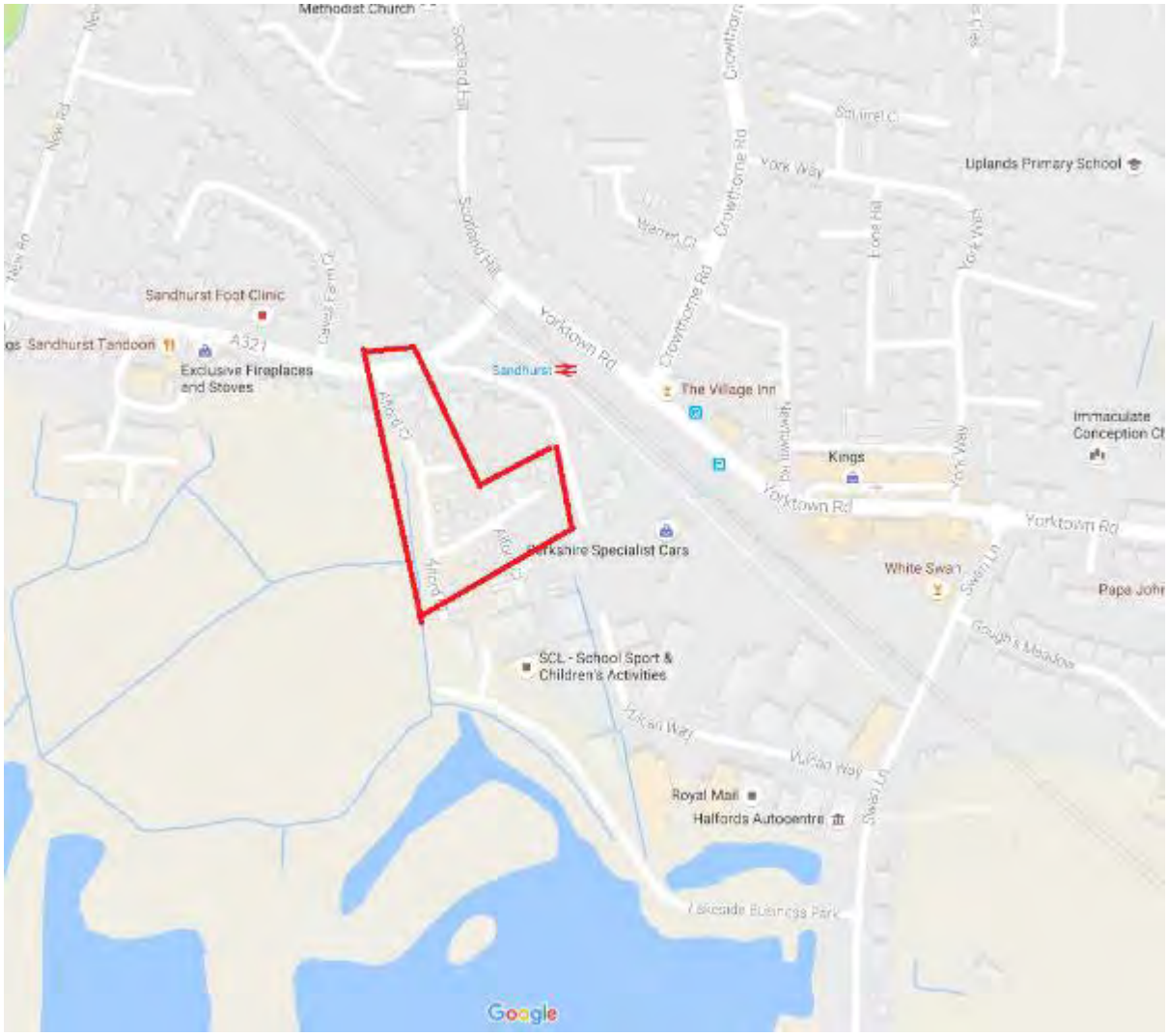
House No 29	
MA SOX 90 W 13klm	Philips Micro Luma R6 11.50klm
	
Light Intrusion Improved - Yes	

House No 31	
MA SOX 90 W 13klm	Philips Micro Luma R6 11.50klm
	
Light Intrusion Improved - Yes	

PH2-017 Alford Close


ALFORD CLOSE
El Sub Sta
Playground
38
32
5
6
11
12
14
18
22
23 to 26
27
40
43
1J
2J
3J
4J
5J
6J
7J
8J
9J
10J
11J
12J
2.0
5.0

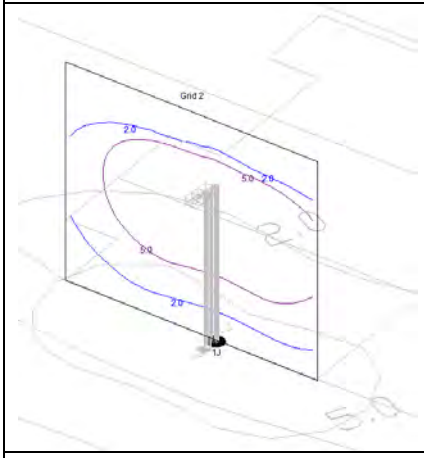
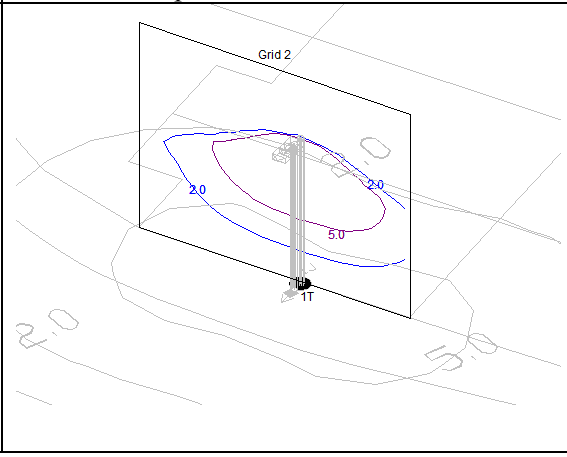
Location:

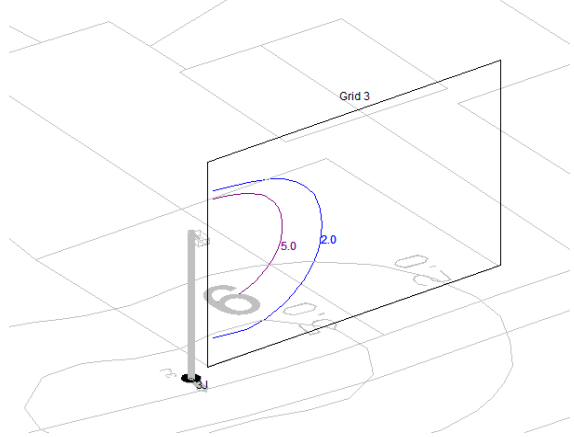
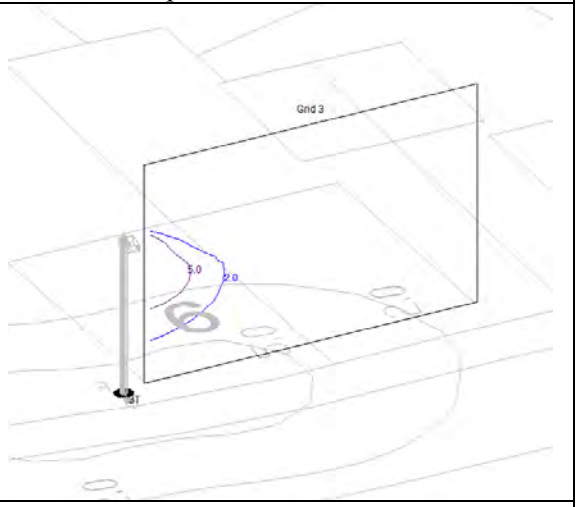

Methodist Church
Uplands Primary School
Sandhurst Foot Clinic
Sandhurst Tandoori
Exclusive Fireplaces and Stoves
Sandhurst
The Village Inn
Kings
Immaculate Conception
Berkshire Specialist Cars
White Swan
SCL - School Sport & Children's Activities
Royal Mail
Halfords Autocentre
Yorktown Rd
York Way
Crowthorne Rd
Scotland Hill
Google

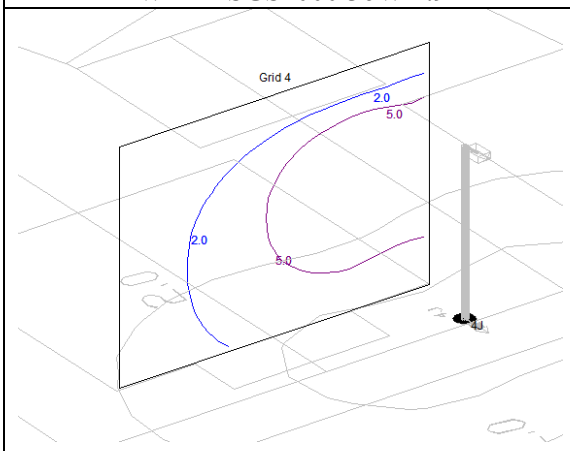
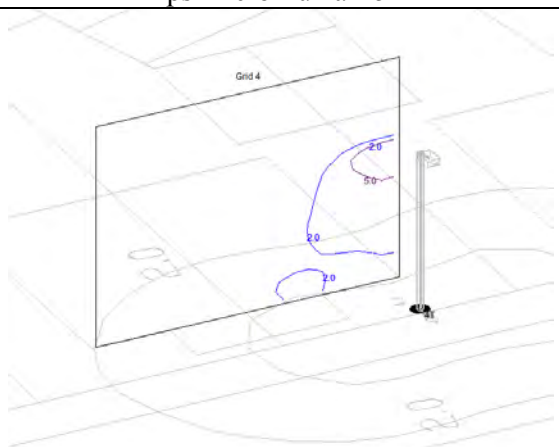
View of the road:

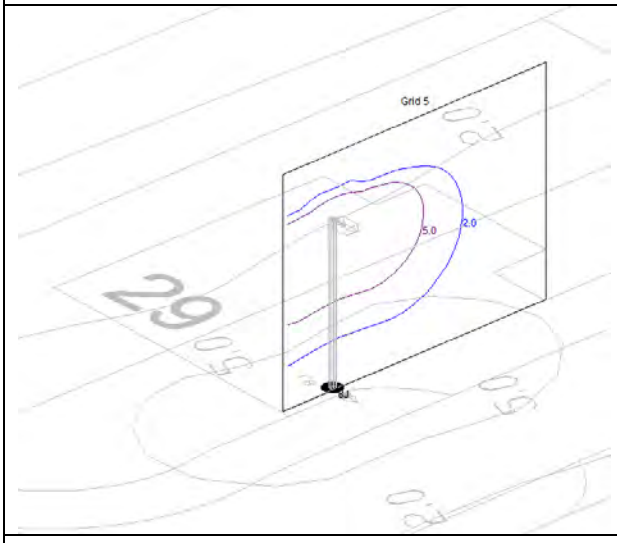
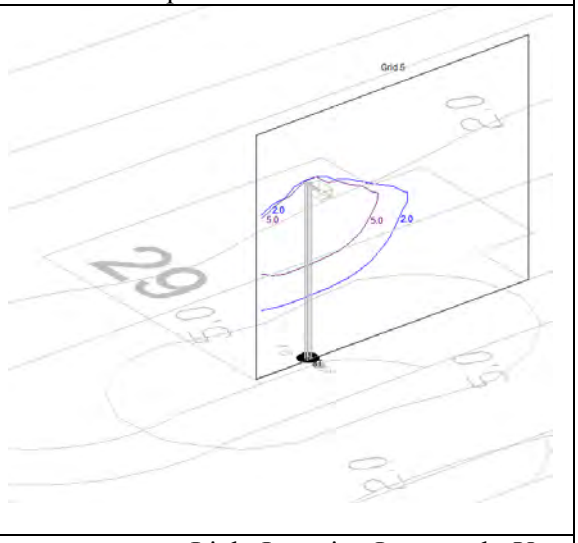
Picture 1

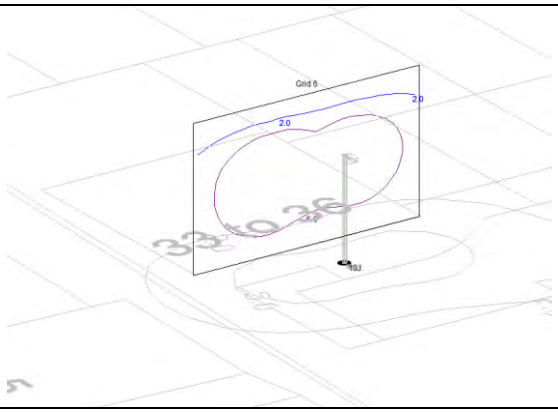
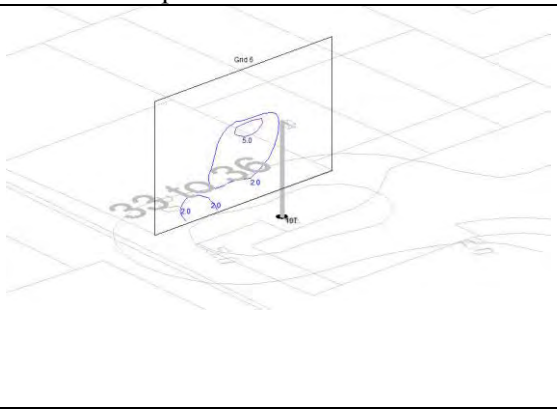
Picture 2

First House	
WRTL SGS2000 36W 2.9klm	Philips Micro Luma R5 2klm
	
Light Intrusion Improved - Yes	

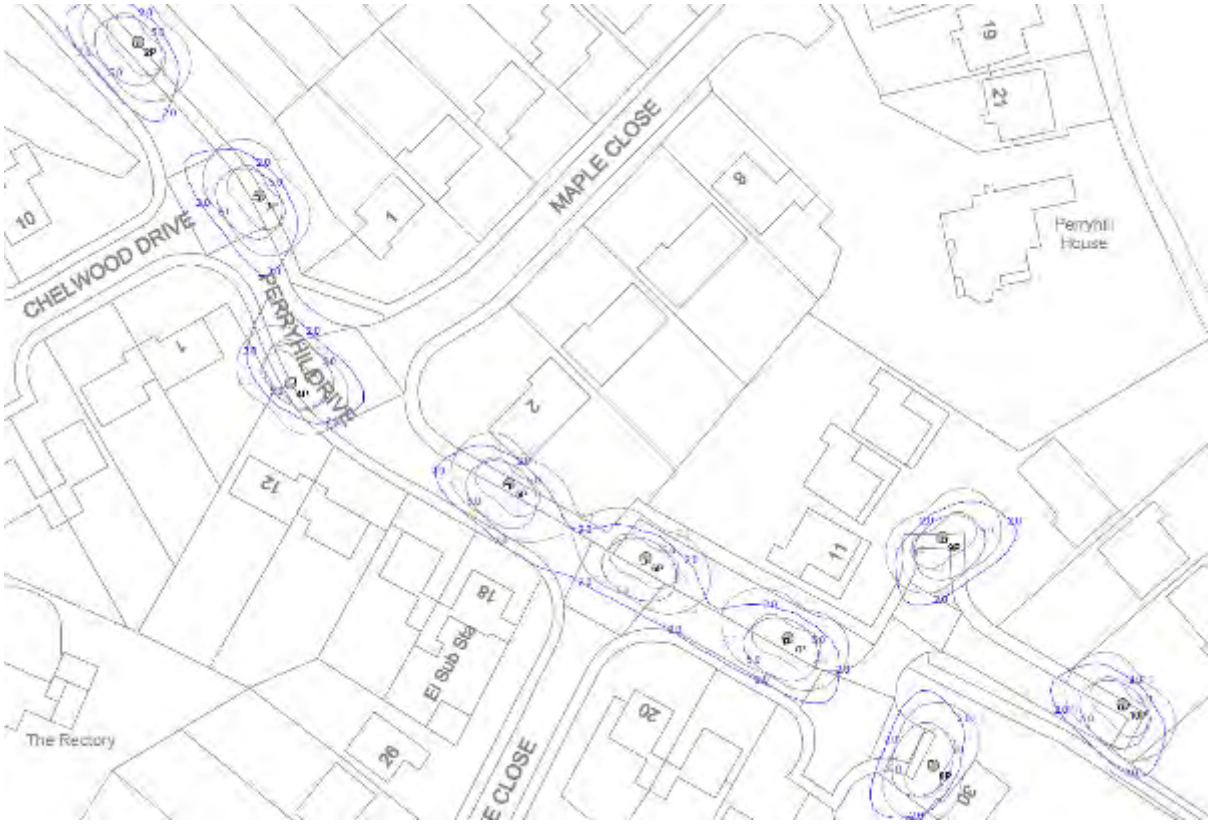
House No 6-7	
WRTL SGS2000 36W 2.9klm	Philips Micro Luma R5 2klm
	
Light Intrusion Improved - Yes	

House No 8-9	
WRTL SGS2000 36W 2.9klm	Philips Micro Luma R5 2klm
	
Light Intrusion Improved - Yes	

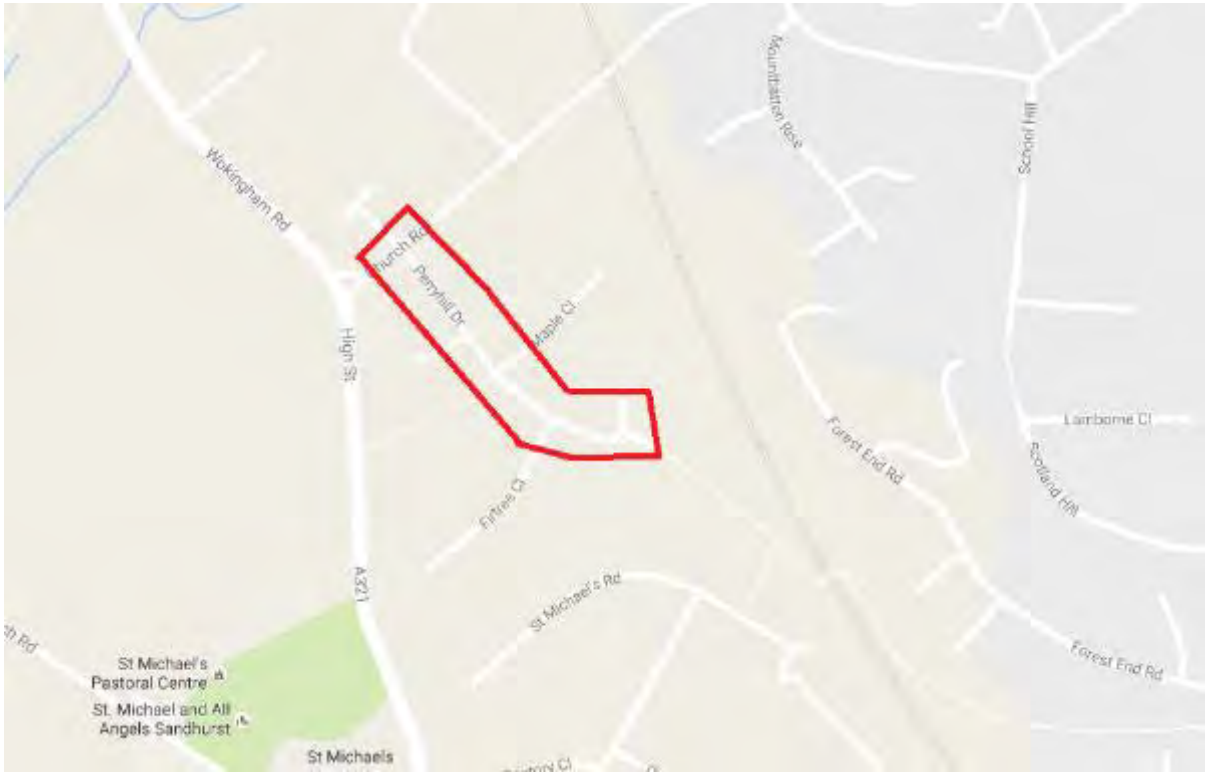
House No 29	
WRTL SGS2000 36W 2.9klm	Philips Micro Luma R5 2klm
	
Light Intrusion Improved - Yes	

House No 33-36	
WRTL SGS2000 36W 2.9klm	Philips Micro Luma R5 2klm
	
Light Intrusion Improved - Yes	

PH2-025 Perryhill Drive



Location:

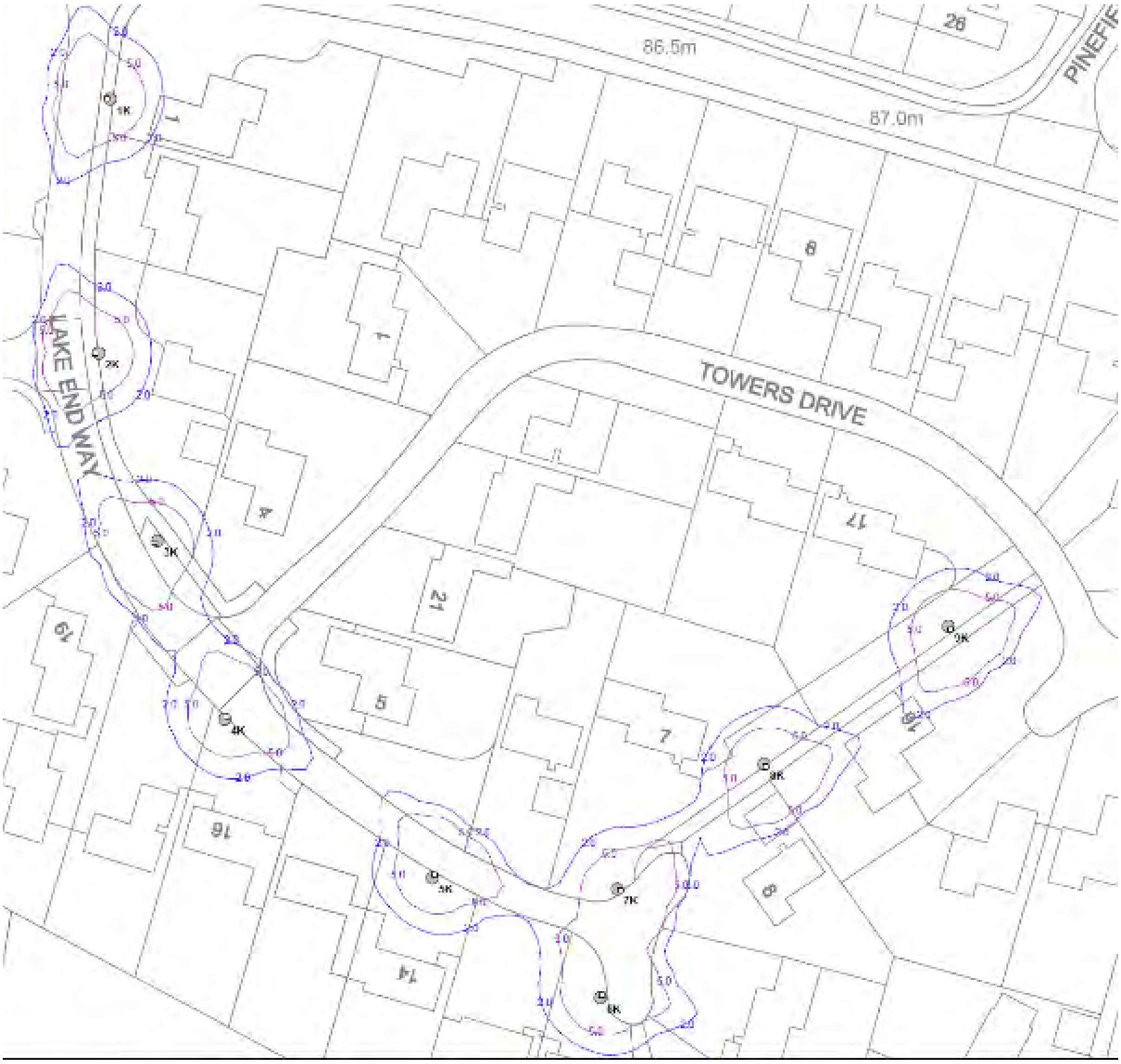

Wokingham Rd
High St
Perryhill Dr
Maple Cl
Fifteen Cl
A321
St Michael's Rd
Forest End Rd
Scotland Hill
Lairborne Cl
St Michael's Pastoral Centre
St. Michael and All Angels Sandhurst
St Michaels

View of the road:

Picture 1:

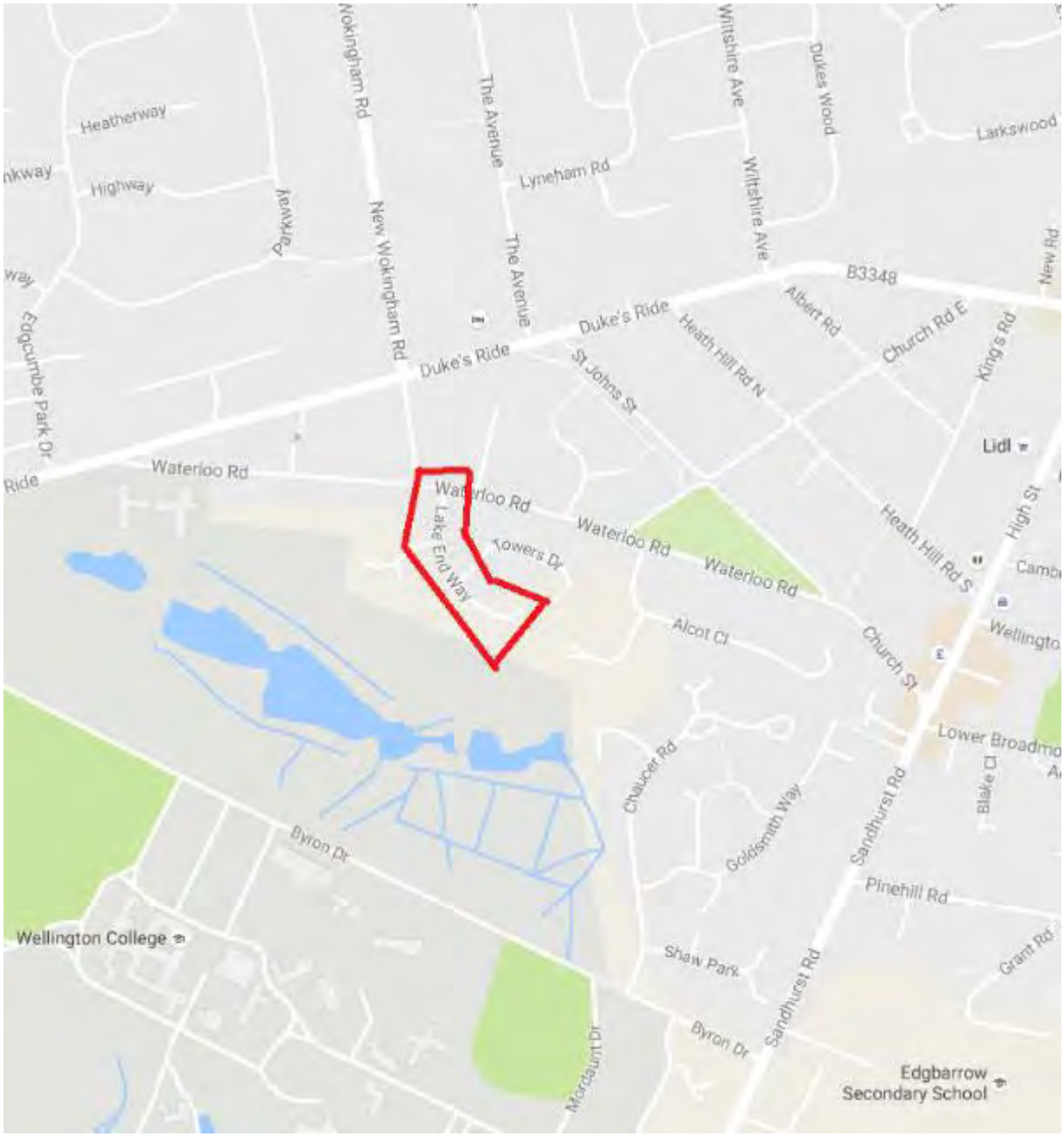
Picture 2:

PH2-029 Lake End Way



TOWERS DRIVE
LAKE END WAY
86.5m
87.0m

Location:

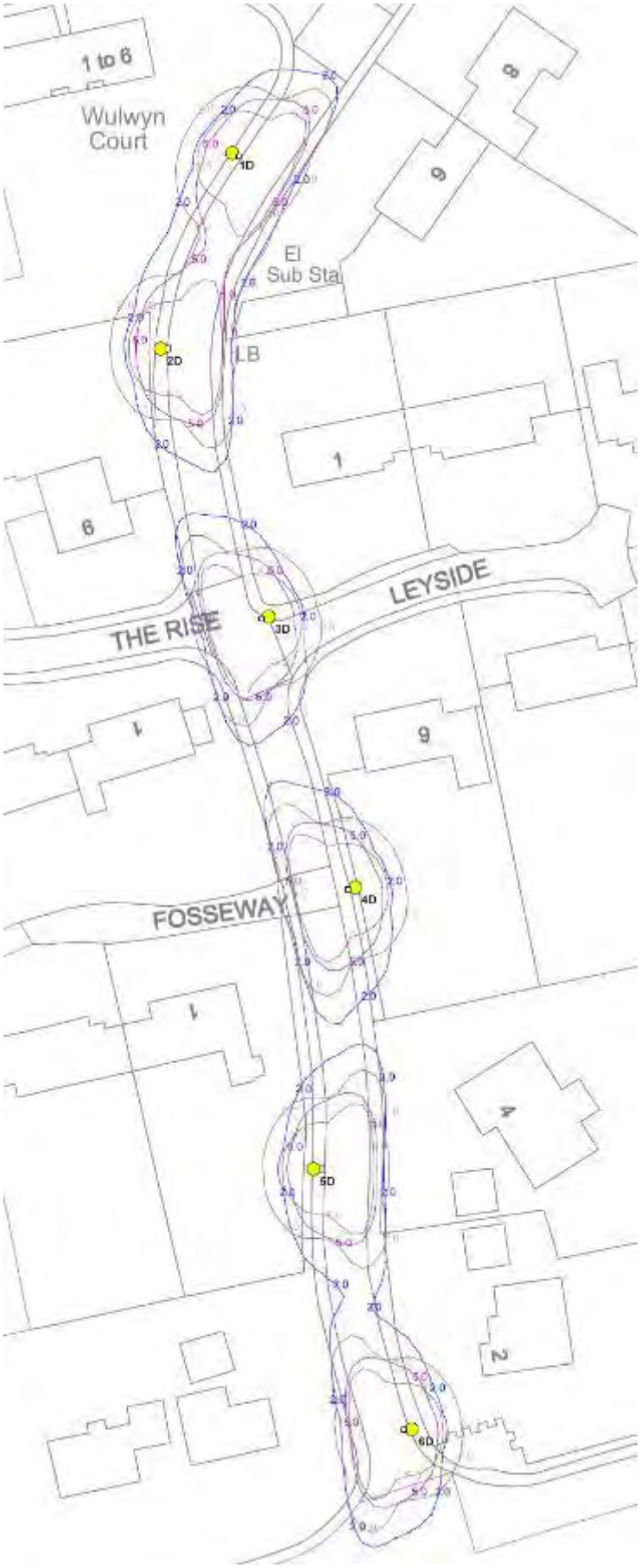

Heatherway
Highway
Wokingham Rd
New Wokingham Rd
The Avenue
Lyneham Rd
Wiltshire Ave
Dukes Wood
Larkswood
B3348
Duke's Ride
Albert Rd
Church Rd E
King's Rd
St Johns St
Heath Hill Rd N
Edgcumbe Park Dr
Waterloo Rd
Lake End Way
Towers Dr
Lidl
Heath Hill Rd S
High St
Alcot Ct
Church St
Chaucer Rd
Goldsmith Way
Sandhurst Rd
Blake Cl
Lower Broadmo
Byron Dr
Pinehill Rd
Wellington College
Shaw Park
Grant Rd
Mordaunt Dr
Edgbarrow
Secondary School

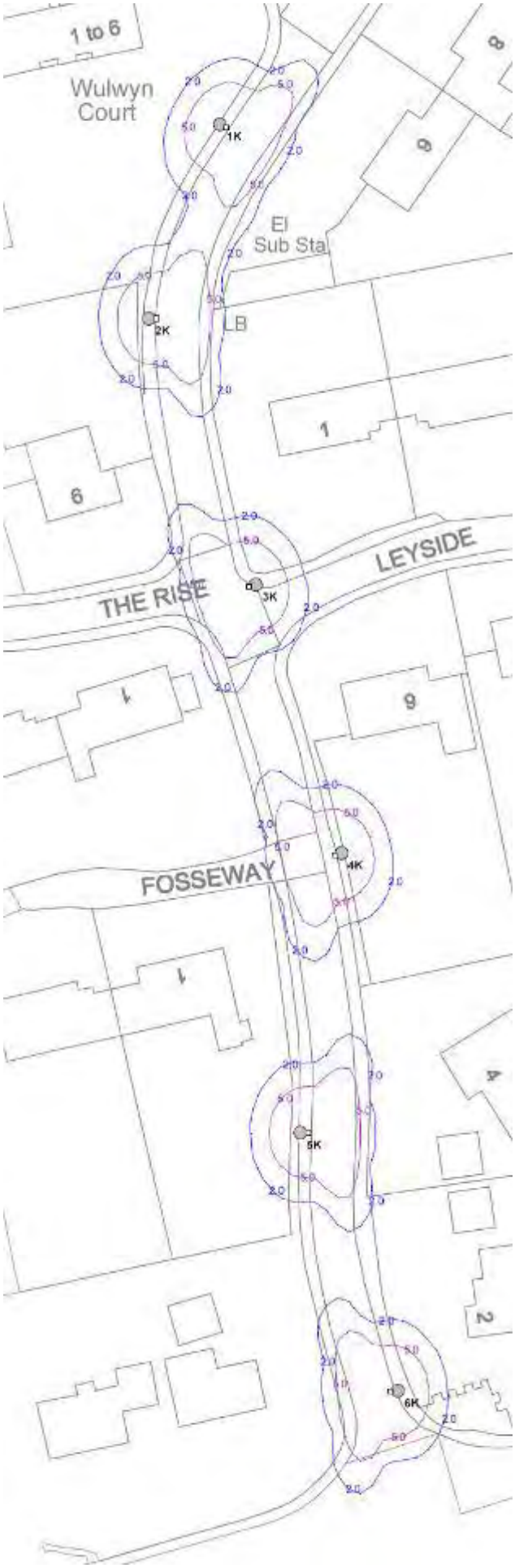
View of the road:

Picture 1:

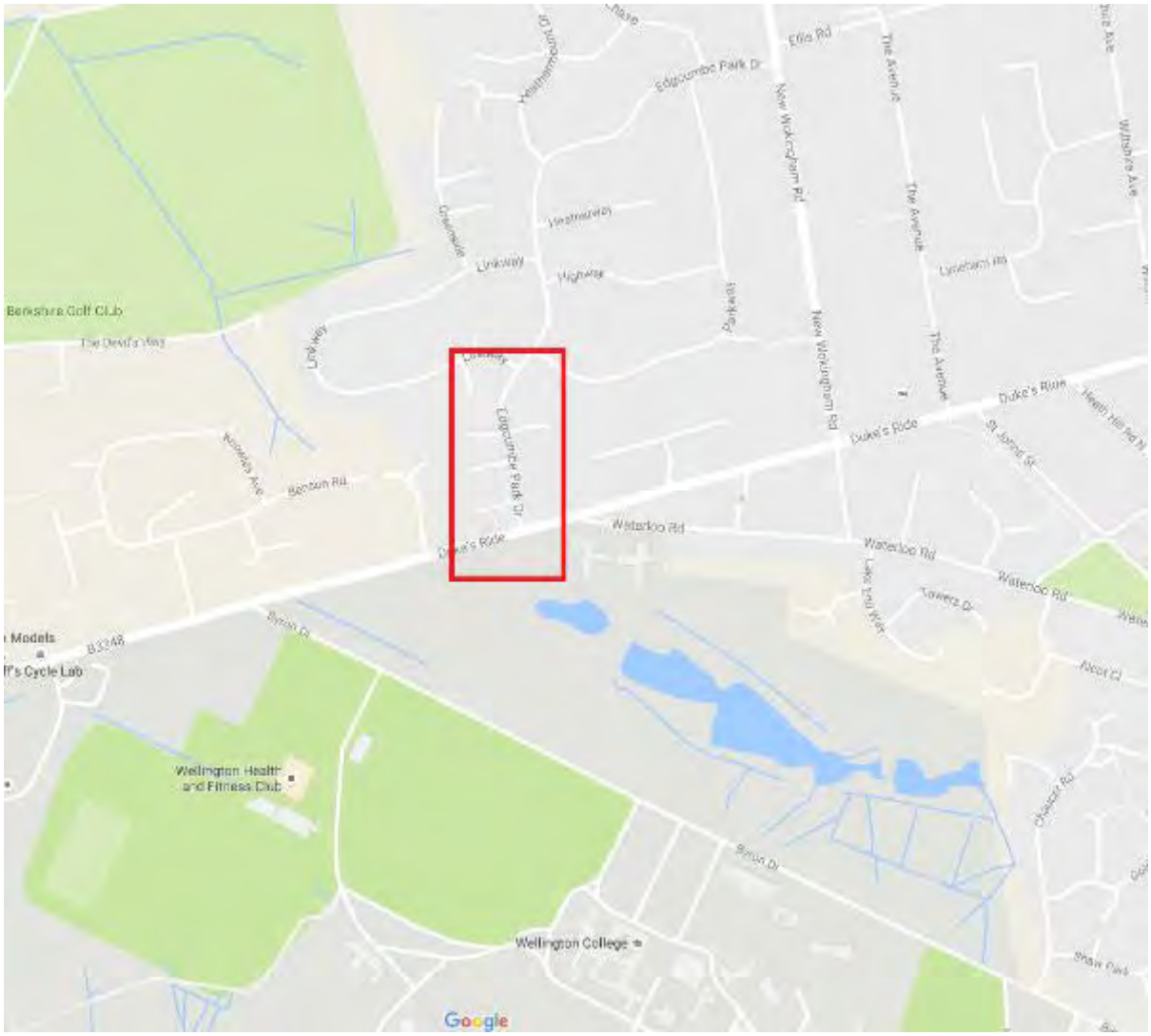
Picture 2:

PH2-037 Edgecumbe Drive




1 to 6
Wulwyn Court
1K
2K
3K
4K
5K
6K
El Sub Sta
LB
THE RISE
LEYSIDE
FOSSEWAY
1
6
9
4
2

Location:

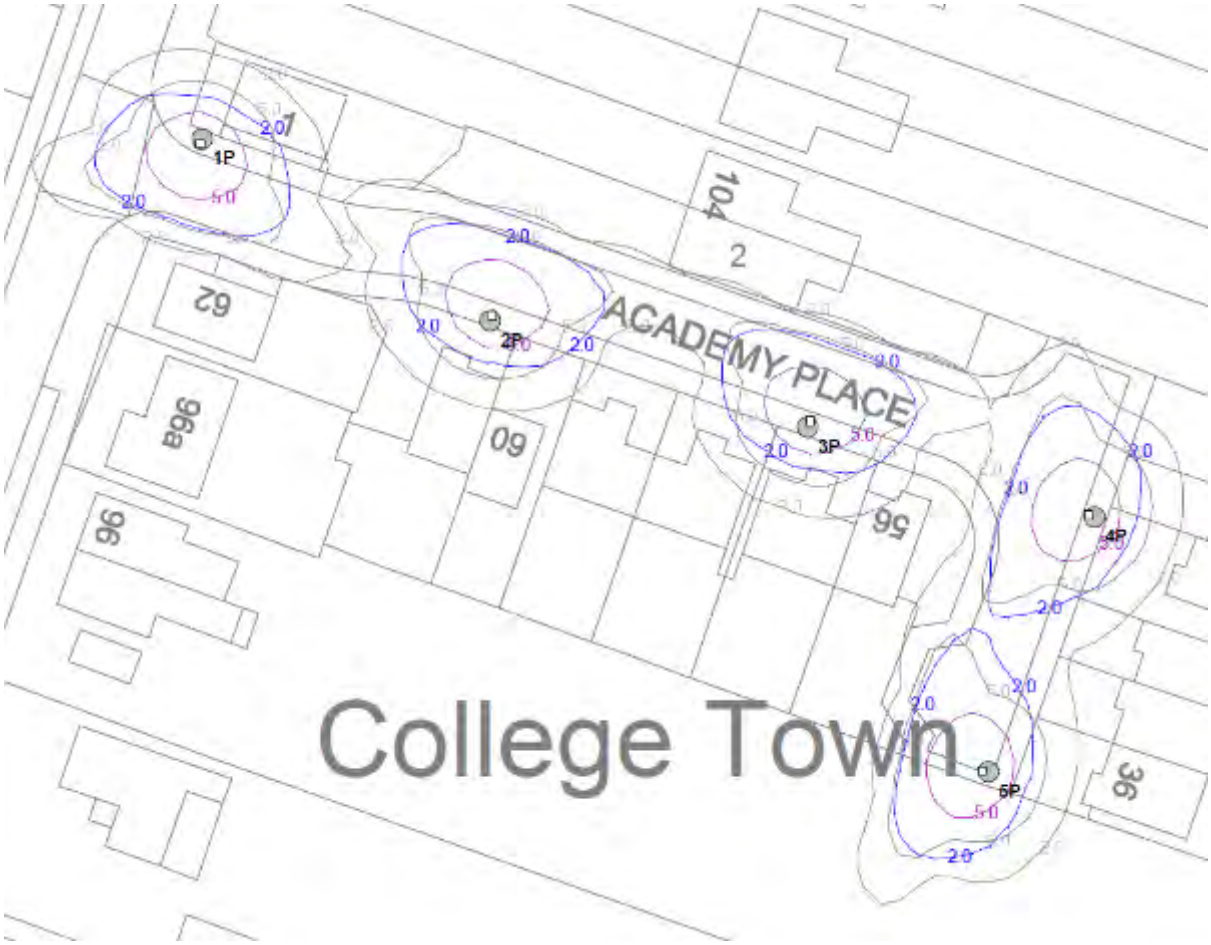


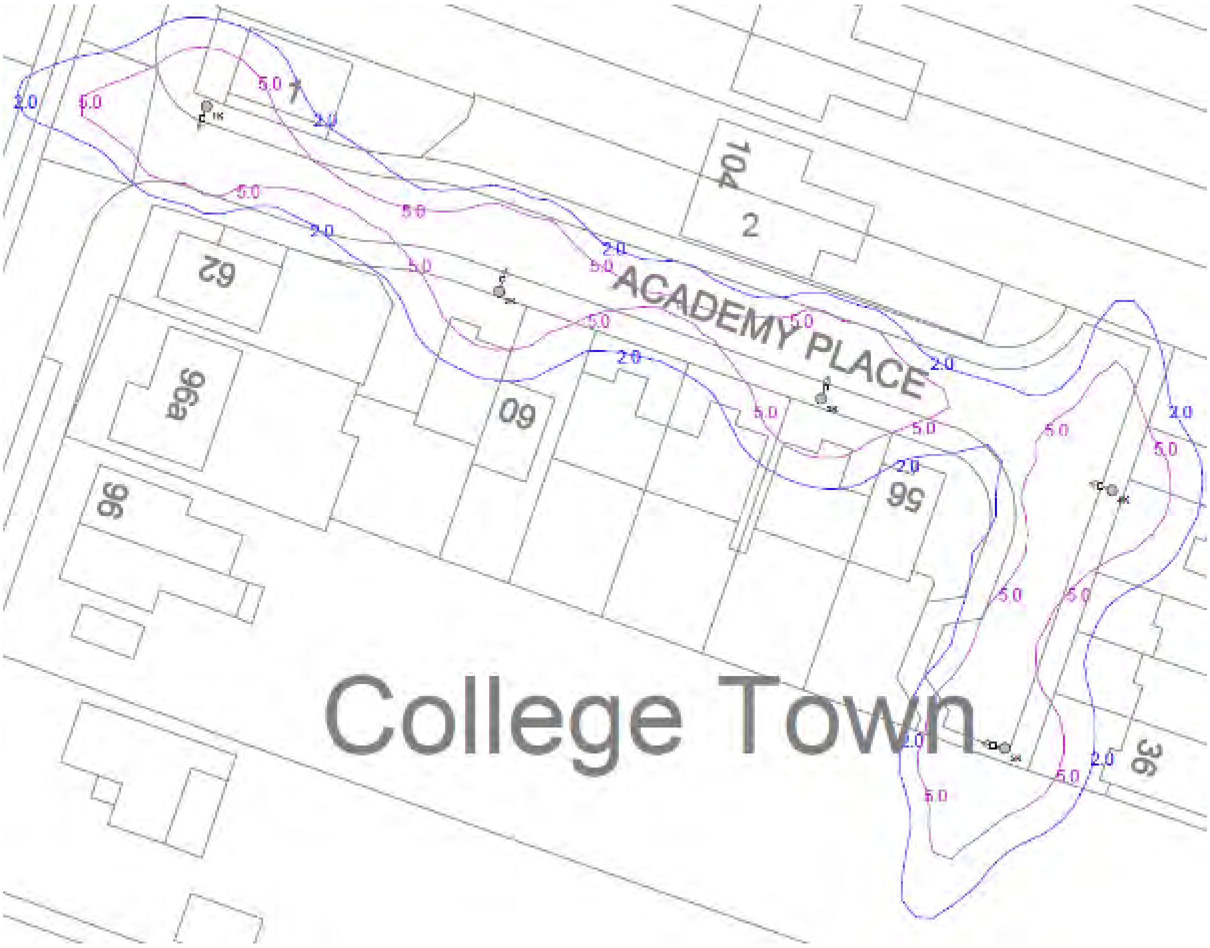
View of the road:

Picture 1

Picture 2:

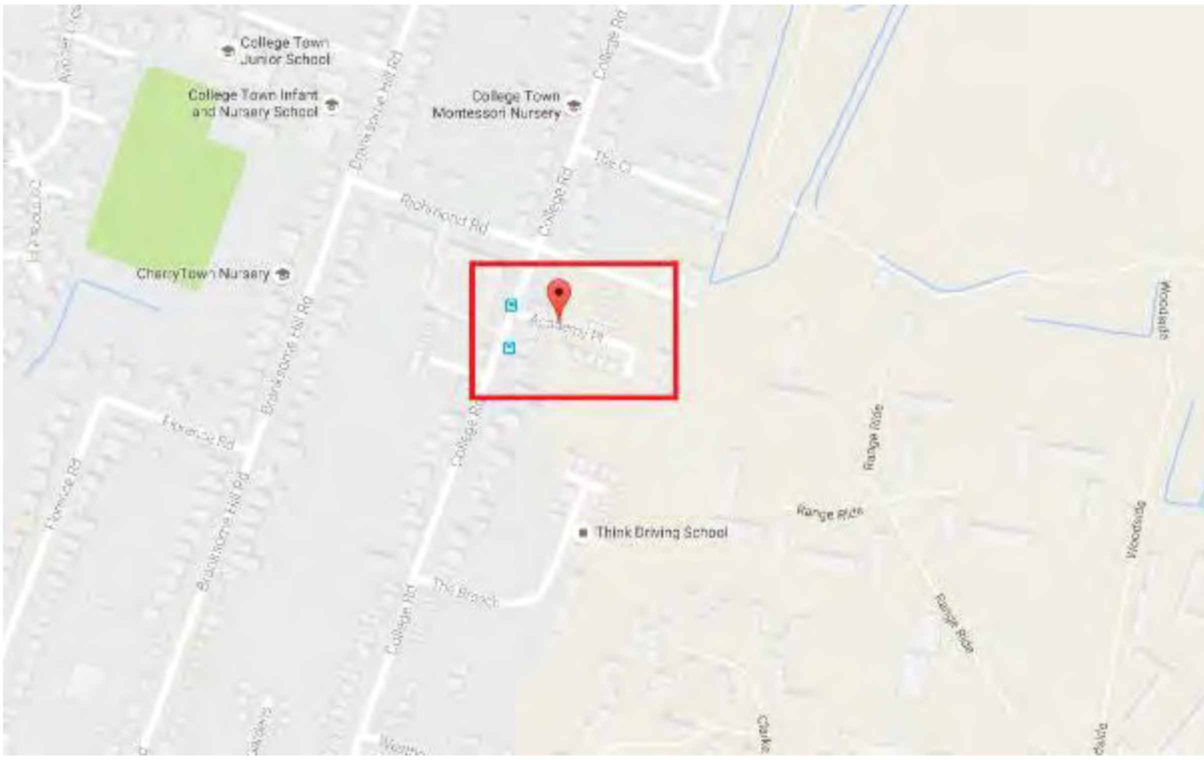
PH2-053 Academy Place





ACADEMY PLACE
College Town
104
2
62
96a
96
60
56
36
2.0
5.0

Location:

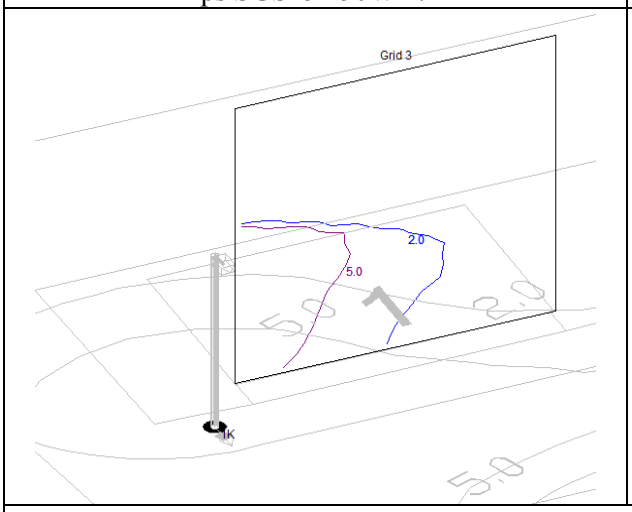
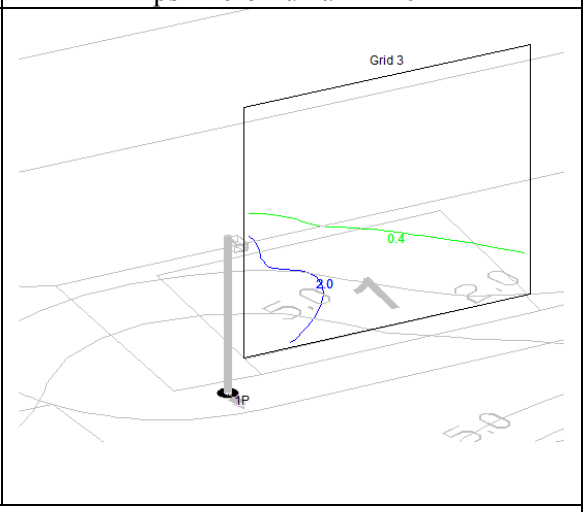


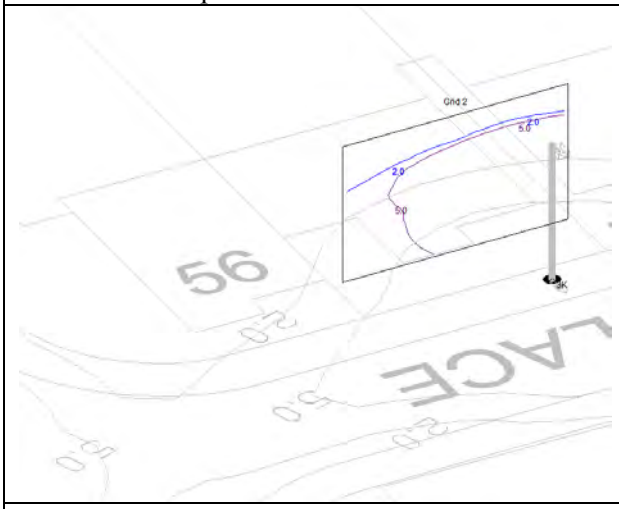
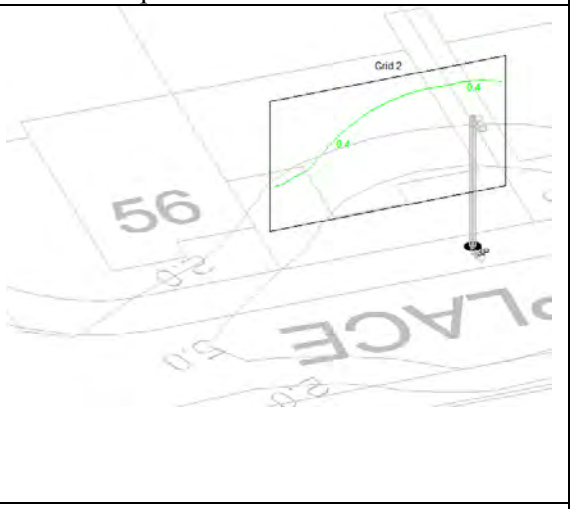
College Town Junior School
College Town Infant and Nursery School
College Town Montessori Nursery
CherryTown Nursery
Richmond Rd
College Rd
Branksome Hill Rd
Florence Rd
Think Driving School
Range Ride
The Branch
Woodside

View of the road:

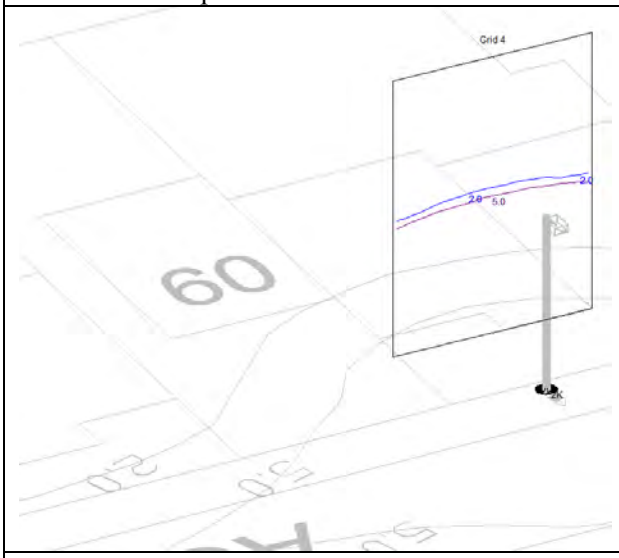
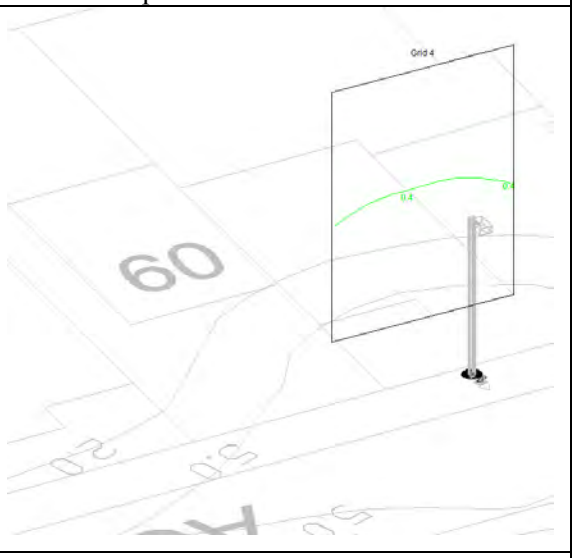
Picture 1:

Picture 2:

House No 1	
Philips SGS252 50W 4.4klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

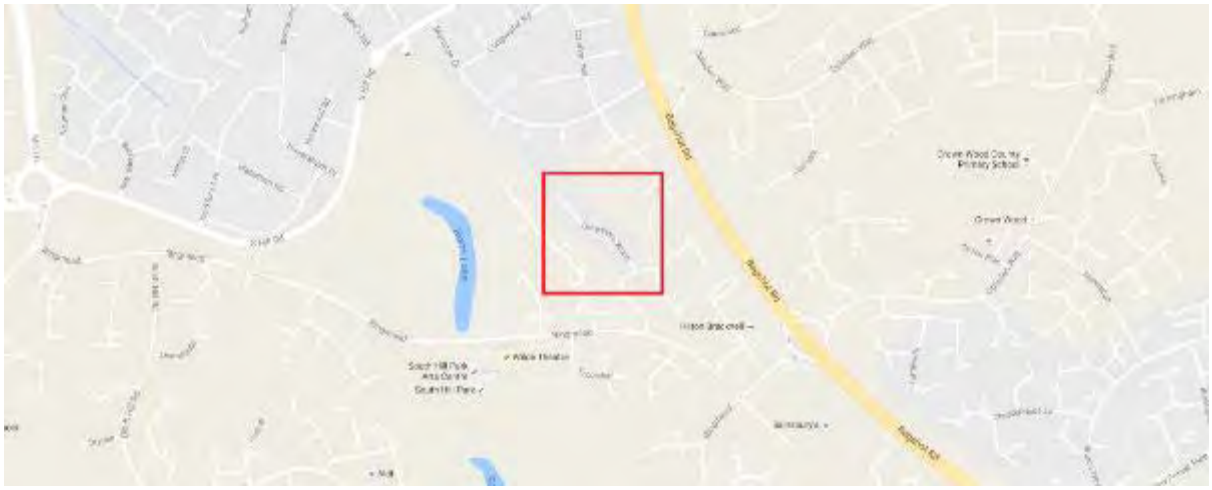
House No 55	
Philips SGS252 50W 4.4klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

House No 59

Philips SGS252 50W 4.4klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

PH3-003 Greenham Wood

Location:

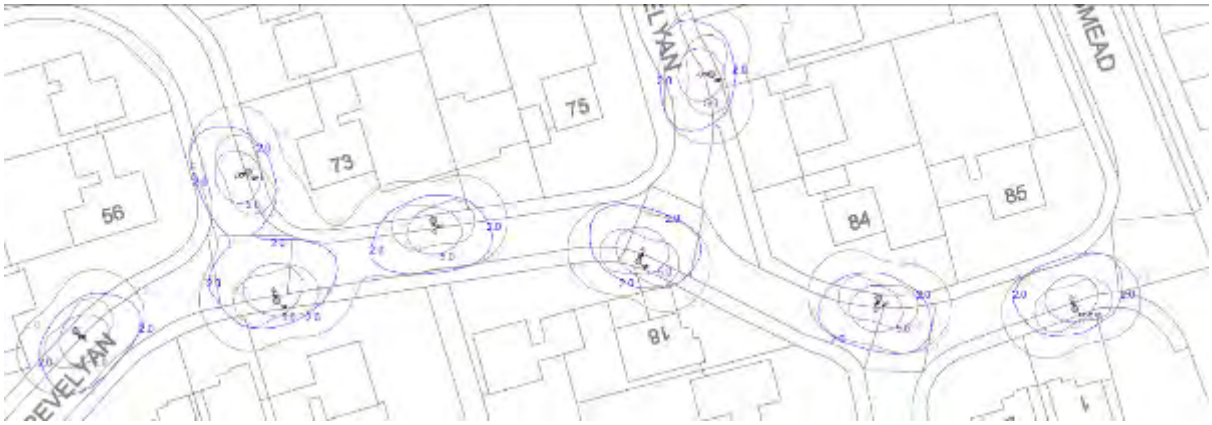


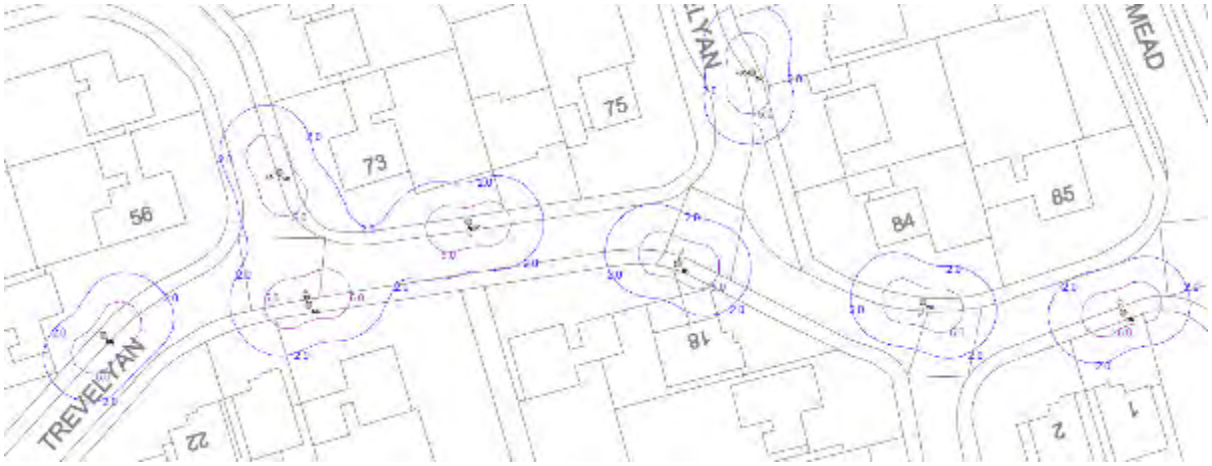
View of the road:

Picture 1:

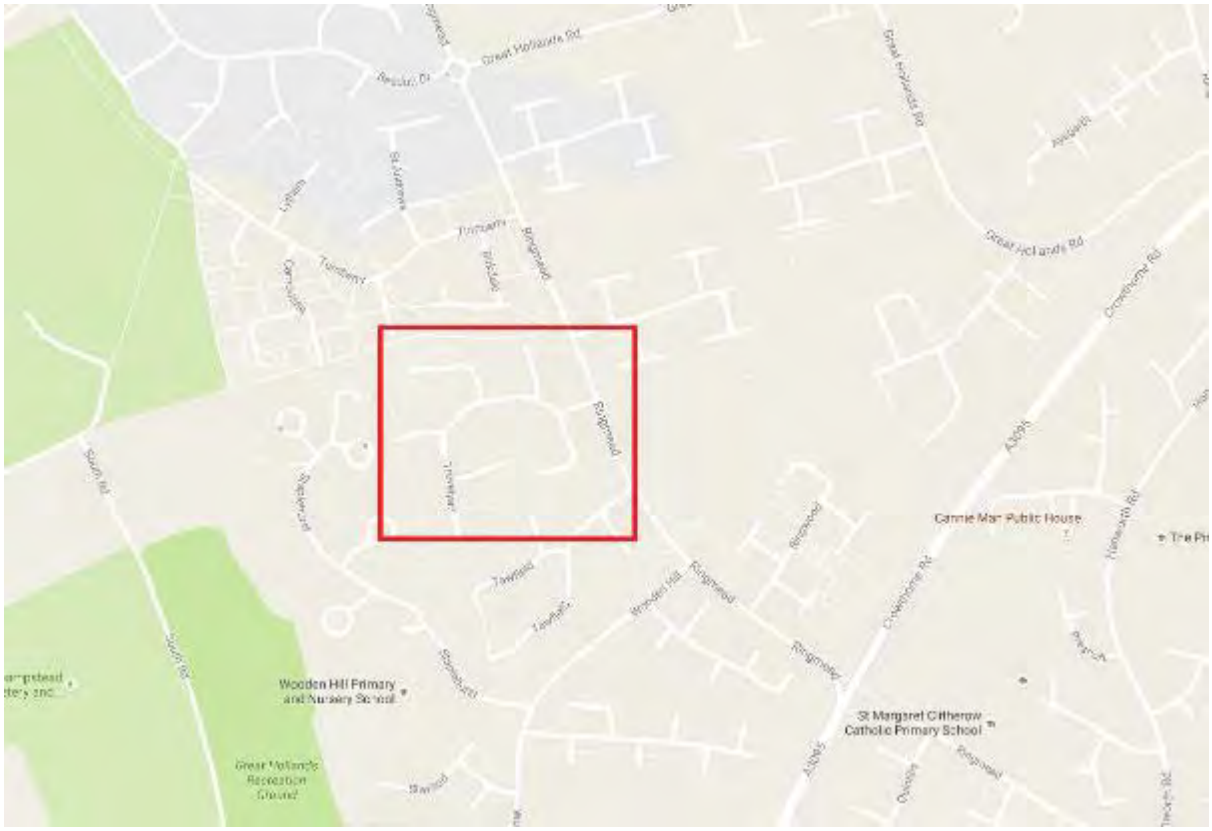
Picture 2:

PH3-010 Travelyan





Location:



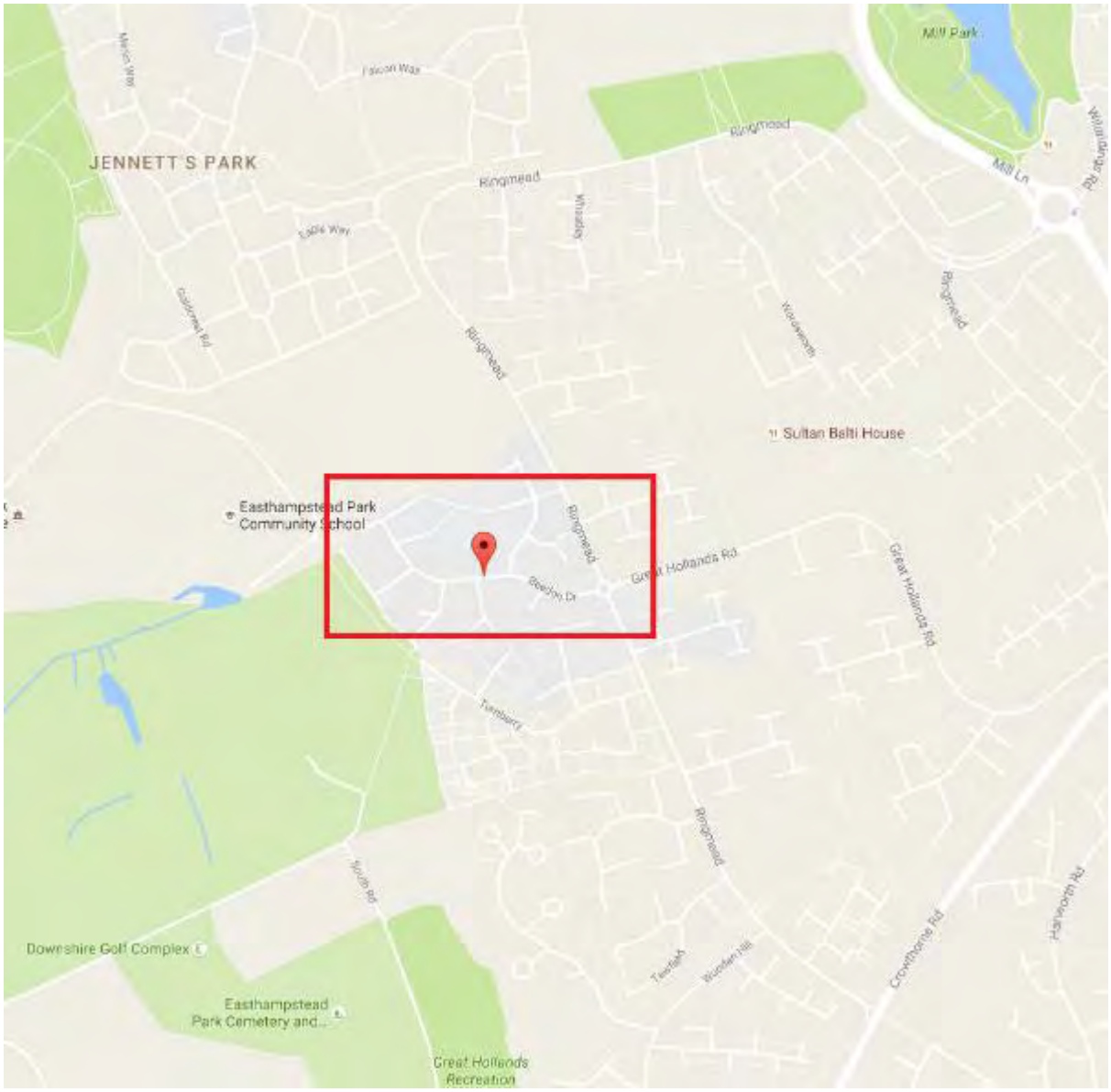
View of the road:

Picture 1:

Picture 2:

PH3-024 Beedon Drive

Location:

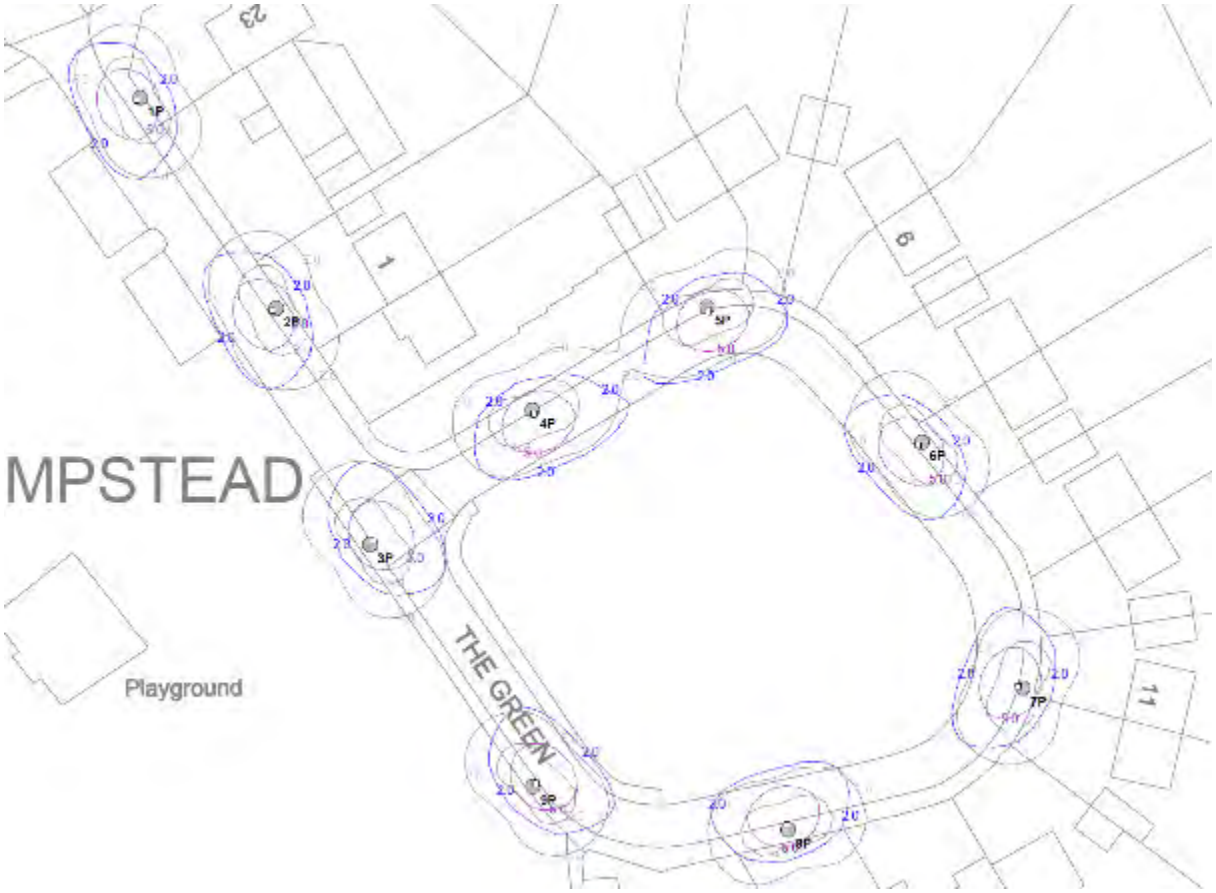

JENNETT S PARK
Ringmead
Mill Park
Mill Ln
Sultan Balti House
Easthampstead Park Community School
Great Hollands Rd
Dowershire Golf Complex
Easthampstead Park Cemetery and...
Great Hollands Recreation

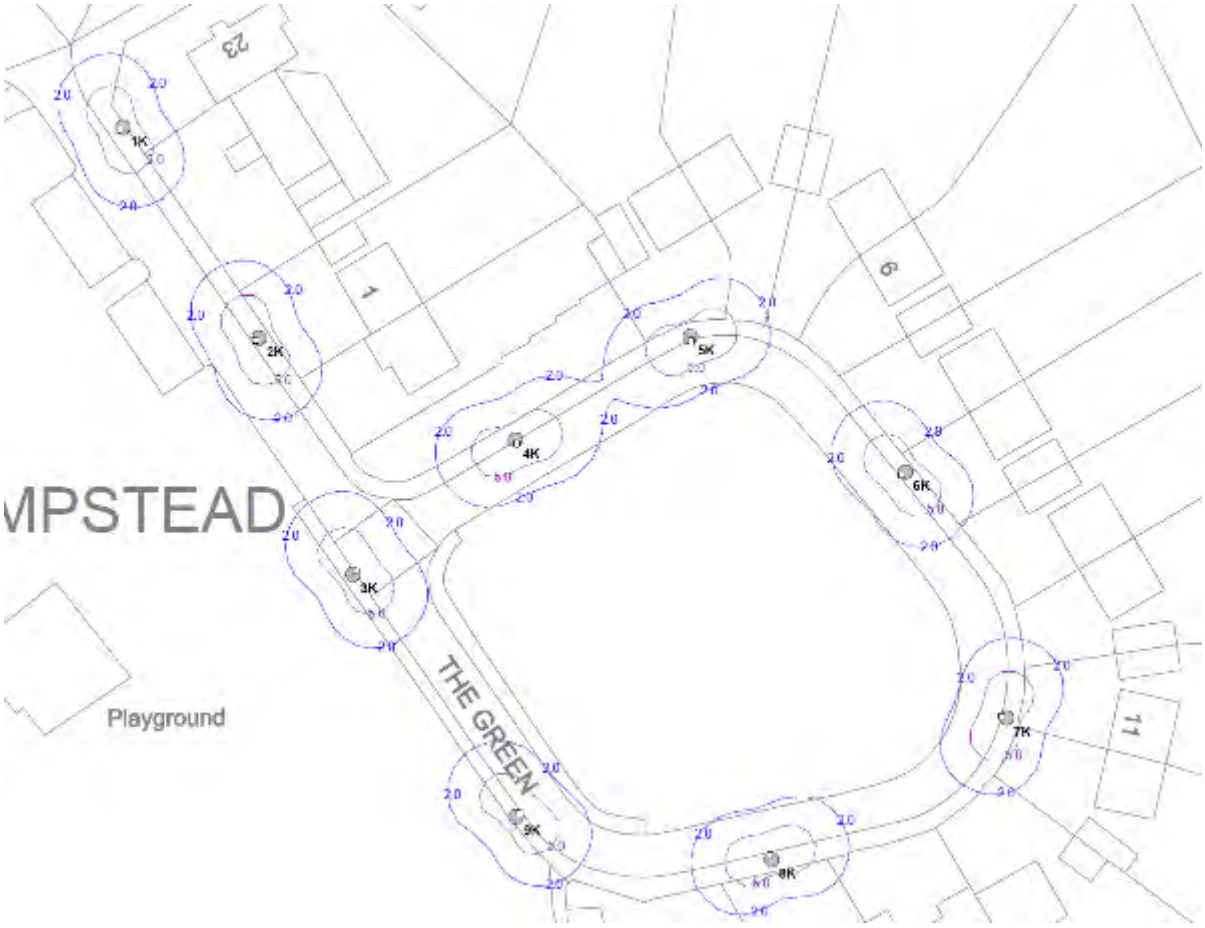
View of the road:

Picture 1

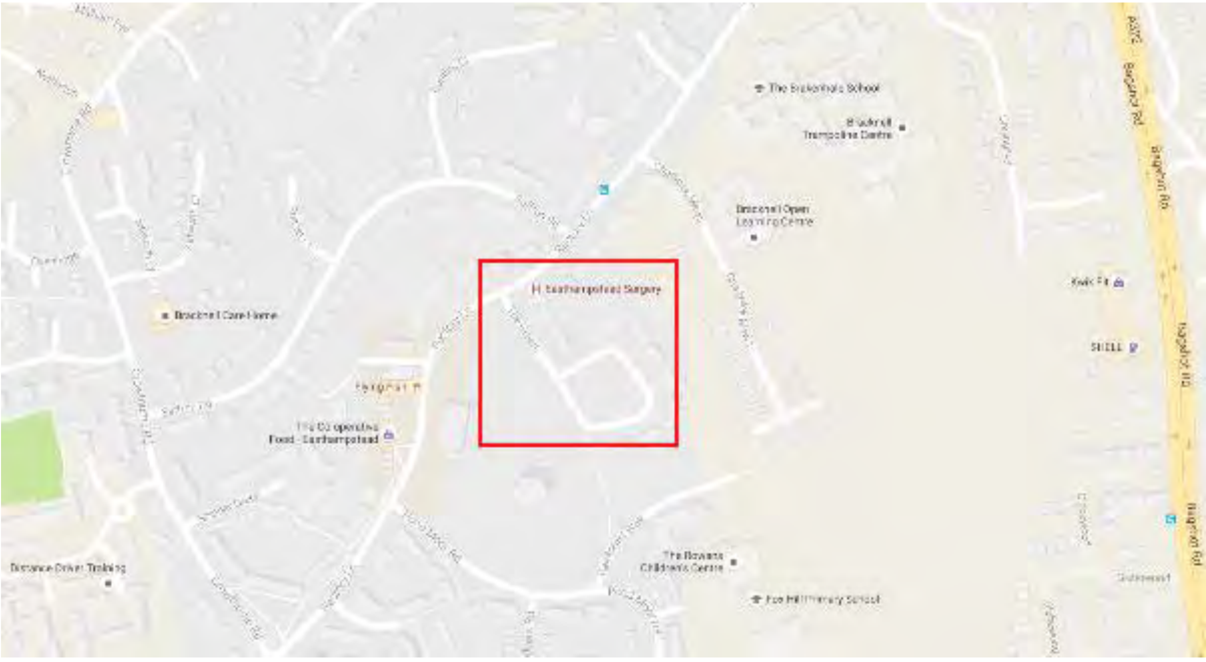
Picture 2:

PH3-034 the Green





Location:



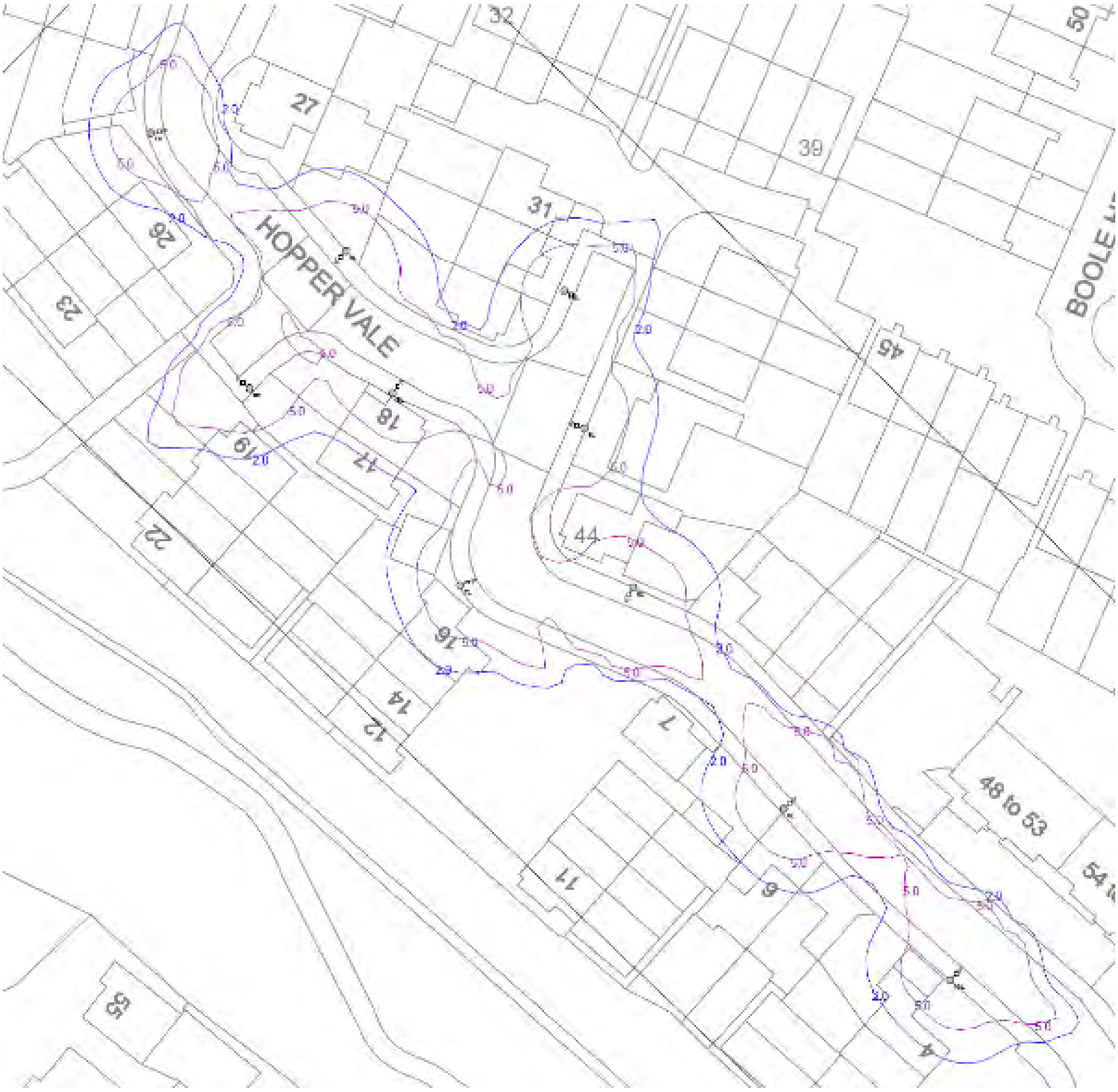
Bracknell Care Home
Bracknell Open Learning Centre
The Rowans Children's Centre
Distance Driver Training
SHELL
Bagshot Rd

View of the road:

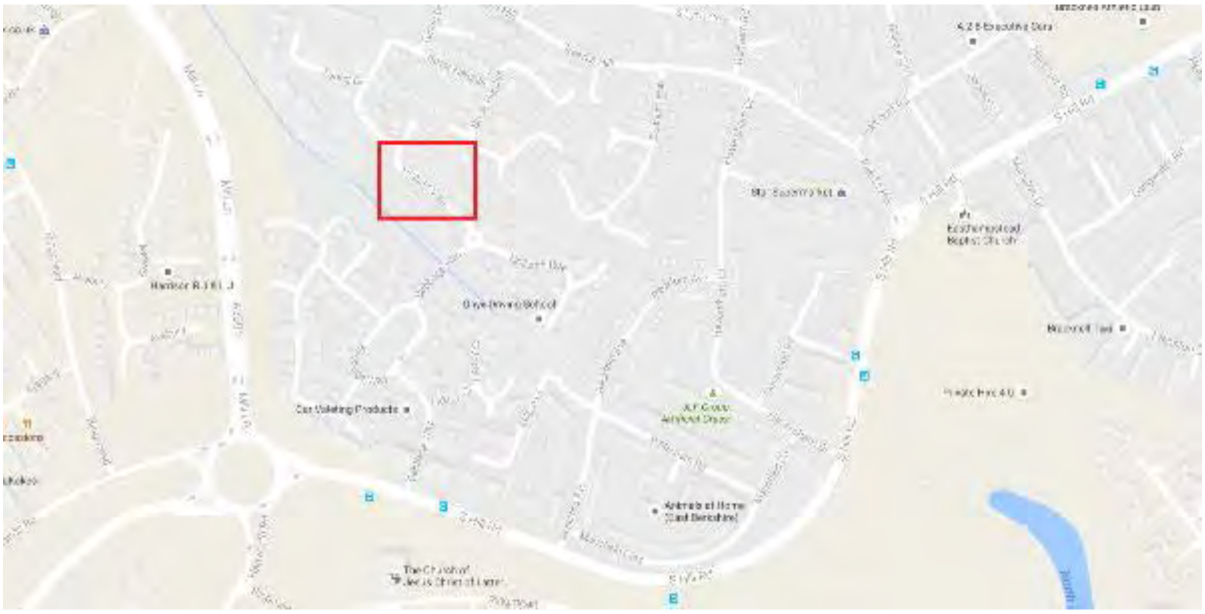
Picture 1:

Picture 2:

PH3-043 Hoppe Vale


HOPPER VALE
BOOLE
27
31
39
32
50
26
23
18
19
17
22
16
14
12
7
44
45
11
9
4
55
48 to 53

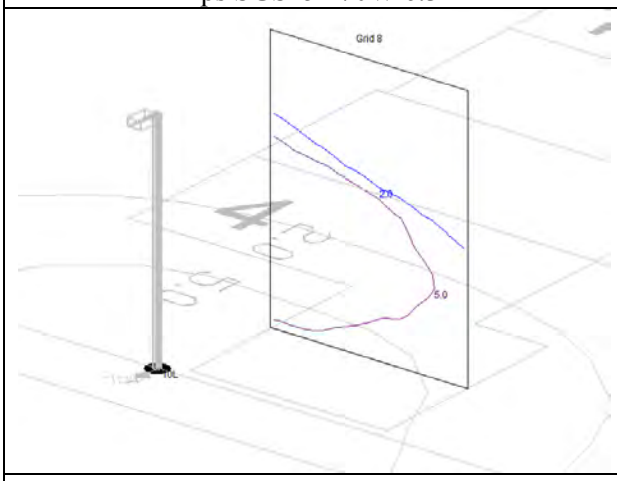
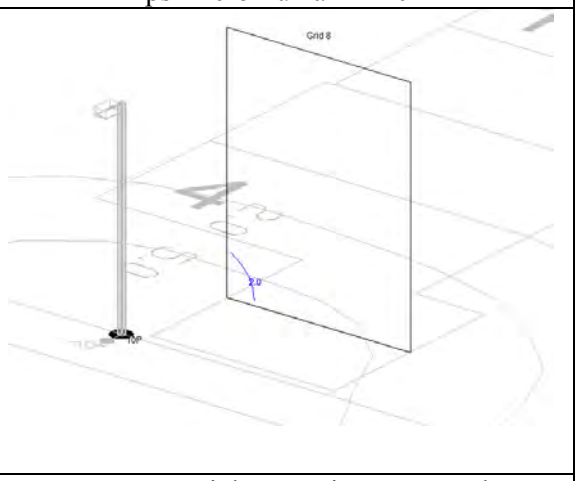
Location:

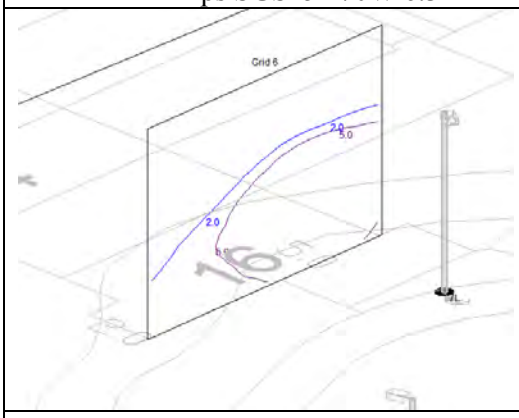
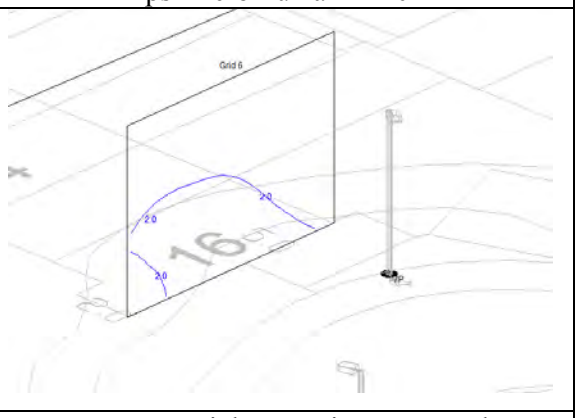


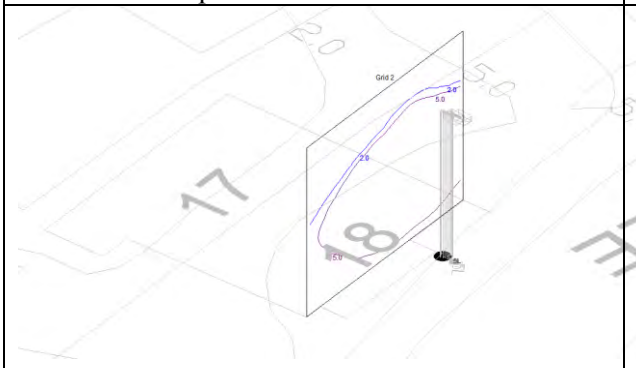
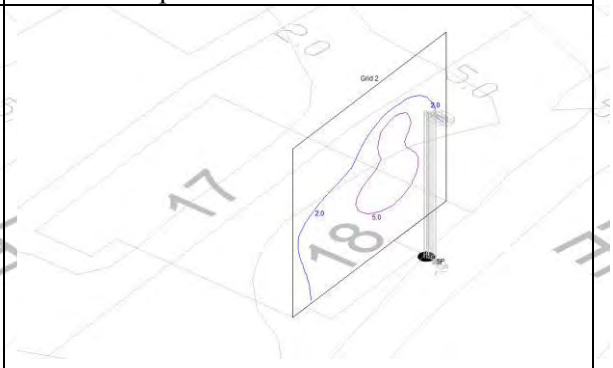
View of the road:

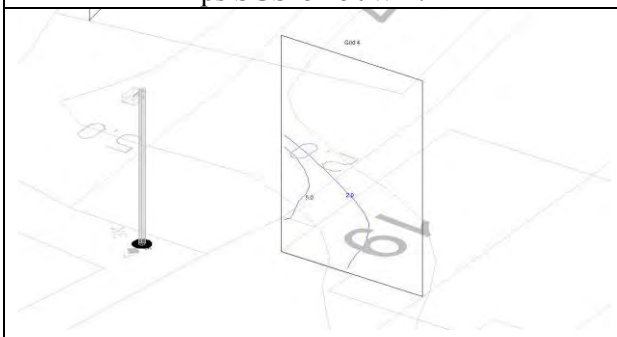
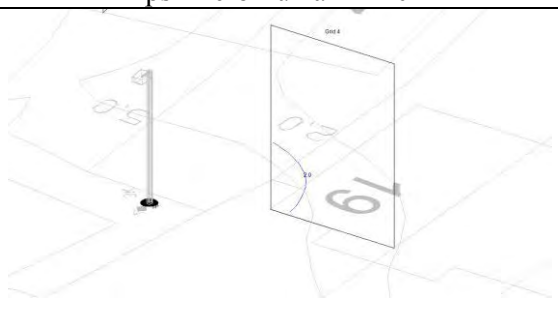
Picture 1:

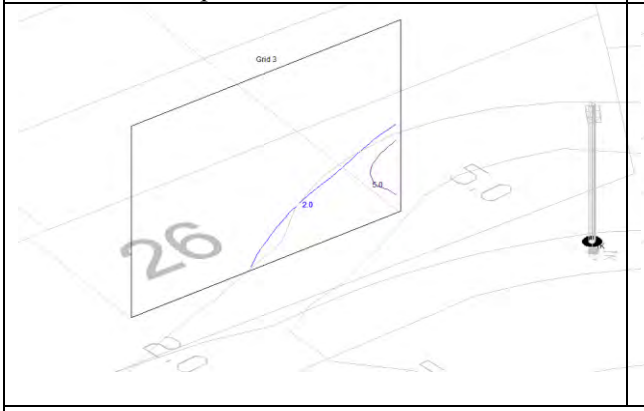
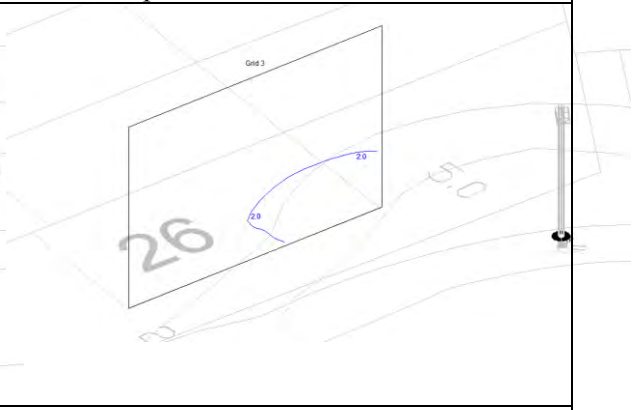
Picture 2:

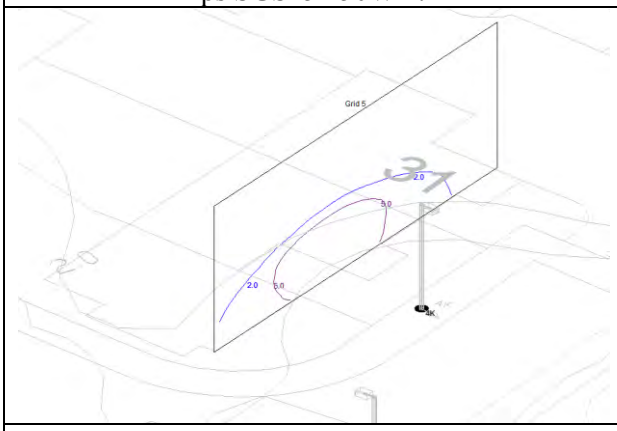
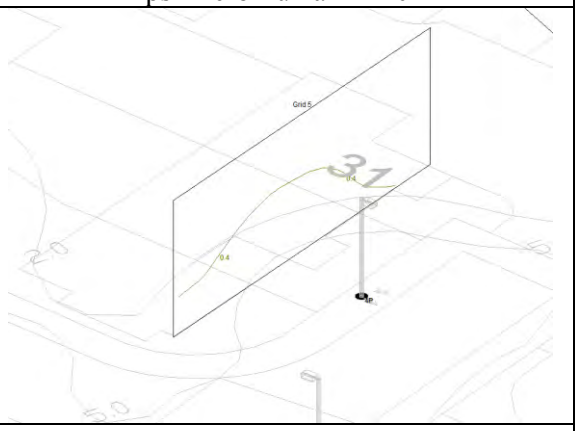
House nr 4	
Philips SGS252 70W 6.3klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

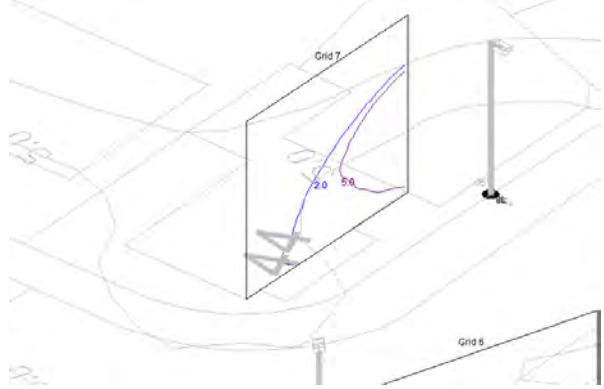
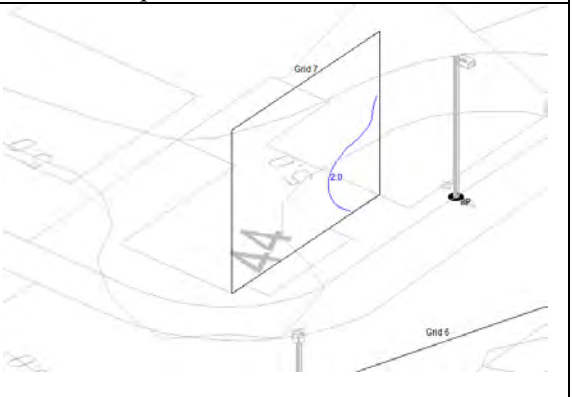
House nr 16	
Philips SGS252 70W 6.3klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

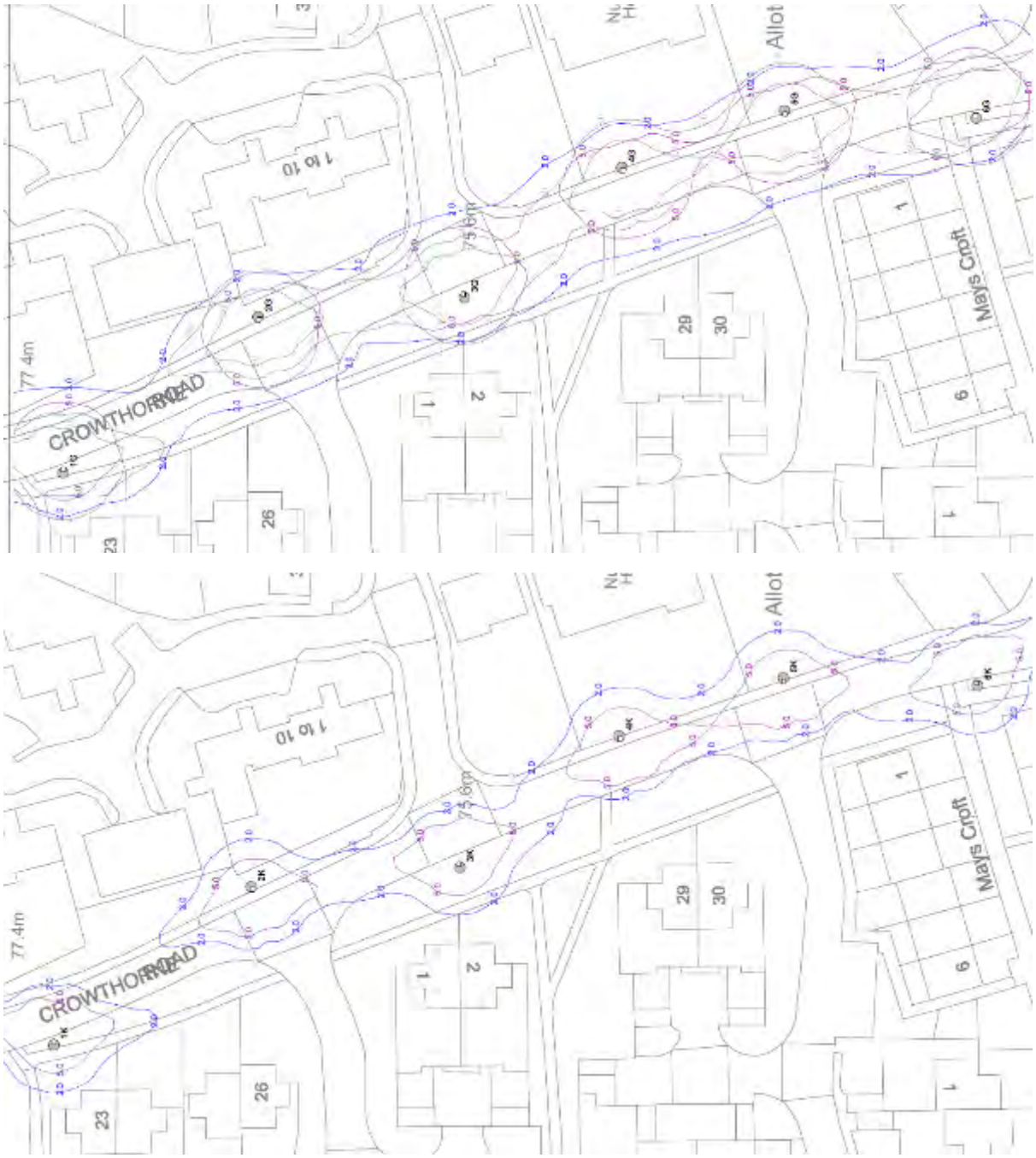
House nr 18	
Philips SGS252 70W 6.3klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

House nr 19	
Philips SGS252 50W 4.4klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

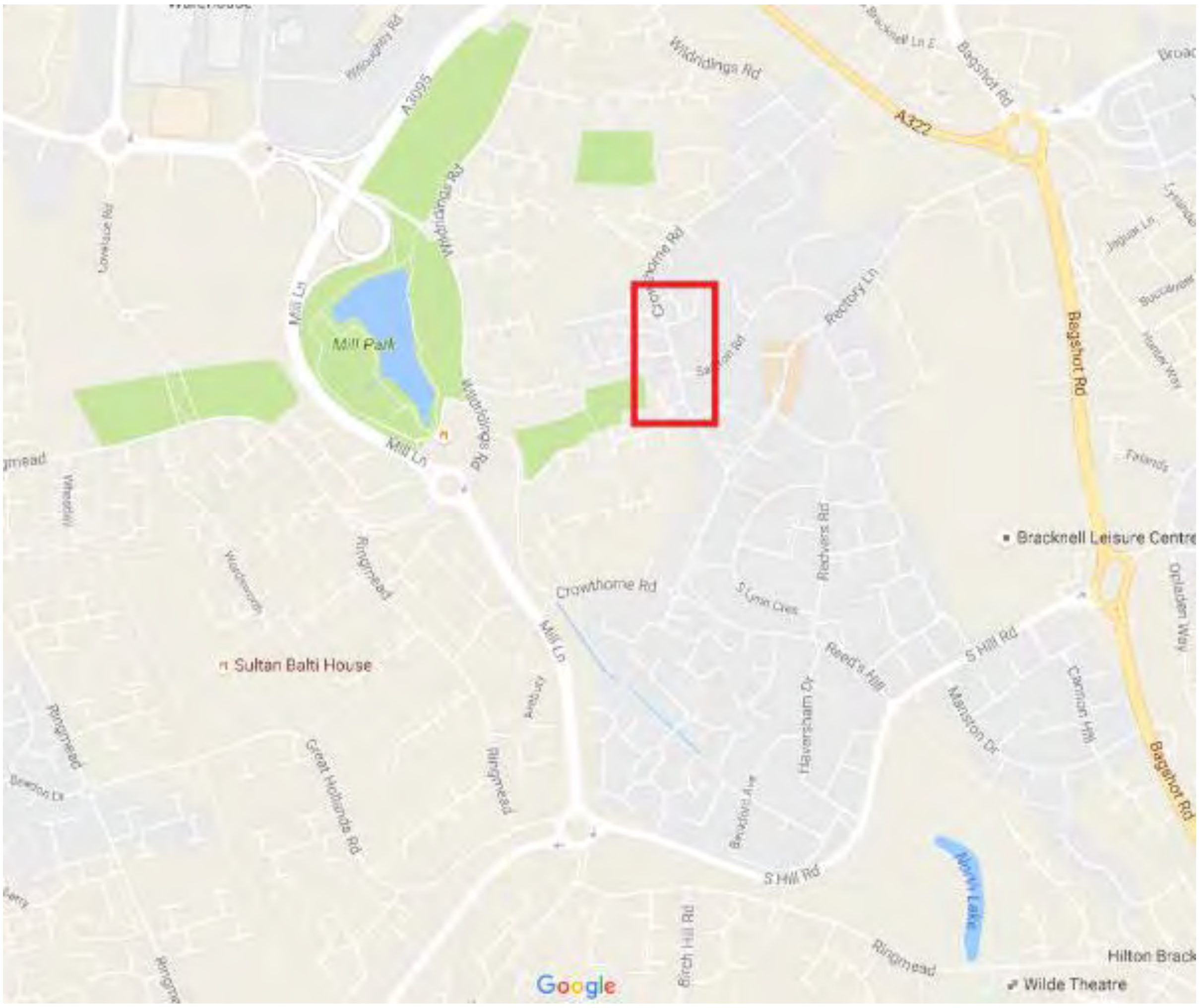
House nr 26	
Philips SGS252 50W 4.4klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

House nr 31	
Philips SGS252 50W 4.4klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	

House nr 44	
Philips SGS252 70W 6.3klm	Philips Micro Luma DM10 2klm
	
Light Intrusion Improved - Yes	


CROWTHORNE ROAD
77.4m
75.6m
Mays Croft
1 to 10
29
30
26
23
2
1
6

Location:



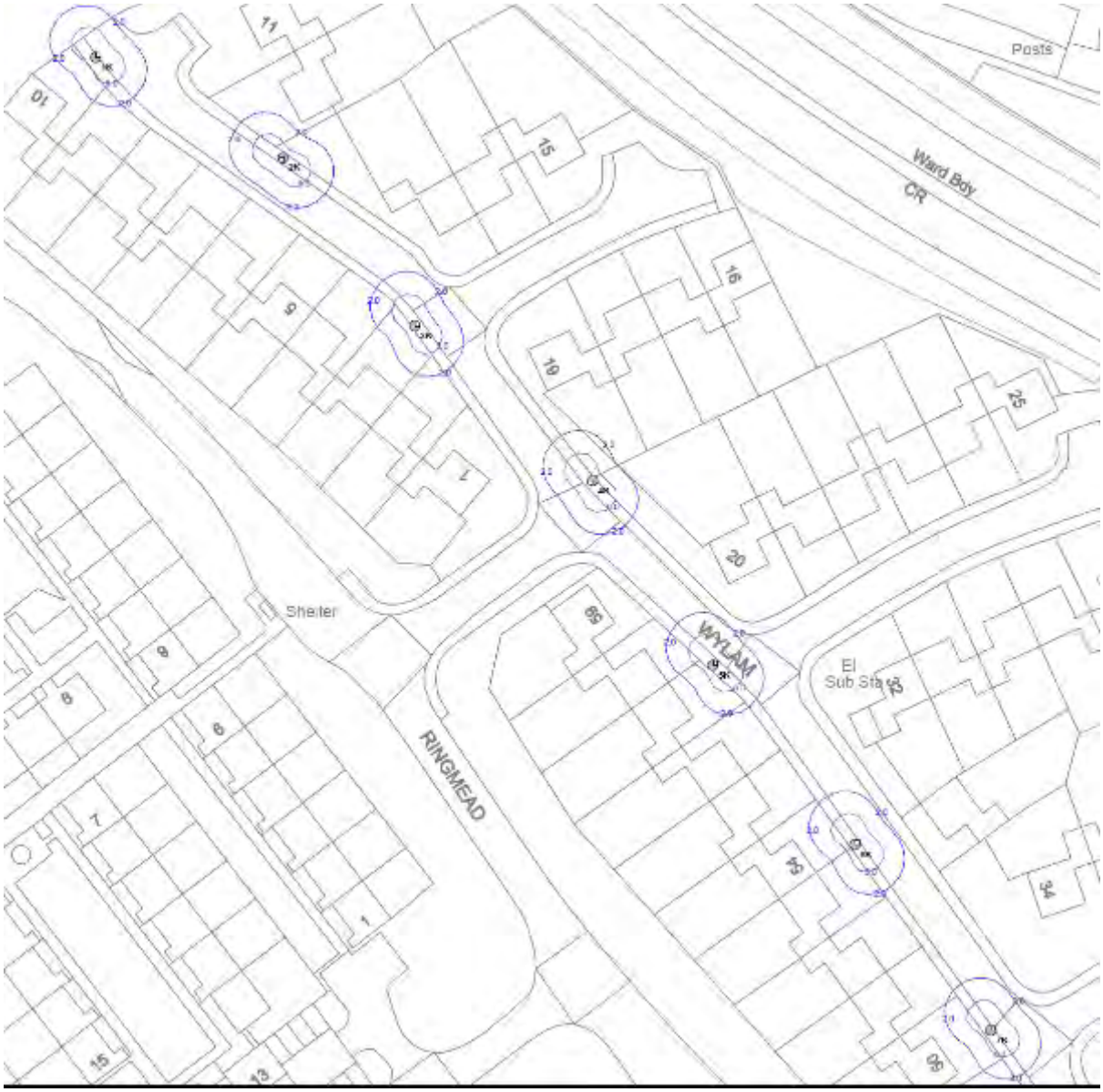
Wildridings Rd
A322
Bagshot Rd
A3095
Mill Park
Mill Ln
Crowthorne Rd
Rectory Ln
Bracknell Leisure Centre
Sultan Balti House
Ringmead
Great Hollands Rd
S Hill Rd
Redvers Rd
Reed's Hill
Haversham Dr
Birch Hill Rd
Wilde Theatre
Google

View of the road:

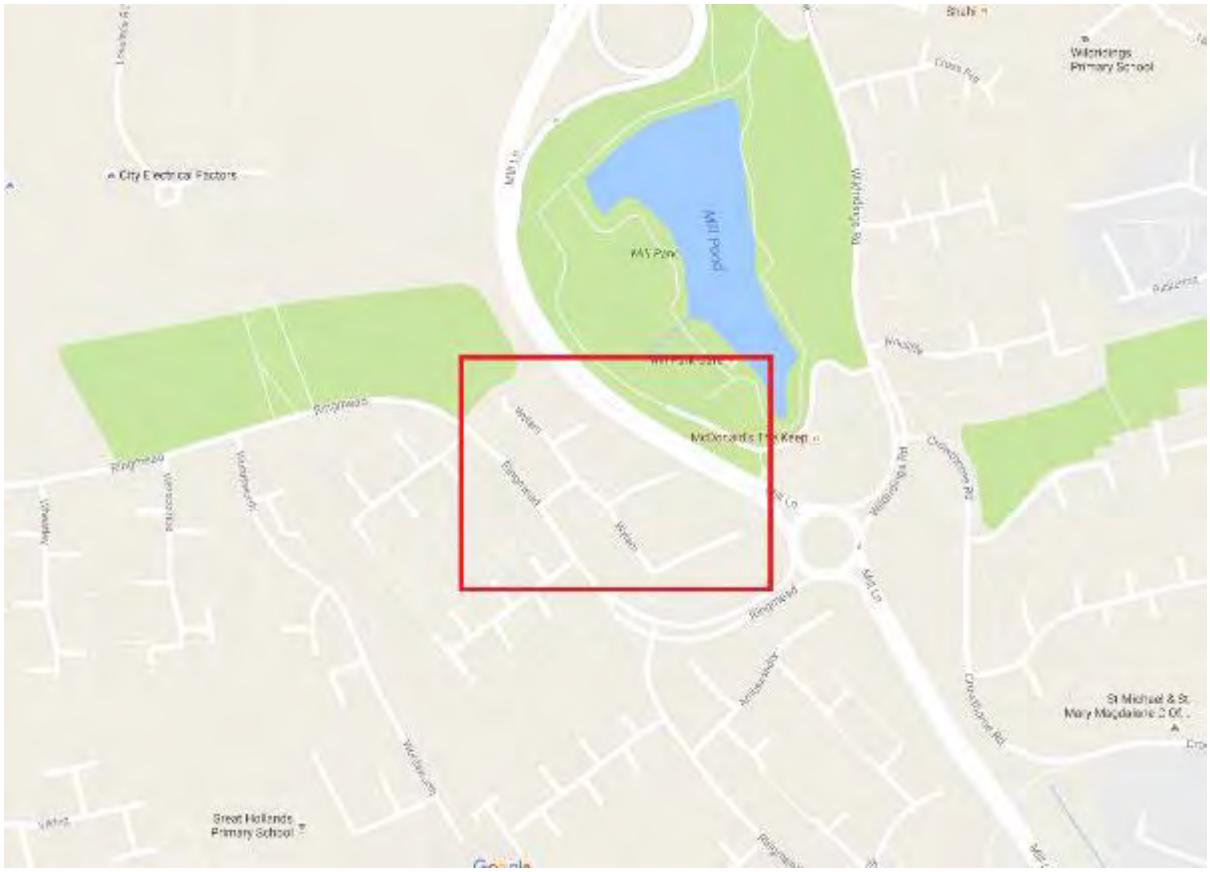
Picture 1:

Picture 2:


Posts
Ward Boy
CR
Shelter
RINGMEAD
WYLAM
El
Sub Sta


Posts
Ward Boy
CR
RINGMEAD
WYLAM
Shelter
El
Sub Sta

Location:

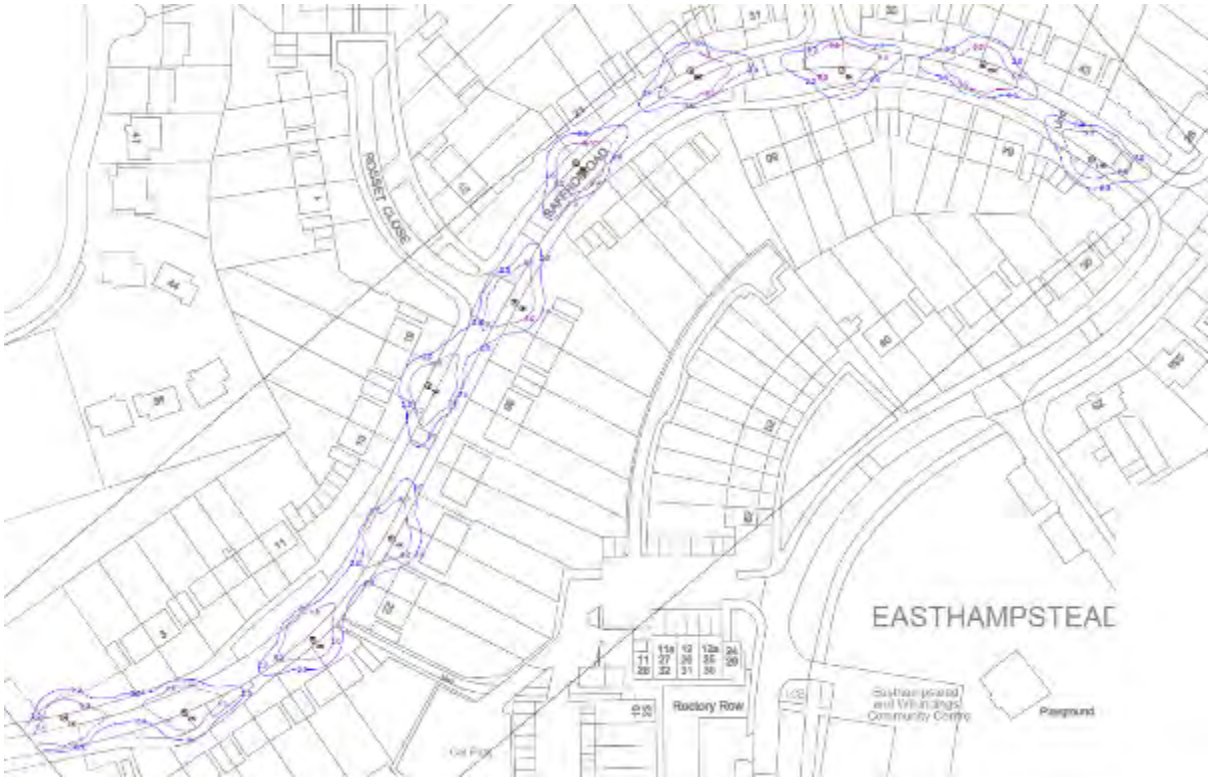


View of the road:

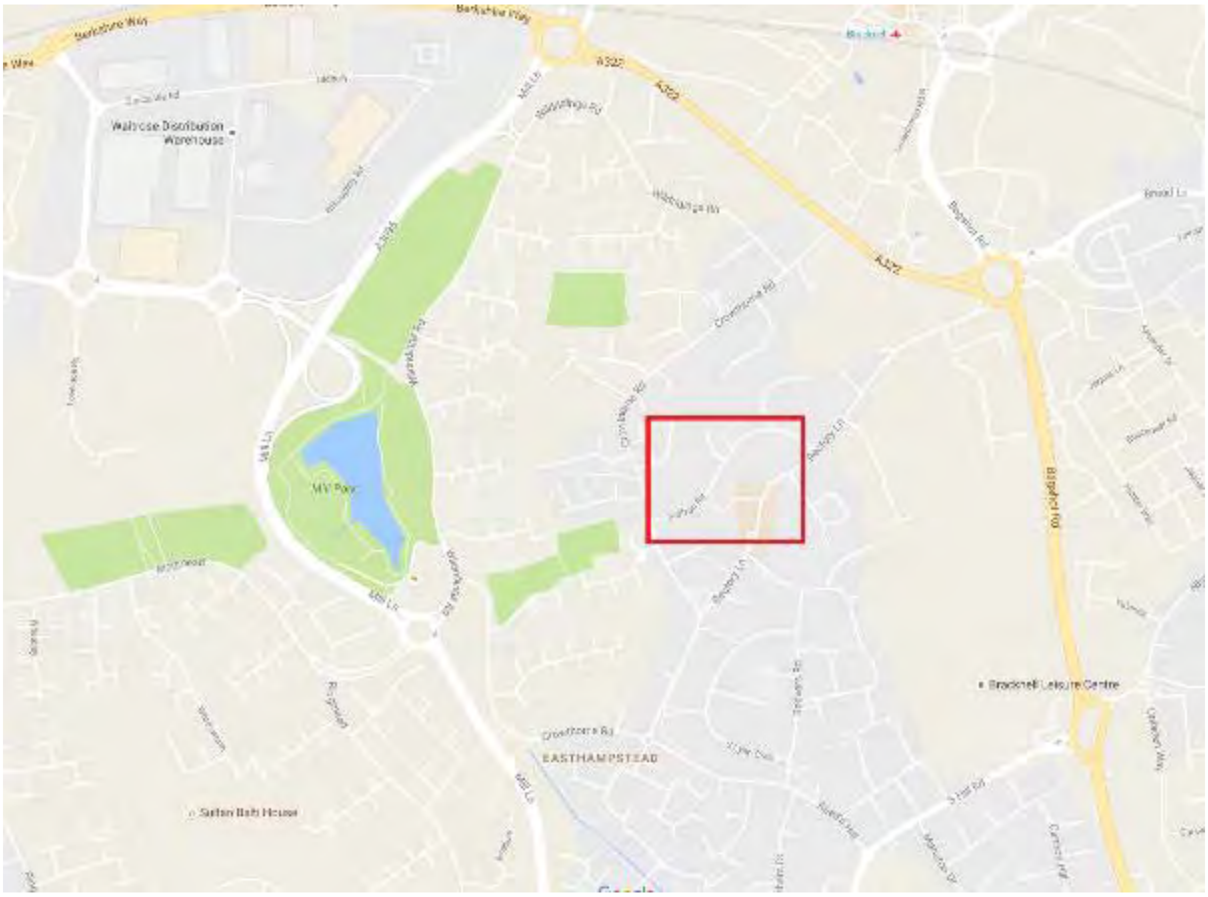
Picture 1

Picture 2:

PH4-052 Saffron Road



Location:



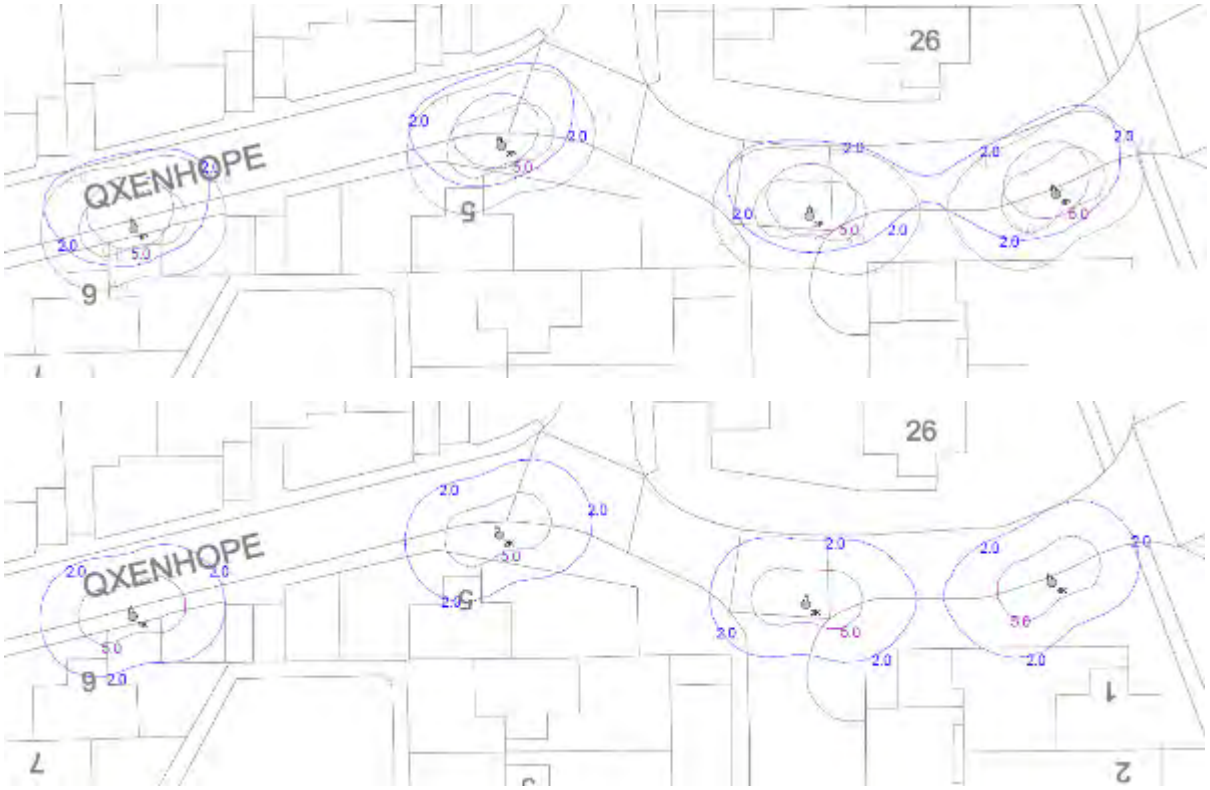
Waitrose Distribution Warehouse
A322
EASTHAMPSTEAD
Bracknell Leisure Centre

View of the road:

Pictrure 1:

Picture 2:

PH4-055 Oxenhope



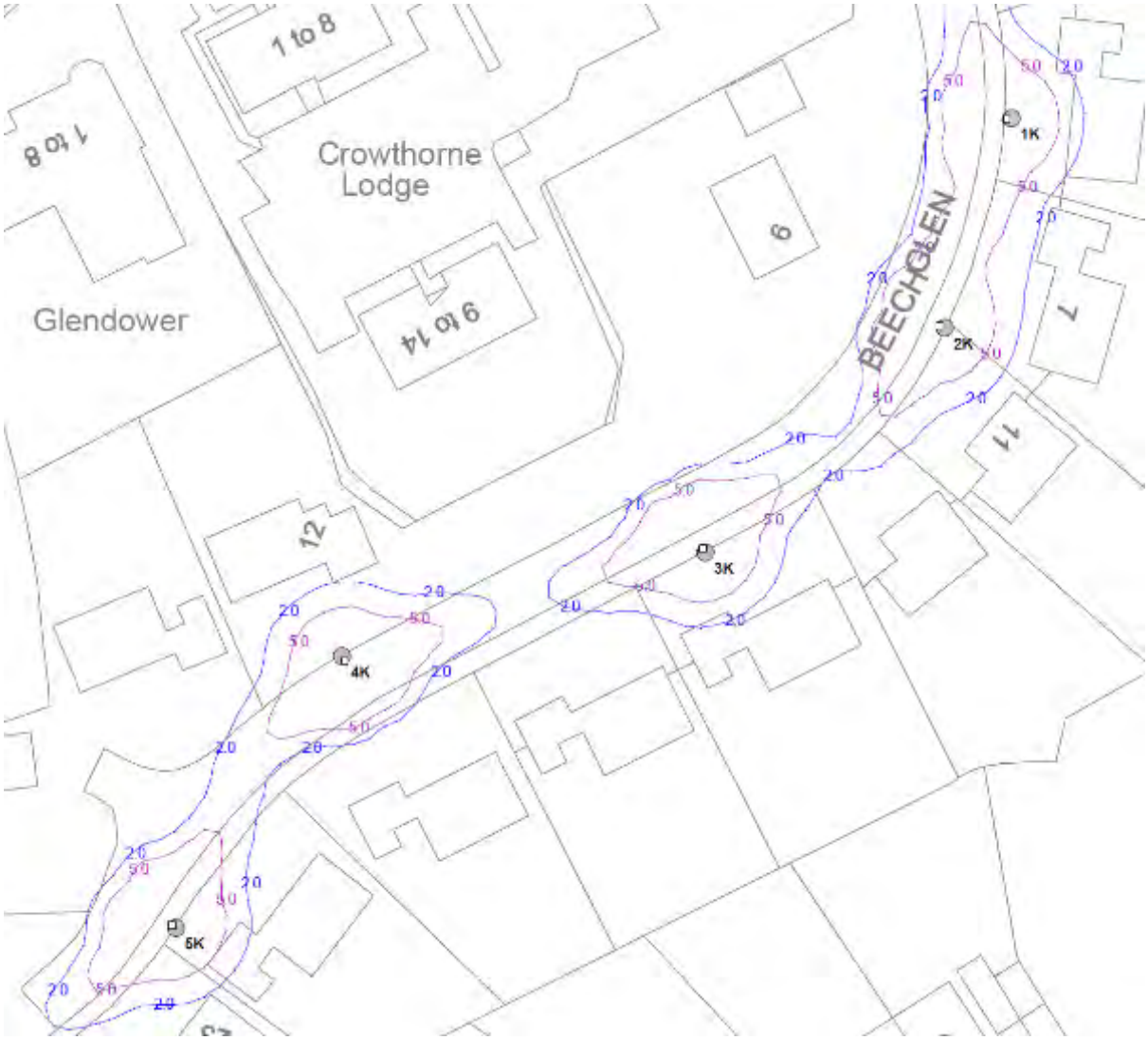
Location:

Viw of the road:

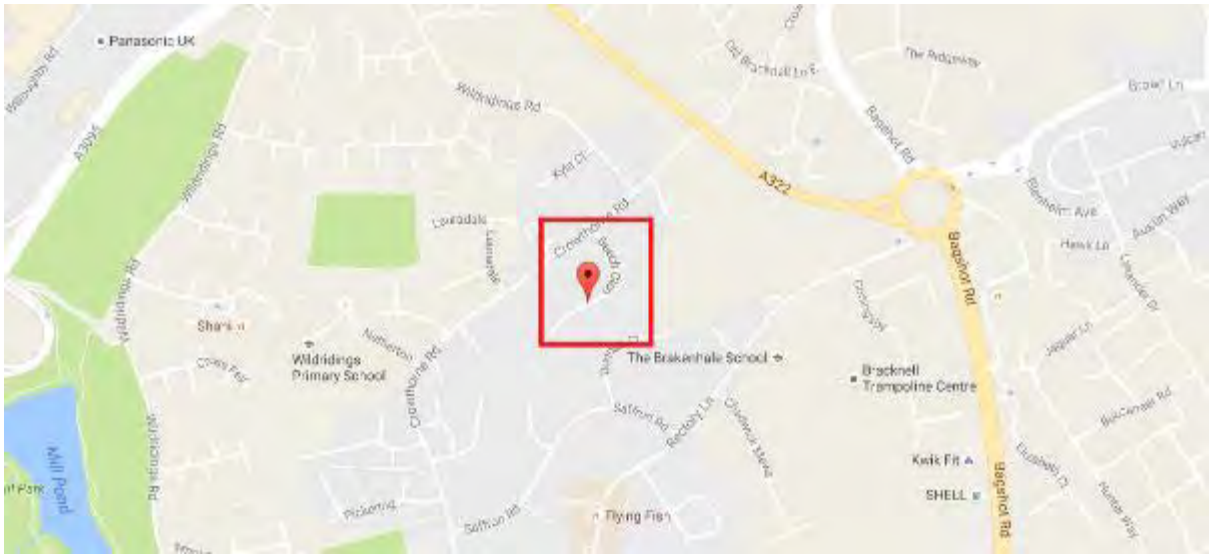
Picture 1:

Picture 2:

PH4-062 Beech Glen


1 to 8
Crowthorne Lodge
Glendower
9 to 14
6
BEECHGLEN
7
11
12
1K
2K
3K
4K
5K
20
50

Location:


Panasonic UK
Wildridings Rd
Kiln Cl
A322
Bagshot Rd
Crowthorne Rd
Beech Cl
Wildridings Primary School
The Brakenhale School
Bracknell Trampoline Centre
Kwik Fit
SHELL
Flying Fish
Mill Pond

View of the road:

Picture 1:

Picture 2:

8.2 Appendix B – Land, Nature and Biodiversity

8.2.1 Statutory Nature Designations

Sites of Special Scientific Interest England – SSSI

Below is a list of SSSIs and the relevant road sections where lighting is adjacent to these designations.

Small Areas

Wykery Copse

- Peacock Lane, Crutchley W, Butler Drive

Englemere Pond

- A329 London Rd, B3017, Kings Ride

Swinley Park and Brick Pits

- B3430, Swinley Rd
- Chawridge Bourne
- Not Affected

Wellington College Bog

- Edgbarrow Rise
- Sandhurst to Owlsmoor Bogs and Heaths
- South Road, Rackstraw Road A3095, Crowthorne Rd
- Blackwater Valley
- A321 (Marshall Road)

Large Areas

Windsor Forest and Great Park

- Drift Rd, Winkfield Plain B3022 and B383 – Sunninghill Rd , Mounts Hill, A332

Broadmoor to Baghot Woods and Heaths

- A322 Bracknell Rd, B3430, A3095 Foresters Way, Magdalene Rd

8.2.2 Special Areas of Conservation (England)

. Below is a list of the relevant road sections where lighting is adjacent to this designation. Windsor Forest and Great Park

- Drift Rd, Winkfield Plain B3022 and B383 – Sunninghill Rd , Mounts Hill, A332
- South Road, Rackstraw Road A3095, Crowthorne Rd

8.2.3 Special Protection Areas

8.2.3.1 Below is a list of the relevant road sections where lighting is adjacent to this designation.Thames Basin Heaths - Sandhurst to Owlsmoor Bogs and Heaths

- South Road, Rackstraw Road A3095, Crowthorne Rd

8.2.3.2 Broadmoor to Baghot Woods and Heaths

- A322 Bracknell Rd, B3430, A3095 Foresters Way, Magdalene Rd

8.2.4 Local Nature Reserves

These are listed below alongside the road names where existing lighting is in place.

Farley Copse

- Tippits Mead
- Hombrook Drive

Temple Copse

- Temple Way and Culver Croft

Tinkers Copse

- Matthews Chase

Jock's Copse

- Crockford Place

Piggy Wood

- Tocker G – HebbeCastle Down, Huson Road

Whitegrove Copse

- Harvest Ride, TopCommon, FP from Gough's Lane to Tarragon Cl

Hayley Green Wood

- not effected

Englemere Pond

- A329 London Rd, B3017, Kings Ride, Ambarrow Court – Wokingham Road

Edgbarrow Woods

- Sandhurst Rd / Crowthorne Rd, Edgbarrow Rise,

8.2.5 Local Wildlife Sites

There are 29 LWS within 25 metres of street lights as follows:

Local Wildlife Site Name	Parish
Allsmoor Wood	Bracknell
Beggars Roost/Adj. Strawberry Hill	Warfield
Binfield Hall	Binfield
Binfield Manor	Binfield
Binfield Manor	Warfield
Broadmoor Bottom (part)	Crowthorne
Bryony Copse/Temple Copse	Binfield
Piggy Wood	Warfield
Popes Meadow	Binfield
Savernake Park	Winkfield
Shepherds Meadow (south)	Sandhurst
The Copse	Binfield
Whitegrove Copse	Warfield
Wildridings Copse	Bracknell
Edmunds Green	Warfield
Edgbarrow Hill and Heath	Sandhurst
Yately Road Woodland	Sandhurst
Farley Copse	Binfield
Brickwork Meadows	Warfield
Tinkers Copse and Jocks Copse	Binfield
Yateley Lakes/Yateley Gravel Pits	Sandhurst
Butter Hill	Crowthorne
Tarman's Copse	Bracknell
Seeby's Copse	Sandhurst
Bill Hill	Bracknell
Big Wood	Binfield and Wokingham
Shepherds Meadow (north)	Sandhurst
Big Wood	Warfield
Northerams Wood	Bracknell

8.2.6 Registered Parks and Gardens (England)

The Register of Parks and Gardens of Special Historic Interest in England was established in 1983 and now contains over 1600 sites. The Register serves to ensure that the features and qualities which make these landscapes of national importance can be safeguarded. Each site is graded into three bands to give added guidance on their significance; grade I have international importance; grade II* are considered to be of exceptional historic interest and grade II are of national importance.

8.2.6.1 Affected Areas

- Addiscome rd, Lower Broadmoor rd, Chaplains Hill, School Hill,
- Kentigern Drive,
- South Hill Rd, Ringmead, Frobisher,
- St mark's Road, Popeswood Rd,
- Pigeonhouse Lane, A330, Forest Rd
- A322
-

8.3 Appendix C – Columns In Important Bat Areas (to be Shielded)

Site Name	ID
Allsmoor Lane	8, 11, 3, 10, 12, 1, 17,16, 15, 18, 13, 4, 7, 2, 14, 6, 5, 9
Axbridge	8
Bayden Square	4
Binfield Road	55, 59, 56, 71, 70, 51, 52
Boltons Lane	10, 14, 13
Brookers Row	1
Brownrigg Crescent	4, 5, 7A, 7, 6
Butler Drive	14, 15, 24, 16, 23, 20, 21, 17, 19, 22, 18
Chaplains Hill	14, 13, 12, 11, 15, 20, 17, 19, 18, 7 , 16 A-B,2,1, 4, 5, 3, 8, 6, 9, 10
Crockford Place	8, 1, 2
Culvercroft	7, 6, 4, 3, 5
Darby Vale	1
Durley Mead	2, 4, 3
Fielding Gardens	2
Flemish Place	10, 13, 12, 11
FP 03 Ringmead To South Hill Road	23A, 34, 32, 31, 30, 33, 36, 35, 29, 28, 27, 26, 25, 23, 22, 24
FP 08 Worlds End Hill To Bagshot R	2, 6, 5, 3, 4, 1
FP 17 Mendip Road To Warwick	10, 9, 8, 7, 15, 22, 23, 14, 13, 17, 18, 20, 21, 19, 11, 16, 6, 4, 1, 12, 3, 2, 5, 8, 3, 4, 7, 6, 5
FP 25 Savernake Way Around Pond To	4, 11, 2, 13, 3, 12, 8, 9, 1, 5, 6, 7, 10
FP 26 Savernake Way To Wyresdale	4, 2, 20, 21, 22, 23, 8, 6, 3, 7, 5, 1
FP 31 Westmorland Drive To Trunk F	1, 5, 2, 3, 4
FP 33 Oakdale To Southwick Court	22, 21, 19, 20,
FP 34 Jigs Lane South To Goughs La	17, 16, 15, 14
FP 35 County Lane To Warfield Park	10, 1, 5, 9, 6, 4, 2, 3, 8, 7 ,
FP 36 Jigs Lane South To Julius Hi	2, 3, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 9, 4, 1
FP 37 Makepiece Road To Darby Vale	10, 9, 8, 7, 12, 11, 13, 4, 5, 6, 2, 3, 1
FP 40 Harvest Ride To Hamlet Stree	8, 10, 9, 3, 2, 5, 6, 4, 7, 1
FP 45 Crowthorne Road To Rectory L	2, 5, 7, 6, 3, 4
FP 46 Rectory Lane To Wildridings	5, 9, 7, 6, 4, 3, 8, 13, 17, 16, 15, 1, 14
FP 49 Evenlode Way Rear To Isis Wa	6

FP 50 Abingdon Road To Snaprails P	6, 5, 4
FP 52 Owlsmoor Road To Wellington	16, 26, 21, 19, 18, 17, 14, 15, 20, 23, 24, 22, 25
FP 54 Liscombe To Ringmead	3, 4, 5, 6, 7, 2, 9, 1, 8, 12, 11, 10
FP 55 South Hill Park To Ringmead	1, 9, 3, 2, 11, 10, 7, 8, 5, 6, 4, 12
FP 57 Warfield Park Farm Drive To	4, 3, 7, 8, 1, 6, 5, 2
FP 58 Forest Road To County Lane	15, 14, 12, 11, 10, 3, 6, 5, 7, 4, 18, 17, 1, 2, 8, 9, 16, 13
FP 59 Savernake Pond To Allsmoor L	3, 2, 1, 10, 11, 9, 14, 4, 7, 12, 15, 6, 13, 5, 8
FP 60 Harvest Ride To Top Common	2, 4, 3, 1, 5, 6
FP 66 Julius Hill To Bullbrook Dri	1, 3, 5, 6, 4, 2
FP 67 Harvest Ride To Temple Way	5, 4, 3, 2, 1, 6, 7
Foresters Way	44, 43, 42, 35, 41, 37, 39, 33, 31, 40, 29, 38, 30, 36, 28, 27, 32, 34
Frobisher	12, 13, 14
Goddard Way	12, 14, 11, 5, 6, 7, 13 A-B
Greystock Road	1, 2
Harvest Ride	59, 58, 141, 82, 81, 80, 79, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 83, 139, 137, 135, 133, 1, 2, 57, 131, 130, 127, 74, 78, 77
Hill Copse View	4, 3
Hoffman Close	4, 1, 3
Hombrook Drive	7
Hope Avenue	9
Hythe Close	14, 13
Jevington	6
Jigs Lane South	6, 5, 7, 8, 9, 13, 15, 17, 19
Julius Hill	6, 5, 7
Kimberley	12
Lily Hill Drive	7, 9, 1, 2, 3, 8, 4, 5, 11, 6, 10
Lily Hill Road	18, 19, 23, 24, 25, 20, 21, 22, 24, 30, 31, 27, 25, 29, 21, 22, 23, 26, 28
Long Hill Road	41, 20, 22, 24, 23, 36, 35, 37, 38, 39, 19, 34, 40, 21, 13, 15, 18, 11, 12, 14, 16, 17
Lower Broadmoor Road	50, 51, 55, 56, 57, 49, 44, 46, 52, 41, 43, 45, 42, 47, 48, 53, 54
Makepiece Road	2, 1
Mendip Road	9, 10, 11
New Forest Ride	23, 24, 25, 26, 21
Nine Mile Ride	40, 50, 54, 53, 52, 51, 60, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64, 63, 62, 61, 98, 97, 96, 95, 94, 93, 92, 91, 90, 89, 49, 48, 47, 46, 59, 57, 56, 55, 39, 100, 99, 25, 42, 43, 38 A-B, 41, 58, 45, 44, 37, 36, 33, 32, 35, 34, 31, 29, 30, 28, 15, 27, 26, 24, 23, 22, 6, 12, 11, 10, 9, 8, 14, 20, 5, 13, 18, 21, 19, 7, 103, 76, 75, 74, 102, 101, 77, 88, 87, 86, 85, 83, 84, 82, 81, 79, 80, 78
Oareborough	7
Old Wokingham Road	3, 2, 5, 7, 6, 8, 9, 10, 1, 22, 21, 23, 24, 4, 20

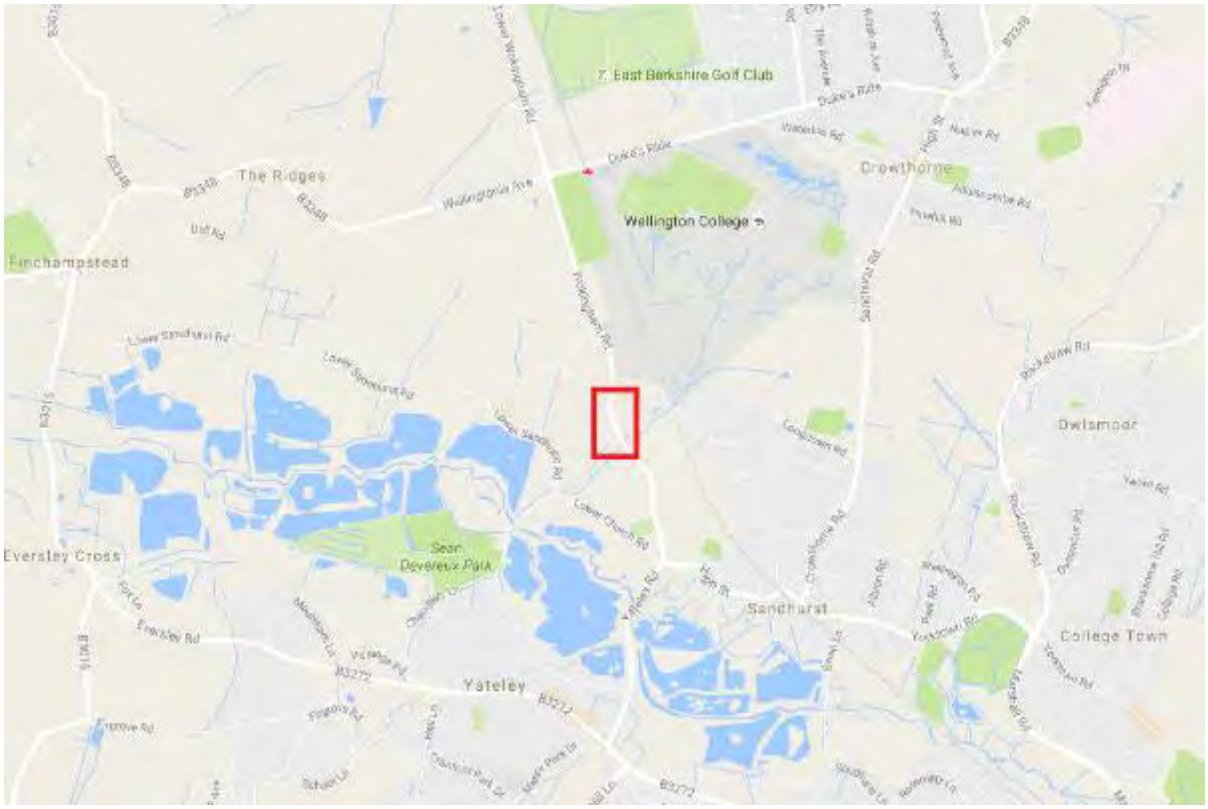
Owlsmoor Road	45
Peacock Lane	65, 64, 63, 62, 61, 60, 58, 59, 52, 50, 48, 17, 15, 13, 11, 7, 46, 45, 56, 57, 54, 9
Priory Road	27 A-B, 22, 23, 1, 21, 26, 19, 20, 18, 7445, 24
Pyegrove Chase	5, 4
Rectory Lane	5
Ringmead	23, 22A, 27, 21, 20, 16, 15, 24, 25, 13, 22, 17, 14, 26, 18, 19
Roman Way	9
School Hill	5, 6, 9, 3, 4, 1, 2, 7, 8, 10
Scott Terrace	9, 8
Setter Combe	3, 2
South Meadow	1, 2, 3
South Road	3, 4, 2, 1, 6, 5
St Marks Road	1, 12, 4, 3, 13, 2, 15, 6, 5, 7, 10, 8, 9, 11, 14
Tarnbrook Way	8
Temple Way	32, 16, 17, 15
Tippits Mead	7, 10, 9, 14, 8
Upavon Gardens	4, 3
Upper Broadmoor Road	11, 12, 19, 20, 21, 22, 25, 24, 14, 17, 23, 13, 15, 16, 18
Waldron Hill	8, 6, 7, 5, 4, 3
Warfield Park Farm Drive	4
White City	3
Wyresdale	5, 4

8.4 Appendix D – Land, Nature and Biodiversity Lighting Assessment

Wokingham Road

Comparison: Existing

Location:



View of the road:

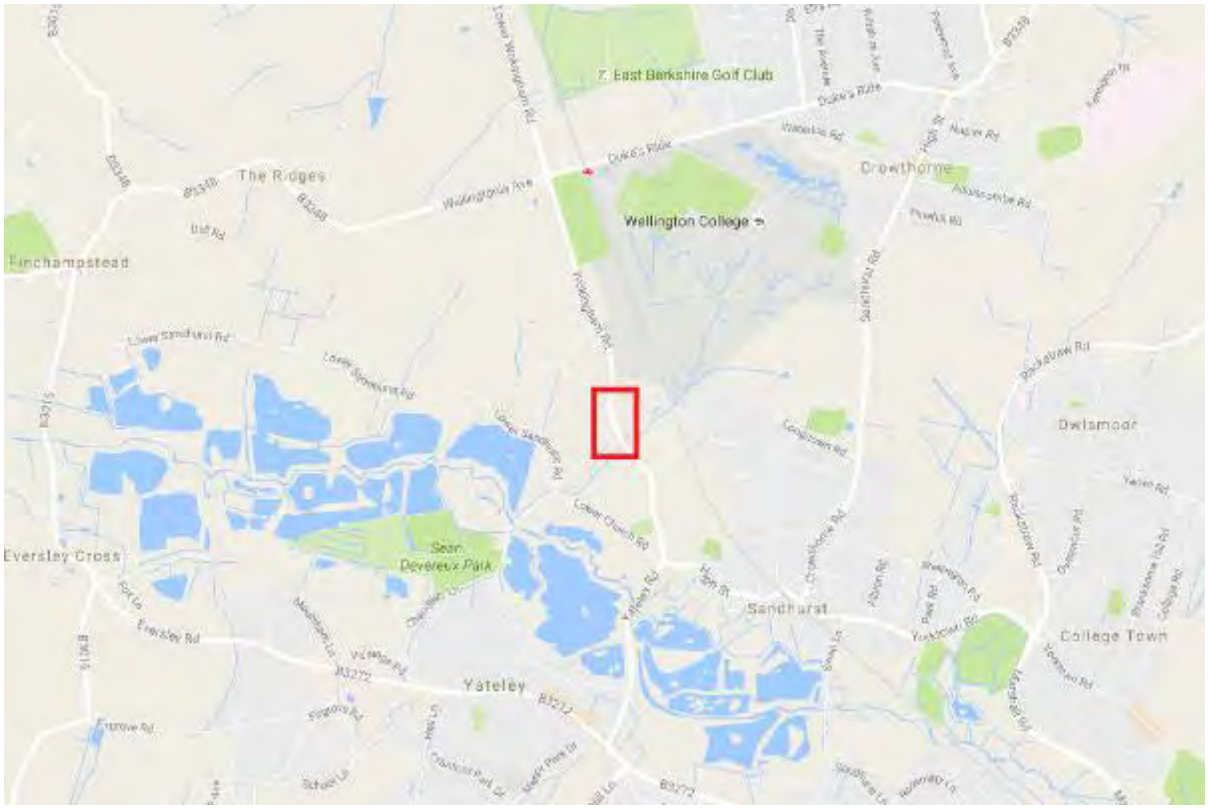
Picture 1:

Picture 2:

Wokingham Road

Comparison: Existing

Location:



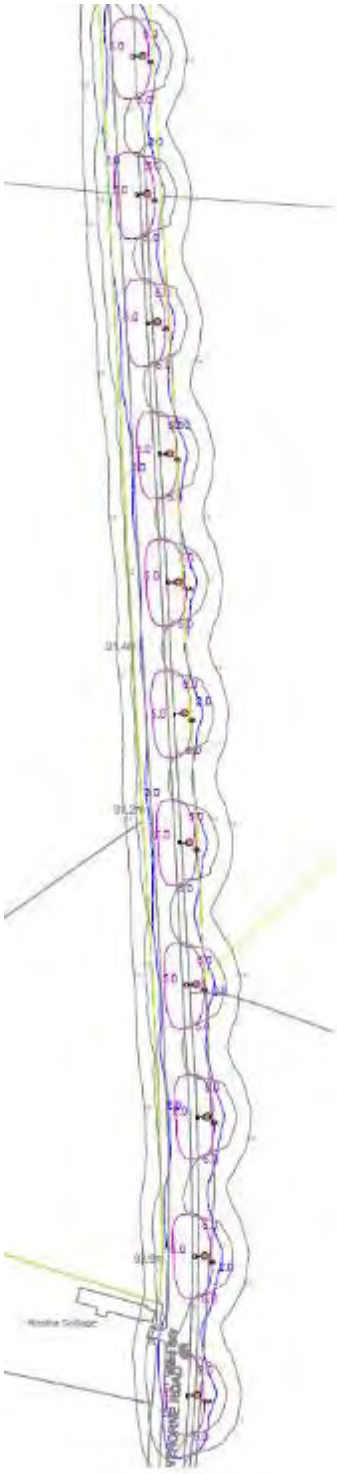
View of the road:

Picture 1:

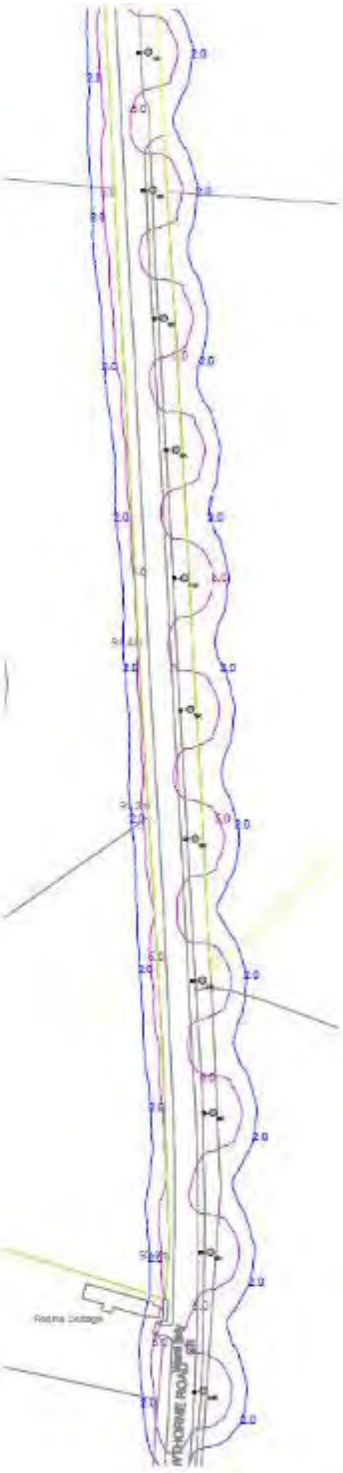
Picture 2:

PH1-007 Crowthorne Road

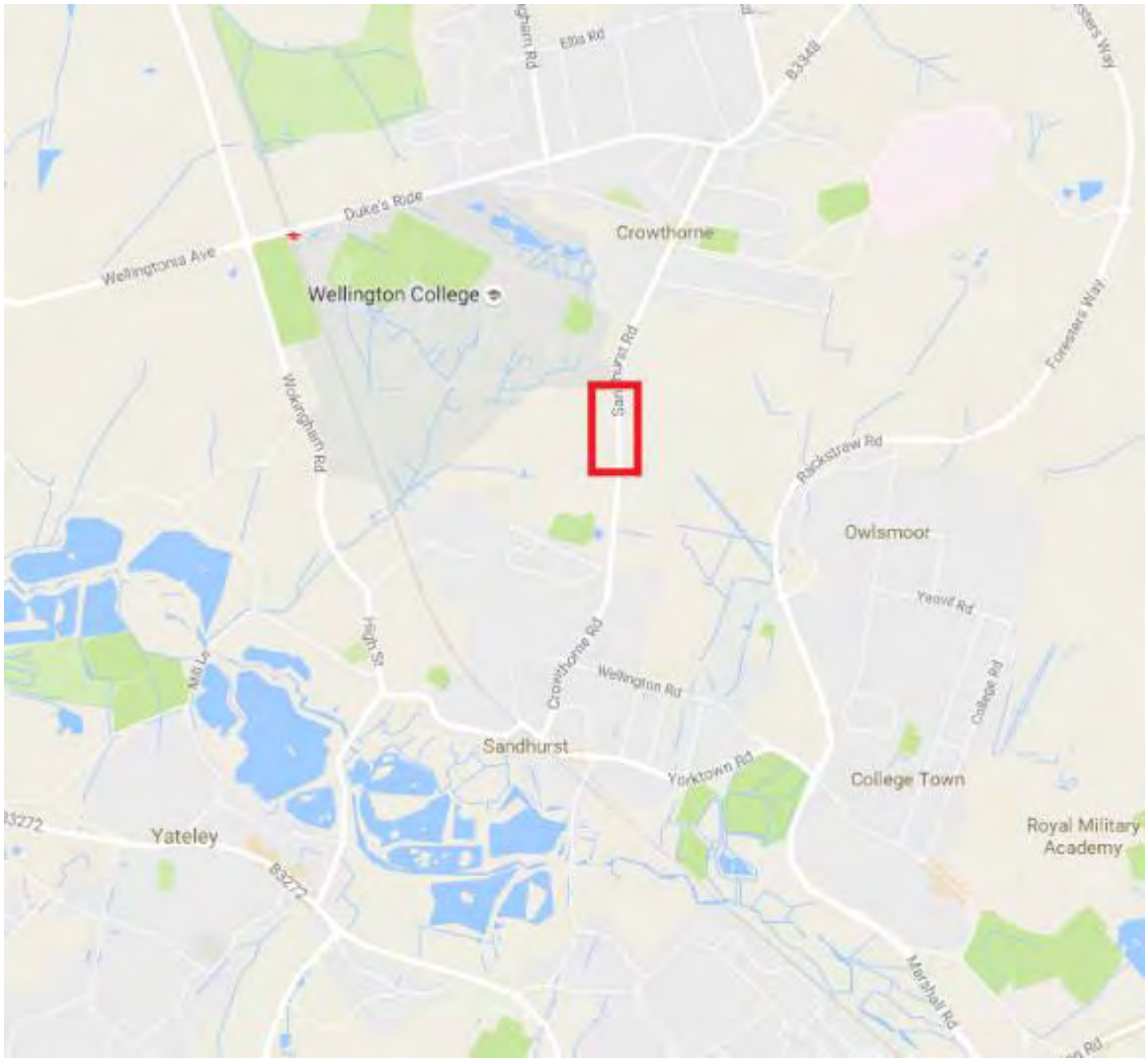
Comparison:



Existing:



Location


Duke's Ride
Wellington College
Crowthorne
Wellingtonia Ave
Wokingham Rd
Sandhurst Rd
Rackstraw Rd
Owlsmoor
Yeovil Rd
College Rd
Crowthorne Rd
Wellington Rd
Sandhurst
Yorktown Rd
College Town
Royal Military Academy
Yateley
B3272
Marshall Rd
Forresters Way
B3348

View of the road:

Picture 1:

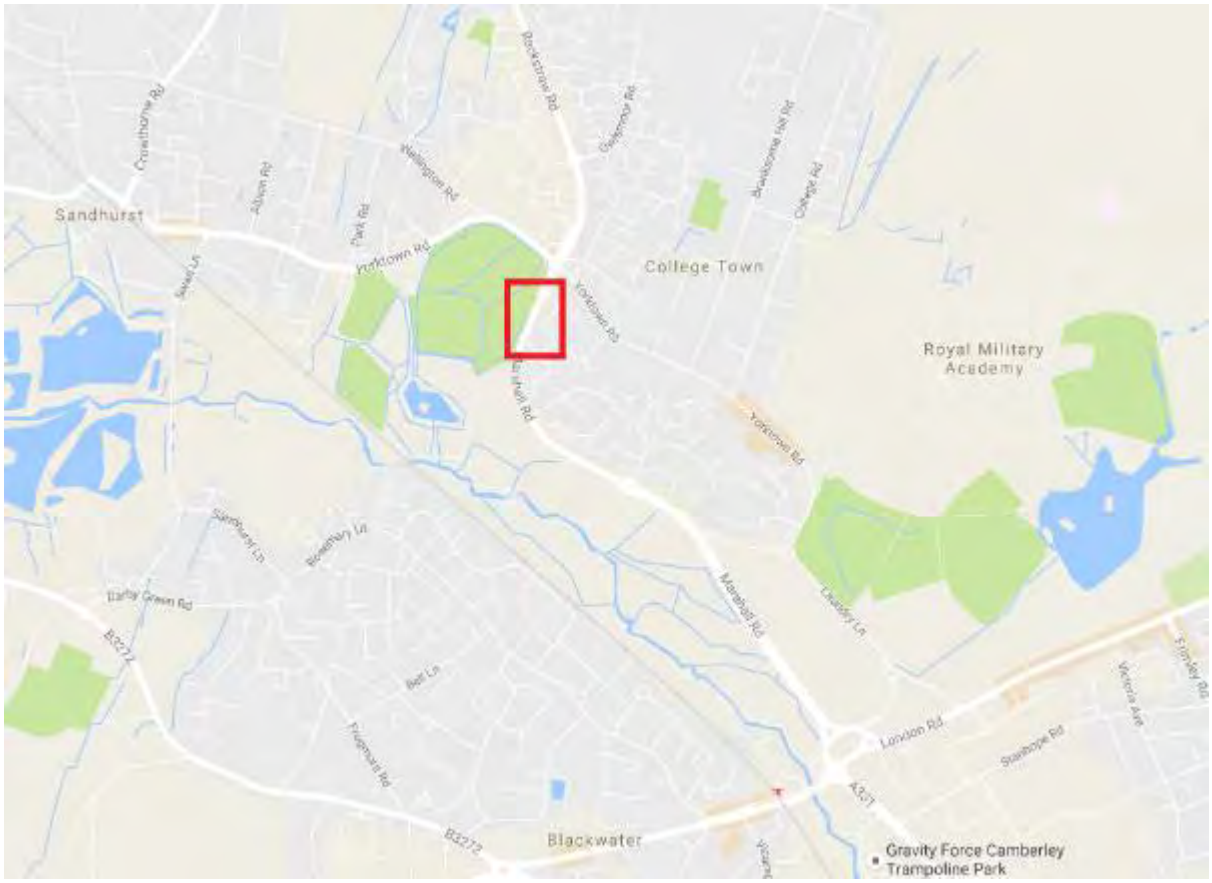
Picture 2:

PH1-010 Marshall Road

Comparison:

Existing:

Location:



View of the road:

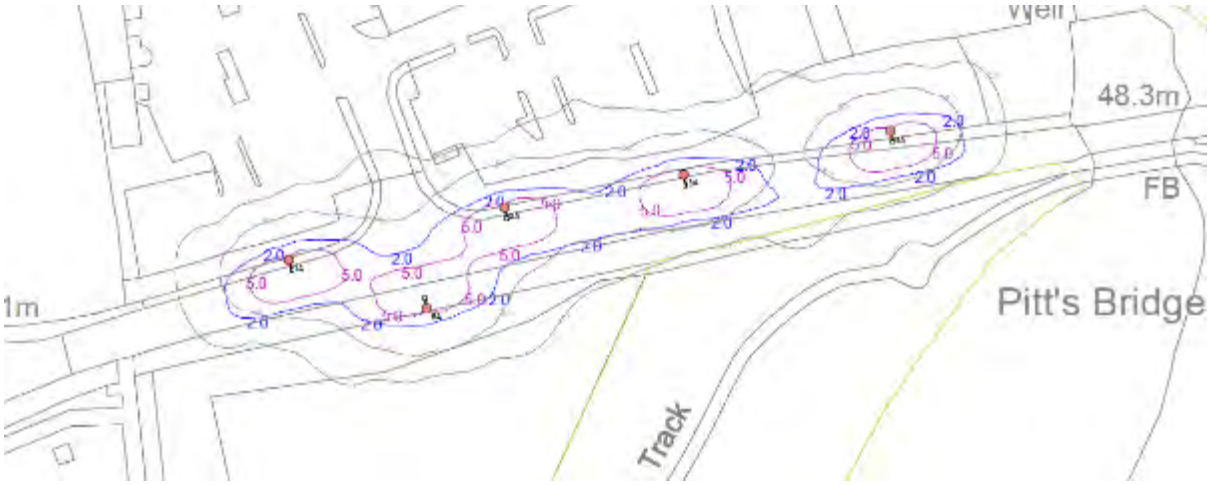
Picture 1:

Picture 2:

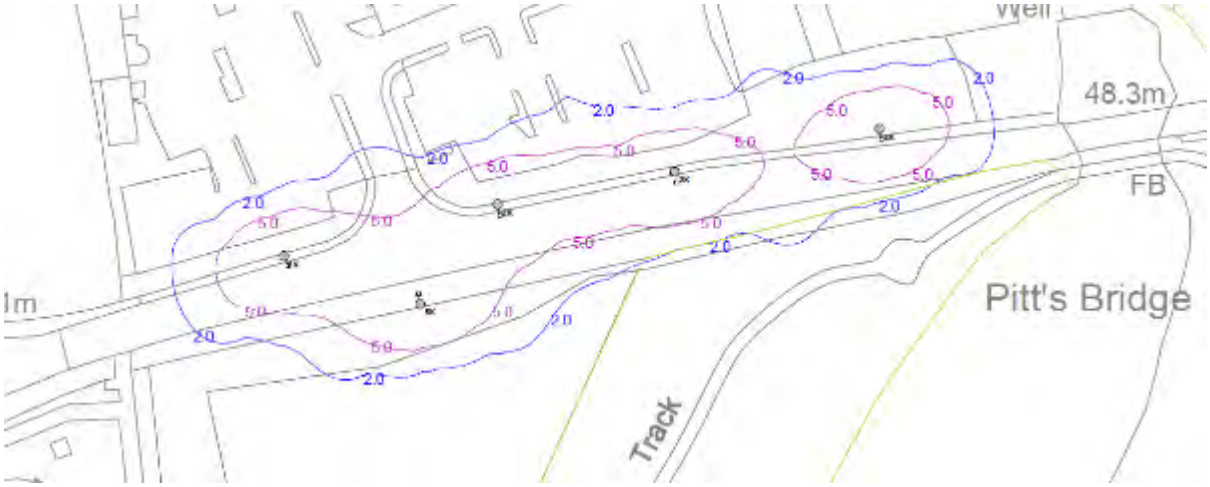

Marshall Rd

PH1-012 Forest Road

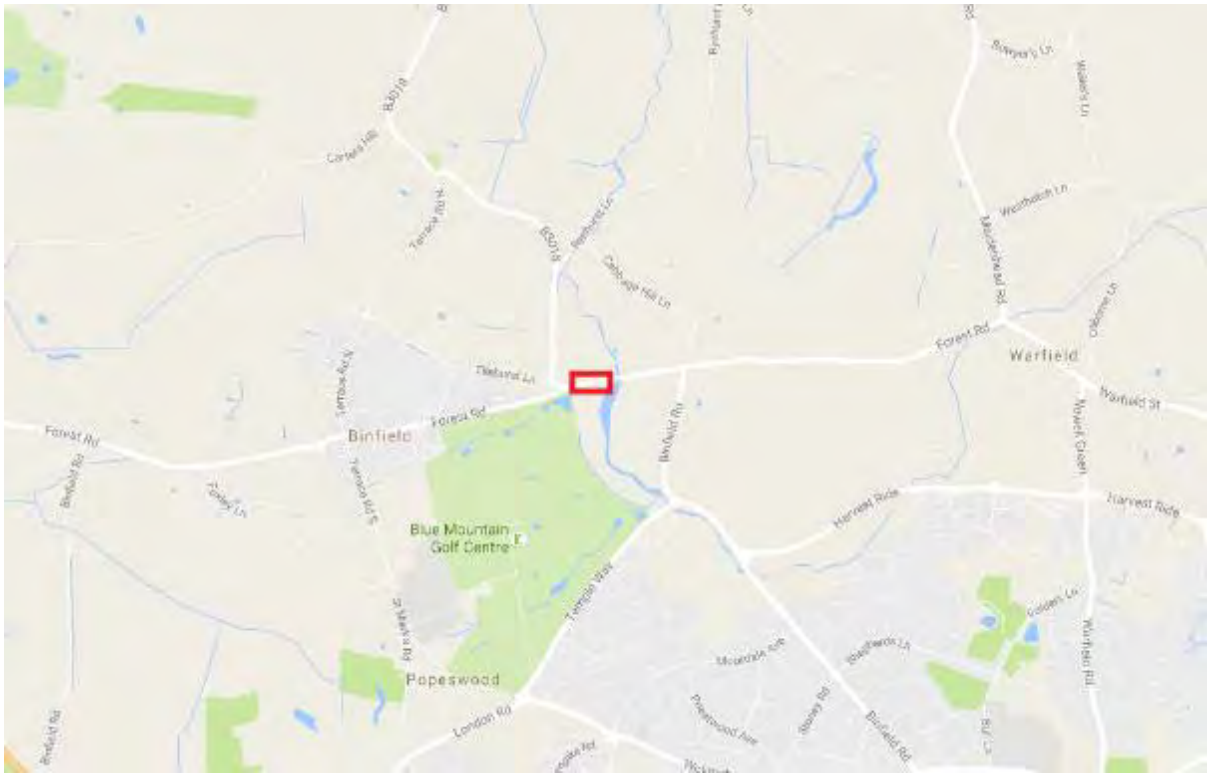
Comparison:



Existing:



Location:



View of the road:

Picture 1:

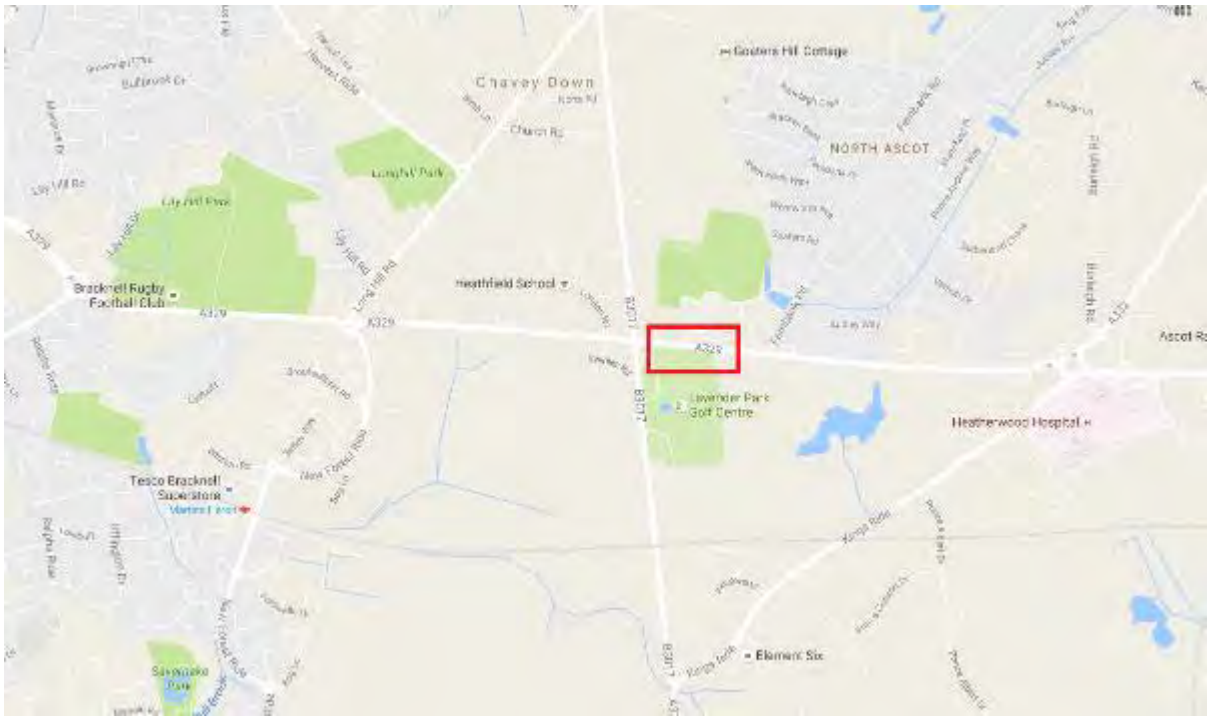
Picture 2:

PH1-002 London Road

Comparison:

Existing:

Location:



View of the road

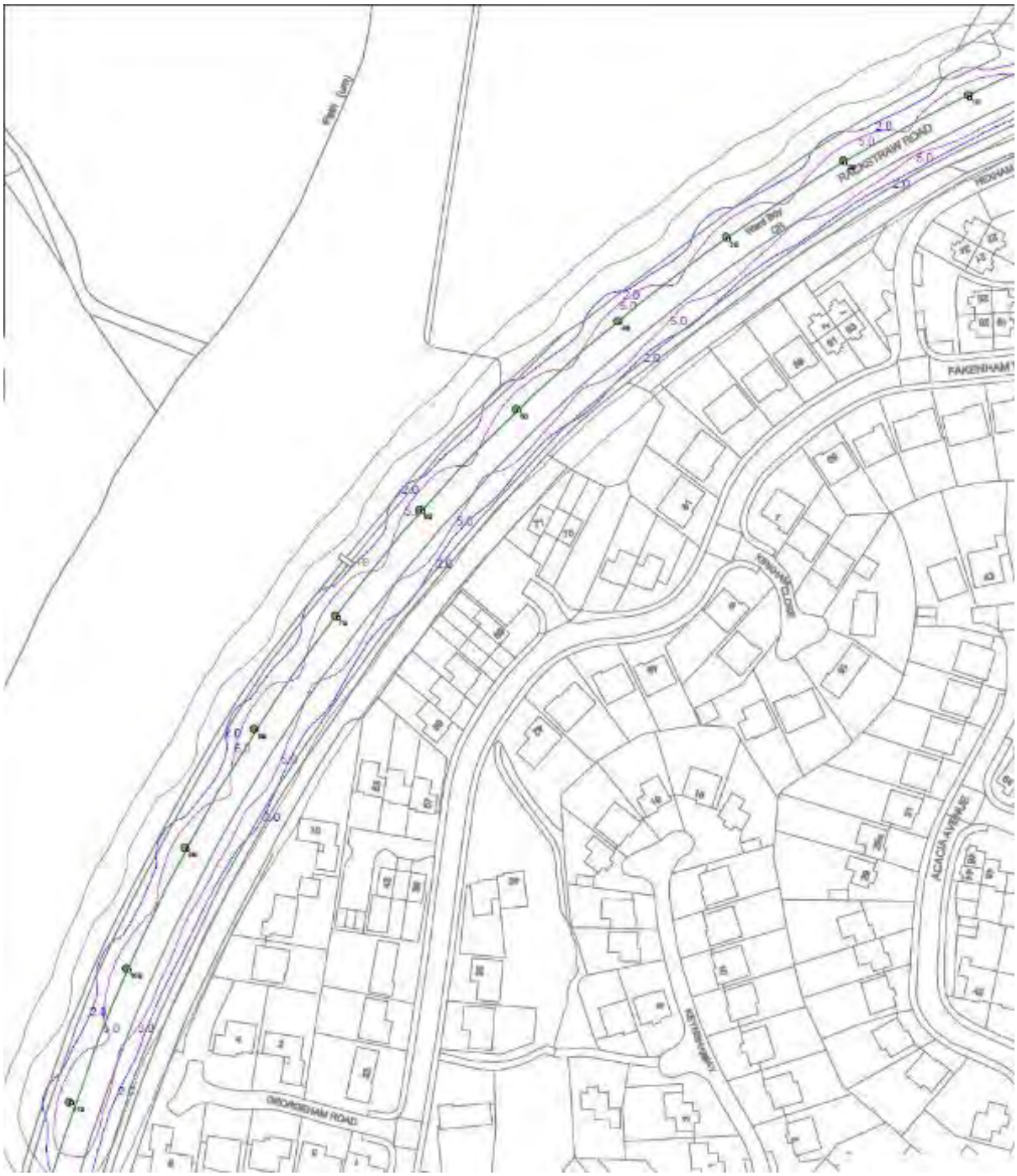
Picture 1:

Picture 2:


A329
N3

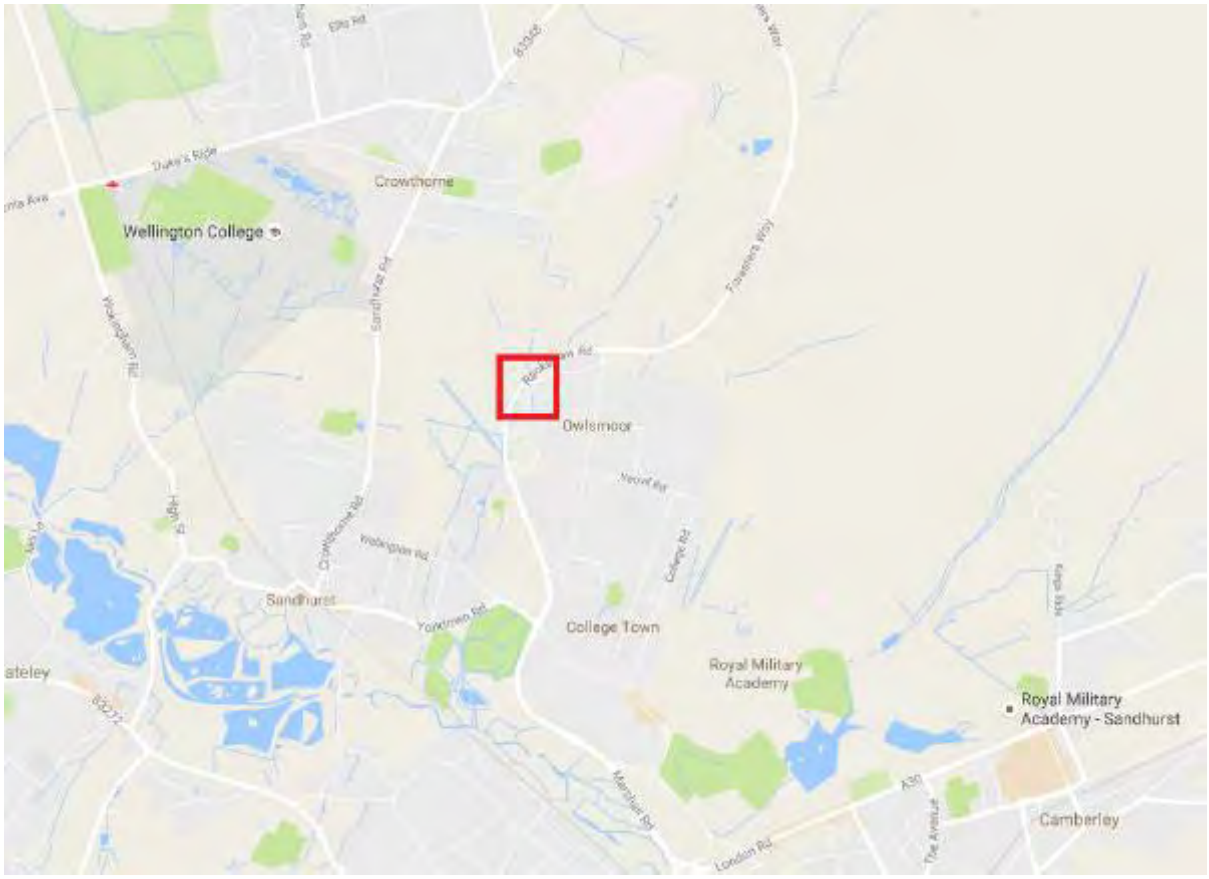
PH1-009 Rackstraw Road

Comparison:



Existing:

Location:



View of the road:

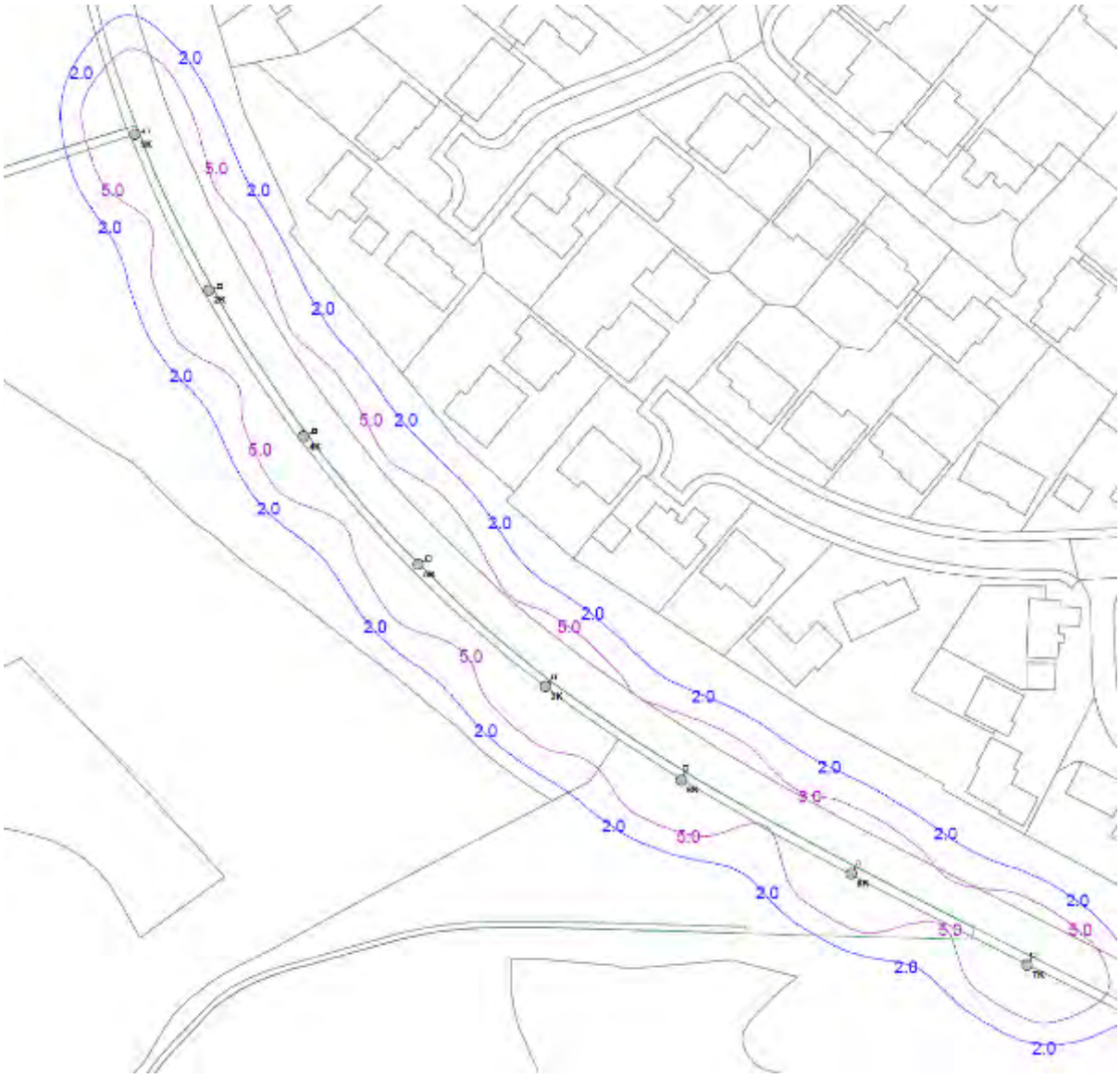
Picture 1:

Picture 2:

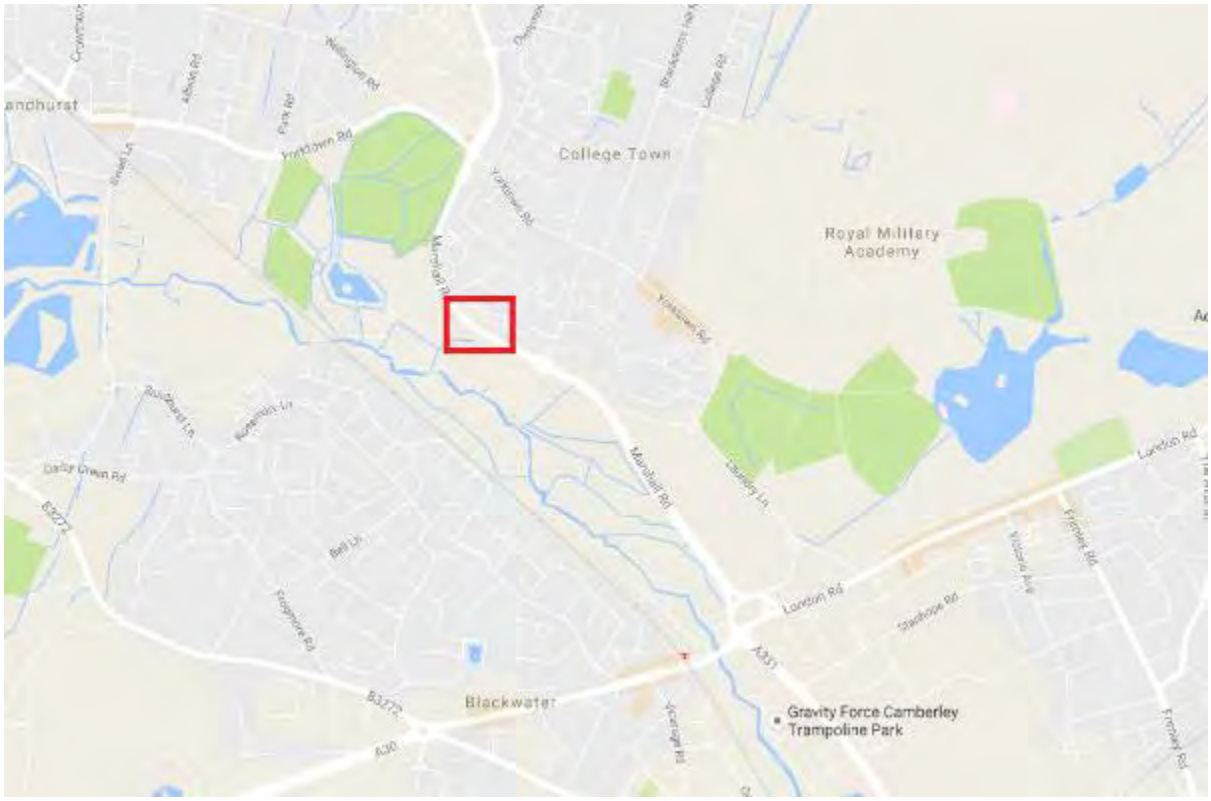
PH1-010 Marshall Road

Comparison:

Existing:



Location:



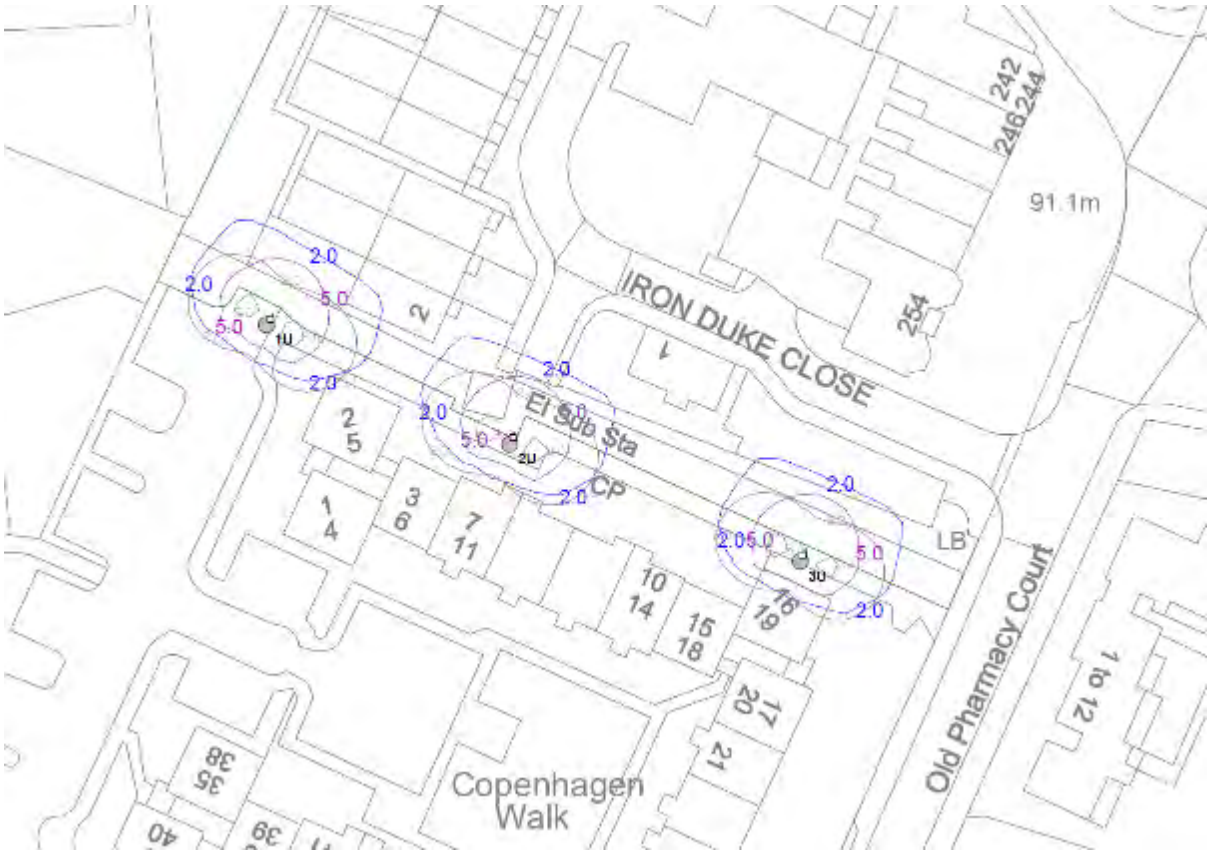
View of the road:

Picture 1:

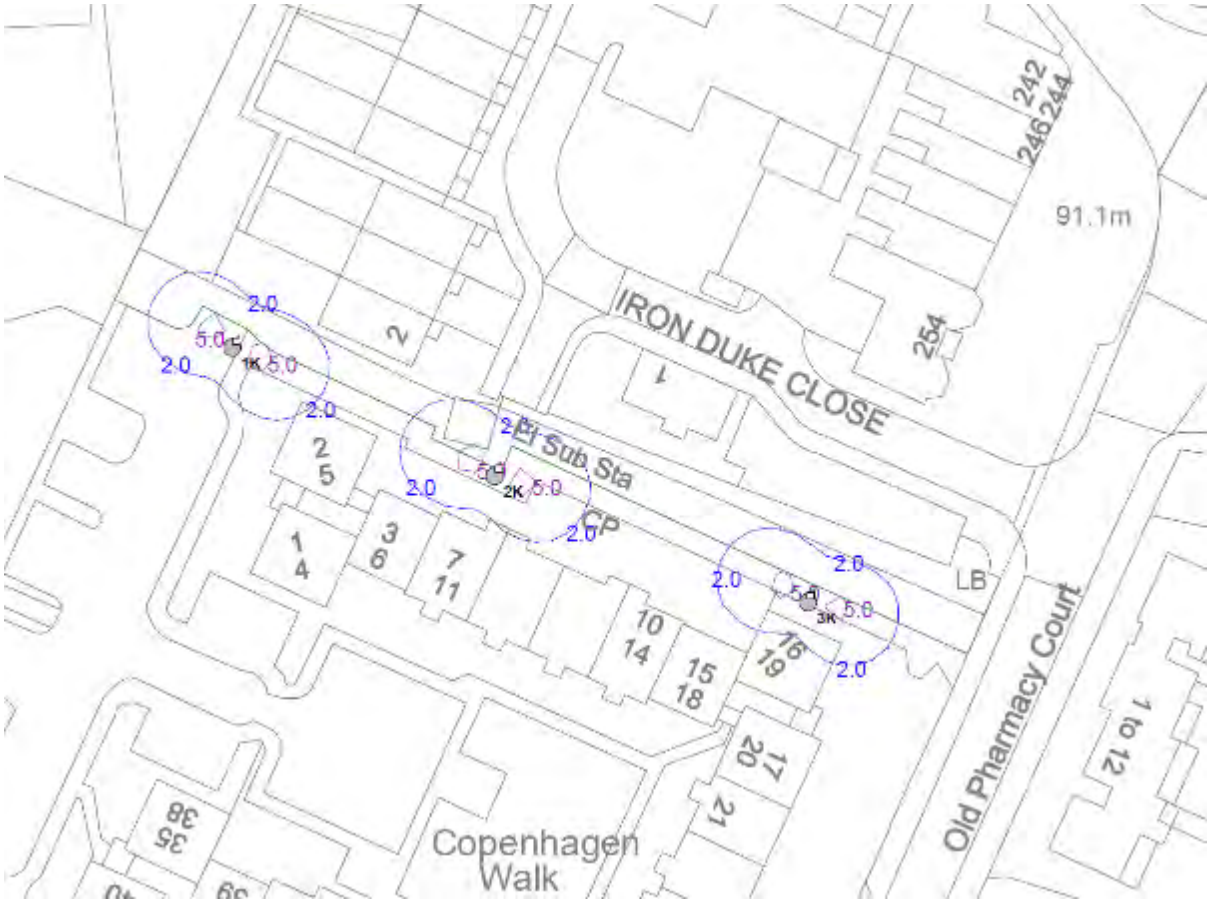
Picture 2:

PH2-081 Copenhagen Walk

Comparison:



Existing:



Location:

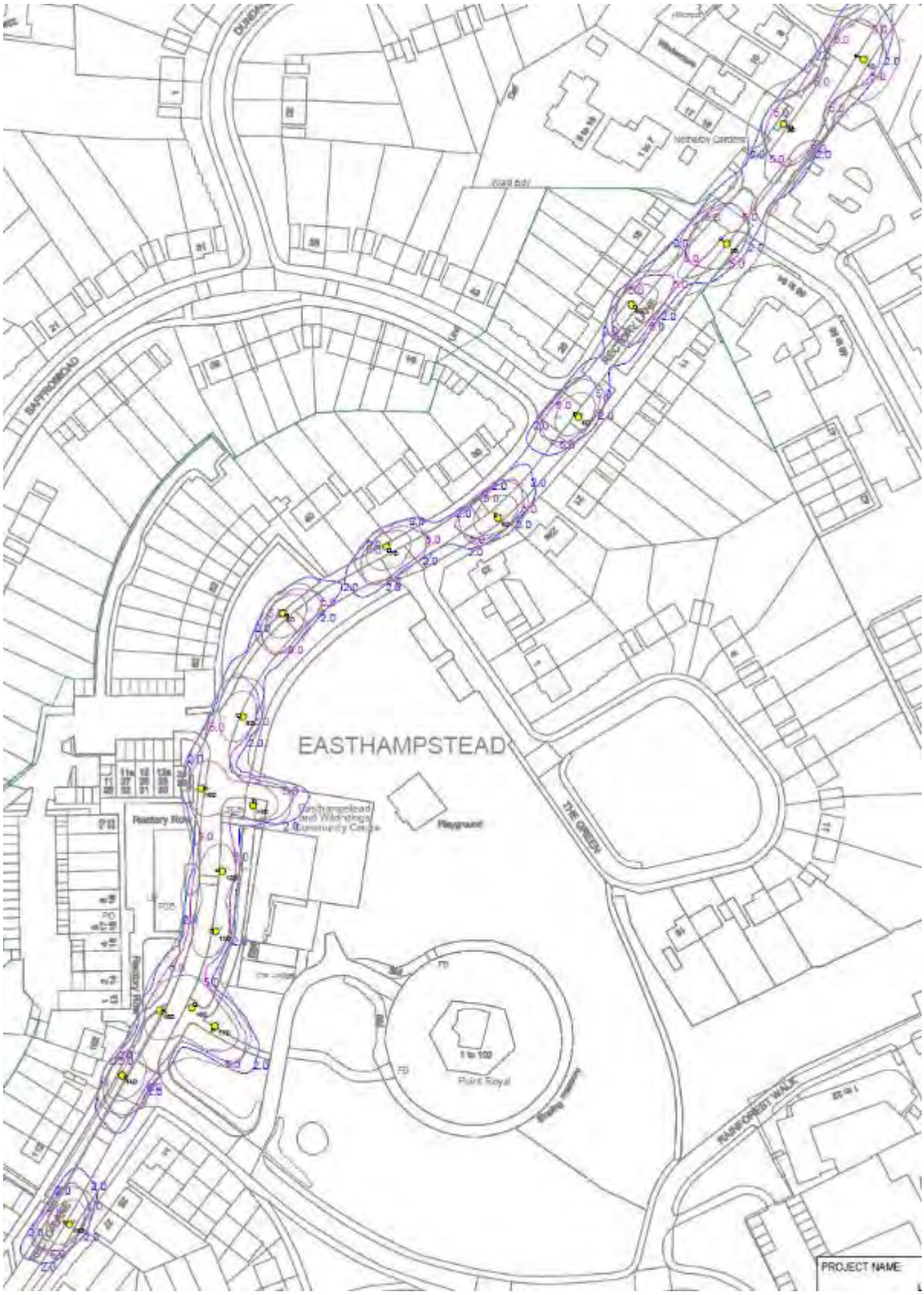
View of the road:

Picture 1:

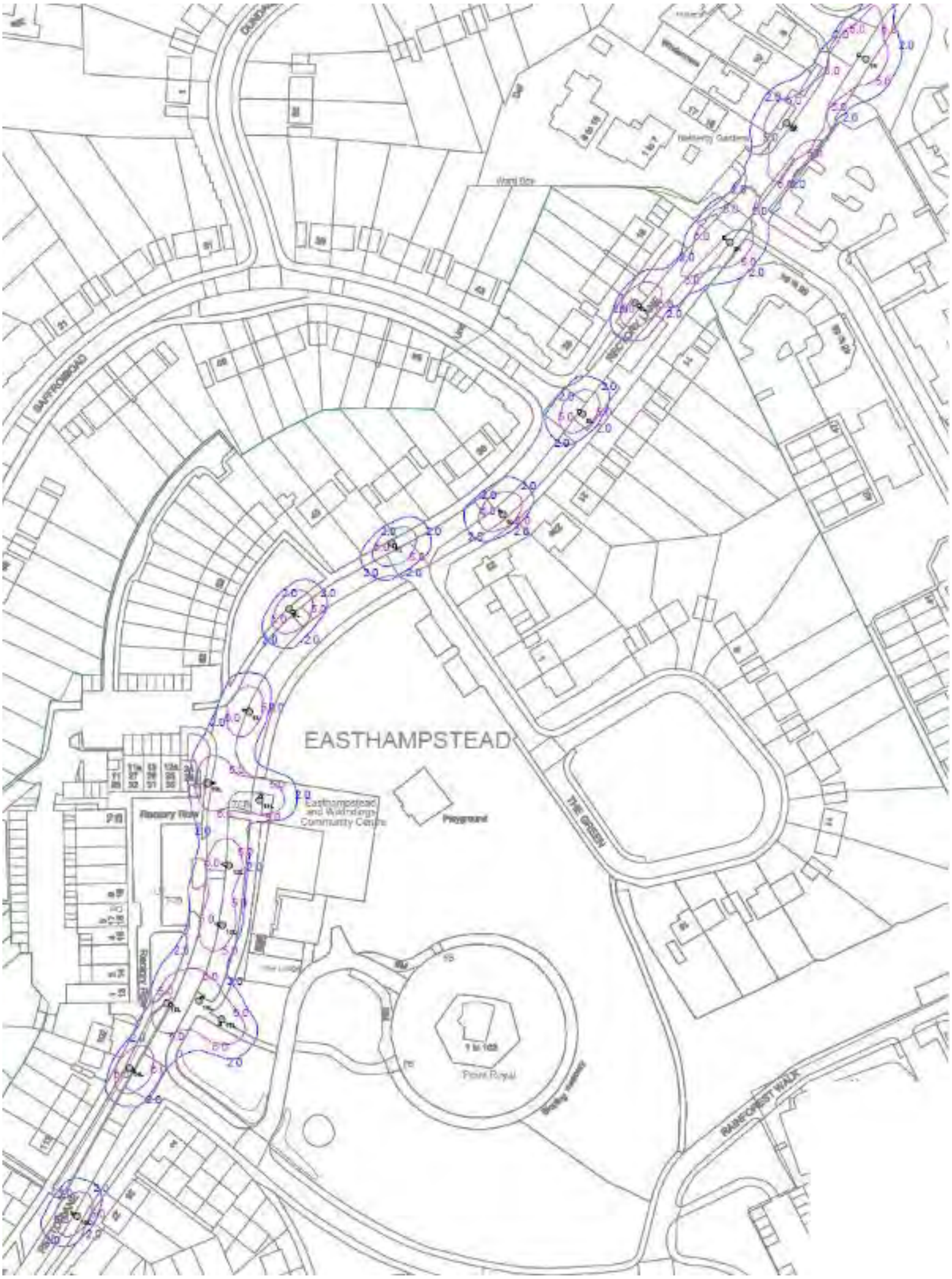
Picture 2:

PH3-008 Rectory Lane

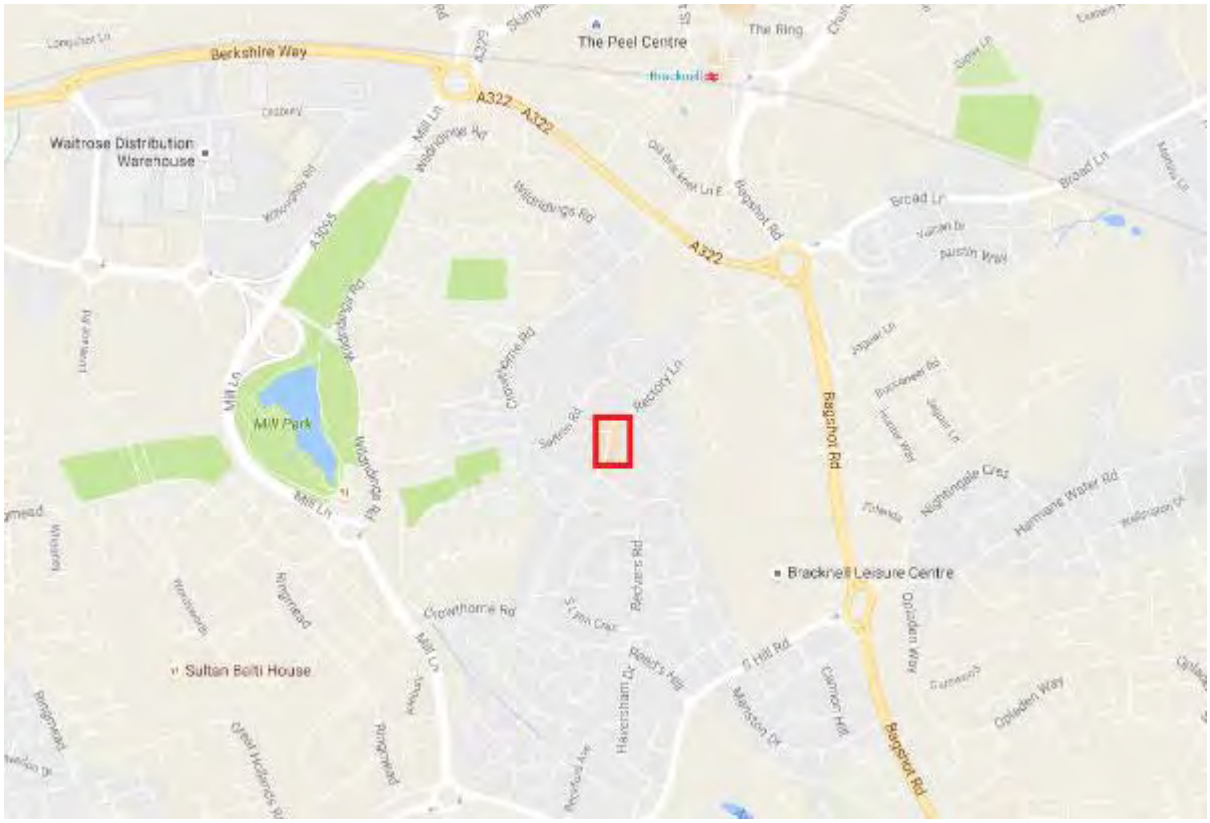
Comparison:



Existing:


EASTHAMPSTEAD
Easthampstead and Wildridings Community Centre
Playground
Rectory Row
THE GREEN
RAINFOREST WALK
Point Royal
SAFFRON ROAD

Location:



View of the road:

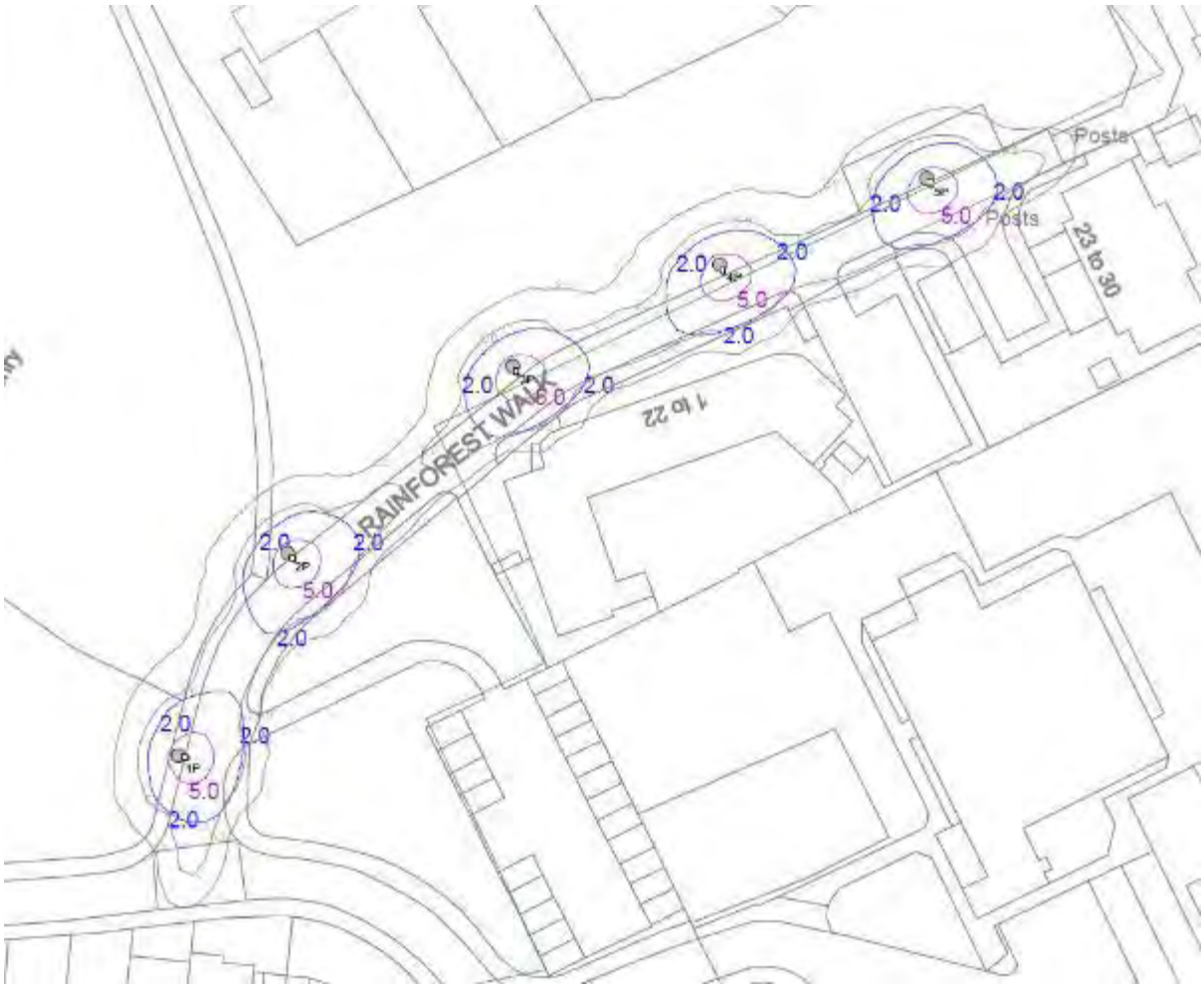
Picture 1:

Picture 2:

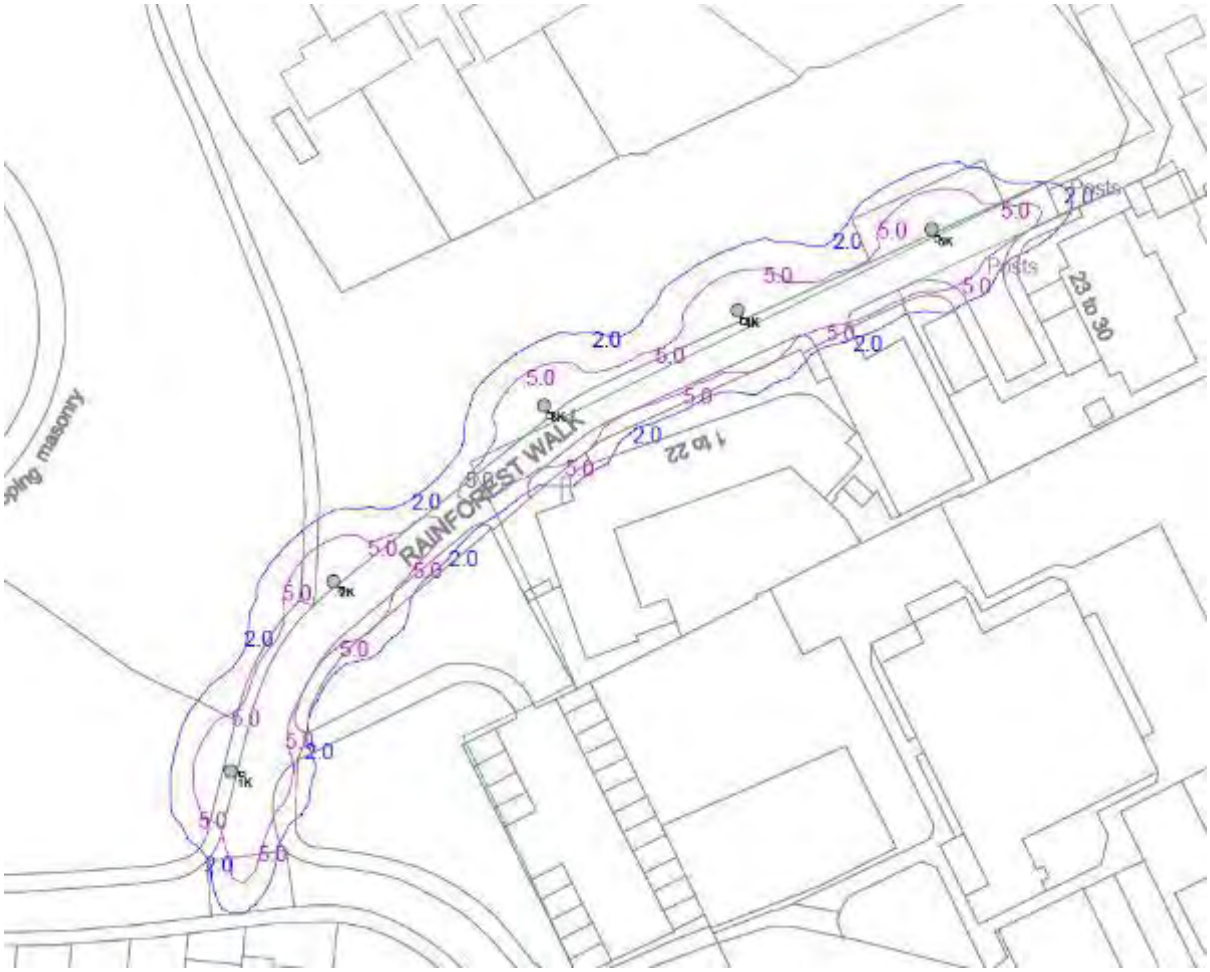

Rectory La

PH3-072 Rainforest Walk

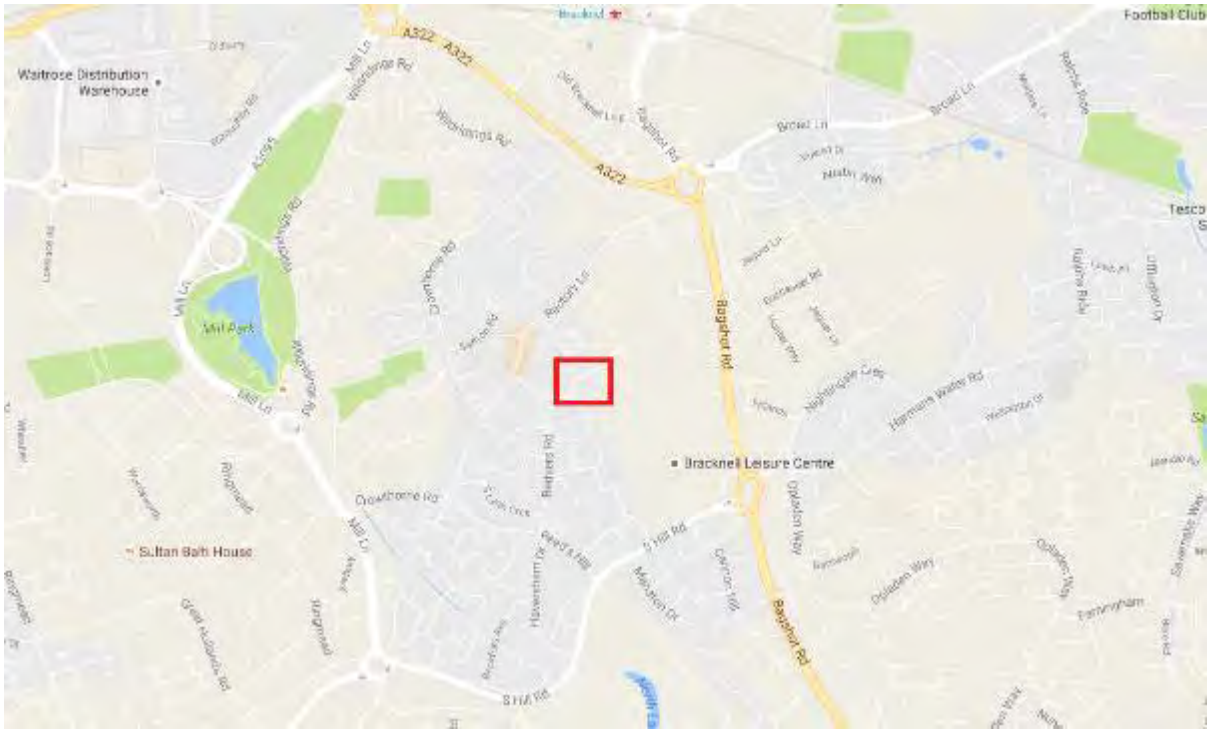
Comparison:



Existing:



Location:



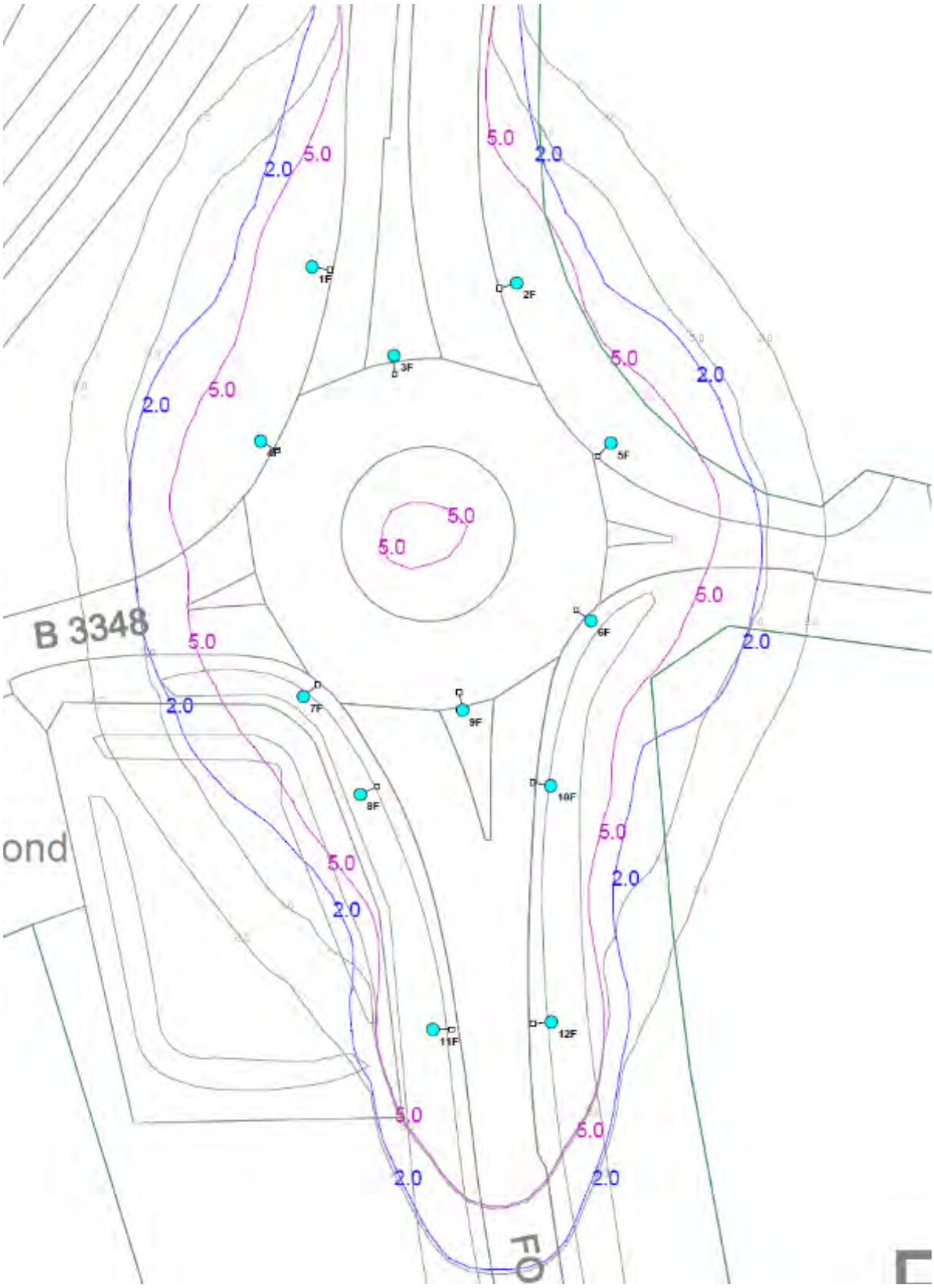
View of the road:

Picture 1:

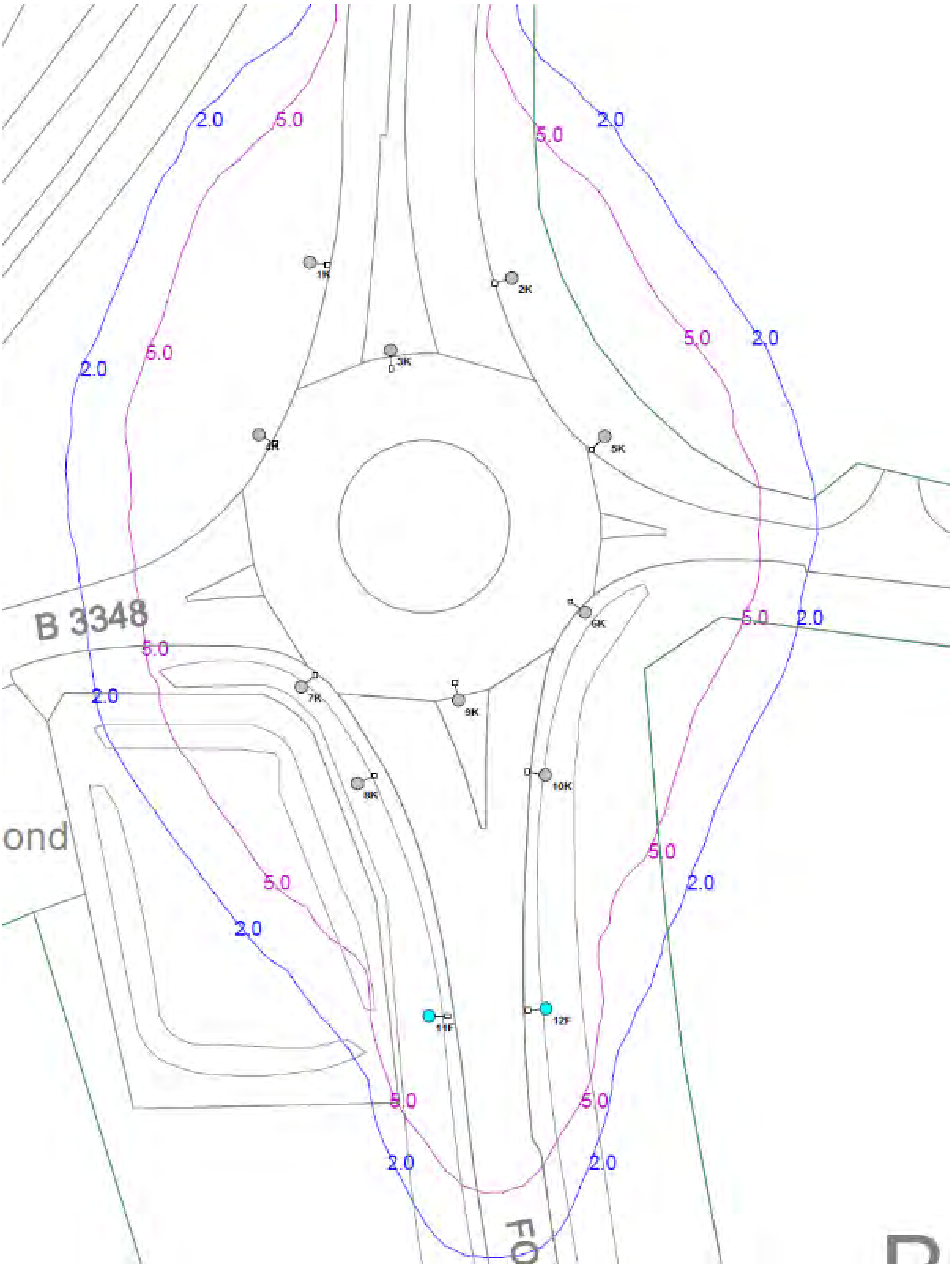
Picture 2:

PH1-021 Foresters Way

Comparison:

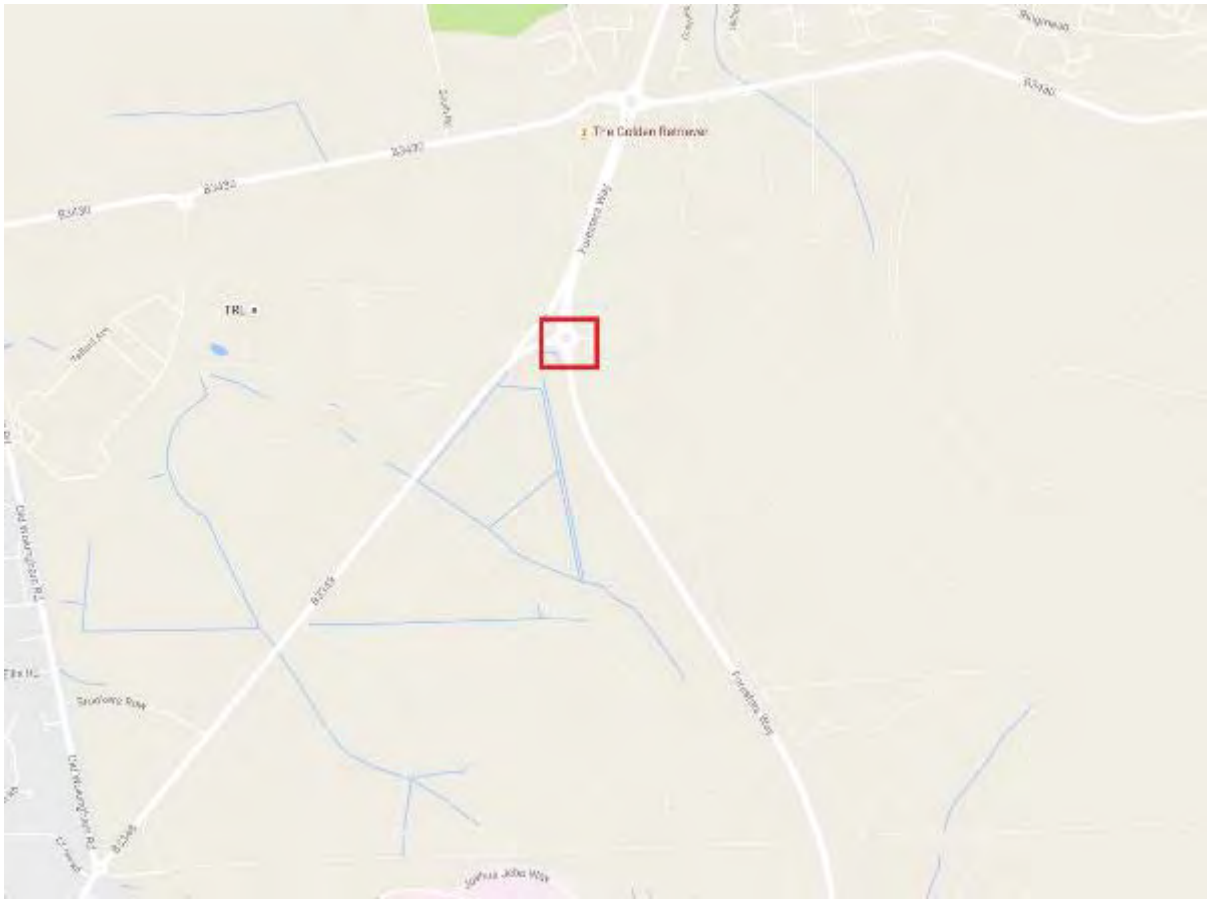


Existing:



2.0
5.0
5.0
2.0
1K
2K
3K
5.0
2.0
2.0
5.0
4K
5K
B 3348
6K
5.0
5.0
2.0
2.0
7K
9K
8K
10K
ond
5.0
5.0
2.0
2.0
11F
12F
5.0
5.0
2.0
2.0
FO

Location:



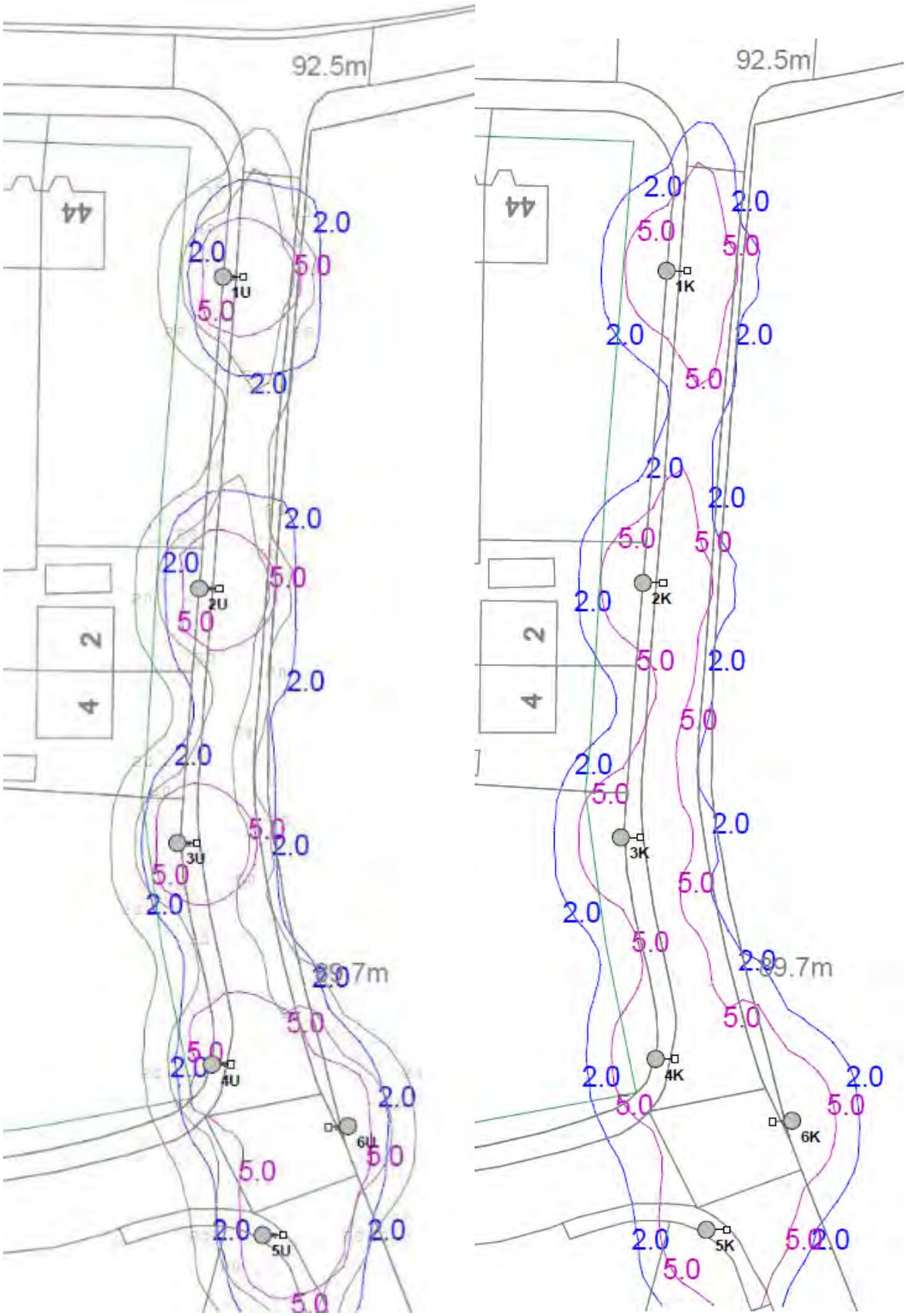
View of the road:

Picture 1:

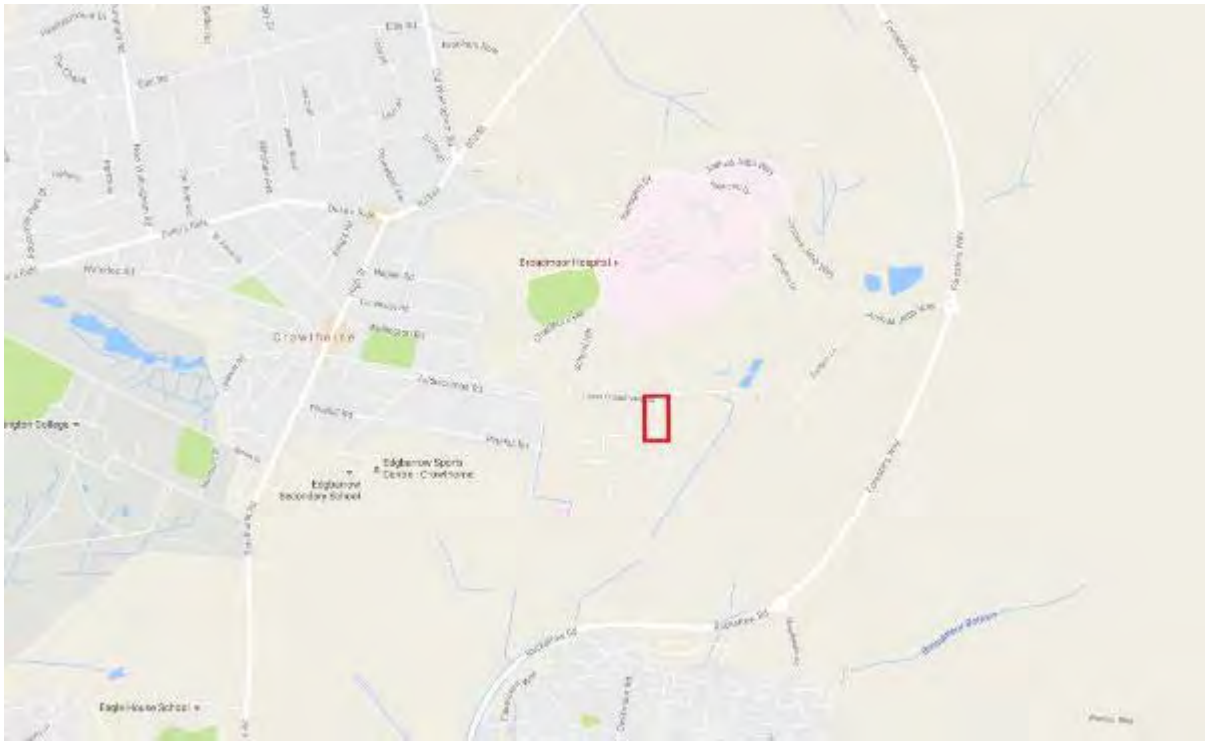
Picture 2:

Comparison:

Existing



Location:



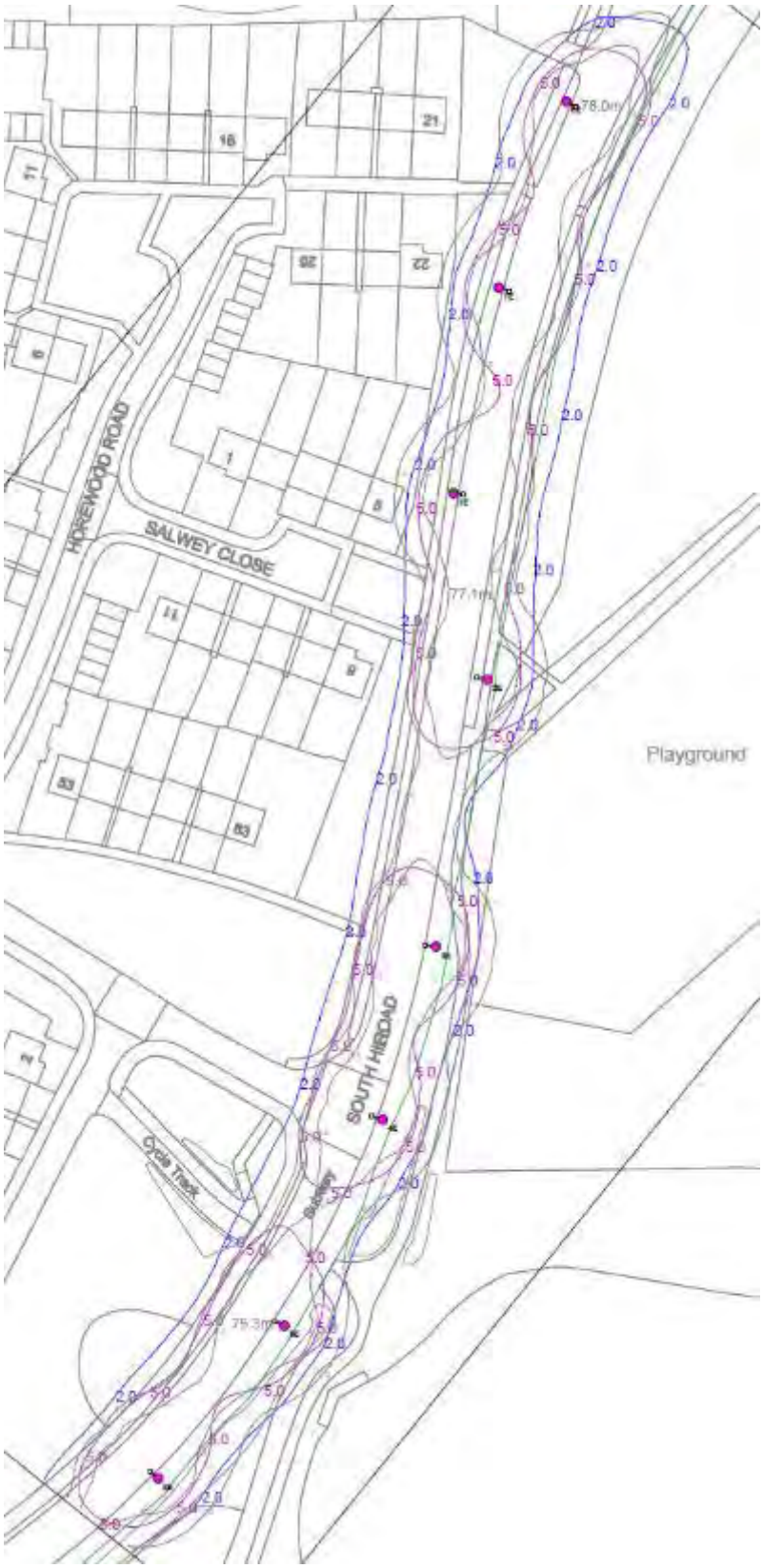
View of the road:

Picture 1:

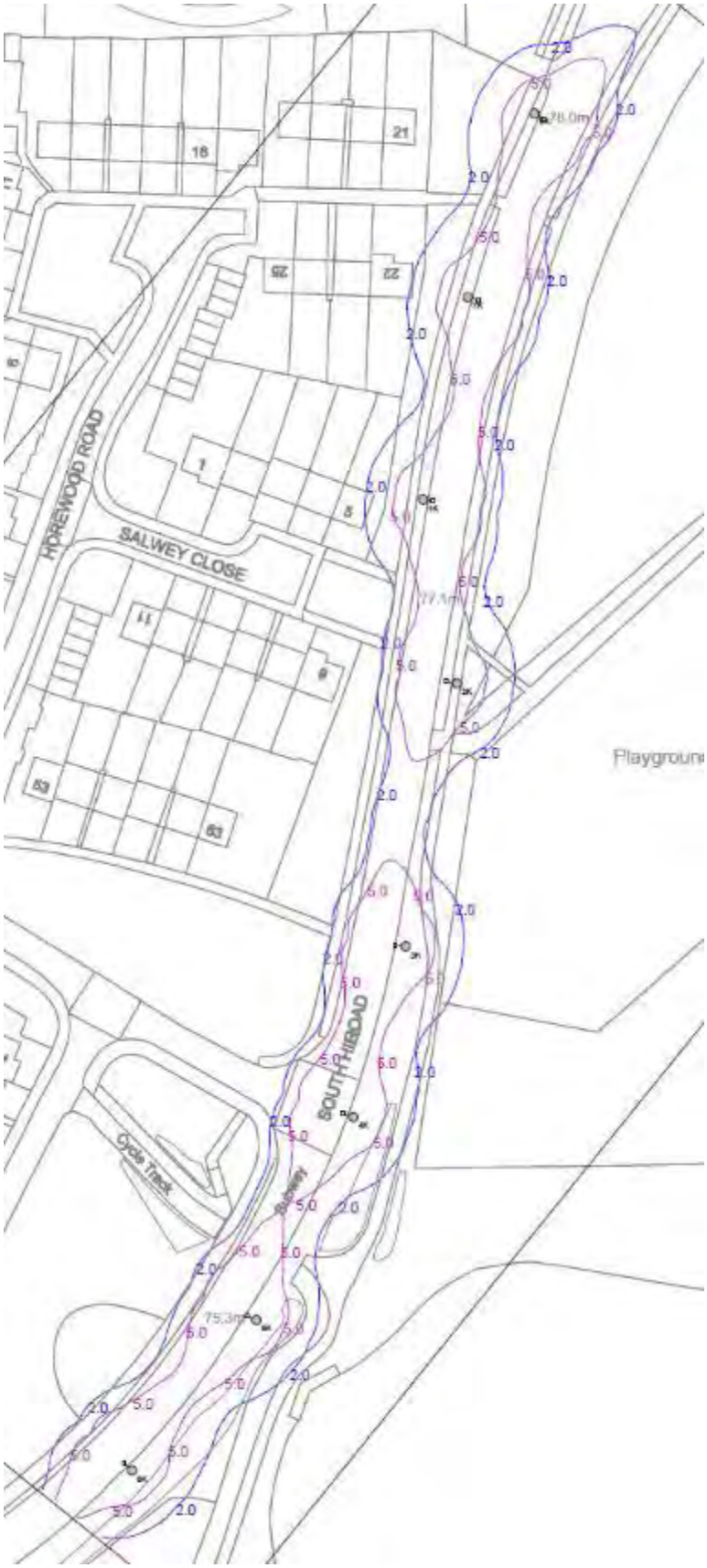
Picture 2:

PH3-004 South Hill Road

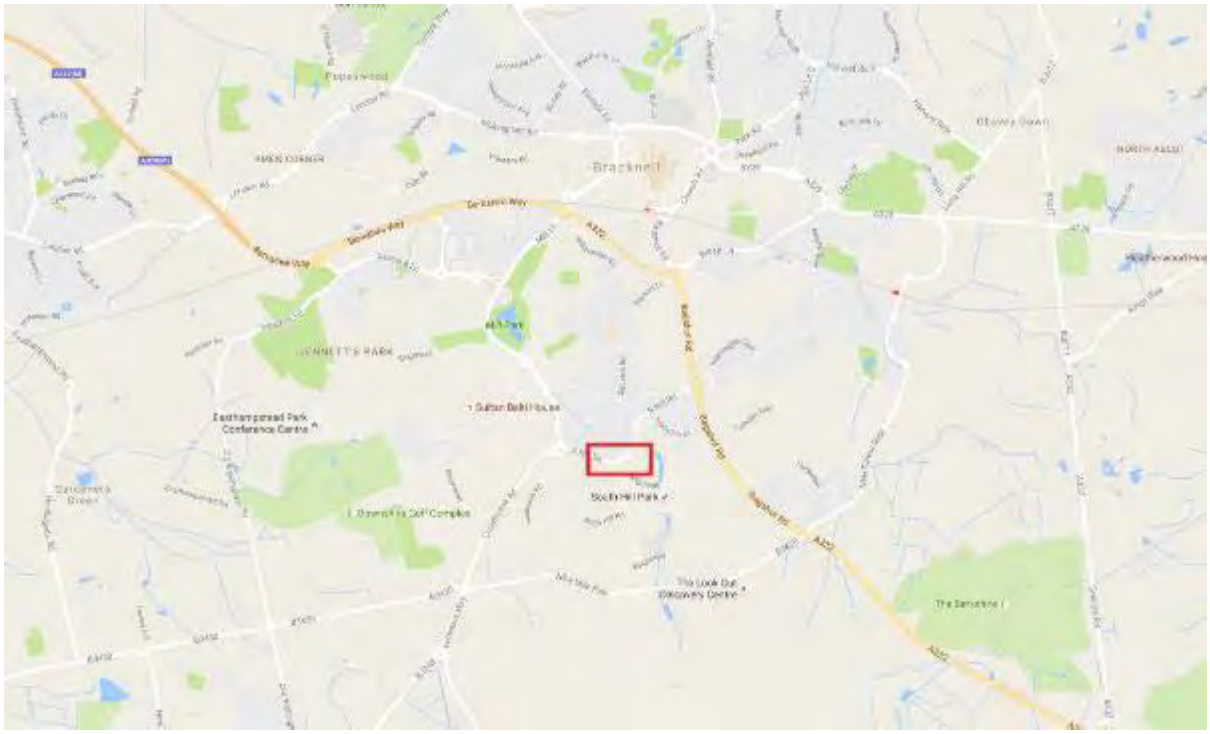
Comparison:



Existing:


HOREWOOD ROAD
SALWEY CLOSE
SOUTH HILL ROAD
Cycle Track
Playgroun

Location:



View of the road:

Picture 1:

Picture 2:

8.5 Appendix E – Overview of Proposed Technology

8.5.1 LED Technology

LED (Light Emitting Diodes) street lighting has been chosen as the preferred technology and has several advantages over outdated but widespread technologies:

1. They consume half the energy of some types of traditional street lights. The reduced consumption is derived principally from the higher light output per electricity input and the ability to readily control lighting levels without deterioration. The introduction of dimming strategies can increase these saving further.
2. Reduced Lamp Renewal Costs. Service life expectancy of LEDs is 20-25 years, with extended warranties of up to 25 years available. When compared to conventional lamps, which have service life expectancies of 3-6 years, this represents a substantial reduction in maintenance requirements resulting in lower costs and less disruption to the network.
3. Better quality of Light. LEDs have good quality bright white light more akin to daylight. This makes colour rendering particularly good when compared to both low and high pressure sodium light sources. It will increase the visibility of pedestrians and cyclists to road users and those on CCTV. The light output produced is more directional resulting in less light pollution, and it is also possible to reduce lighting and get a better quality of lighting with less power.

LED technology is also consistent with many of the principles of the Government's 'Smart Cities' agenda - energy efficient, connected, integrated and intelligent. This is why the move to LED street lighting has been so strongly endorsed by the All Party Parliamentary Lighting Group that has been set up to promote the application of LED lighting technologies to address local concerns, improve the quality of street lighting (thus making our streets safer), and reinforcing the wider sustainability agenda.

8.5.2 Central Management System

Central Management Systems (CMS) allow for the effective management of the street lighting and lit furniture assets and can reduce routine scouting by instantly identifying faults with apparatus on your network.

8.5.2.1 CMS Summary benefits:

CMS provide an energy event log which is generated and submitted to the National Measurement Office (NMO) and when used in conjunction with UMSUG codes, this ensures that the energy is billed accurately.

Reports can be created for the authority providing information on active power consumption and cumulative p to date or in a period of time specified by the user. These reports can be created automatically as specified e.g. monthly or can be created upon request.

The CMS can monitor a vast range of parameters and these can then be reported back through to the designated maintenance supervisor / managers. The following measureable parameters include:

Lamp Condition	Times	Electrical	Control Unit	Control Unit
•Failure •Day Burning •Cycling	•Switching times •Burn Hours •Event Log	•Power Info •Current Info •Power Factor Info	•Missing Data •Temperature •Fault	•Voltage Info •Power cycles

All the above parameters can be used to generate reports and these can be set up by the maintenance supervisor who can determine what information he needs to be reported.

The CMS will also help with performance targets to ensure that the authority / managing agent can maintain overall outages levels. It will also negate the need for routine scouting on the asset. The CMS can generate a wide range of reports and these can include summaries of percentage in lighting and the time it takes to fix a fault etc.

8.6 Appendix F – Environmental Statements

8.6.1 Luminaire manufacturer Environmental Profile (Philips)

8.6.1.1 Sustainability & Reducing Environmental Impact

In developing our approach, Philips adopted the World Wildlife Fund's (WWF) Living Planet Report. This report looks into the Human Development Index (HDI) as well as the ecological footprint of each nation on this planet. Most developed countries have a high ecological footprint but there is still a large portion of the world's population who are in need of further development. If all countries are to continue developing with the current rate of resource consumption, we will face the challenge of resource scarcity. Their model outlines Earth's finite amount of natural resources and the need for smarter solutions to meeting human needs.

8.6.1.2 Investment in Green Innovation

Green Innovation is the research and development of new generations of green products and technologies. Our green product portfolio focuses primarily on energy and resource efficiency.

In 2014, Philips already achieved this EUR 2 billion Green Innovation EcoVision program target a year ahead of schedule as it invested some EUR 463 million in Green Innovation, excluding Lumileds and Automotive.

Lighting continued to be the largest contributor in Green Innovation, mainly as a result of investments in LED. With a 2014 investment of EUR 255 million in Green Innovation (excluding Lumileds and Automotive at EUR 105 million), Lighting invested EUR 32 million more than in 2013.

Beyond significant energy efficiency benefits of LED, investing in connected lighting system supports the transition to a more circular economy. E.g. Power over Ethernet-enabled luminaires eliminate the need for power cabling, simplifying installation and lowering initial costs. Flexible and open system architecture streamlines servicing and maintenance, affords an easy upgrade path, and extends system lifetime.

8.6.1.3 Green Products

Philips drive sustainability in all aspects of product creation through our Eco-design process. The six green focal areas of Eco-design enable us to offer our customers Green Products; they are products that can help reduce costs, energy consumption and CO2 emissions. At year-end 2014, Philips' Green Products sales reached 52% of the year's total sales.

Related Proof points:

- Philips installed a 2-megawatt wind turbine to meet around 70% of the power requirements of their Lighting manufacturing plant, Lightolier, in the US.
- Philips is one of the industry partners that initiated a conflict-free tin sourcing program in the Democratic Republic of Congo.
- The world is currently consuming over 2.5 times the amount of resources than the Earth can sustainably support. Our main target is to reduce carbon emissions by 40% by 2016. We are minimizing our ecological footprint through energy efficiency measures, green IT and renewable energy. Philips are investing in new machinery to reduce our water consumption and waste.
- Their Workplace Innovation program – which supports flexi-time working – and green travel plans enable our employees to contribute to our carbon reduction target. All employees have a responsibility to ensure we achieve our goal of world-class occupational health and safety performance.

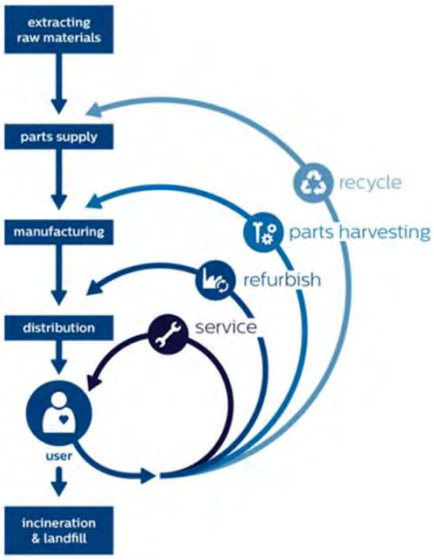
8.6.1.4 Supplier Sustainability

Philips require their suppliers to share our commitment to sustainability and have designed programs to engage and support them on a shared journey towards continuous improvement.

The Philips' Supplier Sustainability Declaration is part of all purchasing contracts and includes expectations on ethical behavior, working conditions and environmental management. By 2016, our goal is to have 72% of our suppliers adhere to our sustainability requirements. They encourage positive change in their supply chain Global metals and minerals extractives supply chains face multiple sustainability issues, particularly in countries afflicted by conflict. Philips collaborates closely with industry-wide initiatives to find innovative solutions to these problems through our Conflict Free Tin Initiative.

8.6.1.5 Circular Economy

Circular Economy is a driver for innovation in the areas of material, component, and product reuse, as well as new business models such as solutions and services. In a Circular Economy, the more effective use of materials enables the creation of more value, both through cost savings and by developing new markets or expanding existing ones. Key characteristics of this approach are customer access over ownership, business model innovations, reverse cycles and logistics, innovations for material-, component-, and product reuse, products designed for disassembly and serviceability.



In 2013, Philips started its circular economy approach and became a global partner of the Ellen McArthur Foundation, the leading organization on the concept.

8.6.1.6 Philips examples

Refurbishing medical products: in 2014 we inaugurated our healthcare imaging systems refurbishment facility in Best, the Netherlands. Pre-owned equipment is converted into 'as-new systems' with full warranty and re-configured to customers' needs by using the renewed components, latest software releases and updates.

Project Mainstream: cross-industry collaboration initiative driven by the Ellen MacArthur Foundation, the World Economic Forum and McKinsey. Philips is in the Steering Board and lead of the work stream Asset-tracking. Project addresses the outer circle of the circular economy concept, the material streams where significantly more traction is needed to scale up to mainstream business and improve material quality.

8.6.1.7 Awards

8.6.1.8 Fair Trades

Philips abides by its Ethics and Business Conduct Policy. Within this document is a section about 'Fair Competition Guidelines' and how we adhere and act towards these. And ensure that our supply chain does the same.

8.6.1.9 Human rights

With due regard to the Universal Declaration of Human Rights, which states that all parties in society, including corporate persons, have a duty to respect and safeguard human rights, and within the framework of the legitimate role of business, Philips supports and respects human rights and strives to ensure that its activities do not make it an accessory to infringements of human rights.

8.6.1.10 *Child, bonded and forced labour*

Under no circumstances will Philips make use of forced or bonded labour, nor will it employ children in violation of Conventions no. 138 and no. 182 of the International Labour Organization.

8.6.1.11 Free market competition

Philips supports the principle of free market competition as a basis for conducting its business and observes applicable competition laws and regulations.

8.6.1.12 Investing in People

Philips has currently achieved the Standard Accreditation from Investors in People. We are now working towards the next level accreditation for Investor in People.

8.6.2 CMS manufacturer Environmental Profile (Telensa)

8.6.2.1 Sustainable communities

Telensa are good neighbours who engage with and work with their local communities, e.g. by encouraging a knowledge their technology activities in the community and how they can help support a sustainable environment (street lighting management especially).

8.6.2.2 Natural resource protection and environmental enhancement

Telensa do not pollute or contaminate land or water and manage their waste responsibly. Telensa seek to enhance and improve the environment through good design and management.

Telensa work with their supply chain to deliver mutually sustainable solutions that deliver value for money e.g. shipping by sea from Far East manufacturer.

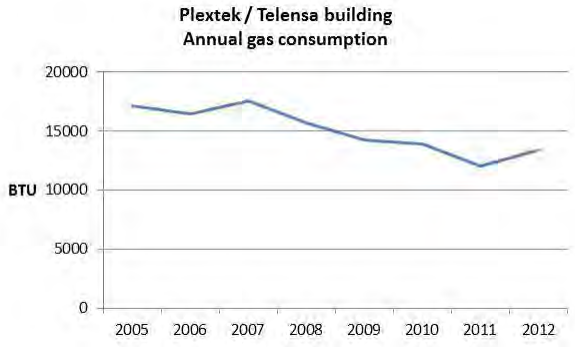
The main packaging used by Telensa for delivery of products is cardboard. Telensa actively encourage customers to return packaging for reuse wherever practical. The packaging used for base stations is regularly returned for reuse as its own function is protection of equipment during delivery. As the operations team from Telensa normally attend the installation of base stations they return the packaging to their onsite base station manufacturing team for reuse.

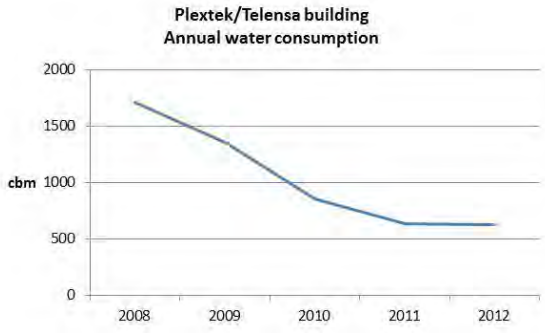
8.6.2.3 Sustainable consumption and carbon footprint

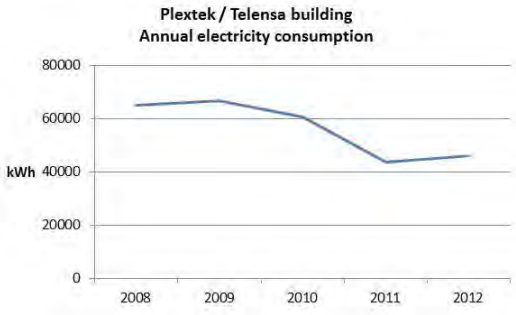
Telensa work to reduce their own consumptions. E.g. the building in which Telensa operate has installed water saving measure and light saving measures indoors and out.

Telensa operates in same building and shares facilities with parent company, Plextek. Approximately 80% of the facility is standard office space. There is dedicated building services management with continuous monitoring of utilities with measures adopted to reduce consumptions

Resulting trends in utilities consumptions are downwards:







The company has a formal environmental policy, and accepts responsibility for the impacts its operations have on both the local and global environment and is committed to reducing them.

The company has an active preventative maintenance plan to ensure that the complete facility, including HVAC plant, is operating efficiently.

8.6.2.4 Green travel

Telensa actively encourage their employees to consider reducing their individual carbon footprints with support for travelling to and from the office by bicycle, car sharing, public transport. Telensa have facilities to help e.g. bicycle racks, showers etc. The company has a formal policy on car sharing and actively encourages staff to car share

8.6.2.5 Sustainable manufacturing techniques

Sub contract and in house manufacturing facilities are subject to the same drivers to sustainability as described above for the business overall, and with manufacturing and assembly in mind there is additional scrutiny on avoid waste in raw materials and energy consumption in the assembly process.

Telensa has a close working relationship with Clarion their manufacturing partner in Malaysia. There are regular visits and multi-disciplined audits, which include scrutiny on use of raw materials and avoiding waste and on the input costs into the manufacturing process which includes energy.

Telensa is socially conscious, both in terms of its role as a business in a community and also through the nature of the work it is involved in, namely street lighting, being a public service.

Telensa is a socially responsible employer and committed to equality and diversity. This commitment is demonstrated by the fact that Telensa's employees are from very varied backgrounds of race/ethnic origin: ca. 25% of employees are from minority ethnic/cultural origins.

In its own community Telensa, through its connection with Plextek, provides its employees with a broad social programme of events for employees and their families, such as activity days out, fireworks, displays and various parties.

Many local charities and events have been supported: Sponsors Uttlesford Orchestra annually Sponsored Bowls Gala; Day Sponsored an Easter Bunny at Great Chesterford School; annually Sponsored Great Chesterford Gala Raffle prize to the Great Chesterford Steam up annually; Raffle prize to the Little Chesterford Village Fete; and many more.

Telensa's business is street lighting and is helping the local authority operators of street lighting deliver a more effective and efficient lighting service to it's public. Relative to previous generations, street lighting is now undergoing a period of rapid change, with new lighting types (e.g. LED) appearing and new control systems, like Telensa's PLANet solution. Telensa is keen to support its local authority customers present the new technologies to its public. For example Telensa have joined local authority street lighting managers to present and demonstrate the PLANet system to council members and also to the public, including evening events to show the members and public how new lighting works and the features of control systems; this helps council members understand what they are 'getting for their money'.

A further example of supporting a local Authority was Telensa's equipment being shown by an authority at a county fair. In this way Telensa recognises that helping to educate the stake-holders in public lighting is important. Telensa will be happy to take part in activities in which the council wish to present thenew lighting to the public, for example demonstrations of the controlling of light in the evenings; introducing the system to schools & colleges and community groups.

8.6.3 Contractor Environmental Policy (Ringway)

1. Works should be conducted tidily and minimise disturbance of soft estate (as practicable, do not park vehicles or store materials, on the soft estate).
2. Clear, advance notice of works should be given to minimise visual/ noise concerns of residents.
3. Traffic management measures should be clearly signed and works should be undertaken at an appropriate time of day/night, to minimise disruption/congestion.
4. All works should adhere to BS5228 Parts 1 and 2, Noise in Relation to Construction. Liaison with local Environmental Health Officer should advise of works and ascertain need for section 60 consent (under Control of Pollution Act 1974). A Section 60 consent gives powers to the Local Authority to control noise and vibration from construction sites. If work is going to be exceptionally noisy, or carried out at night a Section 60 consent should be considered.
5. Turn off machinery when not in use (to minimise noise, fumes and fuel consumption).
6. Dust created should be suppressed appropriately.
7. Seal odour sources when not in use, advise residents if prolonged use is likely.
8. All drainage, especially surface water must be treated sensitively. Works must avoid chemical or particulate pollution of local drainage system, especially any ditches/watercourses. This includes disturbance of silt in watercourses.
9. Fuels and materials should be stored appropriately so that contamination of land and water are avoided. Ensure that spill kits are available on the site.
10. Waste needs to be accurately classified and treated appropriately, with sub-contractors holding the relevant waste licenses. The waste hierarchy should always be considered on every job, reuse of waste on site and recycling is the preferred option, with landfill used only as a last resort.

Waste Hierarchy

Avoid – Reduce - Reuse – Recycle – Waste to Energy - Landfill

11. If any artefacts are uncovered during works the Environmental Advisor should be notified.
12. Tree rooting zones: as a rule tree roots spread out as far as the tree is high. Compaction to the roots as a result of the storage of heavy equipment and vehicles etc., can have major impact on the growth of the tree. Avoid storing plant and materials under trees.
13. If working under trees, be careful to avoid severing tree roots. As a rule, roots as thick as you thumb are vital to the health of the tree and should not be cut.
14. If you suspect there are invasive or injurious plants on the site, stop work and seek advice. Giant Hogweed can cause serious blistering if contact is made with the sap, DO NOT touch. Himalayan Balsam and Japanese Knotweed are extremely invasive and require specialist removal and disposal. Ragwort is harmful to livestock, we have a legal duty to prevent it spreading from our land.
15. If you suspect there may be protected species on the site, seek advice. All protected species and their habitats are legally protected from disturbance, harm and death. Some species require licences/ consents for working near them e.g. badgers, bats, great crested newts and dormice.
16. Before any works are carried out near a watercourse advice must be sought from the Environment Agency to determine the control required. A consent is needed from the EA if:
    - Working in or over a river, flood plain, watercourse
    - Working within 8m of a riverbank
    - Working within 4m of the foot of an embankment from the land side.