

Croxley Noise Webtag Appraisal for the Preferred Scheme (Rail Link) and Low Cost Alternative (Bus Link)

Introduction

Completion of the plan level webTAG worksheets for noise would require the use of noise models to estimate the population that would be exposed to different levels of noise for the two different do-something (bus and rail) scheme options compared to without the scheme for both the opening year and 15 years after opening.

Model calculations are currently not available for either the bus route or the proposed rail link, so this appraisal predominantly comments upon the population that could be affected by the scheme (address points used as an indicator) within distance bands from the centre line of the new transport corridor of 0-50 m, 50-100 m, 100-200 m, 200-300 m and 300-400 m as recommended in the Webtag guidance documents and the Design Manual for Roads and Bridges. It also describes the proposed transport movements for each option and the possible differences between bus and rail noise.

Historical noise calculations were available for the rail link and these have also been summarised. However, it must be noted that the baseline data and calculations are very old (1994) and should be re-evaluated by a specialist noise consultant. There are no similar calculations for the bus link.

Traffic Data

Traffic flow information that is provided within the Croxley Rail Link Major Scheme Business Case (February 2008) has been used during this appraisal, as summarised below.

The preferred option (rail link) would allow the Metropolitan Line to continue to run at a rate of 6 trains per hour in each direction every day of the week. Over the course of the day it is predicted that there will be 108 each way or a total of 216 passing any point on the route. The earliest departure from Watford Junction would be 0600 and the latest arrival at Watford Junction would be 0030.

The low cost option (bus link) would see 3 buses run per hour between 0600 and 0000 in each direction all week for the main service between Croxley Station and Watford Junction station, and 2 per hour each way for an additional route between the business park and Watford Junction, which would only run Monday to Friday. This equates to a total of 120 bus journeys per day during the week, 108 on a Saturday and 84 on a Sunday.

As can be seen from the information provided above, the frequency of train movements with the preferred scheme is significantly greater than the frequency of bus movements, especially at the weekend.

Population Data

Address Point data were used to identify the number of properties within 400 m of the proposed schemes, giving an indication of the population that

could be affected by the scheme. This information is shown for bands of 0-50 m, 50-100 m, 100-200 m, 200-300 m and 300-400 m surrounding the preferred option and the low cost option. For both options the new section of the transport link along the disused railway line has been considered separately to the sections where the option makes use of existing used infrastructure, i.e. where the option runs along existing roads/railway lines. In addition, for the preferred option consideration has also been given to the section of railway where trains will no longer run if the scheme is implemented, between the start of the connection to the disused rail line and Watford Metropolitan Station.

Preferred Option

Tables 1, 2 and 3 below show the number of properties in the distance bands for the different zones of the preferred rail scheme, as shown in Drawing 1 of the Noise Appendices.

Table 1: Along new rail link

Distance from centre line	Number of residences in band	Cumulative
0-50 m	390	390
50-100 m	1008	1398
100-200 m	1173	2571
200-300 m	1552	4123
300-400 m	1925	6048

Table 2: Along existing railway line from link to Watford Junction Station

Distance from centre line	Number of residences in band	Cumulative
0-50 m	383	383
50-100 m	508	891
100-200 m	892	1783
200-300 m	1316	3099
300-400 m	910	4009

Table 3: Along redundant line to Watford Metropolitan Station

Distance from centre line	Number of residences in band	Cumulative
0-50 m	141	141
50-100 m	259	400
100-200 m	446	846
200-300 m	565	1411
300-400 m	452	1863

As can be seen from the tables above, approximately 6048 properties are within 400 m of the new section of railway and may be exposed to newly introduced train noise. However, some of these properties at the western end may already experience train noise from trains using the existing metropolitan line and at the eastern end from trains running on the West Coast Mainline. 4009 properties are within 400 m of an existing train line and may therefore experience an increase in the number of trains passing per hour. Some of these properties will also have been counted in table 1 because of the overlap in distance bands.

1863 properties are within 400 m of the section of the existing Metropolitan line to be closed, where there is likely to be a reduction in noise level. However, properties to the south of this section are also at the start of the new link to the disused line, so any decrease in noise due to the closure of the existing line may be cancelled out by the construction of the new line. Again some of these properties will also have been counted in table 1 because of the overlap in distance bands.

Low Cost Option

Tables 4, and 5 show the number of properties within distance bands of the different zones for the low cost bus scheme, as shown in Drawing 2 in the Noise Appendices.

Table 4: Along new busway

Distance from centre line	Number of residences in band	Cumulative
0-50 m	314	314
50-100 m	809	1223
100-200 m	960	2083
200-300 m	1286	3369
300-400 m	1521	4890

Table 5: Along section of bus route using existing roads

Distance from centre line	Number of residences in band	Cumulative
0-50 m	960	960
50-100 m	601	1561
100-200 m	2275	3836
200-300 m	1886	5722
300-400 m	4356	10078

As can be seen in the tables above 4890 properties are within 400 m of the new link which will be converted into a busway and may therefore be exposed to noise from the introduction of buses along the disused branch line.

10078 properties are within 400 m of the proposed routes where buses would use the existing roads. However, in these locations the population will already be exposed to the existing road traffic noise. At either end there will be some overlap in properties so some properties included in table 5 will also be counted in table 4.

Population Summary

The number of properties surrounding the rail link along the disused corridor exceeds the number of properties surrounding the new bus link along the disused corridor. Although both links run along the same line the rail link is slightly longer as it connects with the existing Metropolitan Line across a new high viaduct, whereas the bus route diverts onto the existing road network at this point.

The preferred scheme involves the closure of the Metropolitan Line to the north of Croxley station to Watford Metropolitan station. This is likely to result in a reduction in noise at the properties surrounding this section of line. However properties near to the proposed viaduct and the start of the new rail link are unlikely to experience a decrease in noise due to this closure because any benefit may be cancelled out by the construction of the new link.

The low cost option does not involve the closure of the Metropolitan Line to the north of Croxley station and Watford Metropolitan station so the noise levels are likely to remain at a similar level to their existing levels in the vicinity, and no properties will experience a decrease in noise levels.

In addition to the number of properties likely to be affected by the scheme it is also necessary to consider the location of and effects on other sensitive receptors. There are a number of schools, a hospital, churches and a museum in the vicinity of both the rail route and the bus routes. These are shown on drawing 3 in the Noise Appendices. The number of each type of receptor within distance bands of the two options is shown in the table below.

Table 6: Distance of Sensitive Receptors from Two Alignments

	Distance from alignment				
	0-50 m	50-100 m	100-200 m	200-300 m	300-400m
Preferred Option (Rail Link)					
Schools/Education Buildings	2	2	2	3	1
Places of Worship/Halls	1	2	3	3	0
Hospitals/Care Centres/Clinics	0	1	0	1	3
Courts	1	0	0	0	0
Low Cost Option (Bus Link)					
Schools/Education Buildings	3	2	2	2	0
Places of Worship/Halls	0	1	1	2	4
Hospitals/Care Centres/Clinics	0	0	1	1	0
Courts	0	0	0	1	0

Assumptions

For the purposes of this appraisal it has been assumed that neither option affects traffic flows on the road network in and around Watford. Therefore only impacts of introducing trains or buses along the proposed routes and closure of the section of Metropolitan Line leading to Watford Metropolitan Station have been considered.

In the absence of noise modelling and calculations to compare the noise impact of the two schemes it has been necessary to base the comparison on the differences in flows associated with the two options and the number of properties within 400 m that could be affected. Noise modelling should be carried out to give more robust conclusions about the comparison of the likely noise impacts of both schemes.

Appraisal of Noise for the Preferred Scheme (Rail Link)

In addition to considering the frequency of train movements and the number of properties within 400 m of the proposed rail link, historical data and calculations undertaken in 1994 can provide a starting point for considering the potential magnitude of changes in noise level.

Existing Noise Predictions

Aspinwall and Company Report

In October 1994 Aspinwall & Company, environmental specialists, produced an Environmental Statement for the Croxley Rail Link which included noise and vibration predictions at locations along the proposed new rail link, as shown in drawing 4 in the Noise Appendices. Track Wheel Interaction Noise Software (TWINS) was used in the calculations and took into account the following factors:

- The number of trains in each direction during the day;
- Trains speeds on 'up' and 'down' lines at the various locations;
- The distance of noise-sensitive receptors from the tracks;
- The angle of view of the line for each noise-sensitive receptor;
- The effect of acoustic screening due to cuttings or other existing screening; and
- Additional noise due to traction motors and brakes.

The results were produced using day time data only, and assumed the use of A62 train stock and 8 trains per hour in each direction. The results are shown in table 7.

Table 7: Predicted Noise Levels from Aspinwall Report, October 1994

Map Ref		A	B	C	D
	Address	Day	Existing	Predicted	Difference
A1	Grosvenor Court/Cavendish Court	54.3	59.3	60.5	1.2
A2	Cottages at 1-8 Watford Road	64.9	70.7	71.7	1
A2	Grand Union Canal	58.3	65.4	66.2	0.8
A3	Sydney Road	70.8	51.3	70.8	19.5
A3	St Anthony's RC Primary School	61.3	51.3	61.7	10.4
A4	Tolpits Close/Tolpits Lane	64.2	55.0	64.7	9.7
A4	Holm Oak Park	67.3	55.0	67.5	12.5
A4	Kelmscott Close	73.0	55.0	73.1	18.1
A4	Proposed residential development at Tolpits Lane	71.7	55.0	71.8	16.8
A4	Harwoods Recreation Ground and allotments opposite	75.2	55.0	75.2	20.2
A4	The Laurence Haines Infants and Junior School	65.9	55.0	66.2	11.2
A5	Cardiff Road	64.2	54.5	64.6	10.1
A6	Elfrida Road	64.5	61.0	66.1	5.1
A6	Watford Grammar School	66.5	61.0	67.6	6.6
A6	Neal Street	73.7	61.0	73.9	12.9
A6	Field Infant School	66.8	61.0	67.8	6.8
A6	Dyson Court	57.1	61.0	62.5	1.5
A6	Water Lane	66.3	61.0	67.4	6.4
A7	Shaftesbury Road/Ebury Road	74.1	65.4	74.6	9.2
A7	Gladstone Road	74.1	65.4	74.6	9.2
A7	Queens Place/ Ottoman Terrace	74.6	65.4	75.1	9.7
A8	Queens Road	72.3	61.2	72.6	11.4

A – L_{Aeq} levels from LUL train operation only during the day (dB).

B – Existing L_{Aeq} level during the day (dB).

C – Predicted L_{Aeq} level during the day after construction (dB).

D – Increase in L_{Aeq} level during the day as a result of construction (dB).

As can be seen from the table the change in noise level was calculated to vary significantly along the length of the route from an insignificant difference of 1 dB to a significant increase of 20.2 dB. These locations are all between 10 m and 250 m from the centreline of the proposed link.

London Underground Limited (LUL) Scientific Services Report

London Underground Limited (LUL) Scientific Services also produced a report which calculated predicted noise levels. Their report took into account day time (0600-2400) noise levels as well as night time (0000-0600) levels. A map showing the locations for which the noise levels were predicted is shown in drawing 4 in the Noise Appendices. The results are summarised in table 8.

Table 8: Predicted Noise Levels from LUL Scientific Services Report

		A	B	C	D	E	F	G	H
Reference Area	Address	Day	Existing	Predicted	Difference	Night	Existing	Predicted	Difference
Viaduct	7 Watford Road	54.7	70.7	70.8	0.1	42.9	61.1	61.2	0.1
	Training Ship Renown	54.5	59.3	60.5	1.2	42.7	50.4	51.1	0.7
	1 Cavendish Court	50.7	59.3	59.9	0.6	38.9	50.4	50.7	0.3
Watford West	517 Whippendell Road	43.0	51.3	51.9	0.6	31.2	43.9	44.1	0.2
	105 Sydney Road	62.7	51.3	63.0	11.7	50.9	43.9	51.7	7.8
	90 Sydney Road	47.6	51.3	52.8	1.5	35.8	43.9	44.5	0.6
	38 Sydney Road	50.1	51.3	53.8	2.5	38.3	43.9	45.0	1.1
	13/15 Sydney Road	50.0	51.3	53.7	2.4	38.2	43.9	44.9	1.0
	12 Tolpitts Lane	65.6	58.0	66.3	8.3	53.8	50.0	55.3	5.3
	109 Hagden Lane	55.4	55.0	58.2	3.2	43.6	47.9	49.3	1.4
50/71 Holm Oak Park	59.0	55.0	60.5	5.5	47.2	47.9	50.6	2.7	
Cardiff Road	65 Cardiff Road	66.8	54.5	67.0	12.5	53.8	49.2	55.1	5.9
	13 Cardiff Road	68.2	54.5	68.4	13.9	56.4	49.2	57.2	8.0
	Watford Grammar School	58.3	54.5	59.8	5.3	46.5	49.2	51.1	1.9
	8 Elfrida Road	64.3	61.0	66.0	5.0	52.5	55.0	56.9	1.9
	50 Neal Street	69.1	61.0	69.7	8.7	57.3	55.0	59.3	4.3
	Field Infant School	55.0	61.0	62.0	1.0	43.2	55.0	55.3	0.3
Watford High Street	2 New Road	65.3	65.4	68.4	3.0	53.5	61.0	61.7	0.7
	32 Water Lane	65.9	65.4	68.7	3.3	54.1	61.0	61.8	0.8
	33 Water Lane	68.1	65.4	70.0	4.6	56.3	61.0	62.3	1.3
	30 Water Lane	68.3	65.4	70.1	4.7	56.5	61.0	62.3	1.3
	18/19 Water Lane	69.4	65.4	70.9	5.5	57.6	61.0	62.6	1.6
	Dyson Court	60.9	65.4	66.7	1.3	49.1	61.0	61.3	0.3
	25 Gladstone Road	68.1	65.4	70.0	4.6	56.3	61.0	62.3	1.3
	Watford Central Primary School	51.1	55.0	56.5	1.5	39.3	51.0	51.3	0.3

Reference Area	Address	A	B	C	D	E	F	G	H
		Day	Existing	Predicted	Difference	Night	Existing	Predicted	Difference
Watford Junction	75 Gladstone Road	68.4	65.4	70.2	4.8	56.6	61.0	62.3	1.3
	121 Gladstone Road	69.6	65.4	71.0	5.6	57.8	61.0	62.7	1.7
	7 Ottoman Terrace	70.2	61.2	70.7	9.5	58.4	57.2	60.9	3.7
	5 Edbury Road	66.0	61.2	67.2	6.0	54.2	57.2	59.0	1.8
	45 Shaftesbury Road	69.8	61.2	70.4	9.2	58.0	57.2	60.6	3.4
	123 Queens Road	67.7	61.2	68.6	7.4	55.9	57.2	59.6	2.4
	183 Queens Road	66.2	61.2	67.4	6.2	54.4	57.2	59.0	1.8

A – L_{Aeq} levels from LUL train operation only during the day (dB).

B – Existing L_{Aeq} level during the day (dB).

C – Predicted L_{Aeq} level during the day after construction (dB).

D – Increase in L_{Aeq} level during the day as a result of construction (dB).

E – L_{Aeq} levels from LUL train operation only at night (dB).

F – Existing L_{Aeq} level at night (dB).

G – Predicted L_{Aeq} level at night after construction (dB).

H – Increase in L_{Aeq} level at night as a result of construction (dB).

Summary

From the historic data provided by Aspinwall and LUL, and the number of properties within 400 m of the scheme, it can be assumed that some properties in the area will suffer from an **adverse** impact on noise levels as a result of introducing trains to the disused Croxley Green Branch Line. However, should the preferred option be constructed, then some properties in the vicinity of the Croxley to Watford Metropolitan section of line may see a **beneficial impact** in noise levels. Less properties are likely to benefit from the closure of this section of line than are likely to be affected by re-introducing trains, so overall the preferred scheme is likely to have an adverse noise impact. Modelling and more up to date calculations are required to determine the extent and magnitude of this impact.

Appraisal of Noise for the Low Cost Scheme (Bus Route)

As for the potential noise impact of the rail scheme, due to the introduction of buses along a currently disused corridor and the number of properties within 400 m of this corridor it is likely that some properties will experience an **adverse** impact on noise levels. Modelling and noise calculations will be required to determine the degree of this impact.

Qualitative Comments

The frequency of train movements would be significantly higher than the frequency of the buses, especially at the weekend. However, when considering the noise impacts it should be noted that the amount of noise created by trains and buses varies, and that people respond differently to the introduction of train noise when compared to the introduction of road traffic noise. Some modern energy efficient buses can be relatively quiet. Similarly, electric trains may not be particularly intrusive if not travelling very quickly. Engine noise in buses can be more intrusive when buses have to stop and then accelerate.

Croxley Rail Link MSBC

Air Quality – Transport Analysis Guidance Appraisal

30 April 2008

Produced for
Hertfordshire Highways

Prepared by
Carol Chan
Air Quality Consultant

West Hall
Parvis Road
West Byfleet
Surrey
KT14 6EZ
UK

T +44 (0)1932 3370501
F +44 (0) 1932 336630

Document Control Sheet

Project Title Croxley Rail Link MSBC

Report Title Air Quality – Transport Analysis Guidance Appraisal

Revision 2

Status Final

Control Date 30 April 2008

Record of Issue

Issue	Status	Author	Date	Check	Date	Authorised	Date
1	Draft	C Chan	23.04.08	J Lenham	29.04.08	J Lenham	29.04.08
2	Final	C Chan	23.04.08	K Smith	30.04.08	K Smith	30.04.08

Distribution

Organisation	Contact	Copies
Mouchel	Karen Smith	1
Hertfordshire County Council	Richard Boutal	1

This Report is presented to Hertfordshire County Council (HCC) in respect of the Croxley Rail Link and may not be used or relied on by any other person or by the client in relation to any other matters not covered specifically by the scope of this Report. Notwithstanding anything to the contrary contained in the report, Mouchel Limited is obliged to exercise reasonable skill, care and diligence in the performance of the services required by HCC and Mouchel Limited shall not be liable except to the extent that it has failed to exercise reasonable skill, care and diligence, and this report shall be read and construed accordingly.

Contents

Document Control Sheet	i
Contents	ii
Tables.....	iii
1 Introduction.....	4
2 Methodology.....	6
3 Results.....	10
4 Mitigation.....	14
5 Summary.....	15
6 Appendices.....	17

Tables

Table 1	Estimated Annual Mean Background Concentrations at Site ($\mu\text{g}/\text{m}^3$)	9
Table 2.....	Properties within 200m of the proposed Rail Link and Bus Link	10
Table 3	Rail Route TAG Summary – PM_{10}	10
Table 4	Rail Route TAG Summary – NO_2	11
Table 5	Bus Route TAG Summary – NO_2	11
Table 6	Bus Route TAG Summary – NO_2	12
Table 7	Regional Emissions Summary	13
Table 8	Greenhouse Gas Emission Summary	13

1 Introduction

Mouchel has been commissioned by Hertfordshire Highways to undertake an Air Quality Transport Analysis Guidance (TAG) Appraisal for the Croxley Rail Link Major Scheme Business Case (MSBC).

The Air Quality TAG Appraisal has appraised the potential impacts on local air quality, regional air quality and greenhouse gas emissions of the two options for the Proposed Scheme. The Appraisal has identified properties that are likely to be affected by the changes in air quality that are likely to result from the implementation of the two different options, and considers both the likely beneficial and likely adverse impacts on air quality. This Appraisal was undertaken according to the Department of Transport guidance, Transport Analysis Guidance (TAG) Units 3.3.3¹, 3.3.4² and 3.3.5^{3/4}.

1.1 Transport Analysis Guidance (TAG) Unit 3.3.3 The Local Air Quality Sub-objective

This TAG Unit provides guidance on assessing the impact of transport options on local air quality.

Road transport, which is a significant source of particulate matter (PM₁₀) and nitrogen dioxide (NO₂), is one of the major sources of local air pollution, especially in towns and cities. In urban areas, emissions from road traffic (e.g. cars, buses, lorries etc.), combined with occasions of poor atmospheric dispersion, could make a significant contribution to pollutant concentrations. Concentrations of these two pollutants are at risk of exceeding the objectives near major roads so the Local Air Quality sub-objective focuses on these two pollutants.

The approach to assessing local air quality at the plan level is based on a quantification of the change in exposure to pollutants at properties in the opening year.

The guidance on appraising local air quality impacts focuses on effects arising from changes in road traffic. Due to the uncertainty in traffic forecasting and the size of traffic flow change needed to affect air quality, options which change traffic flows by less than 10% are scoped out, unless the road is a motorway (due to the high traffic flows) or there are particular sensitivities (e.g. traffic congestion, change to the speed limit or the presence of an Air Quality Management Area (AQMA)).

¹ The Local Air Quality Sub-Objective TAG Unit 3.3.3, April 2004, Department of Transport

² The Regional Air Pollution TAG Unit 3.3.4, February 2004, Department of Transport

³ The Greenhouse Gas Sub-Objective TAG Unit 3.3.5, October 2006, Department of Transport

⁴ The Greenhouse Gasses Sub-Objective TAG Unit 3.3.5, December 2004, Department of Transport

1.2 Transport Analysis Guidance (TAG) Unit 3.3.4 The Regional Air Pollution

Transport can also have air pollution impacts over larger areas than those that are described in this guidance as being local. Most notably, these impacts are acidification, excess NO₂ and the generation of tropospheric ozone. These are regional issues, affecting areas with distance scales of some 10s to 100s of km. For these effects, the impacts may be felt by humans or ecosystems at considerable distances from the source of the emissions. Partly as a consequence of this, it is difficult to quantify impacts associated with emissions from particular sources. The only sensible approach is to assess the change in emissions associated with alternative transport schemes.

For the purposes of the appraisal, nitrogen oxides (NO_x) and PM₁₀ were taken to be an indicator of the potential for regional air pollution impacts arising from options as this regional pollutant is the most strongly linked with transport.

1.3 Transport Analysis Guidance (TAG) Unit 3.3.5 The Greenhouse Gas Sub-objective

Carbon dioxide (CO₂) is considered to be the most important greenhouse gas and therefore has been used as the key indicator for the purposes of appraising the impacts of the transport options on climate change.

Although the focus is on CO₂ emissions, it has been considered in terms of the change in the equivalent tonnes of carbon emission (as C) as a result of implementing the two different proposed schemes at Croxley.

2 Methodology

This Appraisal, which considers air quality impacts, has been based on the methodologies set out in TAG Unit 3.3.3, 3.3.4 and 3.3.5. Changes in traffic flow leading to increased or decreased pollutant emissions have the potential to bring about significant impacts on air quality.

The scheme proposes to bring the currently disused Croxley Green Branch railway line back into use as either a dedicated bus route or as a new railway line linking the London Underground Metropolitan Line to Watford Junction Station. Although the Scheme may also generate or change traffic flows on the existing local road network, only the new flows on the disused railway line have been considered in this appraisal because traffic data on the wider road network was not available at the time of carrying out the assessment.

2.1 Local Air Quality (TAG Unit 3.3.3)

At the plan level, individual link data is likely to be available. Therefore the aim at this level is to quantify the *change* in exposure at properties in the opening year (or 2005 if the option would be operational at this time) that would result from each scheme option.

The quantification needs to take account of *all* significant changes in exposure, whether on the existing or new routes, or elsewhere on the local network.

If the project is within one or more AQMAs and Action Plans are proposed or exist, it is particularly important to understand the consequences of the option. Also it is important to consider not just changes in traffic flow but also changes in traffic composition and operating conditions (perhaps as a result of traffic management projects).

Pollutant concentrations for the appropriate appraisal year for the routes affected for both the Do-Nothing and Do-Something scenarios should be calculated. The calculation of pollutant concentrations is to be carried out using the Highways Agency Design Manual for Roads and Bridges (DMRB) Air Quality Spreadsheet Version 1.03c⁵.

To quantify the exposure, the change in numbers of properties within distance bands is required. The Appraisal should produce a value that defines the magnitude of exposure due to the addition, or removal, of pollution from a specific number of properties.

The TAG Appraisal methodology takes account of all significant changes in exposure, whether on existing or new routes, or elsewhere on the local network. A

⁵ www.highways.gov.uk - Design Manual for Roads and Bridges Air Quality Spreadsheet Version 1.03c, July 2007, Highways Agency

negative value indicates that there is reduced exposure and therefore a general improvement in air quality. A positive value indicates an increase in exposure and therefore a general detrimental effect upon air quality.

2.2 Regional Air Pollution (TAG Unit 3.3.4)

The calculation of total emissions should be undertaken using the strategy level methodology described in TAG Unit 3.3.3: The Local Air Quality Sub-objective.

DMRB screening spreadsheet 1.03c “regional” worksheets allow total emissions to be estimated and should be used for assessing strategic options. The input data required to run the spreadsheet includes the number of vehicle kilometres travelled; the year of assessment; average vehicle speed; the proportion of HDV and road type (used to define vehicle fleet composition).

The primary source of road traffic emission factors for this calculation should be consistent with those set out in the DMRB Air Quality Spreadsheet.

2.3 Greenhouse Gas (TAG Unit 3.3.5)

For the purpose of the appraisal, a conservative approach is to assume that all carbon present in the fuel is released as CO₂, although in reality, some of the carbon is released as particles or hydrocarbons. Carbon emission (as C) should be estimated for the ‘Do-Nothing’ and ‘Do-Something’ schemes for each year of the appraisal period (60 years). The monetary value for the changes in C emission should also be calculated. To provide traffic estimates for 60 years additional elements of the TAG need to be completed to. As these elements have not been completed for the schemes, this appraisal is undertaken by following the previous guidance: TAG Unit 3.3.5 (Dec 2004).

Carbon emissions are estimated for the opening year with both options. The DMRB screening spreadsheet (Regional) was used for this Appraisal. This approach is described in the Local Air Quality Sub-Objective Unit 3.3.3, methodology for strategies.

2.4 Rail Emissions in Local Air Quality

There is no methodology for assessing rail transport in the Local Air Quality sub-objective. For a fair comparison between rail transport and road traffic, an equivalent emission factor for trains has been estimated and used in the DMRB screening methodology spreadsheet.

The NAEI⁶ emission factor database provides the emission factors for various train types. For intercity trains, which are the most comparable type of train provided in the database to London Underground trains, the NO_x emission factor is 0.089165 kg/km and PM₁₀ emission factor is 0.02106 kg/km. Using the DMRB screening spreadsheet, it is estimated that the NO_x emissions produced by one train is equivalent to approximately 34.9 buses travelling at 48 km/hr in 2013 (appraisal year). For PM₁₀, one train is equivalent to approximately 49.5 buses travelling at 48 km/hr in 2013. These factors were used to estimate the number of buses to be input into the spreadsheet to reproduce the emissions from the trains.

2.5 Scenarios

This Appraisal has been undertaken for the Proposed Scheme in the opening year (2013) and has considered the following 3 scenarios:

- 2013 Do-Nothing (DN) without Proposed Scheme; and
- 2013 Do-Something (DS) with Proposed Scheme – Preferred Rail Link Option; and
- 2013 Do-Something (DS) with Proposed Scheme – Lower Cost Bus Link Option.

2.6 Traffic Data

Detailed traffic data was not available at this stage of the Appraisal. It is anticipated that the existing Metropolitan Line service frequency between Watford and Central London of 6 trains per hour would operate between Croxley and Watford Junction Station.

The bus way service is proposed to offer a 20 minute headway service in each direction between Croxley station and Watford Junction (i.e. 3 buses per hour). Also, additional buses are proposed between Croxley Business Park and Watford Junction Station during the peak hours on Monday to Friday.

Therefore it is estimated that the average daily traffic for the Rail Route is approximately 216 trains per day (equivalent to 7539 buses for NO_x emission and 10689.8 buses for PM₁₀ emission); and Bus Route is approximately 113 buses per day.

2.7 Background Concentration

Watford Borough Council (WBC) does not have any monitoring units measuring background concentrations in Croxley. In the absence of any local background monitoring data LAQM.TG(03) recommends the use of empirically-derived national background estimates available from NAQIA.

⁶ National Atmospheric Emissions Inventory (NAEI) - http://www.naei.org.uk/datachunk.php?f_datachunk_id=7 – Accessed 20/4/2008

Table 1 shows the mean estimated Annual Mean background concentrations for NO_x, NO₂, and PM₁₀ for each grid square that covers the scheme area. Background estimates for NO_x are presented, as they are required in the conversion of modelled NO_x concentrations to total NO₂. Concentrations have been factored forward to those years considered in this Appraisal, using scaling factors provided in LAQM.TG(03) and are shown in underlined italics.

Concentrations estimated by NAQIA incorporate spatial variation in the expected emission trends of pollutants, which cannot be incorporated into the LAQM.TG(03) scaling factors; these are designed to represent typical pollutant trends.

Table 1 Estimated Annual Mean Background Concentrations at Site (µg/m³)

Grid square	2007			2013		
	NO ₂	NO _x	PM ₁₀	NO ₂	NO _x	PM ₁₀
509500, 195500	<u>21.30</u>	<u>33.29</u>	<u>23.39</u>	<u>18.81</u>	<u>26.85</u>	<u>21.54</u>
510500, 195500	<u>22.44</u>	<u>35.97</u>	<u>23.87</u>	<u>19.77</u>	<u>28.88</u>	<u>21.93</u>
511500, 195500	<u>22.06</u>	<u>35.05</u>	<u>23.48</u>	<u>19.38</u>	<u>28.14</u>	<u>21.54</u>
Mean	21.93	34.77	23.58	19.32	27.95	21.67

Table 1 shows that while Annual Mean background pollution concentrations in the area are below the Objective limit (40 µg/m³) in all years, such concentrations do not include any contributions from local sources of pollution, such as from road traffic emissions.

3 Results

3.1 Property Counts

Properties within 200 m of the proposed new section of routes for both options were counted in 50 m bands and are listed in Table 2.

Table 2 Properties within 200m of the proposed new Rail Link and Bus Link

Distance from corridor centre	Rail Link	Bus Link
0 – 50 m	390	314
50 – 100 m	1007	809
100 – 150 m	480	393
150 – 200 m	686	563
Total	2563	2079

No double counting for the Proposed Scheme due to single route is considered in the Appraisal.

However, for the rail link, consideration should also be given to the number of properties within 200 m of the section of the existing London Underground Metropolitan Line which will be closed, and where London Underground trains will no longer run (between where the Metropolitan Line crosses Baldwin's Lane and Watford Metropolitan Station). There are approximately 846 properties within 0 – 200 m of the centreline of the section of the rail line to be closed. Some of these properties however will also have been included in the table above as they also fall within 200 m of the new rail link.

3.2 Local Air Quality Impact

3.2.1 Rail Route

Table 3 and Table 4 provide the results for NO₂ and PM₁₀ for the Rail Route option.

Table 3 Rail Route TAG Summary – PM₁₀

PM10, SUMMARY OF ROUTES: THE AGGREGATED TABLE	0-50m (i)	50-100m (ii)	100-150m (iii)	150-200m (iv)	0-200m (v=i+ii+iii+iv)
Total properties across all routes (min)	390	1007	480	686	2563
Total properties across all routes (some)	390	1007	480	686	2563
<i>Do-minimum PM10 assessment across all routes</i>	8451.3	21821.69	10401.6	14865.62	Total assessment PM10 (I): 55540.21
<i>Do-something PM10 assessment across all routes</i>	9375.6	22516.52	10512	14927.36	Total assessment PM10 (II): 57331.48
Net total assessment for PM10, all routes (II-I)					1791.27
<i>Number of properties with an improvement</i>					0
<i>Number of properties with no change</i>					0
<i>Number of properties with a deterioration</i>					2563

It is anticipated that the air quality would deteriorate (positive value 1791.27) (rail contribution to pollution concentrations only). TAG methodology suggests that 2563 properties would have a deterioration of air quality as a result of the rail option.

Table 4 Rail Route TAG Summary – NO₂

NO₂, SUMMARY OF ROUTES: THE AGGREGATED TABLE	0-50m (i)	50-100m (ii)	100-150m (iii)	150-200m (iv)	0-200m (v=i+ii+iii+iv)
Total properties across all routes (min)	390	1007	480	686	2563
Total properties across all routes (some)	390	1007	480	686	2563
<i>Do-minimum NO₂ assessment across all routes</i>	7534.8	19455.24	9273.6	13253.52	Total assessment NO ₂ (I): 49517.16
<i>Do-something NO₂ assessment across all routes</i>	11700	22758.2	9806.4	13541.64	Total assessment NO ₂ (II): 57806.24
Net total assessment for NO₂, all routes (II-I)					8289.08
<i>Number of properties with an improvement</i>					0
<i>Number of properties with no change</i>					0
<i>Number of properties with a deterioration</i>					2563

It is anticipated that the air quality would deteriorate (positive value 8289.08) (rail contribution to pollution concentrations only). TAG methodology suggests that 2563 properties would have deterioration of air quality as a result of the rail option.

The information provided in the tables above has not considered the potential improvement in local air quality for the properties within 200 m of the section of the London Metropolitan Line that will be closed between Baldwin's Lane and Watford Metropolitan Station. This however has not been quantified. It should also be noted that some of these properties may experience an improvement in air quality from the closure of the section of the Metropolitan Line, but at the same time may suffer a deterioration due to the introduction of trains along the new link, where they also fall within 200 m of the new section of railway.

The appraisal also hasn't taken into consideration the increase in the number of trains using the section of existing rail line that is in use between Watford High Street Station and Watford Junction Station.

3.2.2 Bus Route

Table 5 and Table 6 provide the results for NO₂ and PM₁₀ for the Bus Route option.

Table 5 Bus Route TAG Summary – NO₂

PM₁₀, SUMMARY OF ROUTES: THE AGGREGATED TABLE	0-50m (i)	50-100m (ii)	100-150m (iii)	150-200m (iv)	0-200m (v=i+ii+iii+iv)
Total properties across all routes (min)	314	809	393	563	2079
Total properties across all routes (some)	314	809	393	563	2079
<i>Do-minimum PM₁₀ assessment across all routes</i>	6804.38	17531.03	8516.31	12200.21	Total assessment PM ₁₀ (I): 45051.93
<i>Do-something PM₁₀ assessment across all routes</i>	6813.8	17539.12	8516.31	12200.21	Total assessment PM ₁₀ (II): 45069.44
Net total assessment for PM₁₀, all routes (II-I)					17.51
<i>Number of properties with an improvement</i>					0
<i>Number of properties with no change</i>					0
<i>Number of properties with a deterioration</i>					2079

It is anticipated that the air quality would deteriorate (positive value 17.51) (road traffic contribution to pollution concentrations only). TAG methodology suggests that 2079 properties would have deterioration of air quality as a result of the Bus Option, while no properties would have an improvement or no change.

Table 6 Bus Route TAG Summary – NO₂

NO₂, SUMMARY OF ROUTES: THE AGGREGATED TABLE	0-50m (i)	50-100m (ii)	100-150m (iii)	150-200m (iv)	0-200m (v=i+ii+iii+iv)
Total properties across all routes (min)	314	809	393	563	2079
Total properties across all routes (some)	314	809	393	563	2079
Do-minimum NO ₂ assessment across all routes	6066.48	15629.88	7592.76	10877.16	Total assessment NO ₂ (I): 40166.28
Do-something NO ₂ assessment across all routes	6119.86	15670.33	7600.62	10882.79	Total assessment NO ₂ (II): 40273.6
Net total assessment for NO ₂ , all routes (II-I)					107.32
Number of properties with an improvement					0
Number of properties with no change					0
Number of properties with a deterioration					2079

It is anticipated that the air quality would deteriorate (positive value 107.32) (road traffic contribution to pollution concentrations only). TAG methodology suggests that 2079 properties would have deterioration of air quality as a result of the Bus Option, while no properties would have an improvement or no change.

This appraisal hasn't taken into consideration the impact of introducing buses onto the existing road network at either end of the scheme beyond the disused Croxley Green Branch Line.

3.3 Air Quality Management Areas

According to the latest Review and Assessment Report (2005) of WBC, there are currently six AQMAs within the Borough area. However none of these AQMAs are within 200 m of the Proposed Scheme. The nearest AQMA is approximately 0.75 km from the centre of the route.

3.4 Qualitative Statement

3.4.1 Rail Route

The Proposed Rail Route leads to an increase in Annual Mean PM₁₀ concentrations at 20 m from the centre of the proposed route in excess of 1 µg/m³. The maximum increase is 2.37 µg/m³ compared with the without Scheme scenario.

The Proposed Rail Route leads to an increase in Annual Mean NO₂ concentrations at 20 m from the centre of the proposed route in excess of 2 µg/m³. The maximum increase is 10.68 µg/m³ compared with the without Scheme scenario.

3.4.2 Bus Route

The Proposed Bus Route does not lead to an increase in Annual Mean PM₁₀ concentrations at 20 m from the centre of the proposed route in excess of 1 µg/m³.

The Proposed Bus Route does not lead to an increase in Annual Mean NO₂ concentrations at 20 m from the centre of the proposed route in excess of 2 µg/m³.

3.5 Regional Air Quality

Table 7 provides the results of the regional assessment for the two scenarios.

Table 7 Regional Emissions Summary

All links	Regional TAG Results		Compare with	
	2013 Emissions (tonnes/year)		2005	
Link title	NO _x	PM ₁₀	NOx emission = 445 tonnes/year	PM10 emission = 35 tonnes/year
Rail link	21.089	0.498	4.74%	1.42%
Bus link	0.283	0.004	0.06%	0.01%

Table 7 shows that the NO_x and PM₁₀ emissions of the Proposed Rail route are higher than Proposed Bus route in the same Appraisal year.

Both route options are anticipated to have a positive change with the DN scenario. Therefore it is anticipated that a negative impact (increased emission) on regional air quality compared to the without scheme scenario will occur.

It is anticipated that the NO_x and PM₁₀ emissions from Rail Route are approximately 4.7% and 1.4% of total transport emission of NO_x and PM₁₀ respectively in WBC in 2005. It is anticipated that the NO_x and PM₁₀ emissions from the Bus Route is less than 1% of both NO_x and PM₁₀ of total transport emissions in WBC in 2005.

3.6 Greenhouse Gas Appraisal

Table 8 provides the results of the greenhouse gas appraisal for the two options.

Table 8 Greenhouse Gas Emission Summary

All links	Greenhouse Gas TAG Results		Compare with	
	2013 Emissions (tonnes/year)		2005	
Link title	C		C emission = 22841 tonnes/year	
Rail link	572		2.51%	
Bus link	14		0.06%	

Table 8 shows that the C emission of both Rail and Bus routes are anticipated to be higher than the DN scenario in the Appraisal year. Therefore there is estimated to be a negative impact on greenhouse gas resulting from either of the proposed schemes.

4 Mitigation

Although providing a useful tool for the appraisal of the likely impacts on air quality that may result from the Proposed Scheme, the TAG methodologies have limitations. The use of the DMRB Screening Method for the prediction of pollutant concentrations for input to the appraisal process is based on empirical relationships. This approach to the prediction of pollution concentrations cannot account for local parameters which are likely to influence the dispersion of road traffic pollutants, such as local topography, surface roughness, atmospheric chemistry and meteorology.

It is anticipated that the Proposed Scheme would encourage use of public transport and hence the traffic mode in the local network may change. This could lead to an improvement in air quality in the wider area. However, this Appraisal only considered the traffic on the disused Croyley railway link. Therefore a further assessment is recommended to include traffic from the local road network.

This Appraisal did not consider the potential impacts of proposed new train stations and bus stations. Therefore it is recommended that any further assessment should include these.

Given the nature of the Proposed Scheme, there is not considered to be a reasonable justification for the implementation of mitigation controls.

5 Summary

With the Proposed Scheme in operation, it is anticipated that the concentration of NO₂ and PM₁₀ would not exceed the limits of Annual Mean objectives.

There is anticipated to be deterioration in both rail and bus routes which have a negative impact on local air quality, i.e. positive value in change of exposure to NO₂ and PM₁₀ concentrations within 200 m of the proposed schemes.

The rail route is considered to lead to a change in Annual Mean PM₁₀ and NO₂ concentrations at 20 m from the road centre in excess of 1 µg/m³ and 2 µg/m³ respectively. The bus route is not considered to lead to a change in Annual Mean PM₁₀ and NO₂ concentrations at 20 m from the road centre in excess of 1 µg/m³ and 2 µg/m³ respectively.

There are anticipated to be net deterioration in both rail and bus routes which have a negative impact (positive value in change of NO_x, PM₁₀ and carbon emissions within 200 m of the Proposed Scheme).

Appraisal Summary Table (AST), local air quality calculation spreadsheets and Worksheets for Regional Air Quality and Greenhouse gas emission are provided in the Appendices.

We have used our reasonable endeavours to provide information that is correct and accurate and have discussed above the reasonable conclusions that can be reached on the basis of the information available.

6 Appendices

APPRAISAL SUMMARY TABLE - AST

Scheme: Croxley Rail Link MSBC		Preferred Option – Rail Link Lower Cost Option – Bus Link		
OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE ASSESSMENT	ASSESSMENT
ENVIRONMENT	Local Air Quality	<p>Rail Link</p> <p>There are not anticipated to be any exceedences of air quality objectives for PM₁₀ and NO₂.</p> <p>It is anticipated that the option does not affect the air quality of the six AQMAs in the Borough.</p> <p>The option leads to an increase in Annual Mean PM₁₀ concentrations at 20m from the road centre of the proposed route in excess of 1µg/m³.</p> <p>The option leads to an increase in Annual Mean NO₂ concentration at 20m from the road centre of the proposed route in excess of 2µg/m³.</p> <p>It is anticipated that 2563 properties would experience deterioration in air quality due to the introduction of trains on the rail link. Some properties (max of 846) would experience an improvement in air quality due to closure of a section of the London Underground Metropolitan Line. There is some double counting here and some of these 846 properties would also be adversely affected by the introduction of trains on the new link.</p> <p>Any property that would be demolished or constructed as part of the scheme was not considered in the TAG calculation.</p>	<p>Rail Link</p> <p>PM₁₀ Number of properties with an improvement = Max 846 Number of properties with a deterioration = 2563</p> <p>NO₂ Number of properties with an improvement = Max 846 Number of properties with a deterioration = 2563</p>	<p>Rail Link</p> <p>Exposure Score PM₁₀ = 1791.27</p> <p>Exposure Score NO₂ = 8289.08</p>

		<p><u>Bus Link</u></p> <p>There are not anticipated to be any exceedences of air quality objectives for PM₁₀ and NO₂.</p> <p>It is anticipated that the option does not affect the air quality of the six AQMAs in the Borough.</p> <p>The option does not lead to an increase in Annual Mean PM₁₀ concentrations at 20m from the road centre of the proposed route in excess of 1µg/m³</p> <p>The option does not lead to an increase in Annual Mean NO₂ concentration at 20m from the road centre of the proposed route in excess of 2µg/m³.</p> <p>It is anticipated that 22079 properties would experience deterioration in air quality and no properties would experience an improvement.</p> <p>Any property that would be demolished or constructed as part of the scheme was not considered in the TAG calculation.</p>	<p><u>Bus Link</u></p> <p>PM₁₀ Number of properties with an improvement = 0 Number of properties with a deterioration = 2079</p> <p>NO₂ Number of properties with an improvement = 0 Number of properties with a deterioration = 2079</p>	<p><u>Bus Link</u></p> <p>Exposure Score PM₁₀ = 17.51</p> <p>Exposure Score NO₂ = 107.32</p>
--	--	--	--	---

	<p>Regional Air Quality</p>	<p><u>Rail Link</u></p> <p>The change in emission of PM₁₀ is 0.5 tonnes per year for the rail route option relative to the Do Nothing in the assessment year; approximately 1.4% of PM₁₀ emissions from all transport in Watford Borough Council in 2005.</p> <p>The change in emission of NO_x is 21.1 tonnes per year for the rail route option relative to the Do Nothing in the assessment year; approximately 4.7% of NO_x emissions from all transport in Watford Borough Council in 2005.</p> <p><u>Bus Link</u></p> <p>The change in emission of PM₁₀ is 0.004 tonnes per year for the bus route option relative to the Do Nothing in the assessment year; approximately 0.01% of PM₁₀ emissions from all transport in Watford Borough Council in 2005.</p> <p>The change in emission of NO_x is 0.283 tonnes per year for the bus route option relative to the Do Nothing in the assessment year; approximately 0.06% of PM₁₀ emissions from all transport in Watford Borough Council in 2005.</p>	<p><u>Rail Link</u></p> <p>NO_x emission = 21.1 tonnes/year</p> <p>PM₁₀ emission = 0.5 tonnes/year</p> <p><u>Bus Link</u></p> <p>NO_x emission = 0.283 tonnes/year</p> <p>PM₁₀ emission = 0.004 tonnes/year</p>	<p>N/A</p>
--	------------------------------------	--	---	------------

	<p>Greenhouse Gases</p>	<p><u>Rail Link</u></p> <p>The change in emission of C (as carbon) is 572 tonnes per year for the rail route option relative to the Do Nothing in the assessment year; approximately 2.5% of C emissions from all transport in Watford Borough Council in 2005.</p> <p><u>Bus Link</u></p> <p>The change in emission of C (as carbon) is 14 tonnes per year for the bus route option relative to the Do Nothing in the assessment year; approximately 0.06% of C emissions from all transport in Watford Borough Council in 2005.</p>	<p><u>Rail Link</u></p> <p>C emission = + 572 tonnes/year</p> <p><u>Bus Link</u></p> <p>C emission = + 14 tonnes/year</p>	<p><u>Rail Link</u></p> <p>An increase in C emission compared to DN. No information is available for each of the appraisal period. Therefore no appraisal scores available.</p> <p><u>Bus Link</u></p> <p>An increase in C emission compared to DN. No information is available for each of the appraisal period. Therefore no appraisal scores available.</p>
--	--------------------------------	---	---	--

Regional Air Quality

Worksheet 1 Regional Air Quality - Strategy and Plan Level

Option Name:	Bus route	Present Year:	2007	Future Year:	2013
Tonnes per year					
	Do-Minimum		Do-Something	Do-Something compared with	
	Present	Future	Future	Present Do-Min	Future Do-Min
PM10	0	0	0.004	0.004	0.004
NO_x	0	0	0.283	0.283	0.283

Qualitative Comments: The change in emission of PM10 is 0.004 tonnes per year and change in emission of NOx is 0.283 tonnes per year for bus route option relative to the Do Nothing in the assessment year. Bus route emission is approx. 0.01% of PM10 emission and 0.06% of NOx emission from all transport in Watford Borough Council in 2005. Rail emission have not been taken into account in the assessment.

Data Sources: DMRB Screening Method 1.03 is used. Traffic information is provided by K. Smith via emails on 9 & 11 April 2008. Assumptions on AADT and average speed were made as no detailed data was available.

Worksheet 1 Regional Air Quality - Strategy and Plan Level

Option Name:	Rail route	Present Year:	2007	Future Year:	2013
Tonnes per year					
	Do-Minimum		Do-Something	Do-Something compared with	
	Present	Future	Future	Present Do-Min	Future Do-Min
PM10	0	0	0.50	0.50	0.50
NO_x	0	0	21.09	21.09	21.09

Qualitative Comments: The change in emission of PM10 is 0.5 tonnes per year and change in emission of NOx is 21.1 tonnes per year for bus route option relative to the Do Nothing in the assessment year. Rail route emission is approx. 1.4% of PM10 emission and 4.7% of NOx emission from all transport in Watford Borough Council in 2005.

Data Sources: DMRB Screening Method 1.03 is used. Traffic information is provided by K. Smith via emails on 9 & 11 April 2008. Assumptions on AADT and average speed were made as no detailed data was available.

Greenhouse Gas Emission

Worksheet 1 Environment: Greenhouse Gases - Strategy and Plan Level

Option Name:	Bus route	Present Year:	2007	Future Year:	2013
Tonnes per year					
	Do-Minimum		Do-Something	Do-Something compared with	
	Present	Future	Future	Present Do-Min	Future Do-Min
C	0	0	14	14	14
The total emission from all zones in the study area					

Qualitative Comments: The change in emission of C (as carbon) is 14 tonnes per year for bus route option relative to the Do Nothing in the assessment year. Bus route emission is approx. 0.06% of total C emission from all transport in Watford Borough Council in 2005. Rail emission have not been taken into account in the assessment.

Data Sources: DMRB Screening Method 1.03 is used. Traffic information is provided by K. Smith via emails on 9 & 11 April 2008. Assumptions of AADT and average speed were made as no detailed data was available.

Worksheet 1 Regional Air Quality - Strategy and Plan Level

Option Name:	Rail route	Present Year:	2007	Future Year:	2013
Tonnes per year					
	Do-Minimum		Do-Something	Do-Something compared with	
	Present	Future	Future	Present Do-Min	Future Do-Min
C	0	0	572	572	572
The total emission from all zones in the study area					

Qualitative Comments: The change in emission of C (as carbon) is 572 tonnes per year for rail route option relative to the Do Nothing in the assessment year. Rail route emission is approx. 2.5% of total C emission from all transport in Watford Borough Council in 2005.

Data Sources: DMRB Screening Method 1.03 is used. Traffic information is provided by K. Smith via emails on 9 & 11 April 2008. Assumptions on AADT and average speed were made as no detailed data was available.

Worksheet 1 Environment: Landscape (Preferred Rail Option)

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Pattern	<p>No strong landscape elements exist in the largely urbanised study area.</p> <p>The Croxley Green Branch runs through the most prominent landscape element in the study area, a small part of the Colne Valley Linear Park and part of the Croxley Moor Landscape Character Area within Watford. Situated within floodplain to the south east of the study area, it is characterised by a low lying mix of vegetation ranging from grassland and scrubland, with mature trees and shrubs forming belts along disused transport lines and access tracks.</p> <p>The small urbanised area of landscape in the west of the study area, along the Grand Union Canal, is an enclosed area of green space accommodating footpaths. The canal itself is a linear feature with, at times, dense vegetation lining the banks before passing under the viaduct of the Metropolitan LU rail line. This elevated rail line supports mature dense vegetation, effectively enclosing the area and limiting views. Beyond this dominant physical and visual barrier, landscape elements begin to rise gently with large fields bounded by residential development and woodland. West Herts Golf Club and Cassiobury Park (a Grade II registered park) are nearby as the urban fringe gives way to rural fields and large areas of woodland.</p>	<p>The pattern of the study area is inconsistent and disconnected. With no common features between them, the landscape areas will matter at a local level only.</p>	<p>The inconsistent patterns are common among urban fringe landscapes</p>	<p>Low at the local level.</p> <p>With no significant areas of landscape, a lack of national landscape designations and significant features in terms of pattern, the landscape is common to urban settlements.</p>	<p>Lost features of this landscape pattern can be substituted easily as no engrained patterns exist.</p>	<p>Neutral.</p>	<p>None.</p>

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Tranquillity	<p>There are limited levels of tranquillity in the study area as it is predominantly an urban environment, and as such traffic and other transport noise is constant, along with industrial and commercial activity.</p> <p>The Grand Union Canal offers a degree of remoteness and isolation compared to the busier streets, with running water, fewer people and occasional enclosure within vegetation, it is not always obvious that there is a surrounding urban area.</p> <p>Similarly the Colne Valley Linear Park offers some separation from the urban surroundings, but overall the tranquillity of the landscape elements are compromised by the urban atmosphere that surround them and no real sense of tranquillity exists.</p>	Given the urban nature of the study area, the tranquillity will matter at a local scale.	This level of disturbed tranquillity is common in urban landscapes	<p>The importance is low at the local level.</p> <p>More tranquil settings can be found in the nearby Cassiobury Park and other landscapes of around the urban fringe area.</p>	Tranquillity cannot be easily recreated.	<p>Slight adverse.</p> <p>While tranquillity is not an established feature within the landscapes, or townscape, of the study area the introduction of trains will increase disturbances, and areas such as along the Grand Union Canal where some relief from the urban environment can be found will suffer.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Cultural	<p>There are no strong cultural links known to the study area that contribute to the landscape character, with the exception of archaeological potential along the undisturbed River Colne Valley Park Area and the Grand Union Canal which forms an historic link from London to the Midlands and is valued for the recreational activities it provides and has potential for industrial archaeology. The Grade II registered Cassiobury Park is in the wider area but will not be affected by the scheme.</p>	<p>With no strong cultural landscape links evident, the existing elements are typical of the local area and will matter at the local scale.</p>	<p>The cultural elements of the landscape are common in the area.</p>	<p>Cultural importance is low at the local level.</p>	<p>Cultural elements can not normally be easily substituted.</p>	<p>Neutral.</p> <p>The scheme, using mostly an existing route/infrastructure, will not disturb any sensitive cultural areas. The new viaduct over the Grand Union Canal will replace a demolished bridge and will not significantly change the setting of this feature.</p>	<p>None.</p>

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Land cover	<p>Land cover adding to the landscape character within the study area is most notably found in the Colne Valley Linear Park area to the south east where semi natural vegetation surrounds the watercourse. A range of vegetation including grassland, scrub and mature trees and shrubs exist in a largely unmanaged setting which creates the largest green space along the Croxley Green Branch in the study area.</p> <p>Mature plantings along transport routes, particularly the elevated Metropolitan LU line and the Croxley Green Branch itself, provide green corridors through the urban setting.</p> <p>Areas of urban open space, including managed playing fields and allotment gardens, exist mostly beside the Croxley Green Branch, and add community and social value to the land cover.</p> <p>Open landscape and large blocks of woodland exist beyond the study area to the north-west and south-west within the urban fringe landscape - and the stronger landscape features in the study area are mostly part of this fringe that extends into the urban townscape.</p>	The areas which do contain landscape elements within the study area are not of exceptional quality, have no national designations and will matter at a local scale.	The scattered green space and linear plantings along transport routes are common within the area.	Land cover importance is low at the local level.	Land cover in the study area can be recreated or substituted.	<p>Neutral.</p> <p>Loss of some mature plantings will occur along the Croxley Green Branch and on the embankment where the viaduct connects to the existing rail track. However this should be replaced where possible, and the scheme will otherwise have minimal impacts on land cover.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Summary of character	<p>The landscape within the study area from Croxley Green Station to Watford High Street is limited due to the predominant townscape. Areas of landscape are typically contained and disconnected spaces within areas of development and do not display the typical features of natural or rural landscapes. The vegetated transport routes, including the Grand Union Canal and the Croxley Green Branch, provide green links to the more open landscapes that can be found, but overall the landscape elements do not combine to establish a significant landscape presence within the study area. The wider landscape in the surrounding area is more prominent as settlements are limited by floodplains and the rural landscapes of the green belt along the urban fringe, but the study area has few connections with these areas, and are instead small pockets of green space with no common use or features tying them together.</p>	<p>The disconnected landscapes in the study area are typical of urban areas, and will matter at the local scale.</p>	<p>The level and condition of landscape elements are common within urban areas.</p>	<p>Low at the local scale. No significant landscape features exist within the study area.</p>	<p>The landscape contains few features which cannot be substituted or recreated elsewhere.</p>	<p>Neutral. The proposed scheme will have minimal impacts on the limited landscape elements within the study area. Use of the existing route/ infrastructure will assist greatly in this. The most significant impacts will be to the tranquillity of the area which will see an increase in transport noise. Otherwise the few landscape elements will not be disturbed significantly.</p>	<p>None.</p>

Reference Source(s): Magic (Multi Agency Geographic Information for the Countryside), Watford District Plan Adopted 2003, The Countryside Agency's (now part of Natural England) Countryside Character Initiative – Character Area 111: Northern Thames Basin, Hertfordshire Plateaux and River Valleys, Site Visit 22/04/08

Summary assessment score: Neutral.

Qualitative comments: The study area consists predominately of townscape elements; the landscape elements that do exist, do not display the characteristics typical of open or rural countryside. Rather, the landscape elements are contained and disconnected, and bear no relationships with each other. This is typical of urban fringe landscapes, where elements may exist, but are forced to the periphery of the development, or exist cut off from other elements. The rail option will not result in any significant impacts to the relatively few landscape features in the area. Impacts are largely limited to the new viaduct over the Grand Union Canal and Watford Road, and the disturbance to the already low levels of tranquillity of the area. As the majority of the scheme is contained within the existing rail corridor, disturbances are limited and will not have any significant impacts on the landscape character of the area overall.

Worksheet 1 Environment: Landscape (Low Cost Bus Option)

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Pattern	<p>No strong landscape elements exist in the largely urbanised study area.</p> <p>The Croxley Green Branch runs through the most prominent landscape element in the study area, a small part of the Colne Valley Linear Park and part of the Croxley Moor Landscape Character Area within Watford. Situated within floodplain to the south east of the study area, it is characterised by a low lying mix of vegetation ranging from grassland and scrubland, with mature trees and shrubs forming belts along disused transport lines and access tracks.</p> <p>The small urbanised area of landscape in the west of the study area, along the Grand Union Canal, is an enclosed area of green space. The canal itself is a linear feature with, at times, dense vegetation lining the banks before passing under the viaduct of the Metropolitan LU rail line. This elevated rail line supports mature dense vegetation, effectively enclosing the area and limiting views. Beyond this dominant physical and visual barrier, landscape elements begin to rise gently with large fields bounded by residential development and woodland. West Herts Golf Club and Cassiobury Park (a Grade II registered park) are nearby as the urban fringe gives way to rural fields and large areas of woodland.</p>	<p>The pattern of the study area is inconsistent and disconnected. With no common features between them, the landscape areas will matter at a local level only.</p>	<p>The inconsistent patterns are common among urban fringe landscapes.</p>	<p>Low at the local level.</p> <p>With no significant areas of landscape, a lack of national landscape designations and significant features in terms of pattern, the landscape is common to urban settlements.</p>	<p>Lost features of this landscape pattern can be substituted easily as no engrained patterns exist.</p>	<p>Neutral.</p>	<p>None.</p>

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Tranquillity	<p>There are limited levels of tranquillity in the study area as it is predominantly an urban environment, and as such traffic and other transport noise is constant, along with industrial and commercial activity.</p> <p>The Grand Union Canal offers a degree of remoteness and isolation compared to the busier streets, with running water, fewer people and occasional enclosure within vegetation, it is not always obvious that there is a surrounding urban area.</p> <p>Similarly the Colne Valley Linear Park offers some separation from the urban surroundings, but overall the tranquillity of the landscape elements are compromised by the urban atmosphere that surround them and no real sense of tranquillity exists.</p>	Given the urban nature of the study area, the tranquillity will matter at a local scale.	This level of disturbed tranquillity is common in urban landscapes.	<p>The importance is low at the local level.</p> <p>More tranquil settings can be found in the nearby Cassiobury Park and other landscapes around the urban fringe area.</p>	Tranquillity cannot be easily recreated.	<p>Neutral.</p> <p>The introduction of buses within the townscape will have minimal impacts upon the limited sense of tranquillity available in the study area.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Cultural	<p>There are no strong cultural links known to the study area that contribute to the landscape character, with the exception of archaeological potential along the undisturbed River Colne Valley Park Area and the Grand Union Canal which forms an historic link from London to the Midlands and is valued for the recreational activities it provides and has potential for industrial archaeology. The Grade II registered Cassiobury Park is in the wider area but will not be affected by the scheme.</p>	<p>With no strong cultural landscape links evident, the existing elements are typical of the local area and will matter at the local scale.</p>	<p>The cultural elements of the landscape are common in the area.</p>	<p>Cultural importance is low at the local level.</p>	<p>Cultural elements can not normally be easily substituted.</p>	<p>Neutral. The scheme, using mostly an existing route/ infrastructure. Will not disturb any sensitive cultural areas.</p>	<p>None.</p>

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Land cover	<p>Land cover adding to the landscape character within the study area is most notably found in the Colne Valley Linear Park area to the south east where semi natural vegetation surrounds the watercourse. A range of vegetation including grassland, scrub and mature trees and shrubs exist in a largely unmanaged setting which creates the largest green space along the Croxley Green Branch in the study area.</p> <p>Mature plantings along transport routes, particularly the elevated Metropolitan LU line and the Croxley Green Branch itself, provide green corridors through the urban setting.</p> <p>Areas of urban open space, including managed playing fields and allotment gardens, exist mostly beside the Croxley Green Branch, and add community and social value to the land cover.</p> <p>Open landscape and large blocks of woodland exist beyond the study area to the north-west and south-west within the urban fringe landscape - and the stronger landscape features in the study area are mostly part of this fringe that extends into the urban townscape.</p>	The areas which do contain landscape elements within the study area are not of exceptional quality, have no national designations and will matter at a local scale.	The scattered green space and linear plantings along transport routes are common within the area.	Land cover importance is low at the local level.	Land cover in the study area can be recreated or substituted.	Neutral. Loss of some mature plantings will occur along the Croxley Green Branch. However this should be replaced where possible, and the scheme will otherwise have minimal impacts on land cover.	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Impact	Additional Mitigation
Summary of character	<p>The landscape within the study area from Croxley Green Station to Watford High Street is limited due to the predominant townscape. Areas of landscape are typically contained and disconnected spaces within areas of development and do not display the typical features of natural or rural landscapes. The vegetated transport routes, including the Grand Union Canal and the Croxley Green Branch, provide green links to the more open landscapes that can be found, but overall the landscape elements do not combine to establish a significant landscape presence within the study area. The wider landscape in the surrounding area is more prominent as settlements are limited by floodplains and the rural landscapes of the green belt along the urban fringe, but the study area has few connections with these areas, and are instead small pockets of green space with no common use or features tying them together.</p>	<p>The disconnected landscapes in the study area are typical of urban areas, and will matter at the local scale.</p>	<p>The level and condition of landscape elements are common within urban areas.</p>	<p>Low at the local scale. No significant landscape features exist within the study area.</p>	<p>The landscape contains few features which cannot be substituted or recreated elsewhere.</p>	<p>Neutral. The proposed scheme will have minimal impacts on the limited landscape elements within the study area. Use of the existing route/ infrastructure will assist greatly in this.</p>	<p>None.</p>

Reference Source(s): Magic (Multi Agency Geographic Information for the Countryside), Watford District Plan Adopted 2003, The Countryside Agency's (now part of Natural England) Countryside Character Initiative – Character Area 111: Northern Thames Basin, Hertfordshire Plateaux and River Valleys, Site Visit 22/04/08

Summary assessment score: Neutral.

Qualitative comments: The study area consists predominately of townscape elements; the landscape elements that do exist, do not display the characteristics typical of open or rural countryside. Rather, the landscape elements are contained and disconnected, and bear no relationships with each other. This is typical of urban fringe landscapes, where elements may exist, but are forced to the periphery of the development, or exist cut off from other elements. The bus way option will not result in any significant impacts to the relatively few landscape features in the area, much of the established vegetation along the Croxley Green Branch will be removed to widen the route and will initially detract from the setting, but overtime the existing green corridor will be re-established with replacement vegetation. Otherwise there will be no significant impacts on the landscape character of the area overall.

Worksheet 1 Environment: Townscape (Preferred Rail Option)

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Layout	<p>The townscape is characterised predominately by linear residential streets and light industry/commercial development, with open green spaces of the urban fringe landscape extending into the periphery of the study area. Along the Croxley Green Branch urban open spaces are concentrated either side, and feature a mix of playing fields, community gardens and infrequently managed areas of scrub or woodland. The street layout contains several 'A' roads throughout the study area with long secondary connecting roads, and smaller residential avenues and roads infilling. Newer developments, both industrial and residential, to the south of the Croxley Green Branch have a broader and more organic street layout respectively. Other transport routes such as rail lines dissect the layout of the townscape and seem to form boundaries within it. While the major routes of the M25 and the M1 exist nearby, they do not influence the townscape character directly.</p>	Matters at the local scale.	Common within the surrounding townscape.	<p>Moderate at the local level.</p> <p>Some early forms of town planning are evident within the study area, particularly to the north of the Croxley Green Branch.</p>	Can be replaced.	No future areas of development identified in the study area affecting the layout.	<p>Slight adverse.</p> <p>The addition of an elevated rail viaduct will have significant adverse visual and physical affects locally, increasing the intensity of the route layout in the affected area, and overshadow existing open space below it. However, it affects a small area overall, and the scheme as a whole will not have an impact on the pattern of the townscape layout.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Density and mix	Density of the townscape along the Croxley Green Branch varies from medium to low density. The light industrial and commercial developments in the west consist of low warehouses or office buildings on large plots, relative to the medium density housing within the residential areas either side of the rail line. Most residential properties are 2 storeys with gardens, however there are dwellings such as blocks of flats and semi detached homes within areas of the local townscape as well. Higher density development in the area can be found associated with the Watford General Hospital, and local schools and the football stadium add a mix of uses and users in the area.	Matters at the local scale.	Common within the surrounding townscape.	Medium at the local level.	Can be replaced, but not readily.	No future areas of development identified in the study area affecting the density and mix.	Neutral to slight beneficial. The scheme and additions, such as the new/upgraded stations and car park, will add to the mix of development in appropriate areas and should contribute to the vitality of the area.	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Scale	<p>Predominately residential, the scale of buildings is typically 2-3 storeys high in most areas. Linear terrace housing lined streets increase the sense of scale by limiting views and blocking the skyline in the more traditional housing areas. Other residential areas contain larger blocks of flats but sit within a more open development and retain a sense of space. The light industrial buildings are relatively low and do not crowd the view in the area, some older factory buildings sit more prominent among the older areas of the townscape.</p> <p>The hospital and football stadiums are of a scale greater than the surrounding allotments, green space and residential areas and form significant large scale elements within the pattern of the townscape.</p>	Matters at the local scale.	Common within the surrounding townscape generally, with some disproportionate variations in scale between some townscape elements.	Low at the local level.	Can be replaced.	No future areas of development identified in the study area changing the scale.	<p>Slight adverse.</p> <p>The addition of the rail viaduct will introduce a dominating element within the currently open road network of this area. Connecting the rail lines will increase the apparent scale of rail network and will result in visual impacts as it forms an intrusive and conspicuous structure in local views.</p> <p>It should be ensured that the materials and construction of the new viaduct is in keeping with the character of the Grand Union Canal.</p> <p>Other new additions will be of an appropriate scale within the existing townscape however.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Appearance	<p>The range of housing periods (including Victorian, inter-war housing, post 1950's housing developments and new builds), create the assortment of materials and styles within the study area.</p> <p>Generally across the study area however, homes are 2 storey brick houses with tiled roofs lining the streets. Variation in finishes, such as bare brick or plastered walls, allows for some individuality within the uniform housing types. Newer housing areas contain a greater range of building types (from blocks of flats to semi detached homes) but share common materials and styles. So while there is variation in housing, there are commonalities that tie them together creating distinct neighbourhoods.</p> <p>Industrial developments are typically 2-3 storey masonry or brick structures with a low but large appearance, a range of facades exist depending on their function. Some of the more recent developments are taller modern brick buildings with steel and glass fittings, distinct from the older red brick factory buildings also found in the area.</p>	Matters at the local scale.	Common within the surrounding townscape.	Medium at the local level.	Most elements can be replaced.	No future areas of development identified in the study area affecting appearance.	<p>Slight to moderate beneficial.</p> <p>The viaduct will introduce a detracting element to the western end of the study area simply due to its prominence in an already constrained area, regardless of materials. This impact will be local however, whereas elsewhere the revival of the disused track, upgraded stations and facilities will lift the overall appearance of the area, replacing the buildings and infrastructure falling into disrepair.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Human interaction	<p>Moderate levels of human interaction are catered for within the townscape - typical residential footpaths along the streets provide pedestrian access to local shops and other amenities and services in the area. Walking tracks for recreational purposes also exist, including along the Grand Union Canal and access within the Colne Valley Linear Park. Socially oriented interactions are associated with the community public spaces in the area that are often adjacent to the Croxley Green Branch itself, such as allotment gardens and playing fields. Higher levels of human interaction will occur around public facilities like the hospital, and events at the football stadium will lead to temporarily higher levels of pedestrians.</p>	Matters at the local scale.	Common within the surrounding townscape.	Medium at the local level.	Can be replaced.	No areas of development identified in the study area affecting human interaction.	<p>Slight Beneficial.</p> <p>The scheme will improve connections within the townscape and should increase human interaction locally, with positive effects for the area.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Cultural	<p>The surrounding townscape contains some important cultural elements. Historical areas with Edwardian and Victorian housing create small districts of distinctive streets compared to the newer post 1950's housing, industrial buildings and recent commercial developments. The range of buildings, styles and dates (from Victorian housing to modern developments such as the hospital) help to create the older districts distinctiveness, which contributes greatly to the variety of character and charm within the townscape. Additionally, the Grand Union Canal at the western end of the study area forms an historical development, connecting London to the Midlands, and provides for recreational activities.</p>	Matters at the local scale.	Adds a level distinctiveness from the wider surrounding townscapes.	Medium to High at a local level.	Areas of the townscape with cultural significance cannot be replaced easily, if at all.	No future areas of development identified in the study area affecting cultural elements.	<p>Neutral.</p> <p>The scheme will not have any significant impacts on any identified cultural aspects of the townscape. Utilising existing route/ infrastructure prevents disturbance among valued areas. The new viaduct over the Grand Union Canal will replace an existing one, neutralising the potential to over crowd this area.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Land use	<p>Land use is varied across the study area, however residential areas are most common, with light industrial/commercial areas forming the next most frequent land use.</p> <p>Other uses adding to the character include the higher level of urban open space (allotments and playing fields) along the Croxley Green Branch, compared to the wider townscape. These areas are used for recreation and social interaction.</p> <p>Facilities such as the football stadium and the hospital add further community use to the townscape.</p>	Matters at the local scale.	Common within the surrounding townscape.	Low at the local level.	Can be replaced.	No future areas of development identified in the study area affecting land use.	<p>Neutral</p> <p>The scheme will overall have little impact on land use, as it largely uses the existing the route/ infrastructure.</p> <p>The new viaduct will have negative implications to existing land use, as it will overshadow a playground and demolish an existing building (Cinnamond House). This may encourage changes to existing use in the area.</p> <p>Positive impacts will also be realised with the new car parking facilities and stations replacing some neglected areas.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Summary of character	<p>The character of the townscape in the study area is shaped by the mix of use and range of housing styles and dates across the area. The industrial and commercial areas, community facilities and public spaces provide diversity of use and function in the area, which helps to maintain a good level of human interaction between the areas. Street patterns and layout also reflect both the use and era of the differing areas across the townscape. Landscape elements increase with the rural/urban fringe of the greenbelt and surround the settlement further to the north-west and the south of the study area limiting the spread of the townscape.</p> <p>While the scope of influences and features seen to be adding to the character is diverse in terms of land use and the range of building periods and patterns, it is not exceptional within the wider surrounding townscapes of Watford.</p>	Matters at the local scale.	<p>Typically common within the surrounding townscape.</p> <p>No elements of the townscape are particularly rare and may be found in townscapes in the wider area.</p>	<p>Medium at the local level.</p> <p>Some elements of the townscape have particular value outside the local community.</p>	<p>Generally townscape elements can be replaced; however some such as cultural have limited opportunities to do so.</p>	<p>No significant or obvious changes have been identified as occurring.</p>	<p>Slight beneficial.</p> <p>The proposed scheme will have no significant widespread impact upon the townscape character. As much of the scheme is to use existing route/ infrastructure physical disruptions are minimised. Localised impacts of a higher magnitude will occur, but will not affect the townscape as a whole.</p> <p>Overall the scheme should benefit the townscape character, primarily through lifting the appearance and introducing new interactions and vitality with in it.</p>	None.

Reference Source(s): Magic (Multi Agency Geographic Information for the Countryside), Watford District Plan Adopted 2003, The Countryside Agency's (now part of Natural England) Countryside Character Initiative – Character Area 111: Northern Thames Basin, Hertfordshire Plateaux and River Valleys, Site Visit 22/04/08

Summary assessment score: Slight Beneficial

Qualitative comments: The elements and features present within the townscape of the study area are typical of the surrounding area. Areas of particular value, such as the historical Victorian and Edwardian housing areas, will not receive impacts as a result of this scheme. Overall, the revival of the Croxley Green Branch and the removal of

derelict buildings and infrastructure will benefit the adjacent townscape character through a lift in appearance and improved interactions within it. There are negative impacts associated with the new viaduct over the Grand Union Canal and Watford Road but these will be localised. Overall the reinstatement of the rail line minimises any adverse impacts through the use of the existing route, avoiding any physical disruptions to the townscape fabric and the scheme will be a benefit to the area.

Worksheet 1 Environment: Townscape (Low Cost Bus Option)

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Layout	<p>The townscape is characterised predominately by linear residential streets and light industry/commercial development, with open green spaces of the urban fringe landscape extending into the periphery of the study area. Along the Croxley Green Branch urban open spaces are concentrated either side, and feature a mix of playing fields, community gardens and infrequently managed areas of scrub or woodland.</p> <p>The street layout contains several 'A' roads throughout the study area with long secondary connecting roads, and smaller residential avenues and roads infilling. Newer developments, both industrial and residential, to the south of the Croxley Green Branch have a broader and more organic street layout respectively. Other transport routes such as rail lines dissect the layout of the townscape and seem to form boundaries within it. While the major routes of the M25 and the M1 exist nearby, they do not influence the townscape character directly.</p>	Matters at the local scale.	Common within the surrounding townscape.	<p>Moderate at the local level.</p> <p>Some early forms of town planning are evident within the study area, particularly to the north of the Croxley Green Branch.</p>	Can be replaced.	<p>No future areas of development identified in the study area affecting the layout.</p>	<p>Neutral.</p> <p>The scheme, largely using existing route/ infrastructure, will not alter any townscape patterns significantly other than a shift from the traditional rail mode to buses.</p> <p>Overall there are benefits and detractions.</p> <p>The minor modifications to the street layout to convert and connect the rail line will add depth to the pattern, and add further connections within the townscape.</p> <p>However measures to accommodate the buses within the town centre are likely to lead to adverse impacts on movement in this area.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Density and mix	Density of the townscape along the Croxley Green Branch varies from medium to low density. The light industrial and commercial developments in the west consist of low warehouses or office buildings on large plots, relative to the medium density housing within the residential areas either side of the rail line. Most residential properties are 2 storeys with gardens, however there are dwellings such as blocks of flats and semi detached homes within areas of the local townscape as well. Higher density development in the area can be found associated with the Watford General Hospital, and local schools and the football stadium add a mix of uses and users in the area.	Matters at the local scale.	Common within the surrounding townscape.	Medium at the local level.	Can be replaced, but not readily.	No future areas of development identified in the study area affecting the density and mix.	Neutral. The scheme will have no significant impact on the density and mix of the townscape.	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Scale	<p>Predominately residential, the scale of buildings is typically 2-3 storeys high in most areas. Linear terrace housing lined streets increase the sense of scale by limiting views and blocking the skyline in the more traditional housing areas. Other residential areas contain larger blocks of flats but sit within a more open development and retain a sense of space. The light industrial buildings are relatively low and do not crowd the view in the area, some older factory buildings sit more prominent among the older areas of the townscape.</p> <p>The hospital and football stadiums are of a scale greater than the surrounding allotments, green space and residential areas and form significant large scale elements within the pattern of the townscape.</p>	Matters at the local scale.	Common within the surrounding townscape generally, with some disproportionate variations in scale between some townscape elements.	Low at the local level.	Can be replaced.	No future areas of development identified in the study area changing the scale.	<p>Neutral.</p> <p>The scheme will not have any significant impacts upon the scale of the townscape. Additions are limited to bus stops and traffic signals and no intrusive or out of scale structures are to be introduced.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Appearance	<p>The range of housing periods (including Victorian, inter-war housing, post 1950's housing developments and new builds), create the assortment of materials and styles within the study area.</p> <p>Generally across the study area however, homes are 2 storey brick houses with tiled roofs lining the streets. Variation in finishes, such as bare brick or plastered walls, allows for some individuality within the uniform housing types. Newer housing areas contain a greater range of building types (from blocks of flats to semi detached homes) but share common materials and styles. So while there is variation in housing, there are commonalities that tie them together creating distinct neighbourhoods.</p> <p>Industrial developments are typically 2-3 storey masonry or brick structures with a low but large appearance, a range of facades exist depending on their function. Some of the more recent developments are taller modern brick buildings with steel and glass fittings, distinct from the older red brick factory buildings also found in the area.</p>	Matters at the local scale.	Common within the surrounding townscape.	Medium at the local level.	Most elements can be replaced.	No future areas of development identified in the study area affecting appearance.	<p>Slight beneficial.</p> <p>The scheme will revive the Croxley Green Branch, remove derelict stations and lift the appearance of the study area around the Croxley Green Branch.</p> <p>Re-grading of the cutting in some areas will result in a loss of the vegetated cover, but should be replaced in time.</p> <p>Traffic signals and other road measures to accommodate the buses may have result in slight detractions from the streetscapes.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Human interaction	Moderate levels of human interaction are catered for within the townscape - typical residential footpaths along the streets provide pedestrian access to local shops and other amenities and services in the area. Walking tracks for recreational purposes also exist, including along the Grand Union Canal and access within the Colne Valley Linear Park. Socially oriented interactions are associated with the community public spaces in the area that are often adjacent the Croxley Green Branch itself, such as allotment gardens and playing fields. Higher levels of human interaction will occur around public facilities like the hospital, and events at the football stadium will lead to temporarily higher levels of pedestrians.	Matters at the local scale.	Common within the surrounding townscape.	Medium at the local level.	Can be replaced.	No areas of development identified in the study area affecting human interaction.	Slight Beneficial. The scheme will improve connections within the townscape and should increase human interaction locally, with positive effects for the area.	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Cultural	The surrounding townscape contains some important cultural elements. Historical areas with Edwardian and Victorian housing create small districts of distinctive streets compared to the newer post 1950's housing, industrial buildings and recent commercial developments. The range of buildings, styles and dates (from Victorian housing to modern developments such as the hospital) help to create the older districts distinctiveness, which contributes greatly to the variety of character and charm within the townscape. Additionally, the Grand Union Canal in the western end of the study area forms an historical development, connecting London to the Midlands, and provides for recreational activities.	Matters at the local scale.	Adds a level distinctiveness from the wider surrounding townscapes.	Medium to High at a local level.	Areas of the townscape with cultural significance cannot be replaced easily, if at all.	No future areas of development identified in the study area affecting cultural elements.	Neutral. The scheme will not have any significant impacts on any identified cultural aspects of the townscape. Utilising existing route/ infrastructure minimises disturbance among valued areas.	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Land use	<p>Land use is varied across the study area, however residential areas are most common, with light industrial/commercial areas forming the next most frequent land use.</p> <p>Other uses adding to the character include the higher level of urban open space (allotments and playing fields) along the Croxley Green Branch, compared to the wider townscape. These areas are used for recreation and social interaction.</p> <p>Facilities such as the football stadium and the hospital add further community use to the townscape.</p>	Matters at the local scale.	Common within the surrounding townscape.	Low at the local level.	Can be replaced.	No future areas of development identified in the study area affecting land use.	<p>Neutral</p> <p>Other than the transport mode shift from rail to buses along the Croxley Green Branch, the scheme will have little impact upon land use in the area.</p>	None.

Features	Description	Scale it matters	Rarity	Importance	Substitutability	Changes in do minimum	Impact	Additional Mitigation
Summary of character	<p>The character of the townscape in the study area is shaped by the mix of use and range of housing styles and dates across the area. The industrial and commercial areas, community facilities and public spaces provide diversity of use and function in the area, which helps to maintain a good level of human interaction between the areas. Street patterns and layout also reflect both the use and era of the differing areas across the townscape. Landscape elements increase with the rural/urban fringe of the greenbelt and surround the settlement further to the north-west and the south of the study area limiting the spread of the townscape.</p> <p>While the scope of influences and features seen to be adding to the character is diverse in terms of land use and the range of building periods and patterns, it is not exceptional within the wider surrounding townscapes of Watford.</p>	Matters at the local scale.	<p>Typically common within the surrounding townscape.</p> <p>No elements of the townscape are particularly rare and may be found in townscapes in the wider area.</p>	<p>Medium at the local level.</p> <p>Some elements of the townscape have particular value outside the local community.</p>	<p>Generally townscape elements can be replaced; however some such as cultural have limited opportunities to do so.</p>	<p>No significant or obvious changes have been identified as occurring.</p>	<p>Neutral to slight beneficial.</p> <p>The proposed scheme will have no significant widespread impact upon the townscape character. As much of the scheme is to use an existing route/infrastructure, physical disruptions are minimised.</p> <p>Overall the scheme will benefit the townscape though the general lift in appearances and services, although there will be some negative implications within the town centre to accommodate bus services.</p>	None.

Reference Source(s): Magic (Multi Agency Geographic Information for the Countryside), Watford District Plan Adopted 2003, The Countryside Agency's (now part of Natural England) Countryside Character Initiative – Character Area 111: Northern Thames Basin, Hertfordshire Plateaux and River Valleys, Site Visit 22/04/08

Summary assessment score: Neutral to Slight Beneficial

Qualitative comments: The elements and features present within the townscape of the study area are typical of the surrounding area. Areas of particular value, such as the historical Victorian and Edwardian housing areas, will not receive impacts as a result of this scheme. Overall, the re-use of the Croxley Green Branch and the removal of

derelict buildings and infrastructure will benefit the adjacent townscape character through a lift in appearance and improved interactions within it. The sense of rejuvenation in the area will be slightly offset by the impact of accommodating the buses within the existing townscape of the town centre.

Croxley Rail Link – Preferred Option: Rail Link					
TAG Unit 3.3.9 The Heritage of Historic Resources Sub-Objective					
Feature	Description	Scale it matters.	Significance	Rarity	Impact
Form	Historic urban topography of Medieval Watford – streets, roads and other thoroughfares, Grand Union canal, property boundaries, especially former 'burgage plots', market places, Cassiobury Grade II Registered Park, historic street furniture especially public structures such as water troughs, clocks and market crosses, other areas with special functions such as burial grounds and industrial areas. Open areas along River Colne and Gade valleys. St. Mary's Churchyard and Estcourt Conservation areas. Watford Underground Station built 1925 in Arts and Crafts style to suit the then rural surroundings of the Watford branch of the Metropolitan Railway.	The heritage resource contributes to policy commitments at a national, regional and local level.	Scheduled Monuments and Listed Buildings are of national importance. The Conservation areas and historic park and gardens are of regional and local significance.	All aspects of the heritage resource within the study area are not rare within a national and local context.	There may be a slight adverse impact on the form of the cultural heritage resource if Croxley Green station and the permanently disused section of the Green branch line, Watford Metropolitan Station and northern section of Met line, Watford West Station and Watford Stadium station are demolished and decommissioned. Potential for adverse impacts on the setting of Estcourt conservation area. Potential benefits on railway heritage and furniture from reinstatement of the disused rail line from Ascot Road to Watford High Street station.
Survival	The form, scale and layout of the heritage resource is as expected for an urban/industrial developed landscape of the 19 th and 20 th centuries. There is potential for good survival of prehistoric remains within the deeper alluvial layers of the Gade and Colne Valleys. Medieval deposits not likely to have survived 19 th /20 th century development.	Preservation of the cultural heritage resource is a material consideration in national policy guidance.	The survival of the heritage resource is average.	The survival of the heritage resource is not rare.	As above. In addition the construction of a car park at Ascot Road and new stations may adversely affect below ground remains.
Condition	The condition of the heritage resource is variable as expected for the state of preservation of an urban/industrial developed landscape.	Preservation of the condition is a material consideration in the management of the heritage resource.	The condition of the heritage resource is average.	The condition of the heritage resource is not rare.	There will be a slight adverse impact on the condition of the heritage resource if the northern end of the Met line falls into disrepair (viaduct).
Complexity	The complexity of the heritage resource is average for the type and periods represented by the heritage resource.	The complexity of the heritage resource matters at regional and local level.	The complexity of the heritage resource is nationally, regionally and locally significant.	The complexity of the heritage resource is not rare.	There will be a neutral impact on the complexity of the heritage resource.

Croxley Rail Link – Preferred Option: Rail Link					
TAG Unit 3.3.9 The Heritage of Historic Resources Sub-Objective					
Feature	Description	Scale it matters.	Significance	Rarity	Impact
Context	The context of the heritage resource is generally compromised, but the overall integrity and intelligibility of the individual assets are generally recognisable.	The context of the heritage resource matters at a regional and local level.	The context of the heritage resource is significant at a national regional and local level.	The context of the heritage resource is not rare.	There will be a slight adverse impact on the context of the heritage resource due to demolition of stations and decommissioning of the northern end of the Met line.
Period	All periods from the Palaeolithic to the post-medieval and modern period are represented within the study area.	The period of the heritage resource matters at a national regional and local level.	The period is significant at a national, regional and local level.	The periods represented within the heritage resource are not rare.	There will be a neutral impact on the period of the heritage resource

Reference Sources: Croxley Rail Link Archaeological Desk-Based Assessment (Network Archaeology Limited January 2002), Supplementary Planning Guidance SPG 28 Watford: Historic Environment Character Statement and Guidance

Summary Assessment Score: Slight Adverse

Qualitative comment: The assessment is based on historical desk-based sources, minimal design information and the site has not been visited. The assessment score assumes adequate and appropriate mitigation of adverse impacts on the known and potential heritage resource, without the benefit of any site survey/intrusive evaluation to more accurately assess the potential for heritage resource

Croxley Rail Link – Low cost alternative					
TAG Unit 3.3.9 The Heritage of Historic Resources Sub-Objective					
Feature	Description	Scale it matters.	Significance	Rarity	Impact
Form	Historic urban topography of Medieval Watford – streets, roads and other thoroughfares, Grand Union canal, property boundaries, especially former 'burgage plots', market places, Cassiobury Grade II Registered Park, historic street furniture especially public structures such as water troughs, clocks and market crosses, other areas with special functions such as burial grounds and industrial areas. Open areas along River Colne and Gade valleys. St. Mary's Churchyard and Estcourt Conservation areas. Watford Underground Station built 1925 in Arts and Crafts style to suit the then rural surroundings of the Watford branch of the Metropolitan Railway.	The heritage resource contributes to policy commitments at a national, regional and local level.	Scheduled Monuments and Listed Buildings are of national importance. The Conservation areas and historic park and gardens are of regional and local significance.	All aspects of the heritage resource within the study area are not rare within a national and local context.	Slight adverse impacts may result if Croxley Green Station, the permanently disused section of the Green Branch line, Watford West Station and Watford Stadium Station are demolished A neutral impact is likely to result from the retention and continued use of Watford Metropolitan Station and the northern section of the Metropolitan line (ensures maintenance of viaduct as with do min). Potential adverse impacts on the setting of Estcourt conservation area. Adverse impacts on railway heritage and furniture from the permanent conversion of the disused rail link to a road.
Survival	The form, scale and layout of the heritage resource is as expected for an urban/industrial developed landscape of the 19 th and 20 th centuries. There is potential for good survival of prehistoric remains within the deeper alluvial layers of the Gade and Colne Valleys. Medieval deposits not likely to have survived 19 th /20 th century development.	Preservation of the cultural heritage resource is a material consideration in national policy guidance.	The survival of the heritage resource is average.	The survival of the heritage resource is not rare.	As above.
Condition	The condition of the heritage resource is variable and as expected for the state of preservation of an urban/industrial developed landscape.	Preservation of the condition is a material consideration in the management of the heritage resource.	The condition of the heritage resource is average.	The condition of the heritage resource is not rare.	There will be a neutral impact on the condition of the heritage resource.
Complexity	The complexity of the heritage resource is average for the type and periods represented by the heritage resource.	The complexity of the heritage resource matters at regional and local level.	The complexity of the heritage resource is nationally, regionally and locally significant.	The complexity of the heritage resource is not rare.	There will be a neutral impact on the complexity of the heritage resource.
Context	The context of the heritage resource is generally compromised, but the overall integrity and intelligibility of the individual assets are generally recognisable.	The context of the heritage resource matters at a regional and local level.	The context of the heritage resource is significant at a national regional and local level.	The context of the heritage resource is not rare.	There will be a neutral impact on the context of the heritage resource.

Croxley Rail Link – Low cost alternative					
TAG Unit 3.3.9 The Heritage of Historic Resources Sub-Objective					
Feature	Description	Scale it matters.	Significance	Rarity	Impact
Period	All periods from the Palaeolithic to the post-medieval and modern period are represented within the study area	The period of the heritage resource matters at a national regional and local level	The period is significant at a national, regional and local level	The periods represented within the heritage resource are not rare	There will be a neutral impact on the period of the heritage resource

Reference Sources: Croxley Rail Link Archaeological Desk-Based Assessment (Network Archaeology Limited January 2002), Supplementary Planning Guidance SPG 28 Watford: Historic Environment Character Statement and Guidance

Summary Assessment Score: Slight Adverse

Qualitative comment: The assessment is based on historical desk-based sources, minimal design information and the site has not been visited. The assessment score assumes adequate and appropriate mitigation of adverse impacts on the known and potential heritage resource, without the benefit of any site survey/intrusive evaluation to more accurately assess the potential for the heritage resource

Worksheet 1 Environment: Biodiversity - Plan Level

Scheme / option: Croxley Rail Link, Preferred Option: Rail link between London Metropolitan Line and Watford Junction Station

Area	Description of feature / attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment score
Croxley Common Moor Site of Special Scientific Interest (SSSI)	Series of meadows, marshland, trees and woodland along the banks of the River Gade.	National	High – assemblage of species and habitats including several rare species.	Lowland dry acid grassland is a UKBAP priority habitat due to massive declines in the past.	High	Neutral	Neutral
Lairage Land Local Nature Reserve (LNR)	A group of meadows by the river Colne, comprising rough grassland, plantation woodland and scrub; the river Colne, and its margins, and reedbed. Bird species include: whitethroat, green woodpecker, grey wagtail, reed warbler, linnet, chiffchaff, blackcap, swift, swallow, house-martin and cuckoo. Bats include both species of pipistrelle and noctule.	Local	Medium	Certain habitats, e.g. reedbeds are declining nationally and are UKBAP priority habitats. Certain species, e.g. linnet, noctule and soprano pipistrelle are declining nationally and are UKBAP priority species.	Medium	Minor negative	Slight adverse
Broad-leaved woodland	Secondary woodland of relatively recent origin. Mostly ash or sycamore dominated with occasional or locally frequent oak, wild cherry, willows, birch, apple and field maple. Much of this woodland can be considered to be mature (i.e. with trees of stem diameter > 20 cm.).	Local	Medium	Lowland mixed deciduous woodland is a UKBAP priority habitat.	Lower	Minor negative	Slight adverse
Grassland	Rank grassland dominated by false oat-grass often accompanied by red fescue and very occasionally cat's-ear, yarrow and ribwort plantain. The grassland is generally not particularly species-rich.	Local	Medium	Stable	Negligible	Major negative	Neutral
Scrub	Small scattered patches along with some larger areas of dense bramble.	Local	Medium	Stable	Negligible	Minor negative	Neutral
Reptiles	No records of reptiles from study area, but habitat is suitable, particularly for grass snake. Grass snake, common lizard and slow worm known from 10 km grid square.	Local	Medium	Grass snake, common lizard and slow worm all UKBAP priority species due to population declines.	Lower	Major negative	Slight adverse
Great crested newt (GCN)	Surveys in 2002 and 2003 failed to detect GCN from study area, but habitat is suitable. GCN known from 10 km grid square.	Local	Medium	GCN is a UKBAP priority species due to population declines.	Lower	Major negative	Slight adverse

Area	Description of feature / attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment score
Bats	Initial bat survey undertaken at suboptimal season (late-October) in 2003 found no evidence of bats in the trees, hedges or built structures within study area. Maternity bat roost (pipistrelle) known from ~150 metres north of route at Croxley Marina Railway Bridge (TQ088961). Habitats along route are likely to be of value for commuting/foraging bats.	Local	Medium	Certain bat species, e.g. noctule, brown long-eared and soprano pipistrelle are declining nationally and are UKBAP priority species.	Lower	Minor negative	Slight adverse
Birds	No survey undertaken. Habitats likely to support typical range of suburban / woodland species, possibly including UKBAP species.	Local	Medium	Certain bird species, e.g. song thrush, linnets and dunnocks are UKBAP priority species.	Lower	Minor negative	Slight adverse
Badgers	Field surveys in 2003 and 2004 found signs of badger activity along route but no permanently occupied setts. Active setts were found nearby and disused setts were found along the route. The route provides potentially optimal habitat for badger setts and foraging.	Local	Medium	Stable	Lower	Minor negative	Slight adverse
Croxley Green Branch (i.e. the disused railway)	Wildlife corridor for a range of species.	Local	Medium	Urbanisation of wider area means that surviving green wildlife corridors are of increased value.	Medium	Minor negative	Slight adverse

Reference Source(s): THIS ASSESSMENT HAS BEEN BASED ON OLD SURVEY INFORMATION (I.E. MOSTLY DATED 2000 TO 2004) AND LIMITED DESK-BASED STUDY. THE INFORMATION PRESENTED HERE MUST THEREFORE BE TREATED WITH CAUTION.

Summary assessment score: MODERATE ADVERSE.

Qualitative comments: THIS ASSESSMENT IS BASED ON INCOMPLETE INFORMATION.

Worksheet 1 Environment: Biodiversity - Plan Level

Scheme / option: Croxley Rail Link, Low Cost Option: Segregated Busway

Area	Description of feature / attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment score
Croxley Common Moor Site of Special Scientific Interest (SSSI)	Series of meadows, marshland, trees and woodland along the banks of the River Gade.	National	High – assemblage of species and habitats including several rare species.	Lowland dry acid grassland is a UKBAP priority habitat due to massive declines in the past.	High	Neutral	Neutral
Lairage Land Local Nature Reserve (LNR)	A group of meadows by the river Colne, comprising rough grassland, plantation woodland and scrub; the river Colne, and its margins, and reedbed. Bird species include: whitethroat, green woodpecker, grey wagtail, reed warbler, linnet, chiffchaff, blackcap, swift, swallow, house-martin and cuckoo. Bats include both species of pipistrelle and noctule.	Local	Medium	Certain habitats, e.g. reedbeds are declining nationally and are UKBAP priority habitats. Certain species, e.g. linnet, noctule and soprano pipistrelle are declining nationally and are UKBAP priority species.	Medium	Minor negative	Slight adverse
Broad-leaved woodland	Secondary woodland of relatively recent origin. Mostly ash or sycamore dominated with occasional or locally frequent oak, wild cherry, willows, birch, apple and field maple. Much of this woodland can be considered to be mature (i.e. with trees of stem diameter > 20 cm.).	Local	Medium	Lowland mixed deciduous woodland is a UKBAP priority habitat.	Lower	Minor negative	Slight adverse
Grassland	Rank grassland dominated by false oat-grass often accompanied by red fescue and very occasionally cat's-ear, yarrow and ribwort plantain. The grassland is generally not particularly species-rich.	Local	Medium	Stable	Negligible	Major negative	Neutral
Scrub	Small scattered patches along with some larger areas of dense bramble.	Local	Medium	Stable	Negligible	Minor negative	Neutral
Reptiles	No records of reptiles from study area, but habitat is suitable, particularly for grass snake. Grass snake, common lizard and slow worm known from 10 km grid square.	Local	Medium	Grass snake, common lizard and slow worm all UKBAP priority species due to population declines.	Lower	Major negative	Slight adverse
Great crested newt (GCN)	Surveys in 2002 and 2003 failed to detect GCN from study area, but habitat is suitable. GCN known from 10 km grid square.	Local	Medium	GCN is a UKBAP priority species due to population declines.	Lower	Major negative	Slight adverse

Area	Description of feature / attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment score
Bats	Initial bat survey undertaken at suboptimal season (late-October) in 2003 found no evidence of bats in the trees, hedges or built structures within study area. Maternity bat roost (pipistrelle) known from ~150 metres north of route at Croxley Marina Railway Bridge (TQ088961). Habitats along route are likely to be of value for commuting/foraging bats.	Local	Medium	Certain bat species, e.g. noctule, brown long-eared and soprano pipistrelle are declining nationally and are UKBAP priority species.	Lower	Minor negative	Slight adverse
Birds	No survey undertaken. Habitats likely to support typical range of suburban / woodland species, possibly including UKBAP species.	Local	Medium	Certain bird species, e.g. song thrush, linnets and dunnocks are UKBAP priority species.	Lower	Minor negative	Slight adverse
Badgers	Field surveys in 2003 and 2004 found signs of badger activity along route but no permanently occupied setts. Active setts were found nearby and disused setts were found along the route. The route provides potentially optimal habitat for badger setts and foraging.	Local	Medium	Stable	Lower	Minor negative	Slight adverse
Croxley Green Branch (i.e. the disused railway)	Wildlife corridor for a range of species.	Local	Medium	Urbanisation of wider area means that surviving green wildlife corridors are of increased value.	Medium	Minor negative	Slight adverse

Reference Source(s): THIS ASSESSMENT HAS BEEN BASED ON OLD SURVEY INFORMATION (I.E. MOSTLY DATED 2000 TO 2004) AND LIMITED DESK-BASED STUDY. THE INFORMATION PRESENTED HERE MUST THEREFORE BE TREATED WITH CAUTION.

Summary assessment score: MODERATE ADVERSE.

Qualitative comments: THIS ASSESSMENT IS BASED ON INCOMPLETE INFORMATION.

TAG Worksheet for Impact Assessment Stage 1

TAG Unit 3.3.11

Worksheet 2 Environment: Water Environment - Strategy Level

PREFERRED SCHEME

Objectives	Positive, Negative or Insignificant Impact
<p>Environmental Capital Based Objectives: 1. Source Protection Zone (SPZ1) surrounding the project area. 2. Construction in the 1 in 100 year floodplain.</p>	<p>1. Negative Impact: The areas in the vicinity of the project sites are served by the water abstraction zone in Watford-Croxley area. The local environment - general health of people residing in the area could be impacted due to the pollution risk posed by construction activity proposed in the area. Careful planning will be required during construction as well as operation phases of the project to protect the groundwater in the project area. The water supply in the project may be disrupted during the construction phase. Alternative supply arrangements have to be provided prior to the construction work. 2. Negative Impact: The proposed scheme will result in fill in 100-year floodplain and adversely impact flood levels and peak flows in the area. It will be required to provide compensatory floodplain storage in the vicinity of the project site to mitigate the impacts.</p>
<p>Regional Objectives: 1. Water Quality in River Colne & River Gade Water 2. Flood levels and peak discharges in River Colne & River Gade</p>	<p>Negative to Neutral Impact: 1. The construction activity and routine runoff may cause slight adverse impact on the water quality of these rivers due to discharge of pollutants. This may further impact the local ecology in the area. Pollution control measures should be incorporated in the design to mitigate these impacts. 2. Construction in the floodplain may cause flood levels and peak flows in these rivers to rise. However, the mitigation measures discussed could reduce the risk of flooding in downstream side of the project site.</p>
<p>National Objectives: 1. Surface Water Quality in Colne & Thames Region</p>	<p>Neutral to Insignificant: 1. River Colne outfalls into River Thames via Wraysbusy River. The local pollution caused in River Colne may be mitigated during its course of flow before the flow reaches River Thames.</p>

TAG Worksheet for Impact Assessment Stage 1

TAG Unit 3.3.11

Worksheet 2 Environment: Water Environment - Strategy Level

LOW COST OPTION

Objectives	Positive, Negative or Insignificant Impact
Environmental Capital Based Objectives: 1. Source Protection Zone (SPZ1) surrounding the project area. 2. Construction in the 1 in 100 year floodplain.	1. Negative Impact: The areas in the vicinity of the project sites are served by the water abstraction zone in Watford-Croxley area. The local environment - general health of people residing in the area could be impacted due to the pollution risk posed by construction activity proposed in the area. Careful planning will be required during construction as well as operation phases of the project to protect the groundwater in the project area. The water supply in the project may be disrupted during the construction phase. Alternative supply arrangements have to be provided prior to the construction work. 2. Negative Impact: The proposed scheme will result in fill in 100-year floodplain and adversely impact flood levels and peak flows in the area. It will be required to provide compensatory floodplain storage in the vicinity of the project site to mitigate the impacts.
Regional Objectives: 1. Water Quality in River Colne & River Gade Water 2. Flood levels and peak discharges in River Colne & River Gade	Negative to Neutral: 1. The construction activity and routine runoff may cause slight adverse impact on the water quality of these rivers due to discharge of pollutants. This may further impact the local ecology in the area. Pollution control measures should be incorporated in the design to mitigate these impacts. 2. Construction in the floodplain may cause flood levels and peak flows in these rivers to rise. However, the mitigation measures discussed could reduce the risk of flooding in downstream side of the project site.
National Objectives: 1. Surface Water Quality	Neutral to Insignificant: 1. River Colne outfalls into River Thames via Wryatsby River. The local pollution caused in River Colne may be mitigated during its course of flow before it reaches River Thames.

Reference Sources:

1. Croxley Rail Link Major Scheme Business Case, Hertfordshire County Council, February 2008
2. Croxley Rail Link Design Specifications Report, Mouchel Parkman Consulting, March 2006
3. Environment Agency Website: www.environment-agency.gov.uk

Summary Assessment Score:

Environmental Capital Based Objectives - Negative

Regional Objectives - Negative to Neutral

National Objectives - Neutral to Insignificant

Qualitative Comments:

1. The preliminary assessment indicates that the adverse impacts are more significant in immediate vicinity of the project site and may be transferred to the Colne River catchment.
2. The significance of these impacts becomes less pronounced at the regional and national scale and the type of impact (neutral or negative) is very similar for the preferred and low cost options.
3. Detailed investigations and modelling should be taken up as the scheme progresses and suitable mitigation measures and best management practices should be incorporated in the design.

TAG Worksheet for Impact Assessment Stage 1

TAG Unit 3.3.11

Worksheet 1 Environment: Water Environment - Plan Level

PREFERRED OPTION

Description of study area/ Summary of potential impacts	Feature	Attributes/Services	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
Description of Study Area	River Colne, River Gade & GUC	Chemical & Biological Water quality	Good Quality (RE2) - River Colne Fair Quality (RE3/RE4) - River Gade Poor Quality (RE4/RE5) - GUC	Medium	Medium	Limited	Medium	Minor	Insignificant
The project is located between Croxley and Watford Junction. The study area is of urban nature. The important surface water features include River Gade, GUC and River Colne. The area is well connected by bus routes and rail network (overland and underground).									
Potential Impacts	Groundwater	Groundwater vulnerability	Highly vulnerable due to permeability and presence of SPZ1; groundwater levels not known.	High	High	Limited	High	Minor	Significant
Surface water pollution due to construction and operation.									
Groundwater pollution due to high permeability and presence of source protection zone.									
Presence of 1 in 100 yr floodplain.	Floodplain	Conveyance of flood flows	Presence of 1 in 100-year floodplain	Medium	Medium	Limited	Moderate	Major	Significant

LOW COST OPTION

Description of study area/ Summary of potential impacts	Feature	Attributes/Services	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
Description of Study Area	River Colne, River Gade & GUC	Chemical & Biological Water quality	Good Quality (RE2) - River Colne Fair Quality (RE3/RE4) - River Gade Poor Quality (RE4/RE5) - GUC	Medium	Medium	Limited	Medium	Minor	Insignificant
The project is located between Croxley and Watford Junction. The study area is of urban nature. The important surface water features include River Gade, GUC and River Colne. The area is well connected by bus routes and rail network (overground and underground).									
Potential Impacts	Groundwater	Groundwater vulnerability	Highly vulnerable due to permeability and presence of SPZ1; groundwater levels not known.	High	High	Limited	High	Moderate	Highly Significant
Surface water pollution due to construction and operation.									
Groundwater pollution due to high permeability and presence of source protection zone.									
Presence of 1 in 100 yr floodplain.	Floodplain	Conveyance of flood flows	Presence of 1 in 100-year floodplain	Medium	Medium	Limited	Moderate	Major	Significant

TAG Worksheet for Impact Assessment Stage 1

TAG Unit 3.3.11

Worksheet 1 Environment: Water Environment - Plan Level

Reference Sources:

1. Croxley Rail Link Major Scheme Business Case, Hertfordshire County Council, February 2008
2. Croxley Rail Link Design Specifications Report, Mouchel Parkman Consulting, March 2006
2. Environment Agency Website: www.environment-agency.gov.uk

Summary Assessment Score:

Preferred Option	Slight Adverse Impact
Low Cost Option	Moderate Adverse Impact

Qualitative Comments:

1. The above impact assessment of proposed transport options on the Water Environment in Watford area is based on project background information and preliminary desktop research.
2. Further detailed assessment will be required using recommended methods as the scheme progresses. This will include consultation with the Environment Agency and stake holders, site visits and field investigations and modelling of various scenarios with and without the mitigation measures.
3. Although the results of this preliminary assessment indicate slight to moderate adverse impacts on the water environment, these impacts could be mitigated using appropriate design methods and best management practices.

ENVIRONMENT: PHYSICAL FITNESS

Activity Duration per day	Change in Number of People	
	Pedestrians	Cyclists
Less than 30 minutes	Not modelled but some expected	Not relevant
Greater than 30 minutes	Not relevant	Not relevant

Reference source(s):

Not relevant

Summary assessment score:

Neutral

Qualitative comments:

The closure of Watford Met station will result in a proportion of existing users walking further to the neighbouring Ascot Road station, but similarly there will be passengers who will walk less, and the overall impact on existing users is expected to be neutral. Other users who transfer from bus are not expected to have significant changes to their walking activity. The modelling work undertaken does not quantify car transfer, as this is forecast to be a small proportion of the total demand. Increasing the choice of destinations served by the Metropolitan Line and improving links to other parts of Watford from Watford Junction may encourage more people to make their journey by public transport. Although new passengers would typically have to walk to the station for their journey, thereby increasing the overall number of people who walk and having a positive impact on physical fitness, the overall rating would be assessed as neutral under NATA guidelines. The scheme is not likely to have significant impacts on the number of people who walk more than 30 minutes a day or on cyclists.

ENVIRONMENT: JOURNEY AMBIENCE

Factor	Sub-factor	Better	Neutral	Worse
Traveller Care	Cleanliness	X		
	Facilities	X		
	Information	X		
	Environment	X		
Travellers' Views	-	X		
Traveller Stress	Frustration	X		
	Fear of potential accidents	X		
	Route uncertainty	X		

Reference source(s):

Not relevant

Summary assessment score:

Moderate beneficial

Qualitative comments:

For users who transfer from bus, Croxley Rail Link provides significant improvement in service quality and information to the high standards set by London Underground Limited. This includes standard LUL carriages which will provide a good level of comfort for passengers, real time travel information and be maintained on a regular basis. The existing track would be repaired to provide a good ride quality that will also be a marked improvement compared to existing bus provisions. The proposed viaduct linking the Croxley Branch and the Metropolitan Line will introduce a new view of the area for passengers.

Passengers transferring from heavy rail are unlikely to have significant ambience benefits over the long term, given that London Overground have plans to improve journey ambience of Silverlink Metro stations.

ASSESSMENT OF SECURITY SUB-OBJECTIVE

Security Indicator	Relative importance (High/Medium/Low)	Without strategy (Poor/Moderate/High)	With strategy (Poor/Moderate/High)
Site perimeters, entrances and exits	High	Moderate	High
Formal surveillance	High	Poor	High
Informal surveillance	Medium	Medium	High
Landscaping	Low	Medium	High
Lighting and visibility	High	Medium	High
Emergency call	High	Poor	High

Approximate numbers of users affected:

700,000 passengers per annum (who transfer from bus)

Overall assessment of impact on Security sub-objective:

Moderate beneficial

Reference source(s):

Not relevant

Qualitative comments:

The station environment will be designed in accordance to TfL's station design standards and guidance to ensure that a high level of security and of passenger-perceived security will be provided. There will be a variety of measures implemented to enhance safety and security including CCTV, passenger help and information points, and lighting in addition to the presence of staff on vehicles and at stations.

ACCESSIBILITY - SEVERANCE

Change in Severance	Population Affected	
	A411 Exchange Rd/ Beechen Grove	Total Affected
Large negative		
Moderate negative		
Slight negative		
Neutral		
Slight positive		
Moderate positive	Approx. 900	Approx. 900
Large positive		

Reference source(s):

Not relevant

Assessment score:

Slight beneficial

Qualitative comments:

As the Croxley Rail Link alignment is an existing railway alignment and (new) viaduct, no pedestrian or cycle movements will be adversely affected by the scheme. The scheme utilises an existing transport corridor and can provide improved access. The provision of a new walkway between Watford High Street Station and the Harlequin Shopping Centre has the benefit of improving pedestrian access and reducing the severance effects of the town centre ring road.

INTEGRATION - PASSENGER INTERCHANGE

Passenger Interchange Indicator	Without strategy (Poor/Moderate/High)			With strategy (Poor/Moderate/High)
	Standard (Bus)	Standard (Underground)	Standard (Busway)	
Waiting environment	Poor	High	Moderate	High
Level of facilities	Poor	High	High	High
Level of information	Poor	High	High	High
Visible staff presence	Poor	Moderate	Moderate	High
Physical linkage for next stage of journey	Moderate	High	Moderate	High
Connection time and risk of missing a connection	Poor	Moderate	Poor	Moderate

Approximate numbers of users affected:

700,000 passengers per annum (strategic demand of Croxley Rail Link)

Overall assessment of passenger interchange impact:

Strong beneficial

Reference source(s):

Not relevant

Qualitative comments:

There will be direct access to national rail for Metropolitan Line users at Watford Junction for West Coast Main Line services north to the Midlands, North West and Scotland and south to London. There will be direct access to local rail services to north (Hemel Hempstead, Leighton Buzzard) and south (Harrow, Queens Park, Euston). Integration with these services will provide direct connections to Heathrow, Birmingham International, Gatwick, Luton and Stansted Airports.

The Croxley Green branch line is seamlessly integrated into the existing LUL network; providing direct access from Watford Junction through central London and providing easy interchange to other parts of the London Underground network. Closure of the existing Watford Met Station will adversely impact a minority of existing users.

There will be improved bus interchange opportunities at Ascot Road, Watford High Street and Watford Junction. The introduction of the Croxley Rail Link scheme may also negate the need for some interchange movements altogether. A Park & Ride site has been identified at Ascot Road. Redevelopment at Watford Junction will include significant parking provision and potentially at Croxley and Moor Park for access to Watford.

Provision is to be made at all stations for cycle parking. Cycles are also allowed on Metropolitan Line trains off-peak. The introduction of stations close to residential catchments should encourage walk-in traffic.

The station environment will be designed in accordance to TfL's station design standards and guidance to ensure that high quality interchange environment, information and facilities will be provided.

INTEGRATION - FREIGHT INTERCHANGE

Freight Indicator	Without strategy (Poor/Moderate/High)	Without strategy (Poor/Moderate/High)
Reliability (at the interchange facilities only)	Not Relevant	Not Relevant
Level of facilities for freight users	Not Relevant	Not Relevant
Freight transfer	Not Relevant	Not Relevant
Timetabling, connections, co-ordination	Not Relevant	Not Relevant
Level of information for freight users	Not Relevant	Not Relevant
Freight security at the interchange	Not Relevant	Not Relevant

Approximate numbers of users affected:

None

Overall assessment of passenger interchange impact:

Neutral

Reference source(s):

Not relevant

Qualitative comments:

Croxley Rail Link does not result in any specific impact on freight movements.

INTEGRATION - LAND-USE POLICY

Land-Use Policies or Proposals	
Local	The Preferred Scheme will contribute beneficially to all identified local land use policies and strategies. Beneficial contributions will also be made to all associated locally proposed schemes.
Regional	The Preferred Scheme will contribute beneficially to all of the identified regional land use policies and strategies.
National	The Preferred Scheme will contribute beneficially to all of the identified national land use policies and strategies.

Reference source(s):

The policy fit of Croxley Rail Link was reviewed with respect to various national, regional and local policies. It was concluded that the proposals were consistent with land use policy and therefore were assessed as beneficial.

Local	Assessment Score
Hertfordshire Local Transport Plan 2006/07 - 2010/11	Beneficial
Local Development Framework - Core Strategy, Three Rivers District Council (June 2006)	Beneficial
Three Rivers Local Plan - 1996-2011(adopted 2002)	Beneficial
Planning Now for Hertfordshire's Future- Deposit Draft Version (February, 2003) Hertfordshire Structure Plan 2001-2016	Beneficial

Regional	Assessment Score
Regional Funding Allocations - Advice to the Government from the East of England (January 2006)	Beneficial
Sustainable Futures - Integrated Regional Strategy for the East of England, East of England Regional Assembly, (October 2005)	Beneficial
East of England Plan - Draft Revision to the Regional Spatial Strategy (RSS) for the East of England, EERA (December 2004)	Beneficial
Regional Planning Guidance for the East of England (RPG 14) - Draft Strategy, (February, 2004)	Beneficial
A Shared Vision - the Regional Economic Strategy for the East of England (November 2004)	Beneficial
Our Environment Our Future - The Regional Environment Strategy for the East of England, The East of England Regional Assembly and the east of England Environment Forum, (July 2003)	Beneficial
A Sustainable Development Framework for the East of England, EERA, (October 2001)	Beneficial
The London Plan - Spatial Development Strategy for Greater London, (February, 2004)	Beneficial
RPG9 - Regional Planning Guidance for the South East, (March 2001)	Beneficial

National	Assessment Score
Delivering Better Transport: Priorities for 2006-07 to 2008-09 (DfT, 2005)	Beneficial
PPS6 - Town Centres and Retail Developments, (ODPM, 2005)	Beneficial
Future of Transport White Paper (DfT, 2004)	Beneficial
Making the Connections - Final Report by the Social Exclusion Unit (ODPM 2003)	Beneficial
The Ten Year Plan (DETR, 2000)	Beneficial

Assessment score:

Beneficial

Qualitative comments:

The Watford area lies at the boundary of the East of England and Greater London regions and as such is affected by the plans and policies of both these regions. While the Watford area lies in Hertfordshire County within the East of England region, it also falls within the M25 motorway and is directly or indirectly linked to Central London by various transport modes. Given the location of Watford both regions have been considered.

Beneficial contributions will also be made by other locally proposed schemes. Access to Watford Junction will be improved by 2012 as part of the Watford Junction Improvement project, including a new multi-storey car park and access road, promoting park and ride usage of the station and improving access to the station for all modes. This will result in more trips made with a rail/ Underground leg which would have been entirely by car previously. Recent traffic management schemes in Watford town centre have meant that car use has been discouraged and walking has been made easier for pedestrians. This has resulted in an increase in the attractiveness of public transport modes; further similar measures are proposed to be introduced if this application for funding the Croxley Rail Link is successful.

INTEGRATION - OTHER GOVERNMENT POLICY

Government Department	Policies Helped	Policies Hindered
Department for Communities and Local Government	Our Towns and Cities: The Future - Delivering an Urban Renaissance	n/a
Department for Environment, Food and Rural Affairs	A Better Quality of Life, the Strategy for Sustainable Development Working Together for Clean Air, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland	n/a
Department for Innovation, Universities and Skills	Education and Skills: Delivering Results, A Strategy to 2006 Equality and Diversity National Skills Strategy Success for All	n/a
Department for Transport	Future of Transport White Paper (2004) Delivering Better Transport: Priorities for 2006-07 to 2008-09 (2005) The London Plan - Spatial Development Strategy for Greater London, (2004)	n/a
Department for Work and Pensions	Opportunity for All	n/a
Department of Health	The NHS Plan	n/a
Department for Culture, Media & Sport	The Historic Environment: A Force for our Future A New Commitment to Neighbourhood Renewal: A National Strategy Action Plan	n/a
Cabinet Office	Making the connections: Final Report on transport and social exclusion from the Social Exclusion Unit	n/a
HM Treasury	Fiscal Policy: A New Framework for Public Investment 2007 Spending Review	n/a
ODPM	PPS6: Town Centres and Retail Developments PPG13: Transport	n/a

Reference source(s):

As in table above

Assessment score:

Beneficial

Qualitative comments:

The schemes have been appraised against the Other Government Policy sub-objective based on the examination of alignment/consistency with key policy documents and their objectives. The policies listed above cover a range of areas including housing, regeneration, environmental protection, education, social justice, health, heritage, neighbourhood renewal, social exclusion, economic growth and public expenditure.