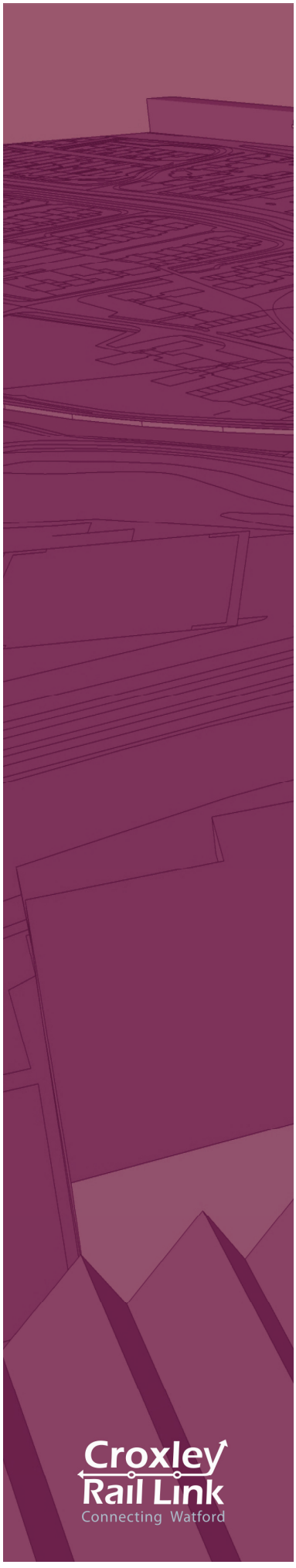

Croxley Rail Link
Connecting Watford

Scheme Development Report

September 2011

Croxley Rail Link
Connecting Watford

Hertfordshire

NetworkRail

UNDERGROUND

THREE RIVERS DISTRICT COUNCIL

WATFORD BOROUGH COUNCIL

Croxley Rail Link

Scheme Development Report

Report

September 2011

Prepared for:
Hertfordshire County Council
Hertfordshire County Council
Highways House
41-45 Broadwater Road
Welwyn Garden City
AL7 3SP

Prepared by:
Steer Davies Gleave
28-32 Upper Ground
London SE1 9PD

+44 (0)20 7910 5000
www.steerdaviesgleave.com

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1 Introduction

Background

1.1 The Croxley Rail link project has been under development for over 16 years. The scheme was first developed by London Underground Limited (LUL) who prepared the initial business case, demand forecasts, and engineering feasibility and design work from 1994 to 1997. Since then Hertfordshire County Council (HCC) has taken overall responsibility of the project and in conjunction with LUL submitted a Major Scheme Business Case (MSBC)to the Department for Transport (DfT) in 2008. The DfT then requested further work on the business case, which was completed and re-submitted in the latest 2009 MSBC.

1.2 In 2010, a new government was elected and announced a Comprehensive Spending Review in which all major transport projects were re-appraised to ensure value for money, strategic fit and deliverability. Following this, the Croxley Rail Link has been invited to submit a Best and Final Funding Bid (BAFB) to the DfT.

1.3 This report describes the development of the Croxley Rail link project from the scheme defined in the 2009 MSBC to the BAFB. A number of changes have been made to the schemewith the aim of maximising value for money. This includes the consideration of options identified in the January 2011 Expression of Interest (EoI) document. This report is intended to document and explain the process of scheme development for the Croxley Rail Link, describing the steps taken to develop and improve the scheme taking account of the objectives of the new government.

1.4 This report sets out the changes in scope, design and engineering considered and undertaken. The report also provides a consideration of the impacts of these changes on the original objectives of the scheme, and explains the rationale for choosing to make or reject each change.

Report Objectives

1.5 Theobjectives of this report are:

- To describes the changes to the project from the 2009 MSBC to the BAFB;
- To draw together various technical value engineering / design option exercises into a single non-technical summary;
- To show the options that have been considered, both pursued and abandoned and the rationale;
- To provide an estimate of the cost savings achieved through the scheme development process from the 2009 MSBC to the BAFB, and
- To provide an assessment of the impact of the changes on the achievement of the scheme objectives, deliverability, timescales, costs and other factors.

Structure of the Report

1.6 The rest of this report is structured as follows:

- **Section 2 – Scheme Overview** provides a description of the project in its original 2009 MSBC form, including a description of the main elements of the scheme, and capital costs.
- **Section 3 – BAFB Scheme Development** provides a description of the process of scheme development explaining how the project has been developed from MSBC to BAFB.
- **Section 4 – Cost Savings** provides a full account of the cost savings achieved through the BAFB scheme development process.
- **Section 5 – Performance Against Objectives** provides a comparative assessment of the MSBC and BAFB scheme against the stated objectives for the project.

Summary

1.7 In summary the scope of the project remains largely the same as the 2009 MSBC, however the design and construction of the scheme has been altered to maximise value by reducing the design specification. Significant changes to the project include:

- Reductions in the level of provision and finishing quality at the new Ascot Road and Watford Hospital stations.
- Reductions in the level of provision and finishing quality at Watford High Street, and Watford Junction stations including the omission of platform lengthening and a staff accommodation building.
- The removal of a rail turning section at Watford Hospital station and the retention of the Watford Metropolitan line section for use as a reversing facility.
- Consequent reductions in design, assurance, risk and project management costs.
- Some increases in cost due to design and provision requirements unforeseen at the MSBC stage.

1.8 Overall these changes will reduce the capital cost of the scheme by £5.2m relative to the MSBC cost estimate.

2 Scheme Overview

2.1 The 2009 MSBC for the Croxley Rail Link proposed adiversion of the Watford Branch of the Metropolitan Line to Watford Junction via Watford High Street. New stations were proposed on the new rail link at Ascot Road, which would form a park and ride site for the area and Watford General Hospital.

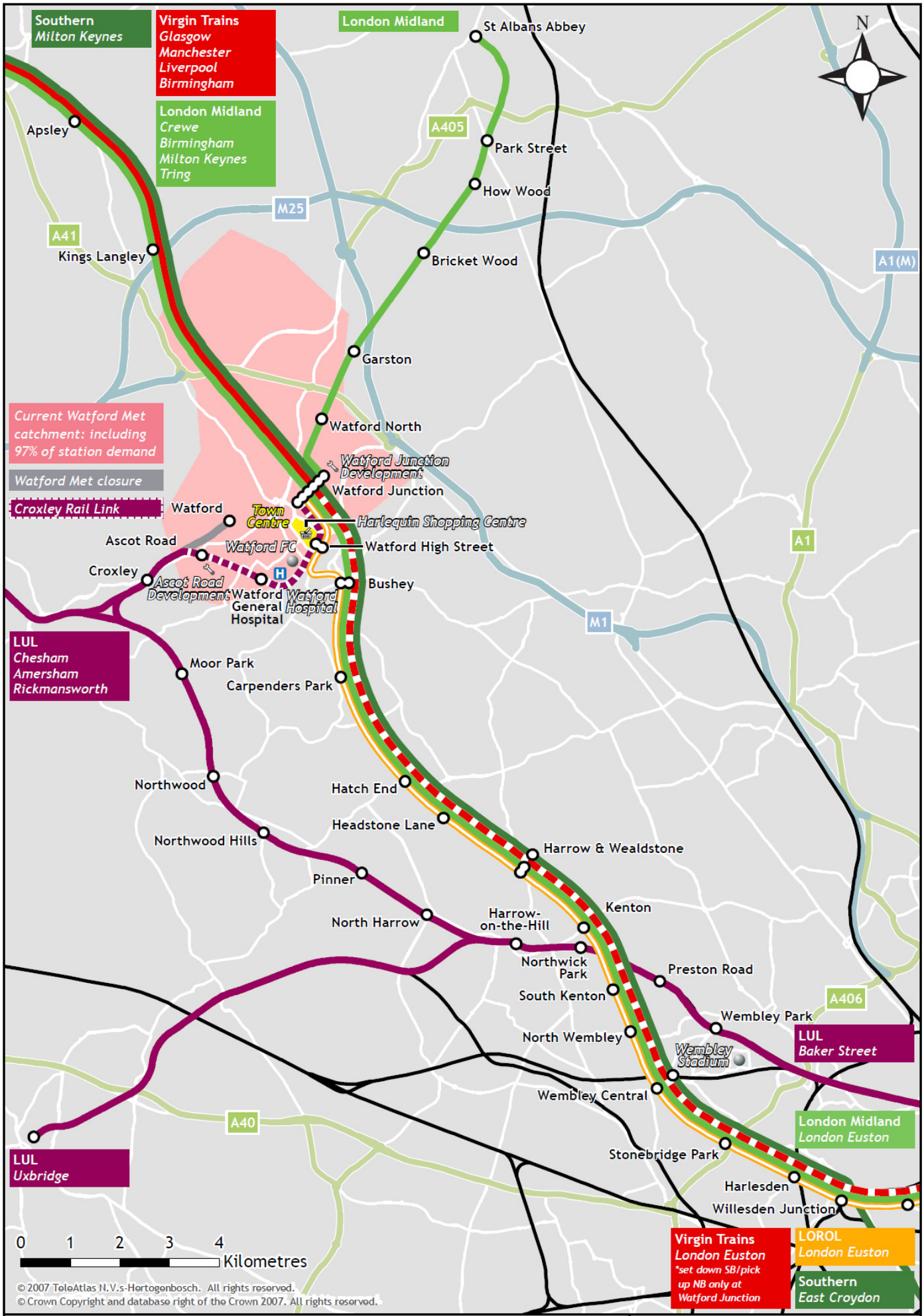
2.2 As part of the scheme the existing Metropolitan Line alignment to the current Watford terminus would be closed to passengers, with services diverted to Watford Junction. The link would be achieved by providing an embankment and viaduct from the Croxley rail line across Watford road passing between the A412 roundabouts and over the Grand Union Canal and Gade River and joining onto the disused rail link.

2.3 The Link would be served by diverting services at Watford Metropolitan station to Watford Junction via Watford High Street and the new stations at Ascot Road and Watford Hospital. This would give a frequency on the Croxley Rail Link of up to six trains per hour in the peak, and four in the interpeak.

2.4 The following bullet points summarise the key scope of work required to deliver the 2009 MSBC Croxley Rail Link:

- A viaduct and embankment linking the current Metropolitan Line 1.3km south of the existing Watford terminus to the disused rail alignment between Croxley and Watford High Street;
- The reinstatement of double track on the disused Croxley alignment, including a new junction with the Watford Junction to London Euston DC route at Watford High Street;
- Work to bring the bridges, cuttings and embankments on the disused Croxley alignment into operational use;
- New stations at Ascot Road and Watford General Hospital; and
- An additional rolling stock unit to deliver the extended services.

2.5 A map showing the current rail network in the Watford area, the proposed Croxley Rail Link and the section of the Watford Metropolitan Line alignment linking to Watford Met that will close is shown overleaf. A more detailed map of the viaduct and station locations is also shown on the following page.



Croxley Rail Link

Overview

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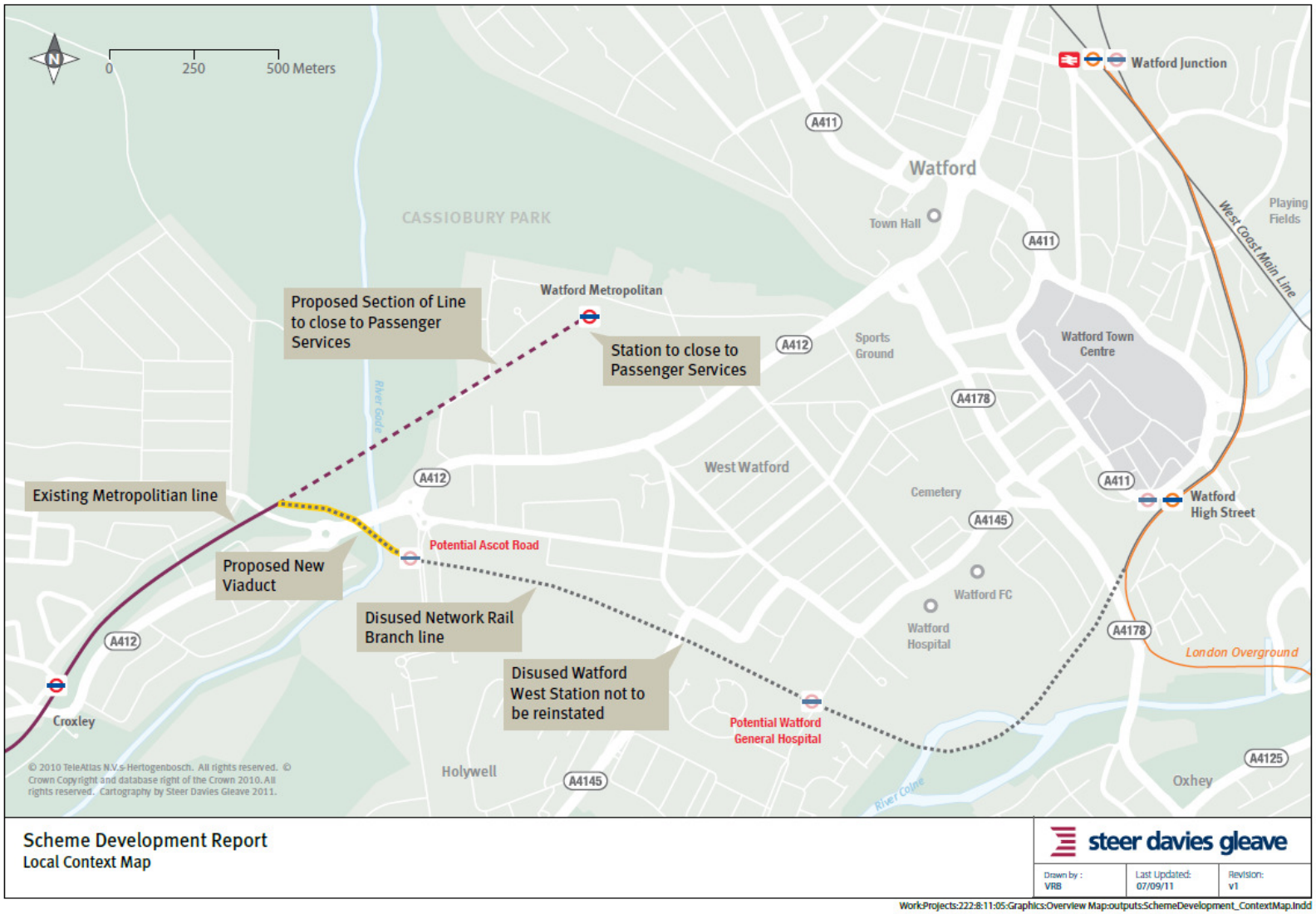
N
0
250
500 Meters
Watford Junction
A411
Watford
CASSIOBURY PARK
Town Hall
Playing Fields
West Coast Main Line
Watford Metropolitan
Proposed Section of Line to close to Passenger Services
Station to close to Passenger Services
A412
Sports Ground
Watford Town Centre
A4178
River Gade
West Watford
Cemetery
A411
Watford High Street
Existing Metropolitan line
A412
A4145
Potential Ascot Road
Proposed New Viaduct
Watford FC
Watford Hospital
Disused Network Rail Branch line
A4178
London Overground
A412
Croxley
Disused Watford West Station not to be reinstated
Potential Watford General Hospital
A4125
Holywell
A4145
River Colne
Oxhey
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Scheme Development Report
Local Context Map
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Drawn by : VRB
Last Updated: 07/09/11
Revision: v1
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2009 MSBC Scheme Definition

2.6 The main civil infrastructure work required for the 2009 MSBC Croxley Rail Link includes:

- 4.5km of new railway track;
- A 0.4km embankment and viaduct over Watford Road, Grand Union Canal and River Gade linking the Metropolitan Line and the Croxley Green Branch;
- New stations at Ascot Road and Watford General Hospital;
- Upgrading of Watford High Street& Watford Junction stations;
- Maintenance of Tolpits Lane, Vicarage Road and Wigenhall Road Overbridges.

2009 MSBC Capital Costs

2.7 In the 2009 MSBC the total capital cost of the project was estimated at £111.8m (2007 prices). A breakdown of thecost estimates by item is shown in Table 2.1.

TABLE 2.1 2009 MSBC SCHEMECOST BREAKDOWN

Cost Item	£M 2007 Prices
Construction Costs	51.87
Preliminaries	11.02
Contractor Overheads	4.72
Design	4.00
Project Management	3.35
Assurance	1.89
Third Party Costs	7.78
Possession Costs	0.50
Land Costs	4.00
Public Inquiry	1.00
Vehicle Costs	8.30
Third Party Compensation	0.25
Monitoring and Evaluation	0.43
Scheme Costs Excluding Risk	99.11
Risk Allowance from QRA	12.70
Total	**111.81**

Rail Link Funding Requirement

2.8 The forecast funding requirement, assuming construction spend in 2013/14 and 2014/15 was estimated at £172m, including risk allowance. These cost estimates were based on a real inflation assumption of 2.5% per year and did not include optimism bias.

3 BAFBScheme Development

3.1 Since the 2009 MSBC the scheme scope and design has been examined to ensure maximum value for money for the project, subject to achieving the objectives of the project and meeting the operational and health & safety requirements of Network Rail and London Underground.

3.2 The costs included in the 2009 MSBC were based on estimates developed in the Mouchel Parkmen (now Mouchel) Consolidated Cost Review, undertaken in 2007. These costs were based on a level of detail consistent with the programme entry stage. The scheme development process has meant that the design of the project has progressed significantly since then. Accordingly, the accuracy and detail of the latest BAFB cost estimates is now considerably developed.

Development Process Overview

3.3 This scheme development process has involved three elements:

- Changes to **Design Standards**applied to the project, agreed through discussions with Network Rail and London Underground;
- Improved**Design Detail**aspart of the development of the Transport Works Act Order (TWAO); and
- An intensive **Value Engineering Exercise**.

3.4 The changes to **Design Standards** has involved a re-examination of therequirements of the project including the level of provision at stations and of key scheme components such as the viaduct and permanent way. The improvements to**Design Detail** has developedthe detail and accuracy of the project plans.

3.5 The **Value Engineering Exercise** has involved several tasks, including:

- A high level consideration of changes to the scope of the project;
- A series of Value Engineering Workshops involving London Underground, Network Rail& Hertfordshire County Council to assessand agree changes to the design of the project and to ensure all possible costs savings have been considered;
- Design reviews with London Underground and Network Rail to ensure the minimum level of station, track& service provision compatible with those organisations operational and health & safety requirements;
- A whole scale update of the level of provision, cost& risk estimates for all elements of the project sufficient to support BAFB and TWAO applications; and reflecting the updated design; and
- Development of the detail and accuracy of the estimated scheme costs from ‘Strategic’ to ‘Outline’ level.

Design Standards

3.6 The 2009 MSBC cost estimates included costs for two new stations at Ascot Road and Watford Hospital. The 2010 EOI document proposed that these stations would

be Docklands Light Rail (DLR) type stations representing the minimum level of station provision - with no permanent staff and automated ticket machines for example. Following negotiations with London Underground (LU), this level of provision has been revised and upgraded to meet LU's minimum requirements.The standard included within the BAFB is higher than the DLR type stationproposed within the EOI, but still represents a significant cost saving on LU's standard requirements. As a result a number of cost savings have been made from the MSBC estimates.

3.7 However a greater understanding of the requirements of the project, including the level of pedestrian flows and health and safety and operational requirements means that some costs have risen. These costs relate to the following points:

- London Underground requires the provision of staffed stations at Ascot Road and Watford Hospital. This has increased the design and operating costs of the stations and their associated structures.
- The inclusion of costs related to new signage at other London Underground station to identify the changes to the underground network.

Design Detail

3.8 The design development has resulted in a significant progression of the project and specifically:

- Moving from RIBA stage B to RIBA stage C for the design of London Underground serviced stations at Ascot Road and Watford Hospital; and
- Moving from GRIP stage 2 to GRIP stage 3 for the design of Watford High Street station.

3.9 Through this process a number of scheme costs have changed between MSBC and BAFB. These changes relate to the following points:

- A requirement to provide an electrical substation as part of the project which was not foreseen at the MSBC stage;
- An increase in signalling costs; and
- A reduction in telecommunication costs;

Value Engineering Exercise

3.10 The scheme development process has involved a high level review of the scope of the project, and an ongoingvalue engineering exercise to ensure that value for money has been maximised wherever possible. This process has secured a potential significant reduction in project costs. **These proposed changes are described below.**

Watford Hospital Station

3.11 Several changes to the original scope and design have been made at Watford Hospital. These changes include:

- Reduction in the size of the buildings, to the minimum possible level of provision;
- Reduction in the quality of station finishing;

- Reduction in CCTV provision; and
- Increased use of pre-fabricated materials in station construction.

Ascot Road Station

3.12 Similarly several changes to the scope and design have been made at Ascot Road. These changes include:

- Reusing the station gates from Watford Metropolitan station;
- Reduction in the quality of station finishing; and
- Reducing the length of platform canopy.

Watford High Street

3.13 Changes to the scope and design of improvements to Watford High Street station, including:

- Omitting the platform extensions;
- Omitting concrete paviours; and
- Omitting services to platform extensions.

Watford Junction

3.14 Changes to the scope and design of improvements to Watford Junction. These include:

- Omitting extensions to platforms 1&2;
- Omitting additional platform benches;
- Omitting new platform totems
- Omitting additional welfare provision on platform 1&2; and
- Reduction in the level of additional signage.

Other Savings

3.15 A number of further costs savings have been identified, including:

- A reduction in the provision of Permanent Way by removing turn back facilities at Watford Hospital station and retaining the Watford Metropolitan line section as a reversing facility.
- A reduction in the level of design, project management, land and assurance costs (as a result of the reduction in scheme scope and design.
- Reduced land costs as a result of the reduced scope of station design.

3.16 As a result of the increases design detail, and the progression to more detailed RIBA and GRIP design stages, the level of cost risk in the project has also significantly reduced.

3.17 In response to DfT question regarding the possibility of not extending the platforms at Watford High Street and Watford Junction Stations, our initial response was to confirm that it would be contrary to Network Rail's standards to have trains overhanging the platforms and, that for operational reasons the platforms would need to be extended at Watford Junction station.

3.18 The issue has been re-visited and it has been agreed with Network Rail that a risk based approach can be taken in conjunction with industry partners. A key change

to the stabling proposals at Watford Junction removes an operational constraint previously identified which enables us to adopt the working assumption on platform extensions set out above.

3.19 The value engineering exercise is on-going and will continue into the detailed design and construction stages. Table 3.1 summarises the changes made to the project from these considerations for the BAFB, including the rationale and a summary assessment of the impact on the objectives of the scheme.

TABLE 3.1 VALUE ENGINEERING EXCERCISE

Change	Rationale& Impact
Reduction of design scope at Watford Hospital	Changes to the design of Watford Hospital station include reducing the size of station buildings, reducing the finish quality and the level of CCTV coverage and omission of turning facilities. These changes will slightly reduce the overall quality of the station but the level of provision for staff and travellers remains unchanged. Overall the changes will not have a significant impact on the objectives of the project.
Reduction of design scope at Ascot Road station	Changes to the design of Ascot Road station include re-using the ticket machines from Watford Metropolitan station (which will be closed as part of the scheme), reducing the finish quality and providing a shorter platform canopy. These changes will slightly reduce the overall quality of the station, but overall will not have a significant impact of the objectives of the project.
Reduction of design scope at Watford High Street	Changes to the design of Watford High Street include omitting the planned platform extensions, associated services and concrete paviours. These changes will reduce the maximum capacity of the station but provision will remain more than sufficient to meet forecast demand. The overall impact on scheme objectives is not likely to be significant. A risk assessment will be undertaken to confirm the impact of this change.
Reduction of design scope at Watford Junction	Changes to the design of Watford Junction include omitting extensions to platforms 1 & 2, omitting the provision of staff accommodation, platform benches and other welfare provisions. The impact of the changes is a reduction in the level of station quality and service, particular for members of staff, along with an increased performance risk. Apart from the platform extension omission, the overall impact on scheme objectives is not significant.
Permanent Way	By removing the turn-back facility at Watford Hospital station there is a significant reduction in the level of permanent way required for the scheme, this will reduce scheme costs. This change could have a significant impact on the operational flexibility of the service which will be mitigated by using the Watford Metropolitan line as a stabling facility.
Reduction in Design Costs	The reduction in project design scope (for example the omission of the staff accommodation building through shared provision at Watford Junction) means that there is a significant reduction design requirements for the project. This cost saving has no impact on the objectives of the project.
Reduction in Project Management Costs	The reduction in project design scope also reduces the project management costs of the scheme. This cost saving has no impact on the objectives of the project.
Reduction in Assurance Costs	The reduction in project design scope also reduces the assurance costs of the scheme. This cost saving has no impact on the objectives of the project.
Reduction in LU Preliminary Costs	The reduction in project design scope reduces the preliminary costs for London Underground. This cost saving has no impact on the objectives of the project.

Reduced Land Costs	As a result of the reduced design scope of the project, including the omission of employee accommodation at Watford Junction, and platform extensions at Watford High Street and Watford Junction, the land costs of the project have been reduced. This saving will have no impact on the objectives of the project.

Other Changes Considered

3.20 In addition to the costs savings identified above, a number of other changes have been considered. These changes have not been pursued for a variety of reasons but are described here to illustrate the extent of the value engineering exercise and to demonstrate that all possible options have been considered as part of this process.

Single Track Viaduct

3.21 Consideration has been given to the provision of a single track viaduct instead of the proposed double track structure. However, the size of the viaduct would only be marginally reduced and the resultant cost saving would be relatively small.

3.22 Critically, this option would severely restrict the operational flexibility of the rail link at times of disruption and would create a performance risk for the service. On this basis, scope reduction to a single track viaduct has not been pursued.

Embankment

3.23 Providing an embankment in place of the viaduct was considered. This would reduce the design & engineering costs of the project, however the size and length of the embankment means that the overall cost saving would not be significant.

3.24 The option would also have significant impacts on the objectives of the scheme, including a major visual impact on the surrounding area. It would also drastically alter ground levels and increase the risk and severity of flooding on the River Gade. The option has not been pursued.

Stations

3.25 Reducing the number of stations constructed from the two planned at Ascot Road and Watford General Hospital was considered. However, this would result in a significant reduction in the benefits of the scheme. There is no site available that would allow these distinct functions to be fulfilled at a single station.

3.26 Ascot Road will contain a park and ride site whilstWatfordHospital combines a local walk-in catchment with access to the hospital. The areas around both stations are also expected to see large amounts of development in future years.

3.27 Although no developments are ultimately dependent on the delivery of the project, both stations support development schemes in their local area. These sites include the recently occupied western end of Whippendell Road, including a new Travel Inn, the Whippendell Dental Clinic and Care Home, a supermarket and significant residential developments between Whippendell Road and the Croxley Rail Link lines.

3.28 There are several large development projects within Watford progressing through the planning process and located near to the proposed stations including:

- Watford Health Campus;
- Watford Junction Interchange;
- Watford Business Park;
- Ascot Road;
- The Charter Place Redevelopment Scheme, and
- The Civic Centre Education / leisure campus.

3.29 The closure of Watford Metropolitan station is substantially mitigated by the opening of Ascot Road station which is 1.2km to the south west. Removing Ascot Road in particular would therefore increase the adverse impact for current users of Watford Met by further increasing the distance to the nearest underground station.

3.30 The removal of either station from the scope of the project would therefore have a significant negative impact on the strategic, economic and financial case of the project. Both stations remain as part of the project scope.

Service Provision

3.31 The frequency of services provided has a direct impact on the infrastructure requirement, the number of additional rolling stock sets required to deliver the service and the associated benefits realised. However, reducing the level of service also reduces the attractiveness of the service and has implications for downstream frequency, patronage and revenue.

3.32 Options have been reviewed to identify all feasible changes in service frequency that could maximise benefits and minimise costs within operational parameters. This work confirms that the service level proposed in the 2009 MSBC submission (diverting all current services at Watford Met to Watford Junction giving a frequency of six trains per hour) remains the strongest performing option.

Station Platforms

3.33 Providing a single island platform instead of two separate directional platforms at each station has been considered. This would reduce the design and construction costs of the stations. However the option would require altering the alignment of the rail link, and re-building the pedestrian bridge at Watford Hospital to enable tracks to pass either side of the platform. and this would significantly increase the overall costs of the project.

Signalling

3.34 A reduction in the cost of the signalling system has been considered by reducing the scope of operational information that is made available to the London Underground control offices. This option could achieve significant savings but would have a significant negative impact on safety and performance.

Viaduct

3.35 The design of the viaduct has been examined to minimise costs. This has included a consideration of the type of cladding, the number of walkways and number of spans included in the design.

Electrification

3.36 The supply of power to the track has been examined. This has included consideration of sharing power supply with the Health Campus.

Other Items

3.37 A number of other cost savings have been considered including:

- Seeking additional contributions from developers and other promoters;
- Leasing rather than purchasing additional rolling stock;
- Investigating the sale of land and buildings at Watford Met and Watford West;

- Omitting walkways on existing bridges.

3.38 These options are continuing to be investigated as part of the scheme development process but had not been confirmed at the time of writing.

4 Project Costs

4.1 The value engineering changes to the project are estimated to result in a total £25.0m reduction in the capital cost of the project relative to the MSBC estimates. However these savings have been partially offset by increase in the design standards and requirements which were unforeseen at the MSBC stage.

4.2 These have increased the costs of the scheme by £19.7m. Meaning that overall the capital cost of the project has fallen by £5.2m from the previous estimate to £104.3m excluding inflation.

4.3 Table 4.1 provides a breakdown of the project costs, showing the 2009 MSBC and the latest BAFBestimates compared at a consistent 2011 price base. Including the expected cost of inflation between 2011 and 2015.Table 4.1 shows that the largest item of cost reduction is related to lower cost risk. As a result of the more detailed design the risk adjustment of the project has been reduced by £8.9m. The next largest area of cost saving is in third part costs (£8.5m), profit and overheads (£1.5m) and assurance (£1.3m). There have also been significant savings to the level of telecoms (£2.7m).

Conversely the largest item of cost increase is related to the provision of an electrical substation for the project and increases costs by £6.1m relative to the MSBC. There has also been a significant increase in the costs of signalling (£5m), station construction costs (£3.6m) and permanent way (£2.5m).

TABLE 4.1 MSBC &BAFB CONSTRUCTIONCOST ESTIMATES (£)

Item	MSBC £2011	BAFB £2011	Extra/Saving (£)
Stations	8,424,735	11,690,000	3,265,265
New structures	7,464,600	10,050,000	2,585,400
Existing structures	1,889,443	1,760,000	-129,443
Earthworks and retaining walls	2,750,000	2,600,000	-150,000
Demolitions	94,600	230,000	135,400
Permanent way	5,862,450	8,400,000	2,537,550
Removal of ballast	138,193	0	-138,193
Fencing	550,000	640,000	90,000
Power	6,697,350	12,820,000	6,122,650
Service diversions	407,000	400,000	-7,000
Signalling	11,880,000	16,920,000	5,040,000
Telecomms	2,772,000	0	-2,772,000
Environmental	385,000	385,000	0
Landscape/streetscape/highways alterations	0	0	0
Preliminaries	10,504,174	10,320,000	-184,174
Profit & O/H	4,486,466	2,964,750	-1,521,716
Design	3,804,523	3,300,000	-504,523
Project Management inc legals	2,392,782	2,150,000	-242,782
Assurance	1,794,586	500,000	-1,294,586
Third party costs	8,559,046	0	-8,559,046
Possession costs	550,000	540,000	-10,000
Rolling stock	9,132,200	9,000,000	-132,200
Risk	13,970,000	5,100,000	-8,870,000
Land	4,400,000	4,240,000	-160,000
Third party compensation	275,000	160,000	-115,000
Operational Monitoring	407,034	200,000	-207,034
Sub-Totals	**109,591,182**	**104,369,750**	**-5,221,432**

5 Performance Against Objectives

5.1 The primary objectives of the scheme are:

- To enhance sustainable links to and between residents and employment, business, education, health and leisure opportunities within Watford and across Hertfordshire, and to key external attractors, notably north-west & central London and the national rail network, thus reinforcing Watford's role as a key transport hub north of London.
- To promote economic and housing development by improving public transport linkages between current / potential employees, Watford town centre and the key development areas of Watford Junction, Watford Business Park / Ascot Road and the Watford Health Campus; and
- To provide a credible alternative to car travel, with inherently lower environmental impacts per trip including, noise and greenhouse gas emissions.

5.2 The changes made through the scheme development process do not materially affect the achievement of these core objectives. The level of provision at Ascot Road and Watford Hospital stations is similar to the level anticipated within the MSBC meaning that the level of service and design will also be similar.

5.3 The scope and quality of design, welfare provision and finish at the stations served by the rail linkhas been reduced slightly to minimise the costs of the project. Overall there may therefore be a slight reduction to the overall experience for passengers and staff as a result of the changes to the stations. Overall the impact of thechanges made through the scheme development process is a reduction in cost and improvement in the level of design detail and accuracy. The effect on the project objectives are not likely to be significant.

CONTROL SHEET

Project/Proposal Name	Croxley Rail Link
Document Title	Scheme Development Report
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