Infrastructure Projects

Value Management Value Engineering (VM3)

Project Name: WAML Capacity Enhancements
OP Reference: 128008
Project Manager: [redacted]
Sponsor: [redacted]

Prepared B[redacted]
Job Title: [redacted]
Signature: [redacted]
Date: 25 April 2016

Endorsed By: [redacted]
Job Title: [redacted]
Signature: [redacted]
Date:

Authorised By: [redacted]
Job Title: [redacted]
Signature: [redacted]
Date:

Contents

GRIP Context

Current GRIP Stage:	4
GRIP Stage(s) to which this report relates:	3C/4
Estimated start of significant physical works:	September 2016

1. Executive Summary

These proposals form part of a wider VE phase that was instructed subsequent to an Anticipated Final Cost (AFC) being identified at the end of GRIP 3C, which significantly exceeded the figure of £132.4M that was calculated at GRIP 3B and gained Department for Transport (DfT) approval. Currently, a shortfall of around £25M exists between AFC and available funding and the intent of this VE process is to engineer the minimum possible scope and lowest cost option to close the funding gap.

Outline information on the key outcomes from these Workshops is provided in the table below based on the principal agreement impacting the direct construction costs.

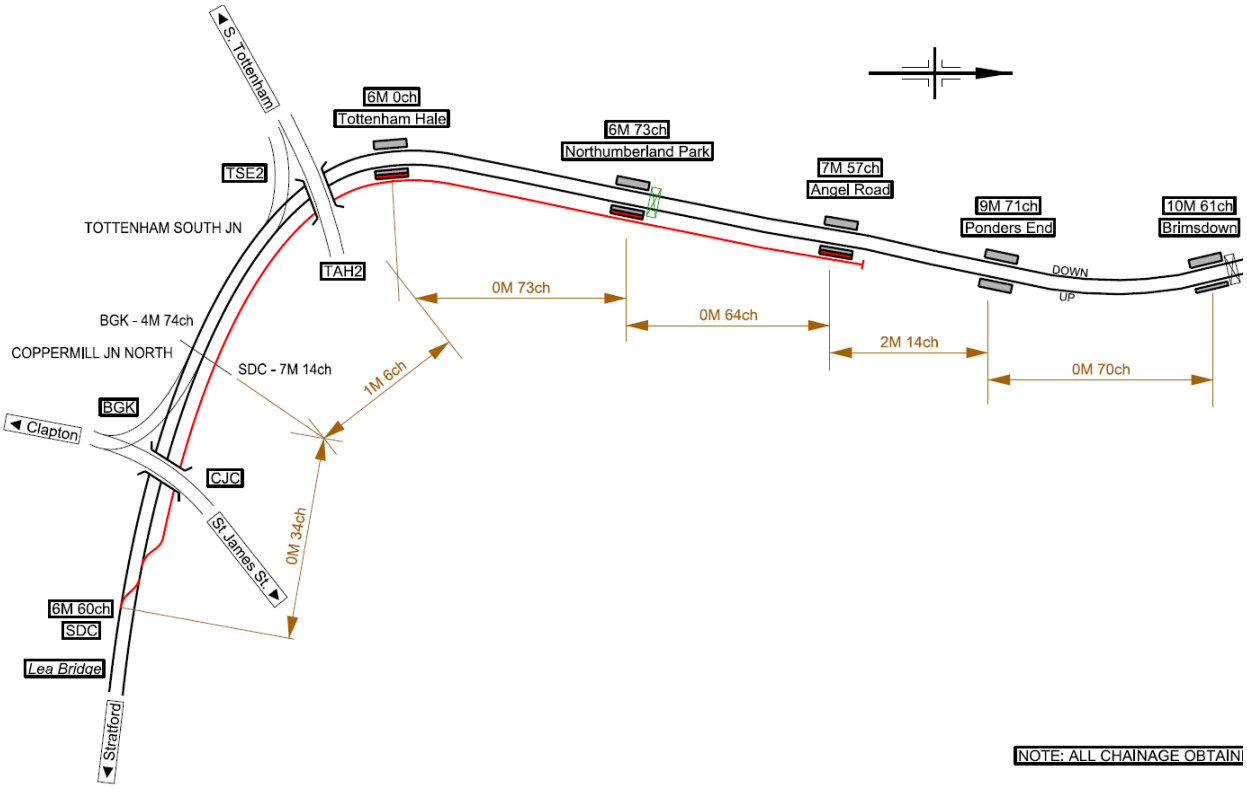
Agreement	Impact 1Q16 (approx.)
PWay 1. Review of track alignment	Allows ALO working, reducing the number of possessions, retains majority of existing OLE and enables piles to be installed to the Twin Track Cantilevers for the passive 4th track Reduces material costs and formation depths as Crossrail2 plans redesign Outline saving on P-way as a result of changes to method, reduced drainage £2.4m
Drainage 1. Confine to station areas and review in line with track re-alignment which reduces scope.	Reduces cost as 3c design assumed length of track. Drain runs abortive when CR2 is constructed. Alterations to Tottenham Hale station further reduce the track drainage requirements. Change in pipe diameter and direction of flow remove the need to attenuation tanks at Ferry Lane. Reduce costs See above P-way.
OLE 1. New track position reduces need to touch Mk.3B OLE structures on mainline. 2. CR2 provision for Twin Track Cantilevers to be located in 4th track cess north of Tottenham Hale. No CR2 provision for Single Track Cantilevers south of Tottenham Hale 3. Retention of existing mainline OLE masts	Significant savings in materials, foundations and possession requirements. Re-sighting of 5 signals avoided and signalling gantry removed from scope. Outline saving to OLE inclusive of all civils £3.2m
E&P 1. Junction Lighting only at Lea Bridge. 2. Non relocation of LOC's supply points due to new track alignment. 3. Change in supply arrangement to utilise spare capacity in existing.	Outline saving inclusive of all civils £900k

Signalling 1. Existing Signals: Retaining 2No existing signals and change portal to straight post as a consequence of track realignment. 2. Existing LOC's 9.41, 11.68 and 11.87: retain due to track realignment.	Outline saving £240k. Reduction in signalling staging and therefore the possession requirements.
Structures 1. SDC 666 U/B - Flexi Arch solution proposed rather than re-instatement 2. BGK 1393; Bridge to be replaced with new abutments and deck rather than re-instatement.	Both structures increase in value in the estimate but produce VE in WLC UB666 – Add £70k UB1393 Add £820k
Tottenham Hale Station 1. Link Bridge Option is to retain the bridge as per the AIP, retain the existing AGA accommodation, bridge moved north to end of canopy with walkway and staircase into the station frontage area interfacing with LUL at ground floor level.	Proposal saves programme time, reduces prelims and allows station to operate normally during construction Overall Saving £580k
Ancillary Civils 1. Jarrow Road boundary wall: Install the boundary relative to revised track position and retaining much of the earth bund. Install palisade fence on the bund to remove requirement for brick wall.	Solution significantly reduces material removal from site. Will act as acoustic barrier during construction Material will be reused to form pile mats and crane pads for 1393, generating a further cost saving. Overall saving £880k
OPS Telecoms 1. Northumberland Park URX: Down side cable route is no longer required due to omission of wide-way sterilisation therefore URX can be omitted along with the down side cable route through existing station structures.	Overall saving on telecoms for whole scheme; £140k

The Programme, prelims and schedule 4 costs were all reviewed in light of the revised works and adjustments made to reflect these changes and the resulting revised costs were incorporated into the estimate. The resources were also re-aligned to the revised GRIP stages and plans and similarly the resulting costs incorporated into the estimate.

2. Background

The 'WAML Capacity Increase Project' is part of the Anglia Route Collaboration Enhancement portfolio of works to be delivered within the CP5 period. Its origins lie within the July 2011 London & South East Rail Utilisation Strategy. The required output of the Scheme is to provide infrastructure to enable an increase of two trains per hour in the peak period between Stratford and Angel Road. The long term objective will be achieved by the introduction of two new lines along this section of the railway.



The CP5 Scope to address the medium term Objective will construct a 3rd LINE that addresses the medium term demands along the route from Lea Bridge to Angel Road Station. The scope includes station upgrades providing step free accessibility and additional platforms at Tottenham Hale, Northumberland Park and a new station at Angel Road located approximately 300m south of the existing station which will be decommissioned.

Key requirements:

- Provision of a new 25mph single lead junction from immediately north of Lea Bridge Station connecting to a new single bi-directional 3rd Line to the East of the existing Cambridge Lines.
- Single 3rd Line is to extend as a minimum to a new platform at Tottenham Hale station, suitable for 8 car trains.
- Extension of the new single line to new platforms (suitable for 8-car trains) at Northumberland Park Station and a relocated Angel Road Station.

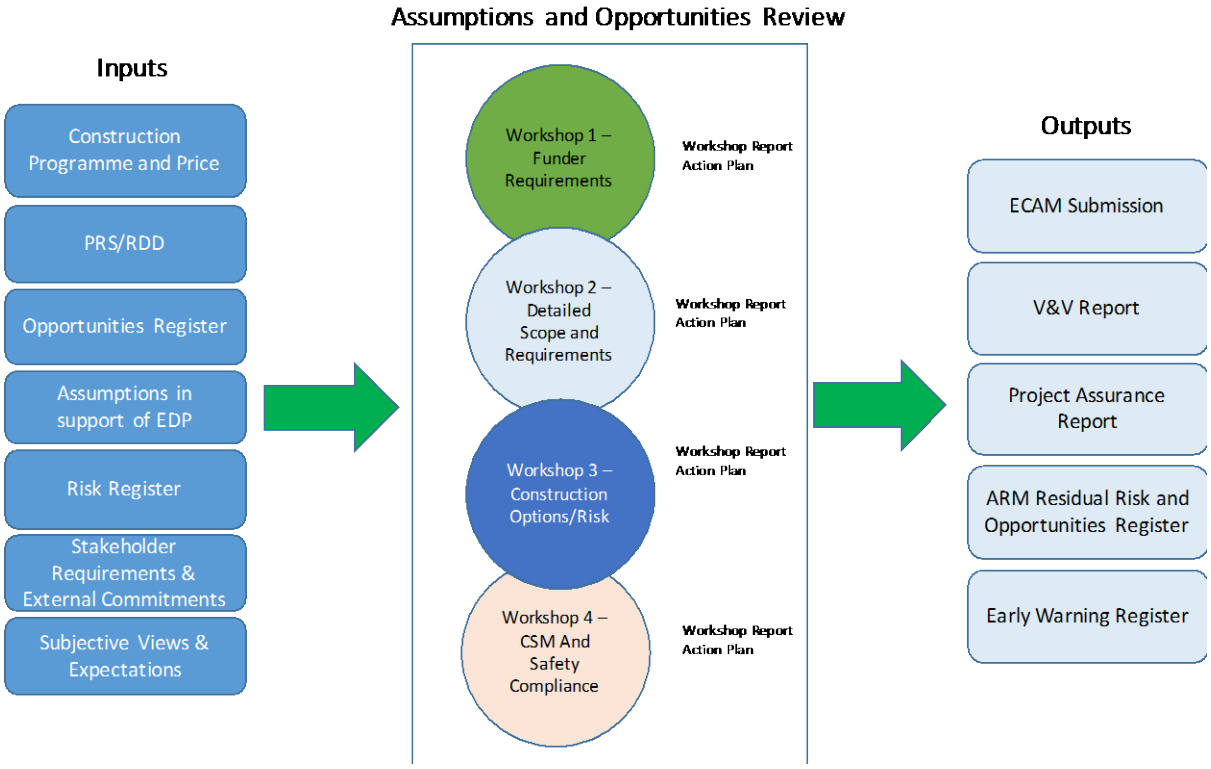
- The majority of the existing signalling and telecoms infrastructure currently located in the UP Cess will remain in position with a limited number of Location cases being relocated in the DN CESS to accommodate the new 3rd Line.
- All new infrastructures to be electrified at 25kV with signalling suitable for the proposed train service.
- Each station to have step free accessibility by the provision of footbridges with lifts or ramps.
- Closure of the existing Angel Road Station.
- Closure of Northumberland Park Level Crossing requiring a TWAO.
- Active provision for a future 4th Line by provision of twin track cantilever OLE portals.

The WAML Capacity Enhancement project achieved Approval in Principle (GRIP 3C) of its associated multidisciplinary design submissions in December 2015. At the same time, the capital cost of the project was found to exceed the budget agreed at the conclusion of the previous single option selection stage (GRIP 3B) by as much as £25m. Due to this funding shortfall, the subsequent detailed design activities were paused and the project embarked on a short Value Engineering (VE) phase to identify savings in capital cost to reduce or eliminate the budget exceedance. The opportunity was also taken to consider the future Crossrail 2 project within this VE phase, as Crossrail 2 proposes a number of wide ranging changes to much of the same railway infrastructure as WAML Capacity Improvement.

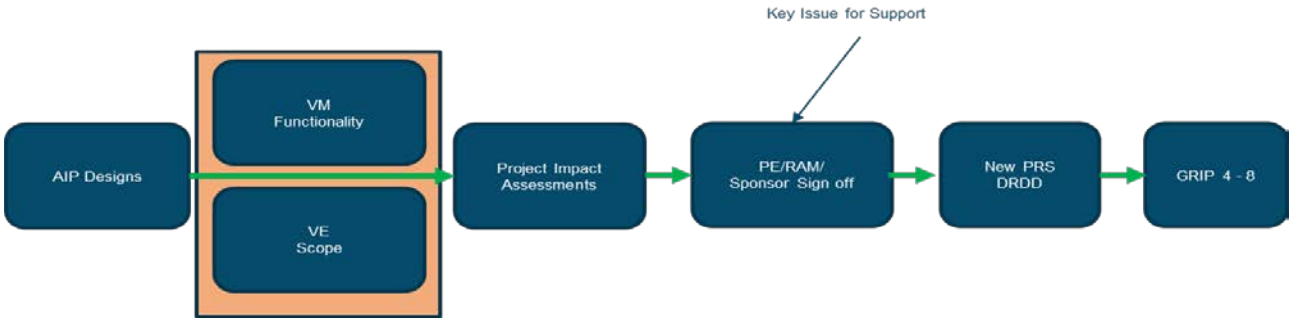
3. Methodology and Objective

3.1 Workshop Protocol and Techniques Used

The proposed approach to the Value Management and Value Engineering exercise was to split down the opportunities and assumptions into more focused workshops to build on the work already undertaken by the team. This involved establishing a number of detailed reviews, independently facilitated with a targeted audience of decision makers. These workshops quickly established the opportunities that could be pursued to reduce cost de-risk the programme and/or remove uncertainty around delivery. Post each workshop, the completion of a sectional report and a targeted action plan to close these out were produced.



The diagram below details below the process that was followed in undertaking the VM/VE Exercises, ensuring full functionality of the Scheme was continually considered to ensure the Client's Requirements were able to be realised.



3.2 Workshop Objectives

The Project embarked on a series of VM/VE Exercises over an 8 week period. The Process above defined changes to the scope to support a reduction of the overall AFC for the Project whilst maintaining full functionality expected from the Sponsor's Remit. These were as follows:

There were 4 workshops concentrating on the scope and risk items that were categorised into the following:

- VfM 1 Funder Requirements – those principle output statement or committed items to funders that needed to be re-affirmed and validated. Any additional third party items, funding or future provision were also be reviewed. This workshop was about reviewing the strategic aims of the project and the principles that have formed the PRS. This session brought alignment with other projects on the Line of Route, for example, the need to passively prepare for a 4th track, the alignment with Crossrail 2 and the requirements of the Meridian Water development.

- VfM 2 Detailed Scope and Requirement – this workshop challenged the scope that has been derived from the PRS/Output specification and whether or not some of the scoped items could be reduced/removed without affecting the outputs or committed functionality. This mainly focused on the Client Specification /Remit and Requirements. This drew in key risk and assumptions and work to close these out, for example, the requirements for work at Northumberland Park where the footbridge goes or the overall requirement for track drainage.

- VfM 3 Construction Options and Risks - A workshop looked at some of the key assumptions surrounding construction and to ensure that these were converted into planned activities, for example, this workshop covered issues surrounding track access requirements or overall requirement to remove spoil from site.

- VfM 4 CSM and Safety Compliance – ensured that any alteration to the project's output/scope does not materially affect the safety risk assessment on the project. A review with the maintainer and operators as to whether other scope reduction items could be undertaken without compromising on their ability to discharge their duties formed part of the workshop. This required formalised risk assessments as necessary.

Over the four workshops, the key actions and issues were captured with the detail being maintained in the WAML VM & VE Opportunities Tracker. Overall, the project had to find sufficient headroom on the budget and programme to have confidence that it could deliver the values within the EDP submission.

A high-level programme to complete this exercise was produced with a weekly report tracking progress in closing out specific assumptions and VE opportunities:

- Commence workshops: 7th Dec 2015
- Complete workshops: 12th Feb 2016
- Finalise VM/VE Report: 26th Feb 2016
- Revised 3D submission: 7th March 2016
- Commence ECAM Process: 28th March 2016
- ECAM Decision: 27th April 2016
- Investment Paper: 10th June 2016

4. Workshop Outputs

4.1 Review and clarification of Functional Requirements of the Project

The Functional requirements of the Project are straight forward. The Client's remit is that the Project is to provide infrastructure to enable an increase of two trains per hour in the peak period between Stratford and Angel Road. This will be achieved by constructing a 3rd LINE that addresses these medium term demands along the route from Lea Bridge to Angel Road Station.

Following a review the Project concluded that regardless of the Assumptions and Opportunities that formed part of the VM/VE Exercises the required Functionality of the scheme must be retained regardless of cost savings of opportunities that were identified. Only opportunities that supported the functionality of the scheme were taken as cost savings.

4.2 Review of Design Options of Component Elements of the Project

The Value Engineering phase of the WAML Capacity Improvement project has explored a variety of cost saving AIP design changes, whilst also considering the future plans of Crossrail 2. The majority of the cost savings have been made by reducing the degree of "active provision" for a future 4th Line demanded in the existing Project Requirements Specification. Whilst the VE proposals remain compatible with a 4th Line, more work in the future would be necessary to construct this 4th Line than the existing AIP designs allow.

The project Team reviewed each project discipline to identify value engineering opportunities and potential savings. The bullet points below summarise the major VE proposals identified:

- Permanent Way – "3.5" track position
  - Enables most of the existing main line OLE structures to be retained as existing. New cantilever structures to electrify the third line (with passive provision for fourth line).
  - Enables E&P Angel Road North feeder to be retained as existing.
- Telecoms – Combined Upside cable route between Tottenham Hale and Angel Road Station.
- E&P – removal of junction lighting at existing Coppermill Junction and Tottenham South Junction.
- Drainage – removal of fourth track and fourth platform provision for new drainage systems.
- Stations – amendments to Tottenham Hale and Northumberland Park station designs to reduce the impact on existing station structures, canopies and E&P systems.
- Traction Power – third line fed from only Coppermill feeder station, with minimal alterations to Northumberland Park feeder station.

To understand and realise these changes formally, it was envisaged that revised AIP designs would be required for at least the OLE and bridge structures design disciplines. Simple addendums to the existing AIP documents were offered for the remaining disciplines to ensure that the principles of the amended design were understood by all parties before embarking on

detailed design. This approach was agreed with the Network Rail Project Engineers for each discipline and endorsed by the Designated Project Engineer.

Notwithstanding the fact that it is practical to incorporate these efficiencies into the project designs, once the AIP amendments and/or addendums are completed these will be sent to the Network Rail Project Engineers and RAMs for endorsement.

These opportunities and expected savings are detailed below:

Identification Number	VE Opportunity	Potential Range of Cost Efficiencies £	Impact on Functional Requirements	Practicality of this Efficiency
128008–001 P-Way	Move the track to a position between tracks 3 and 4 (track reference 3.5)	£2.4m	None	Achievable
128008-002 P-Way	Reduce track from CAT 2 to CAT 3 south of Tottenham Hale.	Savings incorporated in 128008-001	None	Achievable
128008-003 Drainage	Confine to station areas and re-locate due to revised track position 3.5	Savings incorporated in 128008-001	None	Achievable
128008-004 Drainage	Pipe bore increased to omit need for attenuation tanks at Tottenham Hale and Angel Road	Savings incorporated in 128008-001	None	Achievable
128008-005 OLE	New track position 3.5 reduces need to touch Mk.3B OLE structures on mainline.	£3.2m	None	Achievable
128008-006 OLE	CR2 provision for Twin Track Cantilevers to be located in 4th track cess north of Tottenham Hale. No CR2 provision for Single Track Cantilevers south of Tottenham Hale	Savings incorporated in 128008-005	None	Achievable
128008-007 OLE	Equipment for electrification on 3rd track will be Series 2 and utilise same equipment as GOB.	Savings incorporated in 128008-005	None	Achievable

	Mk.3B equipment used for main line interfaces. Beyond turnout OLE will be Series 2 on 3rd track			
128008-008 OLE	Modifications to existing Mk.3B equipment on Mainline made rather than replacement with Series 2 equipment.	Savings incorporated in 128008-005	None	Achievable
128008-009 OLE	Retention of existing mainline OLE masts	Savings incorporated in 128008-005	None	Achievable
128008-010 E&P	3rd track to be fed from Coppermill feeder in lieu of Northumberland Park feeder	£900K	None	Achievable
128008-011 E&P	New circuit breakers not required to existing feeder station at Northumberland Park	Savings incorporated in 128008-010	None	Achievable
128008-012 E&P	Junction lighting is only required at Lea Bridge. No requirement for junction lighting at Tottenham south or Coppermill Junction	Savings incorporated in 128008-010	None	Achievable
128008-013 E&P	Angel Road SSP North Feeder: First two location suites to be retained	Savings incorporated in 128008-010	None	Achievable
128008-014 E&P	Use existing Angel Road SSP with 650v extension.	Savings incorporated in 128008-010	None	Achievable
128008-015 E&P	Lea Bridge Junction Lighting Existing UTX: Utilise spare capacity and remove need for new UTX.	Savings incorporated in 128008-010	None	Achievable
128008-016 E&P	FSP outside the	Savings	None	Achievable

	Project Area: 3.5 track positions allows for the first two LOC's on the North Feeder to be retained.	incorporated in 128008-010		
128008-017 Signalling	Existing Signals: Retaining 2No existing signals and change portal to straight post as a consequence of moving track to the 3.5 position.	£240K	None	Achievable
128008-018 Signalling	Existing LOC's 9.41, 11.68 and 11.87: retain due to the track 3.5 position.	Savings incorporated in 128008-017	None	Achievable
128008-019 Signalling	DLMs & HVI Receivers; The current signalling equipment was installed in 2002 reuse of the DLM and HVI receivers is proposed	Savings incorporated in 128008-017	None	Achievable
128008-020 Structures	SDC 666 U/B - Flexi Arch solution proposed rather than re-instatement	+ £70K	None	Achievable
128008-021 Structures	BGK 1393; Bridge to be replaced with new abutments and deck rather than re-instatement.	+ £820K	None	Achievable
128008-022 Tottenham Hale	Link Bridge Option is to retain the bridge as per the AIP, retain the existing AGA accommodation, bridge moved north to end of canopy with walkway and staircase into the station frontage area interfacing with LUL at ground floor	£580K	None	Achievable

	level.			
128008-023 Tottenham Hale	SISS; Existing AGA accommodation is retained, proposal to install an REB in lieu of a CER at Tottenham Hale, similar to Lea Bridge	Savings incorporated in 128008-021	None	Achievable
128008-024 Ancillary Civils	Jarrow Road boundary wall: Install the boundary relative to 3.5 track position and retaining much of the earth bund. Install palisade fence on the bund to remove requirement for brick wall	£880K	None	Achievable
128008-025 Ops Telecoms	Northumberland Park URX: Down side cable route is no longer required due to omission of wide-way sterilisation therefore URX can be omitted along with the down side cable route through existing station structures.	£140K	None	Achievable

4.3 Summary of Value Engineering Opportunities / Efficiency Identified

The Project Team discussed the outcome of the review of the value engineering opportunities and agreed that, based on the assessment criteria utilised, the following would be taken forward. The delegates also identified the actions required to realise the opportunity.

Identification Number	VE Opportunity	Action Required to Realise	Action Owner	Action Due Date
128008–001 P-Way	Move the track to a position between tracks 3 and 4 (track reference 3.5)	AiP Addendum only	[redacted]	May 2016
128008-002 P-Way	Reduce track from CAT 2 to CAT 3 south of Tottenham Hale.	AiP Addendum only	[redacted]	May 2016
128008-003 Drainage	Confine to station areas and re-locate due to revised track position 3.5	AiP Addendum only	[redacted] -	May 2016
128008-004 Drainage	Pipe bore increased to omit need for attenuation tanks at Tottenham Hale and Angel Road	AiP Addendum only	[redacted] -	May 2016
128008-005 OLE	New track position 3.5 reduces need to touch Mk.3B OLE structures on mainline.	Full AiP revision	[redacted]	May 2016
128008-006 OLE	CR2 provision for Twin Track Cantilevers to be located in 4th track cess north of Tottenham Hale. No CR2 provision for Single Track Cantilevers south of Tottenham Hale	Full AiP revision	[redacted]	May 2016
128008-007 OLE	Equipment for electrification on 3rd track will be Series 2 and utilise same equipment as GOB. Mk.3B equipment used for main line	Full AiP revision	[redacted]	May 2016

	interfaces. Beyond turnout OLE will be Series 2 on 3rd track			
128008-008 OLE	Modifications to existing Mk.3B equipment on Mainline made rather than replacement with Series 2 equipment.	Full AiP revision	[redacted]	May 2016
128008-009 OLE	Retention of existing mainline OLE masts	Full AiP revision	[redacted]	May 2016
128008-010 E&P	3rd track to be fed from Coppermill feeder in lieu of Northumberland Park feeder	AiP Addendum only	[redacted]	May 2016
128008-011 E&P	New circuit breakers not required to existing feeder station at Northumberland Park	AiP Addendum only	[redacted]	May 2016
128008-012 E&P	Junction lighting is only required at Lea Bridge. No requirement for junction lighting at Tottenham south or Coppermill Junction	AiP Addendum only	[redacted]	May 2016
128008-013 E&P	Angel Road SSP North Feeder: First two location suites to be retained	AiP Addendum only	[redacted]	May 2016
128008-014 E&P	Use existing Angel Road SSP with 650v extension.	AiP Addendum only	[redacted]	May 2016
128008-015 E&P	Lea Bridge Junction Lighting Existing UTX: Utilise spare capacity and remove need for new UTX.	AiP Addendum only	[redacted]	May 2016
128008-016 E&P	FSP outside the Project Area: 3.5 track positions	AiP Addendum only	[redacted]	May 2016

	allows for the first two LOC's on the North Feeder to be retained.			
128008-017 Signalling	Existing Signals: Retaining 2No existing signals and change portal to straight post as a consequence of moving track to the 3.5 position.	AiP Addendum only	[redacted]	May 2016
128008-018 Signalling	Existing LOC's 9.41, 11.68 and 11.87: retain due to the track 3.5 position.	AiP Addendum only	[redacted]	May 2016
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128008-021 Structures	BGK 1393; Bridge to be replaced with new abutments and deck rather than re-instatement.	AiP Addendum only	[redacted]	May 2016
128008-022 Tottenham Hale	Link Bridge Option is to retain the bridge as per the AIP, retain the existing AGA accommodation, bridge moved north to end of canopy with walkway and staircase into the station frontage area interfacing with LUL at ground floor level.	AiP Addendum only	[redacted]	May 2016

128008-023 Tottenham Hale	SISS; Existing AGA accommodation is retained, proposal to install an REB in lieu of a CER at Tottenham Hale, similar to Lea Bridge	AiP Addendum only	[redacted]	May 2016
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128008-025 Ops Telecoms	Northumberland Park URX: Down side cable route is no longer required due to omission of wide-way sterilisation therefore URX can be omitted along with the down side cable route through existing station structures.	AiP Addendum only	[redacted]	May 2016

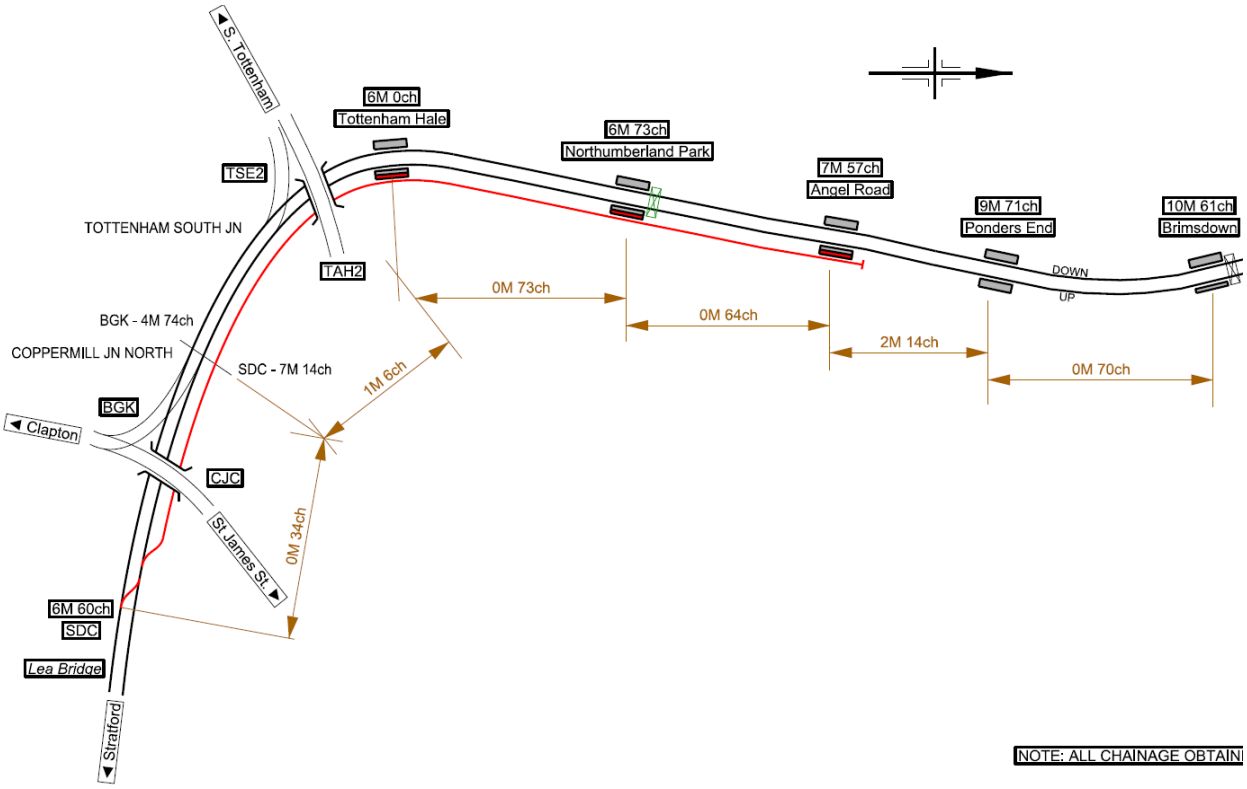
5. Action Plan and Owners

The following actions were recorded in the workshop. Owners were assigned from people within the workshop.

Number	Action	Owner	Close-out Date
1	Close-out P-Way requirements	[redacted]	May 2016
2	Close-out Drainage requirements	[redacted]	May 2016
3	Close-out OLE requirements	[redacted]	May 2016
4	Close-out Traction Power requirements	[redacted]	May 2016
5	Close-out E&P/M&E requirements	[redacted]	May 2016
6	Close-out Signalling requirements	[redacted]	May 2016
7	Close-out Structures requirements	[redacted]	May 2016
8	Close-out Tottenham Hale requirements	[redacted]	May 2016
9	Close-out Ancillary Civils requirements	[redacted]	May 2016
10	Close-out Ops Telecoms requirements	[redacted]	May 2016

6. Appendix A – Functional Requirements

The 'WAML Capacity Increase Project' is part of the Anglia Route Collaboration Enhancement portfolio of works to be delivered within the CP5 period. Its origins lie within the July 2011 London & South East Rail Utilisation Strategy. The required output of the Scheme is to provide infrastructure to enable an increase of two trains per hour in the peak period between Stratford and Angel Road. The long term objective will be achieved by the introduction of two new lines along this section of the railway.



The CP5 Scope to address the medium term Objective will construct a 3rd LINE that addresses the medium term demands along the route from Lea Bridge to Angel Road Station. The scope includes station upgrades providing step free accessibility and additional platforms at Tottenham Hale, Northumberland Park and a new station at Angel Road located approximately 300m south of the existing station which will be decommissioned.

7. Appendix B – Abbreviations and Definitions

A list of abbreviations and references used in this report are detailed as below:

Abbreviations and Terminology	Full Description of Reference
AFC	Anticipated Final Cost
AGA	Abellio Greater Anglia
AIP	Approval In Principle
ALO	Adjacent Line Open
ARC	Anglia Route Collaboration
ARM	Active Risk Manager
CESS	Safe Walkway
CP5	Control Period 5
CR2	Crossrail 2
CSM	Common Safety Method
DfT	Department for Transport
DNO	Distribution Network Operator
DRRD	Delivery Route Requirements Document
E&P	Electrification and Plant
ECAM	Enhancement Cost Adjustment Mechanism
EDP	Enhancements Delivery Plan
FOC	Freight Operating Company
FSP	Functional Supply Point
GRIP	Governance for Railway Investment Projects
LOC	Location Case
LU	London Underground
NR	Network Rail
NR PM	Network Rail Project Manager
NUM	Northumberland Park
OLE	Overhead Line Equipment
ORR	The Office of Rail and Road
PRS	Project Requirements Statement
QDR	Qualitative Design Review
RAM	Route Asset Manager
S&C	Switch and Crossing
S&T	Signals and Telecommunications
TfL	Transport for London
TOC	Train Operating Company
TOM	Tottenham Hale
TP	Traction Power
TSI	Technical Specification for Interoperability

TWAO	Transport and Works Act Order
UKPN	United Kingdom Power Network
URX	Under Road Crossing
UTX	Under Track Crossing
VFL	Volker Fitzpatrick Ltd
VE	Value Engineering
VM	Value Management
WLC	Whole Life Cost

8. Appendix C – Attendees

VfM 1 – Funder Requirements Workshop

Attendees:

[redacted]

VfM 1a - CR2 Requirements Workshop

Attendees:

[redacted]

[redacted]

VfM 2 - Detailed Scope Requirement Workshop

Attendees:

[redacted]

[redacted]

VfM 3 - Construction Options and Risks Workshop

Attendees:

[redacted]

VfM 4 - CSM and Safety Compliance Workshop

Attendees:

[redacted]

9. Revision History

Table 9.1 Document History

Version	Date	Author	Comments
1.0	26 April 2016	[redacted]	Issued for Review