



Appendix O – Risk and Opportunities Register

20 October 2017

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1 Introduction

The document presents the risks and opportunities assessed by the project team as significant in the delivery of the Western Link project.

Risks are split into two sections:

- Project management and delivery risks: those presenting wider risks to the client body; and
- Project risks: those affecting the cost, scope and timescale for the project.

Project management and delivery risks are presented in section 2. Project risks are presented in section 3

The project team has also reviewed potential opportunities (i.e. positive risk events) and these are presented in section 4.

Section 5 presents a Monte Carlo analysis undertaken on the project risks.

2 Project Management and Delivery Risk

Project management and delivery risks have been developed through dialogue between the project management team and key discipline leads. Risks covered are those thought to present a threat to the client body. They have been assessed based on review of the probability of occurrence and the impact on cost, programme or quality should they occur.

Table 1: Project Management and Delivery Risk Register

Project Management and Delivery Risk Register

RISK							Risk & Probability Impact Matrix		
Ref. No	Risk/Event	Category	Source	Consequence	Mitigation	Impact	Likelihood	Severity	
Governance Risks									
1	Project Executive does not approve progression of scheme to Stage 4	Programme	Client	Delay in the approval of the stage 3 submission will lead to delay in progression of the planning application and future project stages whilst issues/comments are addressed	Project team to make recommendation regarding the progression of the project from Stage 3 to 4. If progression beyond Stage 3 is not granted, then project team to outline risks of delaying a decision to progress.	3	2	Yellow	
2	Project Executive does not approve progression of scheme to Stage 5	Programme	Client	Delay in the approval of the stage 4 submission will lead to delay in progression to construction whilst issues/comments are addressed.	Project team to make recommendation regarding the progression of the project from Stage 4 to Stage 5. If progression beyond Stage 4 is not granted, then project team to outline risks of delaying a decision to progress.	3	2	Yellow	
3	Non-approval of the CPO by Executive Board.	Programme	Client	Delay in the approval or non-approval of the CPO will lead to delay in progression of the scheme or halting of the scheme whilst issues/comments are addressed.	Ensure all EB members are aware of the scheme and ensure that the Council Leader is briefed on the risk of delay in this process.	4	2	Orange	
4	Call in by Scrutiny Board at stage 3 or 4 and deliberation for a period that delays progression.	Programme	Client	Delay in progression of future project stages.	included time in the programme to allow for a reasonable call in period and prepare evidence in advance should they call in on the grounds of process or contentious issues.	3	2	Yellow	
5	Internal authority budgets are not approved for dealing with claims under Planning Blight. The authority is unable to process valid claims due a lack of budget.	Reputation	Client	The authority receives valid claims from affected residents that cannot be honoured. Either the authority exposes itself to legal challenge or takes a very hard-line view regarding the payment of claims.	The relevant internal officers are to be made aware of the payment of blight claims issue. This is to be fully explained as an issue on approval of the preferred route, rather than if funding is gained. As the scheme is included in the Local Plan, then this would be an issue regardless of the funding opportunity from Central Government for Western Link. A budget	3	2	Yellow	

Project Management and Delivery Risk Register

					for dealing with planning blight claims needs to be made available. Approval for this must come from Lynton Green.			
6	DfT fails to approve OBC	Cost	Client	If the OBC submission is unsuccessful, the funding which the authority has committed to progress stage 3 of the project will not be recoverable and the future development of the scheme will be unfunded.	Early discussions with DfT need to be undertaken and queries answered appropriately. The OBC needs to be robust, evidence based and third party reviewed prior to submission. The Authority will need to halt the project at an appropriate point (likely end of stage 3) and consider submission in future rounds of funding to allow the scheme to progress.	4	3	Orange
7	DfT fails to approve FBC	Cost	Client	If the OBC submission is unsuccessful, the funding which the authority has committed to progress stage 3 and 4 of the project will not be recoverable and the future development of the scheme will be unfunded.	Early discussions with DfT need to be undertaken and queries answered appropriately. The FBC needs to be robust, evidence based and third party reviewed prior to submission. The Authority will need to halt the project at an appropriate point (likely end of stage 4) and consider submission in future rounds of funding to allow the scheme to progress.	4	2	Orange
8	Central government cancel the Large Local Majors Funding following a successful funding award	Cost	Client	If the OBC submission is successful and the scheme progresses to FBC stage, it is likely that the authority will need to spend large amounts of funding 'at risk' as final funding will only be devolved once the FBC is submitted. This requires all statutory approvals to be achieved, all property to be acquired, the PI to be complete and 'target cost' to be achieved with the contractor. The cost will be significant and if central government rescind the funding offer then the authority is left with a large liability.	Early discussions with DfT need to be undertaken and a robust risk management process established. The council is beholden to the terms of any funding offer from the DfT so the focus needs to be on managing the process to a successful conclusion.	4	1	Yellow
Land Risks								
1	Ecological mitigation measures required beyond those allowed for.			Additional cost and time.	Carry out necessary ecological surveys and hold dialogue with EA and Natural England.	4	3	Orange

Project Management and Delivery Risk Register

2	Local Plan fails at EIP	Reputation	Client	The Local Plan fails at EIP. Inspector identifies that the Local Plan needs to be redone. No Local Plan basis for delivery of the Western Link.	Ensure that relevant modelling results are reported to the project executive and that the scenarios and assumptions are clearly explained.	3	2	Yellow
3	Utilities – additional diversions required and/or statutory undertaker objection to any required CPO is received and remains unresolvable.			Additional cost and time, with potential for two Public Inquiries.	Carry out ground survey of area and engage statutory undertakers in scheme development.	4	3	Orange
4	Special Parliamentary Procedure (SPP) – if exchange land cannot be offered for affected Commons/open land, scheme could be subject to SPP.	Programme	Client	Loss of reputation for the Council, delay to project, possibility of elements of the scheme not being able to be delivered.	Take legal advice. Ensure that green areas are adequately accessible and do not prompt the need for TVG status. The process for achieving TVG status is difficult and the requirement is high - the above would reduce the risk of any application being successful. Investigate options and provide suitable exchange land to avoid SPP.	4	3	Orange
Appraisal Risks						2	3	Yellow
1	Preparation of evidence to justify the preferred route at PI	Reputation	Client	Inability to justify scheme leads to impact on public reputation and inability to justify to government and PI	Project Manager to log and control flow of appropriate evidence. Legal support to advise on appropriate inputs into the PI.	3	2	Yellow
2	Modelling – Western Link is the first test of the new Warrington Multi Modal Transport Model (MMTM)	Reputation	Client	Incorrect or challengeable modelling data leads to impact on public reputation and inability to justify to government and PI	Assurance role being provided by WSP. Modelling work has had input and check from both AECOM and Mott MacDonald	4	3	Orange
Scheme Design/Development Risks								
1	Scheme cost increases lead to additional funding requirement on WBC	Cost	Client	Western Link client team required to investigate the provision of additional funds internally or via alternative sources. WBC required to cancel the scheme or agree to additional borrowing.	Ensure periodic cost reviews are held and ensure that value engineering is undertaken at key stages of the project.	2	4	Yellow
2	Planning Permission is not granted for the scheme	Programme	Client	If planning permission is not granted progression of the scheme to stage 4 will be delayed or halted.	Undertake pre-planning discussions with authority. Prepare necessary EIA and transport assessments in advance and submit for third party review.	3	3	Yellow

Project Management and Delivery Risk Register

3	Network Rail approvals delay or increase cost of project.	Programme	Client	Increased cost and programme.	Hold early dialogue with Network Rail. Include approval processes in programme. Employ consultant with knowledge of Network Rail processes.	4	4	Red
4	Procurement Exercise fails to identify a suitable D&B contractor	Programme	Client	Stage 4 of the project cannot progress without a D&B contractor in place. Scheme progression is delayed	Issue PQQ to shortlist suitable D&B contractors. Undertake competitive dialogue OJEU process to allow discussion of scheme requirements.	4	3	Orange
5	Scheme is unsuccessful at Public Inquiry	Programme	Client	Scheme incurs delays and is either not developed or goes through the appropriate statutory channels to challenge the decision	Maintain project records, maintain consistent project team. Employ third party for assurance role and maintain a risk register. Engage solicitor to assist with legal processes and ensure clear vision and consistent treatment of scheme across all professional appointments and internally within the Council, meeting the legislative, economic, social and environmental requirements to justify the scheme coming forward	5	3	Red
6	Performance of D&B Contractor is sub standard	Programme	Client	Scheme experiences delays during detailed design or construction due to inadequate performance or management of the D&B Contractor	Set in place robust reporting and monitoring process during detailed design and construction phases. Provide suitable project Governance. Draft construction contract with appropriate share of programme risk.	3	3	Yellow
7	The construction of the physical assets are not completed on time or to specification	Programme & Quality	Client	The asset delivered is either late or not of sufficient quality leading to delays whilst issues are rectified. Negative impact on achieving scheme benefits and loss of reputation for WBC	Set in place robust reporting and monitoring process during construction phases. Draft construction contract with appropriate share of programme risk. Appoint Clerk of Works to monitor quality and progress	3	3	Yellow
Consultation/Opposition Risks								
1	Local political opposition to the scheme increases during the next stage of works when the council is spending major capital monies at risk. This additional time, effort and management of any unpredicted opposition	Programme	Client	Increases to cost for responding to queries, FOI's etc. Plus, any internal, council queries and discussions require additional project management time	Ensure that decision making members are well briefed on the reasons for the scheme and any opposition members are kept appropriately informed of the reasons and justifications for the scheme.	4	3	Orange

Project Management and Delivery Risk Register

	leads to increases in cost and an additional burden on the programme							
2	Physical public protest leads to inability of scheme to progress on site	Programme	Client	Scheme timescales extended as the council has to apply for the relevant removal notices and enforce with bailiffs and sheriffs.	Ensure that all relevant properties are acquired prior to start on site.	3	2	Yellow
3	Negative media coverage of the scheme leads to lots of local opposition. The scheme benefits are not sufficiently extolled.	Reputation	Client	The council is required to liaise heavily with the press and public perception is created that the scheme has no benefits. This leads to further negative media coverage and damage to council reputation.	Monitor and control press releases and responses to media queries.	2	2	Green
4	CPO Approach – Council has unclear approach to Blight issues, and/or scheme requires CPO and has been subject to some opposition.	Reputation	Client	Public objection to scheme, loss of reputation for council, delay to scheme. Precedence for future schemes.	Employ solicitor to provide legal advice. Agree CPO and blight approach with Executive Board. Hold consultation events ahead of planning. Maintain close dialogue with directly affected land owners.	4	3	Orange
5	Delivery of the Preferred Option requires additional properties to be CPO'd	Reputation	Client	The work required to deliver the scheme increases and the potential opposition to the scheme increases. This leads to programme delays and reputational damage as sheriff and bailiff action is required.	As part of developing the preferred option design, further evidence must be identified to refine the option and assess the ability of the scheme to avoid properties as much as reasonably practicable whilst maintaining the scheme benefits.	3	3	Yellow
6	Inappropriate media coverage of the scheme	Reputation	Client	Leads to negative public reaction and ongoing, direct opposition to the scheme	Ensure that key information is retained as confidential. Ensure that press releases are reviewed by the Comms department and they are well timed and appropriate.	2	2	Green
7	Stakeholder Objection.	Reputation	Client	Loss of reputation for council, delay to project.	Hold consultation events ahead of planning. Maintain close dialogue with directly affected land owners and interested parties.	4	3	Orange
Management Risks								
1	Work Package Management and Co-ordination is insufficient	Quality	Client	The division of tasks into distinct packages has potential to create disconnect between the outputs being produced. This could delay the programme whilst issues are rectified or reduce the overall quality of delivery	The Project Management team will be responsible for co-ordinating work package activities to ensure key interdependencies are managed and the overall programme is maintained. This will	3	2	Yellow

Project Management and Delivery Risk Register

					be reviewed and discussed at project team meetings			
2	Resource Management	Quality	Client	The project is likely to experience peaks in work load and other periods of relative quiet for some teams. The right resource needs to be available consistently throughout the project to ensure quality and delivery to programme.	Resource will be planned in advance by each organisation based on the delivery methodology and scope defined in the project plan. This will be monitored and evaluated each month to reforecast demand as necessary.	2	3	Yellow
3	Information Management.	Quality	Client	The vast amount of information that is produced needs to be accessible to the right people at the right time. Failure of this could delay the programme or negatively impact third party communication	The project Information management plan will set out the procedures to be adopted for production, storage and issue of information both within the project team and externally.	2	2	Green
4	Configuration Management.	Quality	Client	Failure to ensure a consistent basis of design between disciplines or failure to maintain appropriate version control could result in wasted work or poor-quality outputs.	The information management plan will set out a consistent version control procedure for all teams. A common data environment will be used to progress designs.	2	2	Green
5	Communication and Teamwork	Quality	Client	The delivery team will be large and drawn from a variety of disciplines, backgrounds and companies. Failure to achieve good communication and a spirit of collaboration will negatively impact the delivery programme and quality.	Each will package will hold specific work package meetings to discuss issues. There will be an overall project meeting to maintain communication access work packages. Official communication protocol will be set out in the communications plans but alongside this team days will be held to encourage collaborative working. Co-location of key team members will be utilised at relative points on the programme.	2	2	Green
6	Health and Safety	Quality	Client	The Health and Safety of project team members and third parties during design and construction will need to be paramount to prevent injury or harm.	The design team will conduct hazard review meeting during the design process to identify and mitigate potential risks. Hazard reduction will continue on site with the contractor conducting regular H&S reviews. All works will need to be undertaken with an appropriate risk assessment and method statement. Key operatories will be subject to specific risk meetings.	3	2	Yellow

Project Management and Delivery Risk Register

7	Strategy and Objectives	Quality	Client	The scheme has been developed to meet specific objectives, defines based on the need for intervention. Should these change, the nature of the scheme would need to be reviewed and the intended outputs altered.	Ensure that scheme objectives are based on sound evidence and continue to review their relevance throughout the project.	1	3	Green
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Source: <Insert Notes or Source>

3 Project Risks & QRA

Project risks have been assessed as part of the Quantified Risk Assessment (QRA) process adopted for the Western Link project which is discussed further in section 3 of the OBC financial case. The QRA process involved the population of risk register by each of the disciplines involved in delivering the OBC.

The populated risk registers formed the basis of discussion at risk workshops during which the risks were reviewed, added to/amended and quantified where appropriate. The resultant risk register is presented below.

Table 2: Project Risk Register & QRA

Project Risk Register & QRA										
WESTERN LINK STAGE 2b										
RISK										
Ref. No	Risk/Event	Category	Source	Consequence	Mitigation	Least Likely LB £	Most Likely MLB £	Maximum MB £	Probability P - %	Quantitative Cost Calculation = ((LB+2*MLB+MB)/4)* P £
1	Inappropriate media coverage of the scheme	Reputation	Client	Leads to negative public reaction and ongoing, direct opposition to the scheme	Ensure that key information is retained as confidential. Ensure that press releases are reviewed by the Comms department and they are well timed and appropriate. Ensure communication is understood by public and members	£25,000	£50,000	£100,000	40%	£22,500.00
2	Change to funding mix affects WBC costs, WBC have to borrow more	Cost	Client	Western Link client team required to investigate the provision of additional funds internally or via alternative sources	Ensure periodic cost reviews are held and ensure that value engineering is undertaken at key stages of the project.	£2,000,000	£5,000,000	£10,000,000	10%	£550,000.00
3	Errors in traffic model outputs	Programme	Transport Planning	Delay to programme, possible need to redesign scheme, incorrect scheme selection	Detailed checking process for all traffic modelling outputs.	£100,000	£200,000	£300,000	20%	£40,000.00
4	Longer than expected time to complete traffic modelling	Programme	Transport Planning	Delay to programme, potentially miss funding submission date	Regular programme monitoring. Early warnings raised.	£100,000	£200,000	£300,000	10%	£20,000.00
5	Poor highway foundation conditions due to soft alluvial deposits and dredged waste deposits (Arpley Meadows) causing settlement of	Cost	Geotechnical	Poor ride quality and Remedial Works	If earthwork <3m height adopt geocell basal reinforcement; if >3m height adopt pile load platforms to transfer load to either Glacial Soils or Rockhead	£100,000	£500,000	£1,000,000	10%	£52,500.00

Project Risk Register & QRA

WESTERN LINK STAGE 2b

	highway leading to poor ride quality and remedial work									
6	Road construction beneath tidal groundwater levels - potential to infiltrate road drainage, below road surfacing, soften existing rail viaduct foundations; liaison with NR required.	Programme	Geotechnical	Road failure and or pathway for regular flooding	Design to allow for coffer dam and piled road slab to provide resilience against water pressures - impact on NR viaduct to be modelled	£25,000	£50,000	£100,000	25%	£14,062.50
7	Earthworks Mass Haul balance - due to river crossings there is a large imbalance between cut/fill with fill dominant	Cost	Geotechnical	High cost of imported material; significant truck movements with accompanying H&S and Environmental risks	Seek to reduce earthwork footprint where possible; earthworks >4.5m to be reinforced soil	£10,000	£15,000	£25,000	10%	£1,625.00
8	Earthworks - Waste Disposal Potential for all excavated ground between MSC and St.Helens Canal/Sankey Brook to be contaminated - high cost of disposal to non-hazardous and hazardous landfill	Cost	Geotechnical	High waste disposal costs; significant truck movements with accompanying H&S and Environmental risks	Where possible minimise excavation into waste deposits - adoption of geocell within design. Increased quantities could be remediation	£4,559,750	£6,383,650	£9,119,500	50%	£3,305,818.75
9	Prolongation of Public Inquiry	Programme	Client	Delay in progression of the project to site.	Include for Public Inquiry in programme for future stages. Maintain project records so that evidence base for decision making can be provided. Book Legal support early to	£25,000	£50,000	£100,000	20%	£11,250.00

Project Risk Register & QRA

WESTERN LINK STAGE 2b

ensure best available advice.										
10	WBC political approach, Delays land acquisition leading to delay in start on site.	Programme	Client	Delay in start on site date, loss of reputation due to perceived lack of co-ordination of process	Establish well defined CPO timetable and process. Engage specialist advice.	£50,000	£100,000	£500,000	15%	£28,125.00
11	Stakeholder objection to proposals leading to planning, design approvals, site access or land acquisition delays Peel, Solvay, UU, PQ Silcas, Transpenine Trail	Programme	Client	Delay in start on site or cancelation of the project should planning not be granted.	Engage with stakeholders during all stages of the project to inform them of proposals and agree accommodation works, revised accesses etc	£25,000	£50,000	£100,000	50%	£28,125.00
12	Statutory Body Objections to scheme EA	Programme	Client	Additional time and design in reaching agreement	liaison early with all elements	£125,000	£250,000	£500,000	25%	£70,312.50
13	Statutory Body Objections to scheme Network Rail	Programme	Client	Additional time and design in reaching agreement	liaison early with all elements of NR	£125,000	£250,000	£500,000	50%	£140,625.00
14	Statutory Body Objections to scheme Natural England	Programme	Client	Additional time and design in reaching agreement	liaison early with all elements	£125,000	£250,000	£500,000	25%	£70,312.50
15	Objections/challenge raised to procurement process	Programme	Client	Delay to project whilst project is halted to respond to challenge. Possible re-run of procurement leading to addition cost and delays	Procure delivery team through OJEU compliant means.	£50,000	£75,000	£100,000	10%	£7,500.00
16	Sufficiently experienced delivery team not available	Programme	Client	Delay to project whilst teams become available or reduced quality of delivery	Provide advance notification of intended delivery approach and notify potential teams	£50,000	£100,000	£200,000	35%	£39,375.00

Project Risk Register & QRA						WESTERN LINK STAGE 2b				
17	Insufficient time allowance for design period or re-design requirements leading to delays.	Programme	Client	Delay to start on site	Procure programme with well-defined and agreed design duration. Establish co-ordinated design process for delivery.	£20,000	£100,000	£200,000	20%	£21,000.00
18	Resident/Politician /Stakeholder challenges consultation	Reputation	Resolve	Consultation has to be undertaken again, impacts on programme and cost	Thorough Statement of Community Involvement documenting process undertaken and evidence of how consultation was amended and adapted when ongoing. Learn lessons to implement at Stage 2B	£15,000	£20,000	£60,000	50%	£14,375.00
19	Onerous conditions imposed by MSCC on sale of land and construction of foundations and structure in close proximity to Ship Canal	Cost	Bridges	Increased cost of detailed design due to lack of agreement to MSCC conditions	Seek effective engagement with Peel Ports and Peel Holdings and negotiate their access in return for suitable constraints.	£1,000,000	£2,000,000	£3,000,000	45%	£900,000.00
20	Onerous conditions imposed by Network Rail agreement to construction of bridge crossings of Rail Lines	Cost	Bridges	Additional cost of construction due to technical requirements and extended programme to obtain required possessions	Seek effective engagement with Network Rail and negotiate suitable constraints.	£250,000	£350,000	£500,000	50%	£181,250.00
21	Ground conditions worse than anticipated	Cost	Bridges	Advanced copies of borehole data shows pile lengths likely to be near the upper limit of ranges given for costing. May require up to 20% increase in pile length	Review against completed GI report and specify further GI for preferred route.	£250,000	£500,000	£1,000,000	25%	£140,625.00

Project Risk Register & QRA						WESTERN LINK STAGE 2b				
22	Vertical alignment tie in difficulties due to existing topography and height restrictions not accurate on OS Mapping and LIDAR	Design	Highways	Worst case is the route could not be completed to ensure the safe movement of vehicles and pedestrians and full re-design is required	Full topographical survey of the preferred route required to confirm vertical alignment risk can be mitigated. (E.g over MSC, under WCML, over Mersey at Forest Way)	£250,000	£750,000	£1,000,000	15%	£103,125.00
23	Horizontal alignment tie in difficulties due to existing topography not accurate on OS Mapping	Design	Highways	Worst case is the route could not be completed to ensure the safe movement of vehicles and pedestrians and full re-design is required	Full topographical survey of the preferred route required to confirm horizontal alignment risk can be mitigated. (E.g through WCML and Walton Viaduct, around electrical grid site)	£250,000	£750,000	£1,000,000	15%	£103,125.00
24	Sustainable drainage not agreed with EA as only possible with preferred route chosen.	Design	Highways	EA not agreeing the drainage proposal are sustainable and will address flood risk suitably. Worst case is the route could not be completed to ensure sustainable development, additional attenuation and flood protection	Complete sustainable drainage assessment of the preferred route to ensure suitable outfalls, attenuation and flood protection is calculated for the preferred route with reference to the flood model. Confirm assumptions used for drainage with EA and WBC.	£500,000	£1,000,000	£2,000,000	30%	£337,500.00
25	Utility clashes due to limited corridor for route, including all general stats risks	Cost	Highways	Costly diversions of high level utilities impacted by the construction of the route. Worst case is multiple high cost diversions are required to complete route	GPR survey of entire preferred route. Modify alignment of preferred route to minimise diversions	£3,000,000	£4,000,000	£5,000,000	75%	£3,000,000.00
26	Severance / closure of public rights of way reducing permeability of the area to non-motorised modes.	Design	Transport Planning	Potential objections from interested parties. Retrospective design changes	Ensure design lines are incorporated as design progresses. Minimise disruption to public rights of way.	£100,000	£150,000	£250,000	25%	£40,625.00

Project Risk Register & QRA						WESTERN LINK STAGE 2b				
27	Link road causing severance of local communities and facilities.	Design	Transport Planning	Potential objections from interested parties. Retrospective design changes	As design progresses accurately map populations and trip attractors to help ensure severance is minimised	£100,000	£200,000	£300,000	25%	£50,000.00
28	Replacement of community facilities	Design	Transport Planning	Potential objections from interested parties. Retrospective design changes,		£100,000	£200,000	£300,000	50%	£100,000.00
29	Achieving adequate access to Network Rail / EWS depot adjacent to WCML	Design	Transport Planning	Potential objections from interested parties. Retrospective design changes	Negotiate with rail operators on their minimum access requirements	£20,000	£50,000	£100,000	10%	£5,500.00
30	Cost of acquiring businesses where severance results in whole property being acquired.	Cost	LSH	Additional Cost of Compensation.	Early negotiations with claimants to ascertain likelihood of such a claim being received.	£1,000,000	£1,500,000	£3,000,000	20%	£350,000.00
31	Impact on ongoing businesses where part only taken.	Cost	LSH	Additional Cost of Compensation.	Early negotiations with claimants to ensure impact on businesses is minimised as far as reasonably possible.	£1,000,000	£1,500,000	£3,000,000	25%	£437,500.00
32	Impact on residential property (including nearby property).	Cost	LSH	Additional Cost of compensation. Negative press/PR.	Avoid acquisitions of residential property where possible. Maintain a budget for blight and Part 1 claims which is reviewed regularly.	£1,000,000	£2,000,000	£3,000,000	10%	£200,000.00
33	Improving market conditions.	Cost	LSH	Additional Cost of compensation	Frequent LCE reviews to ensure accuracy of budget to take into account market conditions.	£250,000	£500,000	£1,000,000	20%	£112,500.00
34	Lack of information (e. g floor areas, internal/external repair of buildings, unknown ground conditions and information	Cost	LSH	Additional Cost of compensation	Early negotiations with claimants to ascertain likelihood of such a claim being received.	£250,000	£500,000	£1,000,000	25%	£140,625.00

Project Risk Register & QRA

WESTERN LINK STAGE 2b

	relating to business accounts/profitability).									
35	Claims for No Land Taken (where properties have now been avoided through route realignment).	Cost	LSH	Additional Cost of compensation	Maintain access to all properties during works. Obtain traffic management plans at the earliest opportunity for review.	£1,000,000	£2,500,000	£5,000,000	50%	£1,375,000.00
36	Weather event, stats diversions delayed, supply chain difficulties	Programme	Construction	Additional construction activities time and cost	Robust programme, monitoring and management	£500,000	£1,000,000	£1,500,000	50%	£500,000.00
37	Additional Inflationary Effects	Cost	Construction	Additional time and cost		£4,000,000	£8,000,000	£16,000,000	25%	£2,250,000.00
38	Impact of Brexit	Cost	Construction	Change in legislation, labour supply, standards, taxation		£500,000	£2,000,000	£3,000,000	15%	£281,250.00
39	Ecological - Wintering Birds	Cost	Environment	Mersey is area of significance	additional surveys, restriction on construction, purchase of mitigation land	£200,000	£750,000	£3,000,000	25%	£293,750.00
40	Ecological	Cost	Environment		additional surveys, restriction on construction, purchase of mitigation land	£1,000,000	£2,000,000	£3,000,000	20%	£400,000.00
41	Archaeological	Cost	Environment	Additional time and cost for investigating any finds	surveys and investigation	£500,000	£750,000	£1,000,000	25%	£187,500.00
42	Village Green Status applied for by objectors to a route	Cost	Construction	Additional time and cost	Legal advice on prior noticing to public areas	£50,000	£100,000	£250,000	10%	£12,500.00
43	Poor highway foundation due to Gatewarth Landfill encountered beneath road alignment, potential for	HSE	Geotechnical	Poor ride quality, high maintenance liability, environmental risk of inducing leachate release from landfill, HSE risk of inducing landfill gas release into	Minimise excavation into landfill (after 40+ years, much of the biodegradation should have occurred, hence settlement less of an issue than Arpley) - reinstate capping as	£1,000,000	£1,500,000	£2,000,000	20%	£300,000.00

Project Risk Register & QRA

WESTERN LINK STAGE 2b

	radioactive waste, on-going bio-degradation inducing settlement, landfill stability issues, waste disposal issues and leachate and gas and landfill liability issues Phases 1&2 1970's Landfill (40% domestic waste, 60% industrial waste - potential radioactive rubble from Risley) - recent settlement and stability issues; Phase 3 1980's - unknown waste but potential leachate collection system			drainage runs, potential to destabilise landfill slopes; potential radioactive waste	required. If earthwork <3m height adopt geocell basal reinforcement; if >3m height adopt pile load platforms to transfer load to either Glacial Soils or Rockhead					
44	Design Scope Changes	Cost	Construction	Additional time and cost	Control and definition of scope by Client and delivery team	£7,500,000	£10,000,000	£15,000,000	55%	£5,843,750.00
45	HSE	HSE	Construction	Additional time and cost	Risk and mitigation identification during Detailed Design and Construction	£750,000	£1,000,000	£2,000,000	10%	£118,750.00
46	Traffic Management Restrictions	Programme	Construction	Additional time and cost	Agree restrictions at outline stage of design and pricing	£250,000	£500,000	£1,000,000	20%	£112,500.00
47	Insufficient land take to allow construction at junctions	Design	Highways	Additional, disruption to travelling public, time and cost	Consider additional land purchase for temporary roads, agree TM strategy early and communicate	£2,500,000	£5,000,000	£10,000,000	20%	£1,125,000.00

Project Risk Register & QRA						WESTERN LINK STAGE 2b				
48	Rail possessions overruns	Programme	Highways	Additional, disruption to travelling public, time and cost	Robust possession planning and back up plans, increased insurance provision	£1,500,000	£2,500,000	£5,000,000	10%	£287,500.00
49	Non-availability of NR OROR possession	Programme	Construction	Additional, disruption to travelling public, time and cost	Robust possession planning and back up plans, increased insurance provision	£1,500,000	£2,500,000	£5,000,000	5%	£143,750.00
50	Traffic Modelling requires wider WBC network Improvements	Cost	Highways	Additional cost of construction works		£5,000,000	£7,500,000	£10,000,000	50%	£3,750,000.00
51										£27,621,131.25

Source: <Insert Notes or Source>

4 Opportunities

Project opportunities (i.e. positive risk events) have been assessed as part of the Quantified Risk Assessment (QRA) process adopted for the Western Link project which is discussed further in section 3 of the OBC financial case. The QRA process involved the population of opportunity registers by each of the disciplines involved in delivering the OBC.

The populated opportunity register formed the basis of discussion at risk workshops during which the risks and were reviewed, added to/amended and quantified where appropriate. The resultant opportunity register is presented below.

Opportunities have been assessed based on review of the probability of occurrence and the impact on cost, programme or quality should they occur.

Table 3: Opportunity Register**Opportunity Register**

Ref	Item	Comments	impact	likelihood	severity
1	Headroom allowance over River Mersey reduced by Peel Ports so Forrest Way bridge has reduced headroom	Embankments on Approach to bridge have reduced height leading to reduced costs.	3	3	yellow
2	Arpley Tip	Reopen to facilitate disposal of material from scheme leading to reduced costs for export of hazardous material	3	2	yellow
3	Remediation of material onsite to engineering fill	Reduced cost for export of hazardous material	3	3	yellow
4	Reduce diversion to overhead electric cables	Revise vertical alignment possible and recued costs for diversion cost	4	3	red
5	Reduce service diversions	Reduce extent of diversions through dialogue with utilities companies. Reduced diversion costs achieved.	2	4	yellow

Source: Mott MacDonald

5 Monte Carlo Analysis

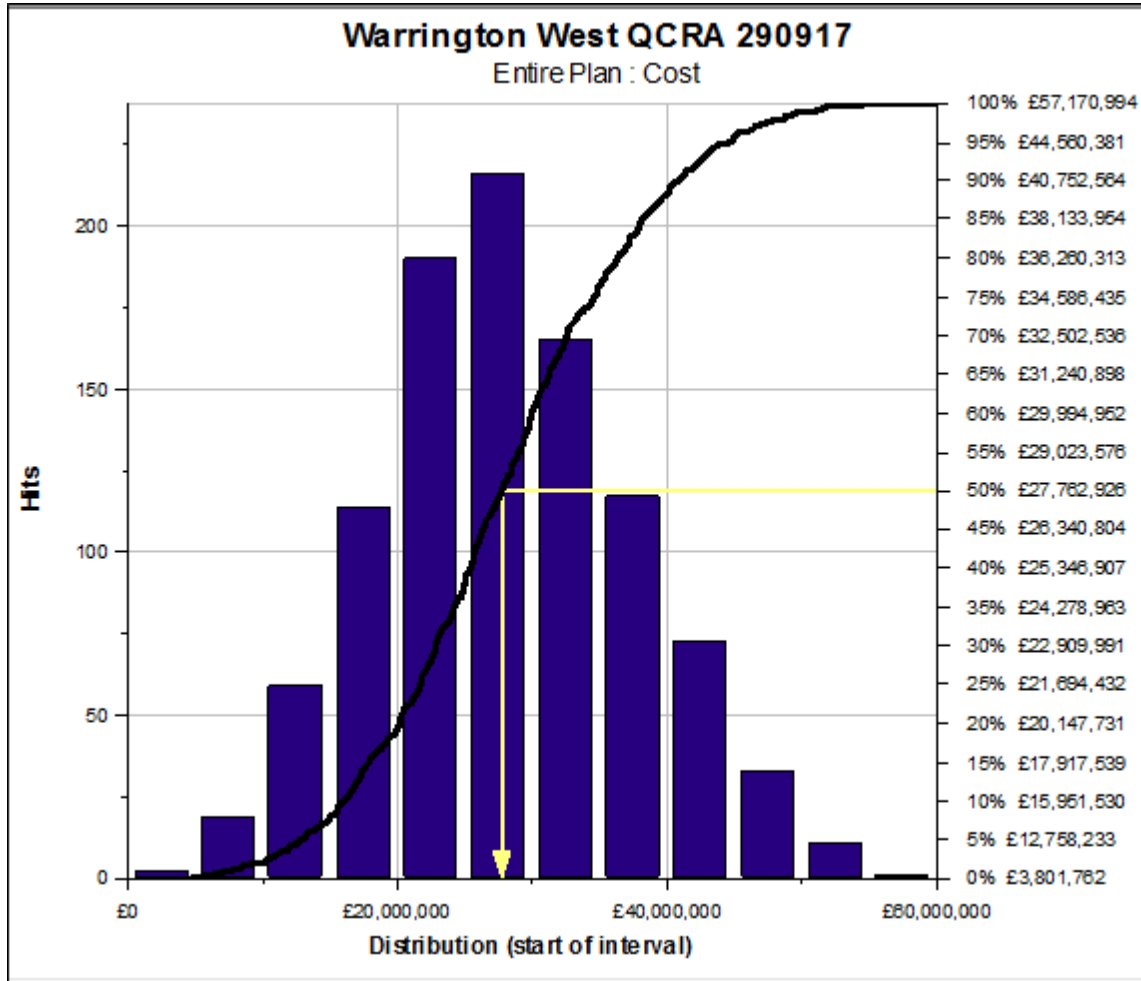
A Monte Carlo analysis of the project risks has been undertaken. This analysis takes data which is uncertain and runs a number of simulations to obtain a statistical representation of the probability of the outcome. The Monte Carlo analysis is important as it enables scenario based analysis to be generated to inform the assessment of risk and sensitivity testing of the project.

The Monte Carlo analysis indicates a probabilistic outturn cost (or P50 value) of £27,762,926 will be required based upon the identified risk impacts taken from the project risk register. The full range of cost outturn at 5% increments is shown in the cumulative probability curve below.

The value of risk included in the project costs presented in the financial case is £27,621,131. This has been based on the Quantified Assessment undertaken as noted in section 3. The P50 value returned by the Monte Carlo analysis is seen as a validation of this figure obtained from the QRA as it is within 0.5%.

The Monte Carlo analysis also shows that in 80% of cases, the costs associated with risk will not exceed £36,260,313 (known as the P80 value). This value has been used as part of the sensitivity testing described in the Economic Case.

Figure 1: Western Link Project Risk Monte Carlo Analysis



Source: Mott MacDonald

