
**Manchester City Council
Report for Information**

Report to: Children and Young People Scrutiny Committee - 10 October 2017

Subject: New Central / East Secondary School

Report of: Interim Director of Education

Summary

This report provides a further update on progress to establish a new secondary school in central / east Manchester, which was approved by the Executive in December 2016, in order to meet a growing need for secondary school places. It provides a summary of the independent review conducted by Arup into work originally carried out by Laing O'Rourke and Ramboll to determine the site conditions of Nutsford Vale and identify a remediation strategy to enable a new school to be built and addresses comments outstanding from the Children and Young People Scrutiny Committee on 5 September 2017.

Recommendations

The Children and Young People Scrutiny Committee are asked to:

1. Note the outcome and conclusions of the Arup independent review of the work undertaken by Laing O'Rourke and Ramboll to investigate site conditions and determine how the site can be remediated to enable the construction of a secondary school.
 2. Note the review undertaken of an alternative site proposed for the required new secondary school.
 3. Note the availability of 'Green Lung' open space that will continue after the development of the proposed school.
 4. Note that the Free School Academy presumption process to identify the Council's preferred provider for the proposed new school will commence shortly.
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Wards Affected – primarily Gorton South and Longsight

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Background documents (available for public inspection):

The following documents disclose important facts on which the report is based and have been relied upon in preparing the report. Copies of the background documents are available up to 4 years after the date of the meeting. If you would like a copy please contact one of the contact officers above.

1. Report to Children and Young People Scrutiny Committee – 6 September 2016
2. Report to Executive Committee – 14 December 2016
3. Report to Children and Young People Scrutiny Committee – 5 September 2017

1.0 Introduction

1.1 This report follows a report submitted to this Committee on 5 September and provides a further update on progress to establish a new secondary school in central / east Manchester which was approved by the Executive in December 2016. The proposed location for the new school is part of Nutsford Vale, Matthews Lane, in Gorton South. This report outlines:

- The outcome and conclusions of an independent review by Arup of the work undertaken by Laing O'Rourke and Ramboll to investigate site conditions and determine how the site can be remediated to enable the safe construction of a secondary school;
- A review of an alternative site proposed for a new secondary school; and
- The availability of 'Green Lung' open space that will continue after the development of the proposed school.

2.0 Background

2.1 The report to Children and Young People Scrutiny Committee on 5 September 2017 outlined the council's approach to ensuring that the community and key stakeholders have been consulted and informed throughout the process. The following list demonstrates the extensive level of consultation and information that has been provided:

- 3 Public Consultations
- 3 consultation meetings with Friends of Nutsford Vale
- 1 consultation meeting with Friends of Nutsford Vale on site to specifically discuss wider Vale improvements
- 1 x meeting with Friends of Nutsford Vale and Cllr Rosa Battle, (Executive Member for Children's Services at the time) and Amanda Corcoran, Interim Director of Education
- 2 x meetings with Friends of Nutsford Vale and independent consultant Arup
- 3 consultation meetings with the Grange School
- 2 consultation meetings with City of Trees (Red Rose Forest)

2.2 Throughout the process the council have encouraged as many people as possible within the local community to contribute to the consultation process, in order to have a strong breadth and diversity of feedback and gain an insight into the widest possible range of local views.

2.3 Throughout the consultation process efforts were made to extend the geographical area of invitees, and the types of invitation was broadened from door to door leaflet delivery, to social media networks such as MCC twitter and Facebook, plus the Local Neighbourhood Facebook page.

2.4 The previous report to Children and Young People Scrutiny Committee in September 2017 referenced the three Public Consultation events that were held in Longsight, Levenshulme and Gorton South between February and July 2017, in order to gain the feedback of all local residents. Invitation and attendance was as follows:

Consultation	Leaflet issued	Invites	Recorded attendees	% of attendees against invitations delivered
1. Feb 2017	1000		91	9%
2. Mar 2017	2500		36	1.4%
3. July 2017	4800		63	1.3%

3.0 Initial Site Investigations

3.1 Since initial works to determine the viability of the site were carried out, contamination related testing was undertaken on the Matthews Lane project. This included gathering information about the site through desk studies, walkover surveys and intrusive investigations. As outlined in the report to Scrutiny on 5 September the Council commissioned Laing O'Rourke and Ramboll to undertake a range of detailed intrusive site investigation surveys to understand its' suitability for the development of a secondary school and survey works were carried out between November 2016 and January 2017. The initial feedback provided by the site survey works regarding matters such as materials found, landfill depth and capping depth, were fed into the site appraisal process. The report to Children and Young People Scrutiny on 5 September included the detail of the initial site investigation works undertaken.

3.2 The approach has been to identify and assess the risks that exist on the site. This has been done in conjunction with the Environmental Health Office from the City Council and the Environment Agency to ensure they, as statutory consultees to the planning process, are in agreement with the approach being adopted. This assessment has identified measures that have been or are being designed and managed as part of the development proposals to ensure a school can be safely built on the site and to safeguard members of the public, adjacent properties, future users and the construction team.

4.0 Arup Review

4.1 At the consultation events concerns were raised about the validity of the site investigation works undertaken by Laing O'Rourke and Ramboll. An independent assessor, Arup, were engaged to review the process undertaken and they have assessed the compliance of Laing O'Rourke / Ramboll against recognised standards and best practice, together with a technical review of the information provided. The full report compiled by Arup is attached at **Appendix A** to this report.

4.2 In summary the review by Arup noted that:

- There are no issues that preclude the development of the school at Nutsford Vale:

- A Compliance Review concluded that the approach taken by Ramboll has been compliant with current best practice;
- A Technical Review determined that the overall conclusions drawn by Ramboll to date are considered to be compliant with current best practice and are technically appropriate for this stage in the design and planning process; and
- The information provided by Ramboll and Laing O'Rourke is considered adequate to demonstrate that the risks should be mitigatable.

4.3 The key contaminants that have been found were outlined in the previous Scrutiny Committee report and specific concern was raised around the presence of, specifically, cyanide and mercury. As further tests and results and assessments have been made available, Arup have been able to comment that; "*Review of Ramboll's groundwater screening assessment in the interpretative report indicates cyanide and mercury have not been detected in groundwater at a concentration above drinking water standards*". The risk assessments have also confirmed that the perceived risk to human health is low to moderate and is manageable with the appropriate measures in place. The attached report outlines measures that will be put in place to ensure that the community, contractors, and end users, are not be exposed to any contact during and after the development.

4.4 In order to try to allay the concerns raised by the Friends of Nutsford Vale (FONV) two events were organised for them to meet with Arup to understand the review work being undertaken by Arup and to provide the opportunity for questions and queries to be raised. One of the issues raised by FONV at these meetings was to receive comfort that the Council have learnt lessons from a primary school built at Reddish Vale in Stockport. From the information available on this school development we are confident that the ground engineering proposals for the school building proposed at Matthews Lane are robust. They have been developed as the ground conditions have been better understood through soil, groundwater and ground gas monitoring results and the team are able to determine and refine the engineering solutions required for the development.

4.5 In order to continue to be completely open and transparent with the local community it is proposed to establish open lines of communication with the community. This will be through monthly Community Liaison meetings led by the Council's Project Manager supported by both the Site Project Manager and the Neighbourhood Coordinator.

The purpose will be to discuss, among other things: what planning conditions have been applied and why, how planning conditions will be discharged and progressed and an explanation of forthcoming construction activities on the site advising on such things as vibration concerns and the structural stability of properties in the vicinity of excavations.

5.0 Review of an Alternative Site

5.1 Following the Children and Young People Scrutiny Committee meeting on 5 September officers were asked to consider an alternative site for the construction of a new secondary school. This site is in the Gorton South Ward and is located, off Barlow Road adjacent to the boundary with Reddish. The site is a vacant sports

facility and was East Manchester Cricket Club until the club closed and withdrew their interest in it. This site is only 3 acres in size. The site would only be viable if the adjacent Levenshulme allotments were relocated and the allotment site was included. The site including the cricket ground and allotments is 16 acres although the DfE BB103 recommended minimum area for a 1200 school is 17 acres.

5.2 Whilst access to this site is poor and the site is adjacent to the Stockport border and is likely to therefore attract Stockport as well as Manchester children the site is feasible. The removal of the sporting facility would require Sport England approval which is likely to require ensuring alternative sports provision is provided, which could be through the facilities of a new school.

5.3 The biggest challenge would be in relocating the allotments. There are 227 plots, 215 of these are full and the remaining 12 are currently unfit for use due to issues of ground contamination. There is a waiting list for plots on the site and the Allotment Society are working to bring 6 of these plots back in to use.

5.4 The current position of Levenshulme Allotments will make the case to dispose of the allotment very challenging. There is a process for the disposal of Statutory Allotment sites and the three key aspects of the statutory criteria for disposal are as follows:

- The Secretary of State is satisfied that adequate provision will be made for allotment holders displaced by the action of the local authority; or
- The Secretary of State is satisfied that such provision is unnecessary; or
- The Secretary of State is satisfied that such provision is not reasonably practicable.

The following policy criteria has to be met before disposal is approved:

- The allotment in question is not necessary and is surplus to requirement;
- The number of people on the waiting list has been effectively taken into account;
- The council has actively promoted and publicised the availability of sites and has consulted the National Allotment Society; and
- The implications of disposal for other relevant policies, in particular local plan policies, have been taken into account.

5.5 Options to relocate the allotment are limited and could not be achieved in one alternative site. The time to complete the total relocation and to secure the formal closure of the allotments, highly unlikely given past experience of seeking to close allotments, will not meet the timelines for providing the school places needed and it is recommended that this option is discounted.

5.6 Children and Young People Scrutiny Committee also asked officers to consider the expansion of existing secondary schools as an alternative to building a new secondary school. A programme of expanding schools, both primary and secondary schools, has been underway for over three years and the majority of existing secondary schools have already been expanded in the City. Options for further expansions are limited and in many cases will provide an additional one off bulge class rather than an additional class across all year groups. Officers will continue to promote expansions but as these will go nowhere near meeting the

needs of the additional pupil places that are required a new secondary school is required.

6.0 Retention of the Green Lung

6.1 From the outset the council have openly acknowledged the fact that the development of a new secondary school on Nutsford Vale will require part of the Nutsford Vale open space.

6.2 However the council remains mindful of the need and desire to maintain and promote the 'green lung' benefits of its open and natural areas, in line with the vision of the Green and Blue Infrastructure Strategy which includes having effective and appropriate tree and woodland management and planting.

6.3 It is important to note that:

- The site is not designated for its nature conservation value.
- There are no nationally designated Landscape features on site.
- There are no priority ecological habitats on site.
- All woodland has been planted after 1998 and has an age of less than 29 years.
- No notable protected or priority species have been recorded on the site, with the exception of foraging bats (as opposed to roosting or breeding bats).
- To facilitate access into the proposed school development 39 individual mature trees are to be removed from the belt of trees fronting Matthews Lane.
- In this instance using Manchester City Council's policy of 2 for 1 replacement 78 new individual trees minimum size 14 – 16cm girth are to be planted within the new school grounds as indicated on the Landscape Masterplan.
- New native tree and shrub planting belt to the western boundary of the school replicating species found in the remaining Nutsford Vale site - ranging from 8m wide at its narrowest up to 30m at its widest. This area once established will act as a landscaped screen between the school and adjacent residential and works buildings plus become a natural environmental on-site resource.
- The area could be used to develop a future Forest Schools programme.
- Native hedgerow planting along sections of the eastern and southern school boundary to add nature conservation interest, help integrate the site into the wider Nutsford Vale and act as a green screen
- Individual tree planting throughout the site for seasonal interest, shade and habitat creation.
- Shrub beds containing flowering nectar rich species to encourage insects and butterflies plus add seasonal interest.
- In addition to measures being taken to retain the key elements of a natural environment within the school boundary, the benefits and desirability of providing an improvement scheme to the wider Nutsford Vale is also recognised.
- The objective of these improvements would be to retain and enhance the semi-natural habitats on the remaining Nutsford Vale green space and to

improve visitor access and the visitor experience to the area of semi-natural green space.

6.4 To achieve these objectives commitment to a wide range of improvements works are being proposed; a Nutsford Vale Improvement Works drawing for these proposals can be found at **Appendix B**, which includes plans such as:

- To relocate recent planting of approximately fifty number fruit trees, which form a developing Community Orchard, from the proposed Matthew Lane School site to a suitable location within Nutsford Vale
- To implement elements of the Nutsford Vale (South) Management Plan and the Draft Nutsford Vale Management Plan 2012-2022 prepared by Groundwork, Red Rose Forest and Manchester City Council; including the thinning of up to 25% of 16500m² of existing woodland to improve ecological habitat, creating habitat lo and brash piles within the woodland; removal and replacement of dense woodland edge scrub; coppicing of scrub woodland along pathways and creation of a new woodland ride providing suitable habitat for woodland edge butterflies.
- Addition of bird, bat and hedgehog boxes plus two purpose built hibernacula
- To replace and reform a path network on Nutsford Vale green space to safeguard community investment in the site. Additional 390 linear m's of paths added to replace path network removed from footprint of Matthew Lane school site.

6.5 In addition to the continued and in some ways improved ecological and open space benefits provided by Nutsford Vale, this location is also surrounded by a range of areas of natural/Semi-natural Parks and Open spaces, within walking distance of Nutsford Vale.

6.6 Whilst neither East nor Central has an abundance of natural/semi natural open space, East is better served and does have a good supply of other types of open space.

6.7 The proposed school would take some of the natural/semi natural land at Nutsford Vale, but not all of it and other improvements to the rest of the area would enhance the quality of the remainder of the site, **Appendix C** provides a map showing the surrounding availability of this type of accessible open space which continue, alongside Nutsford Vale to provide the 'green lung' effect, for the local community and the wider city.

7.0 Conclusion

7.1 The report submitted to Children and Young People Scrutiny on 5 September outlined the intrusive site investigations carried out by Laing O'Rourke and Ramboll and the validation of this work by the Council's Environmental Health Office and the Environment Agency. Following concerns raised through the consultation process, Arup were commissioned to undertake a full review of the work carried out by Laing O'Rourke and Ramboll. This included Arup holding two meetings with the Friends of Nutsford Vale to explain both the process of their review and the outcome of it. Arup concluded that there are no issues that preclude the development of the school at Nutsford Vale.

Recommendations

The Children and Young People Scrutiny Committee are recommended to:

Note the outcome and conclusions of the Arup independent review of the work undertaken by Laing O'Rourke and Ramboll to investigate site conditions and determine how the site can be remediated to enable the construction of a secondary school.

Note the review undertaken of an alternative site proposed for the required new secondary school.

Note the availability of 'Green Lung' open space that will continue after the development of the proposed school.

Note that the Free School Academy presumption process to identify the Council's preferred provider for the proposed new school will commence shortly.

Manchester City Council
**Matthews Lane Proposed High
School**
**Independent Review of
Contamination Aspects**

REP/257352/R1

Issue | 29 September 2017

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 257352

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Appendices

Appendix A

Compliance Review

Appendix B

Technical Review

Executive Summary

Arup has been commissioned by Manchester City Council (MCC) to carry out an independent review of documents relating to ground contamination prepared by Ramboll and Laing O'Rourke (LOR) in relation to a proposed school development at Matthews Lane in Manchester, the site of a former landfill.

The concerns relating to ground contamination at the proposed school development at Matthews Lane can be divided into three main topics that have been systematically considered in this review:

- human health, both of future school pupils, staff and neighbouring residents;
- groundwater contamination resulting from the landfilled waste and its potential impact on local groundwater resources and surface watercourses (controlled waters); and
- landfill gas and the potential risks it poses to future users of the school and neighbouring residents.

The first part of this review comprised a Compliance Review considering compliance of the methodology of the Ramboll assessments with relevant best practice standards.

The second part comprised a detailed Technical Review of the documents initially submitted by Ramboll, namely desk study, factual report, interpretative report and remedial (or remediation) strategy.

Additionally, the scope included engagement with Friends of Nutsford Vale (FONV), a local community group, to understand their specific concerns relating to contamination. A series of questions and answers to address these concerns have been included in Section 5, and a follow-up session held with FONV to discuss.

Following the initial compliance and technical reviews, where further information was needed, a series of queries were submitted to Ramboll/LOR. Supplementary information has been provided by Ramboll/LOR in response to these questions, and these have been included in this review.

Summary findings

As would be anticipated at this stage of the design and planning process, many aspects have not yet been fully assessed and additional data, risks assessments and the design of mitigation measures are required prior to construction.

It is believed that none of these issues preclude the principle of development of the school, but will need to be considered and where required, appropriate mitigation measures developed to address them.

There is further work still to complete at this stage which is typical for proposed developments on brownfield land, where the planning application is supported by information and assessments to demonstrate that mitigation of risks can be achieved. However, details of the mitigation measures are not usually provided at

application stage and development of the mitigation design usually takes place following grant of planning consent. If consent is granted it is usually conditioned to require any outstanding information prior to commencement of construction, typically ground investigation, risk assessment and remedial strategy and a verification report following completion.

The EHO is the lead regulator in relation to the potential risks posed to human health and from landfill gases. The EA is the lead regulator in relation to the potential risks posed to controlled waters. As statutory planning consultees, the EHO and EA will make recommendations to the Planning Authority regarding approval and planning conditions. If planning consent is granted, it is usually conditioned to require any outstanding information prior to the start of construction, typically ground investigation, risk assessment and remedial strategy and a verification report following completion. It should be noted that Ramboll/LOR have already partially fulfilled some of these requirements with the information reviewed to date. The EHO and EA will also be consulted on additional information provided in response to planning conditions and will make recommendations regarding the discharge of those conditions.

Compliance Review

The Compliance Review concluded that the approach taken by Ramboll has been broadly compliant with current best practice. This conclusion was drawn with the benefit of additional information provided by Ramboll, which showed that their decisions were evidence-based.

Technical Review

The Technical Review determined that the overall conclusions drawn by Ramboll to date are considered to be compliant with current best practice and are technically appropriate for this stage in the design and planning process.

Information review

In this context the information provided by Ramboll/LOR is considered adequate to demonstrate the risks should be mitigatable. In some instances by providing responses to some of Arup's queries, a greater level of detail has been provided than would actually be normally expected at this stage. The data collection and assessments to inform design of mitigation at Matthews Lane School are not yet complete, however Ramboll/LOR demonstrated that their work remains ongoing.

Ramboll/LOR have acknowledged the need for additional pieces of information, particularly in relation to the management of risks during construction, which would normally be provided prior to the start of construction.

Findings

Human Health risks

- Arup's interpretation of the information submitted for this review agrees with the general approach towards human health risk assessment and the main conclusions arrived at by Ramboll.
- The review has identified that Ramboll's approach is in line with current best practice and is strongly precautionary in terms of the human health assessment criteria used for soil to be placed within the school site;
- Ramboll has addressed Arup's queries regarding the proposed remediation solutions, providing further detail where necessary to demonstrate that the risks have been adequately assessed;
- Provided that the proposed mitigation measures are implemented in line with Ramboll/LOR's own recommendations, then the site should not pose an unacceptable risk to health during and after development.

It should be noted that landfill gas risks have been considered separately, see **Section 3.4**.

Controlled waters risks

Although groundwater investigations and controlled waters risk assessment has been undertaken by Ramboll/LOR, several aspects have not been fully assessed at this stage or the proposed approach confirmed. Again, this is typical for brownfield developments where ground investigation and risk assessment often takes place in phases, with data gaps being identified and progressively closed out with further data collection and risk assessment. It is acknowledged that the current investigations are being undertaken in full consultation with the Environment Agency (EA) in line with their requirements and current best practice.

The amount of information presented by Ramboll/LOR in relation to controlled waters is commensurate with what would be expected with a planning application submission. Planning conditions are typically applied to ensure the additional information is produced and approved by the environmental regulators prior to commencement of works. Ramboll /LOR acknowledge the need for the majority of the additional information prior to construction.

The main points relating to groundwater and surface water protection at Matthews Lane landfill are identified below.

- The significance of the current groundwater and surface water impact, and potential for future impact, associated with the landfill waste body within the school site has not yet been fully assessed, as required by Environment Agency guidance 'Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination'. Ramboll has indicated additional ground investigation, groundwater monitoring and sampling of Nico Ditch is required to inform further controlled water risk assessment. This risk assessment should determine the need for remediation to protect groundwater and surface water. Ramboll has consulted the EA regarding the scope of

further assessment. It is expected the further assessment and mitigation design would be required by pre-commencement planning conditions, which may include additional proposals for groundwater remediation.

- The Ramboll reports acknowledge that piling presents an additional risk to groundwater that must also be assessed. On brownfield redevelopments where necessary, a 'Foundation Works Risk Assessment' (also known as a piling risk assessment) is required by a pre-commencement planning condition. Typically a piling risk assessment is not prepared at planning application stage, however an outline draft Piling Risk Assessment has been produced by Expanded for Laing O'Rourke. The potential for piling to increase shallow groundwater levels and vertical gradient to the sandstone, thus increasing flow along existing pathways between waste and sandstone, must also be considered.
- Ramboll has indicated all drainage from hardcover areas will be transmitted offsite, and the controlled waters risk assessment will consider the need for low permeability cover in any non-hardstanding areas. The geotechnical design should consider the need for reinforced utility corridors to prevent settlement impact on drainage and other utilities.
- Geotechnical ground improvement proposals should consider the impact on shallow groundwater and propose mitigation. Increasing shallow groundwater level also increases the vertical gradient to the sandstone aquifer, potentially resulting in greater contaminant migration. This should be considered in the groundwater risk assessment.

Landfill Gas

Arup's interpretation of the information submitted for this review agrees with the general approach towards landfill gas risk assessment and the main conclusions arrived at by Ramboll. The review has identified that:

- Ramboll's use of continuous gas monitoring is in line with current best practice and is likely to provide a reasonable worst-case on which to develop gas mitigation measures;
- The information presented in the initial reports is considered to be typical of the level of detail which would be required at planning application stage;
- Ramboll and Laing O'Rourke acknowledge that landfill gas poses a potential risk to the school development and potentially adjacent site users;
- Sufficient data is not yet available to provide an assessment of the risk, but this is in the process of being collected and will be reported in October 2017, together with proposed mitigation measures.

Conclusions and Recommendations

As would be anticipated at this stage of the design and planning process, many aspects have not yet been fully assessed and additional data, risk assessments and design of remediation/mitigation measures are required prior to construction.

As discussed previously, it is believed that none of these issues preclude the principle of development of the school. They will need to be considered as additional information and assessments are undertaken, and where required, appropriate mitigation measures developed to address them.

Planning conditions will need to be applied to ensure these assessments and appropriate design is completed pre-construction and that the approved works are implemented. It is recommended, in line with best practice, that their compliance with these planning conditions are assessed by the Environment Agency and MCC Environmental Health Officer.

Arup's review identified some gaps in the information provided to date that should be filled as further information is developed. The following recommendations are made to ensure that the actions are carried forward and the information provided prior to the start of construction:

Human health

- The Remedial Strategy should be updated to state that existing soils will not be re-used at surface in the school development;
- The proposal for raised planters to be sited on hardstanding and filled with soils suitable for a 'residential with plant uptake' scenario should be included in the Remedial Strategy;
- The Construction and Environmental Management Plan (CEMP) should consider the potential for, and mitigation of, cross-boundary migration of asbestos fibres during construction;
- The LOR proposed methodology for the control of odour/nuisance during construction should be documented in the CEMP;
- The LOR proposed methodology for the prevention of the spread of contamination onto adjacent highways during the construction period should be documented in the CEMP;
- The Remedial Strategy should consider the implications of unforeseen radiological contamination, and any measures that would be required in mitigation.

Landfill gas

- Further information on gas protection for future buildings within the school development, details of any gas venting required in external areas of the school and an approach to prevent new utilities becoming future pathways for gas should be prepared following the outcome of the revised gas risk assessment;
- A risk assessment, developed using the results of the continuous gas monitoring, should be prepared which considers the potential for gas migration offsite both during construction and in the future;
- The potential for Nico Ditch and other existing drainage to act as a potential gas migration pathway should be considered;

- The potential presence of, and risks associated with, landfill trace gases should be considered.

Water environment

- A risk assessment should be prepared which fully assesses the risks to groundwater and Nico Ditch associated with the waste body. The assessment should take into account the results of further groundwater monitoring and sampling of Nico Ditch which is currently in progress;
- Piling through the waste body presents significant additional risk to groundwater that has not yet been fully assessed. The proposed piling methodology has changed as the scheme has developed, and Continuous Flight Auger (CFA) piling is now proposed instead of driven piles, following consultation with the EA. A piling risk assessment should be prepared that considers the feasibility of the proposed method as well as the risks associated with existing pathways and those created by new piles. EA approval should be obtained prior to commencement of piling;
- Geotechnical ground improvement has the potential to increase shallow groundwater levels and increase contaminant migration into the sandstone. This should be assessed through groundwater risk assessment and appropriate mitigation proposed.

Arup recommends that this report is circulated to the EHO and EA officers dealing with the planning submission, to ensure that where recommendations for additional information requirements have been made as a result of this review, these can be captured as any planning conditions are developed, or taken into account when considering applications made for the discharge of conditions.

1 Introduction

1.1 Background

Arup has been appointed by Manchester City Council (MCC) to undertake an independent third party review of documents prepared by Ramboll Environ (Ramboll) for Laing O'Rourke (LOR) relating to a proposed new high school at Matthews Lane, located on a former landfill site. The commission has three main components:

- a compliance review,
- a detailed technical review; and
- responses to technical questions raised by the Friends of Nutsford Vale (FONV).

This report is structured to reflect these three main components.

1.2 Scope of compliance review

The scope of the compliance review comprised a detailed review of the methodology presented in the Ramboll documents, to determine whether it is in compliance with the relevant best practice standards and the production of a report comparing best practice requirements with the approach taken for each element of the ground investigation, risk assessment and remediation design process.

The compliance review did not seek to verify any interpretation of the data made by Ramboll (i.e. the ground model and risk assessments) as this was the subject of the detailed technical review presented elsewhere in this report.

The compliance review findings are presented in **Section 2** and supporting information is presented in **Appendix A**.

Where technical clarifications have been needed in relation to compliance, these have raised with Ramboll and Laing O'Rourke, and supplementary information provided to ensure the review could be completed. Any remaining issues arising from the compliance review are identified and discussed in **Section 2.4**.

1.3 Scope of technical review

The scope of the technical review builds on the findings of the compliance review undertaken by Arup. The technical review focused on the interpretation of the data by Ramboll (i.e. the ground model and risk assessments and remedial strategy) and whether the conclusions drawn are technically appropriate and in line with industry and regulatory guidance and best practice. The review considered the adequacy of the approach and the measures proposed to mitigate risks to school users, neighbours and the environment both during construction and when in use as a school.

The technical review findings are presented in **Section 3** and supporting information is presented in **Appendix B**.

Arup provided Ramboll/LOR with a series of questions seeking further information or clarification on 14th September 2017. Ramboll/LOR responded to the queries in several communications. Remaining issues arising from the technical review are identified in **Section 3**.

1.4 FONV Questions and Answers

A stakeholder engagement meeting was held with FONV on 22nd August 2017. The purpose of the meeting was to inform FONV of the scope of the Arup review and to understand the specific concerns of FONV in relation to contamination.

A series of questions that FONV wanted considering were identified and Arup has prepared a response to each one, based on our review of the information provided by Ramboll/Laing O'Rourke. The questions and answers are presented in **Section 5**.

1.5 Documents reviewed

The documents made available to the initial compliance and technical review are as follows:

- Ramboll Environ (2017) EBN High Schools – Matthews Lane, Manchester. Contaminated Land and Geotechnical Desk Study Report. Prepared for Laing O'Rourke, 13th June 2017. Project No. 1620001457-006
- Ramboll (2017) EBN High Schools – Matthews Lane Manchester. Contaminated Land Interpretative Report. Prepared for Laing O'Rourke. Project No. 1620001457, Version 4 24th July 2017
- Ramboll (2017) EBN High Schools – Matthews Lane Manchester. Remedial Strategy. Prepared for Laing O'Rourke. 24th July 2017. Version 4
- Ramboll Environ (2017) EBN High Schools – Matthews Lane, Manchester. Ground Investigation Factual Report. Prepared for Laing O'Rourke, 13th June 2017, Version 4. Project no. 1620001457-006
- Ramboll Environ (2017) EBN High Schools – Matthews Lane, Manchester. Development Area Human Health Risk Assessment. Prepared for Laing O'Rourke, 14th July 2017, Version 1 For Comment

The following documents were subsequently provided by Ramboll/Laing O'Rourke to inform the review. These reports have been numbered to allow cross-referencing in the text:

- [1] Ramboll Sampling Strategy Note 11/9/17 Memo No. 010093688362-RUK-00-XX-DN-GEO-007
- [2] Laing O'Rourke responses to Arup queries by email dated 21st September 2017

- [3] Ramboll Environ (2017) Ground gas mitigation plan – School Development. Memo No. 1620001457-006/03 dated 11th July 2017.
- [4] The Coal Authority (2017) CON29M Non-Residential Mining Report. EBN High Schools – Matthews Lane, Manchester, Greater Manchester M19 3DS. Issued on 6th July 2017. Ramboll Remedial Options Appraisal Note 11/9/17. Memo no. 010093688362-RUK-00-XX-DN-GEO-008
- [5] Ramboll Environ (2017) EBN High Schools – Matthews Lane, Manchester. Development Area Human Health Risk Assessment, Prepared for Laing O-Rourke, Revision V2 30th August 2017 Document Ref 010093688362-RUK-00-XX-RP-GEO-008-v2
- [6] Ramboll response to Arup queries by email dated 19th September 2017
- [7] Ramboll PAH surrogate marker calculator for soils at Matthews Lane
- [8] United Utilities: Sewer records for Matthews Lane
- [9] Malcolm Hughes Land Surveyors, Topographical survey and underground services drawings (Sheets 18895-7A, 18895-8A and 18895-9A) surveyed in January 2017
- [10] Ramboll Matthews Lane Academy Hardstanding Layout drawing No. 010093688362-RUK-XX-XX-DR-C-00700
- [11] Expanded Piling (2017) Draft Foundation Works Risk Assessment for proposed CFA piling into the sandstone aquifer at the Matthews Lane site. Ref. 1707-027
- [12] Minutes from EA and EHO meetings dated 12th May, 16th June, 10th July and 17th August 2017
- [13] Correspondence from EA to MCC dated 24th May, 20th June, 17th July and 21st August 2017
- [14] Ramboll Series of drawings showing proposed ground floor layouts for proposed school buildings
- [15] Ramboll Environ (2017) Remedial Options Appraisal Note, dated 11/09/2017, Memo No. 010093688362-RUK-00-XX-DN-GEO-008
- [16] Email from Ramboll to Arup dated 21st September 2017, including statements on radioactive wastes and standards for soil to be used in allotment areas
- [17] Email from Ramboll to Arup dated 18th September 2017, included responses to questions raised during technical review

1.6 Limitations

Consideration of costs and cost benefit, such as costs to implement mitigation measures, is outside the scope of this review. Arup has not been provided with any information regarding the potential cost of the proposed scheme.

This report has considered contamination issues relating to the proposed school development only. Other potential ground-related considerations such as geotechnical stability, design and archaeology are outside the scope of this review, except where any potential solutions may result in contamination risk.

This review only considers the area identified for the school, which is the subject of the planning application.

This review has been undertaken independently from the Environment Agency and MCC Environmental Health Officer who would be consulted on the planning application and planning condition discharge and would make recommendations to the Planning Authority relating to ground contamination.

2 Compliance Review

2.1 Key guidance and best practice standards

There are numerous pieces of individual guidance which deal with the investigation, assessment and remediation of potentially contaminated land. For the purposes of this review, two key pieces of guidance have been used in order to assess compliance: Model Procedures for the Management of Land Contamination (referred to as CLR11) and the British Standard: Investigation of potentially contaminated sites – Code of practice (referred to as BS10175). These pieces of guidance are summarised below.

2.1.1 Defra/EA Model Procedures CLR11

The technical framework for the investigation, assessment and remediation of land affected by contamination in England is contained within the Defra/Environment Agency publication CLR11 Model Procedures for the Management of Land Contamination¹. Several other pieces of guidance are then referenced from this central document, including Secondary Model Procedures guidance documents, which provide technical advice on various aspects of the process.

CLR11 recommends that the assessment of potentially contaminated land is broken down into three key phases: risk assessment, options appraisal and implementation of the remediation strategy. At each phase of the process a number of criteria are set, which will be used to assess compliance with the Model Procedures.

Manchester City Council has published Planning Guidance in Relation to Ground Contamination: Guidance Note for Applicants, Developers, Land Owners and Consultants². The processes in this document are consistent with the CLR11 framework. This guidance document presents a number of ‘checklists’ which can be used to ensure that the correct level of information is provided. These checklists have been used in this review as a further tool to ensure compliance with CLR11.

2.1.2 British Standard BS10175

British Standard document BS10175:2011+A1:2013 Investigation of potentially contaminated sites – Code of practice (BS10175) is the principal piece of guidance relating to the design and execution of ground investigations for contaminated land. This document has multiple references within it to other sources of information, which have been taken into account where possible. The

¹

http://www.claire.co.uk/index.php?option=com_content&view=article&id=187&catid=45&Itemid=256

²www.manchester.gov.uk/download/downloads/id/11878/planning_guidance_relating_to_ground_contamination.pdf

definition of ‘investigation’ within BS10175 includes the desk study phase as well as intrusive investigations. Therefore, compliance with BS10175 has been checked for all stages of the investigation of the site.

2.2 Conclusions of compliance review

The review considered the initial set of documents (listed in **Section 1.5**) prepared by Ramboll for Laing O’Rourke, and assessed the compliance of the contamination assessments with key guidance. Ramboll subsequently provided additional information (also listed in **Section 1.5**) designed to address specific questions raised by Arup during the Compliance Review process.

The compliance review with CLR11 identified that a remedial options appraisal, a process whereby justification is provided for the remedial options adopted, was not provided in the initial set of documents. Ramboll have provided a ‘Remedial Options Appraisal Note’ [16] which sets out the options considered for each pollutant linkage. The supplementary information presented by Ramboll demonstrates broad compliance with the requirements of Model Procedures for the Management of Land Contamination (CLR11).

With regard to compliance with the British Standard BS10175:2011, whilst the exploratory hole layout and sampling strategy for soil, groundwater and ground gases was not included in the initial set of reports provided to Arup for this review. This has been provided as supplementary information in Ramboll’s, ‘Sampling Strategy Note’ [1], which makes it clear that they have carried out the work in compliance with the appropriate standards. Ramboll’s responses are therefore considered adequate to address the compliance issues raised and the work carried out to date is considered to be broadly compliant with BS10175.

3 Technical Review

3.1 Technical review process

The technical review process involved the consideration of each of the initial documents in turn, namely desk study, ground investigation factual and interpretative reports, human health risk assessment and remedial strategy. Arup reviewed the information obtained by Ramboll in isolation from the Ramboll interpretation, in order to draw independent conclusions. Arup’s conclusions were then compared to those made by Ramboll.

The technical review of each document is presented in a series of tables in **Appendix B**, together with summary text outlining the key questions identified in the review and supplementary information provided by Ramboll. Ramboll subsequently provided responses for many of the technical questions raised, which are listed in **Table C1** and summarised in this section.

Although several phases of ground investigation and risk assessments have been undertaken, further more detailed investigations to look at ground gas risk and groundwater quality are still underway; risk assessments and the details of mitigation measures to deal with any risks are therefore not available at this time. **Table 3.1** below lists the key documents provided by Ramboll/LOR to date and also lists the assessments and information which is yet to be produced, according to the Ramboll/LOR information reviewed and typical planning requirements³. Ramboll and Laing O’Rourke have provided assurances that the information listed in the table will be prepared in due course.

Table 3.1 Contamination-related reports and data to be produced for Matthews Lane School (by typical planning stage)

Planning stage	Reports/information provided
Prior to grant of planning consent	<ul style="list-style-type: none"> • Desk Study • Ground investigation factual report (to be updated) • Ground investigation Interpretative Report (GIR) (to be updated) • Human health detailed quantitative risk assessment v2 (DQRA) • Piling (Foundation Works) Risk Assessment (draft)
Prior to commencement of construction (Ramboll/LOR committed to produce)	<ul style="list-style-type: none"> • Additional groundwater monitoring wells, groundwater monitoring and Nico Ditch monitoring • Controlled waters risk assessment (risks associated with the waste body, piling, ground improvement, drainage strategy) • Piling (Foundation Works) Risk Assessment (final) • Additional gas monitoring, including continuous gas monitoring within school building footprint and along western site boundary, gas surface emissions survey • Ground gas DQRA and gas mitigation design • Asbestos Management Plan (AMP) and Risk Assessments and Protocol Statements (RAPS) including dustiness testing for asbestos fibre release potential

³ It should be noted that no discussion has been held with MCC regarding the likely planning conditions for this scheme and the information and stages listed in Table 3.1 are based on Arup’s experience of typical requirements for the redevelopment of brownfield land

Planning stage	Reports/information provided
	<ul style="list-style-type: none"> Remedial Strategy (Final) including specific measures for Earthworks, foundations, ground improvement (and leachate/gas measures required as a result of ground improvement), cover system including soil quality standards, material management, ground gas protection, potable water supply pipe assessment, leachate management/remediation (if required) Protocol for unforeseen contamination Verification Plan Construction Environmental Management Plan (CEMP) Drainage strategy, including consideration of need for reinforced utility corridors Materials Management Plan (MMP)
During construction	<ul style="list-style-type: none"> Implementation of works in accordance with approved documents Supervision by the Project Environmental Consultant, periodic site audits as a minimum Notification to EA, MCC of unforeseen contamination Ongoing review of AMP, CEMP, MMP and remediation plan as necessary Gas and groundwater monitoring in accordance with approved plans
Prior to occupation or use of the development	<ul style="list-style-type: none"> Verification Report CDM Regulations Health and Safety file Post-development gas monitoring – in buildings and on boundary

The issues identified in the technical review have been grouped into three main ‘themes’ as follows:

- Human health risks
- Landfill gas risks
- Controlled waters risks
- This section presents the findings of the technical review in accordance with these themes.

3.2 Human health risks from soil and vapour

3.2.1 Review of human health risk information

This section considers the information presented by Ramboll in relation to risks posed by soil (including landfilled wastes) and vapours. The risks posed to health by landfill gas are considered in **Section 3.4** below.

Ramboll presents a Preliminary Risk Assessment (PRA) in their Desk Study report. The PRA was found to be in general compliance with current best practice (see **Section 2**). Arup generally concurs with the potential sources of contamination identified.

The desk study report presented sufficient information to develop a Conceptual Site Model (CSM) which identified a number of potential pollutant linkages relating to human health, both during construction and in the final, developed condition of the site:

- Risk that there could be asbestos containing materials in the ground, and that construction workers, adjacent site users and future school users might inhale the fibres;
- Risk that the existing capping and landfill materials close to the surface could be contaminated with a range of chemicals. Construction workers, adjacent site users and future school users might be exposed to these through the inhalation of dust and direct skin contact with the soil;
- Risks that volatile chemicals within the existing capping and landfilled waste could be inhaled by construction workers, adjacent site users and future site users.

Arup's review concurs with these potential pollutant linkages. The ground investigations described in the Factual Report were designed to provide further information to prove or disprove the pollutant linkages identified. Ramboll then carried out a Generic Quantitative Risk Assessment (GQRA) in line with best practice to assess these potential pollutant linkages. The assessment concluded that asbestos is a potential risk which needs management during and after construction, and that certain chemicals in the existing capping/landfilled wastes might pose a risk to health and warranted further investigation and assessment. Arup's review of the information agrees with the interpretation of the data and determined that the approach taken by Ramboll was strongly precautionary in terms of the assessment criteria used.

Ramboll have also provided supplementary information to demonstrate the use Benzo(a)pyrene as a surrogate marker to assess the potential risks to health from several genotoxic Polynuclear Aromatic Hydrocarbons (PAH) in line with the best practice guidance.

FONV have queried whether radiological contaminants were considered by Ramboll. Ramboll have clarified MCC's records of the landfill were reviewed as part of this exercise, and that they did not identify any evidence to suggest that the landfill had received radiological materials. As such, radiological contaminants were not identified as a potential contaminant of concern. Arup considered that this approach was reasonable at that point, in the absence of any specific information relating to the placement of radiological materials within the landfill.

Given that concerns have been raised during consultation with FONV regarding this, we would recommend that the Remedial Strategy considers the implications of unforeseen radiological contamination, and any measures that would be required in mitigation.

The Detailed Quantitative Risk Assessment (DQRA) looked specifically at the potential risks posed by the existing capping and landfilled materials within the school site, either from direct contact, the inhalation of dust or vapour inhalation. The EHO (as lead regulator for human health) had requested that additional ground investigation was carried out, to provide more soil testing data and greater confidence in the outcome of further risk assessments, and this was undertaken.

The DQRA concluded that isolated areas of contamination were not of potential concern, although the risk assessment assumed that they would not be disturbed during construction, which was not guaranteed in the initial reports. Subsequent

information provided by Ramboll has confirmed that site-won materials will not be re-used at the surface within the school site, therefore with than caveat the conclusions of the DQRA are appropriate in this respect. This assumption will need to be included in future revisions of the Remedial Strategy.

Initial drawings provided by Laing O'Rourke referred to a potential allotment area within the school, and Arup initially had queries relating to the assessment of materials for this area. However, Manchester City Council have confirmed that no allotments are proposed as part of the scheme, only raised planters. These queries are no longer relevant. Ramboll has confirmed that the raised beds are to have a solid base, which will prevent any mixing with the soils beneath, and are to be filled with imported soil validated against 'residential with plant uptake' generic assessment criteria. These assumptions will need to be included in a future revision of the Remedial Strategy.

The initial reports submitted do not provide details of the management of potential risks to adjacent sites during construction; for example, the potential release of asbestos fibres, the transport of mud and contaminated soil onto surrounding roads, or the potential nuisance and risks associated with odours and vermin. However, this level of detail would not normally be supplied at planning application stage, but will be required prior to the start of any construction activities. Ramboll/Laing O'Rourke have provided methodologies regarding how they propose to manage these specific risks during construction.

A summary of the key questions raised by Arup during the technical review is provided in **Table 3.2** below, together with the response received from Ramboll. The adequacy of the response to each question has been colour-coded to enable easier reading. All issues raised have been closed out to a standard which is considered appropriate for the proposed planning application. The further actions relate to information which should be submitted prior to the start of construction.

Table 3.2 Arup questions and Ramboll/LOR response: human health risks

Arup question	Ramboll response	Conclusions and further actions
<p>Green shading: issue addressed and closed out Amber shading: further actions required Red shading: issue not closed out</p>		
<p>Approach to PAH risk assessment: GQRA and DQRA use surrogate marker approach to assess genotoxic PAHs. Confirmation required that the genotoxic PAH profile in the soils taken from Matthews Lane is in line with guidance.</p>	<p>Calculation working sheet provided, which confirms the correct approach has been adopted.</p>	<p>Use of surrogate marker approach justified. No further actions.</p>
<p>Potential for radiological contaminants: Has the potential for radiological contaminants to be present within the landfill been considered?</p>	<p>There was no evidence within the desk study to suggest that radiological materials were likely to be significant at this site thus no specific investigation was completed in this regard.</p>	<p>Information included review of MCC records for the landfill, which did not identify radiological materials specifically, therefore Ramboll did not identify radiological contaminants as a potential contaminant of concern. Recommend that the Remedial Strategy considers the implications of unforeseen radiological contamination and any measures that would be required in mitigation.</p>
<p>Asbestos risk to school users: Additional sampling and analysis was recommended regarding the risks posed by asbestos fibres if onsite soils are to be re-used in shallow areas.</p>	<p>DQRA concluded that direct contact pathways would be removed in landscaping areas through the use of a geotextile break layer, overlain with 'clean' imported soil. Imported 'clean' soil will be required to be certified to demonstrate that it is in accordance with the design team specifications.</p>	<p>Remedial Strategy to confirm that existing soils will not be re-used at ground surface.</p>
<p>Asbestos risk to offsite users: Mitigation measures were identified as necessary during site works to prevent the cross boundary migration of asbestos during construction.</p>	<p>The proposals to manage the risks of cross boundary migration of asbestos during construction will be addressed within the Construction Environmental Management Plan (CEMP) to be developed by Laing O'Rourke.</p>	<p>CEMP is to include proposals to manage cross-boundary migration of asbestos.</p>
<p>Soil to be used in allotment area: Is it intended that the proposed 'clean' soil standards also apply to soils placed in the allotment area?</p>	<p>MCC has clarified that no allotments are included with in the proposed development, and that these will be raised planters. Ramboll has confirmed that raised planters will be filled with clean imported soil conforming to 'Residential with plant uptake'</p>	<p>Use of raised planters and concrete base will prohibit contact with soils at depth and proposed soil quality standards are</p>

Arup question	Ramboll response	Conclusions and further actions
	standards and located on hard-surfacing to prevent mixing with soil beneath the planters.	appropriate for areas where plants may be grown for human consumption. These details need to be included in revised Remedial Strategy.
Odour and nuisance during construction: How will odour and potential nuisance from exposed excavated wastes be managed during construction?	Any landfill waste material brought to the surface is to be removed from site as soon as practicable, thus minimising any odour. Landfill waste will be temporarily stored in designated areas prior to being loaded onto the wagons for prompt disposal off site. The intention is to have all waste removed by the end of each day although this may not always be possible. If waste needs to be stored overnight it will be kept on a sealed surface or in skips and covered by heavy duty sheeting to minimise odours and prevent vermin. If necessary, odour control atomisers will be used.	Plans are in place to manage nuisance from odours and vermin. This detail needs to be included in the CEMP.
Dropping of mud/soil on highways: What measures will be put in place to avoid mud/contamination being dropped from vehicles leaving the site?	A large tarmaced temporary haul road area will be created which runs through the middle of the site. Only clean delivery and collection vehicles will be allowed to travel on this road. Loading/unloading of vehicles will be carried out in such a manner that clean collection/delivery vehicles will always be parked on the sealed surface whereas construction vehicles will deliver the material to the edge of the road and load/unload to and from there. All waste removal vehicles will be sheeted to prevent contaminated material from being transferred onto public highways. The piling rig will have to sit directly on the haul road and carry out the piling operation from there. When this happens, the road will be cleaned at the end of each piling shift to ensure no contaminated material is left exposed. Pile arisings will be temporarily stored in contained areas and loaded onto clean disposal vehicles from the edge of the area. There will be a daily roadsweeper on site to ensure that all haul areas are kept clean and tidy. The roadsweeper will also be in used on the public highway immediately in the vicinity of the site entrance. There will also be a wheel washing/jet washing facility on site to remove any contaminated material prior to vehicles leaving the site.	Plans are in place to control the spread of contamination onto neighbouring public highways. This detail needs to be included in the CEMP.

3.2.2 Human health risk conclusions

Arup's interpretation of the information submitted for this review agrees with the general approach towards human health risk assessment and the main conclusions arrived at by Ramboll. The review has identified that Ramboll's approach is in line with current best practice and is strongly precautionary in terms of the human health assessment criteria used for soil. Ramboll has addressed Arup's queries regarding the proposed remedial solutions, providing further detail where necessary to demonstrate that the risks have been adequately assessed. Provided that the proposed mitigation measures are implemented in line with Ramboll and Laing O'Rourke's own recommendations, then the site should not pose an unacceptable risk to health during and after development. It should be noted that landfill gas risks have been considered separately, see **Section 3.4**.

The information presented in the initial reports is considered to be typical of the level of detail which would be required at planning application stage and, in providing responses to some of Arup's queries, a greater level of detail has been provided than would normally be expected at this stage. Ramboll and Laing O'Rourke have acknowledged the need for additional pieces of information, particularly in relation to the management of risks during construction, which would normally be provided prior to the start of construction.

MCC's Environmental Health Officer (EHO) is a consultee of the planning process and will review the contamination-related aspects of the planning application and will make recommendations to the Planning Authority regarding approval and planning conditions. If planning consent is granted it will be the responsibility of MCC's EHO to ensure that the appropriate information is provided to protect human health prior to the discharge of any pre-commencement planning conditions.

3.3 Controlled waters risks

3.3.1 Review of controlled waters risk

In relation to controlled waters, the Ramboll assessments to date have followed best practice, identifying risk to groundwater and surface water as requiring further investigation initially in the desk study preliminary risk assessment, followed by ground investigation to inform development of the controlled waters risk assessment presented in the interpretative report.

The ground investigation installed groundwater monitoring wells in 15 exploratory holes, three of which sampled the glacial deposits underlying the waste and one in the sandstone principal aquifer. Elevated contaminants with ammoniacal nitrogen in particular, a key contaminant of landfill leachate, was identified in the sandstone aquifer. Nico Ditch was not sampled as part of the ground investigation.

Based on the findings of the ground investigation, the Ramboll interpretative report concluded that the risks to the water environment associated with the waste body required further investigation and risk assessment and that risk management measures may be required to protect the water environment.

The potential risks associated with cyanide and mercury have been raised by FONV and councillors as a particular concern. Review of Ramboll's groundwater screening assessment in the interpretative report indicates cyanide and mercury have not been detected in groundwater at concentration above drinking water standards.

Piling through the waste body was also identified in the interpretative report as a potentially significant groundwater risk that required further assessment.

The Ramboll draft remedial strategy identified the need for a piling risk assessment and appropriate risk mitigation and also that further assessment of the risks to groundwater associated with the waste body is required.

Geotechnical ground improvement needs further consideration to ensure appropriate management of shallow groundwater/leachate. The site drainage strategy must be developed to ensure drainage is transmitted offsite and consider the need for reinforced utility corridors to prevent settlement related drainage issues.

Based on Arup's review of controlled waters assessment in the initially supplied documents, namely the desk study, factual ground investigation report, interpretative report and remedial strategy the questions identified in the first column of **Table 3.3** below were returned to MCC and Ramboll. Ramboll responded as indicated in the second column of **Table 3.3** and supplied the supplementary information identified in **Section 1.5**. The conclusions of the review and additional information to be supplied prior to commencement of construction are identified in the third column of the table below.

Table 3.3 Arup questions and Ramboll/LOR responses: controlled waters risk

Arup question	Ramboll response	Conclusions and further actions
<p>Green shading: issue addressed and closed out Amber shading: further information required prior to construction Red shading: issue not closed out</p>		
<p>Controlled waters risk assessment: Further investigation was recommended in Table 9.1 of the Interpretative report to assess the potential risks to the water environment. Has this been done and are the results and assessment available? Does the risk assessment demonstrate the risks to groundwater associated with the leachate/waste body within the proposed development area are acceptable?</p>	<p>Consultation has taken place between Ramboll/LOR/MCC/EA in relation to this issue and additional investigation is currently being progressed. Additional groundwater monitoring wells were installed in August 2017, and further groundwater monitoring is being completed over August and September 2017, however the results and interpretation will not be available until October 2017, when the results from 4 No. rounds of groundwater monitoring will be presented to the EA & EHO at a consultation workshop.</p>	<p>Risks to groundwater and surface water have not yet been fully assessed. Interpretation of additional groundwater monitoring to risk assessment to be provided when available (October 2017) Risks to groundwater associated with the existing waste body should be considered, in accordance with EA guidance 'Remedial targets methodology: hydrogeological risk assessment for land contamination' Consideration to be given to implications of former spring/watercourse within site in hydrogeological model.</p>
<p>Protection of groundwater in glacial till: The Till is identified as an Unproductive Aquifer in the desk study and interpretative reports, but the Landmark and EA information describe this unit as a Secondary Undifferentiated aquifer. In discussions with the EA to date, have they stated whether they consider the superficial deposits to be a potential receptor?</p>	<p>Consultation has taken place between Ramboll/LOR/MCC/EA in relation to the critical receptors and this has been confirmed as the sandstone Principal Aquifer underlying the site; the natural Till underlying the landfill site has not been identified as an aquifer that requires consideration as a potential receptor.</p>	<p>EA meeting minutes suggest EA accepts sandstone is the receptor to consider. No further action required.</p>
<p>Foundation works (piling) risk assessment: When will the foundation works risk assessment (FWRA) for the proposed piling work be completed? Section 8 of the Remedial Strategy states that it should be updated as consultations with the EA progress (in relation to piling). Is an update available, or a summary of discussions with the EA to date?</p>	<p>The draft Piling Risk Assessment prepared by Expanded was provided to Arup for review.</p>	<p>Draft Piling Risk Assessment by Expanded provided 21 Sep 2017. This document is an outline draft and must be completed and approved by EA prior to works commencing. The draft piling risk assessment proposes CFA piles, whereas the Ramboll interpretative report notes driven piles are the only feasible option due to the landfill contents causing obstruction. CFA piles present a much lower risk to groundwater than driven piles, and less</p>

Arup question	Ramboll response	Conclusions and further actions
		<p>vibration. The piling risk assessment should consider the feasibility of proposed method.</p> <p>In addition to creation of pathways along piles, shallow groundwater level may be increased by piling due to by displacement which could result in greater contaminant flux to sandstone along existing pathways.</p>
<p>Risks to surface water (Nico Ditch): Will the potential for Nico Ditch to act as a controlled waters receptor (and gas migration pathway, see gas section) be assessed? Nico Ditch culvert location, invert level and diameter would inform initial assessment of its potential significance. Further information may be required to complete the assessment (such as water sampling, gas monitoring, culvert condition survey).</p>	<p>Nico Ditch is being sampled as part of the additional groundwater monitoring works currently being undertaken and will form part of the controlled waters risk assessment to be reported in October 2017.</p> <p>Refer to attached United Utilities records and Malcolm Hughes' below ground services survey drawings for your information.</p>	<p>Assessment of risk to Nico Ditch and the need for remedial measures should be considered in the controlled waters risk assessment, in preparation by Ramboll.</p>

3.3.2 Controlled waters risk conclusions

Although groundwater investigations and controlled waters risk assessment has been undertaken by Ramboll/LOR, several aspects have not been fully assessed at this stage or the proposed approach confirmed. However, this is typical for brownfield developments where ground investigation and risk assessment often takes place in phases, with data gaps being identified and progressively closed out with further data collection and risk assessment.

The amount of information presented by Ramboll/LOR in relation to controlled waters is commensurate with what would be expected with a planning application submission. Planning conditions are typically applied to ensure the additional information is produced and approved by the environmental regulators prior to commencement of works.

Ramboll /LOR acknowledge the need for the majority of the additional information prior to construction and have stated that it will be provided prior to construction in emailed responses to questions raised by Arup, as documented in the table above.

The Environment Agency is the lead regulator for groundwater and surface water and will be the ultimate decision-maker in relation to groundwater and surface water protection. The EA has had pre-planning communications with Ramboll/LOR, as evidenced by meeting minutes supplied by Ramboll. It is expected the EA will be consulted by the planning authority on the school planning application and will make recommendations regarding planning conditions. If planning conditions are applied the EA would normally be consulted on additional information and would advise the planning authority when the proposals are acceptable.

The main conclusions relating to groundwater and surface water protection at Matthews Lane landfill are identified below.

The significance of the current groundwater and surface water impact, and potential for future impact, associated with the landfill waste body within the school site has not yet been fully assessed, as required by Environment Agency guidance 'Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination'. Ramboll have indicated additional ground investigation, groundwater monitoring and sampling of Nico Ditch is required to inform further controlled water risk assessment. This risk assessment should determine the need for remediation to protect groundwater and surface water. Ramboll have consulted the EA regarding the scope of further assessment. It is expected the further assessment and mitigation design would be required by pre-commencement planning conditions, which may include additional proposals for groundwater remediation.

The Ramboll reports acknowledge that piling presents an additional risk to groundwater that must also be assessed. Typically on brownfield redevelopments where necessary, a 'Foundation Works Risk Assessment' (also known as a piling risk assessment) is required by a pre-commencement planning condition. Typically a piling risk assessment is not prepared at planning application stage,

however an outline draft Piling Risk Assessment has been produced by Expanded for Laing O'Rourke. The potential for piling to increase shallow groundwater levels and vertical gradient to the sandstone, thus increasing flow along existing pathways between waste and sandstone, must also be considered.

The method of piling has changed in the documents presented by Ramboll/LOR. In the interpretative report Ramboll propose driven piles noting 'the contents of the landfill are such that the piling options are limited to driven piles'. However the draft piling risk assessment considers only Continuous Flight Auger (CFA) piles, a lower groundwater and vibration risk method. The piling risk assessment should consider the feasibility of proposed method as well as the risks to groundwater, and compare the preferred piling type to options.

Ramboll have indicated all drainage from hardcover areas will be transmitted offsite, and the controlled waters risk assessment will consider the need for low permeability cover in any non-hardstanding areas. The geotechnical design should consider the need for reinforced utility corridors to prevent settlement impact on drainage and other utilities.

Geotechnical ground improvement proposals should consider the impact on shallow groundwater and propose mitigation. Increasing shallow groundwater level also increases the vertical gradient to the sandstone aquifer, potentially resulting in greater contaminant migration. This should be considered in the groundwater risk assessment.

3.4 Landfill gas risks

3.4.1 Review of landfill gas risks

This section considers the information presented by Ramboll in relation to risks posed by landfill gases. The Preliminary Risk Assessment (PRA) in the Desk Study report identified 'ground gases' from both on and offsite sources as a potential risk to construction workers, future school users and the occupiers of adjacent sites. Arup agrees with this conclusion, as the information available suggests that the Matthews Lane site is still likely to be generating landfill gas (albeit at a much lower rate than when the waste was first deposited).

The main risk assessed by Ramboll in relation to landfill gas is that posed to the future school users. Ramboll has followed current best practice guidance in the assessment of risks posed by gases in the ground to new developments, and Arup concurs with their finding that a high level of gas protection should be provided to the new buildings, to provide adequate comfort that gases will not be able to enter the buildings. Ramboll has consulted with the EHO (the lead regulator for ground gas risks, including landfill gas) in determining the need for further investigation which will provide the parameters used to design the gas protection. It is understood that the details of the gas protection for the site have yet to be determined, but it is acknowledged that gas risk will need to be mitigated in order to make the school site safe for use.

The initial reports provide the results of 'spot' monitoring for gas, where the site is visited at defined intervals and gas measurements are taken. Whilst the use of

spot monitoring is consistent with current best practice, Arup queried the frequency of the monitoring carried out by Ramboll, as the total period of monitoring did not match with their own recommendations. The monitoring data presented in the Factual report shows that not all wells capable of being monitored for gas were tested on all visits; those wells which demonstrated the highest gas flow of 2.8 litres per hour used in the risk assessment (WS11 and BH08) were only monitored on five occasions⁴, which is unlikely to provide a suitable level of confidence in the data.

Ramboll confirmed that the decision had been taken to carry out continuous gas monitoring in place of the spot monitoring, in order to obtain a realistic 'worst case' view of the gassing regime. In addition, Ramboll also intend to measure surface gas emissions, using a flux box or similar method. Arup concurs that the use of continuous gas monitoring and surface flux monitoring would provide a better dataset on which to base the design of gas protection measures. Continuous gas monitoring is considered to be the industry best practice to develop a robust dataset, and is appropriate for this site where landfill gas is likely to present a significant risk.

Whilst Ramboll has monitored for a range of gases likely to be associated with former landfill sites, this has not included trace gases to date. Further gas monitoring and assessment is underway. It is recommended that any further assessments should consider the potential for landfill trace gases to be present.

Ramboll confirm in the Remedial Strategy that the development should not introduce preferential pathways for gas migration to on- and off-site receptors via new drains/utility trenches. A utilities trace identified that there is an existing culvert (Nico Ditch) close to the southern boundary of the site, together with minor drainage features which appear to extend into the site, particularly associated with the existing school to the east. The initial set of reports provided to Arup did not identify existing services as potential pathways for landfill gas to migrate onto offsite areas, both during construction and in the future. Arup queried this and Ramboll has subsequently stated that existing services, in addition to new ones, will be considered in the gas report which is currently in preparation.

Ramboll acknowledge the potential risks to offsite users in their risk assessments, involving the lateral migration of gases in the ground. Ramboll states that no evidence of effective offsite gas control measures has been identified, as the gas venting trenches installed when the landfill was closed cannot be found. In addition, Ramboll identify that gas behaviour may change as a result of the proposed ground improvement and the significant increase in hardstanding to be provided on the site. Arup queried whether adequate information was available to allow a complete picture to be developed of the potential changes and the lateral gas migration risk. Ramboll has provided confirmation that the potential for lateral migration will be considered in the revised gas report, to be issued in October 2017.

⁴ Note that the Interpretative report only considers gas monitoring data to 31st March, but the Factual report includes a further round of monitoring on the 10th May.

A summary of the key questions raised by Arup during the technical review is provided in **Table 3.4** below, together with the response received from Ramboll. The adequacy of the response to each question has been colour-coded to enable easier reading. All issues raised have been closed out to a standard which is considered appropriate for the proposed planning application. The further actions relate to information which should be submitted prior to the start of construction.

Table 3.3 Arup questions and Ramboll/LOR responses: landfill gas risks

Arup question	Ramboll response
<p>Green shading: issue addressed and closed out Amber shading: further actions required Red shading: issue not closed out</p>	
<p>Adequacy of gas monitoring: Additional gas monitoring, prior to construction, is identified as being necessary in the Remedial Strategy and in the Ground gas mitigation plan. When is this anticipated to be complete and risk assessments reported?</p>	<p>The additional ground gas monitoring has now been completed by the specialist sub-contractor (GGS). GGS are aiming to issue their report to Ramboll w/c 09/10 for review and production of a summary memo, which will include any recommendations for further monitoring. This information will be issued by Ramboll in October 2017.</p>
<p>Potential for existing and new drains/utilities to act as gas migration pathways: Has the potential for utilities and drains (including Nico Ditch culvert) to act as gas migration pathways been considered? How will new utilities be designed to ensure that drainage/utilities trenches do not introduce preferential pathways for gas to migrate offsite or into buildings?</p>	<p>The potential risk of drainage/utility trenches forming preferential pathways has been identified, and this is being investigated with our ground gas specialist as part of the additional ground gas risk assessment works, and will be reported in October 2017.</p>
<p>Potential for altered landfill gas behaviour: The development will cover a large part of the site with hard surfacing and buildings, and stabilisation/compaction will reduce the permeability of the surface soils meaning that gas may be forced laterally as a result. Will the risks associated with lateral migration be considered in the gas monitoring and mitigation plan? What mitigation measures are likely to be proposed?</p>	<p>Whilst the detailed assessment and conceptual site model are still being developed, the ground gas surveys undertaken to date have not seen evidence of any pressurised gas source.</p> <p>However, as the groundworks/ stabilisation/compaction will likely change the soil permeability and gas regime, the provision of venting trenches or venting stacks will be investigated through an effective ground-gas monitoring programme during the construction process, and following review of pending risk assessment report.</p> <p>Although unlikely to be required near to building structures, venting stacks may be an option within landscaping or near playing fields etc. should they be considered a requirement in future.</p>

3.4.2 Landfill gas risk conclusions

Arup's interpretation of the information submitted for this review agrees with the general approach towards landfill gas risk assessment and the main conclusions arrived at by Ramboll. The review has identified that Ramboll's current use of continuous gas monitoring is in line with current best practice and is likely to provide a reasonable worst-case on which to develop gas mitigation measures.

The information presented in the initial reports is considered to be typical of the level of detail which would be required at planning application stage. Ramboll and Laing O'Rourke acknowledge that landfill gas poses a potential risk to the school development and potentially adjacent site users. Sufficient data is not yet available to provide an assessment of the risk, but this is in the process of being collected and will be reported in October 2017, together with proposed mitigation measures, and this information would standardly be provided to discharge pre-commencement planning conditions.

The MCC Environmental Health Officer (EHO) is the lead regulator in relation to the potential risks posed by landfill gases. As a planning consultee the MCC EHO will make recommendations to the Planning Authority regarding approval and planning conditions. The EHO will also be consulted on additional information provided in response to planning conditions and will make recommendations regarding the discharge of conditions.

4 Conclusions & Recommendations

4.1 Conclusions

The concerns relating to ground contamination at the proposed school development at Matthews Lane can be divided into three main topics that have been systematically considered in this review:

- human health, both of future school pupils, staff and neighbouring residents;
- groundwater contamination resulting from the landfilled waste and its potential impact on local groundwater resources and surface watercourses; and
- landfill gas and the potential risks it poses to future users of the school and neighbouring residents.

The initial reports issued by Ramboll and Laing O'Rourke for review by Arup have been checked for both compliance against current best practice and technical competency. Where further information was needed to assess compliance a series of queries were submitted to Ramboll/LOR and supplementary information was provided which has been included in this review.

The overall conclusions drawn by Ramboll to date are considered to be compliant with current best practice and are technically appropriate. As would be anticipated at this stage of the design and planning process, many aspects have not yet been fully assessed and additional data, risk assessments and design of remediation/mitigation measures is required prior to construction.

4.2 Recommendations

The technical review has identified the following areas which require additional consideration:

Human health

- The remedial strategy should be updated to state that existing soils will not be re-used at surface in the school development;
- The decision to use soils compliant with 'residential without plant uptake' standards in the proposed allotment area should be documented in the DQRA or Remedial Strategy;
- The proposal for raised planters within the school site to be sited on hardstanding, together with the proposal to fill these planters with soil suitable for a 'residential with plant uptake' use, should be included in the Remedial Strategy;
- The CEMP should consider the potential for, and mitigation of, cross-boundary migration of asbestos fibres during construction;

- The LOR proposed methodology for the control of odour/nuisance during construction should be documented in the CEMP;
- The LOR proposed methodology for the prevention of the spread of contamination onto adjacent highways during the construction period should be documented in the CEMP.
- The Remedial Strategy should consider the implications of unforeseen radiological contamination, and any measures that would be required in mitigation.

Landfill gas

- Further information on gas protection for future buildings within the school development, details of any gas venting required in external areas of the school and an approach to prevent new utilities becoming future pathways for gas should be prepared;
- A risk assessment should be prepared which considers the potential for gas migration offsite during construction and in the future;
- The potential for Nico Ditch and other existing services to act as a potential gas migration pathway should be considered;
- The potential presence of, and risks associated with, landfill trace gases should be considered.

Water environment

- The controlled waters risk assessments to date have not fully assessed the risks to groundwater and Nico Ditch associated with the waste body. Further ground investigation, groundwater monitoring and sampling of Nico Ditch is proposed and subsequent risk assessment. The presence of the former spring/watercourse within the site should be considered when interpreting the hydrogeology of the site. Ramboll indicate work is in progress and evidence of consultation with the EA as this develops has been supplied;
- Piling through the waste body presents additional risk to groundwater that have not yet been fully assessed. The proposed piling methodology has changed as the scheme has developed, and CFA piling is now proposed instead of driven piles, following consultation with the EA. A piling risk assessment should be prepared that considers the feasibility of the proposed method as well as the risks associated with existing pathways and new piles, comparing the preferred piling type with other piling methodologies. EA approval should be obtained prior to commencement of piling.
- Geotechnical ground improvement has the potential to increase shallow groundwater level and increase contaminant migration to the sandstone. This should be assessed through groundwater risk assessment, and appropriate mitigation proposed.

Typically for proposed developments on brownfield land, the planning application is supported by sufficient information and assessments to demonstrate that

mitigation of risks can be achieved. However, details of the mitigation measures are not usually provided at application stage and development of the mitigation design takes place following grant of planning consent. The minimum submission with a planning application is a desk study (including a preliminary risk assessment), although for higher risk sites ground investigation and risk assessments are often required. If consent is granted it is usually conditioned to require any outstanding information prior to commencement of construction, typically ground investigation, risk assessment and remedial strategy, and a verification report following completion.

In this context the information provided by Ramboll/LOR is adequate to demonstrate the risks can be mitigated. The data collection and assessments to inform design of mitigation at Matthews Lane School are not yet complete however Ramboll/LOR have provided assurances that this will be undertaken. Planning conditions could be applied to ensure these assessments and appropriate design is completed pre-construction and that the approved works are implemented.

The Environment Agency and MCC Environmental Health Officer would normally scrutinise the additional Ramboll/LOR information prior to discharge planning conditions.

5 FONV Questions and Answers

A stakeholder engagement meeting was held with FONV on 22nd August 2017. The purpose of the meeting was to inform FONV of the scope of the Arup review and to understand the specific concerns of FONV in relation to contamination.

The following questions were raised at the meeting and Arup has prepared a response to each one, based on our review of the information provided by Ramboll/Laing O'Rourke. A short non-technical response is provided in italics and more detail provided in plain text.

Question 1: The site was capped when the landfill was completed. How does the proposed scheme impact the cap and landfill reinstatement? How is this mitigated?

The existing capping has been found to be variable in thickness and potentially contains contaminants which are not suitable for the proposed school use. Laing O'Rourke propose a new clean capping, which complies with the requirements of the Remedial Strategy.

Manchester City Council (MCC) records state that the landfill was capped with 1m of clay and 1m of soil during restoration between 1980 and 1983. However, the capping may have been altered as a result of more recent landscaping works for Nutsford Vale Park. Ground investigations have proved a variable thickness clay-based capping across the site, less than 1m in some areas.

Ramboll proposes that none of the existing capping will remain at ground surface within the proposed school site and that a new capping will be provided where the soil is not otherwise covered with buildings, artificial playing surfaces or hardstanding.

The Ramboll proposed capping design includes a minimum of 300mm imported topsoil together with a physical break layer to warn anyone digging in the site of the potential risks associated with the soils beneath the cap.

The controlled waters risk assessment and drainage strategy should consider the need for low permeability capping to reduce infiltration.

The proposed capping design must be approved by the Environmental Health Officer at MCC and the Environment Agency (EA) prior to construction and all imported clean soils to be used in the capping must be validated as clean and suitable for use by Laing O'Rourke.

Question 2: How has potential for child exposure to contaminants been considered?

The Ramboll human health risk assessments consider exposure of children to contaminants during use of the school.

The Generic Quantitative Risk Assessment (GQRA) presented in the Interpretative report provides an initial conservative assessment of the potential

child exposure to contamination in the soil. The GQRA identifies children as potentially at risk from exposure to contaminants at the Matthews Lane site generally and therefore additional assessment is warranted. The GQRA Generic Assessment Criteria (GAC) used by Ramboll are designed to be protective of the health of children aged between 0 and 6 years; children of this age are assumed to be more sensitive to contamination compared to older children and adults due to their lower bodyweight and behaviour. This resulted in a highly conservative assessment of the site soil, since the actual age of future users of the school is likely to be higher and users of the wider public open space also higher. The DQRA report considers exposure to shallow soils by children of high school age, using reasonable worst-case assumptions about how long they might spend on the site, and concludes that the risks are acceptable.

Question 3: What is the proposal for verification to demonstrate the proposed works have been completed? Is it independent?

Approval of the Verification Report by the Environmental Health department at Manchester City Council and the Environment Agency would be required prior to occupation of the school and must provide evidence the works have been carried out as proposed.

The Remedial Strategy presents proposals to verify the work carried out on site to mitigate the identified risks. It is normal practice for the Local Planning Authority to make the Verification Report a pre-occupation condition, meaning that the developer needs to demonstrate that the work has been done in accordance with the Remedial Strategy before the building can be put into use.

Standard practice is that the verification of remediation is not carried out by an independent third party, but normally by a suitably qualified consultant employed by the Principal Contractor. Ramboll has advised Arup that they will be employed by LOR to undertake a 'watching brief' during the development. This would normally involve the preparation of the verification report also. The verification report is then scrutinised and approved by the EHO and EA before the planning condition can be discharged.

Question 4: It appears that new gas monitoring installations are present on site. Why has gas monitoring been changed?

Ramboll have indicated that continuous gas monitoring is now being carried out on the site, to provide more confidence in the gas monitoring results and help in the design of the gas protection for the new school. It is likely the different installations reported by FONV are to accommodate the continuous gas monitoring equipment.

Ramboll has stated that a detailed ground gas monitoring and mitigation plan has been developed with input from a ground gas specialist, Ground Gas Solutions Ltd. This additional continuous gas monitoring is understood to be currently underway on the site. Continuous gas monitoring uses the standpipes installed during previous phases of investigation, but the monitoring equipment is different to that used for the 'spot' monitoring which Ramboll has carried out previously.

Continuous gas monitoring usually requires equipment to be installed above the ground in the location of each standpipe being monitored, as the equipment is too large to fit down the hole. We understand that the results of this additional monitoring will be reported in October 2017.

Question 5: Why is there a separate report on human health risk and not one for controlled waters? Have risks to controlled waters been assessed fully?

Risks to controlled waters are still being assessed and would not usually be required to be concluded at planning application stage. Ramboll has indicated additional sandstone monitoring wells, groundwater monitoring and also sampling of Nico Ditch are ongoing and a controlled waters risk assessment will be reported in October 2017 that will inform the final remedial strategy.

Although groundwater investigations and controlled waters risk assessment has been undertaken by Ramboll/LOR several aspects have not yet been fully assessed or the proposed approach to mitigate risks confirmed. However this is typical for brownfield developments where ground investigation and risk assessment often takes place in phases, with data gaps being identified and progressively closed out with further data collection and risk assessment. The amount of information presented by Ramboll/LOR in relation to controlled waters is commensurate with what would be expected with a planning application submission. Usually planning conditions are applied that require outstanding information and assessments and an approved remediation strategy prior to commencement of construction.

The controlled waters risk assessment should consider the risks to the water environment from the waste body, changes as a result of ground improvement and piling, and future leachate generation potential. Ramboll propose risks to groundwater from piling are presented in a separate risk assessment and an outline Piling Risk Assessment has been provided.

The Environment Agency is the lead regulator for groundwater and surface water. The EA has had pre-planning communications with Ramboll/LOR, as evidenced by meeting minutes supplied by Ramboll. It is expected the EA will be consulted by the planning authority on the school planning application.

Question 6: How will construction affect stability or settlement on the adjacent site(s)? Have potential stability issues to the adjacent site been considered?

Review of geotechnical proposals is outside the scope of Arup's commission.

Ramboll have provided the following response to this question:

Landfill material does not extend to under the adjacent properties, with the piled foundations to the building footprints founding within the competent ground underlying the landfill that is outside the zone of influence of the adjacent properties, therefore the only anticipated affect would be from site activities through potential vibration that may occur. CFA piling is widely accepted as one of least vibration generating piling methods. This is confirmed by historical

data published within BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration. However detailed design and pre-start reviews with Expanded Piling will ensure that vibration risks are well understood and minimised.

Baseline vibration monitoring is proposed on site in agreed locations to understand current vibration levels on site without any construction activity. There will be a continuous programme of vibration monitoring which will take place throughout the duration of the construction phase and, particularly, through groundworks which are most likely to generate vibration (piling and ground compaction).

Design proposals have also aimed to keep excavations as shallow as possible and based on the proposed distance from adjacent properties to these excavation areas we believe this aspect will be manageable.

Data from the vibration monitoring will be regularly reviewed in line with BS 7385-2: 1993. Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration, site vibration levels will be assessed to prevent any damage to neighbouring properties. If vibration levels are found to be excessive, vibration generating activities will be stopped, reviewed and appropriately adjusted as necessary to bring the vibration levels to within acceptable levels.

Question 7: Recognising anecdotal evidence of wastes from Geigy at Middleton, Clayton Aniline, ICI Dyestuffs and munitions waste, have the investigations and risk assessments considered the potential variability of wastes, and associated contaminants (e.g. DDT)? Have radiological contaminants been considered?

Chemical testing of soil and groundwater samples by Ramboll has included the range of contaminants appropriate to the potential contaminants of concern. Radiological contaminants have not been tested as review of MCC landfilling records did not indicate they would be a potential contaminant of concern. We have recommended that the part of the remedial strategy that considers unforeseen contamination considers the risk that this may be radiological.

Ramboll tested for a wide range of potential contaminants in the soil as part of the investigations. This included a limited amount of testing of soil for pesticides/herbicides (including DDT), semi volatile organics compounds (includes anilines, phenols) and volatile organic compounds (includes solvents). The samples tested were all relatively shallow and not from the deeper waste. This was consistent with their conceptual site model, in that people using the site are more likely to come into direct contact with materials close to the surface.

Groundwater testing has also included a wide range of potential contaminants appropriate to the potential contaminants of concern, albeit on a limited number of samples and on one occasion only, including pesticides/herbicides (including DDT), semi volatile organics compounds (includes anilines, phenols) and volatile organic compounds (includes solvents). The risk assessment has considered all the test results to identify contaminants of concern that require further consideration.

Ramboll have clarified MCC's records of the landfill were reviewed as part of this exercise, and that they did not identify any evidence to suggest that the landfill had received radiological materials. As such, radiological contaminants were not identified as a potential contaminant of concern. Arup considered that this

approach was reasonable at that point, in the absence of any specific information relating to the placement of radiological materials within the landfill.

Given that concerns have been raised during our consultation with FONV regarding this, we have recommended that the Remedial Strategy considers the implications of unforeseen radiological contamination, and any measures that would be required in mitigation.

Question 8: Is there a risk for gas/leachate migration to Nico Ditch?

Ramboll have not yet fully assessed the risks of gas and leachate migration to Nico Ditch. Ramboll has stated that sampling of Nico Ditch is ongoing and this will be considered in the ground gas risk assessment and controlled waters risk assessment, to be issued in October 2017.

Nico Ditch was identified as a surface water receptor and a potential pollutant linkage at desk study stage but has not been assessed in the Ramboll risk assessments prepared so far. Approval of the controlled waters risk assessment (including consideration of Nico Ditch and groundwater) will be required prior to work commencing. The Environment Agency is the lead water environment regulator.

Nico Ditch also has potential to be a pathway for ground gas from the waste body. Ramboll has confirmed that Nico Ditch will be considered as a potential pathway for ground gas in the ground gas risk assessment.

Question 9: Can the proposed costs be reviewed, to see if they are robust?

Review of costs is outside the scope of this review.

Question 10: Has off-site disposal of potential contaminated soils been adequately reviewed?

LOR has provided a statement detailing how soils will be handled both on-site and off-site, to minimise the risk to neighbouring residents and landowners.

Understandably transporting contaminated soils offsite is of concern given high-profile cases such as the former steelworks at Corby. LOR has provided details to show how they intend to dispose of materials offsite, which will include wheel washes for vehicles leaving the site, sheeting to cover the vehicles and skips, road sweepers to ensure that any mud dropped on local roads is cleaned away etc. This is usually provided in the Construction Environmental Management Plan (CEMP). LOR should demonstrate that these measures were employed in the Verification Report, which will need to refer back to the CEMP.

Question 11: Has the stability of the landfill and potential for settlement been adequately assessed? What is the geotechnical

mitigation – ground improvement, piling etc? FONV estimate that that land will continue to sink for a further 20 years.

Review of the geotechnical assessments carried out by Ramboll is outside the scope of Arup's commission. Ground improvement has been identified as being necessary to limit the future settlement of the ground and piling is required to prevent future movement of the new buildings. These mitigation measures are commonly considered in the design of buildings, roads and services on landfill sites.

Question 12: How does this site compare with Reddish Vale School, where there have been many complications?

We are unable to provide a response as a review of the circumstances of the Reddish Vale School construction is outside the scope of this review. However, it is worth noting that landfill sites have been successfully redeveloped for a variety of uses. The success of the development largely rests with the contractor's ability to manage the risks both during construction and over the life of the development.

Question 13: Will it be safe for adjacent residents and users of Nutsford Vale during construction?

Proposed measures to manage risks to adjacent residents and users of Nutsford Vale during construction have not yet been presented, but will require approval by the EHO in advance.

The risk assessments will need to demonstrate that the construction works and the long-term effects of the development on the site will not pose a risk to residents of Nutsford Vale. The Construction Environmental Management Plan (CEMP) will document how the works will be managed to protect local residents. Potential issues to be considered include: gas emissions caused by the ground improvement; changes to the gassing regime caused by the development itself (i.e. new gas routes out of the landfill); nuisance and odours during development; soil, dust emissions during development. The details of all of these aspects have not yet been presented but Ramboll/LOR have committed to providing them and they will need to be approved by the environmental regulators before construction can begin.

Question 14: It is understood that the proposed construction methodology for the school is modular, to reduce the construction programme. Does the construction programme allow for mitigation such as limited area of exposed contaminated material in excavations?

The Remedial Strategy as it is presented currently appears to be designed to minimise disturbance of the waste body, but detailed plans of earthworks and phasing are not yet available.

Whilst some earthworks cut and fill is likely to be necessary to create the right ground levels for the development, the overall aim of the Remedial Strategy is to limit the amount of landfill waste which needs to be excavated, as this material would not be suitable for re-use and would need to be taken offsite.

Earthworks phasing plans indicating when and where waste will be exposed have not been provided, however limiting exposed waste area would assist with managing odour, dust etc and is expected to be documented by LOR in the CEMP and approved by environmental regulators in advance.

Question 15: Are independent soil / groundwater samples and interpretation necessary?

There is no reason to suspect the existing soil/groundwater testing data is invalid. Ramboll is a reputable professional engineering and environmental consultancy with a quality management system. This review has considered the adequacy of the interpretation presented by Ramboll/LOR.

The soil and groundwater testing carried out to date has been done using a United Kingdom Accreditation Service (UKAS) accredited laboratory, to the Environment Agency's MCERTS standard, where applicable. The MCERTS standard and UKAS require laboratories to meet stringent standards of quality control and quality assurance.

Considering the above there is no reason to suspect the accuracy of the soil and groundwater data presented in the Ramboll reports. There would also be no benefit in visiting site to take 'check' samples, as it would be impossible to accurately replicate the Ramboll sample test result, due to the heterogeneity of the waste body.

A preferable strategy is to ensure that the dataset is representative of the materials being tested i.e. that enough samples have been taken to provide confidence in the results, considering the conceptual site model and risk assessment.

The scope of this review includes consideration of the available data and, whilst not replicating the risk assessments produced by Ramboll has considered the robustness and validity of the interpretation presented.

Question 16: Is the extent of the pit understood (depth and area)? Has the investigation reached natural ground?

Ramboll have completed ground investigations that prove natural ground (and waste thickness) across the school site.

Nineteen exploratory holes extend to the base of the made ground and prove natural ground in the school site (out of a total of 35 exploratory holes within the school development site).

Along the western and southern site boundary made ground thickness is typically 0.5 to 2.0m thick in a zone up to 40m wide (12 exploratory holes). To the north and east of this border area the made ground thickness, and former clay pit depth, is much greater at between 8.6 and 15m (proven in 7 holes). Exploratory holes

proving the base of the waste within the deeper area are at approximately 100m spacing and therefore features such as spines of natural material separating tipped waste areas are unlikely to have been identified.

Appendix A

Compliance Review

A1 Compliance with CLR11 Model Procedures

The methodology presented in the initial documents was reviewed for compliance with CLR11 Model Procedures. Where questions were raised regarding compliance, Ramboll provided the supplementary information which is listed in **Section 1.5** of the main report. The detail of this review is presented in a series of tables in this appendix, together with summary text.

A1.1 Risk Assessment

CLR11 states that the process of risk assessment needs to be iterative; where unacceptable risks are identified, then further information needs to be collected which allows the risks to be examined in more detail and uncertainty to be reduced.

The process of risk assessment adopted at Matthews Lane has followed this approach. The Desk Study report presents the results of a Preliminary Risk Assessment (PRA), the Interpretative Report presents a Generic Quantitative Risk Assessment (GQRA) and a Detailed Quantitative Risk Assessment (DQRA) has been provided for human health within the proposed development area only.

A1.1.1 Preliminary risk assessment (PRA)

The key procedural points for a PRA are defined in CLR11 as follows:

- Define the context and objectives of risk assessment;
- Identify and collect the information needed on potential contaminants, pathways, receptors and other relevant characteristics of the site and its setting;
- Keep information under review and understand need to obtain more information to refine understanding;
- Identify the need for further assessment.
- Compliance of the Desk Study with CLR11 is presented in checklist format in **Table A1** below. The Desk Study report fulfils the requirements for a Preliminary Risk Assessment in CLR11 and BS10175. It presents information on the expected ground conditions, potential for contamination and an outline conceptual site model based on the proposed development of the site as a high school. The preliminary risk assessment is based on the “source-pathway-receptor” model required by guidance.

The preliminary risk assessment identifies the potential for unacceptable risks to be present and recommends that further action is taken, specifically that an intrusive ground investigation is carried out. The proposed scope of the ground investigation is outlined in general terms in the desk study report. Compliance of the actual ground investigation against this scope is discussed in **Section A1.1.2**.

CLR11 places emphasis on the need to identify uncertainties in the information used in the risk assessment, as this can have an impact on the level of confidence in the outcomes of the risk assessment. There is no single section in the desk study report which sets out the limitations and uncertainties in the model, but various assumptions, limitations and uncertainties are presented throughout the report and the ground investigation design should reduce the level of uncertainty over ground conditions and contamination.

Table A1 Compliance with CLR11 for a desk study report (referred to as preliminary risk assessment in CLR11)

CLR11 requirement (based on MCC checklist)	Evidence of provision in Ramboll report
Site description	Section 2.2; included details collected during a site reconnaissance visit carried out in November 2016.
Detailed site plan showing the site location, extent and boundary	Figure No. 1620001457-006/E/001 and 1620001457-006/E/002a
Review of historical information including copies of historical maps where available	Historical Ordnance Survey (OS) maps viewed at 1:1250, 1:10,560 and 1:10,000 scales (Section 3). Copies of historical maps presented in Appendix C.
Background information on past and present uses of the site and surrounding area	Present site use is described in Section 2.2; surrounding current uses are described in Section 2.3 and in Section 4, Table 4.4 (contemporary trade/fuel station entries)
Appraisal of the environmental setting, including:	Section 4
Geology	Table 4.1
Hydrology and hydrogeology	Hydrogeology in Table 4.2; hydrology in Table 4.3
Coal mining	Table 4.1 and Section 6
Landfill/waste management issues	Table 4.4
Water abstractions and discharges	Abstractions: Groundwater in Table 4.2, surface water in Table 4.3 Discharges: Table 4.4
Pollution incidents	Table 4.4
IPPC Part A and B	“Regulated activities” listed in Table 4.4
Radon	Table 4.1

CLR11 requirement (based on MCC checklist)	Evidence of provision in Ramboll report
Drainage and services	Drainage included in Table 4.3 Services information not included, but was later obtained for the ground investigation (Section 2.3, Ground Investigation Factual Report)
Review of previous desk studies or site investigations	Previous desk study by Curtins Consulting Ltd (Section 1.4) BGS borehole records (Section 6)
Risk screening using an initial conceptual model, including:	Section 5
Source characterisation	Section 5, Table 5.1
Exposure/migration pathway descriptions	Section 5, Tables 5.2 and 5.3
Environmental receptor identification and discussion	Section 5, Table 5.2
Identification of potential pollution linkages	Section 5, Tables 5.3 and 5.4 general pollutant linkages. Potentially significant linkages in Table 5.5 Linkages presented graphically in Figure 3
Descriptions of the limitations and uncertainties in the conceptual model	General limitations of study (Section 1.5) Four possible layouts under consideration, unknown which one will be taken forward at time of report (Section 1.1) Notes to Tables 5.4 and 5.5 in Section 5
Recommendations and conclusions	Section 7 (conclusions) and Section 8 (recommendations)
Not included in requirements for planning, but covered in report	UXO risk assessment (Section 3.1) Geohazard identification (Section 4, Table 4.1) Flood risk (Section 4, Table 4.3) Sensitive environments (Section 4, Table 4.4) Preliminary geotechnical assessment (Section 6)

A1.1.2 Generic quantitative risk assessment (GQRA)

The key procedural points for a GQRA are defined in CLR11 as follows:

- Confirm outline conceptual site model and the context of the risk assessment
- Define the objectives of the risk assessment
- Identify generic assessment criteria (GAC)
- Review the information requirements and practicality/cost of obtaining the necessary information
- Assess whether GAC are appropriate for use, for each pollutant linkage
- Identify unacceptable risks
- Review the information and decide whether further risk assessment is needed, further ground investigation, or whether risk management options can be identified now.

Compliance of the GQRA with CLR11 is presented in checklist format in **Table A2**.

Table A2 Compliance of factual and interpretative reports and supplementary shallow investigation presented in DQRA with CLR11 requirements

CLR11 requirement (based on MCC checklist)	Evidence of compliance	Additional evidence provided
Site investigation methodology, to include:		
A clear investigation scheme, based on findings of desk study	Investigation scheme set out in Desk Study report, Section 8. Comparison of scope against scope of work carried out confirms that all proposed work was done, apart from Coal Authority Mining Report, which was not presented in the reports	CA mining report provided [5] which confirms no mining risk.
Methods of investigation with justification of the methodology and investigation techniques used	Methods of investigation are set out in the Factual Report i.e. the types of boreholes/window samplers used. Justification provided of changes to proposed methods where unsuccessful in penetrating ground conditions (Factual Report Section 3.2)	N/A
Justification of exploration locations and a plan showing their position	Section 3 of Interpretative Report sets out what was done in terms of investigation scope. No clear scheme of	Ramboll provided further justification of investigation scheme [1] to address Arup concerns.

CLR11 requirement (based on MCC checklist)	Evidence of compliance	Additional evidence provided
	<p>investigation provided in Factual or Interpretative reports i.e. one which sets out the rationale behind location of investigation points</p> <p>Plan included as Figure No. 1620001457-006/E/002 in Factual and Interpretative reports.</p>	
Sampling and analytical strategy	<p>Sampling strategy was not provided in either Factual or Interpretative report i.e. justification of where samples would be taken from. Some detail in DQRA i.e. focus was shallow (<1m) soils, tied in with CSM.</p> <p>Analytical strategy partially presented in Factual report as list of parameters which might be analysed for (Section 3.5). No discussion in Factual or Interpretative Reports provided as to rationale for testing based on conceptual site model. Rationale provided in DQRA report for shallow soils testing.</p>	<p>Ramboll provided further justification of investigation scheme [1] to address Arup concerns.</p> <p>Noted that scheme of 4th and 5th phases of GI developed in conjunction with EA/EHO in line with best practice.</p>
Coverage of investigations (statistical significance – targeted and non-targeted)	<p>Investigation coverage shown on Figure 1620001457-006/E/002 appears to show a targeted, or judgemental, sampling regime rather than a non-targeted regular grid of sample points across the site, although the rationale for the investigation coverage is not discussed in either report.</p> <p>Investigation locations appear to focus in particular on the proposed locations of the school buildings with a much lower density of points across the rest of the site.</p>	<p>Ramboll provided further justification of investigation scheme [1]. Note that more investigation is underway, so further information will be provided. Investigation extent cannot be judged fully until complete. Ramboll accept in reports that insufficient info to address some concerns (gas, groundwater) so need more investigation.</p>
Environmental monitoring including water sampling and gas monitoring/sampling	<p>Groundwater sampling and testing and in-situ gas monitoring carried out.</p> <p>Compliance with BS10175 checked, discussed elsewhere</p> <p>Compliance with CIRIA C665/BS8485 discussed elsewhere</p>	N/A
Results and findings of the investigation, including:		
Ground, groundwater and gas conditions encountered	<p>Ground conditions discussed in Section 4.1 and Table 4.1</p> <p>Groundwater discussed in Section 4.2 and 4.4</p> <p>Ground gas conditions discussed in Section 6</p>	N/A

CLR11 requirement (based on MCC checklist)	Evidence of compliance	Additional evidence provided
Presentation of laboratory analysis, sampling and monitoring results	All data is presented in the Factual Report and DQRA report.	N/A
Discussion of any ground contamination encountered	Included in Table 4.3 Factual report which presents visual and olfactory evidence of contamination encountered during the fieldwork, which is additional to the ground contamination (landfill) extent identified in the ground conditions Section 4.1	N/A
Refine conceptual site model	Section 7 revisits the conceptual site model with the benefit of the data from the ground investigation. Pollutant linkages arising from the GQRA process are set out in Table 7.1 (sources), Table 7.2 (receptors) and Table 7.3 (Pathways) Revised CSM presented in Drawing No. 1620001457-CLIR-FIG 4 Groundwater flow contours presented Interpretative Report, Appendix A	N/A
Qualitative and quantitative risk assessments, clearly identifying pollutant linkages	GQRA for soil presented in Section 5.1 GQRA for water presented in Section 5.2 Qualitative risk assessment (revised based on updated CSM) presented in Table 7.4 DQRA for soil within school only presented in DQRA report. No consideration of groundwater risks at DQRA level.	N/A
Recommendations for remediation	No remediation strategy presented in Interpretative Report. Report states that a remediation strategy is in preparation (Section 9.6) and was subsequently prepared separately.	Remedial Strategy report assessed separately (see Table A3).
Recommendations for further investigation (if required)	Additional monitoring for ground gases are recommended to confirm the gas regime (Table 7.1) Additional sampling and analysis recommended regarding risks posed by asbestos fibres (Table 9.1) Further investigation to assess risks to water environment (Table 9.1)	Ramboll confirm additional gas monitoring underway [4] LOR confirm that asbestos risks will be considered in the Asbestos Management Plan (AMP) [3] Ramboll confirm additional groundwater monitoring underway [18]

A1.1.3 Detailed quantitative risk assessment (DQRA)

The key procedural points for a DQRA are defined in CLR11 as follows:

- Confirm the conceptual model and the context of the risk assessment
- Identify unacceptable risks
- Review the context, criteria and information to decide the next step
- Consider what further assessment is needed

Compliance of the DQRA with CLR11 is presented in checklist format in Table A2, above.

A1.2 Options appraisal and remedial strategy

The Remedial Strategy partially fulfils the requirements for an options appraisal in CLR11. A limitation is that no options appraisal has been presented comparing a range of potential options to deal with each of the unacceptable risks identified; only the preferred option has been documented in the Remedial Strategy. It is possible that this is because the only feasible options for remediation are those which have been chosen, but no record of this decision-making process has been presented.

The key procedural points for Stage 3 of the options appraisal process in CLR11 are as follows:

- Define which pollutant linkages are to be addressed using single or combined remediation options
- Consider how the options will be combined in practice
- Determine whether a strategy can be developed which meets all of the objectives.

Compliance of the Remedial Strategy with CLR11 is presented in checklist format in **Table A3**, below.

Table A3 Compliance of remediation strategy with CLR11

CLR11 requirements (using MCC checklist)	Evidence of provision	Additional evidence provided
<p>Detailed outline of works to be carried out Description of ground conditions Type, form and scale of contamination to be remediated</p>	<p>Works to be carried out outlined in Section 1.3, although no detail provided; for example, changes in site level, earthworks and site preparation</p> <p>Ground model presented in detail in Section 3. Note Section 3.5 gas monitoring stated as 9 rounds over 9 weeks, but actual monitoring was 9 rounds over 17 weeks (11/1/17 to 10/5/17)</p> <p>Gas protection measures to buildings, to meet CS4</p> <p>May be a requirement for mitigation measures to prevent offsite gas migration, to replace original gas venting trenches at western and eastern boundaries</p> <p>Prudent to complete further surface continuous monitoring near the proposed buildings to confirm the gas regime</p> <p>A strategy regarding how to monitor, remove or direct leachate and gases is required during construction</p> <p>Foundation works risk assessment required to protect aquifer</p> <p>Further risk assessment to decide whether site soils are suitable for use in a school development. Likely that imported clean capping will be needed in certain areas.</p> <p>Barrier pipe for potable water supplies</p> <p>Consideration of potential migration of leachate offsite</p> <p>Creation of gas pathways via service channels</p> <p>Nuisance/odour issues from excavation of waste</p> <p>Decommissioning of the boreholes</p> <p>More shallow soil sampling and detailed risk assessment of volatiles in soils</p> <p>Risks associated with ground gases</p> <p>Risks to controlled waters</p>	<p>Outside scope of Arup review.</p> <p>Gas monitoring data not adequate from spot monitoring but Ramboll confirm continuous gas monitoring now underway at site [4]</p> <p>Ramboll confirm revised gas risk assessment to consider this [4]</p> <p>Ramboll confirm surface monitoring currently underway at site [4]</p> <p>Ramboll confirm this will be considered in gas risk assessment and controlled waters assessments [18]</p> <p>Ramboll provided draft FWRA for Arup review [12]</p> <p>DQRA considered suitability of soils for re-use and concluded that they could be used (pending presence of asbestos). Ramboll confirmed that intention is to cap whole site with clean imported materials where no hardstanding/buildings/pitches [18]</p> <p>Gas pathways via services to be considered in gas risk assessment due October 2017 [18]</p>

CLR11 requirements (using MCC checklist)	Evidence of provision	Additional evidence provided
		Additional shallow soil sampling was carried out for DQRA and risk assessment for volatiles completed in line with good practice.
Consents, agreements and licenses (waste management issues)	None obtained/presented in report.	N/A
<p>Implementation and validation of remediation</p> <p>Use of on-site observations and visual evidence</p> <p>Chemical analysis/monitoring data</p> <p>Proposed clean-up standard</p> <p>Construction Quality Assurance (CQA)</p>	<p>Testing frequencies for site-won material provided in Section 7.1.1</p> <p>Cleanup standards proposed: residential without plant uptake GACs</p> <p>Verification of gas membrane to CIRIA C735</p> <p>Long term monitoring of boundary wells recommended for gas</p> <p>Monitoring of leachate and groundwater during ground improvement</p> <p>Cover system and validation details (section 11)</p> <p>Unforeseen contamination protocol (Section 14.1)</p> <p>Verification plan (Section 15)</p>	<p>Arup queried suitability of residential without plant uptake standards for use in allotment area. MCC has stated that no allotments are to be present in the scheme, the area in question is to comprise raised planters only. Ramboll confirmed that raised planters will have a concrete/hard base to prevent intermixing with soil beneath and soils used in planters and that soil within the planters will conform to 'residential with plant uptake' standards. This decision should be documented in the Remedial Strategy and DQRA (if appropriate).</p>

A2 Compliance with BS10175

Broad compliance with BS10175:2011+A1:2013 and referenced guidance has been checked. Checking of compliance has been limited for all on-site elements of the work such as sample collection, where no detailed records have been presented confirming that samples were collected in accordance with the guidance e.g. the type of sample containers used, whether sampling implements were cleaned between samples and whether monitoring wells were installed correctly.

Section 3.2 of the Ramboll Ground Investigation Factual Report states that the work was undertaken in general accordance with BS10175:2011. The typical objectives of a Desk Study are set out in Clause 4.2, Table 1 of BS10175:2011+A1:2013. These objectives have been used to assess compliance of the Desk Study with the British Standard. The outcomes of the assessment are presented in Table A4.

A2.1 Desk Study

The typical objectives of a Desk Study are set out in Clause 4.2, Table 1 of BS10175:2011+A1:2013. These objectives have been used to assess compliance of the Desk Study with the British Standard. The outcomes of the assessment are presented in **Table A4**, below.

Table A4 Compliance of desk study report with British Standard BS10175:2011+A1:2013

BS10175:2011+A1:2013 objective	Evidence of provision	Additional evidence provided
Provide information on past and current uses of the site and surrounding area and the nature of any hazards and physical constraints	Historical Ordnance Survey (OS) maps viewed at 1:1250, 1:10,560 and 1:10,000 scales (Section 3). Present site use is described in Section 2.2; surrounding current uses are described in Section 2.3 and in Section 4, Table 4.4 (contemporary trade/fuel station entries)	N/A
Identify current and likely future receptors, potential sources of contamination and likely pathways and any features of immediate concern, including those that could be introduced in the future	Potential source-pathway-receptor linkages are presented in Section 5	N/A
Identify any aspect of the site requiring immediate attention	None identified in report	N/A
Provide information on the geology, geochemistry, soil, hydrogeology and hydrology	Section 4	N/A

BS10175:2011+A1:2013 objective	Evidence of provision	Additional evidence provided
Identify potentially different sub-areas of a site based on differing ground conditions, potential contamination and past, present and future uses	Not identified explicitly in report, but by inference there may be at least two sub-areas within the site, as landfilling is believed to have only taken place within the former clay pit	This was closed out at ground investigation stage, when it became clear that landfilling extended across the site.
Produce an initial conceptual model for the site as a whole and/or for zones within the site	Conceptual model in Section 5 does not zone the site, but the graphical conceptual model in Figure 3 identifies that landfilled refuse is only believed to cover part of the site	See comment above.
Provide information for the preliminary risk assessment	Qualitative risk assessment presented, with estimates of risk magnitude, in Section 5, Table 5.4	N/A
Identify areas where informed decisions are to be made using specialist assessment techniques and advisors	UXO risk assessment identifies a low risk (Section 3.1).	N/A
Provide data to assist in the design of potential subsequent exploratory and main investigations and give an early indication of possible remedial requirements	Section 8 recommends investigation scope. Indication of remedial requirement for contamination not provided in Section 7 although discussion of possible remediation for geotechnical reasons provided	N/A
Provide information relevant to worker health and safety and to the protection of the environment during field investigations	Not included in desk study report, but may have been communicated to ground investigation contractors at a later stage, as would be standard practice	N/A
Identify the need to involve regulatory bodies prior to the intrusive investigation	Yes, in Section 8.	N/A

A2.2 Exploratory hole layout and sampling strategy

General headings from BS10175 have been used to assess compliance of the ground investigations with the British Standard. The results of this assessment are presented in **Table A5**, below.

Table A5 Compliance of ground investigations with BS10175:2011+A1:2013

BS10175:2011+A1:2013 objective	Evidence of provision	Additional evidence provided
<p>Design and planning of the investigation</p> <p>Analytical suite should be based on the contaminants identified as potential sources in the conceptual site model</p> <p>Exploratory hole locations should be designed to investigate the potential linkages identified in the conceptual site model</p> <p>Scope of investigation should be discussed and agreed with the Regulators (i.e. Environment Agency and MCC Contaminated Land Officer) where appropriate</p>	<p>Analytical suite set out in Section 3.5 of the Factual Report matches with the list of potential contaminants presented in Table 5.1 of the Desk Study report, with some additions (e.g. cyanide, sulphate, sulphide)</p> <p>Exploratory hole locations discussed below in more detail.</p> <p>It is not known whether the design of the first phases of ground investigation was discussed with the regulators (MCC or EA)</p> <p>Fourth phase of GI was requested by MCC and presumably scope agreed with them.</p>	<p>FONV queried presence of other wastes in landfill e.g. ICI, munitions, radioactive waste. ICI/chemical wastes likely to be covered by range of contaminants of concern tested by Ramboll. Munitions wastes unlikely given UXO risk stated by Ramboll in Desk Study to be low. Arup queried whether radioactive waste should have been considered by Ramboll who stated that there was no evidence within the desk study to suggest that radioactive wastes were likely to be significant risk on this site, thus no specific investigation was completed in this regard. However, as a contingency response to the unexpected contamination risk, Ramboll will update the Remedial Strategy identifying that construction waste/arising should be screened for radiation as part of the contaminated land watching brief. Issue closed out.</p> <p>Ramboll confirmed [1] that first 3 phases of GI done prior to EA/EHO engagement, but later phases have involved them fully [14], [13] including scope of 4th phase (shallow soil testing for DQRA) and 5th/6th phases (groundwater/surface water testing, gas testing)</p>
<p>Site safety and environmental protection</p> <p>Personnel experience</p> <p>Pre-investigation considerations</p>	<p>Section 3.2 of Factual Report states all locations checked for services using plans and cable avoidance tool, hand-dug inspection pits prior to drilling</p> <p>It is not possible to comment on site safety compliance or personnel experience as this information has not been provided</p> <p>The risk of Unexploded Ordnance (UXO) had been considered in the Desk Study report (Section 3.1) and the risk was assessed to be low. No further action was taken</p>	<p>N/A</p>

BS10175:2011+A1:2013 objective	Evidence of provision	Additional evidence provided
<p>Sampling strategies Targeted/non-targeted sampling methods Number of locations and pattern to be informed by the risk assessment and the required degree of confidence in the results Sampling depths to be based on the conceptual model and expected pathways/interactions</p>	<p>No rationale or discussion is provided concerning the exploratory hole layout. However, the layout suggests that a judgemental or targeted sampling strategy has been adopted, although this is not specified in either report. The strategy regarding sampling and sample depths is not discussed in the Factual or Interpretative reports. The DQRA report states that sampling was to characterise shallow soils only (<1m).</p>	<p>Ramboll has provided additional statement regarding sampling strategy [1] which provides evidence of good practice in the development of the investigations. Later phases developed in consultation with regulators, which is best practice.</p>
<p>Soil sampling and testing Sampling should not result in cross-contamination Does the report refer to the contaminants identified in CSM? MCERTS UKAS accredited lab Leachate/pore water data where groundwater quality at risk from soil contamination Observations made during sampling should be taken into account in specifying testing</p>	<p>Reports do not mention how cross-contamination was prevented during sampling Ramboll state that samples were transported to laboratory in cool boxes, transported with pre-frozen cool packs as promptly as possible. Chain of custody documentation kept (Section 3.3 factual report. Also stated in DQRA report) i2 Analytical carried out testing for first 3 phases in accordance with MCERTS and ISO17025. UKAS accredited lab. Some deviating results for waste acceptance due to holding times but relate to SOM, pH, ANC, TOC, results relate to waste and not used for human health assessment. Deviating results due to holding times for BTEX, MTBE, total CN in BH03 and SOM, Total CN in BH04. Both samples are from deep wastes and not used in human health DQRA completed to date. ESG carried out testing for 4th phase of investigation in accordance with MCERTS and ISO17025. UKAS accredited lab. No deviating samples noted.</p>	<p>Ramboll provided comment to justify this. Deviating samples not queried further with Ramboll, as not likely to make a significant difference to the outcome of the DQRA. Might affect waste classification but that is outside Arup's scope for review.</p>
<p>Groundwater sampling and monitoring Monitoring well locations should be determined on the basis of the CSM</p>	<p>No rationale provided on the placement of monitoring wells, but wells provided around site perimeter and in main body of site</p>	<p>Rationale for well placement provided by Ramboll in separate statement [1]. Restrictions included vegetation, difficulty of drilling and cross-contamination worries over drilling into the aquifer. Gas monitoring wells in 2nd phase</p>

BS10175:2011+A1:2013 objective	Evidence of provision	Additional evidence provided
<p>Wells should not be screened across strata</p> <p>Wells should be developed before sampling, ideally two weeks prior to sampling</p> <p>Sampling should be designed to avoid cross-contamination and loss of contaminants. Low flow sampling preferred to reduce amount of water requiring disposal and avoid loss of volatiles</p> <p>Wells should be purged before sampling</p> <p>To ensure purging effective, monitoring of chemical parameters should be carried out during purging</p> <p>Disposable bailers to be used to prevent cross-contamination</p> <p>Where practicable, groundwater should be characterised using data from a series of sampling operations</p>	<p>Response zones confined to single stratum</p> <p>Factual Report (Section 3.3) states that monitoring wells were developed by purging 10x well volume. Date not provided for developing.</p> <p>Section 3.3 Factual Report states that wells were purged 3x well volume using submersible WASP pump (shallow) and inertial foot valves (deep). Samples recovered using low-flow peristaltic pump or disposable bailers, as appropriate. Geochemical parameters recorded during purging including temperature, conductivity, dissolved oxygen and oxidation reduction potential</p> <p>One round of groundwater samples taken from suitable installations</p> <p>Calibration certificates for gas monitoring equipment not provided</p>	<p>of GI specifically designed and placed along western boundary to investigate cross-boundary movement of gas [1].</p> <p>Single round of groundwater monitoring not compliant with best practice, but Ramboll confirmed further groundwater analysis is underway now [18].</p>
<p>Monitoring and sampling of ground gas</p> <p>Monitoring well locations should be determined on the basis of the conceptual site model. Guidance on spacing provided in CIRIA C665 and BS8576:2013</p> <p>Monitoring wells design should be suitable for gas monitoring i.e. screened area allows for assessment of gas production from specific stratum</p> <p>Timing and frequency of gas monitoring to be based on the conceptual model, site conditions (CIRIA C665 and BS8576:2013)</p>	<p>The Desk Study stated that gas monitoring would need to comprise “nine rounds over six months to meet the requirements of current UK ground gas guidance”. The actual gas monitoring comprised nine rounds over a four month period.</p> <p>Table 4.2 of CIRIA C665 provides guidance on the spacing of gas monitoring wells. Where the gas hazard is moderate (the example is given of ‘older domestic landfill sites’) and the sensitivity of the end use is moderate, the initial nominal spacing of gas monitoring wells is advised to be “Close (25-50m)”. Spacing of wells within the proposed development area or the wider site does not meet this requirement, being between 30-80m spacing.</p>	<p>Spot gas monitoring not best practice as period too short, but Ramboll now carrying out continuous monitoring [4] which is considered best practice and highly appropriate to this site where gas could be fluctuating widely over time.</p> <p>Note that additional gas monitoring/investigation is underway, including surface monitoring [4] which might address this. On hold pending further gas risk assessment.</p>

Table A6 Queries raised by Arup in Compliance Review and Ramboll responses

Compliance concern	Ramboll response	Issue closed out?
<p>Compliance with CLR11: Ramboll reports identify that risks to groundwater require further assessment but this information is not presented.</p>	<p>Risks to groundwater are being investigated further with two additional down-gradient boreholes and 2 additional monitoring rounds. The number and location of boreholes penetrating the wastes during initial and additional investigations has been limited due to the potential for introduction of new pollutant pathways through to the aquifer. The scale of works has also been considered in cost/benefit terms and will be phased for all works to ensure no unnecessary expenditure (each BH takes approx. 1 week to complete making installation of new wells very expensive on this site as well as a potential risk to the aquifer). All further investigation and monitoring of groundwater will also be restricted to balance risks of introducing new pathways and the ideal requirements/ benefits from monitoring.</p>	<p>Yes, pending issue of groundwater risk assessment which includes the results of the additional sampling advised by Ramboll.</p>
<p>Compliance with CLR11: A formal options appraisal has not been presented, which looks at a range of potential options to deal with each of the unacceptable risks identified. It is possible that this is because the only feasible options for remediation are those which have been chosen, but no record of this decision-making process has been made available.</p>	<p>The geotechnical design solution to limit differential settlement of the external works drove the remediation solution. A remediation options appraisal was effectively undertaken as the Remedial Strategy was written and revised several times in conjunction with discussions and development of the design in particular the geotechnical design works, however these iterations and previous options are not discussed in the Remedial Strategy presented for the planning submission.</p> <p>The thought process for geotechnical design (which has effectively dictated much of the ground contamination solutions) is detailed in meeting notes and the geotechnical design reports.</p> <p>A statement regarding the Remediation Options Appraisal will be prepared w/c 11/09 to assist with Arup's Compliance Review and can then be incorporated within the Remediation Strategy together with any further comments that arise from the detailed document review that Arup are due to commence.</p>	<p>Options Appraisal statement issued by Ramboll on 11/9/17 which set out the rationale behind the development of the remediation strategy and the limitations placed on remedial options because of the geotechnical requirements of the scheme. This is considered an adequate response to demonstrate compliance with CLR11.</p> <p>Ramboll to incorporate the Options Appraisal statement into their Remedial Strategy as a record.</p>

Compliance concern	Ramboll response	Issue closed out?
<p>Compliance with BS10175: No rationale or discussion is provided in any of the reports regarding exploratory hole layout.</p> <p>Without justification of the design, the exploratory hole layout and sampling strategy is not considered to be compliant with current best practice.</p>	<p>Scope to comply with best practice is balanced with the practicalities and limitations of the site in consultation with MCC and EA for all works. There are site access limitations and extensive tree coverage that have influenced the sampling.</p> <p>A statement regarding the sampling strategy will be prepared w/c 11/09 to assist with Arup's Compliance Review and can then be incorporated within the Desk Study/Factual Report together with any further comments that arise from the detailed document review that Arup are due to commence.</p>	<p>Sampling Strategy memo issued by Ramboll on 11/09/17 which detailed the chronological development of the ground investigation and provided reasoning behind the locations and depths of the investigation points. The information submitted commits to further ground investigation being undertaken to address weaker aspects of the current assessment (groundwater and gas). This is considered an adequate response to demonstrate compliance with BS10175.</p> <p>Ramboll to incorporate the sampling strategy details into their Factual and/or Interpretative reports.</p>
<p>Compliance with BS10175: Very little investigation or testing has been carried out in the areas of the proposed sports pitches</p>	<p>The sports pitches are all-weather or multi-use games area type pitches and as such will be constructed such that there will be no direct contact pathway between users and soils. Outdoor air inhalation risks were considered sufficiently low that no further sampling and analysis was required beyond the initial investigations. The additional soil sampling was targeted to the buildings to address risks from volatiles in soils.</p>	<p>Sampling Strategy memo issued by Ramboll on 11/09/17 explains that “the existing capping of the landfill was identified during the ground investigation works to be of variable thickness. This and the design requirements for hardstanding areas across the site and also the construction of the sports pitch, led to the design understanding that the whole site would be engineered to remove all direct contact pathways post development. Risks to human health on site were therefore considered only from volatiles. Additional investigation was recommended to address this.”</p> <p>This is considered an adequate response to demonstrate compliance with BS10175. Whilst the coverage of soil testing across the school site is still patchy in some areas, the risk assessment has developed soil standards which will be protective of health via inhalation pathways, and the testing required as part of the Remedial Strategy should ensure that no unsuitable soils are placed near surface.</p>
<p>Currently, a single round of groundwater sampling has been undertaken from all suitable monitoring wells. BS10175 recommends that a series of sampling events is required, as groundwater quality can fluctuate over time.</p>	<p>Risks to groundwater are being investigated further with two additional down-gradient boreholes and 2 additional monitoring rounds, with the scope of works developed in consultation with the EHO and EA.</p>	<p>Yes, pending issue of groundwater risk assessment which includes the results of the additional sampling advised by Ramboll.</p>

Compliance concern	Ramboll response	Issue closed out?
Duration of gas monitoring carried out (9 visits over 4 months instead of 6 months) is not in line with recommendations made by Ramboll in the Desk Study.	The results of the first nine rounds of gas monitoring were generally consistent and whilst the initial spot monitoring was not strictly in compliance with guidance it was known that further more detailed monitoring and works in this regard would be required. This issue and approach was discussed and agreed with MCC towards the end of the initial monitoring period. It was therefore considered reasonable to stop the recommended first phase of spot monitoring slightly short of best practice.	Yes, pending issue of the gas risk assessment which includes the results of the additional sampling advised by Ramboll in their memo regarding ground gas mitigation plan dated 11/07/17.
No consideration has been given to the potential for landfill trace gases, only bulk gases monitored to date.	<p>The strategy for further ground gas monitoring to the development site has been documented in a memo that have been submitted to the EHO and can be provided to Arup for review, although it is not proposed to form part of the planning submission as the monitoring is on-going).</p> <p>There is also a separate memo detailing the strategy for further ground gas monitoring to the wider Nutsford Vale site, which again can be provided to Arup for review (if MCC wish to expand their brief beyond the development site), however it is not proposed to form part of the planning submission.</p> <p>Ground Gas Solutions Ltd have now progressed with development of further ground gas monitoring for the site and it is anticipated that their additional works will resolve any concerns on this issue in relation to risks to the development and also risks to neighbouring properties</p>	
The spacing of gas monitoring wells is not considered to be compliant with the guidance in CIRIA C665 without further justification of the investigation design.	Scope to comply with best practice is balanced with the practicalities and limitations of the site in consultation with MCC and EA for all works. There are site access limitations and extensive tree coverage that have influenced the well location.	
The level of gas monitoring and investigation is not considered to be sufficient to properly understand the gassing regime at the site.	Ground Gas Solutions Ltd have now progressed with development of further ground gas monitoring for the site and it is anticipated that their additional works will resolve any concerns on this issue in	

Compliance concern	Ramboll response	Issue closed out?
	relation to risks to the development and also risks to neighbouring properties.	

Appendix B

Technical Review

B1 Technical Review

B1.1 Desk study

The purpose of a desk study is to identify and collect information on potential contaminants which might be present, the potential receptors to the contamination and identify potential pathways by which contamination might reach the receptors. The information collected can include, but is not limited to, a description of the site and surrounding area, a review of historical information, particularly historical mapping, and an appraisal of the environmental setting of the site, for example the geology and any known pollution issues.

A desk study would normally be provided at planning application stage for sensitive developments proposed on a brownfield site. The desk study represents the first stage of the risk assessment process and where risks are identified, or there is uncertainty in the data, the process continues on to collect more detailed information. Arup has reviewed the desk study in this context, recognising that it is part of a process, and where questions have been raised or gaps identified in the information, that these are carried forward to be addressed in later documents.

The desk study review process is documented in **Table B1** and the main findings are described below.

Table B1 Desk study technical review

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
Site description	Arup has not carried out separate site reconnaissance. From available mapping, no additional comments to make regarding description of site and surrounding area based on cross-check with current OS mapping and plans presented by Ramboll.	N/A
Detailed site plan showing the site location, extent and boundary	No comments.	N/A
Review of historical information including copies of historical maps where available	Nico Ditch is noted to be an antiquity along the southern site boundary, possibly not within site boundary, although extent not clear on mapping. Not mentioned in desk study report. Not queried further as Arup scope does not extend to non-contamination related issues.	N/A

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
Background information on past and present uses of the site and surrounding area	<p>Historical mapping coverage is patchy in relation to the possible extent of the clay pit in the south of the site. Brief online search carried out to see if other resources (e.g. aerial imagery) readily available. Additional info viewed at: http://manchesterhistory.net/LONGSIGHT/INDUSTRY/Jacksons.html which has aerial image of northern part of site, but does not show southern end. Ramboll possibly viewed this same image.</p> <p>An aerial imagery search may have been useful to investigate extent of clay pitting as part of the desk study; this may have been done but is not documented in Ramboll report. It is noted that the BGS and EA records both show extent of landfilling to cover entire site area, however, so intrusive investigation would be suitable to confirm extent of landfilling across the site.</p>	N/A
Appraisal of the environmental setting, including:	See comments below.	
Geology	No comment.	N/A
Hydrology and hydrogeology	<p>Superficial aquifer (Devensian Till) is Secondary Undifferentiated (sources: Landmark and Environment Agency online). Ramboll concluded that the Till is classified as an Unproductive aquifer, but this differs from the information provided in the desk study.</p> <p>Landmark Detailed River Network map shows an extended culvert crossing the southern end of the site, connecting to the eastern end of Nico Ditch. Ramboll identifies that Nico Ditch is culverted beneath Matthews Lane. It is assumed that Ramboll may have considered line of culvert to be inaccurate as shown on the Detailed River Network map. No other evidence presented in desk study regarding culverted Nico Ditch.</p> <p>Historical mapping identified a small stream and spring within the site boundary circa 1907/8. No discussion in desk study as to whether this water feature could have been culverted within the site.</p>	<p>Ramboll confirmed in email response [3] that EA considers the Principal aquifer as the principal receptor. No further requirement to consider Till.</p> <p>Ramboll provided the results of a utilities trace in the Factual Report and UU plan [9] which confirms Nico Ditch is in culvert within Matthews Lane. Utilities trace based on site information and is more accurate than Detailed River Network map. No further action required.</p> <p>Ramboll provide utilities trace plans within Factual Report which identifies several drainage features within the site, but not a culverted watercourse in this location. Likelihood of culvert remaining is low, given that it was not identified during the utilities trace, and subsequent clay extraction in this area of the site is likely to have diverted this feature.</p>

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
		However, anecdotal evidence from FONV suggests that the spring formerly in this area may still be present, as the clay pit filled up with groundwater on abandonment. Implications of potential spring/watercourse to be considered in CWRA.
Coal mining	CA mining report not provided in desk study report.	Ramboll provided a copy of the CA mining report [5] which confirms no coal mining risk within site.
Landfill/waste management issues	<p>The Landmark information and EA online records show that GMWDA Pink Bank Lane landfill is present to the immediate north of Matthews Lane landfill. According to EA online records, Pink Bank Lane first received waste on 16th Feb 1981 and the last input of waste was on 1st May 1981. The landfill received household, inert and commercial waste. These dates may be inaccurate as it is unlikely the pit was filled in 10 weeks. Ramboll do not identify Pink Bank Lane landfill in Table 4.4 as an adjacent landfill site.</p> <p>Licensing dates suggest Matthews Lane landfill was filled first and Pink Bank lane second, meaning the waste within the northern part of the study area is younger. EA online records show that Pink Bank Lane appears to have received slightly different wastes to Matthews Lane (no Industrial, Special waste, liquids or sludge).</p>	Ramboll identify Pink Bank Lane in Interpretative report.
Water abstractions and discharges	No comments.	N/A
Pollution incidents	No comments.	N/A
IPPC Part A and B	No comments.	N/A
Radon	No comments.	N/A
Drainage and services	Possible culverted Nico Ditch within the site boundary, shown on Landmark Detailed River Network map. Inferred by Ramboll to be within Matthews Lane, rather than within the site boundary. Not possible to confirm location on basis of desk study information.	<p>Factual Report and UU plan [9] which confirms Nico Ditch is in culvert within Matthews Lane. No further action required.</p> <p>Ramboll provide utilities trace plans within Factual Report which identifies several drainage features</p>

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
	Possible culverted second stream/spring within site boundary, based on historical mapping which shows a former watercourse crossing the site. No discussion of likelihood of this in desk study report; possibly dismissed as site was subject to clay extraction and therefore stream/spring may have been diverted around the clay pit at this point.	within the site, but not a culverted watercourse in this location. Likelihood of culvert remaining is low, given subsequent clay extraction in this area of the site. No further action required.
Review of previous desk studies or site investigations	Curtins desk study not very detailed, limited to a short paragraph about the Matthews Lane site. Curtins state in their desk study that “the northern half of the site became a clay pit only to be filled by circa 1980” but this does not match with the Landmark data presented by Ramboll which suggests that landfilling took place over the entire study area.	Ramboll later revise their landfilled area boundary in Interpretative Report to cover the entire site. No further action.
Risk screening using an initial conceptual model, including:	<p>CSM does not identify the potential for odour/nuisance to adjacent site users during construction, if landfilled refuse is to be disturbed.</p> <p>Superficial deposits are classified by Ramboll as Unproductive strata, but this does not match the Landmark or BGS online information which classes the Till as a Secondary Undifferentiated aquifer.</p>	<p>Ramboll/LOR provided a statement by email dated 18th September 2017 [18] providing a methodology whereby odour and nuisance is proposed to be controlled during construction. It is recommended that this detail is included in the CEMP.</p> <p>Designation of superficial deposits by Ramboll is incorrect, but a minor technical point as Ramboll has confirmed that the EA do not consider the till to be the principal receptor for controlled waters at this site.</p>
Source characterisation	No comment.	N/A
Exposure/migration pathway descriptions	<p>Water environment pathway: there may be culverted watercourses within the site boundary (Nico Ditch and un-named stream/spring) which may be at risk from contamination.</p> <p>The Devensian Till is classified as a Secondary Undifferentiated aquifer and therefore may have higher permeability lenses/horizons capable of supporting groundwater abstraction or acting as a pathway.</p>	<p>Issue of potential culverted watercourses closed out with provision of additional information, documented above.</p> <p>Issue of Devensian Till aquifer closed out on provision of additional information, documented above.</p>
Environmental receptor identification and discussion	<p>CSM does not identify Nico Ditch as a potential controlled waters receptor</p> <p>Superficial deposits are classed as ‘Secondary Undifferentiated’, not Unproductive</p>	Ramboll confirmed that following consultation with the EA, Nico Ditch is being considered in future risk assessments for controlled waters and is being

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
		<p>sampled [18]. This is also documented in the minutes of meetings with the EA and EHO [14] [13]</p> <p>Designation of superficial deposits by Ramboll is incorrect, but a minor technical point as Ramboll has confirmed that the EA do not consider the till to be the principal receptor for controlled waters at this site.</p>
<p>Identification of potential pollution linkages</p>	<p>Leaching and migration of mobile contaminants from on-site sources to groundwater receptors (Principal Aquifer and Secondary Undifferentiated Aquifer) and surface watercourses assigned 'Low Likelihood', but it may be 'Likely' at this stage, resulting in 'Moderate' level of risk (not 'Low/Moderate')</p> <p>CSM does not identify Nico Ditch or other off site drains or utility routes as potential gas pathways.</p>	<p>Groundwater assessment details provided by Ramboll as additional information. Confirms risk assessment not complete at this stage, but is being developed with full consultation with EA and EHO [13], [14]</p>
<p>Descriptions of the limitations and uncertainties in the conceptual model</p>	<p>No comments.</p>	<p>N/A</p>
<p>Recommendations and conclusions</p>	<p>Need to establish location of culvert(s) and utility routes in vicinity of the site and assess as potential receptor/pathway</p>	<p>Information provided in Factual Report and UU drawings as additional information [9]</p>
<p>Not included in requirements for planning, but covered in report</p>	<p>No comments.</p>	<p>N/A</p>

B1.2 Ground investigation factual and interpretative reports

The purpose of the ground investigation is to test whether the sources and potential pollutant linkages identified in the desk study are present on site, or are viable during construction or in the developed condition of the site.

The review of the Factual and Interpretative reports identified some differences with the Ramboll interpretation of the data; this process is documented in **Table B2**.

Table B2 Ground investigation factual and interpretative report technical review

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
Site investigation methodology, to include:		
A clear investigation scheme, based on findings of desk study	Clear scheme of investigation not presented in report. Study area for report is taken as the entire Matthews Lane landfill site, not just the proposed school site (not a technical issue, just noted for checks on interpretation of data).	Ramboll provided a statement justifying the development of GI at the site [1]. It is noted that later stages have been developed in consultation with EHO/EA in line with best practice.
Methods of investigation with justification of the methodology and investigation techniques used	Additional consideration should have been given to the investigation of existing services e.g. Nico Ditch, the possible drainage features which extend into the landfill and any other service ducts in the ground, which could be potential pathways for ground gas to migrate from the site onto adjacent areas.	Ramboll confirmed that Nico Ditch is being investigated as part of the controlled waters study currently underway [3] Ramboll confirmed that Nico Ditch/services also being considered as part of additional gas risk assessment [3]
Justification of exploration locations and a plan showing their position	Rationale for investigation not provided.	Ramboll provided a statement justifying the development of GI at the site [1]. It is noted that later stages have been developed in consultation with EHO/EA in line with best practice.
Sampling and analytical strategy	Sampling strategy not provided.	Ramboll provided a statement justifying the development of GI at the site [1]. It is noted that later stages have been developed in consultation with EHO/EA in line with best practice.
Coverage of investigations (statistical significance – targeted and non-targeted)	Scheme of investigation not clear from information provided in report. A non-targeted sampling plan may have been better to understand the shallow soils across the site, in particular the open space areas such as	Ramboll provided a statement justifying the development of GI at the site [1], as above.

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
	<p>playing fields, the allotment area and soft landscaping/ecological areas, not just those around the proposed buildings, as soil is likely to be moved around as a result of construction.</p>	<p>Ramboll's statement justifies the placement of exploratory holes and confirms that targeted investigation was carried out around buildings, as the investigations were also to provide information for geotechnical design. It is noted that further investigation of shallow soils was provided as part of the DQRA, and the scope of the investigation was developed in consultation with the EHO, in line with best practice.</p>
<p>Environmental monitoring including water sampling and gas monitoring/sampling</p>	<p>Continuous gas monitoring would provide better understanding of the gas flux over time.</p> <p>Landfill trace gas analysis has not been considered to date, but may be an important consideration, particularly as odours were noted in many of the exploratory holes and odours may impact on neighbours during construction.</p> <p>Surface emissions from those parts of the site which are not to be disturbed should also be established, using a flux box or similar method</p> <p>23 combined gas/groundwater monitoring installations are noted but only 11 reported samples in App E and once only. Only two of these samples are from outside the waste body (BH01 and BH02) and both of these are located in the southern (upgradient) part of the site.</p> <p>Section 4.4 refers to sampling of BH3, but BH3 sample not reported in App E.</p> <p>No sampling of the nearest watercourse, Nico Ditch. Upstream/downstream samples on an adjacent watercourse would provide evidence that could rule it out as a potential controlled waters receptor.</p>	<p>Ramboll has confirmed that continuous gas monitoring is now being carried out [4].</p> <p>LOR has provided a statement regarding odour control during construction [3] but no specific statement regarding the investigation of trace gases has been received. However, the full scope of the GGS investigations has not been provided so this may be part. Pending review of GGS report/risk assessment.</p> <p>Ramboll has confirmed that GGS are also carrying out surface emissions survey at the site [4].</p> <p>Ramboll has confirmed that additional groundwater testing is currently underway, more than one round will be provided. Scope of investigation developed in consultation with EA, in line with best practice. Missing data for BH3 sample may be reported in future CWRA. Pending review of CWRA.</p> <p>Ramboll confirms Nico Ditch now being sampled [16].</p> <p>Groundwater contours do not take into account possible effect from former watercourse and spring in the southern part of the site. Needs to be considered when interpreting future data from additional monitoring.</p>
<p>Ground, groundwater and gas conditions encountered</p>	<p>Soil - Samples have been tested for contamination from a variety of depths, not just within the shallow (<1m) zone where contact may occur. This may</p>	<p>DQRA report presented more shallow soils data to boost the dataset and provide greater confidence in the outcome of the risk assessment.</p>

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
	<p>have been to investigate potential impacts on perched water quality and vapour risk.</p> <p>Gas - All available monitoring wells were only monitored for five rounds in total, less than the required number of visits for spot monitoring.</p> <p>Groundwater – As noted above there is very limited data on groundwater conditions outside the waste body. The single Sherwood Sandstone (Principal Aquifer) sample indicates significant contamination – ammoniacal nitrogen, possibly related to the waste body. The dataset is insufficient to assess risks to groundwater and determine need for mitigation to protect groundwater receptors.</p> <p>Hydrogeological conceptualisation does not consider reasons for shallow groundwater flow to the north (possibly leakage from Nico Ditch or groundwater discharge location to the north)</p> <p>Cross sections based on exploratory hole data would be informative.</p>	<p>Ramboll carrying out more gas investigation at the site, with GGS [4]</p> <p>Ramboll carrying out more groundwater investigation at the site, in consultation with EA. CWRA to be prepared.</p> <p>Assume this will be covered in CWRA, as Nico Ditch is being considered as part of the additional investigations.</p> <p>Ramboll has stated (pers. comm.) that cross sections were provided in the Geotechnical Ground Investigation Report. This document was not part of the information provided for Arup to review as geotechnical considerations are outside our scope. Noted that cross sections exist and would be useful to include in Interpretative report.</p>
Presentation of laboratory analysis, sampling and monitoring results	<p>BH3 groundwater analysis data missing from Appendix E of Factual Report.</p> <p>Well development records and gas calibration certificates not presented in Factual Report.</p>	<p>Assume will be included in future CWRA.</p> <p>Well development records would prove that work was done, as only statement in Factual report that this was done at present. Gas calibration certificates are a typical requirement of the MCC EHO and prove that equipment was calibrated and reliable. Since the spot monitoring data is being superseded by further gas monitoring [4] then this is not critical, provided that reliance is not placed on spot monitoring. EHO may request certificates via planning.</p>
Discussion of any ground contamination encountered	No comments on Table 4.3 content.	N/A

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
Refine conceptual site model	<p>No comment on the interpretation of the general ground conditions.</p> <p>Revised CSM presented in Table 7.2 considers risks to wider site area in addition to the school.</p> <p>CSM does not mention the proposed area of allotments within the school site. Graphical and written CSM references potential exposure in school playing fields and landscaping only.</p> <p>CSM does not identify existing utilities or Nico Ditch as potential pathways for gas and controlled waters impact.</p>	<p>MCC subsequently confirmed that there are now no proposals for allotments within the school site. The former allotment area is to comprise raised beds. Ramboll confirmed the raised beds will have a solid base, to prevent intermixing with the soil beneath. Ramboll also confirmed that any imported soil to be used in raised planters proposed for growing vegetables, would be validated against 'residential with plant uptake' GAC. Ramboll are to update the Remedial Strategy to reflect these proposals.</p> <p>Ramboll has confirmed that drains/Nico Ditch will be considered in gas risk assessment in future [18]</p>
Qualitative and quantitative risk assessments, clearly identifying pollutant linkages	<p>Human health risk assessment stated to cover entire site area, not just the school (noted as area outside school site is not within Arup's review). Soil data used is from entire site area, samples tested roughly 50:50 from inside and outside proposed school area.</p> <p>Generic Assessment Criteria (GAC) for naphthalene is 0.99mg/kg – lower than published S4UL, so more protective. No further action required.</p> <p>Benzo(a)pyrene used as a surrogate marker for genotoxic PAHs. No justification is presented that the genotoxic PAHs are similar to the test material used in the Culp study.</p> <p>No consideration of potential odour issues during construction (see desk study comment previously).</p>	<p>Technical point – note that DQRA report included additional information which boosted the amount of investigation points and samples available within the school site specifically. Concerns raised in compliance review about poor coverage of GI resolved for school site soils; although overall coverage is still not regular, number of samples tested has increased, providing more confidence in the data. View balanced with fact that Ramboll/LOR now propose that no existing soils should be exposed at ground level. Noted that scope of 4th phase of GI developed in consultation with EHO.</p>

Information requirement (based on MCC checklist)	Arup technical review comment	Position following Ramboll provision of additional info
	<p>Gas monitoring data available for the sandstone aquifer and glacial till shows methane and carbon dioxide present, not discussed as a potential pathway.</p> <p>Table 7.4 – Level of risk correctly identified as Moderate for Aquifer from ammoniacal N in leachate (see desk study comment above).</p>	<p>Ramboll provided justification of the use of surrogate marker approach [8]. All samples fell within limits of Culp study so approach justified.</p> <p>LOR has provided methodology for odour control during construction [3]</p> <p>Assume this will be considered in gas risk assessment report to be issued in October 2017.</p> <p>No further action.</p>
Recommendations for remediation	See comments on Remedial Strategy.	See Table B3.
Recommendations for further investigation (if required)	<p>In addition to these requirements consideration should be given to: surface monitoring for ground gas emissions by flux box or similar method; landfill trace gas analysis and odour considerations; consideration of utilities/drainage as a gas migration pathway to offsite receptors; DQRA for schools use to include the potential risk within the proposed allotment and ecological study areas.</p>	<p>Ramboll confirms use of flux box monitoring [4] LOR provided method for control of odour during construction [3] Trace gas analysis not provided, need to check forthcoming gas risk assessment. Utilities as gas pathways being considered in future gas risk assessment [18] MCC confirm that no allotments are to be provided. Raised planters to be sited in this area are to have a solid base and be filled with soil suitable for use where plants are to be grown for consumption (Ramboll). This needs to be included in the DQRA/Remedial Strategy.</p>

B1.3 DQRA and Remedial Strategy reports

The DQRA focused specifically on the risks posed by the existing shallow ‘capping’ soil to future users of the school. In the second part of the assessment, the risks considered were only via the inhalation pathway, since existing soils were assumed to be not exposed at ground surface in the final development. The review of the DQRA is presented in **Table B3**.

The Remedial Strategy is noted to have been completed prior to the DQRA; therefore some of the recommendations require updating as a result of that later work. The technical review process for the Remedial Strategy is documented in **Table B4**.

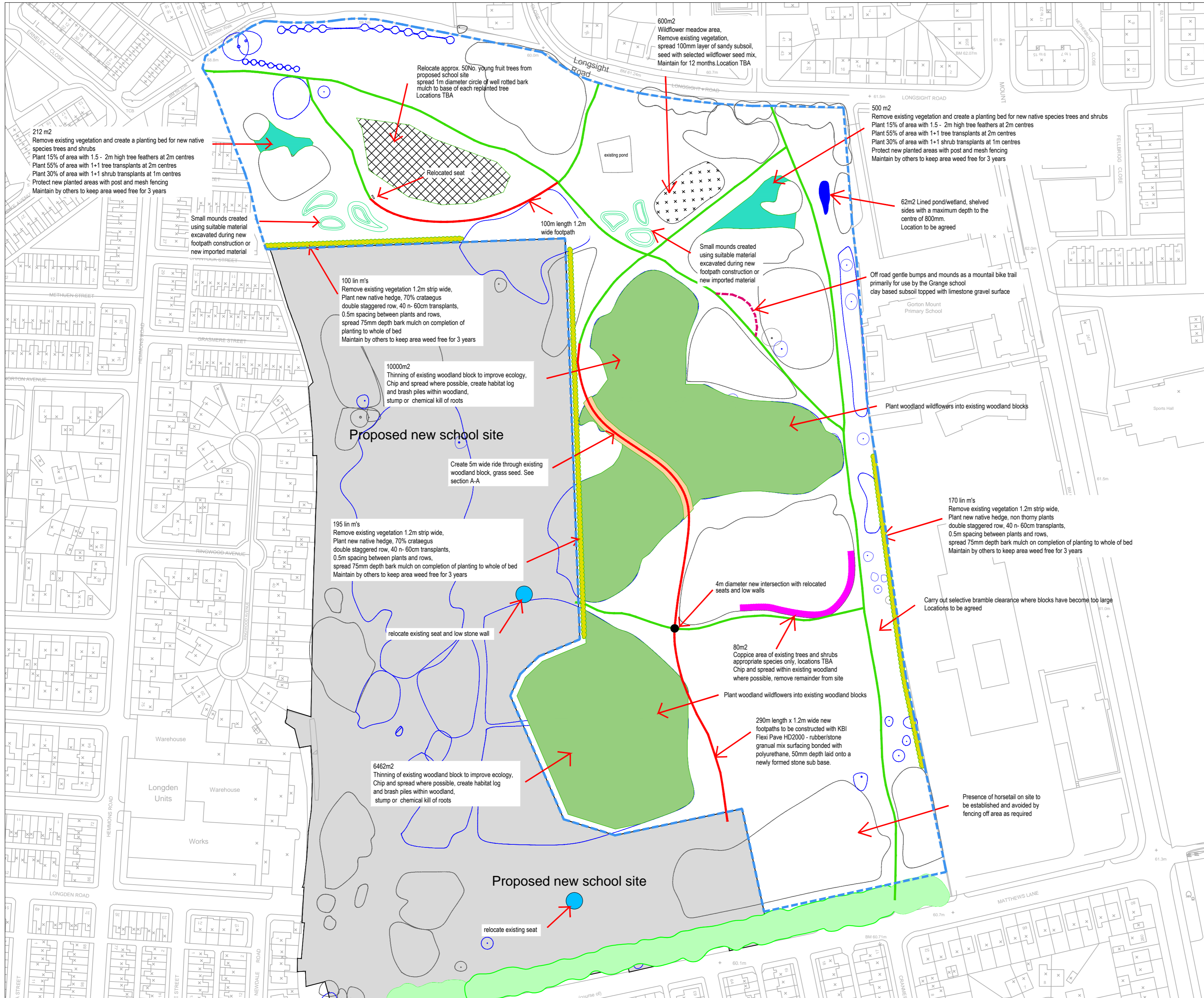
Table B3 Technical review of DQRA report

Information requirement (based on MCC checklist)	Arup technical review comment	Position following provision of Ramboll additional info
Confirm the conceptual model and the context of the risk assessment	The approach towards the risk to health from Benzo(a)Pyrene was queried previously (see Table B2). The risk assessment assumes no movement of soil around the site. Section 6.4 states “there is no school vegetable patch” but this does not match with the development proposal drawing which still shows an allotment area and raised beds.	Ramboll has provided justification of the use of Culp et al [8] Arup queried this with Ramboll/LOR and MCC. Response received is that no allotments are being provided within the school. The ‘vegetable patch’ relates to raised planters. Raised planter provisions queried with Ramboll. Ramboll confirmed that soils in are to conform to residential with plant uptake and raised beds to be provided with a solid base to prevent intermixing with soil beneath. This detail should be carried into a future revision of the Remediation Strategy and DQRA.
Identify unacceptable risks	No comments.	N/A
Review the context, criteria and information to decide the next step	The outcome of the risk assessment is that site-won soils could be used in shallow landscaping areas of the site, but with the caveat that other risks (notably from asbestos) would need to be mitigated.	Ramboll has confirmed that site-won materials will not be used and site-wide capping of the school site is proposed [18]. This should be included in future revision of Remedial Strategy.
Consider what further assessment is needed	No comments.	N/A

Table B4 Technical review of Remedial Strategy

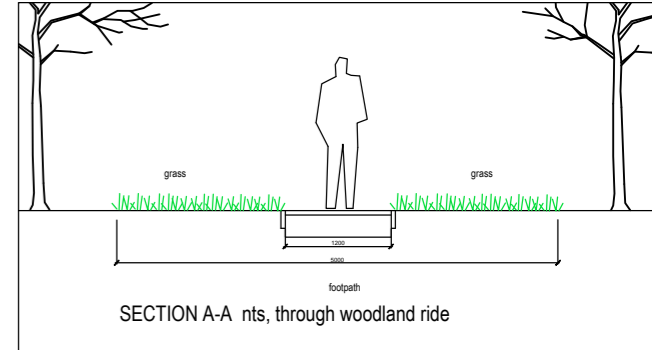
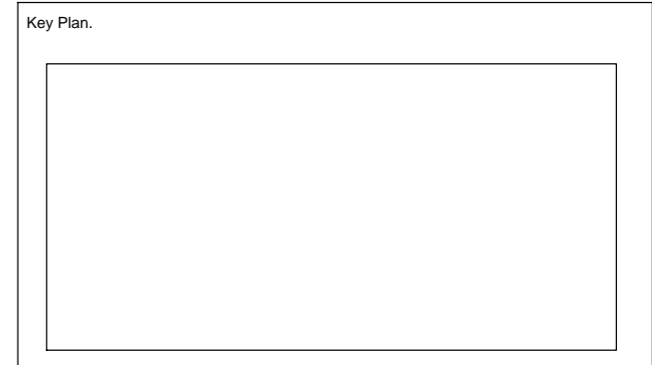
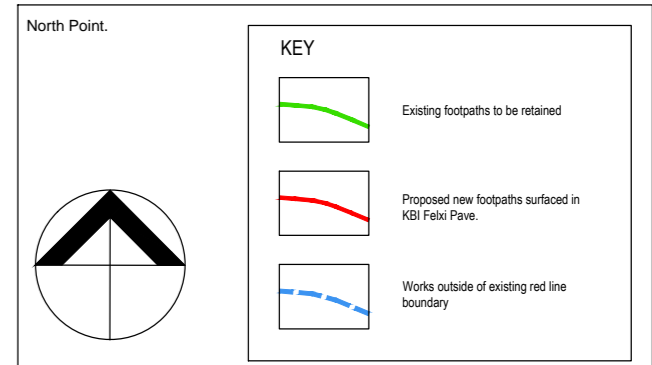
Information requirement (based on MCC checklist)	Arup technical review comment	Position following provision of Ramboll additional info
<p>Detailed outline of works to be carried out Description of ground conditions Type, form and scale of contamination to be remediated</p>	<p>Section 3.5 ground gas design still being developed, not presented in detail, additional monitoring awaited, no further comments made on this currently.</p> <p>Additional info on the following is required:</p> <p>Details of how drains/utility trenches will be engineered to prevent them becoming pathways for gas migration during construction and in long term</p> <p>How will odour and nuisance be managed during construction?</p> <p>How will wastes be handled when taking materials offsite to prevent risk of dropping mud/contamination onto nearby roads?</p> <p>Groundwater - Remedial strategy appears to only be considering additional risk to groundwater associated with piling. Mitigation of the risks to groundwater and surface water associated with the waste body are omitted, and Ramboll refer to a Part IIA assessment, however no details are provided. EA communication is referred to but no details are provided.</p>	<p>Ground gas risk assessment to be issued in October 2017 [18]</p> <p>Will be covered in gas risk assessment [18]</p> <p>LOR has provided mitigation measures statement for this. To be included in CEMP [3]</p> <p>LOR has provided mitigation measures for this. To be included in CEMP [3]</p> <p>Ramboll have confirmed details of further investigation for groundwater and controlled waters risk. Risk Assessment to be completed in October 2017 [18]</p>
<p>Consents, agreements and licences (waste management issues)</p>	<p>Consents/licences would not normally be expected pre-planning</p>	<p>No further action at this stage.</p>
<p>Implementation and validation of remediation Use of on-site observations and visual evidence Chemical analysis/monitoring data Proposed clean-up standard Construction Quality Assurance (CQA)</p>	<p>Comment carried forward from Interpretative and DQRA reports: standards for site-won/re-used soil may not be suitable for school allotment area.</p>	<p>MCC confirm that no allotments are proposed. Ramboll statement that raised planters will be provided with a solid base and soils conforming to 'residential with plant uptake' standards. This should be incorporated into the DQRA and Remedial Strategy future revision.</p>

Information requirement (based on MCC checklist)	Arup technical review comment	Position following provision of Ramboll additional info
	<p>Proposed thickness of clean cover (450mm) may not be suitable for use in school allotment area, which may require thicker capping.</p> <p>Proposals for monitoring of vibration due to piling/ground improvement not provided.</p>	<p>LOR has provided a statement on vibration [3]. Geotechnical considerations outside scope of Arup's report but were included as they are tied in with the type of ground improvement and piling solution chosen, which themselves depend on the outcome of risk assessments for gas and controlled waters. LOR has since confirmed that piles are to be CFA [12] which will limit vibration and LOR will monitor vibration from construction and compaction.</p>



Notes
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Items to be added into proposals - locations TBA
Supply & install the following bird, boxes into suitable trees at heights recommended by manufacturer:
Schwegler 1B Bird Box (26mm diameter entrance hole) 3No.
Schwegler 1B Bird Box (32mm diameter entrance hole) 2No.
Schwegler 2H Open Fronted Robin Box 2No.
Supply & install the following bat boxes into suitable trees at heights recommended by manufacturer:
Schwegler 2F bat boxes 2No.
Schwegler 1FF bat boxes 2No.
Supply & install into a woodland/scrub area
Schwegler hedgehog domes 5No.
Construct using rubble, old pipes etc:
hibernaculas - size approx 1m x 2m diameter 2No.



PO1	03-08-17	Preliminary	NH	IN
Rev	Date	Revision Note	By	Check

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Job title
Mathews Lane

Drawing title
Nutsford Vale Improvement Works

Status	File Name	X-Ref File			
Preliminary					
Drawn by	date	checked by	date	Scale at A2	Scale at A4
NH	02-06-17	IN	02-06-17	1:1250	2500
Job No.	CPI cat.	Dwg No.	Revision		
2268	LG(92)	30	P01		
Contractors Drawing No. 010093688362-EWL-03-00-DR-A-92-30					

