ARUP

BAM Nuttall Ltd

Victoria North: Phase 2 - St. Catherine's Wood

DQRA Addendum

Reference: VNIF-ARP-ZZ-YYY-RP-CG-0021

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Executive Summary

This Detailed Quantitative Risk Assessment (DQRA) Addendum report has been prepared by Arup on behalf of BAM Nuttall Ltd (BAM) to present an assessment of the risks to controlled waters and human health associated with the existing ground conditions in the St. Catherine's Wood area of Victoria North. St Catherine's Wood is also referred to as planning phase 2 of the Victoria North scheme. This report aims to present sufficient information to discharge the first part of Condition 7a of planning consent 137079/JO/2023, namely the submission of further site investigation and risk assessment to support the development of a Remediation Strategy, for the planning phase 2 area. This report reviews and collates the findings of previous ground investigations and risk assessments, where those findings were pertinent to St. Catherine's Wood.

Historical development in St. Catherine's Wood was a corn mill, built in the early 1800s, a late 1800s church and school and residential buildings. Part of the area was later used as a playground. St Catherine's Wood is to be developed as an area of formal public open space (POS), with new hard and soft landscaping and some retained soft landscaping.

Previous ground investigation included samples recovered from within the planning phase 2 area, in which no contaminants exceeded the relevant human health generic assessment criteria (GAC) for public open space (parks). Trace quantities of asbestos were identified in two exploratory holes. In both cases, asbestos fibre concentrations were below the laboratory limit of detection and at depth. No specific soil remediation is proposed for the protection of human health within St. Catherine's Wood.

Earthworks are proposed for most of the St. Catherine's Wood area, which will include limited regrading of existing slopes to facilitate a series of accessible footpaths and the import of materials to supplement the regrading operations including subsoil and topsoil for planting. In the peripheral areas in which regrading is not proposed, existing vegetation is to be preserved.

Remedial targets specific to the area of the site adjacent to the River Irk have previously been generated, using the Environment Agency's Remedial Targets Methodology (RTM) and infiltration parameters that are appropriate to this area of the site. These previously-derived remedial targets are now proposed for use as part of a suite of import criteria for general fill to be used in St Catherine's Wood (**Table 1**).

Soils that are to be locally relocated as part of regrading activities within St Catherine's Wood are not considered to require screening against re-use criteria, as their retention on site will present no new risks to controlled waters or human health. If soils that are grossly contaminated (as assessed on a visual/olfactory basis) are encountered they will not be re-used. Levels of potential contaminants in soils generated from the planning phase 1 area are likely to be too great for use in planning phase 2, due to risks associated with the adjacent River Irk. Where there is a shortfall of material, general fill will be imported from off-site (i.e. not imported from elsewhere in the Victoria North site), which will need to meet the imported general fill criteria (**Table 1)**. Testing will be required for every 500m^3 of general fill material that is imported.

For topsoil and subsoil, relevant British Standards have been used to supplement the RTM-derived remedial targets, to address phytotoxic risks associated with zinc, copper and nickel. The thresholds set out in the British Standards are higher than the RTM-calculated criteria for nickel and zinc and therefore, the site-specific criteria previously derived for these metals remain (**Table 1**).

1. Introduction

1.1 Commission

This report has been prepared by Arup on behalf of BAM Nuttall Ltd (BAM) to present an assessment of the risks to controlled waters and human health associated with ground contamination at the St. Catherine's Wood area of Victoria North. St Catherine's Wood is also referred to as planning phase 2 of the Victoria North Scheme.

Manchester City Council proposes redevelopment of St. Catherine's Wood including the following elements:

- Regrading of existing slopes;
- The creation of accessible footpaths;
- Planting to supplement existing vegetation;
- Provision of an active transport route onto Red Bank Plateau.

Earthworks will be limited to regrading operations, with only limited filling operations including the possible import of general fill and the import of topsoil and subsoil for planting.

Arup has previously completed several risk assessments for Victoria North, which included the St. Catherine's Wood area of the site. These include a Detailed Quantitative Risk Assessment (DQRA) [1] and Updated DQRA [2]. The assumptions of previous risk assessments are considered to be still valid as the original DQRA and all subsequent assessments have assumed that St. Catherine's Wood would remain as an area of public open space with woodland planting.

The purpose of this report is to review and collate the findings of the previous Arup risk assessments that are pertinent to St. Catherine's Wood, to identify the remediation requirements to be implemented as part of the St Catherine's Wood redevelopment.

1.2 Planning context

Planning consent 137079/JO/2023 enables a number of relevant planning conditions for the Victoria North site to be discharged in discrete phases. This DQRA is relevant to works associated with planning phase 2 only.

Condition 7 relates to ground contamination. The amended Condition 7a of the above planning consent addresses issues associated with ground contamination. The full text of condition 7a is as follows:

"Notwithstanding the Ground Investigation Interpretative Report, Victoria North Infrastructure Works, ARUP, Reference: VNIF-ARP-ZZ-YYY-RP-CG-0009, Dated: 31 January 2022 and Ground Investigation Interpretative Report, Victoria North Infrastructure Works, ARUP, Reference: VNIF-ARP-ZZ-YYY-RP-CG-0009, Dated 23 February 2022., (a) before the development hereby approved commences (excluding vegetation clearance and tree removal), the following information shall be submitted for approval in writing by the City Council, as Local Planning Authority:

- Submission of the further Site Investigation and Risk Assessment Reports
- Submission of a detailed Remediation Strategy
- Submission of a Remediation Implementation Plan and verification plan.

The development shall then be carried out in accordance with the approved details."

This report aims to present sufficient information to discharge the first part of Condition 7a of planning consent 137079/JO/2023, namely the submission of further site investigation and risk assessment and to support the development of a Remediation Strategy for the planning phase 2 of Victoria North.

1.3 Previous assessments and reports

This DQRA addendum for St. Catherine's Wood should be read in conjunction with previous DQRA reports [1][2], which provide detailed assessment of the risks to controlled waters. A Ground Investigation Report

(GIR) [3] was prepared using the results of the 2019 and 2021 AEG and 2022 BAM ground investigations [4][5][6], which included generic controlled waters risk assessment and human health risk assessment.

1.4 Limitations

This report was prepared by Arup on behalf of BAM Nuttall Ltd. It takes into account our client's particular instructions and requirements. This report was not intended for, and should not be relied on by, any third party and no responsibility is undertaken to any third party in relation to it.

All reasonable skill, care and diligence have been exercised within the timescale available and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in preparing the report, it is possible that other ground contamination or ground conditions as yet undetected, may exist and consequently reliance on this report must be limited accordingly.

2. The Site

2.1 Site location and description

Referred to as planning phase 2, the St. Catherine's Wood area forms part of the wider Victoria North development, north of Manchester Victoria railway station and centred at approximately SJ 84770 99629.

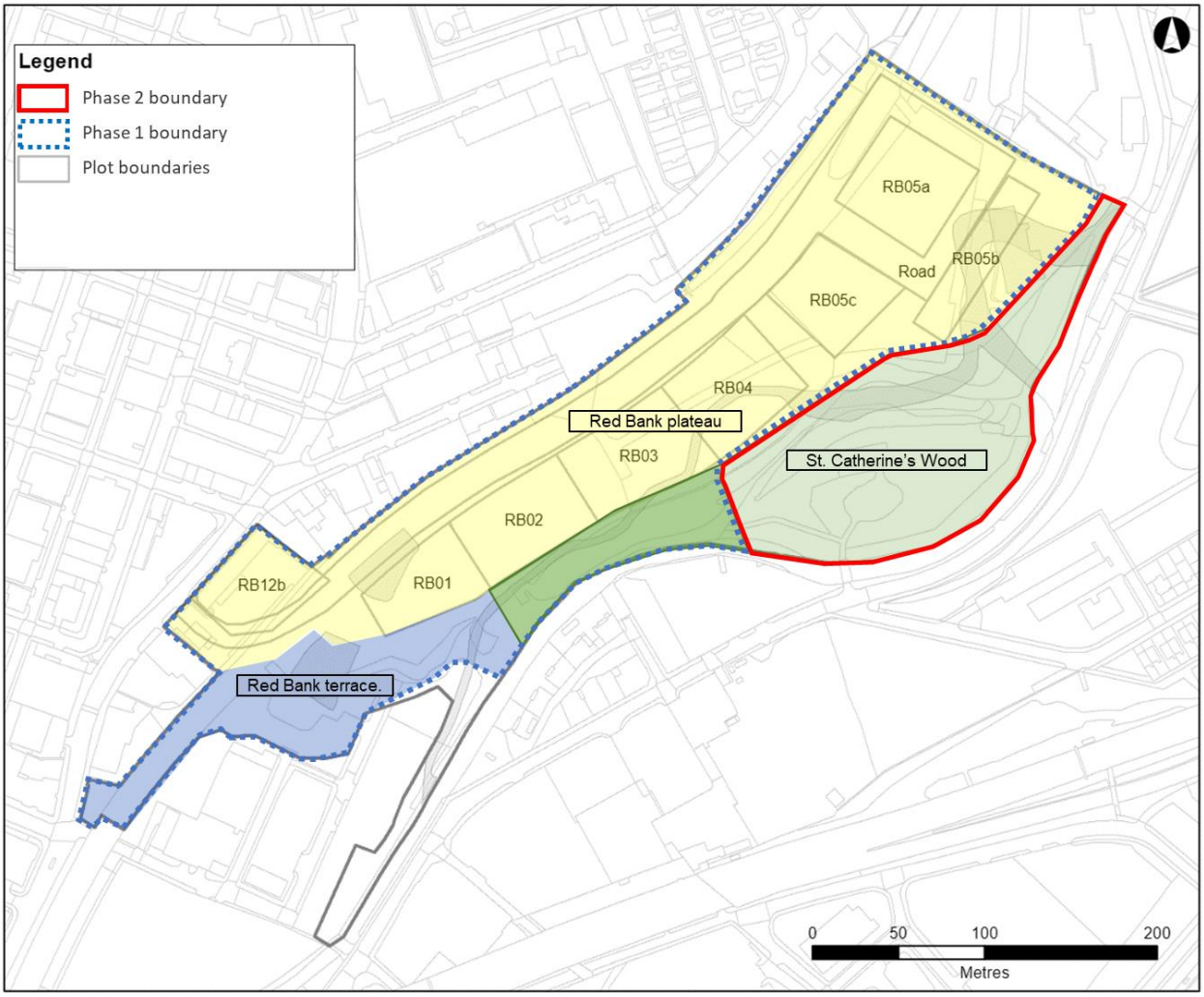


Figure 1 St Catherine's Wood (red boundary) within larger Victoria North development

St. Catherine's Wood extends down from Red Bank Plateau at c. 42 mOD to the banks of the River Irk at c. 30 mOD. Along the north-eastern boundary, slopes extend north towards the adjacent Packaging Products site beyond the northern boundary.

In the GIR [3], DQRA [1], and updated DQRA [2], Plot RB05b was included as part of 'St. Catherine's Wood' area. As shown on **Figure 1** however, Plot RB05b and adjacent areas to the east have since been included in the phase 1 planning application and as such are not considered in planning phase 2.

2.2 Geology

The made ground encountered across much of this area was predominantly granular and is generally described as gravelly sand and sandy gravel. Cohesive made ground is variable but generally described as soft to stiff sandy gravelly clay.

Underlying the made ground in areas of the site adjacent to the river, alluvium is variable in composition and described as medium dense slightly gravelly sand and soft sandy clay or clayey sand. Alluvium is limited in

extent, being mostly encountered close to the River Irk and in buried river channels and is recorded as between 0.3m and 4.7m thick.

Underlying made ground and alluvium (where present) glacial till is described as soft to firm, becoming stiff at depth, slightly sandy gravelly clay. Granular bands have been identified within the till, described as medium dense to very dense brown slightly clayey sandy gravel and gravelly sand.

Solid strata were encountered as follows:

- Collyhurst Sandstone - The Collyhurst Sandstone was encountered in the north-eastern part of St Catherine's Wood at the P&P slope location. It is generally described as extremely weak red brown coarse grained distinctly weathered sandstone.
- Manchester Marls - The Manchester Marl was encountered in the central part of St Catherine's Wood. It is generally described as a reddish brown extremely weak thinly laminated clayey mudstone (weathered).

Rockhead level varies between approximately 25mOD and 32mOD. Generally, the rock head level is at higher elevation at north, gradually decreasing in elevation towards the river.

2.3 Former meander and mill race

Historic mapping shows an old meander bend of the River Irk that is now buried beneath Red Bank plateau, together with a buried former mill race that extended from the meander bend for much of the length of Red Bank plateau (**Figure 2**). Beginning some time before 1850, made ground has been used to infill these features.

The former meander and mill race were considered as a possible preferential pathway for groundwater movement local to the gasworks. As discussed in the DQRA [1] and Updated DQRA [2], there is no evidence that these features are or have been acting as preferential pathways for contaminant migration.

The proposed works within St. Catherine's Wood are not anticipated to uncover or disturb the former meander or mill race features, therefore no new or additional linkages associated with these features will be created as a result.

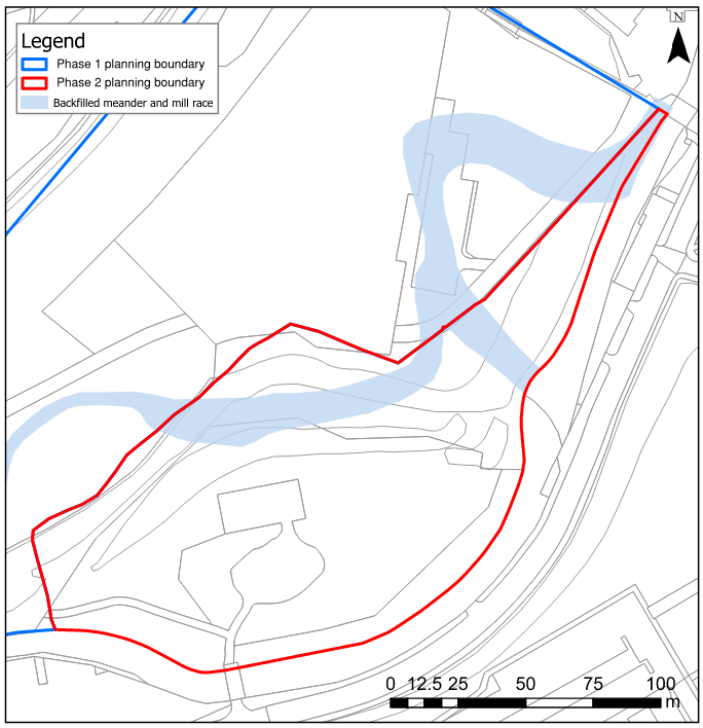


Figure 2 Meander bend and mill race within Phase 2

2.4 Proposed development

St Catherine's Wood is to be developed as a formal area of public open space (POS), with new hard and soft landscaping proposed across much of the planning phase 2 area.

Earthworks will be limited to regrading existing slopes to facilitate a series of accessible footpaths, the possible import of materials to supplement the regrading operations and import of subsoil and topsoil for the proposed planting.

In peripheral areas of the planning phase 2 area, existing vegetated slopes are to be preserved, with works kept to an absolute minimum, to protect existing habitats.

As discussed in previous reports, historical development in the St. Catherine's Wood was limited to a water-driven corn mill, built in the early 1800s, a late 1800s church and school and residential buildings. Given the limited industrial history of St. Catherine's Wood, soils that are locally relocated as part of regrading activities are not considered to require screening against re-use criteria, as their retention on site will present no new or different risks to controlled waters. Excavated soils that are obviously/grossly contaminated (as assessed on a visual/olfactory basis) will not be re-used.

Material imported to planning phase 2 will be imported from off-site, not from the phase 1 area and will need to be tested, to demonstrate that it will not raise or introduce new risks to controlled waters or human health.

St. Catherine's Wood will have no formal surface water drainage system, as is the current situation.

2.5 Regulator engagement

The Environment Agency and local authority contaminated land team have been engaged from an early stage in the Victoria North scheme. A meeting was held in March 2024 regarding the proposed redevelopment of St. Catherine's Wood. The Environment Agency requested confirmation of the input parameters and assumptions made in the DQRA to ensure they are protective of the River Irk. These issues are addressed in Section 3.2, below.

3. Controlled Waters DQRA

3.1 Approach

There are no Generic Assessment Criteria (GAC) available for the direct assessment of contaminants in soil applicable to controlled waters. Therefore, the DQRA [1] and Updated DQRA [2] included evaluation of groundwater and soil leachate data to identify contaminants of concern and possible sources of soil contamination that may present a risk of impacts to the underlying Principal Aquifers and River Irk.

The DQRA [1] assumed that a small quantity of material extracted from Red Bank plateau would need to be transferred to proposed earthworks in St. Catherine's Wood. However, this is no longer proposed.

Section 6 of the Updated DQRA [2] identified several contaminants of concern based on comparison of data obtained by ground investigation against published water quality standards and background water quality to identify which contaminants warrant further detailed assessment.

This screening identified the following contaminants of concern for materials transferred from other areas of the Victoria North development:

- Nickel and zinc
- TPH – Aliphatic fractions C8-C16, aromatic fractions C8-C35
- PAH (fluoranthene, anthracene, benzo(a)pyrene)
- PFOS and PFOA (as marker compounds for PFAS)

Remedial targets were generated using the Environment Agency's Remedial Targets Methodology (RTM). The approach to assessing the risks posed by contamination to controlled waters is outlined in Section 6 of the Updated DQRA [2], in accordance with the Environment Agency's land contamination guidance [9] and groundwater protection guidance [10].

3.2 DQRA assumptions: infiltration rates

The input parameters and assumptions used in the RTM models are set out in Appendix D of the previous DQRA assessments [1][2], which should be read in conjunction with this report.

St. Catherine's Wood was assumed to remain as open space comprising slopes, paths and planting. Some runoff is expected from the slopes and evapotranspiration from planting, but it was considered likely that a high proportion of rainfall will continue to infiltrate. The assumed infiltration rate across St. Catherine's Wood used in the DQRA was 60%, i.e. 60% of the average annual rainfall will infiltrate into the ground, with 40% being lost as runoff, through evaporation or via evapotranspiration.

3.3 DQRA outcome

Due to the close proximity of St. Catherine's Wood to the River Irk, the DQRA derived a series of soil re-use criteria for the relevant contaminants of concern. Two sets of re-use criteria (Zone 1 and Zone 2) were generated for fill derived elsewhere within the Victoria North site, that was to be placed within St. Catherine's Wood. Zone 1 referred to the area of placement within 50m of the River Irk, whilst Zone 2 was between 50 and 130m from the river. As the targets for Zone 1 and Zone 2 were not significantly different, the DQRA [1] proposed to adopt the Zone 1 targets as the re-use criteria for imported fill materials used within Zones 1 and 2, close to the River Irk.

Re-use criteria were not derived for materials within St. Catherine's Wood that were to be locally regraded, as there is no evidence to indicate the water quality within the River Irk is being adversely impacted by existing ground conditions and therefore local redistribution of existing materials will not introduce new contaminant linkages or increase risks to controlled waters.

Although the DQRA assessments [1][2] included proposals for the re-use of suitable fill recovered from planning phase 1, in the development of St. Catherine's Wood, these proposals are no longer to be

implemented. If there is a shortfall in general fill material, this will be imported from outside of the Victoria North scheme.

Suitability for use will be established by screening of imported fill materials against a range of determinands, as set out in **Table 1.** For contaminants of concern, that have been assessed by detailed quantitative risk assessment, the relevant site-specific criteria are included in **Table 1.** For other determinands, generic assessment are proposed, based on residential end-use without private gardens, adjusted on the basis of professional judgment to ensure that potentially hazardous material is not imported to the site. The rationale used to select the proposed import criteria is set out in Appendix A. All imported general fill is to meet the acceptability criteria set out in **Table 1**.

Contaminant	Generic acceptability criteria (mg/kg)	RTM-calculated acceptability criteria (mg/kg)	RTM-calculated leachable acceptability criteria (mg/l)
Antimony	500	-	-
Arsenic	40	-	-
Beryllium	1.7	-	-
Cadmium	85	-	-
Total chromium (including trivalent and hexavalent chromium)[4]	6	-	-
Copper	200	-	-
Lead	310	-	-
Mercury	10	-	-
Nickel	-	26.5[5]	0.05
Selenium	430	-	-
Vanadium	500	-	-
Zinc	-	191[5]	0.4
Cyanide	24	-	-
Cyanide (free)	24	-	-
Boron	500	-	-
Phenol (Monohydric)	50	-	-
Asbestos	No visible asbestos <0.01%	-	-
TPH C8-C35	-	1000[1,2]	-
TPH – Aromatic C8-C10	-	153[5]	1.64
TPH – Aromatic C10-C12	-	76[5]	0.53
TPH – Aromatic C12-C16	-	208[5]	0.72
TPH – Aromatic C16-C21	-	323[5]	0.35
Acenaphthene	50	-	-
Dibenz-a-h-anthracene	0.32	-	-
Fluoranthene	-	0.04[5]	0.00003
Fluorene	50	-	-
Indeno(1,2,3-cd)pyrene	46	-	-
Phenanthrene	50	-	-

Contaminant	Generic acceptability criteria (mg/kg)	RTM-calculated acceptability criteria (mg/kg)	RTM-calculated leachable acceptability criteria (mg/l)
Pyrene	50	-	-
Naphthalene	13	-	-
Acenaphthylene	50	-	-
Anthracene	-	0.15[5]	0.0005
Benzo(a)anthracene	15	-	-
Benzo (g,h,i) perylene	50	-	-
Benzo(a)pyrene	-	0.4[5]	0.00006
Benzo(b)fluoranthene	4.1	-	-
Benzo(k)fluoranthene	50	-	-
Chrysene	32	-	-

Notes

1. RTM-calculated remediation criteria for several of the TPH fractions are far in exceedance of any soil concentrations. Any soils exceeding these criteria would be visibly grossly contaminated. Therefore, it was considered appropriate to set a soil remediation target for TPH C8-C35.
2. If exceedance is noted, the risk-derived criteria for individual carbon bands detailed in this table shall be applied.
3. Not used
4. If total chromium exceeds 6mg/kg, the results will be assessed further to identify the nature and hazard associated with the presence of chromium in the relevant samples.
5. If solid analysis concentrations exceed the RTM calculated acceptability criteria, leachability testing will be required. The results of leachability testing will be compared with the RTM-calculated leachable acceptability criteria specified.

Table 1. Planning phase 2: Criteria for imported general fill (for subsoil and topsoil, see Section 5)

Testing against the criteria set out in **Table 1** will be required for every 500 m^3 of general fill material imported to the planning phase 2 site as per the Victoria North HIF Infrastructure and Enabling Works Specification [11]. A minimum of three samples should be taken per source.

4. Human Health DQRA

4.1 Screening of soil data

A human health soil screening assessment was undertaken as part of the Ground Investigation Report [3], which should be read in conjunction with this report. The approach taken is detailed in Section 6 of the GIR.

Soil data from St. Catherine's Wood was screened against generic assessment criteria (GACs) for a public open space (parks) scenario and using a soil organic matter (SOM) value of 6%, which were considered to be appropriate for the area's current and future use. Since these assessments were undertaken, the planning boundaries have been amended (**Section 2.1**).

4.2 Risk assessment outcome

Within planning phase 2, a total of 22 soil samples were screened across the AEG 2019 [4], 2021 [5] and BAM 2022 [6] ground investigations. Screening of 7 soil samples identified none in which contaminants exceeded the relevant human health GAC. Asbestos in the form of small bundles of amosite fibres was identified in one exploratory hole (WS103). The quantity of asbestos fibres in soil was below the limit of detection of the test (0.001% by weight). The sample was taken 1m below ground level.

Table 2. Soil samples exceeding human health GACs for public open space (parks) in planning phase 2

Contaminant	POS GAC (mg/kg)	No. of samples	Conc. range % by weight	Exceedances			
				No.	Location	Depth (mbgl)	Concentration (% by weight)
Asbestos	Presence	7	<0.001	1	WS103	1.0m	Amosite fibres <0.001

The risk assessment concluded that no unacceptable concentrations of contamination were identified within the samples tested from St. Catherine's Wood, therefore no specific remediation was considered necessary for human health protection.

4.3 Risks from imported materials and unexpected or residual contamination

Depending on the final cut/fill balance, it may be necessary to import general fill for use in planning phase 2. Imported fill will be from off-site and not from other areas of the Victoria North site. Imported general fill materials will be screened against the criteria in **Table 1**, which are significantly lower than human health assessment criteria for parks. Therefore, the imported materials will not pose a risk to human health provided they meet the criteria in **Table 1**.

Topsoil and subsoil will need to be imported for landscaping, with between 100 and 600mm of soil being required, depending on the specific planting requirements set by the landscape architect. The topsoil and subsoil will need to meet the requirements of the British Standards for Topsoil (BS3882:2015) and Subsoil (BS8601:2013). These criteria are discussed in Section 5, but imported topsoil and subsoil will not pose a risk to human health provided they meet the criteria in **Table 1** and the British Standard(s).

Where areas of previously unidentified soil contamination are identified during the works, they will be dealt with in accordance with a discovery strategy that will be presented in the forthcoming planning phase 2 remediation strategy.[12] In the peripheral areas of the planning phase 2 site, existing dense vegetation and steep gradients will limit public access, meaning that frequent human exposure to any previously unidentified contamination will be unlikely.

5. Subsoil and Topsoil Requirements

The British Standards for Topsoil (BS3882:2015) and Subsoil (BS8601:2013) specify the concentrations of certain phytotoxic contaminants: zinc (<300 mg/kg if pH of soil is >7), copper (<200 if pH >7) and nickel (<110 if pH >7). For nickel and zinc, the thresholds identified in these British Standards are higher than the RTM criteria identified in **Table 1** and therefore the RTM-derived values for these determinands have been used.

Topsoil and subsoil is to be imported from off site (i.e. not imported from elsewhere in the Victoria North site). Imported topsoil and subsoil shall meet the acceptability criteria set out in **Table 1,** together with the requirements of the relevant British Standards (BS BS3882:2015, BS8601:2013).

The frequency of testing of topsoil and subsoil for chemical validation will be as per the Victoria North HIF Infrastructure and Enabling Works Specification [11]:

- 1 per 100m^3 for brownfield or unknown sources.
- 1 per 500m^3 for greenfield sources.

With a minimum of 3 samples per source.

6. Conclusions

6.1 Conclusions and summary of risk assessment findings

This risk assessment has adopted the findings of the Updated Controlled Waters DQRA, which included the St. Catherine's Wood area of Victoria North. The infiltration assumptions used in the previous DQRA were relevant to St. Catherine's Wood and were different to those used on Red Bank plateau. The soil criteria derived in the Updated DQRA were applicable to soils recovered from elsewhere within Victoria North that were proposed for reuse within St. Catherine's Wood.

Re-use of site-won material from other areas of the Victoria North development is no longer proposed. If there is a requirement for imported general fill material, this material shall meet the Zone 1 criteria (to be protective of the River Irk) as set out in the Updated Controlled Waters DQRA [2] and reproduced in **Table 1** of this report.

There is a requirement to import subsoil and topsoil for planting as part of the proposed redevelopment. This material will also need to meet the criteria in **Table 1** of this report.

The existing material in St. Catherine's Wood is deemed suitable for reuse within St Catherine's Wood, which is to be an area of public open space. No requirement for specific remediation has been identified, as there is no evidence to indicate the water quality within the River Irk is being adversely impacted by existing ground conditions and a human health screening assessment has determined that the soils are suitable for use within a public open space area.

6.2 Recommendations for remediation strategy

No specific remediation is required at St. Catherine's Wood. To address the requirements of planning condition 7a however, a Remediation Strategy and Remediation Implementation Plan will be prepared for the planning phase 2 works, covering the following:

- Implementation of a discovery strategy during the earthworks, to ensure that previously unidentified areas of contamination are dealt with and are not taken for re-use as fill elsewhere within the site.
- Decommissioning of existing monitoring wells from previous ground investigation. In addition, any historic water wells that are encountered during the works will be decommissioned.
- If general fill materials are needed in St Catherine's Wood, these will not be imported from other areas of the Victoria North site and will be sourced from elsewhere. Imported general fill will need to be tested to ensure it complies with the import criteria set out in **Table 1**. These criteria have been determined to be protective of the River Irk and human health. The forthcoming remediation strategy will include frequency of testing and approach to data interpretation.
- Imported topsoil and subsoil should also be tested to ensure it achieves the criteria in **Table 1**. These criteria have been determined to be protective of the River Irk, human health and plant health. In addition to the criteria in **Table 1**, imported topsoil and subsoil will need to meet BS3882:2015 for topsoil and BS8601:2013 for subsoil.

References

[1] Arup (2022) Controlled Waters Detailed Quantitative Risk Assessment VNIF-ARP-ZZ-YYY-RP-CG-0011, November 2022.

[2] Arup (2023) Controlled Waters Detailed Quantitative Risk Assessment VNIF-ARP-ZZ-YYY-RP-CG-1000, 21 August 2023.

[3] Arup (2022) Ground Investigation Report VNIF-ARP-XX-XXX-RP-CG-0009, August 2022

[4] AEG (2019) Northern Gateway Final Factual Report (Rev.00) NW1580

[5] AEG (2021) Northern Gateway Phase 2 Final Factual Report (Rev.00) NW1604

[6] BAM (2022) Victoria North HIF Infrastructure and Enabling Works – Phase 3 GI, Ground Investigation report – Factual Account BAX.326R, October 2022

[7] Arup (2023) Victoria North HIF Infrastructure Works – Phase 1 Remediation Implementation and Verification Plan VNIF-ARP-ZZ-YYY-RP-CG-0017, 27 October 2023

[8] Arup (2024) Victoria North: Gasworks remediation area VOCs DQRA

[9] Environment Agency, 2019. Land contamination: risk management https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks

[10] Environment Agency, 2017. Groundwater protection https://www.gov.uk/government/collections/groundwater-protection

[11] Arup (2023) Victoria North HIF Infrastructure & Enabling Works Specification for Highway Works - Civil Infrastructure VNIF-ARP-ZZ-YYY-SP-C-00, 20 November 2023

[12] LK Group (2024) St. Catherine's Wood, Phase 2 Victoria North, Remediation Strategy, May 2024.

Appendix A

Rationale behind selection of soil import criteria

Rationale behind selection of soil import criteria – St. Catherine's Wood

The residential without plant uptake GACs have been used as basic import criteria for soils to be placed within the POS at St Catherine's Wood. This is because the GAC for POS are generally very high values, and import of material at those values could allow the import of hazardous waste/contaminated soils. Some of the residential GACs however, are also very high numbers that would potentially permit the import of contaminated materials. In these cases, professional judgement has been applied to moderate the higher GAC numbers to concentrations that would be more typical of uncontaminated made ground. Contaminated soils should not be imported to site.

Some of the contaminants have RTM values, which take precedence over the human health GAC as they are lower. It is important to protect the quality of controlled waters within St Catherines Wood as it is next to the River Irk.

The import criteria for copper is based on the British Standards for topsoil and subsoil.

For TPH, only the aromatic RTM targets are quoted in the table below. Note that the DQRA assessed both aliphatic and aromatic TPH fractions, and came up with criteria for both that are protective of controlled waters. However, the aliphatic fraction criteria were generally very large (>1000mg/kg) so a simplified approach is taken here, where an overall threshold of 1000mg/kg TPH and if this is exceeded, some of the lower aromatic TPH fractions are checked against the RTM targets to ensure there is no risk to controlled waters.

The criteria chosen for imported material to St Catherine's Wood are as follows:

Contaminant	Generic acceptability criteria (mg/kg)	RTM-calculated acceptability criteria (mg/kg)	RTM-calculated leachable acceptability criteria (mg/l)[5]	Rationale
Antimony	500	-	-	Residential without plant uptake GAC is 618mg/kg. Rounded to 500mg/kg.
Arsenic	40	-	-	Residential w/o plant uptake GAC
Beryllium	1.7	-	-	Residential w/o plant uptake GAC
Cadmium	85	-	-	Residential w/o plant uptake GAC
Total chromium (including trivalent and hexavalent chromium)[4]	6	-	-	Residential w/o plant uptake GAC for hexavalent chromium. Used to assess total chromium, with the requirement that if total Cr exceeds 6mg/kg, it will trigger a need for more testing to determine the species of Cr present.
Copper	200	-	-	Residential w/o plant uptake GAC is 7130mg/kg. 200mg/kg is based on the British Standard requirement for topsoil and subsoil, which will be protective of health and planting.

Contaminant	Generic acceptability criteria (mg/kg)	RTM-calculated acceptability criteria (mg/kg)	RTM-calculated leachable acceptability criteria (mg/l)[5]	Rationale
Lead	310	-	-	Residential w/o plant uptake GAC
Mercury	10	-	-	Residential w/o plant uptake GAC is 56mg/kg. This has been reduced to 10mg/kg, based on professional judgement. Soils containing 50mg/kg mercury are likely to indicate a contaminated source.
Nickel	-	26.5[5]	0.05	Residential w/o plant uptake GAC is 181mg/kg. The RTM value is lower, so is used as the import criteria for Ni.
Selenium	430	-	-	Residential w/o plant uptake GAC
Vanadium	500	-	-	Residential w/o plant uptake GAC is 1200mg/kg. Reduced to 500mg/kg soil containing 1200mg/kg Vn likely to indicate a contaminated source.
Zinc	-	191[5]	0.4	Resi w/o plant uptake GAC is 40,000mg/kg. RTM is lower, so used as the import criteria for Zn.
Cyanide	24	-	-	Residential w/o plant uptake GAC
Cyanide (free)	24	-	-	Residential w/o plant uptake GAC
Boron	500	-	-	Residential w/o plant uptake GAC for Boron is 10,775mg/kg. Reduced to 500mg/kg as soils with >10,000mg/kg boron likely to indicate a contaminated source.
Phenol (Monohydric)	50	-	-	Residential w/o plant uptake GAC is 1200mg/kg. Reduced to 50mg/kg as import of materials containing >1000mg/kg phenol likely to indicate contaminated source. Phenol is not usually present >50mg/kg in made ground soils.
Asbestos	No visible asbestos <0.01%	-	-	No GAC available. Based on professional judgement.
TPH C8-C35	-	1000[1,2]	-	Agreed with EA as threshold for TPH. If exceeded, triggers the need to check speciated TPH against individual criteria

Contaminant	Generic acceptability criteria (mg/kg)	RTM-calculated acceptability criteria (mg/kg)	RTM-calculated leachable acceptability criteria (mg/l)[5]	Rationale
TPH – Aromatic C8-C10	-	153[5]	1.64	Residential w/o plant uptake GAC is 269mg/kg. RTM value is lower, so adopted for import criteria.
TPH – Aromatic C10-C12	-	76[5]	0.53	Residential w/o plant uptake GAC is 1240mg/kg. RTM value is lower, so adopted for import criteria.
TPH – Aromatic C12-C16	-	208[5]	0.72	Residential w/o plant uptake GAC is 2480mg/kg. RTM value is lower, so adopted for import criteria.
TPH – Aromatic C16-C21	-	323[5]	0.35	Residential w/o plant uptake GAC is 1817mg/kg. RTM value is lower, so adopted for import criteria.
Acenaphthene	50	-	-	Residential w/o plant uptake GAC is 336mg/kg. Reduced based on professional judgement as concentrations of 300mg/kg would indicate contamination of source.
Dibenz-a-h-anthracene	0.32	-	-	Residential w/o plant uptake GAC
Fluoranthene	-	0.04[5]	0.00003	Residential w/o plant uptake GAC is 1580mg/kg. RTM value is lower, so adopted for import criteria.
Fluorene	50	-	-	Residential w/o plant uptake GAC is 183mg/kg. Reduced to 50mg/kg as >100mg/kg would indicate contaminated source.
Indeno(1,2,3-cd)pyrene	46	-	-	Residential w/o plant uptake GAC
Phenanthrene	50	-	-	Residential w/o plant uptake GAC is 1520mg/kg. Reduced to 50mg/kg as GAC would indicate contaminated source and likely be hazardous waste.
Pyrene	50	-	-	Residential w/o plant uptake GAC is 3790mg/kg. Reduced to 50mg/kg as GAC would indicate contaminated source and likely be hazardous waste.
Naphthalene	13	-	-	Residential w/o plant uptake GAC
Acenaphthylene	50	-	-	Residential w/o plant uptake GAC is 506mg/kg. Reduced to 50mg/kg as GAC would indicate contaminated source.

Contaminant	Generic acceptability criteria (mg/kg)	RTM-calculated acceptability criteria (mg/kg)	RTM-calculated leachable acceptability criteria (mg/l)[5]	Rationale
Anthracene	-	0.15[5]	0.0005	Residential w/o plant uptake GAC is 36,600mg/kg. RTM value is lower, so used as import criteria.
Benzo(a)anthracene	15	-	-	Residential w/o plant uptake GAC
Benzo (g,h,i) perylene	50	-	-	Residential w/o plant uptake GAC is 359mg/kg. Reduced to 50mg/kg as GAC would indicate contaminated source.
Benzo(a)pyrene	-	0.4[5]	0.00006	Residential w/o plant uptake GAC is 3.2mg/kg. RTM value is lower, so used as import criteria
Benzo(b)fluoranthene	4.1	-	-	Residential w/o plant uptake GAC
Benzo(k)fluoranthene	50	-	-	Residential w/o plant uptake GAC is 107mg/kg. Reduced to 50mg/kg as GAC could indicate contaminated source.
Chrysene	32	-	-	Residential w/o plant uptake GAC

Notes

1. RTM-calculated remediation criteria for several of the TPH fractions are far in exceedance of any soil concentrations. Any soils exceeding these criteria would be visibly grossly contaminated. Therefore, it was considered appropriate to set a soil remediation target for TPH C8-C35.

2. If exceedance is noted, the risk-derived criteria for individual carbon bands detailed in this table shall be applied.

3. Not used.

4. If total chromium exceeds 6mg/kg, the results will be assessed further to identify the nature and hazard associated with the presence of chromium in the relevant samples.

5. Routine leachability testing is not required. Leachability testing will be undertaken only if solid analysis concentrations exceed the RTM calculated acceptability criteria. The results of leachability testing will be compared with the RTM-calculated leachable acceptability criteria specified.

6. Visibly contaminated or odorous material must not be imported to site.