RAMBOLL

ENVIRONMENT
& HEALTH

10 July 2020

Department of Education
School Infrastructure NSW
Attn: Mayank Chaturvedi
Level 8, 259 George Street
Sydney NSW 2000

By email: Mayank.chaturvedi@det.nsw.ed.au

Dear Mayank

RE: INTERIM AUDIT ADVICE LETTER NO. 1 - REVIEW OF REMEDIAL ACTION PLAN, CHATSWOOD PUBLIC SCHOOL, 5 CENTENNIAL AVENUE, CHATSWOOD NSW

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Ref 318001008

1. INTRODUCTION

As a NSW Environment Protection Authority (EPA) accredited Contaminated Site Auditor, I am conducting an Audit under the *Contaminated Land Management Act 1997* (the CLM Act) in relation to the subject site. This Interim Audit Advice (IAA) has been prepared to provide an independent review of the suitability and appropriateness of environmental investigations completed at the site and a Remediation Action Plan (RAP) prepared to address identified contamination.

The Department of Education intends to undertake upgrades to buildings and facilities at both Chatswood Public School and Chatswood High School including construction of new buildings and refurbishment of existing facilities. Environmental consultant JBS&G Australia Pty Ltd (JBS&G) completed Detailed Site Investigations (DSIs) at both school sites to determine the potential for contamination. A State Significant Development Application (SSDA) was lodged for the proposed development (SSD 9483) that relates to both the public school and the high school. The EPA provided a response to the SSDA in which they requested the engagement of an EPA-accredited Site Auditor for works related to the public school to ensure that any identified soil contamination was appropriately managed through the development process.

The public school site is approximately 1.4 hectares (ha) and is currently an operational primary school. The site is to be remediated by School Infrastructure NSW (SINSW) to address identified contamination in fill material at the site as part of the school redevelopment.

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This interim letter is based on a review of the documents listed below and observations made on a site visit on 24 June 2020, as well as discussions with Johnstaff who are the project manager.

The reports reviewed were:

- 'Preliminary Site (Contamination) Investigation with Limited Sampling, Proposed Redevelopment Chatswood Public School, High School and Public School "Bush Campus", Chatswood' dated 16 April 2018, Douglas Partners Pty Ltd (Douglas) (*the PSI*).
- 'Hazardous Building Materials Survey, Chatswood Public School, Chatswood Education Precinct, 5 Centennial Avenue, Chatswood NSW' dated 19 February 2019, JBS&G (*the HBMS*).
- 'Chatswood Public School Chatswood Education Precinct, Detailed Site Investigation, 5 Centennial Avenue, Chatswood NSW' dated 28 October 2019, JBS&G (*the DSI*).
- 'Upgrades to Chatswood Public School and Chatswood High School, Chatswood Public School Remedial Action Plan, 5 Centennial Avenue, Chatswood NSW' dated 20 February 2020, JBS&G (*the RAP*).

Additional documentation reviewed was:

- Letter 'Chatswood Education Precinct (SSD 9483) Advice on the Environmental Impact Statement (EIS)' from NSW EPA (Laura Ansted) dated 28 April 2020.

The DSI was included as an Appendix to the Geotechnical Report prepared by Pells Sullivan Meynink (PSM) for the site and high school site dated 18 February 2020. This IAA does not review the adequacy of the PSM Geotechnical Report however, where applicable, information on the site stratigraphy and hydrogeological conditions encountered during the geotechnical investigation have been included.

2. SITE DETAILS

2.1 Location

The site details are as follows:

Street address:	5 Centennial Avenue, Chatswood, NSW 2067 (Attachment 1)
Identifier:	Lot 1 DP812207 and Lot C DP346499
Local Government:	Willoughby City Council
Owner:	NSW Department of Education
Site Area:	Approximately 1.4 ha
Zoning:	R2 – Low Density Residential under the Willoughby Local Environmental Plan 2012

The boundaries of the site are well defined by adjoining streets and properties.

2.2 Adjacent Uses

The site is located within an area of mixed residential and commercial land uses. The surrounding site use includes:

North: Residential land uses and James Street

East: Pacific Highway with commercial land uses further east

South: Centennial Avenue with residential and commercial properties further south

West: Jenkins Street and residential properties

Nearby sensitive receptors include adjacent residential properties. The closest environmental receptors were reported to be Swaines Creek, approximately 660 m to the west and down-gradient of the site, which flows into Lane Cove River.

2.3 Site Condition

At the time of the RAP preparation the site was an operational primary school in the layout shown in Attachment 2.

JBS&G reported the site condition as follows:

- The site generally sloped in a westerly direction with substantially sloped and terraced topography, indicating a degree of cut and fill is likely to have occurred at the site.
- Five large buildings were present across the southern portion of the site, utilised as classrooms, offices, a library and a canteen.
- Asphalt sealed playgrounds and an asphalt sealed carpark were located at the centre and northeast corner of the site. Additional playgrounds were located at the north and northwest portion of the site, which featured an open space sports field covered with synthetic grass, a basketball court and a tennis court.
- The site contained some vegetation in between hardstand areas including large gum and eucalyptus trees, some minor grass cover and perennial herbs. Vegetation was found sporadically throughout the site and its borders. All vegetation appeared unstressed and in good health.

The site conditions observed by the Auditor during a site visit on 24 June 2020 were consistent with those noted by JBS&G. Surfaces were either covered by asphalt or synthetic cover, including around tree roots, and landscaped areas were in garden beds.

The HBMS was completed for the buildings and identified non-friable asbestos containing material (ACM), lead containing dust, lead based paints, synthetic mineral fibres and polychlorinated biphenyls (PCBs) in various buildings on the site. There is no mention in the HBMS of the potential for hazardous building materials to be present in soils outside the buildings. No site-specific asbestos management plan was available for the site.

2.4 Proposed Development

The site is to be redeveloped by SINSW for ongoing use as a primary school. As shown on Attachment 3, this will involve retention of the historical school buildings to the east and the west of the site and historical brick retaining walls, demolition of several buildings including the hall in the northeast, the building in the south and the building in the western-most portion of the site with construction of three new multi-level buildings in the north and new carpark and play area in the west. Most of the remaining hardstand and play areas will be resurfaced. The majority of trees will be removed, and new landscaped areas will be installed.

The redevelopment is to be undertaken as a staged process. For the purposes of this audit, the 'residential with soil access' land use scenario will be assumed as this is appropriate for primary school use.

3. SITE HISTORY

Douglas undertook a review of the site history in the PSI which was based on aerial photographs, site photographs, NSW EPA records, Council records, school website, SafeWork NSW dangerous goods records and Certificates of Title. The Auditor has summarised the site history in Table 3.1.

Table 3.1: Site History

Date	Activity
Pre 1895	The site was orchards prior to acquisition by the Government for school usage
1895 to present	The site has been used for primary school uses. The school has been subject to renovations and additions. Title records indicate that a Hotel Proprietor owned the site between 1969 and 1974 and as such parts of the site may have been used for hotel uses during this time.

The search of Council records identified a development application (DA) from 2005 for paving and landscape works in the school grounds. A drawing included with this DA indicated that an "incinerator compound" was located to the south of the existing sports courts, to the east of the northern end of the main building in the west of the site.

The site was not listed on the NSW EPA contaminated land data base however Chatswood Toyota located at 728 Pacific Highway, approximately 70 m north of the site, was listed by the NSW EPA as being regulated. The records for this nearby site indicated that a notice of completion of approved Voluntary Management Proposal was issued in 2013. A Site Audit Statement (SAS) published for the property indicated that the contaminants of concern were petroleum hydrocarbons in soil and groundwater which had the potential to migrate onto adjoining residential properties. The adjoining residential properties of concern were located down-gradient to the west of the listed property. The Auditor for the regulated site considered that remediation and validation had been conducted substantially in accordance with the requirements, and that no further groundwater monitoring was necessary.

The search of the SafeWork NSW records for the storage of hazardous chemical records did not locate any records pertaining to the site.

Douglas indicated that no information on former construction or demolition of buildings at the site or information on previous filling could be obtained. Despite these data gaps, Douglas considered that sufficient information was available for the site to assess potential contaminants of concern and the contamination risk profile.

Further to the site history presented in the DSI, JBS&G undertook a search of the NSW EPA's Per- and Poly- Fluoroalkyl Substances (PFAS) Register and the NSW Fair Trading loose fill asbestos insulation register as part of the DSI. No records pertaining to the site were encountered. JBS&G noted that the incinerator identified by Douglas was likely to incinerate waste generated by the school only, and the development of large portions of the school (playground etc.) pre-date the incinerator, and, as such, any impacts from the incinerator were likely to be highly localised and not widespread.

3.1 Auditor's Opinion

In the Auditor's opinion, the site history provides an adequate indication of past activities. The site history indicates historical orchard land uses prior to 1895 before primarily school uses. The most significant potential for contamination at the site is associated with the incinerator compound, filling of the site with material of unknown source and composition and uncontrolled demolition of structures containing hazardous building materials.

4. CONTAMINANTS OF CONCERN

Douglas provided a list of the contaminants of concern and potentially contaminating activities in the PSI. These have been tabulated by the Auditor in Table 4.1.

Table 4.1: Contaminants of Concern

Activity	Potential Contaminants
Filling – Imported contaminated filling may have been used to level the site prior to construction of buildings and pavements	Metals, total recoverable hydrocarbons (TRH), benzene toluene ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAH), PCB, organochlorine pesticides (OCP), organophosphate pesticides (OPP), phenols and asbestos
Demolition of former buildings/hazardous materials/degradation of the current buildings.	Asbestos, Synthetic Mineral Fibres (SMF), PCB, PAH and coal tar
Previous orchard land use	Metals, PCB, OCP, OPP and volatile organic compounds (VOC)
Incinerator compound and by products associated with incinerator use	PAH, BTEX and PCBs
Offsite commercial land uses such as car dealerships (Chatswood Toyota)	Metals, TRH, BTEX, PAH, PCB, OCP, OPP, VOC, phenols and asbestos

Based on a review of the PSI, including the soil sampling results, JBS&G identified the following areas of environmental concern and associated contaminants of potential concern:

- Fill materials, imported or reworked fill to create site levels: Metals, TRH, BTEX, PAHs, PCB, OCP and asbestos
- Former orchard: Metals, OCP, OPP and asbestos
- Incinerator: Metals, PAHs, PCBs and asbestos

Following the DSI, the RAP considered that heavy metals (copper, nickel and zinc), PAHs (naphthalene, benzo(a)pyrene (B(a)P), carcinogenic PAHs as B(a)P toxicity equivalent quotient (TEQ), and total PAHs) and TRH were the main contaminants of concern and were considered to be present across the entire site within fill soils.

4.1 Auditor's Opinion

VOCs and coal tar were identified as potential contaminants of concern by Douglas however were not specifically assessed. Based on the results of the PSI and DSI, the Auditor considers that the analyte list used for the investigations was adequate to identify significant impact by these potential contaminants, and adequately reflects the site history and condition.

There has been no assessment by the consultants for the presence of PFAS, but in the Auditor's opinion there are no indications in the site history that they would be potential contaminants of concern.

5. STRATIGRAPHY AND HYDROGEOLOGY

5.1 Stratigraphy

Based on the reviewed geological maps, Douglas and JBS&G both reported that the site is underlain by dark grey to black Ashfield Shale of the Wianamatta Group which weathers to a residual clay profile.

Douglas undertook 13 boreholes and JBS&G undertook 16 boreholes at the site as shown in Attachment 2. The sub-surface profile encountered is summarised by the Auditor in Table 5.1.

Table 5.1: Stratigraphy

Depth (mbgl)	Subsurface Profile
0.0 – 2.0	Fill material comprising silty sand, sandy silt, sand, sandy gravel, silty clay and gravelly clay filling with anthropogenic inclusions of ash, organic matter, gravel, brick, asphalt and plastic. Asphalt pavement was encountered at the surface in more than 50% of the sampling locations. Seven sample locations were terminated in fill or refusal on what was suspected to be shale bedrock.
0.2 to depth	Natural clay was encountered beneath the fill material and generally extended to termination depths of the boreholes or to the underlying bedrock. Shale bedrock was encountered either directly beneath the fill or underlying the natural clays.

mbgl – metres below ground level

The PSM Geotechnical Investigation undertook 17 boreholes at the site and encountered similar stratigraphy to Douglas and JBS&G.

Based on a review of acid sulfate soil (ASS) risks maps, Douglas and JBS&G indicated that the site is in an area of non-occurrence of ASS. Douglas indicated that ASS are not likely to be present at the site while JBS&G indicated that based on observations made during the DSI, sediments typical of potential and actual ASS were not observed.

5.2 Hydrogeology

Douglas undertook a search for registered bores in February 2018. Two bores were identified within a 500 m radius of the site and approximately 350 m east of the site. The bores were installed into clay, shale and sandstone in 1967 and 2005 for recreational purposes and have drill depths of 21.6 and 162.6 mbgl respectively. The standing water level was reported at 25.6 mbgl in one bore. The Auditor also undertook a search of registered bores in June 2020. The same two bores were identified.

Groundwater investigations have not been undertaken at the site. Depth to groundwater over the site is not known. Groundwater was not encountered during the intrusive investigations which extended to a maximum depth of 4.0 mbgl. Based on the reported geology and surrounding topography, JBS&G indicated that the direction of groundwater flow would be to the west towards the Lane Cove River.

The RAP indicated that groundwater at the site was not expected to occur within shale bedrock, however may be present within more permeable strata such as sandstone or highly fractured bedrock. Perched groundwater was expected to occur at existing interfaces of soils and underlying bedrock.

5.3 Auditor's Opinion

The Auditor considers that the stratigraphy is sufficiently well known for the purpose of remedial planning. Further investigation to characterise fill material is not considered necessary prior to demolition and remediation given the access restrictions due to site infrastructure and the proposed remediation strategy to cap fill material at the site.

Intrusive groundwater investigations were not undertaken at the site. The site history does not indicate the presence of point source contamination that would be likely to cause groundwater contamination that would present a risk to future site occupants. The Auditor considers that the shallow formation underlying the site is of low permeability and therefore the potential for significant groundwater contamination or migration of contamination is low and therefore the absence of intrusive groundwater investigation is acceptable.

6. EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL

The data sources are summarised in Table 6.1.

Table 6.1: Summary of Investigations

Investigations	Field Investigations	Analytical Data Obtained
Preliminary Site Investigation (Douglas, 2018) *Fieldwork date: January 2018*	28 boreholes (BH1 to BH28) were completed across both the public school and high school sites. 13 boreholes (BH16 to BH28) were located in accessible areas of the public school site to provide site coverage.	14 soil samples: TRH/BTEX, PAHs 13 soil samples: Metals 12 soil samples: total phenols, OCP, OPP, PCB and asbestos (presence/absence) 3 soil samples: TRH Silica Gel Clean Up 5 soil samples: Toxicity Characteristic Leaching Procedure (TCLP) PAHs 2 soil samples: TCLP lead
Detailed Site Investigation (JBS&G, 2019) *Fieldwork date: January 2019*	16 boreholes (BH_P_01 to BH_P_14, BH_P_9a and BH_P_16) in accessible areas of the site to provide site coverage.	15 soil samples: Metals, PAH and asbestos (500 mL % w/w) 10 soil samples: TRH/BTEX 5 soil samples: OCPs 2 soil samples: PCBs

The Auditor has assessed the overall quality of the data by review of the information presented in the referenced reports, supplemented by field observations. The Auditor's assessment follows in Tables 6.2 and 6.3.

Table 6.2: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Data Quality Objectives (DQO) Douglas and JBS&G defined specific DQOs in accordance with the seven-step process outlined in Schedule B2 of NEPM (2013). The following decisions were identified in the DQOs for the DSI: • Are there any unacceptable risks to likely future on-site receptors? • Are there any issues relating to background soil concentrations that exceed appropriate site soil criteria? • Are there any impacts of chemical mixtures? • Are there any aesthetic issues at the site? • Is there any evidence of, or potential for, migration of contaminants from the site? • Is a site management strategy required?	The identified DQOs were considered appropriate for the investigations conducted.
Sampling pattern and locations Investigation locations were spaced within accessible areas to gain coverage of the majority of the site. The various fill materials at the site were targeted for sampling with natural soils also sampled.	There are spatial soil sampling data gaps under building footprints however the majority of these building footprints will remain or be covered/capped as part of the development. In the Auditor's opinion, the lack of investigation locations inside the building footprints is not considered significant as the investigation locations target the likely primary source of contamination at the site (fill material).

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Sampling density The combined (Douglas and JBS&G) sampling density of 29 locations over approximately 1.4 ha exceeds the minimum of 25 recommended by EPA (1995) *Sampling Design Guidelines*. The coverage provides a 95% confidence of detecting a residual hot spot of approximately 29 m diameter. The majority of soil samples were of fill, with only two natural samples analysed. The majority of soil samples were analysed for PAH, TRH, BTEX, metals and asbestos with around half of the samples analysed for PCBs, OCP, OPP and phenols.	Lower densities of analysis for PCBs, OCP, OPP and phenols are considered acceptable based on the absence of detections (refer Section 8). In the Auditor's opinion the sampling density was adequate to characterise the fill material for the purpose of remediation planning. Natural soils at the site have not been characterised, with only two samples analysed at the fill/clay interface. This is considered acceptable given the lack of deep contamination sources identified, the identified contaminants of concern in fill being of generally low mobility (refer Section 8) and in consideration of the proposed cap and containment remediation strategy.
Sample depths Samples were collected and analysed from a range of depths, with the primary intervals being within the shallow fill (0-0.15 mbgl), directly beneath pavements, at 0.5 mbgl and then at 0.5 m intervals to the termination depths of the borehole at around the fill/natural interface. Surface samples obtained during the DSI by JBS&G may have included asphalt pavements. The photographic log presented in the DSI indicates asphalt at the surface of sampling locations however the corresponding borehole log does not indicate asphalt at the surface.	In the Auditor's opinion, the potential inclusion of asphalt pavement fragments from surface cover may be the source of detections of PAHs and TRH in near surface samples. Generally, the sampling strategy was appropriate and adequate to characterise the primary material types present on site for the purpose of remedial planning.
Sample collection method Sample collection was via solid stem auger and hand auger. Soils were collected from the auger flights, it has not been specified whether the external material was removed prior to collecting the sample. The asbestos analysis completed during the PSI was for the presence/absence of asbestos in small volume soil samples from boreholes. During the DSI, 500 mL samples were collected for laboratory analysis for asbestos fines/ fibrous asbestos (AF/FA). Field quantification of asbestos (10 L samples) was not undertaken therefore the asbestos quantification was not in accordance with the methodology outlined in NEPM (2013) (Schedule B1).	Sample collection from the auger flights is not ideal as it can result in loss of volatiles and sample cross contamination, however, based on the absence of potential sources of these contaminants and the low concentrations reported, the sampling method is not considered to have had a significant impact on the data set. Assessment of asbestos contamination was completed on soil samples of limited volume from soil bores which allows limited visual inspection for potential ACM. The sample method and absence of field quantification of asbestos is not considered to be a significant deficiency as the RAP provides an outline for any unexpected finds encountered during development works which can include asbestos.
Decontamination procedures Decontamination procedures were not specified by Douglas however a rinsate sample was obtained during the PSI sampling event. JBS&G indicated in the DSI that sampling equipment (augers) were cleaned via brushing and rinsing between sampling events to prevent cross contamination. New gloves were reportedly used by Douglas and JBS&G for each new sample.	Although not clearly documented, it is not expected that the potential lack of decontamination will adversely impact the reliability or usability of the data.
Sample handling and containers Samples were placed into prepared and preserved sampling containers provided by the laboratory and chilled during storage and subsequent transport to the labs. Samples for asbestos analysis obtained during the DSI were placed in plastic zip-lock bags. Asbestos analysis of the Douglas samples was performed from glass jars which were sub-sampled by the laboratory.	Acceptable.
Chain of Custody (COC) Completed COC forms were provided in the reports.	Acceptable.

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Detailed description of field screening protocols Field screening of samples was not undertaken by Douglas. Field screening for volatiles was undertaken by JBS&G using a photoionisation detector (PID). Soil sub-samples were placed in ziplock plastic bags and the headspace measured for VOCs after allowing time for equilibration.	Although Douglas did not use a PID for the field screening of volatiles the samples displaying hydrocarbon odours were selected for analysis. In the Auditor's opinion, the absence of field screening data for the PSI soil sampling event does not impact on the completeness of the data.
Calibration of field equipment JBS&G indicated that calibration of the PID had been undertaken prior to use and checks were performed during use. Calibration certificates from the equipment supplier were provided by JBS&G as were the field calibration records.	Acceptable.
Sampling logs Soil logs are provided within the reports, indicating sample depth, PID readings and lithology. The logs report no indications of contamination were found, however hydrocarbon odours were noted in fill materials at three sample locations.	Acceptable.

Table 6.3: QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC	Auditor's Opinion
Field quality control samples Field quality control samples including trip blanks, trip spikes, rinsate blanks, field intra-laboratory and inter-laboratory duplicates were undertaken for the soil sampling event completed by Douglas during the PSI. Field intra-laboratory and inter-laboratory duplicates and a rinsate blank were undertaken for the soil sampling event completed by JBS&G during the DSI, however, no trip blanks or trip spikes were analysed as part of the DSI. JBS&G noted that all sample handling procedures, including the transfer and storage of samples into chilled eskies, were adhered to prior to and during shipment to the laboratory. JBS&G did not consider the omission to adversely affect the representativeness of the data set.	Acceptable.
Field quality control results The results of field quality control samples were generally within appropriate limits. The following exceptions were noted: • Exceedance of the relative percent difference (RPD) limits for metals and PAHs for both the intra and inter-laboratory soil duplicates analysed during the PSI. Douglas indicated that the exceedances were not significant as the recorded concentrations were generally close to the detection limit, were heterogenous and had typically low actual differences. • JBS&G indicate that high RPDs in the duplicate samples can be expected when materials are heterogeneous and/or when analyte concentrations are close to the limit of reporting (LOR). JBS&G considered elevated RPDs for both intra-laboratory and inter-laboratory duplicates were acceptable on the basis that the reported concentrations are typically within 10 times the LOR. As a conservative measure JBS&G adopted the highest values in the interpretation of data. • Low concentrations of DDT (0.0001 for DDT+DDE+DDD (Total) and 4.4'-DDT), were detected within the rinsate sample collected by JBS&G on 23 January 2019 during the DSI. JBS&G noted that no pesticides were reported within soils at any of the sample locations and therefore the potential false positive is not considered to significantly impact upon the data set.	Overall, in the context of the dataset reported, the elevated RPD result and detections of pesticides in the rinsate are not considered significant and the field quality control results are acceptable.

Field and Lab QA/QC	Auditor's Opinion
NATA registered laboratory and NATA endorsed methods Douglas used Envirolab as the primary laboratory during the DSI and Eurofins | mgt was the secondary laboratory. Eurofins | mgt was the primary laboratory used by JBS&G during the DSI and Envirolab were the secondary laboratory. Laboratory certificates were NATA stamped. Analysis for asbestos in accordance with NEPM (2013) is not NATA accredited.	Acceptable
Analytical methods Analytical methods were included in the laboratory test certificates. Both laboratories provided brief method summaries of in-house NATA accredited methods used based on USEPA and/or APHA methods (excluding asbestos) for extraction and analysis in accordance with the NEPM (2013). Asbestos identification was conducted using polarised light microscopy with dispersion staining by method AS4964-2004 *Method for the Qualitative Identification of Asbestos Bulk Samples*.	The analytical methods are considered acceptable for the purposes of the site audit, noting that the AS4964-2004 is currently the only available method in Australia for analysing asbestos.
Holding times Review of the COCs and laboratory certificates indicate that the holding times had generally been met, with the exception of the holding time for one TCLP PAH sample analysed during the PSI. Douglas and JBS&G also reported that holding times were met.	Acceptable
Practical Quantitation Limits (PQLs) *Soil:* PQLs (except asbestos) were less than the threshold criteria for the contaminants of concern. *Asbestos:* The limit of detection for asbestos in soil was 0.01% w/w although NEPM (2013) analyses were reported to 0.001% w/w for AF/FA based on a larger volume of soil assessed.	*Soil (except asbestos):* Overall the soil PQLs are acceptable. *Asbestos:* In the absence of any other validated analytical method, the detection limit for asbestos is considered acceptable. A positive result would be considered to exceed the *"no asbestos detected in soil"* criteria.
Laboratory quality control samples Laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks, internal standards and duplicates were undertaken by the laboratories.	Acceptable
Laboratory quality control results The results of laboratory quality control samples were generally within appropriate limits, with the following exceptions: • Slightly elevated matrix spike recoveries were recorded for copper, lead and zinc. Acceptable recoveries were obtained for the laboratory control samples.	The slightly elevated matrix spike recoveries are not considered to affect the usability of the data and the laboratory quality control results are acceptable.
Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy) Predetermined data quality indicators (DQIs) were set for laboratory analyses including blanks, replicates, duplicates, laboratory control samples, matrix spikes, surrogate spikes and internal standards. These were discussed with regard to the five category areas. The DSI concluded that "*The field sampling and handling procedures across the site produced QA/QC results which indicate that data collected is of an acceptable quality for the DSI objectives.* *The NATA certified laboratory reports indicate that the project laboratories were achieving levels of performance within their recommended control limits during the period when the samples from this program were analysed.* *On the basis of the results of the field and laboratory QA/QC program, the soil data are of an acceptable quality upon which to draw conclusions regarding the environmental condition of the site."*	An assessment of the data quality with respect to the five category areas has been undertaken by the Auditor and is summarised below.

6.1 Auditor's Opinion

In considering the data as a whole, the Auditor concludes that:

- While data is likely to be adequately representative of the overall conditions for the purpose of remedial planning, the potential inclusion of asphalt in the surface soil sampling matrix is not likely to be representative of underlying fill conditions. The absence of characterisation of natural soils is acceptable.
- The data is considered to be adequately complete.
- There is a high degree of confidence that data is comparable for each sampling and analytical event.
- The primary laboratory provided sufficient information to conclude that data is of sufficient precision.
- While most of the data is likely to be accurate, there is some doubt regarding possible loss of volatiles and potential for asbestos to be present as a result of the sampling methods adopted.

7. ENVIRONMENTAL QUALITY CRITERIA

The Auditor has assessed the results against Tier 1 criteria from National Environmental Protection Council (NEPC) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, as Amended 2013 (NEPM, 2013). Other guidance has been adopted where NEPM (2013) is not applicable or criteria are not provided. Based on the proposed development being a primary school, the human health criteria for 'residential with accessible soil' and ecological criteria appropriate for 'urban residential and public open space' were adopted.

7.1 Soil Assessment Criteria

Human Health Assessment Criteria

The Auditor has adopted human health assessment criteria from the following sources:

- NEPM (2013) Health Investigation Levels (HILs) for 'Residential' (HIL-A) land use.
- NEPM (2013) Health Screening Levels (HSLs) for 'Low-High Density Residential' (HSL-A&B) land use assuming sand soil type. Depth to source adopted was <1 m as an initial screen.
- NEPM (2013) Management Limits (MLs) for petroleum hydrocarbons for 'Residential and Open Space' land use and assuming coarse soil texture.
- NEPM (2013) HSLs for Asbestos Contamination in Soil for 'Residential A' (HSL-A) land use for asbestos fines/fibrous asbestos (AF/FA) in 500 mL samples and 'no asbestos detected' for presence/absence samples.
- Friebel & Nadebaum (2011) HSLs for direct contact for all land use categories, and vapour inhalation/direct contact pathways for intrusive maintenance workers.

Ecological Assessment Criteria

The Auditor has adopted ecological soil assessment criteria from the following sources:

- NEPM (2013) Ecological Screening Levels (ESLs) for 'Urban Residential and Public Open Space' land use, assuming coarse soil.
- NEPM (2013) Ecological Investigation Levels (EILs) for 'Urban Residential and Public Open Space' land use. In the absence of site-specific soil data on pH, clay content, cation exchange capacity and background concentrations, the published range of the added contaminant limits (ACL) have been applied as an initial screen.

- Canadian Council of Ministers of the Environment (CCME) (2010) *Canadian soil quality guidelines: carcinogenic and other polycyclic aromatic hydrocarbons (PAHs)* soil quality guideline (SQG) for benzo(a)pyrene for 'Residential' land use. The SQG has been adopted in place of the NEPM (2013) ESL as it is based on a larger and more up-to-date toxicity database than the low reliability NEPM (2013) ESL.

Soil Aesthetic Considerations

The Auditor has considered the need for soil remediation based on 'aesthetic' contamination as outlined in *Section 3.6 Aesthetic Considerations* of NEPM (2013) Schedule B1, which acknowledges that there are no chemical-specific numerical aesthetic guidelines. Instead, site assessment requires a balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity.

7.2 Auditor's Opinion

The environmental quality criteria referenced by the Auditor are consistent with those adopted by Douglas and JBS&G with the exception of the following:

- JBS&G adopted the HIL C land use criteria during the DSI. The DQOs for the DSI indicated that the proposed land use was understood to be for secondary school uses and therefore the adopted criteria was applicable at the time of the DSI.
- Douglas calculated site specific EILs using input parameters of aged soil, average CEC of 5 for coarse soil and 20 for fine soil (considered to be conservative), average pH of 4.96 (based of Douglas geotechnical testing at the site), carbon content of 1% (considered to be conservative), clay content of 2% for coarse soil and 40% for fine soil and high for traffic volumes. These numbers were continued in the DSI by JBS&G.

Given the results obtained, the Auditor considers that these discrepancies do not affect the overall conclusions reached by the consultants and the Auditor.

8. EVALUATION OF SOIL RESULTS

As outlined in Table 6.1, Douglas undertook a PSI including the drilling of 13 boreholes in accessible areas of the site. JBS&G undertook a DSI at the site which included the drilling of 16 boreholes in accessible areas of the site to increase the site coverage. Douglas and JBS&G soil sampling locations are shown as Attachment 2. The following sections outline the soil field and analytical results for the PSI and DSI investigations.

8.1 Field Results

The PSI and DSI identified anthropogenic material (including ash, organic matter, gravel, brick, asphalt and plastic) in fill soils. Hydrocarbon odours were noted by JBS&G during sampling of BH_P_07 and BH_P_11 and by Douglas at location BH18. These locations were all located around the site perimeter in the south-western portion of the site and odours were noted at depths of 0.5 to 0.8 mbgl in silty clay fill or silty clay sand fill. No anthropogenic inclusions were noted in the fill at these depths, except for ash in BH18. PID readings were not reported for the PSI however the PID readings recorded by JBS&G at the locations where odours were noted were 5.3 ppm at 0.5 m in BH_P_07 and 2.7 ppm in BH_P_11. The highest PID reading recorded during the DSI was 8.2 ppm in a sample of the natural silty clay at a depth of 1.7 m in BH_P_07.

8.2 Analytical Results

Fill soil samples were analysed for a variety of contaminants and the results have been assessed against the environmental quality criteria outlined in Section 7. The Auditor has summarised the fill analytical results in Table 8.1. Two natural soil samples were analysed, with results discussed following Table 8.1.

Table 8.1: Evaluation of Fill Analytical Results – Summary Table (mg/kg)

Analyte	n	Detections	Maximum	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
AF/FA (500 mL samples)	15	0	<PQL	0 above HSL 0.001%	-
Asbestos in soil	12	0	<PQL	0 above 0.1 g/kg	-
BTEX	24	0	<PQL	0 above HSL A&B 0-1 m, sand	0 above ESL (urban residential) (coarse)
F1 (TRH C_6–C_{10} minus BTEX)	24	0	<PQL	0 above HSL A&B 0-1 m, sand 45 mg/kg	0 above ESL (urban residential) 180 mg/kg
F2 (TRH >C_{10}–C_{16} minus naphthalene)	24	5	**130**	**2 above HSL A&B 0-1 m, sand 110 mg/kg**	-
TRH C_6–C_{10}	24	0	<PQL	0 above ML (urban residential) 700 mg/kg	-
TRH >C_{10}–C_{16}	24	5	**140**	0 above ML (urban residential) 1000 mg/kg	**1 above ESL (urban residential) 120 mg/kg**
TRH >C_{10}–C_{16} (Silica Gel Clean Up)	3	1	89	0 above HSL A&B 0-1 m, sand 110 mg/kg	0 above ESL (urban residential) 120 mg/kg
TRH >C_{16}-C_{34}	24	13	**9000**	**3 above ML (urban residential) 2500 mg/kg**	**10 above ESL 300 mg/kg**
TRH >C_{16}-C_{34} (Silica Gel Clean Up)	3	3	**1400**	0 above ML (urban residential) 2500 mg/kg	**2 above ESL 300 mg/kg**
TRH >C_{34}-C_{40}	24	10	2200	0 above ML (urban residential) 10,000 mg/kg	0 above ESL 2800 mg/kg
TRH >C_{34}-C_{40} (Silica Gel Clean Up)	3	1	790	0 above ML (urban residential) 10,000 mg/kg	0 above ESL 2800 mg/kg
Naphthalene	30	8	**9.2**	**2 above HSL A&B 0-1 m, sand 3 mg/kg**	0 above EIL (urban residential) 170 mg/kg
Benzo(a)pyrene	30	21	**82**	-	**4 above CCME SQG (residential) 20 mg/kg**
Benzo(a)pyrene TEQ	30	19	**116.1**	**9 above HIL A 3 mg/kg**	-
Total PAHs	30	22	**650.6**	**4 above HIL A 300 mg/kg**	-
Total Phenols	12	1	98	0 above HIL A 3000 mg/kg	-
Speciated Phenols	1	0	<PQL	0 above HIL A 3000 mg/kg	-
Arsenic	28	19	19	0 above HIL A 100 mg/kg	0 above EIL (urban residential) 100 mg/kg
Cadmium	28	3	0.7	0 above HIL A 20 mg/kg	-
Chromium	28	28	42	0 above HIL A 100 mg/kg	0 above most conservative ACL (urban residential) 190 mg/kg
Copper	28	26	**170**	0 above HIL A 6000 mg/kg	**4 above most conservative ACL (urban residential) 60 mg/kg**

Analyte	n	Detections	Maximum	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
Lead	28	27	180	0 above HIL A 300 mg/kg	0 above generic ACL (urban residential) 1100 mg/kg
Mercury	28	4	0.2	0 above HIL A 40 mg/kg	-
Nickel	28	23	**70**	0 above HIL A 400 mg/kg	**4 above most conservative ACL (urban residential) 30 mg/kg**
Zinc	28	28	**1000**	0 above HIL A 7400 mg/kg	**11 above most conservative ACL (urban residential) 70 mg/kg**
PCB	14	0	<PQL	0 above HIL A 1 mg/kg	-
OCP	17	0	<PQL	0 above HIL A	0 above EIL
OPP	12	0	<PQL	0 above HIL A	-

n number of samples
- No criteria available/used
NL Non-limiting
<PQL Less than the practical quantitation limit

In assessing the results, the Auditor makes the following observations:

- Asbestos was not observed during drilling or detected in the fill samples analysed.
- Concentrations of TRH C_{10}-C_{16} (TRH F2) were identified marginally above the human health criteria in two soil samples, BH18 (1.0-1.1 m) and BH_P_02 (0-0.15 m). The concentration of TRH F2 in the BH18 (1.0-1.1 m) sample was also above the ecological criteria of 120 mg/kg. TRH Silica Gel Clean Up (TRH SGC) analysis was performed on the BH18 (1.0-1.1 m) sample and the results indicated concentrations of TRH F2 were less than the adopted human health and ecological criteria.
- Concentrations of TRH C_{16}-C_{34} (TRH F3) were identified above the ML criteria in three samples and above the adopted ecological criteria in 10 samples. TRH SGC analysis was performed on three samples collected during the PSI (BH18 (1.0-1.1 m), BH21 (0.0-0.1 m) and BH27 (0-0.3 m)) with the resulting TRH F3 SGC results below the adopted assessment criteria, with the exception of the TRH F3 concentration in sample BH21 (0.0-0.1 m) which continued to exceed the ecological criterion of 300 mg/kg. TRH SGC analysis was not completed on samples analysed during the DSI and TRH F3 in one sample collected during the DSI (BH_P_02 (0-0.15 m)) exceeded the ML criteria and the ecological criteria.
- Concentrations of naphthalene were identified above the human health criteria in two samples from BH18 (0.5 and 1.0-1.1 m). Both results were greater than 250% of the adopted human health criteria. The criteria adopted is for coarse soils (sandy) and the Auditor notes that the fill materials logged by Douglas are a clay soil. Based on the most applicable soil matrix the results are not greater than 250% of the human health criteria. The source of the elevated concentrations of naphthalene in the fill at this location is unclear and detection of naphthalene in all other fill samples were near or below the PQL.
- Other volatile petroleum hydrocarbons (TRH C_6–C_{10} or BTEX) were not detected.
- Concentrations of Benzo(a)pyrene TEQ (BaP TEQ) were identified above the human health criteria in nine samples from sample locations BH16, BH17, BH18, BH21, BH23, BH24, BH_P_02 and BH_P_02. Six of these concentrations, located at BH_P_02, BH16, BH18 and BH21, were greater than 250% of the adopted human health criteria. Concentrations of total PAHs were also identified above the human health criteria in four samples (BH_P_02 (0-0.15 m), BH18 (0.5 m), BH18 (1.0-1.1 m) and

BH21 (0.0-0.1 m)). Concentrations of BaP were identified above the CCME SQG (residential) ecological criteria in the same four samples.

- Concentrations of copper and nickel were identified in four samples above the most conservative ecological ACL. Concentrations of zinc were also identified in 11 samples above the most conservative ecological ACL.
- The PSI included analysis of two natural soil samples (obtained from BH17 and BH21) for PAH, TRH, BTEX, total phenols, PCBs, OCP and OPP. Concentrations of PAHs (total PAHs, BaP and BaP TEQ) were detected in these samples at low concentrations, below the adopted criteria, at the interface of the fill and underlying clay.

Soil Leachability

Selected samples were analysed for potential leachability during the PSI in order to classify the fill materials for offsite disposal. TCLP analysis for individual metals and PAHs (including BaP) was undertaken on five samples from within the site. The samples analysed were obtained generally from within the upper 0.5 m. The TCLP analysis identified minor leachable concentrations of lead in two samples.

8.3 Auditor's Opinion

In the Auditor's opinion, the soil analytical results are consistent with the site history and field observations. The results indicate that fill materials have been impacted by heavy metals, PAHs and TRH. The elevated concentrations are likely to be associated with the presence of ash and asphalt within the sample matrix and potential cross contamination from use of augers through asphalt pavements. There is some evidence of localised volatile petroleum hydrocarbon impacts, including detections of naphthalene and TRH C_{10}–C_{16} in association with odours and/or elevated PID readings in the vicinity of BH18. The source of the impact is not clear, however, analytical results following SGC suggest concentrations would not present a significant risk from vapour intrusion. Analysis of fill from other bores in this area did not detect elevated volatile petroleum hydrocarbons, including fill from the JBS&G location BH_P_07 adjacent to BH18.

The Auditor notes that TCLP testing is an acidic procedure designed to simulate leaching of contaminants from material within putrescible landfills. The TCLP test is therefore considered to be an unrealistic measure of leachability on the site and the results are overly conservative. Given that the site is proposed to be generally covered by pavements and any exposed areas will have a minimum cover of clean material, and the general low permeability of the residual soils and bedrock at the site, there is considered to be a low potential for contaminants to leach from fill material to underlying groundwater.

In the Auditor's opinion the site soils have been adequately characterised for remediation planning purposes and the Auditor considers that remediation is required to make the site suitable for the proposed continued use as a primary school with respect to soil contamination. The proposed remediation is discussed in Section 10.

9. EVALUATION OF CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a representation of the contaminant source, pathway and receptor (SPR) linkages at a site. JBS&G developed a CSM and used it to determine the required remediation. The CSM was initially developed based on the results of the preliminary investigations and was updated following the DSI. Table 9.1 provides the Auditor's review of the CSM used by JBS&G in the RAP.

Table 9.1: Review of the Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	Fill material identified across the site containing heavy metals (copper, nickel and zinc), PAHs (naphthalene, BaP, BaP TEQ and total PAHs) and TRH. The contamination sources have been attributed to ash, asphalt and blue metal inclusions within the fill material. JBS&G indicated that the majority of sampling locations were advanced utilising solid flight augers through asphalt that was located at the ground surface, which may have resulted in the entrainment of asphalt in the soil samples obtained as the boreholes were advanced.	The sources of contamination and contaminants of concern including the mechanism of contamination have generally been appropriately identified. The Auditor notes also a localised area of impact by naphthalene was identified.
Affected media	Fill soil	The affected media has been appropriately identified. The potential for contamination of natural soil, groundwater or soil gas is low based on the site use and surrounding uses.
Receptor identification	Future construction workers associated with the development works, students and employees of the proposed primary school, future construction/maintenance workers undertaking ground disturbance and future/current sub-surface excavation/intrusive workers. Given the majority of the site is currently sealed predominantly with hardstand pavement (concrete and asphalt) and proposed redevelopment will consist of predominantly sealed on-grade infrastructure, on site ecological flora/fauna are not considered likely receptors. Possible off-site ecological receptors during development include potential surface water receptors (i.e. Swains Creek to the west of the site).	The human and ecological receptors have been appropriately identified.
Exposure pathways	Dermal and oral contact with impacted soils. Inhalation of dust generated from fill material.	Exposure pathways have been appropriately identified. Limited volatile contamination was identified therefore exposure by vapour inhalation is possible however is considered unlikely.
Presence of preferential pathways for contaminant movement	Sub-surface services will be present as part of site redevelopment and preferential pathways can be created by the generally higher permeability backfill used to re-instate these trenches.	The RAP identified the potential for preferential pathways, however specifics related to the project have not been discussed. The limited volatile contaminants and low leaching potential for identified contaminants in soils indicates that preferential pathways for contamination migration are unlikely to be present.

Element of CSM	Consultant	Auditor Opinion
Evaluation of data gaps	No data gaps identified.	The contamination status beneath buildings is not known and groundwater has not been assessed at the site. Given that point source contamination sources have not been identified, and based on the proposed development details and the general low permeability of the site geology, these data gaps are not considered significant. The unexpected finds protocol within the RAP will reduce the risk associated with the unknown soil conditions beneath buildings to be demolished during the redevelopment.
Potentially complete SPR linkages	During redevelopment of the site, potential human receptors will include: • Inhalation of potential contaminants of concern in dust and migrating upwards from fill material of unknown origins; and/or • Potential dermal and oral contact with impacted soils as present at shallow depths and/or accessible by future service excavations across the extent of the site. While existing sealed surfaces and structures over soil are retained and remain undisturbed, the exposure pathways are incomplete during normal school use. Potential exposure could occur where soils are readily accessible such as in gardens or where soils are exposed by removal of surface cover to facilitate excavation.	The identified SPR linkages are considered representative of pre-remediation site conditions. The redevelopment will include partial hardstand capping cover and clean landscape capping materials at the surface which will remove potential exposure pathways. Ongoing management will be required for works below the capping and to maintain the capping layer. The proposed capping will reduce the potential for leaching of contaminants from within fill and will reduce migration of groundwater, therefore reducing potential risks to off-site receptors.

9.1 Auditor's Opinion

In the Auditor's opinion the CSM is an adequate basis for assessing remedial requirements. The potentially complete SPR linkages are limited to dermal contact and inhalation of dust associated with contaminants in fill by future site users and construction and maintenance workers. It is considered that this exposure pathway can be eliminated through capping of the site and implementation of an environmental management plan (EMP) to manage any future intrusive works below the capping system, as discussed below in Section 10.

10. EVALUATION OF PROPOSED REMEDIATION

10.1 Remediation Required

Based on the investigation results and the revised CSM, JBS&G determined that remediation or management was required to address elevated concentrations of PAHs (naphthalene, BaP, BaP TEQ and total PAHs), TRH and heavy metals (copper, nickel and zinc) in fill material across the entire site footprint. The preferred remediation option identified was to cap and contain the fill material and manage any residual risk through implementation of a long term EMP for the site. The Auditor considers the preferred remedial option to be generally appropriate based on the identified contamination. It is noted that the excavation and offsite disposal of some material will be required to achieve required development levels.

10.2 Evaluation of RAP

The Auditor has assessed the RAP by comparison with the checklist included in NSW EPA (2020) *Consultants Reporting on Contaminated Land* [replaces OEH (2011) *Guidelines for Consultants*

Reporting on Contaminated Sites] although it is noted that the RAP was prepared prior to publication of NSW EPA (2020). The RAP was found to address the required information, as detailed in Table 10.1 below.

Table 10.1: Evaluation of Remedial Action Plan

Remedial Action Plan	Auditor Comments
Remedial Goal JBS&G specify the goals for the remediation and/or management of environmental impact are to: • *"Remove unacceptable risks to human populations utilising/working on/visiting the primary education facility by exposure to contaminated fill materials/soil;* • *Remove or manage unacceptable ecological risks to flora/fauna posed by fill/soil contamination; and* • *Undertake remedial works associated with site development works (i.e. bulk excavation, waste disposal etc) in a manner that best complies with the principles of ecologically sustainable development (ESD)."*	In the Auditor's opinion, these goals are considered appropriate considering the proposed development of the site.
Discussion of the extent of remediation required Soils on the site are unsuitable for direct contact by potentially sensitive human users of the site and/or ecological receptors. Concentrations of a range of constituents including heavy metals, TRH and PAHs exceed criteria provided for the protection of health and/or ecological exposures. These soils are located across the entire extent of the site.	The Auditor considers that the extent of remediation is appropriate.
Remedial Options Remedial options were assessed in Section 5.3 of the RAP and included: 1. On-site treatment of the contamination 2. Off-site treatment of the contamination 3. On-site in situ management of the soil by physical separation, and ongoing management 4. Excavation and offsite removal of the impacted material	The Auditor considers that an appropriate range of options were considered.
Selected Preferred Option The preferred option was discussed within the RAP (Section 5.3) as outlined in Section 10.1, above. On-site in situ management of the soil by physical separation, and ongoing management was considered the preferred remedial option.	The Auditor considers the preferred option to be appropriate however it is noted that the excavation and offsite removal of some impacted fill material will be required to achieve development levels.
Rationale The retention of fill materials will reduce the waste generation and resource requirements of the remediation of the site, as consistent with the ESD objectives. The proposed redeveloped site will be subject to significant areas of building and pavements which will provide physical separation between users of the redeveloped site and retained fill materials. This will assist with preservation of potential heritage items by reducing/avoiding excavation activities. This option is of highest ranking with respect to the ESD principles as a result of the low waste volumes and energy use, and ranks higher on EPA's remediation and waste hierarchies by avoiding significant off-site disposal.	The Auditor considers this rationale to be adequate.
Containment The RAP proposes that impacted soil on the site can be retained with appropriate physical separation to maintain incomplete exposure pathways subject to ongoing management controls. Ideally material would be maintained in place, either below existing or new	The physical separation/capping and containment strategy is considered adequate subject to ongoing management with a long term EMP although it is noted that there is an

Remedial Action Plan	Auditor Comments
surfaces/structures, without disturbance, however some controlled cut and fill during development-related earthworks may be required to facilitate changes in site levels proposed. The following physical separation arrangements are to be implemented within the extent of the site: • Capping of fill materials by new or replacement permanent paved/sealed areas (includes concrete, asphalt, pavers and synthetic grass areas) – installation of a marker layer underlying the depth of the pavement and overlying potentially contaminated material. • Where existing permanent paved/sealed surfaces are to be retained, these will not require a marker layer, and the base of the surface material (concrete, asphalt, paving, synthetic grass) will be considered the marker layer above contaminated material. • For new slab on grade buildings, the slab will provide adequate separation without the need for a marker layer, however a marker layer is recommended below building structures that are not slab-on-grade or where there is potential for future penetration of the footprint area (e.g. to facilitate service maintenance, etc). • Covering of fill materials in landscaped areas: – Installation of the marker layer at a minimum depth of between 0.3 and 0.5 m below final finished site levels in areas of shallow planting (for grasses and shrubs) and use of environmentally suitable materials (e.g. topsoil and mulch) placed above to the final levels. – Installation of the marker layer at a minimum depth of 0.7 m below final finished site levels in areas of new tree planting (or as required for the depth of the plant's root-ball) and use of environmentally suitable materials placed above to the final levels. – In areas of existing trees that are to be retained, removal of at least 0.1 m of impacted soils, installation of the marker layer at a minimum depth of 0.1 m, and placement of wet-pour rubber or similar material to the finish level. • Within underground services trenches – in the event underground services are to be installed within contaminated soil, the service infrastructure will be required to be installed above a marker layer within suitable materials for potential human and/or ecological exposure. The marker layer is to be placed at the base and covering the walls of the trenches to the elevation of the surrounding area marker layer. Where required to be installed, the marker layer shall consist of contrasting brightly-coloured (e.g. orange) geofabric of suitable tensile strength and durability to ensure it remains intact upon completion of development works and into the future.	inconsistency in the RAP regarding the depth of marker layer around existing trees. Section 5.5.2 reports installation of marker layer at minimum 0.1 m while Section 6.3.4 reports validation of the marker layer at 0.15 m depth below finished level. This detail should be clarified before implementation of the RAP.
Proposed Validation Criteria Based on the proposed remediation strategy, collection of validation samples, other than from materials proposed to be imported, is not required. Validation of the marker layer and capping will require: • As-built survey of structures and marker-layer placement. • Survey of marker-layer depth and top of growing media demonstrating satisfaction of minimum requirements. • Survey of marker layer depth and of completed service trenches required to demonstrate satisfaction of minimum requirements. The RAP indicates that imported materials will be utilised in areas with accessible soils, for example, landscape areas or planter boxes constructed above a marker layer. Soils proposed to be utilised in areas of accessible soils are to comprise VENM (NSW EPA 2019), ENM, or another suitable material subject to an NSW EPA Resource Recovery Exemption and Order. Analytical data for materials used in	The Auditor considers the proposed validation criteria to be acceptable.

Remedial Action Plan	Auditor Comments
areas of accessible soils (growing media) shall be compared against adopted criteria as follows: • Site specific EILs derived through the methodology outlined in NEPM (2013); • ESLs for TRH fractions, BTEX and benzo(a)pyrene in coarse grained soil for residential land use (NEPM 2013); • HILs/HSLs for residential with accessible soils, as per NEPC (2013) (HIL A/HSL A/B).	
Proposed Validation Testing The RAP indicates that all material imported onto the site are required to be accompanied by appropriate documentation that has been verified by the appointed site contamination (environmental) consultant. For imported materials: • VENM: If no chemical data is available, or the existing information does not meet the standard required, at least five samples per source site and one per 1,000 m^3 being collected if more than 10,000 m^3. Analysis to include metals, TRH, BTEX, PAHs, OCP, PCBs, asbestos (500 mL). • Material under NSW EPA Resource Recovery Exemptions (Recycled Materials): 1 sample per 70 m^3, analysis to include metals, TRH, BTEX, PAHs, and asbestos (500 mL). In addition to those required under the applicable exemption. • Growing Media (Accessible Soils): 1 per 100 m^3 with a minimum of 3 per source site. Analysis to include metals, TRH, BTEX, PAHs, OCP, PCBs, asbestos (500 mL) and pH.	The Auditor notes that imported material must either be VENM (including quarried material), ENM or be classified under a Resource Recovery Exemption. The density of testing would need to be commensurate with the documentation provided and the consistency of the results.
Interim Site Management Plan (before remediation) No interim measures documented in the RAP.	Adequate given that there are currently minimal opportunities for access to soils.
Unexpected Finds An unexpected finds procedure is presented in Section 7.1 of the RAP, including ceasing works, assessing the find and remediating the find if required.	Adequate.
Site Management Plan (operation phase) including stormwater, soil, noise, dust, odour and OH&S No site management plan has been included within the RAP however Section 8 provides site management information required to be presented in a construction environmental management plan (CEMP).	Minimum requirements to be included in the CEMP as listed in the RAP are adequate.
Contingency Plan if Selected Remedial Strategy Fails Other than unexpected finds, the RAP does not identify specific contingency plans if the remedial strategy fails. The remedial strategy has a low risk of failure, as surplus material would lead to offsite disposal. Contingency procedures are provided for unexpected finds and asbestos.	In the Auditor's opinion, the procedure for handling unexpected finds, which includes stopping work and identification of materials is appropriate and practical and can be implemented within the proposed remediation strategy.
Contingency Plans to Respond to Site Incidents The RAP does not identify specific potential site incidents or present emergency preparedness and emergency contact details.	The Auditor notes that the RAP includes a requirement for development of a Work Health and Safety Plan and CEMP by the remediation contractor prior to remediation works commencing.

Remedial Action Plan	Auditor Comments
Remediation Schedule and Hours of Operation No hours of operation or remediation schedule are presented in the RAP however the RAP indicates that a CEMP is required which will include hours of operation.	Adequate
Licence and Approvals Due to the state significant development status of the proposed redevelopment, the remediation works are classified as Category 1 Remediation Works as per the meaning provided in SEPP 55 and will require development consent under the *Environmental Planning and Assessment Act 1997*. In the event asbestos impacts are identified, a licensed asbestos removalist and SafeWork notification regarding the scope of the removal works is required. If >10 m^2 non-friable (bonded) ACM is identified at the site, the appointed remediation contractor is required to obtain a site-specific permit approving the asbestos works from SafeWork NSW. An appropriately licensed landfill should be selected and the material tracked from the site to the landfill. Excess materials requiring offsite disposal shall be classified in accordance with EPA (2014) *Waste Classification Guidelines* or an appropriate exemption as created under the Protection of the *Environment Operations (Waste) Regulation 2014*.	Acceptable
Contacts/Community Relations Contacts are not provided in the RAP. The RAP indicates that a CEMP is required and Section 8.1.2 indicates that the CEMP is to provide project specific communication protocols, incorporating nomination of specific contact persons & details and requirements for communications/response register.	Adequate
Staged Progress Reporting The RAP does not indicate whether there will be a staged reporting process for the remedial works.	It is understood that the development works will be staged in order to allow the ongoing use of parts of the school.
Long Term Environmental Management Plan The RAP indicates that validation of the site as suitable for the proposed development will be contingent upon the implementation of an EMP to manage residual risks posed by contaminated material to future site users. Section 6.5 of the RAP provides an outline of what the EMP should contain.	The outline provided in the RAP provides an adequate management framework for the nature and extent of contamination although it does not indicate the legal enforcement mechanism of the EMP. The Auditor notes that the EMP could be made legally enforceable as part of the SSD conditions. It is not stated who will be responsible for ensuring implementation of the EMP. Once prepared, the EMP will be reviewed by the Auditor and will be documented in a Site Audit Report and Statement.

10.3 Auditor's Opinion

In the Auditor's opinion, the proposed remediation approach outlined in the RAP is considered appropriate, subject to the successful implementation of the RAP and the preparation of a validation report and Auditor review of an appropriate EMP to manage the capped contamination, including notification and enforcement mechanisms. One minor item in the RAP regarding the depth of marker layer around existing trees should be clarified before remediation commences.

11. COMPLIANCE WITH REGULATORY GUIDELINES AND DIRECTIONS

11.1 EPA Requirements

NSW EPA included a number of requirements in relation to contamination in their letter dated 28 April 2020. The details and status of these are outlined in Table 11.1.

Table 11.1: Status of NSW EPA Comments from Letter dated 28 April 2020

Reference	Detail	Status
1	The Applicant must engage an NSW EPA-accredited Site Auditor throughout the duration of works to ensure that any work required in relation to soil or groundwater contamination is appropriately managed.	Auditor engaged.
2	Prior to commencing with the remediation, the Applicant must submit Interim Audit Advice from the Site Auditor that advises that the site can be made suitable for the proposed use subject to the implementation of the Remediation Action Plan.	Auditor review documented in this IAA.
3	The applicant must adhere to the management measures in the Remediation Action Plan which were approved by the Site Auditor.	Auditor engaged to review remediation.
4	Any variations to the approved Remediation Action Plan must be approved in writing by the Site Auditor.	Scope of work not included in initial Auditor engagement however any variations can be reviewed by the Auditor.
5	If work is to be completed in stages, the Site Auditor must confirm satisfactory completion of each stage by the issuance of Interim Audit Advice/s.	Scope of work not included in initial Auditor engagement however if works are completed in stages, the works can be documented in an IAA or Section A SAS.
6	The Applicant must obtain a Section A1 Site Audit Statement - or a Section A2 Site Audit Statement accompanied by an Environmental Management Plan – from the accredited Site Auditor and submit it to the consent authority prior to commencement of operation. The Site Audit Statement must certify the site is suitable for the proposed use.	Auditor engaged to conduct this task.
7	Prior to operation, the applicant must obtain confirmation from the Certifying Authority in writing that the requirement of condition 6 has been met.	Not applicable to audit scope.

11.2 Auditor's Opinion

The documentation prepared to date has adequately addressed select EPA comments outlined above. It is assumed that the remaining items of the EPA comments will be addressed during the development stages of the project.

12. CONCLUSIONS AND RECOMMENDATIONS

Based on the information presented in the Douglas and JBS&G reports and observations made on site, competent implementation of the RAP should ensure that the site is suitable for its proposed use as a primary school (considered equivalent to 'residential with accessible soils' exposure scenario) via capping of fill, subject to compliance with a suitable long term EMP. The long term EMP will be required to maintain the integrity of the cap and manage risks associated with any potential future disturbance of fill material across the site.

To ensure legal enforceability of the EMP, the Auditor recommends that preparation and implementation of the EMP is included as a condition of consent.

One minor item in the RAP regarding the depth of marker layer around existing trees should be clarified before remediation commences. After successful implementation of the RAP, it is anticipated that a Site Audit Statement and accompanying Site Audit Report will be prepared assessing the suitability of the site for the proposed use, as well as assessing the long-term management requirements. Given the staged approach to remediation proposed, staged Site Audit Statements will likely be prepared.

* * *

Consistent with the NSW EPA requirement for staged 'signoff' of sites that are the subject of progressive assessment, remediation and validation, I advise that:

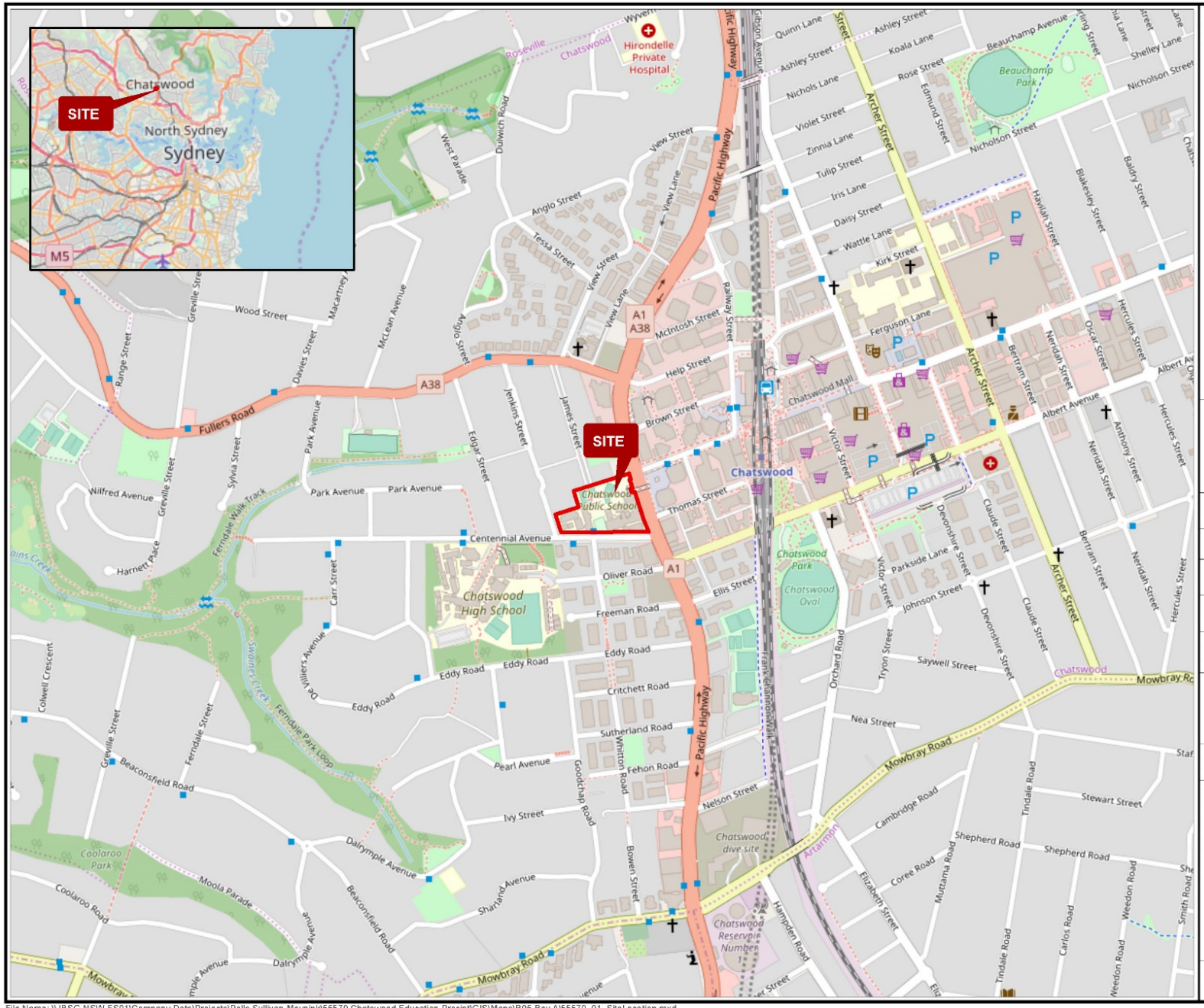
- This advice letter does not constitute a Site Audit Report or Site Audit Statement.
- At the completion of the remediation and validation I will provide a Site Audit Statement and supporting documentation.
- This interim advice will be documented in the Site Audit Report.

Yours faithfully
Ramboll Australia Pty Ltd

Rowena Salmon
EPA Accredited Site Auditor 1002

Attachments: 1 Site Locality Plan
2 Soil Sampling Location Plan
3 Proposed Development Plan

Attachment 1: Site Locality Plan



Legend:
Approximate Site Boundary

JBS&G

Job No: 55579

Client: Pells Sullivan Meynik

Version: R05 Rev A	Date 30/01/2020
Drawn By: AS	Checked By: SG

Scale 1:10,000

0 150 300
metres

Coord. Sys. GDA 1994 MGA Zone 56

5 Centennial Avenue
Chatswood, NSW

Public School

SITE LOCATION

FIGURE 1

File Name: \\JBSG-NSW-FS01\Company Data\Projects\Pells Sullivan Meynik\55579 Chatswood Education Precint\GIS\Maps\R05 Rev A\55579_01_SiteLocation.mxd

Attachment 2: Soil Sampling Location Plan

Legend:
- Approximate Site Boundary
- Historical Sample Locations (DP 2018)
- Sample Locations (JBS&G 2019)

JBS&G

Job No: 55579	
Client: Pells Sullivan Meynik	
Version: R05 Rev A	Date 30/01/2020
Drawn By: AS	Checked By: SG
Scale 1:850	

0 10 20
metres

Coord. Sys. GDA 1994 MGA Zone 56

5 Centennial Avenue
Chatswood, NSW

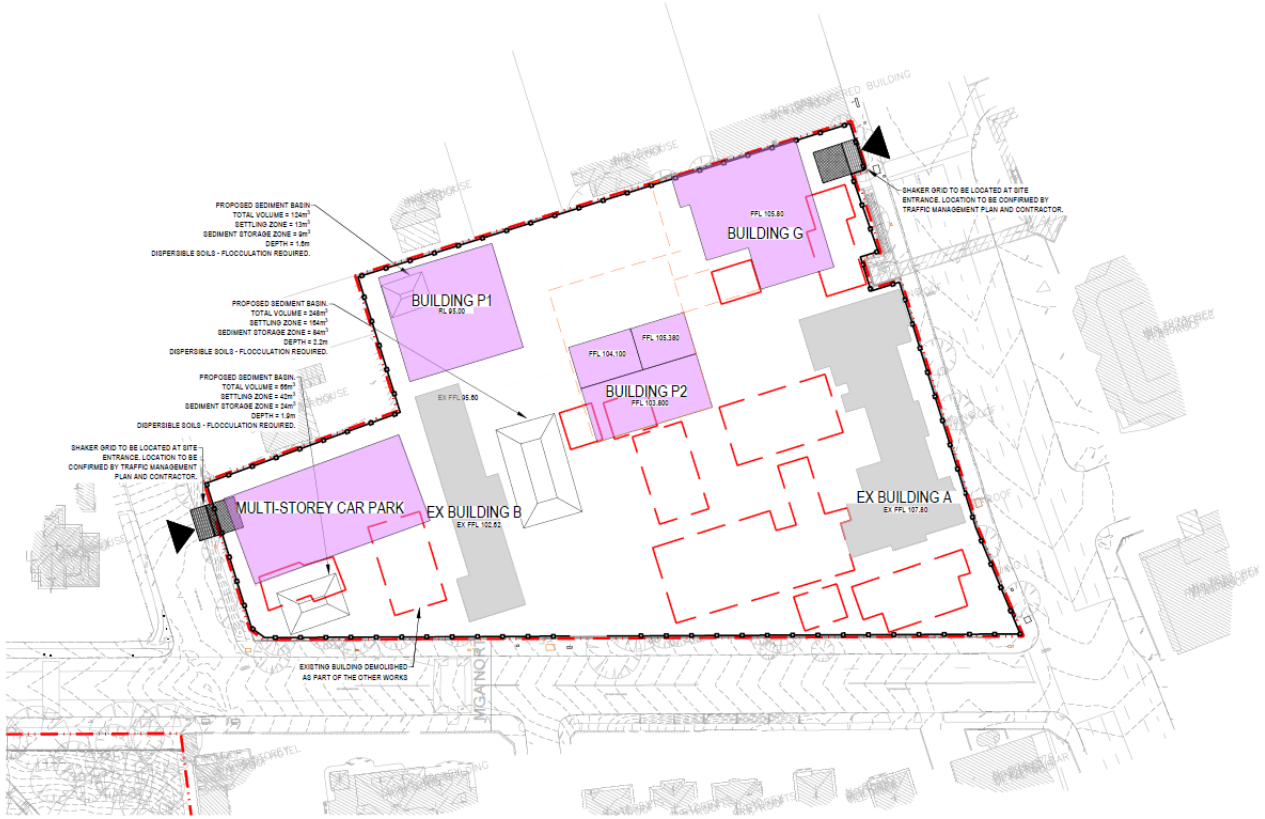
Primary School

HISTORICAL SOIL SAMPLE LOCATIONS

FIGURE 4A

File Name: N:\Projects\Pells Sullivan Meynink\55579 Chatswood Education Precint\GIS\Maps\R05 Rev A\55579_04a_SampleLocations.mxd
Reference: Nearmap - nearmap.com.au - Imagery 21-01-2020

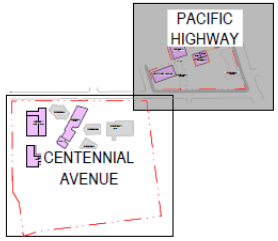
Attachment 3: Proposed Development Plan



LEGEND

- PROPOSED SITE BOUNDARY
- VEHICLE SHAKEDOWN DEVICE
- PROPOSED SILT FENCE
- PROPOSED SWALE
- EXISTING BUILDING TO BE DEMOLISHED
- EXISTING DEMOUNTABLE TO BE REMOVED
- SITE ENTRY POINT

NOTE:
REFER DRAWING CH376-01 FOR EROSION AND SEDIMENT CONTROL DETAILS



KEY PLAN
N.T.S

1:500 10 5 0 10 20 A1
1:1000 A3

REV	DESCRIPTION	DRAWN	APP'D	DATE
H	95% SD FOR COORDINATION	CPO	RET	13.03.20
G	SSDA ISSUE	CPO	RET	11.03.20
F	DRAFT SSDA	CPO	RET	28.02.20
E	DRAFT SSDA	CPO	RET	27.02.20
D	DRAFT SSDA	CPO	RET	18.02.20
C	ISSUED FOR SSDA	CPO	RET	11.12.19
B	ISSUED FOR INFORMATION	CPO	RET	29.04.19
A	ISSUED FOR INFORMATION	CPO	RET	27.03.19

DRAWN:	CPO
DESIGNED:	RET
VERIFIED:	... ../../..
APPROVED FOR TENDER:	... ../../..
APPROVED FOR CONSTRUCTION:	... ../../..

ARCHITECT/CLIENT

UPGRADES TO CHATSWOOD PUBLIC SCHOOL AND CHATSWOOD HIGH SCHOOL
PROJECT

EROSION AND SEDIMENT CONTROL PLAN - PACIFIC HIGHWAY
TITLE

40623-SD-BX-C0710.dwg

WSP
WOOD & GRIEVE ENGINEERS
Stantec

FOR APPROVAL
NOT FOR CONSTRUCTION

AS SHOWN	40623	SD-BX-C0710	I
SCALE @ A1	PROJECT No	DRAWING No	REV

27/03/2020 6:05:01 PM