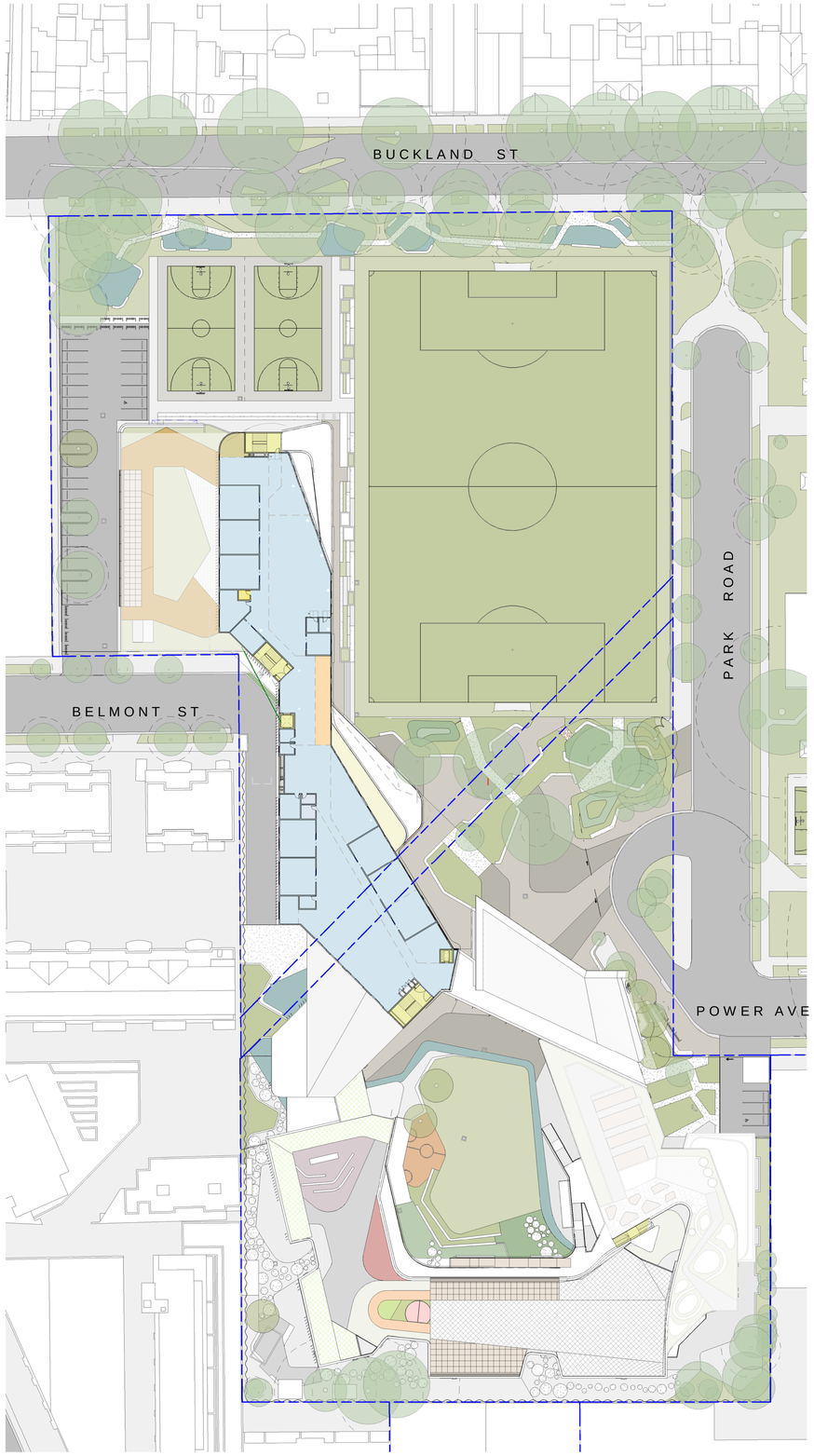
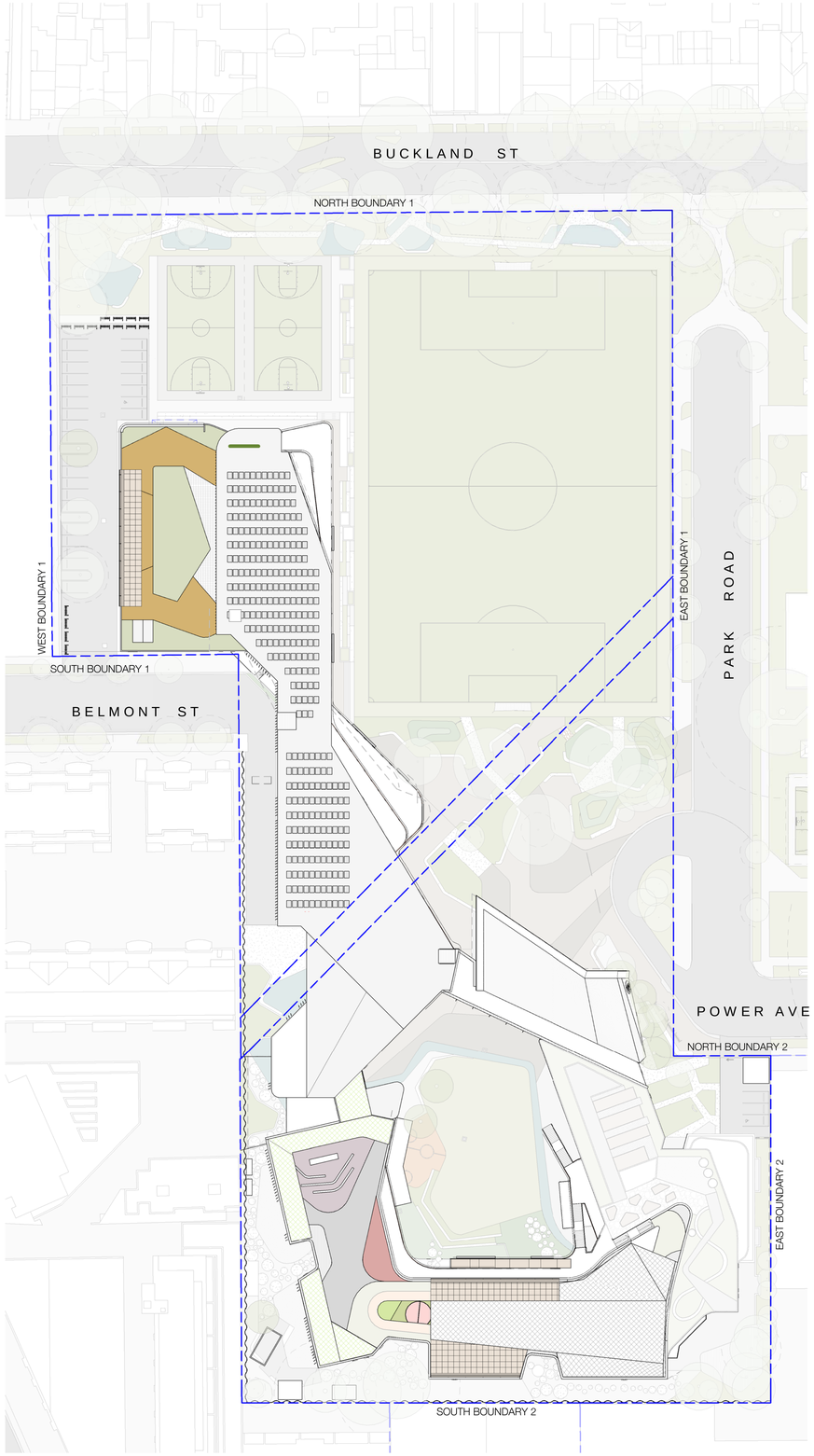


1 FOURTH FLOOR - CAMPUS PLAN
1 : 500



2 ROOF PLAN - 1 to 500
1 : 500

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Rev	Date	Description	Checked	Auth.
P1	01.12.17	Issue For Test of Adequacy	AH	AK

NOT FOR CONSTRUCTION

Project
ALEXANDRIA PARK COMMUNITY SCHOOL

Drawing Title
CAMPUS PLANS - FOURTH FLOOR AND ROOF

Proj. Dir	Proj. Arch	Drawn
AK	AH	BO/HC
Job No.	**Sheet**	**Scale**
161044	B1	1 : 500

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Appendix B – Data Quality Objectives

DATA QUALITY OBJECTIVES

Step 1 – State the Problem

TKD, on behalf of DoE is proposing to redevelop the site and build new school facilities as detailed within Appendix A. Previous investigations have identified soil contamination at the site comprising non-friable (bonded) asbestos widespread lead within fill across the site. A dis-used UST (and possible associated infrastructure as part of a UPSS) has also been identified within the site.

The overall objective is to assess if the remediation areas have been made suitable for the proposed uses.

Step 2 - Identify the Decisions

The decisions to be made based for validation will be as follows:

- Has the identified soil contamination at the site been remediated and / or managed to a level suitable for the proposed passive land use as a school?
- Has imported material been validated as suitable for the proposed land use?
- Has surplus materials, if any, removed from site been disposed to a landfill lawfully licenced to receive such material?

Step 3 - Identify Inputs in the Decision

The inputs required to make the above decisions will be as follows:

- Current understanding of site's current and historical uses.
- Results and findings of previous investigations and assessments.
- Information from the RAP outlining the nature and extent of impacted soils requiring remediation.
- Remediation acceptance criteria (RAC).
- Description and name of the marker layer used.
- Visual observations.
- Photographs.
- Laboratory analytical results and/or VENM/ENM certificates.
- Topographical survey data and site plans for the marker layer, finished levels and proposed fence.
- Waste disposal dockets and truck registers.
- Outcome of quality assessment of relevant data.

Step 4 - Define Boundaries of the Study

The location of the site is shown on the figures attached. The lateral extent of capping will be the entire site.

Step 5 - Develop a Decision Rule

<u>Imported Soils & UPSS</u>

Soil will be imported to the site for backfilling, grading and landscaping purposes. Imported soil will be required to be excavated natural material (ENM) or virgin excavated natural material (VENM) and have appropriate certification in accordance with the NSW EPA ENM/VENM exemption and order. If a certificate cannot be provided or the integrity of the certificate is questionable, then a visual inspection and sampling of the proposed material will be undertaken at the source. Sampling, analysis and validation criteria requirements are outlined in within the RAP. VENM assessment at the source would also be subject to a site history assess whether any activities (historic or current) undertaken at the site may potentially have caused contamination of the source material.

If the results of the analytical data quality control assessment to meet data quality indicators, then the data will be deemed suitable for the purposes of the assessment. In this regard, data will be assessed against completeness, comparability, representativeness, precision and accuracy; and

Soil analytical data shall be compared to the assessment criteria in Table 12.2. If the following statistical criteria are satisfied, then no further assessment or remedial action is considered necessary:

- Either: the reported concentrations in all samples are below the site criteria,
- OR: no single analyte concentration exceeded 250% of the adopted site criterion; and the standard deviation of the results was less than 50% of the site criterion, AND: the 95% Upper Confidence Limit (UCL) of the arithmetic mean concentration for each analyte was below the adopted site criteria.

If the above statistical criteria were not satisfied, further assessment or remedial action is required.

Capped Areas

In the event that contaminated soil cannot be effectively capped or access restricted (i.e. a fence), then a risk-based approach of residual contamination will be required to assess the exposure risk and whether alternative means of remediation or management is required. If asbestos-containing material is visually observed during a visual clearance inspection then it will be required to be removed from that area or capped, and the visual clearance inspection repeated.

If topographic survey data cannot be provided then intrusive investigation will be required to be carried out to confirm the depth of capping and a visual inspection carried out to confirm the presence of the marker layer and presence of the fence.

Removal of Site Soils

If disposal dockets are not provided by the remedial contractor then the landfill will be contacted directly for assistance. If disposal dockets cannot be obtained then the NSW EPA will require notification as a breach of the POEO Act may have occurred.

If the quality control (QC) results meet the data quality indicators (DQI), then the analytical data is considered suitable and reliable for the purpose of this contamination investigation.

Step 6 - Specify the performance or acceptance criteria

There are two types of decision errors:

- Sampling errors, which occur when the samples collected are not representative of the conditions within the investigation area; and
- Measurement errors, which occur during sample collection, handling, preparation, analysis and data reduction.

The null hypothesis, which is an assumption assumed to be true in the absence of contrary evidence, for this validation assessment will be ‘Contamination at the site has not been effectively remediated and/or managed and therefore is not suitable for use’.

These errors may lead to the following decision errors:

- Type I error - Rejecting the hypothesis as false when it is really true: Deciding that effective remediation/management has occurred when the reverse is true; and
- Type II error - Accepting the hypothesis as true when it is really false: Deciding that effective remediation/management has not occurred when the reverse is true.

An assessment will be made as to the likelihood of a decision error being made based on the results of a QA/QC assessment and the closeness of the data to assessment criteria. Additionally, statistical methods such as 95% Upper Confidence Limit (UCL) calculations may be utilised, where applicable.

The acceptable limits on decision errors applied during this investigation and the manner of addressing possible decision errors were developed based on the data quality indicators (DQIs) of:

- Accuracy: a quantitative measure of the closeness of reported data to the true value;

- Comparability: a qualitative parameter expressing the confidence with which one (1) data set can be compared with another;
- Completeness: a measure of the amount of useable data (expressed as %) from a data collection activity;
- Representativeness: the confidence (expressed qualitatively) that data are representative of each media present on the site; and
- Precision: a quantitative measure of the variability (or reproducibility) of data.

Step 7 - Optimise the Design

The purpose of this step was to identify a resource-effective data collection design for generating data that satisfies the DQOs.

To ensure the design satisfied the DQOs, DQIs (for accuracy, comparability, completeness, precision and reproducibility) have been established to set acceptance limits on field methodologies and laboratory data collected.

DATA QUALITY INDICATORS

A summary of the field and laboratory DQIs for the validation assessment are provided in the table below.

Summary of DQIs

Field Considerations	Laboratory Considerations	Comments
Accuracy (bias)		
Are SOPs appropriate and complied with? Has sampling equipment been calibrated?	Analysis of:	Bias introduced:
	Trip blanks;	By chemicals during handling or transport;
	Rinsate blanks;	From contaminated equipment;
	Reagent blanks;	From contaminated reagent;
	Method blanks;	During laboratory analysis;
	Matrix spikes;	During laboratory preparation and analysis (may be high or low);
	Surrogate spikes;	During laboratory preparation and analysis (may be high or low);
	Reference material;	Precision of preparation of analytical method;
	Laboratory control samples;	Precision of preparation of analytical method;
Comparability		
Number of sampling rounds Same methodologies and SOPs used on each occasion. Experienced sampler and same sampler. Climatic conditions (temperature, rainfall, wind).	Sample analytical methods used (including clean-up). Laboratory practical quantification limits (PQL) or limit of reporting (LOR) (justify /quantify if different).	Same approach to sampling (WIs, holding times). Quantify influence from climatic or physical conditions. Samples collected, preserved, handled in same manner (filtered, same containers).

Field Considerations	Laboratory Considerations	Comments
Same types of samples collected (filtered, size fractions).	Same laboratories (justify /quantify if different). Same units (justify /quantify if different).	

Field Considerations	Laboratory Considerations	Comments
Completeness		
Critical locations sampled. Critical depths sampled. SOPs appropriate and complied with. Experienced sampler. Documentation correct including COCs.	Critical samples analysed in accordance with the RAP. Analytes sampled in accordance with scope of works. Appropriate methods and PQL/LORs. Sample documentation correct. Sample holding times complied with.	The required percentage completeness should be specified in the scope of works. Required data must be obtained from critical samples and CoPC. Incompleteness is influenced by: Field performance problems (access problems, difficulties on site, damage); Laboratory performance problems (Matrix interference, invalid holding times); and Matrix problems.
Representativeness		
Appropriate media sampled according to the field program. Media in the field program sampled. Samples properly and adequately preserved Samples in proper custody between the field and reaching the laboratory	Samples analysed according to the RAP.	Samples must be collected to reflect characteristics of each medium. Sample analysis must reflect properties of field samples. Homogeneity of the samples. Appropriate collection, handling, storage and preservation. Detection of laboratory artefacts, e.g. contamination blanks.
Precision		
Field program appropriate and complied with.	Analysis of:	
	Laboratory and inter-laboratory duplicates; and	Measured by the coefficient of variance or standard deviation of the mean or Relative Percentage.
	Field duplicates.	Field duplicates measure field and laboratory precision Difference (RPD) calculations. Variation in RPDs can be expected to be higher for organics, low concentrations (<5 x laboratory PQL/LOR) or non-homogenous samples.

Acceptable limits adopted for data quality indicators for this assessment are outlined in the table below.

Acceptable Limits

Item	Acceptable Limit
Analysis of intra-laboratory duplicates and inter-laboratory duplicates.	Intra-laboratory duplicate samples: Rate of 1:10 (10%) primary soil samples for the same analysis of primary samples; Inter-laboratory duplicate samples: Rate of 1:20 (5%) primary soil samples for the same analysis of primary samples; Calculation of relative percentage differences between primary and duplicate samples. RPD results for soil samples: • 200% (where the average concentration is 0-10 x laboratory PQL); • 50% (where the average concentration is 10-20 x laboratory PQL); and • 30% (where the average concentration is > 20 x laboratory PQL). RPDs will be considered where a concentration is greater than 10 times the PQL/LOR.
Analysis of rinsate blanks	Rate of one (1) sample per batch of soil sampling (where re-usable sampling equipment was used); and Results less than the laboratory PQL/LOR.
Analysis of laboratory prepared trip blanks and trip spikes	Rate of one (1) sample per batch for soil samples where volatiles are analysed; and Results less than the laboratory PQL/LOR.
Analysis of laboratory blanks, surrogates, reference and control samples (soil, groundwater and soil vapour)	The laboratories will be required to conduct their own internal quality program for assessment of the repeatability of the analytical procedures and instrument accuracy under their NATA accreditation. This will include analysis of laboratory blank samples, duplicate samples, spike samples, control samples and surrogate spikes. The laboratory QA/QC procedures and results will be described within the laboratory reports. The laboratory internal QA/QC sample results will be reviewed for comparison with the laboratory's NATA guidelines and Schedule B3 of ASC NEPM 2013.
Laboratories and methods used	National Association of Testing Authorities accredited for the method. Methods should be in accordance with amended ASC NEPM.
Holding times	Samples should be analysed within recommended holding times.
Sample PQL/LORs	Results less than the adopted assessment criteria; justify/quantify if different.

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Appendix C – Validation Criteria

Health investigation levels (HILs)

HILs relevant to a residential land use will be adopted from amended ASC NEPM.

HILs are deemed applicable for assessing human health risk via all relevant exposure pathways of exposure for metals and organic substances. HILs are concentrations below which contaminants in soils are not considered to adversely affect human health. The adopted HILs for validation of imported soil are outlined in the table below.

Adopted Soil HILs

Analyte	Adopted HILs Residential (HIL A) (mg/kg)
Arsenic	100
Cadmium	20
Chromium	100
Copper	6,000
Lead	300
Mercury	40
Nickel	400
Zinc	7,400
Carcinogenic PAHs (as BAP TEQ)*	3
Total PAHs	300
DDT+DDE+DDD	240
Aldrin and dieldrin	6
Chlordane	50
Endosulfan	270
Endrin	10
HCB	10
Heptachlor	6
Methoxychlor	300
PCBs	1

Source: Amended ASC NEPM

*Benzo(a)pyrene toxicity equivalent quotient (TEQ) is calculated by multiplying the concentration of each carcinogenic PAH in the sample by its benzo(a)pyrene toxicity equivalence factor (TEF) and summing these products.

Health screening levels (HSLs)

Soil HSLs will be adopted from Table 1A(3) of the ASC NEPM for vapour intrusion. The soil HSLs from the CRCCARE 2011 will be used to assess the exposure pathway of direct contact (oral ingestion, dermal contact and dust inhalation) for commercial/industrial users and intrusive maintenance workers.

As a conservative approach, a sandy soil type and depth of 0-<1 m will be adopted. Workers working in deeper excavations are anticipated to have their own management plan as part of the work, health and safety procedures. The HSLs adopted are presented in the tables below.

Adopted Soil HSLs for Vapour Intrusion and Direct Contact

Analyte	Adopted soil HSLs (mg/kg)			
	Commercial/Industrial (HSL-D)[1]	Residential (HSL-A)[2]	Direct Contact (commercial/Industrial)[3]	Intrusive Maintenance Worker[4]
Benzene	3	0.5	430	77
Toluene	NL	160	99,000	NL
Ethylbenzene	NL	55	27,000	NL
Xylenes	230	40	81,000	NL
Napthalene	NL	3	11,000	NL
F1 (TRH C_6-C_{10}-BTEX)	260	45	-	-
F2 (TRH C_{10}-C_{16}-Napthalene)	NL	110	-	-
TRH C_6-C_{10}	-	-	26,000	NL
TRH >C_{10}-C_{16}	-	-	20,000	NL
TRH >C_{16}-C_{34}	-	-	27,000	-
TRH >C_{34}-C_{40}	-	-	38,000	-

Notes:

NL: Non-limiting

Source: CRCCARE 2011

[1] ASC NEPM (2013), Table 1A(3)
[2] ASC NEPM (2013), Table 1A(3)
[3] CRC Care Technical Report 10 (2011), Table 4
[4] CRC Care Technical Report 10 (2011), Table A3

Ecological investigation levels

Ecological investigation levels relevant to an urban residential and public open space land use will be adopted from ASC NEPM 2013.

Ecological Investigation Levels (EILs) have been developed for selected metals and organic substances and are applicable for assessing potential risk to terrestrial ecosystems. EILs depend on specific soil physicochemical properties and land use scenarios and generally apply to the top 2 m of soil. Generic EILs for aged arsenic, fresh dichlorodiphenyltrichloroethane (DDT) and fresh naphthalene will be adopted. EILs were calculated for copper, chromium (III), nickel, lead and zinc based on the sum of estimated conservative ambient background concentrations (ABC) and a range of added contaminant limits (ACL).

The ABC of a contaminant is the soil concentration in a specified locality that is the sum of the naturally occurring background level and the contaminant levels that have been introduced from diffuse or non-point sources by general anthropogenic activity not attributed to industrial, commercial, or agricultural activities, for example, motor vehicle emissions. Predicted ABCs will be adopted from Table 16 in Schedule B5b of the amended ASC NEPM based on the average of reported soil iron concentrations at the site.

An added contaminant limit (ACL) is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required. ACLs are based on the soil characteristics of pH, CEC and clay content. A generic ACL will be adopted for lead while a range of ACLs will be adopted for chromium, copper, nickel and zinc

Adopted EILs for validation of imported soil are outlined in the table below.

Adopted EILs

Analyte	Adopted EILs Urban, Residential and Public Open Space (mg/kg)
Arsenic	100
DDT (fresh)	180
Naphthalene (fresh)	170
Chromium	193 - 565
Nickel	31 - 616
Lead	1,100
Copper	97 - 840
Zinc	73 – 1,362

Source: Amended ASC NEPM

Ecological screening levels

ESLs are concentrations of contaminants above which further appropriate investigation and evaluation will be required. They were developed for select petroleum hydrocarbons; they depend on specific soil physicochemical properties and land use scenarios and generally apply to the top 2 m of soil (amended ASC NEPM). As a conservative approach, ESLs for coarse grained soils will be adopted as outlined in the table below.

Adopted ESLs

Analyte	Adopted ESLs Urban, Residential and Public Open Space (mg/kg)
TPH C6-C10 less BTEX	180
TRH >C10 - C16 less Naphthalene	120
TRH >C16-C34	300
TRH >C34-C40	2,800
Benzene	50
Toluene	85
Ethylbenzene	70
Xylenes	105
Benzo(a)pyrene	0.7

Source: Amended ASC NEPM

Petroleum hydrocarbon management limits

Petroleum hydrocarbon management limits provided in the amended ASC NEPM were considered applicable for assessing petroleum hydrocarbons in soil to avoid or minimise the following potential effects of petroleum hydrocarbon contamination:

- Formation of observable light non-aqueous phase liquid (LNAPL);
- Fire and explosion hazards;
- Effects on buried infrastructure (i.e. penetration of, or damage to, in-ground services by hydrocarbons); and
- Aesthetics.

Management limits for a residential, parkland and public open space land use with coarse soil texture will be adopted for validation of imported soil as outlined in the table below.

Adopted TRH Management Limits

Analyte	Adopted TRH Management Limits (mg/kg)
TRH C6-C10 less BTEX	700
TRH >C10-C16 less naphthalene	1,000
TRH >C16-C34	2,500
TRH >C34-C40	10,000

Source: Amended ASC NEPM

Criteria relevant to: Coarse soil texture

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Appendix D - Induction Register

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Name	Company	Date	Signature	Inducted by

Name	Company	Date	Signature	Inducted by

Name	Company	Date	Signature	Inducted by

Appendix E - Conceptual Site Model

Table A: Summary of plausible exposure pathways for human receptors

Source	Media	Plausible Exposure Pathway (No Mitigation)							Receptors	Discussion
		Vapour Inhalation (indoor)	Vapour Inhalation (outdoor)	Dust/fibre Inhalation	Ingestion	Dermal Contact	Vertical/lateral migration	Preferential pathway migration		
Fill (Asbestos & Lead)	Soil	n	n	**P**	p	p	NA	NA	Current/Future School Site Users	Fragments of Bonded ACM were identified within the fill throughout the site during intrusive investigations, and during contractor construction works in the temporary pop up school site. The materials identified in the DSI did not exhibit significant signs of excessive weathering, indicating there is a lower potential for significant proportion of asbestos fines. Bonded ACM in good condition present a low risk to current and future school users, where the Bonded ACM remains in such conditions. Damage to fragments of Bonded ACM (e.g. during construction or future maintenance events) has the potential to release fibres that may increase risks to school users and teaching staff. Lead was detected at levels exceeding the HIL A (residential) criteria in TP3 0.4-0.6. The lead potentially derives from paints on demolition materials observed within the fill at this location. The sample was collected from approximately 0.5m bgs and as such is not considered to currently present an unacceptable risk to school students, however if soils are overturned/mixed during site development, elevated concentrations of lead may pose an increased health risks to school students via inhalation, dermal and ingestion pathways.

										The risk is considered low to current and future students (depending on the site development activities in the vicinity of TP3).
		n	n	**P**	n	n	NA	NA	Construction Workers during redevelopment & existing and future sub-surface Maintenance Workers	Construction and future maintenance workers conducting subsurface excavations may be exposed to contaminated fill materials containing asbestos via inhalation of dust/fibres. Information from previous investigations reveal the ACM is bonded and generally in good condition. Bonded ACM in good condition does not present an inhalation risk, however if disturbed during the construction process, the ACM may be damaged and has the potential to release fibres. The level of lead detected within TP3 did not exceed the Tier 1 screening criteria for commercial/industrial, and thus is not considered to represent a health risk to construction/maintenance workers within the site.
		n	n	**P**	n	n	NA	NA	Users of Adjoining land	Users of adjoining land may be exposed to contaminated fill during site redevelopment activities if dusts and/or fibres were to become airborne and migrate offsite.
		n	n	**P**	n	n	NA	NA	Trespassers or Visitors of the site	Trespassers or visitors to the site may come into contact with fill material in unsealed areas that are contaminated with asbestos where dusts and/or fibres become airborne. Trespassers or visitors are unlikely to come into dermal contact with fill for prolonged periods of times.
UPSS (Hydrocarbons)	Soil & Groundwater	n	n	n	n	n	NA	NA	Current/Future School Site Users	Based on the proposed development layout drawings provided in Appendix A, the exposure pathway from potential hydrocarbon contamination relating to the UPSS is not considered to be present, however hydrocarbons may be present within soil and groundwater directly beneath the UPSS.

										No school buildings are proposed to be built on top of the location of the UPSS, and the soil vapour investigation conducted down-hydraulic gradient of the UPSS did not identify the presence of hydrocarbon vapours that would present an unacceptable risk to current/future school site users. Additionally, school site users are unlikely to come into contact with groundwater.
		n	**P**	n	n	**P**	NA	NA	Construction Workers during redevelopment & Future sub-surface Maintenance Workers	The DSI and vapour investigation did not identify widespread groundwater or soil hydrocarbon contamination within the site, however due to access issues during the construction of the pop-up school, sub-surface conditions in the vicinity of the UPSS could not be assessed. If localised hydrocarbon contamination of soil and groundwater is present around the UPSS, construction workers digging trenches, or removing the UPSS may be exposed to hydrocarbon contamination via the vapour inhalation pathway (when working within a trench only) or via the dermal pathway (if incorrectly handling hydrocarbon impacted soils).
		n	n	n	n	n	NA	NA	Users of Adjoining land	It is assessed that no exposure pathway for users of the adjoining land from impact on the site. The soil vapour investigation conducted down-hydraulic gradient of the UPSS, and the down gradient monitoring well (MW1) did not identify the presence of hydrocarbon vapours that would present an unacceptable risk to users of the adjoining land.
		n	n	n	n	n	NA	NA	Trespassers or Visitors of the site	It is assessed that no exposure pathway for trespassers or visitors to the site.

Notes:

P = plausible complete pathways

p = partially complete pathway depending on site conditions/exposure scenario

n = pathway not complete

NA = not applicable

Notes: