Appendix I – Muirhead North Stage 1 Preliminary Site Investigation
(EcOz 2015)
Muirhead North:
Stage 1 Preliminary Site Investigation

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Executive Summary

A Stage 1 Preliminary Site Investigation was undertaken on behalf of Defence Housing Australia (DHA) to assess the potential for the presence of soil contamination on a ‘greenfield’ site intended for future residential development. The site, referred to as Muirhead North, comprises Lot 9370, Town of Nightcliff.

The primary objective of the assessment was to identify the potential for site contamination, identify and quantify likely risks, and recommend further investigations (if necessary). In accordance with the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) and Australian Standard AS4482.1-2005, EcOz undertook the following scope of works:

- Development of a site history including review of historical aerial photographs, historical titles, planning certificates and contaminated land register
- Discussions with local people familiar with the site and surrounding site uses
- Desktop review of local hydrogeological and geological conditions
- Detailed site inspection and description, including confirmation of adjacent land use and potential offsite sources of contamination.

EcOz undertook a site inspection on 1 April 2015 to collate as much visual and documentary (i.e. site-based records) information as possible regarding the site and immediately surrounding properties. The following factors were assessed:

- Local topography
- Surface water flow direction(s), surface water bodies and/or areas of ponding
- Current and remnant site infrastructure
- Site use activities
- Evidence of surface soil contamination, imported fill material(s), stockpiles, waste and/or stressed vegetation
- Presence of asbestos building materials

The desktop review revealed that the site has always been Vacant Crown Land. A large proportion of the project area was cleared and borrowed prior to 1970, which has largely re-grown and the remainder is relatively undisturbed bush land. There have been no known significant developments, with the main potential sources of contamination being from illegally dumped materials (e.g. hydrocarbons, asbestos).

Illegally dumped household rubbish, car bodies, soil piles and building materials (i.e. steel, concrete, etc) were observed in some areas, which were mainly concentrated near access tracks, particularly in the western section of the site. A small amount of asbestos containing material (ACM) was observed at one location.

Based on a review of the available desktop information and observations made during the site inspection, it is concluded that:

- It is unlikely that there is any extensive contamination with ACM as only a few small fragments were observed at a single location
- It is possible that additional areas of minor ACM contamination could be present that were not identified due to the heavily-vegetated state of the site at the time of the inspection
- There was no evidence of hydrocarbon contamination associated with dumped vehicles and rubbish, and no other potential contaminants were identified
- There is no indication or evidence of likely contamination within the project area and therefore a Stage 2 Detailed Site Investigation is not considered necessary.

It is recommended that in the event ACM is uncovered during the development of the site, a suitably qualified asbestos removal contractor be engaged.
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# Appendices

Appendix A – Site Photographs
1 Introduction

1.1 Purpose

This Stage 1 Preliminary Site Investigation was undertaken on behalf of the Defence Housing Australia (DHA) to assess the potential for the presence of soil contamination on a ‘greenfield’ site intended for future residential development. Referred to as ‘the site’ throughout this report, the Muirhead North proposed development area comprises Lot 9370, Town of Nightcliff.

The primary objective of this Stage 1 Preliminary Site Investigation was to identify the potential for site contamination, identify and quantify likely risks, and recommend further investigations (if necessary).

1.2 Scope

The first step of the contaminated land assessment process, as specified by the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) and Australian Standard AS4482.1-2005, involves the completion of a site history review (also identified as a Preliminary Site Investigation or Phase 1 Environmental Site Assessment).

Under the guidance of the NEPM, EcOz undertook the following scope of works:

- Development of a site history including review of historical aerial photographs and contaminated land register
- Discussions with local people familiar with the site and surrounding site uses
- Desktop review of local hydrogeological and geological conditions
- Detailed site inspection and description, including confirmation of adjacent land use and potential offsite sources of contamination.

A site inspection was undertaken by EcOz on 1 April 2015, to collate as much visual and documentary (i.e. site-based records) information as possible regarding the site and immediately surrounding properties. The following factors were assessed:

- Local topography
- Surface water flow direction(s), surface water bodies and/or areas of ponding
- Current and remnant site infrastructure
- Site use activities
- Evidence of surface soil contamination, imported fill material(s), stockpiles, waste and/or stressed vegetation
- Presence of asbestos building materials (ACM)
2 Site Identification

The Muirhead North site is legally identified as Lot 9370, Town of Nightcliff.

The area proposed for future residential development comprises 51 ha of land on the Lee Point peninsula, approximately 13 km north of the Darwin CBD (Figure 2-1). The area is bounded by Lee Point Road to the west, Buffalo Creek to the east, Lee Point Caravan Park to the north and the existing suburb of Muirhead to the south.

Figure 2-1. Map showing location of Muirhead North
3 Site Setting

3.1 Topography and hydrology

The western section of the site comprises gentle lower slopes (0.5-1.5 % slope), which drain in a south-easterly direction into broad lowland plains (<0.5 – 1.0 % slope). A drainage line enters the site in the north-west corner and flows to the south-east into the Buffalo Creek catchment and into Shoal Bay (Darwin Harbour) (Figure 3-1).

3.2 Geology

The 1:250,000 Geological Survey of the Northern Territory (2006 edition) (Northern Territory Geological Survey) indicates that the site is located on fractured and weathered rock, which consists of shale, greywacke and sandstones and is part of the Cretaceous Darwin Formation. In addition, more recent Tertiary Laterite Gravel and Quaternary Coastal Alluvial (comprising mud, silt and clay) may also be present (Figure 3-2).

3.3 Hydrogeology

Aquifers underlying the site occur in fractured and weathered rock (Figure 3-3), and groundwater flow paths would likely follow the land contours, which is generally towards the south-east. There are several historical groundwater bores located within 1 km of the site (Figure 3-3), and bore logs downloaded from the NT Governments ‘NR Maps’ online database indicate that groundwater quality is slightly saline, with circum-neutral pH and high concentrations of dissolved ions. Bore logs indicate that groundwater strikes generally occur at a depth of around 50 m below ground level, although no information on standing water levels is available.

3.4 Acid sulfate soils

Acid sulfate soils in the Darwin region are generally located within coastal zones associated with tidal estuaries (Hill and Edmeades 2008). According to acid sulfate soil risk mapping the nearest potential occurrence of acid sulfate soils would be in the Buffalo Creek catchment, approximately 300 m from the eastern boundary of the site (Figure 3-4).

The QLD ASS Technical Manual (QLD Government 2014) (referenced by the NT Land Suitability Assessment Guidelines) indicates that “all disturbances to soils, groundwater hydrology or surface water drainage patterns in coastal areas below 5 m AHD should be investigated, designed and managed to avoid potential adverse effects from ASS.” This applies to areas where the ground level is above 5 m AHD but where excavation may occur to depths below 5 m AHD.

The contour data for the proposed development area indicates that the elevation ranges from 6 m AHD at the eastern boundary of the Muirhead North lot to a high point of 25 m AHD near Lee Point Road. On the lower lying eastern section of the Muirhead North lot elevations vary between 7 m to 13 m AHD approximately.

The risk of exposing ASS is considered to be low as no earthworks are proposed that will require excavation below 5 m AHD in any part of the proposed development area. Site assessment of ASS was not deemed necessary based on this information provided by SMEC (DHA’s engineering contractor).
Figure 3-1. Map showing local topography and drainage

Figure 3-2. Map showing local geology
Figure 3-3. Map showing local aquifers and historic groundwater bore locations

Figure 3-4. Map showing locations of potential occurrence of acid sulfate soils
4 Site History

4.1 Land tenure and zoning

The site is classified as Vacant Crown Land (Figure 4-1) and under an amendment to the NT Planning Scheme in October 2009, Lot 9370 Town of Nightcliff was zoned as Specific Use ‘...to facilitate the subdivision, use and development of the land as a residential estate...’(Figure 4-2).

Land to the north of the site includes Freehold land zoned as Caravan Park (CV) and Crown Lease Term zoned as Organised Recreation (OR). Land to the west includes Freehold land zoned as Commonwealth Land (no planning scheme – adjacent ‘2CRU’ site) and to the east includes Vacant Crown Land zone as Public Open Space (PS). Land to the south is Freehold land zoned as Specific Use, similar to the site.

![Map showing land tenure within and surrounding the site](image)

Figure 4-1. Map showing land tenure within and surrounding the site
4.2 Maps and aerial photography

Available aerial photography was interrogated in order to determine the site history, with available images including 1944, 1970, 1987 and 2012 (Figure 4-3). From the available aerial photography and topographic mapping (1:250 000), the following historical site land use observations can be made:

- Vegetation largely cleared and extensive borrowing of soil materials circa 1970, which has gradually re-grown without further substantial disturbance since that time. Appears from aerial photography that borrowed material was probably utilised in construction of Leanyer sewage treatment ponds, to the south-east of the site.

- Informal access tracks throughout

- No obvious infrastructure (e.g. buildings, concrete slabs) at any time.
Figure 4-3. Historical aerial photography of the site
4.3 **Previous and current land uses**

4.3.1 **Within site**

The existing land use within the site is undeveloped bush land, and it is understood that the area has always been Vacant Crown Land, with no formal land use. An inspection of the site (see below) indicated that the informal tracks within the site are used regularly for recreational off-road activities and illegal dumping (i.e. household rubbish, car bodies). As indicated in aerial photos, the site has been extensively borrowed in the past but has not been used for this purpose for some time, as evident in significant regrowth of native trees.

Military remnants in the form of several steel drums are located in the north-west corner of the site and a concurrent heritage assessment indicates that the site, referred to as the ‘Konfrontasi AA Site 1’ (KAS-1), was built ca1963 for stationing of the No. 121 light Anti-Aircraft Battery (Jung 2015).

4.3.2 **Surrounding areas**

Until recently, the land surrounding the site has had limited development. A caravan park was constructed to the north of the site in the mid 1980’s. Up until the 1990’s parcels of Commonwealth land to the west and south were used as air force communications facilities. This included a RAAF Transmission Facility to the west (i.e. known as ‘2CRU’ site) and aerial farm to the south, where the suburb of Muirhead has recently been developed.

4.4 **Potential contamination sources**

A search of the NT Environmental Protection Authority’s contaminated site register indicates that there are no recognised contaminated sites in the vicinity of the site.

Based on the surrounding land use (i.e. predominantly bush land, no heavy industry) and local drainage pathways, the only potential off-site sources of contamination could be the caravan park to the north and former defence communications facility to the west (2CRU). There is unlikely to be any sources of contamination entering the site from the caravan park and a previous site contamination assessment of the adjacent 2CRU parcel of land land did not identify anything that would render the site unsuitable (from a contamination perspective) for a residential end use (GHD 2010).

The main potential sources of contamination on site would be from illegally dumped materials (e.g. fill, hydrocarbons, asbestos).
5  Site Inspection

5.1  Areas inspected

A site inspection was carried out on 1 April 2015, which focussed on areas identified in the site history review as having had historical disturbance (i.e. borrow areas) and within 100 m of any informal access tracks, which are extensive throughout the site. Observations were made both on foot and from vehicle; driving slowly along the access tracks (Figure 5-1).

Figure 5-1. Map showing areas inspected and location of asbestos fragments

5.2  Infrastructure

No evidence of current or previous infrastructure was observed on site (e.g. concrete slabs), apart from the historic military gun emplacement at the north-western corner of the site, which consists of some steel drums and a small excavated area (see Section 4.3.1 for historical detail).

5.3  Wastes and fill materials

Some illegally dumped building materials were observed (i.e. concrete), including household rubbish (fridge, washing machine, etc) and car bodies observed in the western section of the site (i.e. closest to Lee Point Rd), where the majority informal access tracks are present (see Appendix A: Figures A1, A2, A7 and A12).
Extensive areas of mounded soil were observed on site, with many mounds having vegetation re-growth indicating a long period since the disturbance occurred (see Appendix A: Figure A8). In conjunction with reviewed historical aerial photos, it appears that most of the soil mounds are likely to be overburden material from when the majority of the site was probably utilised for borrowed materials in the early 1970's. However, it was generally not possible to distinguish between soil material originating at the site and fill material that may have been imported to the site, with only one instance of recently-placed soil observed that may have been imported (see Appendix A: Figure A6).

The site was heavily vegetated with grass (native and weeds) at the time of the inspection, which meant that most soil piles were covered and therefore difficult to determine whether they may have contained any contaminated materials. Vegetation was pushed to the side to expose the soil on at least one location for most soil piles observed and whilst all material appeared to be ‘clean’, it is possible that potentially contaminated soils could have gone un-noticed during this preliminary investigation.

Particular attention was focussed on identifying any asbestos-containing materials (ACM) present on site, as the illegal dumping of this material (and possibly debris from Cyclone Tracy) is relatively common in bush land adjacent to urban areas around Darwin. ACM was only observed at one location (Figure 5-1), which consisted of several small fragments (see Appendix A: Figures A4 and A5). A thorough search of the immediate area did not identify any further ACM materials.

5.4 Staining and odours

No staining or odours indicating potential contamination (e.g. hydrocarbons) were observed during the site inspection.

5.5 Land uses

The site inspection confirmed the adjacent land uses identified in Section 0. There was no visual evidence observed of potential contamination migrating onto the site from adjacent properties.

Numerous informal vehicle tracks were observed on site, indicating that the area is regularly used for recreational four wheel driving.

5.6 Other site observations

At the time of the inspection during the wet season, the drainage line was flowing and areas of waterlogged soils and ponding were observed across the majority of the eastern section of the Muirhead North (see Appendix A: Figure A3).

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1 It is noted that the geotechnical investigation undertaken by SMEC in January 2015 encountered no groundwater or seepage and the subsurface conditions encountered were amenable to good subsurface drainage. Follow-up inspections of the site undertaken by SMEC in early May 2015 found generally dry conditions; however evidence of where water had ponded in depressions during the wet season was noted.
6 Conclusions and Recommendations

Based on a review of the available desktop search data and observations made during the site inspection, it is concluded that:

- Only one location within the site observed with asbestos containing materials (ACM) indicates that it is unlikely that there is any extensive contamination of ACM.
- Although we are confident that the site inspection identified that it is unlikely to be extensive ACM contamination within the site, there may be some additional areas that were not identified due to the heavily-vegetated state of the site at the time of the inspection.
- There were no other potential sources of soil contamination identified, in either the site history review or site inspection.
- Other than the observed and potential contamination sources specified above, there is no evidence or likely presence of any other contamination within the project area and therefore a Stage 2 Detailed Site Investigation is not required.

It is recommended that in the event that ACM (or other potentially hazardous material) is uncovered during construction a suitably qualified asbestos removal contractor be engaged. The following should be noted in relation to NT WorkSafe requirements for asbestos removal work:

- Licensed businesses engaged in the removal of asbestos require a licensed asbestos assessor during Class A asbestos removal work. The licensed asbestos assessor is required to conduct air monitoring, a clearance inspection and to issue a clearance certificate.
- The clearance inspection must be completed by an independent licensed asbestos assessor. To be independent, the licensed asbestos assessor or competent person must not be involved in the removal of asbestos for that specific job and is not involved in a business or undertaking involved in the removal of the asbestos for that specific job.
- From 1 January 2015, the air monitoring for Class A asbestos removal work and the removal of friable asbestos must be conducted by an independent licensed asbestos assessor.

The risk of exposing ASS is considered to be low as no earthworks are proposed that will require excavation below 5 m AHD in any part of the proposed development area. Service trenching in the low lying areas in the east of Muirhead North is expected to be relatively shallow and not extend below 5 m AHD. Stormwater attenuation basins proposed in the south-east corner of the Muirhead North lot will need to be constructed above the natural surface allowing free-draining discharge of stormwater from the site to the natural drainage channels, and therefore should not disturb any ASS. Should the details of the proposed development change and require excavation below 5 m AHD then ASS risk should be re-assessed at that time.
7 References

EcOz Environmental Consultants 2015, Site Characteristics Assessment for Lot 9370 Town of Nighcliff, Report to Defence Housing Australia, April 2015.


Hill, J and Edmeades, B 2008, Acid Sulfate Soils of the Darwin Region, Land and Water Division, Department of Natural Resources, Environment, the Arts and Sport, Palmerston, NT.

Appendix A – Site Photographs

Figure A1. Dumped household rubbish

Figure A2. Dumped car body

Figure A3. Waterlogged area in eastern section of site

Figure A4. Small fragment of asbestos

Figure A5. Area surrounding observed asbestos

Figure A6. Recent dumped/excavated material
Figure A7. Dumped building materials (concrete)

Figure A8. Historical dumped/excavated soil

Figure A9. Historical dumped/excavated soil

Figure A10. Cleared area on NE boundary

Figure A11. Drain entering site from west

Figure A12. Informal access track