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Little Forest Legacy Site Licence Application

Document LFBG-PC-LA-FD

# **LITTLE FOREST LEGACY SITE 'POSSESS OR CONTROL' LICENCE PURPOSE AND DESCRIPTION OF THE FACILITY**

(rev 0)

**Prepared By  
Australian Nuclear Science and Technology Organisation**

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Little Forest Legacy Site - Purpose & Description of the Facility

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## 1. PURPOSE AND SCOPE

The purpose of this document is to provide a description of the Little Forest Legacy Site (LFLS) which is located at Lucas Heights and owned and managed by the Australian Nuclear Science and Technology Organisation (ANSTO) Nuclear Operations division following transfer of ownership from the Australian Atomic Energy commission. The facility description provides an overview of the site, including its original use, site location, land and features and climate and geology. The document also includes information regarding the disposal of waste at the LFLS, waste characteristics and the current site condition.

ANSTO is seeking an approval for a 'possess or control' licence application of the LFLS facility. The licence application was originally submitted to ARPANSA in 1999 and ANSTO is updating all the documentation and providing additional information and clarifications to the original licence application. This document forms the part of that supporting information of the 'possess or control' licence application

## 2. OVERVIEW

The LFLS is a rectangular grassed area (350 m x 150 m) situated at the northern extremity of the 1.6 km radius buffer zone around the HIFAR Research Reactor at Lucas Heights. The site was used by the former Australian Atomic Energy commission (AAEC) for the burial of low level radioactive waste from the research facilities at Lucas Heights from 1960 to 1968.

The wastes were buried predominantly within two sets of shallow trenches (25 m long x 0.6 m wide x 3 m deep) and consisted of disused contaminated equipment, waste drums, laboratory refuse, chemicals and beryllium contaminated items. The burial of the waste was undertaken in accordance with the international practices employed at the time for the disposal of low level solid and liquid wastes. Once the waste was deposited within the trenches it was covered by about 1 m of the local clay soil. Following the cessation of waste disposal at the site, it has been managed by the AAEC/ANSTO for its ongoing care, maintenance, surveillance and environmental monitoring.

## 3. SITE LOCATION

The LFLS is located at Lucas Heights and occupies a section of generally level terrain within the buffer zone where it protrudes from the 1.6 km radius surrounding the former HIFAR reactor (**Figure 1**). The site is accessed from New Illawarra road on the west side via a gated track adjoining the SITA Resource Recovery Park entrance.

The site is adjacent on three sides to other waste disposal sites that are managed by unrelated entities. On the western boundary is a former municipal waste disposal site known as Harrington's quarry. To the west of this site is the SITA Resource Recovery Park, which currently includes a major municipal landfill operation. Immediately to the east of the site is an area formerly used by the Sutherland Shire Council to dispose of night soil (human excreta). To the north-west of the site lies a former industrial liquid waste site used for the disposal of grease, paints, solvents, tannery wastes, etc., as well as specific hazardous industrial chemicals including dioxin-contaminated materials and residues from herbicide production (Coffey Partners, 1991).

The nearest residential area to the LFLS is the suburb of Barden Ridge, located 2.5 km to the east. The western parts of the suburb of Menai are about 3 km northeast of the site.

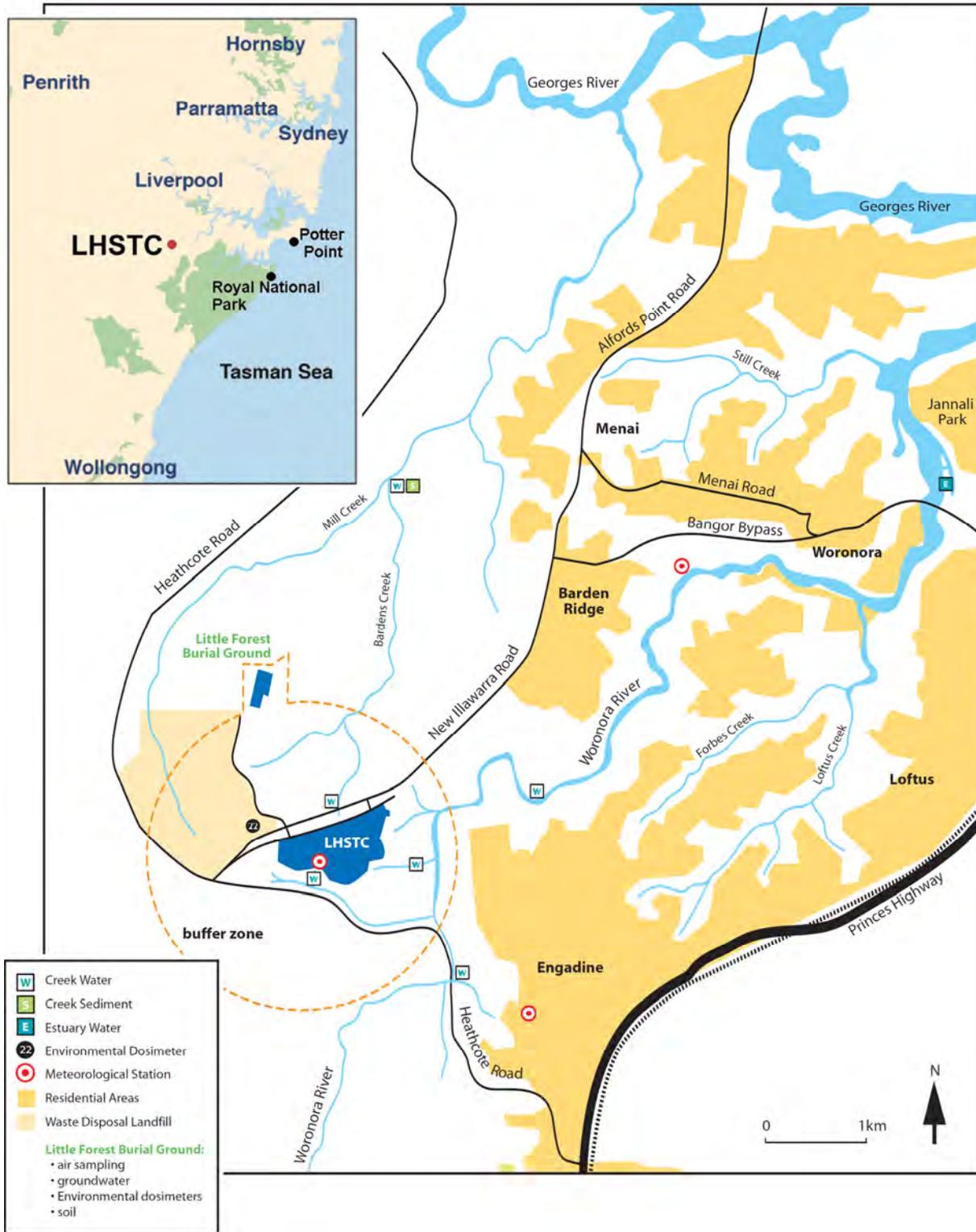
## 4. LAND AND FEATURES

The LFLS perimeter is surrounded by a high cyclone wire fence (2.4 m with 3 strands barbed wire) with cable reinforcement (20 mm thick and 50 cm from the ground). Originally the fenced area was approximately 350 m long by 115 m wide, which on the eastern side was close to the trenches. In 1990, the eastern boundary line was re-positioned some 35 m to the east for about 260 m of its length from the northern end (**Figure 2**) to enclose an area of 350 m long by 150 m wide (excepting the 90 m section on the south east corner that retained the original boundary). The fence perimeter is clear of vegetation to enable vehicular access around the outside of the site. Vehicle access into the site is

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through an entrance gate at the eastern boundary on the south side. Bollards have been placed at the gate entrance and along a section of the north fence to prevent the unauthorised entry of vehicles by force.



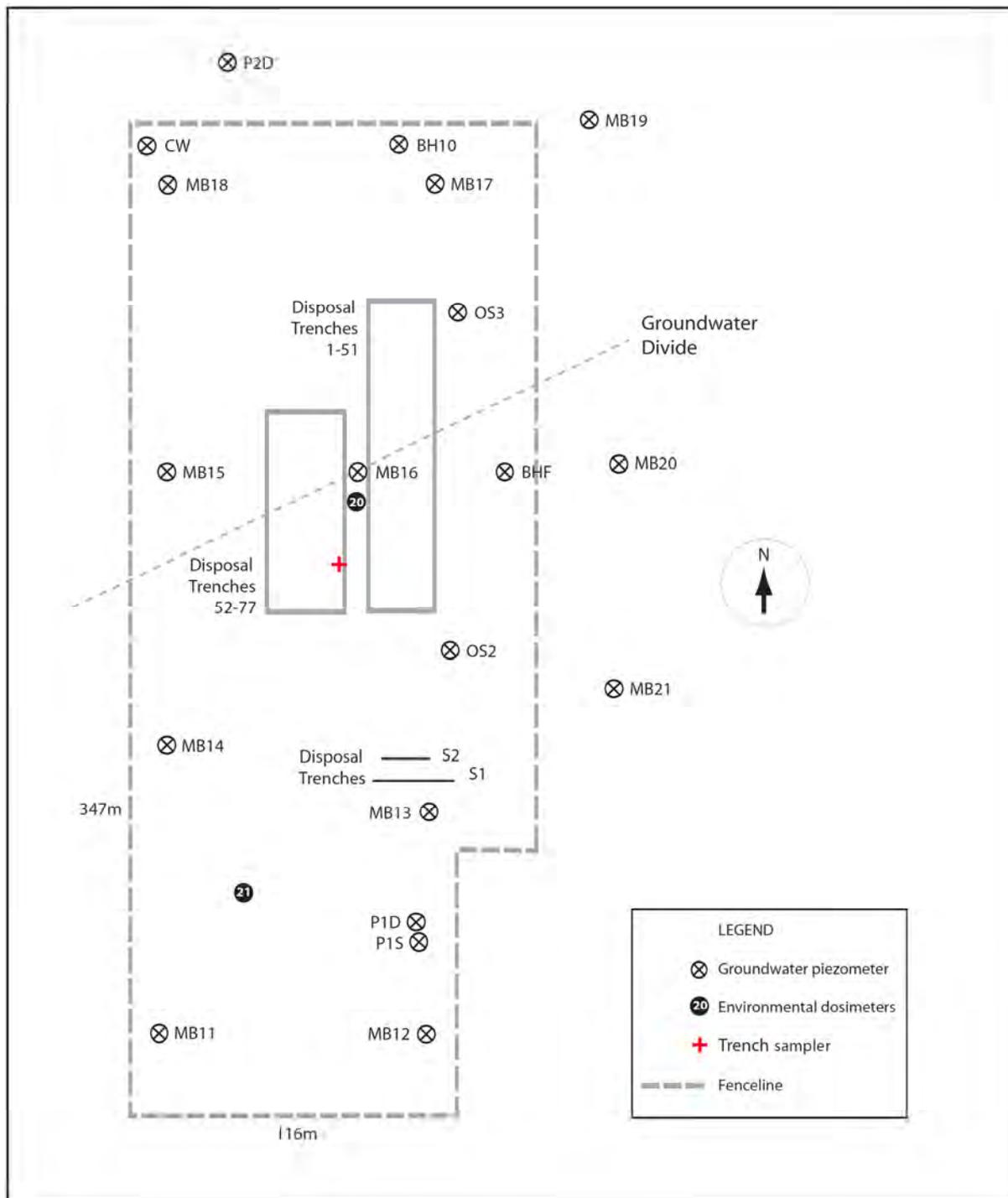
**Figure 1** – General location map for the Little Forest Legacy Site.

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The site was cleared of its original native shale vegetation and is now covered predominantly by grass, which is mown on a regular basis. There are a number of trees and bushes within the site compound however there are few located in close proximity to the waste trenches.

The area slopes slightly to the north and to the southeast, with a surface drainage line developed towards the south-eastern corner of the site. Two adjacent sets of trenches containing the wastes are located on the higher part of the site. In addition, two trenches (S1 and S2) are positioned about 50 metres to the south of the main trenching areas (**Figure 2**).



**Figure 2** – Schematic of the LFLS showing the waste disposal trenches and groundwater bores sampled during regular ANSTO monitoring. The trench sampler (red) is not routinely monitored.

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The dimensions of the east trench set are ~ 120 m long x 25 m (area of ~3000 m<sup>2</sup>) and the dimensions of the adjacent trench set (to the west) are 75 m long x 25 m wide (area of 1875 m<sup>2</sup>). The east trench set comprises 51 trenches and the adjacent western trench set comprises 26 trenches. Each trench is nominally 25 m long by 0.6 m wide by 3 m deep with a ~1 m deep layer of local clay soil above the buried waste. The trenches were spaced 2.7 m apart along the length of the trench set and slightly inclined along their long axes, with the eastern ends ~0.4 m below the western end.

Within the LFLS vicinity there are groundwater bore sampling locations (piezometers) for environmental monitoring. There are nineteen regularly sampled bores (**Figure 2**), four of which are located outside the LFLS perimeter (three to the east and one to the north). There are additional bores (installed 2009-2010) that are sampled intermittently. All ground water monitoring bores are located outside of or between (MB16) the trench areas.

An additional trench sampling point (PVC tube-based), is located within the waste disposal area (**Figure 2**). This was installed in 2011 in a manner avoiding the disturbance of buried objects (Payne et al., 2013). The 'trench-sampler' is capped to prevent direct entry of rainfall, and an automated logger provides regular water-level data from the trench.

## 5. CLIMATE AND GEOLOGY

The LFLS area has a warm temperate climate, with temperatures reaching their peak during February (when the average maximum temperature is 25.9°C and minimum is 17.4°C). The coldest month is July, with maximum and minimum of 15.7°C to 7.1°C respectively (Isaacs and Mears, 1977; Clark, 1996 and 2004). Mean annual rainfall at Lucas Heights was 1008.7 mm for the period 1958–2013 (BOM, 2013). Monthly average rainfall varies between 51.8 mm in September and 119.0 mm in March and the annual average pan evaporation is ~1200 mm (1958 - 2011). Alternating dry and wet periods are common, and can be prolonged as they are linked to wider climatic events such as El Niño and La Niña (Ummenhofer et al., 2009).

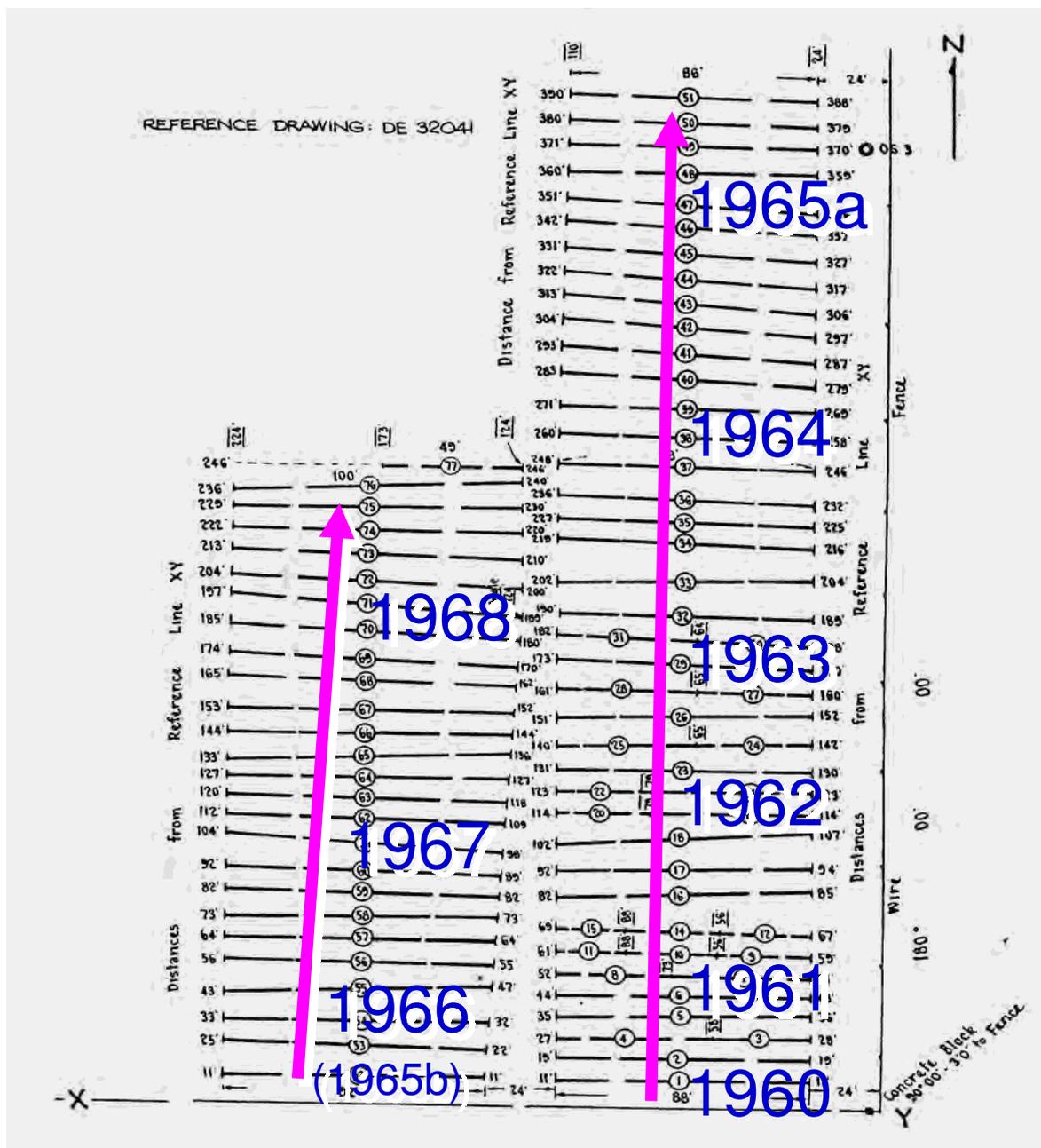
The LFLS site is located in a lens of shale, and the trenches were excavated in the uppermost soil layers. The vadose zone (unsaturated zone above the water table) extends from the surface to a depth of approximately 7–10 m, where the shale layer forms a localised perched water body due to the poor infiltration through the shale. Cores of soils extracted from below and adjacent to the trenches (2012) have typically been unsaturated, with variable levels of soil moisture in perched horizons that appear to be discontinuous across the site. The parent shale is expected to act as a partial barrier to direct downward movement of groundwater into the aquifer in the Hawkesbury Sandstone below (Payne, 2012). Seeps related to the transition between the shale–sandstone interface emerge intermittently at the limits of the shale outcrop southeast of LFLS (AAEC, 1985). The Hawkesbury Sandstone has been interpreted as a layered aquifer system with groundwater occurring in discrete horizons with occasional vertical connections. The upper sandstone units are generally weathered and strongly jointed and fractured, resulting in a dual porosity aquifer in which flow may be dominated by the secondary porosity (McKibbin and Smith, 2000).

## 6. WASTE DISPOSAL AND CHARACTERISTICS

The trenches were dug and filled sequentially as shown in **Figure 3** and covered with a 1 m deep layer of local clay soil before commencing each subsequent trench. The eastern trench set was filled first with the final disposals in 1965 and the western trench set was filled from 1965 to 1968. The 1965 disposals took place in the northern end of the eastern set of trenches (shown as 1965a) and the southern end of the western set (1965b). The two trenches positioned south of the main trenched areas (S1 and S2) were filled in 1967 and 1968 respectively.

Records of the disposal operations were kept and these provide an indication of the materials disposed within each trench. The wastes consisted of a large range of trash from laboratories handling radioactive materials, contaminated equipment, waste packages consigned from other organisations, and beryllium / beryllium oxide scrap (AAEC, 1985). There were also containers resulting from waste processes including drums of solidified sludge from waste water treatment at the AAEC's effluent plant and a number of containers of liquid waste.

The types of radioactivity and chemicals associated with the disposed waste items include fission and activation products, quantities of natural uranium and thorium (around 100 kg in total), small (several gram) amounts of fissile radionuclides and approximately 1 T of beryllium/beryllium oxide (AAEC, 1985). A summary of disposals at the site derived from AAEC records (as reported in 1985) is included in the Appendix.



**Figure 3** – The sequence of filling of trenches at the LFLS from 1960 to 1968. Two additional trenches (S1 and S2) were located to the south of the main trenched areas. These were filled in 1967 and 1968 respectively.

## 7. SITE CONDITION

The site is inspected on a regular basis and a program of environmental monitoring is undertaken (see Safe Storage and Maintenance Plan) to assess the condition of the site and the waste trenches in particular.

## 7.1 Surface Condition

Over the period since operations ceased, there has been intermittent subsidence of the soil covering the trenches. This subsidence is attributed to voids developing in the buried wastes, due to deterioration of containers and disposed objects. Where subsidence has occurred the area has been top dressed with local clay soil to maintain an even covering.

## 7.2 Environmental Monitoring Results

Environmental monitoring has been conducted at the site from the mid 1970's and since the early 1990's a routine program of environmental sampling and analysis at site has focused on groundwater, particulate air-sampling and gamma dose-rate surveys. Occasionally, other environmental samples such as vegetation and soils have been reported. Standard methods such as gamma spectrometry, liquid scintillation counting, and total alpha and beta determinations have been employed for routine measurements. Alpha spectrometry has been used for the detection of actinides in non-routine sampling tasks.

### 7.2.1 Groundwater

The LFLS groundwater samples taken from bore holes located outside of and between the waste trenches have been analysed for total alpha, beta and tritium activities. For tritium, the monitoring results from groundwater wells within the fence boundary have typically been below the ADWG concentration guideline\* (7600 Bq/L). Between 1975 and 2008 more than 1000 groundwater samples were analysed for tritium with 36.7% being reported as less than the minimal detectable activity concentration. However, since the commencement of groundwater sampling the results have indicated the development of a tritium plume. The maximum tritium level detected in groundwater was 390 kBq/L measured from a sample taken between the main trench sets in 1975 (Hughes, C et al., 2011). In addition to the 19 regularly monitored wells, a new set of wells were installed (2009-10) to provide a clearer definition of the plume (these are not sampled as part of the routine monitoring program so are not indicated on **Figure 2**). Since the installation of these new wells, a set of 70 samples taken since 2009 have shown an average tritium activity concentration of 2953 Bq/L and a maximum of 12489 Bq/L (October 2009) taken from a well near the trench sampler.

Gross alpha and beta activity levels are generally well below the ADWG screening levels (0.5 Bq/L gross alpha and 0.5 Bq/ml gross beta<sup>†</sup>) with a few exceptions of gross beta exceeding 0.5Bq/L (maximum of 1 Bq/L) most likely due to natural radioactivity in the groundwater.

Gamma emitting radionuclides (Am-241, Cs-137 and Co-60) have typically not been detected in the groundwater samples (below the minimal detectable activity concentrations stated at the 95% confidence level). There have been a small number of results, generally from samples taken from MB16 (located between the main trench sets) where these gamma emitters (most commonly Co-60) have been detected at levels below 0.5 Bq/L.

### 7.2.2 Radiation and Airborne Contamination

The continuous monitoring of gamma radiation in the middle of the trench areas, at a height one metre above ground-level, consistently indicates no significant difference in annual effective dose from external gamma radiation when compared with background levels. Routine air sampling of airborne

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\* In 1996 the ADWG gave a specific concentration guideline for tritium (7600 Bq/L) but in subsequent revisions a single guideline dose (1 mSv/year) for annual exposure to radioactivity in drinking water has been given. Dose estimation, based on the method given in the ADWG, indicates that a person drinking water with a tritium concentration of 7600 Bq/L would receive an estimated dose of 0.1 mSv over a year (ie a 10% tritium contribution of the current guideline level of 1mSv/year) and this is assumed to be an appropriate contextual guideline level for this description.

† The Australian Drinking Water Guidelines 6 (2011) recommended screening level for gross alpha activity is 0.5 Bq/L and the recommended screening level for gross beta activity is 0.5 Bq/L after subtraction of the contribution from potassium-40. The ADWG states that the recommended screening levels provide a good margin of safety against the dose-based guideline values (total estimated dose of 1.0 mSv per year from all radionuclides in drinking water, excluding the dose from potassium-40). The ADWG guidelines suggest that no action would be required so long as the total radiation dose from a drinking water source does not exceed 1mSv.

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dust suspension at the site have shown no Be or Pu particulates are measured with all data indicating MDA levels for these (below the minimal detectable activity stated at the 95% confidence level).

#### 7.2.3 Trench and Surface Soil Sampling

In the decade immediately following the closure of the LFLS facility, transfer of various radionuclides from the buried waste to the overlying soil was observed (Payne et al., 2013). In 2011 a number of soil samples (0 – 10 cm depth) were taken from locations mostly concentrated around the perimeter of the trenched areas and at the trench sampling point. The soil sampling pattern around the trench sampler consisted of points in circles at a radius of 1 and 3 m and then samples taken at 6 and 10 m distance in the downhill direction from the trench sampler. A number of points were also sampled within 25 to 200 m from the trenched areas. The soil samples were analysed for  $^{239+240}\text{Pu}$  using low-level alpha spectrometry.

It was found that that the majority of the soil samples (10 of 12 samples) from around the perimeter of the trenched area did not exhibit elevated Pu concentrations compared to soil samples from elsewhere in eastern Australia<sup>‡</sup>. Elevated  $^{239+240}\text{Pu}$  soil activities were detected in some samples; however these were all confined within the fenced area and concentrated in the south east slope from the edge of the main trenches. The concentrations of  $^{239+240}\text{Pu}$  in the samples taken down slope from the trenches indicated a  $^{239+240}\text{Pu}$  concentration gradient with the highest activity in the 0–10 cm surface soil of 458 Bq/kg (Payne et al., 2013) and a median value of 50 Bq/kg of the eight samples taken in a 1 metre radius from the trench-sampler.

As part of the 2011 soil and trench sampling study, water samples were taken from the trench sampling point and analysed using alpha spectrometry. Activity concentrations  $^{239+240}\text{Pu}$  and  $^{241}\text{Am}$  were detected in the filtered water samples in the range of 7–13 Bq/L and uranium and thorium activity concentrations were <0.05 Bq/L. The analyses for the non-actinide contaminants of the trench water showed relatively low levels of gamma-emitting radionuclides. Non-actinide activity concentrations in the trench waters were <0.05 Bq/L for  $^{238}\text{U}$ ,  $^{235}\text{U}$ , and  $^{234}\text{U}$ , <0.04 Bq/L for  $^{232}\text{Th}$  and  $^{230}\text{Th}$ , <0.1 Bq/L for  $^{137}\text{Cs}$  and  $^{60}\text{Co}$  and no significant amounts of beryllium were detected (<0.01 mg/L).

The above background Pu activities detected from soil and trench water samples may be partly attributable to dispersion events in the first decade after disposal, after which a layer of soil was added above the trenched area. The disposal records indicate that the trenches near the trench sampler likely received a major proportion of the Pu disposed at the site and the elevated analytical results probably reflect the presence of a nearby buried source within the trench. It is also possible that entry of surface water into the trench and saturation during heavy rain periods would have the potential to distribute radionuclides to the surface.

#### 7.2.4 Summary of Environmental Monitoring

Overall, the results of the regular environmental monitoring program in the past two decades have indicated that detected levels of radioactivity within the region of the site have not been elevated appreciably relative to background levels. Surface soil contamination has been detected above and in the immediate locality of the trenched areas; however, there has not been evidence of wind dispersion of radionuclides from the monitoring of airborne dust suspension samples. In summary, there has not been any off-site radionuclide migration detected, other than low levels of tritium, from the wastes buried at the site (Payne et al., 2013).

## 8. REFERENCES

AAEC (1985). The Little Forest Burial Ground – an information paper. Environmental Science Division, Australian Atomic Energy Commission, AAEC Report DR19, 27 pp.

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<sup>‡</sup> Although the regional background level of  $^{239+240}\text{Pu}$  in soils of the Sydney area has not been determined, an average value for  $^{239+240}\text{Pu}$  of 0.356 Bq/kg (with a range from 0.055 to 1.003 Bq/kg) was recently reported in 11 surface soils and sediment samples taken from locations in the Australian Capital Territory and New South Wales

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- BOM (2011). Summary statistics Lucas Heights (ANSTO). Bureau of Meteorology. ([http://www.bom.gov.au/climate/averages/tables/cw\\_066078.shtml](http://www.bom.gov.au/climate/averages/tables/cw_066078.shtml)). Web-site checked November 2013.
- Clark G.H. (1996). An updated analysis of the Lucas Heights climatology – 1975–1996. ANSTO Report E–731, Sydney, Australia.
- Clark G.H. (2004). An updated analysis of the Lucas Heights climatology – 1991–2003. ANSTO Report E–754, Sydney, Australia.
- Coffey Partners (1991). Little Forest, Potential contaminated lands investigation. West Menai. Report for Department of Planning.
- Giles, M.S., and Dudaitis, A. (1986). Environmental Survey at Lucas Heights Research Laboratories, 1984. Australian Atomic Energy Commission, AAEC/E-638.
- Giles, M.S., Foy, J.J., and Hoffmann, E.L. (1988). Environmental Survey at Lucas Heights Research Laboratories, 1985. Australian Nuclear Science and Technology Organisation, ANSTO/E-677.
- Hankin, S. Little Forest Burial Ground - Geology, Geophysics and Well Installation 2009–2010; ANSTO/E-781; Australian Nuclear Science and Technology Organisation: 2012.
- Hughes, C. E., Cendon, D. I., Harrison, J. J., Hankin, S. I., Johansen, M. P., Payne, T. E., Vine, M., Collins, R. N., Hoffmann, E.L., Loosz, T. Movement of a tritium plume in shallow groundwater at a legacy low-level radioactive waste disposal site in eastern Australia. *J. Environ. Radioact.* 2011, 102 (10), 943–952.
- IAEA (1967). Regulations for the safe transport of radioactive materials. IAEA, Vienna.
- Isaacs S.R. and Mears K.F. (1977). A study of the burial ground used for radioactive waste at the Little Forest area near Lucas Heights New South Wales. Australian Atomic Energy Commission, AAEC Report E-427, 50 pp.
- McKibbin D. and Smith P.C. (2000), Sandstone hydrogeology of the Sydney region. In: McNally G.H & Franklin B.J. (Eds.), 2000, Sandstone city, Sydney's dimension stone and other sandstone geomaterials, Environmental, Engineering and Hydrogeology Specialist Group, Geological Society of Australia, Monograph No 5.
- NHMRC, NRMCC (2011) Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.
- Payne, T.E. (2012). Background Report on the Little Forest Burial Ground Legacy Waste Site December 2012, Australian Nuclear Science and Technology Organisation, ANSTO/E-780, ISBN 1 921268 21 2, ISSN 10307745.
- Payne, T.E., Harrison, J.J., Hughes, C.E., Johansen, M.P., Thiruvoth, S., Wilsher, K.L., Cendón, D.I., Hankin, S.I., Rowling, B., Zawadski, A. (2013). Trench 'Bathtubbing' and Surface Plutonium Contamination at a Legacy Radioactive Waste Site. *Environmental Science & Technology* (in press, 2013).
- Tims, S. G., Fifield, L. K., Hancock, G. J.; Lal, R. R., Hoo, W. T. Plutonium isotope measurements from across continental Australia. *Nucl. Instrum. Methods Phys. Res., Sect. B* 2013, 294, 636–641.
- Ummenhofer C.C., England M.H., McIntosh P.C., Meyers G.A., Pook M.J., Risbey J.S., Sen Gupta A. and Taschetto A.S. (2009). What causes Southeast Australia's worst droughts? *Geophysical Research Letters*, v36, L04706, DOI: 10.1029/2008GL036801.

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## 9. APPENDIX

		<b>Total</b>
<b>Estimated Activity (GBq)</b>	Group I*	0.75 GBq
	Group II*	39.10 GBq
	Group III*	111.50 GBq
<b>Fissile Content</b>	Plutonium	6.9 g
	Uranium-233	5.2 g
	Uranium-235	92.0 g
<b>Fertile Content</b>	Uranium	59.3 kg
	Thorium	48.1 kg
Beryllium Content as Be/BeO (kg)		1070.0 kg
Liquid Volume		8.6 m <sup>3</sup>

**Table 1** – Summary of disposals at LFLS facility derived from AAEC records, as reported in AAEC (1985). \*The AAEC categorised radionuclides in groups I, II and III, which followed a decreasing order of radiotoxicity (based on IAEA, 1967). See Table 2

<b>Selection of Radioactive Nuclides (reproduced IAEA 1967)</b>	
<b>Group 1</b>	Ac-227, Am-241, Np-237, Pa-230, Pa-231, Po-210, Pu-239, Pu-240, Pu-241, Ra-226, Ra-228, Th-228, Th-230, U-232.
<b>Group II</b>	A-41, Bi-210 (RaE), Eu-154, Mixed Fission Products, Pa-233, Pb-210, Ra-223, Ra-224, Rn-222, Sr-90, U-233, Xe-135.
<b>Group III</b>	Ba-140, Ce-144, Cl-36, Co-60, I-131, I-133, In-114m, Ir-192, Kr-85, Ru-106, Sb-124, Sb-125, Sc-46, Sr-89, Th-nat, Tl-204, U-235, U-238, U-nat, Xe-133, Y-91, Zr-95.
<b>Group IV</b>	Au-198, Be-7, Br-82, C-14, Ca-45, Cl-38, Co-58, Cr-51, Cs-135, Cs-137, Cu-64, F-18, Fe-55, Fe-59, K-42, La-140, Mo-99, Na-24, Nb-95, Ni-63, P-32, Ru-103, S-35, T- (in any form other than Group VII), Tc-99, Te-132, Zn-65.
<b>Group V</b>	A-41 (uncompressed), Xe-135 (uncompressed).
<b>Group VI</b>	Kr-85 (uncompressed), Xe-133 (uncompressed).
<b>Group VII</b>	T (as T <sub>2</sub> or HT, or tritium activated luminous paint or tritium gas adsorbed on a solid carrier).

**Table 2** – Categorisation of radionuclides disposed at LFLS (From Isaacs and Mears, 1977).