(P1)

5-8-1997

THE RADIOLOGICAL SURVEY OF ILMENITE STOCKPILES AT NOOSA NORTH SHORE, RAINBOW BEACH AND LAKE FRESHWATER

Introduction

A radiation survey of ilmenite stockpiles at the Noosa North Shore, Rainbow Beach and Lake Freshwater areas was requested 13 June 1997 by Mr Simon Critchley, Director, Radiation Health, Queensland Health.

An on site survey of the ilmenite stockpiles was carried out by Mr Bruce Wallace, Queensland Health Scientific Services 18 June 1997 with the support of Mr David Carmichael, Department of Mines and Energy; Mr Glen Tipman, Department of Environment; and Mrs Matty Pile, Radiation Health, Queensland Health.

Pending the analyses of samples collected during the survey a draft preliminary report 20 June 1997 was provided to Radiation Health. This is the final report and supercedes the preliminary draft.

An Alnor Gammameter 2414B (serial number 13-250-0634) was used for the radiation level surveys reported herein. The instrument is calibrated by the Commonwealth Scientific and Industrial Research Organization specifically for environmental measurements in the effective dose unit, the Sievert. Depending on the applicable conversion, results reported in the dose unit may be slightly lower than results reported in the exposure unit, the Roentgen. However, for practical purposes the following conversion may be used, one hundred micro Roentgen per hour is equivalent to one micro Sievert per hour.

Some attachments to this report are poor copies of original documents. Where appropriate, an original copy may be sourced from Radiation Health.

(P2)

Cameron's Freehold, Noosa North Shore

This private freehold land was inspected 18 June 1997. The Department of Mines and Energy made available a schematic drawing of the site produced from a previous visit and this was used to record radiation level measurements taken over some of the site. The schematic was not sufficiently extensive to allow accurate or reproducible survey transverses of the area.

The remanets of two ilmenite stockpiles are evident on the site. The larger stockpile remanet still has several hundred tonnes of ilmenite remaining which gives rise to dose levels of 0.6 micro Sievert per hour. However, sample 1 (PQ11) taken from this stockpile indicates that higher radiation levels could be expected from the stockpile. The local Council has erected a radiation warning sign at the entrance to this stockpile apparently in an effort to stop the removal of material. Remanets of another stockpile are located 20m to the north east of the larger stockpile, and has radiation levels of 0.25 micro Sievert per hour. The sample 2 (PQ12) collected at this site is approximately two times more active than the radiation level measurement indicating the sampled material could generate a 0.5 micro Sievert per hour field under worst case conditions. A third stockpile ruminant was discovered under vegetation cover some 30m south west of the other two ilmenite sites. Sample 3 (PQ13) was collected from a small pilot hole in this 'new' ilmenite and shows similar levels of radioactivity to sample 2 whilst the radiation level expressed at the surface was a slightly lower at 0.2 micro Sievert per hour.

The Camerons ilmenite is not suitable for distribution and use in the community in its present radiological state as it does not meet the under control practice requirements described in Queensland Health's policy statement on mineral sand residues. The ilmenite will not comply with section 2 (a) (I) of the *Health (Radioactive Substances) Regulation 1994* use an abrasive blast media.

A small ridge extents east of the ilmenite sites in the general direction of the old mill site. The

13

radiation levels over this ridge are, in places, are more than 1.0 micro Sievert per hour. Elevated radiation levels (0.2 to 0.3 micro Sievert per hour) are also evident around the old mill site. It has been noted previously in this report that former processing plant sites are well known for their elevated radiation levels, and their potential to enhance radiation levels following the disturbance or redistribution of materials. Therefore, it is recommended that the contaminated land status of the Camerons Freehold site status be described as 'managed' and that a management plan be prepared. This management plan should be developed in conjunction with a more definitive radiological characterization of the area based a collated site history and should include the management of the ilmenite stockpile and residues.

The author is not aware of the agreed practice type status for the site, however, it is likely it can be described as an out of control practice. Given the current occupancy of the site appears low (partial or intermittent), and the radiation levels measured, Queensland Health would not require any remediation of the site. However, the site in its current condition is not suitable for total occupancy where regular day to day occupancy might occur, e.g. dwelling, businesses, schools, etc. These features should also be included in the site management plan.

It is recommended that Queensland Health's authority under Cabinet Decision No. 55857 of 16 January 1989 to notify the Registrar of Title of land with radiation levels above 0.6 micro Sievert per hour be actioned by Queensland Health.

Bruce Wallace
Senior Health Physicist
5 August 1997

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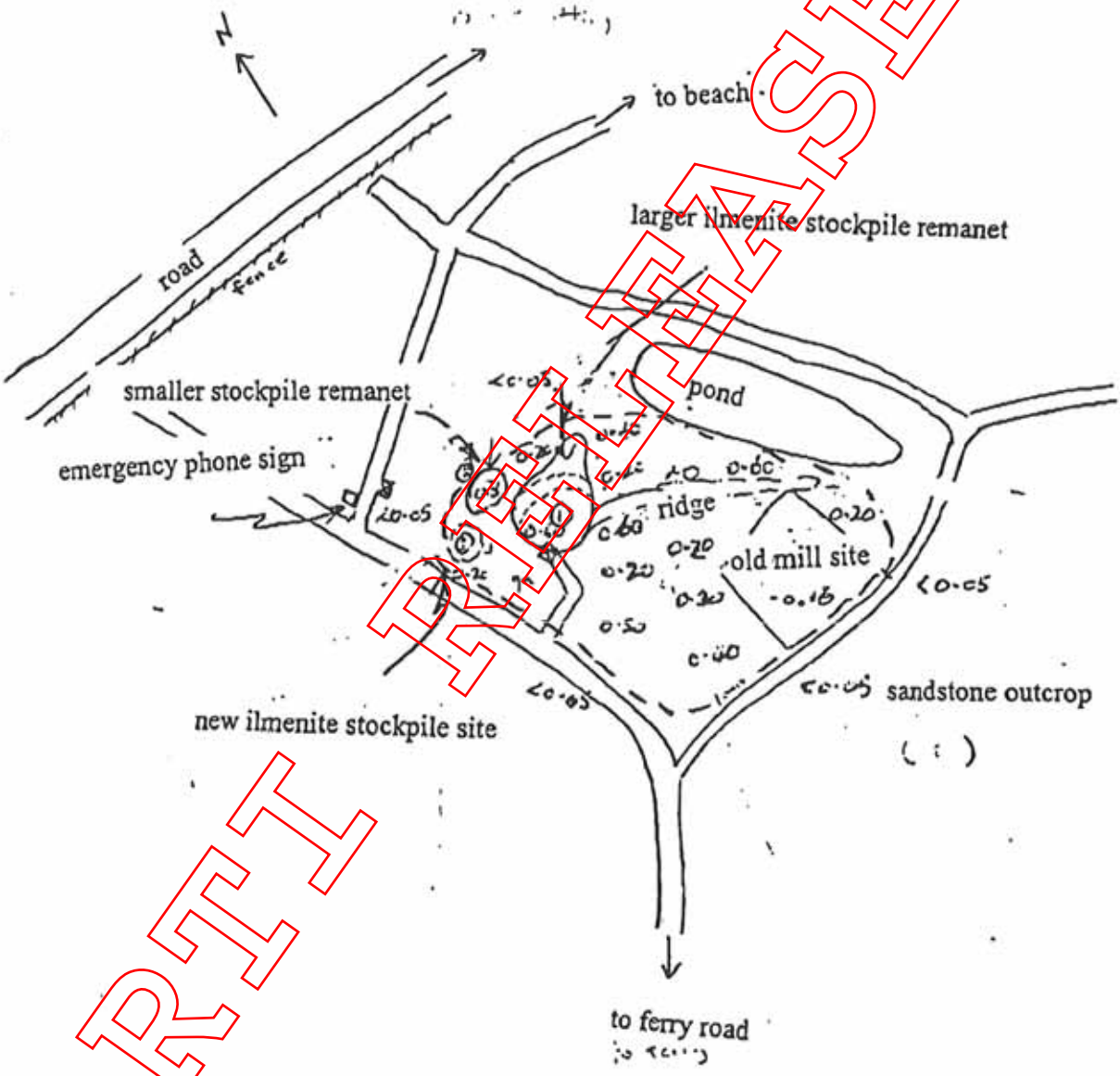
CAMERONS FREEHOLD SITE

18 June 1997



Legend

- approx. delineation of radiation levels above natural background of <0.05 micro Sievert per hour
- 0·60 micro Sievert per hour one metre above the ground
- (1) collection of ilmenite samples

19-6-1997

@ Old Dept of Environment

North Shore Freehold

Mr. Tipman believes that the parts of the roads were filled by the ilmenite. The highest reading was 1.0μSv/h.

There are warning signs stating "Warning Illumunite, Contains Low Level Radiation, Do not remove" (see attached). This area is not accessible by the public. This land is privately owned, but the stock piles of ilmenite are the properties of the Crown.

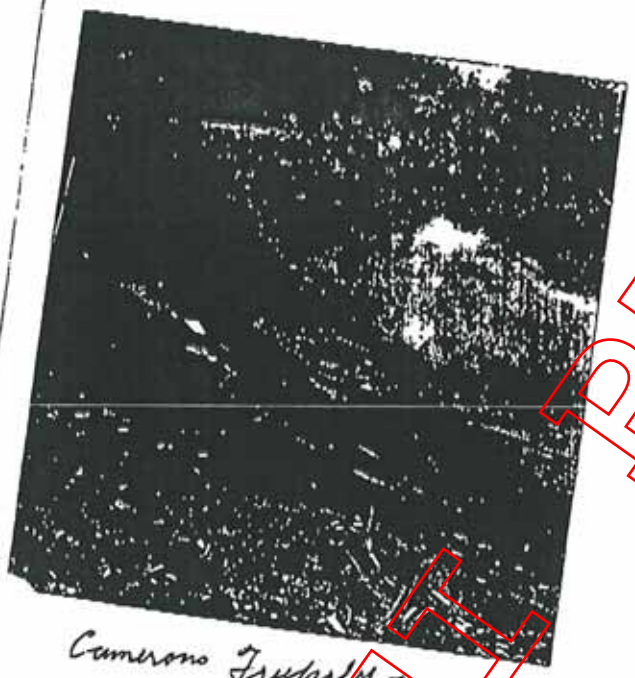
This site may be proposed to be developed as a residential area. Detailed surveys of this area will be required after removal of the stock piles.

FREEHOLD, NOOSA NORTH SHORE

Small dump

Cameron Freehold - Small dump

19.6.97



Cameron Freehold - Large dump

19.6.97

Cameron Freehold - Large dump

19.6.97

FIELD NOTES ILMENITE DUMPS
16 - 19 SEPTEMBER, 1996.

David Carmichael and Mick O'Flynn.

Monday 16 September:

2) *Camerons Freehold.*

Track
The track in from 1st cutting road has ilmenite used as fill. At 26° 21' 29.9'' S, 153° 03' 38.5'' E; 56J 0506103 UTM 7084628; radioactivity reading of 40 - 50 uR/hr.

Mill Site
GPS Mill Site = 26° 21' 36.0'' S, 153° 03' 50.7'' E.
56J 0506383, UTM 7084429.
At the mill site concrete pads, loading area. Container stored on site.

Large Stockpile
Large dump = 26° 21' 33.9'' S, 153° 03' 50.3'' E.
56J 0506389, UTM 7084502.
Large dump roughly circular shape about 30m diameter and has ridge about 3m high.
The ilmenite in the main dump has radioactivity readings of 100-150 uR/hr.

Small Stockpile
Small dump = 26° 21' 33.0'' S, 153° 03' 48.7'' E.
56J 0506349, UTM 7084519.
Small dump possibly 1-1.5m high.

QUEENSLAND HEALT

HEALTH PHYSICS / PRODUCTS

5 August 1997

Mr Simon Critchley, Director
Radiation Health
Environmental Health Unit
450 Gregory Terrace
FORTITUDE VALLEY Q 4006

Dear Mr Critchley

The radiological survey of ilmenite stockpiles at the Noosa North Shore, Rainbow Beach and Lake Freshwater

Please find attached the final report for the survey of the sites described above. This final report follows your request 13 June 1997 for the work and supercedes a preliminary draft provided to you 20 June 1997 .

Yours faithfully

BJ Wallace
Senior Health Physicist.

Enquiries:	Bruce Wallace	**Office Address**	**Phone**	**Fax**
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Client Reference:	0707279 1/9 PQ11			
Letter Reference:	13 June 1997			

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Noosa North Shore, Recreation Reserve 1446

Ilmenite stockpile

This ilmenite stockpile has been previously inspected 18 February 1994 (see Attachment A) by the author to the radiologically characterize the stockpile for the Department of Mines and Energy. It had been agreed by the Department of Mines and Energy, and Queensland Health that the stockpile was produced before regulatory controls where introduced for the management of the radiation hazards associated with the mining and milling of mineral sands. Radiation practices fitting this description are described as out of control practices, i.e. any radiation hazards which may now arise from former practices have to be managed using interventional measures. Queensland Health's policy document; 'Radiation Dose Levels for Properties where Mineral Residues are Deposited on the Ground (see Attachment B) provides further information.

The 18 February 1994 report showed that radiation levels emanating from the stockpile are below those stated for an out of control practice for any occupancy assignment defined in Queensland Health's policy document; 'Radiation Dose Levels for Properties where Mineral Residues are Deposited on the Ground. Sampling of the ilmenite from various depths and locations from the stockpile 18 February 1994 has showed relatively homogenous radioactive concentrations throughout the stockpile. Therefore, should any underlying ilmenite be exposed by man or by erosional forces, the radiation dose from the stockpile should remain below the level that would otherwise require remediation. Queensland Health should not require any site remediation to reduce radiation levels over the stockpile.

While vehicular access to the stockpile has been recently made more difficult by mounding sand on an access tracks leading to the stockpile, from the inspection 18 June 1997, it was noted that ilmenite has been removed from stockpile. This is unsatisfactory. While no in situ remediation is required to reduced radiation levels over the stockpile, the ilmenite is not suitable for distribution and use in the community in its present radiological state as it does not meet the current requirements (the under control practice requirements) described in Queensland Health's policy statement on mineral sand residues. In addition, the ilmenite will not comply with section 2 (a) (i) of the *Health (Radioactive Substances) Regulation 1994* which applies to abrasive blast material that contains radioactive substances in concentrations less than that prescribed under the *Radioactive Substances Act 1958.* Ilmenite compliant with the regulation is used extensively for abrasive blasting, and while speculative, it is possible that material removed from the stockpile has been used for this purpose. If this is so, the removal of the material for this purpose and its ultimate disposal into the community without regard to the ilmenite's radioactive content is of concern.

It is understood that the stockpile is subject to a mining lease application that will bring about the removal of the stockpile. However, it was reported by the Department of Mines and Energy that the lease cannot be granted until issues surrounding native title are resolved, therefore, it is recommended that controls be introduced to prevent the removal of ilmenite from the stockpile. Because of the ready accessibility of the stockpile, it is the author's opinion that administrative controls such as signing or notation on a site management plan are unlikely to be effective on their own in preventing the unauthorised removal of material. Accordingly, it is recommended that engineering controls be considered, e.g. fencing off of the stockpile together appropriate signage, or further inhibiting access to and planting over the stockpile to reduce its accessibility together with an increased level of surveillance of the stockpile by the owner.

The final land contamination status of the stockpile area following the authorised removal of the material needs to be clarified because of the sites proximity to and link to the former processing plant site described below.

Former processing site

The former processing site is located around several concrete pads, approximately 50m north of the ilmenite stockpile (and outside the mining lease application for the Recreation Reserve 1446 ilmenite stockpile). Radiation levels up 0.7 micro Sievert per hour where measured in this area. The site can be described as an out of control practice. While the former processing site radiation levels are below that requiring remediation by Queensland Health, processing sites are well known on the coast of South East Queensland for having elevated radiation levels and for their

potential to enhance radiation levels following the disturbance or redistribution of materials on site. Because the history and extent of the mineral sand residues at this site are not known, and furthermore, because there is a potential for the radiation levels to change, it is recommended that the contaminated land status of the processing site status be described as 'managed'. That is, a management plan should be prepared to ensure the radioactive contaminated land features of the site are appropriately managed in the furture. This management plan should be developed in conjunction with a more definitive radiological characterization of the area based a collated site history.

Queensland Health has an authority under Cabinet Decision No. 55857 of 16 January 1989 to notify the Registrar of Title of land with radiation levels above 0.6 micro Sievert per hour. While there are some gross flaws with this authority in relation to its application, the authority nevertheless provides a means of recording the details of lands contaminated with radioactive material in a similar way to lands entered on the Department of Environment's Land Contamination Register for other forms of contamination. Because radiation levels are above 0.6 micro Sievert per hour on the former processing plant site, it is recommended that this authority be actioned by Queensland Health.

No samples were collected on this site for radiological analysis.

Rainbow Beach ilmenite stockpile

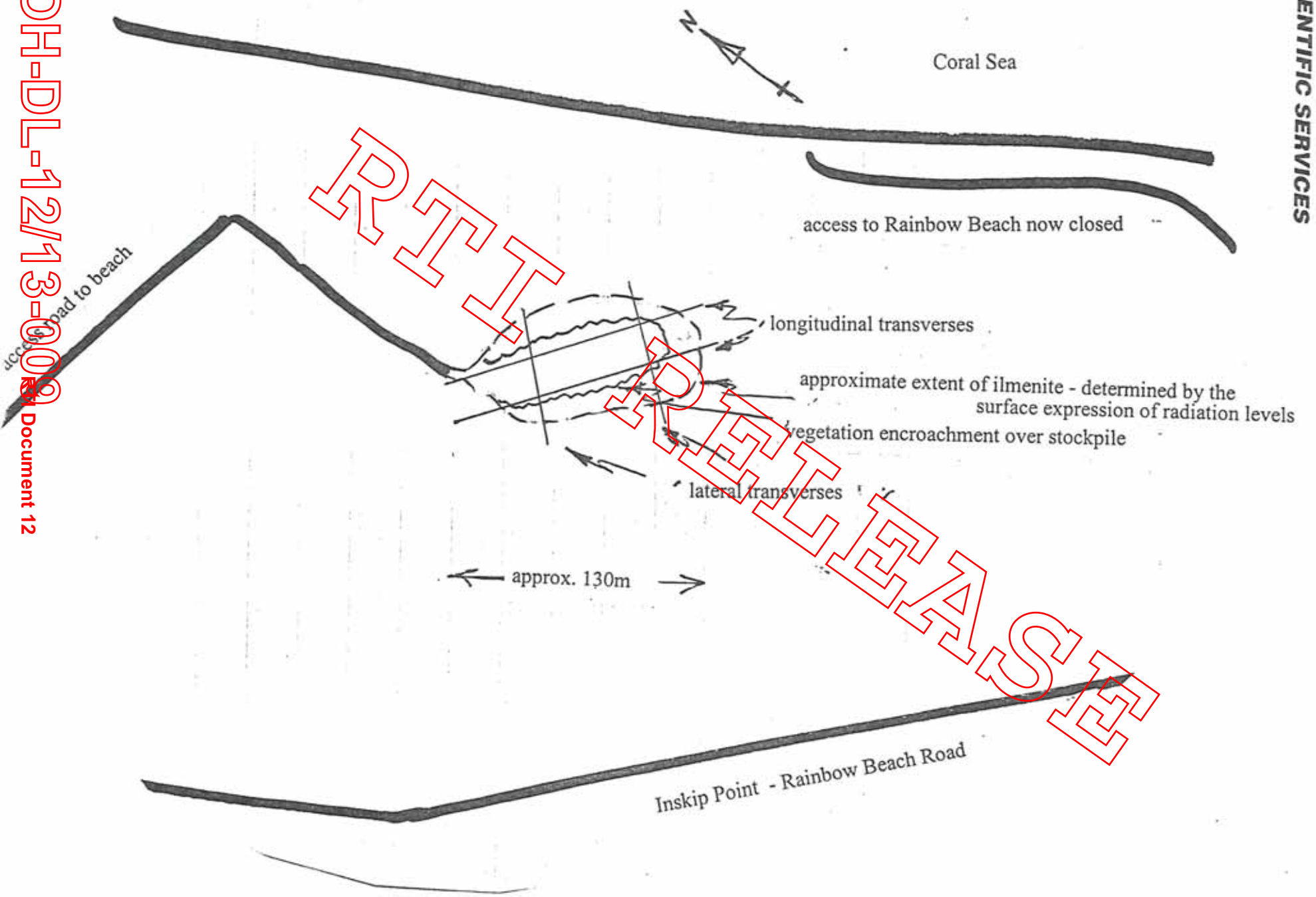
There was limited time to survey this stockpile on 18 June 1997. Accordingly, the survey was necessarily recognizance in nature. A schematic of the area and the stockpile was prepared, and shows the north-west/south-east longitudinal axis of the stockpile is approximately 130m long. Two survey transverses parallel to this stockpile axis were completed to screen the stockpile radiation levels. A further two 40m lateral transverses over the stockpile were also completed for the same purpose. A relatively uniform dose rate of between 0.30 and 0.35 micro Sievert per hour one metre above the stockpile surface was observed during these transverses. These dose rates are consistent with exposure rates measured in 1987 (see Attachment C). At the end of the transverses, where the 6m high stockpile ramps down to the natural topography, the radiation levels quickly lower towards the bottom of the slope due to the decreasing thickness of ilmenite material and the influence on the Gammameter's detection geometry of the natural background radiation levels (<0.05 micro Sievert per hour) around most of the stockpile, except at the south eastern end. The background levels appear to define the areal extent of the stockpile. The slope of the stockpile to the natural land surface is typically gentle and extends some 15m from its flat summit, except on the north-west end of the stockpile where the ilmenite sands have migrated at least 10m with the prevailing south easterly wind forming sharp slopes at the mineral's natural repose angle. Because vegetation is starting to creep over the stockpile, the ilmenite is now only exposed to the wind over a 25 - 30m wide strip running along the longitudinal axis of the stockpile. In time, it seems reasonable to expect that the north westerly movement of sand will stop as the vegetation eventually takes hold of the entire stockpile.

No samples were collected for radiological analysis.

It is agreed by the Department of Mines and Energy, and Queensland Health that the stockpile is an out of control practice. The survey 18 June 1997 showed that the radiation levels over the

RAINBOW BEACH ILMENITE STOCKPILE

18 June 1997



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stockpile are below those applicable for an out of control practice for any occupancy assignment. Queensland Health should not require any site remediation to reduce radiation levels over the stockpile.

Even though the wind has probably removed the surficial materials evident in 1987 and exposed fresh underlying material, the radiation levels over the past decade have remained essentially the same. This provides a level of confidence in predicting that the rest of the stockpile may have similar radiological characteristics to that expressed by the surficial materials seen over the past decade, and therefore, that the radiation levels will remain compliant with the Queensland Health's policy statement for mineral sand residues. However, it is recommended that the stockpile be further characterized by sampling the ilmenite at depth, in a manner similar to the stockpile at Recreation Reserve 1446 on the Noosa North shore to confirm the long term radiation status of the stockpile.

Like the Recreation Reserve 1446 stockpile, the Rainbow Beach stockpile is readily accessible, and a vehicular ramp up the Rainbow Beach stockpile only confirms the obvious accessibility of the ilmenite to the community at large. This is unsatisfactory, because the ilmenite is not suitable for distribution and use in the community in its present radiological state as it does not meet the under control practice requirements. The ilmenite will not comply with section 2 (a) (I) of the *Health (Radioactive Substances) Regulation 1994*. Accordingly, it is recommended that public access to stockpile be restricted using the similar strategies to those that should be adopted for the Recreation Reserve 1446 stockpile.

Should the stockpile be removed, the site status will maintain a 'managed' site due sand processing and milling activities carried in the whole site.

Lake Freshwater ilmenite stockpile, Cooloola National Park

The Lake Freshwater ilmenite stockpile was accessed by four wheel drive vehicle from the Cooloola Beach at low tide. This again restricted the time available to survey the site on 18 June 1997. The Department of Mines and Energy made available a schematic drawing of the site produced from their previous visit to the area. Aerial photographs taken of the area in 1974 and again in 1994 were made available by the Department of Environment. The 1974 aerial photograph shows an ilmenite stockpile on the beach hard up against the foreshore sand dunes and some 100m south of the present Freshwater Creek outlet to the sea. There is also clear evidence in this photograph of the ilmenite migrating 500m northwards up the beach from the stockpile with the prevailing wind and long shore current.

The 1994 aerial photograph was used to construct a schematic plan of the Lake Freshwater area on which to overlay the radiation level measurements and to locate samples collected during the survey. The 1974 aerial photograph was used to locate the original stockpile and evidence of other activities associated with processing mineral sands immediately north of Freshwater Creek on the schematic. The Department of Mines and Energy's survey pegs for the area (pegs +2, +3, +5, +6, & +7) are included on the schematic. However, the pegging is not sufficiently extensive to allow accurate or reproducible survey transverses of the area. Therefore, the radiation levels shown on the Lake Freshwater schematic should only be considered as generally representative of the area and not as definitive plots.

LAKE FRESHWATER ILMENITE STOCKPILE, COOLOOLA NATIONAL PARK

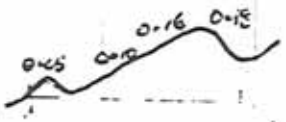
Legend

approx. delineation of radiation levels above natural background of <0.05 microSievert per hour

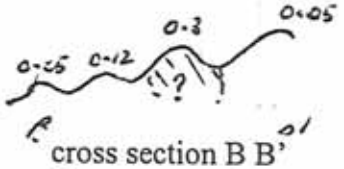
0·10 microSievert per hour one metre above the ground

collection sites for ilmenite samples

+5 Dept. of Minerals and Energy pegs



cross section A A'



cross section B B'

Freshwater Creek

access road to beach and Lake Freshwater camp

exposed ilmenite

walking tracks

approx. location of a ilmenite stockpile from 1974 aerial photograph

Coral Sea

2m high grassed frontal dunes

≃ 250m

18 June 1997

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On 18 June 1997 lenses of ilmenite up to 200mm thick were visible in the frontal sand dunes where Freshwater Creek had dissected the dune in making its way to the sea, and where the sea had eroded away the frontal dunes north of the creek outlet. These lenses of ilmenite are approximately 1m above the high water mark. Samples 1 (PQ15) & 2 (PQ14) of the ilmenite lenses were collected and both reveal similar radioactive concentrations to sample 3 (PQ16) which was collected from over the apparent parent stockpile. Similar concentrations where also measured in samples 4 (PQ18) & 6 (PQ17) to the south and north of the parent stockpile suggesting a common source of material, i.e. from the original stockpile. The samples where also collected to empirically estimate the worst case exposure from a semi- infinite thickness (600mm) and semi-infinite plane of the ilmenite (30m diameter, 1m above). This exercise shows that radiation dose levels of 0.5 micro Sievert per hour could be expected. These worst case estimates of radiation levels are higher than measured over the Rainbow Beach and Recreation Reserve 1446 stockpiles, or measured over the site using a survey meter. The measured radiation levels are further discussed below.

A contour line on the Lake Freshwater schematic contains the radiation levels above the natural radiation background of <0.05 micro Sievert per hour. If the radiation levels measured 18 June 1997 are attributed to the ilmenite stockpile shown in the 1974 aerial photograph, the radiation survey shows the dispersal of some of the stockpile up to 150m southwards along the beach behind the current frontal sand dunes towards Noosa, and also the migration of ilmenite from the stockpile back to Freshwater Creek. Inside the contour line the radiation levels are up to 0.30 micro Sievert per hour. The maximum radiation levels were found over a portion of exposed ilmenite (peg +3) and some 10m north of peg +5 which appears to overly the 'original' stockpile. The reduced radiation levels measured to the south of the stockpile are probably caused by the silica beach sands shielding the underlying ilmenite which can be readily exposed by digging. Ilmenite tails are produced by crabs digging their borrows in this southern area. Lensing of the distributed material may also account for the lower radiation levels measured by the survey meter compared to radiation levels interpreted from samples previously described.

Lower radiation levels were measured to the north and behind the 'original' stockpile are probably caused by a thin covering layer of ilmenite overlying the rear beach dunal system, as only silica tails are bought to surface by crabs digging their borrows in this area. It follows that this ilmenite was most likely blown from the original stockpile back over the rear beach dunes. A similar explanation is likely for the radiation levels measured on the north side of Freshwater Creek at sample location 6. Elevated radiation levels are also seen on low lying areas immediately behind the grassed frontal sand dunes to the north of the creek and extend well past the access road to the beach from the Lake Freshwater camp.

The survey shows that radiation levels from the Lake Freshwater ilmenite and dispersed ilmenite are below the out of control practice requirements for any occupancy assignment. However, there is potential for the measure levels to rise under worst case conditions. While cursory sampling of ilmenite has been carried, it is recommended that the stockpile be cored to radiologically characterized the extent and nature of the Lake Freshwater ilmenite, and thus, to help confirm the long term radiation status of the site. Because the ilmenite is located within the dynamic beach foreshore zone, expert opinion should also be sought as to most likely outcome for the ilmenite, i.e is the sea going to reclaim the ilmenite or are the dunal systems continuing to be built which will see the ilmenite eventually 'lost' in new sand dune formations. Either way, the ilmenite stockpile is going to remain a prominent feature of the area for sometime.

Whilst the Freshwater Creek ilmenite is readily accessible, it is unlike the previously described stockpiles in that the ilmenite cannot be readily removed to any significant extent by the general community because of the limited access to the area and the controlling influence of the Cooloola National Park. Therefore, while the Lake Freshwater ilmenite does not meet the radiation level criteria for an under control practice, i.e. the ilmenite is not suitable for distribution and use in the community in its present radiological state, and the ilmenite will not comply with section 2 (a) (I) of the *Health (Radioactive Substances) Regulation 1994*, it is considered that the ilmenite is best managed by administrative processes. Administrative control could be expressed through the management plan for the site. Such a plan might require regular recognizance of the area by park staff to ensure the ilmenite was not being removed, public notices at the Lake Freshwater camp and on park literature stating that the certain areas of the park contained significant quantities of ilmenite mineral and that the area can be safely explored but material must not be removed.

It is recommended that the Lake Freshwater site have a 'managed' site status. Should the stockpile be removed the site status will remain as a managed site due sand processing and milling activities carried out on the site.

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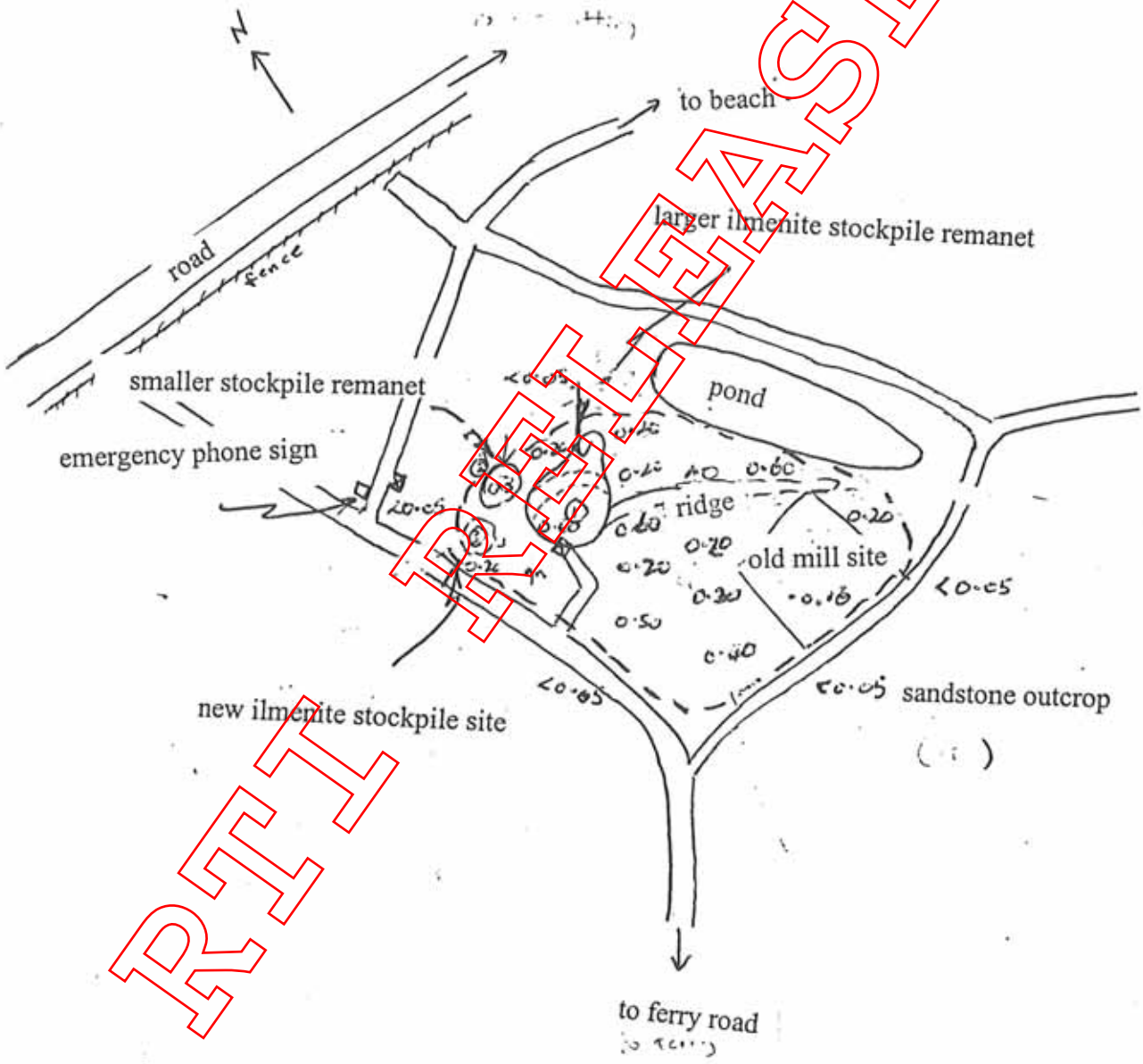
CAMERONS FREEHOLD SITE

18 June 1997



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16 September 1994

Mr Colin Taylor
Director
Minerals Division
Department of Minerals & Energy
GPO Box 194
BRISBANE 4000

Dear Mr Taylor

RADIOACTIVE SURVEY OF ILMENITE STOCKPILE - RECREATION RESERVE 1446, NOOSA NORTH SHORE

I regret the delay in providing the joint radiation level survey results in relation to the stockpile described. This has arisen through our commitment to legislative review processes, the Esk Radioactive Waste Interim Storage Facility and is accentuated by over a thirty percent reduction in professional staff through resignation, retirement, secondment and parental leave.

Radiation Investigation

Attached is the radiation level survey and the gross (gamma) radioactivity of composite samples from the mines survey peg overlaid on the plan provided by your department.

The ilmenite stockpile presents with external gamma radiation in the order of five to seven times above background ie 25 to 40 $\mu R/h$ compared to 7 $\mu R/h$ background. Although not the intent of this work - these radiation levels do not exceed an action level (see attachment) which would require remediation. Should the stockpile be exploited commercially and removed, the work should precede and be managed with the intention of leaving the site with radiation levels as low as reasonably achievable.

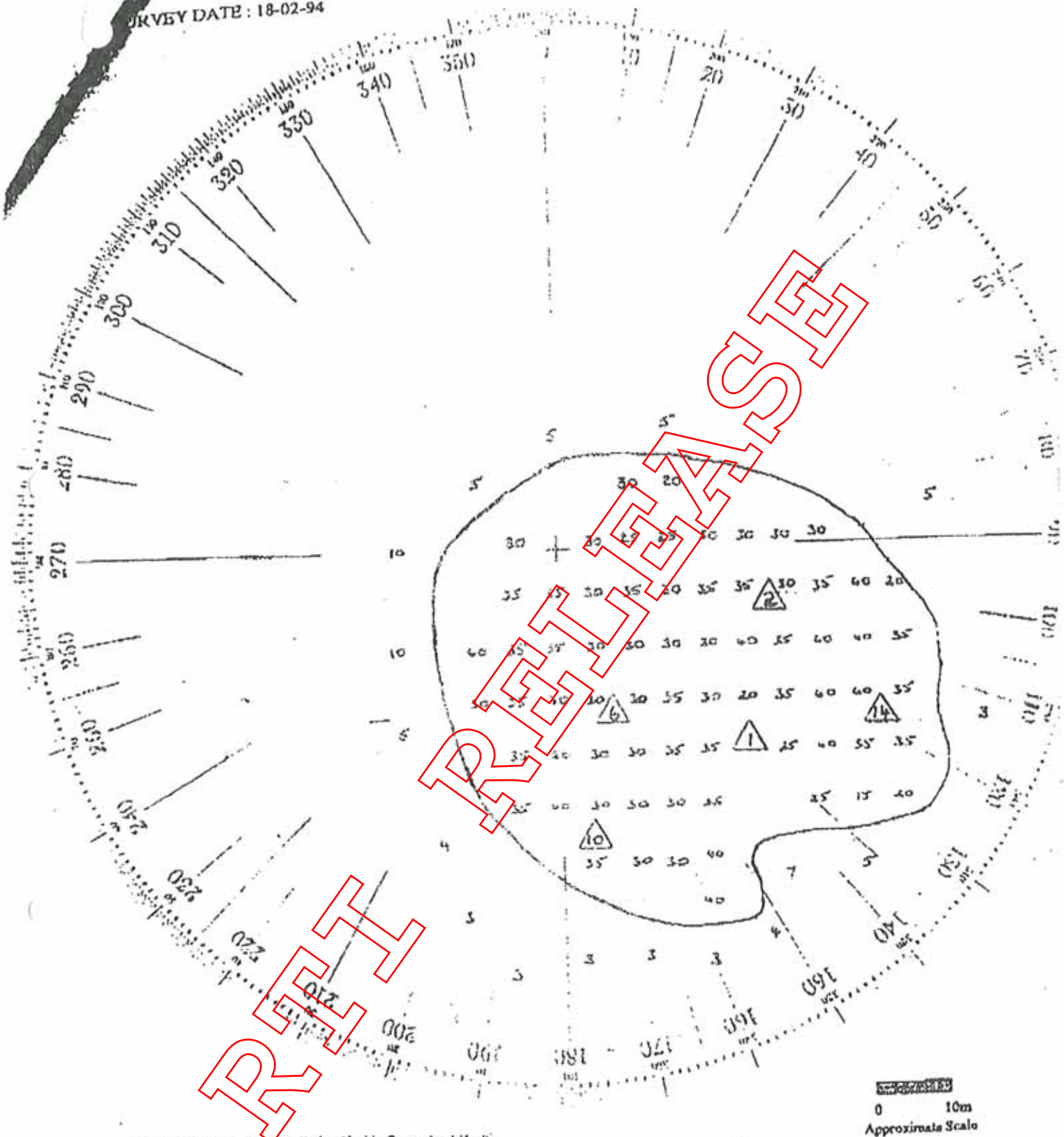
The table at the bottom of the survey plan crudely allows a conversion from gross radioactivity to an external gamma radiation level 1 metre above a semi infinite plane and depth of material. Thus it can be inferred that the variation in the radioactivity with depth is similar to the variation presented from surficial material.

Yours faithfully

B J Wallace
A/Director

ATION SURVEY OF ILMENITE STOCKPILE - RECREATION RESERVE 1446, NOOSA NORTH SHORE

URVEY DATE : 18-02-94



Measurements made by Radiation Health, Queensland Health.
Readings are μR/h at 1m above ground taken with Ainor gammameter 14.4B, and include background.

GROSS GAMMA ACTIVITY OF CORE SAMPLES

△ Mines Survey Pegs :	1	793 counts s⁻¹kg⁻¹	which is equivalent to	44 μR/h at 1m above ground (1)
	2	857	"	50 "
	6	653	"	36 "
	10	578	"	32 "
	14	583	"	32 "

(1) Based on a Standard sample : 359 counts s⁻¹kg⁻¹ which is equivalent to 20μR/h (assuming semi-infinite plane and semi- infinite thickness)

Attachment 5

QUEENSLAND HEALTH

RADIATION DOSE LEVELS FOR PROPERTIES WHERE MINERAL SAND RESIDUES ARE DEPOSITED ON THE GROUND

The aim of this document is to provide the recommended radiation levels for properties with mineral sand residues deposited on the ground. The type of practice involving mineral sand and the occupancy of the property determines the recommended radiation levels. The practice types are classified as; 'under control' practices and 'out of control' practices. The acceptable radiation levels shown on the attached sheet apply only to mineral sand residues that have been technically enhanced by man's activities and where the only dose pathway from the mineral sands is via external gamma radiation.

Under control practice type

These are new or established practices where the mineral sands are regulated or controlled with respect to their radioactivity, and therefore, are "under control". The recommended radiation level are based on the dose to members of the public of 1000 microSievert per annum. Examples of such practices include; the removal of mineral sand tailings from a contaminated site and a mineral sand processing plant site.

Out of control practice type and remedial programs

These are past practices involving mineral sands that preceded regulatory control, i.e. the practice is "out of control". Therefore, the only option now available to control the radiation exposure is to intervene, and where necessary, remediate the property to reduce radiation levels. The recommended radiation levels are action levels for remediation. A property that produces dose levels higher than the appropriate action level will warrant remedial work to reduce radiation levels. Examples of such practices include; former mineral sand milling sites, the deposition of abrasive blast media on the ground before 1986, and the release to the general environment of mineral sand tailings in the 1980s.

Properties requiring remediation may require a site history and radiation hazard assessment completed, together with the remedial program will determine the future land contamination status of the property following remediation.

After remediation to reduce radiation levels below the appropriate action level, where the extent and history of the mineral sand residues were not clearly identified (or known), and therefore, potential exists for the property to cause enhanced radiation levels following disturbance or redistribution of buried material, the owner/occupiers are required to provide a management plan for the property. The management plan requires the owner/occupier to reconfirm that the radiation levels are again below the applicable action level following any disturbance or redistribution of buried material and that any enhanced mineral removed from the property is managed as an under control practice. Where the extent and history of mineral sand residues are known and no further potential exists for enhanced radiation levels, no further action is required by the owner/occupier, following remediation to the appropriate action level.

Mineral sand residues collected from a remedial program can be only disposed off at sites approved by Queensland Health.

Notification to the Registrar of Title of lands with radiation levels exceeding the action level

Queensland Health has an authority (Cabinet Decision No. 55857 of 16 January 1989) to provide to the Registrar of Titles, particulars relating to properties with radiation levels above 60 microRoentgen per hour (0.6 microSievert per hour) and request the entry of these particulars on the Administrative Advice file maintained by the Department of Freehold Titles.

The Contaminated Land Act 1991

The Department of Environment is the lead agency in the management of contaminated lands using the *Contaminated Land Act 1991*. While the land contamination legislation covers an extensive array of hazardous substances, it does not regulate lands contaminated with radioactive substances that are the responsibility Queensland Health and the Department of Minerals and Energy. To promote a whole of government approach to the management of contaminated lands, Queensland Health is involved in the review of contaminated land legislation so that this legislation may also be used to

manage lands contaminated by radioactive substances. Note: it is intended that an amended *Environmental Protection Act 1994* will incorporate the *Contaminated Land Act*.

Radiation dose levels for practices where technically enhanced radiation sources of mineral sands are deposited on the ground

	OCCUPANCY FACTOR		
	Total[1]	**Partial[2]**	**Intermittent[3]**
	(microSievert (μSv) per hour)		
"Under control" Practice	≤ 0.1[4]	≤0.2[4]	Not applicable
These radiation levels are over and above natural background radiation levels. Radiation dose levels are a dose constraint, based on the member of the public dose limit of 1000 microSievert (μSv) per annum.			
"Out of Control" Practice	0.6[5]	1.0[5]	2.5[6]
These radiation levels include a contribution from natural background radiation levels. These radiation dose levels are action levels for remediation purposes, and are based on an intervention level of 5000 microSievert (μSv) per annum.			

Notes

Radiation levels measured 1 metre above ground level.

(1) Occupied on a regular day to day basis e.g. dwellings, businesses and schools.

(2) Occupancies of a few hours per week e.g. parks. Future use of property restricted to partial occupancy.

(3) Occupied on a intermittent basis e.g. roads and footpath. Future use of property restricted to intermittent occupancy.

(4) *Recommendations for limiting exposure to ionizing radiation (1995) (Guidance note [NOHSC:3022(1995)]) and National standard for limiting occupational exposure to ionizing radiation [NOHSC:1013(1995)].*

(5) From InterDepartmental Committee for Radioactive Mineral Sands 8/8/83.

(6) *National Health and Medical Research Council, Guidelines for Remedial Action in Area where Residues from Mineral Sand Mining and Processing have been Deposited (1984).*

Radiation Health
Queensland Health
450 Gregory Terrace
FORTITUDE VALLEY 4006

Phone: 07 3406 8000
Facsimile: 07 3406 8030

4 November 1995

Attachment 4

Radiation Survey of Old Mine Site - Rainbow Beach

Radiation Exposure Rates (µR/h) Measured 1m Above Ground on
[redacted]

Instrument - Austral 2219 R Geiger [?] S/N 52020

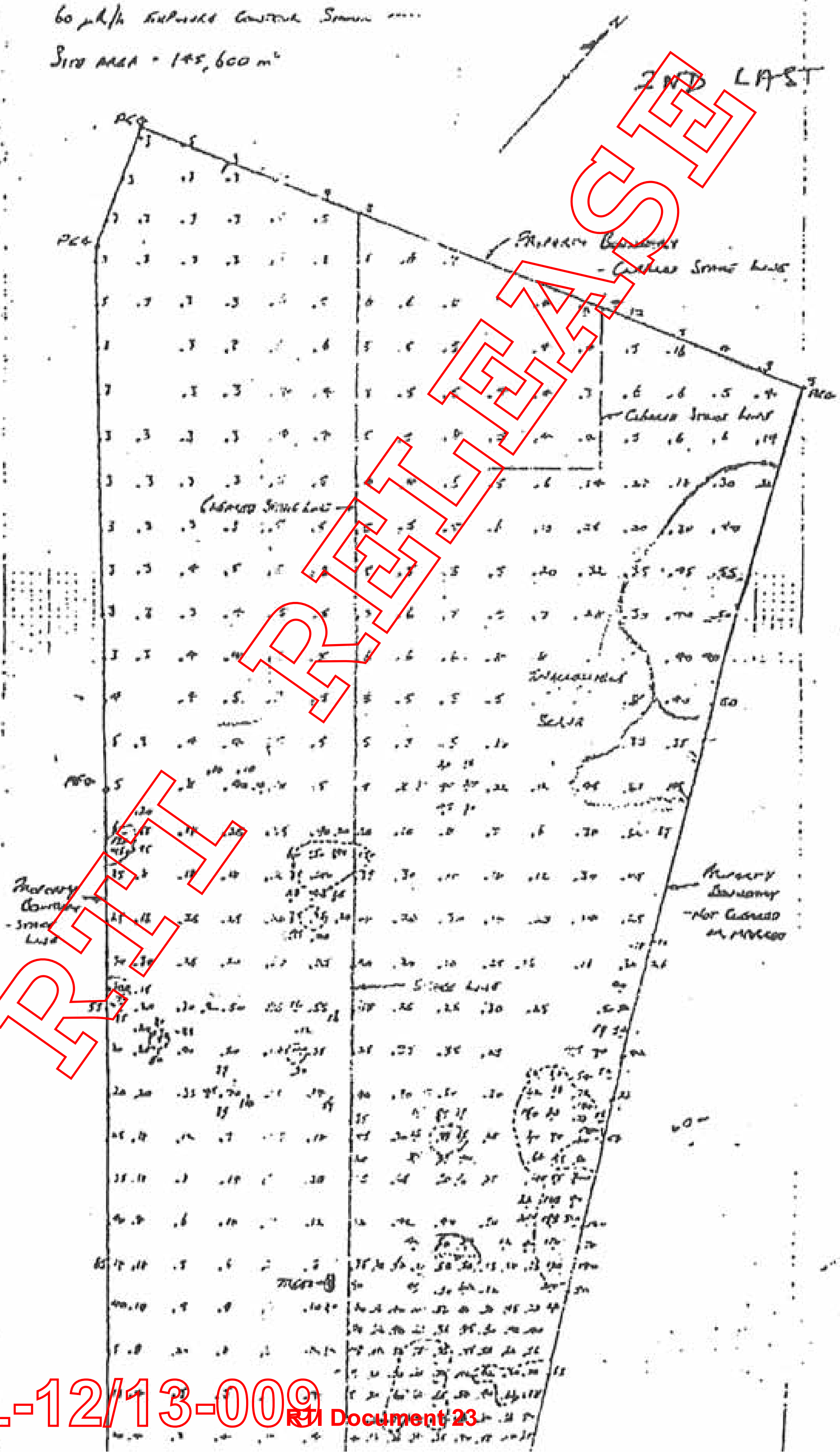
Approx. Scale - 1cm = 20m.

60 µR/h Exposure Contour Shown ....

Site Area = 145,600 m²

Attachment C

2ND LAST SURVEY



Note on file dated 15/6/87
Copy sent to Earl Alexander
Letter of 13/9/88 (Ref 535-61) based on
these results.

(3)

DEPARTMENT OF MINES & ENERGY
Facsimile Transmission

GPO Box 194
Brisbane
Queensland 4001

Facsimile No: (07)3237 0470
Telephone: (07) 3237 1499

Queensland Minerals & Energy Centre
61 Mary Street
Brisbane
Queensland
AUSTRALIA 4000.

If any problems are experienced with transmission, please ring the above phone number.

TO		FROM	
	ATTENTION: **Matty Pile**		NAME: **David Carmichael**
	ORGANISATION: **Radiation Health**		POSITION: **Senior Project Officer**
	FAX No **3406 8030**		PHONE No: **3237 1603**

PRIORITY: PAGES INCLUDING THIS ONE: 5 DATE: June 12, 1997

Dear Matty

As discussed earlier, I am faxing to you a project proposal information summary outlining the background, radiation information notes, and proposed processes.

Detailed radioactivity surveys were carried out at Rainbow Beach in June 1987, and at the Recreation Reserve Noosa North Shore in July 1989 and September 1994. Earle Alexander from this Department recalls that spot measurements were taken by Jim McGilvray around 1984 (give and take a few years) on all the four stockpile sites.

In September 1996 reconnaissance spot surveys on all four sites were undertaken by M. O'Flynn and myself using this Department's meter.

Sincerely,

David Carmichael
Mineral Resources Branch.

QUEENSLAND DEPARTMENT OF MINES & ENERGY
PROJECT PROPOSAL - REMOVAL OF ILMENITE STOCKPILES
COOLOOLA COAST

Introduction

There are 5 identified sites within the Great Sandy Region that contain ilmenite stockpiles. The stockpiles are a remnant of mining for heavy mineral sands which occurred up to the mid 1970's along the Cooloola Coast and on Fraser Island. Mining generally included an on-site separation of heavy minerals from the light minerals using specific gravity separation techniques. This was followed by further separation of the constituent heavy minerals at a secondary plant away from or at the mine site.

The secondary plants separated the ilmenite, which is weakly magnetic, using electromagnets, from the non magnetic fraction. The ilmenite, with little commercial value in those days, was stockpiled close by the secondary plants.

Ilmenite is not of itself radioactive, but in most cases, some monazite was contained in the ilmenite stockpiles. Monazite contains radioactive thorium and can be a radioactive health hazard in sufficient concentrations. There is no perceived present danger to the public as the levels of radioactivity in the stockpiles are low. Reconnaissance surveys on some sites and detailed surveys by the Health Department on others, give levels which fall below that specified for their existing present-day land use.

Removal of the remaining stockpiles and the implications for doing so are being reviewed because:

- Favourable market conditions should allow the stockpiles to be removed at potentially no cost to Government and,
- Any public perception of ongoing health risks would be reduced and,
- Removal would provide a means by which the sites can be rehabilitated.

From a radioactive health and safety issue, the removal of the stockpiles is not necessary but prudent. From a rehabilitation perspective, the stockpiles being a product of sandmining in the region, remain man made features and their removal would restore the areas back to a near natural condition.

The Great Sandy Region Management Plan, (Section 4.03, Mineral Exploration and Mining), states ***"The removal of existing stockpiles of processed minerals may be permitted where such action would contribute to the rehabilitation of the site or to mitigate a recognised health hazard"***. The ilmenite stockpiles fall within this category.

Radioactivity

The type of practice and the type of occupancy determines the recommended gamma radiation levels for the stockpiles. There are two types of practices, ***'out of control'*** and ***'under control'***.

An ***'out of control'*** practice is a past practice involving mineral sands that preceded regulatory control. The recommended radiation levels are action levels for remediation. All the stockpiles are classed as 'out of control'.

An **'under control'** practice is a new or established practice where the mineral sands are controlled with respect to their radioactivity. For example, the removal of the ilmenite to another site would result in the new site to be classed as 'under control'.

All the stockpiles exhibit radiation levels which fall below that specified for their existing present-day land use. The removal of the stockpiles will contribute to the ALARA (As Low As Reasonably Achievable) principle for radioactivity levels with social and economic factors taken into consideration.

The Stockpiles

Rainbow Beach

The stockpile is located on unallocated State land immediately north of the township of Rainbow Beach. The stockpile was recently surveyed and its volume was calculated at 60,000m^3 containing 162,000 tonnes of ilmenite. The land was originally a mining lease on which the dry mill for the processing of feedstock from Fraser Island and Cooloola was sited. The stockpile is revegetated on its flanks and is bare on top. It exhibits relatively low levels of radioactivity which are below the upper limit for total occupancy. The material could be removed with minimal disturbance to the surrounding countryside.

Fraser Island

The two Fraser Island ilmenite stockpiles resulted from sand mining on the island during 1975 and 1976. The stockpiles are located a couple of kilometres southwest of Dilli Village in unallocated State Land. The northern stockpile has been located but the exact location of the second stockpile about 1km to the south, is unknown as the area is inaccessible due to heavy undergrowth. Both stockpiles are reported to be similar in that they are buried and covered with about 300mm of sand. The northern stockpile is completely covered by regrowth. The area is remote and not generally visited by the public.

The volume of ilmenite in both stockpiles is unknown. Reconnaissance radioactivity measurements over the northern stockpile gave readings well below the limit required for total occupancy. The stockpiles on Fraser Island are not included in this project proposal, because of their buried state, relatively remote location and low levels of radiation. Their removal would need to be considered if development of the sites was ever proposed.

Lake Freshwater

A stockpile and redistributed stockpile material occurs immediately south of the entrance to Lake Freshwater camping area in the Cooloola National Park. The volume and the extent of the ilmenite on the ground at this location is not known. Scattered exposures of redistributed ilmenite also occur on the beach and the frontal dunes. Most of these scattered exposures appear to have resulted from erosion and dispersal by wind and water from the main stockpile. The radioactivity levels above black sand on the upper beach adjacent to the foredunes are relatively high but still below the upper limit for intermittent occupancy. The main stockpile area exhibits low levels of radiation well below the upper limit.

The ilmenite could not be removed without considerable disturbance to the vegetation behind the frontal dunes. Removal would firstly involve concentrating the heavy mineral component from the silica sands in the reworked areas. Access to and from the area is restricted to the beach or the four wheel drive track to the Rainbow Beach road. Of all the stockpiles, this material would be the most difficult to remove.

Noosa North Shore, Recreation Reserve 1446.

The removal of the ilmenite stockpile in Recreation Reserve 1446, Noosa North Shore was put to tender by this Department in 1995. The stockpile is currently under a mining lease application. Granting of the lease cannot proceed at this stage until Native Title issues are resolved.

The stockpile measures 60m x 60m x up to 3m high. It contains about 12,000 tonnes of mainly ilmenite. There has been support for this separate project from interested parties including the Department of Environment, a local conservation group, tourist operators, the ferry operator, and the Noosa Shire Council

North Shore Freehold

Freehold land on the Noosa North Shore about 3km north of the ferry has two ilmenite stockpiles, and an associated small stockpile of possible monazite-bearing tailings adjacent to the former dry mill site. All stockpiles are largely revegetated. The volume of ilmenite is not known. The ilmenite in the main stockpile exhibits relatively high radioactivity readings as does the possible monazite tailings stockpile, but both fall below the upper limit for intermittent occupancy. This site exhibits the highest radioactivity readings of all the stockpiles. The site has potentially the greatest need for rehabilitation with removal of the stockpiles for health and safety aspects if the land is to be used in the future for residential development.

The Process

The first steps in this proposed project involve consultation with concerned parties and other interested groups.

This project is regarded as a 'one off' and intends to address the issues raised by the existence of the stockpiles. After consultation if there is general support for the project, a submission will be put to Cabinet for approval to remove the stockpiles. It is proposed that the stockpiles identified for removal will be grouped as a single package and put to tender. The applicants will be required to address all the issues identified in the project such as legislative compliance and approvals, removal methods, transportation methods, downstream processing, waste management practices, and rehabilitation which covers radioactivity, vegetation and land surface.

It is proposed that removal of the ilmenite stockpiles upon unallocated Crown land would be best managed using the legislative controls in the *Mineral Resources Act 1989*. This would entail the successful applicant applying for an exploration permit for minerals, followed by an application for a mining lease. Before a mining lease can be granted an Environmental Management Overview Strategy must be accepted which will address the issues associated with removal of the stockpile and become conditions which attach to the lease ensuring compliance to environmental standards.

The removal of the stockpile located in a National Park would be managed under the *Nature Conservation Act 1992*.

It must be stressed that this proposed project is a removal operation and not a sand mining operation. The proposed project would be jointly managed by the Department of Mines and Energy and the Department of Environment.

FIELD NOTES ILMENITE DUMPS
16 - 19 SEPTEMBER, 1996.

David Carmichael and Mick O'Flynn.

Monday 16 September:

1) *Noosa North Shore Recreation Reserve 1446*. Currently under approved EPM application 11338 by Industrial Abrasives [redacted] Stockpile of ilmenite measuring 60m x 60m x 3m high, containing up to 21,000 tonnes.

Previous removal by [redacted] does not appear to have removed much material. Only a few trucks removed. Some evidence of spillage. He has built a ramp across wet area to the dump.

Queensland Health Department survey, found readings ranging from 20 to 40 uR/hr at 1 m above ground.
Site 4 = 45 uR/hr
Middle of stockpile = 50-60 uR/hr
Disturbed area close to stockpile, yellowish silica sand = ~20 uR/hr

GPS location middle of dump = 26° 19' 50.4'' S, 153° 03' 29.6'' E.
GPS location at Site 4 = 26° 19' 52.1'' S, 153° 03' 28.5'' E.
56J 0505857, UTM 7087631

2) *Camerons Freehold*.

Track
The track in from 1st cutting road has ilmenite used as fill. At 26° 21' 29.9'' S, 153° 03' 38.5'' E; 56J 0506103 UTM 7084628; radioactivity reading of 40 - 50 uR/hr.

Mill Site
GPS Mill Site = 26° 21' 36.0'' S, 153° 03' 50.7'' E.
56J 0506383, UTM 7084429.
At the mill site concrete pads, loading area. Container stored on site.

Large Stockpile
Large dump = 26° 21' 33.9'' S, 153° 03' 50.3'' E.
56J 0506389, UTM 7084502.
Large dump roughly circular shape about 30m diameter and has ridge about 3m high.
The ilmenite in the main dump has radioactivity readings of 100-150 uR/hr.

Small Stockpile
Small dump = 26° 21' 33.0'' S, 153° 03' 48.7'' E.
56J 0506349, UTM 7084519.
Small dump possibly 1-1.5m high.

Presumed Monazite dump
no GPS coverage due to vegetation cover
The presumed monazite dump is at 150 - 200 uR/hr.
The wall is 2.5-3 m high and vegetated with lantana.
There is no visible ilmenite.

3) *Lake Freshwater Site.*

Greg Walker - District Ranger, Rainbow Beach. ph: (074) 863 160
Stan Powell - Ranger, Lake Freshwater.

Immediately south of the beach entrance to the campgrounds. The radioactivity levels range from 100 uR/hr above black sand on the upper beach adjacent to the foredunes, to 4 - 60 uR/hr in the main stockpile area. Removal of the stockpile material and reworked material would involve removal of the Casuarina regrowth and it would constitute a mining operation to concentrate the windblown, and water transported reworked material.

Site 1. (beach berm on northern side of Freshwater Creek)
Beach site = 26° 00' 26.6'' S, 153° 09' 04.3'' E.
56J 0515141, UTM 7123479.
70 -80 uR/hr
Intermixed silica sand and ilmenite reworked by Freshwater Creek entering the beach zone. The high readings may indicate presence of monazite.

Site 2 (northern side of Freshwater Creek in frontal revegetated dunes) =
26° 00' 27.0'' S, 153° 09' 02.3'' E.
56J 0515085, UTM 7123493.
40 uR/hr in dilute areas
45 - 50 uR/hr in areas where layers are exposed

Site 3 (southern side of Freshwater Creek on top of ilmenite dump exposed sand on top and revegetated by Casuarinas on the flanks) =
26° 00' 31.1'' S, 153° 09' 02.9'' E.
56J 0515086, UTM 7123359.
60-89 uR/hr over ilmenite.
This site appears to be the main ilmenite dump and most pure

Site 5 (southern point of ilmenite dump, some reworking) =
26° 00' 34.4'' S, 153° 09' 02.0'' E.
56J 0515057, UTM 7123256.
50-70 uR/hr

Site 6 (Thin layers ilmenite, reworked material from the dump to the north). =
26° 00' 38.9'' S, 153° 00' 59.0'' E.
56J 0514971, UTM 7123096
10-20 uR/hr

Site 7 (Most southernmost extent of reworked ilmenite, dilute material) =
26° 00' 28.0'' S, 153° 09' 03.3'' E.
56J 0515101, UTM 7123437.

Other radioactive readings:
Northern extremity, mottled surficial ilmenite coming out of crab holes up to 50 uR/hr, could be some monazite
On beach in front of Picnic Area sign, 70 - 100 uR/hr.

Tuesday 17 September:

Rainbow Beach Site.
Large dump about 200m long x 100m wide stockpile of approximately 120 000 tonnes. The dump exhibits a relatively low level of radioactivity (35-45 uR/hr) when last surveyed accurately by the Health Department in the 1980s. Revegetated by paperbarks on the flanks, bare of vegetation on the crest. Outside boundaries distinct. No appearance of any reworking of ilmenite.

Site 1 (at northern edge of crest)
25° 53' 53.9'' S, 153° 05' 10.3'' E.
56J 0508657, UTM 7135550.
50-60 uR/hr (occasionally 70-80 uR/hr)
in vegetated areas the readings are as low as 30 uR/hr (still pure ilmenite)

Wednesday 18 September

Nicky Shultz - Urangen Fisheries. ph: (071) 251 077 work.

Mark Gough - Principal Conservation Officer. ph: (07) 3227 6205.
Keith Twyford - District Ranger, Fraser Island. ph: (071) 279 128.
David Redman - Ranger in charge southern Fraser Island
Pat Hedges - Ranger in charge Dilli Village.

1) ***DMM (Dilli Village) northern dump.***

From Dilli village workshed (0.0 km) continue 1.4km south along sand track, veer west to 1.85km at (25° 36' 43.3'' S, 153° 04' 49.2'' E. 56J 0508077, UTM 7167283) where track passes through gap in sand dune. The dump is located about 50m to the southeast of here.

Dump covered by about 300mm of silica sand. Heavily revegetated by trees, shrubs and lantana. The site is level, being the filled remnant of a tailings pond. No holes were drilled through the stockpile to determine the thickness.

Site A: 34cm depth 25° 36' 42.8'' S, 153° 04' 51.9'' E.
56J 0508089, UTM 7167249
20 - 30 uR/hr

Site B: 35 cm depth 25° 36' 45.5'' S, 153° 04' 49.1'' E.
56J 0508064, UTM 7167201
The radioactivity level indicated is 20-50 uR/hr over the exposed hole which is little more than background.

Site C: 22 cm depth 25° 36' 42.7'' S, 153° 04' 48.6'' E.
56J 0508???, UTM 7167279

Site D: There is a slight rise in the ground indicating the edge of the tailings dam.
55cm depth to lenses of ilmenite probably at the edge of the stockpile.
25° 36' 46.8'' S, 153° 04' 48.7'' E.
56J 0508046, UTM 7167188

Site E: ? cm depth 25° 36' 45.1'' S, 153° 04' 50.9'' E.
56J 0508122, UTM 7167222

Site F: 43 cm depth 25° 36' 46.4'' S, 153° 04' 52.3'' E.
56J 0508114, UTM 7167157

2) *DMM (Dilli Village) southern dump.*

Entrance to old Forestry track, now heavily overgrown off track to first dump.

GPS location = 25° 36' 53.3'' S, 153° 05' 02.5'' E.
56J 0508444, UTM 7166973.

About 400m south along the track, blaze in tree = RF 28 at
25° 37.0'' S, 153° 05' 01.4'' E.
56J 0508422, UTM 7166634.

Location of southern dump not found as access to the site prevented by heavy undergrowth.