HAZ 1795

Earthquake Commission

Report into the History of the Development of the Kuirau Park side of Tarewa Road Rotorua, as it relates to Geothermal Activity

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Summary

This report discusses the background circumstance leading to the erection of dwelling houses at 16 and 20 Tarewa Road. It reviews the zoning that was allocated to the sites in the City of Rotorua's, first District Planning Map. It reviews the various steps recorded on the Council Property Files that led to the Building Permits being issued and it reviews a series of old aerial photographs going back to 1937. The various letters and file notes are then discussed and from that material, a conclusion is drawn that suggests that proper diligence was not always impeccable.

An appendix is included that discusses a series of procedures that could be adopted if the risks associated with building in this geothermally active area are to be minimized.

1. Authorization

The Earthquake Commission (EQC) has expressed an interest in the history of building development at the eastern side of Tarewa Road. This follows their recent settlement of claims for two home units that were built at 20 Tarewa Road and that have now been demolished. The units were demolished following a build-up of geothermal heat in the ground beneath that had rendered them uninhabitable.

EQC have requested I investigate just when, why and how those residential sections were rezoned and the buildings came to be developed on them. They are interested to know whether all the legal requirements were met for their development and whether all parties acted with proper diligence.

2. Background

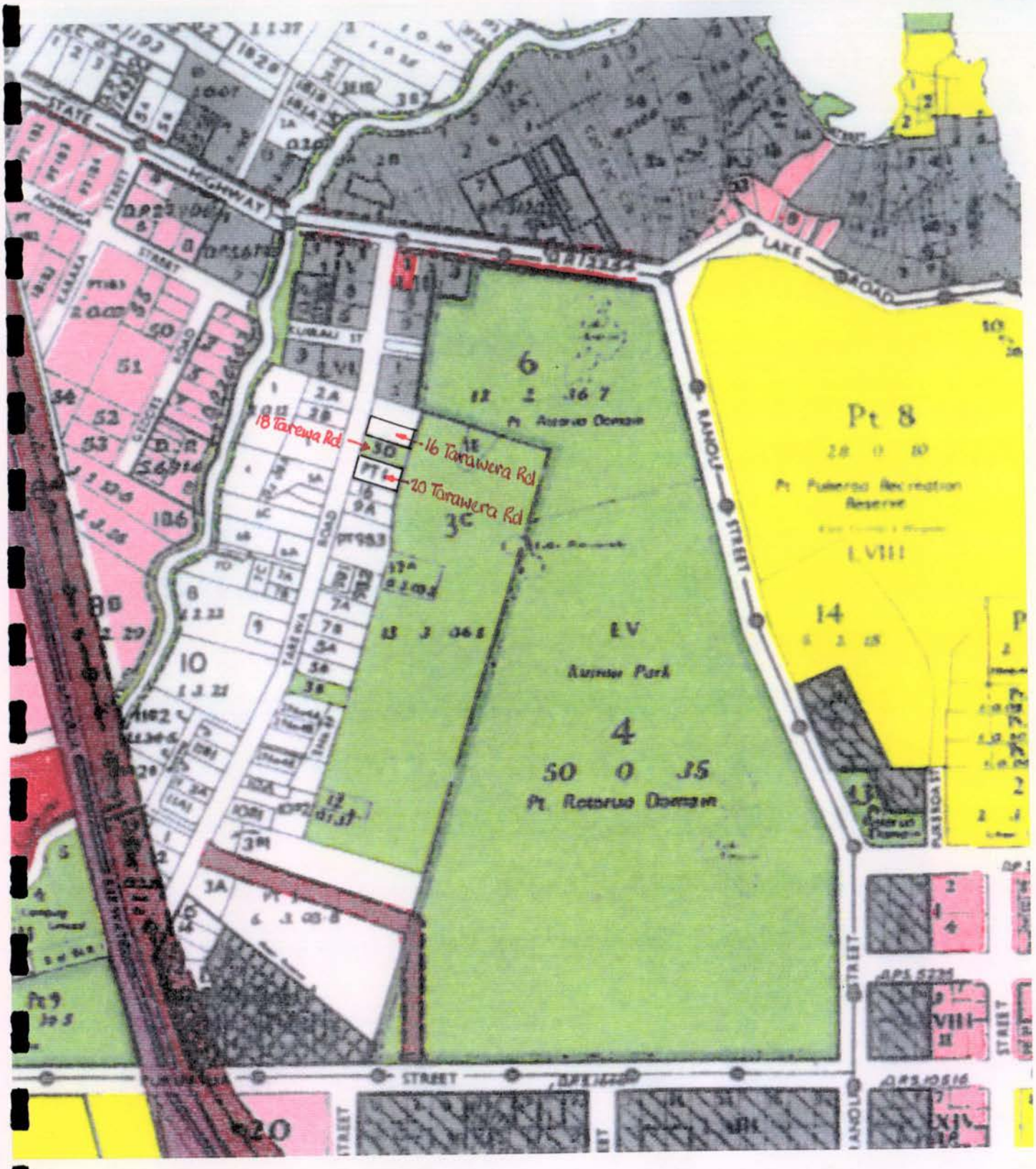
Since man came to Rotorua, he has tended to huddle around the geothermal springs. From the start, he built his homes close by, or even over, geothermal vents. It seems probable that had Rotorua been a green field site with development only commencing since the Resource Management Act became law in 1991, houses would never have been permitted to be built so close to active geothermal features. But the traditional uses seem to have grown with us and been accepted as existing uses. It is easy to empathize with existing Council staff as they try to wrestle with this in an increasingly environmentally conscious world.

One question that needs to be continually addressed, is just how safe is it to build in here? It is easy to appreciate the logic that would argue that buildings close by or even over a geothermal vent are never 'safe'. That it is unreasonable to ask the Earthquake Commission to wear the result of any rash or unsound decision by home owners, Councils, or others. On the other hand, to have such an argument accepted could also mean that few claims are ever accepted by the Commission. Just when should a slow dawning or understanding to a few, of a long standing threat which might affect life and property, be ossified in law? And just who should wear the consequential losses in value? The Government for not acting because they saw the problem only a little earlier, Councils', the Owner, or a body such as the Earthquake Commission? How does one correct the errors of the past without causing loss today? Trying to right past problems is are not confined to Treaty claims. Many of us will no doubt have trouble finding solid ground on these issues.

And on risk, what tools are given to individuals, or Councils, or Governments to allow them to rationally assess that risk? I cannot recall ever seeing a paper, technical or otherwise that would allow any home buyer or his adviser to objectively assess his true risk. It seems doubtful that current LIM reports do that. For example, to assess whether an isolated eruption of a geothermal vent under, or close to a house is more or less likely than, say, beach erosion on a property at the coast. And whether a tsunami has a greater or lessor ability to wipe out a community than a volcanic eruption at Rotorua or Taupo. And if all are possible, just how can the authorities possibly know just how to rank such risk and on when to take decisive action?

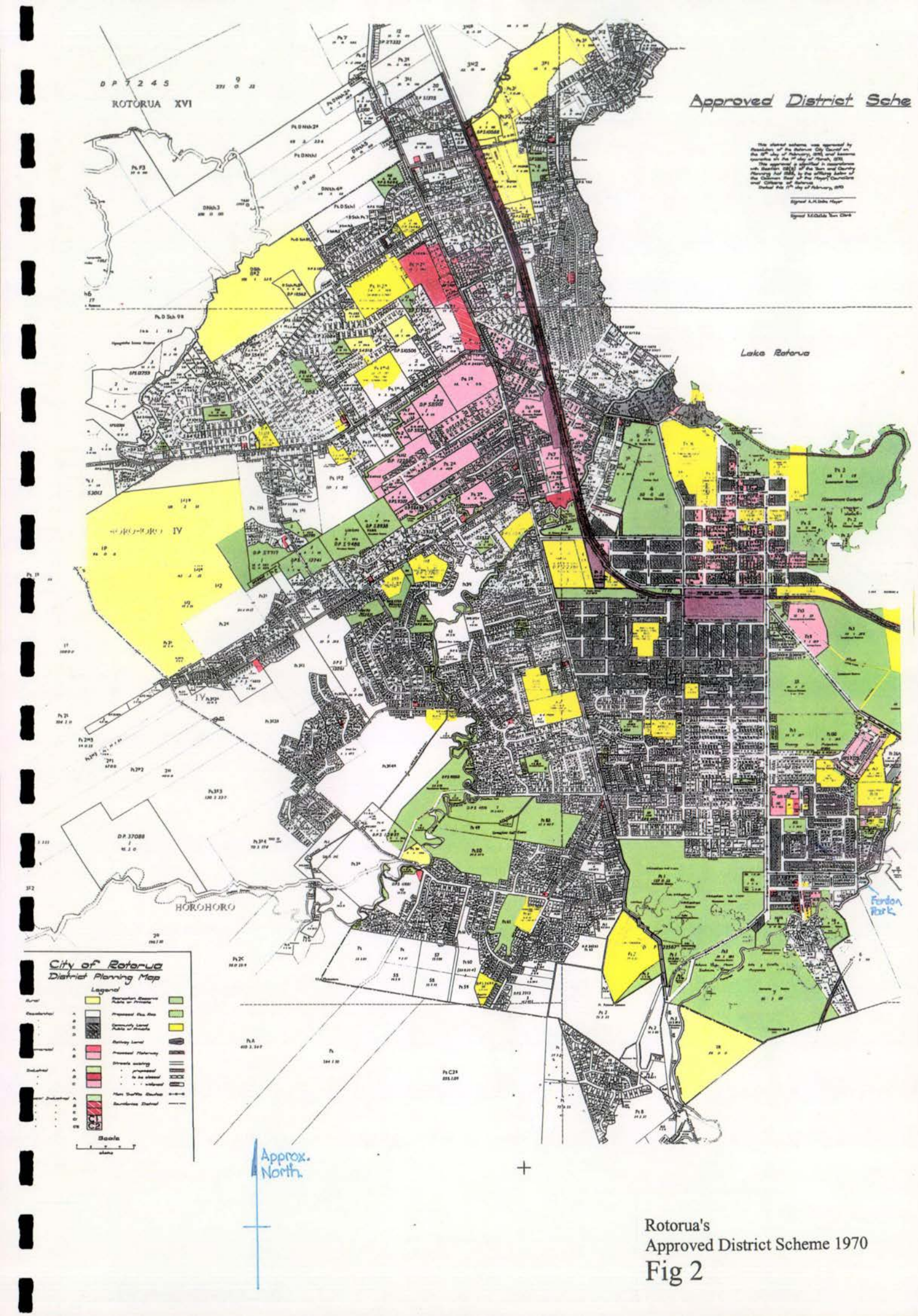
The Commission's discretionary ability in defining the word 'imminent' may raise wider issues. If for example, we were told by Geologists that a major volcanic eruption is imminent, and the Authorities emptied Rotorua, what does one do then? The eruption still may not occur or be as damaging as predicted (especially if exaggeration or simple conservatism had previously set the scene). Who would be bold enough for example, to demand Mt Maunganui be emptied immediately, because of a serious tsunami warning? Or rash enough not to? I cannot help but think that these types of issues quickly become unfathomable. That of course does not mean they should not be debated and researched. But nor does it necessarily mean they should become the target for sensational stories in the media that cannot be challenged. Rational debate for one person, can too easily bring terror to another.

Properties on the Eastern side of Tarewa Road form the Western boundary of Kuirau Park at Rotorua, as can be seen from the attached plan of part of Rotorua (Fig 1). This is an enlarged view of part of the first District Planning Map. The whole Map is shown in Fig 2 (reduced from A2 to A4). This Plan was approved by resolution by the then Rotorua City Council on 17 February 1970. My understanding is that it was first prepared in about 1964.



Approx. North

Part of Rotorua's
Approved District Scheme 1970
Fig 1



Rotorua's
Approved District Scheme 1970

Fig 2

The two properties with naturally occurring geothermal surface features that have been the subject of attention by EQC are at 16 and 20 Tarewa Road and are so marked in Fig 1. Between these two properties is a third section I call 18 Tarewa Road, zoned in this first District Scheme as recreational reserve and has become part of Kuirau Park itself.

3. Procedure

In order to gain some understanding of the circumstances surrounding the development of these sites in Tarewa Road, I chose to restrict the investigation to what formal records I could find, rather than rely upon hearsay and opinion. There were definite reasons for that. The more I delved into this history, the more sure I became that memory and third party comment could too easily reduce to be a matter of opinion, or even of legend or myth.

For example, in the course of this investigation I spoke with a retired medical practitioner who related to me how he used to ride his bicycle around Kuirau Park as a child and knew the area well. He later spoke to me of a large pond in the area east of the Boys High School, between the Railway line and Pererika St. He used to catch frogs there. When I examined early photographs, sure enough there is a pond, but its size could hardly be described at 'large'. No doubt the Doctor was truthful in his account of that pond, the trouble is, that in the telling and more importantly in the receiving of the message, that pond grew in my mind into something out of proportion to reality. This comment seemed to me typical of how childhood memories can mislead. An intelligent, articulate person of integrity was describing a genuine feature at Rotorua, long since gone, yet left me taking an incorrect impression to pass on. This type of message could too easily have led me to a faulty conclusions so I chose to try and avoid them.

Fortunately, I was able to secure old aerial photographs of the area in question. I reflect that a 20 year old at the time of the first aerial photographs that I have (1937), would be over 80 years of age now. Not only is there a reducing number of articulate people from that period still alive, but one might reasonably begin to question the accuracy of recall of those remaining, no matter how genuine the effort. And any quote from a third person relating to this or even an older period seemed to require being treated with even more caution.

It is for these reasons that I chose to try and confine my search to hard copy and to take less account of individual recall.

The various parties with whom I spoke, and their contribution to this investigation were as follows:

3.1. Rotorua District Council

The main source of hard copy available to me came from Rotorua District Council files. The District Manager Mr Ted Hansen was most cooperative and helped me in this search. He indicated that Council took some pride in maintaining an open policy so far as their actions and their records were concerned, and so that proved to be. His approach flowed through to his Chief Inspector Mr Pat Lawrence and Geothermal Inspector Mr Bill McKenna, as well as Town Planning staff, the Council's Archivist and Curator at the Museum, Cherie Meecham.

I reviewed every property file I could find on this Tarewa Road problem area, but avoided pressing for access to confidential files. Mr Lawrence assured me that he could find no comment on those files pertaining to geothermal matters, and such was Council's cooperative approach that I had little difficulty in accepting that as true. Likewise the files pertaining to geothermal matters at Tarewa Rd were temporarily with Mr McKenna and all were made available to me. On both counts, I was able to extract and copy as much material as I chose to from these files.

Council's computer database shows they have about 110 files relating to geothermal matters. Most are 'General' files and are held in the Council archives. Archivist Mr Richard Overy freely made all files available to me that seemed pertinent. I did not review files that seemed to me to be of little relevance to the investigation.

I had a short discussion with Mr J Scholes and Mr R Schlotjes from their Planning Department, on town planning matters and of their understanding of the procedures taken in producing and applying the first District Scheme, that which became operative in 1970.

An invaluable source of information was uncovered at the Rotorua Museum. Ms Meecham gave me ready access to photocopies of old photographs, and it was from here that I was able to track down detailed aerial photographs taken of this general area in Rotorua. She also had stored away 2 large montage of old aerial photographs arranged to form complete aerial views of the core city area. It was here that the real importance of old aerial photographs became clear and caused me to reach back to get copies from original negatives.

3.2. Bay of Plenty Regional Council

The Regional Council have taken a responsibility for Geothermal matters in Rotorua since the passing of the Resource Management Act 1991. They produced a Geothermal Management Plan in 1994 which I understand became operational on 1 July 1999. I enquired through Mr Brett O'Shaughanessey as to what file material they had on Tarewa Road geothermal activity and he indicated they had no such information. I accept that. This Council have probably had an interest in this area for too short a time.

3.3. Mr Gordon Roberts, City Engineer (Retired)

Mr Roberts came to Rotorua in about 1963. He became City Engineer in 1976 and retired in 1992. He was aware of the first District Scheme that contained the District Planning Map (Fig 2). He indicated to me that although the plan became operative in 1970, it was developed and in use much earlier. His recollection was that the plan predated his arrival but conceded it could have begun to be used about 1964. This date had earlier been suggested to me by Mr Schlotjes. Mr Roberts could not recall what events surrounded the decision to zone land east of Tarewa Rd as Residential A.

3.4. Mr Don McArtney, Chief Building Inspector (Retired)

Mr McArtney too, came to Rotorua in about 1963 as a Building Inspector. From discussion with various people and with Mr McArtney, I concluded that the first District Scheme was developed primarily by Mr Doug List (City Engineer- Deceased) and Mr McArtney. Over many years of professional dealings with Mr McArtney, I built a high regard for both his integrity and his common sense.

So it was fortuitous that I was able to contact him and discuss some of the issues I was asked to investigate. I related to Mr McArtney how I had actually witnessed an hydrothermal eruption in Kuirau Park in 1965 or 1966 and he too related how he had experienced a similar eruption in property on the shore line at the East end of Whittaker Road.

He, like Mr Roberts, could not recall the specifics as to why the land at Tarewa Road was zoned as Residential A. He did say that both he and Mr List had at times, vigorously debated where the various zone separation lines should be in the District Planning Map, but not at Tarewa Road. He indicated that much of this Map development was driven by expedience. That is, that planning decisions were severely constrained by existing land uses. General planning principles were in their infancy and he related how both Mr List and himself attended conferences on the subject at Wellington, sponsored by the Ministry of Works in order that local authorities could better understand the issues.

He indicated that in developing this first District Planning Map, they had to address adjacent sites with strongly conflicting end uses. Compromises that might not sit well in today's world, were inevitable. He instanced the Fenton Park area. Even today, it contains a plethora of different zones. These, it seems, were driven more by political expediency and a need to maximize financial returns to Council (who at that time were selling the land following subdivision of the old Council airport), than from any sound planning principle.

Some of the correspondence relating to Tarewa Road was written by Mr McArtney but he did not expand much on the details that I took from the files.

3.5. Rev and Mrs McGechie, Tarewa Road residents

Rev and Mrs McGechie, retired to 12 Tarewa Road about 20 years ago and were useful to me in the initial stages of this investigation as I sought to gain some understanding of the Tarewa Rd area. Mr McGechie knew the area well. His Uncle had lived on this site since 1924.

3.6. Martin, McCaulay, Morton. Surveyors and Engineers

Mr Morton allowed me to review his files on this subject and Mr McCaulay was persistent in seeking out the history of the key sites at 20 Tarewa Road back to when the land was classified as Maori Land. This enabled me to confirm that 18 Tarewa Road went direct from Maori to Council ownership, and confirm that the sites at 16 and 20 Tarewa Rd were at no stage in Council ownership.

This I believed, needed to be checked thoroughly, because of comment I had received that Council had bought, and then sold 16 or 20 Tarewa Road after refusing someone a permit to build because of geothermal activity. I felt this was necessary too, because my recall was that Council officer dealings with their citizens in earlier times, when different attitudes prevailed, were not always as open and transparent as they are today. In about 1970, one had to show written proof of an Owner approved before a property file would be made available.

4. Historical Issues At Tarewa Road

This report concentrates on the properties at 16, 18, and 20 Tarewa Road as defined in Fig 1. Properties in this area and on the East side of Tarewa Road received Certificates of Title under the Land Transfer Act thus:

16 Tarewa Road	15 March 1967	to Ada Martha Clark
18 Tarewa Road	25 September 1967	to The Mayor Councilors ... City of Rotorua
20 Tarewa Road	7 September 1971	to Elizabeth Anne Sirett, Diana Margaret Mees

Before these dates, the land was held under titles issued by the Maori Land Court. I did check property files for the whole of Tarewa Road but found nothing of interest to this investigation.

4.1. Photographs

For the reasons stated above, I chose to rely upon aerial photographs as being the safest way of learning just what natural features existed at these sites before building development on them commenced. I have been able to assemble aerial photographs going back in time to 1937, 62 years ago. The photographs show changes on roughly a decade by decade basis. The actual photographs attached to this main report are left unmarked so that the reader is given a clean record to review. Where appropriate, I mark a Xerox copy of the photograph it in order to make some point.

The geothermal surface features in this area have been called 'Springs' by scientists and 'Ngawha' (boiling springs) by Maori. It seems that neither term may accurately define many features in this particular area. For example, the word spring has 25 different meanings in my Collins dictionary. A water spring is defined as "a natural outflow of ground water, as forming the source of a stream". But few of the features we discuss here have flowing water from them. Most are simply water and solids filled craters and depressions which may or may not accurately reflect the natural water table in the surrounding area.

I define these features as Craters, because the dictionary defines these as "1. a bowl shaped opening in a volcano or geyser. 2. A similar depression formed by the impact of a meteorite or exploding bomb". This term seems to more accurately defines the origin of many of the geothermal features in Kuirau Park. There seems to be an explosive element associated with many depressions. The word 'Crater' more accurately defines the surface features we are discussing rather than the word 'Spring'. Having said that, for convenience, I continue to use the numbers given to these features by DSIR a decade or so ago.

4.2. Features from Photographs

4.2.1. Photograph 1937

This clearly shows a water filled crater in the middle of the site at 20 Tarewa Road. P1937-1 shows its approximate position in relation to the site boundaries. I believe this crater to be 654, the one that somehow became lost as was discussed by IGNS in their note to Council dated 17 August 1998 (P4 and P7). (see EQC files)

4.2.2. Photograph 1945

Crater 654 remained clearly visible in Aug 1945, but by this time vegetation seems to be ringing it. It is difficult to tell how high the vegetation was at that time by viewing this photograph, nor whether the crater was viewable from the road. Because the vegetation almost encloses the feature, it seems possible that water in the crater was not hot. This seems to be confirmed by Thompson in 1953 (see IGNS letter 17 August 1998, P2)

4.2.3. Photograph 1955

By 1955, vegetation seems to have completely encircled the crater. One can still see a shadow on the photograph to indicate crater 654 and the only reason to infer that it was still there was because of the evidence shown in the earlier 1937 photograph. It is probable that this crater will have been known to those living nearby, but by then, may have seemed of little relevance. Vegetation would probably have hidden the crater from view from Tarewa Road. By 1955, a small bathhouse had been installed at the SW corner of 20 Tarewa Road.

4.2.4. Photograph 1963

This oblique photograph of the site, clearly shows the bath house. Adjacent are 4 boxes I cannot identify, but perhaps they are bee hives. This oblique photograph clearly shows the low shrub that hides crater 654.

This 1963 oblique aerial photograph shows what appears to be steam rising from a geothermal feature towards the NE corner of 16 Tarewa Road.

4.2.5. Photograph 1972

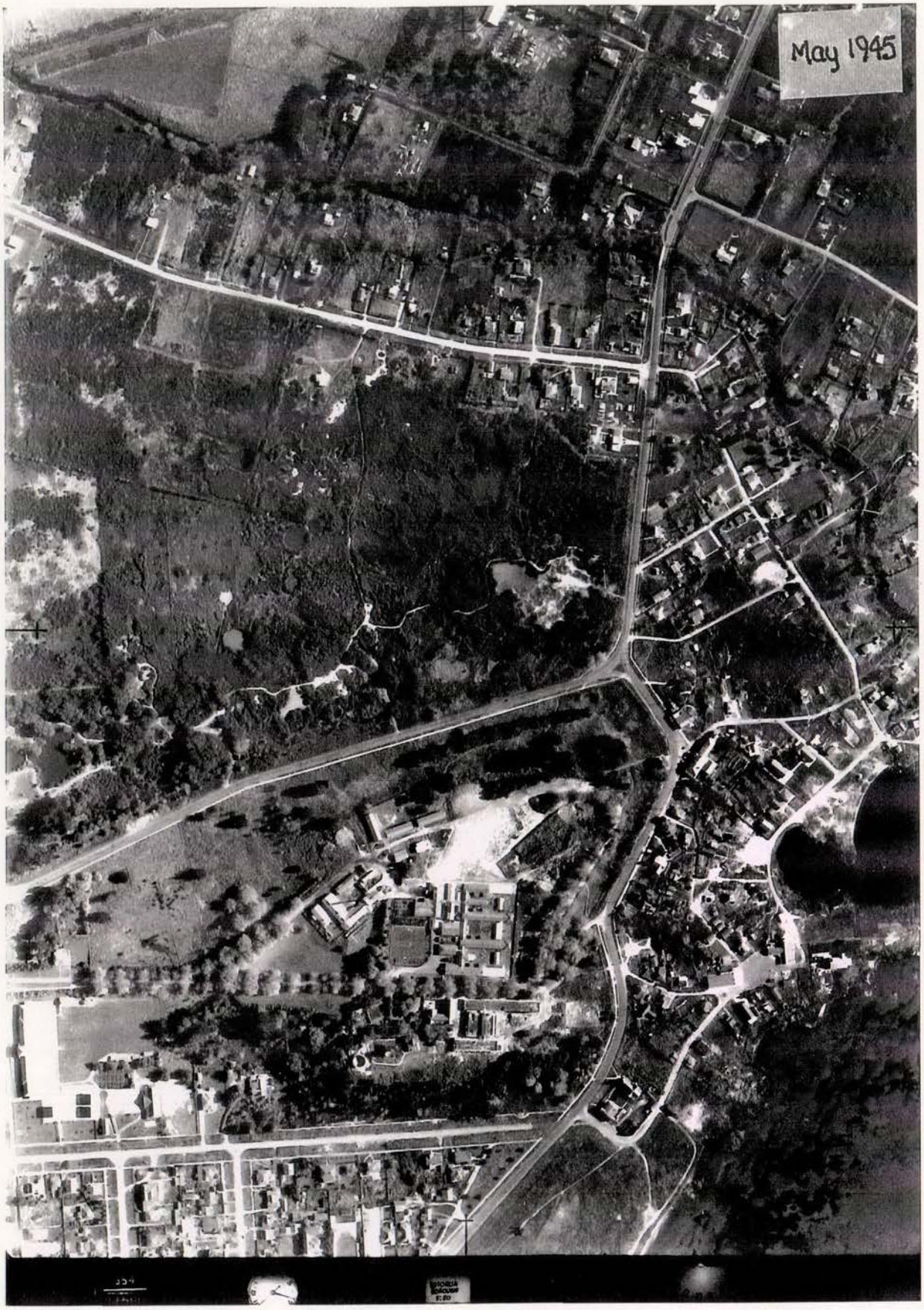
By September 1972, the site at 20 Tarewa Road had been cleared, much as it was 35 years before that. Again, crater 654 can be seen clearly as a dominant feature on the site. This 1972 photograph is useful in also describing another feature of these craters. On P1972-1, I note the white 'tidal' rings around craters 650, 651, 652 and 653 on the Maori reserve land immediately to the South of 20 Tarewa Road and also at crater 657 at the SW corner of 16 Tarewa Road. I conclude from this that these craters were water filled and that a hot or boiling water level was fluctuating within the wider crater wall. I say this because no vegetation would seem to grow where the white pumice mud was continually exposed.

This does not seem to be the case with crater 654, even though it did have a white 'tidal' ring in 1937. Looking back to the earlier photograph, one can clearly see a white rim to the crater, extending out a bit to the NW. That the white rim in 1937 is thin, may suggest nothing more than that the crater had steep sides to most of it. Again, if steep sided, this may add weight that it was not an old weathered crater and that it did have an explosive origin.

Aug 1937
16 Tarewa Rd
657
18 Tarewa Rd
656
20 Tarewa Rd
654
652
650
653

1937-1

1937-2



1945-1

1955-1

1963-1


1972-1

1979-1

1987-1

1990-1

4.2.6. Photograph 1979

In this January 1979 photograph, the two home units at 20 Tarewa Road are clearly visible with the site largely developed with garden and with trees.

P1979-1 shows how the boundary between the Council reserve at 18 Tarewa Rd and 16 Tarewa Road cuts through the very active geothermal crater 657. The water level is low, but clearly fluctuates at this spring as can be seen by its large white border. Interestingly, crater 656 at 18 Tarewa Rd, now has that tell-tale white border to it too. This feature was not clearly visible during the previous 30 year period, but shows as a hot spot where vegetation would not grow, back in 1937. At that earlier time, it does not appear to be water filled either.

It is also of interest to note the white rimmed feature at the NE corner of 16 Tarewa Road. This seems to show the geothermal feature I discussed in the 1963 photograph but it is not seen today. Instead a lawn overlays it and a Rimu tree about 3m high is in the corner.

4.2.7. Photograph 1987

In 1987, an oblique photograph of the subject area shows clean empty sites at both 16 and 18 Tarewa Rd. Crater 656 and 657 are clearly visible and the water level in each would seem to be well below their rim. There seems to be further evidence in this photograph of the geothermal feature toward the NE Corner of 16 Tarewa Road.

4.2.8. Photograph 1990

Three years later, the 1990 photograph shows that a house has been erected at the rear of 16 Tarewa Road, with a garage erected forward of this. I can no longer see evidence of the geothermal feature at the rear of this site. Since then, a further home unit has been erected between this garage (that was shifted toward the rear dwelling in the interim) and crater 657.

4.3. Chronological Order of pertinent Filed Papers

The following information has been gleaned from the various files I have reviewed. As I reviewed these files, I was struck by the absence of filed notes and papers before about 1970. The paper trail dried up. I am not sure of the reasons for that but was drawn to the view that prior to the coming of Xerox machines, most information about properties in the region was simply held in the memories of Inspectors.

4.3.1. 23-July-1969 20 Tarewa Road

At this time (23-7-69), the land was in Maori ownership. It seems from this note that there was vegetation encircling crater 654, and that it was probably blackberry and gorse, so access to its rim might not have been easy. But that did not prevent the Assistant Building Inspector commenting in the file that the 'thermal activity which would make it difficult as a satisfactory building site'. The Inspector must have thought this note to be of some importance because there are so few notes of this type from then or before that period. The only reason I can think he had for penning it, was as an aide to memory for himself and as a warning for future Inspectors.

That is, the fact that there is so little information on file prior to 1970, may indicate how important this thermal activity was to this Inspector. But I could find no evidence that Council officers ever took account of the note as they prepared to release their first District Planning Map, nor to take account of it subsequently.

4.3.2. 17-Feb-1970 Part of the Approved District Scheme

This District Planning Map is shown in Fig 2 (reduced from A2 to A4). I recall this plan was in operation several years before 1970 and this fact has been confirmed by Mr G Roberts, Mr McArtney, Mr J Scholes and Mr R Schlotjes. I vaguely recall that this plan was updated a few years before its release in 1970.

An 'Extract from Rotorua Minute Book Volume 135 Folio 193, Rotorua: Tue 16 Aug 1966' from the Maori Land Court says 'The City Corporation now realises that the two portions of the closed roadway would make very suitable exits from the Kuirau sports area and they will be very necessary when the area is fully developed. The City has offered to buy both pieces and this would appear to be a satisfactory solution in the matter of disposal.' So it seems that 18 Tarewa Road was being considered for use as public land in Aug 1966.

The Map shows these two portions of land fronting onto Tarewa Road, coloured green Reserve. The Northern one is 18 Tarewa Rd. But we know that Ownership of this block only came to Council on 25-Sep-1967. Council it seems considered this area, but the warning of 25-Jul-1969 (4.3.1) was not sufficiently important to cause it to revise the Residential A zoning that was given to both 16 and 20 Tarewa Road.

4.3.3. 7-Sept-1971 20 Tarewa Rd, New Title Issued

A certificate of Title under the Land Transfer Act was issued on 7 Sept 1971 in the name of Elizabeth Ann Sirett and Diana Margaret Mees. The title indicates that prior to this date, the land was under Maori ownership. The site remained in their hands until 30 Oct 1973, when it was transferred to Daniel Joseph O'Sullivan.

4.3.4. 28-Nov-1972 16 Tarewa Rd, Letter from Council

A letter was sent to Mrs A M Clarke (I presume to be Ada Martha Clark who received title for this land on 15 March 1975, 15 months after this letter was written). In the letter, the Chief Inspector cautions Mrs Clarke 'the general strata in the vicinity of Tarewa Road is extremely variable ...., some of which is subject to geothermal activity ....'. The Inspector would seem to encourage building on this site provided certain prudent measures were done.

This letter is further written proof (after the earlier file note of 20 July 1969) that Council Inspectors were well aware of the dangers of geothermal activity in this vicinity. This letter is also evidence that Council Officers at the time were active in seeking to caution land owners of the potential dangers of building on some sites in Rotorua.

4.3.5. 11-June-1973 20 Tarewa Road, Building Permit issued

A building permit application was received for 2 home units on 5 June 1973 and the permit was approved 6 days later, on 11 June 1973. It will be seen that this permit application was not checked and approved by the water and geothermal Inspector.

4.3.6. 7-Mar-1975 20 Tarewa Road, Leasehold Title

A Certificate of Title under the Land Transfer Act, Leasehold, was issued on 7 March 1975 in the name of L J Buckley and P D Buckley, tenants in common in equal shares. It seems from an earlier title that the Buckley's acquired both home units earlier, on 29 Oct 1974.

4.3.7. 15-Mar-1975 16 Tarewa Road, New Title Issued

A Certificate of Title under the Land Transfer Act was issued on 15 March 1975 in the name of Ada Martha Clark.

4.3.8. 1-June-1979 16 Tarewa Road, Letter from Council to LandOwner

The Owner of 16 Tarewa Rd contacted Council to discuss crater No 657 that is situated partly on 16 and 18 Tarewa Road. The District Engineer (Water and Drainage) warns the owner in this letter against filling of crater 657.

4.3.9. 10-Dec-1981 16 Tarewa Road, Memo Senior District Health Inspector

This is a memorandum to the Senior Building Inspector where it is suggested 'the instability of the ground in this area calls for extreme caution and suggests a close examination to see whether Sec 641 of the Local Govt Act 1974 applies'.

4.3.10. 15-Dec-1981 16 Tarewa Rd, Memo re Sec 641 of Local Govt. Act
The District Engineer (Roading and Design) questions whether Sec 641 applies to the checking of building permit applications. He is uncertain whether geothermal hazards are included, but suggests measures be made for such checks.

4.3.11. 11-Feb-1982 16 Tarewa Road, Legal Opinion to District Council
This legal opinion gives specific advice to Council. This opinion discusses issues of risk and of making the house relocatable. It also says 'If it is anticipated that the subsidence or slippage is likely to be sudden rather than creeping it may very well be that although the house is designed to be relocatable in the circumstances of a disaster such relocation could be impracticable'.

4.3.12. 16-Feb-1982 16 Tarewa Road, Chief Inspector to Finance Committee
The Chief Inspector, is asking the Finance Committee RDC to decide whether a Building Permit Application on this site should be approved with certain condition.

4.3.13. 9-Mar-1983 16 Tarewa Road, Letter to Council from Land Owner
It seems from this letter that the Geothermal Inspector and a Building Inspector had visited the site and concluded that so long as a house was 'transportable', they could see no reason why a permit to put a house on this site could not be granted. This approach would seem to have come from Sec 641A (1) of the Local Govt. Act.

4.3.14. 6-July-1983 16 Tarewa Rd, Letter from Council to Land Owner
Council informs the Owner of this land that they will consider an application for a permit in terms of Sec 641 and 641A but that she must obtain Engineering expertise.

4.3.15. 8-Aug-1984 20 Tarewa Road, File note
First recorded evidence I could find on the problems associated with heating beneath the home units on this site

4.3.16. 18-July-1986 16 Tarewa Rd, Letter from Council to Consultant
Engineers for a new Owner are being informed that the structure should be made relocatable and that the site should be the subject of a specific sub-soil investigation.

4.3.17. 21-Oct-1987 16 Tarewa Road, Letter re Building Permit Application
Warning given to a builder that specific approval of Council is needed to build on this site in terms of Sec 641 of the Local Govt Act.

4.3.18. 24 Feb-1988 16 Tarewa Road, Letter from Council to Builder
Council asks for a Geologist's report in respect of the current and long term stability of the site.

4.3.19. 30 Mar 1988 16 Tarewa Road, Engineer letter and DSIR report on site
This engineers letter has an attached Geologists report. The Geologist says 'There are no hydrothermal craters on the site'. He also comments on Taupo Borough Council's views on geothermal ground.

4.3.20. 27 Apr 1988 16 Tarewa Road, Council Resolution
Council resolves that a building permit be issued subject to the provisions of Sec 641A of the Local Govt Act 1974, together with another condition on fencing around crater 657.

4.3.21. 19 May 1988 16 Tarewa Rd, Owner informed Permit Approved
The Owner is informed a building permit is approved in terms of Sec 641A of the Local Govt Act. The Owner is also informed the District Land Registrar is to be notified accordingly.

4.3.22. 15 June 1988 16 Tarewa Rd, Letter from District Land Registrar
The Registrar requests certain information before he can proceed with registration. I found no evidence that Council responded to this letter to enable the registration to proceed.

4.3.23. 4 Nov 1993 16 Tarewa Road, Letter from Council to Owner
Council informs a new Owner that before a second home unit can be built on this site, a new geophysical report is required. Council also informs the Owner that a building consent would be subject to Sec 36(2)(c) of the Building Act (similar to the previous Sec 641A of the Local Govt Act which the new Act has replaced).

4.3.24. 27 June 1995 16 Tarewa Road, Consultants letter and geology report
The engineering consultants attach a geology report to the Owner dated 13 Apr 1995 and suggest a footing design for this second house. Letter to Owner and to Council.

4.3.25. 16 Tarewa Road, Council to Consultants
Council Officers and Subdivision Subcommittee fail to approve an application for a subdivision on this site.

4.3.26. 14 Nov 1997 16 Tarewa Road, Building Consent issued.
After further correspondence, a building consent is issued for a second dwelling on this site.

4.3.27. 13 May 1998 16 Tarewa Road, Concerns about Sec 36 of Building Act
The Council seeks an opinion as to whether Sec 36 can be used so long after the event (6 months later) or did it need to be used at the consent stage.

5. Technical Considerations

It seems probable that before man developed the area between the Utahina Stream and Hospital Hill, it was largely a swamp. That is, with the natural water table close to, or at, ground level. The 1937 aerial photographs clearly show extensive efforts to lay field drains in the Park in order to lower the water table. Even today, after heavy rain, large areas in Kuirau Park behind and at these sites at Tarewa Road, have ground water remaining at the surface. This could also suggest poor run-off or an impermeable surface layer. But this near surface ground water table clearly does not prevent geothermal activity from breaking through to the surface.

The many craters that pock-mark this Park and the subject sites need to be explained. Likewise do the various surface areas where vegetation will not grow. Again, in the 1937 photographs, evidence of old craters extended even under what are now playing fields. No one to my recollection has ever explained how these many craters came to be formed. Below is one possible explanation.

5.1. Crater Formation

I believe it is necessary to try and explain how these craters came to be formed if one is to begin to understand the problems of Tarewa Road. It is also necessary if we are to develop a logical management strategy. In order to gain a deeper understanding of the processes involved, one needs to draw on elementary thermodynamic principles. But I hope to avoid that here in order that an explanation can be better understood by laymen. Others may have a different interpretation.

I now digress. At sea level, water boils at 100°c. There is a direct relationship between the boiling point of water and pressure. The air pressure at sea level is approximately 1 atmosphere. (Engineers call this 1 bar absolute or 100kPa absolute). 0 bar absolute of course is a pure vacuum and is to be found in space. Most pressure gauges show a pressure of 0 bar (gauge) which is actually 1 bar (absolute). Atmospheric scientists work to finer tolerances and refer to that atmospheric pressure as 1000 millibars, the same thing. Atmospheric pressures ranges around this 1000mb figure.

However, Rotorua is about 300m above sea level and here the air pressure is less because the weight of air above us is less. Because the air pressure is less, water theoretically boils here at less than 100°c. This will be self-evident to most readers. These air pressure differences are too small to be of practical meaning in this particular discussion, but it does set the scene for the comments below.

Pressure under the ground water table rises quite suddenly with depth. This is simply because water weighs considerably more than air at normal temperature and pressure. Water is about 1000 times heavier than the same volume of air. So, if we place a pressure gauge at the bottom of a vertical pipe 10m high, it will read 2 bar absolute pressure (1ba for the air pressure above us plus 1ba for the 10m or water).

The boiling point of the water at the bottom of that pipe will no longer be at 100°c but will then have risen to 120.2°c, while the water at the top of the pipe (still at atmospheric pressure), will still boil at 100°c. That temperature variance will occur whether the pipe itself is above or below ground level. Provided there is a 10m column of water in a pipe open to the atmosphere, 2 bar absolute will be the pressure at the pipe base.

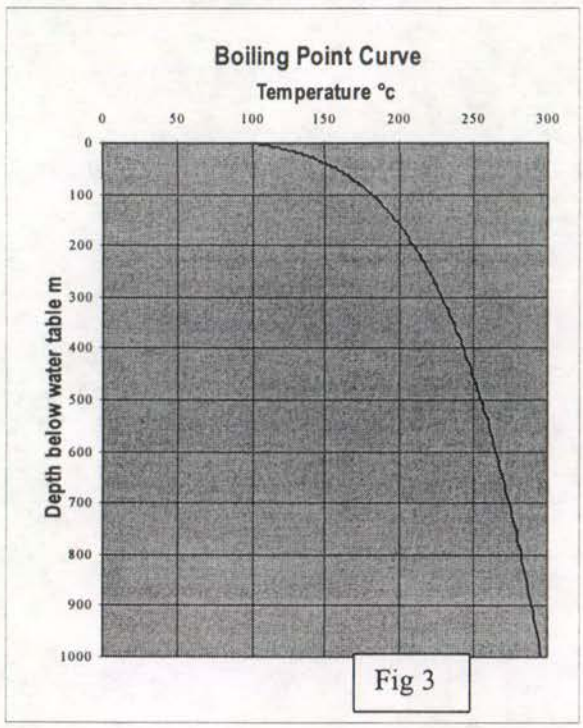


Fig 3

The idea to grasp here is that the boiling point of water rises rapidly, the deeper one goes below the ground water table. This can be seen in the graph in Fig 3 where the boiling point of water is plotted against depth (without adjustment for changing density).

From this graph it will be seen that if the open pipe was not 10m deep, but 500m deep, still water at the bottom would boil at about 263 °c. Water at that depth would be under so much pressure from the weight of water above it, that even if the temperature of the water at that depth rose to 200°c, (twice the boiling point at the ground level), it would not boil. It would remain as docile as if it was in a puddle.

The point is that most water under the Tarewa Road sites (and for that matter, most of Rotorua), remains below its boiling point and while it remains like that it has as much chance of boiling as water in the sea. It is stable and in one sense, quite uninteresting.

But water does boil in Rotorua and does so vigorously in many isolated places. However, this boiling in surface features is probably only be over a small part of 1% of the Rotorua land area. Why does it do this?

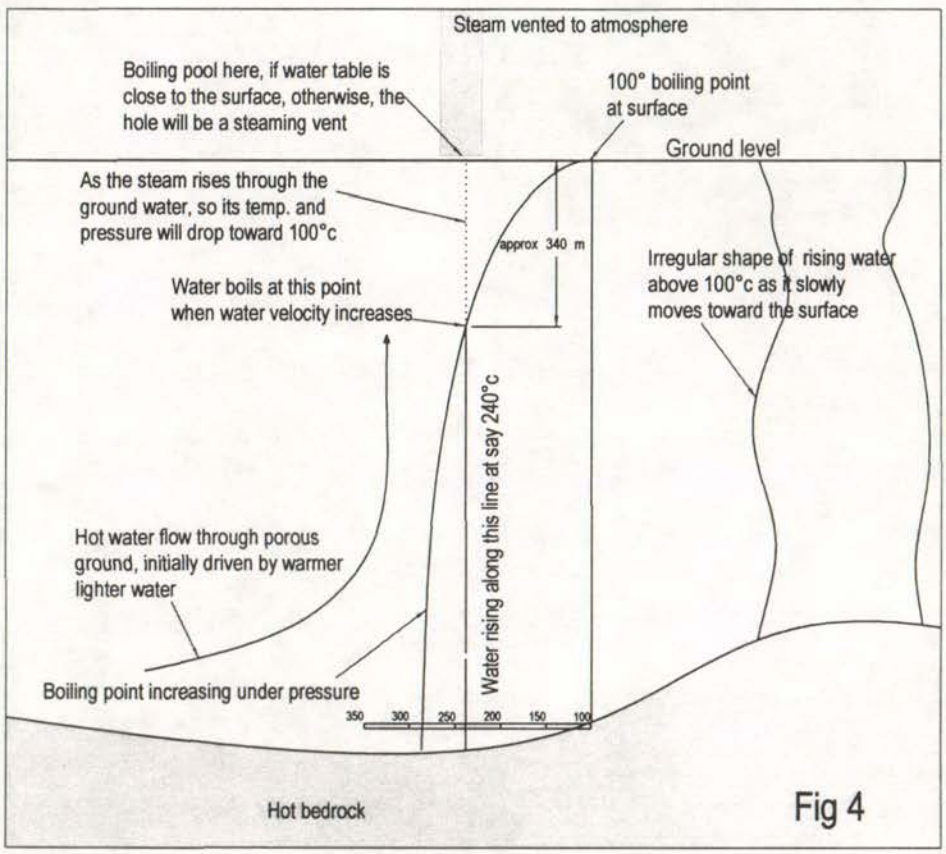
To begin to understand this boiling, I want to introduce another concept, Energy. To define energy is not necessarily easy. Engineers would define energy as the capacity of a body to do work. Energy comes in different forms, it is all around us (and within us). For example, electrical energy, heat energy, kinetic energy (from the relative movement of mass), chemical energy and potential energy (stored energy, waiting to be used). The source of energy for the current purpose is heat energy. It comes from nuclear reactions in the centre of the earth but is experienced by us as heat. Energy in the form of heat is considered to be vigorously vibrating atoms.

At many places in the world, sufficient energy rises from the earth's centre to increase the heat of the water at the surface, finally to its boiling point. If the water receives more energy than that required to boil it (and below 221.2 ba), then the excess energy converts some of the water into minute steam bubbles. This steam, then at exactly the same temperature as the water surrounding it, holds the excess energy.

To get a feel for what is happening at depth, consider a cubic metre of water at a point where the pressure is, for argument sake, 10 bar absolute. If that water temperature is raised to its boiling point (179.9°c) and has to absorb fractionally more energy after that, the extra energy cannot be held in the water or the solid surrounding it, so this energy will convert a minute part of that water into steam. But its temperature will stay the same. A minute water gas (steam) bubble will form.

When rising energy heats water above the temperature of adjacent water, its density reduces. There is a tendency for that hotter water to float up above its colder, heavier, neighbour. When steam is created, the water-steam mixture becomes even less dense. It tends to 'float' up toward the surface.

As that steam-water mix moves upward, so the weight of water above it reduces. This reduced weight means the pressure and hence its boiling point (see Fig 4) will drop too. This in turn means less energy will be required to boil the water and the excess will convert more water to steam That excess energy is converted into ever more steam at ever reducing temperatures, so displacing ever more water and making it lighter again. As it rises, so that water-steam mixture will continuously drop in temperature (and the amount of steam will increase) along the line on that graph in Fig 4. The process continues to the surface, when the steam is finally discharged at its boiling point of 100°c into the atmosphere.



It is of course possible that a colder water aquifer could cut across this rising fluid and absorb some or all of that excess energy in the steam but the upward driving force will normally be the dominant action.

If the water at boiling point is also saturated with some dissolved solid (in Rotorua that solid is normally calcium carbonate), the excess energy, in creating steam, forces some of that solid out of solution because steam cannot retain the solid. The dissolved solid is then deposited on the ground nearby. This calcium carbonate will tend to form around the perimeter of any crack or vent the rising water passes.

It is much the same way as hard water in some towns water supplies deposits solids on the wall of an electric jug. Over time, this process can produce irregular solids lined 'pipes' from depth to the surface. It is from these features that we see vigorously boiling 'fumeroles' like that at 10 Tarewa Road, and in other circumstances, geysers.

But not all boiling water that rises contains a saturated solution of solids by the time it reaches the surface, and it may not even be boiling. In these cases, that tightly confined irregular pipe might be less likely to form. Instead, we see features like mud pools and clear hot water or boiling pools. In the Tarewa Road area, these pools tend to form within the craters mentioned above.

5.2. Ground Permeability

The ground beneath our feet is said to be permeable when it contains continuous voids. The ground is said to have increased 'permeability' when it can better pass water or gas through it, and the degree of that permeability is measured by a factor called the coefficient of permeability. With this concept in mind, one might better appreciate and understand how the formation of the many craters in and around Kuirau Park may have formed.

The Kuirau park area was once a swampy basin and it remains filled with volcanic and/or lake bed debris. The various layers of debris will have changing permeability, and the ground layers may also be tilted and broken. The debris under this site is probably several hundred meters deep, and under there somewhere, is a rock basement. Its actual depth is unknown to me but unimportant for this discussion anyway.

Over time the deeper layering of deposits may well have been twisted and distorted more than the upper, more recent layers, so it may be that the deeper layers have a higher vertical permeability. Vertical permeability in the upper layers however may be so restricted with dense mud layers that they may be reasonably deemed to be impermeable.

It is probable that some layers of solids will be hard free flowing granular material, like sand and pumice from earlier eruptions, while others are mud from decayed pumice, from old land runoff and even organic debris. One difficulty for us here is that too date, no one has ever attempted to map these various layers or their permeability above the bed rock, either at the Tarewa Road site or for that matter, anywhere else in Rotorua either. For discussion purposes, one possible cross section through this field is shown Fig 5.

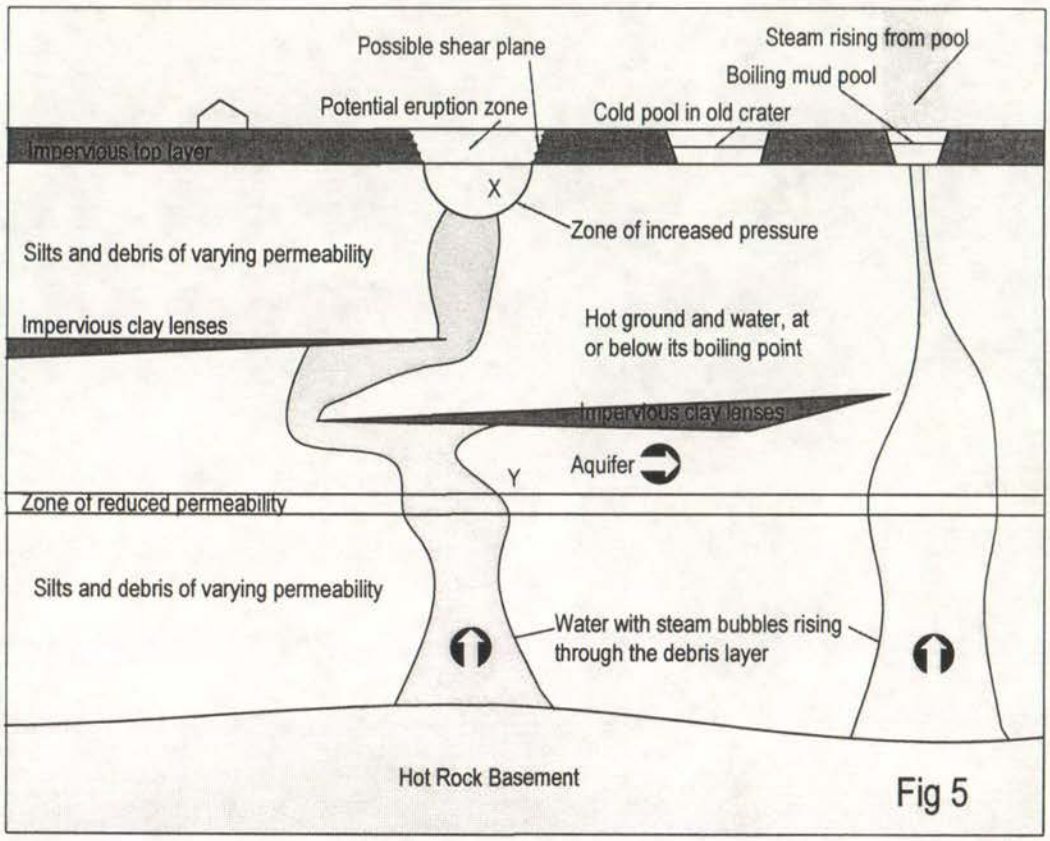
Let us assume that there is an impermeable layer close to the surface in the Kuirau Park area, above a deep geothermal resource. As and if the water temperature at depth (say Y in Fig 5) rises, finally toward its boiling point, so water will tend to rise, toward the underside of an impermeable layer (say X in Fig 5). If that boiling temperature is reached below the impermeable layer, the excess energy may simply allow pressure to build above the normal pressure (for the particular depth).

That is, because this rising energy may be contained by an impermeable layer from above and perhaps with reduced permeability in the other 2 direction, the pressure at X will start to rise above the static pressure. As the excess energy (that is, excess after boiling the water) continues to rise from Y, so the pressure at X will slowly increase.

This quiescent nature of the increasing pressure does not mean that the driving force for the system (its energy), has been somehow dissipated. It simply means that the energy is being stored as potential energy. This will finally result in increased temperatures to match the increased pressure.

This pressure may be partially relieved if there is a minor break in the impermeable layer closeby. It could delay a pressure buildup or even allow a balance to be struck between energy entering the system and energy leaving it. This leakage point could manifest itself in many ways. From a vigorously boiling fumerole (vigorous because there is a sudden pressure drop) to a gently wafting rise of steam through hot ground.

This slow build-up of energy might be contained for decades. But if any vent is insufficient to maintain an energy balance or if energy is not lost some other way, then this flow of rising energy will be relentless with ever more increases in temperature and pressure. These will reflect back to ever greater depth and over an ever widening radius. This energy buildup could well continue with no apparent evidence at the surface that it even exists.



There may not even be a ground surface temperature rise. Nature in effect, is slowly creating a ticking time bomb. Even when there is evidence of geothermal activity at the surface, that does not necessarily mean that the energy being released will be sufficient to prevent the pressure rise. That is, there could be ever increasing amount of stored energy building within the matrix of soils confined by less permeable ground. This increasing reservoir of stored energy is well capable being released with explosive violence.

There can be fluctuations in the rate of energy rising from the hot basement rock. As it changes so heat lost to the surrounding ground will change, as well as changes to the pressure at Y. Likewise, any aquifer of colder, slow horizontal moving water, say on top of any reduced permeability layer, could equally pick up some of the rising energy and again reduce or hold the pressure at X, so dissipating that stored energy.

But there must also be occasions when the thickness of the mud and the shear strength in the impermeable layer above point X is insufficient to retain the ever increasing pressure that has slowly built from below. This shear strength itself can change too, for example from changes to the moisture content in the impervious layer due to heavy rain or alternatively, a long dry period. Likewise the resistance to failure through any shear plane can be easily modified by external events such as an earthquake or a tree root.

But when that ultimate shear strength is exceeded, a sudden and violent eruption must result. The sudden reduction in pressure below the impervious layer, will cause the water to boil violently to some depth, and result in the stored energy being converted into work. The steam will expand and force the overburden up like a huge piston in a steam engine. The energy in that steam will lift not only the impervious overburden but also a considerable mass of water and solids below it, into the air. Once the eruption has released that excess energy, the resulting crater may well settle back to a quiet boiling pool, mud pool or other surface feature like we see in Kuirau Park, perhaps never to erupt at that point again for aeons.

And it may not. We see in Kuirau park what appears to be eruptive craters that actually intersect one another. This may suggest that a second eruption can occur before the first has weathered into the countryside. It seems the impervious mud blown vertically in an eruption and falling back into the crater may well rebuild a shear strength over time and form a plug for yet another energy buildup.

Those who see this crater forming activity as being simulated by the actions of slowly boiling stiff porridge are not too wide of the mark. You have the impermeable skin and the rising energy through an underlying matrix. I witnessed one of these eruptions in the vicinity of the old Kuirau Park foot pool in 1965 or 1966, as I was driving along Ranolf Street from Lake Road. So it seems, has Mr McArtney. But what I do not know is whether we were witnessing events that happen every year or two, or whether we have been lucky enough to witness a 1 in 1000 year event.

The natural state of the ground in this particular area and the craters within it cannot be considered as stable. The permeability in the underlying layers will churn up, and again change with time. So too will the natural water table, and the energy passing from the hot rock basement. Not only might the route to the surface of this boiling water change with time, but so too might the path and flux of the energy through the basement rock.

No doubt there will be many instances where surface geothermal features have not been formed with any such explosive event too.

At the centre of Fig 5, I show a potential eruptive zone before the eruption occurs, and to the right, a crater after an eruption, with boiling water in it. The range and condition of the surface features will vary between wide limits. In the centre is a cold pool in an old crater. The crater may or may not have been refilled with mud to form another impervious seal.

If the mud is impervious then water in the pond will be from rainwater or surface runoff. If it is not, then the water level may be a measure of the true water table. If the mud seal has an impermeability, but is thin and of very low strength, then it is possible that a slight increase in pressure below will break the seal and allow hot water to rise into the old vent before any pressure buildup (for a possible later eruptive event) can occur .

Provided that water is contained, the crater may simply lay dormant with warm or hot water within it. If on the other hand, water can discharge from the crater, at or near ground level, then new and ever hotter water will rise from depth to replace the water lost. And this will occur whether or not the crater has been back filled by man.

This, I believe, is the explanation for the re-emergence of hot water in the old crater 654 beneath the two home units at 20 Tarewa Road. It seems to me that craters adjacent to 654 have been allowed to overflow and these may have triggered the rise in the water temperature beneath the home units, rather than any alleged increase in geothermal energy over the entire region. On balance, I believe that permitting water to discharge from adjacent craters into the storm water system triggered the heat buildup beneath 20 Tarewa Road.

That is, because there may be interconnections to adjacent craters, it is very possible that allowing crater 657 or the crater group at 650 to overflow has caused crater 654 to be reactivate and so damage these home units.

Both craters continue to overflow. As the direct and inevitable consequence of this event, both have been discharging boiling or near boiling water to the street gutter. In my view, this overflow is not a desirable condition and a rim should be built above the existing piesometric height. And/or, the surrounding ground water table should be lowered elsewhere to try and alleviate the problem. That is, it may be worth investigating whether by surface discharging water elsewhere, heat can be redirected away from craters 657 and the 650 group. One might also choose to make use of the existing field drainage system installed in Kuirau Park in 1937.

6. Discussion

The purpose of this report, to try and find out just when, how and why the residential sections in the vicinity of 20 Tarewa Road, Rotorua came to be rezoned and had buildings developed on them. This required more than just a simple assembly of recorded events. In order to find out the why's, I felt I had to give some consideration as to how the regulatory authorities might have thought.

I sought to view this situation through the eyes of those who caused the sites to be zoned for residential purposes, and to try and get some feel for the way those who formulated the District Planning Map in 1970 and those who permitted the homes in Tarewa Road might had thought about geothermal matters at the time.

My interpretation of events that surround the properties at 16, 18 and 20 Tarewa Road is as follows:

6.1. There is no question in my mind that the 2 home units demolished at 20 Tarewa Road, were built over a geothermal crater. I feel sure this is crater 654. The feature can be easily seen in the 1937 and the 1972 photographs although the crater is less clear in the 1945 photograph. It is there, but at that time, vegetation growth may have hidden it from view.

6.2. Crater 654 did not appear to have a large 'tidal' ring of white. I believe these white rings to be a pumice mud rim which is suggestive of fluctuating water levels and with temperatures too high to sustain vegetation. That the ring is not as wide here as in craters nearby may simply indicate that its walls were steeper or that its explosive creation was far more recent. In any case, its tidal ring width is matched by other similar craters in the 1937 photograph.

6.3. The first District Planning Map was approved by resolution on the 16th Feb 1970. Fig 1 shows an enlarged view of the Tarewa Road area from this same Map. While under Maori ownership, a subdivision plan for the area was prepared for part of Kuirau Park. This plan had 2 'notional' access roads connecting to Tarewa Road. The land was subsequently bought by Council to become unformed egress points from Kuirau Park. One of these egress points I call 18 Tarewa Road. The Certificate of Title shows this property was transferred to Council on 25 Sept 1967. Because it is unlikely that Council officers would have zoned a road a reserve, it is likely that Fig 2 was not the original Map but was amended some time after Aug 1966. (see 4.3.2).

6.4. Neither Mr Roberts nor Mr McArtney were able to explain just why the land at much of Tarewa Road was zoned Residential A. My own recollection was that those residential zones, especially between Residential A and Residental B were fixed by the limits of the sewage system in existence at the time. Properties able to be connected to the sewage system were zoned Res B, those outside that region were zoned Res A. It would seem therefore that the sewage system did not extend further south than about 12 Tarewa Road.

6.5. It is reasonable to conclude that the authors of this first Map did not give much weight to physical conditions on the ground in so far as geothermal activity was concerned. The area to the NE of Tarewa Road is Ohinemutu village, the site of the original Maori settlement. Surface geothermal features in this area are common and one may reasonably conclude that this area was settled first, exactly because it contained desirable geothermal features. But this area was still zoned as Res B, which allowed for higher density housing, even with these geothermal features.

6.6. There has been a long history of residential building close to, and perhaps over, geothermal features in Rotorua, so it should be of no surprise to find that no special conditions were deemed appropriate in 1970 for the sites at 16 and 20 Tarewa Road. In terms of Planning issues considered before 1970, I believe the act of zoning the sites as Res A will have seemed entirely reasonable. Geothermal issues were simply not considered.

6.7. A geothermal problem with land at 20 Tarewa Road was filed by the building Inspector in 1969 (see 4.3.1). Whether his concerns then related to crater 654 or crater 652 (which may have encroached from 22 Tarewa Road), is not known by me. In 1969, both properties were under Maori ownership and that boundary line, if known, may have seemed unimportant.

Site ownership changed on 7 Sept 1971 and a new Certificate of Title was issued. By 1972, 20 Tarewa Road had been cleared of scrub and crater 654 was again clearly visible. A building permit was issued for the 2 home units on this site on 11 June 1973. The permit application was made on 5 June 1973 with the owners name given on the permit as W J O'Sullivan (or D J O'Sullivan). Yet the Certificate of Title shows the land transferred to him, 4½ months later, on 30 Oct 1973. I do not know the reason for that although there may have been some delay between the property sale and its formal transfer at the Registrar's office. An aerial photograph of the site was taken in Sept 1972, about 9 months before the permit application was lodged. I believe therefore, that crater 654 was filled after that and before the permit application was lodged. It seems to me that D J O'Sullivan built the home units and sold both to Buckleys about a year later.

6.8. A permit application for the home units at 20 Tarewa Road was lodged on 5 June 1973. 6 days later, the permit was issued. A caution had been placed on Council files 4 years earlier, indicating potential geothermal problem on this site. Aerial photographs showing surface geothermal features, were available. It seems there was provision under Sec 641 of the Local Government Act 1974 to restrict building on suspect sites, but I do not know what control preceded that Act in 1973.

6.9. I am asked to comment as to whether all parties acted with proper diligence. I am referring here to the 20 Tarewa Road site. In this, I believe I must attempt to consider the actions of regulatory authority. I am only too conscious of the fact that I now have the benefit of hindsight. The processing of a minor building of this size would not normally have been passed over to a Council Engineer for review.

It seems probable that a building Inspector would not have viewed the site prior to the permit being issued. However, there will have been a requirement for the builder to inform Council before the first concrete was poured on site. My experience has been that Council Inspectors were diligent in inspecting sites before any concrete was poured, and I have no reason to doubt that was done in this case.

But it is possible the site inspection showed nothing untoward. It is almost certain that crater 654 will have been filled by either the previous owner or the owner who claimed ownership on the permit application. But a busy construction site, with footing excavations, profiles and the like would probably have masked any evidence of recent crater backfilling. In addition, there was no evidence that water in the crater was hot at the time, so there may have been no indication of potential problems to be seen by the visiting Inspector.

Even if there had been evidence of a high water table at the site, or even warm ground, this may not have unduly raised concerns in the Inspector's mind. These home units had concrete floors and as was common at the time, the Inspector would have insisted that the polyethylene damp proof course beneath the concrete was sealed. He may have thought that that was enough. My experience was that this sealing was never done effectively but it was an established practice and was generally enforced.

Council Inspectors (consciously or unconsciously) will have drawn on the collective wisdom of many years of building close to or over geothermal features in other regions of Rotorua. At that time, it was common knowledge that some city buildings were built over old craters and over areas where rising hydrogen sulphide gas is known to accumulate.

So if that crater 654 had been known to an Inspector at the time, that may not necessarily have caused him concern. He might have instinctively done a trade-off as to whether a crater could be considered as 'active' or 'dormant' or 'dead'. These terms of course are meaningless, but he had decisions to make. I cannot recall Inspectors ever having been given guidelines to enable them to rationally assess risk. Guidelines on which they could reach consistent and reasonable decisions. I believe that many of the decisions an Inspector had to make at that time will have been both instinctive and immediate, and of course he will have had little ability to reflect or change his mind. That is because concrete was poured immediately after the inspection. It is very possible that the Inspector knew that crater 654 existed and had been filled in, but his and other Inspectors' prior experience may have suggested that it was reasonable to proceed with these home units anyway.

The Inspector may not have had the slightest idea of the potential for 'rising damp and heat' and even less idea of the potential for any explosive crater formation. Even had he seen that warning from 1969 on geothermal activity (and he should have seen it), he may have brushed the note aside as being a transient event, by then perhaps of little consequence. After all, it may have seemed that many others had built over old geothermal features that had 'died', and there had been no problem. This had clearly been done for decades and he will have had many precedents.

It does not seem to have been normal practice at that time to review old aerial photographs for evidence of past geothermal activity before issuing a permit. Those Inspectors, while acting with diligence and with care, may have seen no need to dig deeper. Nor it would seem, had Council built an experience base on which to justify positive action when they found such activity.

6.10. But I do have reservations that this is the whole story. A letter (see 4.3.4) of 28 November 1972 on the 16 Tarewa Road file from Council indicates that Council knew full well of the problems with the 'general strata in the vicinity of Tarewa Road ...some of which is subject to geothermal activity at both ground and lower levels'.

This letter, it should be noted, was written about 6 months before the permit was issued for 20 Tarewa Road. This could throw a different light on matters. But there is still no hint in this letter that buildings should not be built on geothermal sites. Indeed there is a certain encouragement to do so and on how that might best be achieved (by undertaking an investigation).

If a need to be careful in this vicinity had been established by Inspectors on 28 Nov 1972 (or earlier, in 1969), then I would have expected to find some evidence of similar care on the 20 Tarewa Road file for the period about 6 months later. I found none.

But it does raise the question of whether the arguments I develop above (on what a reasonable Inspector might do), are themselves reasonable. If no debate in fact took place amongst Inspectors about this site, then I question whether this building came to be built more as a result of some lack of communication between Inspectors. It may have taken place of course, but when I spoke with Mr McArtney, he did not volunteer such information to me. Again hindsight might now seem unreasonably harsh. I do believe that Mr McArtney has worked hard over many years to give some consistency to inspections so perhaps this period might fairly be treated as a 'transitionary' period.

But if there was debate, no evidence exists of that on the permit The actual permit document sets aside provision for a water and geothermal inspector to check documents and approve. This was not done. By making provision for geothermal inspections on standard printed permit form, it clear that Council's intention had long been that geothermal considerations should be positively considered. So I question whether a casualness had crept into the permitting proceedure at that time, and whether the person who approved this permit did display proper diligence.

6.11. By 1984, the situation had changed. Crater 654 was clearly receiving energy from below. The crater was filled with solids but the voids within, would still fill with water. This water was clearly being heated from a deeper source.

The problem was recognized as serious, as the file note of 8 August 1984 shows. By the last comment in this note, I conclude that the Inspector knew the issue was beyond his competence and had sought help from DSIR. I have not found written evidence of what DSIR had to say in relation to this heat build up or whether they were actually used.

6.12. Moving on to 16 Tarewa Road. This property remained in Maori ownership until 15 Mar 1975. Crater 657 has always contained very hot water and was clearly active back in 1937. On 26 Sept 1972 (see 4.3.4), Council warned the person who seemed to have an interest in this site, as to the problems with it. A title was issued on this land on 15 Mar 1975 when ownership it seems, passed to the same person who sought that advice 2½ years beforehand.

6.13. Following contact between this Owner and Council, the City Engineer wrote to the Owner on 1 June 1979 warning her against filling in crater 657.

6.14. A permit application was made in 1981 to build at 16 Tarewa Road, by a person who's name does not appear on the title, for a house that was never built. But it did prompt an internal memorandum dated 10 Dec 1981 from the District Health Inspector to the District Building Inspector. This seems to have set in train a series of events that begins to address these geothermal matters in a more systematic way.

6.15. On 15 Dec 1981, the District Engineer questioned whether Sec 641 of the Local Government Act could be applied in this case. This would seem to have triggered Council to seek a legal opinion on the subject. The legal opinion was received on 11 Feb 1982.

6.16. This seems to have resulted in further notes being written to this file (see 4.3.12, 4.3.13, 4.3.14). It seems the legal opinion was the subject of some debate within Council. By 6 July 1983, Council were accepting that a building was going to be allowed on this site (16 Tarewa Road), provided it was transportable and provided that engineering expertise was obtained. It is likely this transportability idea comes directly from Sec 641A of the Local Government Act.

6.17. On 16 July 1986 a new Owner is informed that any structure on the site should be made relocatable and that a subsoil investigation is required. A year later, on 21 Oct 1987 a builder is informed that specific Council approval is required in terms of Sec 641A of the Local Government Act. On 24 Feb 1988, Council requests a geologists report which is written on 30 Mar 1988

The Geologist reports there are no hydrothermal craters on this site. I do not know his reasons for saying that but crater 657 certainly looks to me as though it had an explosive origin. Given the Geologists view is correct, then it seems there may have been no impervious layer close to the surface at that particular spot to prevent the rising energy from reaching the surface.

The geologist then comments on how Taupo Borough Council have established regulations for prohibiting building on geothermal ground. I presume that this was his way of informing Council how another Council tried to define where the margins were, as between a buildable and an unbuildable site.

6.18. On 27 Apr 1988, Council resolved that a permit be issued subject to the provision of Sec 641A of the Local Government Act 1974. The Owner is informed accordingly on 19 Mar. 1988. A copy of this letter is sent to the Land Registry Office as is required by Sec 641A.

The District Land Registrar replied to this letter on 15 June 1988, but I could find no further correspondence on this file to indicate that the District Land Registrar's requirements had been met.

6.19. On 4 Nov 1993, in reply to yet another new Owner (who it seems, sought to place a second home unit at 16 Tarewa Road), Council indicate that a new geophysical report is required 'as there is no constancy in geothermal activity'. The Owner is also informed that the site would again be subject to notification to the District Land Registrar in terms of Sec 36(2)(c) of the Building Act (that had by then, superceded Sec 641A).

6.20. An Engineer's report was finally produced to Council on 27 June 1995, and a letter rejecting this further building permit was sent to the Owner on 9 April 1996

6.21. A Building Consent is issued for a second dwelling at 16 Tarewa Road on 14 Nov 1997, but it seems from the letter of 13 May 1998, that Council failed to use the provisions of Sec 36 of the Building Act 1991.

So it seems that for a second time, Council may have failed to register their concerns about this site with the District Land Registrar. Firstly, in 1988 under the provisions of Sec 641A of the Local Government Act (see 6.18) and secondly in 1998 under the provisions of Sec 36 of the Building Act (see 6.21).

7. Conclusions

7.1. The first question asked of me relates to EQC's interest in the history or the development of the Kuirau Park side of Tarewa Road as residential properties. EQC have expressed an interest in finding out when, why and how those residential sections were rezoned and had buildings developed on them.

When? The key document that set the zoning of this area is the first District Scheme as shown on the City of Rotorua District Planning Map dated 17 Feb. 1970 as shown in Fig 2.

Why? It was zoned as Residential A and while I could find no evidence of any specific debate as to why it should be zoned this way, it seems likely the area was part of the 'remainder' of Rotorua Land. That is, that had neither been reticulated with a sewer at that time nor had commercial or industrial activity nearby. It would seem that no steps were taken in the development of this plan to take account of geothermal activity.

How? I have not tracked through the legal basis under which this plan came into being and have presumed that the Town and Country Planning Act 1953 will have guided its introduction and adoption.

7.2. The second area of interest was whether all the legal requirements were met for the developments, and all parties acted with proper diligence. Two properties are involved, and my response to each is different.

16 Tarewa Road. On the information I have found, I do not believe that Council have conformed with all the legal requirements that they were required to do. It appears to me that they failed to register warnings with the District Land Registrar. Firstly, in terms of Sec 641A of the Local Governmant Act 1974 and secondly, in terms of Sec 36 of the Building Act 1991.

However Council Officers did show diligence in investigating these geothermal issues to the extent of seeking a legal opinion back in 1982, as to their responsibilities, well before any buildings were actually erected on this site. That diligence unfortunately, does not seem to have be consistent over the years. In this, I think their diligence could be seen to be faulty.

20 Tarewa Road. EQC paid out on this property. The permit application was lodged on 6 Jun 1973 and the permit was uplifted on 11 June 1973, a period of 5 working days. A casual examination of the file would seem to indicate that everything about this permit was done correctly, but closer examination shows otherwise.

There are 3 factors that concern me.

Firstly, there was a clear warning on the property file about geothermal on this site 'which would make it difficult as a satisfactory building site'.

Secondly, we have further evidence from the 16 Tarewa Road file, written on 29 Nov 1972, 7 months before this permit was issued, that 'the general strata in the vicinity of Tarewa Road is extremely variable and includes ground conditions ranging from rock to diatomaceous earth, some of which is subject to geothermal activity at both ground and lower levels.

Thirdly, the actual permit document indicates that the permit was issued without being first signed off by the Water & Geothermal Inspector.

Even although I believe that the Inspectors at the time generally acted with proper diligence, it is with a reluctance but in light of the first and second point, that I believe on the third point, Council did not act with proper diligence. I am unsure as to whether the information that I have found would amount to an illegality.

There is one other factor of concern to me that applies to both properties. I believe that had steps been taken to prevent geothermal water discharging from the crater group around 650 at 22 Tarewa Road and from crater 657 at 16-18 Tarewa Road, then it is likely the problems at 16 Tarewa Road may not have occurred. It is also likely that the crater at 20 Tarewa Road would not have been heated and this whole issue would not have arisen. Because this was not done, I believe that those who advised Council and its officers on geothermal matters here, may not have acted with proper diligence either. Hot water continues to overflow unnecessarily today.

During the course of this investigation, certain factors caused me some concern. These factors do not specifically relate to the questions asked of me. But I believe they could affect the way EQC views its risk, in so far as geothermal activity in Rotorua is concerned. Attached as an Appendix to this report are points I believe EQC should consider.

Jack T Just

26 July 1999

Date

Appendix

I believe that the community's appreciation of the geothermal environment and of our need to care for it, has changed markedly and at an ever increasing pace, over the past 40 years. What might be considered as totally unacceptable by an Inspector today, may well have been accepted as reasonable by an equally caring Inspector 20 or 30 years ago. The various points I wish to make are these:

A-1.0 Geothermal Risks in Rotorua

In the main body of this report, I discuss a geothermal situation that could result in a violent eruption. We know such events do occur and that they will continue to do so. But it would be very wrong to conclude from this, that somehow residents were under some sort of serious or imminent threat. It may well be there is a greater chance of being struck by lightning. On the other hand, geothermal events of either a violent or a passive type are with us. But our knowledge and understanding of them, as to their variability both in time and place is essentially, nil. No one has the slightest idea of just where or when a new geothermal feature might occur, or when an existing feature might change.

The only reliable measure we have at this time of where and when geothermal outbreaks might occur, is to review the past. We have no idea of how to predict a geothermal event within a known active area, and even less idea of where the margins to each active surface area might be. This could make the issuance of a Sec 36 notice difficult, because proving a case to an affected Owner, to justify such action could prove almost impossible. Only extreme cases might fall within its scope. It also seems unlikely to me that reverting to the use of the 'precautionary principle' or other 'catch-all' legal phrase, would ever work, until Councils' can prove they have thoroughly tried *all* means and *all* research options that are available to them. Again reasonable means and reasonable options for Council may be insufficient for an affected Owner who has much to lose.

It appears to me that the two properties that are the subject of this report, had problems that may have sprung from old, well documented geothermal features, not new ones. I am drawn to the view that diligence aside, the problems that are addressed in this report come more from a lack of understanding of the resource we are forced to live with than from any recklessness by Council staff.. To improve that understanding and leave us better able to address these issues should be our prime focus. We will have to do far more than persist with the existing inadequate passive monitoring program. We are going to have to actually take steps to better understand the issues that are actually causing us problems. I am convinced that will require the use of skills seldom seen in Rotorua before now, but skills that are readily available to us.

If we are to begin to address these risks then some attempt should be made to define the limits of the surface field and define its pertinent characteristics. In order to get some idea of the issues, attached is Fig 6, a plan of the central Rotorua region together a guess as to the limits of the field at a depth of, say 200m. Also marked on the Plan is a guess of the regions of surface geothermal activity. These lines are not accurate and I am sure they would be changed on closer examination. It is also likely that regions meld into one another in many places.

But each of the various regions with surface activity may well have different features that require different considerations. In assessing geothermal risk, they may have to be treated differently. For example:

A1.1. Kuirau Park-Ohinemutu Region

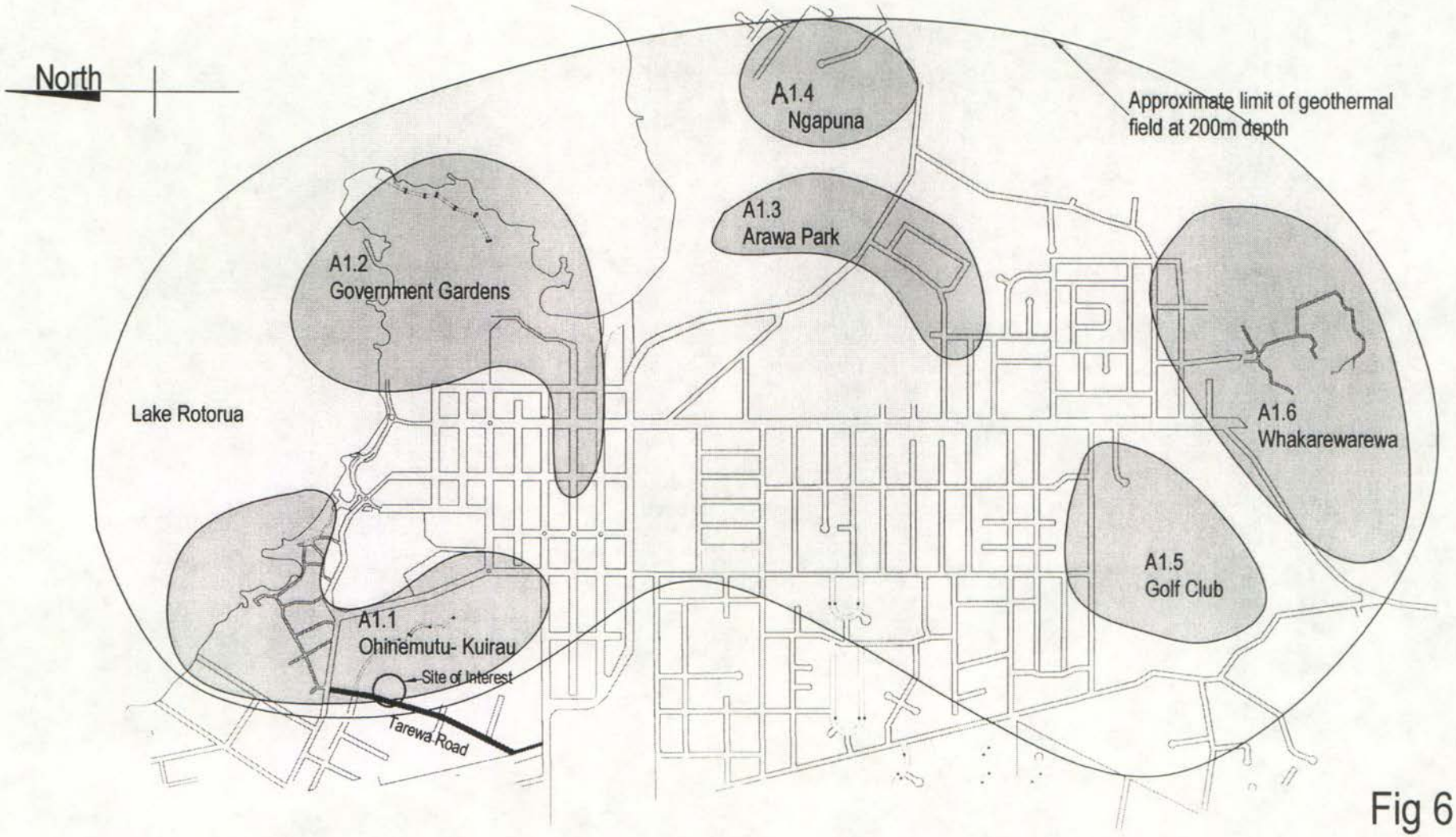

North
A1.4
Ngapuna
Approximate limit of geothermal
field at 200m depth
A1.3
Arawa Park
A1.2
Government Gardens
Lake Rotorua
A1.6
Whakarewarewa
A1.5
Golf Club
A1.1
Ohinemutu- Kuirau
Site of Interest
Tarewa Road

Fig 6

Ground level is close to lake level and the water table is high. I believe that crater creation in this area will continue, and water level changes will affect geothermal activity. Most of the area is parkland and the rest is zoned for residential use. There is a history of blowout's (explosive craters) and changing geothermal activity in the area. In the cradle of this area is Pukeroa (or Hospital hill) which I understand is considered one of the major sources of upwelling geothermal energy. Hydrogen sulphide gas emissions here seem to be lower than elsewhere. This area should be of special interest to EQC.

A1.2. Government Gardens Region

Again, most of the area is in parklands, but there is a tongue extending into the central business area at Eruera St. There are few residential sites in this area. Areas within this region are known gas emission zones with concentrations of H_2S measured at over 1000ppm. Some commercial buildings are built on solid rock sulphur, others have sophisticated sub-floor designs to try and allow the easy discharge of gas. Whether these designs are successful is unclear to me

A1.3. Arawa Park Region

The water table here is deeper, but the H_2S problem is probably worse that the Government Gardens region. This gas would also seem to be mixed with some other odorous gas of a type unknown to me. Much of the area is parkland and an industrial area but there is a small residential area that needs to be addressed in so far as gas is concerned.

Recent research at UCLA and elsewhere on the effects of long term low level exposure of Hydrogen Sulphide in humans, suggest to me that closer examination of the gas question in this area is important for safety reasons.

A1.4. Ngapuna region

The Hameora Place geothermal area is probably the outer limit of the Arawa Park region. Again, the area is either within parklands or in an industrial area.

A1.5. Golf Course Region

This area would seem to meld into the Whakarewarewa region but I separate it for one major reason. The northern area of this region is centred on Sophia St which is known to be an active and changing geothermal area. This residential area is a known strong gas producing region. The water table here is low, but there are regions where rising steam surfaces. There are regions here where I have measured high pressures in the near surface layers, and while reports have been prepared for Government about the dangers of this area, little if anything has been done in mitigation. There are what appears to be large craters in the region, that I understand were caused by gas eruptions. This area should be of special interest to EQC.

A1.6. Whakarewarewa Region

This is the main area of attraction for Tourists and again is mainly parklands. It is generally considered to be the major energy upwelling zone in Rotorua. But again there are residential properties within it. The water table is general low but a stream passes through the centre of the region. Residential homes in some micro-areas here should be carefully checked for both 'rising gas' and 'rising damp'. This area may be of special interest to EQC.

A-2.0 Assessment of the Geothermal Risk.

I have a belief (more a hope) that the threat to both life and property in Rotorua from some sudden or unexpected geothermal activity, is no better and no worse than the risk to life and property from many other potentially hazardous natural events throughout New Zealand. Having said that, I also concede that I have no credible information that could substantiate the hope. Neither does anybody else. In my view, it is imperative that research studies be set in place to address these factors. This is because in Rotorua, there has never been a credible risk assessment done here and the 'plumbing' of the geothermal field above the rock basement is essentially unknown.

Of course, we will never fully understand this field but it seems to me there are reasonable and practical steps we can take in order to assess our risks. In taking these steps, we might get a better idea of when Sec36 of the Building Act becomes an appropriate instrument.

Initial steps required to address these issues seems to me to be:

A2.1. To initially, confine a geothermal study to known areas of surface activity. There is some doubt in my mind that an infra-red survey will accurately define the limits to surface or near surface activity, especially when impermeable layers are at, or close to the surface.

A2.2. To assess whether practical means can be developed to allow the community (and its Inspectors) to better define the limits to the surface features or potentially new surface features.

To assess whether there is ever a time when it is reasonable for a Council to give a Building Consent for a building to be placed over an old crater, filled or otherwise. It may be, given time. But a deeper assessment is required. Especially when Council now has an ability to search old photographs going back to 1937. We need to know whether there are there better means at our disposal than old photographs?

To assess whether the issuing of Building Consents for the erection of dwellings over known geothermally active areas is reasonable, just because such buildings are made transportable. This directly addresses what happened at 12 Tarewa Road. Transportability as a means to address geothermal problems concerns me, even with an apparent legal sanction. This is because of the potential for an explosive eruption and the changing nature of the resource. It is interesting to note that Council's legal opinion in 1982 took some care to caution about 'sudden' events too.

A2.3. The Kuirau Park- Ohinemutu Region. To carry out an investigation to establish the mechanics, rate and limits to the build up of pressure preceding an explosive crater. To assess whether excess pressure can be relieved by practical means. To assess whether there are practical ways the community can be forewarned of such events, for example by the selective use of piesometer tubes like those used for earth dam monitoring. To assess whether a microsystem can in fact be computer modelled in Rotorua in order to try and develop some predictive tools.

A2.4. The Arawa Park Region. To assess whether a grid survey of the near surface layer in the residential area is a practical way to establish the potential or concentrations of 'rising damp' and 'rising gas' in the region. Or whether there are better ways. To better establish the composition of the minor gases here.

A2.5. The Golf Course Region. To carry out an investigation to establish the mechanics, rate and limits to the build up of pressure preceding an explosive gas crater. To assess whether the gas pressure can be relieved by practical means. To assess whether there are practical ways the community can be forewarned of such events, for example by the selective use of piesometer tubes and whether bores should be reactivated. To assess whether a microsystem can in fact be computer modelled in this area in order to try and develop some predictive tools.

A2.6. Whakarewarewa Region. To assess the probability of new geothermal activity beneath the residential homes. To assess the most effective way to monitor for 'rising damp'.

A2.7. To develop guidelines for Inspectors so that they can make decisions based on sound engineering principles, as to when and how to apply Sec 36 of the Building Act 1991. It is doubtful the guidelines mentioned above (4.3.19 and 6.17), those used for Taupo, have much relevance here. They seem to be an easy expedience, a substitute for a carefully developed strategy.

A2.8. Some consideration should also be given to whether there are practical ways to deflect rising energy from sensitive areas and also whether techniques can be developed for dampening and/or scrubbing to waste, H_2S gas.

A2.9. To review the effectiveness of the existing geothermal monitoring program. To assess whether it is a valid exercise for improving our understanding and management of the field, and if it can be improved, to indicate how that might be done.

On funding for researching these issues, it may be that EQC could receive support from both the District Council, the Regional Council and the Government.

A-3.0 Skill Base Requirements

Our basic understanding of this geothermal field in Rotorua, has changed little over the past 20 years. Over the past 15 years, almost all geothermal research has stopped.

I have a view that if the technical issues can be dealt with in a more rigorous professional manner, then many geothermal problems in Rotorua will evaporate. I believe that scientists who study this field are never licensed to comment of matters outside their specific field of expertise. A PhD or BSc in one field is but a layman in another. A fact that is not always disclosed. Most of us do become knowledgeable in fields allied to those in which we qualified. But difficulties arise when just one doubtful statement finds it way into a technical report, especially if presented as a conclusion or unchallengeable a-priori fact. Especially if as a result, property owners have their capital base threatened. And politically loaded words that carry a conclusion with them can be highly destructive on the reporter who writes them.

For example, we see in one letter of advice to Council, words like 'recovery' and 'exploitation'. The latter may be used correctly but for some, it carries with it none the less, an inference of unreasonable greed. That is quite wrong and sends a terrible subliminal message against those who tap and use this resource in a sensitive and caring way.

On the 'recovery' issue, the fact is that nobody in Rotorua or any where have a clue on exactly what is meant by the term. Pohutu Geyser, a clear reference point on which to assess the state of this field, was quiescent for long periods of time within living memory, well before any geothermal bore existed. No one knows whether water levels in monitoring wells now record a 10 year or 1 million year high, or low, or anything in between.

To date, most, if not all the research work done on this field has been completed by geologists, geophysicists or science graduates. They of course, are necessary in order to give us an understanding of the wider scene. But there may be limits in their ability to gain a deeper understanding of the thermodynamics and fluid dynamics in the upper ground layers. In my view, the professional skills required by this community now, are those that will come from experienced Field Engineers who have had extensive modelling experience. In terms of risk for EQC, Councils' and the community, there seems little point in expending funds for research or monitoring if results are to be continually questioned.

Again, in order for the community to gain a confidence in the results of any research, it is important to ensure the advisers can demonstrate their expertise in their field of advise. That all prior reports referenced are reviewed deeply, for balance and for accuracy. That reports are written in a totally transparent way and are not limited to conclusions. That all reports are peer reviewed. And above all, that the scientific ethic employed is consistent and quite impeccable.

A-4.0 Warnings on Property Files

As I reviewed the files in the Tarewa Road area, I became increasingly concerned about the number of warnings (in preparation for using Sec 36 of the Building Act 1991) against potential geothermal problems, that had been placed upon property files at the District Council. As I understand it, under certain circumstance, Building Consents will be issued by Council under Sec 36(2)(c). This requires Council to notify the District Land Registrar when any building consent is issued, so that an entry can be made on the Certificate of Title. As I also understand it, such entries are circumstances where the Earthquake Commission may decline a claim made under any insurance of any property under the Earthquake Commission Act 1993.

3 months ago, when I found red warning notices on property files, I wrote an informal note to a Council officer to express my concern about the potentially damaging affect of such notices, especially as there seemed to be so many of them. Few, if any files that had these warning notices, seemed to contain sufficient in-depth technical reasons to justify such action. There seems to me to be an arbitrary element in the way these property files had been tagged. This, I believed was unfair, seeing as the Inspector, while acting in good faith, was not an expert in the field over which he was passing judgement.

My concerns were that home owners may not appreciate the serious implications of such notices even if they were told of them. But that at some later date, they may impact severely with a sudden fall in property values that would damage the owner. Not only would that site be affected, but by association, those nearby too. But when that stage is reached, the unrecorded detailed reasons may have been forgotten or lost. If debate then caused the notice to be lifted, the damage would be done. The property value could remain affected.

The solution that I suggested in my note in April 1999, was to blanket the town with similar warnings so that an arbitrary line to a confining area, (in effect an action to pick winners), was avoided. Since I penned that note I have had the benefit of discussions with Council officers and with others. I have also had the opportunity to develop my own thoughts further.

While I still believe there is a worrying element attached to the seeming arbitrary nature of these warnings, and that there may be insufficient in-depth technical justification recorded on the files to justify such action; I am now far less sure that a blanket response to the whole of Rotorua is in fact the correct one. Especially if some in-depth field engineering work can be done.

But, rightly or wrongly, it appears to me that there is a certain furtiveness by Council officers in fixing these notices. I gained an impression that officers are only too well aware of their responsibilities in this matter, and that they do act with diligence in initiating such notices. I gain an impression that they do not want to publicize such notices for fear that Council might then face either a stream of legal actions they cannot defend with ease, or alternatively, a fear that officers may have to accept they have insufficient expertise on geothermal matters and know they are unable to justify such action.

While I recognize that these issues should be debated further, another strategy to handle these matters could be:

A4.1. Forewarn each property owner facing such a warning that this event is likely, and give him plenty of time in which to respond.

A4.2. Supply him with a summary of the likely effect on his property value. Inform him just how his property insurance could be affected, including the potential for loss of cover from EQC.

A4.3. Give the property owner an in-depth technical report as to how and why such notice has come to be considered. Include in the report, all means deemed available to him for resolving the problem.

A4.4. As a first step in trying to resolve the matter, invite the home owner (with such advisers as he chooses) to enter into informal discussions with Council and/or, arbitration to try and find a mutually acceptable way to deal with the notice.

A4.5. Allow the owner good time to assess whether he should appeal any decision to a higher Court, before Council actually places a warning on his file.

End.

Earthquake Commission

Report into the History of the Development of the Kuirau Park side of Tarewa Road Rotorua, as it relates to Geothermal Activity

Jack T Just
Consulting Engineer
13 Holland Street
Rotorua

Tel 7-348 2747, Fax 7-347 6595
Email jj@wave.co.nz

22 July, 1998

Copies of Correspondence referred to in Main Report

MEMORANDUM

DATE: 13 MAY 1998

File Ref: P59983
P00750
Doc No: 88112

TO: GLENDA NORWOOD

FROM: BUILDING CONTROLS MANAGER

SUBJECT: **RE: PROPERTIES AT 16 AND 16A TAREWA ROAD**

Recently there was developed on this site new Geothermal activity in the form of a geyser at the LH front corner of the section (see the attached map).

1. A Building Consent was issued for the house at the rear of the site on the 2 May 1988 with a specific design (i.e. Engineer Designed) footings approved by a Geological Consultant.

2. A second Building Consent was issued for the front dwelling on the 14 November 1997, and this too was built to specific Design foundations.

3. The house at the rear has had its sewer cap off as a result of the geothermal activity and to date this is the only damage that has occurred on the site.

4. Both houses have had foundations designed to not only allow for the ground conditions, but to also allow for these to be moved off (i.e. they are relocatable).

Pat Lawrence
Building Control Manager

FILE

13 May 1998

Please Quote: P00750
P59983

Doc No: 88119

Davys Burton
Barristers & Solicitors
PO Box 248
ROTORUA

Attention: Richard Pryce

Dear Richard

RE: OPINION SEC 36 OF THE BUILDING ACT 1991

Richard, you will probably be aware of the recent geothermal activity that has happened at Tarewa Road. The section in question is 16 Tarewa Road.

The section always had geothermal activity on the site and Council has recorded on the file Geological and Engineers report regarding the site and specific designs for foundations etc.

There are two dwellings on the site. One was built in 1988 and the latter one on the front in 1997. Both have been built on RAFT type foundations and have not interfered with the ground (i.e. there is very little, if any penetration of footings as designed by Engineers)

The first house, the one at the rear built in 1988 had a condition attached to the Building Consent.

> *"13. Building Permit Application - Mr N King*
>
> *Referring to clause 1(b) of the report of the District Inspector your Committee notes that a similar application was considered, your Committee RESOLVED that a building permit for the erection of a dwelling/carports upon Lot 5 DPS 26238 No. 16 Tarewa Road, be issued to Mr N King, subject to the provisions of Section 641A(2) of the Local Government Act 1974 .*

There was also a condition (attached) to the consent for subdivision.

I have searched the Title (copy attached) and find that nothing has been recorded on the title.

I realise that Section 641A(2) of the Local Government Act 1974 is almost word for word of Section 36 of the Building Act 1991 and also realise that when we issued the Building Consent for the second dwelling, we should have registered a notice on the title under Section 36 of the Building Act.

There has been no damage to the properties apart from the sewer pipes to first dwelling melting because of ground heat.

The situation is, can Council now use Section 36 of the Building Act or did that need to be completed at building Consent stage.

I have attached copies of the last correspondence regarding the Section 641 Notice between the then owner and the DLR dated May and June 1998 respectively.

Yours faithfully

Pat Lawrence
Building Control Manager

Encl.

BUILDING CONSENT NO: 97/1935

6531/193.00 9.5.26

Project Information Memorandum No: P 59983

Section 35, Building Act 1991

ISSUED BY ROTORUA DISTRICT COUNCIL

FILE

(Insert a cross in each applicable box. Attach relevant documents).

APPLICANT

Name:
MR & MRS MORGAN

Mailing Address:
C/O SOLID TIMBER HOMES LTD
P O BOX 1136
ROTORUA

PROJECT LOCATION

Street Address:
16A TAREWA ROA
ROTORUA

LEGAL DESCRIPTION

Property Number: 59983

Valuation Roll Number: 06531/193.00

Lot: 1 DP:

Section: Block: I

Survey District: TARAWERA

PROJECT

All ☐

Stage No x of an intended stages of:

New Building ☐

Alteration ☐

Intended Use(s) (in detail):
RESITED BUILDING
RESITE DWELLING 1WC
Ex Lockwood
Bidois Road.

Intended Life:

Indefinite, but not less than 50 years ☒

Specified as years

Demolition ☐

Estimated Value: $ 15,000.00

COUNCIL CHARGES

The balance of Council's charges payable on uplifting of this building consent, in accordance with the tax invoice are:

Total: $ 0.00

ALL FEES ARE G.S.T. INCLUSIVE

Signed for and on behalf of the Council:

Name: .....

Position: Admin-Building

Date: 14 / 11 / 97

This building consent is a consent under the Building Act 1991 to undertake building work in accordance with the attached plans and specifications so as to comply with the provisions of the building code. It does not affect any duty or responsibility under any other Act nor permit any breach of any other Act.

This building consent is issued subject to the conditions specified in the attached ..... pages, headed "Conditions of Building Consent No / ."

P00750z FILE

FILE COPY TO: 6531/193

9 April, 1996

Please Quote: ~~6596105~~
Your Ref: 75507/11

Ref: esl0904j.jwt

Martin McCaulay Morton Ltd
Surveyors
PO Box 878
ROTORUA

Attention: Bart Yetsenga

Dear Sir,

APPLICATION FOR SUBDIVISION CONSENT - MORGAN
16 TAREWA ROAD, ROTORUA CENTRAL

At its meeting on 24 November 1995, Council officers and the Subdivision Subcommittee could not recommend that the application for the subdivision of Tarewa East 1B Block I Tarawera Survey District be approved, for the following reasons:

a) The applicant's house site on Lot 1 is very small and appears only to be suitable if the house can be built closer than 5m from the rear boundary and 2.5m from the side boundary which would require the neighbours consent which cannot be guaranteed.

b) Any proposed building is to be sited very close to an existing geothermal hot pool.

c) The existing ground conditions are of low bearing strength in places. The foundations cannot penetrate the aquaclude (sinter layer) at approximately 400mm depth.

d) It is not considered that the applicant has adequately proven that it is unlikely that there will be no inundation from the geothermal hot pool at some stage in the future.

e) Council has evidence from Council's previous Building Inspector (Don McArtney), that the pool has previously overflowed with boiling water and steam, causing damage to the neighbour's house.

It is therefore considered that Lot 1 is not suitable for it's intended use as Council is not satisfied that there will be no inundation from the geothermal hot pool at some stage in the future. It is not considered that the proposal can be approved in terms of Section 106 of the Resource Management Act 1991 and is also considered to be contrary to the objectives, policies and rules contained in the Proposed District Plan.

Please advise whether you wish to take this application to the Statutory Hearings Committee for further consideration.

Yours faithfully

Joanne Watts
Planner

4.3.24 1 of 13.
P00750

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FAX (07) 347-6191

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KING'S BUILDING
77 JELLICOE STREET
P.O. BOX 301
TELEPHONE (07) 573-7717
FAX (07) 573-5617

MOUNT MAUNGANUI
12 GIRVEN ROAD
P.O. BOX 301
TE PUKE
TELEPHONE (07) 575 2859

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DIRECTORS:
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Surv. F.N.Z.I.S. M.N.Z.P.I.
M.I.
REGISTERED SURVEYOR
TOWN PLANNER

A. MORTON
(Hons), M.I.P.E.N.Z.
REGISTERED CIVIL ENGINEER

J.R. LEWIS
Surv. M.N.Z.I.S.
REGISTERED SURVEYOR

CONSULTANT
A.W.R. McCAULAY,
Z.I.S.
REGISTERED SURVEYOR

FILE

75507/9

Rotorua District Council
RECEIVED 29 JUN
REFERRED TO Env
COPY TO
INSTRUCTIONS:

27 June 1995

The District Manager
Rotorua District Council
Private Bag
ROTORUA

Attention: Building Inspectorate

Dear Sir

re: SECOND DWELLING AT 16 TAREWA ROAD FOR R H MORGAN - YOUR REF: P 007 50Z

Please find enclosed a copy of our report (and enclosures) regarding the proposal of our client, Mr R H Morgan, to build a second dwelling on his property at 16 Tarewa Road.

We refer to comments by Colin Alexander in a letter from J D Sholl to our client dated 4 November 1993.

Can you please confirm whether the enclosed reports satisfy Councils concerns in respect of a second dwelling. Our client wishes to be sure building consent will be granted (i.e., not refused because of unsatisfactory foundation for a proposed second dwelling) before proceeding with preparation of building plans and a formal application for building consent.

Please contact the undersigned should you require any clarification of any aspects of the reports.

Yours faithfully
MARTIN McCAULAY MORTON LTD

A M Morton
Registered Engineer

Maria can you Recirculate Ltr

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IRECTORS:
S. ARTIN
p. ... F.N.Z.I.S. M.N.Z.P.I.
P.M.I.
EGISTERED SURVEYOR
OWN PLANNER

W. McCAULAY,
N.Z.I.S.
EGISTERED SURVEYOR

M. ORTON
E. ...ons), M.I.P.E.N.Z.
EG...TERED CIVIL ENGINEER

SSOCIATES
R. ...WIS
S... M.N.Z.I.S.
EG...TERED SURVEYOR

ONSULTANTS
A. GLEGHORN
N.Z.I.V.
EG...TERED VALUER

R. GILLESPIE
N.Z.I.V.
EG...TERED VALUER

J. ...NSEN
N.Z.I.V.
EGISTERED VALUER

75507/6

31 May 1995

COPY

Mr R H Morgan
6 Nicholls Street
Devonport 7310
TASMANIA

Dear Sir

re: 16 TAREWA ROAD - ROTORUA

Firstly, my apologies for missing you when you were in Rotorua last week. However we understand you were able to speak to Harry Alderson from our office who was able to advise you of the conditions and test results relating to your proposed dwelling on 16 Tarawera Road.

We enclose a copy of the report (and account) prepared by Ashley Cody, Geologist, relating to the section. Please note his recommendation on P4 of his report. He considers the potential geothermal hazards to be "low" when compared with other geothermal areas in Rotorua, (last para, P4), but he had not precluded such hazards and that damage would occur if a geothermal event on the site (or adjacent) did occur. (Top P5).

Please note also his conclusions on P5; in particular the last paragraph.

We advise that we have undertaken ground bearing strength tests in the area of the proposed dwelling, with a scala penetrometer and that the results are appended to this letter.

Unfortunately the ground bearing for most of the tests indicated ground of poor or low bearing strength, not suitable for standard pile foundations in normal ground.

Bearing in mind the recommendation by Mr Cody that site excavations should be limited to 0.4m, to prevent penetration of the underlying sinter layer, we would suggest that your proposed dwelling be founded on piles set in reinforced concrete strip footing foundations.

Such foundations should be a minimum of 300mm x 300mm, 20 MPa concrete, reinforced with 4 D12 rods and R10 ties at 300 crs, continuous around the perimeter and along internal pile lines. We also recommend that the concrete footings be poured in 250 grade polythene, to act as a moisture barrier between the ground and concrete foundation.

We trust this is the information you require and would be pleased to assist further if so required.

Yours faithfully
MARTIN McCAULAY MORTON LTD

A M Morton
Registered Engineer

16 TAREWA ROAD - PENETROMETER TESTING

2 MAY 1995

1.	Start	50	Diff
	5	315	265
	10	350	35
	15	455	105
	20	1055	600
	25	1350	295
	30	1530	180
	35	1790	260
	40	1990	200
	45	2310	320

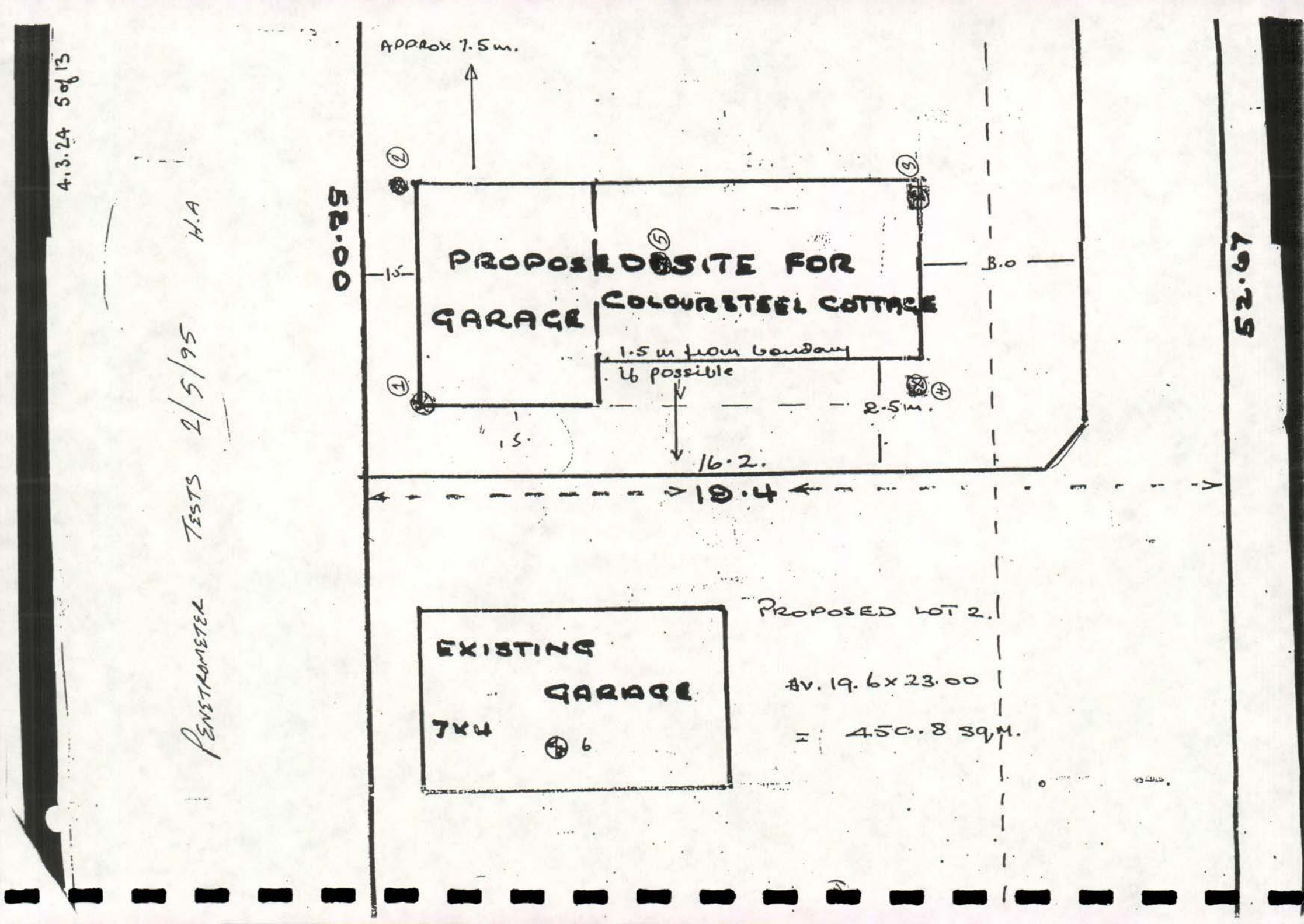
2.	Start	50	Diff
	5	230	180
	10	250	20
	Hard		

3.	Start	50	Diff
	5	300	250
	10	670	370
	15	1080	410
	20	1250	170
	25	1420	170
	30	1530	110
	35	1620	90
	40	1750	130
	45	1980	230
	50	2190	210
	55	2400	210

4.	Start	50	Diff
	5	100	50
	10	200	100
	15	340	140
	20	700	360
	25	1005	305
	30	1280	275
	35	1660	380
	40	1700	40
	45	1730	30

5.	Start	50	Diff
	5	320	270
	10	340	20
	Hard		

N.B: Where "Diff" is 170 or less indicates ground of 100kPa Bearing Strength or greater, i.e., suitable for normal foundations. Most readings don't meet this criteria.


4.3.24 5 of 13
PENETROMETER TESTS 2/5/95 H.A
APPROX 7.5m.
52.00
52.47
PROPOSED SITE FOR GARAGE
COLOUR STEEL COTTAGE
1.5 m from boundary
16 possible
1.5
2.5m.
16.2.
19.4
B.O
EXISTING GARAGE
TANK
6
PROPOSED LOT 2.
Av. 19.6 x 23.00
= 450.8 sq.M.

GEOTHERMAL HAZARD ASSESSMENT OF MORGAN PROPERTY,

16 TAREWA ROAD

Written by: Ashley Cody, Geological Consultant,
10 M^{c}Dowell Street, Rotorua. ph.(07) 3470-669
fax (07).3489-499

Thursday 13 April 1995

PURPOSE OF INVESTIGATION

The owner wishes to build a small cottage and garage in the central part of this section. The property at 16 Tarewa Road is located within an area of geothermal activity and because of this, an assessment of geothermal hazard to the site has been requested.

GEOLOGICAL SETTING

Tarewa Road lies to the west of a largely buried rhyolite lava dome, which is exposed to form the prominent Hospital Hill (also known as Pukeroa Hill). Approximately parallel to and immediately west of Ranolf Street, this lava dome has a steeply dipping (faulted?) western margin. Further westward under Kuirau Park and Tarewa Road, lake sediments overlie the rhyolite, with increasing thickness (to 100m and more) further west.

The lake sediments are largely fine-grained muds and silts, often with peaty beds and generally very poor permeability. However, vertical permeability is pronounced in narrow (fault controlled?) zones across Kuirau Park. This has allowed establishment of many hot springs in the Kuirau Park and Ohinemutu areas.

Kuirau Park and westwards to Tarewa Road has many areas of hot ground, hot springs and weak gas flows escaping to the surface. Consequently the vegetation is largely constrained to heat and acid tolerant species. At times of lower rainfall, vegetation occasionally becomes severely stressed and some die-back of less tolerant plant species occurs. Ground elevation is only ~1-2m above groundwater (and lake) level in this part of Rotorua.

Residential properties have been present along Tarewa Road for ~100 years or so, with very few problems known of due to geothermal activity. A few occurrences of thermal problems in the past have invariably been directly associated with people digging deep holes and drilling wells.

SITE INVESTIGATION PROCEDURES

The area of the section covered by this study is shown on Figure 1.

Heatflow Measurements: Ground temperatures at 200mm depths were measured at 2m grid intervals over the proposed building site to seek any possible anomalous high heatflows (see Figure 2).

Ground Alteration: Shallow augered holes were made at five sites to inspect subsoil materials for thermal alteration (see Figure 3).

General Inspection: The entire section and adjoining lands were closely scrutinised for evidence of possible recent thermal changes. Existing springs were also measured and compared with earlier measurements.

INVESTIGATION FINDINGS

Ground Heatflow

Results of 200mm depth temperatures are given in Figure 2. Ambient values for non-geothermal areas at this same depth and time of year are 17-18^{o}C, compared to values at 16 Tarewa Road in the range of 16-21^{o}C. The only (and very slight) elevation of temperatures was nearest to the existing spring. However, some depression of temperatures may have been present, due to recent heavy rainfall. This is considered insignificant though, because of the absence of recently formed thermally altered minerals and deposits, together with the lack of any recently stressed or killed vegetation.

Heatflow was calculated as less than 0.5 Watts/m^2 over the entire site for the proposed building, considerably less than much of urban Rotorua. Even if 200mm depth temperatures had been as high as 30^{o}C, this would represent a conductive heatflow of barely 1 Watts/m^2.

Augered Investigation Holes

Five holes augered up to 1.25m deep were located across the proposed building site (see Figure 3)..Three of these holes (all in the southern half of the site) were terminated at ~0.40m depths due to the presence of very tough silicified spring sinter beds that could not be penetrated. However, all five holes were cold, indicating no presently active thermal upflows occurred through the proposed building site.

The tough sinter layers at ~0.4m depth appeared to be the result of a prehistorically active hot spring, long since defunct. Possibly these old sinters may have been deposited by the existing spring S657 once overflowing the ground surface. Because the entire northwestern area of Kuirau Park still has numerous weak gas upflows, together with the presence of a hot spring at the western end of 16 Tarewa Road, it is recommended that this sinter ought not be penetrated at all. Any holes made through this tough aquaclude may also allow gases to rise, which would ultimately produce enhanced acid attack of any foundation materials.

Auger Hole Stratigraphies

See Figure 3 for locations of investigation holes.

Hole No:	Depths from G'Level (m):	Findings:
A1	0.00 - 0.30	Dark loose soil & rhyolite gravel fill.
	0.30 - 1.20	Light grey soft muds, sands & peaty silts. Slight thermal alteration. Waterlevel -0.57m, 21.6°C, pH 4.7
A2	0.00 - 0.40	Fill debris (soil, gravel, pug). Hole
	0.40 - ?	ended at hard sinter horizon. Old spring deposits, now cold.
A3	0.00 - 0.35	Dark friable sandy soil, cold and no
	0.35 - ?	thermal alteration. Hole ended at very tough sinter horizon.
A4	0.00 - 0.37	Black sandy soil; cold & no alteration.
	0.37 - ?	Hard sinter horizon.
A5	0.00 - 0.25	Sandy black soil; cold & no alteration.
	0.25 - 1.00	Pale grey/creamy pug with sandy lenses. Wet and soft; thixotropic.
	1.00 - 1.25	Brown peaty pug; thixotropic. ——— ?
	1.25	Hole bottom (collapsing). Waterlevel was -1.00m, 24°C.

RECOMMENDATIONS

No evidence has been found to indicate any threats or enhanced risks from geothermal activity by allowing the proposed modest building to be built, providing several constraints and requirements are met. As the site has been prehistorically thermally active; the greater area continues to have weak gas seepages; and the presence of hot springs nearby, two key suggestions are made here:

1). Stormwater Disposal: Ideally this should be piped off the section (to the street?) and not run into deep soakholes. Any soakhole will need to penetrate the silicified sinter beds, which are acting as major aquacludes and caps over possible hot water and gas upflows. The nature of the fine lake and peaty sediments here are also most unlikely to provide any useful permeability anyway.

2). Building Foundations: The site ought not be excavated through the sinter horizon at ~0.40m depths. Instead, either shallow piles or a rafted slab flooring should be used. Although there is presently no evidence of high heatflow, cold acid gas upflows will acidify shallow groundwaters and produce sulphuric acid attack on floor materials. It is conceivable that hotter upflows could naturally recur here, so it is therefore suggested that a butynol DPC is used under the floor and not ordinary PVC based DPC. This will add a chemically inert barrier which also has high heat tolerance (up to ~80^{o}C), whereas PVC type films have very poor heat tolerances (up to ~55^{o}C).

Excavations for any purposes ought to be restricted to less than ~0.4m depths to avoid puncturing the old sinter beds, as there is a likelihood of very much hotter conditions underlying that horizon. In the event of any future resumption of hotter/increased thermal activity here, any holes through the sinter beds will act as vents and conduits to concentrate gas or hot water upflows.

Note also that soft silt occurs in the northern portion of the section and that this pale grey silt is highly thixotropic ("sensitive"). Therefore any foundations into this unit would be at risk of settlement problems.

GEOTHERMAL HAZARDS

Potential geothermal hazards at 16 Tarewa Road are low for such a site, when compared to other residential areas within active thermal parts of Rotorua. The most likely source of hazard would be from the drilling of geothermal wells at or nearby this section, as such wells ultimately corrode casings to possibly allow boiling geothermal fluids to reach the surface.

The proposed building is shown to be approximately 7.5m away from the eastern end of spring S657 and this is, in terms of building stability, an adequate distance. However, if for unforeseen reasons spring S657 were to have hydrothermal eruptions, some building damage could result. In historical times this has not happened at this site and in the augered holes no evidence of prehistorical explosions was detected.

The natural occurrence of any geothermal disturbances in this area would most probably be accompanied by similar events at many other properties also. Strong local earthquakes or the resumption of volcanic activity are likely triggers to such geothermal problems and although these are likely in the geological future (100s-1000s or years), the drilling of geothermal wells or digging of holes (ie. direct human activity) are considered much more likely causes of geothermal hazards.

CONCLUSIONS

There is no evidence of unusual heat or gas upflows occurring at 16 Tarewa Road, nor any evidence of hydrothermal explosions having ever occurred here. Alkaline hot spring(s) once overflowed the surface in early or pre-European times.

If the above recommendations are adhered to, and the owner accepts that some potential for geothermal hazard exists, then the proposed modest construction does not need to be refused because of natural hazard risk.

The continued maintenance of the protective fencing around spring S657 should be required for safety reasons. The spring ought also to be protected from any misuse or direct abuse, as it represents a natural feature that adds to the intrinsic values of the Rotorua environment.

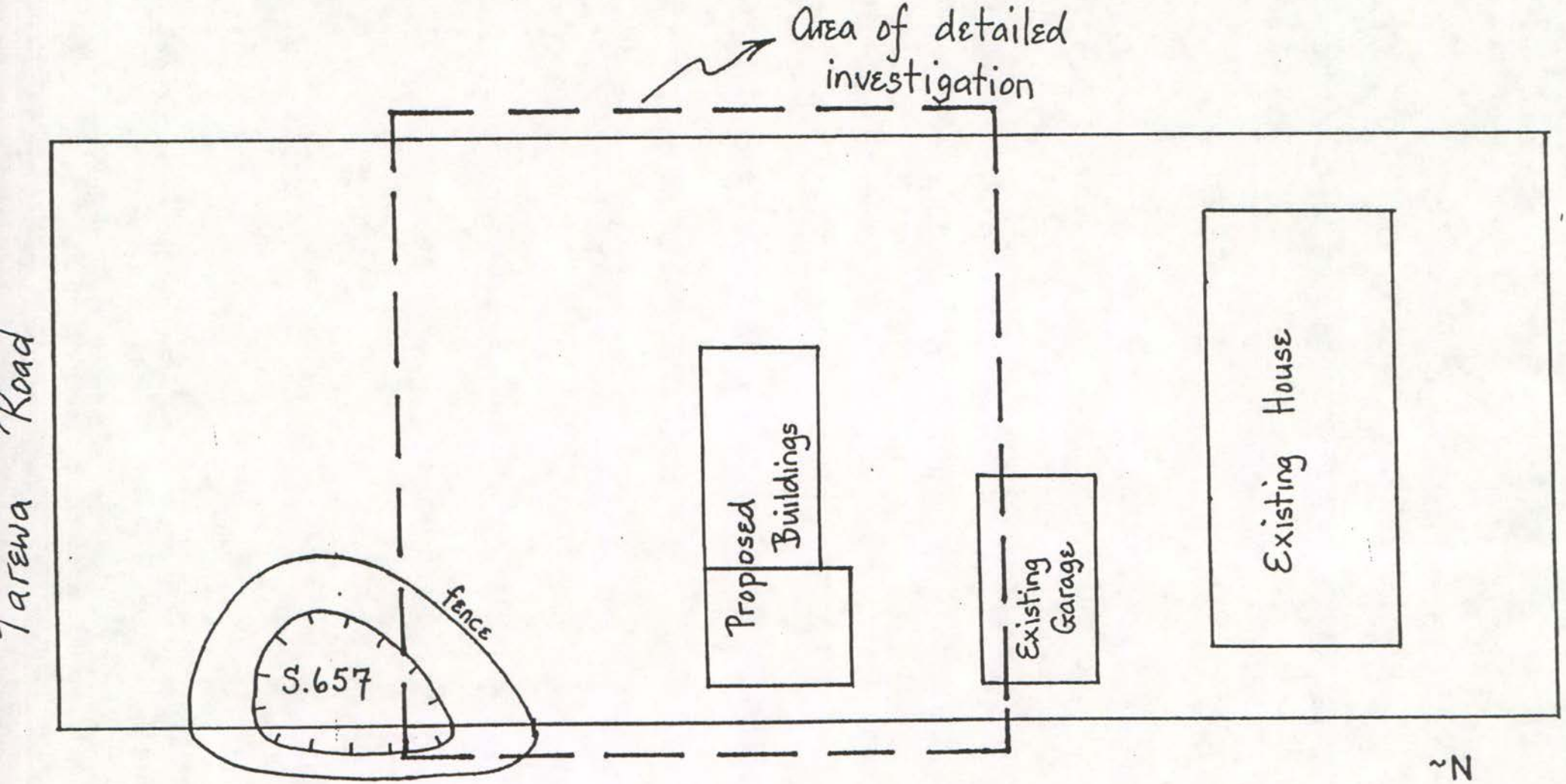
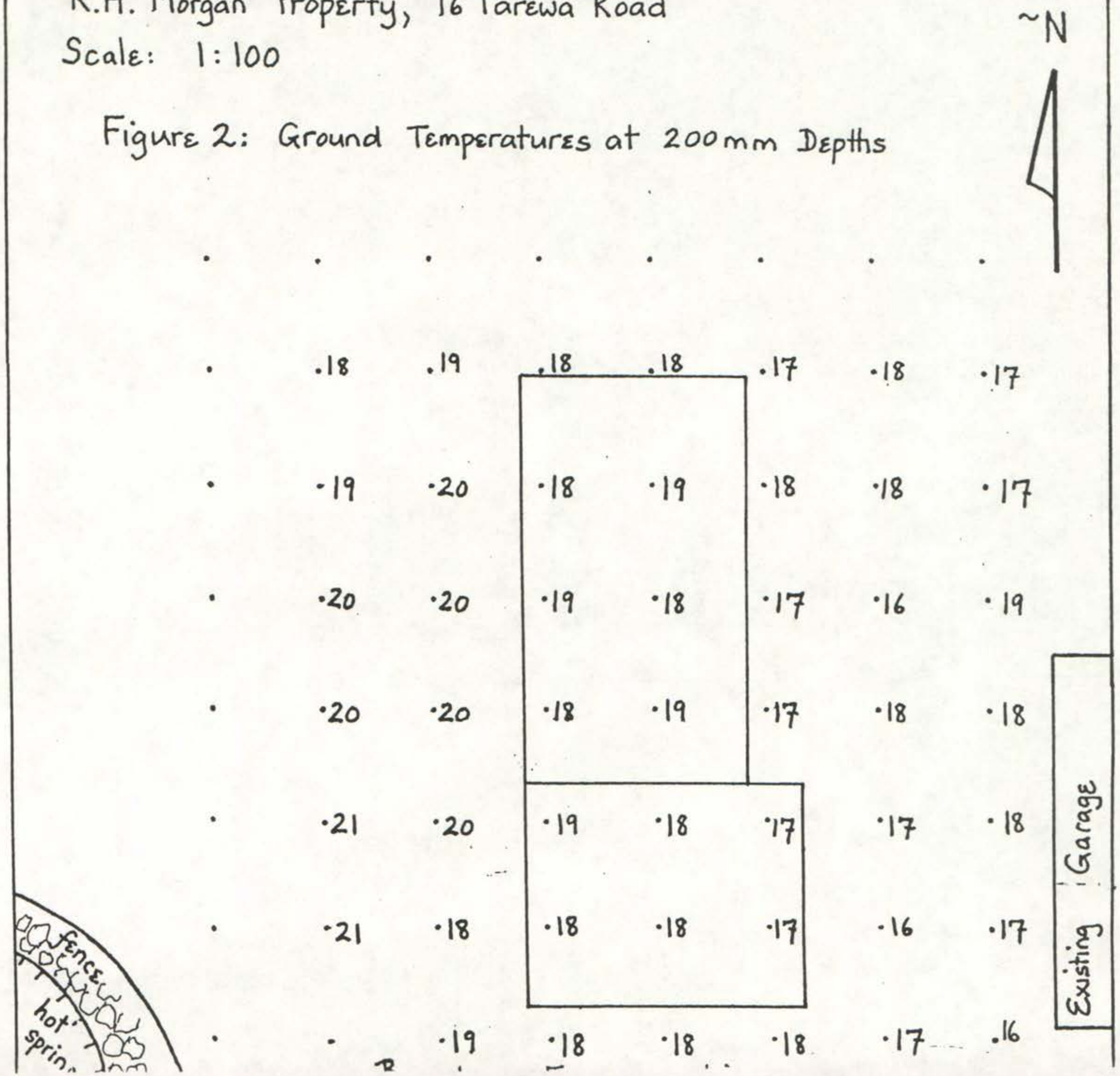


Figure 1: Morgan property, 16 Tarewa Road.

R.H. Morgan Property, 16 Tarewa Road

Scale: 1:100

Figure 2: Ground Temperatures at 200mm Depths

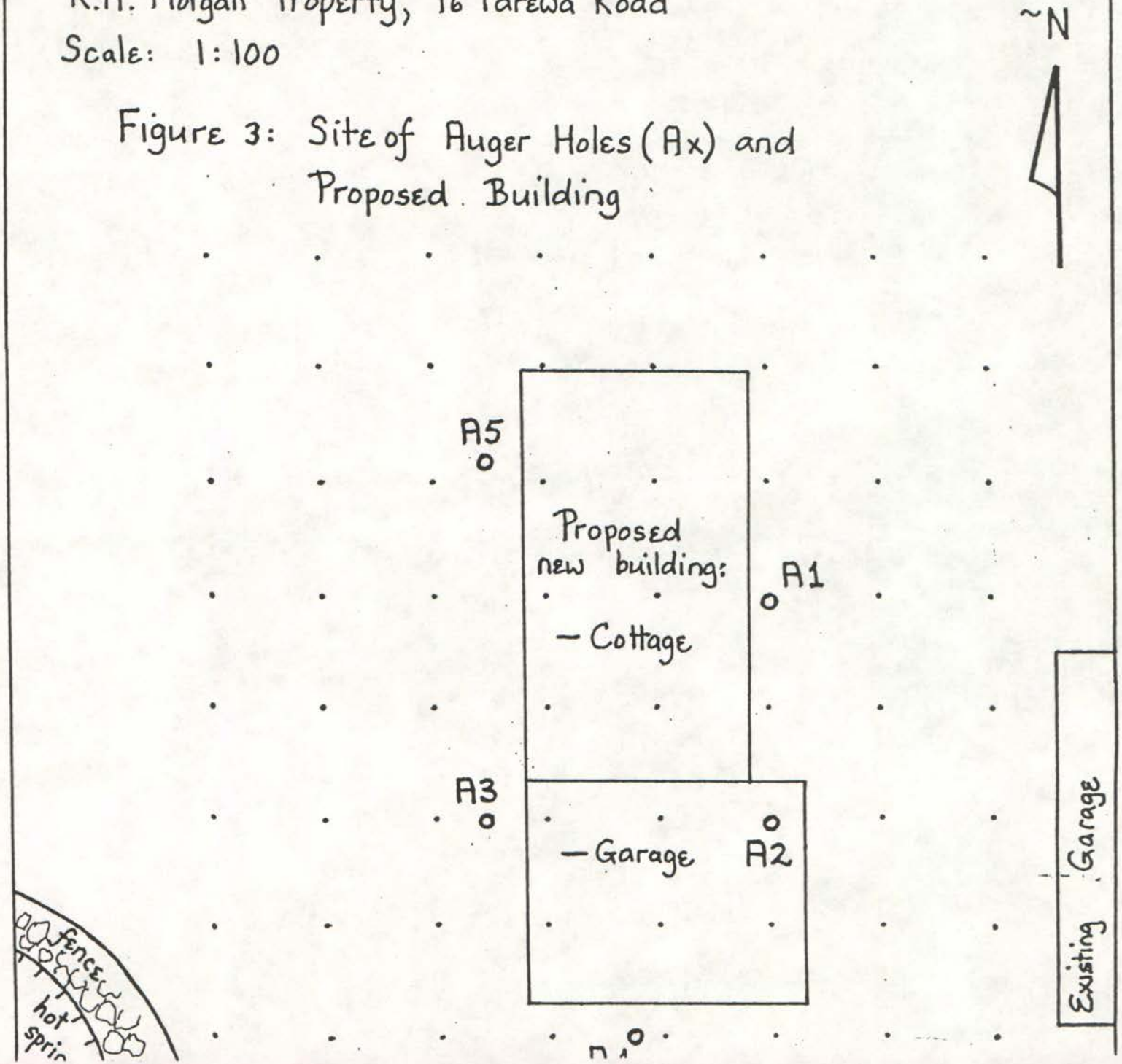


4.3.74 12 of 13

R.H. Morgan Property, 16 Tarewa Road

Scale: 1:100

Figure 3: Site of Auger Holes (Ax) and Proposed Building



4.3.24 13 of 13

4.3.23

FILE

4 November 1993

Please Quote: P00750 Z

WLT329559JSH

Mr R.H. Morgan
6 Nicholls Street
Devonport, 7310
Tasmania
AUSTRALIA

Dear Sir,

16 TAREWA ROAD

I have to hand your letter dated 15 September 1993 and wish to advise as follows.

Insofar as planning requirements are concerned the above-mentioned property is zoned Residential 2 under Council's Operative Transitional District Plan which for a property of 1011 square metres provides for a maximum of two household units (ie one plus the existing household unit) subject to compliance with the normal yard and height requirements.

The property cannot be subdivided at this time but this could be a possibility under the Proposed District Plan which is due to be publicly notified on 17 December 1993. At the present time you have the opportunity of cross-leasing.

Likely conditions on a cross-lease or building consent (which ever is first) would be the provision of screen fencing between the existing and proposed household units on the property and the formation and sealing of driveways to a garage or required parking space for each household unit. To cross-lease would also attract a reserve contribution of 7.5% of the value of the second household unit.

With regard to the second matter, I have referred your letter to the Senior Building Inspector, Colin Alexander who advises as follows-

"The applicant would need to identify the site specifically. Council would require a new geophysical report to be submitted as there is no constancy in geothermal activity. the applicant is under a misconception when he says that the district geologist described the site as non-thermal.

If a building consent was to finally be issued it would be subject to notification to the District Land Registrar in terms of Section 36(2)(c) of the Building Act" (which is much the same as the previous Section 641A of the Local Government Act, which the new Act has replaced).

I trust this answers your queries.

Yours faithfully

JS

J.D. Sholl
Div. Planner, Developmer

4.3.22

DEPARTMENT OF JUSTICE
Land Registry Office
Private Bag
Hamilton
Telephone 82-959
DX 4032

P00 750
63503

1st Floor
Westpac House
Cnr Victoria and Alma Streets
Hamilton

In reply please quote
1/12/10

15 June 1988

District Manager
Rotorua District Council
Private Bag
ROTORUA

ATTENTION: D J McArtney

Dear Sir

RE: BUILDING PERMIT NO. FO41097 - LOT 5 DPS.26238

Please find enclosed a copy of your letter to N C King dated 19 May 1988.

To be acceptable for registration, it must state whether the application is pursuant to Section 641A(1) or (2) Local Government Act 1974 and must include the legal description along with a payment of $40.00 for registration fees.

Yours faithfully

D G Barker
for DISTRICT LAND REGISTRAR

Encl.

4.3.21

ROTORUA DISTRICT COUNCIL

19th May 1988

Please Quote
P00750

Mr N.C. King
PO Box 177
ROTORUA

LT060179DJM
6500/66501/

Dear Sir,

re: BUILDING PERMIT NO. F041097 - 16 TAREWA ROAD - LOT 5 DPS.26238

I am pleased to confirm Council's approval of your application for the above, in terms of Section 641A of the Local Government Act 1974, subject to the condition that the ngawha upon the site being fenced to a safety standard approved by the Acting District Inspector.

I also confirm the issue of Building Permit No. F041097 on 2nd May 1988.

As you are aware, an approval on the above terms requires that the District Land Registrar be notified accordingly. A copy of this correspondence will be forwarded to the Registrar for that purpose.

I would be pleased if you could liaise with our Mr C. Alexander in respect of the approval of the type and standard of fencing to the ngawha, at the appropriate time.

Yours faithfully

D.J. McArtney
Acting District Inspector

The District Land Registrar
Lands & Deeds Office
Private Bag
HAMILTON

Copy for your information.

Date: 13 MAY 1988 ..... 4.3.20

16 Tarewa Rd?

MEMORANDUM FOR:

DISTRICT MANAGER	DISTRICT INSPECTOR
DISTRICT TREASURER	DISTRICT PLANNER
DISTRICT ENGINEER	DISTRICT LIBRARIAN
DIRECTOR OF CORPORATE SERVICES	ART MUSEUM DIRECTOR
MANAGERIAL ASSISTANT	ADMINISTRATION OFFICER
DIRECTOR OF RECREATION & COMMUNITY SERVICES	PERSONNEL OFFICER

I would remind you that the [redacted] / Planning and Bylaws Committee /[redacted] at its meeting on WEDNESDAY 27TH APRIL 1988

adopted the following resolutions:

Please take the appropriate action.

A.E. Hansen
DISTRICT MANAGER

Referring to clause 1(c) of the report of the Acting District Inspector, your Committee notes that the suitability of the site for building development has been confirmed in writing by the District Geologist, D.S.I.R., while the building itself has been designed to be relocatable and the site is so situated as to provide access for relocation. Your Committee accordingly RESOLVED that a building permit be issued to Mr N. King, subject to the provisions of Section 641A of the Local Government Act 1974, and subject further to the ngawha being fenced to a safety standard approved by the Acting District Inspector.

Consulting Engineers Surveyors Planners

HARRISON GRIERSON CONSULTANTS LTD

Our Ref: 303690.1
Your Ref: P00750

P.O. Box 396
Rotorua
New Zealand
Telephone (073) 479-482

84 Eruera Street
Rotorua
New Zealand

6500/6650/1
APP. NO. 1310

30 March, 1988

The Senior Building Inspector
Rotorua District Council
Private Bag
ROTORUA

Att : Mr D.J. McArtney

Dear Sir

RE : BUILDING PERMIT APPLICATIONNO. 1310 - MR N.G. KING PROPERTY
16 TAREWA ROAD, GEOLOGIST REPORT

As requested in your letter of 24th February 1988 and as further discussed with yourself, Mr T. Hansen and Mr Frazer (17.3.88) we submit a Geologist's Report on the above property.

The report has been prepared by Mr C.P. Wood, the District Geologist for the D.S.I.R.

The report confirms our findings as presented to you in our report of 10 December 1987 and indicates a building erected at the eastern end of property is unlikely to be damaged by geothermal activity.

Accordingly would you please give the building permit application urgent attention as this matter has been drawn out over several months at great expense and concern to Mr N. King.

If it is necessary to process this application for building permit under S641a of the Local Government Act we request that the Geologist's report together with our report be submitted for approval to the full Council meeting of 6th April 1988.

Yours faithfully
HARRISON GRIERSON CONSULTANTS LTD

J.H. ALLEN

30-3-88 delivered by hand.
Recd 30-3-88

Enc.

Department of Scientific and Industrial Research

New Zealand Geological Survey

P.O. Box 499
ROTORUA

28 March 1988

Harrison Grierson Consultants Ltd
ATTENTION: Mr J.F. Allen
P.O. Box 396
ROTORUA

REPORT ON N. KING PROPERTY AT 16 TAREWA ROAD

This report examines the thermal activity on the proposed building site, and assesses the current and long-term safety and stability from a geothermal point of view. It does not deal with the physical stability of the subsoils which has been adequately addressed by Harrison Grierson Consultants Ltd.

Hydrothermal Activity in Kuirau Park

Kuirau Park is a low-lying basin that has been filled in by lacustrine, swamp and fluvial deposits. Thermal activity is widespread in the northern part of the park, and is more or less continuous with the Ohinemutu thermal area. Current activity is less intense than has occurred in the historical past, and extensive sinter sheets near the ground surface show that hot spring flow was once more widespread. Historical records suggest that hot springs in the area have always fluctuated in output, and it is likely that there was a major decline in surface outflow when the park was drained in the 1930s.

Hydrothermal Activity on the Site

There is an alkaline-chloride hot spring located near the SW corner of the site. It is known as Waiariki Parekaumoana, and has been given the DSIR number S657. It has a roughly rectangular shape about 8 x 2m, and is lined by thick sinter deposits on the northern and southern sides. The water is clear and was about 0.5 m below ground surface and at 75.5 degrees C with a pH of 7.1 on 22 March 88. The pool has been partly filled by rhyolite boulders which form the western bank, and it also contains much scrap and rubbish.

When surveyed in 1981, the temperature was 72 degrees C and water level 0.2 m below the sinter surface at ground level. The spring is not regularly monitored, but since 1981 it has been seen with the water level close to ground surface. There are no records of overflow in recent years, but sinter is widespread near the surface in the western part of the section indicating that it used to overflow regularly (possibly prior to the 1930s drainage works). The spring must have a subsurface outlet and probably seeps into the subsoil within the top few metres below surface.

Subsoil Stratigraphy and Ground Temperatures

Harrison Grierson reported on the stratigraphy down to depths of 0.75 to 1.5 m at eight sites, and measured ground temperatures at 1 to 2 m depth at seven of these sites. We have checked the consistency of the reported data in five

auger holes as shown on the accompanying plan. The results are given in the following table.

	AH1	AH2	AH3	AH4	AH5
Water level below surface (m)	0.80	0.80	0.50	0.87	0.60
Groundwater pH	5.3	5.4	na	na	na
Groundwater conductivity (micromhos/cm)*	760	910	245	930	660
Groundwater temperature (degrees C)	24.7	30.5	23.4	29.6	28.6
Ground Temperature at ∿2 m depth (degrees C)	30	40	33	37	35

na = not analysed
* for comparison, Rotorua mains supply water has values of about 50-70.

The stratigraphy is not significantly different from that given by Harrison Grierson. Siliceous sinter (hot spring deposits) was present in all auger holes, but not as a continuous layer at the actual home site.

Conclusions

1. The hot spring at the western end of the site is a long-established feature with a history of fluctuating water level. It has not been known to overflow in recent years, but with changing geothermal use, this may happen again within the lifetime of the house. In the past, outflow has affected mainly the western half of the section.

2. There are no hydrothermal explosion craters anywhere on the site. ? It is possible that Spring 657 may commence geyser eruption though not likely. The nearest spring to have erupted in such a way in recent years is S715 which is 120 m to the SE; in November 1981, S715 erupted at intervals over a two-week period sending jets of water, mud and debris to a height of 10 m. An eruption from S657 would probably be similar. The effects of an eruption on surrounding property would depend on wind direction at the time, but would be unlikely to damage a home built at the eastern end of the section.

3. It is not possible to predict the onset of such an eruption, nor even give a probability of it happening at some time within the next 50 years.

4. It is not considered likely that activity will migrate from S657 towards the house location, because the trend of adjacent springs is not in this direction. If any trend can be recognised it is roughly from S657, through S656, to the S649-652 group of springs (see accompanying map of geothermal features). S656 is on the adjacent vacant section, and is a cool, water-filled, old spring vent with a small amount of gas bubbling through the water. Any resurgence of activity would probably cause S656 to become more active, rather than create a fresh breakout.

5. Groundwater on the site is a weakly acidified mixture of rainwater and geothermal water.

6. Ground temperatures are elevated above the expected ambient ground temperature at 1m depth, which should be about 18 degrees C at this time of year. However, over the proposed house site the excess is only a few degrees, and the deeper, 2 m temperatures suggest that there are unlikely to be hidden thermal spots. The highest temperature at 1m depth is 50 degrees C at site 8 (about 10 m north of S657), which is about 32 degrees C above ambient. At site 7 which is 10 m to the northeast, the excess is only 13 degrees C above ambient. This indicates that subsurface flow from the hot spring is to the north or west, away from the house site. However, there may be a small general rise in groundwater temperature if S657 waterlevel rises towards the sinter rim, causing more geothermal water to penetrate the subsoils.

   Taupo Borough Council have established regulations for prohibiting building on geothermal ground. They define a temperature of 40 degrees C or more above ambient at 1m depth as geothermal; from 30-40 degrees C excess is marginal, and below 30 degrees C excess is non-geothermal. By these criteria, the house site is non-geothermal, and the land north of S657 is marginal.

7. Gas seepage at the site was not measured, but there was no smell of H_2S anywhere, and though gas undoubtedly is emitted from the thermal water, it is unlikely to give rise to dangerous levels. The weakly mineralised groundwater at the house site has probably got a very low dissolved gas content.

8. There are no geothermal boreholes on the site so the risk of an eruption from a badly constructed or otherwise defective hole is absent.

9. Unlike most thermal features in Kuirau Park, Spring 657 is an alkaline chloride spring, and should be retained as far as possible in its natural state. It must not be filled in, and the site-developers should attempt to clean out the rubbish and debris in and around the spring before it is fenced-off. Such a natural feature should be regarded as an asset and preserved as part of Rotorua's natural geothermal environment.

C.P. Wood
District Geologist

4.3.18

24th February 1988

Please Quote
P00750

The Manager
Lakeland Homes Ltd
Cnr Fairy Springs & Bidois Rds
ROTORUA

LT050751DJM
6500/66501/

Dear Sir,

16.

BUILDING PERMIT APPLICATION NO. 1310 - MR N.C. KING - TAREWA ROAD

Further to the District Inspector's telephoned advice, and examination of the documentation supporting the amended permit application, the following points are drawn to your attention:

Stormwater & Drainage:

It will be necessary to provide full details of the system of collection and disposal of stormwater from the land and the proposed development thereon.

Health: 12/4/88

This land has a known history of geothermal activity. Previous officers of Council have noted on the property file that there are serious reservations about the development of the land with a building or buildings. Accordingly, I am of the opinion that the land may be injurious to health, in terms of S29 of the Health Act, and decline to accept the proposal without a Geologist's report to confirm the stability of the site.

A plan showing the method of providing protective fencing around the ngawha will need to be provided.

Structural:

A Geologist's report in respect of the current and long term stability of the site is required.

Receipt of your advice in respect of the above matters will enable your application to be more fully considered.

Yours faithfully

D.J. McArtney
Senior Building Inspector

21st October 1987

Please Quote
P00750

Mr B. Wallace
C/- Lakeland Homes
PO Box 4069
ROTORUA

LT038328DJM
6500/66501/

Appn No. 769

Dear Sir,

PROPOSED DWELLINGS (2) - TAREWA EAST NO.1B - 16 TAREWA ROAD (UNIT 1 & 2)

Receipt of your application for the above is acknowledged. Perusal of the plans and specifications has raised the following points which are hereby drawn to your attention:

1. Building Bylaws:

Any proposal to develop the above site would require the specific approval of Council, in terms of S.651A of the Local Government Act.
Such procedure is necessary owing to the fact that the site is subject to potentially high hazard and fluctuating geothermal activity, and further, previous sub-soil investigations have established that ground conditions are such as to require specific foundation design, resulting from detailed engineering and geological investigations.

Documentation incorporating all the above factors would require to be submitted at the time any application was made for Council's approval in terms of the Local Government Act.

Having regard for the peculiarities of the site, and the requirements of S.641A, it is strongly recommended that you take legal advice upon the ramifications of all the circumstances relating to your application. Council's property file will be made available for examination by your legal advisor, and I am sure that such examination would be helpful to your client's interests in the matter.

Resulting from circulation of your application internally, the following comments are forwarded for your additional consideration. It is to be noted that the comments are made in an endeavour to assist with the overall consideration of the application, and shall not be taken as indicating Council's approval, in whole or in part, to any consideration other than that of the requirements of S.641A.

2. Health:
If this application is approved as a building site, positive steps should be taken to ensure the safety of inhabitants of the site from the dangers presented by the hot water in the pool (81°C on 20.10.87).

3. Plumbing & Drainage:
The sub-soil geothermal and temperature conditions are to be assessed before both foul water drainage and water service pipes are to be installed to service the proposed dwellings.

Receipt of your advice in respect of the above matters will enable your application to be more fully considered.

Yours faithfully

D.J. McArtney
SENIOR BUILDING INSPECTOR

4.3.16

July 1986

650/665/A [illegible]:KS

303253

Harrison Grierson Consultants Ltd
P.O. Box 396
[illegible]

Attention : Mr Wilson

Dear Sir

16 TAREWA ROAD - MR N. KING

Your letter of 16 July refers.

Any proposal to develop the above site would require the specific approval of Council, in terms of S.641A of the Local Government Act.

The proposed structure would require to be designed and constructed so that it was relocateable and the foundation design would require to be the subject of specific sub-soil investigation.

Documentation incorporating the above factors would require to be submitted at the time application was made for Council's approval.

Yours faithfully

D.J. McArtney
SENIOR BUILDING INSPECTOR

4.3.15

650/655/12

8 August 1984

FILE NOTE

No 20

GEOTHERMAL ACTIVITY - TAREWA ROAD

Inspected home unit x Chas. Wright. Evidence of extreme heat in garage concrete floor slab. Hose in use to quench heat by flow to 1 m deep hole at front of garage.

Evidence of steam, condensation and heat damage to garage/lounge wall of unit. Damage superficial, to wallpaper, finishing timbers, etc. Condensation obvious in laundry.

Inspection of general area revealed increased activity, water level and discharge flows in the immediate area of home units. Activity level to surrounding areas diminished in comparison to November 1983, water levels noticeably decreased.

Geothermal bore on property not currently serving Y.H.A. Bore servicing not required since November 1983, whereas previously serviced at least three times annually.

Geothermal Inspector to consult D.S.I.R. to ascertain current level of monitoring in the area, also to request different characteristics to bore since Y.H.A. supply discontinued.

Located on property file 16 Tarewa Rd
30.07.98.

D.J. McArtney
SENIOR BUILDING INSPECTOR

Snapper requested info on
Bore records handed over to Ministry of Environment
1986.

4.3.14

file 16 Tarewa Rd 00-7-50

16 Tarewa Rd

6 July 1983

Mrs A.D. Clark
Billie Clark Real Estate
P O Box 719
ROTORUA

Dear Mrs Clark

re: TAREWA EAST NO. 1B

In reply to your letter dated 27 June 1983, I must reiterate the words of the District Manager in his letter dated 3 June 1983 wherein you were informed that Council will consideraan application in terms of Section 641 and 641A of the Local Government Act 1974.

You as land owner must obtain engineering expertise to ensure the safety of the structure concerned and the requirements contained within the said Local Government Act 1974.

It is not for Council or Council's Building Inspectors to advise the minimum standards or type of construction that is desired or required. Council will use its expertise at the time an application for a building permit is received, and more particularly Council cannot undertake to authorise the issue of a permit for any type of building in advance.

Yours faithfully

G.N. Fraser
DISTRICT INSPECTOR

REV. J. K. McGECHIE
THE VICARAGE,
PUKETAPU, H.B.

TELEPHONE
NAPIER 442-393

[redacted]

4.3.13.

9th March, 1983

The Town Clerk,
Rotorua City Council,
Rotorua.

Dear Sir,

At the end of February, 1984 I intend to retire and hope to live in Rotorua. Two aunts and an uncle live at 10 Tarewa Road, 664/1 on your map, all are over 80 years of age. My uncle Mr Charles McGechie aged 94 years has agreed we may build on the back of his section, 12 Tarewa Road, 664 on plan.

While on holiday in January we ascertained there would be sufficient land to put a house at the back of the section, without having to dislodge uncle. Mr Joe Smith kindly brought the housing inspector and they decided it was a safe position, and as long as it was "transportable" they could see no reason why a permit to put a house there would not be granted. Mr. Marchant of parks and reserves staff visited and gave permission to remove the bamboo thicket from the boundary.

It seems we neglected to ask if a house could be built elsewhere and moved to the site along your roads. It would save so much hastle -
(1) if the old folks did not have the bother of workmen around with us so far away
(2) if we did not have to wait around until the house was built, with the bother of stored furniture etc.

We therefore ask for permission to move a transportable house onto the back of section 664 of 12 Tarewa Road, in January or February 1984, please.

Signed J K McGechie

Yours faithfully,

J K McGechie.

The Chairman & Members
FINANCE COMMITTEE

re: BUILDING PERMIT APPLICATION - C. CAREY
18 TAREWA ROAD, VALUATION REF. 650/665/1

Mr C. Carey has submitted a building application for two units to be built on Lot 1B M.L. 20901, Tarewa Road. This section has on it a large extremely hot ngawha. Various reports were called for and produced by the applicant. The section fronts Tarewa Road and Kuirau Park in the vicinity of recent geothermal activity which received publicity in late 1981.

As several of Council officers expressed concern as to the suitability of the site, Council's solicitors were requested to report on the requirements and Council's obligations and responsibilities as found in Section 641 of the Local Government Act 1974 and its amendments.

The letter from Council's solicitors is now before you. Council's solicitors state quite clearly that in their view geothermal activity is one factor which may lead in certain circumstances to erosion, subsidence or slippage and in general to the unsuitability of a site for a particular building. Therefore all applications received for building permits on geothermally active sites will need to be scrutinised carefully.

Because there is doubt in this particular case, the question for Council to decide is firstly whether the building Mr Carey proposes on this site would be liable or prone to damage arising from subsidence from geothermal activity, and secondly, looking into the future (for the period of the useful life of the building), if it is likely during that period to become prone or liable to subsidence. In either case if the answer to either question is in the affirmative the Act says that Council must refuse a permit.

There is no doubt that in the event of a geothermal "blow" the building with its concrete foundations and floor as proposed by Mr Carey, would be damaged, and further that because of recent known geothermal activity in the vicinity of Lot 1B M.L. 20901 this could occur at any time now or in the future.

In the event of Council refusing a permit the applicant has the right to appeal to the Planning Tribunal. As an alternative the applicant can redesign the building so it can be made transportable and upon receipt of such application Council may, subject to such conditions as it may prescribe, issue a building permit if it is satisfied that the building can be relocated from that site. An applicant has a right of appeal against the conditions imposed.

Summary

(1) The general area is highly active geothermally and has very recently recorded unpredictable activity which resulted in the ngawha in question rising in level.

(2) This activity could result in the present ngawha being considerably enlarged and/or in the making of a new ngawha or ngawhas anywhere on the applicant's section within the lifetime of any proposed building.

As a consequence, therefore, noting that the buildings being the subject of this application cannot be considered as relocatable, it is recommended that the application be declined.

Council may wish, however, to draw the applicant's attention to the provisions of Section 641A of the Local Government Act whereby a relocatable building suitably designed, may well receive sympathetic consideration.

G.N. Fraser
DISTRICT INSPECTOR
16.2.82.

DAVYS BURTON HENDERSON & MOORE
BARRISTERS SOLICITORS & NOTARY PUBLIC

PHONE 479-466
FENTON STREET (NEXT B.N.Z.)
P.O. BOX 248
ROTORUA

Our Reference : T.R. Burton

Your Reference :

The District Manager
Rotorua District Council
Private Bag
ROTORUA

11 February 1982

The Heath Inspectors report refers to Lot 1B, which is 16 Tarewa Rd however C. Carey is not mentioned on the title (attached)?

Dear Sir

RE: BUILDING PERMIT APPLICATION - 18 TAREWA ROAD - C CAREY

We refer to your visit to our offices of the 10th of February. We have had the opportunity of examining your file and note the existence of the Ngawha at the front of this section.

We note the contents of the Health Inspector's report of the 10th of December last year. He expresses two areas of concern. Firstly that the whole site appears to be of potentially high hazard. We understand him to be referring to potential geothermal activity. Secondly his concern is with the ability of the thin crust over the geothermal activity to withstand without penetration the laying of building foundations and in general the activities associated with building construction on and residential occupation of the land.

In respect of the first area of concern referred to above Mr Cary commissioned a report from Soilcrete Testing Limited a copy of which dated the 21st of December is on your file. This report as to soil stability is not encouraging. The conclusion states:-

> "This site is not suitable for any structure with standard foundations. The ground is not capable of supporting any significant load without specially designed foundations."

It would seem from the District Inspector's letter to Mr Carey dated the 28th of January 1982 that such specially designed foundations have been produced to the satisfaction of the Council's Engineer.

However the further problem referred to in the Health Inspector's report as to potential geothermal activity affecting the building remains unresolved. The problem is particularly acute in view of the recent blow outs of several Ngawhas in the area which blow outs were observed to have a direct influence on the level of the water in the Ngawha at the front of Mr Carey's section. For this reason the Council has requested Mr Carey to provide a detailed geological report and Mr Watt in his Memo of the 27th of January this year has suggested that this should be provided by a geologist experienced in local volcanic activity. To date no such report has been provided.

SECTION 641 LOCAL GOVERNMENT ACT

The district Engineer in his Memorandum of the 15th of December last year has raised the question as to whether Section 641 of the Local Government Act is applicable in the case of geothermal activity. The Section has been amended by Section 22 of the Local Government Amendment (2) Act 1981. As amended the Section specifies a number of circumstances in which a duty is imposed on the Council to refuse a building permit. Those circumstances include among others the situations where the land on which the building is proposed to be erected is not suitable for the building or where the proposed building is subject to damage from erosion, subsidence or slippage. In our view geothermal activity is one of a number of factors which may lead, in certain circumstances, to erosion, subsidence or slippage and, in general, to the unsuitability of a site for a particular building. The Section is aimed at the result. We think it immaterial whether that result, namely of say subsidence or erosion, occurs because of geothermal activity or from some other cause. For these reasons we are of the view that geothermal activity does come within the scope of Section 641.

We note that prior to the 1981 Amendment Section 641 (2) (b) referred to inundation by sea, river, stream, lake or any other source. However the amendment has deleted any reference to inundation from a water source. It refers only to inundation from erosion, subsidence or slipping.

As noted above the Council's Engineer appears to be satisfied that the foundations of the building as now redesigned make the building suitable for the land in the sense that, other things being equal, the land will bear the load of the building upon it. We think that this resolves the question under Section 641 (2) (a) as to the suitability of the land for the proposed building.

However we note that in this geothermally active area there is a possibility of further Ngawhas appearing on the section. This possibility brings into play the provisions of Section 641 (2) (b). Of the words used in that subsection we think the word "subsidence" most aptly describes what would be the result of the occurrance of a new Ngawha. A subsidence in this context would refer to a sinking down to a lower level or a caving in.

We accordingly think that the Council, in Mr Carey's case should be concerned with the provisions of Section 641 (2) (b) and in particular with the possibility of subsidence. That Section contemplates two distinct situations. We have paraphrased the provisions in relation to each of those two situations: -

1. The Council shall refuse to grant a permit for the erection of any building where the proposed building is subject to damage arising directly or indirectly from subsidence.

2. The Council shall refuse to grant a permit for the erection of any building where the proposed building is likely to be subject to damage arising directly or indirectly from subsidence within the useful life.

It may be of further assistance if the words "prone to" or "liable to" are substituted for the words "subject to".

The presence of the word "likely" in the subsection may be misleading as to the degree of probability of subsidence that is required before the Council comes under an obligation to refuse the permit. The word only occurs in relation to the looking into the future for the period of the useful life of the building and it qualifies the words "subject to" and not the word "subside". So that it is a question whether the ground is likely to become subject to subside rather than whether the ground is likely to subside.

The question for the Council to decide is therefore firstly whether the building Mr Carey proposes to erect on this site would be liable or prone to damage arising from subsidence from geothermal activity or otherwise and secondly, looking into the distant future - for the period of the useful life of the building (which may be 80 - 100 years) - it is likely during that period to become prone or liable to subsidence. In either case the Section says that the Council must refuse a building permit.

The decision is one for the Council to make after a consideration of the relevant evidence available to it. This is subject, of course, to the possibility of Mr Carey being able to satisfy the Council that adequate provision has been or is to be made for the prevention of any damage from subsidence. We find it hard to imagine what those provisions might be in the event of the Council deciding that the building site is prone to subsidence by the opening up of a Ngawha.

Before leaving this topic we would simply comment that from a perusal of your file it would seem that there is adequate material there from which the Council might reasonably decide that the land is, or is likely to become, subject to subsidence.

SECTION 641A OF THE LOCAL GOVERNMENT ACT

This is an entirely new provision. Those parts of the Section which are relevant for the present purposes provide that the Council may notwithstanding the provisions of Section 641 (2), issue a building permit for the erection of a building on any land that is or will be subject to erosion, subsidence or slippage provided that building is designed to be relocatable and the Council is satisfied that the building can be relocated from that site. Provided the building is designed to be relocatable and the Council is satisfied that the building can be relocated from the particular site then the Council can not come under any liability to subsequent owners of the building provided the building permit is specified to be issued under either subsection 1 or subsection 2 of the Section 641A of the Act and the Council immediately upon issuing the permit notifies the District Land Registrar of the issue of the permit under either of those two subsections.

The Section has, no doubt, been enacted in response to one of the problems of the erection of buildings on potentially unstable sites. That problem is that the builder and the Council issuing the building permit are the parties who could reasonably be expected to investigate the stability of

the site before commencing building. Subsequent purchasers therefore assume that the building would not have been put there if the land was unstable. By having the doubts about the stability of the land recorded on the Title to the land subsequent purchasers are put on notice of any such possible defect and presumably this will be reflected in the price paid. Subsequent purchasers thereby take the risk of loss upon their own shoulders and can not subsequently turn to the Council seeking recompense if the building subsequently suffers damage from subsidence or slippage.

However bringing the attention of subsequent purchasers to the risk involved is only one of the problems associated with building on unstable land. Other problems include the question of the degree of risk of danger to life and limb in the event of the feared subsidence slipping or erosion; the suddenness with which the feared slipping or subsidence may occur; the degree of probability that it will occur and the scale on which it is likely to occur. Each of these factors will no doubt bear on the density of residential occupation of the land in question which is desirable if at all. This is quite apart from the question of whether the houses themselves are relocatable. If it is anticipated that the subsidence or slipping is likely to be sudden rather than creeping it may very well be that although the house is designed to be relocatable in the circumstances of the disaster such relocation could be impracticable. It may be that where geothermal activity is feared the occurance of the feared activity may make access to the site impossible for the purposes of removing the building. These are all relevant factors.

Section 641A gives the Council a discretion to relax its duty to refuse a permit in the circumstances outlined in Section 641. The purpose of the discretion is to enable the Council to weigh the various factors referred to above and invoke the provisions of the Section if satisfied that the risk of subsidence erosion or slipping is such as would be sufficiently dealt with on the basis of notification to prospective purchasers that the land and building is subject to the risk of subsidence, slipping or erosion and that the building on the land is designed to be and can be relocated. The risk of subsidence, slipping or erosion may be such that despite the precautions envisaged by Section 641A residential occupation of the land is nevertheless undesirable.

PROCEDURE

It should be noted that Section 641C provides for an appeal to the Planning Tribunal against any decision of the Council under Section 641 or Section 641A. This constitutes an additional safe guard for the Council in so far as in cases of doubt the Council may take a cautious approach and have the matter ultimately decided by the Planning Tribunal which decides the matter after having the benefit of an adversary style hearing which gives the opportunity for eliciting all the relevant facts.

The decision made under Section 641 and 641A must be that of the Council and this decision should be embodied in a formal resolution of the Council.

SUMMARY

To summarise in our view geothermal activity does fall within the scope of Section 641. That Section imposes an obligation or duty on the Council to

refuse a building permit where the land is or is likely to become subject to erosion, subsidence or slipping, from whatever cause. Section 641A gives the Council a discretionary power not to exercise what would otherwise be its obligation or duty to refuse a building permit. If it does elect to exercise that discretionary power the proposed building must be designed to be relocatable and the Council must be satisfied that it can be relocated from the particular site in the circumstances which may arise as set out above. In addition the Council must follow the procedures set out in Section 641A (c) (4) as to immediate notification of the District Land Registrar of the issue of the permit. The Council must consider the relevant factors, some of which have been referred to above, in deciding whether to issue the building permit in accordance with the discretion contained in Section 641A. There is provision for appeal against the Council's decision and in cases of doubt a cautious approach should be taken. Whatever the decision of the Council it should be embodied in a formal resolution.

We thank you for the use of your file which we return herewith. If you have any further queries please do not hesitate to contact us.

Yours faithfully
DAVYS BURTON HENDERSON & MOORE

Per:

T.R. Burton

4.3.10

15 December 1981

MEMORANDUM : ACTING DISTRICT INSPECTOR

APPLICATION OF SECTION 641 LOCAL GOVERNMENT ACT

The Senior Health Inspector has sent me a copy of his memo of 10 December to the Senior Building Inspector regarding proposed town houses in Tarewa Road for C Carey.

The memo raises the question of checking building permit applications to see whether the powers provided by Section 641 should be applied to them.

I think it is a little uncertain as to whether geothermal hazards are included in Section 641. Assuming however that they are, as they can result in subsidence or slippage there should be some system of checking building permit applications to see whether Section 641 should be invoked. The Engineers Department does not make any inspection of building sites unless requested. I would suggest that on the cover sheet for applications, provision should be made for checking under Section 641 so that positive decisions are made to check the site or to accept the application without checking and if a hazard is recognised to take action under Section 641.

I would suggest that applicants can't be relied to supply information on this point, but local knowledge dictates that some check should be made.

J C G Watt
DISTRICT ENGINEER
ROADING AND DESIGN

10 December 1981

MEMORANDUM for: SENIOR BUILDING INSPECTOR

PROPOSED TOWN HOUSES - C. CAREY, TAREWA ROAD

Mr C.J. Carey has applied for a building permit to erect two home units on Lot 1B Block I Tarawera S.D., M.L. 20901.

The plan shows a Ngawha between the front unit and Tarewa Road. Temperature measurements taken at 4.00 p.m. today ranged from 53°C at the edge nearest the road to 64°C about 1.5 metres in from half way along the southern side. The water was lapping the edge of the pool after heavy rain and most likely would be hotter in dry weather. Present levels would be approximately 1 metre from the house site depicted.

The adjoining southern site also has three Ngawhas present and there has been considerable geothermal activity in recent weeks at the rear of the Tarewa Road Marae in Kuirau Park and notices have been erected warning of the dangers.

The whole of this site appears to be potentially of high hazard and the Ngawha could be considered as being a statutory nuisance within the meaning of Section 29(a) of the Health Act 1956 unless steps are taken to fence it. A person could fall into the scalding water and this would be enhanced by the erection of buildings on the site.

It is also suggested that the instability of the ground in this area calls for extreme caution and a close examination to see whether Section 641 of the Local Government Act 1974 applies.

There is no geological report on file, but general observation would appear to indicate a thin crust over the geothermal activity which could be penetrated by building foundations or by vehicles coming on to the site.

The matter seems further complicated by the apparent intention to sell the units as "home units" as down on the application form, with the potential for the Council to be sued in the event that the original owner or builder cannot be found at some time in the future should there be injury or death or the development of new Ngawhas in the area.

In my view there are potential dangers to health and property and before approving a permit the Council should require a detailed geological report and indemnity against negligence.

J.A. Campbell
SENIOR DISTRICT HEALTH INSPECTOR

c.c. CHIEF INSPECTOR.

c.c. DISTRICT EXECUTIVE OFFICER.

1 June 1979

Mrs B.M. Clark,
Licensed Real Estate Agent,
P.O. Box 719,
ROTORUA.

Dear Mrs Clark,

VAL. NO. 06500/655/01 - TAREWA ROAD

The Director of Parks has referred your letter of 7 May to me for reply, as the land you refer to does not form a part of the Kuirau Park.

I have examined the hot pool you are concerned with, and can confirm that it does lie partly on your land and partly on that owned by the Council. I have made some investigations, consulted the Geological Survey of the Department of Scientific and Industrial Research and examined old aerial photographs.

The pool is a natural permanent hot spring, which appears not to have altered greatly in area for many years. The level and temperature of the water in springs in this area have changed from time to time, and it is clear that the level has been higher than it is now.

I would advise you not to attempt to fill the spring whether with rocks or any other means. Such action would not quell the thermal activity, but would be likely to cause it to break out in the surrounding area. This of course would result in an extended area becoming unsuitable for building purposes. These affects would extend to the Council-owned section. I am therefore bound to advise the Council to resist any efforts to have the pool filled in.

I regret that I could not accede to your initial request, but would suggest that the pool could be made a most attractive feature of the section with suitable landscaping and protection.

I would also suggest that you check with the Senior Building Inspector regarding the suitability of the rest of the section for building, before making any commitment in this direction.

I trust the above is of some assistance to you.

Yours faithfully,

G.S. Roberts,
DISTRICT ENGINEER (WATER & DRAINAGE).

...tificate No.

...R. Vol. 275 Folio 13

...ansfer No. H.073310.3

SEARCH

26 MAR 1999

COPY 5

43.7 1 of 2

No. 20A/749

REGISTER

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 15th day of March one thousand nine hundred and seventy-five under the seal of the District Land Registrar of the Land Registration District of SOUTH AUCKLAND being a Certificate in lieu of Grant, WITNESSETH that ADA MARTHA CLARK of Rotorua real estate agent

is seized of an estate in fee simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, which said land was originally acquired by Erena te Keho and 4 others equally

as from the 26th day of January one thousand nine hundred and forty-nine under The Maori Land Act 1931

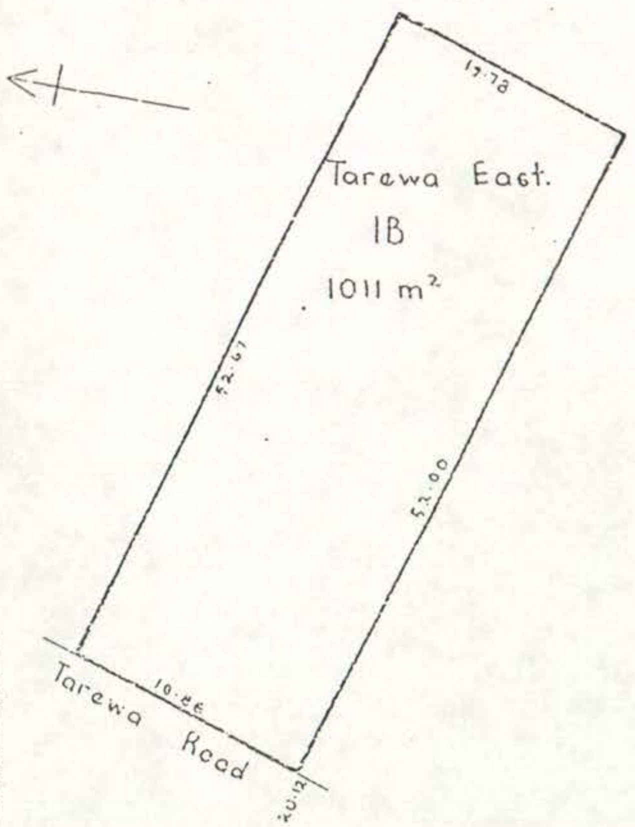
that is to say: All that parcel of land containing 1011 SQUARE METRES more or less being Tarewa East 1B Block

DISTRICT LAND REGISTRAR SOUTH AUCKLAND, N.Z.

H.L.Cameron

ASSISTANT LAND REGISTRAR

Rotorua City.



Measurements are Metric

M.L. 20901

DISCHARGED

H.073310.4 Mortgage to Graeme James Williams produced 15.3.1976 at 1.32 o'c

H081342

H.L.Cameron A.L.R.

~~H.308485.1 Variation of terms of Mortgage H.162636.2 produced 29.9.1980 at 2.19 o'c~~

Entered in Error

for A.L.R.

H.308485.2 Mortgage to John Dacey and Patricia June Dacey produced 29.9.1980 at 2.19 o'c

DISCHARGED

H.509227.1

(for A.L.R.

H.509227.2 Transfer to Keith Thomas Jones of Rotorua insurance representative produced 9.2.1984 at 12.03 o'c

for A.L.R.

H.509227.3 Mortgage to Ada Martha Clark produced 9.2.1984 at 12.03 o'c

DISCHARGED

H664878.1

for A.L.R.

H.664878.2 Transfer to Norman Conrad King of Rotorua contractor produced 27.6.1986 at 9.02 o'c

for A.L.R.

H.664878.3 Mortgage to Westpac Banking Corporation of New Zealand produced 27.6.1986 at 9.02 o'c

DISCHARGED

B.140439.1

for A.L.R.

OVER...

CERTIFICATE OF TITLE 20A/749

B.140439.2 Transfer to Roger Frank Patrick Hungerford-Morgan of Auckland retired and Carola Hungerford-Morgan his wife - 17.5.1993 at 10.47 o'c

for A.L.R.

B.140439.5 Mortgage to Betty Doreen Bradshaw - 17.5.1993 at 10.47 o'c

for A.L.R.

4.3.6 1086

...ence: ...at C/T. 13B/787
...C. Order No.
...se No. H.029649.3

SEARCH

1 JUN 1999

COPY

Land and Deeds 71

No. 183/1381

REGISTER

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

LEASEHOLD

Registered Lease	Name of Lessor	Term of Lease	Lessor's Title:
No. H.029649.3	LLEWELLYN JOHN BUCKLEY and PATRICIA DAWN BUCKLEY as tenants in common in equal shares	999 years as from and including 4.6.1974	Vol. 13B Folio 787

...is Certificate dated the 7th day of March one thousand nine hundred and seventy-five under the seal of the District Land Registrar of the Land Registration District of SOUTH AUCKLAND

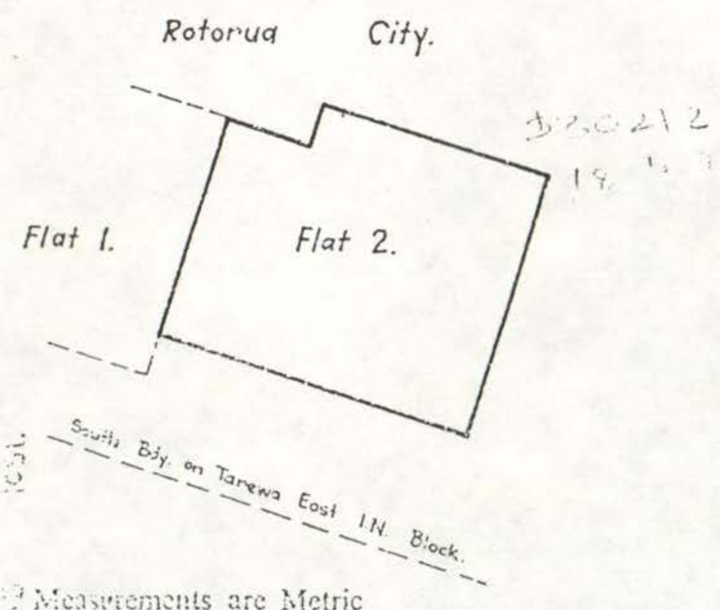
WITNESSETH that PATRICIA DAWN BUCKLEY of Rotorua housewife

...seised of an estate of leasehold created by the lease particulars of which are set out above (subject to such reservations, restric...tions, encumbrances, liens, and interests as are notified by memorials underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that ~~parcel of land containing~~ Flat described as Flat 2 on Deposited Plan S.19597 which said flat is situated in Tarewa East Block 1N

ASSISTANT LAND REGISTRAR

H.239999 Transfer to Charles Johnson Wright of Rotorua retired and Elsie Emma Wright his wife produced 5.7.1979 at 10.29 o'c

for A.L.R.



Measurements are Metric
ML. 20527.
J.E.G.

H.514711.1 Transfer to Barry William Dowse compositer and Audrey Dorothy Dowse his wife both of Auckland produced 12.3.1984 at 11.46 o'c

for A.L.R.

H.514711.2 Mortgage to Bank of New Zealand produced 12.3.1984 at 11.46 o'c

DISCHARGED

for A.L.R.

H.514711.3 Mortgage to Charles Johnson Wright and Elsie Emma Wright produced 12.3.1984 at 11.46 o'c

DISCHARGED

for A.L.R.

H.727780.2 Transfer to Walter Frederick Watson of Rotorua retired and Michiko Watson his wife produced 22.5.1987 at 10.24 o'c

for A.L.R.

H.744395 Transmission to Michiko Watson as survivor entered 13.8.1987 at 12.25 o'c

for A.L.R.

OVER . . .

CT 16B/1081

B518385.1 Certificate under Section 28 Earthquake Commission Act 1993 - 16.12.1998 at 12.04

for DLR

B521349.1 Transfer to The Rotorua District Council - 12.1.1999 at 9.10

for DLR

4.3.6 3of8

SEARCH

18 JUN 1999

COPY

ference:-
... C/T. 13B/787
... Order No.
... No. H.029649.2

Land and Deeds 71

No. 13B/1080

REGISTER

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

LEASEHOLD

Registered Lease	Name of Lessor	Term of Lease	Lessor's Title: Vol.	Folio
No.H.029649.2	LLEWELLYN JOHN BUCKLEY and PATRICIA DAWN BUCKLEY as tenants in common in equal shares	999 years as from and including 4.6.1974	13B	787

This Certificate dated the 7th day of March one thousand nine hundred and seventy-five under the seal of the District Land Registrar of the Land Registration District of SOUTH AUCKLAND

WITNESSETH that LLEWELLYN JOHN BUCKLEY of Rotorua company director

is seised of an estate of leasehold created by the lease particulars of which are set out above (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorials underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the seveal admeasurements a little more or less, that is to say: All that ~~parcel of land containing~~ Flat described as Flat 1 on Deposited Plan S.19597 which said flat is situated in Tarewa East Block 1N

ASSISTANT LAND REGISTRAR

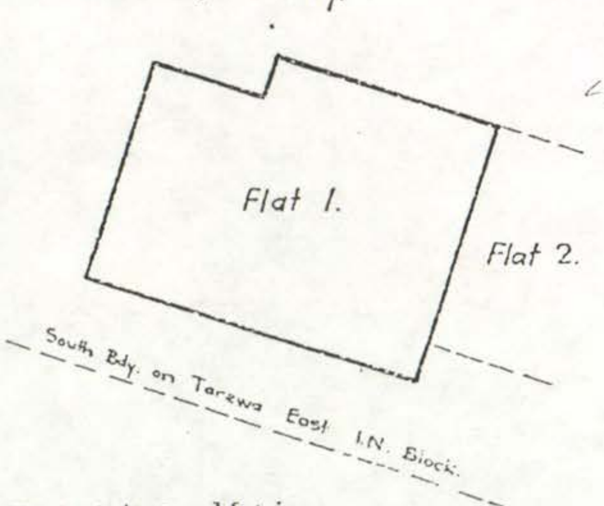
H.227399.3 Transfer to Vivienne Lois Mort of Rotorua ---------- clerk produced 11.4.1979 at 11.05 o'c
for A.L.R.

H.227399.4 Mortgage to The Public Trustee produced 11.4.1979 at 11.05 o'c
DISCHARGED B451533.1 FOR D.L.R.
for D.L.R.

B518386.1 Certificate under Section 28 Earthquake Commission Act 1993 - 16.12.1998 at 12.04
for DLR

B521348.1 Transfer to The Rotorua District Council - 12.1.1999 at 9.10
for DLR

Rotorua City.



Measurements are Metric
Mex. M.L. 25527.
J.E.G.

No. 13B/1080

SEARCH

4.3.6 4 of 6

/ JUN 1999

COPY

References
Prior C/T 13B/787

Transfer No.
N/C. Order No. H.151114

Land and Deeds 69

ONE HALF SHARE TITLE

REGISTER

No. 220/130

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 27th day of September one thousand nine hundred and seventy seven under the seal of the District Land Registrar of the Land Registration District of SOUTH AUCKLAND

WITNESSETH that LLEWELLYN JOHN BUCKLEY of Rotorua company director is seised of an estate in fee simple as to an undivided one half share

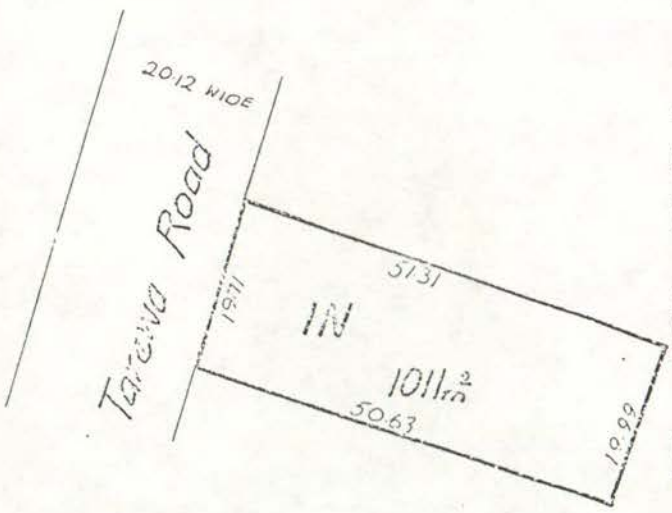
~~is seised of an estate in fee simple~~ (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 1011 SQUARE METRES more or less being Tarewa East 1N Block

ASSISTANT LAND REGISTRAR

THIS CERTIFICATE IS AFFECTED BY THE NOTICED INTERESTS AS AT THE DATE OF ISSUE:

H.015799.3 Mortgage to The South British Guardian Trust Company Limited produced 12.1.1977 at 10.57 o'c DISCHARGED Hugh Ogden
H.227399.1 M. COLE A.L.R.

Rotorua City



H.029649.1 Mortgage The Commercial Bank of Australia Limited produced 24.3.1978 at 10.01 o'c DISCHARGED Hugh Ogden J.P.
H.227399.2 M. COLE A.I.R.

H.029649.2 Lease of Flat 1 Plan S.19597 to Llewellyn John Buckley Term: 999 years as from and including 4.6.1974 produced 7.3.1975 at 10.01 o'c (Leasehold C.T. 18B/1080 issued)

M. COLE A.I.R.

H.029649.3 Lease of Flat 2 Plan S.19597 to Patricia Dawn Buckley Term: 999 years as from and including 4.6.1974 produced 7.3.1975 at 10.01 o'c (Leasehold C.T. 18B/1081 issued)

A.I.R.

H.227399.3 Transfer to Vivienne Lois Mort of Rotorua clerk produced 11.4.1979 at 11.05 o'c Hugh Ogden for A.L.R.

H.227399.4 Mortgage to The Public Trustee produced 11.4.1979 at 11.05 o'c DISCHARGED FOR D.L.R. Hugh Ogden for A.L.R.
B411535.1

B521348.1 Transfer to The Rotorua District Council - 12.1.1999 at 9.10

for DLR

Measurements are Metric

AL 20527
LEG.

No. 220/130

SEARCH

4.3.6 5of6

/ JUN 1999

COPY

References
Prior C/T 13B/787

Transfer No.
N/C. Order No. H.151114

"Land and Deeds 69

ONE HALF SHARE TITLE

REGISTER

No. 22D/131

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 27th day of September one thousand nine hundred and seventy seven under the seal of the District Land Registrar of the Land Registration District of SOUTH AUCKLAND

WITNESSETH that PATRICIA DAWN BUCKLEY of Rotorua married woman is seised of an estate in fee simple as to an undivided one half share

is seised-of-an-estate-in-fee-simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 1011 SQUARE METRES more or less being Tarewa East 1N Block

ASSISTANT LAND REGISTRAR

UNDER CERTIFICATE IS ATTACHED BY THE FOLLOWING INTERESTS AS AT THE DATE OF ISSUE:

H.015799.3 Mortgage to The South British Guardian Trust Company Limited produced 29.12.1974 at 10.57 o'c DISCHARGED 11.4.1979 Hyde A.L.R.
H-221399.1 COLE A.L.R.

H.029649.1 Mortgage to Commercial Bank of Australia Limited produced 7.3.1975 at 10.01 o'c DISCHARGED 11.4.1979 Hyde A.L.R.
H-221399.2 COLE A.L.R.

Rotorua City

H.029649.2 Lease of Flat 1 Plan S.19597 to Llewellyn John Buckley Term: 999 years as from and including 4.6.1974 produced 7.3.1975 at 10.01 o'c Leasehold C.T. 18B/1080 issued

M. COLE A.I.R.

H.029649.3 Lease of Flat 2 Plan S.19597 to Patricia Dawn Buckley Term: 999 years as from and including 4.6.1974 produced 7.3.1975 at 10.01 o'c Leasehold C.T. 18B/1081 issued

A.L.R.

H.239999 Transfer to Charles Johnson Wright of Rotorua retired and Elsie Emma Wright his wife produced 5.7.1979 at 10.29 o'c

Hyde for A.L.R.

H.514711.1 Transfer to Barry William Dowse compositer and Audrey Dorothy Dowse his wife both of Auckland produced 12.3.1984 at 11.46 o'c

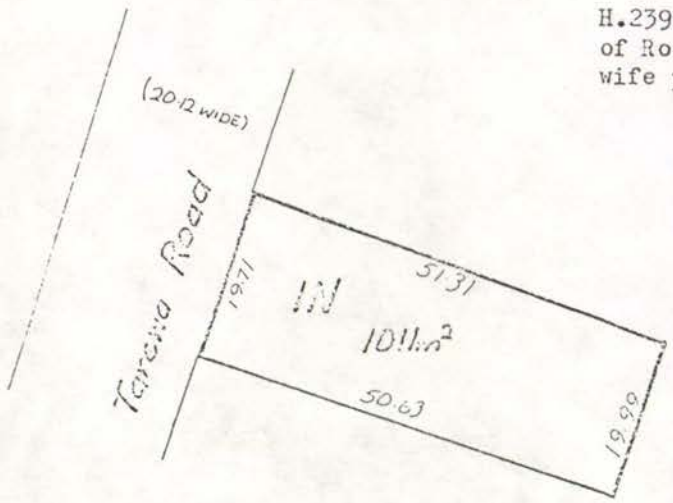
for A.L.R.

H.514711.2 Mortgage to Bank of New Zealand produced 12.3.1984 at 11.46 o'c DISCHARGED A.L.R.

for A.L.R.

H.514711.3 Mortgage to Charles Johnson Wright and Elsie Emma Wright produced 12.3.1984 at 11.46 o'c

for A.L.R.



Measurements are Metric

J.E.G. ML 20527

OVER ...

No. 22D/131

C.T. 22D/131

H.727780.2 Transfer to Walter Frederick Watson of Rotorua retired and Michiko Watson his wife produced 22.5.1987 at 10.24 o'c

for A.L.R.

H.744395 Transmission to Michiko Watson as survivor entered 13.8.1987 at 12.25 o'c

for A.L.R.

B521349.1 Transfer to The Rotorua District Council - 12.1.1999 at 9.10

for DLR

CITY OF ROTORUA

Received 5-6-73.

Application No 6908

Date ..... 197..

BUILDING APPLICATION FORM

TO THE CITY ENGINEER

I hereby apply for permission to erect, repair, alter, extend, demolish, remove a building at No. .....

Tarewa Road (address) for

Mr/~~Mrs~~ D J O Sullivan (owner) of S Tauhara, Motel. Fenton St (address)

according to locality plan and detailed plans, elevations, cross sections, and specification of building deposited herewith in DUPLICATE (see reverse side).

PARTICULARS OF LAND

Val. Roll No. 650/665/12.

Checked ..... clerk

Lot No. Tarewa East 1N Area 1 Roods

D.P. No. 1 N BLK Frontage 65' 0"

Zoning A Depth 161' 0"

PARTICULARS OF USE OF BUILDINGS

Proposed purpose for which every part of building is to be used or occupied (describing separately each part intended for use or occupation for a separate purpose, i.e. shop, factory, dwelling, office, carport, etc.)

Two Home Units

Area of ground floor ~~1430~~ 2360 sq ft

Gross floor area .....

Area of accessory buildings .....

Estimated value 16 000

Building work ~~$8 000~~

Plumbing & Drainage $1 000

Total $17 000

Owner D J O Sullivan (signature)

Address as above

Phone No. 82-1417

Builder ..... (signature)

Address .....

Phone No. .....

FOR OFFICE USE ONLY

Application checked and approved by:

Building Inspector .....

Date 11-6-73

Town Planning Officer DW

Date 8/6/73

Plumbing & Drainage Inspector

Date 8/6/73

Structural Engineer .....

Date .....

Health Inspector .....

Date 8/6/73

Dangerous Goods Inspector .....

Date .....

Water & Geothermal Inspector .....

Date .....

Fire Prevention Officer .....

Date .....

Issue of Permit Approved

City Engineer

Date 11-6-73

Comments .....

SUBJECT	Appln No.	Permit No.	Date	Value	Fee
Building		E67408		$ 16000	$ 48-00
Plumbing & Drainage				$	$
Water Connection				$	$ 20.00
Damage Deposit				$	$
Vehicle Crossing				$	$
Sewer Disconnection				$	$
Stormwater Discon.				$	$
Water Disconnection				$	$
Building Research Levy				$ 17000	$ 8-50
				TOTAL:	~~$56-50~~ 76.50

(see scale of fees on back)

Receipt No. 9855

Street No. .....

Date 13.6.73

4.3.4

16 Tarewa Rd

650/665/1
NEW FILE

McArtney

28 November 1972

Mrs A.M. Clarke,
C/- G.H. Weggery & Co. Ltd,
P.O. Box 395,
ROTORUA.

c.c. SENIOR BUILDING INSPECTOR.

Dear Madam,

TAREWA ROAD - EAST 1B

Receipt of your enquiry of 23 November is acknowledged.

The enclosed print indicates the location of the sewer main and laterals in Tarewa Road. Our records do not show easements, therefore it will be necessary for you to undertake a title search in order to establish whether or not any easements exist.

In the matter of subsoil conditions, I am unable to give you any definite opinion until such time as adequate investigation are undertaken. As you will appreciate, the general strata in the vicinity of Tarewa Road is extremely variable and includes ground conditions ranging from rock to diatomaceous earth, some of which is subject to geothermal activity at both ground and lower levels.

In general, I consider that it would be prudent to allow for increased foundation costs, however as stated above, a subsoil investigation would be the only definite procedure whereby this point could be finalised.

If you are prepared to undertake the type of investigation required, I could arrange for the Senior Building Inspector to be present at the time and this would enable the bearing value of the subsoil to be established.

Yours faithfully,

D.J. McArtney,
CHIEF INSPECTOR.

Reference:
Certificate No.
P.R. Vol. 270 Folio 109
Transfer No. S.551731

4.3.3 1 of 2

Land and Deeds 72

SEARCH

13 JUN 1999

COPY

No. 133/787

REGISTER

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 7th day of September one thousand nine hundred and seventy-one under the seal of the District Land Registrar of the Land Registration District of SOUTH AUCKLAND being a Certificate in lieu of Grant, WITNESSETH that ELIZABETH ANNE SIRETT and DIANA MARGARET MEES both of Rotorua married women are

is seised of an estate in fee simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, which said land was originally acquired by Henare Tatai m.a. and Peni te Akau m.a. in unequal shares

as from the 26th day of January one thousand nine hundred and forty-nine under The Maori Land Act 1931

that is to say: All that parcel of land containing 1 ROOD more or less being Tarewa East Blk 1N

DEPUTY DISTRICT LAND REGISTRAR

~~S.588474 Mortgage to General Finance Acceptance Limited produced 28.2.1973 at 9.45 o'c~~
Entered in Error A.L.R.

S.588171 Mortgage of the interest of Elizabeth Anne Sirett to General Finance Acceptance Limited produced 28.2.1973 at 9.45 o'c
A.L.R.

S.630946 Transfer to Daniel Joseph O'Sullivan of Rotorua motel proprietor produced 30.10.1973 at 9.11 o'c
Rotorua City
A.L.R.

S.649484 Mortgage to Desider Feder and Giselle Feder produced 8.3.1974 at
H.015799.1 DISCHARGED 29 FEB 1974
A.L.R.

H.015799.2 Transfer to Llewellyn John Buckley of Rotorua company director and Patricia Dawn Buckley his wife as tenants in common in equal shares produced 29.10.1974 at 10.57 o'c
A.L.R.

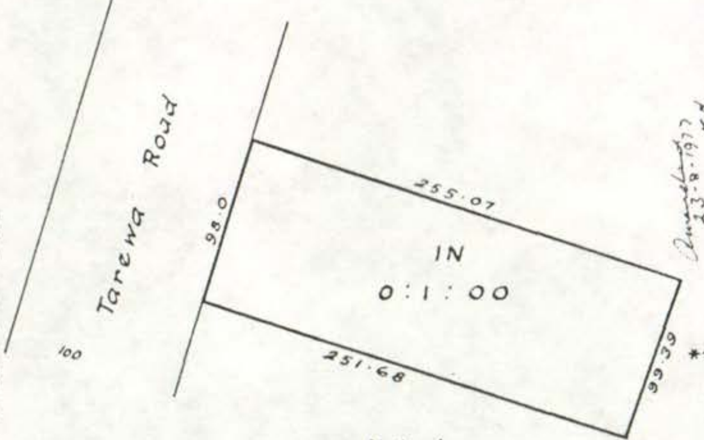
H.015799.3 Mortgage to The South British Guardian Trust Company Limited produced 29.10.1974 at 10.57 o'c
A.L.R.
***

H.029649.2 Lease of Flat 1 Plan S.19597 to Llewellyn John Buckley term: 999 years as from and including 4.6.1974 produced 7.3.1975 at 10.01 o'c
Leasehold C.T. 18B/1080 issued
A.L.R.

H.029649.3 Lease of Flat 2 Plan S 19597 to ~~Llewellyn John~~ Patricia Dawn Buckley term: 999 years as from and including 4.6.1974 produced 7.3.1975 at 10.01 o'c
Leasehold C.T. 18B/1081 issued
A.L.R.

***H.029649.1 Mortgage to The Commercial Bank of Australia Limited produced 7.3.1975 at 10.01 o'c
A.L.R.

METRIC AREA IS 1012 m²



Scale 1 inch = 1 chain
M.L.20527

OVER ...

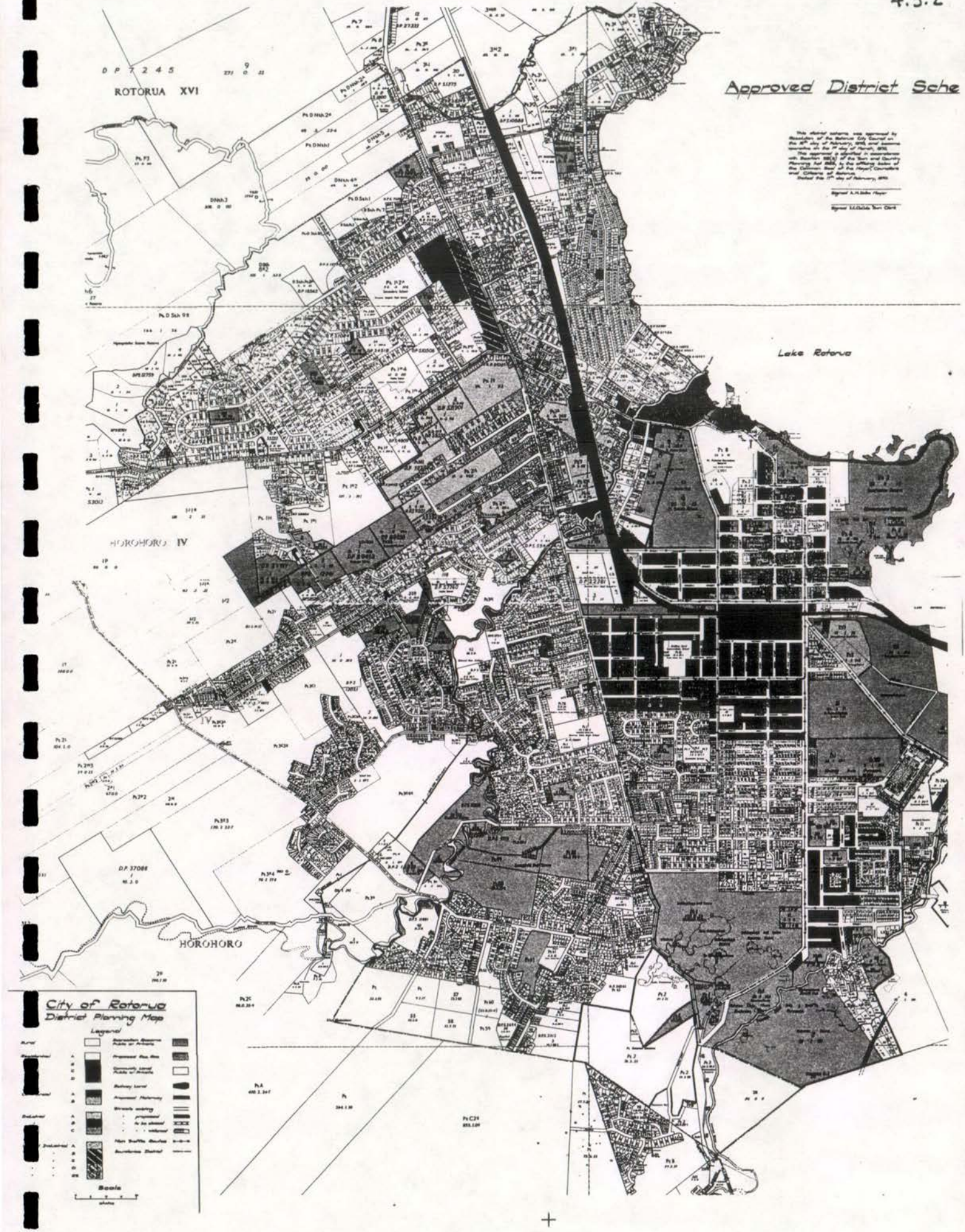
Register copy for L. & D. 69, 71, 72

H.151114 ONCT) Cancelled as to an
27.9.1977) undivided one half
share of Llewellyn
John Buckley and
C.T. 22D/130 issued
Cancelled as to the remaining one
half share of Patricia Dawn Buckley
and C.T. 22D/131 issued

A.L.R.

C A N C E L L E D

Duplicate destroyed.


Approved District Sche
ROTORUA XVI
DP 7245
Lake Rotorua
HOROHORO IV
HOROHORO
DP 37088
City of Rotorua
District Planning Map
Legend
Scale

184

4.3.1

23rd July 1969

65 0/665/12

Tarewa East No 1N

Blk I Tarawera SD 1 rood.

Tarewa Rd.

Town Plan Zoning.

This section is zoned Res A under the town plan.

Services.

Sealed road, Sewerage, power, Water reticulation available.

Section.

This section is reasonably level but is wet in places as well as evidence of thermal activity which would make it difficult as a satisfactory building site. No action has been taken on this section for a number of years and it is badly infested with gorse and blackberry and no action has been taken to clear the land as set out in the requisitions.

~~To survey pegs are visible~~

B J Anderson MNZIBE

Assistant Building Inspector.

Xerox off original from 20 Tarewa Rd, Property File, RDC, 22/3/99