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NGAWHA ENVIRONMENTAL IMPACT - THE DEVELOPING STORY

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ABSTRACT

A 100 MW geothermal power station was proposed near Ngawha Springs and required submission of an environmental impact report before statutory processes could be completed. Although the power station was later deferred for power planning reasons, most of the information required for the report was obtained. Data gathering was a combined effort of many local and natfonal government agencies and other persona and organisations in the private sector.

As with all reporting processes, there is a continual development in the format and content of impact report, to coincide with changing environmental and technical standards. The Ngawha proposal has showed that given sufficient information about the geothermal field, it is possible, and desirable, at an early stage to perform quick tests as to the viability of the field for future use for electricity generation.

INTRODUCTION

In 1980 there was a government policy to establish a number of "energy intensive" industries including a second aluminium smelter. Electricity for the smelter was to be supplied largely from committed south island hydro schemes and consequent on this was a need for a number of new schemes, particularly in the North Island, that could be brought in as quickly as possible. In this setting, the state of knowledge of the Ngawha Geothermal field was reviewed and it was concluded that a geothermal power station could be built by 1990[1]. That is 9 years after its inception. Information on the geothermal field has been published[2] and this paper describes the engineering and environmental studies that were carried out to prepare an Environmental Impact Report (EIR) and obtain clearances necessary for Government Approval of the project. In the previous paper, Mongillo[4] briefly described the location of the Ngawha geothermal field.

Following an audit of the EIR by the Commission for the Environment it was intended to apply for water rights and designation of the land in teras of the Town and Country Planning Act 1978. With the indefinite deferral of the second aluminium smelter the Ngawha Station was also deferred.

Figure 1 shown the original timetable with a number of actions proceeding in parallel. The whole programme of investigations depended on a high level of cooperation between the various etudy teams that were set up.

ENVIRONMENTAL IMPACT REPORT

Guidelines for writing an EIR are available from the Commission for the Environment. The EIR should describe options that have been considered for both technology and sites. A distinction between the EIR and the more formal processes of land designation and water rights is that the formal processes require exact definitions of the one option to be followed.

When the Ngawha power station was deferred in late 1982, it was nevertheless decided to complete outstanding work originally required for the EIR. Most of the work completed was gathered together in a form which could be used, with modifications, as the basis of an EIR should the 100 MW proposal at Ngawha be resurrected at some future date.

The EIR for Ngawha was to describe the existing environment and also the changes that were foreseen in the absence of development. The report would then discuss the project, how the various components fit together and their impact on the environment. This impact relates to both construction and long term operation. The term "environment" is usually taken to mean natural environment but in many projects the social or human environment is more important and the effects are more difficult to predict.

Once the sensitive areas are identified it becomes a design and management exercise to ensure the impacts are acceptable. Hawever, With the township of Ngawha Springe being within the geothermal field, the community quite rightly wished to know how they would be affected by such things as: noise from the power station and traffic; noxious discharge from the station; will the landscape be affected; will there be jobs for them; will services be increased.

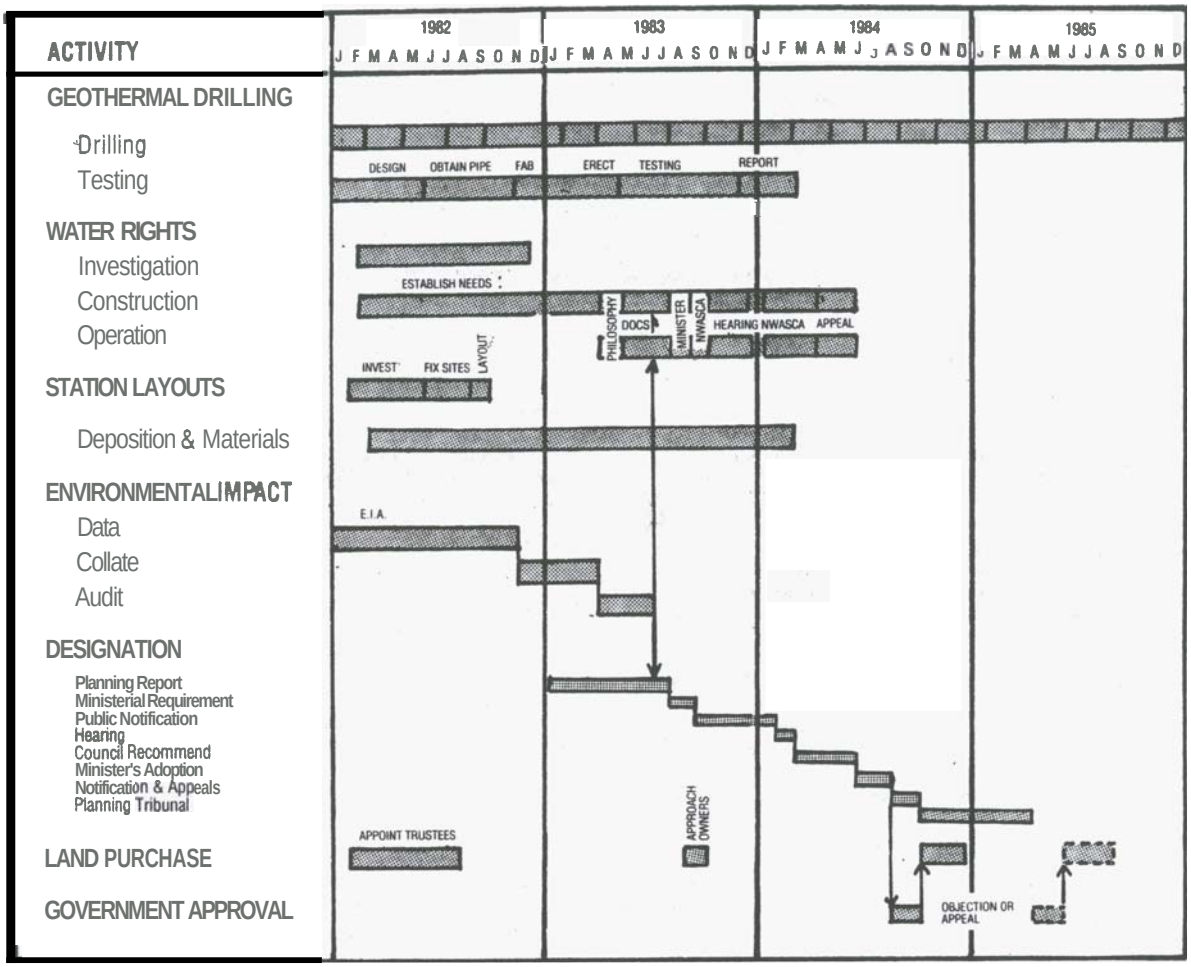

Figure 1. Development programme for Ngawha

The EIR must describe the impacts of various options and explain how the impacts can be alleviated or kept to acceptable standards. Once the report completed the Commissioner for the Environment would normally call for public submissions and prepare his audit. In the Ngawha case the EIR was not taken through this stage.

As can be seen in figure 1, completion of the EIR for Ngawha was on the critical path in the overall project programme. It was thus essential that tasks were adequately coordinated to achieve the target date.

TOWN AND COUNTRY PLANNING ACT

The purpose of the Act is to set up guidelines for the preparation, implementation and administration of regional, district and maritime planning schemes. Planning schemes should have as their general objectives the wise use and management of resources and the effective and efficient direction and control of any development.

It is normal for the Minister of Works and Development to seek to have a designation placed on the land in terms of Section 118 of the Act. The application that must be prepared resembles the EIR in that it must describe the proposal and its impact on the community. It must, however, be specific and describe one firm proposal. Once the documents have been lodged with the local territorial authority, that authority invites submissions from the public and hold8 a hearing. Following their hearing the Council forwards its recommendations to the Minister of Works and Development who grants the designation. Any 'such designation is subject to appeal to the Planning Tribunal. The Minister's decision is not required if the land is already suitably designated under the local council's planning scheme.

WATER AND SOIL CONSERVATION ACT

Under this act applications are made to take or discharge from or to natural water. Geothermal fluid is specifically defined as natural water and thus water rights are required to take geothermal fluid from the ground and to discharge it elsewhere or reinject it. These rights would relate to normal or emergency situations. It is also necessary to apply for water rights for construction activities, e.g. concrete manufacture or fire fighting supply. A total of 20 water rights would be not uncommon.

Hearings are held by the local water board, and may be combined with those held by the local council under the Town and Country Planning Act. The Water Board's recommendations are forwarded to the National Water and Soil Conservation Authority who actually grant (or otherwise decline or amend) the water rights.

These too are subject to appeal and the Planning Tribunal will hold a joint hearing into the appeals.

CLEAN AIR ACT

A Clean Air Licence must be obtained under the Clean Air Act 1972 and Amendments before a power station may begin operating. Formal application for this licence is normally made by the station designers late in the design process when final operating parameters are known. However, at this late stage, it must be assumed that there will be no major delays in this application, and this is ensured by having early discussions With the Department of Health, who issue these licences.

For this reason, the Department of Health are invited to attend meetings of an Air Quality Working Group set up to discuss air pollution aspects of the power station, required for the EIR. This group is further discussed in the section on Specific Studies.

PROGRAMME

Because the EIR process is not (as yet) a statutory process, the timing of the release of the report is not laid down by any statute. It would be possible for the EIR process (i.e. collection of data and writing up) to take place at the same time as the formal applications for consents are being processed. However, the release of the EIR before the formal applications are lodged is highly desirable to enable detailed information to be publicly available at that time.

This enables all interested parties to have as much information as possible about the project and may reduce the number of objections. Once an air of mistrust or obstruction arises time can be lost very quickly.

As may be seen in figure 1, the statutory processes for Water Rights and Land Designation add about two years to the pre-construction time for the power station. Land Designation under the Town and Country Planning Act is on the critical path for the project. Appeals could add at least six months to these times, so any time spent at an early stage in providing more information could lessen the chance of appeals, and thus shorten the total time taken.

Another activity which can be very time consuming is land purchase and the requirements leading up to it. One of the first tasks is *to* identify owners of all affected land, and then to negotiate with the Owners for purchase.

GOVERNMENT APPROVAL

Government Approval gives the Electricity Division authorisation to spend money on permanent works.

This is sought once all the statutory processes have been completed and requires a formal paper to Government requesting funds to commence construction. Any work, e.g. access roads, preliminary housing or land purchase done prior to Government approval must have special authority. It is also possible in certain circumstances to call tenders for key plant items before approval with the expectation of placing an order shortly afterwards.

PUBLIC AND LOCAL AUTHORITY INVOLVEMENT

It is very important to ensure that local community leaders and the public in general know what is happening. Before investigations commence visits are made to the United Council and local councils to inform them of the work and to invite their participation.

In the case of Ngawha these visits were made in December 1980/ February 1981. Following these meetings, the Northland United Council formed a liaison committee with representatives of: Kaikohe Borough Council; Bay of Islands County Council; Hokianga County Council; Tai Tokerau District Maori Council and was chaired by the regional planner from the Northland United Council. Government representation was from the Department of Health, Electricity Division and Oil and Gas Division of Ministry of Energy and Ministry of Works and Development.

This committee met at about three monthly intervals and had use'ful two way information flow. while it was not specifically necessary in this case it is often difficult to convince people that the work in hand is investigatory and must be completed before decisions can be made. It has been claimed on previous occasions that we are withholding information when in fact it does not exist.

LOW GRADE HEAT

. Another important duty carried out by the Northland United Council was in organising a seminar on the use of low grade heat, and holding a public meeting.

Large quantities of separated water at about 130°C are created in the process of separating steam and water at the well head. There are technical reasons why much of this hot water must be re-injected. However a very large amount of heat remains available for a secondary use. Interest in this heat had been expressed from a number of quarters and the seminar was arranged to discuss the possible uses. Proceedings of the seminar were published, with such uses as greenhouses, aquaculture, food processing and drying, timber and other product drying, and tourist use being identified and discussed. (This work is still proceeding under a separate funding.) In the evening following the seminar a public meeting to explain the power station proposal was held where Electricity Division, Ministry of Energy and Ministry of Works and Development speakers described the work and timetable for its completion.

DEVELOPMENT STUDIES

Groups of specialists were drawn together to study each area of concern. From the outset, three major areas of environmental concern were identified, these being mercury released into the atmosphere, effects of development on the existing hot springs and the effects of discharges into the important local streams. These were among many topics studied by the specialists. At the conclusion of the studies, reports were prepared with recommendations on how problems should be handled.

The study programmes were coordinated jointly by Electricity Division of the Ministry of Energy and Power Division of the Ministry of Works and Development.

Some of the groups and organisations involved in studies, in addition to those on purely technical aspects, were as follows:

ORGANISATION/GROUP	FIELD OF STUDY
Air Quality Study Group	Air pollution
NZ Historic Places Trust	Archaeology, maori history
Ministry of Works and Development, Auckland	Noise, Geomechanics
Wildlife Service, Internal Affairs	Wildlife
Ministry of Agriculture and Fisheries	Aquatic ecology
DSIR	Ecology
Ministry of Works and Development, Head Office	Visual Impacts

A number of studies were beyond the resources of Electricity Division, Ministry of Energy and consultants were retained. One was the Social Impact Assessment (SIA). A study brief was prepared and tenders invited before selecting a consultant.

The SIA had four discrete elementst

- Collection of data and description of existing communities.
- Prediction of how each community is likely to develop in the absence of the proposal.
- Description of the project and how it will affect or alter the community,
- Suggestions for mitigating the impacts of the development.

Surveys of affected groups with formal questionnaires were an essential part of gauging local attitudes to the development. Although the SIA was not published, another report[3] summarised all general information contained in the SIA, which had no direct reference to the 100 MW power station proposal.

FIELD PROVING AND DRAWDOWN TEST

Mathematical modelling of fields can only be carried out given some knowledge of field, and drawdown testa are usually used for this purpose.

The drawdown test is essential for two reasonst

- to enable the designers to set the turbine inlet pressure at a level that will be appropriate for the life of the station
- to "prove" that the geothermal field can sustain the proposed draw-off.

It is essential that in the drawdown test, sufficient fluid is extracted to obtain a measurable perturbation in the field. Following the draw-off of fluid the rate of recovery of the temperature and pressure from the perturbation must be measured for a similar time. Following the drawdown and recovery period scientists would analyse the results and write a definitive report.

In the case of Ngawha sustained testing of wells even one at a time is not possible because of the limited capacity of the local streams to absorb the effluent. A true picture of the field and its capabilities is not easily obtained unless the effluent is reinjected back into the ground.

Before the drawdown test can be commenced it is necessary to drill sufficient wells to produce and re-inject the fluid. Six wells at Ngawha were to have been completed and coupled up for the drawdown test and it was proposed that 800 tonnes

per hour be drawn off for 6 months With an additional 6 months recovery period.

COORDINATION OF STUDIES

The whole programme of studies was coordinated by a regular meeting of investigators where progress was discussed. Where any study was found to be slipping behind appropriate action was identified.

A further consultant was engaged to actually produce the EIR. Their work was firstly to design the report contents and format in consultation with the Commission for the Environment. They then arranged for contributors and edited their reports into a smooth flowing coodinated report. The consultants were also responsible for standardising maps and diagrams *and were to* be responsible for the printing of the final report.

SPECIFIC CONCERNS

In the course of the studies, several important features or concerns were identified as requiring further study, as they were likely to have a considerable effect on the power station contruction or operation. These included the existence of a rare sedge, the small natural water courses in the locality, possible effects on the existing Ngawha Hot Springs and air pollution.

The shores of Lake Waiparaheka are the habitat of a rare sedge, Baumea complanata. Attempts at propagation in laboratories have not been successful, and little is known about the plant. For these reasons, care has had to be taken that drilling wastes have not entered the lake in large quantities, and a further study has been made of the sedge.

Water courses in the area are generally small, with several providing fresh water supplies to communities. Because of this it has not been possible to directly discharge drilling wastes into the streams, requiring holding ponds and trickle releases. Drilling has been, and the design and operation of the power station would thus have been affected by the capacity of the streams to accept wastes, but the streams could still remain of potable quality.

Because the existing hot pools at Ngawha Springs have significant historic and reputed curative properties, much concern was expressed that the activity of the pools would reduce when the power station began operation. No precise scientific statement could be made on whether this was likely or not but the problem was acknowledged. To this end, more exhaustive measurements of the geothermal field and existing hot pools were to be made, and an experimental pool to use well fluid was built.

Horticulturalists and farmers were among those expressing concern about the possible effects of air pollutants, *on* a long term basis, on plants and grass. Mercury and hydrogen sulphide were among the pollutants. Assessment of existing levels of pollutants, and short and long term effects of well-testing and power station discharges is continuing, With assistance from NZ Meteorological Service, Department of Health, DSIR and Electricity Division.

ESTIMATE OF COSTS

Before a power station is placed in the "power plan" it is necessary to prepare an estimate of costs and from this compare them with the cost of power from other schemes under consideration. The cost of power from Ngawha was high when calculated at a 10% discount rate. At a 5% discount rate, Ngawha costs appear better.

The enthalpy or heat content of the steam at Ngawha is low (970 J/g) compared with other geothermal fields. Thus to obtain 100 MW, approximately 30 wells would have been required. In addition at least as many more are required for re-injection of the waste fluid and others for back-up "dud" wells. This makes a total of about 80 wells which can cost $1 million each. In addition, pipework would have cost $5 million to transmit the steam to the station and back to re-injection wells.

The cost of many of the components of the power station are independent of size, e.g. establishment including housing, cranes, workshops, and would be comparable with the cost of similar parts of a 1000 MW station such as Huntly. The cost of electrical and mechanical equipment are however, nearly all proportional to size.

A further item which is dependent on the steam characteristics is that of gas extractors - the gas content of Ngawha steam is about 15% compared to Broadlands at 62 and Wairakei at 0.1%. This increases the cost of the plant and requires greater energy to operate.

In 1983 terms the estimate of cost for the Ngawha station was $305 million which gave a cost in the vicinity of 8c per kWh at 80% plant factor. By comparison new coal fired plant operating at a plant factor of 602 would cost about 7 c/kWh.

Should another new geothermal field be suggested for development for electricity generation, there are a number of quick testg that can be applied to decide if it could be economic to develop. These are:

- How much power per well is likely to be available.
- How much separated water will be required to be re-injected.
- What is the gas content of the steam.
- What are the likely establishment and fixed costs.

In addition planning should ensure that wells are drilled as late as possible but consistent with the need for field knowledge. Techniques are being investigated to install well-head generators and if feasible these could be commissioned as soon as the well is drilled to earn some early revenue from the funds which have been spent on the well. They would then be taken on to another field when the main station is completed.

FUTURE PROJECT MANAGEMENT

The experience of Ngawha has showed that even with a tight programme it is possible to obtain an EIR which covers all the necessary points, and fits in with the developing nature of those reports. The main requirement is for efficient control of the programme decided upon, with cooperation by all involved in providing the information.

ACKNOWLEDGEMENT

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