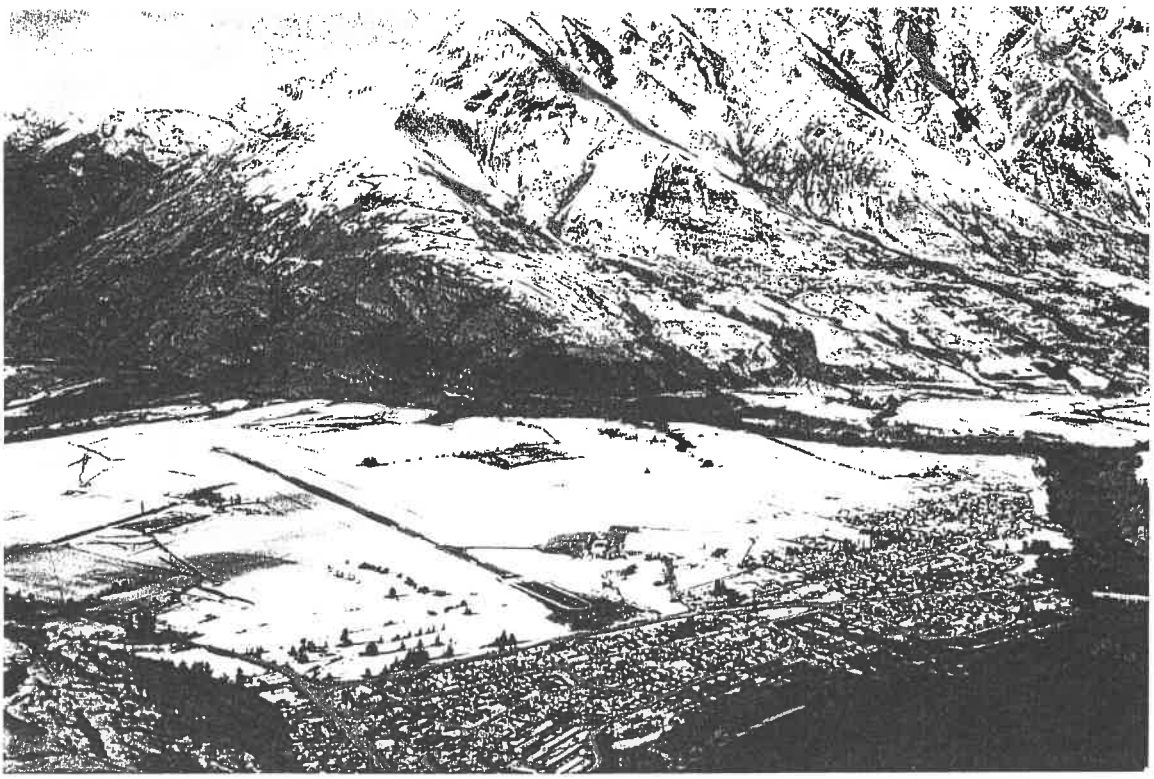
Queenstown Airport Corp Ltd.
P.O. Box 64 Queenstown, N.Z.
Phone (03) 442-3505
Fax (03) 442-3515

QUEENSTOWN LAKES DISTRICT COUNCIL

PRIVATE BAG 50072 QUEENSTOWN, NEW ZEALAND

QUEENSTOWN AIRPORT

ALTERNATIVE SITE STUDY



AIRPLAN

BECA

OCTOBER 1995

QUEENSTOWN AIRPORT

ALTERNATIVE SITE STUDY

PREPARED FOR

QUEENSTOWN - LAKES DISTRICT COUNCIL

BY

AIRPORT PLANNING PTY LTD (AIRPLAN)

IN CONJUNCTION WITH

BECA CARTER HOLLINGS & FERNER LTD

AIRPLAN

Airport Planning Pty Ltd
ACN 005 119 826
615 St Kilda Road
Melbourne Victoria 3004
Australia

BECA

Beca Carter Hollings & Ferner Ltd
132 Vincent St
Auckland
New Zealand

OCTOBER 1995

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APPENDIX A

APPENDIX B

GLOSSARY OF TERMS

AGL	-	Above Ground Level
ATC	-	Air Traffic Control
CAA	-	Civil Aviation Authority of New Zealand
CPI	-	Consumer Price Index
DME	-	Distance Measuring Equipment
DVOR	-	Doppler Very High Frequency Omni Range
DOC	-	Department of Conservation
EIS	-	Environmental Impact Statement
FAA	-	Federal Aviation Administration (USA)
FRS	-	Fire Rescue Service
GA	-	General Aviation
GPS	-	Global Positioning System
HF	-	High Frequency
HIAL	-	High Intensity Approach Lighting
HIRL	-	High Intensity Runway Lighting
ICAO	-	International Civil Aviation Organisation
ILS	-	Instrument Landing System
IMC	-	Instrument Meteorological Conditions
INM	-	Integrated Noise Model
Ldn	-	Aircraft Noise Contour (within which housing not recommended)
LLZ	-	Localiser
MLS	-	Microwave Landing System
MTOW	-	Maximum Takeoff Weight
NDB	-	Non Directional Beacon
NEF	-	Noise Exposure Forecast
OLS	-	Obstacle Limitation Surface
PAPI	-	Precision Approach Path Indicator
QAC	-	Queenstown Airport Corporation Limited
QLDC	-	Queenstown - Lakes District Council
RESA	-	Runway End Safety Area
RMA	-	Resource Management Act
RSR	-	En-route Surveillance Radar
RVR	-	Runway Visual Range
RWY	-	Runway
SAA	-	Standards Association of New Zealand
SMR	-	Surface Movement Radar
TAR	-	Terminal Area Radar
TWY	-	Taxiway
VFR	-	Visual Flight Rules
VHF	-	Very High Frequency
VIP	-	Very Important Person
VMC	-	Visual Meteorological Conditions
VOR	-	Very High Frequency Omni Range
VPH	-	Vehicles per Hour

SCHEDULE OF CONSULTATION

Advice was sought from the following groups, persons or organisations in the course of this study:

Air New Zealand

Ansett New Zealand

Aspiring Airlines Ltd

Central Otago District Council

DOC
- Queenstown Field Office
- Wanaka Field Office
- Dunedin Conservancy

Kati Huirapa Runanga Ki Puketeraki

Land Care Research, Dunedin

Marshall Day Associates

Mount Cook Airline

National Institute of Water & Atmospheric Research Ltd.

New Zealand Historic Places Trust (Dunedin)

Otago Regional Council

QAC

QLDC

Transit NZ (Dunedin)

Warbirds over Wanaka Ltd

SCHEDULE OF DOCUMENTS USED OR REFERRED TO IN THE COURSE OF THIS STUDY

The Climatology of Queenstown Airport New Zealand Meteorological Service - 1983

Queenstown Airport Relocation Study (Interim Report) Rod Carsons, Manager, Alexandra Residency (Ministry of Works and Development) - 27 February 1987

Queenstown Airport Relocation Study - Technical Reports Ministry of Works and Development, Alexandra - March 1987

Queenstown Airport Relocation Study - Preliminary Cost Report Ministry of Works and Development, Alexandra - March 1987

Development Potential of the Alexandra/Clyde Airport - The Pilot Study Alan McGreevy - June 1987

Southern Lakes Regional Airport - A Short Study of Airport Needs in the Southern Lakes Region Airport Consultancy Services (R.L. Ayers), Wanaka - September 1987

Proposed Queenstown Airport - Geotechnical Report Beca Carter Hollings & Ferner - April 1988

Meteorological Conditions at the Proposed Queenstown Airport (Jardines Site) New Zealand Meteorological Service - 20 May 1988

Feasibility Report on New Queenstown Airport (Draft) Beca Carter Hollings & Ferner - July 1988

Queenstown Airport Development Strategy DMR - 12 August 1988

Lakes District Regional Airport - Study of Alternative Sites Duffill Watts & King - October 1988

Lakes District Regional Airport Queenstown Hill Option - Preliminary Estimate of Earthworks Quantities Duffill Watts & King Ltd - October 1988

Lakes District Regional Airport - Queenstown Hill Option - Preliminary Cost Estimate Duffill Watts & King Ltd - January 1989

Queenstown International Airport Submission by Queenstown Airport Committee - May 1990

Queenstown Airport Market Forecast Analysis - Public Report Mc Dermott Miller Group - April 1991

A Survey of the Future Development of a Regional Airport Facility Queenstown Airport Corporation Limited - 4 September 1991

Queenstown - An Aviation Plan (Revised July 1992) J D Henly - July 1992

Queenstown - An Aviation Blueprint for the Future J D Henly - Undated

Queenstown Airport Design Feasibility Study Transplan Inc (New York) - Undated

Plan Change Submission - Volume 1 Beca Carter Hollings & Ferner Ltd - August 1993

Plan Change Submission - Volume 2 - Details of the Plan Change and Map Amendments Beca Carter Hollings & Ferner Ltd

Submissions and Evidence in Support of Plan Change 96 G.L. Berry (Counsel), P S Phillips (Chairman, QAC), L Lennox (BCHF), N Hegley (Hegley Accoustic Consultants), M Foster (BCHF), P Constantine (Constantine Planners)

Southern Lakes Airport Report Noise Management Plan and Airport Noise Impact Report - November 1993

BW Walker - Environmental Effects Report for Proposed Southern Lakes Airport - Duffill Watts & King Ltd - November 1922

McDermott Fairgray Queenstown Airport Passenger Projections 1995-2010 Prepared for Air New Zealand CH and QAC

Vincent County Transitional District Plan

Lakes Queenstown - Wakatipu Transitional District Plan

Otago Regional Plan

Otago Proposed Regional Policy Statement

Resource Management Act

NZ 56805 : 1992

EXECUTIVE SUMMARY

In 1993, Queenstown Airport Corporation (QAC) lodged a private plan change with Queenstown-Lakes District Council (QLDC) under the provisions of the Resource Management Act, to bring down a long term development plan for Frankton Airport. At a public enquiry in 1994, consent to the plan change (known as Plan Change 96) was refused by the hearing Commissioner, with a major reason being that studies to support the application had not adequately considered possible alternative airport sites.

QLDC and QAC engaged Airport Planning Pty Ltd (Airplan) in association with Beca Carter Hollings & Ferner Ltd in May 1995 to make an independant and objective study of the known airport site options.

The study first reviewed previous study reports which covered eleven alternative airport sites distributed over the wider region. These sites were screened using broad critera which resulted in a short list of four alternative sites to be evaluated in more detail for comparison with the existing Queenstown Airport at Frankton. The four airport sites are:

- Jardines
- Queenstown Hill
- Cromwell Terraces
- Wanaka

A series of evaluation criteria were established to compare each of the short listed sites as follows:

- Runway requirements (to suit proposed aircraft types and routes)
- Meteorological conditions
- Airspace considerations
- Surface access to Queenstown
- Availability of utility services
- Assessment of environmental effects
- Budget cost estimates

Conclusions reached resulting from the assessment of each airport site against the above criteria are summarised as follows:

- Queenstown Hill is an unsuitable site for locating an airport due to unsuitable meteorological conditions. In addition, it has severe environmental effects and has the highest cost.
- Jardines is unsuitable due to meteorological conditions (principally turbulence), airspace considerations and environmental considerations

- Cromwell Terraces would provide suitable sites for 24 hour operations by up to the design aircraft. The major disadvantage of this site is its distance from Queenstown
- Wanaka would allow the provision of an airport with trans-Tasman capability but its runway length would be limited to 1800 m. It's major disadvantage is that it is the furthest site from Queenstown.
- Frankton is clearly the preferred site. Because it is an existing major airport, it is clearly preferred with respect to environmental issues, availability of utility services and cost. Other key areas in which Frankton is the clearly preferred site are its proximity to Queenstown and relatively favourable meteorological conditions. Although Frankton cannot accommodate a 2000 m long main runway, it can be developed to accommodate a runway which will allow trans-Tasman operations by B737 size aircraft. The main disadvantage with the Frankton site is that surrounding topography is not compatible with 24 hour operations using an instrument landing system and would not allow operations by B767 size aircraft. Nevertheless, lack of night time operations capability has not been a significant drawback for the airport and on environmental grounds, may in fact, be a positive factor for the future. The inability to operate of B767 size aircraft does not preclude international flights using B737 size aircraft.

1. INTRODUCTION

1. INTRODUCTION

Queenstown Airport is located at Frankton, to the east of the Frankton Arm of Lake Wakatipu. The airport is located on the Frankton River terrace flats which is bordered by the Remarkables mountains to the east, Lake Wakatipu and Peninsula Hill to the west, Queenstown Hill/Sugar Loaf/Ferry Hill to the north west, Slope Hill to the north-east and the Crown Range to the north. The Frankton flats are dissected by the Kawarau and Shotover Rivers and Lake Hayes. The airport was first established in 1935 and scheduled air services commenced in the 1950's. At that time there was no permanent residential settlement at Frankton although some holiday homes existed.

The site of the airport and orientation of its runways are compatible with prevailing winds, with approach and departure tracks along the Kawarau River Valley to the east and over Lake Wakatipu to the west. Although the topography imposed constraints on airport operations, the airport site at Frankton was the best available site within close proximity of Queenstown.

Queenstown and the surrounding district is one of the most scenic areas in New Zealand, with magnificent lakes and mountains. A wide range of outdoor activities are available, including the growing popularity of snow skiing during the winter months. Queenstown has therefore become a popular tourist destination with growing numbers of overseas visitors, particularly from Asia. It is recognised in the Regional and District Plans for Otago and the Queenstown Lakes District respectively as being of national and regional importance in terms of its social, economic and scenic value to New Zealand.

Aircraft movements for the year to March 1995 totalled 58,370 at Queenstown Airport. Passenger traffic at Queenstown Airport has grown at above 10% per annum over the last 5 years and for the year to March 1995 totalled 480,180 passenger movements. Projections for the year 2010 indicate total passenger projections (scheduled and unscheduled) of 1,122,000 at a base growth rate of 5.8% per annum(1). Currently 79% of passenger movements are by overseas visitors.

The growth of tourism in recent years has led to the construction of new international standard hotels and other tourism related facilities, which in turn has created an expanded local population to service the rapidly growing tourism industry.

Current scheduled air services are provided by:

- Air New Zealand	B737-200 aircraft (hushkitted version)
- Ansett New Zealand	BAe146-300 aircraft
- Mount Cook Airline	HS748 aircraft (to be progressively replaced between September 1995 and February 1996 with ATR72 aircraft)

(1) McDermott Fairgray "Queenstown Airport Passenger Projections 1995 - 2010 August 1995"

Sightseeing/charter flights are provided by a range of aircraft including Twin Otter, Nomad, Islander, smaller single engined aircraft and helicopters.

Air New Zealand has pioneered trans-Tasman services for the 1995 winter ski season, with direct services from both Brisbane and Sydney using B737-200 aircraft. Due to the restricted runway length available, which does not allow fully loaded aircraft to fly trans-Tasman, return services have been via Christchurch.

Over the years and particularly since the 1980's, there has been pressure for more residential and tourism development. In 1994, the number of residential building consents issued by Queenstown Lakes District Council (QLDC) totalled 606. Of these, 425 were for dwellings in the Wakatipu Basin and almost half were in the Frankton, Kelvin Heights areas and on Frankton Road. The number of hotels/tourist accommodation facilities is projected to increase by 35% over the next 2-3 years. Development has expanded beyond the borough boundaries towards Fernhill to the west and Frankton, Kelvin Heights to the east and south-east. A consequence of this increased development has been greater numbers of people visiting Queenstown (10-15% of visitors travel by air) and the incidence of more people living under the flight paths for Queenstown Airport. The trend has been for the holiday homes at Frankton to become permanent dwellings. This residential development at Frankton and along the shores of the Frankton Arm of Lake Wakatipu has exposed increasing numbers of people to aircraft noise due to operations at the airport. Tourism growth has also seen more flights into and out of Queenstown by jet and light aircraft.

In recent years, some persons in the Queenstown area, including some residents affected by operations at the airport, have suggested that aircraft operations should be transferred to another site remote from populated areas.

Queenstown Airport was corporatised in 1989, with ownership being transferred to the Queenstown Airport Corporation Limited (QAC) which is a wholly owned trading corporate of Queenstown Lakes District Council. QAC's charter is to ("provide for safe and efficient operations at Queenstown Airport and to develop the airport to meet the aviation needs of the community and growing numbers of tourists").

In 1993, QAC lodged a private plan change with QLDC under the provisions of the Resource Management Act. The purpose of the plan change (referred to as Plan Change 96) was to bring down a long term development plan for the Frankton Airport and associated land use controls on the Frankton Terrace so that the airport could continue to be developed to meet the needs of the growing numbers of passengers and the Queenstown economy which is heavily dependent on tourism.

A Commissioner, acting under delegated authority from QLDC, heard the matter and 274 submissions/cross submissions. He recommended to the Council's hearing committee that Consent to Plan Change 96 be refused, with major reasons being that the studies undertaken to support the application had not adequately considered possible alternative airport sites and whether any such sites may or may not be preferable to continuing to develop the existing airport at Frankton or that it would be desirable to consider the future of the airport in the context of the review of the district plan. This recommendation became the decision of QLDC and has been appealed by QAC and other parties, with the matter not yet having been resolved by the Planning Tribunal. In the meantime, QAC has undertaken runway extension works at the western end of runway 05/23. It has also applied for a resource consent to undertake a 262m extension to the eastern end of runway 05/23. It has also continued consultation with the Council over protection measures for the airport at Frankton including incorporation of noise boundaries in the Council's District Plan to protect airport operations while at the same time recognising the amenity values of residential areas around the airport.

As a consequence of the Plan Change 96 ruling, QLDC required an Alternative Airport Sites Study to be carried out. QLDC and QAC engaged Airport Planning Pty Ltd (Airplan) in association with Beca Carter Hollings and Ferner Ltd (BCHF) in May 1995 to make an objective and independent study of the known options for airport sites. This study involved a review of the previous reports prepared between 1983 and 1993 of studies into various alternative airport sites to produce background material but each site was totally reassessed in terms of a new set of criteria.

Following completion of the review of previous study reports, an assessment of the review was undertaken by the study team in June 1995 at which 11 alternative sites in the wider region were evaluated using a coarse screening approach involving four broad conservations from which four short listed sites in addition to the existing Queenstown (Frankton) Airport were identified for further detail evaluation. These sites are referred to as Jardines (to the south west of Peninsula Hill), Queenstown Hill, Cromwell Terraces (existing airstrip to the west of State Highway 6) and Wanaka (Wanaka Airport).

Airplan and BCHF were commissioned in July 1995 to undertake a detailed study to evaluate alternative airport sites to the existing Frankton Airport site. The determination of a preferred airport site is to be based on testing each short listed site identified at the above workshop against a set of airport planning and other relevant criteria together with a comparison between these four sites and the existing Queenstown Airport at Frankton.

This report provides:

- an outline of the review of previous study reports
- the selection of the short listed airport sites for further evaluation
- the comparative evaluation of the short listed airport sites against the criteria established for this purpose

2. PREVIOUS STUDIES

2. PREVIOUS STUDIES

2.1 PREVIOUS SITES CONSIDERED

A wide range of sites have been considered for the location of an airport to serve Queenstown and the Southern Lakes District. These sites have been reported on in a range of studies that have been undertaken over a number of years.

Airport sites that have been considered in previous studies, other than the existing Queenstown Airport located at Frankton, are:

- Jardines
- Queenstown Hill
- Wanaka
- Cromwell (Racecourse)
- Alexandra
- Glenorchy
- Milford Sound
- Te Anau
- Manapouri
- Von River Valley
- Castle Rock

Reports prepared between 1983 and the present time which analysed particular aspects of these sites were reviewed in the early stages of this study. Each of the previous study reports has addressed one or a number of particular issues (such as meteorological conditions, bulk earthworks, cost of runway construction, etc).

In order to consider the relative merits of each of the airport sites, a list of appropriate site selection criteria was established. Each of the previous study reports was reviewed with reference to this criteria. Airplan's report titled "Queenstown Airport - Review of Previous Study Reports" dated June 1995 summarised the main conclusions from each of these reports against the criteria.

2.2 SHORT LISTED SITES FOR EVALUATION

A set of criteria for the initial coarse evaluation of all sites considered in previous studies was then established in conjunction with Beca Carter Hollings and Ferner on 23 June 1995. The course evaluation was undertaken against a limited number of key criteria in order to identify preferred sites for more detailed comparative evaluation.

The criteria adopted for the coarse evaluation of sites were:

- Surface distance from Queenstown

  Because Queenstown is a predominantly tourism destination, the surface distance was related to the time of travel by coach. In order that air travel maintained its time advantage over surface travel from the main international gateway airport to the South Island and the key domestic hub airport (Christchurch) a coach travel time of approximately 1 hour was set as a reasonable maximum.

- 24 hour capability

  In order to provide maximum flexibility for international connections at Christchurch and Auckland (both of which are 24 hour airports) as well as for direct trans-Tasman services, 24 hour capability was considered to be a desirable target for any new airport.

- Prevailing meteorological conditions

  An assessment of prevailing meteorological conditions relating to the operation of aircraft based on the previous study reports plus local knowledge was made, to determine the sites which would be most suitable. Met conditions taken into account included:

  - prevailing wind(s) and runway orientation relative to these
  - incidence of fog/low cloud
  - incidence of snow and ice
  - incidence of turbulence.

- Location of obstacles relative to site

  Location of obstacles (mountains) relative to take-off and approach paths to the airport's runways.

A simple evaluation matrix using a positive, neutral and negative attribute scoring system was prepared in order to evaluate each site against the above criteria. This matrix is provided on Table 2.1

Table 2.1: ***Initial Coarse Evaluation of Airport Sites Considered in Previous Studies***

SITE	CRITERIA			
	1 HOUR TRAVEL	24 HOUR COMPATIBILITY	MET CONDITIONS	OBSTACLES
Frankton	√	No.	√	√
Jardines	√	?	?	?
Queenstown Hill	√	√	?	√
Cromwell (Terraces)	√	?	√	?
Wanaka	x	√	√	?
Alexandra	x	√	√	√
Glenorchy	x	x	?	x
Milford Sound	x	x	x	x
Te Anau	x	√	x	√
Manapouri	x	√	x	√
Von River Valley	x	?	?	?
Castle Rock	x	√	√	√

Symbols:
- √ positive attribute
- ? data not conclusive from previous reports
- x negative attribute
- No. cannot be provided

Any sites recording a negative attribute were eliminated from further consideration. The results of this evaluation provided the following short listed airport sites for detailed comprehensive evaluation and comparison with the existing Queenstown (Frankton) Airport:

- Jardines
- Queenstown Hill
- Cromwell (Terraces site)
- Wanaka (although in excess of the 1 hour coach travel time criteria, this site was included as it is within the boundary of the Queenstown Lakes District Council and is owned by the council).

It should be recorded in relation to the consideration of the Castle Rock site that representations have been made at several hearings by Mr B Walker that an airport at Castle Rock offers a suitable site as a planning alternative. Mr Walker indicated to the QAC management that inclusion of Castle Rock in the study would benefit the future planning applications intended to be made in relation to this proposal.

In this respect, the QAC requested and received sufficient planning documentation to properly evaluate the proposal on a site location basis. It is significant for future consideration of this site as an airport that planning approval has already been refused by the Planning Tribunal.

The same set of criteria that applied to all sites was applied to the Castle Rock site, with the result that it was not included in the short list.

The consultants also received information on other sites from independent sources, other than previously published reports. As with the Castle Rock information, these were evaluated and in one case provided background evaluation material for one of the short listed sites. It should be noted that the study did not investigate any new areas which had not formerly been evaluated. Visual inspections identified that potential new sites existed in the Cromwell Valley. However, most would be disadvantaged by the ground transportation difficulties identified for Cromwell Terraces and Wanaka.

3. AIRPORT SITES

3. AIRPORT SITES

3.1 AIRPORT LOCATION KEY FACTORS

Airports form a vital component of the transport infrastructure of the city or region which they serve. In the case of Queenstown, the airport is of paramount importance to the large and rapidly growing local tourism industry.

In order to provide maximum convenience to travellers, including minimising the overall journey time, airports should be sited as close as possible to the center which they serve. Worldwide, the trend for major tourism destinations and major resorts is for the airport serving these to be located in close proximity. Regional examples include Cairns, Gold Coast, Hamilton Island (a resort with its own self contained B767 capable airport), Fiji.

If the airport is located remote from the centre which it serves, this will act as a disincentive for visitors who will go to alternative areas which are more accessible by air. Only people determined to visit will use less convenient air services or alternative (generally cheaper and slower) transport modes. In the case of Queenstown, most visitors fly in from Christchurch - being the main South Island international gateway.

As well as the current air services, regular road coach services are available between Christchurch and Queenstown at fare levels which are much less than air fares. The journey time is, however, much longer.

Figure 3.1 illustrates the time and cost comparison of a journey between the city centres of Christchurch and Queenstown by coach and jet aircraft.

From figure 3.1, it is apparent that the time saving relative to the saving in the cost of air travel would be considerably eroded if the airport serving Queenstown was located of a distant location such as Wanaka.

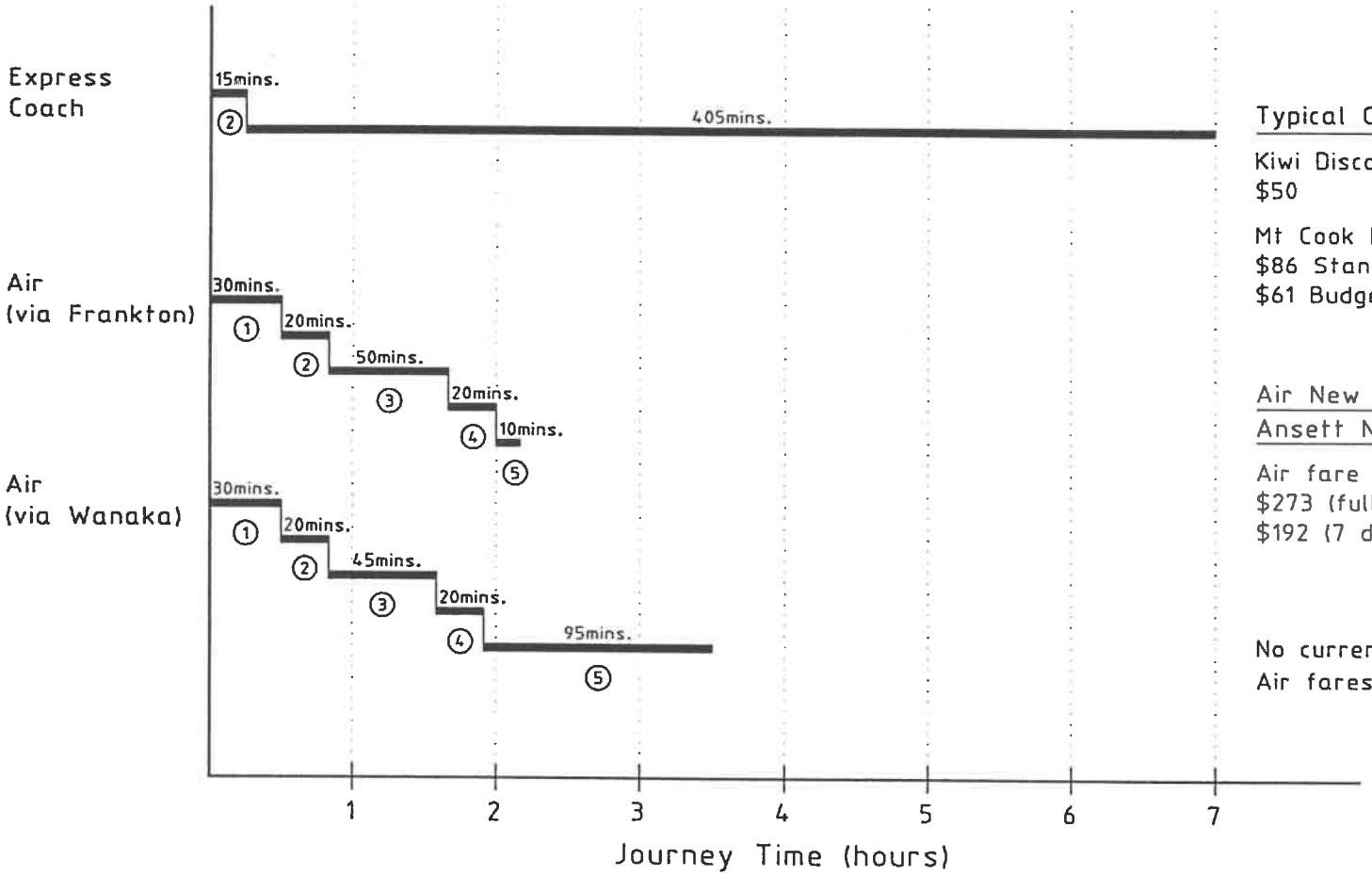
3.2 SHORT LISTED AIRPORT SITES

The short listed airport sites evaluated in this study are described in this section. The locations of the sites are shown on Figure 3.2.

Jardines Site

A possible airport on the Jardines site is bounded by State Highway 6 to the east, Lake Wakatipu to the south and south-west and Wool Shed Road to the west. The site is on gently undulating farmland lying in the lee of the Remarkable Range which dominates the landscape to the east of State Highway 6. Photos 4 and 5 in Chapter 9 show aerial views of the site. The site is some 6 km south of Queenstown (Frankton) Airport.

The road distance from this site to central Queenstown is approximately 17 km (20 mins by coach), with a single lane bridge crossing of the Kawarau River (as shown on the following page.



Typical One Way Fares

Kiwi Discovery
$50

Mt Cook Landline
$86 Standard
$61 Budget

Air New Zealand/Mt Cook Airline/
Ansett New Zealand

Air fare only
$273 (full economy)
$192 (7 day advance purchase)

No current direct Christchurch - Wanaka service
Air fares would be similar to above

LEGEND

① Coach from Christchurch city centre - Airport
② Check-in
③ Air travel (jet aircraft)
④ Baggage claim / transfer to coach
⑤ Coach from Airport - Queenstown city centre

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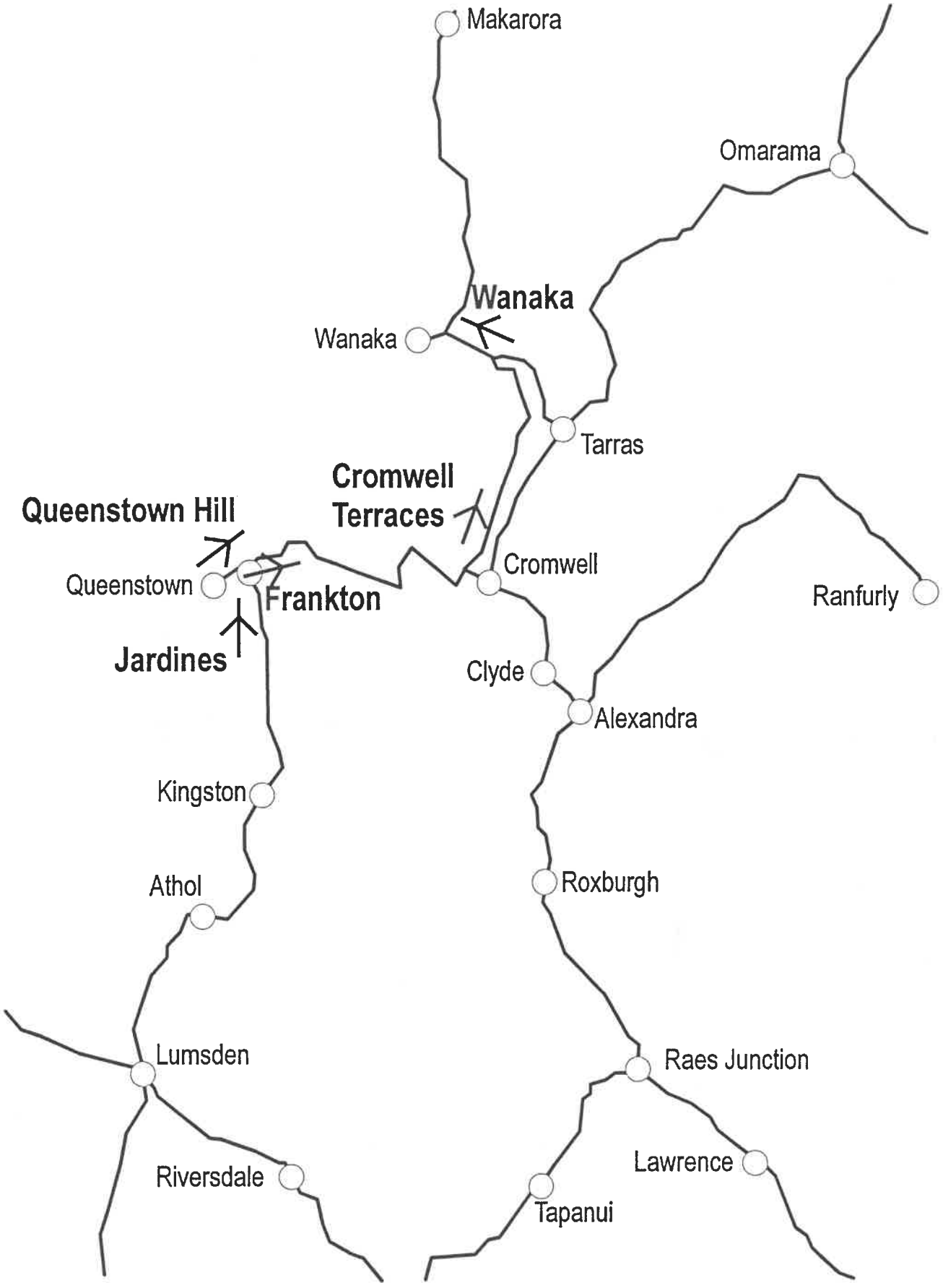
Figure 3.1

COMPARISON OF AIR AND COACH TRAVEL
CHRISTCHURCH - QUEENSTOWN



QUEENSTOWN AIRPORT - NEW ZEALAND
ALTERNATIVE SITE STUDY

AIRPLAN

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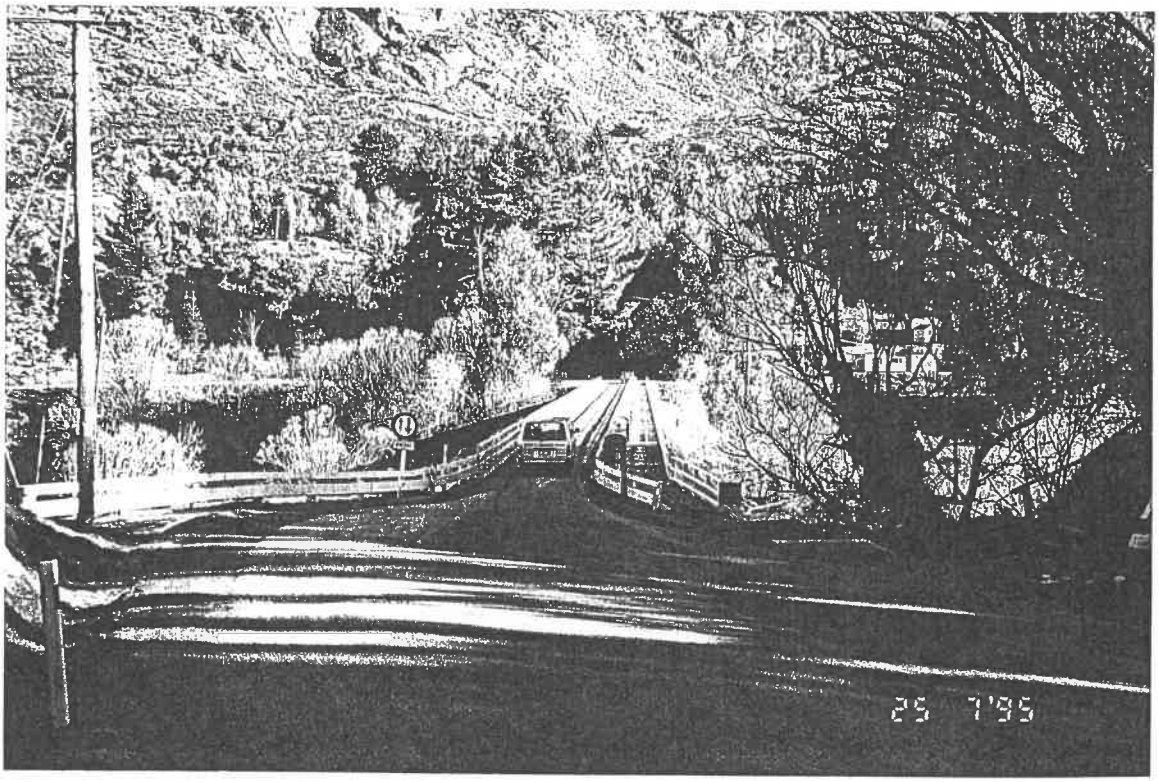
Figure 3.2
AIRPORT SITES



State Highway 6 Bridge Crossing Kawara Falls Dam between Frankton and Jardine Site

There is sufficient land area available to construct an airport with a main runway up to 3000 m long as well as a short cross runway for light aircraft. The site currently contains a privately owned strip for light aircraft. The land area proposed in the 1988 Beca Carter Hollings and Ferner draft report, "Feasibility Study on New Queenstown Airport" for development of an airport on the Jardines site with a 3000 m runway is some 300 hectares.

The elevation of the site is approximately 366 m above sea level.

Queenstown Hill Site

The Queenstown Hill site is on the summit of Queenstown Hill (and Sugar Loaf) which is situated immediately to the north-east of central Queenstown. State Highway 6A runs along the lower slopes of Queenstown Hill alongside the Frankton arm of Lake Wakatipu. The Queenstown to Arrowtown road passes to the east of the hill.

The summit of Queenstown Hill generally comprises a plateau which has considerable undulation. The general elevation of the airport site would be approximately 860 m above sea level, to be formed from the natural surface elevation varying between 850 m and 911 m. Photos 1 and 2 in Chapter 9 show aerial views of the site.

In order to service an airport at this site, a new access road as well as an intersection with State Highway 6A would be required to be constructed. Such a road would be very winding, some 6 km in length - with a continuous gradient over most of its length of 1 in 10. The road distance to central Queenstown is estimated at some 20 km minimum (20 mins by coach).

Cromwell Terraces

A 1600 m x 60 private grass surface light aircraft strip exists at the Cromwell (Terraces) site.

The elevation of the site is 315 m above sea level.

The site is located approximately 6 km north of Cromwell on an elevated platform to the west of State Highway 6 (Cromwell to Luggate section). The Pisa Range rises to the west of the site and Lake Dunstan is to the east of both the site and State Highway 6. Photos 13 and 14 in Chapter 9 show aerial views of the site.

The distance by road to central Queenstown is approximately 67 km (60 mins by coach) via State Highway 6, passing through the Kawarau Gorge to the west of Cromwell (see Photo 12 in Chapter 9). A 2 km spur road would be required from Lowburn Valley Road to provide access to the airport site. Lowburn Valley Road would also require upgrading between State Highway 6 and the spur road to the airport as well as an upgraded intersection with State Highway 6.

Wanaka Airport

Wanaka Airport is owned by the Queenstown Lakes District Council and managed by Queenstown Airport Corporation. The airport is home to the Wanaka Warbirds collection and two air charter and flying training organisations. Regional air services are also provided by Mt Cook Airlines. Ansett New Zealand BAe 146 aircraft have landed at the airport on a pavement concession

The airport is situated adjacent to State Highway 6, between Luggate and Wanaka. It is approximately 15 km south-east of Wanaka township. Photos 8, 9 and 10 in Chapter 9 show aerial views of the site.

The road distance to Queenstown is 104 km (approximately 95 mins by coach), via Cromwell and the Kawarau Gorge (see Photo 12 in Chapter 9). An alternative route via the Crown Range is some 90 km. The road is unsealed for much of its distance, is very windy and is snow/ice affected in winter (it is noted that use of this road is prohibited by car rental companies). This road is therefore unsuitable for use by tourist coaches.

The existing runway is 1200 m long x 30 m wide and is designated 11/29.

The maximum possible runway length on the site is 1800 m due to the existence of river flats to the south-east and a ridge to the north-west beyond each runway end. The current airport site comprises 39 hectares, with little scope available for expansion.

The elevation of the airport is 348 m above sea level.

Queenstown (Frankton) Airport

Frankton is the location of the current airport which serves Queenstown and district. The airport is owned and operated by Queenstown Airport Corporation Limited.

The airport is located adjacent to State Highway 6 near to its intersection with the spur into Queenstown (State Highway 6A). The terminal area at the airport which is located on the south side of the main 05/23 runway, is approximately 7 km by road from central Queenstown (10 mins travel time by coach). Current planning proposes that a new terminal be constructed at the north side of the 05/23 runway.

The land area of the airport is 154.0 hectares, including recent acquisition of land to allow extension of the main runway, provision of a new cross runway and for the new terminal area. Photos 15 and 16 in Chapter 9 show aerial views of the airport and surrounds.

The main 05/23 runway is currently 1,341 m long x 30 m wide. However, the recently constructed 118 m western extension is 45 m wide. A 262 m long x 45 m wide extension of this runway to the east is proposed to be constructed during 1996. The runway extensions will provide a total runway length of 1721 m, in addition to 150 m of additional sealed length whereby a takeoff run of 1931 m will be available. Widening of the original 1341 m long section of the runway from 30 m to 45 m is proposed in the future.

BCHF, who are project managers for the runway extension project advised that a 60 m long stopway is provided at the end of the western runway extension and a 60 m long starter extension is proposed at the eastern runway extension. These can be utilised to extend the take off run available to over 1800 m from each runway end.

A 944 m long x 60 m wide grass light aircraft cross runway strip (runway 14/32), together with a 645 m x 40 m grass runway parallel to the main 05/23 runway, also exists.

The elevation of the airport is 357 m above sea level.

The following sections evaluate these sites against a comprehensive list of criteria, under the following headings:

- runway requirements
- meteorological conditions
- airspace considerations
- availability of utility services
- surface access
- environmental issues
- budget cost estimates

4. RUNWAY REQUIREMENTS

4. RUNWAY REQUIREMENTS

4.1 GENERAL

This analysis of runway requirements is based on the largest aircraft that may operate to Queenstown Airport ie. the "design aircraft."

At present, a mixture of aircraft operate at Queenstown (Frankton) Airport, ranging in size from small, single engined general aviation aircraft to B737-200 hush-kitted airliners. It is noted that due to runway length restrictions capacity of the B737-200 aircraft is limited to 95 passengers. This range of aircraft types can be safely accommodated with the present relatively low number of aircraft movements (54,300 movements in 1993).

However, as traffic increases, delays will occur or some categories may have their operations limited during peak periods due to:

- the incompatible performance characteristics of the various types of aircraft
- airspace constraints from surrounding mountains
- parallel taxiways not currently being available to minimise runway occupancy times

Capacity constraints are not considered in this assessment of runway requirements, rather the runway length requirement is determined for the design aircraft to operate both domestic and possible trans-Tasman services.

4.2 DESIGN AIRCRAFT

The largest aircraft type currently visiting Queenstown (Frankton) Airport is the Boeing B737-200 (hushkitted) operated by Air New Zealand on domestic services and trans-Tasman services from Sydney and Brisbane (commenced 1 July 1995 for the winter ski season). Due to the current operational runway length of 1341 m being inadequate for longer haul B737-200 operations, return services to Sydney and Brisbane are routed via Christchurch. A recently completed extension of 118 m at the western end and proposed extension at the eastern end will result in a total runway operational length of 1,781 m. However, Air New Zealand advised that even with these runway extensions, commercially viable loads from Queenstown to trans-Tasman destinations will not be possible, using the existing B737-200 aircraft.

Both of the major domestic airlines (Air New Zealand and Ansett New Zealand) operate their domestic jet fleet to Queenstown and it is expected that growth in traffic will be accommodated in the short to medium term by increased frequency of service. Air New Zealand advises that it currently has orders for 6 x B737-300 aircraft for delivery in 1998. Current and future aircraft types that the airlines may operate to Queenstown include the B737-300, A320 and the new B737-600/700/800 series. These latter aircraft will enter airline service from 1997 and will ultimately replace the B737-300/400/500 series. The B737-700 is similar in passenger capacity to the B737-300 but will have a larger wing allowing increased range due to a higher fuel capacity. These new aircraft types would allow commercially viable passenger loads from Queenstown to trans-Tasman destinations.

It is highly likely therefore, that trans-Tasman services will continue in the future and be developed, by expanding the current seasonal (ski package) flights, occasional charters, or possibly based on the Air New Zealand hub at the new international terminal at Brisbane Airport. Increased hubbing of passengers at Brisbane, would for instance, allow tourists arriving from Asian ports at Brisbane to transfer to direct flights to Queenstown in smaller aircraft (and vice versa), allowing tour operators to offer twin destination packages to (say) Brisbane (Gold Coast) and Queenstown. B737 sized aircraft would be appropriate for such trans-Tasman services, providing a balance of capacity and frequency of operation.

To cater for peaks of demand and future growth in traffic, the ability to operate larger aircraft types (such as the B757, 767, A300, A310) should be investigated. Such aircraft have similar runway length requirements as the B737 for longer sectors (1500mm or more) eg. trans-Tasman. On the other hand, higher circling speeds provide a constraint with respect to obstacles in flight paths in the vicinity of an airport.

It is recommended that development of the short listed alternative airport sites be based on B737 sized aircraft, with planning to allow for the possible future introduction of up to B767 sized aircraft.

4.3 RUNWAY LENGTH REQUIREMENTS

The ICAO Aerodrome Design Manual - Part 1 Runways, classifies all models of the B737 as Code 4C and B767 as Code 4D. The numeric code 4 in these classifications requires a reference field length of 1800 m and over.

Boeing produces manuals for aircraft manufactured by them titled, "Airplane Characteristics for Airport Planning" which provide indicative runway length requirements for take-off and landing under varying altitude and temperature conditions. Table 4.1 provides indicative required take-off runway lengths for B737-300 and B767-300ER aircraft by reference to these manuals for direct services from Queenstown to Auckland (500 nautical miles assumed) and to Brisbane (1500 nautical miles assumed). It is noted that:

- the distance from Queenstown to both Melbourne and Sydney is less than to Brisbane

- wet runway landing distances are generally more critical than take-off distance on shorter sectors, such as Auckland to Queenstown.

In preparing the indicative runway lengths shown as Table 4.1, it is assumed that only passengers and their baggage are carried (ie. no freight), with passenger loads of:

- B737-300 125 passengers @ 100 kg per passenger
- B767-300 ER 240 passengers @ 100 kg per passenger

In practice, aircraft often operate at less than a full passenger load.

Table 4.1: ***Indicative Take-off Runway Length Requirements***

AIRCRAFT	ENGINES ASSUMED	TAKE-OFF RUNWAY LENGTH (m)			
		QUEENSTOWN-AUCKLAND		QUEENSTOWN-BRISBANE	
		STD (1)	STD (1) + 15°C	STD (1)	STD (1) + 15°C
B737-300 (63,050 kg max design taxi weight)	CFM56-3B-2 (22,000 lb SLST)	1,500	1,600	1,900	2,000
B767-300ER (181,900 kg max. design taxi weight)	CF6-80C2 (lb SLST)	1,350	1,450	1,650	1,700

Notes:

1. STD is standard day with 1013 hPa barometric pressure and 15°C ambient temperature.
2. Assumptions in determining indicative take-off runway lengths
   - An airport altitude of 2000 ft (610m). This is above the actual altitude of all sites except Queenstown Hill
   - Zero runway gradient
   - Zero wind
   - Aircraft air conditioning off
   - Allows for standard diversion at destination
   - No en-route head wind
3. Runway lengths are indicative only. Airlines should be consulted for specific operating procedure prior to facility design. (Air New Zealand advised that minimum runway length for B767-300 regular scheduled operations planning purposes is 1800 m, which is based on wet runway landing performance requirements).

Based on the indicative take-off runway length requirements on Table 4.1, the B737-300 operating trans-Tasman services to Brisbane (2000 m) is critical.

Indicative wet runway landing runway length requirements from the Boeing "Airplane Characteristics for Airport Planning" manuals for maximum landing weight with a 30° flap setting are:

- B737-300 1,700 m
- B767-300 1,800 m

Air New Zealand advised that:

- a runway length of 1,800m would be a minimum for planning purposes for B767-300 scheduled operations, based on wet runway landing performance requirements
- a practical minimum runway length for operations by B737-300 aircraft would be 1,530 m

It is recommended that a runway length of 2,000m be adopted in the assessment of the alternative airport sites. A runway of this length would permit unrestricted trans-Tasman operations by the design aircraft.

The extent to which each site can allow the provision of the recommended runway length is as follows:

- Jardines — Can provide 2,000 m runway with adequate space at each end for provision of RESA's, and high intensity approach lights. It is understood that Airways Corporation would most likely install future technology GPS approach aids in the future instead of ILS. Such aids are assumed to be accommodated within the airport area.
- Queenstown Hill — Can provide 2,000 m runway and RESA's. It is assumed that GPS approach aids could be accommodated within the airport area. 420 m long high intensity approach lighting arrays would need to be mounted on a support structure, which could be very substantial. This would form the minimum length high intensity approach lighting system compared with the normal 900 m long array.
- Cromwell Terraces — Can provide 2,000 m runway, RESA's and GPS installation. Lights for a 420 m long high intensity approach lighting array may require mounting on structure.
- Wanaka — Can provide 1,800 m runway and RESA's. Ground rises to the north-west which could prevent accommodation of approach lights. To the south-east, these would need to be mounted on structure. It is assumed that GPS approach aids can be accommodated within the airport area.
- Frankton — Maximum runway length 1801 m plus stopway and starter extension after proposed extensions completed. High intensity approach lights could probably be physically installed at the south-west end of the runway but would cross State Highway 6 and conflict with existing housing. However, as these houses are inside the air noise boundary defined for the airport, they are intended to be subject to acquisition by QAC. The extent of structure required to support these at the north-east runway end, from the floor of the Shotover River Valley, would make this impractical. It is assumed that GPS approach aids can be accommodated within the airport area.

4.4 RUNWAY AND STRIP WIDTH REQUIREMENTS

Runway Width

The Civil Aviation Authority of New Zealand Advisory Circular AC139-06A stipulates the width of runway for aircraft according to their Reference Code number and letter. The required runway width for both B737 aircraft (Code 4C) and B767 aircraft (Code 4D) is 45 m.

It is noted that current B737 operations to Queenstown Airport with a 30 m runway width, are undertaken under a concession to the above requirement.

Strip Width

Corrigendum 2 to AC139-06A notes that: "Operators of domestic aerodromes should be aware that it is highly probable that within a decade the use of GPS will be approved to precision approach category 1 minima. Should you want this capability for your aerodrome, you should plan on achieving those dimensions and slopes specified in Table 4-1 for precision approach runways."

Corrigendum 2 to AC139-06A recommends that the widths of runway strips at international aerodromes for Code Number 4 aircraft should be:

- 300 m for a precision approach runway (this would apply to the sites for Queenstown Airport when GPS is installed)
- 150 m for a non-precision approach runway

The runway strip width for a precision approach runway at a domestic aerodrome required in Corrigendum 2 to AC139-06A is 220m.

It is recommended that a runway strip width of 300 m (ie. 150 m either side of the runway centreline) be provided in the assessment of all airport sites.

All of the sites can accommodate a 300 m wide runway strip.

4.5 APPROACH AND TAKE-OFF SURFACES

Approach surfaces given in Corrigendum 2 to AC139-06A for Code Number 4 aircraft (eg. B737 and B767) operations on international aerodromes precision approach runways are:

- length of inner edge 300 m
- distance from threshold 60 m
- divergence (each side) 1:6.6
- length 15,000 m
- slope 1:50

Take-off surfaces applicable for all categories of runway for Code 4 aircraft are:

• length of inner edge	150 m (180 m for instrument runways of international airports) - NB adopt 180 m for this study.
• distance from runway end	60 m
• divergence (each side)	1:8
• final width	1,200 m (1,800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night)
slope	1:50 (subject to AC139-06A clauses 4.2.9 and 4.2.11). 1:40 for day time only take-off runways used by non turbo-jet aircraft on domestic operations. -NB adopt 1:50 for this study.

The extent to which each of the sites can meet these requirements is discussed in Chapter 6.

5. METEOROLOGICAL CONDITIONS

5. METEOROLOGICAL CONDITIONS

5.1 BACKGROUND

Meteorological conditions which are of prime importance in determining the siting of an airport and which are used in this comparative assessment of the short listed sites are:

- Prevailing wind speed and direction and the ability to orient runway(s) into the prevailing wind
- Incidence or likelihood of turbulence and/or wind shear on approaches and departures
- Incidence of fog and low cloud
- Incidence of snow/ice.

Meteorological conditions for the short listed sites contained in this report are based on the following sources:

- Report by the New Zealand Meteorological Service titled, "The Climatology of Queenstown Airport" dated 1983
- Report by the New Zealand Meteorological Service titled, "Meteorological Conditions at the Proposed Queenstown Airport" (ie. Jardines site) dated 20 May 1988
- Interviews with pilots familiar with the sites
- Advice from the Operations Divisions of Air New Zealand and Mount Cook Airline
- Data obtained from the National Institute of Water and Atmospheric Research Ltd (NIWA) Wellington. This data, which was obtained specifically from this study is attached at Appendix A.

Obstructions to horizontal wind flow produces disturbed air which may be significant to the operation of aircraft. Large mountains such as the Southern Alps produce "large scale" mechanical turbulence. Sometimes, even in moderate winds of 10-15 knots, airflow can be significantly disturbed.

A large obstruction such as a mountain will generally cause wind speeds to increase at the top of the mountain. As the windspeed increases, standing eddies form in both the windward and lee side of the mountain. These are replaced by widespread turbulence on the lee side when the wind becomes strong (20 knots and above). These conditions are illustrated on Figure 5.1. In such conditions, moderate to severe turbulence will be encountered on the lee side of the mountain with the operation of aircraft being potentially dangerous.

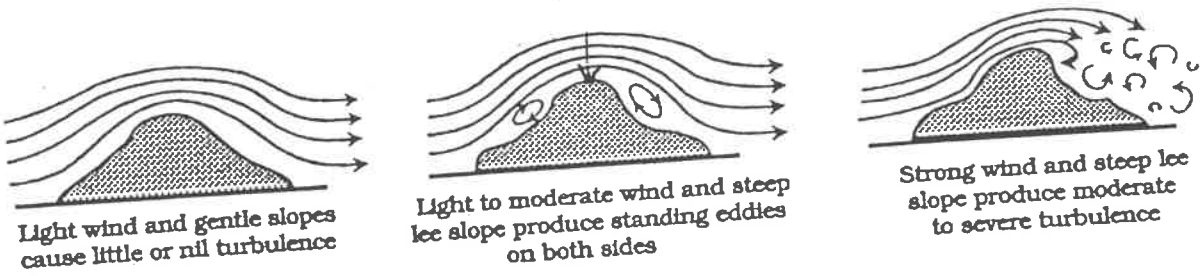


Figure 5.1 ***Formation of Eddies***

When the windward shape of a hill is steep or contains sharp edges (eg. the west face of the Remarkables Range and east face of the Pisa Range), standing eddies or light turbulence is experienced in light/moderate wind conditions but flow separation and considerable turbulence will be experienced in strong winds. These conditions are illustrated on Figure 5.2.

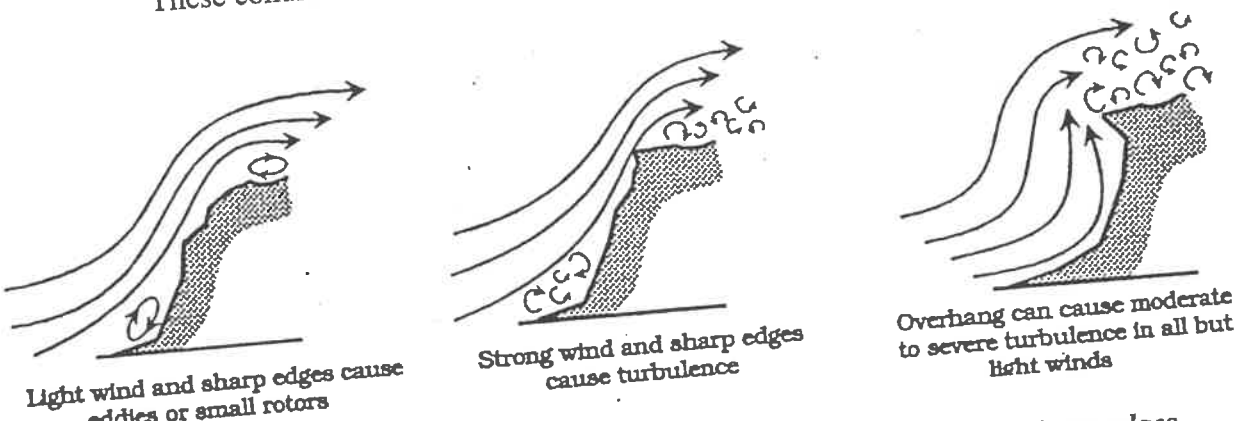


Figure 5.2: ***Turbulence Caused by Steep Mountains with sharp edges***

Although the wind in lower parts of valleys tends to follow valley confines and may be smooth in part, unexpected turbulence can be experienced at valley junctions as well as near saddles and slanting ridges.

5.2 JARDINES SITE

The New Zealand Meteorological Service report "Meteorological Conditions at the Proposed Queenstown Airport" (ie. Jardines Site) dated 20 May 1988, makes the following observations:

- The Queenstown area experiences a high degree of sheltering from the surrounding mountains
- Landforms at the Jardines site are significantly different to Frankton Airport. The gap between Deer Park (Penninsular) Hill and the Remarkables allows airstreams to approach from the north. There is also relatively open exposure of the site to the west and north west.
- North, north-east and south winds are common at the Jardines site (wind roses show that the stronger (higher wind speeds) winds occur from the south)

- Cross winds above 15 knots are rare at the Jardines site, associated with a higher frequency of fresh afternoon and evening wind from the south

  Hence, cross winds at the Frankton Airport due to these southerly winds are more common in the afternoon and evening

- Cross winds from the west and north-west at the Jardines site are most frequent during the afternoon, when the stability of the air is least. Air in this state will overturn more readily giving turbulence and will rise over mountains. Thus, a penetration of the winds to the base of the mountains will lead to pronounced updrafts in the vicinity of the Jardines site and possible turbulence.

- A more serious hazard to aircraft may be the local conditions between Deer Park (Penninsula) Hill and the Remarkables, where intermittent separation of rotors could occur in strong westerlies (westerlies above 21 knots were not observed at the anemometer at the Jardines site during the 6 months study period). Allowing for the expected increase in wind speed with height, the west component of the wind at the level of the top of Deer Park Hill is expected to exceed 20 knots when the wind of the anemometer at the Jardines site exceeds about 10 knots.

  (It is noted that the study team experienced considerable turbulence during trail approaches from both the north and south in the early afternoon on 24 July 1995. At the time, a southerly wind of some 22 knots was advised at Queenstown (Frankton) Airport).

- Frequencies of restricted ceilings (cloud base) and visibilities at the Jardines site are expected to be similar to the Frankton Airport

  The Jardines site is expected to experience an incidence of fogs similar to the built-up part of Queenstown (1.1 days of fog per year) due to fogs drifting in from the north east in the nocturnal winds.

- The Jardines site would be affected by snow and ice at a rate assumed to be similar to the Frankton Airport

5.3 QUEENSTOWN HILL SITE

Although no specific meteorological data is available for the Queenstown Hill site, the following comparisons with the existing Queenstown (Frankton) Airport are based on local advice and observations by the study team:

- Queenstown Hill is enveloped in cloud or has cloud cover for much of the day for 30-40 days per year (see Photo 1, which shows cloud enveloping Queenstown Hill observed by the study team on 26 July 1995).

- The orientation of the runway would be out of the prevailing wind (assuming this to be the same as at Frankton) by some 30°.

- Downdrafts would be experienced on approaches from the east in westerly wind conditions

- Generally, aircraft using an airport on Queenstown Hill would experience more turbulence than Frankton (the study team experienced extreme turbulence during a test flight on 22 March 1995)

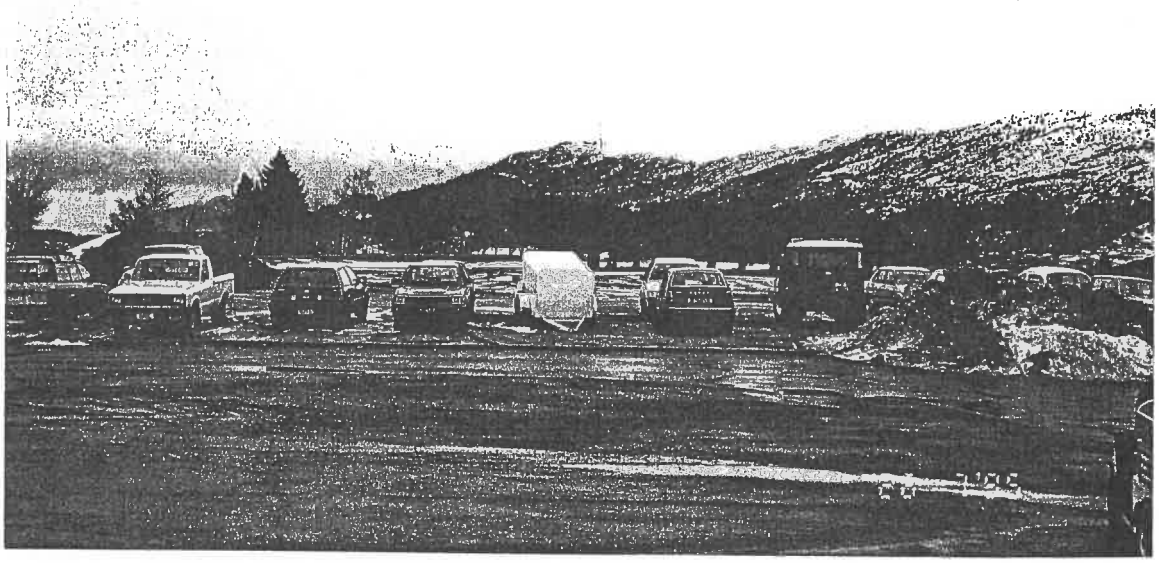


Photo 1: Cloud Enveloping Queenstown Hill viewed from Queenstown (Frankton) Airport Car Park 9.30 am 26-7-1995

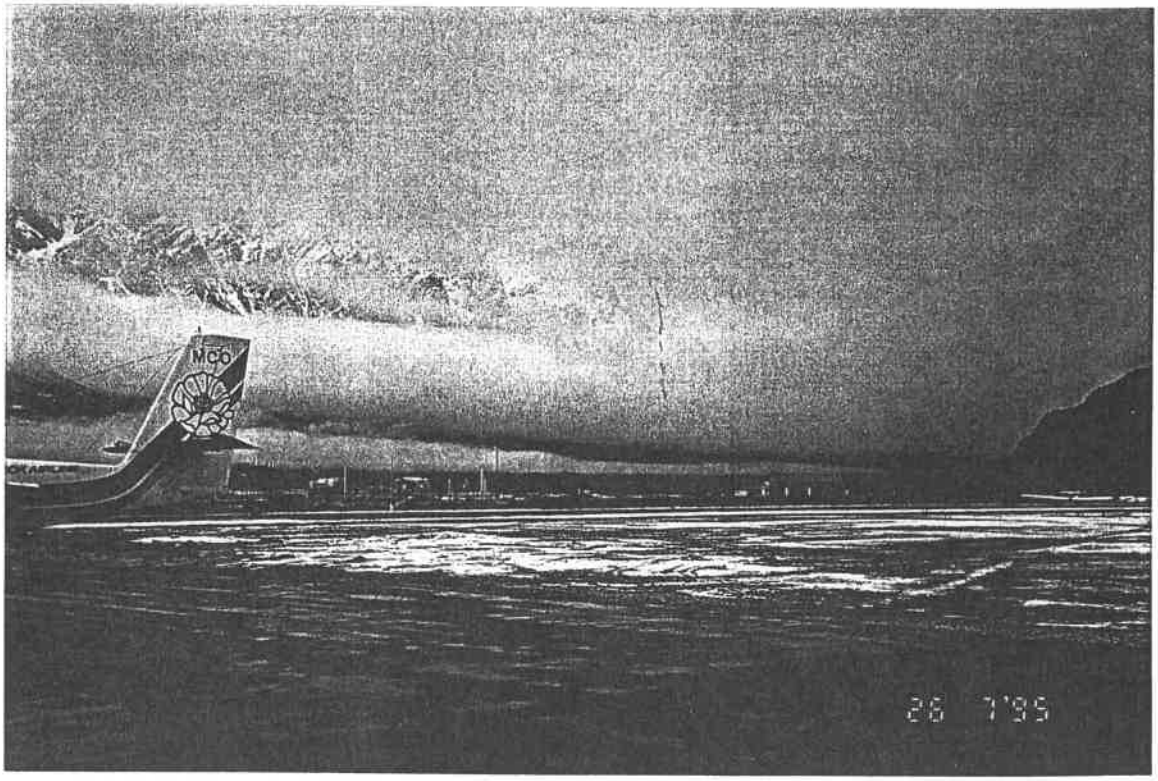


Photo 2: Low Cloud Formation above Queenstown (Frankton) Airport (Looking North-East from Passenger Terminal 9.30 am 26-7-1995

- Snow and ice would be a problem due to the elevation of the site. The top of Queenstown Hill is covered by snow for significant periods during the winter

5.4 CROMWELL TERRACES SITE

Meteorological conditions at the Cromwell Terraces site were derived from advice provided by pilots who are experienced with flying in the area and data observed at weather stations in the area obtained for this study from NIWA (see Appendix A)

- Calm to variable plus light winds (at nearby observation points) occur over 79% of the time
- Strong winds occur 3% of the time, with the most frequent being from the north-east and north
- Winds are most frequent from the south-west (24% of the time), north (9% of the time) and north-east (17% of the time)
- Pilots experienced in flying in the region advised that:
  - Winds in the Clutha Valley are up to 45° off upper winds. Approach to the runway would be to the north when high level westerly winds are experienced (ie. the wind in the valley would be north-west).
  - Severe turbulence is experienced in strong westerly wind conditions due to rotors in the lee of the Pisa Range.
  - Low cloud is a problem in the Clutha Valley. This has become more prevalent since filling of Lake Dunstan.
  - Cromwell experiences a high incidence of fog, with fog occurring on many winter nights. Fog doesn't clear until noon or later
- Fog was recorded at adjacent weather observing stations as occurring on average 23.2 to 30.4 days per annum (The New Zealand "Meteorological Conditions at the Proposed Queenstown Airport" noted the incidence of fogs in valleys in Central Otago with average frequencies of 20-60 days per year).
- The airport site is subject to snow cover. This was evident during the site inspection by the study team on 24 July 1995 (Snow was recorded at adjacent weather observing stations as falling on an average of 3 to 4 days per annum and lying on the ground on average 2 days per annum).

5.5 WANAKA AIRPORT

Meteorological conditions at Wanaka Airport were obtained from data recorded at the automatic weather station located at the airport (provided by NIWA - see Appendix A) as well as advice from local pilots.

- Calm to variable winds occur 10% of the time, with light winds occurring 80% of the time
- Strong winds, most frequently from the north and north-west, occur 1% of the time

- Winds are most frequent from the west (36% of the time), followed by from the south-east (19% of the time) and from the north-west (16% of the time). The runway orientation (east south-east/west north-west) is in accordance with prevailing winds
- No fog data is available at Wanaka Airport but fog occurs at Wanaka township on average 5.5 days per annum. However, advice from a pilot based at Wanaka indicated that fog is often a problem at the airport on 2 to 3 days per week in winter and that although this normally clears by 10:00 to 11:00 am, it can remain all day.
- Snow and ice is less of a problem than at other airport sites (the airport was free of snow when inspected by the study team on 24 July 1995). The only snow data available from NIWA refers to a recording station in Wanaka township, where snow falls on average 3.6 days per annum and lies on the ground on an average of 0.8 days per annum.

5.6 QUEENSTOWN (FRANKTON) AIRPORT

Meteorological data for the existing Queenstown Airport at Frankton is extracted from the 1983 report prepared by the New Zealand Meteorological Service titled "The Climatology of Queenstown Airport" and data provided for this study by NIWA (see Appendix A).

The main points relating to Queenstown Airport meteorological conditions are:

- Prevailing airstream directions at 2100m are from west and north-west over 60% of the time. However, at the Queenstown Airport, these directions occur for less than 20% of the time
- Calm to variable winds occur 7% of the time, light winds (1-10 knots) occur 77% of the time. The high frequency of light winds in all seasons is largely due to sheltering by the surrounding high country
- Strong winds (mean speeds at least 21 knots) occur less than 1% of the time, most frequently from the south
- Winds are most frequent from south to west (54% of the time) and north-east (22% of the time). The alignment of the main runway at approx. north-east/south-west is suitable for the prevailing wind directions
- In strong south to south-west airstreams, frequent turbulence occurs on the approach from the north-east provided the flow is non-laminex
- Downdraughts caused by the presence of Penninsula Hill to the south-southwest, are experienced over the Shotover River and on the climb out from the airport
- Due to the proximity of the steep mountains in nearly all directions, some turbulence is experienced in most gradient flows from the north, through west to the south
- Considerable windshear below 900m - 1200m exists above the airfield level in strong northwest flows

- Since the airport is surrounded by high country, low cloud is infrequent and rarely restricts flying operations. Low cloud does, however, restrict operations on occasions eg. the afternoon Air New Zealand B737 service could not land at Queenstown on 26 July due to low cloud base and light snow falling (see Photo 2).
- Fog (ie. conditions with visibilities below 1000m) occurs on average 3.6 days per annum. Local advice indicates that this normally clears by midday
- Snow falls on average 7.4 days per annum. Snow lying on the ground occurs on average 3.6 days per annum
- The airport was closed on 29 and 30 June 1995 when abnormally heavy snow fell. The runway was cleared of snow by grader and snow was lying on the airfield during the inspection by the study team on 24-26 July 1995. Advice provided to the study team was that the airport is closed to heavy aircraft on average for 2 to 3 days each winter due to snow and ice

5.7 SUMMARY

A summary of meteorological conditions, as they affect operations at the airport sites, is provided on Table 5.1.

From Table 5.1, the respective merits of the short listed sites can be ranked from a meteorological perspective as follows:

1. Wanaka (most preferred)
2. Frankton
3. Cromwell Terraces
4. Jardines
5. Queenstown Hill (least preferred)

The incidence of conditions of low cloud, snow and ice at the Queenstown Hill site, coupled with frequent severe turbulence, would make this site unsuitable for an airport.

Jardines is undesirable due to the frequent severe turbulence that would be experienced by aircraft using an airport at this location.

The Cromwell Terraces site is expected to be affected by fog during winter months and turbulence on approaches due to wind patterns associated with the Pisa Range Wanaka and Frankton, which both have existing airports, experience the most favourable meteorological conditions for the siting of an airport.

Table 5.1: ***Meteorological Conditions at Airport Sites***

METEOROLOGICAL CONDITIONS	AIRPORT SITE				
	JARDINES	QUEENSTOWN HILL	CROMWELL TERRACES	WANAKA	FRANKTON
1. Prevailing wind direction	N, NE & S	S to W, N & NE [1]	SW, N & NE N E & N	W, SE & NW	S to W, NE
2. Direction of strongest winds	S [1]	S [1]		N & NW	S (1% of time)
3. Orientation of main runway	N/S	NNE/SSW [1]	NNE/SSW	ESE/WNW	NE/SW
4. Incidence of turbulence	Frequent Severe	Frequent Severe	Frequent[1]	?	Frequent in S to S-W airstream
5. Incidence of wind shear	?	Frequent	Considerable[1]	?	Considerable in strong N-W airstream
6. Incidence of low cloud	Infrequent [1]	30-40 days/annum	Frequent[1]	?	Infrequent
7. Incidence of fog (days/annum)	3.6 [1]	-	30.4[2]	5.5[2] [3]	3.6
8. Incidence of snow falling (days/annum)	7.4 [1]	Frequent	4[2]	3.6[2]	7.4
9. Incidence of snow lying on ground (days/annum)	3.6 [1]	Continuous during winter	2[2]	0.8[2]	3.6

Notes: 1. Assumed

2. Based on observations at nearby meteorological observing stations

3. Local advice indicated that fog more of a problem at the airport than at Wanaka town (where the meteorological observing station is located).

4. ? indicates that no specific data is available.

6. AIRSPACE CONSIDERATIONS

6. AIRSPACE CONSIDERATIONS

6.1 OPERATIONAL ISSUES

Operational issues were identified in a preliminary report of possible alternative sites in the Queenstown area prepared by Air New Zealand in April 1988. Airport sites reviewed by Air New Zealand that are also included in this study are Jardines, Cromwell Terraces and the existing Queenstown (Frankton) Airport. Sections from the Air New Zealand report concerning operational issues are reproduced below.

Operational Considerations

These are many and varied including weather related factors, surrounding terrain, approach aids, ATC etc.

The items to be considered can be broadly broken down into day and night operations.

Day Operations

- **Approach and Landing**

For operation of jet aircraft up to 767 size, it is very important to have a stabilised approach from 1000 ft to touchdown. For this reason sites which do not allow a clear 3-4 nm final approach to the runway (with perhaps a slight offset acceptable) are rejected.

The approach path should also be clear to allow a 3° approach path nominal (up to 4° may be acceptable depending on glideslope guidance available). To provide terrain clearance, a 3° approach path needs a physical slope clear of terrain of about 1.6° or 2.8%. This is covered by the CAD requirement of a 2% clear path to 18 km (10mm). (Current requirement in the Civil Aviation Authority of New Zealand Advisory Circular AC139-06A is 1:50 slope to 15 km).

Airfields which require a visual circling approach because clearance out to 18 km are not available are not desirable even with a clear 3-4 nm final, particularly if high terrain exists in the circling area as high minima are usually required.

- **Take-off all Engines**

This is not usually critical. Track guidance is required to permit departure in IFR conditions.

- **Take-off Engine Imperative**

This is frequently the most limiting factor on an airfield. The climb capability of twin engine aircraft subsequent to an engine failure may be as low as 100 ft/mile for F27 and 748, rising to 300 ft/mile for 767 and 737-300/500 depending on take-off weight. To clear surrounding mountains 4000 ft above the airfield obviously requires a lot of distance to achieve the height.

Visual circling also requires high take-off minima.

Additional engine ratings (thrust bumps, 10 min take-off thrust) help this situation considerably. Operational procedures can also be used such as circling visually following an engine failure and relanding. Visual circling is a common procedure for 737 and F27 but is not currently used for the 767. Larger aircraft require significantly larger circling areas and may be more difficult to position accurately by visual reference in a high angle-of-attack altitude.

Night Operations

Circling approaches and departures are severely restricted for night operations, especially in mountainous terrain. Visual obstacle clearance cannot be assured at night and to illuminate all obstructions is usually impractical. Depending on the terrain in the circling area, circling guidance lights may be practical to assist positioning, but this is again considered undesirable. (ie. the requirement to circle).

The take-off engine failure case is restricted at night, if circling is not available, to a direct IFR climbout over terrain.

The position taken in this study is that visual circling at night is not acceptable. This means that night operations would be precluded for aircraft which cannot make direct climbouts. This would include F27, 748 and probably 737-200 aircraft. 767-200/300 and 737-300/500 would be able to operate at night at some sites depending on terrain and take-off weight required.

Besides runway lighting, night ops would also require approach lighting (type not specified at this stage).

Instrument Approaches

For day or night operations, some form of instrument approach is required. Regional aircraft types (eg F27, HS748) frequently make approaches to airfields using only NDB's. For 737 and 767 operations, better aids are required, the minimum being VOR/DME with straight approaches (ie. no circling) from both directions. If high side slopes or more accurate tracking is required due to terrain, ILS will be necessary (or possibly just LLZ).

Minima possible depend on the type of aid and (more usually) the type of approach and the missed approach flight path. A minimum cloud base of 1000 ft is considered desirable, but terrain in missed approach area may result in minima up to 3000 ft AGL.

6.2 NAVIGATIONAL/LANDING AIDS REQUIRED

In order to allow reliable operations by jet aircraft, a range of navigational and landing aids will need to be installed at each of the airport sites. Many of the required aids are already provided at the current Frankton (Queenstown) Airport. The cost of providing the required aids is allowed for in the budget cost estimates.

Navigational and landing aids required at each of the airport sites are:

- Precision approach path indicator (PAPI) - already installed at Frankton
- Non directional beacon (NDB) - already installed at Frankton
- Distance measuring equipment (DME) - already installed at Frankton
- Doppler very high frequency omni range (DVOR) - already installed at Frankton
- Instrument landing system (ILS) - Airways Corporation is unlikely to install new ILS systems as these will be superseded by future GPS technology
- Global positioning system (GPS) - future technology
- Operational area lights
- High intensity approach lights (HIAL)
- Winds socks (illuminated for night operations)
- VHF radio - already installed at Frankton
- Control tower - already installed at Frankton.

6.3 OBSTACLES AT AIRPORT SITES

Obstacle Limitation Surface (OLS) drawings were prepared for airports with a runway suitable for Code 4D (eg. B767) aircraft with a Category 1 Instrument Landing System (ILS) approach located at both runway ends at each of the alternative airport sites. A 2000 ft long runway was assumed at all sites except the existing Queenstown Airport, where an 1800 m long takeoff runway was assumed. The straight-in approach surfaces extend at 2% slope for a distance of 15 km from the end of the runway strip (60m from the runway threshold).

The OLS drawings indicate the obstructions that penetrate both the approach splays and the conical and inner horizontal surfaces associated with each runway.

Obstructions penetrating the OLS surfaces are outlined for each airport site as follows.

Jardines Site

The OLS drawing for the Jardines site is shown on Figure 6.1.

The Remarkables Range penetrates virtually the whole of the inner horizontal and conical surfaces to the east of this airport site. Other significant obstructions in the inner horizontal and conical surfaces are Penninsula Hill to the north-west, a knoll 2 km west of the runway, Flagstaff to the west of the airport (on the west side of Lake Wakatipu) and Bayonet Peaks to the south-west of the airport.

Coronet Peak, Ferry Hill and Slope Hill, and the Remarkables Range penetrate the approach surface to the north of the airport. The distance between the Remarkables Range and Penninsula Hill provides a constraint for aircraft approaching and departing the airport which would not be desirable for ILS operations.

Ranges on either side of Lake Wakatipu encroach into the approach surface to the south of the airport.

Air New Zealand has previously investigated the feasibility of instrument approaches and departures at the Jardines sites. The main conclusions reached in their study were:

- approach and climbout paths are difficult in both directions and a "non-instrument" category only appears possible.
- complex approach and departure aids are required including ILS, VOR, 2 x LLZ and NDB (there is no assurance that these aids will work satisfactorily in the mountainous terrain).
- night operations are considered impractical for all aircraft

Queenstown Hill Site

The OLS drawing for the Queenstown Hill site is shown on Figure 6.2.

The inner horizontal surface and conical surface is penetrated by Bowen Peak and Ben Lomond to the west of this site and Mount Dewar to the north.

The approach surface from the north is penetrated by Coronet Peak and the approach surface from the south by Walter Peak and the foothills of Cecil Peak.

Cromwell Terraces

The OLS drawing for the Cromwell Terraces site is shown on Figure 6.3. The proposed runway is located on the existing strip which is at the western side of the terrace.

The inner horizontal and conical surfaces are significantly penetrated by the Piza Range to the west and the foothills of Dunstan Mountains to the west.

The approach surface from the north is penetrated by foothills of the Pisa Range. A small zone at the south end of the southern approach surface is penetrated by the Corrick Range.

Air New Zealand investigated this site in April 1988. They concluded that an 1800 m long runway could be located at the eastern side of the terrace on which the existing runway strip is situated (ie. that assumed in this study) with a 15° dog leg in the northern approach/departure tracks to provide obstacle free approach and departure tracks. Preliminary internal discussions with the Air New Zealand B767 Fleet Group indicated acceptability of this runway location.

The preliminary Air New Zealand report noted that "a VOR approach intercepting final at 3 nm would result in minima of about 1200 ft AGL. ILS would not be necessary. Several NDB's may be necessary also.

Distant terrain would have to be cleared engine-out for night or day IFR operations. The 767-200/300 appear capable of this (to be confirmed) but the B737-200 does not (737-300/500 should be OK). Accordingly B737-200 ops would be restricted to daylight with sufficient minima for circling. For F27/748 aircraft night landings would be possible (not available at ZQN) but night takeoffs would not be possible without visual circling."

The Air New Zealand study concluded (in part) that "F27, 748 and B737-200 night takeoffs would be very difficult to achieve but 767 and 737-300/500 should be acceptable."

Wanaka

The OLS drawing for Wanaka is shown on Figure 6.4.

The northern ends of the Criffel and Pisa Ranges penetrate the inner horizontal and conical surfaces to the south of the airport. The conical surface is also penetrated by Mount Iron to the north-east of the airport and an escarpment on the ranges at the east side of the Clutha River Valley.

The approach surface from the north-east is penetrated by high ground on The Peninsula. The approach surface from the south-west is penetrated by some high points on the slopes of the Pisa Range.

Frankton

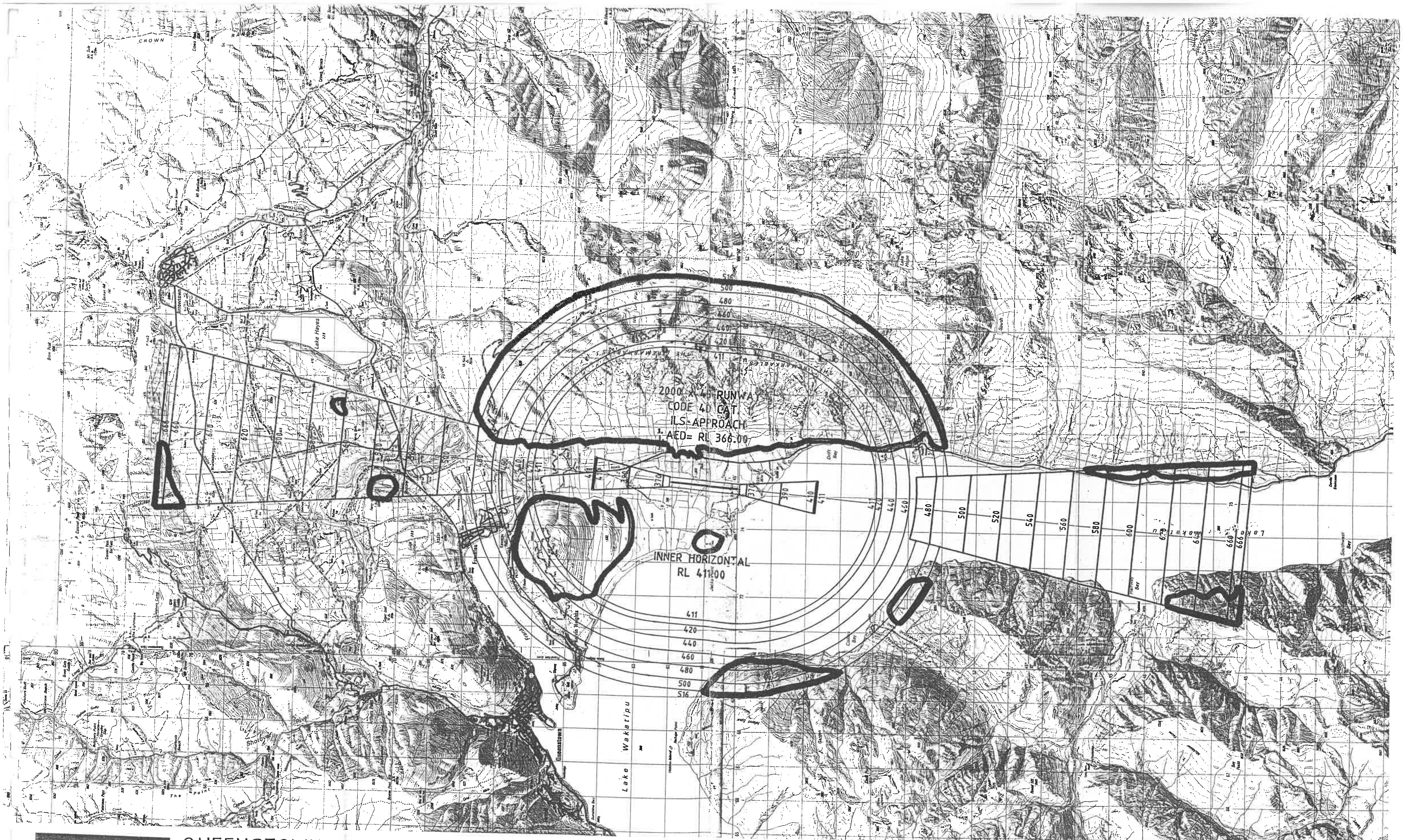
The OLS drawing for the existing Queenstown Airport at Frankton (based on an 1800 m long runway) is shown on Figure 6.5.

Surfaces associated with Frankton are penetrated by surrounding mountains to within close proximity to the airport. The main penetrations of the OLS surfaces are outlined below.

The inner horizontal and conical surfaces are penetrated by:

- Ferry Hill and other high ground to the north
- Slope Hill and other high ground adjacent to Mooney's Swamp to the north - east
- Morven Hill and the Remarkables Range to the east
- The Remarkables Range to the south-east and south
- Penninsula Hill to the south-west
- Queenstown Hill to the west
- Sugar Loaf to the north-west

The approach surface from the north-east is penetrated by Mount Scott, Crown Terraces, Morven Hill and the Remarkables Range. The approach surface from the south-west is penetrated by peaks along the northern shore of Lake Wakatipu (Wedge Peak, Home Hill, Bobs Peak, foothills of Ben Lomond and Bowen Park) and Queenstown Hill.



QUEENSTOWN AIRPORT - NEW ZEALAND
DETERMINATION OF PREFERRED AIRPORT SITE

AIRPLAN

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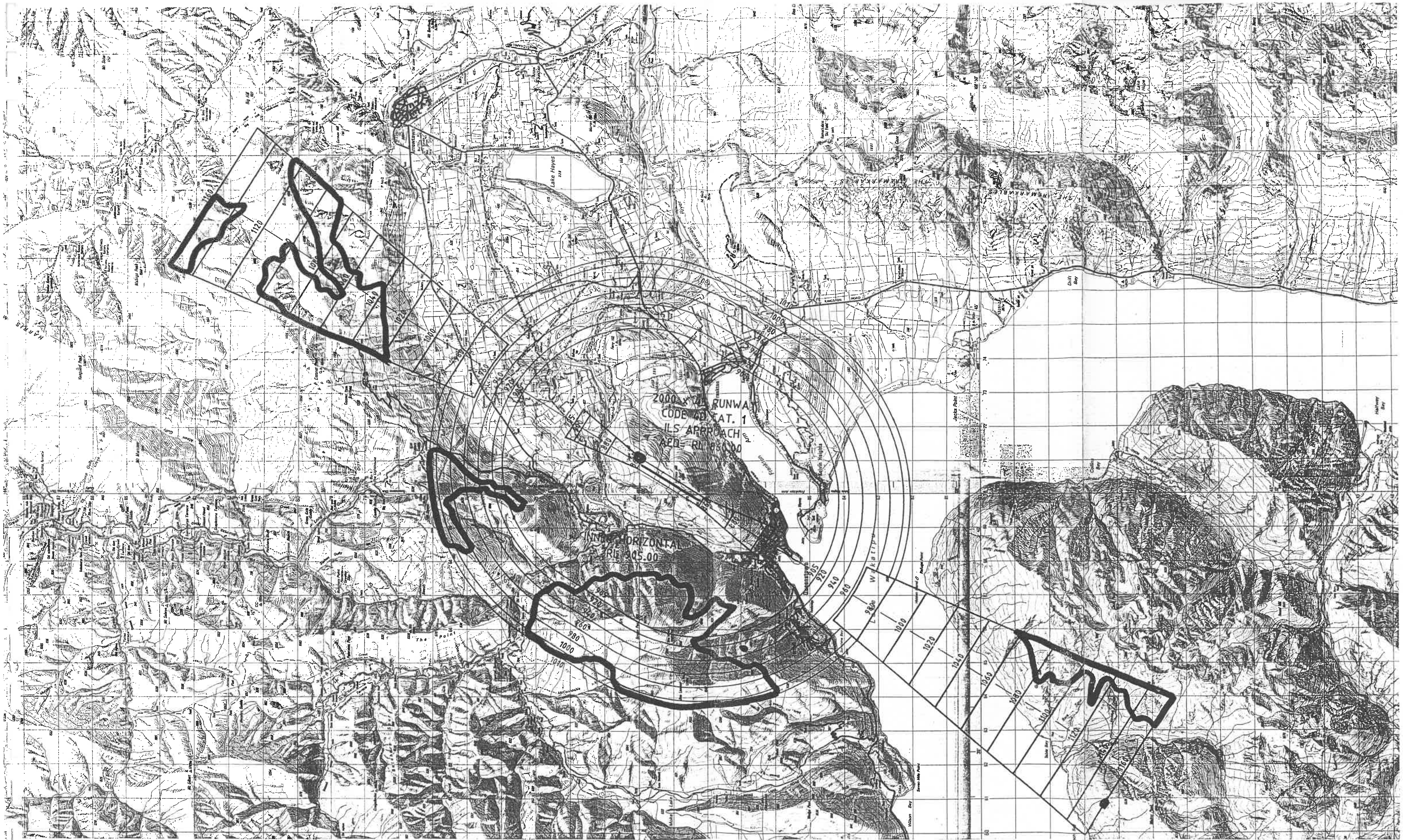
1000 0 1000 2000 3000 4000
SCALE IN METRES 1:100,000 @ A3

N

Figure 6.1
OBSTACLE LIMITATION SURFACES
JARDINES



QUEENSTOWN AIRPORT - NEW ZEALAND
DETERMINATION OF PREFERRED AIRPORT SITE

AIRPLAN

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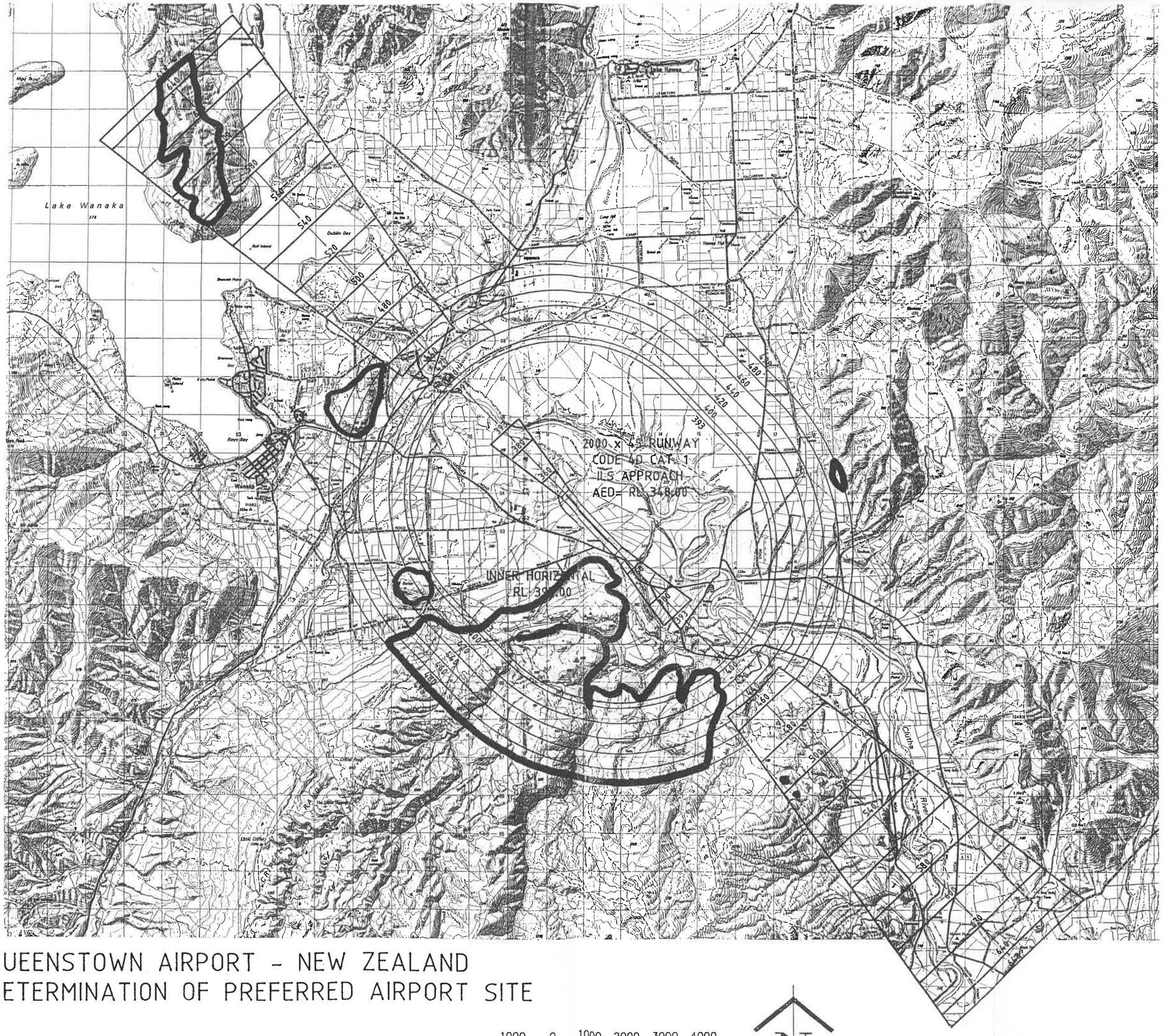
Figure 6.2
OBSTACLE LIMITATION SURFACES
QUEENSTOWN HILL



QUEENSTOWN AIRPORT - NEW ZEALAND
DETERMINATION OF PREFERRED AIRPORT SITE

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SCALE IN METRES 1:100,000 @ A3

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Figure 6.4
OBSTACLE LIMITATION SURFACES
WANAKA

AIRPLAN

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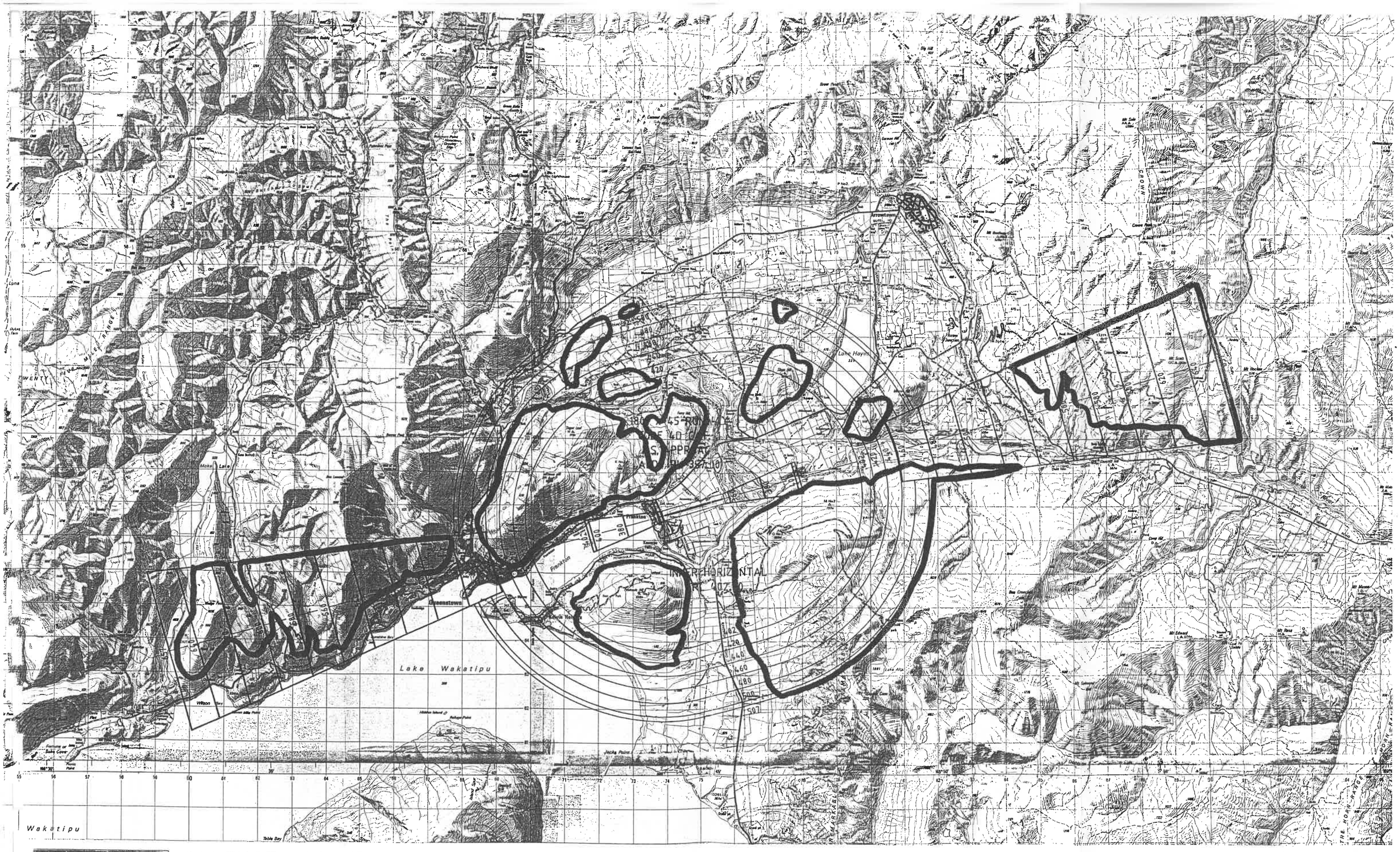

AIRPLAN

QUEENSTOWN AIRPORT - NEW ZEALAND
DETERMINATION OF PREFERRED AIRPORT SITE

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SCALE IN METRES 1:100,000 @ A3

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Figure 6.5
OBSTACLE LIMITATION SURFACES
FRANKTON

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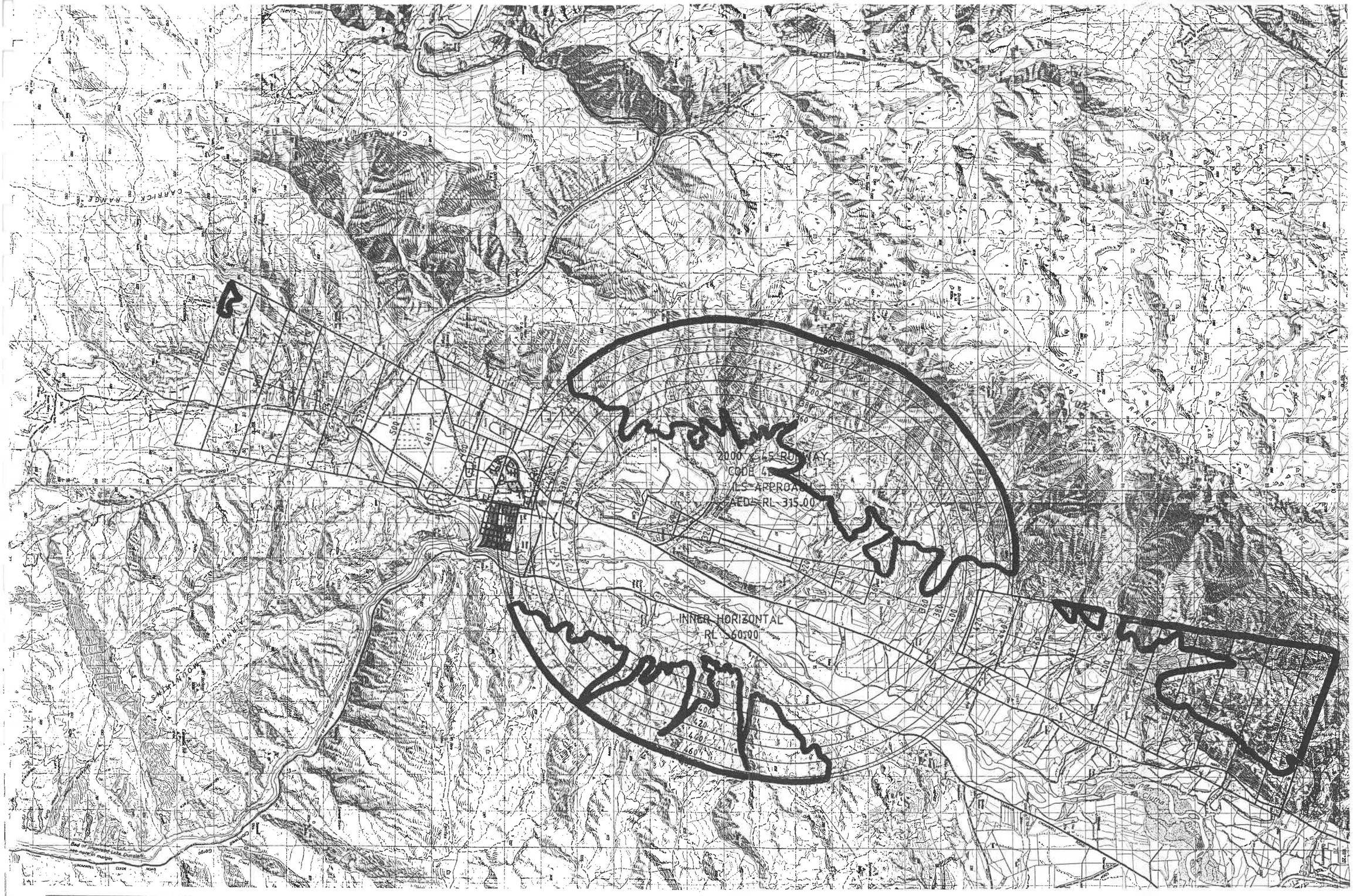

QUEENSTOWN AIRPORT - NEW ZEALAND
DETERMINATION OF PREFERRED AIRPORT SITE

AIRPLAN

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1000 0 1000 2000 3000 4000
SCALE IN METRES 1:100,000 @ A3

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Figure 6.3
OBSTACLE LIMITATION SURFACES
CROMWELL

The Air New Zealand study of airport sites in the Queenstown area in April 1988 noted that "the (existing Frankton) runway has no instrument approach procedure, all approaches being made visually which occasionally necessitates low level flight through the Karawau Gorge following a let down at Alexandra.

Mount Cook achieves an acceptable regularity of service due to their experience in the area and the ability of the 748 to operate VFR in this manner due to its slow speed and manoeuvrability.

Considerable investigation has been conducted over the years by ANZ Flight Ops to determine if 737 operations could be conducted in this way with acceptable safety. The conclusion was that very high clear weather minima would have to be set for the 737. Alternatively, slightly lower minima may be possible with a "cloudbreak" procedure based on the local radio station transmitter."

Since that report was prepared, DVOR/DME equipment has been installed on Slope Hill and daylight jet operations are provided with B737-200 aircraft (Air New Zealand) and BAe 146 - 200/300 aircraft (Ansett New Zealand). However, these operations are not possible when the cloud base is low.

With respect to instrument approaches and departures, the Air New Zealand April 1988 report notes that "the existing runway alignment will not allow straight in approaches from either direction with conventional glideslope angles (up to 4°). This restriction is a function of aircraft performance and applies irrespective of NAVAIDS used.

Similarly, straight ahead departures are not possible following engine failure as it is not possible to climb over surrounding terrain.

The 737 could make visual circling approaches (after a cloudbreak procedure) and visual circling to reland following engine failure (day only), however, operation of the 767 in this manner is not likely to be acceptable to Flt Ops."

Air New Zealand concluded that, "for purely domestic 737 operations, some development of the existing airfield plus an instrument approach (cloudbreak) procedure would give a reasonable day light operation, although weather minima would still be high (NB. these operations have now been implemented).

767 operations would not be practical or night 737's due to circling requirements.

Full IFR/night ops from the existing airfield are possible with sophisticated ground equipment and aircraft capable of steep approach/climbout gradients (DHC 7 or BAe 146). Such aircraft cannot operate trans-Tasman."

6.4 SUMMARY

Based on analysis of the obstacle limitation surfaces conditions and ability to provide straight-in approach and departure tracks for each of the airport sites, the more distant sites (Wanaka and Cromwell) offer advantages over the sites close to Queenstown (Frankton, Jardines and Queenstown Hill). As noted in the April 1988 Air New Zealand study, an alternative runway alignment of the Cromwell Terraces site to the alignment of the existing strip as assumed in this assessment would produce approach/departure tracks with reduced obstructions.

Based on the assessment of OLS surfaces in this study and taking account of the Air New Zealand April 1988 report, ranking of the short listed sites based on infringement of the OLS surfaces by natural features is as follows:

1. Cromwell Terraces -revised runway alignment (most preferred)
2. Wanaka
3. Queenstown Hill
4. Jardines
5. Frankton (least preferred)

Daytime operations by up to B737 size aircraft could be accommodated at all of the airport sites.

It is unlikely that instrument approach or night operations could be implemented at Jardines or Frankton airports due to the surrounding terrain. Circling requirements for larger aircraft types eg. B767, and engine out climb characteristics would preclude such aircraft from operating at these airports.

Cromwell Terraces provides the most suitable site for 24 hour operations by the design aircraft.

7. SURFACE ACCESS TO QUEENSTOWN

7. SURFACE ACCESS TO QUEENSTOWN

7.1 GENERAL

Existing tourist and visitor traffic makes extensive use of coach and shuttle van vehicles to provide transport for passengers to and from the airport. Local residential traffic generally favours private cars. In assessing the requirements for future access to any of the airport sites we have assumed that these patterns of use will continue and that new access roads must be suitable for both bus and shuttle type vehicles.

This will generally require a two lane sealed access road with sealed shoulders sufficient for a large vehicle to park to one side clear of the traffic lanes. A formation width of 15.0m, consisting of two 3.5m wide traffic lanes, two 2.5m wide sealed shoulders and a 1.5m wide pavement edge taper each side would be suitable for access. Ideally, the road alignment and road reserve should be sufficiently generous to allow future upgrading to provide increased traffic capacity when required.

The road distance from Queenstown to three of the sites was measured during the field reconnaissance while the distance to the Queenstown Hill site has been estimated from inspection of the appropriate topographic plans. These distances and approximate travelling times are provided on Table 7.1:

Table 7.1: ***Road Distances from Queenstown to Airport Sites***

SITE	DISTANCE (KM)	TRAVELLING TIME (MINUTES)
Jardines	17	20
Queenstown Hill	20	20
Cromwell Terraces	67	60
Wanaka	104	95
Frankton	7	10

The individual sites (apart from Frankton) require some upgrading of existing or construction of new access facilities. These requirements are discussed individually in the following sections.

7.2 JARDINES

The Jardines site is located in a valley to the west of the Kingston Road (State Highway 6). A new road approximately 750 metres long would be required to provide access and the highway intersection would need to provide dedicated turn bays for traffic entering and exiting the airport.

The existing highway crosses the Kawarau river south of Frankton via a single lane bridge. The Kelvin Heights residential traffic also uses this bridge. The combination of additional airport traffic and the single direction traffic flow is expected to cause considerable delays. A new single lane bridge would solve the capacity problem but may cause traffic confusion with each bridge operating as a single direction flow structure. The best solution is therefore to allow for the construction of a new downstream two lane road crossing which would allow the existing bridge to be used as a control gate structure only. The existing crossing is set in a cutting on the north side and a new route to the crossing point would therefore be required to avoid this.

There are two corners on the highway south of the river which should be eased to improve safety in view of the increased traffic associated with the airport.

This route would be affected by ice and snow to a similar degree to the Frankton site.

7.3 QUEENSTOWN HILL

The access road route to the top of Queenstown Hill has been assessed by inspection of the topographic plans and assuming that the average grade can not exceed eight percent. The difference in height between the assumed runway level of RL 850m and the nearest road at about RL 360 is some 490m so any access road would be a minimum of 6.2 km long from the road. A sustained grade of eight percent for such a distance requires a design speed of around 60 to 80 kph and would result in speed reductions to about 40 to 50kph for trucks and buses.

There is an existing track to the summit of the hill from Tucker Beach Road. The distance to the CBD from the airport via this route is some 19.5 km and we have assumed that access would be provided by this alignment. We have assumed that the access road up the hill will be 7km long, that some 4km of Tuckers Beach Road would require widening and minor realignment and that the balance of the State Highway will not require any additional work.

The winter conditions at Queenstown are likely to limit the use of the steep final portions of this route. The steep sustained grade may require the use of chains for all vehicles and constant snow and ice clearing to keep access open. It is likely that despite intensive maintenance efforts the road may be closed several times a year due to ice and snow.

7.4 CROMWELL TERRACES

This site is located about 1km to the west of State Highway 6 on an elevated terrace some 180m above the adjacent valley floor. Exiting access from the highway is via Lowburn Valley Road and then via an unsealed track about 2km long through Chinaman Gully.

Access upgrading for this site would include construction of a new road along Chinaman Gully, reconfiguration of the intersection with Lowburn Valley Road to give priority to turning movements in to the airport and the formation of new intersection with the state highway providing full shielding for all right turn movements. A new crossing of the Lowburn Valley creek should also be provided.

The state highway through the Kawarau Gorge is the main access section which is vulnerable to winter conditions. The sections west of Cromwell are often closed two or three times each winter and there is no other dependable route to Queenstown. The narrow formation width of several route sections is likely to be a physical constraint on the road capacity at these points.

7.5 WANAKA

This site is the most remote from Queenstown and is reached via State Highway 6. The only upgrading required is to improve the existing entrance road and to construct a fully shielded intersection with the highway.

The route to Wanaka from Queenstown least susceptible to weather conditions is via State Highway 6. An alternate route is to use Highway 89 over the Crown Range but this is much more vulnerable to closure due to weather. For State Highway 6, similar comments to those for Cromwell apply.

7.6 FRANKTON SITE

The existing access to the Frankton site is adequate and no additional work is required on any public road. The existing link road to the terminal is shared by a number of users but has sufficient space to allow future upgrading if required.

The State Highway 6A which serves Frankton has occasional ice and snow problems in winter but is seldom closed as a result.

7.7 SUMMARY

In terms of considerations of practical surface access requirements, the sites are ranked in the following order:

1. Frankton (most preferred)
2. Jardines
3. Cromwell Terraces
4. Wanaka
5. Queenstown Hill (least preferred)

8. AVAILABILITY OF UTILITY SERVICES

8. AVAILABILITY OF UTILITY SERVICES

The main utility requirements for an airport are power, water, telecommunications and waste water treatment. We have assumed that natural gas supply is not required and that each airport will have standby generators to provide power for essential services and lighting in the event of a supply failure.

Apart from Wanaka and Frankton, the alternate sites generally require new service connections for the main utilities. Wanaka will probably require an upgrade of existing utility capacity apart from water. Frankton requires no additional work. Details of the new utility services for the other three sites are provided on Table 8.1.

Table 8.1: New Utility Services Required at Airport Sites

AIRPORT SITE	UTILITY	COMMENTS
Jardines	Power	Build new 1km supply line from the existing lines at the highway. These may need to be increased in capacity
	Water	Lay a new supply from Frankton (8km length) together with booster pumps and site reticulation and reservoir
	Drainage	Discharge to existing drainage systems
	Sewage Disposal	Provide a package plant for treatment and discharge to a disposal field
	Telecommunications	Take from the existing supply along SH6
Queenstown Hill	Power	Require a new (5km) transmission line and transformer from the existing supply along SH6.
	Water	New transmission main (6 to 7km) from town supply, plus booster pump and main storage tank
	Drainage	Drainage lines to existing streams will be required. Pretreatment of apron discharge may be required
	Sewage Disposal	New collector reticulation will be required. Treatment either with a package treatment plant on site or piped to the existing treatment plant.
	Telecommunications	Extend the existing supply along SH6 via a new 6km long line
Cromwell Terraces	Power	New 3km spur line through Chinaman Gully from SH6 is required
	Water	New supply from Cromwell via a 7km transmission line, new site reticulation and reservoir
	Drainage	Discharge to existing watercourses at each end of the site
	Sewage Disposal	Provide a package treatment plant and disposal field on site
	Telecommunications	Take from the existing supply along SH6
Wanaka	Power	Power exists to present airport. Upgrade of supply required
	Water	New borehole
	Drainage	Elevated site allows good outfall. Pretreatment possibly required
	Sewage Disposal	Centralised package sewage treatment system required with disposal field on site
	Telecommunications	Exists at present airport. Upgrade required.
Frankton	Power	Currently available at present terminal location
	Water	Currently available at present terminal location
	Drainage	Currently available at present terminal location
	Sewage Disposal	Currently available at present terminal location
	Telecommunications	Currently available at present terminal location

9. ASSESSMENT OF ENVIRONMENTAL EFFECTS

9. ASSESSMENT OF ENVIRONMENTAL EFFECTS

9.1 OVERVIEW

On a visual inspection of the shortlisted sites it was ascertained what issues required investigation and what the potential environmental impact of airport development at each site would be. These issues became the criteria for assessment set out as follows:

Criteria for Assessment

In assessing the environmental effects of alternative airport sites, the following matters have been used as the criteria for assessment:

(i) Specific environmental considerations

- Visual impact and landscape
- Land use patterns
- Potential loss of agricultural land
- Need for acquisition of housing
- Noise
- Safety
- Ecological concerns
- Archaeological, cultural, historic
- Traffic
- Hazardous goods
- Natural hazards

(i) Statutory considerations under Sections 5, 6 and 7 of the RMA

(ii) Regional and District Plan provisions

The sites can be ranked in order of the magnitude of environmental effects.

Queenstown Hill

(Significant adverse environmental effects)

It was immediately apparent that an airport development on the top of Queenstown Hill would be environmentally degrading, particularly in terms of its adverse road impact, visual effects, degree of construction works involved for airport development and roading.

Jardines

(Moderate adverse effects)

The Jardines sites had few long term environmental effects, however the short term effects were significant. There would be some visual effects from construction due to the undulating characteristics of the land and a change to the existing landscape and visual qualities of the area, a loss of agricultural land and the long term need for substantial road works and a new bridge at Kawarau Falls to facilitate development of the airport. Noise effects would be confined to existing neighbours and noise effects on any new settlement near the lake edge or elsewhere in the valley. Acquisition of two and possibly three properties would be likely.

Wanaka

(Low-moderate adverse effects)

Wanaka is an existing airport. The main environmental impact was considered to be noise effects for the township of Luggate, some further loss of farmland and the need for acquisition of a house. The transportation route via Kawarau Gorge was identified as a significant disadvantage.

Cromwell Terraces

(Low adverse effects)

Development of the Cromwell terraces site appeared unfavourable in terms of visual impact when viewed from the Kawarau Gorge. However, an aerial assessment indicated that buildings and site works would be unlikely to be seen from farmland or Cromwell. This site is already developed as an airstrip and the main impact would be in terms of increased traffic generation along the Kawarau Gorge and its unsuitability for use by large volumes of airport traffic (principally coaches). Some concern was held over safety margins in relation to the sharp drop off at each end of the strip.

Frankton

(Low-moderate adverse effects)

The existing Frankton site is disadvantaged by the proximity of residential development which is affected by noise from airport operations. These two factors continue to be the only environmental effects identified for the existing site, given that the fertile agricultural soils are already lost to production and rehabilitation would be unlikely given Council's planning objectives for the area as enunciated in the Frankton development strategy. Land acquisition has already mitigated against some noise effects and further measures have been proposed via Plan Change 96 and the Eastern Runway Extension resource consent application, and the proposed district plan which incorporates air noise boundaries.

Airport development for each site could be achieved by:

(i) Resource Consent

(ii) Land use controls, i.e. zoning

(iii) Designation

These options are identified but no preference given. All new development requires airspace controls via designation or height restrictions. Use of airspace has been evaluated in terms of environmental considerations, principally noise and visual impact. Air emissions are not considered likely to be significant.

Table 9.1 indicates the likely applications required for resource consent if that were the procedure used.

Table 9.1: Consents Required

LAND USE CONSENT	CONSENTS REQUIRED				
	Jardines	**Queenstown Hill**	**Cromwell**	**Wanaka**	**Frankton**
Non-complying activity	✓	✓	✓	Designated Aerodrome	Designated Aerodrome
Subdivision Consent	✓	✓	✓	✓	-
Air discharge consent		✓	*	-	-
Water discharge consent	✓	✓	✓	✓	-
Building consent	✓	✓	✓	✓	✓

Key: ✓ indicates consent is likely

* indicates a consent is possibly required

\- indicates consent is not required

It is noted that Frankton and Wanaka have permitted activity status for the current airport development. Approval is required for further extensions at Frankton or Wanaka, whereas all of the other sites would need approvals of a more significant scale with consequent uncertainties.

9.2 QUEENSTOWN HILL

9.2.1 Description Of Environment

Queenstown Hill forms a backdrop to the township of Queenstown and rises immediately to the north of Queenstown Bay to a maximum height of about 907m. It is an ice sculptured hill (glacial formation), a huge roche moutonnee with sheer sides to the west and a wide undulating summit. In the north and north-east it adjoins three other ice sculptured hills; Sugar Loaf (911m) and K N°2 (781m) which is separated by Lake Johnson from Ferry Hill (694m). The airport site comprises about 90ha of the summits of both Queenstown Hill and Sugar Loaf, and has a mean altitude of about 860m. This site has pine trees on its southern slopes while on other sides there is little vegetation. To the north Ferry Hill falls down to the Shotover River. To the west it falls steeply away to "The Gorge" while to the south and east it slopes more gently to the Queenstown township and Frankton Arm of Lake Wakatipu. The site and its location are shown in photographs labelled 1 and 2.

The hill slopes comprise Carrick Hill soils and Dunstan steepland soils (not high class).[1] The site is snow covered for extended periods for at least three months of the year. There is no existing available vehicular access to the site.

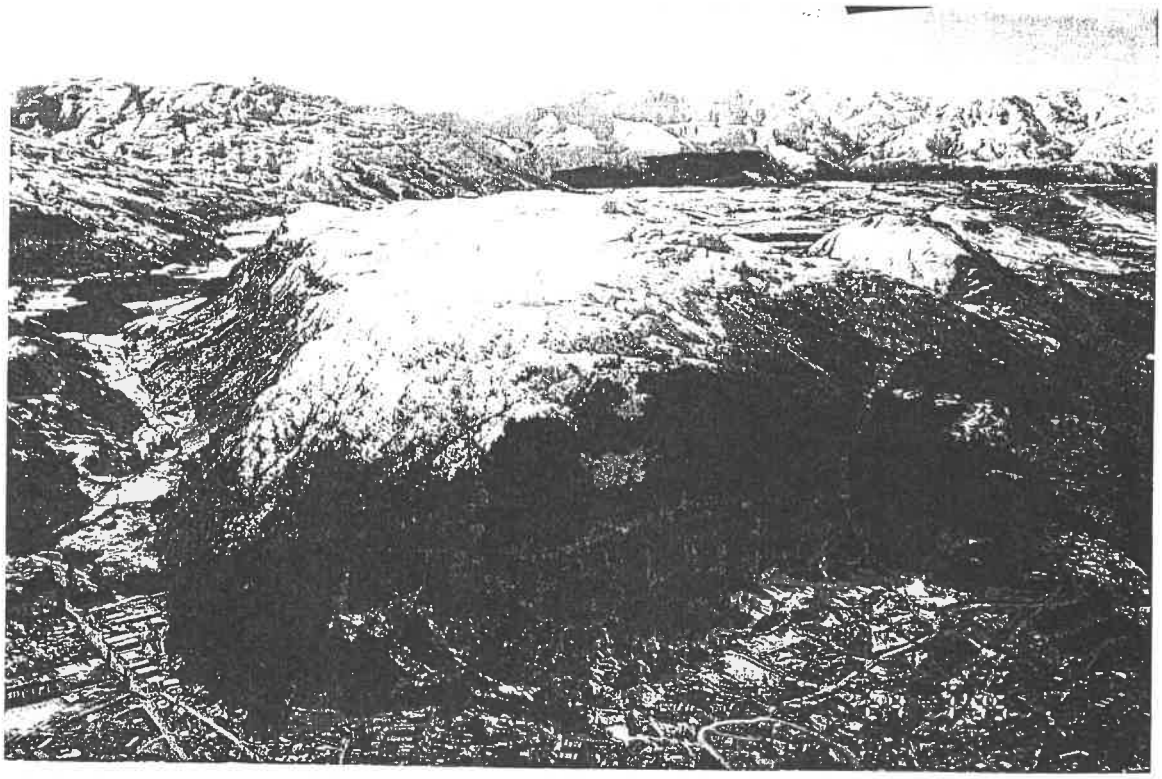
9.2.2 Physical Effects: Landscape And Visual Effects

An assessment of the physical effect of the use of Queenstown and Sugar Loaf Hills (hereafter called Queenstown Hill) as an airport involves consideration of landscape and visual effects. These have different meanings in the context of the RMA. A landscape is both physical and perceptual and is a wider reaching term than visual effects which are confined to human perception (refer L A Campbell and Others and Cross Air Spread Ltd vs Southland District Council (D W114/94 and the definition of Landscape Feature in the Proposed Regional Policy Statement for Otago).

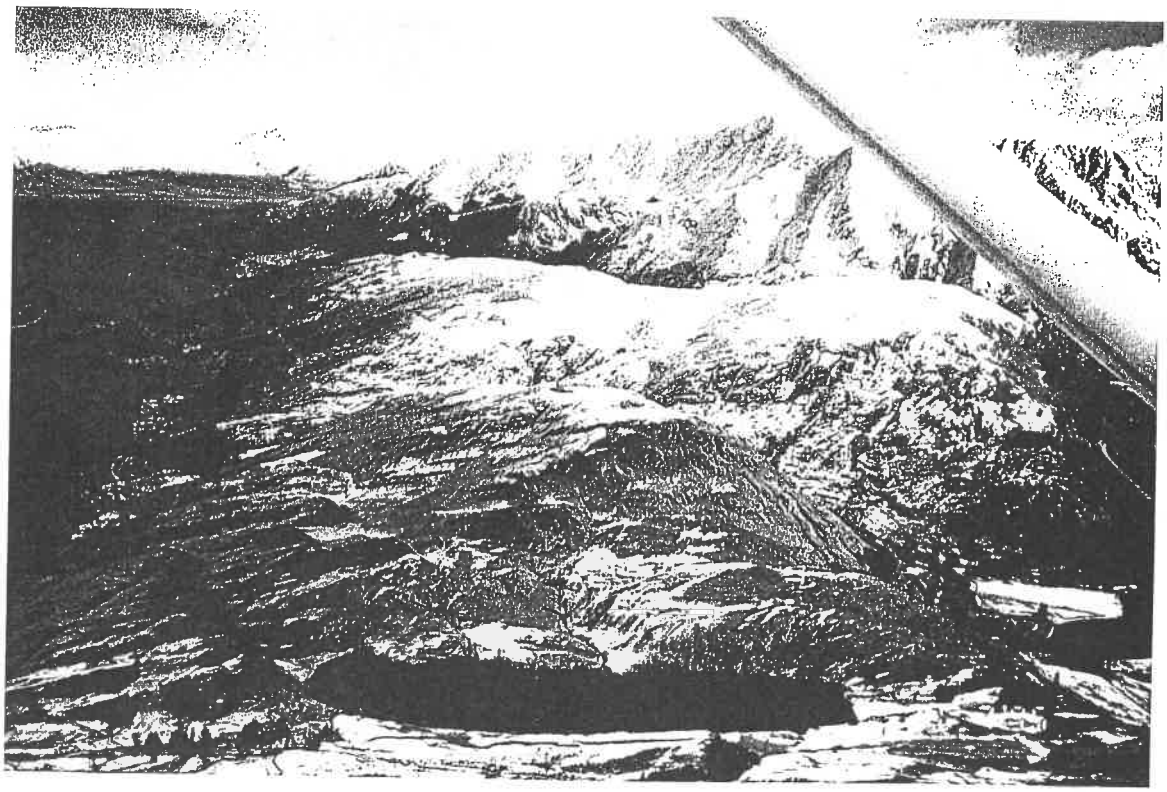
Queenstown Hill is part of the wider landscape of Queenstown and the Lake Wakatipu Basin. It forms a natural backdrop to the township of Queenstown and it adds dimension and character to the town and the higher mountains of the Southern Alps. The combination of mountains, lake, ice sculptured hills (which include Queenstown Hill) and river valleys create an outstanding landscape which is of national importance. There has already been some modification to the landscape. The margins of the lake have been altered and developed to accommodate the settlement of Queenstown (and its satellites) and Glenorchy. The mountain landscape is relatively unmodified, apart from the Gondola and Skyline restaurant on Bobs Peak and ski fields at Coronet Peak and the Remarkables with associated roading.

[1] Land Care Research, Dunedin

QUEENSTOWN HILL



1) View North with Queenstown in Foreground

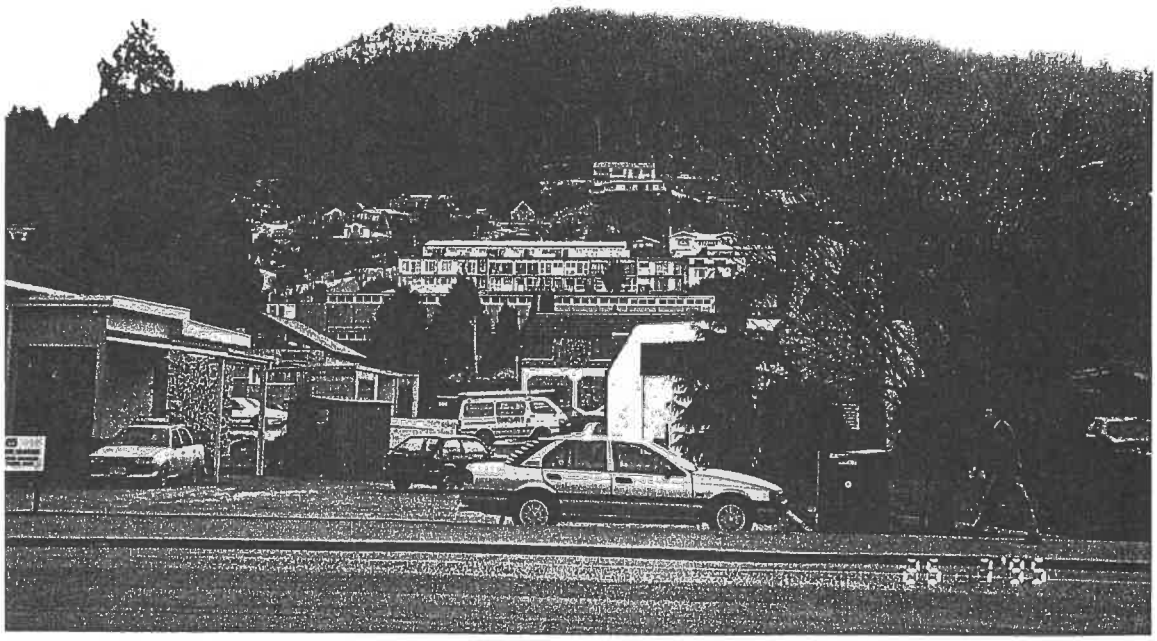


2) View South with Lake Johnson in Foreground

Queenstown Hill itself is a natural feature which can be viewed from almost everywhere in the Wakatipu Basin, although the summit can only be viewed from elevated sites, in particular Coronet Peak ski field, Skippers Road, Peninsula Hill and the road to the Remarkables ski field. These locations are considered to be scenic lookout areas and would be heavily utilised. An airport on the top of Queenstown Hill would involve substantial recontouring of this undeveloped natural feature and the construction of a runway and airport infrastructure (Control Tower, Terminal Building, lighting and navigation aids). These facilities would alter forever this part of the landscape and would intrude visually into scenic alpine views from vantage points described above. The elevation of this site would screen the airport infrastructure from the town and the north-western lakeside but from many other locations in the Wakatipu Basin would serve to accentuate the manmade modification to this feature. Airport and navigational lighting necessary for 24 hour airport operations would compound the identified effects of this feature.

The overwhelming conclusion in terms of visual effects of an airport on Queenstown Hill is that the environment of Queenstown Hill and the wider Wakatipu Basin would be significantly degraded.

Part of the landscape can also be considered as the airspace. Low flying aircraft over the top of Queenstown itself will intrude into the harmony, scale and coherence of the town and its intimate relationship with its surrounds. In this regard all of the Queenstown township would be under the flight path of aircraft arriving or leaving Queenstown Hill. The aircraft arriving at the southwestern end of the airport (which, in terms of prevailing wind, is probably less often than at the Sugar Loaf end) will be between 250 m and 500 m over Queenstown and their "disappearance" into the mountains could be alarming to viewers as similarly could be the view of the aircraft suddenly climbing out of Queenstown Hill (refer photograph 3).



3) **View of Queenstown Hill from Queenstown Beneath Flight Path**

9.2.3 Land Use Patterns

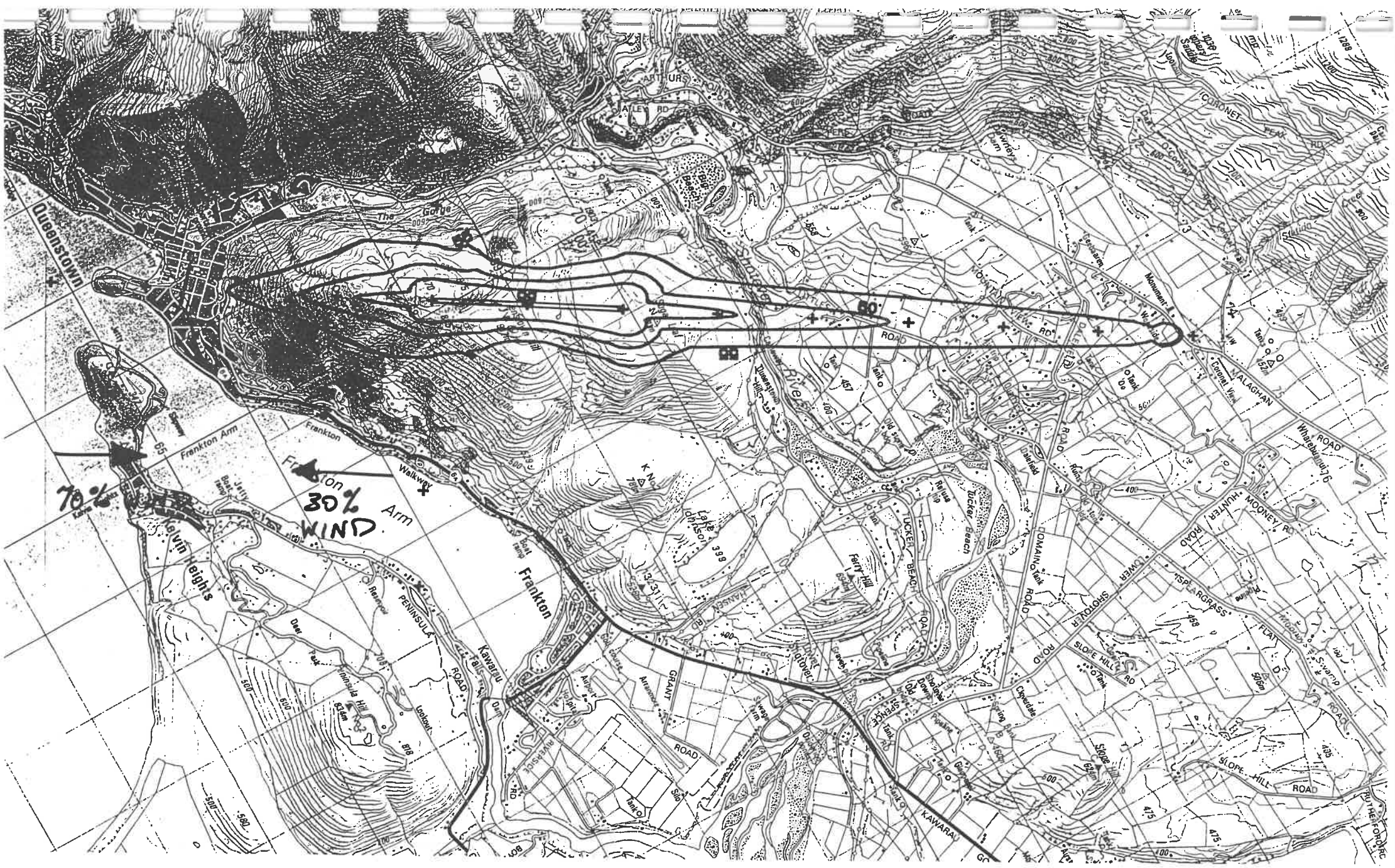
The site is currently part of a high country pastoral farm. The soils are not of high quality and loss of agricultural land of this type is not considered significant. There is no evidence of significant erosion and snow to depths of up to one metre covers the top of the hill in winter. The closest dwellings are about 2,000m from the southwestern end of a runway alignment further down the hill in the township of Queenstown. No acquisition of housing is likely to be required given the elevation of the site.

9.2.4 Noise

The principal environmental effect from airport operations is generally recognised as noise although in the case of Queenstown Hill the visual and landscape effects are of considerable significance.

The impact of aircraft noise on the environs of the airport is determined by three main factors:

(a) The orientation of the runway relative to proximity of neighbours
(b) The number of daytime and nightime aircraft movements
(c) The type of aircraft utilised



N

1000 0 1000 2000 3000 4000

SCALE IN METRES 1:50,000 @ A4

Figure 9.1

NOISE EXPOSURE FORECAST

QUEENSTOWN HILL

NZS 6805

In order to ascertain the noise generated by aircraft predicted to use the alternative airport sites and to assess the environmental effect of the airport, this study has adopted as a standard for noise emissions NZS 6805:1992 "Airport Noise Management and Land Use Planning". The Standard is concerned with land use planning and the management of aircraft noise in the vicinity of an airport, for the protection of community health and amenity values. It is intended to be applicable to all airports and aerodromes to ensure communities living close to the airport are protected from the effects of aircraft noise whilst recognising the need for airport operational efficiency. The Standard provides for the definition of an "airport protection zone" which protects the operational capability of the airport by restricting noise sensitive land use activities such as residential development, while at the same time protecting adjacent land uses from aircraft noise.

The setting of noise boundaries protects the airport from residential encroachment and also ensures that the neighbouring residences are not exposed to unreasonable noise from the airport. However, the setting of noise boundaries around the airport effectively sets a ceiling on the total operations at the airfield. Thus it is very important to allow for reasonable growth of the airfield so that future operational constraints such as curfews do not occur. The Standard suggests a 10 year future planning period as the minimum to allow for airport growth. In this case the data already evaluated for the Frankton airport have been used for all other sites, with the inclusion of two 767 movements per day. The 2010 Ldn contours are used as a basis for all sites. The noise predictions produced during this study used the Federal Aviation Administrations (FAA) Integrated Noise Model (INM) as recommended in NZS 6805. This computer programme uses the Day/Night Sound Level (Ldn) which calculates the cumulative "noise energy" that is produced by all flights during a 24 hour day, with a 10 dB penalty applied to night flights.

The airport protection zone is defined by noise boundaries; the Air noise Boundary and the Outer Control Boundary. NZS 6805 recommends that land uses inside these boundaries are controlled, for example new residential developments are prohibited inside the air noise boundary. A noise limit of 65 Ldn is set at the air noise boundary and the airport is not allowed to exceed this limit.

The noise contours predicted using this data can be used as the basis for locating the air noise boundary (Ldn 65 dBA) and the outer control boundary (Ldn 55 dBA). The Standard also recommends that for smaller airports that involve night flying, single event maximum noise levels should be considered when locating the Air noise Boundary. This concept has not been incorporated in this assessment as the airport at Frankton is not operational at night.

Basis For Calculations

Marshall Day Associates have conducted some preliminary airport noise contour calculations for the four alternative airport sites for Queenstown. Calculations were based on projected aircraft figures for the year 2010, using a single 2km long runway and runway usage split either 70/30 or 50/50 according to wind rose data. All flight tracks were assumed to be straight and the noise contours for the Queenstown Hill site were modified to allow for the additional noise attenuation over the town due to the high elevation of the airstrip. The runway orientation and usage is tabled below.

	Runway Orientation	Runway Usage
Queenstown Hill	03-21	Depart RW 21 70% RW 03 30%
Assumptions • Runway 2km long • No cross runway • All tracks straight		

From the 1:50,000 contour transparencies, overlaid on the appropriate map the following comments, regarding the extent to which residences would be affected, are provided:

Assessment

In relation to neighbouring land uses, Queenstown Hill is surrounded by rural land uses, with the township of Queenstown creeping up the hill some 2,000 m from the runway end. The effects of the topography are to reduce the noise levels, reducing the extent of the noise contours. The Ldn 55 dBA falls short of the existing township although in terms of the Transitional District Plan, some of the hillside land is zoned residential. This area will come inside the 55 dBA outer control boundary. If the New Zealand Standard is followed (NZS 6805), new housing should be prohibited within the outer control boundary. However, if the Council consents to further subdivision of Queenstown Hill, then it is essential that all new dwellings are acoustically treated. It is estimated that any new residential subdivision further up Queenstown Hill will potentially fall inside the Ldn 55 contour (outer control boundary), at the Queenstown end of the runway.

In addition there are a number of rural dwellings inside the Ldn 55 and 60 dos a coutour at the north-eastern end of the runway, which would be exposed to moderate levels of aircraft noise.

9.2.5 Ecological

According to the Department of Conservation, "the scenic amenity of Queenstown Hill is enormous."[2] The Queenstown Hill area contains 40.826ha of conservation land held under Section 62 of the Conservation Act 1987. Tussock grasslands are dispersed with wilding trees and there are small areas of fescue tussock within the conservation area. A walkway is currently being upgraded to the Queenstown Hill summit up to about 950m. In terms of bird life, there are nesting falcons on Queenstown Hill and various water fowl among the tarns. The conservation objectives for Queenstown hill would appear to be in conflict with a proposal to develop the summit as an airport.

9.2.6 Archaeological/Cultural

The Historic Places Trust advises there are no recorded archaeological sites in this location. However, liaison with Iwi (Kati Huirapa Runanga Ki Puketeraki) has revealed that Queenstown Hill is a wahi tapu site of "intense sacredness"[3].

9.2.7 Safety

A proposed airport on the top of Queenstown Hill would be located about 2,000 m from the residential areas in the lower southern slopes. On approach and takeoff, aircraft will be about 1,100 m minimum height above these properties. International Aviation accident statistics indicate that the area where aircraft accidents have mostly occurred is on the airport and on the runway centreline within 1,000m of the runway threshold. Any emergency landings are constrained by the topography in that aircraft undershooting or overshooting the runway will end up on the hill slopes.

The question of safety and low flying aircraft can be considered to be a psychological effect on Queenstown residents or visitors. These effects are acknowledged and discussed in broad terms as follows:

Effects of Low Flying Aircraft

Apart from noise and safety which are addressed in Sections 9.3 and 9.5 respectively, environmental effects from aircraft operations can be defined as:

(i) Dispersion of fuel droplets and carbon particles which may contain some unburnt hydrocarbons on aircraft take-off

(ii) Wind gusts from aircraft taking off or landing

(iii) Visual impact of low flying aircraft

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[2] DOC letter to BCHF dated 21/8/95

[3] Letter to BCHF from Runanga Coordinator 28/8/95

The outcome of item (i) is likely to be a very fine level of impact which would require much more detailed analysis. At this stage, given the elevated mountain setting and the unlikelihood of the airport becoming so heavily trafficked for air emissions to be a significant problem, this issue is identified but does not warrant further consideration.

The outcome of item (ii) is considered to be nil given the distance of the take off and landing thresholds from existing habitation.

The visual impact of low flying aircraft (either from take off or landing) would be significant for people in the township of Queenstown as discussed in Section 8.1.2. The township will be directly under the flight path on final approach and take off and the physical elements of an airport above the town and hidden from its view are likely to create a situation where aircraft suddenly appear overhead or disappear into the hill. This factor will certainly attract the attention of people in Queenstown and may be disturbing, although no detailed analysis of this aspect has been carried out and no definitive conclusion can be reached.

The continued subdivision of Queenstown Hill above the township and to the north along Frankton Arm is recognised and provided for in the Transitional District Plan to a height of about 400 m above the state highway. This will bring residential subdivision to within about 1,500 m of the runway end.

9.2.8 Natural Hazards

In terms of the definition of natural hazards in the RMA (Section 2), there are no known natural hazards which could be of significance in relation to the Queenstown Hill site although erosion, as a result of earthworks and airport construction works, cannot be ruled out and would require specific evaluation if this site were approved for development. The effects of snow on the development of the site would also require evaluation as would the impact of regular snow removal from runways on the remainder of the site (i.e. would stockpiling of snow increase localised water runoff?)

As with the development of all the sites (except Frankton) dust during construction is likely to be a problem.

9.2.9 Traffic

Consultation with the Otago Regional Council has indicated that establishing a road to serve an airport at Queenstown Hill would be difficult in terms of:

(i) finding a suitable access point - not one through local residential streets

(ii) the grade of the slope

The existing road network in Queenstown is not designed to cater for a major traffic generating facility in the location of Queenstown Hill. All access roads on the slope of the hill are "local streets" designed to accommodate daily residential traffic. The environmental effect of coach and hazardous goods traffic on these routes would be significant. Any access route would be steep, difficult to construct and potentially hazardous in adverse weather conditions.

Section 7.3 identifies Tucker Beach Road as being the likely access point subject to more detailed field inspection.

9.2.10 Hazardous Goods

Further to considerations of transportation, the matter of hazardous goods transport is an issue. The height of the site and steepness of any vehicular access makes it doubtful whether safe transport of fuel and other hazardous goods to the airport could be achieved.

9.2.11 Statutory Considerations

Sections 5, 6 and 7 of the Resource Management Act set out the purpose and principles of the Act in relation to promotion of sustainable management of natural and physical resources. These sections are all relevant to an environmental effects assessment of Queenstown Hill for an airport.

Section 5

Section 5 refers to managing the use and development and protection of natural and physical resources to enable communities to provide for their social, economic and cultural well-being and for their health and safety. In this case the natural and physical resource of Queenstown Hill is one of the features which, when combined with other aspects of the unique landscape in Lake Wakatipu, is significant for people's enjoyment of this part of New Zealand and creates Queenstown as a premium tourist destination. The economic welfare of the people in Queenstown now depends heavily on tourism. While improved airport facilities would provide positive social and cultural effects, it is not considered that these need to be achieved at the expense of the environment which is the basis of tourist appreciation of the area.

In terms of subsection (c) of Section 5, the siting of an airport at Queenstown Hill is likely to have adverse visual and landscape effects, traffic, safety and noise implications which can be avoided by rejecting this as a suitable airport site. It is considered that the visual effects cannot be mitigated.

Section 6

Section 6 (b) of the Act sets out, as a matter of national importance:

"(b) The protection of outstanding natural features and landscapes from inappropriate subdivision, use and development."

Section 7

Section 7 refers to:

"(b) efficient use and development of natural and physical resources

(c) maintenance and enhancement of amenity values

(d) intrinsic values of ecosystems

(e) recognition and protection of the heritage values of sites, buildings, places or areas

(f) maintenance and enhancement of the quality of the environment

(g) any finite characteristics of natural and physical resources."

Subsections (b), (c) and (f) of Section 7 also deal with the appropriateness of development of the resource and it is considered that this site would fail to meet the provisions of these sections.

Other relevant matters of importance are considerations of the relationship of Maori and their culture and tradition. Queenstown Hill is of significance to the tangata whenua (see Section 9.2.6).

All these matters have been discussed in the preceding sections.

These are the only statutory matters under Sections 5, 6 and 7 of the Act considered to be of importance in this case.

9.2.12 Regional Plan Provisions

The Otago Regional Plan consists of some of those instruments referred to in Section 368(2) of the Resource Management Act 1991 which were in force in Otago prior to the commencement of the RMA. Specifically, the instruments referred to include:

(a) Local water conservation notices

(b) Water flow standards

(c) Authorisations under Section 22 of the Water and Soil Conservation Act 1967

(d) Bylaws

Of relevance to this report are matters contained in the Plan relating to stormwater/ drainage discharges which are permitted activities subject to conditions and, more specifically, the Otago Catchment Board and Regional Water Board Bylaw 1988 (OCB and RWB Bylaw).

Otago Catchment Board and Regional Water Board Bylaw 1988

The OCB and RWB Bylaw covers inter alia activities affecting watercourses and defences against water (e.g. floodbanks). The Bylaw requires a watercourse consent from the Regional Council before carrying out certain actions affecting watercourses or flood control structures. The controls also require specific maintenance measures to be continued on existing drains. Development of Queenstown Hill will require installation of a drainage regime for which a resource consent may be required in terms of Authorisation N°10 if a discharge into a watercourse is proposed.

PLAN CHANGE 1

Air Discharges

Schedule D of the Proposed Regional Plan change includes hydrocarbons in the specified classes of air pollutants. Jet aircraft produce efflux emissions but these disperse rapidly and no known permanent effect on air quality has resulted at other operational airports in the country. The operation of an international airport of the type proposed does not involve air discharges as described in the Plan Change, with the exception of possible consent for combination of pathological material, garbage and refuse at a rate exceeding 100kg per hour, as set out in Schedule A to the Plan Change. This is also referred to in Section 9.2.13 in relation to provisions in the Proposed Regional Policy Statement for Waste.

9.2.13 Regional Policy Statement

In October 1993 the Proposed Regional Policy Statement was notified. The RPS identifies issues of regional significance. On page 18, Section 3.3, the Proposed Regional Policy Statement identifies tourism as becoming increasingly important to the prosperity of Otago's communities and "The Queenstown Lakes District, the fastest growing local authority in New Zealand and one of the country's major tourist destinations ...". On page 20 it notes the physical resources for Otago include high class soils which comprise only 6% of the total arable land in the region (which itself is only 26% of the total land resource). One of the locations of these high class soils (Class I and II) is identified as being in the Wakatipu Basin. On page 40 it raises issues of sustainable management of high quality soils and maintaining productive capacity of the land. Objectives and policies reflect these goals, specifically Objectives 5.4.1, 5.4.2 and Policy 5.5.2.

Queenstown Hill is not an area of high class soils and the loss of agricultural land of this quality is not considered to be a significant environmental issue.

One of the identified issues in the Plan is set out below:

"5.3.4 Otago's outstanding natural features and landscapes are threatened by inappropriate subdivision, use and development."

Explanation

Much of Otago's natural character is derived from its natural features and landscapes. RMA requires protection of outstanding natural features and landscapes from inappropriate subdivision, use and development. This protection is required in order to ensure that those features and landscapes will always be a part of Otago and that they will be there for future generations to enjoy.

The accompanying Objective 5.4.3 is

"to protect Otago's outstanding natural features and landscapes from inappropriate subdivision, use and development."

This matter has been canvassed in Section 9.2.2 but it should be noted that Queenstown Hill is part of the wider outstanding landscape of the north-western side of Lake Wakatipu. Objective 9.5.2 of the Proposed RPS indicates the need to efficiently utilise existing infrastructure and airport development at Queenstown Hill conflicts with both these two objectives.

A relevant objective is Objective 5.4.4

"5.4.4 To maintain and enhance public access to Otago's recreation and tourist opportunities."

A public scenic walkway exists up to Queenstown Hill. Airport development would retain access to views from this location but the natural landscape and amenity values would be severely compromised.

Air Discharges

The RPS identifies the issue of existing air quality being compromised by adverse effects of discharges to air from:-

(a) The combustion of fuels

Objective 7.4.1

"7.4.1 To maintain and enhance Otago's existing air quality, including visual appearance and odour."

Reference to air discharges is included in Section 9.2.12 above.

Probably the most significant objective of relevance to development of Queenstown Hill is Objective 9.5.4

"9.5.4 To minimise the adverse effects of structures and developments on Otago's environment through avoiding, remedying or mitigating:

(a) discharges of contaminants to Otago's air, water or land; and

(b) the creation of noise vibration and dust; and

(c) visual intrusion; and

(d) significant irreversible effects on

(e) Otago community values"

The Queenstown Hill development will disfigure the existing landscape and have far reaching visual environmental effects in relation to items (b) noise and short term effects from dust and from construction, (c), (d)(i), (ii), (v)

There are issues of cultural significance in terms of development at Queenstown Hill.

P. 32 Waahi Tapu (Sacred Places)

Objective

"To recognise the spiritual and customary importance of waahi tapu ... to Kai Tahu and to recognise and provide for the protection of waahi tapu from physical disturbance, erosion, pollution and inappropriate land use.

Queenstown Hill is a culturally important site which should be protected from negative impacts such as earthworks, structures and pollution.

P.32 Waahi Taoka (Treasured Resources)

"To recognise and provide for the special significance that all taoka play in the culture of Kai Tahu."

The following categories of waahi taoka are a guide to the range of resources requiring consultation with Iwi.

(ii) Kai Tahu cultural and spiritual values; or

(iv) Habitats of indigenous fauna; or

(v) Amenity values; or

(vi) Intrinsic values of ecosystems ..."

Policy 5.5.1

"To recognise and provide for the relationship Kai Tahu have with Otago's land resources ..."

Preliminary consultation with Iwi indicates that the site is unsuitable for development of an airport in terms of the site's cultural significance.

Wastes

Objective 13.4.1

"To protect Otago's communities and resources from the adverse effects of the waste stream, including hazardous substances and wastes."

Explanation

The disposal of wastes and the storage, use, disposal and transportation of hazardous substances and wastes can create many adverse effects which have the potential to damage the environment of Otago. There is a need to protect Otago's environment from the actual and potential effects associated with the waste stream. The adverse effects can take many forms and include:

- threats to the health and integrity of the ecosystem
- threats to human health
- land contamination
- ground water contamination
- surface water contamination
- air pollution
- decreased amenity values
- impact on mahika kai values

Waste disposal off site will be difficult in terms of the identified difficulties in road access, grade and conditions. Methods of sewage disposal have not been evaluated in detail but piping off site or transportation of septic tank waste presents a problem, as does transportation of hazardous fuel and waste (see Sections 9.2.10 and 9.2.12). Table 8.1 identifies the possibility of a treatment plant on-site. This would be unacceptable in terms of the cultural significance of the site.

Proposed Regional Plan: Waste

This is the first Regional Plan for Otago. It deals with contaminated sites and the importance of identifying such sites and taking remedial action to mitigate the adverse effects. It is known that some airport tarmacs can contain residual oil and fuel waste which may permeate the topsoil where fuel spills/leakages have occurred. Design measures such as traps and bunds will be incorporated into any tarmac construction works to contain fuel spillages and ensure that no contamination of subsoil occurs.

Waste disposal from a developed international airport takes the form of food waste, quarantine material (generally food), general refuse and engineering waste/fuel. Methods employed to dispose of waste take the form of incineration on site or under contract to a refuse operator. At present, given the low volume of international flights into and out of Queenstown all refuse from international aircraft is removed and disposed of at Christchurch. General refuse is removed daily by contractor (bulk bin operator). However, a future international airport could not rely on other destinations to remove refuse. Complete aircraft decontamination and waste disposal including incineration would be required.

In the case of Queenstown Hill, significant transportation difficulties are foreseen for waste disposal. It is therefore considered inappropriate to dispose of any goods off site. An air discharge consent may be required for incinerating waste.

The other sites do not have the same difficulties in that they are located on or adjacent to major transport routes and/or have access to townships where waste collection facilities are in place, i.e. Cromwell (Cromwell township), Wanaka (Wanaka township), Jardines (Queenstown). Increased heavy vehicle transport across the Kawarau Falls bridge is a problem while the bridge is single lane, although a pre-requisite for establishment of the airport at Jardines may be an upgraded two-lane bridge.

9.2.14 District Plan Provisions

The District Plan Provisions are currently undergoing review prior to a new District Plan being released later in 1995. However, the existing rules are relevant in providing background to resource management philosophies for the sites concerned. Under the Transitional District Plan for Queenstown Lakes - Wakatipu District Council, the site is zoned Rural B. The land in this zone is identified as generally stable hill and high country which forms a scenic backdrop to the Rural A zone. Pastoral farming is the major rural activity.

Policy 3.3.02 recognises the need to maintain and support the high country pastoral grazing in conjunction with lower lying fertile land in the Rural Z zone and to permit "other uses compatible with scenic values and land stability."

Ordinance 7.01 contains permitted activities which include:

"(b) Landing and take off strips for aircraft providing public or private transport subject to the approval of the Committee."

This provision is in effect a permitted activity which has a discretionary component. Such provisions have been found by the Planning Tribunal to be ultra vires because they do not give certainty as is required for permitted activities.

The buildings and infrastructure associated with an airport would be non-complying activities and as a package given comments relating to Rule 7.01 - the proposal should be treated as a non-complying activity. It is unlikely that a subdivision consent would be required to split off the airport site from the remainder of the landholding. If so, resource consent to a non-complying activity would be likely in terms of Rule 6.05. The policy in relation to subdivision is more relevant to the principles under the Town and Country Planning Act.

It refers to the retention of rural land in farming and avoidance of unnecessary subdivision and loss from production of rural lands.

As indicated, Queenstown Hill has some limited value for pastoral farming purposes but the soils are not significant and the above policy would not be a stumbling block for a subdivision resource consent.

Proposed Plan Change 99, notified in February 1995, is relevant to this assessment in that it includes Queenstown Hill and all of Queenstown in an area of landscape importance. The zoning is intended to remain Rural B. Relevant extracts from this Plan Change are as follows:

P15 "(b) The Wakatipu Basin

The Wakatipu Basin together with the surrounding mountain slopes, hills, surface and margins of the lakes and the landforms surrounding Lake Wakatipu, is a landscape of exceptional scenic quality and character. The enclosing high ground is of particular visual significance in respect of its quality, high visibility and the sensitivity of people viewing it. Much of the enclosing high ground has a very poor absorption capability because of its high visibility and relatively unmodified smooth tussock slopes. The Basin's ice-sculptured hills, including Queenstown, Peninsula, Ferry, Slope and Morven hills are also highly attractive and visible with a low development absorption capability."

P22 "Explanation and Principal Reasons for Adoption

The Queenstown-Lakes District is dominated by an outstanding landscape which is critical to the well-being and economy of not only the District, but also the region and the nation. This relationship of the community to the natural environment and its setting is paramount and as such sustainable management must be undertaken in a manner which gives priority to ensuring the protection of the landscape and visual amenity."

P29 "Explanation and Principal Reasons for Adoption

it is critically important to the social and economic needs of the District that new growth is undertaken in a manner which sustains and enhances the important natural resources amenity values and social aspirations of the community. The Council has chosen to accommodate urban growth through policies of consolidation because this is considered to be more cost effective and efficient in terms of energy use and is least likely to impact on the natural resources and landscape values of the District."

Although this Plan Change does not have full legal status, decisions on submissions being now incorporated into the Proposed District Plan echo clearly the provisions of Sections 5, 6 and 7 of the RMA and the issues of landscape importance described in Section 9.2.2.

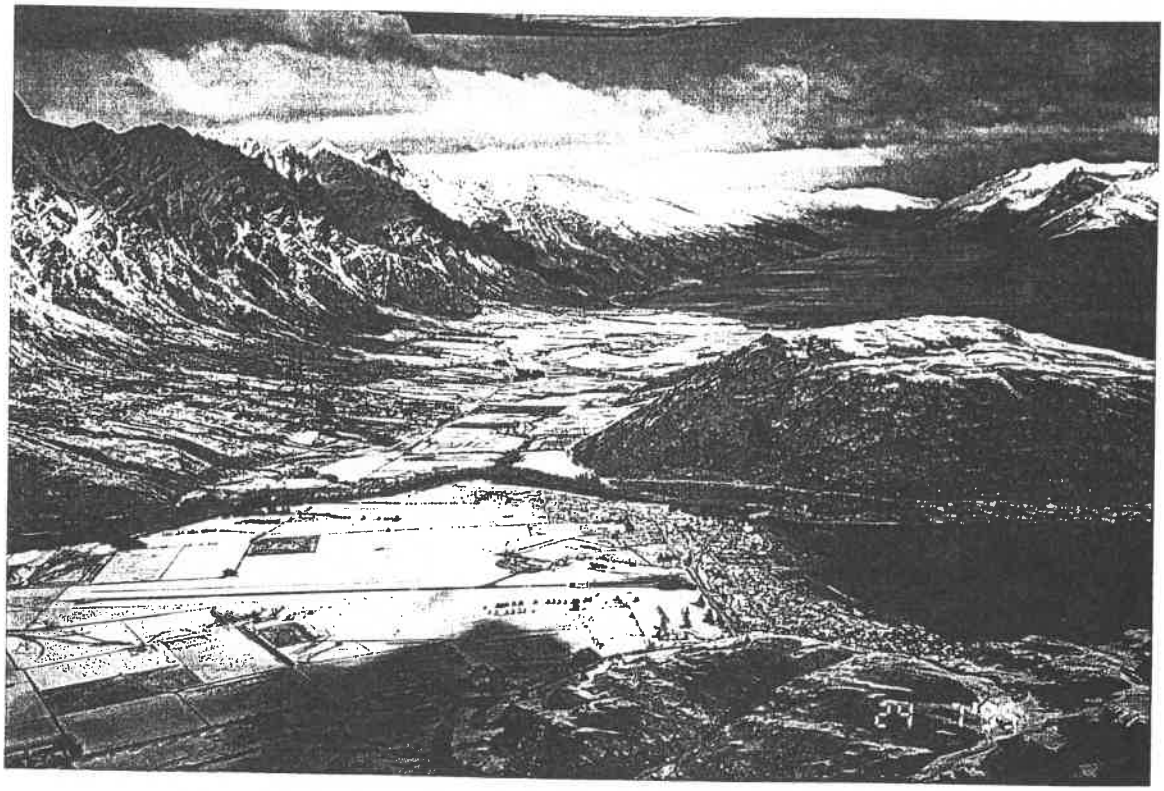
A preliminary assessment of a potential airport development on Queenstown Hill against these objectives and policies concludes that this site is unsuitable.

9.3 JARDINES

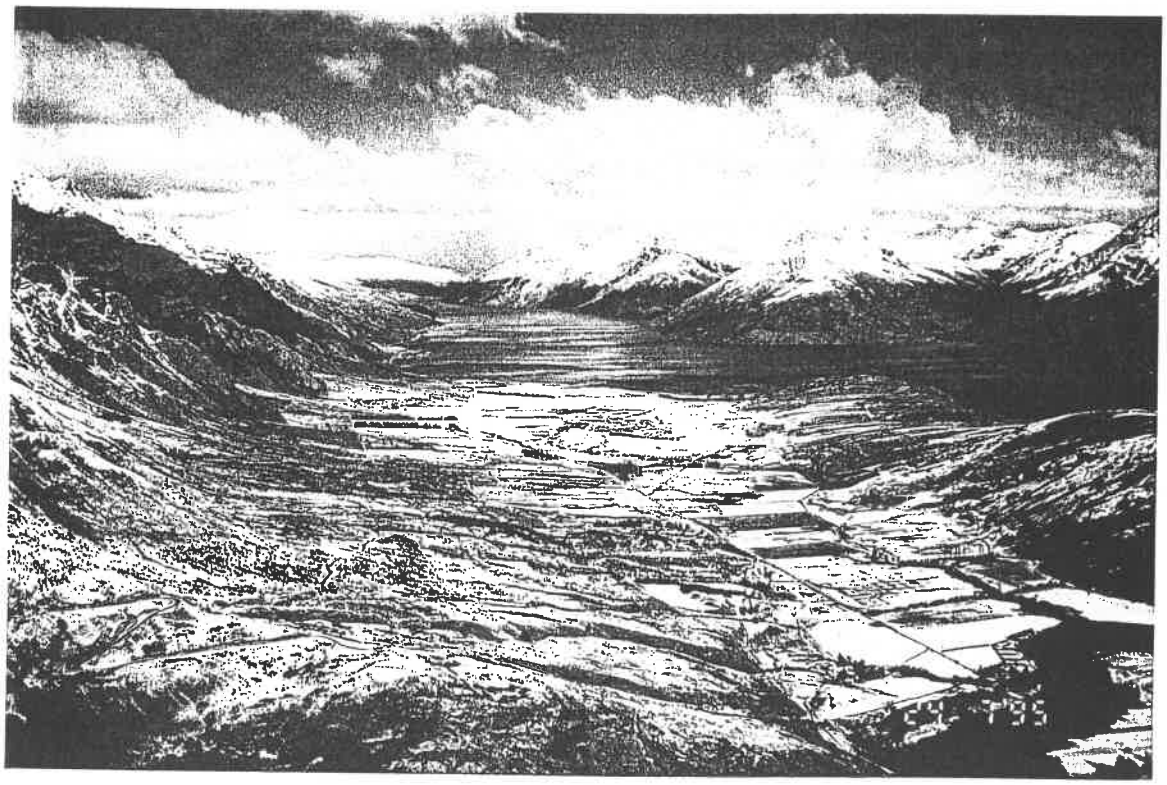
9.3.1 Description Of Environment

The Jardines site is located in a narrow valley lying north-south between the Remarkables Range, the hills of Jacks Point and Peninsula Hill. To the south is Lake Wakatipu and the Kawarau River is at the end of the valley to the north. The one lane Kawarau Falls Bridge links this area with Frankton and Queenstown. The site is part of the old lake bed and the runway configuration as originally proposed in a 1988 study is almost at the edge of Woolshed Bay some 800m from Kingston Road. The site has a gently undulating contour and has an existing 700m grass. The site and its location are shown in photographs labelled 4 and 5.

JARDINES SITE



4) View East with Frankton Airport in Foreground, Peninsula Hill to South



2) View South-east to Woolshed Bay -

Shelter Belts Defining Homesteads

On the old lake sediments are Frankton soils which although not classified are unlikely to be high class. A thick assemblage of silty sandy gravel underlies the entire site and outcrops extensively throughout. These are outwash gravels and are medium dense to very dense, well graded but poorly bedded. Shallow deposits of fine grained sediments consisting of silts, sands and small amounts of clay overly the gravels in places, principally in a broad valley which straddles the southern third of the site. These fine grained compressible sediments are up to 12m thick in this valley and up to 2m thick elsewhere. Lake beach gravels outcrop along the southern edge of the site bordering Lake Wakatipu. Coarsely foliated schist outcrops on the hills to the east and west with outwash gravels located to the immediate east of the proposed site along the base of the Remarkables mountain range. On the fans of the old lake bed high class Pigburn soils have been identified.

9.3.2 Landscape And Visual Effects

The 1988 study identified the visual impact of a proposed airport and associated infrastructure as being dependent upon the degree of modification of the landscape (in particular natural land contours) for airport operations and the distance approach angle and elevation from the site. As with all sites the runway becomes a reference point when viewing from elevation.

The findings of the 1988 study in relation to assessment of visual impact as being minimal are generally supported. Extracts from this study are set out below:

"Visual

The visual impact and scale in the area of the airport is dominated by the size of the Remarkables Range in foreground, and more distantly, Lake Wakatipu, Queenstown Hill and Coronet Peak.

The visual impact of the airport has been assessed from that of the existing residential areas, state highway 6, and the prominent viewing points used by tourists.

Firstly, the visual impact of the airfield and associated buildings from any of the existing residential areas, including Sunshine Bay, Queenstown, Frankton and Kelvin Heights will be minimal, if at all discernible. Queenstown itself lies some 10km from the airport and the majority of Kelvin Heights is totally shielded from the airfield by Peninsula Hill.

Secondly, traffic approaching from the south along SH6 travels along the edge of Lake Wakatipu before veering away from the Lake, rising along farmland and gaining the first views of Queenstown (approximately 15km to the north). From this point the airport lies well below road level (approximately 30m) and all buildings will be beneath the line of sight to even Jacks Point above Woolshed Bay, let alone Deer Park Hill.

Traffic approaching the airport from the north will have only a very limited view of the airport as the foreground rises to block the airport and associated buildings at the lower level."

The third point is modified but the gist is the same in that there is expected to be low visual impact from the prominent visiting points around Queenstown district of the proposed airport. The views of the airport from the road extending up to the Remarkable Ski field, Queenstown Gondola and Coronet Peak Ski field are anticipated to be distant identification of the runway accentuated by lighting and possibly identifiable only by the buildings and modified landscape.

The airport terminal area will be set back from the SH6 frontage by about 800 metres. This, plus its lower elevation, provide the opportunity for contouring and planting to further buffer the airport buildings from SH6. All hill slopes and cut buffers along the runway will be topsoiled and grained. Because of the low slopes required for aircraft safety clearances, these will in general be used for grazing.

Thus, in summary, it is concluded that the visual impacts from both adjacent viewpoints, and more distant points such as Queenstown or Coronet Peak, will be minimal. It should be noted that the neighbouring landholdings will notice a significant change in their view. Acquisition of probably two of these properties is a likely requirement in any event to facilitate airport development."

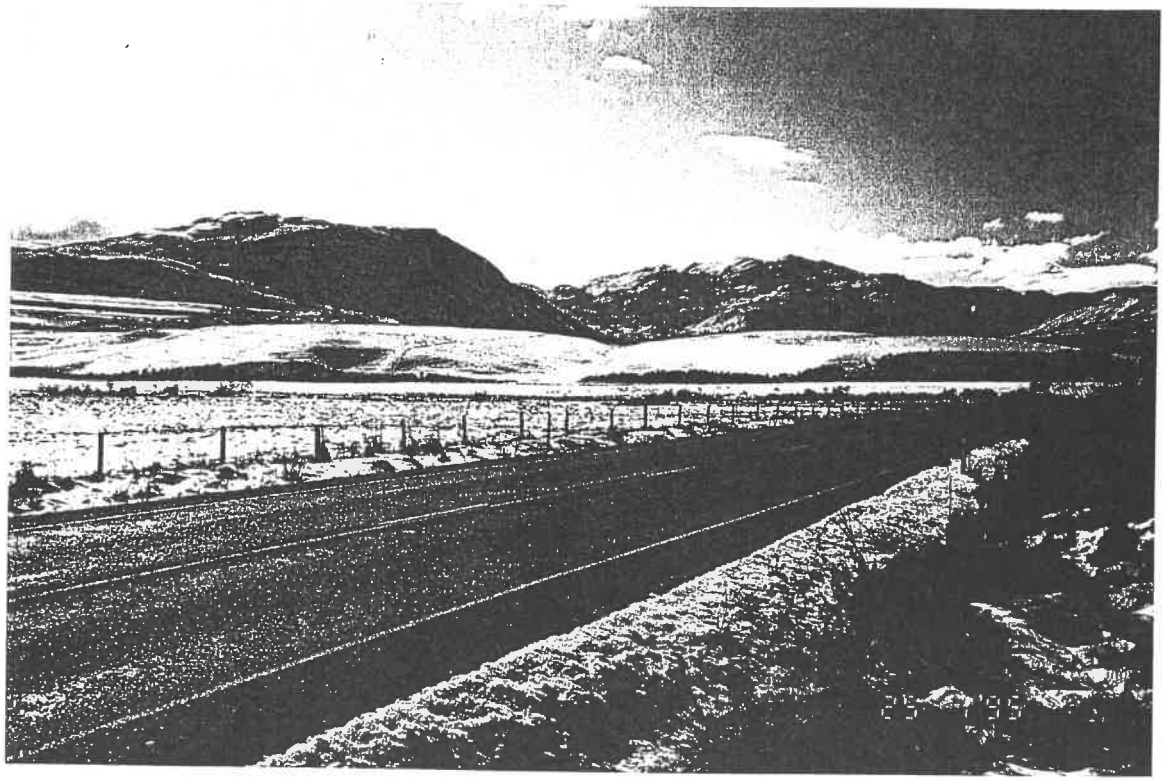
In terms of landscape considerations a broader assessment is required to determine effect of the airport on landscape. The landscape of the valley is identified in Proposed Plan Change 99 as being of significance. The primary significance is considered to be in the coherence of the landscape, the low land of the valley floor accentuating the scale and dominance of the Remarkables. Significant "photographic" views of Lake Wakatipu with open land in the foreground and the lack of structures are features of the landscape when viewed from Kingston Road (SH6). It is envisaged that substantial earthworks would be required to modify the site for airport works and this would alter the countryside feeling existing in the valley. Furthermore, terminal buildings, parking and lighting will create an industrial oasis in this area which will be foreign to the existing landscape. Photographs 6 and 7 depict the existing landscape.

It is noted that Proposed Plan Change 99 identifies part of this site as being suitable for a residential settlement. It is understood that this aspect of the Plan Change will not be followed through by the Council. However, if this does occur (leaving aside the question of airport development) then the present landscape would be changed and the valley would act as a hinterland for the township as in other lowland rural areas.

The presence of an airport in addition to a township will create a cumulative change to the landscape to one of larger scale human intervention and more industrial type airport related activities could be supported by a workforce and population catchment in close vicinity. Conflicts in terms of environmental quality and residential amenity will inevitably occur if both an airport and residential community are destined to establish in and around Jardines. These conflicts are further canvassed in the noise section.

EXISTING LANDSCAPE: JARDINES

6) View Towards Woolshed Bay



7) SH6 View West - Existing Grass Strip to Left of Picture

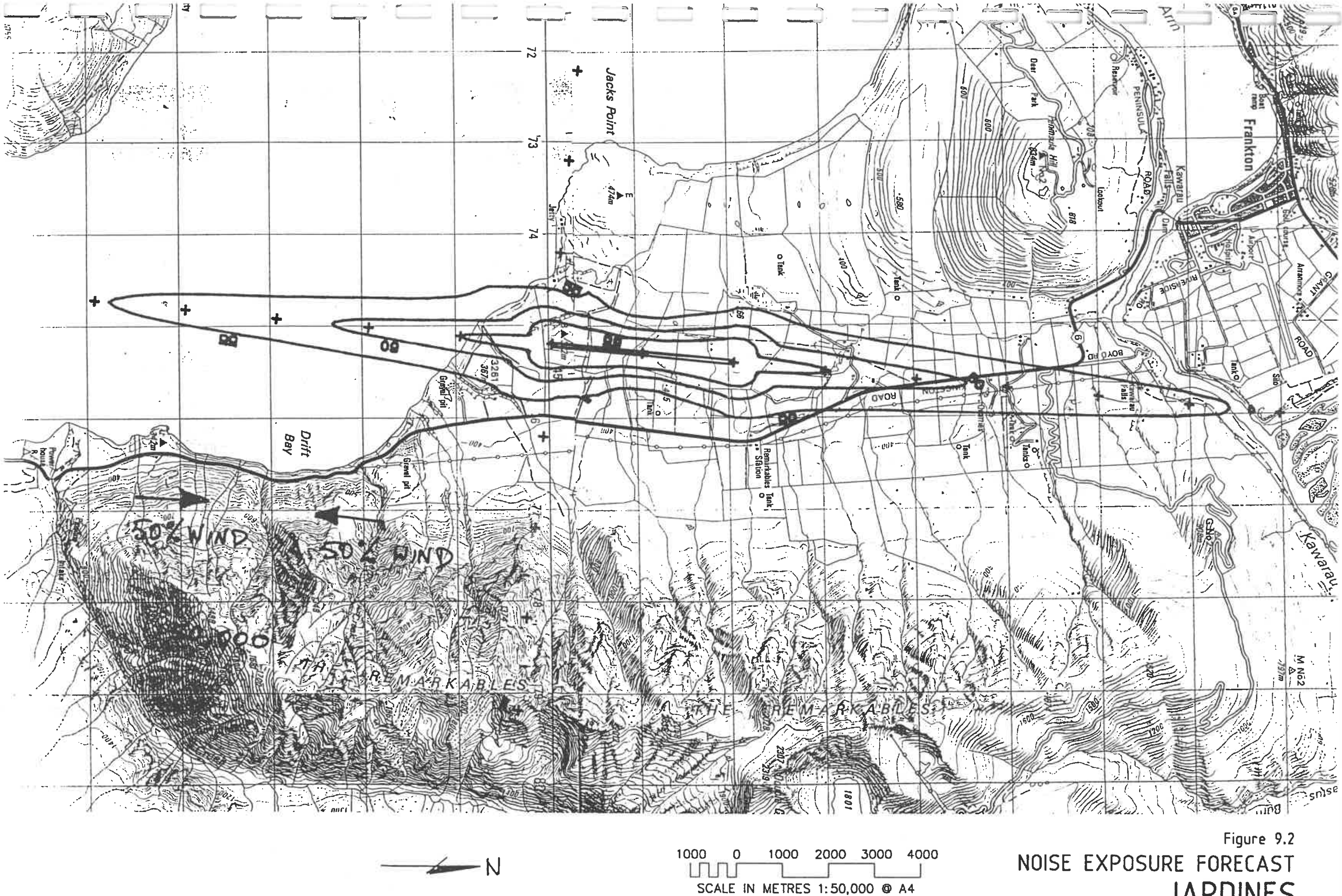


Figure 9.2

NOISE EXPOSURE FORECAST

JARDINES

In relation to visual effects and landscape considerations of low flying aircraft in the vicinity of Jardines, it is considered that provided no new settlements are established in the valley, low flying aircraft will not be highly visible from residential areas (with the exception of the closest neighbours who will be significantly affected). Flight tracks will extend over Frankton to the north (which is already beneath airport approach fans) and Lake Wakatipu to the south. The increase in numbers of low flying aircraft in the valley will be observed by travellers along SH6 which will enhance the perception of a change in rural character. The visual significance of increased use of air space is, on its own, not very significant.

9.3.3 Land Use Patterns

The site is being farmed as an extensive dry stock unit as is most of the land on the valley floor. The land area previously assessed for airport development at this location is in the order of 300ha. This will amount to a measurable loss in agricultural land. However, the significance of this needs to be weighed against possible benefits of relocating the existing airport away from Frankton. In this regard it seems unlikely that if the airport was developed at Jardines, the Frankton site would return to agricultural use. Furthermore Council, in its Plan Change 99, has recognised that agricultural use of the land may not be preserved indefinitely. As indicated, this Plan Change will now be overtaken by the District Plan review process:- the outcome of hearings being included in the Proposed District Plan.

9.3.4 Noise

The basis for assessment of noise, as discussed in Section 9.2.4, in relation to the Queenstown Hill site is also applied to the Jardines site. The following table sets out runway usage.

	Runway Orientation	Runway Usage
Jardines	18-36	No wind data. Assume 50/50 split between runways 18 and 36
Assumptions • Terrain moderately flat • Runway 2km long • No cross runway • All tracks straight		

Assessment

The Ldn 55 dBA contour (outer control boundary) does not cover any township, although a few houses along Kingston Road up to Kawarau Falls will be inside the contour. The 55 dBA contour just reaches the northern bank of the Kawarau river and therefore does not extend onto the Frankton Flats. As discussed in Section 9.3.2 it is important that no new settlement node be established inside the airport's sphere of influence, i.e. inside the Ldn 65 or 55 contours, otherwise the Jardines site may be significantly compromised for airport purposes. In the absence of any existing settlements, of all the sites considered, Jardines would impact on the least number of properties in terms of noise.

9.3.5 Ecological

A survey of the ecology of the site and environs was conducted as part of the 1988 study. The findings are set out below.

"Native and exotic birds of the open country are more common; species such as spurwing plovers, skylarks, pipits and harrier hawks are present. Their habitat requirements extend over quite large areas along both sides of State Highway 6 to Kingston.

The three small streams which cross the area are short torrents falling steeply off the Remarkables, debouching over farms where the flow is underground except during storms. There are no known native fish of significance in them, although in the permanent streams, e.g. Wye Stream (which lies to the south of the site) it is thought several species such as smelt, common bully torrent fish, eel and trout are present. Diversion of the three streams into a perimeter flood control structure will concentrate their respective flows, and the design will be arranged so that a barrier to any possible migration from the lake is not created.

Extensive searches in the region to locate the giant Otago Skink have been fruitless, even in the more likely and less modified habitat to the east of SH6 on the slopes of the Remarkables.

The conclusion reached about the biological values associated with the site after consulting local people and carrying out a literature and reference source search, are that the impact on native species, both faunal and floral, will be insignificant."

Recent consultation with DOC indicates that at Jack's Point, south-west of the proposed runway, there is a 9Ha area of marginal strip with native regenerating scrubland and grasslands. Its value is as an intensive buffer. It also provides landscape amenity and with improved access, will have recreational value. The draft conservation management strategy proposes this area as a scenic reserve.

The Remarkables and Rastus Burn Recreation Reserve are close to the west face bordering the Jardines site. On the site itself, the lowlying wet areas provide habitat for waterfoul.

9.3.6 Historical/Archaeological

Investigations carried out in 1988 are recorded below. Contact with the Historic Places Trust and Iwi has been made and information received on 10 and 28 August 1995 supports the extract from the 1988 report quoted below:

Nothing is known of the Maori use of the area of the proposed airport. No artefacts have been recorded from the site. The early goldminers traversed the area, with rapid expansion of prospecting in the main gold bearing streams to the north. There is no evidence of occupation left of that period of development.

The conclusion reached is that the proposed airport will not impinge on any historical items or values of significance. The "old woolshed" near the lake shore does have local significance, and would b0e affected to a moderate degree by the landscape change. The existing access along "Woolshed Road" needs to be realigned if the crosswind runway (10:28) remains."

9.3.7 Safety

A proposed airport on the Jardines site would be isolated from existing residential settlements. The closest settlement is at Frankton, Kelvin Heights being protected by Peninsula Hill. International Aviation accident statistics indicate that the area where aircraft accidents have mostly occurred is on the airport and on the runway centreline within 1,000m of the runway threshold. The commercial nursery and associated farm buildings would fall just outside this distance, depending on final runway length adopted. The proposed airport is sited some 500m from the lake edge to the south. A future possible settlement location was shown in Proposed Plan Change 99 as being on the airport site. This is obviously a conflict and only one use, either residential or airport, is possible. No future residential uses should be allowed to locate north of this area in the valley and noise impacts would dictate that their location should be considerably further away (refer Section 9.3.4).

Effects of Low Flying Aircraft

Apart from noise and safety which are addressed in Sections 9.3.4 and 9.3.7 respectively, environmental effects from aircraft operations can be defined as:

(i) Dispersion of fuel droplets and carbon particles which may contain some unburnt hydrocarbons on aircraft take-off

(ii) Wind gusts from aircraft taking off or landing

(iii) Visual impact of low flying aircraft

The outcome of item (i) is likely to be a very fine level of impact which would require much more detailed analysis. Wind shear is recorded in this valley and generally some wind at ground level. Therefore any air emissions would quickly disperse. At this stage, given the rural setting and the unlikelihood of the airport becoming so heavily trafficked for air emissions to be a significant problem, this issue is identified but does not warrant further consideration.

The outcome of item (ii) is considered to be nil given the distance of the take off and landing thresholds from existing habitation, and the location of the runway ends parallel to SH6.

The visual impact of low flying aircraft (either from take off or landing) would only be significant for the owner of the farms in the valley and for vehicles using Kingston Road (SH6) although the aircraft will not be directly overhead.

9.3.8 Natural Hazards

There are no known significant natural hazards in this valley. Snow is unlikely to be a problem as the site is at a similar height above sea level as Frankton which records seven days snow per annum. Section 5 refers to problems of wind turbulence and wind shear.

9.3.9 Traffic

A traffic assessment, carried out in 1988, indicated that an increase in traffic volumes would be experienced with the anticipated growth in passenger numbers and increased frequency in jet aircraft movements. This information has been updated in terms of 1995 Statistics from Transit New Zealand.

This increase in vehicular traffic will have to be accommodated, within the airport site, by appropriate numbers of parking spaces provided and the associated road signals, and modifications to State Highway 6.

Since the main access to the proposed airport is planned to be directly from State Highway 6, which is the main route from Queenstown to Invercargill and Dunedin, modifications will have to be made to accommodate traffic gaining access to and from the airport as well as north and southbound traffic.

Currently this straight stretching highway carries a traffic volume of 1,080 vehicles each way daily (average daily count, although seasonal variations will increase that count in view of the existence of the Remarkables Ski field). However, the highway has the capacity to carry 10,000 vehicles daily and consequently the anticipated increase of traffic can easily be accommodated.

Modifications to State Highway 6 should include right and left turning bays to allow access to the airport road and still allow straight-through traffic to continue without disruption. Also appropriate regulatory warning and information traffic signs shall be installed with along the highway, however, these modifications are the responsibility of Transit New Zealand.

SH6 with modifications has the capacity to cope with the anticipated increase of traffic generated by the proposed airport.

Of significance to consideration of the suitability of the Jardines site is the potential impact of airport traffic on the one lane Kawarau Falls Bridge on State Highway 6. It is not proposed by Transit NZ to widen the bridge although a future realignment of SH6 is shown in the informal Frankton Development Strategy document. Since the 1988 study which concluded this bridge was not a problem to airport development at Jardines, further information warrants introduction:

(i) Transit NZ accident statistics indicate that the Kawarau Falls Bridge has a high incidence of accidents. A visual inspection indicated that conflicts occur when vehicles approach simultaneously at each end of the bridge.

(ii) 90% of passengers arriving at Frankton airport on domestic and international airlines use coach transport. This trend is likely to continue. Tracking curves indicate that a 90%ile coach vehicle will have clearance room when crossing the Kawarau Falls bridge.

(iii) Kelvin Heights has developed further as a residential suburb since 1988 and the Remarkables Ski field has opened, generating increased traffic over the bridge with a 90% traffic conflict ratio.

(iv) Airline scheduling now coincides with peak hour commuter traffic. Most popular flights leave Queenstown early in the morning at 8.00 am and the last flight varies according to PAA rules but can be said to correspond roughly to sunset.

It seems more likely in the context of future airport operations and passenger transit that the Kawarau Falls Bridge will not be suitable in the long term for the main connecting point between the airport and Queenstown. In the short term, signalising this access point would be sufficient to mitigate against traffic conflicts.

It is recognised that with continued development of Kelvin Heights and the future airport operations, passenger transit will have a significant effect on the bridge. However, it is concluded that the single lane bridge would cope with the increased traffic but traffic signals may need to be installed to minimise delays and reduce conflicts. If subsequent commercial developments are proposed other than the airport, then a two lane bridge across the Karawau River will be required.

9.3.10 Hazardous Goods

Hazardous fuel transport to Jardines would be from the south via the Kingston Road (SH6) and would not require tankers to cross the Kawarau Falls Bridge. This is not envisaged to be a concern with the Jardines site.

9.3.11 Statutory Considerations

Section 5 (a), (b) and (c) of the RMA are relevant to consideration of an airport development at Jardines. Subsections (a) and (b) support the retention of the rural nature of the land although under (a), airport development is also a requirement to enable the community to provide for their future social, economic and cultural welfare. Subsection (c) refers to avoidance, remedying or mitigation of adverse environmental effects. These effects are discussed in the following section, however the principal issues are loss of prime agricultural land, alteration of important scenic qualities, impact on the Kawarau Falls Bridge and effects on immediate neighbours.

Section 6 (a) and (b) are relevant. The site is part of the old lake bed and can be considered to be its margins. The natural character has been altered by gold mining activities of the last century in addition to farming more recently. However, still at issue is whether further development of a more industrial nature is in accord with subsection (a). Subsection (b) refers to protection of outstanding landscapes. This site is part of an outstanding landscape and further discussion on this issue is contained in Section 8.2.2.

Section 7 (b), (c), (d), (f) and (g) are relevant to this site. It is considered that only if the existing airport site at Frankton is confirmed as being totally unsuitable for future use, should Jardines be an option for development given that such development will compromise the landscape quality and amenity value and remove from production high quality agricultural land. Only then could the development be considered an efficient use and development of natural and physical resources.

9.3.12 Regional Plan Provisions

A discussion of relevant regional plan issues is included in the Queenstown Hill evaluation, refer Section 9.2. A water discharge consent may be necessary for drainage works associated with airport development. On site incineration of waste is not the only option for waste disposal on this site given the easy access to a major transport route and therefore an air discharge consent is probably not required.

Proposed Regional Policy Statement

The proposed RPS is dealt with in Section 9.2.13 of this report in relation to the Queenstown Hill site. The following objectives in relation to soils are considered relevant to the Jardines site:

"5.4.2 To avoid, remedy or mitigate degradation of Otago's natural and physical resources resulting from activities utilising the land resources."

"5.5.3 To minimise the rate of degradation of Otago's land resource through promoting and encouraging land use practices which

(a) maintain, and where practicable, enhance the soils life supporting capacity; and

(b) minimise soil loss; and

(c) maintain, and where practicable, enhance healthy ground cover; and

(d) avoid, remedy or mitigate the detrimental contamination of soil.

"5.3.2 The primary productive capability of Otago's land resource may be compromised by activities which result in one or more of the following:

(a) the loss of vegetation cover; or

(b) the degradation of the soil resource; or

(c) flooding or inadequate drainage.

Soil degradation is defined as "a change in soil properties that causes a long term decline of productivity." Soil erosion is the most severe form of soil degradation but may be preceded by less obvious changes to physical, chemical and biological properties of topsoil and subsoil that affect plant growth and long term productivity. The more subtle forms of soil degradation may take the form of topsoil compaction, loss of permeability, loss of fertility, increasing acidity, loss of organic matter and declining biological activity."

"5.5.2 To retain Otago's existing high class soils for use in primary production except where no practicable options exist to accommodate other uses.

Explanation

High class soils are limited within Otago and should be retained, as far as practicable, for primary productive purposes in order to protect their versatility to meet the needs of future generations. Uses which remove those soils from primary production will need to demonstrate that they can go nowhere else within Otago."

The Jardines site is located on one of the only large areas of flat land in close proximity to Queenstown. It is identified as being of high value for food production in terms of District Plan provisions.

The development of Jardines site is difficult to reconcile against these objectives and policies. This is expanded in Section 9.3.3 Land Use Patterns.

One of the identified issues in the Plan is set out below:

"5.3.4 Otago's outstanding natural features and landscapes are threatened by inappropriate subdivision, use and development.

Explanation

Much of Otago's natural character is derived from its natural features and landscapes. RMA requires protection of outstanding natural features and landscapes from inappropriate subdivision, use and development. This protection is required in order to ensure that those features and landscapes will always be a part of Otago and that they will be there for future generations to enjoy."

The accompanying Objective 5.4.3 is

"5.4.3 To protect Otago's outstanding natural features and landscape from inappropriate subdivision, use and development."

This matter is further canvassed in Section 9.3.2 but it should be noted that the Jardines site is recognised as an area of landscape importance (refer Section 9.3.13).

Objective 5.5.5 is relevant to this application.

"5.5.5 To minimise the adverse effects of landuse activities on the quality and quantity of Otago's water resource through promoting the:

(a) Creation, retention and where practicable enhancement of riparian margins; and

(b) Maintaining and, where practicable, enhancing vegetation cover to safeguard land and water values; and

(c) Avoiding, remedying or mitigating the contamination of groundwater and surface water by chemicals, nutrients and sediments resulting from landuse activities."

The issue of stormwater runoff from the sealed runway area is specifically addressed in Section 8.2.3. This effect can be mitigated by siltation control measures and drainage works which are subject to discussion and consent by the Regional Council. A water discharge consent is required.

Policy 6.5.5 refers to the need "to promote a reduction in the adverse effects of contaminant discharges into Otago's water bodies". This application does not involve the discharge of contaminants. There will be increased stormwater runoff from the proposed development. Any deposit of hydrocarbons into the stormwater system as a result of airport operations will be safeguarded against by the adoption of a drainage plan and traps/bunds to contain such substances. These works can be the subject of discussion with the Otago Regional Council.

Policy 6.5.9 refers to the need to provide mitigation to lessen the threat posed by flooding. Alterations to permeability of the land surface can affect surface run-off and have implications for a water catchment area (this site is swampy in places). However, those effects which are possible from an increased sealed runway area can be mitigated by water management and flood protection engineering solutions. No evidence of flooding of the site is known although swamp vegetation is evident to the west of the runway alignment. The proposed works are unlikely to be significant in terms of flood risk.

Policy 9.5.2 focuses on promotion of efficiency in the development and use of Otago's infrastructure through "(a) Encouraging development that maximises the use of existing infrastructure while recognising the need for more appropriate technology."

The explanation refers to the reduction in costs to the community as a result of consolidation and improved use of existing infrastructure. Policy 9.5.3 refers to the sustainable management of Otago's transport network. Again the maintenance of existing available transport resources is an emphasis. In this case the airport development would be a significant new development in the transport network which would also require some traffic improvements at Kawarau Falls Bridge.

Wastes

"Obj 13.4.1 To protect Otago's communities and resources from the adverse effects of the waste stream, including hazardous substances and wastes.

Explanation

The disposal of wastes and the storage, use, disposal and transportation of hazardous substances and wastes can create many adverse effects which have the potential to damage the environment of Otago. There is a need to protect Otago's environment from the actual and potential effects associated with the waste stream. The adverse effects can take many forms and include:

- threats to ecosystem health and integrity
- threats to human health
- land contamination
- ground water contamination
- surface water contamination
- air pollution
- decreased amenity values
- impact on mahikakai values

Waste disposal off site will not be difficult in view of the proximity to SH6. Sewage disposal would be required and an on-site disposal system of disposal would be envisaged. Careful management of stormwater runoff will be required to ensure that no pollutants escape into the system. The same is true of potential ground contamination beneath tarmac areas.

These comments are reiterated in a discussion on the provisions of the Proposed Regional Plan: Waste in Sections 9.2.13.

9.3.13 District Plan Provisions

Under the Transitional District Plan for Lakes Queenstown Wakatipu District Council, the site is zoned Rural A. This zone identifies land having a moderate to high value for food production specifically in the "Kingston-Garston area in the vicinity of State Highway 6." The relevant policy is "... to ensure that the agricultural potential of the district is maintained and supported ... to encourage ... the use of this land for active farming purposes and to discourage development which would result in the loss of the land from active production. It is the intention however to permit uses providing a service to the rural community." While the airport would provide an essential service to the community, the development of Jardines would result in a loss of productive land which, as indicated in Section 9.3.3 is unlikely to be replaced by rehabilitation of the Frankton site to agricultural use.

The provision for airstrips as permitted activities subject to Committee discretion is discussed in Section 9.2.14. As the proposal incorporates terminal development, parking, lighting and other associated works it is appropriate that the matter be dealt with as a non-complying activity.

The subdivision provisions, particularly Rule 6.05, are likely to be relevant and non-complying activities would be assessed against the policy for retention of high class soils.

Decisions on submissions to Proposed Plan Change 99 are to be incorporated into the Proposed District Plan due for release in mid October. Protection of the landscape is set out as a fundamental objective of the Transitional District Plan and the Plan Change. The Jardines airport site is identified as an area of landscape significance. The specified Plan Change objectives are attached in Appendix B. Those of most relevance to consideration of the Jardines site are (i), (iii), (v), (vi), (viii), (x) and (xi). The Plan Change originally identified a suitable settlement site in the location which is the subject of these investigations into airport development. It is understood that, as a result of submissions, this node will no longer form part of the Plan Change. Further settlement anywhere in the valley except in the lee of the Remarkables, would be inappropriate in view of environmental effects which would arise from airport operations, specifically noise.

A preliminary assessment of a potential airport development at Jardines against the District Plan objectives and policies concludes that there are conflicts between the activity and the District Plan provisions and also some conflicts between expected outcome of the Plan provisions. The main problems with the site are the loss of prime agricultural land and modifications to an area of landscape significance.

9.4 WANAKA

9.4.1 Description Of Environment

The Wanaka site comprises the existing Wanaka Airport. It is situated adjacent to SH6 (Albert Town Road). To the east is the Clutha River and about 2.5km to the south is the Luggate township. The site is a river terrace and the soils are Luggate shallow sandy loam which are not high class. The airport is contained within the flat elevated terrace which drops away steeply at the south some 500 m from the 29 runway end. To the north the terrace extends further but a shelter belt is located parallel to the 11 runway and some 500 m distant. Mountains form a backdrop to the east and west.

The on-site environment, as shown in photographs 8 and 9 consists of a 1200m x 30m sealed strip and 15m taxiway. A series of hangars and the Fighter Pilots Museum are sited adjacent to the taxiway. A private hangar and grass airstrip are sited between the site and SH6.

9.4.2 Physical Effects

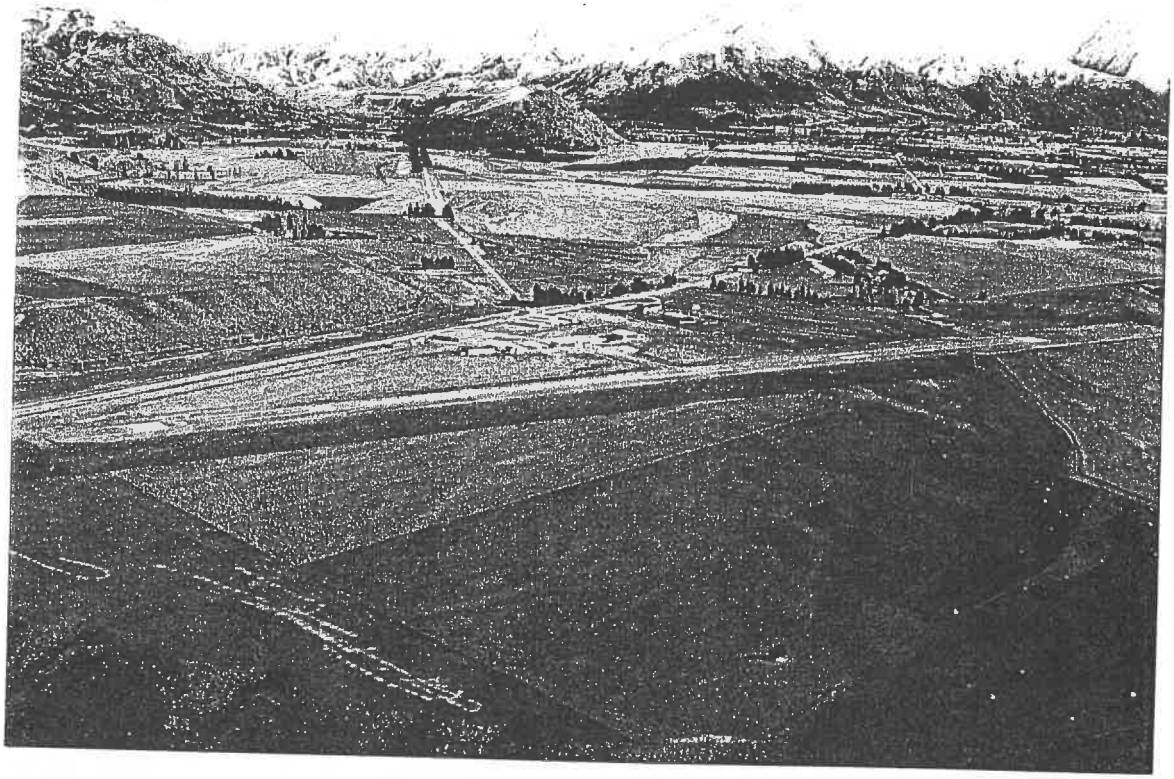
Landscape and Visual Effects

Wanaka Airport has an attractive setting. The airport site is screened from the township of Luggate by high ground (terrace) leading to Mount Barker and by the complex system of terraces. Luggate lies in a hollow in the lee of the Pisa Range. One farmhouse is located off the north end of the runway. Existing farmhouses are protected by established shelter and would have a filtered view of the airport. Strategic planting is likely to screen most of the airport activities. The SH6 alignment is such that the airport is only visible travelling north when turning the bend in the highway which is about at the 29 runway end (refer photograph 10). The State Highway veers away from the airport in a north westerly direction and it is not anticipated that a more intensive airport development would be visible when travelling in either direction along SH6 except in close proximity to the facility. Views from the farmland on the terrace above the airport would include the runway although there appeared to be no dwelling in this location. At elevation the hangars and airstrip are noticeable and give an impression of a small scale rural industrial activity. However, there are no ski fields or public lookout points which would have the airport in their view.

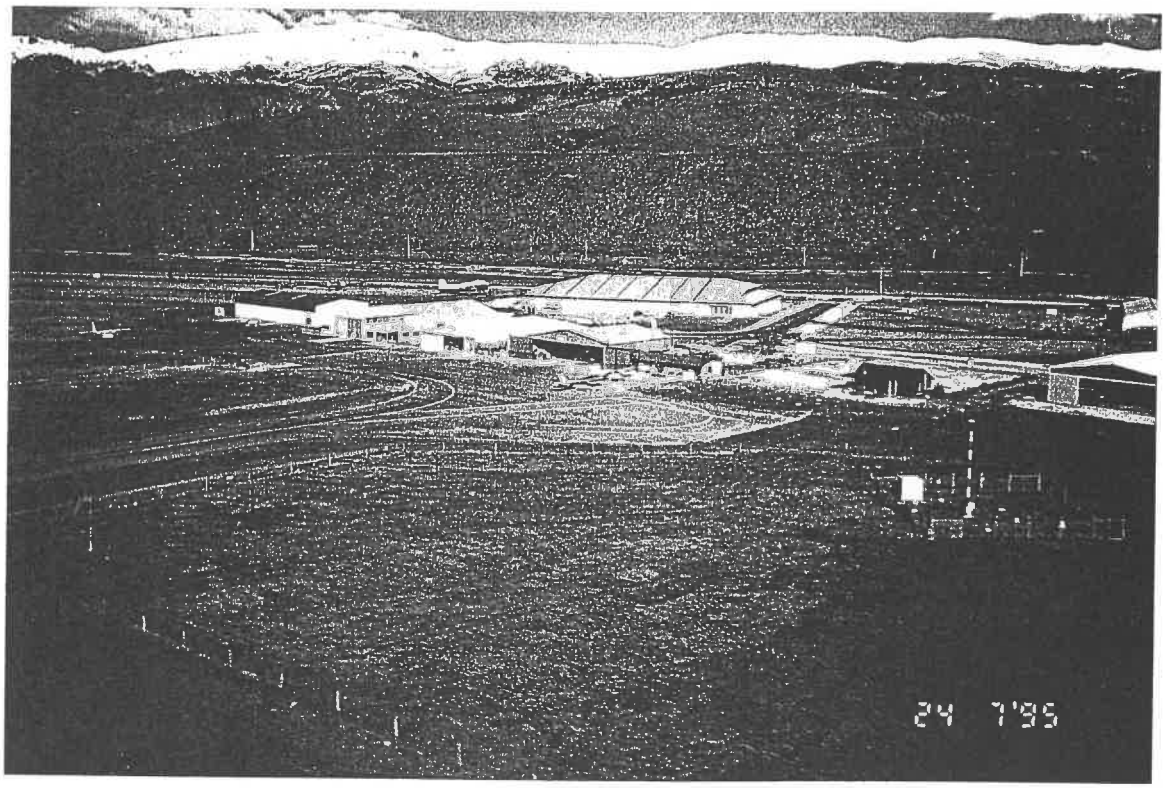
Upgrading of this airport to an international facility would result in minor changes to the existing landscape and providing buildings are of a low profile, ie maximum of two storeys the visual impact would be minor.

While the Transitional District Plan classifies the vicinity as of high landscape quality, in terms of the overall high quality of scenery and landscape in the study area, it is considered that this specific site and surrounding area is of less importance and would not be classified as outstanding when compared with the immediate environs of Queenstown township.

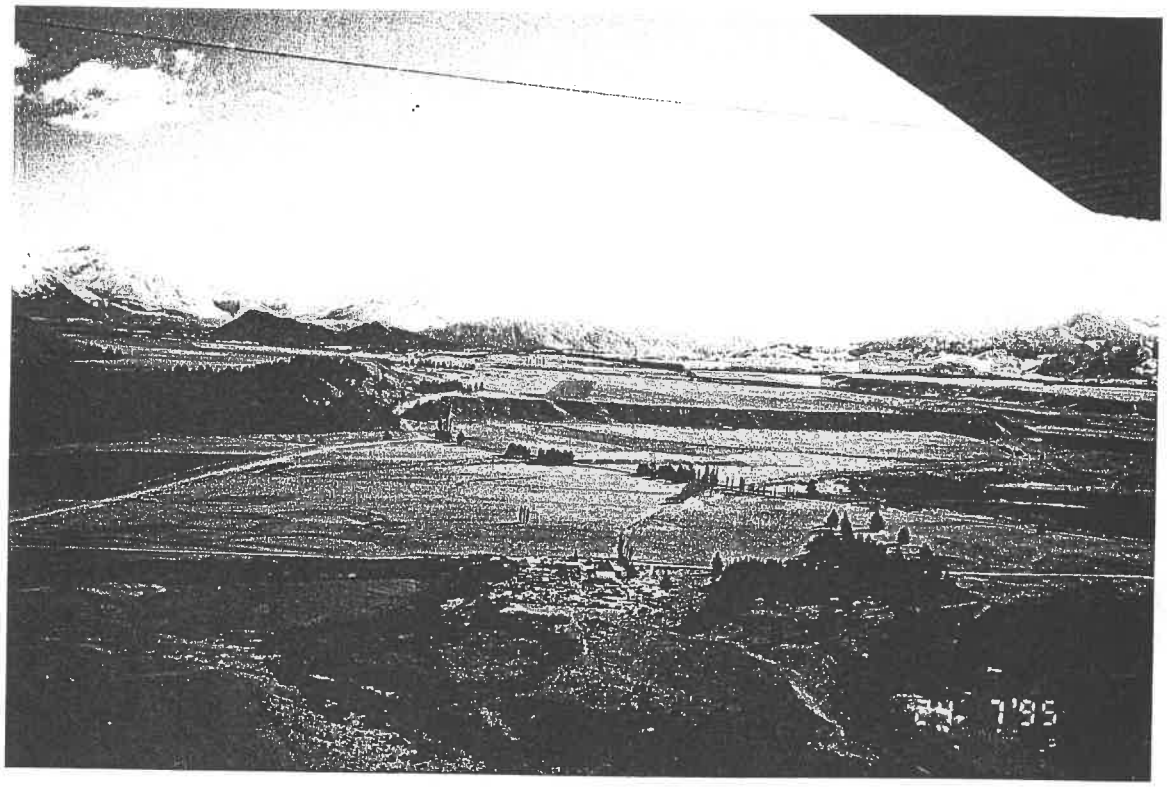
WANAKA
ON SITE ENVIRONMENT AND SURROUNDING LANDSCAPE



8) **View North-west**



9) **View of Airport Buildings with Mt Barker in Distance**



10) Wanaka Airport - Access from the South

The Terrace at the Base of Mt Barker Conceals the Airport from View

9.4.3 Land Use Patterns

The airport is in a rural locality where dry stock farming prevails. The soils are not of high quality. Airport development would involve more intensive development of the site for terminal and parking and there would be loss of agricultural land where a runway extension to 2,000m was required. The effect of this loss of agricultural land would be minor. Acquisition of at least one house off the northern end of runway could be required.

9.4.4 Noise

The basis for assessment of noise, as discussed in Section 9.2.4, in relation to the Queenstown Hill site is also applied to the Wanaka site. The following table sets out runway usage.

	Runway Orientation	Runway Usage
Wanaka	11-29	Depart RW 11 70% RW 29 30%
Assumptions • Terrain moderately flat • Runway 2km long • No cross runway • All tracks straight		

Assessment

The existing timber mill at the end of runway 29 is located within the 65 dBA contour. As this is an industrial activity, no noise mitigation measure would be required and operation of this facility could continue in the short term with the potential need to acquire the land in the future. The farm house at the 11 end of the runway is likely to be noise affected and may need to be acquired. Some of the houses in the north-east part of Luggate will lie inside the 55dBA contour but the majority of the town lies outside this contour. A few rural properties on the Luggate - Cromwell Road to the east of the town will also be inside the Ldn 55 contour (outer control boundary). A number of houses in Albert Town also fall inside the Ldn 55 contour.

9.4.5 Ecological

There are significant conservation values in the environs of the Wanaka Airport according to DOC. Should this site become the preferred airport site, a detailed evaluation of the proposal in terms of botanical and entomological values would be required.

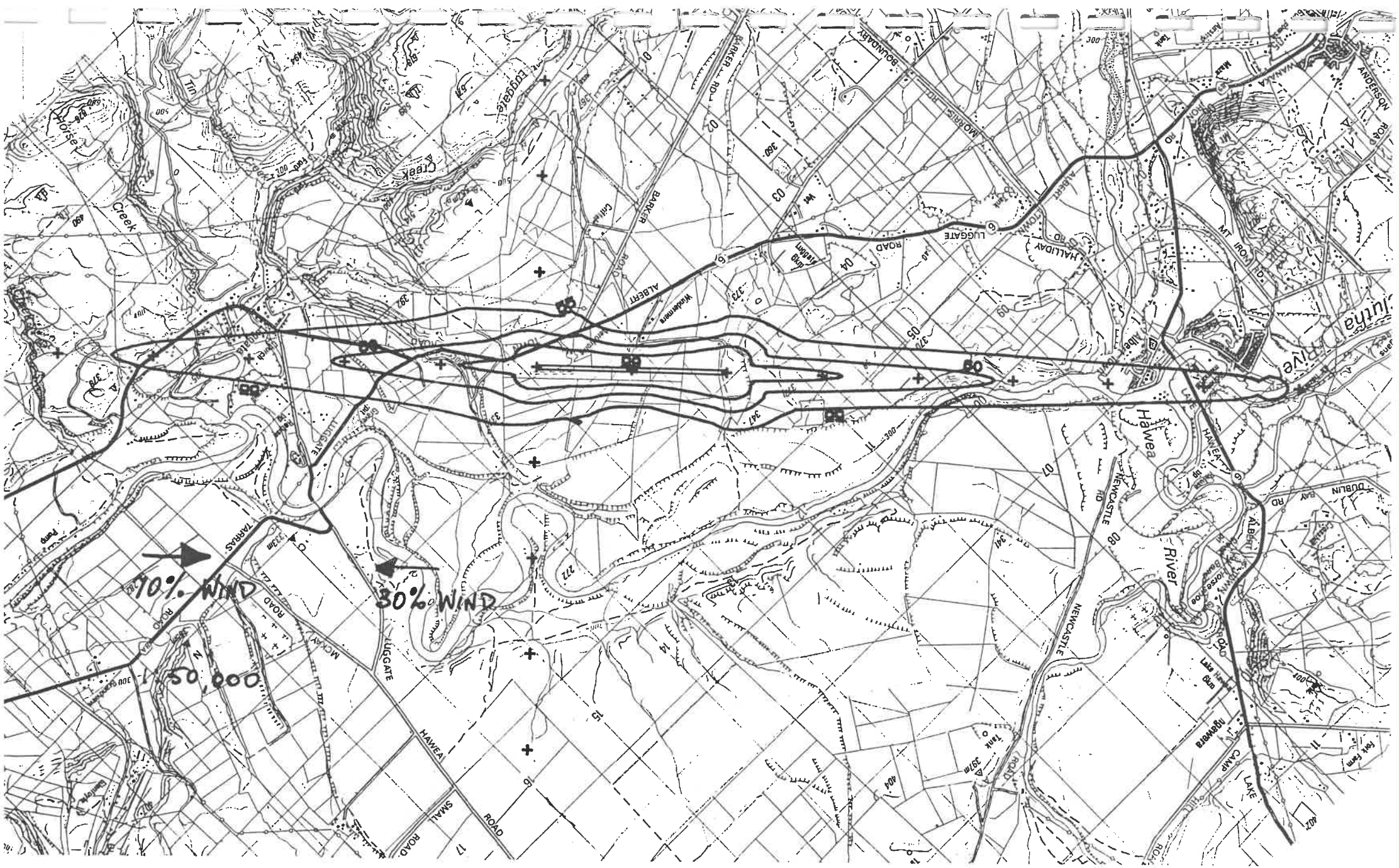


Figure 9.3
NOISE EXPOSURE FORECAST
WANAKA

9.4.6 Archaeological, Cultural Historic

Contact with the Historic Places Trust and the Manager of Iwi Liaison (Otago Regional Council) has established that there are no known archaeological or cultural values associated with the Wanaka Airport site.

9.4.7 Safety

The existing airport has only one dwelling off the runway and near the centreline alignment. International Aviation accident statistics indicate that the area where aircraft accidents have mostly occurred is on the airport and on the runway centreline within 1,000m of the runway threshold. Acquisition of this dwelling would be required.

Jet aircraft do not currently use this airstrip very often and the introduction of low-flying jet aircraft is not considered to be significant in terms of safety issues.

Effects of Low Flying Aircraft

Apart from noise and safety which are addressed in Sections 9.4.4 and 9.4.7 respectively, environmental effects from aircraft operations can be defined as:

(i) Dispersion of fuel droplets and carbon particles which may contain some unburnt hydrocarbons on aircraft take-off

(ii) Wind gusts from aircraft taking off or landing

(iii) Visual impact of low flying aircraft

The outcome of item (i) is likely to be a very fine level of impact. At this stage, given the rural setting and the unlikelihood of the airport becoming so heavily trafficked for air emissions to be a significant problem, this issue is identified but does not warrant further consideration.

The outcome of item (ii) is considered to be nil given the distance of the take off and landing thresholds from existing habitation. In addition the depth of the RESA areas will ensure that engine runup prior to takeoff is not a problem.

The visual impact of low flying aircraft (either from take off or landing) is dealt with in Section .... As the aircraft will not be directly overhead on the centreline alignment there is unlikely to be a significant adverse effect. Increased visual effects will result for people occupying the farmland to the northwest and west but strategic planning around dwelling houses and the airport facilities will minimise this effect.

9.4.8 Natural Hazards

The only known natural hazards affecting development at Wanaka Airport are snow and fog which are separately discussed in Section 5.

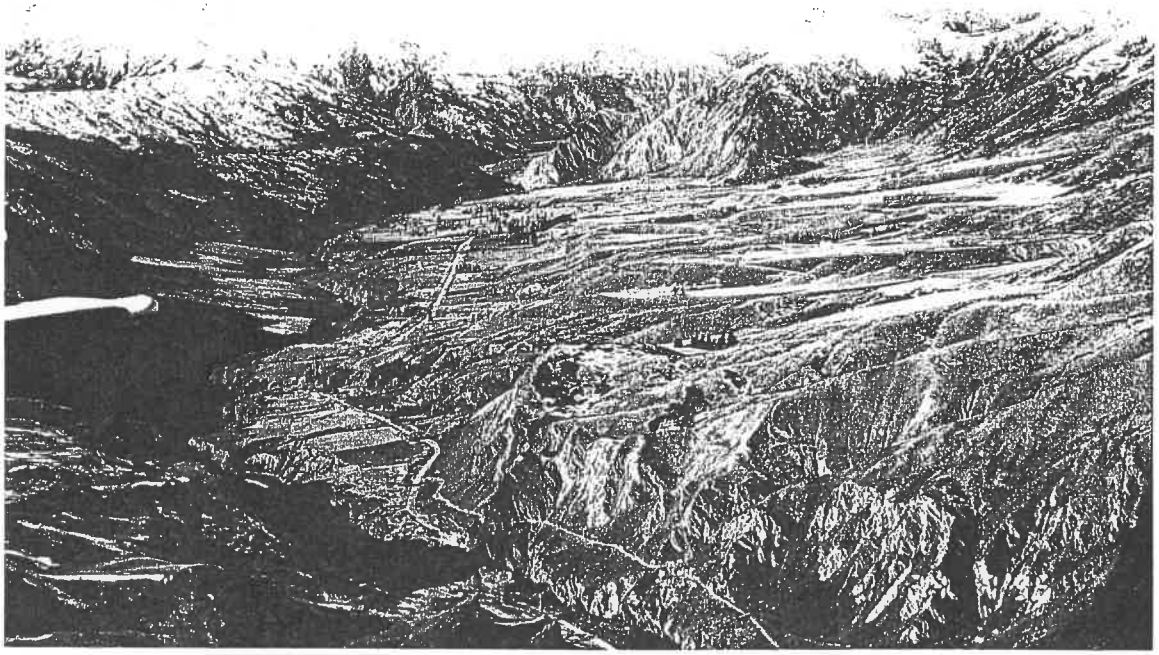
9.4.9 Traffic

Traffic volumes are not an issue, but the only route to Queenstown would be through the Kawarau Gorge which is considered to be an undesirable major access route for coaches. This is a narrow winding road which has high incidences of ice in the winter. An aerial view of the Kawarau Gorge is shown on photographs 11 and 12. Accident statistics from Transit New Zealand indicate that a number of road accidents occur in the Kawarau Gorge. Access to Queenstown via the Crown Range would be inappropriate for the same reasons and the fact that this route is often snow covered in the winter and recognised by rental car firms operating out of Queenstown as being hazardous. Distance from Queenstown is identified as an issue elsewhere in the report.

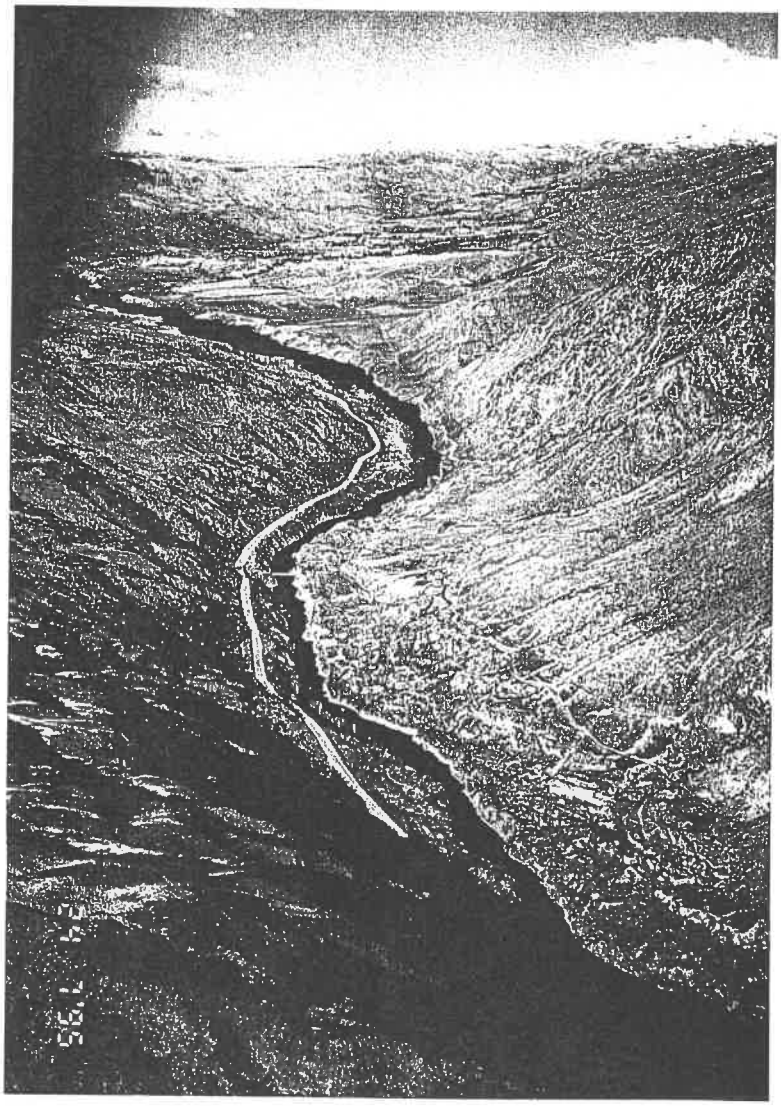
9.4.10 Hazardous Goods

The transportation of fuel would logically occur via Cromwell from Dunedin or Invercargill which would mean no need for vehicles to use the Kawarau Gorge.

AERIAL VIEWS OF KAWARAU GORGE



11)



(12)

9.4.11 Statutory Considerations

Assessments of Queenstown Hill and Jardines have recorded the relevance of Sections 5, 6 and 7 of the RMA. In this case Section 5(a) refers to sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations.

Wanaka airport is an existing physical resource. Further development of such resource in the context of this study would be on the basis of meeting the transportation needs of future generations and would therefore be in accordance with Section 5(a). Section 5(b) is not of importance in this case given that the airport is already developed and recognised in the transitional district plan. No high class soils are identified and further works involved in runway extension and airport development will employ practices of re-using topsoil. Section 5(c) refers to environmental effects. Effects associated with Wanaka Airport are noise impacts on Luggate and farmhouses and minor visual effects. The former are not significant enough to warrant land acquisition with the possible exception of the home at the end of the northern end of the runway but acoustic measures for new dwellings and additions to dwellings can mitigate against adverse effects on residential amenity. Landscaping is a mitigation measure to reduce visual impact.

There are no matters of national importance identified for Wanaka. The landscape is not identified as being outstanding.

In terms of Section 7 subsections (b), (c), (f) and (g) are relevant.

More intensive development of Wanaka Airport is an efficient use and development of a physical resource. Amenity values will be maintained by noise mitigation measures and planting. The environmental quality will be similar to what exists.

In terms of (g) the findings of this study reinforce the fact that criteria for development of airport sites of the scale envisaged are difficult to meet. Available and operational sites which are permitted in District Plans must therefore be considered to be finite resources, the efficient management of which is important to achieve the principles of the RMA.

9.4.12 Regional Plan Provisions

These matters have been extensively canvassed in the preceding two assessments. The relevant provisions for an assessment of this site are the matters relating to stormwater and drainage discharges (existing stormwater discharges via natural runoff into the Clutha River and is a permitted activity).

PLAN CHANGE 1

Plan Change 1, relating to air discharges, is not relevant in that waste products are unlikely to be incinerated on site. Waste management will involve contracting these works.

9.4.13 Proposed Regional Policy Statement

The references to the importance of tourism (Section 3.3) are of relevance as for all sites. References to high class soils and outstanding landscapes are not relevant.

Objective 5.4.2 and Policy 5.5.3 are supported by development of Wanaka Airport as an existing valuable physical resource. No high class soils are affected and soil management can be employed to ensure that future development does not remove totally from production topsoils.

Objective 9.5.4 refers to minimising the adverse effects of structures and developments on Otago's environment in terms of inter alia:

(a) discharges;

(b) noise, dust;

(c) visual intrusion.

Sections 9.4.2, 9.4.4 and 9.4.7 of this report have dealt with these matters. All are able to be mitigated in terms of measures specified in these sections.

Policy 9.5.2 focuses on promotion of efficiency in development and use of Otago's infrastructure through

"(a) encouraging development that maximises the use of existing infrastructure while recognising the need for more appropriate technology".

Wanaka Airport is already part of the transport network and Policy 9.5.3 refers also to sustainable management of that network. This emphasis has prompted inclusion of Wanaka in the shortlisted sites.

Section 15 identifies that the effects of an activity or process are not always constrained to the area in which they originate, eg the region's land transport network.

The proposed RPS indicates that the recognition of the actual and potential transfer of adverse effects between areas is required to enable the sustainable management of the entire region.

In this case the issue of connection between Wanaka and Queenstown by road involves transportation through a gorge in the Central Otago district. Additional vehicle movements and in particular coach movements are likely to increase the potential for accidents in this area.

9.4.14 District Plan Provisions

Under the Vincent County Section of the Plan for Lakes Queenstown Wakatipu the site comprising Pt Lot 1DF 16921 BLR VIII Lower Hawea SD and 81.5214ha is designated "Luggate Airport". In terms of this designation all airport works within the area of the designation are permitted.

The land to the east (at the end of the runway 29 (end)) is zoned Rural 1 and the remainder of land is zoned Rural 2.

Rural 1 is the general rural zone while Rural 2 is a landscape protection zone. The zone is intended specifically to protect the approaches to Lake Wanaka and the upper reaches of the Clutha River.

The District Plan recognises the importance of the existing landscape as a tourist attraction either due to its scenic qualities, historic associations (gold running) or outdoor recreation opportunities. The Plan also recognises the strategic importance of Vincent County has in providing the connecting transportation routes between the main tourist routes and urban areas.

The Plan identifies the areas around Luggate and Albert Town as being quiet retirement areas, close to recreation opportunities and indicates careful assessment is required for future large scale projects and identifies that investigations have been carried out into hydro electric energy projects - Luggate and Queensberry.

PLAN CHANGE 99

Under Proposed Plan Change 99 the site is in an area zoned Rural 2 and adjoins the Rural 1 zone at the southern end. This Rural 1 zoned land is at a lower level below the river terrace and no acquisition of this higher quality agricultural land would be necessary. A runway extension to the northwest would take out of production some 9 to 12 ha of land used for pastoral farming.

Plan Change 99 notes Mt Barker as a special landscape figure and seeks to avoid the adverse effects of development in the vicinity. Any airport development would be on flat land at the base of Mt Barker. Existing development has no interrelationship or impact upon Mt Barker and this would be the expected outcome for an expanded airport on this site. The open rural nature of the valley will still be the predominant character.

9.5 CROMWELL TERRACES

9.5.1 Site Description

The Cromwell Terraces site is an existing airstrip on a terrace between Chinaman and Birchalls Gully to the east and west and Clarks Road and Harriers Gully to the north. To the east is State Highway 6 and to the west the Pisa Range. This terrace is one of a series of plateaus (separated by gullies) leading into the Pisa Range. The soils are lowburn shallow sandy loam and lowburn very shallow sandy loam which are not high class. The site has an existing grass strip 1,600 m x 60 m. There are shelter belts parallel to the runway to the east and west and at the 02 runway end two shelter belts define fields extending to the eastern side. A vehicle access exists off the Cromwell-Luggate Road at Lowburn Valley Road. This access is through Chinamans Gully. The airstrip is not visible from SH6 as the road passes at the bottom of the terrace.

PHYSICAL EFFECTS

9.5.2 Landscape And Visual Effects

Lake Dunstan and lowland farmland dominates the valley at a low level with the Dunstan and Pisa mountain ranges framing the valley to the east and west respectively. The landscape between Lake Dunstan and the Pisa Range is of elevated flat plateaus used for farming purposes, with higher ground rising to the Pisa mountain range to the west (refer photographs 13 and 14).

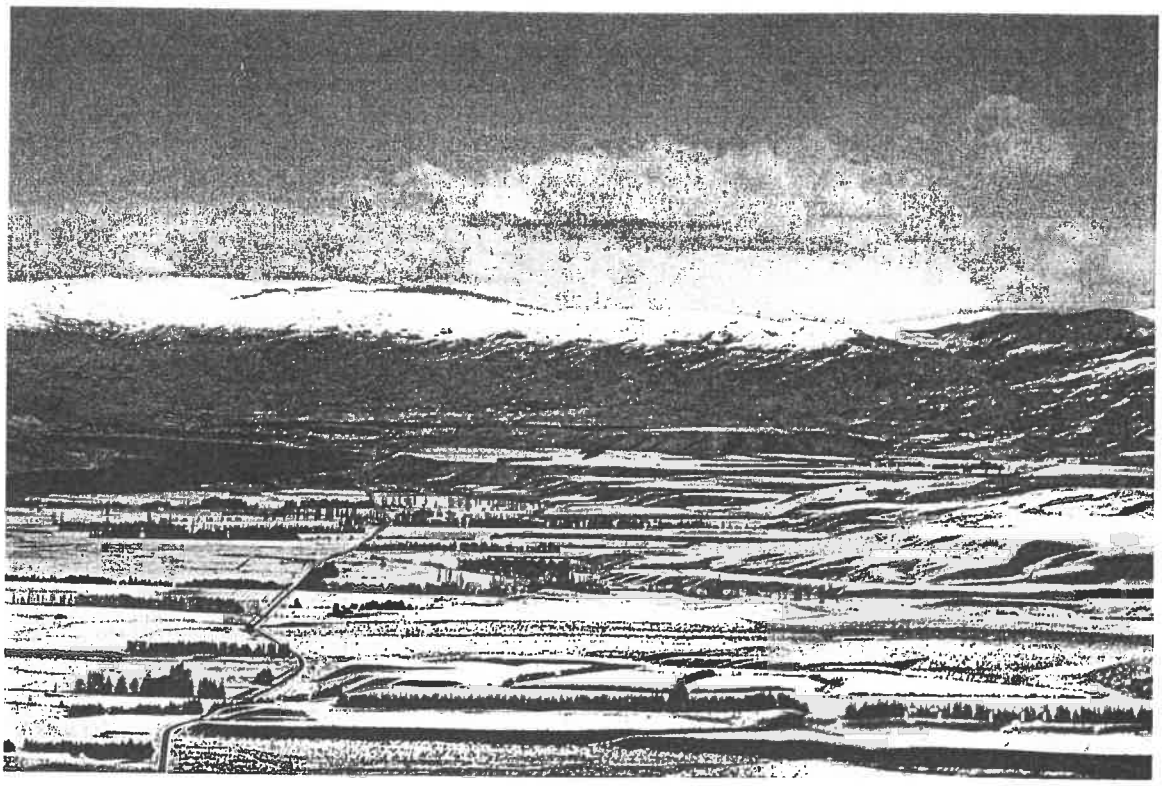
At the level of SH6 the plateau and gully landscape is not clearly defined and the impression of the site is an airport being established on top of a hill. However, an aerial view indicates that there are substantial amounts of flat land in terraces above the road level. The landscape has an open rural character with arguably the more attractive view being at the upper end of the valley where the mountains frame the farmland and Clutha River below.

The site, the subject of this analysis, is part of generally open pastoral farmland characterised by few buildings. Some shelter belts and contouring evidence cropping activities.

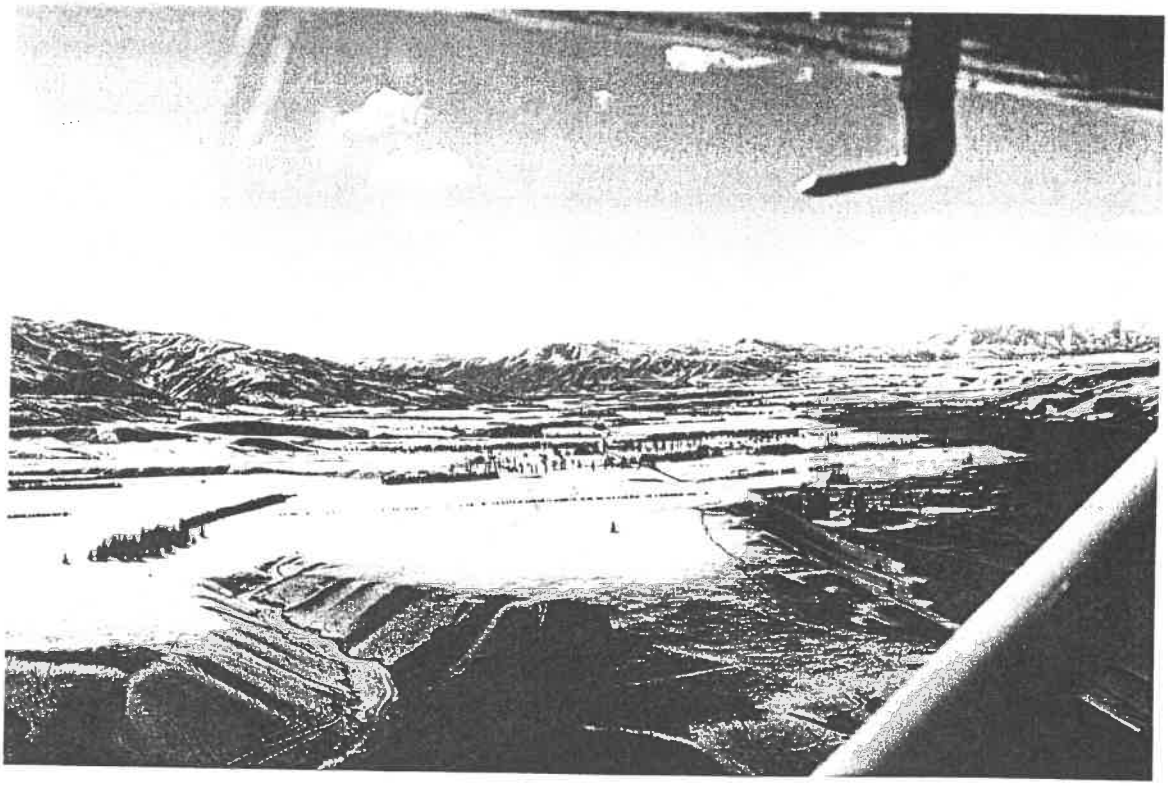
9.5.3 Land Use Patterns

The airstrip is predominantly being used for topdressing although Mt Cook Airlines has also used this strip in the past. As indicated the neighbouring properties are used for farming purposes. The neighbourhood comprises an old river bed and glacial stone formations. The soil is lowburn shallow sandy loam and lowburn very shallow sandy loam which is not of high quality for food production. There is no evidence of erosion. The development of the site for a full scale airport would involve the utilisation of additional agricultural land for construction of a terminal and associated infrastructure. This would reduce the available agricultural land by about 60 ha. Given that rainfall in the area is low and the soils relatively stoney, the loss of land for agricultural purposes is not considered significant.Noise

LANDSCAPE : CROMWELL TERRACES



13) View South - Grass Strip (snow covered) on Terrace Immediately to West (right) of Lake Dunstan



14) View North - Airstrip to West (left of picture)

9.5.4 Noise

The basis for assessment of noise, as discussed in Section 9.2.4, in relation to the Queenstown Hill site is also applied to the Cromwell site. The following table sets out runway usage:

	Runway Orientation	Runway Usage	
Cromwell	02-20	Depart RW 20 RW 02	50% 50%
Assumptions • All terrain moderately flat • Runway 2km long • No cross runway • All tracks straight			

Assessment

The Ldn 55 dBA contour passes through the area marked as the township of Lowburn and it appears that a quarter of the town would lie inside the 55 dBA contour. Up to six rural properties would also fall within the 55 contour, being located in Lowburn Valley between the site and Lowburn.

A visual inspection noted that there were no farmhouses at the 02 end of the runway along their centreline alignment within the 55 Ldn contour. The Cromwell and Wanaka sites can be deduced to have similar noise effects on existing rural communities.

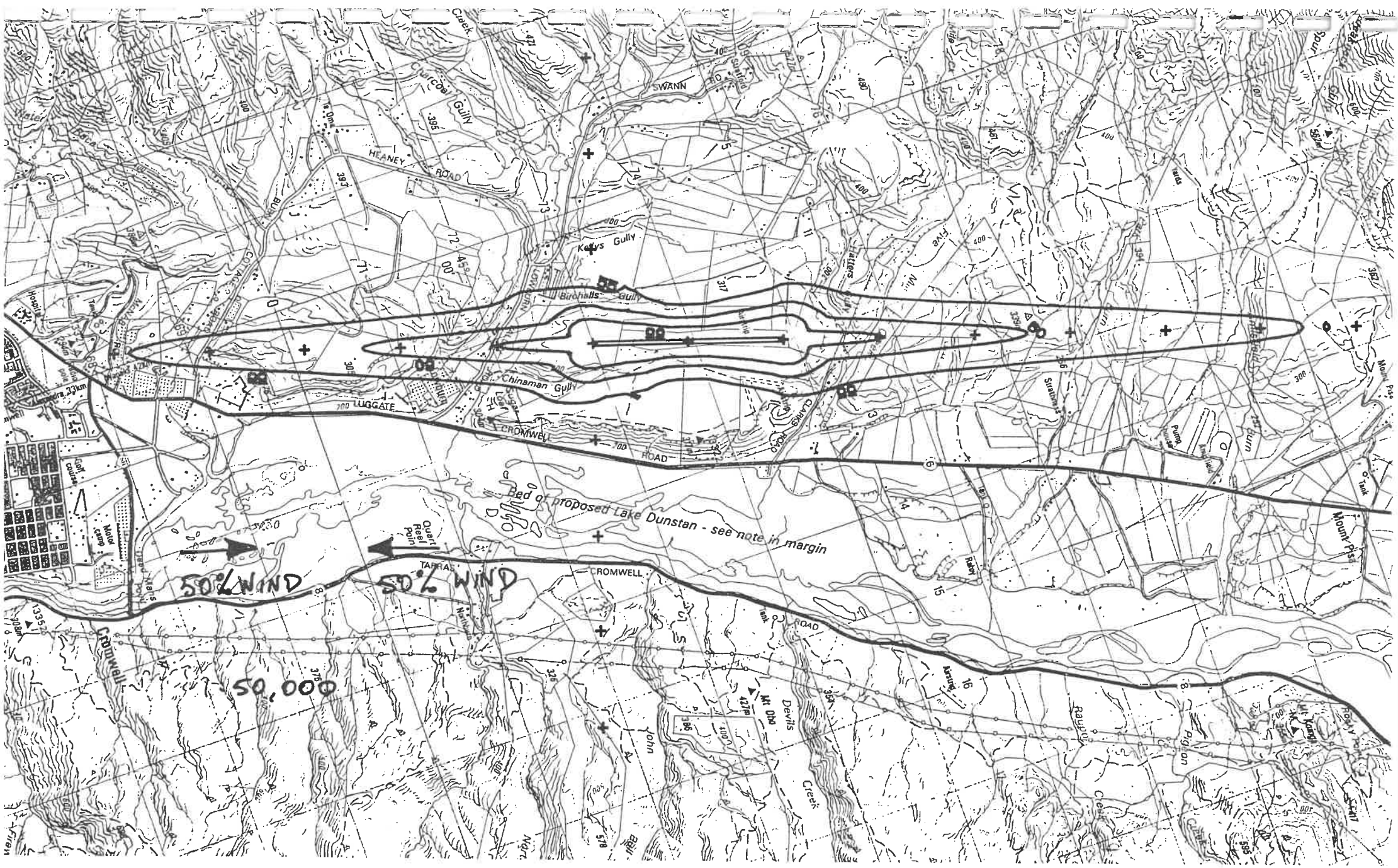
9.5.5 Ecological

There is no record available from sources at DOC and Central Otago District Council of conservation values present at the Cromwell Terraces site.

9.5.6 Archaeological/Cultural/Historic

According to the Historic Places Trust there are a number of recorded sites relating to goldmining activity (including dams, tailings and shafts) in Gilbys, Kellys, Burchalls and Chinaman Gullies. Earthworks and development associated with an airport would not interfere with these sites. However, prior to any road upgrading in Chinaman's Gully a more detailed archaeological survey would be required.

There was historic Maori occupation of this area and sites of cultural significance may exist on the Terraces. However, confirmation of these would be subject to an archaeological survey.


N
1000 0 1000 2000 3000 4000
SCALE IN METRES 1:50,000 @ A4
Figure 9.4
NOISE EXPOSURE FORECAST
CROMWELL

9.5.7 Safety

There are no existing dwellings on the runway centreline within this area. However, the plateau falls away steeply at each end and aircraft overshooting the runway would fall off the edge. Aviation accident statistics indicate that the area where aircraft accidents have mostly occurred is on the airport and on the runway centreline within 1,000m of the runway threshold. The available length of runway is greater than the existing Frankton airport site and the ability to accommodate a 90 m RESA should improve the overall safety of this strip.

Effects of Low Flying Aircraft

Apart from noise and safety which are addressed in Sections 8.3 and 8.5 respectively, environmental effects from aircraft operations can be defined as:

(i) Dispersion of fuel droplets and carbon particles which may contain some unburnt hydrocarbons on aircraft take-off

(ii) Wind gusts from aircraft taking off or landing

(iii) Visual impact of low flying aircraft

At this stage, given the rural setting and the distance of the takeoff and landing thresholds from existing dwellings, combined with the unlikelihood of the airport becoming so heavily trafficked for air emissions to be a significant problem, the outcome of items (i) and (ii) is considered to be nil.

The visual impact of low flying aircraft would not be significant for the neighbouring properties given their distance away and screening by topography and shelter belts. As with Queenstown Hill, travellers on SH6 may have the sensation of seeing lowflying aircraft disappear into elevated land. However, once an airport became established on the site, people would become accustomed to this situation.

9.5.8 Natural Hazards

The site is not subject to any hazard apart from snow on occasions in the winter. Erosion and flooding is not a problem.

9.5.9 Traffic

There is an existing vehicular access to the site through Chinaman's Gully via Lowburn Valley Road. The access would require upgrading to cope with the volumes of airport traffic. It is screened from SH6 and the township of Cromwell. Some intersection upgrading may be required at the junction of Lowburn Valley Road and SH6. The major access problem associated with this site is the necessity of accessing Queenstown via the windy Kawarau Gorge. As stated in comments on the Wanaka site, this route is undesirable as the major transport route for coach traffic. It is prone to icing during the winter. Transit NZ accident statistics indicate that there is a high incidence of traffic accidents occurring along this stretch of road.

9.5.10 Hazardous Goods

The transportation of fuel could be routed via Cromwell to avoid use of the windy Kawarau Gorge.

9.5.11 Statutory Considerations

The preceding assessments have dealt in detail with the significance of Sections 5, 6 and 7 of the RMA for an assessment of site suitability. This site is an existing airfield. However, as it only consists of a grassed strip, its use for agricultural purposes is not, at present, compromised. In terms of Section 5(b) its present state safeguards the life supporting capacity of the soil. However, the soils are not of high quality for food production and more permanent construction works for an airport would not conflict with Section 5 which sets out the purpose of "sustainable management" as managing the use, development (underlining added) of natural and physical resources in a way "... which enables communities to provide for their social, economic ... well-being."

In terms of Section 5(c) there are minimal adverse environmental effects identified. The main concern is over the access route via the Kawarau Gorge and the need to evaluate the exact location of cultural sites.

The only relevant matter of national importance under Section 6 may be (e), "The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga". The significance of this issue is not confirmed at this stage as the exact location of cultural sites has not been determined by the Kati Huirapa Runanga. However, it is possible that airport development could occur around these "sites" without disturbance to them. Should the Cromwell Terraces be nominated as the preferred alternative airport site, then an archaeological survey should be commissioned prior to any further planning being undertaken.

Section 7(a) and (e) add further emphasis on the cultural significance of the site. Other matters in Section 7 relate to amenity and quality of the environment. It is considered that airport development can be designed on this site to blend (to some extent) with the environment. Lighting will not be visible except from elevation, although the indication in Section 4.3 is that lighting may be on structures and until the location of these lights is confirmed, more accurate comment cannot be made. Low level terminal and carpark lighting can be screened from neighbouring properties.

9.5.12 Regional Plan Provisions

The relevant regional plan provisions are identified in Sections 8.1.12 and 8.2.12 in relation to Queenstown Hill and Wanaka. Matters relating to stormwater and drainage discharges are relevant to this site also. Development of a drainage system may involve an application for discharge into a watercourse and possibly Five Mile Creek.

Air Discharge consents are unlikely to be required and it is probable that incineration of waste can occur at a facility in Cromwell rather than on-site, although on-site incineration would have only minor adverse environmental effects in relation to air emission.

9.5.13 Regional Policy Statement

The objectives and policies relating to high class soils and outstanding natural features and landscapes are not of significance for an evaluation of this site. Objective 5.4.4 refers to maintenance of public access to Otago's recreation and tourist opportunities. This objective is an important rationale behind development of any of the airport sites. Effects of air discharges (Objective 7.4.1) can be mitigated, as can the visual impact of the development (9.5.4). Dust will occur during the construction stage at all sites and measures to prevent adverse effects on neighbouring properties would be required.

The most significant regional planning issue in the case of the Cromwell site is referred to in Section 15. Section 15 identifies cross boundary issues, i.e. the effects of an activity are not always constrained to the area in which they originate.

Cross Boundary Issues

Section 15 identifies that the effects of an activity or process are not always constrained to the area in which they originate.

Examples

- The region's land transport network and the movement of road and rail traffic both across the region and between other regions
- The effects of weather events including flooding, droughts and snow
- The discharge of contaminants into the air or water or onto land

All of the resource issues considered within the Proposed RPS experience some sort of cross boundary issue.

"In such cases the community or area that is affected generally has little or no control over that activity. Therefore it occurs outside their administrative area" (or, conversely, the location of the activity in an adjoining area where it benefits another local community area).

"Recognition of the actual and potential transfer of adverse effects between areas is required to enable the sustainable management of the entire region."

The development of the Cromwell Terraces site would create substantially greater traffic volumes between Queenstown and the site via the Kawarau Gorge. The suitability of this site must be considered in terms of increased safety risks of larger numbers of heavy coach vehicles and light commercial vehicles (shuttle) travelling through a windy road. This is not a desirable choice of access and better routes exist in terms of the Frankton site and Jardines (subject to bridge upgrading or traffic management).

9.5.14 District Plan Provisions

The site is located in Vincent County which now falls into two local authority districts; to the west, Lakes-Queenstown-Wakatipu District and to the east, Central Otago District Council. The site is zoned Rural 1 (which applies to 90% of rural land). The purpose of the zone is to provide for a range of agricultural and horticultural activities with some rural factory farming, timber mills and forestry listed industries as discretionary activities. The proposal to establish an airport on the site would be a non-complying activity.

Emphasis in the Plan is on retention of a high level of visual amenity in the Rural 1 zone, notwithstanding that areas of special landscape significance are included in the Rural 2 zone.

Diversification of agricultural uses is encouraged in the context of avoiding the "indiscriminate mixture of compatible uses."

Another key objective is

"... to provide an adequate framework for rational utilisation of the resources in the district."

The proposal does not offend the general objectives and policies for the zone, being an efficient use and development of an existing resource in an area where visual impact will be localised and loss of agricultural land is confined to 60 ha of less productive land.

The District Plan identifies accessibility of water as a major problem in the semi arid and semi humid climatic zones, a category which applies to this site. Investigations into water availability for fire fighting and general terminal use has not been undertaken. Piping water from Lake Dunstan, or presumably the creeks in the gully areas, would be a cost on the development.

9.6 FRANKTON

9.6.1 Description Of Environment

The present airport is located on the Frankton Terrace with access from SH6A. It is owned and operated by the Queenstown Airport Corporation, a wholly owned trading corporate of the Queenstown Lakes District Council.

The site is flat and abuts the residential settlement of Frankton to the west and, beyond that, Lake Wakatipu. It adjoins the Shotover River bed which is some 14m below the level of the site. On other boundaries the land is rural with the Shotover Industrial Estate to the northeast. The extent of the land area now owned and being acquired by the Corporation is 131.23ha.

The airport is at latitude 45 degrees 01.3 minutes south and longitude 168 degrees 44.2 minutes east at elevation 1,171ft (357m). It is located in a relatively sheltered bowl, with the surrounding ranges and mountain peaks rising to more than 6,000ft above the airfield level. The Remarkables Range lies to the southeast, separated from Peninsula Hill by a narrow valley leading to the Jardines site. The ice sculptured hills; Queenstown Hill, K N°2, Ferry and Slope Hills are to the northwest. Morvern Hill is at the end of runway 23, some 3,000m beyond the airport boundary. The existing landscape is depicted in photographs 15 and 16.

The main runway is designated 05-23, is sealed and has the declared dimensions of 1,341m in length by 30m and 45m in width, within a grassed runway strip 1,524m long by 150m wide. The recent extension of the runway is not yet available for operational use but will increase the length to 1,459m. Ultimately a sealed width of 45m for the total length of the runway is planned for to comply with international and New Zealand standards for Code C commercial jet aircraft.

A parallel grass runway 645m x 40m is located to the north of the main sealed runway. A secondary runway, for crosswind operations by light aircraft, designated 14-32, is a prepared grass runway strip 944m long by 60m wide.

PHYSICAL EFFECTS

9.6.2 Landscape And Visual Effects

The Wakatipu Basin is an area of outstanding scenic qualities. The Queenstown Airport is an existing activity which is lawfully established by way of designation under the Transitional District Plan and, as such, it is a recognised part of the existing landscape or physical environment.

Flight paths of aircraft arriving at and departing from Queenstown Airport are also a recognised use of the airspace; airspace protection measures existing in the form of designations in the Queenstown-Lakes-Wakatipu Transitional District Plan. These flight paths essentially avoid residential areas, most aircraft movements are over the Crown Range to the north of Morvern Hill and then have a straight approach into Queenstown Airport.

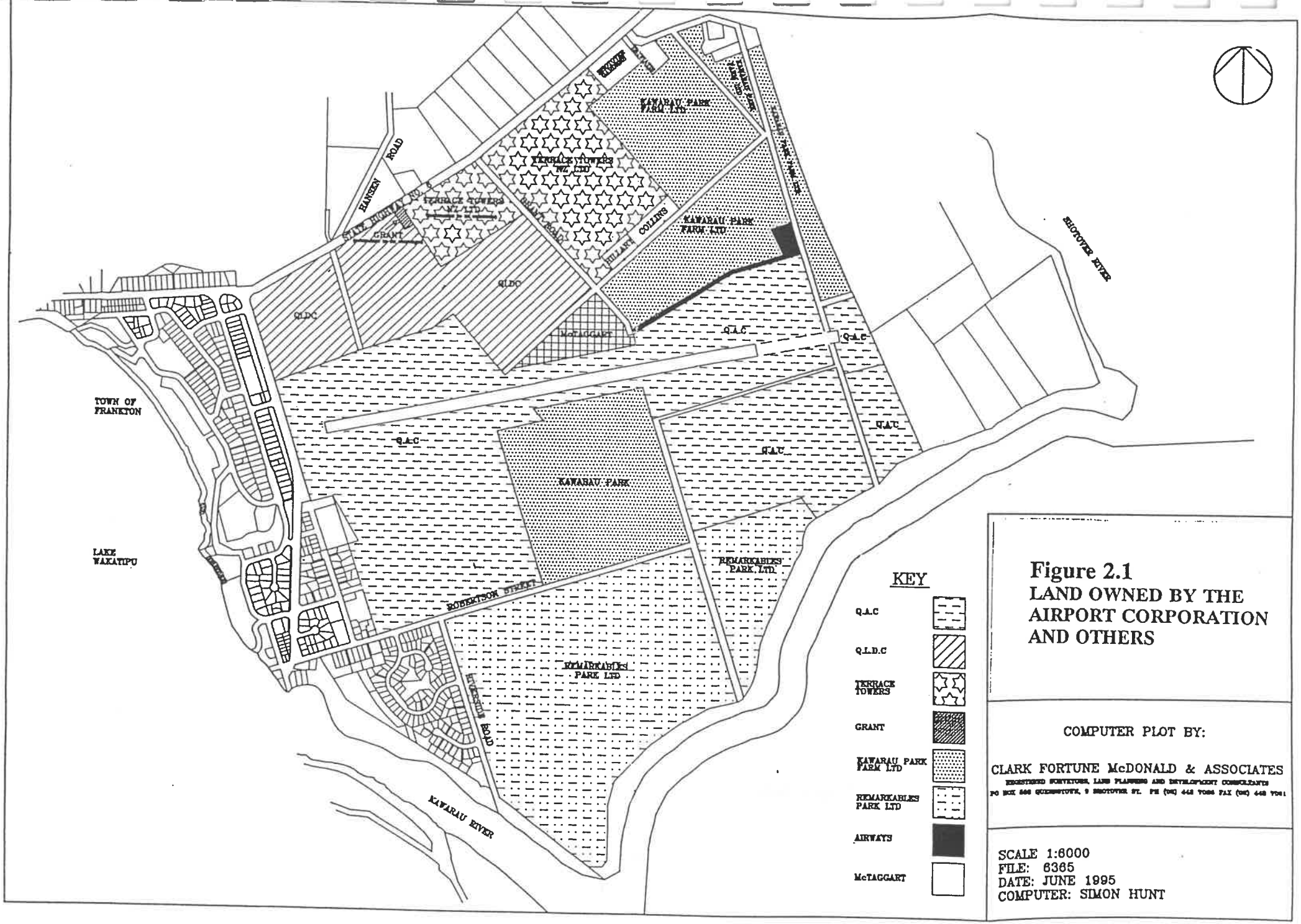


Figure 2.1
LAND OWNED BY THE AIRPORT CORPORATION AND OTHERS

COMPUTER PLOT BY:

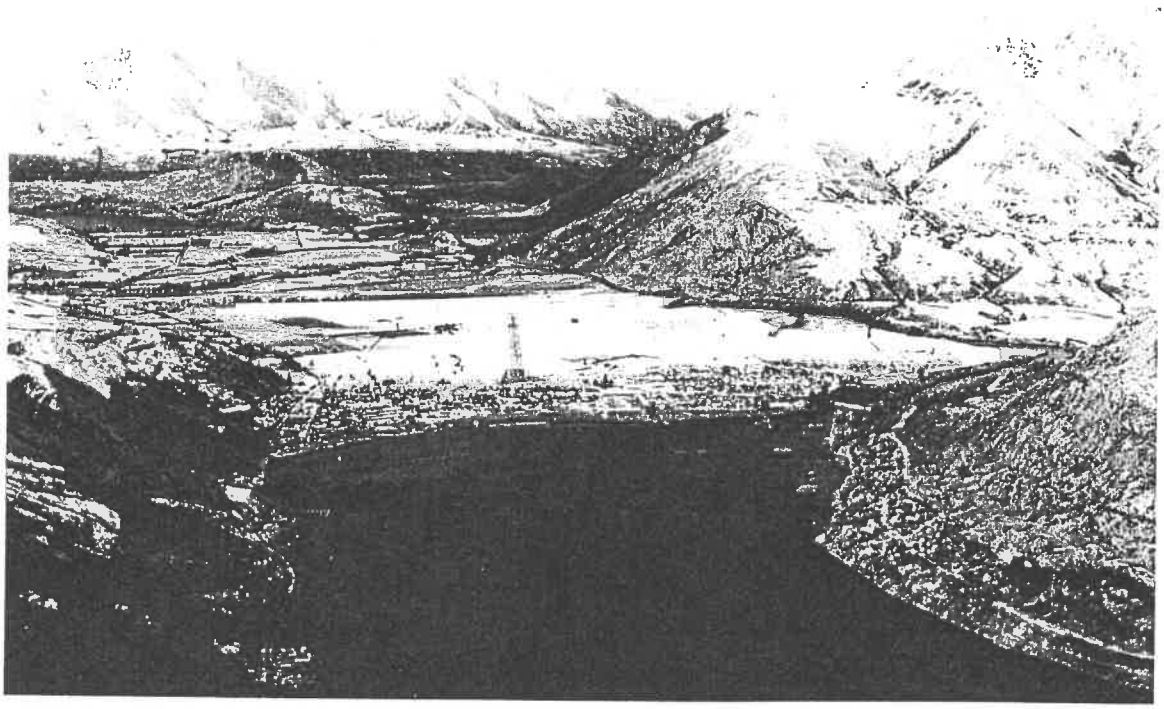
CLARK FORTUNE McDONALD & ASSOCIATES

REGISTERED SURVEYORS, LAND PLANNERS AND DEVELOPMENT CONSULTANTS

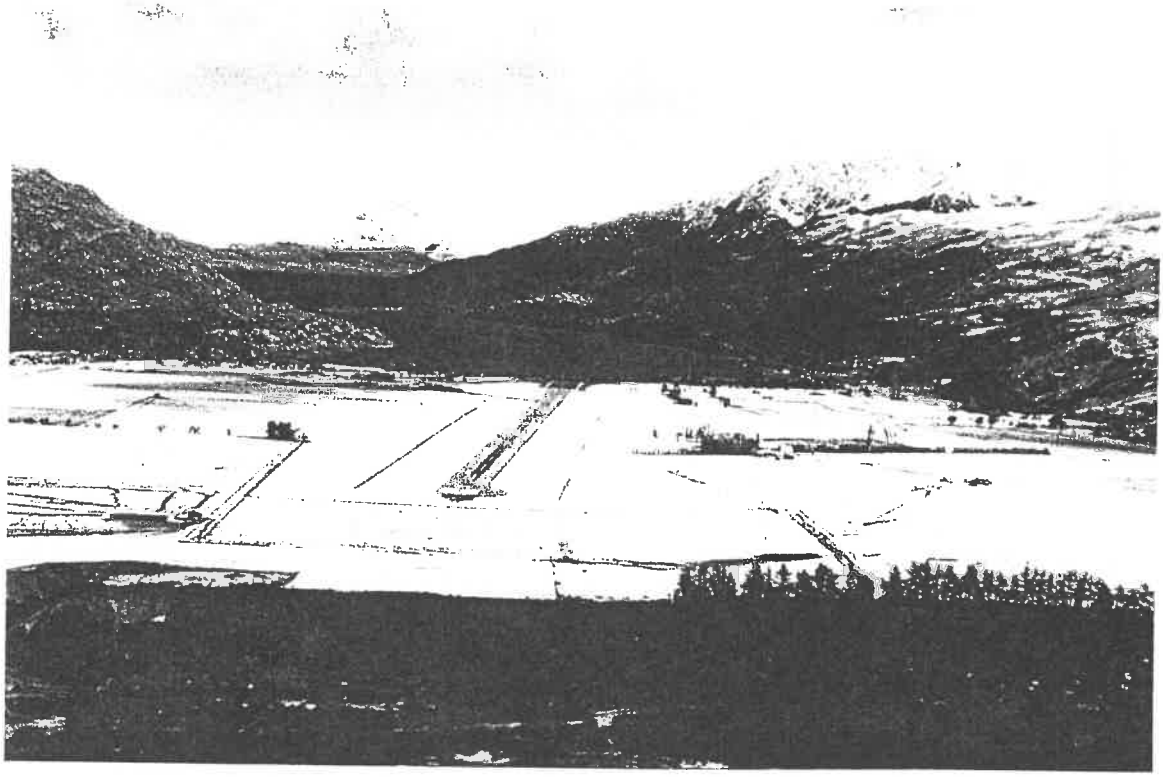
PO BOX 646 QUEENSTOWN, 9 SHOTOVER ST. PH (03) 442 9086 FAX (03) 442 9081

SCALE 1:6000
FILE: 6365
DATE: JUNE 1995
COMPUTER: SIMON HUNT

FRANKTON AIRPORT



15) **Existing Landscape**



16) **Scale of Buildings - Terminal to East (Left) of Runway Accessed by the Existing Taxiway**

The topographical constraints and flight tracks dictate that aircraft will be at high altitudes between 2,000 m and 3,000 m over Arrowtown. No flight tracks cross directly over Queenstown. Frankton residential area is adjacent to the airport and low flying aircraft have a significant presence over this area and, to a much lesser extent, Kelvin Heights, due to the infrequency of landings and take-offs occurring at the 05 end of the runway. An eastern runway extension, for which resource consent is currently being sought, will mitigate against some of the impacts of aircraft on residential areas at Frankton by moving aircraft operations further eastwards by up to 500m, although full use of the entire runway is still required for jet operations when a northeasterly wind prevails. Cross wind circuits (usually utilised by light aircraft) give rise to aircraft approaches and take-offs between Ferry and Slope Hills to the northwest and over Kingston Road to the south.

The importance of airspace considerations is that any new airport would require use of a wide area of airspace for aircraft operations. Presence of volumes of aircraft in what has been generally unused or clear airspace will have a visual impact for some considerable distance. While some people enjoy the interest of aircraft in their view, for others Queenstown and the Wakatipu Basin is valued for its outstanding scenery which will be compromised by the regular presence of aircraft in the backdrop.

9.6.3 Land Use Patterns

The operational areas of the site are designated as a local purpose reserve, aerodrome under the Transitional District Plan. The remainder of the site is grazed. The soils on the Frankton Terraces are Shotover loamy silt which is nominated as a high class soil.[4] Future developments at the airport are likely to require minimal encroachment onto these soils, however indications from the Council via the Frankton Development Strategy are that the area in the vicinity is intended to be developed in the future for urban purposes rather than adhering to principles of maintaining the productive capability of the land. Acquisition of housing if necessary at the western end (05) of the main runway is proposed in the immediate future as a noise mitigation measure. (Approximately 52 dwellings are identified as being affected). In terms of QAC's future expansion plans, Plan Change 96 identified requisite purchase of land shown on Figure 3 (Plan Change 96), of which the Grant property has now been acquired. The Council has resolved that the airport will continue to be operational for at least the next fifteen years even without these purchases to facilitate further development.

9.6.4 Noise

The principal environmental effect arising from airport operations at Frankton is noise. The noise impact of the airport on its environs is determined by three principal factors:

- The orientation of the runway(s) and taxiways.
- The type of aircraft and frequency of landings and takeoffs.
- The relative proximity of airport neighbours.

---

[4] Landcare Research, Dunedin

During the last ten to fifteen years some community concern has been expressed over light aircraft noise (an approach path problem) and B737 aircraft using the airport. With respect to the latter the Corporation as a matter of policy, has decided to adopt as a standard for noise emissions NZS 6805:1992 "Airport Noise Management and Land Use Planning". This means that older Code C aircraft are expected to meet Chapter 3 specifications, which in the case of Air New Zealand's B737-200 aircraft has been achieved by the installation of hush kits. At the same time light aircraft movements will need to be redirected to reduce flights over Frankton Arm itself.

Adoption of such a standard allows the Corporation to protect adjacent land users from aircraft noise above the prescribed standard and to define an airport protection zone which in turn protects the airport from noise sensitive land use activities such as residential development. This airport protection zone approach incorporating air noise boundaries was proposed as part of Plan Change 96 and the approach agreed upon by QAC, the Council and other parties is to include the airnoise boundary by way of designation in the Proposed Plan and outer control boundary by incorporation as a rule. This approach will protect the rights to compensation or buyout of the existing residential properties under the flight path at the western end of the main runway.

Boeing 737 Noise Levels

The eastern extension will have the additional noise benefit of allowing the Boeing 737-300 aircraft to utilise Queenstown Airport in the future. The current runway length is not sufficient to allow the 737-300 to operate. The 737-300 is approximately 6-7 dB quieter than the 737 Hushkit. This noise reduction is similar to the difference between the 737-200 with and without the Hushkit and so the 737-300 is approximately 12 dB quieter than an un-hushkitted 737-200.

Air New Zealand has announced it intends to replace half their Boeing 737 fleet with 737-300 aircraft by the end of 1998. The eastern runway extension will allow this aircraft to operate into Queenstown at this time, with its inherently lower noise levels. As the Boeing 737-200 Hushkit is the noisiest aircraft regularly using the airport, this reduction should be noticeable by the residents.

The proposed eastern extension has been acknowledged in the Commissioner's decision and in the Frankton development strategy as being important to reduce the overall noise from the airport. Use of the eastern end of the main runway rather than crosswind runway by small aircraft takes these light aircraft operations further from residential areas where there is now almost continuous noise resulting from the large number of flights utilising the crosswind runway. The Frankton Development Strategy indicates that the 262m runway extension at its eastern end is the best practicable option to ensure the emission of noise does not exceed a reasonable level.

There are 52 properties located inside the proposed air noise boundary (65 Ldn) and the designation in the proposed District Plan will provide the mechanism for purchase of these. There are approximately 150 houses located between the Ldn 55 and 65 contour at the western end of the runway. Rules in the proposed District Plan will provide for acoustic insulation of new dwellings or additions to existing dwellings inside the outer control boundary.

While the projected increased use of jet aircraft on runway 05-23 will increase the noise climate slightly in the Frankton Arm area, this increase in aircraft movements is not a direct consequence of the proposed runway extension and the findings of the noise studies previously commissioned are still the relevant mechanisms for identifying noise sensitive locations. These locations have been identified and appropriate planning controls will be implemented as part of the new District Plan to ensure the long term protection of the airport operation and the surrounding community.

9.6.5 Ecological

The immediate ecological environs of the Queenstown Airport have been significantly altered from their natural state. Much of the original ecological character of the area has changed as a result of road, airport, residential, rural and industrial development and recreational use. Species that do inhabit the area are fairly robust and seem able to withstand the by-products of airport activities. There would be little or no ecological impact resulting from the operation of the proposed extended runway, given that aircraft are already at low levels on approach over the Shotover River.

Several bird species have been identified in the area including Turns, Plovers, Paradise, Shelduck, Falcon, Gulls (Red and Black Bills), Banded Potterill, Black and Red Oyster Catchers.

Birds that currently breed in close proximity to the Airport appear to be unaffected by aircraft noise. There is no evident problem of bird strike associated with the sewage farm and the closer proximity of the runway extension to this land use is not expected to give rise to any change in the situation.

9.6.6 Archaeological/Cultural

The Frankton site is not identified as having archaeological or cultural significance.

9.6.7 Safety

No aircraft lands at the existing Queenstown Airport outside the stipulated required runway length and safety margins set down by International Safety Standards. However, a proposed 262 m extension to the main runway will enhance these margins for current aircraft types using Queenstown Airport.

A proposed eastern extension to the runway brings aircraft taking off and landing closer to the Shotover River end of the airport. QAC owns the land in this location and land owned by Kawarau Park Farms Ltd will be well to the side of the runway. At the Shotover River bank aircraft will be about 14m lower on approach than currently. International Aviation accident statistics indicate that the area where aircraft accidents have mostly occurred is on the airport and on the runway centreline within 1,000m of the runway threshold. Kawarau Park Farms Ltd is not on the runway centreline and is therefore not adversely affected when considering safety issues. While properties at the western end are on the runway centreline they are now further away during the critical takeoff and landing manoeuvres for the majority of flights.

There have been no major air accidents at Queenstown Airport and while airport operations are already close to properties at the western end, the question of safety can be considered to be a psychological effect on occupants of these properties as can low-flying aircraft. These effects are acknowledged but there are no necessary mitigation measures due to the distance between the proposed runway extension and the closest neighbours.

In terms of operational safety, the runway extension must be viewed as a mitigation measure to manage the airport resource in a way that will improve safety margins. In terms of passenger safety the weather conditions, terrain and elevation contribute to requiring longer runway length for jet aircraft than at other airports. Queenstown has one of the shortest commercial runways in New Zealand which is also one of the most challenging for landings and take offs due to the abovementioned factors; runway length, weather, terrain and elevation. Two recorded examples of the constraints on take off and landing manoeuvres are that a large jet aircraft overshot the runway in April 1990 and another large jet aircraft had an engine failure on take off in January 1995. In relation to the first incident, a tail wind gust contributed to an aircraft landing too far down the runway on arrival at the 05 end and failing to stop. It veered left through grass, a fence, crossed a ditch and stopped in the adjoining paddock. Fortunately no major damage to the aircraft occurred nor were there any injuries. A longer runway and RESA, as proposed by QAC in its application for runway extension, would have provided enhanced safety margin to allow the aircraft to stop on the sealed runway strip.

In relation to the second incident when, at 500ft over Lake Wakatipu, one of the two engines failed, the aircraft executed an emergency landing at the Queenstown Airport. The success of this landing is tempered by the knowledge that the situation may have had a different outcome given that the fuel load and the heavily weighted aircraft (at maximum permissible take off weight) made an emergency landing on one engine potentially very difficult on such a short runway with houses at one end. As it happened, even with emergency stopping procedures activated, the full length of the present runway was utilised in the landing. A longer runway (achieved by the proposed eastern extension of 262m) would provide an enhanced safety margin to reduce the risk of aircraft running out of runway room on take off or landing in emergency situations or when error in pilot judgement or weather phenomena results in a take off or landing too far down the runway.

Effects of Low Flying Aircraft

Apart from noise and safety which are addressed in Sections 8.5.4 and 8.5.7 respectively, environmental effects from aircraft operations can be defined as:

(i) Dispersion of fuel droplets and carbon particles which may contain some unburnt hydrocarbons on aircraft take-off. These are normal jet efflux emissions. The jet aircraft using Queenstown Airport do not have the facility to dump raw fuel.

(ii) Blast effects from aircraft taking off or landing

(iii) Visual impact of low flying aircraft

The outcome of item (i) is likely to be a very fine level of impact which would require much more detailed analysis. Nearby residents have previously cited air pollution as a concern regarding aircraft operations. However, as a result of the eastern extension to the main runway, there will be an additional distance of most aircraft movements from habitable areas and given the predominant takeoff and landing direction, air emissions as a direct result of use of the runway extension, should not be a significant problem and, in fact, are likely to have less impact on residents in the Frankton area. This issue is therefore identified but, for the above reasons, not discussed in detail.

The outcome of item (ii) is considered to be minor given the distance of the take off and landing thresholds from existing habitation. In addition the proximity of the take off start to the river bank will result in significant dispersions of blast prior to reaching any existing activity areas. The runway will be well above the Shotover River bed and blast will also have dispersed in this location so as not to cause adverse effects on the qualities of the river.

The visual impact of low flying aircraft (either from take off or landing) will be less significant for the owners of land at the western end as the aircraft will be higher in the sky on many more occasions.

9.6.8 Natural Hazards

There are no identified natural hazards. The land Used for airport purposes appears stable, not prone to flooding or subsidence consistent with the adjacent river bank areas. The Shotover River is well below the plateau upon which the airport is located and therefore rises in river levels and erosion will have no effect on the use of land for airport.

9.6.9 Traffic

Access to the Frankton site is via State Highway 6A. There are no problems of congestion or capacity on the network and access to Queenstown is very convenient (15 minutes maximum travelling time).

9.6.10 Hazardous Goods

Fuel transportation to Frankton is currently via SH6 (Kingston Road) from Invercargill. This route is windy along the lake shores and involves access across the Kawarau Falls one lane bridge. While this is not the optimum route in terms of safe transportation of a hazardous product, it is a better alternative than for Cromwell Terraces and Queenstown Hill, and when compared with Jardines, only involves a slightly greater travel distance and also crossing the Kawarau Falls Bridge. No problems with hazardous fuel transportation have so far been experienced with airport operation.

9.6.11 Statutory Considerations

The purpose and principles of the RMA of relevance to assessment of the Frankton site are:

"5(a) Sustaining the potential of natural and physical resources .... to meet the reasonably foreseeable needs of future generations."

This site is a developed airport and, as such, is a regional and national resource in terms of its importance for the New Zealand tourism industry and local economy. The existing adverse environmental effects can be mitigated by

(i) acquisition of housing at the western end of the main runway inside the Ldn 65 contour

(ii) incorporation of noise boundaries in the District Plan

(iii) adjusting the threshold on runway 05/23 at the western end

(iv) constructing an extension at the eastern end of the main runway

Future monitoring and mitigation measures can include reorganisation of airport layout to relocate light aircraft movements, changes in aircraft technology are also likely to introduce quieter aircraft into the international and domestic routes, an example of this is the planned replacement of HS748 aircraft with ATR.

Section 6 is not relevant. The site is an area identified as an outstanding landscape. The existing airport is already a part of that landscape.

In terms of Section 7(b), there is already substantial investment in the existing airport resource. Retention of the site for airport purposes must be considered an efficient use and development of the physical resource, given other criteria for airport selection nominated in Section 2. Environmental Considerations, have determined that all other sites studied have limitations and, given that the identified adverse effects at Frankton can be reasonably mitigated, then continued use of the site is an efficient use of the resource. Other alternative urban land uses will reduce the high class soils available for agricultural use whereas airport use requires a buffer in terms of the noise boundaries and air space protection measures which encourage retention of the land in rural use. Further to this matter, Section 7(g) refers to finite characteristics of natural and physical resources.

The criteria for selection of an airport site are onerous and very few sites would meet all the requisite criteria. The airport resource must be considered to be finite in that its duplication or replacement elsewhere is extremely difficult (refer Castlerock decision).

Section 7(c) and (f) relate to environmental quality as the airport is existing little adverse visual effect on amenity is predicted as a result of more intensive operations. Mitigation measures for noise effects have been included above.

9.6.12 Regional Plan Provisions

The most relevant provisions of the Regional Plan relate to stormwater and drainage discharges. There is an existing drainage system which is proposed to be upgraded and modified to provide for stormwater control. No water or air discharge consents are likely to be required.

9.6.13 Regional Policy Statement

In October 1993 the Proposed Regional Policy Statement was notified. The RPS identifies issues of regional significance. On page 18, Section 3.3, the Proposed Regional Policy Statement identifies tourism as becoming increasingly important to the prosperity of Otago's communities and "The Queenstown Lakes District, the fastest growing local authority in New Zealand and one of the country's major tourist destinations ..." On page 20 it notes the physical resources for Otago include high class soils which comprise only 6% of the total arable land in the region (which itself is only 26% of the total land resource). One of the locations of these high class soils (Class I and II) is identified as being in the Wakatipu Basin. On page 40 it raises issues of sustainable management of high quality soils and maintaining productive capacity of the land. Objectives and policies reflect these goals, specifically Objectives 5.4.1, 5.4.2 and Policy 5.5.2 as follows:

Objective

"5.4.1 To promote the sustainable management of Otago's land resources in order:

(a) To maintain and enhance the primary productive capacity of land resources; and

(b) To meet the present and reasonably foreseeable needs of Otago's communities."

"5.4.2 To avoid, remedy or mitigate degradation of Otago's natural and physical resources resulting from activities utilising the land resource."

Policy

"5.5.2 To retain Otago's existing high class soils for use in primary production except where no practicable options exist to accommodate other uses.

Explanation

High class soils are limited within Otago and should be retained, as far as practicable, for primary productive purposes in order to protect their versatility to meet the needs of future generations. Uses which remove those soils from primary production will need to demonstrate that they can go nowhere else within Otago."

The airport is located on one of the only large areas of flat land in close proximity to Queenstown. The pre-requisite for a suitable airport location is flat land with no obstacle intrusion over a prescribed area of airspace.

Although Queenstown Airport has some operating restrictions due to the topography of the area in the vicinity of Queenstown, it still represents the only available airport for jet operations within convenient accessibility of Queenstown. Queenstown Airport is now a national and regional physical and economic resource. The use of the site for an airport keeps to a minimum, effects on high class soils by making available for reuse the topsoil excavated in the course of airport improvements and the maintenance of the non operations area in agricultural use. (This practice takes cognisance of Policy 5.5.3).

Objective 5.5.5 is relevant to this application.

"5.5.5 To minimise the adverse effects of landuse activities on the quality and quantity of Otago's water resource through promoting the:

(a) Creation, retention and where practicable enhancement of riparian margins; and

(c) Avoiding, remedying or mitigating the contamination of groundwater and surface water by chemicals, nutrients and sediments resulting from landuse activities."

Further runway development raises the issue of stormwater runoff from the increased sealed runway area and the potential for siltation from the proposed metalled stock access road. These works can be mitigated by siltation control measures and drainage works which are subject to discussion and consent by the Regional Council. No water discharge consent is required.

Policy 6.5.5 refers to the need "to promote a reduction in the adverse effects of contaminant discharges into Otago's water bodies". The existing use of the airport does not involve the discharge of contaminants. Any deposit of hydrocarbons into the stormwater system as a result of airport operations can be safeguarded against by the adoption of a drainage plan and traps/bunds to contain such substances. These works can be the subject of discussion with the Otago Regional Council.

Policy 6.5.9 refers to the need to provide mitigation to lessen the threat posed by flooding and, more relevant in this case, riverbank erosion. Alterations to permeability of the land surface can affect surface run-off and have implications for a water catchment area. However, those effects which are possible from an increased sealed runway area can be mitigated by water management and flood protection engineering solutions. Flooding of the Shotover River has not reached the plateau on which the airport is located and the proposed works are unlikely to be significant in terms of flood risk. Riverbank erosion can be dealt with by appropriate planting and drainage measures (specified in Section 14.3).

Policy 9.5.2 focuses on promotion of efficiency in the development and use of Otago's infrastructure through "(a) Encouraging development that maximises the use of existing infrastructure while recognising the need for more appropriate technology."

The explanation refers to the reduction in costs to the community as a result of consolidation and improved use of existing infrastructure. In this case the retention of the airport at Frankton is a saving to the community of about $40 million for new airport development.

Policy 9.5.3 refers to the sustainable management of Otago's transport network. Again the maintenance of existing available transport resources is an emphasis.

Policy 9.5.5 is given cognisance to in this application. Section 8.5.4 documents that noise effects from the operation of the airport can be mitigated against.

9.6.14 Proposed Regional Plan: Waste

This is the first Regional Plan for Otago. It deals with contaminated sites and the importance of identifying such sites and taking remedial action to mitigate the adverse effects. It is known that some airport tarmacs can contain residual oil and fuel waste which may permeate the topsoil where fuel spills/leakages have occurred. Queenstown Airport is not a contaminated site. In the case of the existing apron area where refuelling occurs, traps and bunds can be established to ensure that no contamination of the land or stormwater is likely in terms of aircraft waste disposal. This is at present contracted off site and international flights are sealed and all waste disposed of at Christchurch. An increase in international flights would create the need for on-site incineration facilities or off-site contracted disposal, both of which will have minimal environmental effects in terms of transportation network or air discharge, however on-site disposal would require an air discharge permit.

9.6.15 District Plan Provisions

Under the Transitional District Plan for Lakes-Queenstown-Wakatipu District, the Frankton Airport is legally described as:

"Part Section 6, Block 34, Town of Frankton; Section 166 and part Sections 33-38, 63, 100-106, 162 and 163 Block 1, Shotover Survey District; parts being more particularly defined as Lots 3, 4, 5 DP 22121 and Lots 1 and 2 DP 22194".

(Note: This legal description excludes the Grant land legally described as Sections 98, 99, 107, 108, 109, 110,. 111, 116, 117, 118, 119, 146, 147, 148, 164, and parts sections 100, 101, 102, 103, 104, 105, 106, 162 comprising 53.5619 hectares recently purchased.)

In the Operative District Plan it is designated "Local Purpose Reserve : Queenstown Airport". It has an underlying zoning of Rural A. The uses provided for by this designation are not detailed in the district plan and there are no specific rules or performance standards governing the use of the land. Accordingly, it is reasonable to assume that all airport related activities are permitted uses as of right including runways.

The approach and departure flight paths at each end of both the main runway and cross vector are currently protected from intrusive or inappropriate land developments by specific airport protection zones.

The land to the west of the main runway is zoned Residential 8 (Airport Protection). The other three approach and departure flight paths are zoned Rural P (Airport Protection). The principal objective of these zones is to uphold airport protection as the overriding concern when considering development proposals on land under these normal approach paths. The concept of airport protection is predominant. Each zone, as well as specifically limiting the range and type of land uses that may establish, places specific limitations such as height on the bulk of any structure. The zones extend from the threshold of the main and subsidiary runways for 1067 metres and 60 metres respectively. The whole of the eastern runway extension lies within the Rural P zone where airport uses are neither permitted nor discretionary activities. In effect the runway extension has to be assessed as a non-complying activity even though, for reasons given in Section 6, the proposed extension complies with the thrust and intent of the protection zone and is in accordance with the objectives and policies of the Transitional District Plan.

9.7 OUTSIDE FRANKTON AIRPORT

9.7.1 General

While the two principal land use zones applicable to this land are rural and residential, there are, within these zones, a considerable number of different land uses established.

The land generally situated to the north, east and south of the airport is zoned Rural A. This zone includes land having a moderate to high potential value for food and pastoral production. The permitted land use activities reflect this. In addition, however, this zone did provide an opportunity for rural-residential activities, amongst other non-farming activities until the introduction of Plan Change 99. At present, the land zoned Rural A within the vicinity of the airport is used primarily for food and pastoral production.

To the north-east of the airport lies the Shotover Industrial Estate. The land within this estate is zoned Industrial 1. This zone permits the establishment of potentially noxious industries and therefore its location away from residential development and areas of potential residential development is significant. The range of permitted uses in the Industrial 1 zone is broad, in keeping with its purpose, but the performance standards are relatively tightly drawn to ensure minimal adverse environmental effects. The presently zoned area is substantially occupied and there are plans for expansion of the zone to the south (see Frankton Development Strategy).

Further to the east, and on the lower river terrace adjacent to the Shotover River, is situated the Council's sewage treatment works. This site is designated and has an underlying zoning of Rural B; the same zoning that covers the balance of the land on this river terrace. The permitted land uses within this zone are substantially the same as for the Rural A zone but the expectation is that they will focus more on pastoral farming because of the generally poorer soils. The land zoned Rural B and which adjoins the runway extension is substantially undeveloped river terrace.

The predominant land use to the west of the airport, off the end of the main runway across SH6, is residential - the Frankton residential area. This land is zoned Residential 1 and the established land uses reflect the purpose of this zone - low density residential development.

The current pattern of zoning in and around the airport is shown on Figure 5.1.

9.7.2 Plan Change 99

This plan change was promulgated by the QLDC and publicly notified on 4 February 1995. Decisions on the outcome of submissions are due for release shortly. The Plan Change has as its principal objective:

"recognition of a growing concern about the impact of subdivision and buildings on the important natural resources and visual amenities of the rural area"

The Change proposes new objectives and policies for the rural zones as well as new district wide objectives and policies on landscape and visual amenity, urban growth, district well-being and identity. New rules are introduced affecting minimum lot size of subdivision, minimum lot size for new dwellings as well as the location, appearance and design of houses and buildings.

This plan change, as originally promulgated, provides protection for the existing airport site at Frankton. For example, the minimum subdivision lot size allowed in the Rural A zone currently surrounding the airport on three sides is now raised to 150 hectares. No existing land titles exceed this new threshold and hence closer rural/residential subdivision creating potential incompatible land use is effectively prevented from notification date. In addition there is particular emphasis upon the preservation and enhancement of the open visual character of the whole Frankton Flat area by the use of appropriate resource management mechanisms. Apart from the Terminal complex an airport operation by its nature is one of the least visually intrusive users of large areas of flat land.

On page 30 of the Plan Change it is noted that:

"The District, and the Wakatipu Basin in particular, contains a number of significant physical resources most notably the airport and the major roads. These resources are a critical component of the social and economic well-being of the residents and any provision for new growth needs to have regard to the impact of new development on those resources ..."

Further, under the Plan Change Objective section on page 35 setting out the objectives that must be satisfied inter alia, it states:

"Development which has regard to the Queenstown Airport and the value of that resource to the District."

The restrictions on rural subdivision in the Plan Change and general policy it contains are supportive of open space and limiting of inappropriate residential or other development in the area likely to be affected by airport development.

9.8 EVALUATION OF NON OPERATIONAL ISSUES

From an environmental perspective, leaving aside the earlier operational matters, there are no ideal airport sites which do not have any impact in terms of the criteria selected:

- **Specific Impacts**
  - Visual impact and landscape
  - Land use patterns
    : potential loss of agricultural land
    : acquisition of housing
  - Noise
  - Safety
  - Ecological considerations
  - Archaeological/historic/cultural
  - Traffic
  - Natural hazards
  - Hazardous goods
- **Resource Management Act Considerations**
- **Regional and District Plan Provisions**

All of the sites have impacts in some of these respects and any overall conclusion has to prioritise the importance of various environmental considerations. In this respect, physical effects (visual impact, landscape and land use patterns), noise, safety and traffic are considered most significant for all sites in this study, although other criteria have importance for some sites.

Any comparison of environmental issues between Frankton and other sites must place importance on the fact that Frankton exists as a developed airport and therefore is a significant existing physical resource. The negative effects are tangible matters for which mitigation measures can be established. It is considered that closure of the airport at Frankton, which is an existing resource and establishment of a new airport elsewhere in locations which are identified as having adverse effects, is not achieving the purpose and principles of the RMA to the same extent that Frankton, as an existing resource, is able to.

10. BUDGET COST ESTIMATES

10. BUDGET COST ESTIMATES

Rough order of cost estimates, exclusive of GST, have been prepared for the construction of each of the new airports and for the upgrading of Wanaka and Frankton to reach a similar standard to the others. The estimates exclude the cost of land acquisition.

The budget cost estimates are provided on Table 10.1.

The cost estimates do not allow for the discounting effect of including funds raised from the sale of Frankton. The effect of this would be to only reduce the magnitude of total costs but would not effect the relative cost of each option and hence does not assist in site selection.

Table 10.1: Budget Cost Estimates [1]

ACTIVITY	AIRPORT SITE				
	JARDINES	QUEENSTOWN HILL	CROMWELL TERRACES	WANAKA	FRANKTON[5]
Site clearance	75	150	50	30	)
Earthworks	1533	5600	1022	345	)
Pavements	11200	11200	11200	7750	)
Topsoiling, grassing	2160	2160	2160	560	) 1800
Drainage	6000	6000	6000	2640	)
Perimeter fence and road	1620	1620	1620	1620	)
Surface markings and WDI	300	300	300	300	)
Approach and edge lighting and controls [4]	1141	1141	1141	1141	1141
PAPI	250	250	250	250	0
Terminal (International and domestic)	18000	18000	18000	18000	9000 [3]
Fuel storage and reticulation	250	250	250	250	100
Control Tower and equipment	1500	1500	1500	1500	1500
Rescue Fire service and vehicles	1150	1150	1150	1150	500
DVOR/ DME	1000	1000	1000	1000	0
Access roads	2950	7300	1850	400	0
Utilities	1210	1435	1205	1210	300
Subtotal	50339	59056	48698	38146	14341
Contingency at 15%	7551	8858	7305	5722	2151
Consents, fees at 10%	5034	5906	4870	3815	1434
TOTAL	62924[2]	73820[2]	60873[2]	47683[2]	17926 [5]

Notes:
(1) All costs are in thousands of dollars (excluding GST)
(2) Costs exclude land acquisition of new sites
(3) Assumes relocation of a domestic terminal, including international service, and taxiways
(4) Assumes night/IFR approaches possible
(5) Includes additional costs required to meet CAA standards assuming eastern runway extension (approx $1.8 million) proceeds.

11. EVALUATION AND CONCLUSION

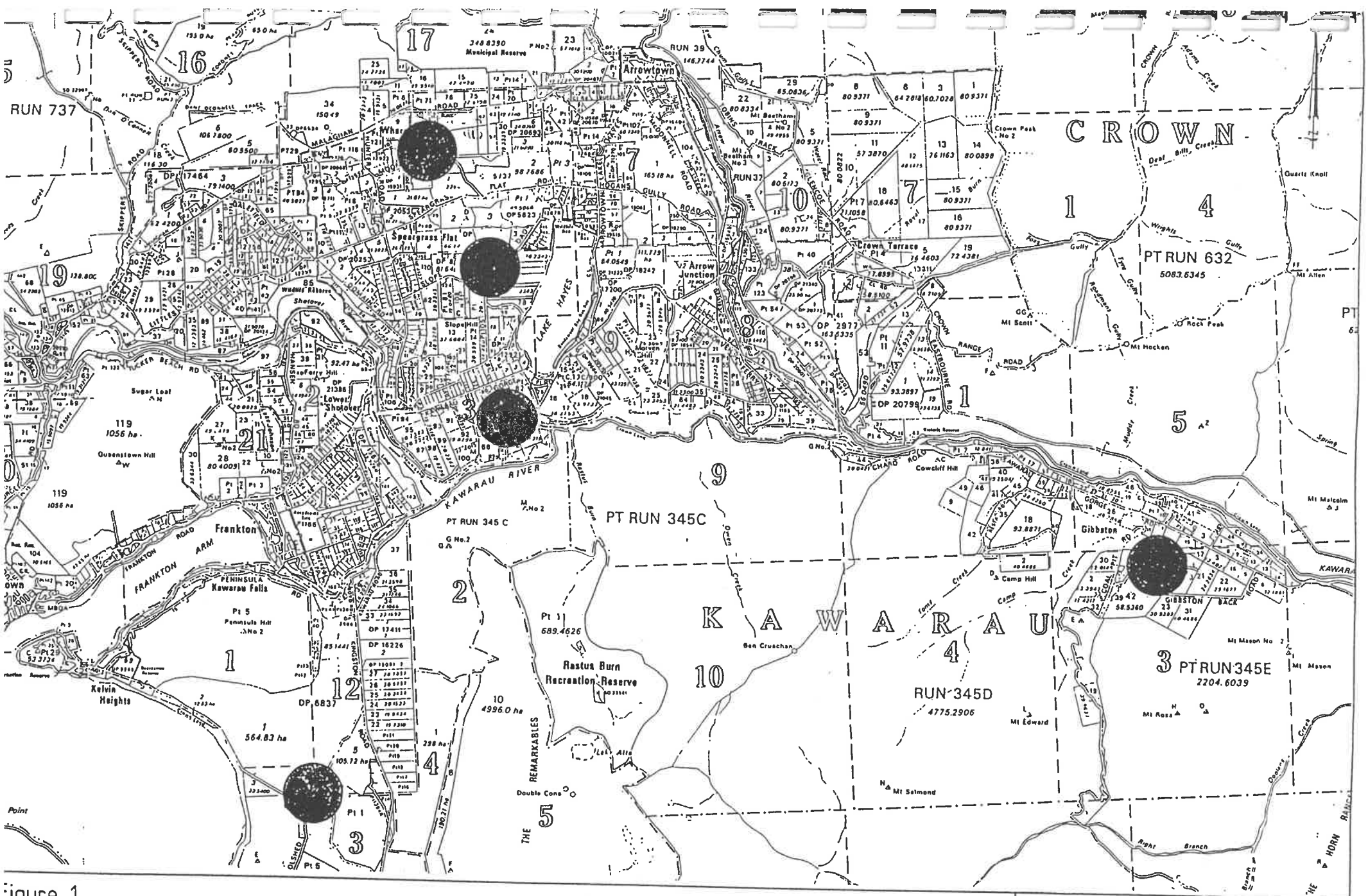


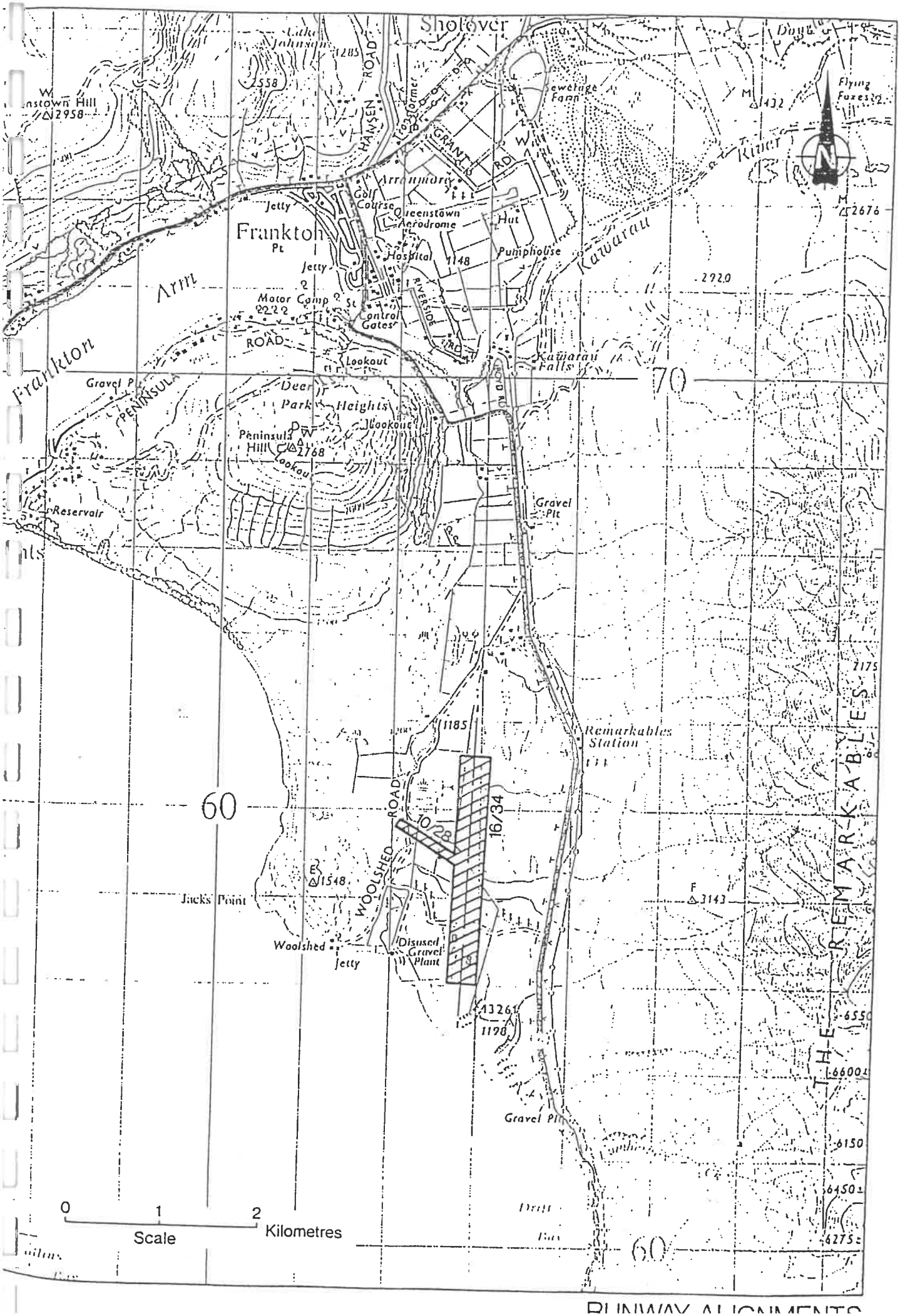
Figure 1

POSSIBLE LOCATIONS FOR NEW SETTLEMENT - WAKATIPU BASIN

LEGEND

POSSIBLE LOCATIONS FOR NEW SETTLEMENT

Northpoint Vertical
Scale 1:50,000 @ A2



RUNWAY ALIGNMENTS

11. EVALUATION AND CONCLUSION

11.1 EVALUATION OF ALTERNATIVE SITES

This study has evaluated the short listed sites with reference to relevant criteria for determining a preferred site. The preceding chapters have discussed the merits of each of the alternative sites with respect to the selection criteria. At the conclusion of each chapter the sites have been ranked in terms of the specific criteria evaluated.

Tables 11.1 to 11.5 summarise the main outcomes of the assessment of each site relative to the selection criteria.

As well as a careful determination of all issues and factors included in the brief, a weighted evaluation of the alternatives was undertaken using a + (positive attribute), o (neutral) and - (negative attribute) scoring system. The scores were then aggregated to obtain the most favoured option. The evaluation matrix is provided on Table 11.6. The evaluation matrix on Table 11.6 shows that the existing Queenstown Airport at Frankton is the most suitable airport site.

11.2 CONCLUSION

The conclusions reached from analysis of each alternative site against each set of criteria are summarised as follows:

Available Runway Length

The ability of each site to accommodate a runway capable of accommodating the design aircraft (B737 and B767 size aircraft) for trans-Tasman operations was investigated. A 2000 m nominal runway length within a 300 m wide strip, with appropriate landing aids to permit 24 hour operations was identified as being required.

The Jardines, Queenstown Hill and Cromwell sites can accommodate a 2000 m runway but the maximum runway length possible at Frankton and Wanaka is some 1800 m. Substantial structures would be required to support approach lights for instrument and night landings at all sites except Jardines.

Meteorological Conditions

Previous reports of meteorological conditions as well as data obtained from the National Institute of Water and Atmospheric Research and from interviews with local pilots were used as the basis for determining relevant meteorological conditions at each airport site.
Analysis of meteorological conditions showed that Queenstown Hill would be unsuitable for the location of an airport providing scheduled airline services due to the high incidence of low cloud, snow and ice and turbulence on approaches. Similarly, Jardines would not be desirable due to the high incidence of turbulence.

Table 11.1: **Summary of Assessment of Airport Site at Jardines**

CRITERIA	COMPLIANCE WITH CRITERIA	COMMENT
1. AIRPORT SITE		
1.1 Land area available	63 Ha - 525 Ha (different studies)	
1.2 Expansion potential	Yes	
1.3 Ability to orient runways into prevailing wind	Yes(Terrain dictates N-S alignment)	Confirm against wind data
1.4 Existing main runway length/width	-	Existing private strip
1.5 Elevation (above sea level)	366m	
2 AIRCRAFT REQUIREMENTS		
2.1 Largest aircraft capability	None	No current runway
2.2 Can larger aircraft be accommodated	-	
2.3 Maximum runway length possible	3,000m x 45m	2000m Initial length
2.4 Critical aircraft and operation	B767 trans-Tasman	Terrain will dictate maximum size operated
3 METEOROLOGICAL CONDITIONS		
3.1 Wind speed (max) - Main RWY - Crosswind RWY	21-25 knots -	
3.2 Prevailing wind direction	N,NE & S	Wind direction influenced by valley
3.3 Incidence of fog	Probably similar to Queenstown / Frankton	Confirm
3.4 Turbulence	Considerable at less than 500 ft above ground level. Prevalent in certain wind conditions	Undesirable site due to turbulence, (Dave Park has flown tests - provide reports/letter)
3.5 Wind shear	Considerable at less than 500 ft above ground level	Undesirable site due to turbulence, (Dave Park has flown tests - provide reports/letter)
3.6 Incidence of snow / ice	Similar to Frankton (7 days/annum)	
3.7 Incidence of low cloud base	Infrequent	Assumed based on Frankton
4 AIRSPACE CONSIDERATIONS		
4.1 Proximity of high ground	OLS surfaces infringed. Mountains surrounding generally running N-S and NNE-SSW. Heights between 1150m and 1450m above aerodrome level, with peaks 300m higher. Remarkable's to E of site.	
4.2 Approach/departure tracks	Marginal. Both N and S approaches effected	Severe constraint to north between Peninsular Hill and Remarkable's with Ferry Hill Straight ahead
4.3 Missed approach procedures	Marginal	Severe terrain restrictions, particularly to the north
4.4 Ability to operate in IFR conditions	Difficult to provide a suitable instrument approach from south. Impossible from north	
5 SURFACE ACCESS		
5.1 Road distance (coach time) from Queenstown	17 km (20 mins)	
5.2 Existing road conditions	Sealed State Highway 6	Narrow bridge (single lane) over Kawarau River
5.3 Capacity of existing roads	Controlled by single lane bridge	
5.4 Road useability in bad weather	Some icing in winter	Seldom (if ever) closed
5.5 Access road to airport site from main highway	750m spur road from State Highway 6	
6 AVAILABILITY OF UTILITY SERVICES		
6.1 Power	New 1 km spur.	Upgrade existing mains, running parallel to State Highway 6
6.2 Water	New supply from Frankton (8 km)	
6.3 Drainage	Discharge to existing drainage systems	
6.4 Sewage disposal	Package plant and disposal field required	
6.5 Telecommunications	New 1 km spur, assumed	Possible need to upgrade trunk cable parallel to State Highway 6
7 NAVIG/LANDING AIDS INSTALLED/ REQUIRED		
7.1 PAPI	Required	
7.2 NDB	-	
7.3 DME	Required	
7.4 DVOR	Required	
7.5 ILS	Possibly required	Dependant on timing of GPS. Terrain constraints may limit use for approaches from south and prevent use from north
7.6 GPS	Proposed	Future technology (Criteria to be determined in future)
7.7 Operational area lights	Required	Required for instrument and night operations
7.8 HIAL lights	Required	Required for ILS/GPS approaches
7.9 Wind sock	Illuminated required	
7.10 VHF radio	Required	
7.11 Control tower	Required	Required for jet operations
7.12 Air traffic control	Required	Required for jet operations
8 BUDGET COST ESTIMATES		
8.1 Total Cost	$ 62.9 million	Excludes cost of land acquisition
9 ENVIRONMENTAL ISSUES		
9.1 Aircraft noise impact on existing communities	No residences within 65 Ldn contour Area identified as future residential settlement. Frankton airport housing would be affected by aircraft noise	
9.2 Impact on existing housing by establishment of airport		
9.3 Loss of agricultural land	Significant effect on existing farm operation	
9.4 Visual and landscape impact	Moderate	Building development visible from wide area
9.5 Ecological	Insignificant	
9.6 Historical/archaeological/cultural impact	None	
9.7 Natural hazards and safety	None	
9.8 Vehicular traffic (between airport and Queenstown)	Single lane bridge on Highway 6 Significant clash with existing residential traffic	Traffic improvements required
9.9 Hazardous goods delivery	Slightly closer than Frankton to Invercargill	Aviation fuel transported by road tanker from Invercargill

Table 11.2: **Summary of Assessment of Airport Site at Queenstown Hill**

CRITERIA	COMPLIANCE WITH CRITERIA	COMMENT
1. AIRPORT SITE		
1.1 Land area available	90 Ha	Assume 860m contour (massive earthworks required)
1.2 Expansion potential	Nil	
1.3 Ability to orient runways into prevailing wind	Runway orientation offset to prevailing wind	Frankton Airport wind data assumed
1.4 Existing main runway length/width	-	No existing runway
1.5 Elevation (above sea level)	860m	Approx 500m higher than Frankton site
2 AIRCRAFT REQUIREMENTS		
2.1 Largest aircraft capability	None	No current runway
2.2 Can larger aircraft be accommodated	-	
2.3 Maximum runway length possible	2000m	
2.4 Critical aircraft and operation	B767 - trans-Tasman operations	
3 METEOROLOGICAL CONDITIONS	-	
3.1 Wind speed (max) - Main RWY	-	
- Crosswind RWY	-	
3.2 Prevailing wind direction	W, SW &S	
3.3 Incidence of fog	-	Affected by low cloud base
3.4 Turbulence	With a strong S-SE wind, the turbulence and mountain wave effect associated with the plateau would make flying operations difficult	Severe turbulence on occasions
3.5 Wind shear	Frequent	
3.6 Incidence of snow / ice	Winter frost and snow	Snow throughout winter period
3.7 Incidence of low cloud base	Significant (30-40 days/annum)	
4 AIRSPACE CONSIDERATIONS		
4.1 Proximity of high ground	OLS surfaces infringed to north-west and west	
4.2 Approach/departure tracks	Infringements by high ground	
4.3 Missed approach procedures		To be advised by airlines
4.4 Ability to operate in IFR conditions		To be advised by airlines
5 SURFACE ACCESS		
5.1 Road distance (coach time) from Queenstown	20 km minimum (20 mins) - varies dependant on route	New road plus intersection with state highway required
5.2 Existing road conditions	State Highway 6 sealed	Possible upgrade of other existing roads
5.3 Capacity of existing roads	No capacity constraint on State Highway 6	
5.4 Road useability in bad weather	Access road likely to be ice/snow affected in winter	
5.5 Access road to airport site from main highway	6.2 km new access road	Sustained 8% gradient
6 AVAILABILITY OF UTILITY SERVICES		
6.1 Power	5 km transmission line	
6.2 Water	6-7 km pumped supply from Queenstown plus booster pump & storage tank	
6.3 Drainage	Elevated site allows good outfall	Assumes direct route. Pretreatment may be required
6.4 Sewage disposal	Package plant or outfall to existing Queenstown system	
6.5 Telecommunications	6 km cable run	
7 NAVIG/LANDING AIDS INSTALLED/ REQUIRED		
7.1 PAPI	Required	
7.2 NDB	-	
7.3 DME	Required	
7.4 DVOR	Required	
7.5 ILS	Possibly required	Dependant on timing of GPS
7.6 GPS	Proposed	Future Technology (criteria to be determined in future)
7.7 Operational area lights	Required	Required for instrument and night operations
7.8 HIAL lights	Required	Required for ILS/GPS approaches
7.9 Wind sock	Illuminated required	Illuminated required for night operations
7.10 VHF radio	Required	
7.11 Control tower	Required	Required for jet operations
7.12 Air traffic control	Required	Required for jet operations
8 BUDGET COST ESTIMATES		
8.1 Total Cost	$ 73.8 million	Excludes cost of land acquisition
9 ENVIRONMENTAL ISSUES		
9.1 Aircraft noise impact on existing communities	55 Ldn noise contours extend over land zoned for future residential subdivisions on Queenstown Hill	Flight tracks pass over Queenstown town centre. Elevation of airport site will mitigate against aircraft noise impact on development New housing areas on hillside will be noise affected
9.2 Impact on existing housing by establishment of airport	None	
9.3 Loss of agricultural land	Hill country farming would be displaced	Not high quality soils
9.4 Visual and landscape impact		Major hill contour reconstruction widely visible Major access road Buildings visible from high elevation (tourist) view points Established walkway
9.5 Ecological		
9.6 Historical/archaeological/cultural impact	Significant cultural site	Plaque notes Maori significance (see Duffil Watts report) Gold Mine site
9.7 Natural hazards and safety	Access road hazardous due to sustained grade and icing	
9.8 Vehicular traffic (between airport and Queenstown)	Difficult grade conditions	
9.9 Hazardous goods delivery	Significant risk for road delivery	Aviation fuel delivered by road tanker from Invercargill

Table 11.3: **Summary of Assessment of Airport Site at Cromwell Terraces**

CRITERIA	COMPLIANCE WITH CRITERIA	COMMENT
1. AIRPORT SITE		
1.1 Land area available	32 Ha	Insufficient area for major airport
1.2 Expansion potential	150 (plus) Ha	With land acquisition
1.3 Ability to orient runways into prevailing wind		Runway oriented on available site which is understood to align with prevailing winds. Topography controls wind direction up and down valley, with Northerly direction prevailing
1.4 Existing main runway length/width	1600m (grass)	
1.5 Elevation (above sea level)	315m	
2 AIRCRAFT REQUIREMENTS		
2.1 Largest aircraft capability	Sufficient length for domestic jet services	Full runway pavement construction required
2.2 Can larger aircraft be accommodated	Yes	With runway extension and full pavements
2.3 Maximum runway length possible	2400m	Maximum length possible on terrace site with current orientation
2.4 Critical aircraft and operation	B767 trans-Tasman	
3 METEOROLOGICAL CONDITIONS		
3.1 Wind speed (max) - Main RWY - Crosswind RWY	1600m x 60m -	Unsealed private strip No cross runway
3.2 Prevailing wind direction	NE-SW (North prevails)	Typically NW winds channelled along Clutha Valley
3.3 Incidence of fog	Understood that site escapes valley fogs	
3.4 Turbulence	Turbulence due to rotors from Pisa Range in westerly winds	Local turbulence at each end of terrace due to gullies
3.5 Wind shear	Expected	Can be expected as a result of rotors etc. from Pisa Range
3.6 Incidence of snow / ice	Snow cover in winter	Observed snow cover at site inspection 24/7/95
3.7 Incidence of low cloud base	Frequent	Assumed, based on local advice
4 AIRSPACE CONSIDERATIONS		
4.1 Proximity of high ground	High ground penetrates OLS surfaces to east and west	
4.2 Approach/departure tracks	Infringements by high ground, particularly to north	Alternative runway site at east of terrace gives improved approach/departure tracks
4.3 Missed approach procedures		To be confirmed by airlines
4.4 Ability to operate in IFR conditions	Possible	To be confirmed by airlines
5 SURFACE ACCESS		
5.1 Road distance (coach time) from Queenstown	67 km (60 min)	
5.2 Existing road conditions	Sealed state highway, well maintained	
5.3 Capacity of existing roads	Limited by Karawau Gorge and single lane bridge	
5.4 Road useability in bad weather	Icing in winter	Occasionally closed to traffic
5.5 Access road to airport site from main highway	2 km new access road, 1 km upgrade Lowburn Valley Road and new intersection Lowburn Valley Road/State Highway 6	
6 AVAILABILITY OF UTILITY SERVICES		
6.1 Power	3 km spur along Chinaman Gully	Main transmission lines along Lowburn Valley Road require upgrading
6.2 Water	7 km pipeline from Cromwell and storage reservoir	
6.3 Drainage	Elevated site allows good outfall to existing watercourses	Outfall may need pretreatment
6.4 Sewage disposal	Package plant and disposal field required	
6.5 Telecommunications	Assume 7 km supply cable from Cromwell	
7 NAVIG/LANDING AIDS INSTALLED/ REQUIRED		Provide appropriate aids for proposed site
7.1 PAPI	Required	
7.2 NDB	-	
7.3 DME	Required	
7.4 DVOR	Required	
7.5 ILS	Possibly Required	Dependant on timing of GPS
7.6 GPS	Proposed	Future technology (criteria to be determined in future)
7.7 Operational area lights	Required	Required for ILS/GPS approaches
7.8 HIAL lights	Required	Required for ILS/GPS operations. Cannot be accommodated on terrace if full runway length provided
7.9 Wind sock	Illuminated Required	
7.10 VHF radio	Required	
7.11 Control tower	Required	Required for jet operations
7.12 Air traffic control	Required	Required for jet operations
8 BUDGET COST ESTIMATES		
8.1 Total Cost	$ 60.9 million	Excludes cost of land acquisition
9 ENVIRONMENTAL ISSUES		
9.1 Aircraft noise impact on existing communities	55 Ldn noise contour extends over Lowburn	
9.2 Impact on existing housing by establishment of airport	None	
9.3 Loss of agricultural land	Minor impact	
9.4 Visual and landscape impact	Minimal	
9.5 Ecological	Not located in an area with biological (flora and fauna) significance	Screened by surrounding landforms from State Highway 8
9.6 Historical/archaeological/cultural impact	Presence of historical/cultural sites	Some historical/cultural sites in gully areas.
9.7 Natural hazards and safety	Minor	
9.8 Vehicular traffic (between airport and Queenstown)	Increased vehicular traffic on Kawarau Gorge route	
9.9 Hazardous goods delivery	Closer and easier delivery route for fuel delivery than other sites	Road tanker from Invercargill or Dunedin

Table 11.4: **Summary of Assessment of Airport Site at Wanaka**

CRITERIA	COMPLIANCE WITH CRITERIA	COMMENT
1. AIRPORT SITE		
1.1 Land area available	39 Ha	Insufficient area for major airport
1.2 Expansion potential	1800m runway length	Limits : River bank to east, Ridge to west
1.3 Ability to orient runways into prevailing wind	Current orientation satisfactory	Cross winds limit some GA/Warbirds operations
1.4 Existing main runway length/width	1200m x 30m	Sealed runway. Chipseal on 100 base course on 150 sub-base. Inadequate for large aircraft
1.5 Elevation (above sea level)	348m	
2 AIRCRAFT REQUIREMENTS		
2.1 Largest aircraft capability	Existing BAe-146 (limited payload/range)	Sustained operations would require pavement reconstruction
2.2 Can larger aircraft be accommodated	B737 type (limited payload/range) with runway extension	Would require pavement reconstruction
2.3 Maximum runway length possible	1800m	Maximum length possible on site
2.4 Critical aircraft and operation	B737	
3 METEOROLOGICAL CONDITIONS		Require Met. data and analysis
3.1 Wind speed (max) - Main RWY - Crosswind RWY	Cross winds limit some GA/Warbirds operations -	No cross runway
3.2 Prevailing wind direction		
3.3 Incidence of fog	Often in winter can last several days (June & July)	Ground fog - Potentially operationally significant
3.4 Turbulence	Occasional turbulence, sometimes bad for GA	Not operationally significant
3.5 Wind shear		Not operationally significant
3.6 Incidence of snow / ice	Not significant	
3.7 Incidence of low cloud base	No apparent problems for let down procedures	
4 AIRSPACE CONSIDERATIONS		Investigate for proposed site (after OLS drawing) - Airplan
4.1 Proximity of high ground		Need OLS drawing
4.2 Approach/departure tracks		Problem on 11 leading and 29 take-off
4.3 Missed approach procedures		
4.4 Ability to operate in IFR conditions		
5 SURFACE ACCESS		
5.1 Road distance (coach time) from Queenstown	104 km (95 mins)	
5.2 Existing road conditions	Sealed state highway well maintained	Kawarau Gorge section has winding conditions
5.3 Capacity of existing roads	Ample capacity for airport generated traffic	Restricted capacity in Kawarau Gorge section with narrow bridge
5.4 Road useability in bad weather	Ice in Kawarau Gorge section a problem in winter	Road sometimes closed to traffic
5.5 Access road to airport site from main highway	Located adjacent to state highway	
6 AVAILABILITY OF UTILITY SERVICES		
6.1 Power	Transmission line adjacent to site	Possibly upgrade existing supply adjacent to airport
6.2 Water	New borehole	
6.3 Drainage	Elevated site allows good outfall	Pretreatment possibly required
6.4 Sewage disposal	Centralised package plant and disposal field required	Existing facilities have individual systems
6.5 Telecommunications	Supply available nearby	Possibly upgrade existing supply to airport
7 NAVIG/LANDING AIDS INSTALLED/ REQUIRED		
7.1 PAPI	Required	
7.2 NDB		
7.3 DME	Required	
7.4 DVOR	Required	
7.5 ILS	Possibly required	Dependant on timing of GPS. Terrain constraints may prevent practical use
7.6 GPS	Proposed	Future technology (criteria to be determined in future)
7.7 Operational area lights	Required	Required for instrument and night operations
7.8 HIAL lights	Required	Required for ILS/GPS approaches
7.9 Wind sock	Installed (non-illuminated)	Illuminated windsocks required
7.10 VHF radio	Required	
7.11 Control tower	Required	Required for jet operations
7.12 Air traffic control	Required	Required for jet operations
8 BUDGET COST ESTIMATES		
8.1 Total Cost	$ 47.7 million	Excludes cost of land acquisition
9 ENVIRONMENTAL ISSUES		
9.1 Aircraft noise impact on existing communities	55 Ldn noise contour extends over part of Luggate township	
9.2 Impact on existing housing by establishment of airport	One house required to be purchased	
9.3 Loss of agricultural land	Minor	
9.4 Visual and landscape impact	Minor	Add to significant existing facilities
9.5 Ecological	Not located in an area with biological (flora and fauna) significance	
9.6 Historical/archaeological/cultural impact	None	
9.7 Natural hazards and safety	Snow/fog	
9.8 Vehicular traffic (between airport and Queenstown)	Increased vehicular traffic on Kawarau Gorge route	Alternative Crown Range route not appropriate
9.9 Hazardous goods delivery	Adjacent to main road	Road tanker from Invercargill or Dunedin

Table 11.5: **Summary of Assessment of Airport Site at Frankton (Current Queenstown Airport)**

CRITERIA	COMPLIANCE WITH CRITERIA	COMMENT
1. AIRPORT SITE		
1.1 Land area available	131.2 Ha	Further acquisition planned
1.2 Expansion potential		Limited
1.3 Ability to orient runways into prevailing wind	Main runway 05/23	Oriented into prevailing wind (SW)
1.4 Existing main runway length/width	1,458m x 30m	Includes western extension
1.5 Elevation (above sea level)	357m	
2 AIRCRAFT REQUIREMENTS		
2.1 Largest aircraft capability	B737/A320/Equivalent	
2.2 Can larger aircraft be accommodated	No	
2.3 Maximum runway length possible	1720m x 45m	Planned future runway extension (could provide up to 1870 m at high cost)
2.4 Critical aircraft and operation	B737	With slight weight restriction on trans-Tasman
3 METEOROLOGICAL CONDITIONS		
3.1 Wind speed (max) - Main RWY - Crosswind RWY	20knots ave. max (84% daytime winds below 10 knots)	100% operational 100% operational
3.2 Prevailing wind direction	W-SW to SW, N-NE to E-NE, S to S-SE	
3.3 Incidence of fog	Ave. 3.6 days/annum (mainly autumn)	Clears by mid-day (Not operationally significant)
3.4 Turbulence	Some turbulence in most gradient flows from N through W to S. Frequent in strong S - SW airstreams for approach from the NE	Not operationally significant
3.5 Wind shear	Down draughts, caused by the presence of Peninsular Hill to the S-SW are experienced over the Shotover River and on climb out. Windshear below 900-1200m in strong NW flows	Not operationally significant
3.6 Incidence of snow / ice	Snow falls 7.4 days/annum (lies 3.6 days/annum)	Not operationally significant
3.7 Incidence of low cloud base	Infrequent	Causes occasional flight cancellations, particularly for jets
4 AIRSPACE CONSIDERATIONS		Check after OLS prepared (Airplan)
4.1 Proximity of high ground	Peninsula Hill 3km S-SW (840m). Remarkable's 7km E&SE (over 1800m) 2-3km N&NW (600m, with peaks 1000m further N) Crown Range 15km E-NE of airport	Terrain constrains type of aircraft and operational minima
4.2 Approach/departure tracks		Contained in published information
4.3 Missed approach procedures		Contained in published information for up to B737 aircraft
4.4 Ability to operate in IFR conditions	Not possible for B767 or night B737 operations	Current cloudbreak procedure based on DVOR/DME at Slope Hill
5 SURFACE ACCESS		
5.1 Road distance (coach time) from Queenstown	7 km (10min)	
5.2 Existing road conditions	Sealed state highway	
5.3 Capacity of existing roads	No capacity restraints	
5.4 Road useability in bad weather	Some icing in winter	Seldom (if ever) closed
5.5 Access road to airport site from main highway	Existing access road from State Highway 6	
6 AVAILABILITY OF UTILITY SERVICES		
6.1 Power	Currently available	At current terminal location
6.2 Water	Currently available	At current terminal location
6.3 Drainage	Currently available	At current terminal location
6.4 Sewage disposal	Currently available	At current terminal location
6.5 Telecommunications	Currently available	At current terminal location
7 NAVIG/LANDING AIDS INSTALLED/ REQUIRED		
7.1 PAPI	Installed	
7.2 NDB	Installed	
7.3 DME	Installed	Located on Slope Hill
7.4 DVOR	Installed	Located on Slope Hill
7.5 ILS	-	Terrain constraints prevents practical use of ILS
7.6 GPS	Proposed	Future technology
7.7 Operational area lights	Required	
7.8 HIAL lights	Required with GPS	Significant support structure required
7.9 Wind sock	Existing (non illuminated)	Illuminated windsocks required for night operations
7.10 VHF radio	Exists	
7.11 Control tower	Exists	
7.12 Air traffic control	Operating	
8 BUDGET COST ESTIMATES		
8.1 Total Cost	$ 15.7 million	Excludes cost of land acquisition
9 ENVIRONMENTAL ISSUES		
9.1 Aircraft noise impact on existing communities	Airport has adopted NZS 6805-1992 Existing residential areas at western end of the min 05-23 runway are now affected. INM model shows that. Increased use of jet aircraft on runway 05-23 will increase noise climate in the Frankton arm but the proposed eastern runway extension will mitigate against this because aircraft will be at higher altitude to the west of the airport after take-off. Introduction of new 16-34 cross runway will result in some decrease in aircraft noise for the existing residential areas.	
9.2 Impact on existing housing by establishment of airport	Some housing affected	
9.3 Loss of agricultural land	Minor, due to other existing land uses	
9.4 Visual and landscape impact	Minor	Add to significant existing facilities
9.5 Ecological	None	
9.6 Historical/archaeological/cultural impact	None	
9.7 Natural hazards and safety	Flying over existing residential areas Shotover bank at eastern end	
9.8 Vehicular traffic (between airport and Queenstown)	Minimal	
9.9 Hazardous goods delivery	No worse than existing	

Table 11.6 (Sheet 1): ***Evaluation Matrix - Alternative Airport Sites***

		Jardines	Queenstown Hill	Cromwell Terraces	Wanaka	Frankton
1.	**RUNWAY FACILITIES**					
1.1	Airport can accommodate 2000 M long runway	0	0	0	-	-
2.	**METEOROLOGICAL CONDITIONS**					
1.1	Runway orientation into prevailing winds	0	0	0	0	0
1.2	Incidence of fog/low cloud	+	-	-	0	+
1.3	Incidence of turbulence and/or wind shear	-	-	-	0	0
1.4	Incidence of snow	0	-	0	+	0
3.	**AIRSPACE CONSIDERATIONS**					
3.1	Proximity of high ground	-	0	+	0	-
3.2	Approach/departure tracks	-	0	+	+	-
3.3	Missed approach procedures	-	0	+	+	-
3.4	Ability to operate in IFR conditions	-	0	+	0	-
4.	**ACCESS TO QUEENSTOWN**					
4.1	Road distance	0	0	-	-	+
4.2	Existing road conditions	0	0	0	0	0
4.3	Existing road capacity	-	-	0	0	+
4.4	Road usability in bad weather	+	-	0	0	+
4.5	Access road from highway to airport site	0	-	-	+	+
5.	**AVAILABILITY OF UTILITY SERVICES**					
5.1	Power	0	-	-	+	+
5.2	Water	-	-	-	0	+
5.3	Drainage	0	-	-	0	+
5.4	Sewage disposal	-	-	-	0	+
5.5	Telecommunications	0	-	-	+	+

Table 11.6 (Sheet 2): ***Evaluation Matrix - Alternative Airport Sites***

	Jardines	Queenstown Hill	Cromwell Terraces	Wanaka	Frankton
6. ENVIRONMENTAL ISSUES					
6.1 Visual impact	0	-	0	0	0
6.2 Landscape	-	-	0	0	0
6.3 Land use patterns	-	0	0	0	0
6.4 Acquisition of housing	-	0	0	-	-
6.5 Aircraft noise	0	0	0	0	-
6.6 Safety	0	-	0	+	0
6.7 Ecological concerns	+	-	0	+	+
6.8 Archeological, cultural, historic	+	-	0	+	+
6.9 Traffic	0	-	-	-	+
6.10 Hazardous goods	0	-	0	0	0
6.11 Natural hazards	-	0	+	0	-
6.12 Statutory considerations (RMA)	-	-	0	0	0
6.13 Regional and district plan provisions	-	-	0	0	0
7. COST					
7.1 Budget cost estimate	-	-	-	-	+
Overall Score	-11	-21	-6	+4	+6
Ranking	4	5	3	2	1

Key: + Positive attribute
o Neutral
- Negative attribute

Overall score is arrived at by attributing 1 point for a + and deducting 1 point for a -.

Wanaka emerged as the best airport site with respect to meteorological conditions followed by Frankton and Cromwell Terraces.

The overall rating of the sites due to meteorological conditions is as follows:

1. Wanaka (best)
2. Frankton
3. Cromwell Terraces
4. Jardines (unsuitable)
5. Queenstown Hill (operations of scheduled services precluded)

Airspace Considerations

The airport sites are all located in mountainous areas. However, airspace surrounding the sites closer to Queenstown, particularly the existing Frankton Airport and the Jardines site have considerable penetrations of the obstacle limitation surfaces including the straight-in approach and departure surfaces. Operations of larger aircraft types such as the B767 would not be possible at these airports due to circling requirements and engine out climb characteristics. Night operations are not possible due to the proximity of mountains. However, Frankton Airport can accommodate day time operations by up to B737 size aircraft.

The sites at Cromwell Terraces and Wanaka would allow 24 hour operations by the design aircraft.

The overall rating of the sites on account of airspace considerations for 24 hour operations by up to B767 size aircraft is:

1. Cromwell Terraces (best)
2. Wanaka
3. Queenstown Hill
4. Jardines
5. Frankton (daytime operations by B737 size aircraft)

Surface Access

The airport sites were compared under this criteria for their distance from the centre of Queenstown. The closest airport to Queenstown, ie. Frankton, rates highest, with Wanaka lowest, being the most distant.

The road linking the Jardines site to Queenstown currently crosses the Kawarau River on a single lane bridge. This would need widening.

A new access road would need to be constructed to the top of Queenstown Hill. This would have a long steep gradient and be subject to icing conditions in winter.

The Cromwell Terraces and Wanaka sites would be linked with Queenstown by State Highway 6 passing through the Kawarau Gorge which is subject to icing in Winter. Furthermore, a new access spur road would be required to the Cromwell Terraces site.

The overall rating of the sites on account of their distance from the centre of Queenstown is:

1. Frankton (closest)
2. Jardines
3. Queenstown Hill (requires steep access road)
4. Cromwell Terraces (via Kawarau Gorge)
5. Wanaka (furthest, via Kawarau Gorge)

Availability of Utility Services

The availability of utility services (electricity, water, drainage, sewage disposal, telecommunications) of each site was compared, with sites where such services were available rating higher.

The overall rating of each site based on availability of utility services is:

1. Frankton (all services existing)
2. Wanaka (most services exist, some require upgrading)
3. Jardines (main services available via short spurs from mains adjacent to State Hightway 6)
4. Cromwell Terraces
5. Queenstown Hill (major spurs up mountainside required to connect to main services).

Environmental

Environmental issues concerning each of the sites were evaluated with respect to a wide range of criteria as follows:

- Specific environmental considerations
  - visual impact and landscape
  - land use patterns
  - potential loss of agricultural land
  - need for acquisition of housing

  - aircraft noise
  - safety
  - ecological concerns
  - archaelogical, cultural, historic
  - traffic
  - hazardous goods
  - natural hazards
- Statutory considerations under Sections 5, 6 and 7 of the RMA
- Regional and District Plan provisions

The ranking of the sites in ascending order of the magnitude of environmental effects was assessed in the study as follows:

1. Cromwell Terraces (low adverse effects)
2. Frankton (low-moderate adverse effects)
3. Wanaka (low-moderate adverse effects)
4. Jardines (moderate adverse effects)
5. Queenstown Hill (significant adverse environmental effects)

Cost

Budget cost estimates for development of an airport at each of the undeveloped sites to allow full trans-Tasman operations were prepared. The cost to upgrade Frankton to a similar standards was also estimated.

The order of ranking of each airport site in ascending order is:

1. Frankton (lowest cost - existing airport)
2. Wanaka (upgrade existing airport)
3. Cromwell Terraces
4. Jardines
5. Queenstown Hill (most expensive)

Summary

Review of the conclusions obtained by the relative assessment of each site against the evaluation criteria results in the following conclusions:

- Queenstown Hill is an unsuitable site for locating an airport due to meteorological conditions. In addition, it has severe environmental effects and has the highest cost

- Jardines is unsuitable due to meteorological conditions (principally turbulence), airspace considerations and environmental considerations
- Cromwell Terraces would provide suitable sites for 24 hour operations by up to the design aircraft. The major disadvantage of this site is its distance from Queenstown
- Wanaka would allow the provision of an airport with trans-Tasman capability but its runway length would be limited to 1800 m. It's major disadvantage is that it is the furthest site from Queenstown.
- Frankton is clearly the preferred site. Because it is an existing major airport, it is clearly preferred with respect to environmental issues, availability of utility services and cost. Other key areas in which Frankton is the clearly preferred site are its proximity to Queenstown and relatively favourable meteorological conditions. Although Frankton cannot accommodate a 2000 m long main runway, it can be developed to accommodate a runway which will allow trans-Tasman operations by B737 size aircraft. The main disadvantage with the Frankton site is that surrounding topography is not compatible with 24 hour operations using an instrument landing system and would not allow operations by B767 size aircraft. Nevertheless lack of night time operations capability was not been a significant drawback for the airport and on environmental grounds, may in fact, be a positive factor for the future. The inability to operate of B767 size aircraft does not preclude international flights using B737 size aircraft.

APPENDIX A

WIND DATA

NIWA

Taihoro Nukurangi

Brief interpretation of Cromwell Aerodrome wind data

Hourly observations: Sep1976- Oct 1984

Wind recordings at this site were from instrumental readings made at hourly intervals, by an anemometer, situated atop a 6 metre mast (with good open land exposure) located at Cromwell Aerodrome.

Analysis of the annual wind summary shows that winds were most frequent from the southwest (prevailing 24% of the time). Northeasterlies were second most frequent (prevailing 19% of the time). Northerlies prevailed 17% of the time.

Calm to light variable conditions occurred 4 percent of the time. Light winds (mean speeds in the range 1 to 10 knots) [0.5 to 5 ms^{-1}]) prevailed 75 percent of the time.

Strong winds (mean speeds at least 21 knots) prevailed 3 percent of the time, being most frequent from the northeast and north.

1 knot = 0.52 ms^{-1}
1 ms^{-1} = 1.94 knots

NIWA

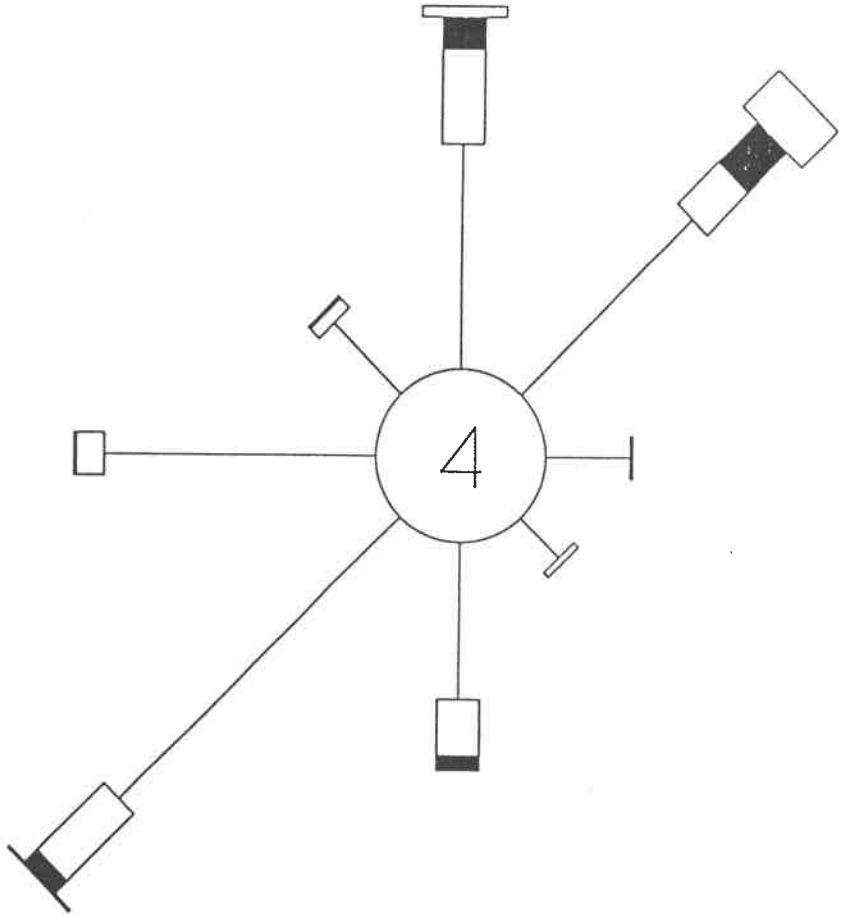
Taihoro Nukurangi

CROMWELL AERODROME I59020

HRLY OBS, 1976–1984

PERCENTAGE FREQUENCY

WIND SPEED



NIWA
Taihoro Nukurangi

FREQUENCIES (PER THOUSAND) FOR: CROMWELL AERODROME
MONTHS: ALL HOURS: ALL

DATA FROM PERIOD: Sep 1976 - Oct 1984

SPEED(KT) DIR	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	ALL-S
N	51	51	44	15	4	1					165
NE	73	40	27	26	16	7	1				190
E	35	5	1								41
SE	19	7	3								29
S	35	36	26	7							105
SW	98	86	44	8	1						236
W	95	32	13	1							140
NW	32	13	6	1							52
*	40	1									40
ALL DRNS	477	270	163	59	21	8	1				1000

* UNSPECIFIED DIRECTION
CALM

NIWA
Taihoro Nukurangi

Brief interpretation of Cromwell MWD wind data

Hourly observations: Nov 1994- Jan 1989

Wind recordings at this site were from instrumental readings made at hourly intervals, by an anemometer, situated atop a 6 metre mast (having open-land exposure) located at the old Cromwell Ministry of Works and Development site.

Analysis of the annual wind summary shows that winds were most frequent from the northeast (prevailing 12% of the time). Southerlies were second most frequent (prevailing 11% of the time).

Calm to light variable conditions occurred 49 percent of the time. Light winds (mean speeds in the range 1 to 10 knots) [0.5 to 5 ms^{-1}]) prevailed 48 percent of the time.

Strong winds (mean speeds at least 21 knots) prevailed less than 1 percent of the time, being most frequent from the northeast.

1 knot = 0.52 ms^{-1}
1 ms^{-1} = 1.94 knots

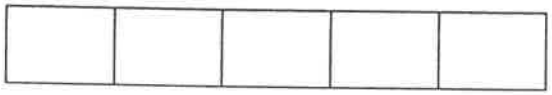
NIWA

Taihoro Nukurangi

CROMWELL MWD I59021

HRLY OBS, NOV 1984 - JAN 1989

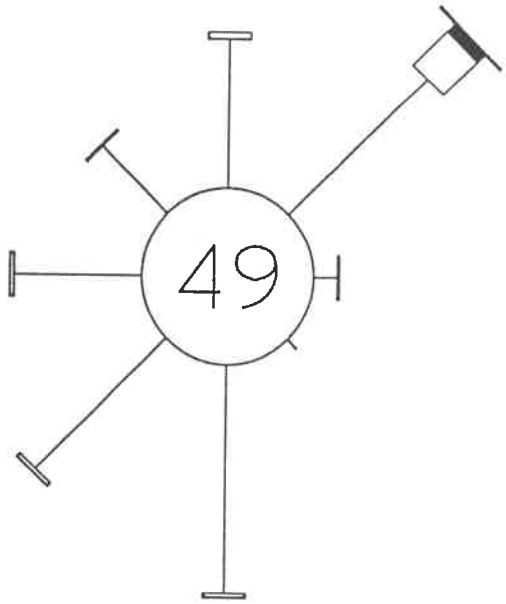
PERCENTAGE FREQUENCY



0 5 10 15 20 25

WIND SPEED

1-10 11-15 16-20 >20 KNOTS



NIWA
Taihoro Nukurangi

FREQUENCIES (PER THOUSAND) FOR: CROMWELL MWD I59021
MONTHS: ALL HOURS: ALL

DATA FROM PERIOD: Nov 1984 - Jan 1989

SPEED(KT) DIR	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	ALL-S
N	54	16	3								74
NE	55	35	22	5	1						117
E	8	3	1								13
SE	4	2									5
S	74	30	2								107
SW	65	20	2								87
W	42	17	2								62
NW	35	8	1								44
*	9	1									10
ALL DRNS	346	132	34	6	1						519

* UNSPECIFIED DIRECTION
CALM 504

NIWA
Taihoro Nukurangi

Brief interpretation of Wanaka wind data

Hourly observations: May 1992 - Sep 1994

Wind recordings at this site were from instrumental readings made at hourly intervals, by an anemometer located at Wanaka Airport.

Analysis of the annual wind summary shows that winds were most frequent from the west (prevailing 36% of the time). Southeasterlies were second most frequent (prevailing 19% of the time). Northwesterlies prevailed 16% of the time.

Calm to light variable conditions occurred 10 percent of the time. Light winds (mean speeds in the range 1 to 10 knots) [0.5 to 5 ms^{-1}]) prevailed 80 percent of the time.

Strong winds (mean speeds at least 21 knots) prevailed 1 percent of the time, being most frequent from the north and north west.

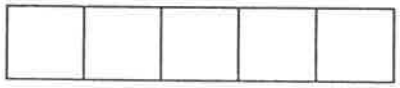
1 knot = 0.52 ms^{-1}
1 ms^{-1} = 1.94 knots

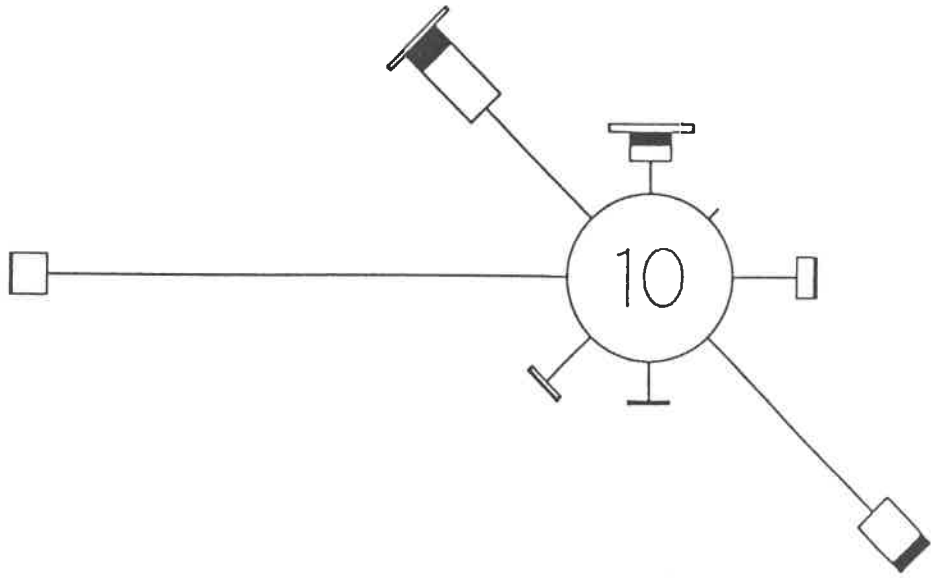
NIWA
Taihoro Nukurangi

WANAKA AIRPORT

HRLY,MAY 1992 - SEP 1994

PERCENTAGE FREQUENCY





WIND SPEED

NIWA
Taihoro Nukurangi

FREQUENCIES (PER THOUSAND) FOR: WANAKA AIRPORT AWS
MONTHS: ALL HOURS: ALL

DATA FROM PERIOD: MAY 1992 - SEP 1994

SPEED(KT) DIR	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	ALL-S
N	16	5	10	8	4	1					45
NE	8	1									9
E	28	14	11	2							55
SE	72	82	32	8							194
S	15	9	2								26
SW	30	10	3	1							43
W	175	164	23	1							364
NW	58	40	46	16	3						163
*	72										72
ALL DRNS	474	324	126	37	9	1					971

* UNSPECIFIED DIRECTION
CALM 28

NIWA
Taihoro Nukurangi

Brief interpretation of Queenstown Airport wind data

Nov 1991 to Sep 1994 period, ***Hourly observations***

Winds at this site were recorded by an anemometer situated atop a standard 10 metre mast. The recording site has flat open-land exposure.

Analysis of the annual wind summary shows that winds were most frequent in the sector from south through west (prevailing 54% of the time). However, northeasterlies prevailed 22% of the time.

Calm to variable winds occurred 7% of the time, and light winds (mean speeds in the range 1 to 10 knots) [0.5 to 5 ms^{-1}]) prevailed 84 % of the time.

Strong winds (mean speeds at least 21 knots) occurred less than one percent of the time, being most frequent from the south.

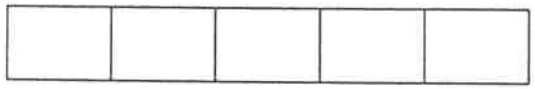
1 knot = 0.52 ms^{-1}
1 ms^{-1} = 1.94 knots

NIWA
Taihoro Nukurangi

QUEENSTOWN AIRPORT

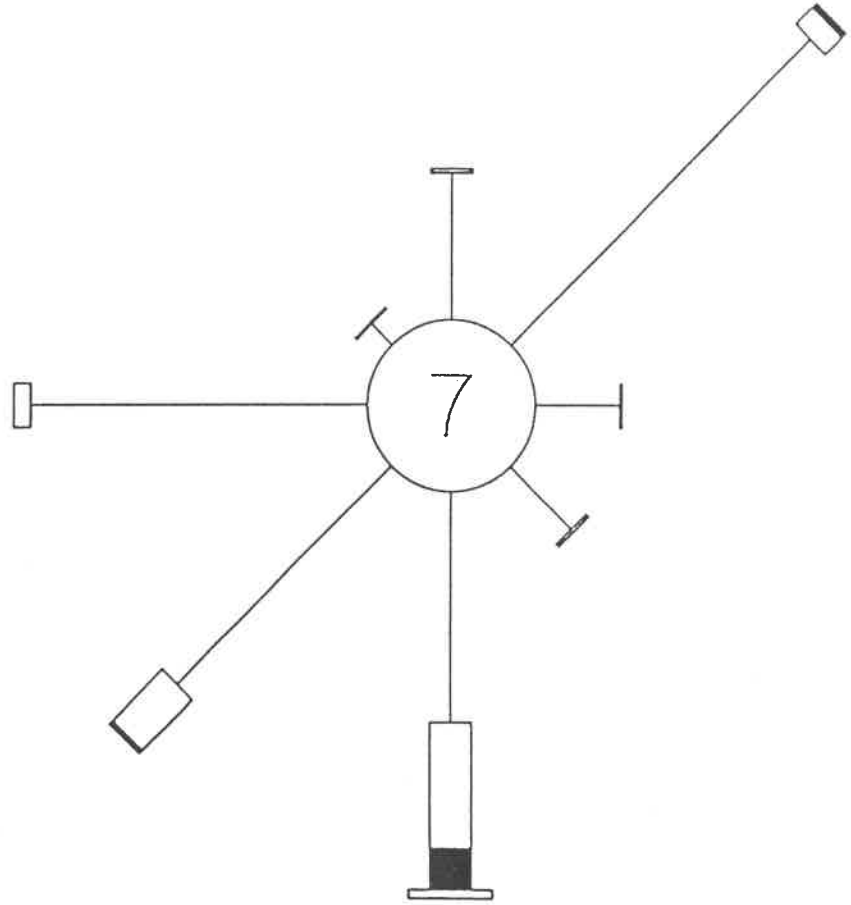
HRLY,NOV 1991 - SEP 1994

PERCENTAGE FREQUENCY



WIND SPEED

1-10	11-15	16-20	>20	KNOTS
2 - 19	20 - 28	29 - 37	>37	km/h



NIWA
Taihoro Nukurangi

FREQUENCIES (PER THOUSAND) FOR: QUEENSTOWN AIRPORT AWS
MONTHS: ALL HOURS: ALL

DATA FROM PERIOD: NOV 1991 - SEP 1994

SPEED(KT) DIR	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	ALL-S
N	48	21	2								72
NE	140	64	11	3							218
E	38	3	1								43
SE	29	13	2								45
S	38	70	60	19	3	1					191
SW	54	91	34	2							181
W	80	82	8								171
NW	11	3	1								15
*	55										55
ALL DRNS	494	348	120	24	3	1					990

* UNSPECIFIED DIRECTION
CALM 9

1 knot = 1.853 km/h

INCIDENCE OF FOG

RESTATSD
REQUESTED BY BURGESS

NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH
STATISTICAL VALUES OF Days of occurrence: Fog
Detail Report

day

DATE : 07-AUG-95

STATION I59012 CROMWELL SUB STN SEASON: JAN - DEC PERIOD: 1949 - 1988

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1949/1949						1.0	2.0	0.0	0.0	0.0	0.0	0.0	
1950/1950	0.0	0.0	0.0	1.0	3.0	3.0	5.0	0.0	0.0	0.0	0.0	0.0	12.0
1951/1951	0.0	0.0	1.0	1.0	6.0	6.0	2.0	2.0	1.0	0.0	0.0	0.0	19.0
1952/1952	0.0	0.0	0.0	4.0	1.0	3.0	4.0	1.0	1.0	0.0	0.0	0.0	14.0
1953/1953	0.0	0.0	0.0	0.0	4.0	7.0	1.0	0.0	0.0	1.0	0.0	0.0	13.0
1954/1954	0.0	0.0	0.0	1.0	9.0	4.0	2.0	1.0	1.0	0.0	0.0	0.0	18.0
1955/1955	0.0	0.0	0.0	0.0	3.0	2.0	9.0	3.0	0.0	0.0	0.0	0.0	17.0
1956/1956	0.0	0.0	0.0	2.0	12.0	6.0	9.0	0.0	0.0	0.0	0.0	0.0	29.0
1957/1957	0.0	0.0	0.0	2.0	4.0	1.0	3.0	2.0	0.0	0.0	0.0	0.0	12.0
1958/1958	0.0	0.0	0.0	0.0	2.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	10.0
1959/1959	0.0	0.0	0.0	2.0	1.0	4.0	5.0	6.0	0.0	0.0	0.0	0.0	18.0
1960/1960	0.0	0.0	0.0	3.0	4.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	10.0
1961/1961	0.0	0.0	0.0	3.0	6.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0
1962/1962	0.0	0.0	0.0	4.0	6.0	3.0	2.0	1.0	0.0	0.0	0.0	0.0	16.0
1963/1963	0.0	0.0	0.0	3.0	3.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
1964/1964	0.0	0.0	0.0	2.0	2.0	4.0	2.0	1.0	0.0	0.0	0.0	0.0	11.0
1965/1965	0.0	0.0	1.0	7.0	2.0	0.0	3.0	1.0	0.0	0.0	0.0	0.0	14.0
1966/1966	0.0	0.0	0.0	1.0	3.0	6.0	4.0	3.0	0.0	0.0	0.0	0.0	17.0
1967/1967	0.0	0.0	0.0	1.0	3.0	5.0	4.0	2.0	0.0	0.0	0.0	0.0	15.0
1968/1968	0.0	0.0	1.0	2.0	4.0	8.0	1.0	2.0	0.0	0.0	0.0	0.0	18.0
1969/1969	0.0	0.0	1.0	0.0	2.0	3.0	1.0	1.0	0.0	0.0	0.0	0.0	8.0
1970/1970	0.0	0.0	0.0	0.0	1.0	8.0	5.0	0.0	0.0	0.0	0.0	0.0	14.0
1971/1971													
1972/1972													
1973/1973													
1974/1974													
1975/1975													
1976/1976					3.0	6.0	1.0	2.0	0.0	0.0	0.0		
1977/1977							6.0	0.0	0.0		0.0	0.0	
1978/1978	0.0	0.0		1.0									
1979/1979													
1980/1980													
1981/1981													
1982/1982													
1983/1983													
1984/1984	0.0	0.0	0.0	3.0	4.0	6.0	5.0	1.0	0.0	0.0	0.0	0.0	19.0
1985/1985	0.0	0.0	0.0	1.0	11.0	11.0	5.0	0.0	0.0	0.0	0.0	2.0	30.0
1986/1986	3.0	1.0	1.0	0.0	7.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0
1987/1987	0.0	0.0	0.0	2.0	4.0	10.0	6.0	2.0	1.0	0.0	0.0	0.0	25.0
1988/1988	0.0	0.0											
MEAN	0.11	0.04	0.20	1.77	4.23	4.41	3.46	1.11	0.14	0.04	0.00	0.07	15.88
SD	0.58	0.19	0.41	1.63	2.87	2.87	2.59	1.37	0.36	0.19	0.00	0.38	5.65
OBS	27	27	25	26	26	27	28	28	28	27	28	27	25
MAX	3.0	1.0	1.0	7.0	12.0	11.0	9.0	6.0	1.0	1.0	0.0	2.0	30.0
MAX YEAR	1986	1986	1951	1965	1956	1985	1955	1959	1951	1953	1949	1985	1985/1985
MIN	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
MIN YEAR	1950	1950	1950	1953	1952	1958	1961	1949	1949	1949	1949	1949	1963/1963

STATION I59021 CROMWELL M.W.D. SEASON: JAN - DEC PERIOD: 1971 - 1984

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1971/1971	0.0	0.0	0.0	3.0	8.0	6.0	7.0	2.0	0.0	0.0	0.0	0.0	26.0
1972/1972	0.0	0.0	0.0	1.0	2.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	4.0
1973/1973	0.0	0.0	0.0	1.0	0.0	6.0	13.0	0.0	1.0	0.0	0.0	0.0	21.0
1974/1974	0.0	0.0	0.0	1.0	4.0	10.0	4.0	0.0	0.0	0.0	0.0	0.0	19.0
1975/1975	0.0	0.0	0.0	1.0	4.0	8.0	2.0	1.0	0.0	0.0	0.0	0.0	16.0
1976/1976	0.0	0.0	0.0		4.0	6.0	1.0	4.0	0.0	0.0	0.0	1.0	
1977/1977	0.0	0.0	0.0	1.0	3.0	5.0	10.0	2.0	0.0	2.0	0.0	0.0	23.0
1978/1978	0.0	0.0	0.0	1.0	10.0	13.0	10.0	5.0	3.0	0.0	0.0	0.0	42.0
1979/1979	0.0	0.0	0.0	1.0	6.0	14.0	7.0	2.0	0.0	0.0	0.0	0.0	30.0
1980/1980	0.0	1.0	0.0	6.0	14.0	10.0	6.0	1.0	0.0	0.0	0.0	0.0	38.0
1981/1981	0.0	0.0	0.0	2.0	5.0	10.0	3.0	3.0	0.0	0.0	0.0	0.0	23.0
1982/1982	0.0	0.0	0.0	12.0	7.0	3.0	4.0	0.0	1.0	0.0	0.0	0.0	27.0
1983/1983	0.0	0.0	0.0	1.0	3.0	7.0	0.0	0.0	1.0	0.0	0.0	0.0	12.0
1984/1984	0.0	0.0	1.0	4.0	4.0	4.0	7.0	1.0	0.0	0.0	0.0	0.0	21.0
MEAN	0.00	0.07	0.07	2.69	5.29	7.29	5.36	1.50	0.43	0.14	0.00	0.07	23.23
SD	0.00	0.27	0.27	3.20	3.56	3.85	3.89	1.61	0.85	0.53	0.00	0.27	10.06
OBS	14	14	14	13	14	14	14	14	14	14	14	14	13
MAX	0.0	1.0	1.0	12.0	14.0	14.0	13.0	5.0	3.0	2.0	0.0	1.0	42.0
MAX YEAR	1971	1980	1984	1982	1980	1979	1973	1978	1978	1977	1971	1976	1978/1978
MIN	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
MIN YEAR	1971	1971	1971	1972	1973	1972	1983	1972	1971	1971	1971	1971	1972/1972

STATION I59024 CROMWELL 2 SEASON: JAN - DEC PERIOD: 1984 - 1991

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1984/1984							0.0	0.0	0.0	0.0	0.0	0.0	
1985/1985	0.0	0.0	0.0	0.0	10.0	11.0	4.0	0.0	0.0	0.0	0.0	0.0	25.0
1986/1986	0.0	0.0	0.0	0.0	6.0	4.0	0.0	2.0	0.0	0.0	0.0	0.0	12.0
1987/1987	0.0	0.0	0.0	3.0	4.0	11.0	6.0	8.0	0.0	0.0	1.0	0.0	33.0
1988/1988	0.0	0.0	0.0	6.0	3.0	13.0	4.0	4.0	0.0	0.0	0.0	0.0	30.0
1989/1989	0.0	0.0	0.0	2.0	8.0	8.0	13.0	13.0	3.0	0.0	0.0	0.0	47.0
1990/1990	0.0	0.0	0.0	1.0	0.0	11.0	8.0	10.0	1.0	0.0	0.0	0.0	31.0
1991/1991	0.0	0.0	0.0	1.0	11.0	8.0	12.0	3.0	0.0	0.0	0.0	0.0	35.0
MEAN	0.00	0.00	0.00	1.86	6.00	9.43	5.88	5.00	0.50	0.00	0.13	0.00	30.43
SD	0.00	0.00	0.00	2.12	3.96	2.99	4.91	4.81	1.07	0.00	0.35	0.00	10.58
OBS	7	7	7	7	7	7	8	8	8	8	8	8	7
MAX	0.0	0.0	0.0	6.0	11.0	13.0	13.0	13.0	3.0	0.0	1.0	0.0	47.0
MAX YEAR	1985	1985	1985	1988	1991	1988	1989	1989	1989	1984	1987	1984	1989/1989
MIN	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
MIN YEAR	1985	1985	1985	1985	1990	1986	1984	1984	1984	1984	1984	1984	1986/1986

ESTATSD
EQUESTED BY BURGESS

NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH
STATISTICAL VALUES OF Days of occurrence: Fog
Detail Report

day

DATE : 07-AUG-95

TATION I49711 WANAKA

SEASON: JAN - DEC PERIOD: 1972 - 1990

EAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
972/1972									0.0	0.0		0.0	
973/1973	0.0	0.0	0.0										
974/1974	0.0	0.0	0.0	0.0	1.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
975/1975	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	4.0
976/1976	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
977/1977	0.0	0.0	0.0	0.0	0.0	3.0	1.0	0.0	0.0	0.0	0.0	0.0	4.0
978/1978	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
979/1979	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
980/1980	0.0	0.0	0.0	2.0	4.0	5.0	2.0	1.0	0.0	0.0	0.0	0.0	14.0
981/1981	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
982/1982	0.0	0.0	0.0	3.0	0.0	3.0	2.0	1.0	0.0	0.0	0.0	0.0	9.0
983/1983	0.0	0.0	0.0	0.0	2.0	8.0	0.0	0.0	0.0	0.0	1.0	0.0	11.0
984/1984	0.0	0.0	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	0.0	0.0	6.0
985/1985	0.0	0.0	0.0	1.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
986/1986	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
987/1987	0.0	0.0	0.0	0.0	1.0	4.0	2.0	0.0	0.0	0.0	0.0	0.0	7.0
988/1988	0.0	0.0	0.0	0.0	3.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
989/1989	1.0	0.0	0.0	0.0	1.0	2.0	0.0	1.0	0.0	0.0	0.0	0.0	5.0
990/1990	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.0					
EAN	0.06	0.00	0.00	0.41	0.88	2.76	1.00	0.24	0.00	0.00	0.06	0.00	5.50
D	0.24	0.00	0.00	0.87	1.22	2.25	1.12	0.44	0.00	0.00	0.25	0.00	3.58
BS	18	18	18	17	17	17	17	17	17	17	16	17	16
AX	1.0	0.0	0.0	3.0	4.0	8.0	3.0	1.0	0.0	0.0	1.0	0.0	14.0
AX YEAR	1989	1973	1973	1982	1980	1983	1984	1980	1972	1972	1983	1972	1980/1980
IN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
IN YEAR	1973	1973	1973	1974	1975	1979	1974	1974	1972	1972	1974	1972	1979/1979

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NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH
STATISTICAL VALUES OF Days of occurrence: Fog
Detail Report

day

DATE : 07-AUG-95

STATION I58074 QUEENSTOWN AERO SEASON: JAN - DEC PERIOD: 1969 - 1992

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1969/1969	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1970/1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971/1971	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1972/1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973/1973		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1974/1974	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
1975/1975	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	3.0
1976/1976	2.0	0.0	0.0	3.0	1.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	9.0
1977/1977	0.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1978/1978	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1979/1979	0.0	1.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	3.0	7.0
1980/1980	1.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
1981/1981	0.0	1.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	5.0
1982/1982	0.0	1.0	0.0	1.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.0
1983/1983	1.0	1.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
1984/1984	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	5.0
1985/1985	0.0	0.0	1.0	3.0	3.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	9.0
1986/1986	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1987/1987	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	3.0
1988/1988	0.0	0.0	1.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	5.0
1989/1989	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0
1990/1990	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
1991/1991	0.0	0.0	0.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	6.0
1992/1992	1.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0					
MEAN	0.39	0.33	0.25	0.54	0.46	0.50	0.29	0.13	0.00	0.17	0.22	0.17	3.59
SD	0.66	0.56	0.61	0.93	0.83	0.83	0.62	0.45	0.00	0.39	0.52	0.65	2.56
OBS	23	24	24	24	24	24	24	24	23	23	23	23	22
MAX	2.0	2.0	2.0	3.0	3.0	3.0	2.0	2.0	0.0	1.0	2.0	3.0	9.0
MAX YEAR	1976	1977	1984	1976	1985	1983	1988	1991	1969	1975	1976	1979	1976/1976
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1969	1970	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1970/1970

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REQUESTED BY BURGESS STATISTICAL VALUES OF Days of occurrence: Fog day DATE : 07-AUG-95
Detail Report

STATION I58061 QUEENSTOWN SEASON: JAN - DEC PERIOD: 1929 - 1991

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1929/1929										0.0	0.0	0.0	
1930/1930	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1931/1931	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1932/1932	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1933/1933	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1934/1934	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1935/1935	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1936/1936	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1937/1937	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1938/1938	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939/1939	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1940/1940	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1941/1941	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1942/1942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
1943/1943	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1944/1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1945/1945	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1946/1946	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1947/1947	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1948/1948	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1949/1949	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1950/1950	0.0	0.0	0.0	0.0	3.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	5.0
1951/1951	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	3.0
1952/1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953/1953				0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
1954/1954	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1955/1955	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1956/1956	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957/1957	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958/1958	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959/1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0
1960/1960	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	4.0
1961/1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962/1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963/1963	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1964/1964	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1965/1965	0.0	0.0	1.0	6.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
1966/1966	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	2.0
1967/1967	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	3.0
1968/1968	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1969/1969	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1970/1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971/1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972/1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973/1973	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1974/1974	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1975/1975	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1976/1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
1977/1977	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

STATION 158061 QUEENSTOWN SEASON: JAN - DEC PERIOD: 1929 - 1991

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1978/1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979/1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980/1980	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1981/1981	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1982/1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983/1983	0.0	1.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1984/1984	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
1985/1985	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1986/1986	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1987/1987	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	4.0
1988/1988	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1989/1989	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1990/1990	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1991/1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEAN	0.02	0.10	0.10	0.16	0.31	0.16	0.10	0.02	0.02	0.06	0.06	0.03	1.13
SD	0.13	0.35	0.30	0.79	0.64	0.49	0.39	0.13	0.13	0.30	0.25	0.18	1.53
OBS	61	61	61	62	62	62	62	62	62	63	63	63	61
MAX	1.0	2.0	1.0	6.0	3.0	2.0	2.0	1.0	1.0	2.0	1.0	1.0	8.0
MAX YEAR	1984	1990	1939	1965	1950	1964	1950	1967	1951	1987	1951	1959	1965/1965
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1930	1930	1930	1930	1930	1930	1930	1930	1930	1929	1929	1929	1930/1930

INCIDENCE OF SNOW FALLING

TATION 159024 CROMWELL 2 SEASON: JAN - DEC PERIOD: 1984 - 1991

EAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
984/1984							0.0	0.0	0.0	0.0	0.0	0.0	
985/1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
986/1986	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	3.0
987/1987	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
988/1988	0.0	0.0	0.0	0.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0
989/1989	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
990/1990	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
991/1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
IEAN	0.00	0.00	0.00	0.14	0.43	0.14	0.50	0.25	0.00	0.13	0.00	0.00	1.71
D	0.00	0.00	0.00	0.38	0.79	0.38	0.76	0.46	0.00	0.35	0.00	0.00	0.95
BS	7	7	7	7	7	7	8	8	8	8	8	8	7
AX	0.0	0.0	0.0	1.0	2.0	1.0	2.0	1.0	0.0	1.0	0.0	0.0	3.0
AX YEAR	1985	1985	1985	1990	1988	1986	1986	1988	1984	1985	1984	1984	1986/1986
IN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
IN YEAR	1985	1985	1985	1985	1985	1985	1984	1984	1984	1984	1984	1984	1985/1985

ESTATSD
EQUESTED BY BURGESS

NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH
STATISTICAL VALUES OF Days of occurrence: Snow
Detail Report

day

DATE : 07-AUG-95

TATION I49711 WANAKA

SEASON: JAN - DEC PERIOD: 1972 - 1990

EAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
972/1972									1.0	0.0		0.0	
973/1973	0.0	0.0	0.0										
974/1974	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0
975/1975	0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0	1.0	0.0	0.0	0.0	7.0
976/1976	0.0	0.0	0.0	0.0	0.0	2.0	3.0	2.0	0.0	0.0	0.0	0.0	7.0
977/1977	0.0	0.0	0.0	0.0	2.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	4.0
978/1978	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0
979/1979	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	3.0
980/1980	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	2.0
981/1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0
982/1982	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	3.0
983/1983	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	1.0	0.0	0.0	0.0	5.0
984/1984	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	3.0
985/1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
986/1986	0.0	0.0	0.0	0.0	1.0	4.0	1.0	1.0	0.0	0.0	0.0	0.0	7.0
987/1987	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	1.0	0.0	0.0	5.0
988/1988	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
989/1989	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
990/1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
EAN	0.00	0.00	0.00	0.00	0.29	1.06	0.94	0.65	0.35	0.06	0.06	0.00	3.56
D	0.00	0.00	0.00	0.00	0.59	1.39	1.20	0.93	0.49	0.24	0.25	0.00	2.06
BS	18	18	18	17	17	17	17	17	17	17	16	17	16
AX	0.0	0.0	0.0	0.0	2.0	4.0	4.0	3.0	1.0	1.0	1.0	0.0	7.0
AX YEAR	1973	1973	1973	1974	1977	1983	1987	1975	1972	1987	1980	1972	1975/1975
IN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
IN YEAR	1973	1973	1973	1974	1974	1974	1977	1974	1974	1972	1974	1972	1981/1981

STATION I58074 QUEENSTOWN AERO SEASON: JAN - DEC PERIOD: 1969 - 1992

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1969/1969	0.0	0.0	0.0	0.0	0.0	3.0	0.0	1.0	0.0	1.0	0.0	0.0	5.0
1970/1970	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	2.0
1971/1971													
1972/1972	0.0	0.0	0.0	0.0	1.0	5.0	0.0	3.0	1.0	0.0	0.0	0.0	10.0
1973/1973		0.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	
1974/1974	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1975/1975	0.0	0.0	0.0	0.0	0.0	2.0	4.0	3.0	3.0	1.0	1.0	0.0	14.0
1976/1976	0.0	0.0	0.0	0.0	0.0	2.0	2.0	1.0	0.0	2.0	1.0	0.0	8.0
1977/1977	0.0	0.0	0.0	0.0	3.0	0.0	1.0	0.0	2.0	1.0	0.0	0.0	7.0
1978/1978	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
1979/1979	0.0	0.0	0.0	1.0	2.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	7.0
1980/1980	0.0	0.0	1.0	0.0	0.0	0.0	4.0	2.0	0.0	0.0	0.0	0.0	7.0
1981/1981	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.0	3.0	0.0	0.0	0.0	7.0
1982/1982	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	1.0	2.0	0.0	0.0	8.0
1983/1983	0.0	0.0	0.0	0.0	2.0	4.0	2.0	1.0	0.0	0.0	0.0	2.0	11.0
1984/1984	0.0	0.0	0.0	0.0	1.0	1.0	2.0	4.0	2.0	0.0	0.0	0.0	10.0
1985/1985	0.0	0.0	0.0	1.0	1.0	0.0	1.0	2.0	0.0	2.0	0.0	0.0	7.0
1986/1986	0.0	0.0	0.0	0.0	0.0	4.0	3.0	2.0	0.0	0.0	0.0	0.0	9.0
1987/1987	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	3.0
1988/1988	0.0	0.0	0.0	0.0	5.0	1.0	0.0	2.0	0.0	0.0	0.0	0.0	8.0
1989/1989	0.0	0.0	0.0	0.0	1.0	4.0	0.0	0.0	0.0	1.0	0.0	0.0	6.0
1990/1990	0.0	0.0	0.0	2.0	0.0	1.0	2.0	0.0	4.0	1.0	0.0	0.0	10.0
1991/1991	0.0	0.0	0.0	0.0	0.0	2.0	4.0	4.0	0.0	0.0	1.0	1.0	12.0
1992/1992	0.0	0.0	2.0	1.0	2.0	2.0	3.0	3.0					
MEAN	0.00	0.00	0.13	0.22	0.91	1.65	1.61	1.52	0.77	0.50	0.14	0.14	7.43
SD	0.00	0.00	0.46	0.52	1.28	1.75	1.47	1.31	1.23	0.74	0.35	0.47	3.31
OBS	22	23	23	23	23	23	23	23	22	22	22	22	21
MAX	0.0	0.0	2.0	2.0	5.0	5.0	4.0	4.0	4.0	2.0	1.0	2.0	14.0
MAX YEAR	1969	1969	1992	1990	1988	1972	1975	1984	1990	1976	1975	1983	1975/1975
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1969	1969	1969	1969	1969	1970	1969	1970	1969	1970	1969	1969	1974/1974

NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH
STATISTICAL VALUES OF Days of occurrence: Snow
Detail Report

day

STATION I58061 QUEENSTOWN SEASON: JAN - DEC PERIOD: 1929 - 1991

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1929/1929										0.0	2.0	0.0	
1930/1930	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	1.0	0.0	1.0	0.0	6.0
1931/1931	0.0	0.0	0.0	0.0	0.0	4.0	3.0	1.0	1.0	1.0	1.0	0.0	11.0
1932/1932	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	1.0	0.0	0.0	0.0	7.0
1933/1933	0.0	0.0	0.0	0.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	3.0
1934/1934	0.0	0.0	0.0	0.0	1.0	3.0	2.0	4.0	3.0	0.0	0.0	0.0	13.0
1935/1935	0.0	0.0	0.0	0.0	4.0	3.0	0.0	3.0	1.0	1.0	0.0	0.0	12.0
1936/1936	0.0	0.0	0.0	0.0	3.0	1.0	8.0	3.0	4.0	0.0	0.0	0.0	19.0
1937/1937	0.0	0.0	0.0	0.0	0.0	5.0	2.0	1.0	1.0	0.0	0.0	0.0	9.0
1938/1938	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	4.0
1939/1939	0.0	0.0	0.0	0.0	0.0	1.0	9.0	3.0	0.0	1.0	0.0	0.0	14.0
1940/1940	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1941/1941	0.0	0.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	4.0
1942/1942	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	1.0	0.0	0.0	4.0
1943/1943	0.0	0.0	0.0	0.0	2.0	5.0	0.0	1.0	0.0	0.0	0.0	0.0	8.0
1944/1944	0.0	0.0	0.0	0.0	0.0	4.0	1.0	1.0	1.0	1.0	0.0	0.0	8.0
1945/1945	0.0	0.0	0.0	0.0	2.0	1.0	4.0	0.0	2.0	1.0	0.0	0.0	10.0
1946/1946	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	3.0	0.0	0.0	7.0
1947/1947	0.0	0.0	0.0	0.0	0.0	3.0	2.0	2.0	3.0	1.0	0.0	0.0	11.0
1948/1948	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	5.0
1949/1949	0.0	0.0	2.0	0.0	1.0	4.0	2.0	3.0	3.0	0.0	0.0	0.0	15.0
1950/1950	0.0	0.0	1.0	2.0	0.0	3.0	3.0	1.0	0.0	0.0	0.0	0.0	10.0
1951/1951	0.0	0.0	0.0	1.0	3.0	1.0	3.0	6.0	0.0	1.0	0.0	0.0	15.0
1952/1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953/1953				0.0	0.0	1.0	1.0	1.0	3.0	0.0	0.0	0.0	
1954/1954	0.0	0.0	0.0	0.0	0.0	2.0	3.0	2.0	0.0	1.0	0.0	0.0	8.0
1955/1955	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1956/1956	0.0	0.0	0.0	0.0	1.0	0.0	2.0	2.0	1.0	0.0	0.0	0.0	6.0
1957/1957	0.0	0.0	0.0	0.0	2.0	0.0	3.0	0.0	0.0	1.0	0.0	0.0	6.0
1958/1958	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	2.0	0.0	0.0	0.0	7.0
1959/1959	0.0	0.0	0.0	1.0	5.0	0.0	0.0	1.0	0.0	0.0	2.0	0.0	9.0
1960/1960	1.0	0.0	0.0	0.0	0.0	2.0	3.0	5.0	0.0	0.0	1.0	2.0	14.0
1961/1961	0.0	0.0	0.0	3.0	0.0	8.0	3.0	0.0	5.0	0.0	0.0	0.0	19.0
1962/1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	5.0
1963/1963	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	3.0	1.0	4.0	5.0	16.0
1964/1964	0.0	0.0	0.0	0.0	3.0	2.0	3.0	6.0	5.0	1.0	1.0	1.0	22.0
1965/1965	3.0	3.0	2.0	0.0	0.0	4.0	5.0	2.0	2.0	8.0	5.0	3.0	37.0
1966/1966	0.0	0.0	0.0	0.0	1.0	6.0	2.0	3.0	3.0	0.0	1.0	1.0	17.0
1967/1967	0.0	0.0	0.0	2.0	3.0	1.0	0.0	1.0	5.0	0.0	5.0	0.0	17.0
1968/1968	0.0	0.0	0.0	1.0	0.0	5.0	6.0	2.0	4.0	9.0	0.0	0.0	27.0
1969/1969	0.0	0.0	0.0	3.0	2.0	6.0	5.0	5.0	1.0	1.0	0.0	0.0	23.0
1970/1970	0.0	0.0	0.0	0.0	5.0	1.0	4.0	0.0	2.0	1.0	0.0	0.0	13.0
1971/1971													
1972/1972	0.0	0.0	0.0	0.0	5.0	6.0	3.0	4.0	2.0	2.0	0.0	0.0	22.0
1973/1973	0.0	0.0	0.0	0.0	2.0	1.0	0.0	2.0	1.0	2.0	0.0	0.0	8.0
1974/1974	0.0	0.0	0.0	0.0	2.0	5.0	4.0	1.0	1.0	0.0	0.0	0.0	13.0
1975/1975	0.0	0.0	0.0	0.0	3.0	3.0	6.0	4.0	3.0	1.0	1.0	2.0	23.0
1976/1976	0.0	0.0	0.0	0.0	0.0	6.0	9.0	2.0	0.0	3.0	3.0	0.0	23.0
1977/1977	0.0	0.0	0.0	1.0	3.0	2.0	2.0	2.0	5.0	0.0	1.0	0.0	16.0

STATION I58061 QUEENSTOWN SEASON: JAN - DEC PERIOD: 1929 - 1991

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1978/1978	0.0	0.0	0.0	0.0	0.0	5.0	0.0	3.0	0.0	2.0	1.0	0.0	11.0
1979/1979	0.0	0.0	0.0	1.0	3.0	1.0	2.0	4.0	3.0	0.0	0.0	0.0	14.0
1980/1980	0.0	0.0	0.0	0.0	0.0	1.0	7.0	6.0	1.0	0.0	1.0	0.0	16.0
1981/1981	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	7.0	0.0	0.0	0.0	11.0
1982/1982	0.0	0.0	0.0	0.0	0.0	2.0	1.0	5.0	1.0	5.0	0.0	1.0	15.0
1983/1983	1.0	0.0	1.0	0.0	3.0	8.0	1.0	1.0	2.0	0.0	0.0	0.0	17.0
1984/1984	0.0	0.0	0.0	1.0	2.0	0.0	3.0	5.0	1.0	2.0	0.0	0.0	14.0
1985/1985	0.0	0.0	0.0	2.0	1.0	0.0	0.0	1.0	1.0	2.0	0.0	0.0	7.0
1986/1986	0.0	0.0	0.0	0.0	1.0	6.0	7.0	5.0	0.0	0.0	0.0	0.0	19.0
1987/1987	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	3.0	0.0	0.0	6.0
1988/1988	0.0	0.0	0.0	0.0	3.0	1.0	0.0	4.0	2.0	0.0	0.0	0.0	10.0
1989/1989	0.0	0.0	0.0	0.0	2.0	5.0	1.0	1.0	1.0	0.0	0.0	0.0	10.0
1990/1990	0.0	0.0	0.0	2.0	0.0	2.0	5.0	0.0	4.0	1.0	0.0	0.0	14.0
1991/1991	0.0	0.0	0.0	0.0	0.0	5.0	3.0	4.0	0.0	0.0	0.0	0.0	12.0
MEAN	0.08	0.05	0.10	0.34	1.16	2.38	2.49	2.15	1.56	0.95	0.48	0.24	12.08
SD	0.42	0.39	0.40	0.75	1.49	2.23	2.31	1.82	1.68	1.72	1.13	0.82	6.91
OBS	60	60	60	61	61	61	61	61	61	62	62	62	60
MAX	3.0	3.0	2.0	3.0	5.0	8.0	9.0	6.0	7.0	9.0	5.0	5.0	37.0
MAX YEAR	1965	1965	1949	1961	1959	1961	1939	1951	1981	1968	1965	1963	1965/1965
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1930	1930	1930	1930	1930	1933	1933	1930	1933	1929	1932	1929	1952/1952

RESTATSD NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH PAGE : 1
REQUESTED BY BURGESS STATISTICAL VALUES OF Days of occurrence: Snow day DATE : 07-AUG-95
Detail Report

STATION I59012 CROMWELL SUB STN SEASON: JAN - DEC PERIOD: 1949 - 1988

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1949/1949						4.0	0.0	3.0	1.0	0.0	0.0	0.0	
1950/1950	0.0	0.0	0.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	3.0
1951/1951	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	4.0
1952/1952	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1953/1953	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	3.0
1954/1954	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	4.0
1955/1955	0.0	0.0	0.0	0.0	0.0	1.0	4.0	0.0	0.0	0.0	0.0	0.0	5.0
1956/1956	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	4.0
1957/1957	0.0	0.0	0.0	0.0	1.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	5.0
1958/1958	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	1.0	0.0	0.0	0.0	6.0
1959/1959	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	4.0
1960/1960	0.0	0.0	0.0	0.0	0.0	1.0	2.0	1.0	0.0	0.0	0.0	0.0	4.0
1961/1961	0.0	0.0	0.0	0.0	0.0	3.0	1.0	0.0	2.0	0.0	0.0	0.0	6.0
1962/1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
1963/1963	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	3.0
1964/1964	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0
1965/1965	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	3.0	0.0	0.0	7.0
1966/1966	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	4.0
1967/1967	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1968/1968	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	3.0
1969/1969	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	1.0	0.0	0.0	4.0
1970/1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971/1971													
1972/1972													
1973/1973													
1974/1974													
1975/1975													
1976/1976					0.0	1.0	1.0	1.0	0.0	0.0	0.0		
1977/1977							0.0	0.0	0.0		0.0	0.0	
1978/1978	0.0	0.0		0.0									
1979/1979													
1980/1980													
1981/1981													
1982/1982													
1983/1983													
1984/1984	0.0	0.0	0.0	0.0	0.0	1.0	2.0	1.0	0.0	0.0	0.0	0.0	4.0
1985/1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986/1986	0.0	0.0	0.0	0.0	0.0	1.0	2.0	1.0	0.0	0.0	0.0	0.0	4.0
1987/1987	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	2.0
1988/1988	0.0	0.0											
MEAN	0.00	0.00	0.00	0.04	0.15	1.00	1.11	0.68	0.29	0.26	0.04	0.00	3.48
SD	0.00	0.00	0.00	0.20	0.46	1.14	1.23	0.86	0.53	0.71	0.19	0.00	1.73
OBS	27	27	25	26	26	27	28	28	28	27	28	27	25
MAX	0.0	0.0	0.0	1.0	2.0	4.0	4.0	3.0	2.0	3.0	1.0	0.0	7.0
MAX YEAR	1950	1950	1950	1950	1959	1949	1955	1949	1961	1965	1963	1949	1965/1965
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1950	1950	1950	1951	1950	1950	1949	1950	1950	1949	1949	1949	1970/1970

STATION 159021 CROMWELL M.W.D. SEASON: JAN - DEC PERIOD: 1972 - 1984

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1972/1972	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	3.0
1973/1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.0
1974/1974	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	3.0
1975/1975	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	4.0
1976/1976	0.0	0.0	0.0		0.0	2.0	3.0	2.0	0.0	0.0	1.0	0.0	
1977/1977	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1978/1978	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1979/1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.0
1980/1980	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	1.0	0.0	4.0
1981/1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	2.0
1982/1982	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	4.0
1983/1983	0.0	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	4.0
1984/1984	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.0	0.0	0.0	0.0	0.0	4.0
MEAN	0.00	0.00	0.00	0.00	0.15	0.77	1.31	1.00	0.08	0.00	0.15	0.00	3.08
SD	0.00	0.00	0.00	0.00	0.55	1.09	1.25	0.82	0.28	0.00	0.38	0.00	0.90
OBS	13	13	13	12	13	13	13	13	13	13	13	13	12
MAX	0.0	0.0	0.0	0.0	2.0	3.0	3.0	2.0	1.0	0.0	1.0	0.0	4.0
MAX YEAR	1972	1972	1972	1972	1977	1978	1976	1973	1981	1972	1976	1972	1975/1975
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
MIN YEAR	1972	1972	1972	1972	1972	1973	1973	1977	1972	1972	1972	1972	1973/1973

INCIDENCE OF SNOW LYING

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DATE : 07-AUG-95

STATION 159012 CROMWELL SUB STN SEASON: JAN - DEC PERIOD: 1976 - 1988

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1976/1976					0.0	0.0	3.0	1.0	0.0	0.0	0.0		
1977/1977							0.0	0.0	0.0		0.0	0.0	
1978/1978	0.0	0.0		0.0									
1979/1979													
1980/1980													
1981/1981													
1982/1982													
1983/1983													
1984/1984	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1985/1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986/1986	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1987/1987	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1988/1988	0.0	0.0											
MEAN	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.17	0.00	0.00	0.00	0.00	0.75
SD	0.00	0.00	0.00	0.00	0.00	0.00	1.10	0.41	0.00	0.00	0.00	0.00	0.50
OBS	6	6	4	5	5	5	6	6	6	5	6	5	4
MAX	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.0	0.0	0.0	0.0	0.0	1.0
MAX YEAR	1978	1978	1984	1978	1976	1976	1976	1976	1976	1976	1976	1977	1984/1984
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1978	1978	1984	1978	1976	1976	1977	1977	1976	1976	1976	1977	1985/1985

STATION I59021 CROMWELL M.W.D. SEASON: JAN - DEC PERIOD: 1972 - 1984

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1972/1972	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	1.0	0.0	0.0	0.0	4.0
1973/1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
1974/1974	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0
1975/1975	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1976/1976	0.0	0.0	0.0		0.0	0.0	3.0	1.0	0.0	0.0	0.0	0.0	
1977/1977	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1978/1978	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1979/1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
1980/1980	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	4.0
1981/1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1982/1982	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	3.0
1983/1983	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	3.0
1984/1984	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	3.0
MEAN	0.00	0.00	0.00	0.00	0.08	0.54	1.23	0.38	0.08	0.00	0.00	0.00	2.17
SD	0.00	0.00	0.00	0.00	0.28	0.97	1.42	0.51	0.28	0.00	0.00	0.00	1.34
OBS	13	13	13	12	13	13	13	13	13	13	13	13	12
MAX	0.0	0.0	0.0	0.0	1.0	3.0	4.0	1.0	1.0	0.0	0.0	0.0	4.0
MAX YEAR	1972	1972	1972	1972	1977	1978	1980	1972	1972	1972	1972	1972	1972/1972
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1972	1972	1972	1972	1972	1973	1972	1974	1973	1972	1972	1972	1981/1981

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STATION 159024 CROMWELL 2 SEASON: JAN - DEC PERIOD: 1984 - 1991

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1984/1984							0.0	0.0	0.0	0.0	0.0	0.0	
1985/1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
1986/1986	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	3.0
1987/1987	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1988/1988	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
1989/1989	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1990/1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991/1991	0.0	0.0	0.0	0.0	0.0								
MEAN	0.00	0.00	0.00	0.00	0.57	0.33	0.43	0.00	0.00	0.14	0.00	0.00	1.67
SD	0.00	0.00	0.00	0.00	1.51	0.52	0.79	0.00	0.00	0.38	0.00	0.00	1.51
OBS	7	7	7	7	7	6	7	7	7	7	7	7	6
MAX	0.0	0.0	0.0	0.0	4.0	1.0	2.0	0.0	0.0	1.0	0.0	0.0	4.0
MAX YEAR	1985	1985	1985	1985	1988	1986	1986	1984	1984	1985	1984	1984	1988/1988
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1985	1985	1985	1985	1985	1985	1984	1984	1984	1984	1984	1984	1990/1990

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STATISTICAL VALUES OF Days of occurrence: Snow Lying
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DATE : 07-AUG-95

STATION I49711 WANAKA SEASON: JAN - DEC PERIOD: 1972 - 1990

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1972/1972									0.0	0.0		0.0	
1973/1973	0.0	0.0	0.0										
1974/1974	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1975/1975	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1976/1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1977/1977	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1978/1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979/1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980/1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981/1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1982/1982	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1983/1983	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1984/1984	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1985/1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
1986/1986	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1987/1987	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0
1988/1988	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1989/1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990/1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
MEAN	0.00	0.00	0.00	0.00	0.18	0.24	0.24	0.06	0.00	0.00	0.00	0.00	0.75
SD	0.00	0.00	0.00	0.00	0.39	0.56	0.56	0.24	0.00	0.00	0.00	0.00	0.68
OBS	18	18	18	17	17	17	17	17	17	17	16	17	16
MAX	0.0	0.0	0.0	0.0	1.0	2.0	2.0	1.0	0.0	0.0	0.0	0.0	2.0
MAX YEAR	1973	1973	1973	1974	1974	1986	1987	1985	1972	1972	1974	1972	1986/1986
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1973	1973	1973	1974	1975	1974	1974	1974	1972	1972	1974	1972	1976/1976

STATION I58074 QUEENSTOWN AERO SEASON: JAN - DEC PERIOD: 1972 - 1991

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1972/1972	0.0	0.0	0.0	0.0	0.0	7.0	0.0	2.0	0.0	0.0	0.0	0.0	9.0
1973/1973		0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1974/1974	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1975/1975	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1976/1976	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	4.0
1977/1977	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1978/1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979/1979	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
1980/1980	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	0.0	0.0	0.0	0.0	5.0
1981/1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
1982/1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983/1983	0.0	0.0	0.0	0.0	0.0	2.0	2.0	1.0	0.0	0.0	0.0	0.0	5.0
1984/1984	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	4.0
1985/1985	0.0	0.0	0.0	1.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	5.0
1986/1986	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	3.0
1987/1987	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	4.0
1988/1988	0.0	0.0	0.0	0.0	13.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	15.0
1989/1989	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
1990/1990	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1991/1991	0.0	0.0	0.0	0.0	0.0								
MEAN	0.00	0.00	0.00	0.05	0.75	1.05	0.89	0.58	0.00	0.11	0.00	0.00	3.56
SD	0.00	0.00	0.00	0.22	2.92	2.04	1.24	0.84	0.00	0.46	0.00	0.00	3.84
OBS	19	20	20	20	20	19	19	19	19	19	19	19	18
MAX	0.0	0.0	0.0	1.0	13.0	7.0	4.0	2.0	0.0	2.0	0.0	0.0	15.0
MAX YEAR	1972	1972	1972	1985	1988	1972	1976	1972	1972	1985	1972	1972	1988/1988
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN YEAR	1972	1972	1972	1972	1972	1973	1972	1973	1972	1972	1972	1972	1974/1974

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STATISTICAL VALUES OF Days of occurrence: Snow Lying
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day

DATE : 07-AUG-95

STATION I58061 QUEENSTOWN SEASON: JAN - DEC PERIOD: 1972 - 1991

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SEASON
1972/1972	0.0	0.0	0.0	0.0	0.0	6.0	0.0	2.0	0.0	0.0	0.0	0.0	8.0
1973/1973	0.0	0.0	0.0	0.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0
1974/1974	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0
1975/1975	0.0	0.0	0.0	0.0	0.0	2.0	7.0	3.0	0.0	0.0	0.0	0.0	12.0
1976/1976	0.0	0.0	0.0	0.0	0.0	4.0	10.0	1.0	0.0	0.0	0.0	0.0	15.0
1977/1977	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	4.0
1978/1978	0.0	0.0	0.0	0.0	0.0	5.0	1.0	0.0	0.0	0.0	0.0	0.0	6.0
1979/1979	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	2.0
1980/1980	0.0	0.0	0.0	0.0	0.0	0.0	4.0	2.0	0.0	0.0	0.0	0.0	6.0
1981/1981	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	0.0	0.0	0.0	3.0
1982/1982	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	3.0
1983/1983	0.0	0.0	0.0	0.0	0.0	5.0	3.0	0.0	0.0	0.0	0.0	0.0	8.0
1984/1984	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	4.0
1985/1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	0.0	0.0	3.0
1986/1986	0.0	0.0	0.0	0.0	0.0	3.0	2.0	3.0	0.0	0.0	0.0	0.0	8.0
1987/1987	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	3.0
1988/1988	0.0	0.0	0.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0
1989/1989	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
1990/1990	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	1.0	0.0	0.0	4.0
1991/1991	0.0	0.0	0.0	0.0	0.0								
MEAN	0.00	0.00	0.00	0.00	0.75	1.68	2.00	0.95	0.11	0.16	0.00	0.00	5.68
SD	0.00	0.00	0.00	0.00	2.49	2.08	2.58	1.08	0.46	0.50	0.00	0.00	3.73
OBS	20	20	20	20	20	19	19	19	19	19	19	19	19
MAX	0.0	0.0	0.0	0.0	11.0	6.0	10.0	3.0	2.0	2.0	0.0	0.0	15.0
MAX YEAR	1972	1972	1972	1972	1988	1972	1976	1975	1981	1985	1972	1972	1976/1976
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
MIN YEAR	1972	1972	1972	1972	1972	1973	1972	1974	1972	1972	1972	1972	1974/1974

APPENDIX B

2 Plan Change Objectives

The Council acknowledges that it cannot prevent requests for plan changes from any party. However, the Council wishes to take a lead in the future provision and planning for new settlement areas and has identified areas which in a broad sense may be suitable subject to a full assessment of all matters. The Council has therefore set out the objectives which should direct the development of new settlements:

i *Development which has full regard to the major District policy considerations in respect of the landscape, services, waterways and the protection of rural amenity.*

ii *Urban development of a scale and character consistent with a primary emphasis on protecting the visual landscape features of the Basin. (Refer District Wide Policies - New Section 1.4.03(A))*

iii *Development which avoids urban growth on land or landforms which are of significant landscape value or detracts from the margins of waterways.*

iv *Development with a primary emphasis on urban consolidation which avoids, remedies or mitigates adverse impacts on water, air and other natural resources and which makes efficient use of land chosen for a new settlement.*

v *Urban growth which avoids versatile and high quality soils unless the need for this protection is outweighed by the protection of other natural or physical resources or important amenity values.*

vi *Development which makes efficient use of infrastructure.*

vii *Development which occurs in a form well detached from current urban boundaries and does not promote a dispersed or unco-ordinated pattern of development or the spread of existing urban boundaries.*

viii *Development which takes into account the economic and environmental costs of providing roading, water and sewerage infrastructure.*

ix *Development which avoids natural hazards.*

x *Development which has regard to the Queenstown Airport and the value of that resource to the District.*

xi *Development which has regard for the major roading infrastructure both as transport links and scenic routes through the Wakatipu Basin and between existing settlements.*

xii *Development which achieves an attractive but clearly definable urban-rural interface.*

xiii *Development which maximises pedestrian, cycling and amenity linkages both within the new growth areas and between those areas and existing transport (pedestrian and vehicle) amenity linkages to the existing settlements.*

xiv *Development which is varied and imaginative in design, environmentally sensitive and does not replicate existing traditional residential subdivision design and development.*

xv *Development which avoids, remedies or mitigates adverse effects on values of significance to the takata whenua.*