GAP ANALYSIS SUMMARY REPORT

August 2018
GAP ANALYSIS SUMMARY

1. Purpose of Gap Analysis
2. The Scope
3. Information Summaries
4. Key Reference Documents
5. Recommendations for Further Research

Purpose of Gap Analysis

The Gap Analysis and eventual conceptual masterplan is guided by the overall guiding principle for the project which is:

Enhancing Milford Sound, its corridor, and Fiordland National Park as key New Zealand visitor ‘icons’ providing a ‘world class’ visitor experience that is accessible, upholds the conservation values, reflects the unique nature of the place, and adds value to Southland and New Zealand Inc.

The purpose of the Milford Opportunities Gap Analysis was to understand what is known about Milford Sound/ Piopiotahi, confirm key assumptions/ research that can be taken forward into the conceptual masterplan process and identify and demonstrate where current gaps in knowledge are that require further research to inform the conceptual masterplan for Milford Sound/Piopiotahi.

A full report is available, providing the relevant research that underpins the conceptual masterplan work going forward.
The Topics of Interest:

The Gap Analysis involved the collation of a range of information based on the topics identified below:

The Place:

- The natural environment
- The built environment
- Cultural and historic features
- Natural hazards
- How the place impacts and interacts with the wider region

The Customer:

- Understanding the customers
- Future demand
- Views on the wider region opportunities
- Understanding the economic cost/potential

Legislation, Policy, Planning:

- Legislative framework
- Proposed developments
- Previous master planning/concept plans

Best Practice:

- Managing visitor demand and accessibility
- Examining visit value
- Visitor demand and biodiversity impacts research
- Masterplans

Key Information Summaries

Research projects for specific consideration through this Gap Analysis phase were identified by the Governance Group at the outset of the Milford Opportunities project getting underway. A summary of the findings from these projects is provided below.
VISITOR INFORMATION DATA AND STATISTICS

Overarching statement

Research projects for specific consideration through the Gap Analysis phase were identified by the Governance Group at the commencement of the Milford Opportunities project. The following is a summary of findings under six topics:

- Visitor Information data and statistics
- Queenstown Visitor Market Influencers
- Conservation Values (Milford and the corridor)
- Stocktake of organisations associated with Milford now – what they do and what they provide
- Understanding the current visitor experience and expectations
- Future visitor numbers prediction modelling for 5, 10 and 20 years

Gross visitor numbers to Milford

1.2 mil  Gross visitor numbers
5771   Boat passengers
         (Highest recorded peak day 22.02.2018 - Chinese New Year)

28   Cruise liners made 96 visits 2017/2018
255,065   Cruise liner passengers
          (Most stay on board)
946,787   Visitors took a cruise on Milford via Freshwater Basin

Milford Visitors who took a cruise

Vehicle numbers

2586   Largest daily vehicle number at Homer Tunnel
       22nd Feb (Chinese New Year)
< 10%   Volume of heavy vehicles on Milford Road

Parking and occupancy

35%   Vehicles arrive between 10am and 1pm

- Average stay is 3 hours
- Early arrivals still occupy carpark when late arrivals arrive
- Parking demand has exceeded capacity of available parking on 20 - 30 days on last three seasons
- Average car number from TDG report is 4.4

* Key source: Crowe Horwath for MSTL

* Key source: NZTA Corridor Management Plan (Jan 2018) [Milford Sound Tourism Transport Infrastructure Review Traffic Management Strategy May 2017]
VISITOR INFORMATION DATA AND STATISTICS

Milford Airport

<table>
<thead>
<tr>
<th></th>
<th>Landings - movements to and from aerodrome</th>
<th>Overflights (no landing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2018</td>
<td>2421</td>
<td>681</td>
</tr>
</tbody>
</table>

Queenstown Airport

<table>
<thead>
<tr>
<th></th>
<th>Passenger movements for 2017/18 (Queenstown airport)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,054,515</td>
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<tr>
<td></td>
<td>5.1mil</td>
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Movements to and from Milford aerodrome

<table>
<thead>
<tr>
<th></th>
<th>FEBRUARY 2017</th>
<th>FEBRUARY 2018</th>
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<tbody>
<tr>
<td>Landings</td>
<td>602</td>
<td>681</td>
</tr>
<tr>
<td>Overflights (no landing)</td>
<td>2458</td>
<td>2421</td>
</tr>
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Arriving from Queenstown / Te Anau

<table>
<thead>
<tr>
<th></th>
<th>International visitors to Queenstown visit Milford</th>
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<tbody>
<tr>
<td></td>
<td>Of domestic visitors to Queenstown go to Piopiotahi/Milford</td>
</tr>
<tr>
<td></td>
<td>International visitors to Southland visit Milford</td>
</tr>
<tr>
<td>40-50%</td>
<td>20%</td>
</tr>
<tr>
<td>19%</td>
<td></td>
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Accommodation

<table>
<thead>
<tr>
<th></th>
<th>Queenstowns annual accommodation capacity</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>2,781,329</td>
</tr>
<tr>
<td></td>
<td>829,082</td>
</tr>
</tbody>
</table>

Accommodation Occupancy

* Key source: Transport Infrastructure Review May 2017 TDG for Milford Sound Tourism
2018 New Zealand Tourism forecast
- Most forecasted growth is from holiday makers / those visiting friends/relatives
- Percentage movement in visitor numbers to Milford Sound has varied widely annually

4.5% Expected growth rate per annum for visitor arrivals to NZ

5.1 mil Projected visitors to New Zealand in 2024 from 3.7mil in 2017

$14.8bil Expected International spend in 2024 (Up 40% from 2017)

Visitor numbers to Milford Sound
- Percentage movement in visitor numbers to Milford Sound has varied widely annually with as much as:

28% Increase in visitor numbers to Milford in 2017

-11% Decrease in visitor numbers to Milford in 2012

4% p.a Median annual growth since 1992

Projected visitors to Milford in 2023
- 1.2 mil
- From 0.95 million to March 2018

Tourism forecasts predict that China will become NZ’s largest market in terms of expenditure at the end of the forecast period.

Visitor growth predictions
- Crowe Harwarth - Visitor Trends, Dec 2016 provides a formula for estimating current numbers of visitors to Milford Sound and applies growth rates of 4% or 10% p.a
- Growth predictions for 2017/2018 have exceeded forecast

1.2 mil Projected visitors to Milford in 2023

2mil Visitors to Milford Sound by 2035

Growth predictions

Australia is New Zealand’s largest visitor market
Australian market will continue to be healthy and set to grow by 23% by 2025

1.5mil visitors to NZ in 2017

FUTURE VISITOR NUMBERS PREDICTION MODELLING - 5,10,20 YEARS

2018 (Current) 946,787 visitors
2023 (5 Years) 1,200,000 visitors
2028 (10 Years) 1,470,311 visitors
2038 (20 Years) 2,283,378 visitors

YEAR ENDING MARCH
QUEENSTOWN VISITOR MARKET INFLUENCERS

International, national media messages

- Piopiotahi/Milford Sound has always historically been sold as a 'Queenstown Regional Visitor Experience'.
- Sold as a 'one day' experience from Queenstown.
- Its embedded - it's the message sold to the world.
- Social media (Facebook and TripAdvisor) all have a role to play.
- Sold in this way by the whole tourism ecosystem.

Local media

- Cut price operators - cheap trips to Piopiotahi.
- Accommodation providers, Isite and Tourism Agencies all promoting Piopiotahi (can influence un-educated travellers).
- Social media (Facebook and trip advisor).

Enticing people to experience Piopiotahi/Milford Sound in a day, whether by coach or flying.

How to travel to Piopiotahi/Milford Sound

- Flights into Queenstown - frequent, cheaper than other options.
- Car rental from Queenstown - more of them and cheaper? better advertised?
- Organised transport - coach etc.

Signage/local advertising

- Driving the price to the bottom.

Travel Trade Collective

Southern Lakes New Zealand is a travel trade collective, promoting Wanaka, Queenstown and Fiordland to the world, as a package.

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1 Personal Communication: Graeme Budd, Destination Queenstown (June 2018)
2 Anecdotal feedback provided during project engagement (March 2018)
QUEENSTOWN VISITOR MARKET INFLUENCERS

Most common travel package to Piopiotahi/Milford once in Queenstown?

3 nights
Common length of stay
Meaning limited time - cutting experience short
- Accommodation pre-booked in Queenstown
- Queenstown accommodation is expensive so if pre-booked, it’s unlikely they will re-book elsewhere on arrival

Undersold experience

$115
Kiwi Experience: Milford Explorer from Queenstown
One Stop Adventures

“Journey to New Zealand’s “eighth wonder of the world” Milford Sound, with an amazing scenic drive & unforgettable 2 hour cruise”

Milford experience

- One day package available (coach - boat - coach) and the boat schedule caters for this
- Free independent traveller
- Campervan
- Coach - fly - coach

Other Queenstown attractions after visiting Piopiotahi/Milford Sound

- There are other options
- The operators make it easy and attractive to sell more options in addition to the Piopiotahi/Milford Sound experience...so they do

Trend is changing...

- Anecdotally people are now staying in Wanaka and Te Anau. Te Anau is booked out in peak season

Cruise schedule for peak operating days in February

10:30 - 1:30pm
Daily peak cruise time

6
Number of day cruise operators
(Not including stops by large cruise ships and overnight cruises)

<table>
<thead>
<tr>
<th>Time slot</th>
<th>Number of cruises departing</th>
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<tbody>
<tr>
<td>7 - 8:59 am</td>
<td>3</td>
</tr>
<tr>
<td>9 - 9:59 am</td>
<td>5</td>
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<tr>
<td>10 - 10:59 am</td>
<td>6</td>
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<tr>
<td>11 - 11:59 am</td>
<td>6</td>
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<td>12 - 12:59 pm</td>
<td>6</td>
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<tr>
<td>13 - 13:59 pm</td>
<td>11</td>
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<td>14 - 14:59 pm</td>
<td>4</td>
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<tr>
<td>15 - 15:59 pm</td>
<td>5</td>
</tr>
<tr>
<td>16 - 16:59 pm</td>
<td>6 (3 are overnight)</td>
</tr>
<tr>
<td>17 - 17:59 pm</td>
<td>2</td>
</tr>
</tbody>
</table>

*Key source: Milford Opportunities

CONSERVATION VALUES: PIOPIOTAHI-MILFORD AND CORRIDOR

Terrestrial Environment - Northern Fiordland Protection site

Piopiotahi/Milford Sound consists of a large terrestrial and marine environment providing habitat to some of the rarest floral, faunal, marine and invertebrate species of national and international significance. Among the rare species, some of which are endemic to this area are Bottle Nose Dolphin, Tawaki/Fiordland Crested Penguin, and Boulder Butterfly.

The habitats for rare species extend beyond the Piopiotahi/Milford Sound area, into the corridor and wider Fiordland/Regional setting.

Several organisations are driving the protection and management of the conservation values of this area including:

- Department of Conservation
- Fiordland Marine Guardians
- Fiordland Conservation Trust
- Other locally supported projects and organisations

As the master plan process develops and site specific solutions/concepts are established further focussed research to understand consequences to conservation values will need to be undertaken.

Piopiotahi-Milford forms part of Te Wahi Pounamu World Heritage Area

Significant landscape values of this unique landscape contribute to its world ranking:

Biophysical (biotic and abiotic)

Associative (culture and meaning) and

Sensory (visual etc.)
STOCKTAKE OF ORGANISATIONS ASSOCIATED WITH MILFORD NOW

What they do and what they provide

<table>
<thead>
<tr>
<th>Kaitiakitanga</th>
<th>Regulatory Functions</th>
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<tbody>
<tr>
<td>Te Rūnanga o Ngāi Tahu</td>
<td>Regulatory Authorities</td>
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<tr>
<td>Apakura</td>
<td>Department of Conservation</td>
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<tr>
<td>Makaawhio Ruanga</td>
<td>Southland District Council</td>
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<tr>
<td>Te Ao Marama Inc</td>
<td>NZTA</td>
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<td></td>
<td>Environment Southland</td>
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<table>
<thead>
<tr>
<th>National Governance</th>
<th>Local Governance</th>
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<tbody>
<tr>
<td>NZ Conservation Board</td>
<td>Local Government</td>
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<tr>
<td>Southland Conservation Board</td>
<td>MBIE</td>
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<tr>
<td>Fiordland Marine Guardians</td>
<td>NZTA</td>
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<td>Milford Sound Tourism</td>
<td>Ministry of Transport</td>
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<td>Milford Sound Infrastructure</td>
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<td>NZTA</td>
<td>Otago Regional Council</td>
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<table>
<thead>
<tr>
<th>New Zealand Government</th>
<th>Provision of infrastructure</th>
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<tbody>
<tr>
<td>Department of Conservation</td>
<td>SDIC, LDC, CDC, ODC</td>
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<tr>
<td>Ministry for the Environment</td>
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<td>Milford Sound Infrastructure</td>
<td></td>
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<tr>
<td>NZTA</td>
<td></td>
</tr>
<tr>
<td>Ministry of Transport</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Recreation</th>
<th>Tourism Marketing / Governance</th>
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<tbody>
<tr>
<td>Recreational Users</td>
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<tr>
<td>Day Visitors</td>
<td>Recreational Fishers</td>
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<tr>
<td>Hikers</td>
<td>Recreational Boaters</td>
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<td>Great Walk Walkers</td>
<td>Recreational Kayakers</td>
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<tr>
<td>Venture Southland</td>
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<tr>
<td>Destination Fiordland</td>
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<tr>
<td>Destination Queenstown</td>
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<tr>
<td>MBIE</td>
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<table>
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<th>New Zealand Government</th>
<th>Industry</th>
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<td>MBIE</td>
<td>Real Journeys</td>
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<tr>
<td>NZTA</td>
<td>Cruise Milford</td>
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<table>
<thead>
<tr>
<th>Community</th>
<th>Business Interests</th>
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</thead>
<tbody>
<tr>
<td>Residents of Milford</td>
<td>Residents of Fiordland</td>
</tr>
<tr>
<td>Te Anau Community Board</td>
<td>Te Anau Community Board</td>
</tr>
<tr>
<td>Fiordland Fishermen’s Association</td>
<td>Fiordland Lobster Company Ltd</td>
</tr>
<tr>
<td></td>
<td>Real Journeys</td>
</tr>
<tr>
<td>Manapouri Community Development Agency</td>
<td>Milford Community Trust</td>
</tr>
<tr>
<td>Fiordland Trails Trust</td>
<td>Southern Discoveries</td>
</tr>
<tr>
<td>Skyline Enterprises</td>
<td>Mitre Peak Cruises</td>
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<tr>
<td></td>
<td>Queenstown Milford User Group</td>
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<tr>
<td>Te Anau &amp; Manapouri Community</td>
<td>Southland Community</td>
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<tr>
<td>New Zealanders</td>
<td>Ultimate Hikes</td>
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<td></td>
<td>Rosco’s Kayaks</td>
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<td></td>
<td>Distinction Hotels</td>
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<td>Tour Guides</td>
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<td>Nth Southland Townships</td>
<td>Queenstown Community</td>
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<tr>
<td>International Community</td>
<td>FIT Vehicle Suppliers</td>
</tr>
<tr>
<td></td>
<td>Heli &amp; Plane Operators</td>
</tr>
<tr>
<td></td>
<td>Bus Companies</td>
</tr>
<tr>
<td></td>
<td>Accommodation Providers</td>
</tr>
</tbody>
</table>

†Includes Natural Hazard Management
‡This represents a ‘snapshot’ of industry and is not intended to be a comprehensive list.
UNDERSTANDING CURRENT VISITOR EXPERIENCES AND EXPECTATIONS

Milford visitor expectations and experience

- From market research undertaken by Tourism New Zealand, The #1 factor influencing consideration of NZ as a visitor destination is; ‘Spectacular Landscapes/Natural Scenery’
- From the information available, overall visitor perceptions to Piopiotahi/Milford Sound remain positive

Piopiotahi has a major role to play given that the following comes up when you Google ‘top things to do in New Zealand’:

Things to do in New Zealand
- Milford Sound
- Mitre Peak, waterfalls, seals & penguins
- Aerial / Mount Cook
- Mountain, glacier, lake, hiking, and
- Fiordland National Park
- Milford Sound, Mitre Peak & Mirror Lakes
- Tongariro National Park
- Tongariro Alpine Crossing & volcanoes

Customer experience

- Sourced from TripAdvisor, Facebook and Google
- By aggregating over 5000 online reviews for Milford Sound over the last 5 years, it is possible to detect trends and themes in customer perception.
- Because there is more to be learnt from negative feedback, themes from the findings have been presented in the table

<table>
<thead>
<tr>
<th>Issue</th>
<th>Approximate percentage of ‘negative’ responses</th>
<th>Possible solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generally underwhelmed by scenery</td>
<td>~20%</td>
<td>Provide other attractions nearby that cater to a wide variety of tastes</td>
</tr>
<tr>
<td>Limited parking space around attractions (Mirror Lakes, The Chasm)</td>
<td>~17%</td>
<td>Allow more parking space near attractions if possible, encourage park ‘n’ ride</td>
</tr>
<tr>
<td>Long drive from Queenstown to Milford Sound (8-10 hours on bus)</td>
<td>~12%</td>
<td>Remind tourists of the unusual driving experience beforehand</td>
</tr>
<tr>
<td>Road safety</td>
<td>~6%</td>
<td>Improve traffic flow if possible</td>
</tr>
<tr>
<td>Milford Sound Visitor Centre car park too far from cruise terminal</td>
<td>~5%</td>
<td>Expand existing car park</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Build car park closer to cruise terminal if possible</td>
</tr>
<tr>
<td>Homer Tunnel - darkness of tunnel, one-lane, long waiting time to get in [Less negative reviews recently compared to previous years]</td>
<td>~3%</td>
<td>Improve traffic management if possible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Make visitors aware of the potential waiting time at traffic light</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advise visitors to leave enough travel time</td>
</tr>
<tr>
<td>Bad service by members of staff</td>
<td>~1%</td>
<td>Improve service quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide better visitor experience</td>
</tr>
<tr>
<td>Other/no comment</td>
<td>~36%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Key source: TripAdvisor, Facebook and Google
UNDERSTANDING CURRENT VISITOR EXPERIENCES AND EXPECTATIONS

Otago University study - ‘The Milford Sound Experience’

- ‘The Milford Sound Experience’ undertook a one-off survey of 365 people, from 22 nationalities between the ages of 18 – 90 which was completed at the end of March 2017 (5% margin of error). Some useful results were observed through this study.

The key findings were:
- Number of visitors or aircraft noise did not affect their satisfaction substantively
- Car drivers and passengers most likely to agree with crowding as an issue (along Milford Road)
- Most visitors stopped twice on road journey
- Ongoing monitoring is needed

Results of relevant questions

Otago University Study ‘the Milford Experience’ March 2017

- How was your Milford Experience overall?
- Did you stop on the way to look at scenery?
- How was your scenery experience?
- Driving through the trees and the Homer Tunnel got me all excited
SURVEY RESULTS

Milford opportunities project online survey

The public were invited to take part in an online survey to gather a range of information about stakeholders in the Milford area, the issues they believe are important and any sources of information they would recommend so as to inform the master plan and ongoing research.

- 121 participants
- Demographics:
  - Predominantly locals 64.2%
  - Regional residents 23.3%
- Main interest group:
  - Tourism managers/operators 37.2%
  - Residents 34.5%

Sample commentary

“Milford is fast becoming a circus with business clamouring to get on the gravy train. The natural environment needs to be protected and numbers managed.”

“As Milford is renowned for the great ‘Milford Track’, people are often disappointed that there are no free accessible 2-3 hours tracks on this side of the tunnel.”

“Lack of infrastructure to manage tourist numbers particularly on the road but also in terms of information.”

“Don’t forget the locals – the fishing industry and recreational users should have space and be accounted for too.”

“Lack of infrastructure to manage tourist numbers particularly on the road but also in terms of information.”

“How Milford could be managed sustainably into the future

Common themes:

‘Park and Ride’ most frequently mentioned
Increase infrastructure capacity eg more carparks
Charge for access to cover costs

Top 3 concerns

1. Tourist numbers
2. The road and associated facilities
3. Development of Milford

Further to this commonly cited issues were inadequate infrastructure capacity, poor driving behaviour and better visitor information required.

Specific issues raised a number of times

Common themes:

- Lack of toilets or shelter at Milford airport, no community or recreation centre for residents.
Key Reference Documents to Inform the Masterplan Development:

Key Reference Documents to Inform the Masterplan Development Are:

- Milford Sound Risk from Landslide-generated Tsunami, GNS Science (2015)
- Tourism in Queenstown and Milford Sound: Trends and Patterns, C.Goble & Dr C. Orchiston (2016)
- Conserving Fiordland’s biodiversity 1987-2015 The Challenges, the achievements, the knowledge, K-A.Edge & R.Reid
- The Ngāi Tahu Claims Settlement Act 1998
- Corridor Management Plan: Frankton to Milford Sound 2018-2028, NZTA
- Features of Interest Te Anau to Milford, NZTA (2014)
- Milford Opportunities Project Memo, MBIE (2017)
- Visitor Trend Analysis – Strategic Plan 2016-2026, Crowe Horwath (2016)
- The Milford Sound Experience visitor survey, University of Otago (2017)
Recommendations for Further Research:

Further Research Recommendations

1. **Infrastructure** - Understanding the collective package of infrastructure in Piopiotahi Milford Sound and the Milford Corridor (including Te Anau). What is the capacity of this infrastructure and the constraints? What opportunities exist for new infrastructure or changes to existing infrastructure provision? What impacts might arise from extracting non-essential infrastructure out of Piopiotahi or through relocation to new sites? Where does infrastructure provide cost effective and efficient opportunities for new development?

2. **Land Analysis** - Design-led work is required to map important landscapes that might be affected by development, identify places where development or visitor facilities (large or small) might be suitable, including infrastructure impacts. Identification of hazards and risks that impact investment.

3. **Cultural Values** - While we have a base level of knowledge of the cultural values associated with Milford Sound and the Corridor, we require greater resources to fully understand and embed the aspirations of iwi into the conceptual masterplanning.

4. **Legislation** - Undertake an assessment of Legislative change options to enable the Milford Opportunities project to realise the vision. This could consider options such as a Piopiotahi visitor levy, international visitor levy, district by district taxes etc. There is also a knowledge gap in terms of lower level legislation, how it regulates land use and development in the project area, could inform the master planning exercise and potential for enabling or restrictive plan changes at this level i.e. FNPMP / District Plan.

5. **Hazard Analysis** - Undertake assessment of hazard risks (natural and human) for the specific purpose of informing the conceptual masterplan. This will include climate change, natural hazards, resilience, human related hazards including oil spill potential, vehicle crashes, sinking vessels etc. This is fundamental to informing the conceptual masterplan development. There are many significant natural hazard risks i.e. avalanche and human related i.e. Homer Tunnel in localised areas.
6. **Economic Analysis** (scope currently under development) Currently there is little known about what visitors to Milford Sound spend; in Milford Sound itself, along the corridor, in the Wider Southland Region. Work is required to better understand what economic value visitors bring to the local and wider area. And whether this is offsetting the costs associated with providing a safe, attractive place for people to visit.

7. **Customer Journey Mapping and Typologies** Undertake a Customer Journey Mapping and Typology development exercise to better understand the key values, and points of significance for visitors coming into the project area. Customer Journey Mapping is possible for a range of the Customer types including tourists, recreational users and residents for example.

8. **Visitor Monitoring Programme** A multi-agency visitor monitoring programme will be designed utilising existing data sources and proposing new data sources. A quantitative survey will be designed utilising the existing University of Otago survey. The programme delivery will be costed and based on an initial five-year term. The programme implementation will require the acquisition of hardware, software and other resources for delivery and will result in a Milford Visitor Annual Report. It is recommended that the implementation be funded for an initial five-year term.

9. **Understanding the Operator** Currently there is very little information available about the tourism operator market for Milford Sound and the wider region, beyond what is anecdotally available (acknowledging that information may be commercially sensitive). There is a desire to better understand the market structure and characteristics of operators. What dictates supply and demand? How does the market know when it is saturated? What are the current trends telling us?

10. **Conservation Values** While there is a significant amount of research available regarding conservation values, further research will be required once the broad conceptual masterplan has been formed, to better understand the potential consequences of the proposed approach.