

Fraser Island Dingo Strategic Research Program

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Executive Summary

This Strategic Research Program articulates the Queensland Governments approach to implementation of the research program component of the Fraser Island Dingo Conservation and Risk Management Strategy (FIDCRMS). The research program is one of the four individual, but integrated, programs which support implementation of the FIDCRMS and form the basis for management of the Fraser Island dingo. The four programs include:

- Risk intervention;
- Communication and education;
- Research program;
- Evaluation and review.

These programs will be delivered through a collaborative approach by Government agencies in partnership with other stakeholder organisations and the broader community.

The FIDCRMS sets a target for the research program of “A comprehensive research program (which) is operational and delivering transparent and relevant research findings in a timely manner to inform management and assist decision making”. To achieve this target The Strategic Research Program prioritises projects to deliver information that facilitates evidence based decision making, disseminates research and encourages adaptive management and adoption of new techniques that improve human safety, animal welfare and dingo conservation.

Development of the Strategic Research Program has drawn significantly from the recommendations of both the Ecosure Review and the Review Steering Committee. Additional information has been drawn from past documents including previous management plans, research reports and publications and through consultation with a Dingo Working Group comprised of technical experts from universities and other research organisations.

The program consists of two elements, the approach being taken to achieve desired outcomes and the corresponding performance measures designed to track progress and gauge success. A key component of the program is the identification of Priority Research Areas that seek to improve the status of knowledge for the management of dingo conservation and human safety. Three broad research areas (Themes) have been identified and outcomes articulated to advance Fraser Island dingo conservation and risk management, and human safety. These themes are:

- Theme 1. Dingo Conservation and Ecology;
- Theme 2. Dingo Behavioural Management and Direct Intervention;
- Theme 3. Human Management and Education.

Part A of this Strategic Research Program presents an overview of the Priority Research Areas including a detailed description of the key research outcomes, research agenda and potential approaches to research under each of the research themes. Part B details the approach to implementation of the program as outlined by the FIDCRMS, including proposed governance arrangements and the framework for evaluation and review.

Introduction

Fraser Island Dingo Conservation and Risk Management Strategy

In July 2013, the Department of Environment and Heritage Protection—in collaboration with the Department of National Parks, Recreation, Sport and Racing—released the *Fraser Island Dingo Conservation and Risk Management Strategy* (the Strategy).

The Strategy has been informed by the recommendations of an independent scientific review of previous Fraser Island dingo management by environmental consultancy Ecosure Pty Ltd, and an external expert Review Steering Committee.

The Strategy establishes an over-arching framework for the management of Fraser Island's wild dingo population and seeks to promote the best outcomes for dingo conservation and human safety as well as placing a strong emphasis on the importance of dingo welfare (Figure 1).

Under a vision statement, there are three key strategic directions that identify the critical components to achieve this future. Clear priority objectives highlight the core challenges to be addressed and the outcomes being sought.

The Strategy identifies an implementation plan as the vehicle to progress the vision and objectives of FIDCRMS. Four individual but integrated programs support implementation and form the basis of Fraser Island dingo management:

- Risk intervention;
- Communication and education;
- Research;
- Evaluation and review.

Compliance activities are conducted in a coordinated fashion across all four programs. The programs are to be delivered through a collaborative approach by Government agencies in partnership with stakeholder organisations and the broader community.



Figure 1. The hierarchy of planning and programming for implementation of the FIDCRMS

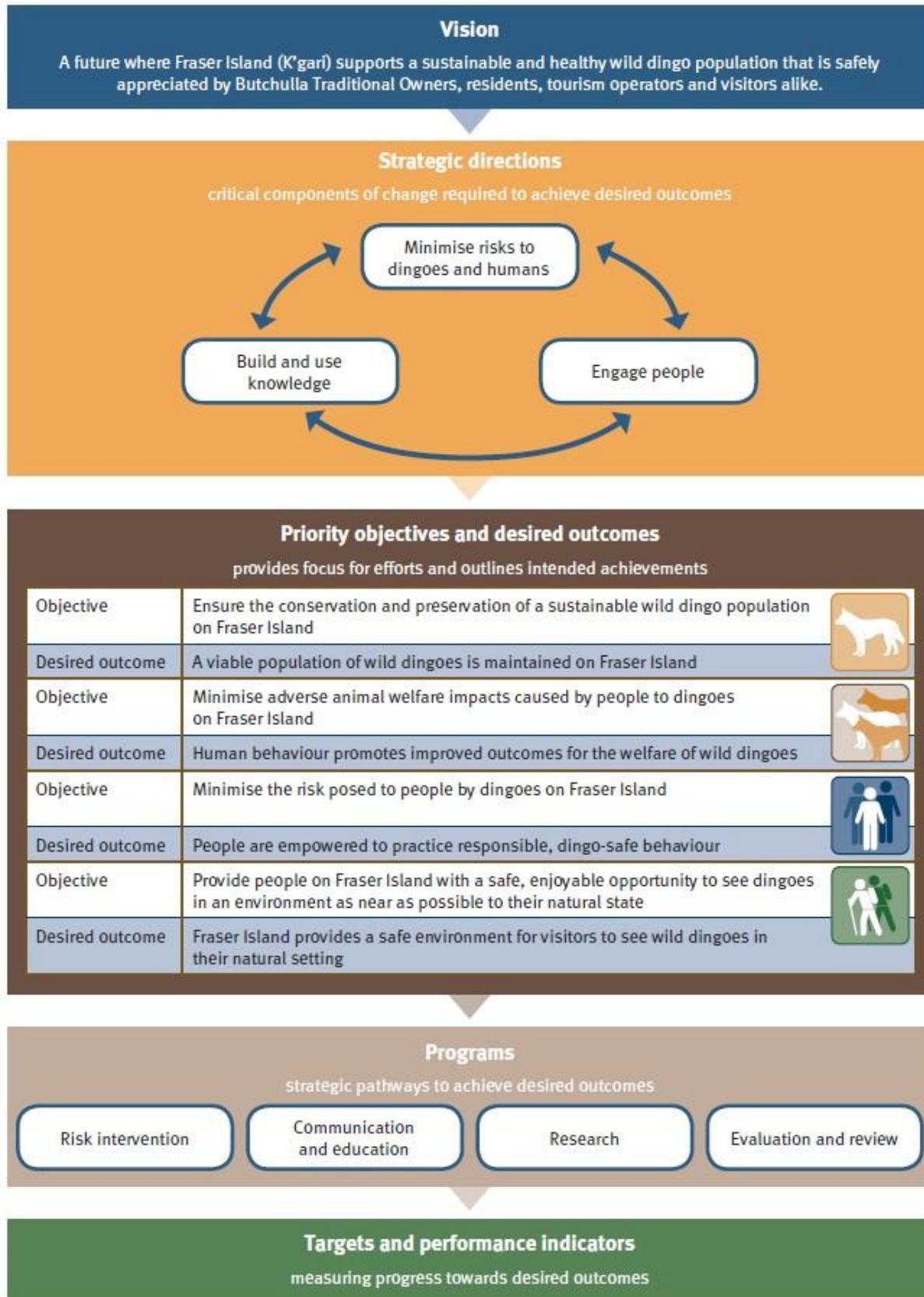


Figure 2. Over-arching framework for the management of Fraser Island's wild dingo population

The Fraser Island Dingo Strategic Research Program

This document, the Strategic Research Program articulates the Queensland Government's implementation of the FIDCRMS Research Program. This document draws significantly from the previous recommendations of the Ecosure Review and the Review Steering Committee's recommendations. Additional information has been drawn from past documents including previous management plans, research reports and publication.

The FIDCRMS sets a target for the research program of "A comprehensive research program (which) is operational and delivering transparent and relevant research findings in a timely manner to inform management and assist decision making".

The Strategic Research Program described in this document prioritises projects to deliver information that facilitates evidence based decision making, disseminates research and encourages adaptive management and adoption of new techniques that improve human safety, animal welfare and dingo conservation.

The Strategy's research program consists of two elements, the approach being taken to achieve desired outcomes and the corresponding performance measures designed to track progress and gauge success. The eight approaches to the research program are presented in the Table 1 below.

Approach	Relevant objective(s)	Performance measure
Develop a strategic program that maintains and encourages research studies into: <ul style="list-style-type: none"> management techniques that maximise both human safety as well as dingo conservation and welfare the biology and ecology of dingoes on Fraser Island; and the sociological behaviour of human/dingo interactions. 	 	The status of knowledge for the management of dingo conservation and human safety is greatly improved.
Identify information gaps and management questions requiring investigation.	 	Research conducted addresses management needs and guides management actions.
Encourage research methods that minimise the need to handle dingoes (e.g. photographic identification, camera trapping to monitor behaviour, roll stations, lick blocks, etc).		The majority of research techniques employed do not require the direct handling of dingoes.
Develop and continuously refine tools/models to allow the timely identification of concerning trends regarding impacts to dingo conservation and human safety.	 	Tools/models are established to identify concerning trends regarding impacts to dingo conservation and human safety, enabling early and effective management intervention.
Explore innovative partnerships and funding arrangements to deliver research programs		A range of partnerships have been formed to deliver research outcomes, especially those projects that address information gaps.
Adopt an international perspective regarding best practice management of mitigating adverse interactions between humans and potentially dangerous wildlife.		Dingo management on Fraser Island provides an internationally-informed, world-class example of mitigating adverse interactions between humans and potentially dangerous wildlife.
Explore technological options for the collection of data (historic and new information) to expedite analysis, interpretation and reporting to inform management, decision making, communication and education.		Technologies have been investigated for adoption in regards to the collection, analysis, interpretation and reporting of data and research findings.
Publication of research findings in a timely manner to reach a broad audience (e.g. academic literature, government publications, magazines, communication material), and encourage external scientific research to evaluate changes in dingo management activities.		Knowledge generated from research activities is accessible for inclusion in decision making and development of initiatives for management.

Table 1. Approaches and performance measures for Research Program from FIDCRMS

Part A of this Strategic Research Program presents an overview of the Priority Research Areas including a detailed description of the key research outcomes, research agenda and potential approaches to research under each of the research themes. Part B details the approach to implementation of the program as outlined by the FIDCRMS, including proposed governance arrangements and the framework for evaluation and review.

Part A: Priority Research Areas

Priority Research Areas

Priority Research Areas have been identified in Table 2. Three broad research areas (Themes) have been identified and outcomes articulated to advance Fraser Island dingo conservation and risk management and human safety.

- Theme 1. Dingo Conservation and Ecology;
- Theme 2. Dingo Behavioural Management and Direct Intervention;
- Theme 3. Human Management and Education.

Research Prioritisation: Background and Justification

Theme 1 - Dingo Conservation and Ecology: Population Estimates and Trends

Current ecological knowledge indicates that large carnivores are necessary for the maintenance of biodiversity and ecosystem function. For conservation managers a clear understanding of population numbers and demographics is basic to management. Even more critical is monitoring changes and trends in these indicators which may relate to natural or anthropogenic factors.

The number of dingoes making up the population of Fraser Island fluctuates throughout the year. High numbers are associated with dingo pup births that occur from June to August. This peak is followed by a drop in numbers due to natural attrition. In 1998 a well-known dingo expert, Dr Laurie Corbett, estimated Fraser Island dingo numbers to be between 100 and 200 individuals.

The aim of research under this outcome area is to establish a rigorous assessment method to establish a figure for the Fraser Island dingo population number and demographics and provide for comparison of trends/changes. A key principle in developing these assessment methodologies is to utilise methods that interfere with the dingoes as little as possible to obtain the desired answers. As such, non-invasive methods will be favoured in preference to those requiring direct capture and interference with animals.

Theme 1 - Dingo Conservation and Ecology: Dingo Conservation Genetics

Conservation genetics is a key consideration in relation to the conservation management of the Fraser Island Dingo population due to the relatively small size of Fraser Island and its isolation from other mainland dingo populations. The interplay of these two factors combined with past and current levels of human disturbance and activity on the island increase the potential for inbreeding depression, resulting from matings between close relatives leading to lower levels of genetic diversity. The potential consequences of lower levels of genetic diversity include reduced fitness and long-term adaptability in natural populations.

A second and equally important genetic issue relevant to conservation of the Fraser Island dingo is the risk of increased hybridisation with domestic/wild dogs which could effectively dilute the purity of the dingo on Fraser Island. Widespread sampling of dingo populations across Australia indicates that significant hybridisation has occurred between dingoes and domestic dogs in the mid and south east Australian seaboard, including Fraser Island. Fraser Island dingoes have cross breed with domestic or feral dogs in the past to a similar extent as most mainland populations with levels of hybridization estimated to be between 17 and 30% (QPWS unpublished). Hybridisation therefore poses a genuine potential threat to the conservation of the dingo as a pure distinct subspecies.

Dingoes remain an integral part of the natural environment on Fraser Island and their ecological importance is recognised being protected as a native species within the national park. Fraser Island dingoes are now protected from further hybridisation with domestic/wild dogs, and due to their relative isolation the Island also offers the best chance of maintaining a population free from further introgression.

The aim of research under this outcome area is to establish a baseline understanding of the levels and trends in genetic diversity, relatedness between individuals on the island, potential of genetic identification of individuals, gene flow and hybridisation in Fraser Island dingoes relevant to the long-term conservation of a self-sustaining viable population.

Theme 1 - Dingo Conservation and Ecology: Dingo Health

This research is focused on ensuring both a healthy population of Fraser Island dingoes and on directing appropriate management to ensure the health and welfare of individual animals is maintained and not adversely effected by either natural or man-induced changes to the environment on the island. Feedback from the community has identified concerns regarding the perceived impacts of some management practices on the health of dingoes on Fraser Island.

The research would aim to both determine the prevalence of diseases and general health of the dingo population and investigate the relationships between key health indicators and environmental conditions. An important outcome sought from this work would be elucidation of clear correlations between external body characteristics and other directly measured values obtained from trapped animals as a basis for developing a health assessment scoring system based on external characters.

Whilst there is recognition that understanding the spatial and temporal patterns in key prey species for the dingo has links to understanding natural cycles in body condition and health it is a large and complex area of ecology and not considered a high priority to inform dingo management of Fraser Island.

Theme 2 - Dingo Behaviour Management: Minimising Opportunities for Negative Dingo Interactions

This field of research is focused on indirect intervention that typically does not involve the capture or otherwise handling of dingoes. The outcomes of research should lead to measures or management actions which reduce risks of human or dingo harm while encouraging natural dingo behaviours.

Physical separation through engineering solutions is a key component of this approach. The main engineering solution that is currently being used to manage the interactions between dingoes and people is fencing. Other engineering solutions include:

- BBQ and wash up facilities;
- Food and gear lockers;
- Lighting;
- Toilets;
- Fish Cleaning Stations.

Analysis of dingo behaviour and condition both pre and post installation of engineering solutions should be undertaken to determine the effectiveness of these measures and methods developed to direct decision making and prioritisation for these resource intensive solutions.

Understanding the dingoes' behavioural profile, particularly in relation to natural cycles (such as breeding or whelping season) is another key management approach. Information can be used to identify high risk sites or seasons allowing managers to respond appropriately. Examples of potential management recommendations or outcomes from such investigations could include either increased education during breeding season or temporary closure of camping sites during specific periods.

Theme 2 - Dingo Behaviour Management: Adverse Conditioning and other Direct Intervention

The numbers of visitors to Fraser Island has significantly increased over the past few decades. Associated with this is the potential for inappropriate interactions between dingoes and people. Aggravating the circumstance is the fact that summer and Easter peaks in visitor numbers also coincide with those periods in the dingo behaviour cycle (breeding and whelping) when incidents of aggression directed at people are most likely to occur.

Dingoes, as demonstrated by past incidents, are capable of lethal aggression towards people. Feeding of dingoes by humans strengthens inappropriate behaviour, so that all feeding (direct or indirect, deliberate or accidental) significantly increases the risk to human safety. Previous studies have identified this sequence of events increase the likelihood of an incident and coined the term habituation.

Significant effort and resourcing has been allocated by management in an effort to reduce habituation resulting in a reduction in the number and severity of incidents.

Nonetheless further research is required. Additional management options between the two extremes of 'doing nothing' and 'humane destruction' are required in order to reduce the total number of habituated dingoes and to reverse the habituation process. Adverse conditioning refers to those

techniques to modify or reverse the dingoes' behaviour to a more 'natural' warier state towards people and/or educate dingoes to avoid particular locations.

Previous 'hazing' trials have proved to be limited in success and highly controversial. Any adverse conditioning studies will require careful design and implementation and pay particular attention to animal welfare considerations. Investigations should consider successful strategies used in similar human-wildlife conflict situations both nationally and internationally.

Physical separation of dingoes and people is addressed under Minimising Opportunities for Negative Dingo Interactions (Theme 2, above), while public education is addressed under Human Attitudes to Dingoes (Theme 3, below).

Theme 3 - Human Management and Education: Human Attitudes to Dingoes

There is growing recognition that effective management of wildlife species and socio-ecological systems needs to fully consider the role that humans play in every stage of the process. This is clearly a key consideration in management of dingoes in an environment such as Fraser Island which has high levels human visitation and hence high potential for interactions between dingoes and humans. As such it is important to investigate psychological aspects of human attitudes to the island's dingoes so that the effectiveness of public education programs and associated materials (signage, brochures, web-based materials) and programs for communicating government strategies and actions to key stakeholder groups are maximised. Any examination of human attitudes and behaviours in relation to Fraser Island dingoes should be conducted in the context of international best practice approaches to managing human wildlife interactions.

Ongoing education and engagement in effective and appropriate ways to achieve the dual aims of dingo conservation and risk minimisation with Butchulla Traditional Owners, residents, tourism operators and visitors is essential for improved management. A large number of dingo-related educational products and activities are provided through many distribution methods and locations, both on and off the Island. These use a multi-media approach and include face to face communication with NPRSR staff, brochures, web pages, extensive signage, DVDs, mass media and audio announcements.

The Fraser Island dingo communication and education program is a key component of the FIDCRMS and is considered one of the best available in international terms. There is however a lack of scientific evidence to directly support some of the key messages and approaches in the program relating to human dingo interactions. There is also a need to assess the effectiveness of existing communication and education programs to ensure they are positively influencing attitudes and behaviours. Given the potential importance of human behaviour in influencing dingo aggression, there is a need for a more thorough and objective research and assessment of the evidence-base for these messages.

Research exploring opportunities to enhance the incorporation of current thinking in persuasion theory and social marketing into the dingo safe strategy are supported by this Strategic Research Program.

Theme 3 - Human Management and Education: Traditional History and Management

There is considerable debate in the literature regarding the exact nature of the relationship between Indigenous people and dingoes with anthropological observations varying from limited interaction to uses of dingoes as hunting aids, camp dogs or pets. A common conclusion is that the dingo/Aboriginal relationship was one of quasi-domestication where humans and dingoes lived in close association but did not depend on each other for survival. The nature of this domestication may possibly also have contributed to some level of genetic connectedness with mainland dingo populations.

Greater archaeological and anthropological documentation on the importance of the ecological, cultural and spiritual interactions of dingoes and Butchulla Traditional Owners is an important first step in understanding the relevance of these historical interactions between Fraser Island dingoes and the Butchulla traditional owners to present day management. Of equal importance to building this knowledge base is the need to examine the barriers to the integration of Indigenous knowledge and aspirations into the management of dingoes on Fraser Island and thereby identifying opportunities to incorporate this into policy and operational management frameworks.

Table 2 – Priority Research Areas to improve the status of knowledge for the management of dingo conservation and human safety

Theme	Outcome	Research Agenda	Links to existing data collection/research	Objectives of the FIDCRMS & Applications to Management
Dingo Conservation and Ecology	<p>1. Population Estimate and Trends</p> <p>Provision of an accurate estimate of the absolute abundance and population trends for the dingo population on Fraser Island, in order to assess population cycles over time, carrying capacity in relation to environmental conditions, responses to management actions and the overall long term viability of the Fraser Island dingo population using Population Viability Analysis and other relevant methods if appropriate.</p>	<ul style="list-style-type: none"> • Develop an efficient, cost effective and scientifically rigorous survey design to provide an assessment of the number of dingoes on the island. The approach should enable ongoing monitoring of population trends and be repeatable annually with the same methodology. • Provide basic information on demographics and spatial and temporal components of pack numbers, territories and intra and inter-pack sociality, population age structure and breeding status should be collected. This information would complement information on population size and trends and provide a basis for better understanding population dynamics and responses to management. • Inform a calculation of a minimum viable population or self-sustaining dingo population and develop methods to model varying management actions to determine potential impacts on population viability. • Develop methods that minimise the need to handle dingoes. <p><i>Potential Approach</i></p> <ul style="list-style-type: none"> • While indices are not estimates of actual population numbers, properly constructed indices can be applied to make comparisons between populations or to monitor trends against accurate benchmarked estimates. Examples include tracking rates, faecal pellet counts, capture rates, bait consumption or visual observations, among many possibilities. • Effective ongoing relative abundance monitoring is likely to be achievable through minor adjustments to existing mark-recapture techniques and analysis practices (i.e. recording trap effort, strategic camera deployment, etc.). • Acquisition of an initial population estimate through DNA profiling, where DNA samples could be obtained from dingoes or faecal material, could be undertaken to identify 	<p>QPWS programs:</p> <ul style="list-style-type: none"> • Tagging and monitoring. • Individual profiles. • Incident monitoring. • Scat analysis. • DNA collection. • Autopsy • Skull measurement. • Activity monitoring. 	  <ul style="list-style-type: none"> • Monitor population status & viability. • Monitor population responses to environment conditions and management.

		<p>the minimum number of individual dingoes known to be alive during a defined period. This approach could also potentially identify relatedness between individuals and groups and offer a hands-off approach.</p> <ul style="list-style-type: none"> Greater exploration of innovative technologies, including facial recognition approaches, as alternatives to conventional population sampling techniques should be undertaken. These passive techniques could reduce the need to capture and tag dingoes improving dingo welfare and reducing management time and costs. 		
	<p>2. Dingo Conservation Genetics</p> <p>Estimation of the levels and trends in genetic diversity, relatedness, gene flow and hybridisation among Fraser Island dingoes and identify any trends or clusters of inbreeding, low genetic diversity or hybridisation relevant to management. This analysis should consider the potential impacts of management actions and development on the island which may contribute to any fragmentation or isolation within the dingo population.</p>	<ul style="list-style-type: none"> Assess and monitor the levels of genetic diversity, relatedness, gene flow and hybridisation among Fraser Island dingoes and identify any trends or clusters of inbreeding, low genetic diversity or hybridisation relevant to management. This analysis should consider the potential impacts of management actions and development on the island which may contribute to any fragmentation or isolation within the dingo population. Develop methods that minimise the need to handle dingoes. <p><i>Potential Approach</i></p> <ul style="list-style-type: none"> Utilise tissue samples for DNA analysis. Such samples have been collected from corpses of animals resulting from natural causes and/or management actions and from animals trapped for past research and monitoring. Analysis of morphological measurements obtained from both corpses and live animals would complement any genetic analysis. Alternatively, acquisition of an initial population estimate through DNA profiling, where DNA samples would be obtained from living dingoes preferably utilising non-invasive techniques including faecal DNA, tongue lick plates, etc. could be undertaken. Project scope could include trial application of reproductive technologies to assist in managing the genetics of the wild dingo population. 	<p>QPWS programs:</p> <ul style="list-style-type: none"> Skulls and DNA collected from FI dingoes. Past genetic sampling incl. faecal DNA. 	 <ul style="list-style-type: none"> Monitor genetic diversity & population viability. Identify impacts on population genetics from natural events and management.
	<p>3. Monitor Dingo Health</p> <p>A program that monitors and assesses the health of Fraser Island dingoes now</p>	<ul style="list-style-type: none"> Develop a dingo health monitoring program and determine the prevalence of diseases and general health of the dingo population. Investigate the relationships between key health indicators and environmental conditions. 	<p>QPWS programs:</p> <ul style="list-style-type: none"> Past trapping data. Photo collections. 	 <ul style="list-style-type: none"> Monitor health and condition of

	<p>and over time in order to assess health in relation to environmental conditions and management actions to ensure that catastrophic loss of individuals is not imminent and to ensure the long term viability of Fraser Island dingoes.</p>	<p><i>Potential Approach</i></p> <ul style="list-style-type: none"> Establishing clear correlations between external body characteristics and other directly measured values obtained from trapped animals as basis for health assessment scoring system based on external characters. These studies could initially be undertaken on a dingo population outside of Fraser Island and then validated through application to Fraser Island dingoes as part of other research or monitoring activities. Once these correlations are validated, photographic and visual sampling could be utilised to monitor aspects of health. Results from dietary analysis of gut contents from autopsied animals could be related to physical condition, cause of death, parasitic load and age, and compared with scat sampling results. There is a significant body of existing data from past studies as well as unanalysed scat and stomach samples that could be utilised to support this outcome. 		<p>dingoes.</p> <ul style="list-style-type: none"> Identify impacts on population and individual health from natural events and management.
Dingo Behaviour Management	<p>4. Minimising Opportunities for Negative Dingo Interactions</p> <p>Understand spatial, temporal and behavioural patterns of dingoes to inform assessments of risks of negative interactions and enable better management decisions aimed at minimising negative interaction and preventing serious human injury when interactions occur.</p>	<ul style="list-style-type: none"> Develop models of dingo behaviour to identify spatial, temporal and behavioural patterns which would inform risk assessments and hence inform appropriate management and communications to mitigation negative interactions. <p><i>Potential Approach</i></p> <ul style="list-style-type: none"> Investigate patterns in the spatial and temporal distribution of incidents, demographics of incident victims and dingoes and correlations with environmental conditions and natural prey availability. Monitor dingo abundance and behaviour at sites across the island, including remote sites and high use visitor centres. Record the frequency and duration of dingo visits to these sites, developing behavioural and visitation models linked to actual and predictive dingo incidents. Investigate correlations between dingo breeding season (and other cycles) and the levels of aggression towards humans. Desk-top analysis of the frequency and type of incidents against management actions (i.e. fencing) would help confirm their efficacy, and whether they reduce incidents or cause them to increase in other areas. Explore innovative facial recognition approaches to 	<p>QPWS programs:</p> <ul style="list-style-type: none"> Interaction database. Griffith University surveys and behavioural recordings. 	  <ul style="list-style-type: none"> Minimise risks of negative human/dingo interactions. Inform planning and management for infrastructure development. Inform management programs and practices.

		monitoring dingoes that could reduce the need to capture and tag dingoes.		
	<p>5. Averse Conditioning and Other Direct Intervention</p> <p>Assessment of the efficacy of a range of aversion techniques to reduce the number of habituated dingoes and reverse pre-existing habituation to promote appropriate dingo behaviour and increase public safety.</p>	<ul style="list-style-type: none"> Rigorously evaluate the effectiveness of a range of past, present and potential approaches to adverse conditioning that have occurred through experimental trials to determine their potential for application on Fraser Island. Identify techniques which could be trialled on dingoes outside of Fraser Island prior to pilots to validate any positive results from those trials. <p><i>Potential Approach</i></p> <ul style="list-style-type: none"> Animal welfare and ethical considerations will be critical in determining the type of aversion techniques which are investigated. A range of adverse conditioning techniques to discourage dingoes, including non-lethal projectile weapons (e.g. rat shot/projectiles, spray bottles containing offensive or irritating contents, ultrasonic devices, stockwhips and aversive baits and collars) have already been trialled or proposed for use on Fraser Island. Future investigations should draw on the experiences and results from these trials and examine alternative approaches. Initial trials could be conducted using captive animals in a controlled situation. Other specific actions should be initiated to support aversion conditioning including localised public awareness program, detailed monitoring of dingo visitor incidents, scat analysis and monitoring of other locations to ensure problem dingoes have not relocated. Investigation of suitability of national or international strategies used in similar human-wildlife conflict situations should be investigated. Project scope could include investigating non-invasive reversible reproductive control options for dingoes identified as being highly habituated and who consistently produce litters that are taught habituated behaviour to potentially break the habituation cycle, reduce incidents and the need for destruction of aggressive dingoes. 	<ul style="list-style-type: none"> QPWS programs: Results & observations from past hazing trials. 	 <ul style="list-style-type: none"> Reduce habituation of dingoes and socialisation between humans and dingoes.
Human Management	<p>6. Human attitudes to</p>	<ul style="list-style-type: none"> Examine human attitudes and behaviours in relation to Fraser Island dingoes in the context of international best 	<ul style="list-style-type: none"> Beckmann's reviews of 	

and Education	<p>Dingos</p> <p>Better understanding of: 1. The psychological aspects of human attitudes to the Island's dingoes so public education programs and associated materials (signage, brochures, web-based materials) can be more effective and 2. Programs for communicating government strategies and actions to key stakeholder groups.</p>	<p>practice approaches to managing human wildlife interactions.</p> <p><i>Potential Approach</i></p> <ul style="list-style-type: none"> Monitor visitor awareness of the dangers of dingoes and the precautions that should be taken in a situation of confrontation with one or more dingoes. Determine the impacts of key education delivery variables on the effectiveness of education in reaching audiences and influencing knowledge and behaviour, in order to inform cost efficiency and improve effectiveness of the education strategy. Successful examples of national or international strategies used in similar human-wildlife conflict situations should be examined. Investigate various techniques and media styles to identify the most effective education messages. Social research to determine the level of risk that visitors are willing to accept so as to inform, with consideration to legal obligations, the level of management required. 	<p>education strategy.</p> <ul style="list-style-type: none"> Griffith University questionnaires. Public submissions to reviews of dingo management. 	<ul style="list-style-type: none"> Inform development of effective communication and education programs.
	<p>7. Traditional History, Management and Aspirations</p> <p>Traditional and historical knowledge of the interactions between Fraser Island dingoes and the Butchulla traditional owners relevant to present day management.</p>	<ul style="list-style-type: none"> Examine traditional knowledge and the historical interactions between Fraser Island dingoes and the Butchulla Traditional Owners relevant to present day management. <p><i>Potential Approach</i></p> <ul style="list-style-type: none"> Capturing traditional knowledge and oral histories in relation to dingoes and the Fraser Island environment. Social research to determine the level and type of interrelations between Traditional Owners and the dingo. This might include examining the keeping of dingoes in domestic/semi-domestic situations; the use of physical and chemical barriers and impacts of association on the dingo population and movements both on the island and with the mainland. Identification of the barriers to integration of Traditional Owner knowledge into management and opportunities to adopt these aspirations. 	<ul style="list-style-type: none"> Indigenous consultation processes associated with other programs. Collection of indigenous knowledge on dingoes, prey species & natural cycles. 	 <ul style="list-style-type: none"> Integrate traditional knowledge and aspirations into human/dingo management programs.

Priority Objectives and desired outcomes of the FIDCRMS

Icon				
Objective	Ensure the conservation and preservation of a sustainable wild dingo population on Fraser Island	Minimise adverse animal welfare impacts caused by people to dingoes on Fraser Island	Minimise the risk posed to people by dingoes on Fraser Island	Provide people on Fraser Island with a safe, enjoyable opportunity to see dingoes in an environment as near as possible to their natural state
Desired Outcome	A viable population of wild dingoes is maintained on Fraser Island	Human behaviour promotes improved outcomes for the welfare of wild dingoes	People are empowered to practice responsible, dingo-safe behaviour	Fraser Island provides a safe environment for visitors to see wild dingoes in their natural setting

Part B: Implementing key approaches

Research priorities (FIDCRMS Approach 1 & 2)

As detailed in Part A of this strategy Research Priorities were established largely from the recommendations of both the Ecosure Review and the Review Steering Committee. Additional information was then drawn from past documents including previous management plans, research reports and publications (refer to the list of references and key research studies at the end of this document) and through consultation with a Dingo Working Group comprised of technical experts from universities and other research organisations. The priority research areas are clearly articulated in Table 1. These priorities will be regularly reviewed and refined in conjunction with the findings of relevant research and as new technologies emerge and become available.

Identifying information gaps (FIDCRMS Approach 2)

The Ecosure review and the strategy acknowledge that significant research into the ecology and behaviour (ethology) of dingoes in concert with social and psychological studies of human-wildlife interactions and associated behavioural changes of humans towards wildlife has been undertaken and contributed to improved human safety and the conservation and welfare prospects of dingoes. Nonetheless they also recognise that improvements in knowledge are important to both facilitate evidence based decision making and to continuously adapt and improve the management program.

Key research areas and knowledge gaps for Fraser Island dingoes identified in this program have been developed based on examination of research requirements as well as in consultation with NPRSR and a number of external authorities such as the Fraser Island Dingo Working Group.

The recommendations are largely consistent with the previous research recommendations by Lundie-Jenkins (2001), Corbett (2009) and Ecosure (2012).

Several streams of data are presently being collected and should continue to be collected. These include ongoing data on:

- Dingo incidents (including location, date, time, code);
- Humane destructions (including sex, location, date etc);
- Risk level trends (including site and contributing factors);
- Ear tag register (including age, sex, location, date, time, ear tag colour and placement, weight, body condition, foot caught, identifying feature etc);
- Visitor surveys.

The presently available information in these datasets already has the capacity to address several key knowledge gaps suitable for improving dingo management, such as the influence of humane destruction activities on the breeding component of the dingo population.

There are several streams of data which are not being collected at present, but which should be collected in the future. These include data on:

- Campground briefings (i.e. number of briefing per month);
- Visitor numbers (i.e. number of visitors per day/month);
- Trapping effort (i.e. number of captures per trap-night);
- Dingo sightings (i.e. dingoes photographed on automated cameras);
- Dingo movements (i.e. from DNA samples);
- Dingo abundance and population structure (i.e. from DNA samples and tagging data);
- Rate of infringements (as opposed to issuing of penalties).

By making a series of small, but important amendments to current data collection practices in order to obtain this data, great advances can be made in our knowledge of dingo ecology and management with little financial investment. For example, strategic DNA sampling, remote camera use, and the collection of the right pieces of information during routine trapping and tagging programs have the potential to yield all the data necessary to measure changes in dingo abundance and demographics over time.

Annual audit statements provided by NPRSR will allow for evaluation and review of knowledge gaps and management questions requiring further investigation.

Research that minimises dingo handling (FIDCRMS Approach 3)

A focus of any research should be to utilise methods that interfere with wildlife as little as possible to obtain the desired answers. Where possible, non-invasive methods will be favoured in preference to those requiring direct capture and interference with animals.

Nonetheless research activities are conducted under approval from an animal ethics committee, which oversees and evaluates the process for compliance with recognised animal welfare standards.

Continued research into innovative alternative methods that reduce handling of dingoes will be supported.

Dingo trapping and tagging are key areas where improvements are sought and may include the following:

- Change the type and amount of lure used at individual trap sites to reduce the likelihood of inadvertent recapture, habituation, and risk to non-target species;
- Improve the efficiency of trapping efforts and hence reduce the number of individual traps used to capture one individual dingo to ensure best practice animal welfare outcomes and increase the number of available traps;
- Use a trap-alert system to reduce the need for regular checking of traps and reduce the time a dingo spends in the trap. Systems are available that can be used outside the mobile communications network;
- Replace pin-down poles with catch-poles to increase human safety and reduce potential injury to the dingo;
- Reassess the use of sedatives for standard handling and minor procedures. Minimising drug use can reduce the likelihood of potential complications arising, eliminate the need for dingo transport and recovery, reduce the time it takes to process the dingo, and increase the amount of staff time available to monitor additional traps. However, potential benefits of sedatives should be further explored before disbanding them i.e. creating partial retrograde amnesia to reduce negative associations could in some instances possibly reduce risk of subsequent aggression;
- Limit ear tagging to individuals weighing more than 10 kilograms, consistent with current policy. Body condition should also continue to be considered. Maintaining size and condition limits for tagging will provide for best practice welfare outcomes;
- Tagging should continue to be restricted to individuals exhibiting or anticipated to exhibit problematic behaviour, and not all dingoes.

It is recognised that current ear tagging is controversial. Many other methods have been trialled (i.e. alternative tags, colour-marking) however these have proven unsuitable. Continued research into alternative methods will continue, with the current tags being used until such time a suitable alternative can be identified.

Identify trends in dingo conservation and human safety (FIDCRMS Approach 4)

Procedures, tools and models will be continuously refined to allow for timely identification of concerning trends regarding impacts to dingo conservation and people's safety.

Of particular interest are:

- Dingo population viability;
- The levels of genetic diversity and hybridisation of FI dingoes;
- Dingo impacts on FI ecology;
- Dingo incidents/human safety.

Innovative partnerships and funding arrangements (FIDCRMS Approach 5)

Innovative partnerships and funding arrangements will be explored to enable work on priority projects. The Queensland Government will seek to enhance cooperative partnerships with research organisations to deliver on research priorities to advance the Strategy's objectives.

The University of the Sunshine Coast leases the Dilli Village facility on Fraser Island as a campus and is well placed to lead research on Fraser Island including projects supporting dingo conservation and risk management.

The Queensland Government has allocated up to \$60,000 during 2014 to help stimulate and build capacity in priority areas of research to support management of dingoes on Fraser Island. The Fraser Island Dingo Research Grant Program will invite expressions of interest from Queensland based research organisations for projects to commence during 2014. Funding will be allocated based on a competitive bid process—based on recommendations from an evaluation panel. The panel will be comprised of scientists and conservation experts who will assess research bids against the criteria.

Adopting an international perspective (FIDCRMS Approach 6)

The Review Steering Committee strongly recommended that much could be gained in dealing with dingoes on Fraser Island from adopting an international perspective with regard to human-wildlife interactions. International wildlife management projects will be investigated for best practice in mitigating adverse interactions between people and potentially dangerous wildlife.

Data collection, analysis, interpretation and reporting (FIDCRMS Approach 7)

The management of Fraser Island dingoes is a complex issue involving numerous and diverse stakeholders. The capture, storage and retrieval of data relating to dingo conservation and risk management are critical to effectively building and disseminating knowledge.

QPWS collects a significant amount of observational data in day-to-day operations which are generally used to inform management and reporting requirements.

Technological options for QPWS to develop a database to effectively capture and interrogate the information recorded through day-to-day operations will be further explored.

Technological options will be maintained and new opportunities explored for the collection and management of data (historical and new information) to expedite analysis, interpretation and reporting to inform monitoring, management, decision making, communication and education.

The ability for all relevant researchers to search and retrieve data and generate reports will be central to the database design. New technologies including web-based data portals and data clouds will be explored to provide greater access to information and data to inform evaluation and review of management actions.

Publication of research findings (FIDCRMS Approach 8)

The Eclosure review highlighted concern with the significant lack of data dissemination. At present only limited information is made available on the internet, with Right To Information (RTI) requests by selected stakeholder groups comprising much of the information dissemination. This situation fosters scepticism and disharmony from the public.

To rectify this situation a Fraser Island dingo research library providing links to research programs and published papers will be developed on the NPRSR website. Options to include raw data collected through QPWS day-to-day operations will also be explored.

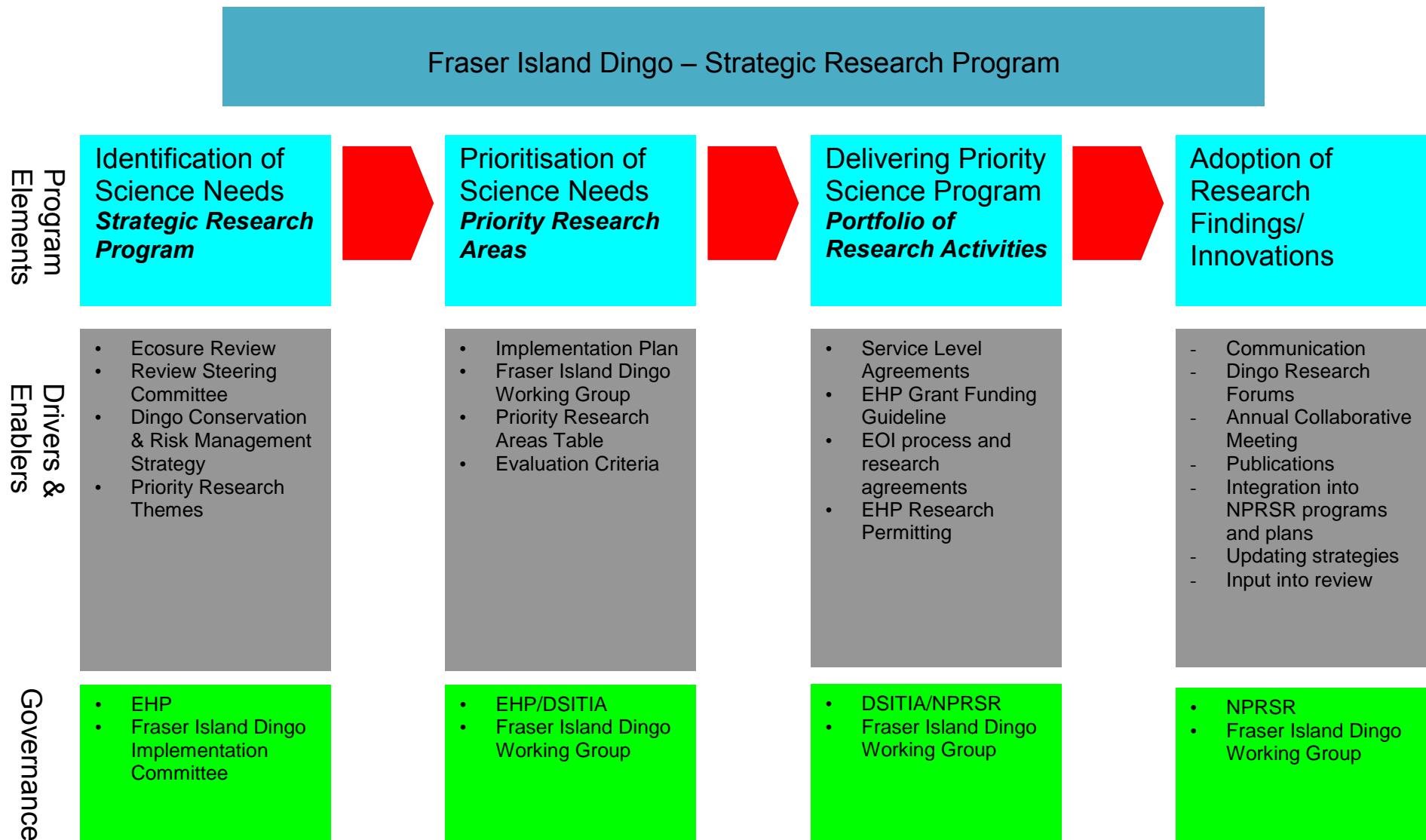
Forums to promote information sharing and the release and publication of past research will be facilitated by government agencies in collaboration with research institutions and professional societies including the Australasian Wildlife Management Society.

Governance Arrangements

The actions to deliver the program are intended to be delivered through a collaborative whole of government approach and through partnership with research organisations. This partnership approach provides the knowledge, capacity and support necessary for co-ordinating the successful delivery of the program.

The Research Program is coordinated in a partnership arrangement between DISITIA, EHP and NPRSR. The governance arrangements are set out in Figure 3. A responsibility assignment matrix based on the RASCI (Responsibility/Accountability/Support/Consultation/Information) model will be developed to further clarify the partnership approach.

Figure 3. Proposed governance arrangements for delivery of key program elements for Strategic Research Program



Department of National Parks, Recreation, Sport and Racing

- Day-to-day management;
- On-ground co-ordination and deliver of the Strategy's operational programs;
- Setting strategic directions in planning and evaluation and review of the Strategy.

Department of Environment and Heritage Protection

- Strategic planning, evaluation and review;
- Corporate communications;
- Compliance, enforcement and legal support;
- Research.

Department of Science, Information Technology, Innovation and the Arts

- Science support and innovation.

Department of Agriculture, Fisheries and Forestry

- Animal ethics Committee assessments and approvals;
- Information technology and database management.

The Fraser Island Dingo Working Group (DWG) was established in 2009 to advise the government in the development of a dingo population estimates on the island. Subsequently the role of the group has expanded to advise the government on dingo conservation and risk management including advice on sociological aspects of wildlife behaviour and the interactions between wildlife and people. The group is currently made up of scientists from three south-east Queensland universities, the RSPCA, and government departments. The working group is a valuable resource and will be maintained and formalised under a Terms of Reference and coordinated by NPRSR.

EHP will lead coordination of the DWG under a Terms of Reference. It is intended that the group meet biannually to review and advance the approaches outlined in this Strategic Research Plan.

Evaluation and Review

Evaluation and review is a key element of the Strategic Research Program. In support of the Strategy the target for evaluation and review is:

A meaningful adaptive management system of monitoring, reporting, evaluation and review is facilitating continuous improvement of outcomes for both dingo conservation and human safety on Fraser Island.

Achievement of the priority objectives and desired outcomes will form the basis of measuring the ultimate success of the Strategy. As an interim step performance indicators and targets have been developed against each of 8 research approaches outlined by the FIDCRMS.

This evaluation framework for the Strategic Research Program is presented in Table 3.

Table 3. Evaluation framework and interim performance targets for the Strategic Research Program

Approach	Relevant Objective(s)	Performance Measure	Performance Indicator	Performance Target	Target Owner
<p>Develop a strategic program that maintains and encourages research studies into:</p> <ul style="list-style-type: none"> management techniques that maximise both human safety as well as dingo conservation and welfare; the biology and ecology of dingoes on Fraser Island; and the sociological behaviour of human/dingo interactions. 	   	The status of knowledge for the management of dingo conservation and human safety is greatly improved.	Strategic Research Program developed	<ul style="list-style-type: none"> The Strategic Research Program is publicly available by August 2014. Grant Program distributed to Queensland Universities by August 2014. 	EHP DSITIA

Identify information gaps and management questions requiring investigation.		Research conducted addresses management needs and guides management actions.	<ul style="list-style-type: none"> Periodic and ongoing monitoring and evaluation of available information and priority management requirements. Support research forums/conferences to facilitate dissemination and peer review of research outcomes. 	<ul style="list-style-type: none"> Fraser Island Dingo Research Forum convened and proceedings published by 2015. DWG provide guidance and advice on the research agenda. DWG meetings held annually. 	EHP EHP EHP/NPRSR
Encourage research methods that minimise the need to handle dingoes (e.g. photographic identification, camera trapping to monitor behaviour, roll stations, lick blocks, etc).		The majority of research techniques employed do not require the direct handling of dingoes.	<ul style="list-style-type: none"> Research undertaken in partnership or supported by the Queensland Government demonstrates all practical and reasonable steps to minimise dingo handling. 	<ul style="list-style-type: none"> All research involving interfering with dingoes has animal ethics approval. Trapping and ear tagging practices for population monitoring are phased out. DNA samples collected from live animal's uses non-invasive techniques. 	NPRSR NPRSR NPRSR

<p>Develop and continuously refine tools/models to allow the timely identification of concerning trends regarding impacts to dingo conservation and human safety.</p>		<p>Tools/models are established to identify concerning trends regarding impacts to dingo conservation and human safety, enabling early and effective management intervention.</p>	<ul style="list-style-type: none"> Identified priority research includes investigations into Tools/models to identify trends regarding impacts to dingo conservation and human safety. 	<ul style="list-style-type: none"> Annual surveys of dingo population numbers and demographics completed and openly available. 	EHP/NPRSR
<p>Explore innovative partnerships and funding arrangements to deliver research programs.</p>		<p>A range of partnerships have been formed to deliver research outcomes, especially those projects that address information gaps.</p>	<ul style="list-style-type: none"> Partnerships to deliver research programs are developed. 	<ul style="list-style-type: none"> Research Grants Program developed and implemented by 01 August 2014. 	EHP
<p>Adopt an international perspective regarding best practice management of mitigating adverse interactions between humans and potentially dangerous wildlife.</p>		<p>Dingo management on Fraser Island provides an internationally-informed, world-class example of mitigating adverse interactions between humans and potentially dangerous wildlife.</p>	<ul style="list-style-type: none"> Percentage of research international collaborators. 	<ul style="list-style-type: none"> Increase the number of publications with international collaborators by 5% per year over the life of the Plan. Annual collaborative meeting convened. 	EHP EHP/NPRSR

<p>Explore technological options for the collection of data (historic and new information) to expedite analysis, interpretation and reporting to inform management, decision making, communication and education.</p>	<p>Technologies have been investigated for adoption in regards to the collection, analysis, interpretation and reporting of data and research findings.</p>	<ul style="list-style-type: none"> • Data collection and recording procedures reviewed for appropriateness and consistency. 	<ul style="list-style-type: none"> • Data collection procedure guide and centralised database developed and openly available by June 2015. 	NPRSR
<p>Publication of research findings in a timely manner to reach a broad audience (e.g. academic literature, government publications, magazines, communication material), and encourage external scientific research to evaluate changes in dingo management activities.</p>	<p>Knowledge generated from research activities is accessible for inclusion in decision making and development of initiatives for management.</p>	<ul style="list-style-type: none"> • Dingo educational and research messages are up to date, accurate and relevant. 	<ul style="list-style-type: none"> • Research data is analysed and a scientific report published within 6 months of project completion. • Web bases “library” on research available on Government website. • Proceedings of research forums published. 	EHP/NPRSR/DSITIA

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