LIFESTYLE AND COMMUNITY / COMMUNITY LIFE

Mosquito Management Plan

June 2025

Cairns REGIONAL COUNCIL

Contents

Acronyms and Abbreviations

APVMA	Australian Pesticides and Veterinary Medicines Authority
ARMP	Activity Risk Management Plan
AQIS	Australian Quarantine and Inspection Service
BFV	Barmah Forest virus
BTI	*Bacillus thuringiensis* subspecies *israelensis* Larvicidal Treatment
BQ	Biosecurity Queensland
CDNA	Communicable Diseases Network Australia
CHIKV	Chikungunya virus
CoP	Code of Practice
CRC	Cairns Regional Council
CRM	Customer Request Management
DAFF	Department of Agriculture, Fisheries and Forestry (Federal)
DART	Dengue Action Response Team under Cairns Tropical Public Health Service
DMA	Queensland Disaster Management Act 2003
EHO	Environmental Health Officer
EP Act	Queensland Environmental Protection Act 1994
GPS	Global Positioning System
IGR	Insect Growth Regulator (such as Methoprene)
IMM	Integrated Mosquito Management
JE/JEV	Japanese Encephalitis Virus
JSA/JSEA	Job Safety Analysis
KUN/KUNV	Kunjin Virus (considered to be a variant of West Nile virus)
LDMG	Local Disaster Management Group
LGAQ	Local Government Association of Queensland
LGA	Local Government Area
MARC	Mosquito and Arbovirus Research Committee (Inc.)
MBD	Mosquito-Borne Disease
MCAA	Mosquito Control Association of Australia
MVE/MVEV	Murray Valley Encephalitis Virus
MMP	Mosquito Management Plan
NAM	Cairns Regional Council's Natural Assets Management team
NAQS	Northern Australia Quarantine Strategy (DAFF)
NOCS	Notifiable Conditions System, Queensland Health
SOP	Standard Operating Procedure
SSA	Council's current shared internal mapping platform
SWARMMS	State-wide Arbovirus Response and Mosquito Management System
SWMS	Safe Work Method Statements
SWP	Safe Work Procedures
TBC/TBD	To Be Considered /Developed
ULV	Ultra-Low-Volume
RRV	Ross River Virus
WHO	World Health Organization
WHS	Workplace Health and Safety
WNV	West Nile Virus
WTMA	Wet Tropics Management Authority

Introduction

The Cairns Regional Council local government area (LGA) encompasses 1,687km^2 of land on a narrow coastal strip between the Great Dividing Range and the Coral Sea. It extends from the Eubenangee Swamp (near Mirriwinni) in the south, to the Macalister Range (near Ellis Beach) in the north. The Cairns LGA incorporates land tenure under state, private and corporate ownership/management which includes significantly large mosquito breeding areas. CRC focuses its current efforts on land it is responsible for as well as resident's private properties on request. There is scope for and successful examples of other LGAs in Queensland undertaking broader management activities of mosquitoes that encompass state land.

The inhabited/developed/populated area of Cairns is dominated by low lying coastal plains interspersed with swamps and is subject to high annual rainfall. The region includes extensive natural breeding areas and mosquito habitat including tidal swamps, freshwater wetlands and rainforests. Estuarine swamp covers 6,939 Ha and freshwater swamp 5,894Ha. The wet season significantly increases the area of standing fresh water and mosquito breeding.

There are around 35 commonly encountered species of mosquitoes in Far North Queensland. A number of these species are known vectors of disease. Known mosquitoes of concern, (disease vectors) in the region are:

- *Oc. Notoscriptus* and *Oc. vigilax*.
- *Aedes aegypti*.
- *Culex annulrostris*, *C. gelidus*, *C. sitiens* and *C. quinquefasciatus*.
- *Verrallina carmenti* and *V. funereal*.
- *Anopheles annulipes* and *A. farauti*.

Adult mosquitoes readily attack people inside the home and outdoors, both in sun and shaded areas, feeding during the day, early evening, night, and early morning.

Differentiation between nuisance and vector species for management actions is not considered influential due to the variety of species present at any one site and practicalities of works and treatment. Preliminary CRC monitoring indicate vector species dominate sites and corresponds with extensive State monitoring.

While technology and scientific advances have led to significant improvements in mosquito management programs worldwide, it is not possible to eradicate mosquito nuisance. The environmental impact of mosquito programs can be severe if not carefully developed and the complete elimination of mosquitoes would have substantial ecosystem impacts.

Mosquito populations fluctuate throughout the year with peak activity experienced during October and March. This aligns with a combination of factors including higher ambient temperatures which can speed up certain stages of mosquito lifecycle, higher-than-average tides and rainfalls. Monsoonal rains can also increase the size and distribution of mosquito breeding sites significantly.

Executive Summary

Cairns Regional Council (Local Government) is responsible for managing public health risks associated with mosquitoes under the Queensland *Public Health Act 2005*. The aim of this Mosquito Management Plan (MMP) is to minimise contact between mosquitoes and humans to the extent that is practicable through various mosquito control strategies. This is achieved through an integrated pest management approach which uses biological, physical, chemical and behavioural control measures to manage mosquito populations and associated public health risks.

Cairns Regional Council has developed this Plan in alignment with the Queensland Joint Strategic Framework for Mosquito Management 2010-2015, and to satisfy the Department of Environment and Science's Mosquito Management Code of Practice.

Program Objectives

The Mosquito Management Plan objectives include:

- Managing and reducing nuisance mosquitoes.
- Minimising mosquito-borne disease.
- Educating the public and increasing awareness of mosquito-borne diseases to encourage positive action reducing vector contact.
- Working within budget constraints.

Alignment with Council's Strategic Plans and Goals

In accordance with the Council's Corporate and Operational Plans, the aim of this document is to protect our iconic natural environment and create a safe, sustainable place that supports quality of life through effective mosquito management. This MMP strives to:

- Value and protect the natural environment through efficient and safe treatment strategies.
- Minimise mosquitoes using sustainable control measures.
- Reduce the transmission of mosquito-borne diseases, creating safer outdoor spaces.
- Increase public awareness through staff interactions and media.
- Continually improve the plan and review solutions as a leader in local government.

Benefits to Mosquito Management

This MMP will result in a reduction of mosquitoes which achieves the following benefits:

- Reduction in disease transmission.
- Low level of disturbance in the evenings.
- Being able to spend time outside with minimal nuisance.
- Potentially vulnerable community members have reduced contact with mosquitoes.
- Improved outcomes for amenity, liveability, work, sport and leisure.
- Reduction in transmission of heartworm in dogs.
- Economic advantages for outdoor dining and tourism.
- Potential increase in property values.
- Reduction in costs associated with vector-borne disease such as medical and vet expenses and time off work.

Statutory Management/Legislation

Mosquito management in Queensland is governed by a number of legislative instruments and guidelines. The legislation and guidelines prescribe the legal obligations of Local Government to manage public health risks associated with mosquitoes and carry out monitoring and control of mosquito populations.

These oblgiations include but are not limited to:

Legislation	Section	Relevance
QLD Public Health Act 2005 ***Public Health Risk means:*** ***The Public Health Act 2005 defines a Public health risk as*** ***(a) an animal, structure, substance or other thing that—*** ***(i) is, or is likely to become, a breeding ground or source of food for designated pests; or*** ***(ii) harbours, or is likely to become something that harbours, designated pests; or*** ***(b) any of the following that is, or is likely to be, hazardous to human health, or that contributes to, or is likely to contribute to, disease in humans or the transmission of an infectious condition to humans.***	s13	Council is responsible for Local Government **public health risks**. These risks are itemised in the *Public Health Act 2005* or if prescribed under a regulation which is to be administered and enforced only by local government. Mosquitoes are defined as 'a designated pest' and as such Council is responsible.
	s17	The State may require a report from Local Government regarding administration and enforcement under the Act.
	Chapter 8	Makes provision to address **public health emergencies** and when a public health emergency is declared under the Public Health Act 2005 allows for the exercise of considerable powers to meet the emergency. Unlike DMA, does not overrule requirements in the EP Act.
	s20 The Local Government Act 2009, chapter 5, part 2, does not apply to the administration and enforcement of this Act by a local government.	**Enforcement and entry** are under the Public Health Act for authorised officers. rather than the Local Government Act when the Authorised Prevention and Control Program does not apply.
	s36 (2) and s38	**Authorised Prevention and Control Program** Conditions and authorisation covering entry to properties and mosquito treatment actions under the Act rather than Local Government/Authorisation (more capability and easier process).

Legislation	Section	Relevance
QLD Public Health Regulation 2018	Division 2. Mosquitoes s17	Requirement to ensure place is **not a breeding ground** for mosquitoes : (1) A relevant person for a place must ensure water or another liquid that has accumulated at the place is not a breeding ground for mosquitoes. Maximum penalty—40 penalty units. (2) For subsection (1), it is irrelevant whether the accumulation is artificial, natural, permanent or temporary. (3) In a proceeding for an offence against subsection (1), it is a defence for the defendant to prove that the defendant took all reasonable steps to comply with subsection (1). (4) In this section – ***breeding ground,*** for mosquitoes, means a place where mosquito eggs, larvae or pupae are present. *Examples of places where liquid may accumulate and be a breeding ground for mosquitoes* – bromeliads, containers, ditches, drains, gutters, car bodies, ponds, swimming and tidal pools, sump traps, tyres, tubs, water features.
	s18 and s19	Construction, installation and maintenance of water tanks in line with mosquito proofing requirements.
QLD Disaster Management Act 2003		**Emergency Response** if a State of Disaster declared. May overrule other Acts if inconsistencies apply in provisions being addressed by the State of Disaster e.g. some EP Act requirements.
QLD Local Government Act 2009	s191	**Entry to properties** as a Local Government officer, rather than as an authorised officer under the Public Health Act. Note, generally, for the purposes of Vector works, enforcement and entry are under the Public Health Act rather than the Local Government Act when the Authorised Prevention and Control Program does not apply. This would only apply for officers unauthorised under the Public Health Act.
QLD Medicine and Poisons (Pest Management Activities) Regulation 2021		Appropriate **use of chemicals** requirements for pest works.

Legislation	Section	Relevance
Local Government Association of Queensland Mosquito Management Code of Practice 2014 **Note: As of development of this document there is a draft new Code of Practice. Where possible this MMP has been developed in line with the draft Code as much as possible and where no conflict arises.**		Specifies what **MMPs must or should consider** (depending on circumstance), to achieve compliance with *Environmental Protection Act 1994*, (General Environmental Duty) and accepted practices. MMPs are not mandatory, but compliance with the Code (CoP) is a defence against a charge of unlawfully causing environmental harm and could be considered a reasonable and practical action under the General Environmental Duty. This MMP has specifically been developed based on guidance from the CoP. Some basic components identified: • Treatment thresholds (triggers). • A mosquito surveillance program. • Strategies to minimise environmental risk. • Integrated mosquito management to suit the area. • Review and evaluation of the MMP.
QLD Environmental Protection Act 1994	s319 A person must not carry out an activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm.	Management of **environmental risks** of any program or operations (General Environmental Duty).
QLD and Federal Biosecurity Acts		Limited impacts on mosquito management for the purposes of this plan. Pests under Mosquito provisions are not considered as pests under the *Queensland Biosecurity Act*.
QLD Pest Management Act 2001		Superseded – Old Act
QLD Exotic Diseases in Animals Act 1981		Superseded – Old Act

Role of the Local Government (Council Obligations)

Local Government obligation is to control mosquito breeding on Council land to "ensure place is not a breeding ground" and a general obligation for managing/preventing health risks of which mosquitoes are considered a Council responsibility (*Queensland Public Health Act 2005*). Mosquitoes are specifically listed as designated pests. There is no Council responsibility for managing gnats or midges (which are considered a nuisance only).

This is achieved through the implementation of an integrated pest management program which includes:

- Monitoring potential breeding sites and mosquito populations.
- Eliminating or managing established mosquito breeding sites.
- Preventing new mosquito breeding sites.
- Carrying out mosquito control treatments to prevent the transmission of disease.
- Monitoring the effectiveness of control measures.
- Investigating mosquito complaints.
- Compliance checks and legal direction to private land managers as appropriate to manage their obligations.
- Provision of public information and education to help manage public health risks associated with mosquitoes.

Council also has additional obligations regarding an Emergency Response in case of a declared State of Disaster (DMA), or obligations relating to a public health emergency (Queensland Public Health Act) or receive directions from the responsible agency. This would be specific to the matters addressed in each situation. Historically, during Cyclone Larry, CRC staff were directed by Queensland Health to conduct fogging runs in Cairns and Innisfail.

Reporting Requirements

Council has an obligation to report any notifiable diseases identified to Queensland Health. Generally, this occurs on presentation of personal health issues through medical services and does not involve Council action unless otherwise directed/requested by Queensland Health.

Internally, Council collates data for reporting and has a number of options for data output depending on needs of the day. Council may be required to report:

- Records of pest control treatments for any audits.
- Actions related to administration and enforcement of the *Public Health Act* under s17.

Authorised Prevention and Control Program

Cairns Regional Council is currently operating under a Queensland Public Health Authorised Prevention and Control Program (renewed yearly), which allows authorised officers to:

- Minimise the risk of Dengue and Zika outbreaks in the local government area.
- Inspect yards and premises to include residential and industrial areas between 8:00am – 6:00pm.
- Targets the Aedes aegypti species.
- Apply Insect Growth Regulators (IGRs), pesticides and set traps in the absence of the resident or with their consent.
- Timeframe is reviewed with State Government as required.
- Provides stronger property treatment and entry powers.

It is important to note that Council cannot implement the equivalent Program under legislation and current works are dependent on State leadership regarding. Council can implement a

Program under s427 Queensland *Public Health Act 2005*, however, this can only apply to health risks that are solely the responsibility of Local Government, which does not include mosquito disease risks actioned by Queensland State Programs such as the Queensland State Dengue Program.

The Cairns Tropical Public Health Service (part of Queensland Health) is the current contact regarding.

Stakeholders

Collaboration and Consultation

Council's Vector Management team consults and collaborates with many other agencies and stakeholders to develop and deliver the MMP. These stakeholders include:

- Queensland Health.
- CRC Environmental Health Unit.
- Australian Quarantine and Inspection Service.
- DART (Cairns Tropical Public Health Service).
- Local Disaster Management Group.
- CRC Disaster Management Team.
- Cairns Port Authority.

Responsibilities

Group	Responsibility
CRC Natural Assets Management Unit - Vector Team	Operational planning for mosquito management in Council. Mosquito treatment and operations on Council land. Education, engagement and compliance related treatment on private land. Assistance to Queensland Health on request for disease outbreak responses. Risk Mitigation activity or arrangements on Council land.
Queensland Health	Overall responsibility under the *Queensland Public Health Act 2005* for the control of communicable diseases in Queensland, including mosquito-borne diseases.
CRC Environmental Health Unit	Landholder compliance regarding mosquito issues and internal expertise regarding public health issues relating to Council.
Australian Quarantine and Inspection Service	Undertake ongoing trapping and surveillance activities to detect incursions of exotic mosquitoes at international air and seaports. AQIS also works in collaboration with Queensland Health and Local Government to assist in the control and eradication of exotic mosquitoes from these ports where necessary.

Group	Responsibility
DART Dengue Action Response Team	Queensland Health team setup to address the risk of Dengue.
CRC Disaster Management Team	Providing advice to CRC's Natural Assets Management unit of CRC disaster obligations and coordination for significant events involving mosquito management.
Local Disaster Management Group	Support during significant events detailed under Disaster Management Plans coordination of recovery after an event including involvement with mosquito spread operations post disasters impacting on recovery.
Cairns Port Authority	Actions on-site to prevent new incursions of exotic mosquitoes and monitoring and reporting associated as a location of potential incursion.
Private Landholders /Land Managers	The management of mosquitoes on private property is the responsibility of owners and residents.

Resources

Funding

Vector funding allocation is based on supporting the operations inherent to this MMP.

Current Team and Equipment

At time of development of MMP:

Major Plant Natural Assets (Vector Team)

Description	Detail	Purpose
2 Utes **1 shared Ute NAM**	Fleet #4355 and 4456 4349	Chemical fogging, treatment runs, inspections.
2 Dynafog L30 ULV Fogging Units vehicle mounted	Fleet #90004 and 90003	For fogging treatment.
Shared NAM Quikspray unit	13935	For BTI or other spray pesticide application.
A range of backpack blowers and smaller handheld equipment		General operations and treatment.

Other units such as water trailers, spray equipment and trucks can be arranged internally to Council.

CRC's Vector Management Team

Role	Relevant Duties
Coordinator Natural Assets	Vector Team Supervisor

Role	Relevant Duties
Senior Vector Control Officer	Vector Operations
Vector Control Officer	Vector Operations
Supervisor Environmental Health	Environmental Health Compliance
Senior Environmental Health Officer	Environmental Health Compliance

Mosquito Considerations

Biology and life cycle are important when considering treatment strategies. Behaviour and biology will significantly affect treatment efficacy and practicality.

Mosquito Breeding Cycle

- Larva (larvae – plural) emerge from eggs.
- Larva develops and emerges as a pupa (pupae – plural).
- Pupa develop into an adult mosquito.
- They are typically laid on or adjacent to water or in an area where water will accumulate.
- Eggs can stay dormant for over a year.
- From hatching to emerging generally takes about a week.
- Mosquitoes typically live for up to a month and can migrate 50km in that time (dependent on species).

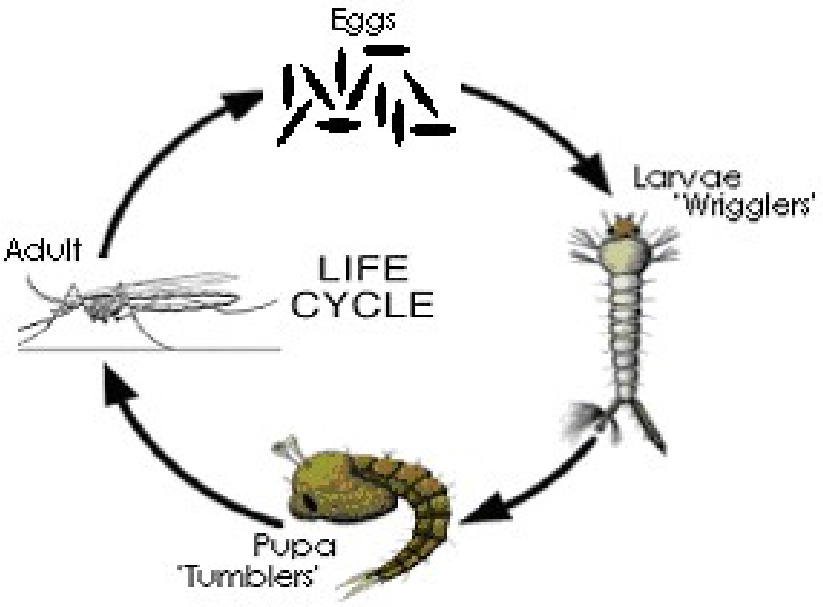

Figure 1 Lifecycle of a mosquito

Breeding Sites

Breeding sites are mainly concentrated in temporary or semi-permanent water bodies and upper tidal reaches inundated following higher than average tides, also natural and artificial containers.

Council is responsible for managing breeding sites on Council land. Breeding sites on private land can result in Council giving directions for corrective actions to the responsible person at the place. Council may work with State Government to manage land that these agencies control.
Council's Vector mapping is available as packaged for purpose Workspaces/Projects both in SSA and Konect, (NAM field based), and as datasets separate in Council's GIS data storage.

Council's mapping database includes mosquito breeding habitat, known locations, protected and sensitive area layers for the range of potential impact considerations e.g. Wet Tropics, Fish Habitat areas, "Do not treat" areas etc. in SSA and Konect.

Mosquito breeding areas are prevalent across the Council area as the region has a plethora of freshwater and saltwater bodies (examples of habitat in Figure 5.2). This does not necessarily represent mosquitoes requiring management.

Figure 2 Example Estuarine habitat mapping around Northern Beaches

Please refer to the

Other Relevant Council /Historical Documentation section of this document for further access to Council's mapping.

Mosquito Behaviour

Treatment strategies can take advantage of mosquito behaviour or must be considered to be effective.

Mature mosquitoes take up overnight residence or shelter in dark areas. Treatment of vegetation on edges of open areas can be more efficient and effective than treating an entire park. Barrier treatments take advantage of the mosquito's weak flight and preference to shelter in dense vegetation. If vegetation barriers (hedges) are placed in between breeding/harbourage areas and the site you want to protect from mosquitoes, it is likely they will land there before continuing on to their host.

Mosquitoes lay their eggs in and around areas that are likely to become inundated. As such, correct timing is needed to treat pre and post inundation to manage the population.

Mosquitoes have different ranges from their breeding areas (harbourage), some as small as tens of meters, up to one-way migrations of 50km.

Different mosquito species have more painful bites than others, travel further in a generation (restock rate), have different habitat (domestic container breeders vs natural wetland areas), breeding requirements (brackish vs freshwater, clean vs stagnant), adult activity times (diurnal/nocturnal/crepuscular) and larval physiology. Adult preference for harbourage in natural or indoor environments is a consideration, for example *Cu. quinquefasciatus* is a very domesticated species, preferring the inside of houses to live. These details are summarised in NAMs Mosquito and Vector Reference Sheet DM#6983871. As an example, treatment of biting nocturnal adults with a non-residual adulticide is generally not considered effective if treated in daytime.

Adult mosquitoes can travel extensively. Repopulation of treated areas can reduce practicality of treatment methods and must be assessed for efficacy against species travel distances and areas/land tenures/permissions that are accessible for treatment.

Types of Mosquito

Known mosquito species (and visually confusing similar species) in the Cairns region are summarised in NAM's Mosquito and Vector Reference Sheet DM#6983871.

Saltmarsh Mosquitoes

From a nuisance perspective, saltmarsh mosquitoes potentially have the greatest impact on residents across the Cairns region as they tend to be the most vigorous and aggressive biters on people in the outdoors.

The emergence of these mosquitoes is triggered by tidal events that inundate the inter-tidal and mangrove areas along the coastline and river estuaries.

Saltmarsh mosquito species are able to easily fly over 10km from the intertidal saltmarsh areas into residential areas, with the typical high impact zone being within a 5km radius of saltmarsh areas. Unless these adjacent and extended areas are treated, any localised treatment is largely ineffective.

Cooperation with state and private landholders is essential in the context of Cairns as significantly large areas are comprised of saltwater mosquito breeding area that are not under CRC control. More effective management strategies would rely on extensive cross tenure and agency activity to target travelling adult mosquitoes.

Comparatively, several other Queensland councils have established programs that encompass management over state and private land tenures including Redlands and Brisbane.

Freshwater Mosquitoes

Freshwater mosquitoes breed quickly in water that is pooling after rainfall or flood events.

Freshwater mosquitoes can be found breeding across the region, on both private and Council managed land. The emergence of freshwater mosquitoes is dependent on environmental conditions, with high or on-going rainfall resulting in ideal breeding conditions. At these times, a high number of mosquitoes can emerge and impact residential areas.

Container-Breeding Mosquitoes

From a risk perspective, container breeding mosquitoes, potentially most heavily impact on the community due to their ability as a vector of disease and the close proximity to residents increasing exposure. Aedes aegypti, a common container breeder in the region is a primary vector of Dengue and carries a range of other diseases, noting the significant reduction in risk associated by the release of Wolbachia.

Any container holding water, including dog bowls, pots, tyres, tarps, palm fronds, bird baths and gutters, provide habitat for these mosquitoes to develop. As little as 100ml of water can produce up to 400 adult mosquitoes.

Whilst these species do not readily fly a great distance; they can have a major impact around the home. Residents are encouraged to empty any type of vessel or object that can hold water. For immovable items like pools, spas, ponds etc. growth regulators are added and owners advised to maintain, decommission or introduce biological control methods as a long-term solution. Reductions in standing water around the home is considered a very effective strategy to manage these mosquitoes. Resident's failure to act is directed to Council's Environmental Health Officers (EHOs) for compliance action.

Environmental Consideration

Council has an environmental duty to do no harm to the flora and fauna in the region. Under the EP Act, general environmental duty, Local Governments can carry out mosquito control activities in accordance with the Code of Practice.

Excessive or widespread control of mosquito populations may disrupt established food chains in certain ecosystems. Mosquitoes are part of the natural ecosystem with mosquito larvae eating microscopic organic matter in the water, as part of normal ecosystem function recycling nutrients. Mosquito larvae are also a valuable food source for fish and other species such as dragonflies.

Adult mosquitoes have been identified as an important food source for natural predators such as birds, bats, dragonflies, lizards, frogs and spiders. Mosquito larvae also form an integral component of the wetland food chain, acting as a food source for damselfly nymphs, dragonfly

nymphs, water striders, water fleas, beetle larvae and a range of fish species, (Russell, 1993).

Disease/Nuisance

Mosquitoes are responsible for the spread of a number of diseases, and some are common nuisance biters.

Public health risk obligations apply only to something that is likely to be harmful to human health or contribute to disease in humans and are not relevant to animal diseases unless they meet these criteria. That being the case, there is still economic and community benefit to the region in reducing animal specific diseases such as heart worm in dogs.

Disease Risks

Mosquitoes are vectors of diseases in Far North Queensland and these diseases may include/be caused by:

- Barmah Forest Virus (BFV)
- Chikungunya Virus (CHIKV)
- Dengue Fever
- Heart Worm (dog)
- Japanese Encephalitis (JEV)
- Kunjin Virus (KUNV)
- Lumpy Skin Disease (LSD) (cattle) – high risk for incursion in Australia
- Malaria
- Murray Valley Encephalitis (MVE)
- Ross River Virus (RRV)
- Zika

More information on mosquito diseases can be found here:
https://www.health.qld.gov.au/clinical-practice/guidelines-procedures/diseases-infection/diseases/mosquito-borne

Whilst all species of mosquitoes are declared pests under the Public Health Act 2005, known vectors of higher-risk diseases are more important targets for strategic reasons.

Disease	Year to date: 1 Jan - 26 May 2024						Annual totals				
	2024	2023	2022	2021	2020	2019	2023	2022	2021	2020	2019
Mosquito borne diseases											
Barmah Forest virus	7	11	8	11	15	5	27	20	20	31	
Chikungunya	0	0	0	0	0	1	0	0	0	0	
Dengue	8	6	0	0	3	13	7	3	0	3	
Flavivirus unspecified	0	0	0	0	1	0	0	0	0	2	
Japanese encephalitis virus (JEV)[4]	0	0	0	0	0	0	0	0	0	0	
West Nile virus/ Kunjin virus	0	0	0	0	0	0	0	0	0	0	
Malaria[6]	5	2	2	0	4	7	4	11	2	5	
Murray Valley Encephalitis (MVE)	0	0	0	0	0	0	0	0	0	0	
Ross River virus	85	39	43	40	85	84	52	59	53	116	
Yellow Fever	0	0	0	0	0	0	0	0	0	0	
Zika virus	0	0	0	0	0	0	0	0	0	0	
Other mosquito borne infections	0	0	0	0	0	0	0	0	1	0	

Figure 3: Queensland Government Notifiable Diseases Report for 2024 January to May for the Cairns and Hinterland region. Taken from https://www.health.qld.gov.au/clinical-practice/guidelines-procedures/diseases-infection/surveillance/reports/notifiable/annual as at 27/05/2024.

State data regarding diseases present, is reduced for justifying a Dengue treatment program and provides limited arguments for State's Authorised Prevention and Control Program for Dengue, that Council currently operates under. This was the basis of most historical Council vector mosquito works. Long term this presents a risk to operations and may change Queensland Health's role and programs in the region, further limiting Council operations resulting from changes in powers associated.

This is largely due to the success of the Eliminate Dengue trial program, (now called World Mosquito Program), headed up by Monash University's release of Wolbachia, preventing transmission (https://www.worldmosquitoprogram.org/en/about-us/our-story). This has resulted in significantly reduced Dengue infections in the region with local infections rare to none (based on Queensland Health reporting DM#6925808). Over 80% of the Dengue mosquito population is thought to harbour Wolbachia. Dengue Mosquitoes at Yorkey's Knob (original release location) are thought to host at close to 100% of the population.

Ongoing long-term monitoring by State is underway to establish whether these communities have been 'dengue-proofed' and whether the protection extends to other mosquito-borne viruses like those that cause Zika, chikungunya and yellow fever. Initial anecdotal findings are positive. Informal advice received from Queensland Health officers, is that a small proportion of infected mosquitoes in Wolbachia treated areas are still able to transmit the Dengue virus.

There is also justification for a mosquito program for other mosquito-borne diseases such as Ross River Virus with frequent infections reported to Queensland Health.

There have been recent concerns regarding outbreaks of Japanese Encephalitis (JEV) in southern parts of the State. For the general public this is not currently considered cause for concern in the Cairns region. The risk is considered low based on the significant differences in number of piggeries and size in outbreak regions versus the Cairns region. Infected feral pigs have been identified in Cape York. Limited information for spread and extent of JEV is available at this time.

It is known that feral pigs can be a vector for JEV infections, (ABC News, 2022). Council's feral pig program reduces pig numbers in the region especially in urban areas. Council also has assisted NAQS for disease monitoring in feral pigs and takes samples as part of its feral pig program.

Long term, JEV may justify a mosquito program similar to Dengue. However, there is limited information currently available, and the situation is developing. DART have sampled CRC wastewater sites to obtain vector mosquitoes associated as part of investigation into transmission.

People working with pigs or high potential for contact with feral pigs need to consider the risk associated and take appropriate actions. There are vaccines available to prevent human infection. The Communicable Diseases Network Australia (CDNA), as of development of this document, recommends personnel are vaccinated who work directly with mosquitoes performing surveillance (field or laboratory based), control and management, and indirectly through management of vertebrate mosquito-borne disease surveillance systems, (e.g. sentinel animals).

Additionally, there are emerging threats and zoonotic diseases from SE Asia that create potential risk of new or greater incursions. As an example, the Asian Tiger Mosquito (Aedes albopictus), is considered to be a major human and livestock health risk as it has an aggressive nature, wide potential habitat spread and is a carrier of serious disease (CSIRO, 2021). It can be found in the Torres Strait and has been found in major Australian ports, whilst at this stage further incursions are being prevented.

Nuisance Biting

In addition to the disease significance, mosquitoes are also a common source of nuisance biting and, in some cases, cause severe reactions. This can cause significant impacts on the lifestyle of residents and tourists to the region.

It is a responsibility of residents to take measures to reduce nuisance biting i.e. screen houses, cover up, use repellent, coils, etc.

Midges

Biting midges, or sand-flies as they are often mistakenly referred to, are a common source of

nuisance biting in the Cairns region. Midges are not considered to be designated pests under the Public Health Act 2005 as they have no known disease significance. Midge populations significantly increase after the full moon and new moon affecting residents living in close proximity to tidal areas.

Pesticides are limited in practicality and efficacy to control midges. Adulticides for midges are thought to be only effective for several hours. Daily treatment for midges is not practical to reduce nuisance biting. Monitoring of midges to target treatment is difficult and time consuming with low return on effort. There has been some success using barrier treatments, proving somewhat effective in parts of the Sunshine Coast, but this is anecdotal at this stage.

Personal protection such as insect repellent is thought to be the most effective strategy to manage this nuisance across the region. The use of fans can also be highly effective in stopping midges from entering outdoor areas, as midges are very small and will not fly directly into an air current.

Baseline Survey/Existing Data

In the last few years Council has received 836 mosquito complaints (based on 2021-2024). Complaint numbers vary from season to season and the amount of rainfall received.

Maps of mosquito fogging areas have been identified and routine fogging has been historically undertaken during the working week based on these locations.

Mosquito Management Strategies

Cairns Regional Council has adapted a strategy of chemical and biological controls to form part of an integrated pest management system. This allows the officers to use a variety of methods to reduce and treat for mosquitoes.

Best practice treatment actions focus on disrupting the mosquito lifecycle for maximum practical effect. This usually targets larvae.

Chemical Treatment

Current chemical control methods are summarised in DM#5304060 NAM Pesticides and Chemical Information Cheat Sheet.

Treatment areas targeted will change per the response required but generally will be product available and location limited e.g. waterbody, water containers, open natural dry areas.

Chemical treatment is considered effective unless specific issues are identified for location, such as label limitations, environmental concerns, safe use, chemical sensitivity concerns or impacts to apiarist businesses.

In all situations, the effective product with the least safety and environmental off-target impacts, is intended to be used. This is expected to be reviewed in line with product availability and legislation. Registered products, permits and labels can be found on the APVMA's database.

It is important to note that repetitive or poor practices tied to continued use of same Mode of Action pesticides, leads to resistance in mosquito populations. It is intended, as part of

operations, that insecticides with different Modes of Action should be rotated as possible and practical. Insect Growth Regulators (IGRs) such as Methoprene, have not been identified as contributing to resistance to treatment.

Use Limitations for Chemical Treatment Methods

It is important to note the restrictions on how mosquito pesticide products can and should be used. This is often specified on labels or permits and additional risks for product use are discussed in the NAM Pesticides and Chemical Info. Reference Sheet DM#5304060 including target use cases for each product.

For example:

- Many vector product specific spray label requirements indicate high potential for environmental harm; considered hazardous to fish and aquatic invertebrates.
- Off-target impacts – native insects, bees, non-nuisance, beneficial species, other insects, fish and aquatic wildlife.
- Adulticide products (including most fogging products) have significant efficacy limitations:
  - A fogging space spray is effective for 40 minutes dependent on various environmental factors (e.g. temperature, wind, humidity). Once the space spray has settled or evaporated it provides no residual control over the adult mosquito. Mosquitoes that are present outside the treated area can reoccupy the space.
- Repeated use of the same chemical groups breeds resistance in the population (equivalent to running routine schedule of fogging runs). This will have long term impacts on immediate efficacy and when a disease response is required. There is little scope for change from using Mode of Action pesticides group 3A without introducing the use of more hazardous 1B organophosphates.
- Some products rely on a rate measurement for application, based on species. This requires knowledge and makeup of species populations before treatment. This means that trapping is a requirement to justify and legally use such products. Works also cannot be reactive without an extended surveillance program for the region.
- Fogging for "optimum application time is generally in the morning and evening when most species are active" (Aqua K-Othrine label) vs. community safety impacts e.g. joggers.
- To be most effective, fogging treatment campaigns should target adult harbourage areas with triggers based on breeding events, behaviour of mosquito species and not be routine runs.
- There are limitations of product use (per product) targeting runoff into waterways, preventing use "immediately adjacent" to water bodies and drainage lines or during adverse weather conditions. These limitations severely impact practicality during wet season due to changes in conditions.
- Limitations on where many Adulticide fogging chemical products can be used; most product labels state "not to be used adjacent to water bodies" or very similar wording. This covers many locations on Council land that may be desirable to treat. Some 1B chemicals (organophosphates- Chlorpyrifos) are registered for wet areas but are in classes deemed more hazardous and are generally preferred to be avoided in built up/public areas.
- Many fogging products have additional solvents or carrier agents, adding additional risk that must be considered. Current products used (Aqua K-Othrine) are water based reducing risk.

To summarise, all known chemical treatments have narrow treatment capability often restricted by location (dry, wet, or adjacent), or specific larvae life stages (instars) or adults. Many products have significant restrictions to limit off-target impacts to insects such as bees or beneficial insects (other 'good' mosquito larvae that eat problem mosquito larvae). Many

products also have application limitations of timing, weather allowed and access restrictions post treatment.

Although there are limitations to pesticide control, they can be an effective measure when used appropriately and as part of an integrated management plan. Seasonal or weather-related ecosystem changes that follow mosquito activity (such as a predator population developing that prey on larvae), can be assisted by careful use of an initial growth regulator (such as Methoprene). This limits mosquito development until beneficial predators take hold. Once an ecosystem begins to dry and breeding places are reduced, a return to pesticide treatment may occur.

Fogging/Space (Spraying) Application

Fogging is used as large space spray (adulticide). Treatment is currently scheduled ahead of time and may vary to meet label requirements, depending on the wind, weather and staff availability.

Currently fogging is based around triggers of numbers trapped where nuisance value is at around 80 trapped adults.

Council uses an ultra-low volume (ULV) fogging machine as the fogging unit. The fogging machine is mounted and stored on the back of a four-wheel drive vehicle and its operation occurs at earliest practical work hours, five days per week (to avoid members of the public potentially impacted, align with mosquito activity and noise impacting community/wildlife).

Larvicides like BTI were found to be incompatible with fogging units due to clogging of the 25-micron filters and excessive wear and maintenance of plant components. The product label for BTI identifies the product as suitable for ULV applications but the reality is it is unsuitable. Fogging units are also restricted in the application of BTI from the vehicle-based unit as the area needs vehicular access. A Quikspray unit with a courser filter and 200m of hose made the application of BTI to vehicle inaccessible swamps much more effective. Limitations have been recognised with the Quikspray unit as the 200m hose is not long enough to reach internal swamp areas of Council land.

Traditionally, vector control officers fogged for mosquitoes targeting adults (Deltamethrin) on Council controlled land. A review of Aqua K (Deltamethrin) use and application areas has identified that the product is reasonably safe to use in specific areas of Council land that is distanced from aquatic environments.

It is important to note that the early morning adulticide treatment will most likely impact only mosquitoes active during this period. Any mosquito activity outside the treatment window will have limited contact with fogged pesticides.

Ground Based Application

When needed, backpack or powered spray units are intended to be used in a localised, targeted manner (not as space sprays) and reactively to community complaints. Multiple products are suitable for this purpose, but all tend to have limitations to dry land application only and not adjacent to waterways.

Intended products for this purpose act as a contact barrier targeting locations that mosquitoes will rest (e.g. underneath vegetation, protected spots, cool dark areas). Vegetation barrier plantings at problem areas take advantage of this treatment method. There is significant opportunity in the region for more use of this method depending on circumstances.

Pyrethrin based pesticides are the preferred products in industry for this purpose, due to efficacy and availability. They can be effective in reducing adult mosquito numbers for up to six weeks. They are non-target specific and therefore impact a range of insects. As such, they should only be applied when the potential adverse impacts on the local ecosystem can be mitigated, and where the treatment will be effective in substantially reducing the adult mosquito numbers in the wider community.

Pellets and Briquettes Application

When larvae are found, pellets and briquettes are applied to mosquito breeding areas (water bodies and containers).

IGRs such as Methoprene, work by interrupting the mosquito lifecycle, preventing them from emerging to adults. Generally, these are dispersed by hand. It takes time for these products to release and can last up to a few months. Similar BTI larvicidal products are also available.

Alternatively, backpack granular blowers allow an effective application for hard to access locations by increasing treatment distance.

An efficient, economic, and effective treatment into the future could be the use of drones for treatment, which the team is investigating.

Aerial Application

Saltmarsh areas, which make up a substantial portion of Cairns Regional Council surrounds (and problem nuisance mosquitoes' habitat) are thought not to be effectively treatable unless broad scale aerial spraying is utilised. This is considered impractical for the Cairns region based on current restraints/restrictions (cost, pesticide requirements, environmental impacts, safety, flight paths and licences). Agreement between all the different landholders would also have to be sought.

BTI or Methoprene products are considered the safest and environmentally friendliest options for aerial control, (see Biological Control below for more detail regarding BTI).

Surface Tension Modification

Products such as Envirosafe Mosquito drops/Aquatain AMF liquid mosquito drops can be used to modify the surface tension of water bodies (creates a thin film of silicone-based product). This disrupts mosquito larvae ability to breathe and is an effective method of controlling smaller water bodies. Historically, paraffin and domestic kerosene has also been used for this purpose but are no longer considered suitable.

Chemical Storage

Please note, any changes to storage locations of chemicals used for vector control must be updated on all officer's Licences and must meet specific storage requirements per legislation. Refer to s57 Queensland Medicine and Poisons (Pest Management Activities) Regulation 2021.

Council's Environmental Health team also have licences that require updates for any storage requirements changes.

Personal Repellents/Devices

Personal repellents are often considered the first line of defence against biting mosquitoes and

consequently, mosquito-borne diseases.

There are a range of personal repellent products available, but those with active ingredients of 20% DEET or picaridin, have been shown scientifically to be most effective. Compared to DEET, picaridin is odourless and less sticky and does not dissolve plastic. However, it is not considered as long lasting. Citronella is generally considered to be less effective, at least over length of time, (Kongkaew, 2011). Other studies on citronella candles have found limited but some effect (Lindsay, 1996).

In addition, air diffusers containing the active ingredient metofluthrin can also be effective in repelling mosquitoes from entering a defined zone or space. There are also a range of burners, coils and sticks, usually containing a pyrethroid with some identified efficacy.

Other products/formulations may be suitable and as effective, however there is a large contingent of products with no scientific basis or limited, unproven efficacy. Of particular note, gadgets with sound emitters or sonic devices have largely been proven to have no scientific basis. Wristbands marketed as safe alternatives to rubbing or spraying repellents on skin have also been identified as largely ineffective.

Biological Treatment

Biological control refers to the natural reduction of mosquitoes developing to adulthood, breeding success or stunting behaviour as a vector of disease (transmission). For example, predation of larvae by fish reduces mosquito numbers and Wolbachia reduces transmission capability.

Biological control occurs naturally in many water bodies and when present will reduce the need for other control methods. The introduction of fish can be an effective, long-term control for mosquito breeding in man-made situations such as backyard ponds.

Historically, Council had a fish breeding program for release that has since been discontinued (DM#322899). Introduction of fish to natural environments does not form part of this plan due to the large size and temporary nature of many breeding sites making this limited in practicality in the region.

Council utilises BTI (*Bacillus thuringiensis subspecies israelensis*) to treat saltmarsh and large waterbody areas, with the product being distributed via ground-based sprayer/backpack. BTI is a naturally occurring bacterium that when eaten by the mosquito larvae kills it. It is a species targeted product, does not impact any other species and can be safely used adjacent to waterbodies in marine and freshwater areas.

Other Management/Treatment Actions

Physical Treatment/Control

Physical control methods are measures taken to reduce the potential for mosquito breeding and harbourage by modifying the natural or built environment. Examples of physical control actions include:

- Maintenance of open stormwater drains to remove obstruction to ensure water not held for more than five days (where the drain is not flowing, or no natural predators are present).
- Reduction of emergent vegetation providing shelter/preferred habitat in known breeding sites.

- Filling in or drainage of low-lying land to reduce pooling.
- Slashing of vegetation which provides harbourage for adult mosquitoes.
- Cleaning up yards to remove containers which will collect water.
- Ensuring septic and water tanks are sealed and vents fitted with mosquito proof screens.
- Ensuring that there is suitable and safe access for Mosquito Management to occur.

Some physical controls, such as maintenance of drains are undertaken routinely. Yard clean-ups and sealing of tanks are the responsibility of land managers and will be the subject of education campaigns and compliance if necessary.

Historical Council Control Methods

Council previously had a substantially different treatment program with many arrangements trialled and discontinued. This has largely been covered in Council's Analysis of Existing Service Triggers, Operating Costs and Operational Planning Document from 2015 (DM#4893883). Note, some of the findings and considerations are no longer relevant or appropriate given the span of years since. Changes have generally been to address cost, disease risk fluctuations and industry best practice updates. Some highlights include helicopter broadscale treatment and the defunct Native Predatory Fish Release Program (DM#322899).

Previously, Council committed to an extensive Trapping Surveillance Program, detail can be found in Cairns City Council's Mosquito Light Trapping Plan (DM#544975).

Personal Protection Strategies\Private Control

Personal protection strategies are available to individuals and households that can greatly reduce the risks of mosquito exposure. These points are intended to be included or considered in any educational campaigns, material or when assessing capacity for land managers to take responsible actions.

Such strategies may include:

- The removal of mosquito breeding sources within their properties.
- The use of personal insect repellents.
- The installation of screening on dwellings.
- A change in behaviour to avoid mosquito habitats at times of greatest mosquito activity.

All of which can reduce the risks of disease. However, for these strategies to be effective there must be engagement with the community and communication informed by mosquito monitoring and research.

Residents can assist in the control of mosquitoes by taking these steps at home:

- Inspecting house and yard to remove any accumulation of water, such as emptying pot plant bases weekly or filling the base with sand to absorb water; bromeliads and other water holding plants should be washed out weekly.
- Cleaning roof gutters out regularly and trimming back trees which can block gutters.
- Ensuring rainwater tanks are screened or treated.
- Keeping swimming pools maintained.
- Birdbaths, fishponds and ornamental pools washed out weekly and where possible stock with suitable native fish.
- Stocking dams with native fish and keep the edges clear of vegetation.

Larger parcel land managers have significant capabilities to use many physical treatment options. Refer to the Physical Treatment/Control options section above.

Private Land Chemical Treatment

Private land managers are also able to treat vegetation around their homes or properties with products with the active ingredient Bifenthrin. This can assist to manage the impact of adult mosquitoes that typically rest in cool, dark areas around buildings.

Land managers can consider pellets/briquettes to treat standing water as a slow-release method of managing mosquito larvae. This is covered in the Pellets and Briquettes Application section of this document.

Land managers would be encouraged to consider products modifying the surface tension of standing water bodies as an effective control method. This is covered in the Surface Tension Modification section of this document.

Surface tension modification and pellets/briquette (Methoprene based) treatments are generally considered safe to use and do not affect water potability if used correctly. However, a licenced pest technician may be required to treat rainwater tanks using these techniques and land managers would be encouraged to make enquiries privately.

Fish Habitat Areas and other Protected Matters

The Protected Matters Search Tool can be used to check if protected matters exist in and around the mosquito management activity with supporting policies and guidelines to assist in determining if an action requires a referral and an approval.

Fish Habitat areas are identified in field mapping available to Officers. Where mosquito management using products is required in a declared Fish Habitat Area, notification must be submitted to DPI at least 5 business days before commencement of the pest management activity and works are required to follow the associated Code of Practice.

Ongoing Monitoring and Surveillance

Identified historical problem areas are monitored and Council runs an associated surveillance program. Mosquito surveillance is recommended as part of the basic scope of a MMP and should target all mosquito species for which control activity is warranted.

Ongoing, monitoring before and after treatments or controls to confirm treatment or control efficacy is expected to take place.

Property Surveys

During the year, Vector Control officers may check the higher risk properties in Cairns. These may consist of tyre dealers, nurseries and car wreckers.

Queensland Health Referrals

Queensland Health's Dengue Action Response Team (DART) have historically identified high risk and referred properties to Council for further enforcement and education.

Customer Requests

Any CRMs received reporting illness or resulting in illness should be referred to Queensland Health or failing that, reported directly in line with legal obligations for notifiable diseases. This includes but is not limited to: RRV; BFV; MVE; WNV and KUNV. However, Council still has

interest in managing the non-disease portion of the complaint.

Some basic CRM statistics, locations and time of year rates can be found in DM#7065965 NAM – Vector CRM Stats Analysis Reporting.

CRMs by their nature tend to be reactive in response to adult biting. As such, response to meet customer expectations/satisfaction has been to address adult population despite the limited long-term efficacy of actions targeting the adult population (adult mosquitoes repopulate quickly from adjacent areas).

These complaints may provide information on areas where mosquito impacts are greatest. However, the tolerance of individuals to mosquitoes varies greatly and the number of complaints may not be directly related to actual mosquito populations or risk.

From a nuisance standpoint, mosquito monitoring finding numbers above a pre-determined level sets appropriate action. If no mosquitoes are observable at location, then no action is intended to be taken unless additional issues are identified creating risk. Higher numbers and actions to be defined in a SOP (TBD).

To determine mosquito numbers actionable in response to CRMs, risk or nuisance the following methods are planned to be utilised:

- Sweep netting at problem property/location.
- Dip count of larvae from a breeding water body.
- Light trap or GAT trap placed overnight (or for longer suitable time) at problem property/location.
- Landing rate count (LRC) as a quick measure of nuisance (number of adults landing on a person within a specified timeframe). Collected with an aspirator.

To determine risk associated from mosquitoes, numbers are useful but additionally species needs to be identified. There is limited purpose in actioning mosquitoes regardless of number if they do not carry disease from a health risk perspective (the mosquito complaint relates to a non-disease carrier). Actionable/trigger numbers or species will be defined in a SOP/workflow per the risk, currently in DM#7399141 but some general advice and detail is below.

Future, technological opportunities for monitoring and surveillance include the assessment of automatic monitoring devices, counters, and remotely measured water levels as triggers for actions.

Triggers for Treatment Actions

In general, the SOP/Workflow found in DM#7399141 will determine triggers and associated treatment and is used as the operational document for actions taken by Council officers. It considers risk, practicality of treatment, options available and tenure to decide on actions and treatment methods. Some specific or more detailed considerations are covered below.

Larval Treatment Triggers

Practically, if sufficient larvae are identified breeding on site, location will be targeted for treatment. Refer to DM#7399141 Treatment Workflow for specific treatment numbers.

It is generally considered more difficult to identify species from larvae, however 4th instar larvae are considered much less difficult and water sources can be used to narrow down identification.

Practically, based on field and resource limitations, no attempt will be made to identify species unless adults are able to be captured.

Adult Treatment Triggers

If sweep netting, at the identified location of concern, captures a significant number of mosquitoes, this will trigger treatment actions (see DM#7399141 Treatment Workflow) depending on access and practicality.

Separately certain risk triggers, such as species identified, may trigger action taken.

Traps are placed at problem location overnight and if it captures a significant number of mosquitoes or high-risk mosquitoes, this will trigger treatment. Different traps are effective for different mosquito species. Detail regarding suitable traps can be found in DM#6983871 NAM - Mosquito and Reference Sheet. Most traps rely on a small amount of dry ice or similar generating carbon dioxide and/or light as an attractant into the trap structure.

Staff need to have time available, be trained, have the tools and space to identify adult mosquitoes for species to be an effective benchmark. As staff time is limited, numbers are the preferred trigger condition for operations at this stage.

Identification

Some tools, guides and equipment exist with the Natural Assets and Environmental Health teams for identification, but staff time available limits use. This would be a useful and effective target to improve the program if extra resources could be made available to utilise.

The DART program has potential capacity to assist with mosquito identification if time and resources allow on a case-by-case basis.

Identification requirements are expected to develop in line with future surveillance program needs identified. For some treatment methods, different treatment rates require identification of species and behaviour allows more targeted treatment. To address current limited identification of species, treatment rates used target all species or compatible rates.

Community Behaviour

Extension\Public Education

Council plays an important role in educating the community about mosquitoes and mosquito-borne diseases. Information and advice are readily available via the Cairns Regional Council website or by speaking with one of our experienced Vector Control Officers. Council conducts mosquito education programs with education providers, events and community groups.

Local Government is responsible for managing public health risks associated with mosquitoes and mosquito breeding sites. Council authorised persons have powers to serve notices and undertake enforcement action to prevent public health risks where appropriate. Some common activities Council undertakes include:

- Investigate complaints about mosquitoes and mosquito breeding sites.
- Conduct school education programs.
- Provide information to the public via our website and brochures.
- During inspections, assist with treatment, demonstrate treatment methods and educate the public during a complaint inspection.

Compliance

Vector Control Officers investigate complaints from the community. This involves a site visit and the provision of education to the public as the preferred initial response. If a resident fails to take steps to prevent mosquito breeding an Environmental Health Officer may undertake further enforcement action which can include the issuance of Public Health Orders and fines.

Administration

Mapping and Record Keeping

Customer complaints are investigated and recorded in the Customer Request Management system.

Council keeps a register of people who do not want fogging/chemical treatment near their property or business. These people go on a Do Not Treat Register (DM#6846007). This register is reviewed periodically. A project is underway for concerns to be recorded directly into mapping and exported to excel as a backup. This will be more practical for in field officers to identify areas to avoid whilst treating areas.

Vector Control Officers keep records of treatment effort, mosquito numbers and species when identified and pesticide use records (legislated).

SWARMMS has been considered as an industry standard mapping package and for Vector based data collection. However, based on DART and internal team feedback, it is not fit for Council use. DART uses internally developed mapping (CREST mapping platform).

Konect is currently the field mapping tool of choice for the NAM vector team, given it meets requirements and is already in use for the general NAM team in similar duties. Long term this data can be migrated to other platforms as needed, as the dataset can easily be exported to a range of industry standard formats.

SSA is used internally to Council as the shared internal platform for viewing mapping data. It is available via the Council intranet and has a specific workplace/project set up for Natural Assets Management inclusive of vector works. Konect data is currently transferred to that platform regularly.

As other tools and opportunities are identified they will be reviewed for use.

Training and Staff Development

It is essential that personnel involved in the operational aspects of the MMP are suitably qualified, trained and/or supervised. More than one staff member should be trained in mosquito management. Skills required to carry out the requirements of the MMP safely and effectively are:

- Basic mosquito ecology.
- Principles of integrated mosquito management.
- Surveillance and monitoring techniques.
- Collection, recording and identification of mosquito samples.
- Standard operating procedures for equipment.
- Safe storage, handling, and application of chemicals/larvicides.
- Use of appropriate PPE in accordance with product labelling, SDS and environmental conditions.

- Calibration techniques.
- Information technologies/geographical information systems.
- Pest Management Technician's Licence.
- Ability to work within the workplace health and safety guidelines, relevant SOPs, SWMS, SWP's and per training.
- Ability to educate the public.
- Investigate and respond to complaints.
- Entry procedures and application of relevant legislation to role duties.

Council Vector Control Officers have previously completed the MOZ-01 Mosquito Management Course. Mosquito identification courses are available through Environmental Health Australia or the MCAA – Introduction to Mosquito Management/Basics of Mosquito Control (not nationally recognised). This training is targeted and practical, focusing on mosquito issues and effective treatment practices rather than general pest treatment licencing requirements.

A suitable minimum training and licencing basis identified (nationally recognised) for a Pest Technician role is the following course (or equivalent):
- CPP30119 - Certificate III in Urban Pest Management

The minimum training for a Pest Technicians licence (must be separately applied for) required to do the role are:
- CPPUPM3005 – Manage pests without applying pesticides; and
- CPPUPM3006 – Manage pests by applying pesticides; and
- CPPUPM3018 – Maintain equipment and pesticide storage area in pest management vehicles.

They are packaged as CPPSS00046 - Manage non-timber pests.

These are included in Certificate III in Urban Pest Management.

Local training for minimum requirements has not been identified. Online training is limited by practical components that need to be supervised by suitably qualified licenced officers in a range of activities not included as part of regular Council works.

Review of Plan and Efficacy

This is a working document and will be reviewed every three years to ensure continuous improvement. This will allow a review of efficacy from collected data, risk and condition changes or any trends to be addressed as practical.
Seek relevant approvals before undertaking any modifications of works described in this document.

Efficacy

Early data collected from 2022 to 2024 indicates that the program is successful under the current operational strategy. Of note:
- Notifiable disease reporting has not noted any increase associated with Vector works operational changes/review.
- The post Tropical Cyclone Jasper flooding event (December 2023) did not result in a significant upswing in notifiable diseases reported despite being good conditions for mosquito breeding. This indicates that the response from program was likely effective.
- Surveillance data currently indicates significant population drops wherever treatment is applied for all life stages observed. However, multi-year data would be required to remove

seasonal/weather effects. Early trends observed are expected to strengthen as data collected becomes higher quality and more comparable.
- CRM numbers were trending up before program changes. They appear to have stabilised post operational review.
- Feedback from officers in DART has been supportive and positive regarding program changes and during consultation.

Distribution of Strategy

Copies of this strategy will be distributed to Council's EHOs, DART, Local Disaster Management Group (LDMG) and any other identified suitable stakeholders. This plan should generally be sent for both consultation and distribution to all appropriate stakeholders listed in the Stakeholders section of this plan.

This plan will also be hosted on CRC's internal digital filing system.

Due to privacy requirements associated with some information in this document such as contact details, this plan is not intended for general publication. Portions of this plan can be provided to appropriate external agencies such as treatment strategies shared during inter-agency planning.

Safety and Environmental Considerations

Please refer to CRC's associated safety documentation for any controls, risk assessments and risk/hazard management not covered by this document. This includes but is not limited to:
- DM#6120471 - CRC Emergency Spill Response Flowchart.
- DM#7616947 - NAM – JSA - Chemical Spill Emergency Response
- DM#5304060 - NAM Pesticides and Chemical Info. Cheat Sheet.
- DM#6835845 - NAM – PPE Requirements for spraying.
- DM#6987369 - NAM – JSA - Pest Mosquito Treatment – Pesticides.

Copies can be acquired by contacting Council's Vector Team Supervisor. These cover operational risks, procedures and controls.

For sensitive or high-risk places there is a requirement to implement an Activity Risk Management Plan (ARMP). Templates can be found on the Queensland Health website.

High-risk places are identified as a place used for intensive or high-density livestock farming, processing food or food manufacturing; and includes land adjacent to the place that is owned or occupied by the same person.

Sensitive places are identified as a building used for aged care, childcare, schooling or health care purposes; and includes land adjacent to the building used for the same purposes.

Waste Management

Containers are disposed in line with label requirements. Where possible containers are recycled. Where this is not possible, containers are triple rinsed, punctured and disposed of at an approved site.
Expired insecticides are returned to the manufacturer if practical (locally), otherwise they are disposed of at an approved place.
Vehicles are inspected at start and end of day to ensure that minimum amounts of chemical are being prepared for the day as well as disposed appropriately at end of day, including empty

containers.

Equipment and Maintenance

In order to minimise wear, potential for incidents and minimise noise generated, equipment is utilized and regularly maintained in line with the manufacturer specifications and Council's fleet maintenance scheduling. Records of maintenance are kept in that system.

Disaster or Emergency Response

Mosquitoes can be a major problem following major events tied to flooding, major runoff or storm surge. Potential for an emergency situation also arises if exotic mosquitoes are introduced either naturally or accidentally, or if there is an outbreak of mosquito-borne disease in Queensland. Council is prepared to respond to emergencies such as flooding and other disasters that can increase community exposure to mosquitoes. This is in line with our legislative obligations detailed above. All emergency response to mosquitoes is undertaken in alignment with State emergency plans and the Cairns Regional Council Disaster Management Plan.

Liaison between Council's Vector Management Team and the relevant lead agencies responsible for the management of disaster situations or disease outbreaks is crucial to the implementation of a vector management response. The Local Disaster Management Group is the responsible management unit for disaster situations including flooding, cyclones and storm surges. Queensland Health is the lead agency responsible for the management of disease outbreak within the region.

Learnings from post-Tropical Cyclone Jasper (2023) flooding disaster response and recovery:

- Impacted areas from flooding are unlikely to have increased mosquitoes for at least two weeks. This gives time for preventative measures in localised areas. Mature mosquitoes will still fly in from untreated areas.
- Fogging is generally ruled out due to standing water, post events.
- Authorised officers under the Queensland Public Health Act can apply Methoprene treatment regardless of pest licence under current State Dengue Programs.
- Stocks of Methoprene are key during an event and recovery, neighbouring Council areas and other groups will compete for limited stocks reducing accessibility for purchase. Other products can be used to supplement works when practical, but Methoprene is the key product to secure for an event.
- As a base line, four staff can approximately inspect and treat (as required) 90 properties in a standard workday. This includes inspection if treatment required, tipping out containers, basic advice, record keeping and Methoprene treatment.
- Licensed Pest Management Technicians should be reserved for planning and treatment using products requiring licences.
- Tropical Cyclone Jasper (2023) was a freshwater flooding event, this may have contributed to a delay in breeding, as the predominant nuisance mosquito in many areas are saltwater breeding in flood effected areas. This may have also flushed out breeding areas including midges, providing some relief. Tidal inundation events can be significantly worse from increasing biting mosquito habitat related to retained water post inundation.
- The current Vector team structure of two licenced staff severely restricts works requiring that licence. Any availability of staff limited by an event would further impact capacity for a response. Sensitive areas treatments require a sensitive site endorsement (conditioned additional on licence) on top of an activity risk management plan development by a suitably licenced officer. This covers any treatment required on aged care homes, childcare

etc.
- Either a tidal inundation event or flooding from rainfall can flush out any pre-event treatment. There are licenced products targeting this use, but care must be taken to maintain efficacy.
- State is unlikely to declare a state of emergency post a flooding event such as Jasper as it was not considered significant disease risk. Recovery efforts were based on community impacts from biting mosquitoes, not significant diseases risk. As such Queensland Health assistance is limited by this.

Future Considerations

Ongoing research, identification and monitoring is essential for the effective delivery of Mosquito Management Programs. New species incursions, new diseases, emergent threats and environmental changes are likely to change the risks and management associated with mosquitoes in the region. Some of this is outside the scope and resources of the current program.

The DART program currently investigates potential new diseases and mosquito incursions that may impact on this plan. There is potential for introduction of exotic species via either the Port or travellers coming through Queensland. Of particular note, the species Aedes albopictus which threatens to invade mainland Queensland and has a higher potential for the spread of diseases in the region if established. In areas encountered in the Torres Strait it appears to have outcompeted the Dengue Mosquito, (Muzari, 2018). This would be concerning as most vector programs targeting Dengue are not currently developed with this mosquito in mind.

Climate change is also expected to increase the risk from mosquitoes through potential higher rainfall, temperature and changes to habitat. The greatest concern is that with increased temperatures and inundation events, the geographic range of pest and vector species will increase. This in turn will increase the risk of human disease, particularly "tropical" diseases such as Malaria and Dengue. Other changes could be extended breeding or biting windows. Assessing the impact of climate change is a complex process and is a driver of the MMP review process, addressing any changes to risk. Discussion regarding this can be found in Gale, R. (2017) and has previously been used to prioritise actions and inform Council's CRC Coastal Hazard Adaptation Strategy.

Product, industry involvement and MMP reviews should pick up best practice management changes as they develop allowing appropriate program adjustments. Ongoing, there is also a high expectation for pesticide use desirability, availability, and environmental impact assessments to drive product changes.

Possible additional program measures (currently outside of operational resources) are to include:
- Free tyre disposals, either annual, a certain amount, or free domestic, as this is a commonly found breeding container in the area (program cost would have to be considered). Targeted trials are currently being undertaken associated with this.
- Targeted annual compliance programs similar to backyard inspections for registered dogs. These could target mosquito harbourage generally, or pool and water tank requirements.
- Increased staff numbers or other capacity increases (considered drone treatment programs) to better target under-managed locations.
- More action in targeted areas and situations towards increasing water flow and reducing stagnant bodies of water.

Long term, these will be assessed, and associated business cases developed.

Urban Development/Planning Considerations

To minimise mosquito attacks when planning development, parks or public use areas:

- Picnic tables/features/gathering points – locate away from vegetation in open areas (problem mosquitoes favour low wind, protected areas).
- Vegetation buffers – can be treated taking advantage of mosquito sheltering behaviour. This allows targeted treatment.
- Future development should consider adjacent land types.
- Sediment retention basins and other development activity can provide temporary habitat for mosquito breeding and must be managed.

Queensland Health produces guidance associated with development: Guidelines to minimise mosquito and biting midge problems in new development areas (health.qld.gov.au).

Other Relevant Council /Historical Documentation

DM#322899	*Cairns City Council's Native Predatory Fish Release Program for Mosquito Control*
DM#544975	*Cairns City Council's Mosquito Light Trapping Plan*
DM#6211612	*Draft Mosquito Management Plan 2020*
DM#6602753	*Draft Mosquito Management Plan 2021*
DM#7002453	*Holloways Activity risk management plan pest control activity in high risk or sensitive places*
DM#6925808	*Local Gov. Monthly Notifiable Diseases Report*
DM#6983871	*NAM's Mosquito and Vector Reference Sheet*
DM#5304060	*NAM Pesticides and Chemical Info. Cheat Sheet*
DM#6950204	*Notifiable Diseases Report from Queensland Department of Health - Communicable Diseases Branch*
DM#7065965	*NAM – Vector CRM Stats Analysis Reporting*
DM#7399141	*NAM Treatment triggers/Workflow for Mosquito works*
DM#4893883	*Vector Control - Analysis of Service Triggers Operating Costs and Work Planning Report 2015*
DM#6846007	*Vector Control – Do Not Fog Register for Mosquitoes -No Fogging List*
Konect based vector mapping – mapping backups here:	G:\City Works\Infrastructure Management\Projects\Pest Management\Tables\Konect Backups
SSA based vector mapping – accessible on Council intranet	Spectrum Spatial https://ssaprod-internal.cairns.council/connect/analyst/mobile/#/main?mapcfg=%2FAnalyst%2FNamedProjects%2FNatural%20Assets%20Management

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DM #5586007 – Queensland Joint Strategic Framework for the Management of Mosquitoes

Glossary

Alphaviruses	Inclusive of Ross River virus, Barmah Forest virus and Chikgunya.
Arbovirus	Virus transmitted by arthropods.
Arthropod	Invertebrate animals which have jointed limbs, a segmented body and an exoskeleton made of chitin. Examples include insects, spiders, ticks and centipedes.
Dengue	Mosquito-borne infection with one of four serotypes of Dengue virus.
Endemic	The constant presence of a disease or infectious agent within a given geographic area or population.
Epidemic	The occurrence in a community or region of cases of an illness or other health-related event clearly in excess of what is expected.
Exotic	Mosquitoes or diseases which have never been found within a geographic area or population.
Flaviviruses	Inclusive of Dengue, Japanese encephalitis, West Nile virus, Kunjin virus and Zika virus.
Instar	In mosquitoes this refers to stages between larval skin molt, which occurs four times. When the 4th instar moults it becomes a pupa.
Malaria	A vector-borne infectious disease caused by protozoan parasites of the genus Plasmodium.
Morbidity	Disease rate.
Mortality	Death rate.
Public Health Risk	The *Public Health Act 2005* defines a public health risk as (a) an animal, structure, substance or other thing that— (i) is, or is likely to become, a breeding ground or source of food for designated pests; or (ii) harbours, or is likely to become something that harbours, designated pests; or (b) any of the following that is, or is likely to be, hazardous to human health, or that contributes to, or is likely to contribute to, disease in humans or the transmission of an infectious condition to humans.
Space Spraying	Treatment of adult insects using insecticide via dispersal of a liquid fog into an outdoor area.
ULV Spraying	The term ULV is the acronym for Ultra-Low-Volume, the name given to the technology used to treat areas with small amounts of chemical in concentrate form. This is the primary fogging method utilised by the Vector team to chemically treat mosquito prone locations when fogging is desirable. Typically defined as less then 5L per Hectare.
Vector	Any organism that functions as a carrier of an infectious agent between the organism and a different species. This definition is sometimes limited to Arthropods. For the purposes of this document, the vector organism is considered to be mosquitoes.
Viraemia	The presence of virus in the blood.

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