Weed and Pest Mangement Plan

Queensland Curtis LNG

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1.0 INTRODUCTION

This Weed and Pest Management Plan (WPMP) provides procedures to ensure controls to manage potential weed and pest species at the proposed QCLNG facility on Curtis Island.

An independent environmental consultant will formally review the plan every five years. Results of this review will be submitted to the Department of Infrastructure and Planning (DIP) and the Department of Environment and Resources Management (DERM). An independent environmental consultant will also undertake an informal review of the plan annually, in conjunction with QGC, to ensure that all actions are being undertaken and that QGC are fulfilling their commitments.

1.1 Project Description

The proposed location of the LNG Facility is six km north east of Gladstone on the south-western side of Curtis Island between Laird Point and Hamilton Point. The site is located immediately north of China Bay and south of Graham Creek.

This WPMP applies to construction and operation of the LNG Facility and export pipeline right-of-way on Curtis Island and excludes marine infrastructure or mainland areas.

1.2 Aims and Objectives

This WPMP aims to provide a detailed methodology to mitigate and manage identified impacts associated with the establishment and spread of weed and pest species, during the construction and operation phases of the LNG Facility. Key objectives are:

- no weed or pest species are introduced through construction activities;
- the abundance of existing weed species are reduced;
- maintain and enhance the biodiversity values of the site; and
- no impediments to native flora and fauna from increased competition of weed or pest species.

1.3 Overview of Weed and Pest Issues

A weed can be defined as any plant growing where it is not wanted. Most weeds are introduced, although they can also be native. Weeds cost Queensland an estimated $600 million annually and have significant impacts on primary industries and natural ecosystems, as well as human and animal health (DEEDI 2009). Weeds have natural mechanisms that ensure their spread and ongoing distribution and survival, aided by wind and water, and movement with livestock and native animals. The movement and transport of machinery, vehicles and equipment is potentially a major source of weed spread.

A pest can be defined as any animal inhabiting an area where it is not wanted. Australia is host to 56 invasive vertebrate animal species. Pest animals are a critical factor affecting the maintenance of Australia's unique biodiversity and are a cause of major losses in agricultural grazing and cropping industries. Invasive animals, particularly pigs, rabbits, foxes and cats, cost Australasia at least $720 million per annum through environmental, economic and social damage.

Most agricultural sectors suffer significant economic losses through predation of livestock, crop damage, and competition for feed. In addition, controlling feral animals costs governments and

landholders more than $60 million a year. Additionally, about $20 million is spent annually on research to find better methods of management (Invasive Animals CRC 2009).

Weeds and pests pose a significant threat to natural areas, including parcels of remnant vegetation. Weed species, often introduced as ornamental plants, can out-compete native flora in the absence of natural competitors. In such scenarios local fauna populations may also suffer due to habitat degradation or destruction. Pest animals further compromise biodiversity through resource competition, predation, poisoning and the introduction of disease. Feral cats and foxes alone have been associated with the decline or extinction of at least 17 native species, while poison from the infamous cane toad has been linked to the decline of native predators (DEEDI 2009).

In summary weed and pest species compromise biodiversity in a number of ways, including:

- resource competition with native species;
- habitat degradation and destruction;
- predation;
- poisoning; and
- introduction of disease.

Weed and pest species known or expected to occur within the LNG Facility site are identified in *Table 4.1* and *Table 4.2.*

1.4 Document Structure

This provides information about issues that may affect weed control, such as past and present land use, adjacent land use, distribution and abundance of significant weeds.

The management action tables provided in *Table 5.1* should be used in conjunction with the additional information provided as Annexures A through G within this document.

The structure of this plan is as follows:

- Legislative requirements
- Background information
- Weeds and pests of concern
- Prescribed management actions
- Monitoring and review
- Annex A: Weed Identification Mapping and Reporting
- Annex B: Operational Control Procedures
- Annex C: Weed Hygiene Declaration
- Annex D: Management and Control of Pest Animals
- Annex E: Biology of Pest plants
- Annex F: Control Techniques for Weeds in Queensland
- Annex G: Summary Table of Weed Control Prescriptions

2.0 LEGISLATION AND REGULATORY REQUIREMENTS

2.1 Commonwealth

2.1.1 Revised National Weeds Strategy 1999

The *Revised National Weeds Strategy (RNWS)* was produced by the Commonwealth Government in 1999 to reduce the impact of weeds on the sustainability of Australia's productive capacity and natural ecosystems by adopting a more coordinated and integrated approach to weed management. It also defines the roles and responsibilities of various stakeholders in weed management.

The RNWS takes a strategic approach to weed management problems of national significance, addressing environmental and agricultural weeds equally. It describes the nature of the problem, discusses why existing weed management measures are not adequate and lists the roles and responsibilities of government, community, landowners and land users.

Two of the principles upon which this Strategy is based relate to the roles and responsibilities of those involved in weed management. These principles are :

- Successful weed management requires a coordinated national approach which involves all levels of government in establishing appropriate legislative, educational and coordination frameworks in partnership with industry, landholders and the community; and
- The primary responsibility for weed management rests with landholders/land managers but collective action is necessary where the problem transcends the capacity of the individual landholder/land manager to address it adequately.

The Strategy specifies that individual landowners have a role to:

- Understand that weeds are an important factor in land degradation;
- Detect and report new weed occurrences;
- Understand land use systems and the cause/effect relationships which apply to weed problems;
- Apply their knowledge and skills to improve weed management;
- Integrate economic and environmental values in the management of weed problems on their land;
- Cooperate with and, where relevant, plan weed management activities jointly with neighbours; and
- Support and promote sustainable production practices to minimise the development of weed problems.

A central component of the RNWS is the identification of Weeds of National Significance (WONS). WONS are prioritised using a series of questions that measure each weeds invasiveness, impact, potential for spread and socioeconomic and environmental values.

WONS known to occur or have potential to occur within the LNG Facility site are Pond Apple (*Annona glabra*) and Lantana *(Lantana camara*). The national control manual for Lantana (Australian Government 2009a) was a reference document for this report.

2.1.2 Agricultural and Veterinary Chemicals Code Act 1994

All pesticides (herbicides, insecticides and fungicides) used, supplied or distributed in Australia must be registered under the *Agricultural and Veterinary Chemicals Code Act 1994* by the Australian Pesticides and Veterinary Medicines Authority (APVMA: formerly the National Registration Authority for agricultural and veterinary chemicals (NRA). All APVMA approved chemicals (or products) have affixed product labels, which contain specific usage requirements and application rates. Label breaches can result in prosecutions under this Act. Permits for the use of herbicides in a manner not specified on the label are issued by the APVMA.

All herbicides to be used on site in weed management will adhere to relevant requirements under this Act.

2.2 Queensland

2.2.1 Land Protection (Pest and Stock Route Management) Act 2002

The threat that declared weeds and pests pose has been recognised in State legislation under the *Land Protection (Pest and Stock Route Management) Act 2002*. Under this Act Queensland land owners are obliged to destroy declared, Class 1 and 2, pest species on their property. Council may request the removal of declared pests and if necessary issue a Pest Control Notice. It is an offence to fail to comply with a Pest Control Notice. A primary purpose of the *Land Protection (Pest and Stock Route Management) Act 2002* is to achieve pest management on government and privately owned land. Plants that are not declared under state legislation may have control requirements imposed by local governments.

Declared Class 1 and 2 weeds known to occur or have potential to occur within the LNG Facility site are Pond Apple (*Annona glabra*), Mother of Millions (*Bryophyllum delagoense* syn. *B. tubiflorum*), Rubber Vine (*Cryptostegia grandiflora*), Harrisia Cactus (*Harrisia* sp. syn. *Eriocereus* sp.), Prickly Pear (*Opuntia* sp.), and Lantana (*Lantana camara*). Declared Plants of Queensland (DPI 2009i) was a reference document for this report.

2.2.2 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) aims to achieve an integrated and comprehensive approach to conserving nature. It provides a legislative basis for research, community education, dedicating, declaring and managing protected areas, and protecting native wildlife and its habitat. The NC Act allows for the ecologically sustainable use of wildlife and protected areas, and recognises the interests of Aboriginal and Torres Strait Islander people in nature and their co-operative involvement in its conservation. The roles of landholders and the community are recognised and the Act encourages their involvement in conserving nature through voluntary agreements and sustainable use of land and natural resources. The NC Act provides for proclamation of subordinate legislation in the form of regulations and conservation plans.

2.2.3 Land Act 1994

The Land Act 1994 applies to all land including land below high-water mark. The land to which this Act applies must be managed for the benefit of the people of Queensland by having regard to the following principles:

- sustainable resource use and development to ensure existing needs are met and the State's resources are conserved for the benefit of future generations;
- land evaluation based on the appraisal of land capability and the consideration and balancing of the different economic, environmental, cultural and social opportunities and values of the land;
- allocating land for development in the context of the State's planning framework, and applying contemporary best practice in design and land management. When land is made available, allocation to persons who will facilitate its most appropriate use that supports the economic, social and physical wellbeing of the people of Queensland;
- if land is needed for community purposes, the retention of the land for the community in a way that protects and facilitates the community purpose;
- protection of environmentally and culturally valuable and sensitive areas and features; and
- consultation with community groups, industry associations and authorities is an important part of the decision making process.

2.2.4 Agricultural Chemicals Distribution Control Act 1966

Under the *Agricultural Chemicals Distribution Control Act 1966* a person who does not possess the qualifications prescribed for a particular class of commercial operator's licence shall not be entitled to apply for and shall not be granted a commercial operator's licence of that class. A regulation may declare an area to be a hazardous area and prescribe conditions for carrying out aerial or ground distribution in the area. The chief executive must publish a notice of the declaration and conditions in a newspaper circulating generally in the hazardous area. A person must not carry out aerial or ground distribution in a hazardous area unless the distribution is carried out under the conditions prescribed by regulation for the area. Maximum penalty is a 100 penalty units or imprisonment for 6 months.

2.2.5 Guidelines/References

Relevant guidelines include but are not limited to the following:

- Queensland Primary Industries and Fisheries Weed Guide;
- Weed Management Guide - Pond Apple (*Annona glabra*);
- Mother of Millions Fact Sheet;
- *Land Protection (Pest and Stock Route Management) Act 2002*; and
- *Nature Conservation Act* 1992.

2.3 Commitments

The Environmental Impact Statement for the proposed QCLNG Project has several requirements and commitments for the management of Weeds and Pests. *Table 2.1* identifies these key requirements / commitments.

Table 2.1 Weed and Pest Management Commitments

Requirements / Commitment	Section of EIS (QCLNG 2009)
Quarantine measures will be implemented to prevent introduction of weeds and other exotic species to Curtis Island (refer *Section 2.1.5*). Vehicles and equipment will be certified as weed free prior to their initial commencement of works on Curtis Island.	Volume 11 S.2.1.12
No increase in abundance or distribution of weed and pest species as a result of Project activities	Volume 11 S. 2.2.6
The following strategies will be implemented to aid in reducing the spread of weeds and pests: • All vehicles and plant will require certification that they are weed free prior to their initial commencement of works on Curtis Island. Vermin control for the LNG Facility will be undertaken, as required, by an appropriately licensed pest controller.	Volume 11 S. 2.2.6
Regular visual inspections of identified weeds and pest species will be conducted.	Volume 11 S. 2.2.6
Non-compliance and reported incidents will be investigated and closed out.	Volume 11 S. 2.2.6
A record will be maintained of all complaints received and corrective actions undertaken to prevent recurrence.	Volume 11 S. 2.2.6

3.0 BACKGROUND INFORMATION

3.1 Adjacent Land Use

The LNG Facility site and surrounding land is currently used for pastoral grazing of cattle. The historical land use from the 1940's to 1980 included undeveloped land and land used for agriculture including dairying. A former cattle dip site was identified and located within the bounds of the LNG Facility site.

3.2 Historical Aerial Photographs

A review of selected historical aerial photographs of the LNG Facility site and the surrounding area summarises land use of the proposed LNG Facility site and surrounding land from 1961 to 2007. Year descriptions of the historical aerial photographs are summarised in *Table 3.1*.

Table 3.1 Summary of Historical Aerial Photographs

Year	Description
1961	The site at Curtis Island appears to support bushland and is considered undeveloped.
1970	No changes were observed from previous aerial photograph register.
1975	No changes were observed from previous aerial photograph register.
1980	The site at Curtis Island remains undeveloped as bushland. On the mainland, an expansion of agricultural land use is evident. A wharf was constructed west from the site at Yarwun.
1989	No significant changes were observed from previous aerial photograph register.
1996	Some tracks were observed to be opened on Curtis Island. Some future developments were observed at the wharf at Yarwun.
2007	No significant changes were observed at Curtis Island. On the mainland no changes were observed at the mudflats and the adjacent lots located where the future roads and pipelines will be constructed. The wharf at Yarwun was redeveloped and it appears to be filled. Industrial development appears west from the wharf.

3.3 Scheduled Flora Species

Scheduled flora species are plant species listed under the Environmental Protection and Biodiversity Act 1999 or the Queensland Vegetation Management Act 1999. Four scheduled flora species were identified as having preferred habitat within the study area (*Table 3.2*), and were specifically targeted during field survey's by ecologists in 2009, to confirm their presence within the LNG Facility. However, none of the scheduled flora species were recorded within the study area during the field survey. Therefore, based on the survey effort and the existing level of disturbance, scheduled flora species are not expected to occur within the LNG Facility site.

Table 3.2 Scheduled flora species with the potential to occur within the study area

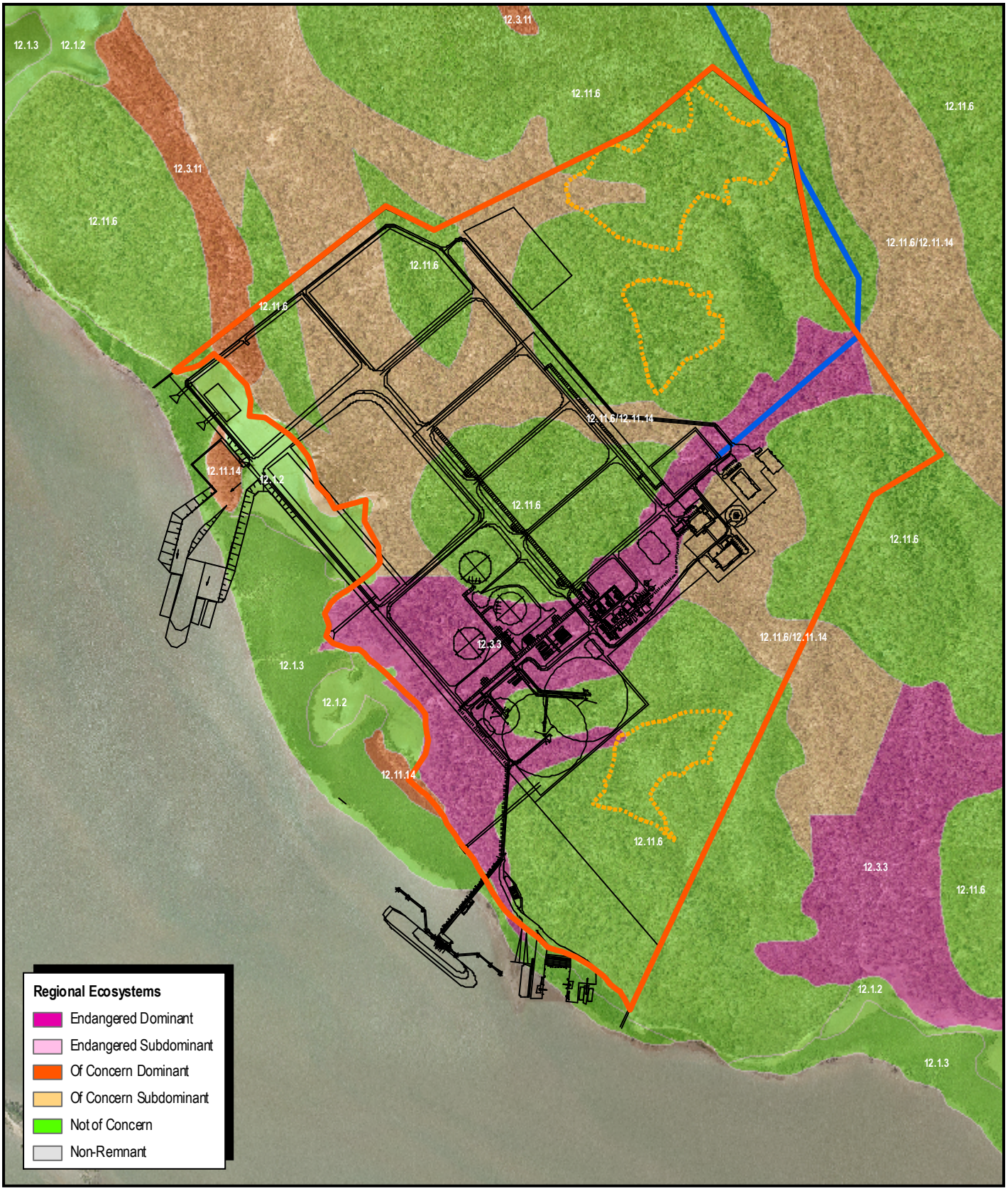
Species Name	*Common Name*	*EPBC Act* Status	*VM Act* Status	Habitat
Atalaya collina	-	E	E	Grows on hillsides, in remnant dry scrubs, together with *A. salicifolia,* but is not as common as that species.
Atalaya rigida	-	-	R	Restricted to eastern Qld from Mt Aberdeen near Bowen, south to Mt Glastonbury south west of Gympie. Occurs in vine thicket and *Araucarian microphyll notophyll* vineforest on red clay soil or black clay loam.
Hernandia bivalvis	Cudgerie	-	R	Vine forests on rocks with shallow soils.
Quassia bidwillii	Quassia	V	V	Below 650m in rainforests, open forest, woodland and mangroves.

1. Under the *VM Act*: The codes are Presumed Extinct (PE), Endangered (E), Vulnerable (V), Rare (R), Common (C) or Not Protected (NP)
2. The values of *EPBC Act* are **Conservation** Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V)

3.4 Vegetation Communities

Vegetation within the LNG Facility ranges from open woodland, with individual eucalypts and iron bark trees, to closed medium density undergrowth of eucalypt saplings. Open woodlands occupy approximately 65 per cent of the site, with medium density saplings occupying the remaining 35 per cent. In certain areas shrub and ground layer vegetation is dominated by Acacia species and herbaceous weeds as a product of historic land use and previous fire events.

Regional ecosystem (RE) mapping of the LNG Facility site and surrounds on Curtis Island shows remnant vegetation communities which have the status of Not Of Concern, Of Concern and Endangered under the provisions of the VM Act, shown in *Figure 3.1.* No vegetation communities listed under the EPBC Act occur within, or within the vicinity of, the LNG Facility site.



Legend

- Proposed QCLNG Site Boundary
- Proposed Export Pipeline
- QCLNG Facility Plant Layout
- Spoil Disposal Area

Source Note:

Aerial photo -Department of Infrastructure and planning for QCLNG Project

Projection: UTM MGA Zone 56 Datum: GDA 94

0 125 250 500 m

Disclamer: Positional Accuracy of RE Data mapped at a scale of 1:100,000 is 100 metres.
Survey and Mapping of 2003 Remnant Vegetation Communities and Regional Ecosystems of Queensland, Version 5.0, EPA (Dec 2005), Certified Regional Ecosystem Map Amendments under the Vegetation Management Act (1999), EPA, 20/08/2008.
Field Assessments undertaken by Unidel as reported in "Revised Regional Ecosystem Mapping"

N

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Project	Queensland Curtis LNG Project
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Title: **Regional Ecosystems of the LNG Facility Site**

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	JB	sEIS Appendix 11.2	Figure 3.1
Approved	SO	File No:	0086165b_SUP_GIS009_S11.2.3.1
Date	19.01.10	Revision	0

Disclaimer:
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4.0 Weeds and Pests of Concern

4.1 Weeds

4.1.1 Weeds of National Significance

Twenty one species have been determined as WONS under the RNWS through the endorsement of the Australian Government and the state and territory governments. Species that are known or with potential to occur within the LNG Facility Site are listed in *Table 4.1*.

Table 4.1 WONS and Declared Weeds Known or with Potential to Occur Within the LNG Facility Site

Common Name	Scientific Name	WONS	Declared Weeds (Class)
Pond Apple	*Annona glabra*	X	2
Mother of Millions	*Bryophyllum delagoense* syn. *B. tubiflorum,Kalanchoe delagoensis*	-	2
Rubber Vine	*Cryptostegia grandiflora*	X	2
Harrisia Cactus	*Harrisia* sp. syn. *Eriocereus* sp.	-	1
	H. martinii, *H. tortuosa* and *H. pomanensis* syn. *Cereus pomanensis*	-	2
Lantana	*Lantana camara*	X	3
Prickly Pear	*Opuntia* sp.	-	1
Praxelis	*Praxelis clematidea*	-	Non declared

WONS = Weeds of National Significance as identified in Revised National Weed Strategy:
Declared Weeds Class as per *Land Protection (Pest and Stock Route Management) Act 2002.*

4.1.2 Declared Plants

There are three classes of declared plants under the *Land Protection (Pest and Stock Route Management) Act 2002*. These plants are targeted for control because they have, or could have, serious economic, environmental or social impacts. Species that are known or likely to occur within the LNG Facility Site are listed in *Table 4.1*. Class 1 weeds are not commonly present in Queensland and if introduced would cause an adverse economic, environmental or social impact. Class 1 pests established in Queensland are subject to eradication from the state if such a pest is sighted it must be reported to the DPI. Class 2 pests are established in Queensland and have, or could have, an adverse economic, environmental or social impact. Class 3 pests are well established in Queensland and have an adverse economic, environmental or social impact (DPI 2009a).

In addition to declared weeds, environmental weeds are plants that invade native ecosystems and adversely affect the survival of indigenous flora and fauna. For example, Praxelis (*Praxelis clematidea)* is rapidly spreading throughout parts of Northern Queensland and is currently listed under the '*Alert List for Environmental Weeds'* collated by the Federal Department of the Environment, Water, Heritage and the Arts. Environmental weeds may have significant economic and social impacts, as well as environmental impacts, including reduction of biodiversity, impacts of landscape, increased risk of fire and potential degradation of water quality (DPI 2009a).

4.1.3 Management and Control of Weeds

There are many methods available to control weeds, but it is common for more than one method to be required to control serious weeds, and integrating several methods over a long period is generally more successful. This approach is known as integrated weed management. Detailed descriptions of the Biology of Pest Plants known to occur or likely to occur within the LNG Facility site are provided in *Annex E* along with appropriate control methods relevant to each species. Details of the application of Control Techniques for Weeds in Queensland are referred to in *Annex F* along with a Summary Table of Weed Control Prescriptions provided in *Annex G* for the application of control methods on each pest species and suitable times of year for each method.

4.2 Pests

4.2.1 Declared Animals

There are three classes of declared animals under the *Land Protection (Pest and Stock Route Management) Act 2002*. Class 1 pests are not commonly present in Queensland and if introduced would cause an adverse economic, environmental or social impact. Class 2 pests are established in Queensland and have, or could have, an adverse economic, environmental or social impact. Class 3 pests are well established in Queensland and have an adverse economic, environmental or social impact. These animals are targeted for control as they represent a threat to primary industries, natural resources and the environment. Declaration imposes a legal responsibility for control by all landowners on land under their management including all landowning state agencies. Unless you have a permit it is an offence under the Act to:

- introduce a pest animal to the state;
- feed a declared pest animal;
- keep a declared pest animal; and
- release a declared pest animal.

Pest animals have significant economic, environmental and social impacts. They have the potential to adversely alter ecosystem function, reduce primary industry productivity and profitability, and threaten human and animal health.

Many pest animals are susceptible to and could act as carriers for a range of exotic diseases including foot-and-mouth, African swine fever and rabies. If these diseases were to enter Australia they would affect livestock and humans and the cost of control and management would be considerable (DPI 2009b).

A list of declared and non-declared pest animals known or with potential to occur within the LNG Facility Site are listed in *Table 4.2*.

Table 4.2 Declared and Non-declared Pest Animals Known or with Potential to Occur Within the LNG Facility Site

Common Name	Scientific Name	Class
Declared:		
Australian Plague Locust	*Chortoicetus terminifera*	2
Migratory Locust	*Locusta migratoria*	2
Spur-throated Locust	*Austracris guttulosa*	2
Cat (other than a domestic cat)	*Felis catus*	2
Dingo	*Canis familiaris dingo*	2
Dog (other than a domestic dog)	*Canis familiaris*	2
European Fox	*Vulpes vulpes*	2
European Rabbit	*Oryctolagus cuniculus*	2
Goat (other than a domestic goat)	*Capra hircus*	2
Feral Pig	*Sus scrofa*	2
Non-declared:		
Cane Toad	*Bufo marinus*	-
House Mouse	*Mus domesticus*	-
Horse	*Equus caballus*	-
Cattle	*Bos sp.*	-
Declared Pest Animals Class as per *Land Protection (Pest and Stock Route Management) Act 2002*		

4.2.2 Management and Control of Pest Animals

A perimeter fence will be erected during construction of the LNG Facility. The EPC Contractor will develop a feral animal eradication plan for the LNG Facility site. The management and control of pest animals applicable to the LNG Facility site is discussed in *Annex D* for future reference.

5.0 PRESCRIBED MANAGEMENT ACTIONS

This section provides the management action table for the WPMP. The prescribed management actions provided in *Table 5.1* are to be used in conjunction with the additional information provided as Annexures A through G within this document.

The following phases are referred to in the management tables:

- Pre-construction: refers to the period prior to any clearing or construction works occur
- Construction: refers to the period of initial overburden stripping and construction of bunds, dam construction and plant and related infrastructure construction
- Rehabilitation: refers to actions to be undertaken when revegetation / rehabilitation is being undertaken
- Ongoing: refers to an action that should be ongoing for the life of the management plan.

5.1 Roles and Responsibilities

The Roles and responsibilities of key roles in the WPMP are listed in *Table 5.1* below.

Table 5.1 Roles and Responsibilities

Role	Responsibility
The Proponent (QGC)	Manage EPC Contractor.
EPC Contractor	Manage all contractors on site and ensure all specifications are met.
Independent Consultant	Assist and monitor any environmental activities and develop specific guidelines for contractors on vegetation removal.
Weed / Pest Contractor	Implement weed and pest control activities and ensure required specifications are met.
Department of Infrastructure and Planning (DIP)	Enforce relevant legislation in relation to Infrastructure and Planning in Queensland.
Department of Environment and Resources Management (DERM)	Enforce relevant legislation in relation to the *Environment Protection and Biodiversity Conservation Act 1999*
Note: Details of activities are provided in *Tables 5.2*	

Table 5.2 Management Action 1: General Weed and Pest Control

Phase	Action	Purpose	Priority	Timeframe
Pre-construction	**1. Conduct weed and pest surveys and mapping after significant rainfall events (See *Annex A*).**	Allow germination of weeds species and identify the overall abundance and diversity of weed and pest species across the LNG Facility Site and adjacent lands, and ensure all areas are managed correctly. Map at appropriate scale.	Priority 1 - High	No less than 1 month before construction
Pre-construction-construction	**2. Install and implement operation control procedures incl. cleaning / wash down facilities and protocols (see *Annex B*)**	Prevent the spread of weeds at the site.	Priority 1 - High	At initial site mobilisation
Pre-construction-ongoing	**3. Provide contractors working in areas with potential for weed infestation with information on appropriate hygiene practices**.	Prevent the spread of weeds at the site.	Priority 1 - High	For new workers throughout construction
Pre-construction	**4. Engage qualified weed contractors** pre-construction and provide with clear and documented identification of weed removal in areas not proposed to be developed.	Ensure effective weed control is carried out.	Priority 1 - High	Within 1 month of construction
Construction-Ongoing	**5. Pest control for the construction camp undertaken**, as required, by an appropriately licensed pest controller.	Ensure effective pest control is carried out.	Priority 1 - High	At all times
	a. Select appropriate method and time of year for targeted weeds species (See *Annexures E* to *G*)	Ensure effective pest control is carried out.	Priority 1 - High	At all times
	b. Undertake weed control in a manner that minimises soil disturbance (See *Annex F*).			
	c. Minimise the use of herbicides. If herbicides are used, ensure correct permits are obtained (See *Annex F*). Selective application (i.e. spot spraying) is preferable to broad scale spraying.			

Phase	Action	Purpose	Priority	Timeframe
	d. Ensure vehicles move from non-contaminated areas to weed-contaminated whilst undertaking weed control activities.			
	e. Avoid moving through weed infestations whenever possible, particularly when weeds are flowering or in seed.			
	f. Remove and dispose of any weed seed and plant parts found on clothing. This will help prevent new weed infestations and the spread of existing weeds.			
	g. Where practicable, minimise areas of bare soil and: • **re-establish vegetation as soon as possible** on bare ground to prevent conditions favouring weed establishment; or • prevent weed establishment by compaction / hardstand establishment.			
	h. Inspect and clean vehicles of weeds and their seeds at weed-contaminated sites. This includes removing mud and dirt from vehicles/ machinery at designated washdown areas (see *Annex B*).			
Construction - Ongoing	**6. Provide weed control contractors with a map showing the location of waterways and associated soaks and drains.**	Ensure minimal impact to the environment whilst works are carried out.	Priority 1 – High	Within 1 month of clearing and grubbing
	a. Minimise the use of herbicides near waterways, take particular care in riparian areas to avoid herbicides entering watercourses.			
	b. Stage weed removal activities to minimise erosion (See *Annex* F) and facilitate the successful establishment of native plant			

Phase	Action	Purpose	Priority	Timeframe
	species.			
	c. Use non-herbicide measures of weed control (e.g. manual removal) near waterways where possible.	Ensure minimal impact to the environment whilst works are carried out.	Priority 1 – High	Within 1 month of construction
	d. Assess the risk to non-target organisms based on herbicide mobility, persistence and toxicity.			
	e. Avoid treating dense beds of submerged weeds in a single application as this may cause deoxygenation when they rot.			
	f. Treat weeds overhanging a waterway or growing within the channel as an aquatic situation.			
	g. Spray when heavy rain is not expected for some time (a minimum of several clear days is required).			
	h. Choose the application method that minimises the amount of herbicide used and its dispersal (See *Annex F*).			
	i. If spraying towards a waterway clearly mark the edge of the creekline / drainage line beforehand.			
	j. Carry herbicides in secure containers when undertaking weed management activities around waterways.			
	k. Mix chemicals and rinse equipment well away from waterways and direct herbicide spray away from the waterway if at all possible.			
	l. Apply the minimum amount of spray required to achieve the degree of wetting specified on the label.	Ensure minimal impact to the environment whilst works are carried out.	Priority 1 – High	Within 1 month of construction

Phase	Action	Purpose	Priority	Timeframe
Lease and Access Track Construction	7. **Earthmoving machinery washed down at dedicated wash down areas prior to entering** the LNG Facility site if or advised by an environmental officer	Ensure outbreaks of weeds do not occur.	Priority 1 – High	At all times
	8. **Earthmoving machinery washed down as soon as possible**, either on site or at the closest wash-down facility, upon completion of works and leaving the site if advised by an environmental officer or operators notice the presence of weeds in the construction area		Priority 1 – High	At all times
Pipeline Construction	9. **During the clear and grade, earthworks machinery and any vehicles entering the right of way must be washed** when entering and upon completion of works.	Ensure outbreaks of weeds do not occur.	Priority 1 – High	At all times
	10. **All machinery arriving at QGC's right of way for clear and grade must be accompanied by a weed free declaration** and will be inspected by QGC FEO's. .		Priority 1 – High	At all times
	11. **Clean on Entry' points (COE)** to be established on completion of clear and grade of the right of way.		Priority 1 – High	At all times
	12. **COE's to be the only access points for machinery and vehicles during pipeline trenching and construction.**	Minimal rewashing will be required.	Priority 1 – High	At all times
Rehabilitation Works	13. **Rehabilitation equipment to be washed down** upon entry of right of way and upon completion of work.	Ensure outbreaks of weeds do not occur.	Priority 1 – High	At all times
Ongoing-progressive rehabilitation	14. **Undertake short term monitoring of weed control success** to identify any outbreaks following weed removal or suppression.	Ensure outbreaks of weeds do not occur, affecting native species growth	Priority 1 - High	Within 1 month Post weed control

Phase	Action	Purpose	Priority	Timeframe
Ongoing-progressive rehabilitation	**15. Monitor existing weed and pest populations by survey every 6 months and eradicate new weeds immediately (See *Annexures E to G*)**. Weed distribution and abundance will be re-mapped and control methods and timing updated accordingly. Pest control will be undertaken as required by a licensed pest controller.		Priority 1 - High	Every 6 months from completion of first weed control
Ongoing	**16. The effectiveness of the WPMP reviewed annually** for a period of five years		Priority 1 – High	Annually
Ongoing	**17. Any issues noted regarding the success of management works will also be relayed to the site manager** on an ongoing basis so that the relevant corrective action can be taken.		Priority 1 – High	At all times

6.0 MONITORING AND REVIEW

An important component of weed and pest management is follow-up work and monitoring. The objective of monitoring is to measure the effectiveness of the proposed control measures in achieving the desired outcomes. Monitoring will help to identify and address any circumstances where the methods prescribed in the WPMP are having limited success. Management must be flexible enough to accommodate changes to the works program as highlighted by monitoring. This will also assist in determining cost effectiveness of weed control measures and allow for the refinement of management budgets.

6.1 Short-Term Monitoring

Short-term monitoring will be undertaken as a 'follow-up' after weed control to ensure that species present in targeted areas have actually been destroyed, and to re-control if necessary. Once weed densities have been initially reduced they need to be regularly monitored, so that any outbreak or spread can be quickly suppressed. This will prevent weeds from re-establishing within targeted areas and will ensure that the initial control effort is not wasted.

This type of monitoring is essential for grassy weeds (such as Parramatta Grass) which can remain hidden amongst areas of native vegetation during initial control activities.

6.2 Long-Term Monitoring

The objective of long-term monitoring is to provide sufficient feedback on the success of the overall weed and pest control program, including the suppression of species and prevention of species spread and establishment. It can also provide information on the successful regeneration of areas of native vegetation containing weed species.

6.3 Reporting and Review

The effectiveness of this WPMP will be reviewed at a frequency to be determined following contract finalisation with the Engineering, Procurement and Construction (EPC) Contractor. The report will also detail any necessary changes to weed and pest control measures in order to achieve more effective control.

Any issues noted regarding the success of management works will also be relayed to the site manager on an ongoing basis so that the relevant corrective action can be taken.

6.4 Responsibility For Implementation of this WPMP

The EPC Contractor will be required to:

- engage suitably qualified contractors and consultants where necessary to implement the WPMP;
- ensure any contractors and staff are aware of this WPMP and its requirements; and
- ensure that monitoring and maintenance regimes are followed in accordance with the WPMP.

7.0 REFERENCES

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Australian Government (2009b) **Weeds of National Significance** http://www.weeds.gov.au/weeds/lists/wons.html Accessed 7/10/09

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DPI (2009e) **Fact Sheet Declared Class 2 Pest Animal – Control of Feral Pigs** Online Resource http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Control-Feral-Pigs-PA7.pdf Accessed 7/10/09

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DPI (2009g) **Fact Sheet Declared Class 1 and 2 Pest Plant – Prickly Pear Opuntia, Nopalea and Acanthocereus spp.** Online Resource http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Prickly-Pear-Control-PP29.pdf Accessed 13/10/09.

DPI (2009h) **Queensland Primary Industries and Fisheries Weed Guide** Online Resource http://www.dpi.qld.gov.au/cps/rde/dpi/hs.xsl/4790_8331_ENA_HTML.htm Accessed 7/10/09

DPI (2009i) **Declared plants of Queensland** Online Resource http://www.dpi.qld.gov.au/cps/rde/dpi/hs.xsl/4790_7005_ENA_HTML.htm Accessed 7/10/09

Invasive Animals CRC (2009) **Invasive Animal Cooperative Research Centre** Online Resource http://www.invasiveanimals.com Accessed 21/10/09

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National Heritage Trust (NHT) (2009c) **Alert List for Environmental Weeds, Weed Management Guide – Praxelis (*Praxelis clematidea*)** Online Resource http://www.weedscrc.org.au/documents/wmg_praxelis.pdf Accessed 12/10/09

Queensland Curtis LNG (QCLNG) (2009) **Draft Environmental Impact Statement** Online Resource http://qclng.com.au/eis/draft-eis Accessed 8/10/09

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A ANNEX A – WEED IDENTIFICATION, MAPPING AND REPORTING

Weed surveys, mapping and reporting are required to identify the overall abundance and diversity of weed species across the LNG Facility site and adjacent lands, and ensure all areas are managed correctly. The following steps will be taken:

- high risk weeds or areas to be noted and used to generate special conditions of access;
- infrastructure audited annually and additional follow-up weed surveys conducted at this time;
- contractors and staff are encouraged to immediately report the location of weed sightings and provide a photo to the site supervisor;
- all vehicles will be issued with weed identification booklet to allow staff to identify weeds during their daily duties. Such reports will be made using a Hazard Observation (HAZOB) Booklet. The most appropriate control method will then be decided and delegated to the appropriate person;
- only licensed Chemcert operators are to spray weeds as there are health and safety risks associated with the use of weed control chemicals.

B ANNEX B – OPERATIONAL CONTROL PROCEDURES

The section details a number of operational activities in the construction field that carry the risks of weed spread. A number of management and control procedures for each activity has been described which must be implemented when undertaking these activities.

B-1 Wash-Down Guidelines

Wash-down guidelines for the LNG Facility site are as follows:

- cleaning / wash down protocols will be established for vehicles and equipment transiting to Curtis Island, with an inspection, wash down, and weed shaker to be established at Auckland Point on the mainland;
- equivalent inspection and wash down facilities will be established on Curtis Island;
- all vehicles must be washed down before transiting to Curtis Island;
- wash down will be thorough, and must involve either compressed air during dry conditions or a high pressure water wash during wet conditions. Both types of washing must take place in a designated wash down bay;
- during wash down, all soil, soil slurry, seeds, mud, and vegetation must be removed from the vehicle or machinery, not only from tyres but from all areas of the vehicle. The vehicle must be on the wash down pad during this operation;
- at the completion of all wash downs, the delegated weed hygiene certifiers will inspect for compliance. When the certifier is satisfied with the vehicle/plant/equipment, he/she will sign off on the Weed Hygiene Declaration (Annex C), along with a signature from the contractor representative;
- wash downs will be monitored by QGC Field Environmental Officers (FEOs), and if there are any breaches they will be reported as an environmental incident;
- a register will be placed at the wash down bay, managed by FEOs, to record the wash downs of vehicles; and
- if the vehicle/plant is towing equipment, the towed equipment must also be washed down prior to traversing a Clean on Entry (COE) point.

B-2 Access Track Construction

During the construction period the following steps must be taken:

- earthmoving machinery must be washed down prior to entering the site/ right-of-way if advised by an environmental officer; and
- earthmoving machinery must be washed down as soon as possible, either on site or at the closest wash-down facility, upon completion of works and leaving the site if advised by supervisor or operators notice the presence of weeds in the construction area.

B-3 Pipeline Construction

During survey mark-up, clear and grade, trenching and rehabilitation, the following steps must be taken:

- during the clear and grade, earthworks machinery and any vehicles entering the right of way must be washed when entering and upon completion of works. All machinery arriving must be accompanied by a weed free declaration and will be inspected by a supervisor prior to works commencing;
- once clear and grade of the right of way is complete, COE points will be established along the right of way. Marked by signs, these will be the only access points for machinery and vehicles during pipeline trenching and construction. Machinery and vehicles must be COE but as long as they do not leave the right of way, gravel roads or sealed roads and it has not rained, they will not require rewashing. COE points will be located at points that intercept gravel or sealed roads so that minimal rewashing will be required. If a COE point is required away from gravel or sealed roads, the access track will be constructed in such a way that minimal rewashing will be required.

B-4 Rehabilitation Works

Rehabilitation equipment will need to be washed down upon entry of right of way and upon completion of work:

- every time vehicle/plant/equipment enters a pipeline easement from any direction of travel, they must be certified clean;
- if a vehicle leaves a COE point and remains on sealed or gravel-based public roads or gas field roads before re-entering the same COE point, it is considered clean; and
- if a vehicle leaves a COE point to any point other than outlined above, it must be cleaned at a wash down facility before re-entering the COE point.

B-5 Operations

All vehicles will be washed down on a regular basis as recommended by the wash down guidelines:

- during day to day operational visits by Production Operators and other staff, vehicles will not require a wash down as long as they do not leave sealed roads, gravel roads or well pads. The only exception to this is if a supervisor recommends vehicles and equipment are to be washed down upon leaving high risk areas. If a vehicle enters an area where it has recently received rained and is muddy, the vehicle will be washed down as soon as possible; and
- if a vehicle passes through a suspected weed infestation area, it is the driver's responsibility to ensure a wash down in completed. For example, pulling onto the road verge to take a phone call might expose the vehicle the weeds such as lovegrass and mother of millions which are common in disturbance zones.

C ANNEX C – WEED HYGIENE DECLARATION

Weed hygiene declaration

Part 1 – Sale or supply of things

(Examples of 'thing' include fodder, grain, seed, livestock, gravel, sand, soil, mulch, packing material, machinery, vehicles, or water)

This declaration is valid for supplying thing/things specified below from _____ to _____ (please provide dates)

1. Thing (please tick the relevant box and provide a brief description)

☐ Fodder ☐ Grain/seeds ☐ Sand/gravel ☐ Machinery ☐ Mulch ☐ Livestock ☐ Other

Amount _____ (e.g. weight, size of load, number of items) Description _____ (e.g. cattle, hay, dozer)

2. Has the 'thing' been moved through, stored in, come from, or used in a place infested with:

	Yes	No	Maybe
Parthenium	☐	☐	☐
Giant rat's tail grass, American rat's tail grass, giant Parramatta grass, Parramatta grass	☐	☐	☐
Prickly acacia	☐	☐	☐
Other (provide details)	☐	☐	☐

3. If you answered 'yes' or 'maybe' in question 2, then what actions have been taken to remove or ensure that there is no reproductive material (please tick the relevant boxes and specify steps taken)

☐ Nil ☐ Washing/cleaning ☐ Quarantine period ☐ Chemical treatment ☐ Certified clean _____ Other

Steps taken _____

4. To the best of my knowledge the 'thing' described above: still contains a weed listed in 2 above ☒ ☐ ☐

I _____ of _____

Town _____ State _____ Telephone _____

Declare that the information that I have provided in this declaration is true and correct and I have read the accompanying explanatory notes before completing this Declaration.

Signature _____ Date _____

Part 2 – Transport of contaminated things

(Vehicle includes anything used for carrying anything or any person by land, water or air, and includes equipment or machinery capable of moving on land).

This declaration is valid for transport and movement of vehicles and other things from _____ to _____ (please provide locations)

1. Movement of vehicles. The vehicle described as: Make _____

Registration no. or engine/frame no. _____ Was *clean prior to entry to _____ (destination)

*Please refer to the definition of clean in the explanatory notes

2. Transport of contaminated things. If you are transporting anything contaminated or possibly contaminated with any declared weed, what actions are being used to contain the weed reproductive material:

☐ Nil ☐ Covered with tarpaulin ☐ Enclosed within container ☐ Chemically treated _____ Other

Actions: _____

I* _____ of _____

Town _____ State _____ Telephone _____

*If same as Part 1 please write 'as above'

Declare that the information that I have provided in this declaration is true and correct and I have read the accompanying explanatory notes before completing this Declaration.

Signature _____ Date _____

Explanatory notes

This declaration was developed in response to landholders, rural industry, community and government desire to minimise the impact of weeds on their business and on the environment. It has been developed to assist in preventing the spread of weeds and other contaminants, and to meet the requirements of Section 45 of the *Land Protection Act (Pest and Stock Route Management) Act 2002*. Completed it provides information on the status of a 'thing', whether it is contaminated or free of weedy material. Part 1 – Sale or Supply of Things of the declaration should be completed by the supplier then given to the receiver before they receive the 'thing'. The receiver can then make an informed decision and take precautions to prevent new infestations. It can also provide written assurance that a vehicle is clean before entering a property.

Why use this declaration?

This declaration can provide:

- A supplier a way of meeting the requirements of section 45 (2) of the Act, if they are supplying any thing that is, or could be contaminated with the weeds listed below.
- A person obtaining a 'thing', information on whether the thing is clean of weed reproductive material or has been infested.
- Assurance that a vehicle was *clean prior to entry onto a property.
- Assurance that any contaminated or potentially contaminated thing is being moved so as not to spread the contaminant.
- Assurance that a product is free of other weedy reproductive material.

Section 45 of the Act makes it an offence to supply a 'thing' that is contaminated with a Class 1 or any of the Class 2 weeds listed below. However, for the Class 2 weeds, a person does not breach Section 45, if they provide a written notice (Part 1 of this declaration) that states that the 'thing' is or may be contaminated. The written notice must be filled and given to the receiver before the 'thing' is supplied.

List of Class 2 species

The following class 2 pests are prescribed for section 45(1)(b) of the Act. These weeds are readily able to infest a wide range of products, from livestock to grain and vehicles. These weeds have a major effect on pasture production and have the capacity to invade large areas of Queensland.

Common name	Species
American rat's tail grass	*Sporobolus jacquemontii*
Giant Parramatta grass	*Sporobolus fertilis*
Giant rat's tail grass	*Sporobolus pyramidalis* and *S. natalensis*
Parramatta grass	*Sporobolus africanus*
Parthenium	*Parthenium hysterophorus*
Prickly acacia	*Acacia nilotica*

Across Queensland, isolated outbreaks of declared plants such as those listed above are found on properties and roadsides each year. Outbreaks of these declared plants are often located hundreds of kilometres from core infestations. These outbreaks occur as a result of machinery, livestock, vehicles, fodder, grain, material and equipment contaminated with weed seeds being transported across the state. A high percentage of seed from prickly acacia and giant rats tail grass remains viable after being eaten and excreted by cattle.

***Definitions**

Clean

- For vehicles, machinery and equipment, clean means that no soil and/or, organic matter that may contain weed reproductive material, is on or in areas that are accessible during cleaning and maintenance work. A checklist and guidelines that show areas that are required to be clean are located on www.dpi.qld.gov.au.
- A vehicle is considered to remain clean if it leaves its point of origin clean and only travels on sealed roads or well maintained unsealed roads.
- For livestock, clean means that animals are internally and externally free of the reproductive material of any declared plant listed in the Land Protection (Pest and Stock Route Management) Regulation 2003. If livestock are suspected to be infested with a declared weed then they should be quarantined within a weed free paddock or pen for a 14-day period.

Weed reproductive material: means any part of the plant that is capable of producing another plant, this can be by sexual and asexual reproduction. Examples include seeds, bulbs, rhizomes, tuber, stem or leaf cutting and the whole plant.

Well-maintained unsealed road: means roads that do not have vegetation growing on or encroaching onto the area occupied by traffic.

For further information: Please contact the relevant Local Government Weeds Officer or the local office of the Department of Primary Industries and Fisheries.

Queensland Government
Department of Primary Industries and Fisheries

D ANNEX D – MANAGEMENT AND CONTROL OF PEST ANIMALS

The management of pest animals must be carried out within the regulations of the *Land Protection (Pest and Stock Route Management) Act 2002* and the *Nature Conservation Act 1992*, and will be dependant on the findings of fauna surveys into their abundance throughout the LNG Facility Site.

A perimeter fence will be in place during construction and operational phases of the LNG Facility to exclude feral animals from entering the site. The EPC Contractor will develop a feral animal eradication plan for the LNG Facility site (some guidance is provided below). However, vermin control for the construction camp will be undertaken, as required, by an appropriately licensed pest controller.

D-1 Management of Wild Dogs and Dingoes

There are several techniques for the management of wild dogs mentioned by the Department of Primary Industries and Fisheries (DPIF) including the use of pesticides in bait, trapping, exclusion fencing, shooting and guard animals. Wild dogs and dingoes are not currently considered a significant threat within the LNG Facility site and no management action is recommended. However state government statistics show the number of wild dogs is growing rapidly in Queensland and is becoming more of an issue. The DPI considers shooting by professionals to be of low concern in regard to animal welfare and is considered an appropriate method (DPI 2009d).

D-2 Management of Wild Pigs

Feral pigs are an environmental and personal safety issue on Curtis Island and their numbers are difficult to control for a number of reasons, as outlined by the Queensland Government fact sheet on control of feral pigs. When poisons can be safely used this is the best method of removing the bulk of the pig population with the least effort, time and expense. A poisoning program can be pig specific if a sound poisoning strategy is followed. Trapping can be an extremely good technique between poisoning campaigns when pig populations are low, or when poisons cannot be used safely. The traps can be made with pig specific triggers that ensure that other local fauna are not trapped. All pigs trapped are to be disposed of at the discretion of the trapper and in accordance with relevant legislation. Details of trap specifications and construction can be obtained from *QLD NRM Facts Control of feral pigs 2001* (DPI 2009e).

D-3 Management of Foxes

Foxes are a prominent pest in the area that QGC operates and have been growing in numbers. Poisoning with 1080 is the most effective large-scale control option; trapping and shooting are also effective when used appropriately. In some situations, fencing may be the only effective means of control (DPI 2009f).

D-4 Management of Cane Toads

Cane toads are in abundance on Curtis Island and their poison has been linked to the decline of native predators. However, currently there are no management strategies that are specific to cane toads. Actions have included detection and surveillance programs at the boundaries of their current

distribution in an attempt to prevent their further spread. Agencies have investigated the potential for using parasites and diseases for their control but this work is in its infancy and would need extensive studies including an assessment of the potential impact of the control agent on native wildlife, particularly native frogs, before they could be used extensively (DPI 2007a).

D-5 Management of Other Pest Species

Other pest species, including feral goats, feral cats, horses and mice are not perceived to be a significant threat to the LNG Facility site. However, they are active in the area. As such they will be managed within regulations on a case by case basis. Further pest management actions can be found at http://www.dpi.qld.gov.au/cps/rde/dpi/hs.xsl/26_4823_ENA_HTML.htm

E ANNEX E - BIOLOGY OF PEST PLANTS

E-1 Pond Apple (Annona glabra)

E-1.1 General

Pond Apple is a Weed of National Significance. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts. Over time the dense thickets it forms can gradually replace everything else in the canopy and create an undesirable new habitat. Its ability to grow in flooded areas and to tolerate salt water has enabled it to spread through much of northern Queensland's wet tropics area. It now infests more than 2000 ha of the Wet Tropics Bioregion, and threatens *Melaleuca* wetlands and native mangrove communities (NHT 2009a). Pond Apple is likely to occur within the LNG Facility site, however, it has not been previously recorded.

E-1.2 Description

Pond apple is a semi-deciduous woody tree, usually about 3–6 m tall, although it can grow up to 15 m (NHT 2009a).

Stems – The plants have grey bark, usually with a single trunk but multiple-stemmed plants are also common since several seedlings may germinate together. Stems often fuse together giving the appearance of a single trunk, but each one maintains its own sap system (NHT 2009a).

Leaves – The plants have alternate leaves, 70–120 mm long with a prominent midrib. The leaves have a light- to dark-green upper surface depending on their age, and are paler on the underside (NHT 2009a).

Inflorescence - The flowers are creamy white to light yellow, about 20–30 mm in diameter and are not easily seen on the tree. They have three leathery outer petals and three smaller inner petals, with a red inner base (NHT 2009a).

Fruit and Seeds – The edible fruit looks like a smooth-skinned custard apple, is similar in shape to a mango and 50–150 mm in diameter. It contains about 140 pumpkin-like seeds (NHT 2009a).

Roots – It may have swollen bases or slightly buttressed roots (NHT 2009a).

For further identification information see National Heritage Trust (2009a) Weed Management Guide for Pond Apple (*Annona glabra)* http://www.weeds.gov.au/publications/guidelines/wons/pubs/a-glabra.pdf

E-1.3 Life Cycle and Dispersal

Pond apple plants start reproducing after two years, producing pale yellow to cream flowers. The flowers do not self-pollinate and pollination is probably brought about by beetles. The fruit form over summer and autumn and drop from the tree after only a short time. The fruit matures after being dropped, the skin turning from green to yellow to black while the flesh turns orange. Leaves of mature trees turn yellow and fall in the dry season. Germination peaks after rainfall and requires a period of temperatures above 25ºC (NHT 2009a).

E-1.4 Control

Pond Apple can be controlled by manual of chemical control methods. Timing of application for each method is discussed in *Annex G*.

Manual Control – Pond apple can be pulled out and bulldozed successfully with monitoring and new seedlings removed (NHT 2009a).

Chemical Control – Stem injection is the preferred method for treating pond apple in aquatic habitats. Two main methods are used to inject herbicides the 'drill and fill' approach or the axe cut method. In still, dry conditions herbicide can also be applied by basal bark spraying and foliar (ie overall) spraying of seedlings (NHT 2009a). Chemical applications will only be applied by a qualified weed contractor.

Table E.1 lists the chemicals permitted for use on pond apple under two 'minor off-label use' permits. These permits are only valid for Queensland and are in force for a restricted time. Permit number PER8297 is valid from 28 April 2005 to 30 June 2010 and permit number PER7485 is valid from 1 July 2004 to 30 June 2009.

Table E.1 Herbicides registered for use on Pond Apple in Queensland

Application Method	Chemical	Rate	Comments
Stem injection	Glyphosate (e.g. Roundup® Biactive).	500 mL per 1 L of water mix.	Apply to actively growing plants.
	Triclopyr (100 g/L) + picloram (50 g/L) (e.g. Tordon* Timber Control Herbicide).	200 mL per 1 L of water mix.	Do not apply to stressed plants.
Cut stump	Triclopyr (240 g/L)+ picloran (120 g/L) (e.g. Access* Herbicide).	1.67 L per 100 L of diesel.	Do not mix with water; cut close to the ground and treat immediately.
	Glyphosate (e.g. Roundup® Biactive).	Undiluted to 1 L per 12 L Water.	Apply immediately after cutting.
Basal bark	Triclopyr (240 g/L)+ picloran (120 g/L) (e.g. Access* Herbicide).	1.67 L per 100 L of diesel.	Do not mix with water; do not treat wet or charcoal coated stems.
	Fluroxypyr (e.g. Starane* 200 Herbicide).	1.5 L per 100 L of diesel mix.	Do not apply to stressed plants.
Foliar	Imazapyr (e.g. Arsenal® herbicide).	800 mL per 100 L of water.mix.	See permit for critical comments
	Glyphosate (e.g. Roundup® Biactive)	1L per 100 L water	Spot spray for wetland/aquatic areas

E-1.5 Recommendations

A combination of manual and chemical control for Pond Apple is recommended for the LNG Facility site (See *Annex G*).

E-2 Mother of Millions (Bryophyllum Sp.)

E-2.1 General

Mother of Millions is an escaped ornamental plant, originating from Madagascar and is a Class 2 declared plant under Queensland legislation. Five species are commonly naturalised in Queensland. One species, *Bryophyllum delagoense* syn. *B. tubiflorum* and *Kalanchoe delagoensis* (common Mother of Millions/Mission Bells/Christmas Bells), and a hybrid, *Bryophyllum* x *houghtonii* syn. B. *daigremontianum* x *delagoense, Kalanchoe* x *houghtonii* (hybrid or crossbred Mother of Millions), is increasing over substantial areas (DPI 2008). Mother of Millions is likely to occur within the LNG Facility site, however, it has not been previously recorded.

E-2.2 Description

Mother of Millions is an erect, smooth, fleshy, succulent plant growing to1 m or more in height (DPI 2008).

Stems – Erect, smooth and fleshy (DPI 2008).

Leaves – *Bryophyllum delagoense* (synonymous with *B. tubiflorum* and *Kalanchoe delagoensis*) (common Mother-of-Millions/Mission Bells/Christmas Bells) has grey-brown fleshy, tubular-like leaves with up to seven projections at the tip of each leaf. *Bryophyllum* x *houghtonii* syn. B. *daigremontianum* x *delagoense*, *Kalanchoe* x *houghtonii* (hybrid or crossbred Mother-of-Millions) leaves are boat shaped with thick stalks and with notches all along the edges of the leaves (DPI 2008).

Inflorescence – Flowers of all species are orange-red and occur in a cluster at the top of a single stem (DPI 2008).

Fruit and Seeds – Seeds are in the form of embryoids (plantlets) that are formed in masses on the leaf edges (DPI 2008).

For further identification information see the Mother of Millions Fact Sheet http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Mother-Millions-PP33.pdf

E-2.3 Life Cycle and Dispersal

Mother of Millions reproduces from masses of embryoids (plantlets) that are formed on the leaf edges. The plantlets drop readily, develop roots, and establish quickly to form a new colony. Seeds can germinate for some years (DPI 2008).

E-2.4 Control

Manual Control – For small areas, pull up plants by hand; stack on a wood heap, and burn. Alternatively bag and dump in bin whose contents are buried at your councils refuse tip rather than recycling into mulch (DPI 2008).

Fire Control – When suitable, e.g. after grading firebreaks, burn infestations along with the accompanying debris on which Mother-of-Millions plants thrive. This is the most economical control, encourages grass competition and lessens the problem for years requiring only spot spraying with

selective herbicides (DPI 2008). A permit for fire management will be obtained from the Rural Fire Service, Rockhampton.

Chemical Control – Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label. Where addition of wetting agent is recommended always use a commercial wetting agent or surfactant. Mother-of-millions may be controlled with herbicides at any time of the year, but infestations are easiest to see in winter when the plants are in flower. Treating infestations at this time of year also has the benefit of preventing new seeds from developing on common mother-of-millions (DPI 2008).

Table E.2 lists the chemicals permitted for use on Mother of Millions under Permit Number PER 10397. This permit is valid for Queensland and is in force from 1 July 2008 to 30 June 2013.

Table E.2 Herbicides registered for use on Mother of Millions in Queensland

Application Method	Chemical	Rate	Comments
Pastures, non-crop land.	2,4-D acid (AF300).	7 L/1000 L/water/ha 70 mL/10 L water.	Overall spray handgun. Overall spray knapsack.
Pastures, rights-of-way, non-crop land, forests, non-agricultural land, commercial / industrial areas.	picloram + triclopyr (e.g. Grass-up, Grazon DS, Picker)	50 mL/10 L water.	Overall spray knapsack. Apply at flowering.
Pastures, rights-of-way, non-crop land, forests, non-agricultural land, commercial / industrial areas.	Fluroxypyr.	600 mL/100 L water + surfactant.	Apply to seedlings and young plants before flowering.
Pastures, rights-of-way, non-crop land, forests, non-agricultural land, commercial / industrial areas	picloram + triclopyr + aminopyralid (e.g. Grazon Extra).	50 ml/10 L water Add 100% concentrate non-ionic surfactant (e.g. BS 1000) at 100 ml/100 L water.	Apply at flowering.
Note: Thorough even coverage of leaves and plantlets is necessary			

E-2.5 Recommendations

A combination of manual and chemical control for Mother of Millions is recommended for the LNG Facility site (See *Annex G*).

E-3 Rubber Vine (Cryptostegia grandiflora)

E-3.1 General

Rubber vine is a Weed of National Significance. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts. Rubber vine has impacts on pastoral and conservation areas of north-eastern Australia. Rubber vine threatens waterways, woodlands and rainforests throughout north-eastern Australia. It also severely threatens riverine vegetation, and can potentially displace the plants and animals that inhabit riverbanks, thereby affecting the water quality of streams. The whole ecological integrity of native vine thickets and riverine systems of northern Australia is under threat from rubber vine (NHT 2009b). Rubber Vine has been previously identified as a known weed species within the LNG Facility site.

E-3.2 Description

Rubber vine is a many stemmed shrub which can climb 30 m into tree canopies, or grow 1 – 3 m high when unsupported in open areas (NHT 2009b).

Stems -Stems are grayish brown with a smooth bark and have two forms: a leaf-bearing branched stem and a longer unbranched 'whip' with fewer leaves that extends onto nearby adjacent vegetation. The plant exudes a milky sap if scratched or broken (NHT 2009b).

Leaves – Leaves occur in pairs and are a glossy dark green in colour. They are oval-shaped with tapered ends (elliptical), 60 – 100 mm long and 30 – 50 mm wide (NHT 2009b).

Inflorescence – The trumpet-shaped flowers are quite large, up to 50 mm long and wide, with five light purple to white petals (NHT 2009b).

Fruit and Seeds – The seed pods are rigid and usually occur in opposing pairs at the end of short stalks, but are quite common as single pods and occasionally triple pods. The pods are up to 120 mm long and 40 mm wide. The brown seeds are flat with a tuft of long, white, silky hairs at one end. Roots grow to a depth of 12 m (NHT 2009b).

For further identification information see the Australian Government Rubber Vine Weed Management Guide (*Cryptostegia grandiflora*) http://www.weeds.gov.au/publications/guidelines/wons/pubs/c-grandiflora.pdf

E-3.3 Life Cycle and Dispersal

About 95% of seed produced by rubber vine is viable. It is scattered short distances from the parent plant by wind that catches the tufts on the seed ends, or longer distances by floating on floodwaters. Most seed remains viable even after the pods have floated on fresh or salt water for over a month, potentially leading to spread between catchments. Seeds can also be spread by birds, or in mud attached to vehicles, machinery and animals. With each seed pod producing between 340 and 840 seeds, a hectare of rubber vine can produce millions of seeds every year. However, the seed is not long lived. If conditions are too dry to allow germination, most of the seed will die after one year (NHT 2009b).

E-3.4 Control

Biological Control – Two biological control agents are widespread in Queensland:

- Rubber Vine Rust (*Maravalia cryptostegiae*); and
- Moth (*Euclastawhalleyi).*

Rubber Vine Rust forms on the underside of leaves and causes them to turn yellow and drop. The rust thrives during the wet season but is less active over the dry season. The Moth, whose caterpillars feed on rubber vine leaves between March and October. Both agents cause damage such as reduced flowering, seed pod production and leaf cover, and occasionally the death of established plants. However, their effectiveness varies with climatic conditions (NHT 2009b).

Fire Method - Fire is an especially valuable part of the integrated control of rubber vine because it kills surface seeds, seedlings and adult plants. If there is sufficient fuel Rubber Vine can be burnt whilst green with high success rates. Infestations may require an initial burn to open them out, a follow-up burn to control regrowth and seedlings within 12 months, and another burn several years later to continue the follow-up (NHT 2009b). A permit for fire management will be obtained from the Rural Fire Service, Rockhampton.

Mechanical Control - Blade or disc ploughs and cutter bars provide reasonable control of rubber vine, but are most often used to penetrate very dense infestations to allow easier access or to open up the canopy. Slashing harms the plant but often does not kill it and care must be taken not to inadvertently bury plant material (e.g. seeds, stems) that could be protected from a fire. Mechanical control is not suited to core problem areas such as gullies and creeks because it can lead to erosion. Permits may be required to conduct mechanical control if native species will be affected (NHT 2009b).

Chemical Method - The strategic use of a range of registered herbicides is an effective method of controlling isolated or outlying Rubber Vine plants. Foliar spraying the entire plant from the ground and aerial spraying are most effective on smaller plants (less than 2 m tall, stem diameter less than 35 mm). The basal bark technique, spraying around the lowest bark up to a height of 500 mm, is effective on plants of stem diameter less than 35 mm at the base. For thicker Rubber Vine, up to 90 mm stem diameter at base, basal bark spray to 1 m high. Foliar, aerial and basal bark spraying will only be conducted when Rubber Vine is actively growing. The cut-stump method is preferred when the stem diameter at the base exceeds 90 mm or if the stems are heavily intertwined (NHT 2009b).

Table E.3 lists the chemicals permitted for use on Rubber Vine under Permit Number PER4594. This permit is valid for Queensland and is in force from 16 July 2008 to 31 March 2010.

Table E.3 Herbicides registered for use on Rubber Vine in Queensland

Application Method	Chemical	Rate
Foliar	Triclopyr + picloram (Grazon DS), Metsulfuron (Brushoff).	Apply at a rate of 200mL product per 10L water.
Basal bark	4-D ester (Rubbervine spray), Triclopyr + Picloram (Access), Triclopyr (Garlon 600), all in diesel.	
Cut stump	As above plus 2,4-D + picloram (Tordon 75-D) in water.	
Soil application	Hexazinone (Velpar L) and Tebuthiuron (graslan), off target damage consideration.	

E-3.5 Recommendations

A combination of chemical and fire control for Rubber Vine is recommended for the LNG Facility site (See *Annex G*).

E-4 Harrisia Cactus (syn. Eriocereus spp.)

E-4.1 General

Harrisia Cactus (*Eriocereus* sp.) is a perennial plant from South America. It was introduced into Queensland as a pot plant in the 1890's. Harrisia Cactus (*Harrisia* sp. syn. *Eriocereus* sp.) is a Class 1 declared plant under Queensland legislation. *H. martinii*, *H. tortuosa* and *H. pomanensis* syn. *Cereus pomanensis* are Class 2 declared plants (DPI 2007b). Harrisia Cactus has been previously identified as a known weed species within the LNG Facility site.

E-4.2 Description

Harrisia cactus is a spiny, fleshy perennial plant forming tangled mats, along the ground, up to 0.5m in height (DPI 2007b).

Stems – Spiny, and fleshy-jointed forming tangled mats along the ground. Stems are ribbed lengthwise with six ribs. Each rib has low, thick, triangular humps at regular intervals (DPI 2007b).

Leaves –Humps have cushions of grey felty hairs, three to five short spines lying flat, and one to three erect, stiff, sharp spines 2.5 – 3 cm long (DPI 2007b).

Inflorescence – Large pink, funnel-shaped flowers with a tinge of white. Flowers grow singularly on a slender scaly grey / green tube 12 – 15 cm long (DPI 2007b).

Fruit and Seeds – Fruit is red, round, 4 - 5 cm across, with scattered bumps with hairs and spines. Numerous small black seeds are embedded in the fruits white juicy pulp (DPI 2007b).

For further identification information see the Harrisia cactus / Moonlight cactus *Eriocereus martinii* and *Eriocereus tortuosus* DECLARED CLASS 2 Fact Sheet Invasive Plants and Animals http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Harrisia-Cactus-PP22.pdf

E-4.3 Life Cycle and Dispersal

Harrisia cactus bears a bright red fruit containing from 400−1000 small black seeds. Fruit and seed are readily eaten by birds and to a lesser extent by feral pigs. Plants are easily established from seed dropped by these animals. Seeds germinate soon after rain. Seedlings quickly produce a swollen tuberous food storage root that develops as the plant grows. Branches take root where they touch the ground and new plants will grow from broken branches and sections of underground tubers. Each plant houses many dormant underground buds that are all capable of re-shooting when the tip growth dies, any small portion of the tuberous root left in the soil will grow (DPI 2007b).

E-4.4 Control

Manual Control – Dig out plants completely and burn. Ensure that all tubers that can grow are removed and destroyed. Ploughing is not considered an effective means of control unless followed by annual cropping.

Biological Control - Two introduced insects have become established in the field:

- Stem-boring Beetle *Alcidion cereicola*; and
- Mealy Bug *Hypogeococcus festerianus*.

The Stem-boring Beetle only attacks older woody stems. In the Collinsville area large beetle colonies developed and contributed to the collapse of dense areas of cactus. The most successful biological control agent is the Mealy Bug now present in Harrisia Cactus in 14 Queensland districts (DPI 2007b).

Chemical Control – There are three herbicides registered for the control of *Harrisia Cactus*. Theses include Metsulfuron, Acess and Tordon TCH. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label (DPI 2007b).

Table E.4 lists the chemicals permitted for use on Harrisia Cactus under Permit Number PER10540 and PER7156. These permits are valid for Queensland and are in force from 1 August 2008 to 31 July 2013.

Table E.4 Herbicides registered for use on Harrisia Cactus in Queensland

Application Method	Chemical	Rate	Comment
Pastures; non agricultural land.	Metsulfuron (eg. Aim WDG, Brush-off).	20 g/100 L water + surfactant.	Spray plant when actively growing to run-off point A follow-up treatment may be necessary.
Pastures; non agricultural land.	Access.	1 L/60 L diesel.	Spray plant when actively growing. Apply as overall spray, wetting all areas of the plant to ground level.
Pastures; non agricultural land.	Tordon TCH.	5 L/100 L water. 2.5 L/100 L water.	Spray plant when actively growing. Treat all stems thoroughly

E-4.5 Recommendations

A combination of manual and chemical control for Harrisia Cactus is recommended for the LNG Facility site (See *Annex G*).

E-5 Lantana (Lantana camara)

E-5.1 General

Lantana is regarded as one of the worst weeds in Australia because of its invasive tendencies, potential for spread, and economic and environmental impacts and is classified as a WON. It forms dense, impenetrable thickets that take over native bushland and pastures on the east coast of Australia. It competes with and reduces the productivity of pastures and forestry plantations and adds fuel to fires (Australian Government 2009). Lantana has been previously identified as a known weed species within the LNG Facility site.

E-5.2 Description

Lantana is a sprawling or scandent shrub or vine normally 1-3 m high, and on rare occasions to 6 m high in favourable conditions, often growing in dense thickets (Australian Government 2009).

Stems – The stems and branches are normally quadrangular in cross-section when young, often well armed with short recurved prickles and sometimes with glands or glandular hairs (Australian Government 2009).

Leaves – Opposite pairs on the stem with successive pairs borne at right angles to each other. The leaves are ovate to oblong-ovate, about 4-10 cm long, 3-6 cm wide, often covered with rough coarse hairs on the upper surface and strongly aromatic due to glandular hairs. The margins are bluntly toothed (Australian Government 2009).

Inflorescence – A dense head of 20-40 brightly coloured flowers, ranging from yellow, orange-yellow, deep orange, deep red, pink, rose-pink to white, often with a variation of colours in each head of flowers and with the flowers having the ability to change colour as they mature (Australian Government 2009).

Fruit and Seeds – Has many berries which ripen from green to shiny purple-black and contain one or two pale seeds (Australian Government 2009).

For further identification information see the Australian Government Weeds in Australia Factsheet for *Lantana camara* http://www.weeds.gov.au/cgi-bin/weeddetails.pl?taxon_id=10892

E-5.3 Life Cycle and Dispersal

Lantana spreads in two ways, layering is a form of vegetative reproduction where stems send roots into the soil allowing it to quickly form very dense stands and spread short distances, also birds and other animals such as foxes consume and pass the seed in their droppings, spreading it over large distances. Butterflies, bees and other insects are attracted by the nectar and pollinate Lantana flowers. About half of the flowers produce seeds, typically 1 - 20 seeds on each flower head. Mature plants can produce up to 12,000 seeds every year, the seeds are thought to remain viable for several years under natural conditions. Lantana is allelopathic and can release chemicals into the surrounding soil which prevent germination and competition from some other plant species (Australian Government 2009).

E-5.4 Control

An integrated approach that uses a variety of control methods including herbicides, mechanical removal, fire, biological control and revegetation gives best results when dealing with Lantana. Best results are obtained by working from areas of light infestation towards heavier infestation, and long-term follow-up control is required after initial attempts. The combination of methods used will depend on the extent of the infestation, the landform on which it is found, and the time of year during which control is to be undertaken. Revegetation of treated sites is also important (Australian Government 2009).

Mechanical Control - Use of machinery can be suitable for extensive infestations, effectively reducing the bulk of infestations and allowing other control treatments, or entirely removing large plants from the ground. The downside is that physical removal using heavy machinery like dozers will likely cause disturbance to soil and desirable vegetation and potentially increase germination of lantana seed and other invasive weeds. Some areas such as steep slopes, gullies, stream banks and areas of sensitive vegetation are unsuitable for mechanical controls.

Fire Method - Fire is usually most effective when lantana is actively growing. Regular controlled burning can help to reduce the height and density of infestations, and create better access for further control. It must be followed up with other controls, however, as it rarely kills the plants.

Biological Control - Four biological control agents have had a major impact on Lantana in Australia:

- Sap-sucking Bug (Teleonemia scrupulosa);
- Two leaf-mining Beetles (Uroplata girardi and Octotoma scabripennis); and
- Seed-feeding Fly (Ophiomyia lantanae).

The biological control agents vary in their effectiveness against the many different types of Lantana. For example, Lantana can drop its leaves when stressed, depriving some agents of their food (Australian Government 2009).

Chemical Control - Control using herbicides can be very cost-effective for smaller infestations and treating re-growth, but less so for extensive infestations. All spraying will occur when lantana is actively growing (usually October to April).

Table E.5 lists the chemicals permitted for use on Lantana under Permit Number PER11463. These permits are valid for Queensland and are in force from 1 July 2009 to 30 June 2014.

Table E.5 Herbicides registered for use on Lantana in Queensland

Application Method	Chemical	Rate
Splatter Gun	Lantana DP-600 herbicide.	75ml chemical / 15L water.
Cut Stump	Lantana DP-600 herbicide.	
Basal Barking	Lantana DP-600 herbicide.	
Foliar Spray	Brushkiller 600	1.5g chemical / 15L water.
Foliar Spray	Weedmaster Duo.	150ml chemical / 15Lwater + Freeway Gold Penetrant.

E-5.5 Recommendations

A combination of chemical, mechanical, fire, biological control and revegetation for Lantana is recommended for the LNG Facility site (See *Annex G*).

E-6 Prickly Pear (Opuntia sp.)

E-6.1 General

Prickly pear (*Opuntia* spp.) is a declared Class 1 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. This plant was introduced into pastoral districts in the 1840's from America and by 1925 invaded over 24 million ha in Queensland and New South Wales. *O. ficus-indica* is not declared. *O. stricta*, *O. aurantiaca*, *O. monacantha*, *O. tomentosa* and *O. streptacantha* species are Class 2 declared pest plants (DPI 2009g). Prickly Pear has been previously identified as a known weed species within the LNG Facility site.

E-6.2 Description

Prickly Pear is a general term used to describe some plants of the Cactaceae family. The plant is a leafless succulent shrub and the term prickly pear' relates to the fruit that is often spiny and pear-shaped (DPI 2009g).

Stems – Stems are divided into segments (pads or joints) that are flat and often incorrectly called leaves (DPI 2009g).

Leaves – Young shoots have true leaves resembling small fleshy scales that fall off as the shoot matures (DPI 2009g).

Inflorescence – Flowers are large, normally seen during spring and can be yellow, orange, red, pink, purple or white depending on the species (DPI 2009g).

Fruit and Seeds – Prickly Pear fruits vary between species and can be red, purple, orange, yellow or green. 'Areoles (spots with clusters of spines) are found on both the pads (joints, segments) and fruit. In addition to spines, areoles often have clusters of sharp bristles (glochids) and tufts of fibre ('wool'). Each areole contains a growing point that can produce roots or shoots (DPI 2009g).

For further identification information see Fact Sheet Declared Class 1 and 2 Pest Plant – Prickly Pear Opuntia, Nopalea and Acanthocereus spp.
http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Prickly-Pear-Control-PP29.pdf

E-6.3 Life Cycle and Dispersal

Prickly Pears reproduce both sexually and asexually. Birds and other animals readily eat the many seeded fruits and deposit seeds in their droppings; the seeds have hard seed coats that allow them to survive heat and lack of water. Asexual reproduction (cloning) of Prickly Pears occurs when pads (joints, segments) or fruits in contact with the ground take root and produce shoots. Animals and floods move broken pads long distances where they can survive periods of drought before weather conditions allow them to set roots (DPI 2009g).

E-6.4 Control

Biological Control – Ten biological control agents remain established in Queensland, nine insects and one mite. These species are:

- Stem-boring Moth (Cactoblastis cactorum and Tucumania tapiacola);
- Cochineal Mealybug (Dactylopius ceylonicus, D. opuntiae, D. confusus, D. tomentosus, and D. austrinus);
- Cell-sucking bug (Chelinidea tabulate);
- Stem-boring Beetle (Archlagocheirus funestus); and
- Prickly Pear Red Spider Mite (Tetranychus opuntiae) (DPI 2009g).

Mechanical and Fire Control - Mechanical control using machinery is difficult because Prickly Pear pads can easily re-establish. A hot fire is an effective control method for dense Prickly Pear infestations. Before burning, consult Queensland Primary Industries and Fisheries to see if this practice is suitable for your pasture and land management practices (DPI 2009g). A permit for fire management will be obtained from the Rural Fire Service, Rockhampton.

Chemical Control - Chemical application for the control of prickly pears in Queensland is an effective method of control. Landholders and contractors will check if the property is in a hazardous area as defined in the *Agricultural Chemicals Distribution Control Act 1966* prior to spraying (DPI 2009g).

Table E.6 lists the chemicals permitted for use on Lantana under Permit Number PER10534. This permit is valid for Queensland and is in force from 1 April 2008 to 30 April 2010.

Table E.6 Herbicides registered for use on Prickly Pear in Queensland

Chemical	Situation	Rate	Method	Comments
Triclopyr	Forest / timber production; land commercial / industrial, non-agricultural, pastures, rights of way.	0.8 L/60 L diesel.	Foliar spray.	For use against common prickly pear, drooping prickly pear, tiger pear.
Triclopyr	Forest / timber production; land commercial / industrial, non-agricultural, pastures, rights of way.	3 L/100 L water.	Foliar spray.	For use against common prickly pear, drooping prickly pear, tiger pear.
	Agricultural land, non-crop; forest / timber production; land / commercial and industrial, pastures, rights of way.	1 L/60 L diesel.	Basal bark / cut stump.	For use against velvet tree pear, tree pears, tiger pear, common prickly pear, snake cactus.
Amitrole	Land around buildings, commercial / industrial, non-agricultural, rights of way.	1 ml/3 cm.	Inject.	
		1 L/25 L.	Foliar spray.	Small plants or regrowth.

E-6.5 Recommendations

A combination of chemical, mechanical and fire control for Prickly Pear is recommended for the LNG Facility site (See *Annex G*).

E-7 Praxelis (Praxelis clematidea)

E-7.1 General

Praxelis is rapidly spreading throughout parts of Northern Queensland and is currently listed under the 'Alert List for Environmental Weeds' collated by the Federal Department of the Environment, Water, Heritage and the Arts. An invader of both disturbed and relatively undisturbed ecosystems, Praxelis could damage conservation areas particularly open eucalypt woodlands. There is also some evidence that it may be poisonous to stock and humans if ingested (NHT 2009c). Praxelis has been previously identified as a known weed species within the LNG Facility site.

E-7.2 Description

Praxelis is an annual or short-lived perennial herb growing 0.2–1.0 m tall (NHT 2009c).

Stems – Brittle and cylindrical covered in short soft hairs (NHT 2009c).

Leaves – Leaves are tear-shaped to diamond-shaped with a conspicuously toothed margin containing between five and eight teeth arranged in opposite pairs along the stems. When crushed emit a pungent odour similar to cats urine (NHT 2009c).

Inflorescence – Flowers are clusters of numerous (30 – 50) lilac or bluish coloured 'florets', 7 – 10 mm long occurring in groups at the ends of stems. The florets are set into a highly conical receptacle (NHT 2009c).

Fruit and Seeds – Seeds are black and about 2.5 – 3.0 mm long. They bear a pale tuft of finely barbed bristles 3 – 4 mm long (NHT 2009c).

For further identification information see the National Heritage Trust Alert List for Environmental Weeds, Weed Management Guide – Praxelis (*Praxelis clematidea*) http://www.weedscrc.org.au/documents/wmg_praxelis.pdf

E-7.3 Life Cycle and Dispersal

Praxelis produces a large numbers of seeds in as little as three or four months after germinating. The seeds spread by a pappus (tuft of barbed bristles) that helps them spread by wind or water or by attaching themselves to animal fur, feathers, clothing, or machinery. Long distance dispersal is mainly attributed to seed attached to vehicles or carried as accidental contaminants of building supplies and landscaping materials. Praxelis is also capable of vegetative growth in which roots and new plantlets form along branches in contact with the soil (NHT 2009c).

E-7.4 Control

Because there are relatively few Praxelis infestations, and it can potentially be eradicated before it becomes established, any new outbreaks will be reported immediately to the Queensland weed management agency or Gladstone local council. Expert assistance will be used to control Praxelis, as control effort that is poorly performed or not followed up can help spread the weed and worsen the problem (NHT 2009c).

Early detection and eradication are important to prevent infestations of Praxelis. Small infestations can be easily eradicated if they are detected early but an ongoing commitment is needed to ensure new infestations do not establish (NHT 2009c).

E-7.5 Recommendations

Prevent the establishment and spread of Praxelis at the LNG Facility site and report any infestations to the authorities (See *Annex G*).

F ANNEX F – CONTROL TECHNIQUES FOR WEEDS IN QUEENSLAND

There are many methods available to control pest plants. Often one method will not be sufficient to control serious weeds, and integrating several methods over a long period will be more successful. This approach is known as integrated weed management. The control methods referred to in this section will be used in accordance with the restrictions (federal and state legislation and local government laws) directly or indirectly related to each control method. These restrictions may prevent the utilisation of one or more of the methods referred to, depending on individual circumstances (DPI 2009h).

F-1 Environmental management

Environmental management aims to alter the conditions required by a particular weed (DPI 2009h).

FIRE CONTROL

Examples: Rubber Vine, Lantana, and Mother of Millions.

SAFETY CONSIDERATIONS

The following general precautions will be taken when using fire:

- The use of fire as a control method requires detailed planning, including installation of fire breaks, and the organisation of personnel and equipment.
- A permit for fire management will be obtained from the Rural Fire Service, Rockhampton.
- Work closely with local Fire wardens based at South End, Curtis Island.
- In all cases, permits and approvals must be obtained.

OTHER CONSIDERATIONS

- Some weeds are fire sensitive (fire will either kill or suppress them), however, the susceptibility of weeds to fire varies greatly.
- In some cases fire is used to kill the weed, in other cases it is used to get access to the weed.
- Be aware that some weeds actually benefit from fire.
- Using fire at times when weed seeds are developing or ripening can help to prevent the release of seeds, but here the timing of the burn is critical.
- This approach is most effective with annual weeds that depend on each season´s seed crop.
- Have you addressed all safety issues?

F-2 Manual control

Manual control is the use of the hands or hand tools to control weeds. An advantage of manual control is that it minimises soil disturbance, and decreases the likelihood of erosion and weed seed germination (DPI 2009h).

MANUAL CONTROL

Examples: Mother of Millions, Pond Apple and Harrisia Cactus.
Hand-pulling aims to remove the entire weed including its roots from the soil. This method is useful for small scale infestations, or with a team of workers. It is best to hand-pull weeds after rain when soil is moist. Sturdy gloves will be worn to avoid prickles, blisters or sap burns to the skin. Hand tools such as broad knives and trowels can be used to remove underground parts of weeds (such as bulbs) and to dig out the crown of the weed (DPI 2009h).

CROWNING

STEP 1
Gently remove and bag seeds or fruit.
STEP 2
Grasp the leaves or stems together so that the base of the plant is visible.
STEP 3
Insert, at an angle, a knife or lever close to the "crown".
STEP 4
Cut through all the roots around the crown.
STEP 5
Remove and bag the crown.

GRUBBING OR CHIPPING

STEP 1
Gently remove and bag seeds or fruit.
STEP 2
Dig at the base of the weed using a mattock or chip hoe.
STEP 3
Depending on the weed, it may be important to expose the root system, and remove the crown (see the crowing method).
STEP 4
In some cases, the mattock or chip hoe is used to cut the stem of the weed below the ground.

REMOVAL OF PLANTS WITH BULBS, CORMS OR TUBERS

STEP 1
Move leaf litter away from base of plant.
STEP 2
Dig down next to the stem until the bulb or tuber is reached.
STEP 3
Remove plant and carefully bag the bulb or tuber.

OTHER CONSIDERATIONS

- Further digging may be required for plants with more than one tuber.
- Some bulbs may have small bulbils attached or present in the soil around it. These need to be removed.
- It may be quicker and more effective to dig out the weed.
- Make sure native plants and seedlings will not be affected.

F-3 Mechanical control

Mechanical control is the use of powered tools and machinery to manage weeds. It is suitable for larger infestations, as it reduces the weed bulk with less manual effort. Care should be taken to minimise soil disturbance (DPI 2009h).

MECHANICAL CONTROL

Examples: Prickly Pear. Rubber Vine, Pond Apple.

Slashing, Mowing, Dozing, Pushing and Felling

STEP 1
Some weeds can be slashed using a tractor slasher or ride-on mower, this method is used where other favourable species will outgrow the slashed weeds.
STEP 2
Bulldozers and chainsaws can be used on woody and tree weeds where they are pushed or felled and finally snigged (dragged away), these methods are only suitable in certain contexts as they create high levels of soil and vegetation disturbance
STEP 3
Grading or scalping the top layer of soil is an effective method of removing a weed seedbank as this method greatly disturbs the soil
STEP 4
Shoots and seedlings also require follow up attention.

OTHER CONSIDERATIONS

- Care should be taken to avoid disturbing the soil or spreading weed seeds from machinery used in the process.
- Disturbing the soil can increase the likelihood of weed seed germination.
- Native vegetation may also be damaged in the course of mechanical control.
- Prior to using mechanical means which involves native plants or weeds near waterways, please check legislative requirements.

F-4 Biological control

Biological control involves the use of insects or pathogens (diseases) that affect the health of the weed. Usually these biocontrol agents are from the same country of origin as the weed species (DPI 2009h).

BIOLOGICAL CONTROL

Examples: Harrisia Cactus, Lantana, Mother of Millions, Prickly Pear, and Rubber Vine.
The Department of Primary Industries and Fisheries undertakes biological weed control research in Queensland. Strict measures are in place to ensure that these agents do not negatively affect native plants and animals or horticultural and agricultural crops (DPI 2009h).

Successful Biological Agents

***Alcidion cereicola* - Stem-boring Beetle (Harrisia Cactus)**
The stem-boring beetle only attacks older woody stems. In the Collinsville area large colonies developed and contributed to the collapse of dense areas of cactus initially. Populations of *Alcidion* have declined with the reduction in the cactus in recent years.
***Teleonemia scrupulosa* - Sap-sucking Bug (Lantana)**
Adults and nymphs suck the cell contents from the undersides of leaves, causing them to brown and wither. Damaged plants may become severely defoliated and stunted, with fewer flowers and seeds produced. Adults live for about three months.
***Dactylopius* sp. - Cochineal Mealybug (Prickly Pear)**
All female cochineal insects are small, sessile mealy bugs that spend their adult lives permanently attached to their host plants sucking plant juices. They are covered by a fine, white, waxy secretion and when crushed yield a carmine colouring. The adult males are small, free-flying insects that do not feed.
***Maravalia cryptostegiae* - Rubber Vine Rust (Rubber Vine)**
Forms on the underside of leaves and causes them to turn yellow and drop. The rust thrives during the wet season but is less active over the dry season. Frequent showers early in the season should result in heavy infestations of rust.

Other Considerations

- Biological control works best in conjunction with other control methods.
- Biological control agents can reduce the vigour, size and competitiveness of weed infestations. However, they rarely get rid of weeds altogether.

F-5 Chemical control

Chemical control involves the use of herbicides. Herbicides control weed plants either by speeding up, stopping or changing the plants normal growth patterns by desiccating (drying out) the leaves or stems or by defoliating the plant (making it drop its leaves) (DPI 2009h).

Chemical Control

Examples: Pond Apple, Rubber Vine, Prickly Pear and Mother of Millions.
It is extremely important to read and adhere to the information contained on the herbicide label. By law, herbicides can only be used in accordance with the claims for use on the label. Most environmental weed applications are not listed on herbicide labels. In these cases it is necessary to obtain an off-label permit. Some techniques are more suitable for control of particular species and in different situations than are others (DPI 2009h).

Safety Considerations

The following general precautions will be taken when using herbicides:

- Read the label before opening the container and follow the instructions.
- Wear protective clothing as directed on the label.
- Wash hands after use and before eating or smoking.

Foliar Spraying

STEP 1
Dilute the selected herbicide with water or diesel at a specific rate and spray over the foliage to point of runoff (until every leaf is wetted, but not dripping).
STEP 2
Blanket spray to treat areas completely infested with weeds using a boom spray from a tractor.
STEP 3
Use a hose and handgun to spray solution from a herbicide tank and pump carried by a tractor or vehicle for large infestations that need targeted applications of herbicide
STEP 4
Smaller infestations can be sprayed using a backpack/knapsack spray unit.
STEP 5.
Spot spraying to treat individual weed plants or areas that only have small clumps of weed infestations.

Other Considerations

- The method is most suited to shrubs, grasses and dense vines less than 6 m tall so that complete coverage is achieved.
- Advantages include quickness and economy.
- Disadvantages include the potential for spray drift and off-target damage.

Basal Bark Spraying

STEP 1
Mix an oil-soluble herbicide in diesel and spray the full circumference of the trunk or stem of the plant.
STEP 2
Ensure the entire circumference of the stem or trunk is sprayed or painted with herbicide solution from ground level to a height of 30 cm.
STEP 3
Treat every stem or trunk arising from the ground.

Other Considerations

- The work is often best performed by contractors.
- Suitable for thin-barked woody weeds and undesirable trees.
- An effective way to treat saplings, regrowth and multi-stemmed shrubs and trees.
- Allows the herbicide to enter underground storage organs and slowly kill the targeted weed.
- A good way to tackle inaccessible areas such as steep banks.

Stem Injection

STEP 1
At the base of the tree drill holes at a 45 degree angle into the sapwood at 5cm intervals.
STEP 2
Fill each hole with herbicide immediately after it is drilled.

Other Considerations

- Plants should be healthy and actively growing.
- Deciduous plants should be treated in spring and autumn when leaves are fully formed.
- For multi-stemmed plants, inject below the lowest branch or treat each stem individually.
- Herbicide must be injected immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases.

Cut Stump

STEP 1
Cut the plant off completely at its base (no higher than 15 cm from the ground) using a chainsaw, axe, brushcutter or machete (depending on the thickness of the stem/trunk).
STEP 2
Spray or paint a herbicide solution onto the exposed surface of the cut stump emerging from the ground.
STEP 3
It is imperative that the herbicide solutions are applied as soon as the trunk or stem is cut.
STEP 4
It is only necessary to place the solution around the edge of the stump for trees with large circumferences.

Other Considerations

- A delay of more than 15 seconds for water-based herbicides and one minute for diesel-soluble herbicides between cutting and applying the chemical will give poor results.
- Two operators working as a team can perform this method effectively.
- The herbicide can be applied from a knapsack, or with a paint brush, drench gun or a hand spray bottle.
- It is a good idea to use a brightly coloured dye in the solution to mark the stumps that have been treated.
- This method has the appeal of removing the weed immediately, and is used mainly for trees and woody weeds.

Cut and Swab

STEP 1
This method is similar to the cut stump method, but is suited to vines and multi-stemmed shrubs.
STEP 2
Cut plant stems through completely close to the ground.
STEP 3
Apply the herbicide immediately to the cut surface emerging from the ground via spray or brush application.

Other Considerations

- In the case of vines with aerial tubers, both ends of the cut stems must be treated with herbicide. An effective way of doing this is to hold both ´bunches´ of cut stems in a container of herbicide for 15 seconds after cutting, so that maximum translocation occurs to both ground and aerial tubers.
- Extra care should be taken when doing this to

ensure spillages do not occur.

STEM SCRAPER

STEP 1
With a knife, scrape 15 to 30 cm of the stem to reach the layer below the bark/outer layer.
STEP 2
Immediately apply herbicide along the length of the scrape.

OTHER CONSIDERATIONS

- A maximum of half the stem diameter should be scraped. Do not ring bark.
- Larger stems (>1cm) should have two scrapes opposite each other.
- Aerial tubers such as Madeira Vine should die with the plant when stem scraping is used. Those that fall from the plant in the scraping process need to be bagged.
- Vines can be left hanging in trees after treatment.

G ANNEX G - SUMMARY TABLE OF WEED CONTROL PRESCRIPTIONS

Table G.1 Herbicides registered for use on Prickly Pear in Queensland

WEED SPECIES	TIMING											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Pond Apple (*Annona glabra*)								Bulldoze with follow-up monitoring and new seedlings removed.				
								Stem Injection followed by basal bark / foliar spraying seedlings with herbicide.				
Mother of Millions (*Bryophyllum* sp.)						Foliar spray with herbicide.						
	Pull up plants by hand.											
	Burn infestations along with the accompanying debris.											
Rubber Vine (*Cryptostegia grandiflora*)	Mechanical Control by blade or disc ploughs and cutter bars to penetrate very dense infestations and allow easier access.											
			Foliar or basal bark spray when diameter <90mm. Cut-stump method if diameter is greater or stems are heavily intertwined.									
	Burn infestations along with the accompanying debris.											
Harrisia Cactus (*Eriocereus* sp.)	Dig out plants completely and burn ensuring all tubers that can grow are removed and destroyed.											
	Foliar spray with herbicide								Foliar spray with herbicide			
Lantana (*Lantana camara*)	Hand slashing, grubbing and digging											
	Burn infestations along with the accompanying debris.											
	Foliar spraying or cut stump method.									Foliar spraying or cut stump method		
Prickly Pear (*Opuntia* sp.)	Burn infestations along with the accompanying debris.											
	Basal Bark plants up to 10 cm diameter. Cut stump diameter greater than 10cm.											
Praxelis (*Praxelis clematidea*)	Report immediately to the Queensland weed management agency or Gladstone local council.											