Plant Assessment Report

Port of Brisbane

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Executive Summary

RPS has been commissioned by Port of Brisbane Pty Ltd (PBPL) to participate in an annual weed monitoring program by undertaking a survey of weeds listed by the Australian Quarantine and Inspection Service (AQIS) along Lucinda and Port Gate Drain, T1-3 Overflow and the Car Precinct areas, at the Port of Brisbane.

The monitoring program aims to monitor weed species listed by AQIS, the *Land Protection (Pest and Stock Route Management) Act 2002* (LPA), and Brisbane City Council (BCC). In addition to this, the survey also monitors the occurrence and abundance of species considered to be exotic, including locally occurring weeds. The annual report provides the results of the monitoring program as well as recommendations with respect to the ongoing management of weeds along Lucinda and Port Gate Drain, T1-3 Overflow and the Car Precinct areas.

The weed monitoring program is currently conducted annually, during post-summer months (March / April). A total of 21 plant surveys along Lucinda Drain, eight along Port Gate Drain and ten surveys along the T1-3 Overflow and Car Precinct areas, have been conducted to date.

Summary of Findings

Lucinda Drain

The following points summarise the findings of the April 2011 plant survey of Lucinda Drain:

- Eighty plant species were recorded. This consisted of 22 native / planted species and 58 exotic species;
- Out of the 58 exotic species, none were AQIS listed weed species;
- One exotic species, *Phyllanthus tellenus* was recorded for the first time during the current survey, it is not declared under the LPA or AQIS;
- Occurrences of Giant Paramatta Grass (*Sporobolus fertilis*), Broad-leaf Pepper (*Schinus terebinthifolia*), Lantana (*Lantana camara*) and Annual Ragweed (*Ambrosia artemisiifolia*), all declared under the LPA, were recorded again during the recent April 2011 survey;
- Singapore Daisy (*Sphagneticola trilobata*) has not been found within Lucinda Drain since November 2009, however this species was found during the recent survey. Similarly, Chinese Elm (*Celtis sinensis*) has not been recorded since March 2007, however was observed during the recent April 2011 survey;
- In comparison with previous surveys, no occurrences of Class 2 Fireweed (*Senecio madagascariensis*) Prickly Pear (*Opuntia* sp.) or Creeping Lantana (*Lantana montevidensis*) were identified during the recent survey;
- A variety of grasses and vines including Guinea Grass (*Megathyrsus maximus* var. *maximus*), Rhodes Grass (*Chloris gayana*) and Glycine (*Neonotonia wightii*) were the dominant groups of species along Lucinda Drain. Common Reed (*Phragmites australis*) dominates the western side of the drain; and

- Exotic species diversity, abundance and coverage have slightly increased in comparison to the survey results of November 2010.

Port Gate Drain

The following points summarise the findings of the April 2011 plant survey of Port Gate Drain:

- Thirty-five plant species were recorded. This consisted of 13 native / planted species and 22 exotic species;
- Out of the 22 exotic species, none were AQIS listed weeds;
- One new species, Whisky Grass (*Andropogon virginicus*), was recorded during the current survey. This species is not AQIS listed or declared under the LPA;
- Occurrences of Broad-leaf Pepper, Groundsel Bush (*Baccharis halimifolia*), Fireweed and Lantana, all declared under the LPA, were recorded again during the recent April 2011 survey;
- Unlike the November 2010 survey, Camphor Laurel (*Cinnamomum camphora*) and Creeping Lantana were not recorded in the recent survey at Port Gate Drain;
- Exotic and native invasive species, in particular Common Reed, Rhodes Grass and Siratro (*Macroptilium atropurpureum*) dominated the Port Gate Drain;
- The number of exotic species present along the drain has decreased in comparison to the previous November 2010 survey; and
- Abundance and coverage of exotic species have slightly decreased in comparison to the previous November 2010 survey.

T1-3 Overflow Area

The following points summarise the findings of the April 2011 plant survey for the T1-3 Overflow area:

- Forty-nine plant species were recorded. This consisted of three native species, and 46 exotic species;
- Out of the 46 exotic species, none were AQIS listed weeds;
- One exotic species, Common Thornapple (*Datura stramonium*), was recorded for the first time during the recent April 2011 survey. This species is not declared under AQIS or LPA;
- Fireweed has not been found within T1-3 Overflow area since September 2008, however this species was found during the recent April 2011 survey;
- Chinese Elm has never been recorded within the T1-3 Overflow area, however this species was observed during the recent April 2011 survey;
- Red Natal Grass and Couch Grass dominated the eastern areas and the western landscaped areas. Cobblers Pegs (*Bidens pilosa*) dominated the northern drain; and
- Exotic species diversity, abundance and coverage have decreased in comparison to the previous November 2010 survey results.

Car Precinct Area

The following points summarise the findings of the April 2011 plant survey for the Car Precinct area:

- Forty-two plant species were recorded. This consisted of 12 native species, and 30 exotic species;
- Of the 30 exotic species, none were AQIS listed weeds;
- All exotic species recorded during the current April 2011 survey have been recorded before in previous surveys within the Car Precinct Area;
- Three species listed under the LPA were recorded in the recent April 2011 survey, including Broad-leaf Pepper and Fireweed;
- No incidences of Giant Parramatta Grass and Groundsel Bush were recorded during the current April 2011 survey in comparison to the previous November 2010 survey;
- Locally occurring exotic grass species such as Rhodes Grass, Guinea Grass and Townsville Stylo (*Stylosanthes humilis*) were the dominant species observed throughout the majority of the Car Precinct area. Common Reed and Umbrella Sedge (*Cyperus eragrostis*) dominated the wetter portions of the Car Precinct area (e.g. within the western trench and around the Visitor Centre Lake); and
- Exotic species diversity, abundance and coverage have decreased in comparison to the previous November 2010 survey results.

Summary of Recommendations

Recommendations regarding the short and long-term management of exotic species within the Lucinda and Port Gate Drain, T1-3 Overflow and Car Precinct areas are provided in this report.

All maintenance activities are to continue as scheduled and should be extended to include exotic species removal, particularly those declared under the LPA. It is noted that some of the declared species may be located along banks and the method of removal should be sensitive to bank stability (e.g. stem injection or cut and paint).

In addition, all areas within the Lucinda and Port Gate Drain, T1-3 Overflow and Car Precinct areas should be maintained as often as the more visible sections of the survey area, where practical and when necessary. It is also recommended that a more integrated and long-term management of the weed species within the survey area is implemented through increasing the native plant cover.

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1.0 Introduction

1.1 Background

RPS has been commissioned by Port of Brisbane Pty Ltd (PBPL) to undertake an annual weed monitoring program along Lucinda Drain and Port Gate Drain, T1-3 Overflow and Car Precinct Areas at the Port of Brisbane. In addition to this, associated reporting that details the findings of the surveys has been prepared. Lucinda Drain and Port Gate Drain are located on land formally described as Lot 99 on SP238079 and Lot 732 on SP142208, respectively. The T1-3 Overflow and Car Precinct areas are located on land formally described as Lot 99 on SP238079. The survey areas are located within the Wynnum-Manly Ward of Brisbane City Council (BCC).

RPS has been involved in the bi-annual monitoring program and has undertaken the plant surveys since 2001. Plant surveys in 2001 were initially conducted along Lucinda Drain with surveys along Port Gate Drain commencing in 2007. In response to a potential weed incursion threat from imported vehicles, the areas known as the Car Precinct and T1-3 Overflow Area were added to the monitoring program in 2008. RPS has produced associated reporting since 2001, which has been presented as two separate documents that has detailed the findings of the surveys and weed management recommendations for Lucinda & Port Gate Drains and the Car Precinct and T1-3 Overflow Area, respectively.

Following a review by Port of Brisbane Pty Ltd (PBPL) and in consultation with Australian Quarantine and Inspection Service (AQIS), a number of changes have been made to the monitoring program in 2011. The surveys are still to be undertaken within all four previous locations, however has been reduced to one survey per year, which is to occur in the post summer months (March / April). AQIS have recommended one target weed list that is to be used for all survey areas and reporting will involve the preparation of one document.

This is the 21st report that has been prepared for the Lucinda Drain and the eighth report for the Port Gate Drain. For the T1-3 Overflow and Car Precinct areas, this is the fifth report that details the results of the 2011 annual weed monitoring program.

1.2 Scope of Works / Objectives

This report has been prepared in response to a request from AQIS to increase surveillance for potential incursions of AQIS listed weed species within the survey areas. The primary objective of the plant survey conducted is to contribute to a long-term annual monitoring program at the Port of Brisbane through identification of AQIS listed weed species, which may enter the country via containers and other materials shipped and unloaded at the Port of Brisbane facility. Additionally, the program aims to monitor species considered to be exotic / invasive, including species declared under the *Land Protection (Pest and Stock Route Management) Act 2002* (LPA), listed by BCC, and locally occurring weed species (from hereafter collectively referred to as exotic species as well as invasive natives).

In particular, the scope of work for this weed monitoring program includes:

- Identification of species declared or listed by the AQIS, LPA, or BCC;
- Monitor the occurrence and abundance of exotic / invasive species;

- Assess the extent of exotic / invasive species;
- Report the findings of the current survey;
- Undertake a comparative analysis of the current and previous survey results; and
- Provide recommendations for the on-going weed management along the drains.

1.3 Site Description

The weed monitoring focuses on the Lucinda and Port Gate Drain, the T1-3 Overflow and Car Precinct areas at the Port of Brisbane. Lucinda Drain is located along the eastern side of the Port of Brisbane (Lot 99 on SP 238079) and provides drainage for stormwater run-off from the hardstand areas adjacent to the drain (**Figure 1.1**). This drain also experiences tidal influence from the Boat Passage, where it discharges through the Lucinda Weir.

Lucinda Drain is a constructed drainage channel comprising of a concrete filled geo-textile sandwich approximately 2.5 kilometres in length. The berms of the channel consist of sand above the geo-textile sandwich. The channel currently has a regular maintenance schedule that provides for the western bank of the drain (adjacent to Lucinda Drive) to be mowed and sprayed for noxious weeds. The eastern bank of the drain has an irregular maintenance program with some time between maintenance events.

Port Gate Drain is located in the south-west portion of the Port of Brisbane at Port Gate. The drain also provides drainage for stormwater run-off from the hardstand areas adjacent to the drain, as well as partially receiving tidal waters from the Boat Passage (**Figure 1.2**). The drain is separated into two portions by Howard Smith Drive and tidal flow is prevented from entering the part of the drain to the south of this road. Unlike Lucinda Drain, the area either side of Port Gate Drain (especially in the northern portion of the drain) consists of either concrete, gravel or compacted earth, which allows for only sparse vegetation growth with the majority of vegetation located in the southern portion of the drain.

The T1-3 Overflow and Car Precinct areas lie parallel to one another, with the Queensland Rail freight line separating the two areas, in the south-western portion of Lot 99 on SP238079 (**Figure 1.3**). The T1-3 Overflow area is situated along Port Drive, and extends around a large hardstand car parking area, towards and past the overpass. This area includes a constructed drain located in the very northern region (**Figure 1.3**).

The T1-3 Overflow area consists of landscaped gardens and lawn on its western side, and a sandy / gravel area on its eastern side. The primary purpose of the T1-3 Overflow is to facilitate in absorbing and filtering excess stormwater that may potentially flow from surrounding hardstand areas. The constructed drain in the northern section consists of a concrete channel, surrounded by lawn, designed to pipe stormwater runoff that has entered nearby stormwater drains out into the Brisbane River.

The Car Precinct area is directly to the west of a large vehicle storage area (**Figure 1.3**). It includes an area extending from the road overpass (situated at the northern end of the site) and incorporates the edge of the lake adjacent to the Visitors Centre.

The Car Precinct area is a constructed drainage channel that comprises a grass-lined trench, with a series of concreted chutes that channel stormwater runoff from the hardstand vehicle storage facility to the east of the drain. The trench provides drainage for excess water that may overflow from nearby areas, which is distributed either south through a stormwater outlet that flows into the lake or north via a series of underground pipes and open drains and into the mouth of the Brisbane River.

It is understood that Lucinda and Port Gate Drain, the T1-3 Overflow and Car Precinct areas currently have regular maintenance schedules (including mowing and spraying for exotic species) facilitated by the PBPL.

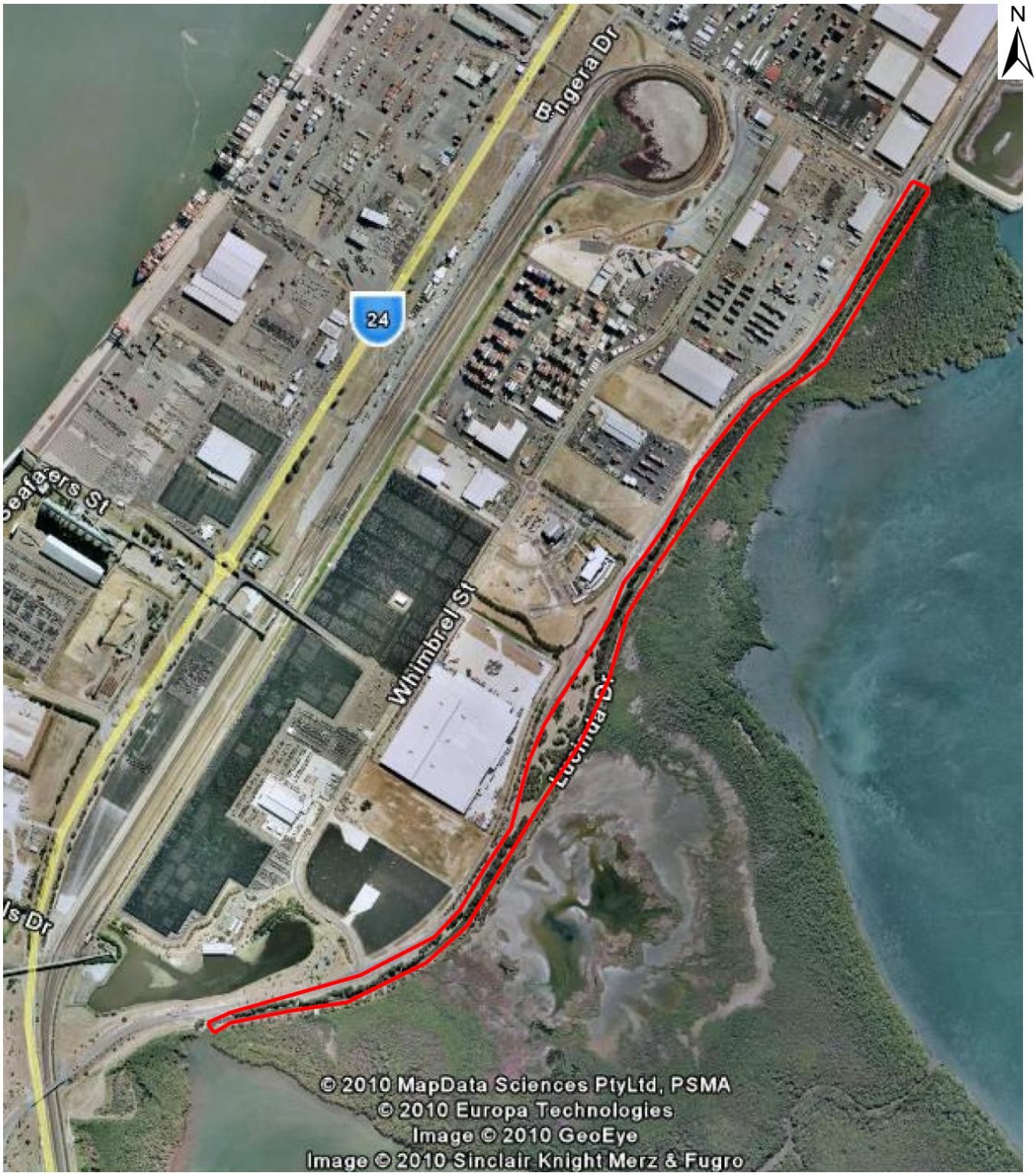

Figure 1.1 – Lucinda Drain Study Area

Client: Port of Brisbane Pty Ltd

Date: 09-04-2010	Compiled by: SS	Project Manager: LF	Scale: Not to scale	Reference: PR102522

RPS

Source: Google 2008

Legend:
Site Boundary

Figure 1.2 – Port Gate Drain Study Area

Client: Port of Brisbane Pty Ltd

Date: 09-04-2010	Compiled by: SS	Project Manager: LF	Scale: Not to scale	Reference: PR102522

RPS

Source: Google 2008

Legend:
Site Boundary

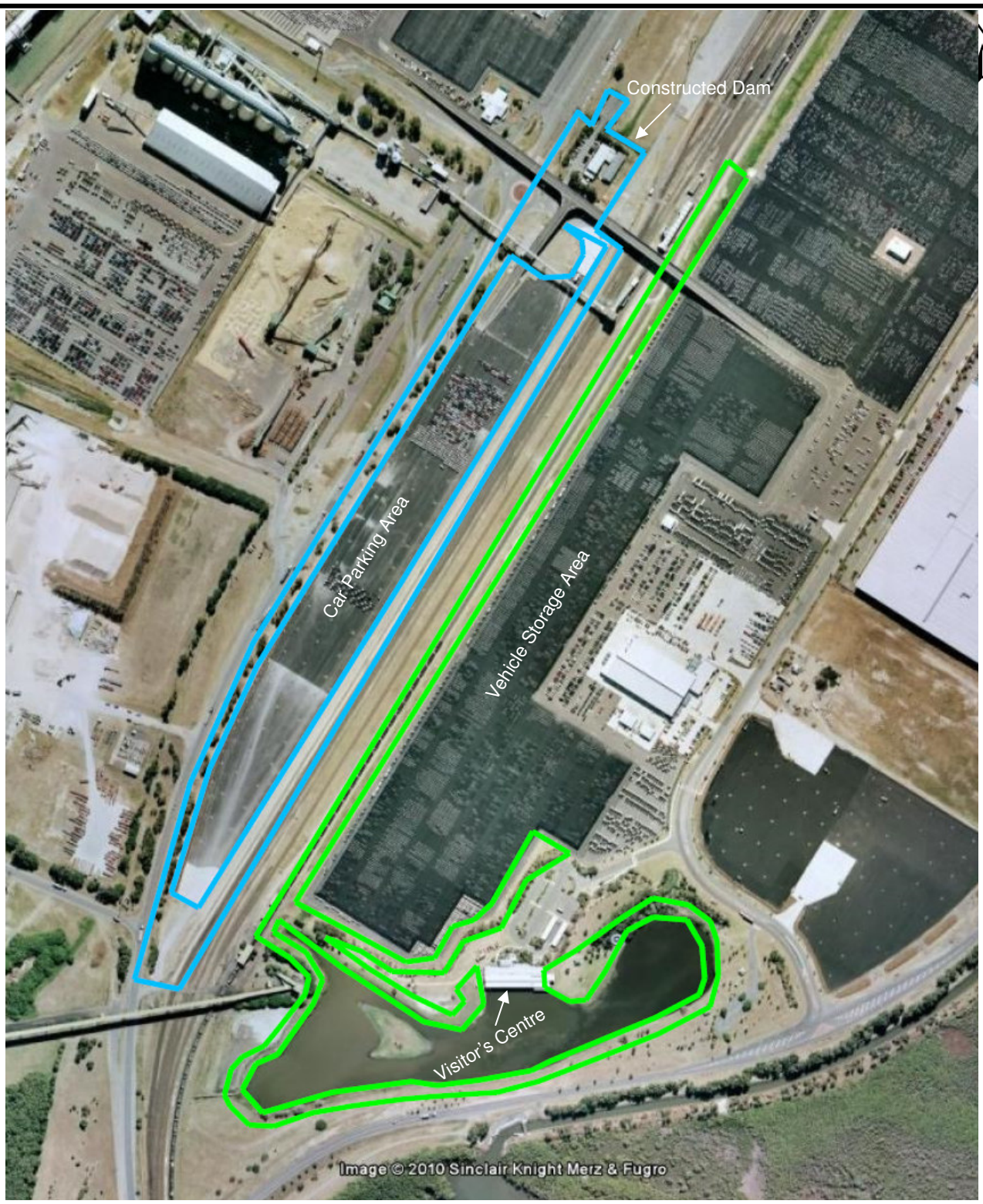

Figure 1.1 – Lucinda Drain Study Area

Client: Port of Brisbane Pty Ltd

Date: 09-04-2010	Compiled by: SS	Project Manager: LF	Scale: Not to scale	Reference: PR102522

RPS

Source: Google 2010

Legend:
Car Precinct Area
T1-3 Overflow Area

2.0 Methodology

2.1 Weed Monitoring Schedule

The weed monitoring program is currently conducted on an annual basis, during the post-summer months (March / April). The weed monitoring surveys were previously undertaken on a biannual basis during both the post-summer and post-winter (October / November) months (**Table 2.1**). During the inception of weed monitoring for T1-3 Overflow and Car Precinct areas in 2008, surveys were undertaken on a three monthly interval, with a baseline study occurring in the month of February (**Table 2.1**).

RPS has conducted a total of 21 plant surveys along Lucinda Drain, eight along Port Gate Drain and ten along the T1-3 Overflow and Car Precinct areas (**Table 2.1**). The latest weed monitoring survey within the survey areas was conducted by two ecologists on the 27th & 28th April 2011, which consisted of verifying the occurrence and abundance of exotic and invasive species.

Table 2.1 Monitoring Schedule of Survey Areas

Year	Season	Lucinda Drain	Port Gate Drain	T1-3 Overflow Area	Car Precinct Area
2001	Post-Summer	✓	-	-	-
	Post-Winter	✓	-	-	-
2002	Post-Summer	✓	-	-	-
	Post-Winter	✓	-	-	-
2003	Post-Summer	✓	-	-	-
	Post-Winter	✓	-	-	-
2004	Post-Summer	✓	-	-	-
	Post-Winter	✓	-	-	-
2005	Post-Summer	✓	-	-	-
	Post-Winter	✓	-	-	-
2006	Post-Summer	✓	-	-	-
	Post-Winter	✓	-	-	-
2007	Post-Summer	✓	-	-	-
	Post-Winter	✓	✓	-	-
2008	Summer (February)	-	-	✓	✓
	Post-Summer	✓	✓	✓	✓
	Winter	-	-	✓	✓
	Post-Winter	✓	✓	✓	✓
	Summer (December)	-	-	✓	✓
2009	Post-Summer	✓	✓	✓	✓
	Post-Winter	✓	✓	✓	✓
2010	Post-Summer	✓	✓	✓	✓
	Post-Winter	✓	✓	✓	✓
2011	Post-Summer	✓	✓	✓	✓

2.2 Target Species

AQIS has prepared a list of weed species identified as weeds of interest within the Port of Brisbane area that present a threat to natural and agriculture systems. This list is presented in **Appendix A**. This list has been revised by AQIS since the previous report to provide an updated and consistent targeted weed species list for the entire Port of Brisbane area.

Exotic species declared under the LPA, and BCC listed environmental weeds are also targeted.

2.3 Plant Survey

The plant survey conducted along Lucinda and Port Gate Drain, T1-3 Overflow and Car Precinct areas consisted of establishing survey transects, and use of the random meander methodology for sampling of exotic and invasive species encountered. The survey was conducted on-foot to ensure that extensive coverage of the areas was achieved.

The plant survey along the Lucinda Drain consisted of sampling exotic and invasive species encountered along a two-metre-wide transect that traversed the entire length of the drain's eastern bank. A complete transect along the western bank of Lucinda Drain was not possible as a result of access issues caused by dense vegetation and narrow banks. However, a visual inspection of the western bank was performed intermittently, where access to the drain was possible.

A two-metre-wide transect traversing the entire length of the western bank of Port Gate Drain was established and surveyed successfully. A complete transect along the eastern bank of Port Gate Drain was not possible as a result of access issues caused by dense vegetation and narrow banks. However, a visual inspection of the eastern bank was performed from the western bank of Port Gate Drain.

The plant survey along the T1-3 Overflow area consisted of two-metre-wide transects, running the entire length of the eastern, northern, western and southern boundaries of the hardstand area. Another transect was established along both banks of the constructed drain just north of the hardstand area.

The plant survey along the Car Precinct area consisted of two transects, which traversed the western and southern boundary of the vehicle storage area, and one non-linear transect that traversed the edge of the lake adjacent to the Visitors Centre.

Weed identifications were carried out utilising available flora and botanical reference material. Samples of weed species unable to be identified in situ, or with the assistance of appropriate field guides, were pressed and sent to the Queensland Herbarium for identification. The presence and abundance of any declared AQIS, LPA, and BCC listed weeds, and other exotic species that occurred along the transects were recorded on data sheets (**Appendix B**).

2.4 Survey Limitations

It should be noted that the detectability of plants and the ability to accurately identify plants to species level may vary greatly with the time of year, prevailing climatic conditions and the presence of reproductive material (e.g. flowers, fruit, and seed capsules). Consequently, the survey conducted should not be regarded as conclusive evidence that certain AQIS, LPA, or BCC declared / listed plants do not occur within the areas

inspected; however every effort has been made to detect theses species in habitat / areas considered suitable.

3.0 Results

3.1 Lucinda Drain

Appendix C contains a list of flora species recorded at Lucinda Drain for both the previous and recent survey. The following points summarise the findings of the recent April 2011 survey:

- Eighty plant species were recorded. This consisted of 22 native / planted species and 58 exotic species;
- Out of the 58 exotic species, none were AQIS listed weed species;
- One exotic species, *Phyllanthus tellenus* was recorded for the first time during the current survey, it is not declared under the LPA or AQIS;
- Occurrences of Giant Paramatta Grass (*Sporobolus fertilis*), Broad-leaf Pepper (*Schinus terebinthifolia*), Lantana (*Lantana camara*) and Annual Ragweed (*Ambrosia artemisiifolia*), all declared under the LPA, were recorded again during the recent April 2011 survey;
- Singapore Daisy (*Sphagneticola trilobata*) has not been found within Lucinda Drain since November 2009, however this species was found during the recent survey. Similarly, Chinese Elm (*Celtis sinensis*) has not been recorded since March 2007, however was observed during the recent April 2011 survey;
- In comparison with previous surveys, no occurrences of Class 2 Fireweed (*Senecio madagascariensis*) Prickly Pear (*Opuntia* sp.) or Creeping Lantana (*Lantana montevidensis*) were identified during the recent survey;
- A variety of grasses and vines including Guinea Grass (*Megathyrsus maximus* var. *maximus*), Rhodes Grass (*Chloris gayana*) and Glycine (*Neonotonia wightii*) were the dominant groups of species along Lucinda Drain. Common Reed (*Phragmites australis*) dominates the western side of the drain; and
- Exotic species diversity, abundance and coverage have slightly increased in comparison to the survey results of November 2010.

3.2 Port Gate Drain

Appendix C contains a list of flora species recorded at Port Gate Drain for both the previous and recent survey. The following points summarise the findings of the recent April 2011 survey:

- Thirty-five plant species were recorded. This consisted of 13 native / planted species and 22 exotic species;
- Out of the 22 exotic species, none were AQIS listed weeds;
- One new species, Whisky Grass (*Andropogon virginicus*), was recorded during the current survey. This species is not AQIS listed or declared under the LPA;
- Occurrences of Broad-leaf Pepper, Groundsel Bush (*Baccharis halimifolia*), Fireweed and Lantana, all declared under the LPA, were recorded again during the recent April 2011 survey;
- Unlike the November 2010 survey, Camphor Laurel (*Cinnamomum camphora*) and Creeping Lantana were not recorded in the recent survey at Port Gate Drain;

- Exotic and native invasive species, in particular Common Reed, Rhodes Grass and Siratro (*Macroptilium atropurpureum*) dominated the Port Gate Drain;
- The number of exotic species present along the drain has decreased in comparison to the previous November 2010 survey; and
- Abundance and coverage of exotic species have slightly decreased in comparison to the previous November 2010 survey.

3.3 T1-3 Overflow Area

Appendix C contains a list of flora species recorded at the T1-3 Overflow area for both the previous and recent survey. The following points summarise the findings of the April 2011 survey:

- Forty-nine plant species were recorded. This consisted of three native species, and 46 exotic species;
- Out of the 46 exotic species, none were AQIS listed weeds;
- One exotic species, Common Thornapple (*Datura stramonium*), was recorded for the first time during the recent April 2011 survey. This species is not declared under AQIS or LPA;
- Fireweed has not been found within T1-3 Overflow area since September 2008, however this species was found during the recent April 2011 survey;
- Chinese Elm has never been recorded within the T1-3 Overflow area, however this species was observed during the recent April 2011 survey;
- Red Natal Grass and Couch Grass dominated the eastern areas and the western landscaped areas. Cobblers Pegs (*Bidens pilosa*) dominated the northern drain; and
- Exotic species diversity, abundance and coverage have decreased in comparison to the previous November 2010 survey results.

3.4 Car Precinct Area

Appendix C contains a list of flora species recorded at the Car Precinct Area for both the previous and recent survey. The following points summarise the findings of the April 2011 survey:

- Forty-two plant species were recorded. This consisted of 12 native species, and 30 exotic species;
- Of the 30 exotic species, none were AQIS listed weeds;
- All exotic species recorded during the current April 2011 survey have been recorded before in previous surveys within the Car Precinct Area;
- Three species listed under the LPA were recorded in the recent April 2011 survey, including Broad-leaf Pepper and Fireweed;
- No incidences of Giant Parramatta Grass and Groundsel Bush were recorded during the current April 2011 survey in comparison to the previous November 2010 survey;
- Locally occurring exotic grass species such as Rhodes Grass, Guinea Grass and Townsville Stylo (*Stylosanthes humilis*) were the dominant species observed throughout the majority of the Car Precinct

area. Common Reed and Umbrella Sedge (*Cyperus eragrostis*) dominated the wetter portions of the Car Precinct area (e.g. within the western trench and around the Visitor Centre Lake); and

- Exotic species diversity, abundance and coverage have decreased in comparison to the previous November 2010 survey results.

4.0 Discussion

4.1 Lucinda Drain

4.1.1 Weed Species Observed

The 21st weed monitoring survey along Lucinda Drain has identified a total number of 80 flora species, of which 58 are considered exotic. No AQIS listed weed species (**Appendix A**) were recorded during the April 2011 plant survey, however, six LPA declared species were recorded (**Table 4.1**).

Table 4.1: Class & Abundance of Weed Species (Under LPA) recorded during Lucinda Drain Survey

LPA Class	Botanical Name	Common Name	Abundance & Location
2	*Ambrosia artemisiifolia*	Annual Ragweed	Low abundance along the western bank
	Sporobolus fertilis	Giant Parramatta Grass	Low abundance along the eastern bank
3	*Celtis sinensis*	Chinese Elm	Low abundance along the eastern bank
	Lantana camara	Lantana	Moderate abundance along the eastern bank
	Schinus terebinthifolia	Broad-leaf Pepper	Moderate abundance along the eastern bank
	Sphagneticola trilobata	Singapore Daisy	Low abundance along the eastern bank

Note: LPA declared plants must be managed according to their classification as follows:

- **Class 1** – landholders are required by law to keep their land free of these species;
- **Class 2** – landholders are required by law to attempt to keep their land free of these species; and
- **Class 3** – landholders may be required to control these species if their land is located adjacent to 'environmentally significant species' such as national parks or reserves.

Appendix D provides GPS co-ordinates of the location of the above-mentioned declared species along Lucinda Drain. One individual occurrence of LPA declared (Class 2) Annual Ragweed, one individual occurrence of LPA (Class 2) Giant Parramatta Grass, ten individual occurrences of LPA (Class 3) Broad-leaf Pepper (including two new occurrences), and 12 individual occurrences of LPA (Class 3) Lantana identified during the previous surveys, were observed in the most recent April 2011 survey. Active treatment to control some of the identified LPA declared Class 2 and 3 species was evident during the April 2011 survey. It is important to note that where Broad-leaf Pepper and Lantana have been treated (i.e. lopped or frilled), regeneration is occurring and secondary treatment is likely to be required.

A new occurrence of LPA Class 3 Singapore Daisy was recorded in the recent April 2011 survey. Whilst this species was not recorded in the previous November 2010 survey, Singapore Daisy has been recorded in other previous surveys along Lucinda Drain. Similarly, Chinese Elm (Class 3) has not been recorded since the March 2007 survey, however one occurrence of this species was observed during the recent April 2011 survey. Fireweed (Class 2) and Creeping Lantana (Class 3) recorded in the previous survey were not recorded in the recent April 2011 survey. This may be a result of successful weed management or general survey limitations, i.e. the species is present, but not detected. In comparison to the previous survey, the overall abundance and diversity of LPA declared species has slightly decreased.

Under the LPA, landholders are obliged to attempt to remove Class 2 species and are encouraged to remove Class 3 species. It is recommended that declared species are removed, including individuals that have been previously planted within this area (i.e. Broad-leaf Pepper). It is noted that a number of declared species are located along the banks of the drain and therefore appropriate removal techniques must be employed to prevent bank instability (e.g. stem injection, lopping etc). Fact sheets for declared pests identified on the site are provided in **Appendix E**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LPA, were identified during the recent survey and are provided in **Table 4.2**. These species have been previously recorded along Lucinda Drain.

Table 4.2: BCC Listed Flora Species recorded during the recent Lucinda Drain Survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Cenchrus echinatus	Mossman River Grass	Environmental Weed	R
Chloris gayana	Rhodes Grass	Environmental Weed	R
Ipomoea cairica	Coastal Morning Glory	Environmental Weed	R
Lantana spp.	Lantana (all species)	Environmental Weed	C
Macroptilium atropurpureum	Siratro	Environmental Weed	R
Megathyrsus maximus var. maximus	Guinea Grass	Environmental Weed	C
Melinis repens	Red Natal Grass	Special Investigation	-
Neonotonia wightii	Glycine	Environmental Weed	C
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C
Tagetes minuta	Stinking Roger	Environmental Weed	R
Solanum nigrum	Blackberry Nightshade	Special Investigation	-

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and
- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2] BCC noxious / environmental weeds must be managed according to their classification as follows:

- **Class E** (early detection and eradication) – Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth;
- **Class C** (containment and reduction) – landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and
- **Class R** (reduce population as part of routine maintenance) – landholders are urged to look out for infestations and plan for their removal during routine maintenance.

4.1.2 Comparison between the Lucinda Drain Surveys

The absence of AQIS listed species is consistent with the findings from previous survey results. An analysis of the diversity and abundance of all exotic plants recorded during the current survey, compared to previous surveys, indicates that there is a variation between both exotic species type and the number of exotic species recorded.

Table 4.3 and **Figure 4.1** highlights the number of exotic species identified in the previous plant surveys of Lucinda Drain since the commencement of the monitoring program in February 2001.

Table 4.3: Number of Exotic Species recorded per survey along the Lucinda Drain

Survey	Number of Exotic Species Recorded
February 2001 Biannual Plant Survey	37
October 2001 Biannual Plant Survey	35
February 2002 Biannual Plant Survey	27
November 2002 Biannual Plant Survey	35
May 2003 Biannual Plant Survey	27
November 2003 Biannual Plant Survey	36
March 2004 Biannual Plant Survey	27
October 2004 Biannual Plant Survey	29
April 2005 Biannual Plant Survey	33
November 2005 Biannual Plant Survey	37
March 2006 Biannual Plant Survey	35
October 2006 Biannual Plant Survey	41
March 2007 Biannual Plant Survey	24
November 2007 Biannual Plant Survey	33
March 2008 Biannual Plant Survey	46
November 2008 Biannual Plant Survey	45
March 2009 Biannual Plant Survey	40
November 2009 Biannual Plant Survey	43
March 2010 Biannual Plant Survey	55
November 2010 Biannual Plant Survey	54
April 2011 Annual Plant Survey	**58**

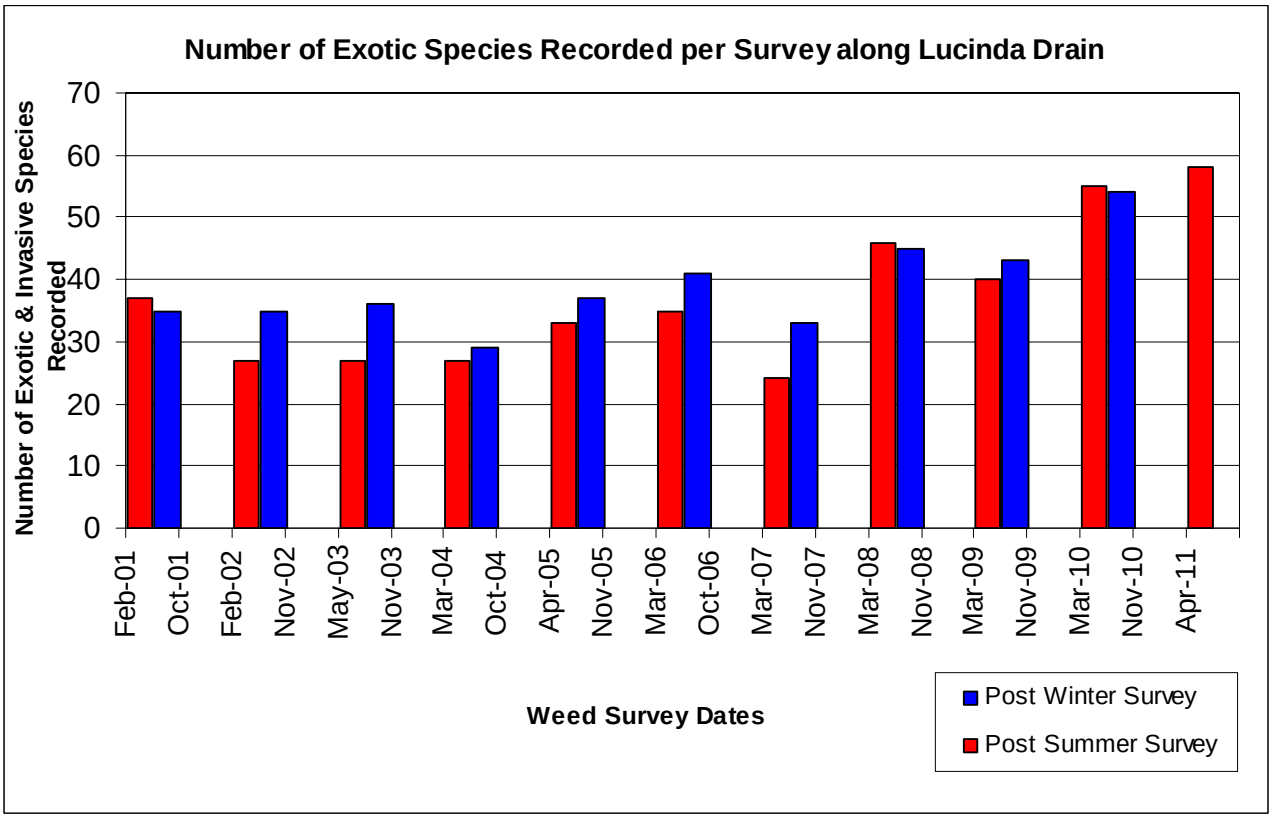

Figure 4.1: Number of Exotic Species Recorded per Survey along Lucinda Drain

Table 4.4 outlines the numbers of exotic species within each family that were recorded in the current April 2011 survey, as well as previous surveys.

Table 4.4: Number of Exotic Species by Family for Lucinda Drain

Family	Number of Exotic Species Present						
	Annual Survey	Biannual Survey					
	April 2011	November 2010	March 2010	November 2009	March 2009	November 2008	March 2008
AGAVACEAE	**0**	1	0	0	0	1	1
AMARANTHACEAE	**2**	1	1	0	1	1	2
ANACARDIACEAE	**1**	1	1	1	1	1	1
ASCLEPIADACEAE	**1**	0	0	0	0	0	0
ASPARAGACEAE	**0**	0	0	0	1	0	1
ASTERACEAE	**13**	14	10	13	9	10	9
BORAGINACEAE	**0**	1	1	0	0	0	0
BRASSICACEAE	**1**	2	1	1	0	1	1
CACTACEAE	**0**	1	1	1	1	1	0
CAESALPINIACEAE	**0**	0	1	0	0	0	0
COMMELINACEAE	**2**	1	2	1	0	0	2
CONVOLVULACEAE	**2**	2	3	1	1	2	1
CYPERACEAE	**0**	0	3	0	0	0	1

Family	Number of Exotic Species Present						
	Annual Survey	Biannual Survey					
	April 2011	November 2010	March 2010	November 2009	March 2009	November 2008	March 2008
EUPHORBIACEAE	**6**	3	3	1	1	0	1
FABACEAE	**12**	8	5	6	6	8	6
LAURACEAE	**0**	0	0	0	0	0	0
LORANTHACEAE	**0**	0	0	0	1	0	0
MALVACEAE	**3**	2	2	1	1	1	2
MORACEAE	**1**	1	1	1	0	0	0
ONAGRACEAE	**1**	2	1	2	1	2	1
OXALIDACEAE	**1**	1	1	0	1	1	1
PASSIFLORACEAE	**1**	0	0	0	0	0	0
PLANTAGINACEAE	**1**	1	1	1	0	1	1
POACEAE	**10**	9	8	6	7	7	8
PORTULACACEAE	**2**	2	2	2	2	2	1
PRIMULACEAE	**0**	1	0	1	1	1	1
RUBIACEAE	**1**	1	1	0	0	0	1
SAPINDACEAE	**1**	1	0	0	0	0	0
SOLANACEAE	**1**	1	2	1	2	1	1
ULMACEAE	**1**	0	0	0	0	0	0
VERBENACEAE	**2**	5	4	3	3	4	3

Note: Shading indicates dominant family group

From the data contained within **Table 4.3** and **Table 4.4**, as well as **Figure 4.1**, the following can be deduced:

- The diversity, abundance and coverage of exotic species have slightly increased since the last survey (November 2010), which may be attributed to the lack of recent maintenance along the majority of the drain and weather conditions preceding the recent survey;
- Unlike the previous November 2010 survey, less than average rainfall occurred prior to the recent survey (**Section 4.5**). The below average rainfall may have limited the growth of more aggressive species, such as exotic grasses that can out-compete other exotic species. This may have allowed for an increase in species diversity to occur during the non-maintenance period when abundance and coverage was high; and
- The dominant family type recorded in the April 2011 survey remained consistent with all other previous surveys, with the greatest number of exotic species originating from the Asteraceae family. The species in this family are resilient and have the ability to grow successfully in disturbed areas.

4.2 Port Gate Drain

4.2.1 Weed Species Observed

The eighth weed monitoring survey along Port Gate Drain has identified a total number of 35 flora species, of which 22 are considered exotic. No AQIS listed weed species (**Appendix A**) were recorded during the April 2011 plant survey, however, four LPA declared species were recorded (**Table 4.5**).

Table 4.5: Class & Abundance of Weed Species (Under LPA) Recorded During Port Gate Drain Survey

LPA Class	Botanical Name	Common Name	Abundance & Location
2	*Baccharis halimifolia*	Groundsel Bush	Low abundance recorded along the southern drain
	Senecio madagascariensis	Fireweed	Low abundance along the drain
3	*Lantana camara*	Lantana	Low abundance recorded along the southern drain
	Schinus terebinthifolia	Broad-leaf Pepper	Moderate abundance recorded along the drain

Note: LPA declared plants must be managed according to their classification as follows:

- **Class 1** – landholders are required by law to keep their land free of these species;
- **Class 2** – landholders are required by law to attempt to keep their land free of these species; and
- **Class 3** – landholders may be required to control these species if their land is located adjacent to 'environmentally significant species' such as national parks or reserves.

Appendix D provides GPS co-ordinates of the location of the above-mentioned declared species along Port Gate Drain. Four individual occurrences of LPA declared (Class 2) Groundsel Bush, five individual occurrences of LPA (Class 3) Broad-leaf Pepper, one individual occurrence of LPA (Class 2) Fireweed and one individual occurrence of LPA (Class 3) Lantana recorded in the previous survey were again identified during the most recent April 2011 survey. Camphor Laurel and Creeping Lantana were recorded in the previous survey, however these species were not observed during the recent survey. This may be a result of successful weed management or general survey limitations, i.e. the species is present, but not detected. In comparison to the previous survey, the overall abundance and diversity of LPA declared species has decreased.

Under the LPA, landholders are obliged to attempt to remove Class 2 species and are encouraged to remove Class 3 species. It is recommended that declared species are removed, including individuals that have been previously planted within this area (i.e. Broad-leaf Pepper). It is noted that a number of declared species are located along the banks of the drain and therefore appropriate removal techniques must be employed to prevent bank instability (e.g. stem injection, lopping etc). Fact sheets for declared pests identified on the site are provided in **Appendix E**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LPA, were identified during the recent survey and are provided in **Table 4.6**. These species have been previously recorded along Port Gate Drain.

Table 4.6: BCC Listed Exotic Flora Species Recorded During the Port Gate Drain Survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Chloris gayana	Rhodes Grass	Environmental Weed	R
Chloris virgata	Feather-top Rhodes Grass	Environmental Weed	R
Ipomoea cairica	Coastal Morning Glory	Environmental Weed	R
Lantana spp.	Lantana (all species)	Environmental Weed	C
Macroptilium atropurpureum	Siratro	Environmental Weed	R
Megathyrsus maximus var. maximus	Guinea Grass	Environmental Weed	C
Melinis repens	Red Natal Grass	Special Investigation	-
Neonotonia wightii	Glycine	Environmental Weed	C
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and
- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2]BCC noxious / environmental weeds must be managed according to their classification as follows:

- **Class E** (early detection and eradication) – Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth;
- **Class C** (containment and reduction) – landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and
- **Class R** (reduce population as part of routine maintenance) – landholders are urged to look out for infestations and plan for their removal during routine maintenance.

4.2.2 Comparisons Between Port Gate Drain Surveys

The absence of AQIS listed species is consistent with the findings from previous survey results. An analysis of the diversity and abundance of all exotic plants recorded during the current survey, compared to previous surveys, indicates that there is a variation between both exotic species type and the number of exotic species recorded.

Table 4.7 and **Figure 4.2** highlight the number of exotic species identified in the previous and current plant surveys of Port Gate Drain since the commencement of the monitoring program in November 2007.

Table 4.7: Number of Exotic Species Recorded Per Survey Along the Port Gate Drain

Survey	Number of Exotic Species Recorded
November 2007 Biannual Plant Survey	29
March 2008 Biannual Plant Survey	36
November 2008 Biannual Plant Survey	39
March 2009 Biannual Plant Survey	28
November 2009 Biannual Plant Survey	31
March 2010 Biannual Plant Survey	28
November 2010 Biannual Plant Survey	40
April 2011 Annual Plant Survey	**22**

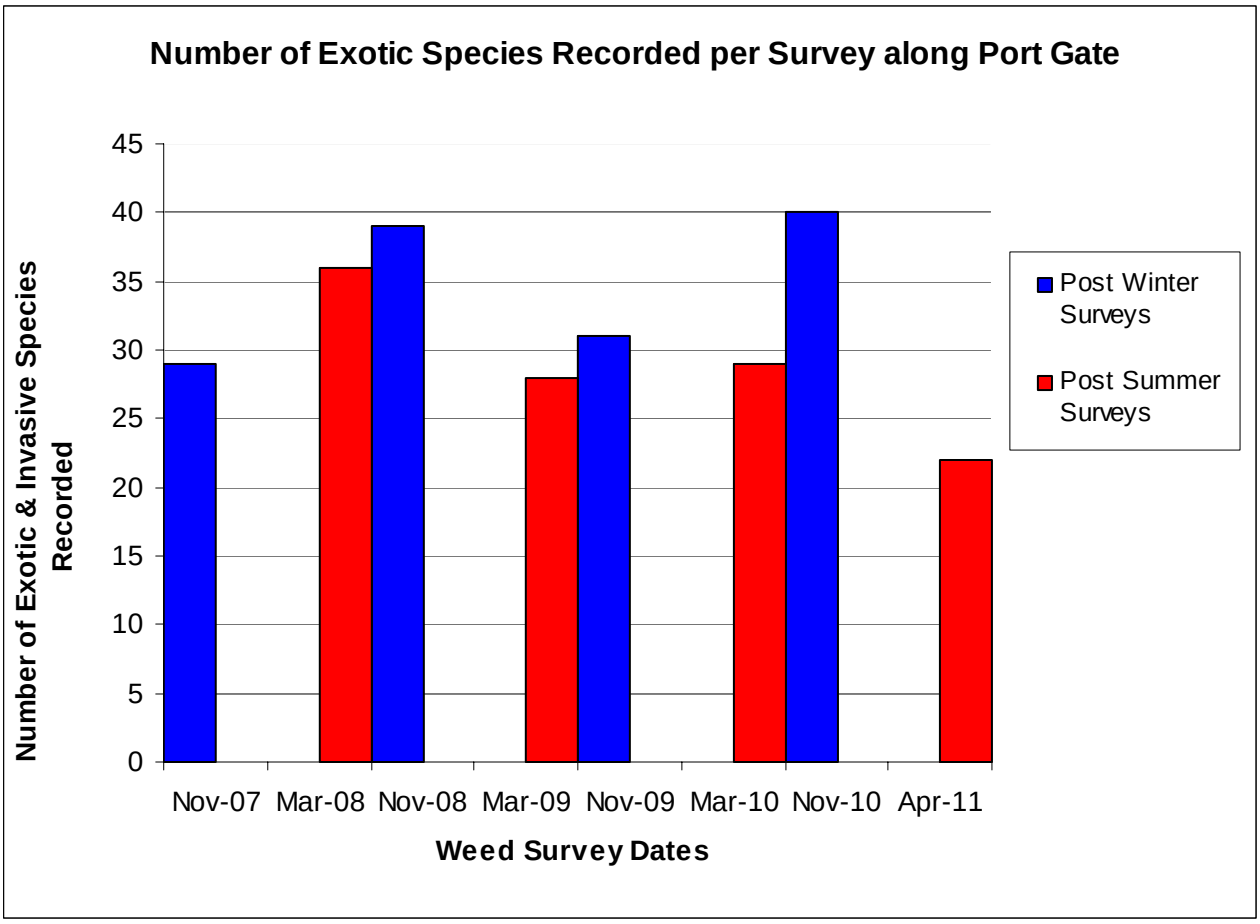

Figure 4.2: Number of Exotic Species Recorded per Survey along Port Gate Drain

Table 4.8 outlines the numbers of exotic species within each family that were recorded in the current April 2011 survey, as well as previous surveys.

Table 4.8: Number of Exotic Species By Family for Port Gate Drain

Family	Number of Exotic Species Present							
	Annual Survey	Biannual Survey						
	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Nov 2008	Mar 2008	Nov 2007
AMARANTHACEAE	**0**	0	0	0	0	0	1	0
ANACARDIACEAE	**1**	1	1	1	1	1	0	0
ASCLEPIADACEAE	**0**	0	0	0	1	1	1	1
ASTERACEAE	**5**	7	7	8	4	9	5	5
BORAGINACEAE	**0**	0	0	0	1	1	0	0
BRASSICACEAE	**0**	2	0	1	1	0	0	0
CONVOLVULACEAE	**1**	1	1	1	1	1	1	1
CYPERACEAE	**2**	3	0	0	0	0	2	0
EUPHORBIACEAE	**0**	1	3	1	1	1	2	0
FABACEAE	**8**	10	6	6	8	8	7	6
LAURACEAE	**0**	1	1	1	0	1	0	0
MYRTACEAE	**0**	0	0	0	0	0	1	1
PAPAVERACEAE	**0**	0	0	0	0	0	0	1
PASSIFLORACEAE	**0**	0	0	0	0	0	1	1
PHYTOLACCACEAE	**0**	0	0	0	0	0	1	1
PLANTAGINACEAE	**1**	1	1	1	1	1	0	0
POACEAE	**9**	14	5	5	7	9	9	7
PORTULACACEAE	**1**	0	1	1	1	1	1	1
PRIMULACEAE	**0**	1	0	1	0	1	0	1
SOLANACEAE	**0**	1	1	2	0	0	1	1
VERBENACEAE	**1**	2	2	2	1	3	2	1

Note: Shading indicates dominant family group

From the data contained within **Table 4.7** and **Table 4.8**, as well as **Figure 4.2**, the following can be deduced:

- The lowest number of exotic species to date was recorded during the recent April 2011 survey and abundance and coverage has also decreased since the last November 2010 survey. This may be attributed to a combination of the maintenance regime along the drain and the weather conditions preceding the survey (**Section 4.5**);
- Unlike the previous November 2010 survey, less than average rainfall occurred prior to the recent survey. The low rainfall would have attributed to the low species diversity, abundance and coverage of exotic species along the drain. Recent maintenance activities along the drain would also contributed to this by removing exotic species or features that aid in detection and identification; and

- The Poaceae family was again recorded as the dominant family at Port Gate Drain for the recent April 2011 plant survey. This dominance could be attributed to the overall harsh conditions that surround the drain. Species from the Poaceae family have pioneer characteristics and are generally the first species to grow back following a disturbance (e.g. maintenance activities).

4.3 T1-3 Overflow Area

4.3.1 Weed Species Observed

The tenth weed monitoring survey along the T1-3 Overflow has identified a total number of 49 flora species, of which 46 are considered exotic species. No AQIS listed species were recorded during the April 2011 survey.

Five new occurrences of Fireweed (LPA Class 2) was detected in the recent April 2011 survey. Fireweed was last recorded in the November 2009 survey. Chinese Elm (LPA Class 3) has never been recorded within the T1-3 Overflow area, however one occurrence of this species was observed during the recent April 2011 survey. **Appendix D** provides GPS co-ordinates for the location of these declared species within the T1-3 Overflow area. In comparison to the previous survey, the overall abundance, coverage and diversity of LPA declared species have increased.

Under the LPA, landholders are obliged to attempt to remove Class 2 species and are encouraged to remove Class 3 species. If any of these LPA declared species are found in this area, consideration should be given to remove individuals and control further establishment. Fact sheets for LPA declared pests identified previously on the site are provided in **Appendix E**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LPA, were identified during the current survey and are provided in **Table 4.9**. Common Thornapple has never been recorded in the T1-3 Overflow area; however the remainder species have been recorded previously.

Table 4.9: BCC Listed Exotic Flora Species Recorded During the T1-3 Overflow Survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Cenchrus echinatus	Mossman River Grass	Environmental Weed	R
Chloris gayana	Rhodes Grass	Environmental Weed	R
Macroptilium atropurpureum	Siratro	Environmental Weed	R
Megathyrsus maximus var. maximus	Guinea Grass	Environmental Weed	C
Melinis repens	Red Natal Grass	Special Investigation	-
Solanum nigrum	Blackberry Nightshade	Special Investigation	-
Datura stramonium	Common Thornapple	Special Investigation	-

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and
- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2]BCC noxious / environmental weeds must be managed according to their classification as follows:

- **Class E** (early detection and eradication) – Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth;
- **Class C** (containment and reduction) – landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and
- **Class R** (reduce population as part of routine maintenance) – landholders are urged to look out for infestations and plan for their removal during routine maintenance.

4.3.2 Comparison between T1-3 Overflow Surveys

An analysis of exotic species results recorded during the recent survey compared to the previous surveys indicates that there is a variation between the number and type of exotic species recorded. **Table 4.10** and **Figure 4.3** highlights the number of exotic species identified in the previous plant surveys of the T1-3 Overflow area since the commencement of the monitoring program in February 2008.

Table 4.10: Number of Exotic Species Recorded Per Survey Along the T1-3 Overflow Area

Survey	Number of Exotic Species Recorded
Baseline Survey (February 08)	48
March 2008 Quarterly Plant Survey	37
June 2008 Quarterly Plant Survey	39
September 2008 Quarterly Plant Survey	42
December 2008 Quarterly Plant Survey	55
March 2009 Biannual Plant Survey	39
November 2009 Biannual Plant Survey	56
March 2010 Biannual Plant Survey	55
November 2010 Biannual Plant Survey	47
April 2011 Annual Plant Survey	**46**

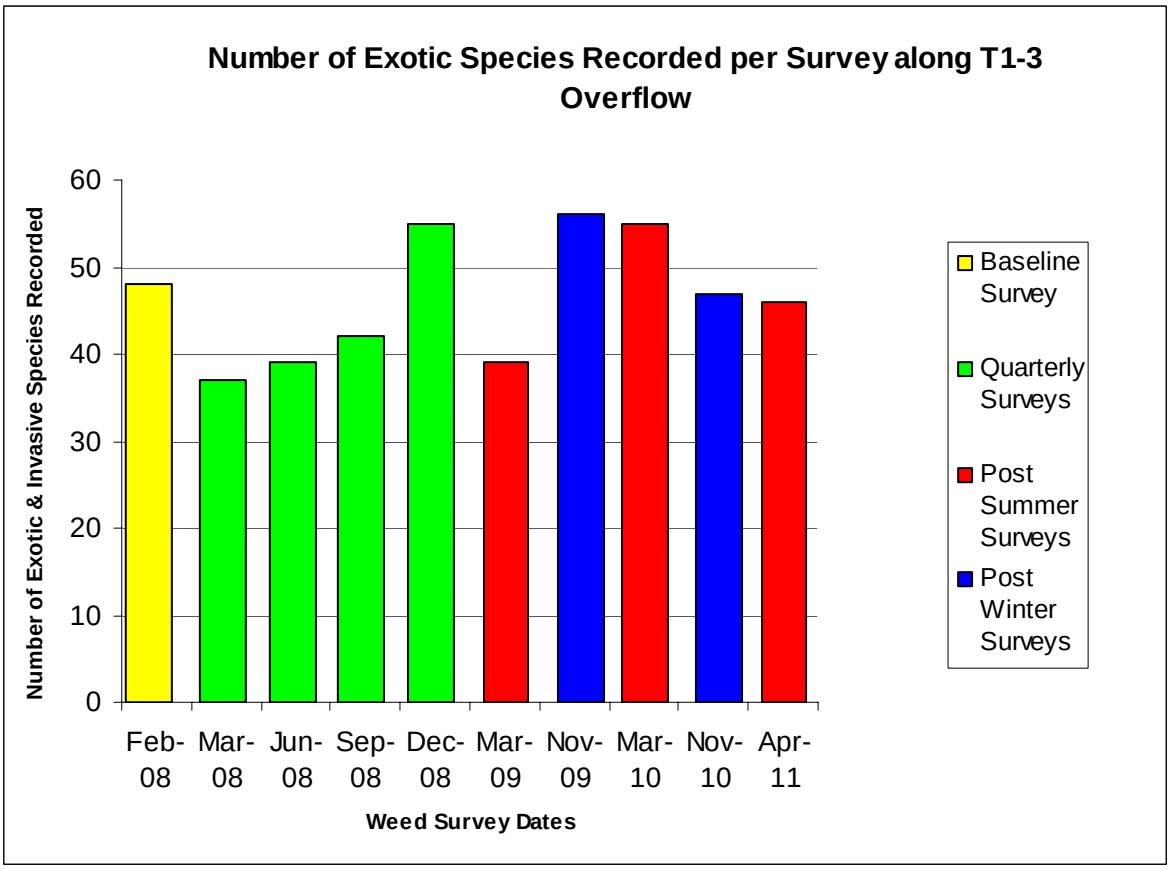

Figure 4.3: Number of Exotic Species Recorded Per Survey Along the T1-3 Overflow area

Table 4.11 outlines the numbers of exotic species within each family that were recorded in the recent April 2011 survey, as well as previous surveys.

Table 4.11: Number of Exotic Species By Family for T1-3 Overflow

Family	Number of Exotic Species									
	Annual Survey	Biannual Survey				Quarterly Surveys				Baseline Survey
	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Dec 2008	Sept 2008	Jun 2008	Mar 2008	Feb 2008
AMARANTHACEAE	**3**	2	3	2	1	2	2	2	2	2
ANACARDIACEAE	**0**	0	0	0	0	1	0	0	0	0
APIACEAE	**1**	1	0	0	1	1	1	1	1	1
ASTERACEAE	**9**	10	8	12	6	9	12	9	8	6
BORAGINACEAE	**0**	0	1	0	1	1	0	0	0	1
BRASSICACEAE	**1**	2	2	2	0	2	2	2	1	1
CARYOPHYLLACEAE	**1**	1	0	1	0	1	1	0	0	0
CHENOPODIACEAE	**0**	2	1	1	0	2	0	1	0	1
COMMELINACEAE	**2**	1	1	0	1	0	1	1	1	0
CYPERACEAE	**0**	0	2	4	1	1	1	1	0	3
EUPHORBIACEAE	**1**	2	2	2	2	1	0	1	1	2

Family	Number of Exotic Species									
	Annual Survey	Biannual Survey				Quarterly Surveys				Baseline Survey
	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Dec 2008	Sept 2008	Jun 2008	Mar 2008	Feb 2008
FABACEAE	**10**	10	8	10	5	10	5	5	8	11
MALVACEAE	**1**	1	1	1	1	1	1	1	1	2
ONAGRACEAE	**2**	2	3	3	2	3	2	2	1	1
OXALIDACEAE	**0**	0	1	0	0	1	0	0	0	0
PAPAVERACEAE	**0**	0	0	0	0	0	0	0	0	1
PLANTAGINACEAE	**1**	1	1	1	1	1	1	1	1	1
POACEAE	**5**	9	10	8	7	8	8	7	6	8
POLYGONACEAE	**0**	1	1	1	1	1	0	0	0	0
PORTULACACEAE	**2**	1	2	2	1	2	1	1	2	2
PRIMULACEAE	**1**	1	1	1	1	1	1	1	1	1
RUBIACEAE	**1**	1	1	1	1	1	1	1	1	1
SOLANACEAE	**4**	1	1	1	1	1	1	1	1	2
TAMARICACEAE	**0**	1	1	1	1	1	0	0	0	0
VERBENACEAE	**1**	2	2	2	3	2	1	1	1	1

Note: Shading indicate dominant family group

From the data contained within **Table 4.10** and **Table 4.11** as well as **Figure 4.4** the following can be deduced:

- The number of exotic species, as well as abundance and coverage that were recorded during the recent April 2011 survey was less than the previous November 2010 survey. This may be attributed to the combination of the maintenance regime and weather conditions preceding the survey (**Section 4.5**);
- Unlike the previous November 2010 survey, less than average rainfall occurred prior to the recent survey. The low rainfall would have attributed to the low species diversity, abundance and coverage of exotic species in the T1-3 Overflow area. Recent maintenance activities in the area would also have contributed to this by removing exotic species or features that aid in detection and identification; and
- In the previous November 2010 survey, the Asteraceae and Fabaceae families were dominant. In the recent April 2011 survey, the Fabaceae family is dominant. This may be attributed to the ability of these species to grow successfully, particularly after a disturbance such as maintenance.

4.4 Car Precinct Area

4.4.1 Weed Species Observed

The tenth weed monitoring survey along the Car Precinct has identified a total number of 42 flora species, of which 30 species are considered exotic. There are no AQIS listed species recorded in the Car Precinct area.

Two LPA declared species were recorded during the April 2011 plant survey. A high abundance of Fireweed (Class 2) is located west of the car storage area and a low to moderate abundance of Broad-leaf Pepper is located near the Visitor's Lake. **Appendix D** lists the GPS co-ordinates of the locations of the LPA declared species identified in the Car Precinct area.

Groundsel and Giant Parramatta Grass recorded in the previous survey was not observed during the recent April 2011 survey. This may be a result of successful weed management or general survey limitations, i.e. the species is present, but not detected. Overall, the abundance and diversity levels of exotic species have decreased since the previous November 2010 survey. Under the LPA, landholders are obliged to attempt to remove Class 2 species and encouraged to remove Class 3 species. Therefore, consideration should be given to the removal of these declared species and control further establishment. Fact sheets for declared species are provided in **Appendix E**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LPA, were identified during the current survey and are provided in **Table 4.12**. These species have been previously recorded in the Car Precinct area.

Table 4.12: BCC Listed Exotic Flora Species Recorded During the Car Precinct Survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Cenchrus echinatus	Mossman River Grass	Environmental Weed	R
Chloris gayana	Rhodes Grass	Environmental Weed	R
Ipomoea cairica	Coastal Morning Glory	Environmental Weed	R
Macroptilium atropurpureum	Siratro	Environmental Weed	R
Megathyrsus maximus var. maximus	Guinea Grass	Environmental Weed	C
Melinis repens	Red Natal Grass	Special Investigation	-
Neonotonia wightii	Glycine	Environmental Weed	C
Ricinus communis	Castor Oil Plant	Noxious Weed	C
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C
Solanum nigrum	Blackberry Nightshade	Special Investigation	-

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and
- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2]BCC noxious / environmental weeds must be managed according to their classification as follows:

- **Class E** (early detection and eradication) – Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth.
- **Class C** (containment and reduction) – landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is

recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and

- **Class R** (reduce population as part of routine maintenance) – landholders are urged to look out for infestations and plan for their removal during routine maintenance.

4.4.2 Comparison between Car Precinct Area Surveys

An analysis of the diversity and abundance of all exotic plants recorded during the recent survey, compared to previous surveys, indicates that there is a variation between both exotic species type and the number of exotic species recorded.

Table 4.13 and **Figure 4.4** highlights the number of exotic species identified in the previous and current plant surveys of the Car Precinct area since the commencement of the monitoring program in February 2008.

Table 4.13: Number of Exotic Species Recorded Per Survey Along the Car Precinct Area

Survey	Number of Exotic Species Recorded
Baseline Survey (February 08)	40
March 2008 Quarterly Plant Survey	44
June 2008 Quarterly Plant Survey	48
September Quarterly 2008 Plant Survey	49
December 2008 Quarterly Plant Survey	59
March 2009 Biannual Plant Survey	46
November 2009 Biannual Plant Survey	54
March 2010 Biannual Plant Survey	47
November 2010 Biannual Plant Survey	52
April 2011 Annual Plant Survey	**30**

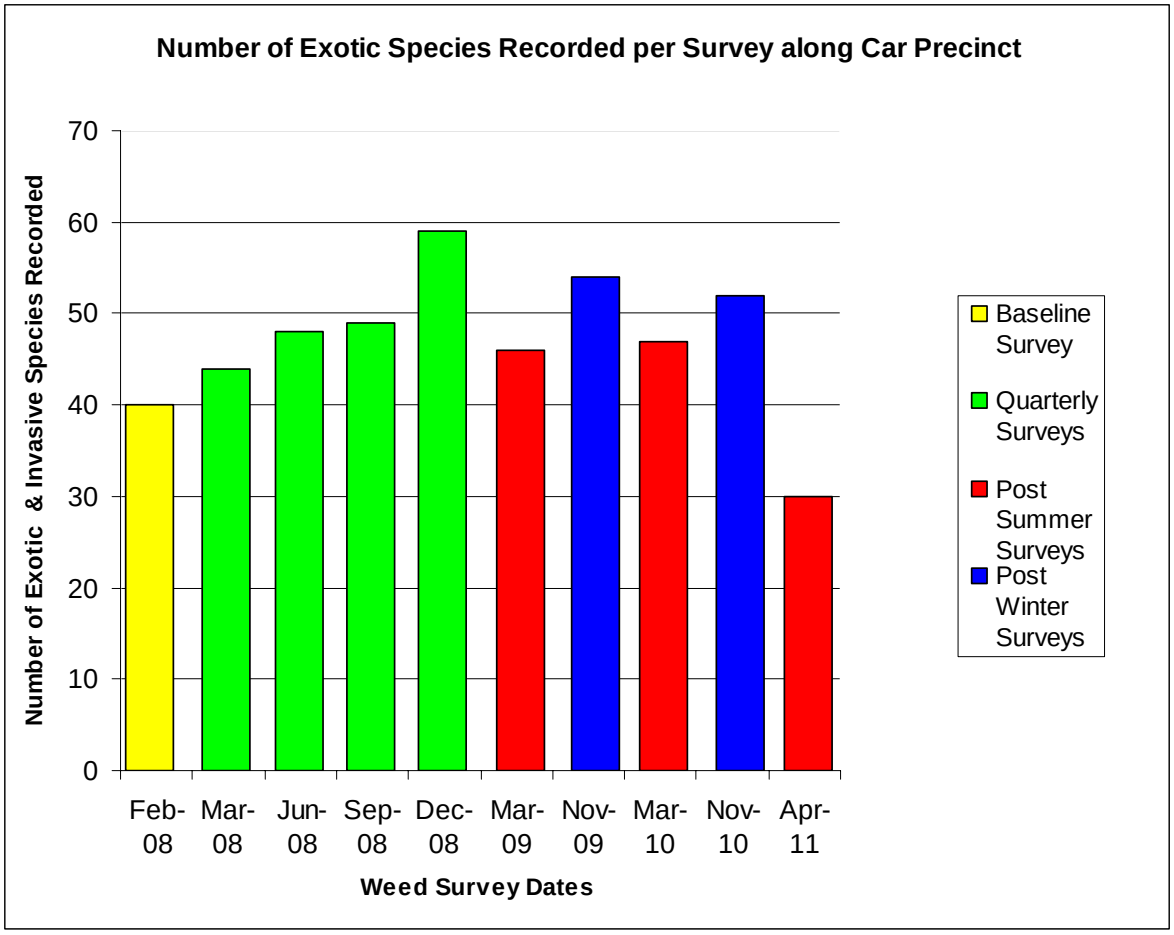

Figure 4.4: Number of Exotic Species Recorded Per Survey Along the Car Precinct Area

Table 4.14 outlines the numbers of exotic species within each family that were recorded in the recent April 2011 survey, as well as previous surveys.

Table 4.14: Number of Exotic Species by Family for the Car Precinct Area

Family	Number of Exotic Species									
	Annual Survey	Biannual Survey				Quarterly Surveys				Baseline Survey
	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Dec 2008	Sept 2008	Jun 2008	Mar 2008	February 2008
AMARANTHACEAE	**1**	2	2	1	1	2	1	1	2	3
ANACARDIACEAE	**1**	1	1	0	1	1	1	1	1	1
APOCYNACEAE	**0**	0	0	0	0	0	0	0	0	1
ASTERACEAE	**5**	10	6	11	9	12	14	13	11	8
BORAGINACEAE	**1**	1	1	0	1	1	1	0	0	0
BRASSICACEAE	**1**	2	1	2	0	2	2	2	0	1
CARYOPHYLLACAE	**0**	0	0	1	0	0	0	0	0	0
CHENOPODIACEAE	**0**	0	0	0	0	2	0	0	0	0
COMMELINACEAE	**1**	0	1	1	1	1	1	1	1	0
CONVOLVULACEAE	**1**	2	2	2	2	2	2	2	2	2
CYPERACEAE	**3**	4	4	5	4	4	1	2	2	2
EUPHORBIACEAE	**2**	3	3	1	2	1	2	3	0	3
FABACEAE	**8**	11	6	8	6	9	5	5	7	5
MALVACEAE	**1**	1	1	2	1	0	1	1	1	1
ONAGRACEAE	**3**	4	3	3	3	3	2	1	1	1
OXALIDACEAE	**0**	0	0	0	0	0	0	0	0	1
PLANTAGINACEAE	**0**	1	1	1	1	1	1	1	1	0
POACEAE	**7**	12	9	9	7	10	10	9	9	6
POLYGONACEAE	**1**	1	1	1	1	1	0	1	1	0
PORTULACACEAE	**0**	1	2	2	2	1	0	1	1	2
PRIMULACEAE	**0**	1	0	1	0	1	1	1	1	1
RUBIACEAE	**1**	0	0	0	0	0	0	0	0	1
SOLANACEAE	**1**	1	1	1	2	2	1	1	1	1
VERBENACEAE	**0**	2	2	2	2	2	3	2	2	0

Note: Shading indicates dominant family group

From the data contained within **Table 4.13** and **Table 4.14**, as well as **Figure 4.4**, the following can be deduced:

- The number of exotic species, as well as abundance and coverage that were recorded in the recent April 2011 survey is significantly less than the number of exotic species recorded in the November 2010 survey;
- Unlike the previous November 2010 survey, less than average rainfall occurred prior to the recent survey. The low rainfall would have attributed to the low species diversity, abundance and coverage of exotic species in the T1-3 Overflow area. Recent maintenance activities in the area would also have contributed to this by removing exotic species or features that aid in detection and identification; and

- Unlike the previous November 2010 survey, the Fabaceae family was the dominant family in the recent April 2011 survey. This is the first time since the monitoring program commenced that the Fabaceae family has been the dominant family in the Car Precinct area. This may be attributed to the ability of these resilient species to grow successfully, particularly after a disturbance such as maintenance.

4.5 Weather Conditions

The following graph (**Figure 4.5**) portrays the rainfall recorded at the Port of Brisbane as well as the long-term rainfall and temperature averages (taken from the Brisbane Airport).

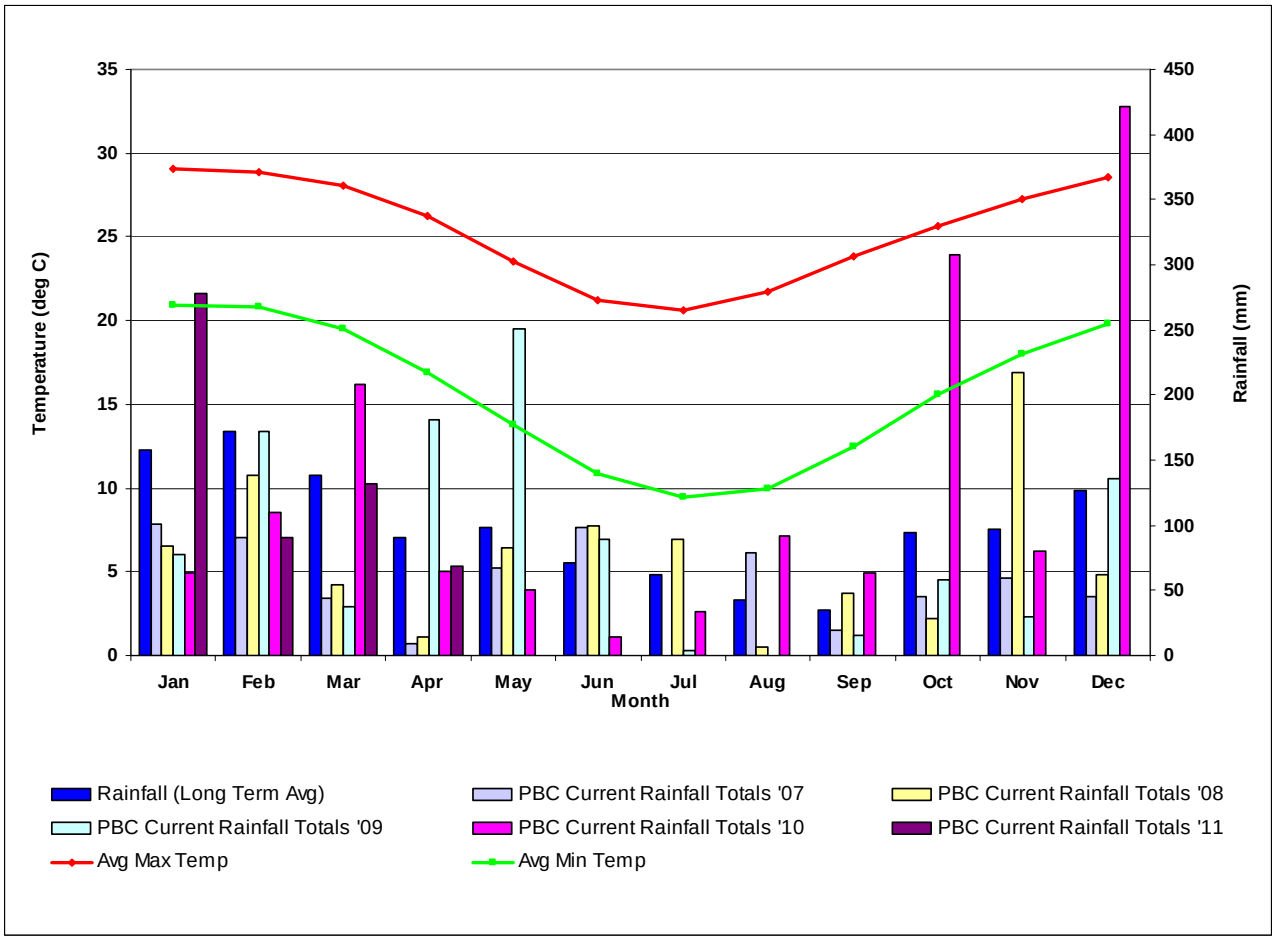

Figure 4.5: Long-term Climatic Averages Compared with the Port of Brisbane Rainfall Data

The following can be derived from this data with respect to the plant growth around Lucinda and Port Gate Drains, the T1-3 Overflow area and the Car Precinct area:

- Rainfall throughout the previous twelve month period (April 2010 – April 2011) has been highly variable. The months of November 2010, as well as February, March and April in 2011 have exhibited less than average rainfall. However, December 2010 and January 2011 received large amounts of rainfall well in excess of the long-term average rainfall;

- As the recent survey was conducted in April 2011, the rainfall preceding was less than the long-term average rainfall levels. The effect of this on the recent survey results varies according to the maintenance regime for each survey area;
- The low levels of rainfall prior to the April 2011 survey combined with recent maintenance activities may have attributed to the decreased species diversity, abundance and coverage, compared with the November 2010 survey for Port Gate Drain, T1-3 Overflow and Car Precinct Area; and
- The lack of recent maintenance along Lucinda Drain allowed for a higher level of abundance and coverage of exotic species for the recent survey, compared to the previous November 2010 survey. The low levels of rainfall limited the growth of more aggressive species that can out-compete other exotic species, thus providing for a higher species diversity compared to the previous November 2010 survey.

5.0 Recommendations

Early detection and intervention is a highly successful (and a cost-effective) method of preventing the establishment of new and emerging weeds, and should be given high priority in weed management programs. The following recommendations pertain to the presence of exotic species occurring along Lucinda and Port Gate Drains, as well as the T1-3 Overflow area and Car Precinct. As no AQIS listed species have been detected, recommendations addressing AQIS listed weed species have not been given.

5.1 Lucinda Drain

Recommendations relating to the management of the banks of the Lucinda Drain and of the inflow of stormwater have been made in previous reports. In addition to these, the following recommendations are made:

- Ensure all existing maintenance programs occur along the eastern bank as well as the western bank of Lucinda Drain. This should include regular mowing and spot spraying / hand pulling of weeds, as well as other weed removal techniques along the eastern bank;
- Ensure attempts are made to remove all declared species listed under the LPA (see **Appendix D** for GPS locations). As there may be bank stability issues associated with the removal of some of these species, it is recommended that a stem injection removal technique is employed. This method will ensure the tree (and associated root structure) remains in situ for as long as possible, whilst simultaneously ensuring all seeding / propagule material is controlled. Also, the routine management of this area should include appropriate maintenance of these species;
- Removal of declared species should be conducted in accordance with the relevant fact sheet provided by the Queensland Primary Industries and Fisheries (**Appendix E**); and
- Continue programmed monitoring of the diversity and status of plant species along the banks of the Lucinda Drain through annual plant surveys.

The positive effects of native vegetation cover, in relation to potentially suppressing or decreasing exotic vegetation cover, have been observed along Lucinda Drain in previous surveys, especially in regards to species from the Casuarinaceae family. Such canopy species provide shading and dense matting from dropped needles, which potentially aids in decreasing the amount of understorey exotic vegetation. Thus the long-term management of exotic species present at Lucinda Drain should be incorporated into a program of integrated weed management, including actions such as:

- Suppression of exotic species through mulching and shading via the planting of a native canopy and understorey;
- Planting density of native species should be responsive to still allow access for the regular maintenance program; and
- Increasing the native understorey diversity to increase competition for resources.

5.2 Port Gate Drain

In comparison to Lucinda Drain, Port Gate Drain has different environmental conditions and disturbance regimes, which require a slightly different management approach. Where areas surrounding the drain are concreted, the establishment of native plants to shade out exotic vegetation is limited. However, for areas of the drain (i.e. the southern region) where it is possible for native plants to be established, it is recommended that a long-term weed management approach is adopted, which incorporates rehabilitation in order to facilitate out-competing of exotic species.

The long-term management of exotic species present at Port Gate Drain should incorporate:

- Implementation of weed control strategies such as mechanical removal through mowing. Chemical weed removal should be kept to a minimum and only used when necessary. It should only involve spot spraying using an environmentally sensitive herbicide during low flow periods;
- Ensure attempts are made to remove all declared species listed under the LPA (see **Appendix D** for GPS locations);
- Continue scheduled maintenance programs along the drain; and
- Continue to monitor the weed status of the drain at regular intervals.

5.3 T1-3 Overflow and Car Precinct Area

The following summarises the recommendations relating to the management of the T1-3 Overflow and Car Precinct Area:

- All survey areas are to be regularly maintained. Areas less visible i.e. the eastern side of the T1-3 Overflow and the western side of the Car Precinct Area should be maintained as often (where practicable) as the other sections of the survey area, when required;
- Regular maintenance of all survey areas should include regular mowing and spot spraying / hand pulling of weeds, as well as other weed removal techniques;
- Climatic conditions (rainfall) should also be a consideration when assessing the frequency of maintenance activities (i.e. increasing the frequency of maintenance activities during favourable growing conditions);
- Ensure attempts are made to remove all declared species listed under the LPA and their specific identification and removal should be included as part of routine maintenance and management of the areas, particularly for the Visitors Centre Lake. **Appendix D** lists the GPS locations of LPA declared weeds and factsheets are provided in **Appendix E**;
- A recommended planting schedule of native species and appropriate densities should be prepared for the northern drain in the T1-3 Overflow area; and
- Continue programmed monitoring of the diversity and abundance levels of exotic species within the T1-3 Overflow and Car Precinct Area through annual surveys.

6.0 References

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Appendix A

AQIS Weed Target Species List

FAMILY	BOTANICAL NAME	COMMON NAME	AUTHOR	COMMENTS
ACANTHACEAE	*Asystasia gangetica subsp. Micrantha*	Chinese Violet	(Nees) Ensermu	Rubber, coffee, oil-palm plantations, environmental weed.
	Blechum pyramidatum	Browne's Blechum, Green Shrimp Plant, Blackweed	(Lam.) Urb	Pastures, gardes, disturbed areas, rainforest understoreys.
ASTERACEAE	*Austroeupatorium inulaefolium*	Austroeupatorium	(H.B.K.) King & Robinson	Tea, rubber, rosella and other plantation crops; roadsides; environmental weed in secondary forests.
	Bidens biternata	Yellow Flowered Blackjack, Five Leaved Blackjack	Merr. and Sherff.	Weed of disturbed and cultivated areas, paddy fields.
	Chromolaena odorata	Siam Weed, Christmas Bush	(L.) King & Robinson	Pastures, oil palm, rubber, coffee, cashew, fruit, maize, forestry. Toxic to livestock. Major environmental weed: secondary forests, roadsides, disturbed sites.
	Hieracium aurantiacum	Orange Hawkweed	CRC Weed Management	Potential threat to alpine country and temperate tablelands of eastern Australia.
	Hieracium pilosella	Mouse-eared Hawkweed	DPIW, TAS	Major weed in pasture and native vegetation and is a serious threat to grasslands and alpine environments.
	Hieracium praeltum	King Devil	-	-
	Mikania micrantha	Mile-a-Minute	H.B.K.	Cocoa, coconut, orchards, rubber, oil palm, sugarcane, vegetables, upland rice, pastures; serious environmental weed
BORAGINACEAE	*Cordia curassavica*	Black Sage	Roem. and Shult.	Environmental weed.
CAPPARIDACEAE	*Cleome rutidosperma*	Fringed Spider Flower	Weeds Australia	Environmental weed of crops.
CHENOPODIACEAE	*Bassia scoparia*	Kochia	CRC Weed Management	Invades crops and pastures.
CYPERACEAE	*Cyperus teneristolon*	-	CRC Weed Management	Semi-arid agricultural crops and damp grasslands. Environmental weed.
	Schoenoplectus juncoides	-	(Roxb.) Palla	Rice, freshwater and tidal swamps.
	Trianoptiles solitaria	Subterranean Cape Sedge	CRC Weed Management	Grows in seasonally damp areas.
EQUISETACEAE	*Equisetum ramosissimum*	Horsetail, Scouring Rush	Desf. subsp. debile (Vauch.) Hauke	Rice terraces and bunds, tea plantations.
EUPHORBIACEAE	*Croton hirtus*	-	L'Herit	Rubber plantations; crops including mung beans, peanuts, soybeans, papaya, vegetables and tobacco.

FAMILY	BOTANICAL NAME	COMMON NAME	AUTHOR	COMMENTS
FABACEAE	*Mucuna pruriens*	Velvet Bean, Cow-Itch	DC.	Weed of pastures and a wide range of dryland crops; smothering habit and ability to climb to tree tops makes a significant potential environmental weed. Irritant hairs can kill livestock if ingested and cause severe skin reaction if touched.
HALORACEAE	*Myriophyllum spicatum*	Eurasian Watermilfoil	L.	Serious weed of lakes, water-storages, canals and rivers. Affects fish and shellfish production and recreational use of water bodies
HYDROCHARITACEAE	*Lagarosiphon major*	Lagarosiphon	CRC Weed Management	Aquatic plant that can dominate freshwater lakes, dams and slow-moving streams.
LAMIACEAE	*Clerodendrum chinense*	Stickbush, Glory Bower, Honolulu Rose, Spanish Jasmine	(Osbeck) Mabb.	Disturbed forests, roadsides, gardens, pastures, plantations, environmental weed.
	Leucas aspera	Pansi-pansi, Feng Chao Cao	(Willd.) Link	Fields, dandy grasslands, wasteland, roadsides, overgrazed areas.
LIMNOCHARITACEAE	*Limnocharis flava*	Yellow Bur-head, Yellow Sawah Lettuce	(L.) Buchenau	Serious weed of rice and wetlands. Used as a green vegetable.
LYTHRACEAE	*Rotala indica*	Toothcup	(Willd.) Koehne	Rice fields, river banks, ditches and moist environments
MELASTOMACEAE	*Clidemia hirta*	Koster's Curse, Soap Bush	(L.) D. Don.	Cocoa, tea, coconut, oil palm and rubber plantations, cultivated areas, pastures, secondary forest and woodlands; other disturbed sites.
	Miconia calvescens	Miconia, Velvet Tree	DC.	Coastland, disturbed areas, natural forests, planted forests, riparian zones, scrub / shrublands, urban areas, wetlands.
MIMOSACEAE	*Acacia karroo*	Karroo Thorn	DPIF	Rangelands and open grasslands, suppresses the growth of agricultural productivity.
	Neptunia plena	Water Dead and Awake, Water Sensitive	(L.) Benth.	Wetlands, swamps and marshes, water-logged or flooded areas.
NYCTAGINACEAE	*Boerhavia erecta*	Erect Tar Vine	L.	Peanuts, sorghum, rice and other annual crops; weed of cultivated land, pastures and coastal environments.
OROBANCHACEAE	*Aeginetia indica*	Ye Gu	L.	Parasitizes bamboo shoots and crops such as rice, maize and sugarcane. Grassy lowlands, wet, swampy ground, forests, roadsides.
	Orobanche ramosa	Branched Broomrape	DAFF	Serious pest of crops and pastures.

FAMILY	BOTANICAL NAME	COMMON NAME	AUTHOR	COMMENTS
PIPERACEAE	*Piper aduncum*	Spiked Pepper, False Karva	L.	Karva crops, grazing lands, abandoned gardens.
POACEAE	*Digitaria insularis*	-	(L.) Mes ex Ekman	Pineapples; unpalatable weed of pastures, headlands,
	Echinochloa glabrescens	A barnyard grass	Munro ex Hook. f.	Rice, maize.
	Eragrostis japonica	Japanese Lovegrass, Pond Lovegrass	(Thunb.) Trin.	Arable lands and rice fields.
	Imperata conferta	Cogongrass, Lalang Jawa	(Presl.) Ohwi	Coconut, roadsides, hillsides, streams and trails in dense or open forest.
	Leptochloa chinensis	Red Sprangletop, Feathergrass	(L.) Nees.	Rice, cotton, soybean, maize, sugarcane, pineapple, sweet potato, vegetables, peanuts, tea, bananas.
	Nasella tenuissima	Mexican feather Grass	Territory and Municipal Services	Pastures and native grasslands. Highly invasive.
	Sacciolepis interrupta	-	(Willd.)	Rice, irrigation channels, wetlands. Potential environmental weed.
RUBIACEAE	*Paederia foetida*	Lesser Malayan Stinkwort	L.	Sugarcane, secondary forest; climbs over shrubs and trees - potential environmental weed.
SALVINIACEAE	*Salvinia cucullata*	Salvinia	Roxb.	Rice, waterways, wetlands.
SCROPHULARIACEAE	*Limnophila sessiliflora*	Ambulia, Asian Marshweed, Shi Long Wei	(Vahl) Blume	Ponds, swamps, rice fields, wet places along streams.
	Striga asiatica	Witchweed	(L.) O. Ktze.	Serious root parasite on rice, maize, sorghum, sugarcane, millet; also on some broadleaf crops including sunflower, tomatoes, some legumes.

Source: www.daff.gov.au

Appendix B

Plant Survey Data Sheet

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
AGAVACEAE					
Agave sp.	Agave	s	-		
AIZOACEAE					
Carpobrotus glaucescens [n]	Pigface	c	-		
Sesuvium portulacastrum [n]	Sea Purslane	c	-		
AMARANTHACEAE					
Alternanthera pungens	Khaki Weed	c	-		
Amaranthus quitensis	South American Amaranthus	h	-		
Amaranthus viridis	Green Amaranthus	h	-		
Gomphrena celosioides	Gomphrena Weed	h	-		
ANACARDIACEAE					
Schinus terebinthifolia	Broad-leaf Pepper	t	3		
ASCLEPIADACEAE					
Gomphocarpus physocarpus	Balloon Cotton Bush	s	-		
ASPARAGACEAE					
Asparagus aethiopicus cv. *Sprengeri*	Asparagus Fern	v	3		
ASTERACEAE					
Ageratum houstonianum	Blue Billy-Goat	h	-		
Ambrosia artemisiifolia	Annual Ragweed	h	2		
Baccharis halimifolia	Groundsel Bush	s	2		
Bidens pilosa	Cobblers Pegs	h	-		
Calyptocarpus vialis	Creeping Cinderella Weed	c	-		
Cirsium vulgare	Spear Thistle	h	-		
Conyza bonariensis	Flaxleaf Fleabane	h	-		
Conyza pusilla	Canadian Fleabane	h	-		
Crassocephalum crepidioides	Thickhead	h	-		
Emilia sonchifolia	Emilia	h	-		
Hypochaeris radicata	Flatweed	h	-		
Parthenium hysterophorus	Parthenium Weed	h	2		
Senecio sp. *(lautus)*	Fireweed	h	-		
Soliva pterosperma	Bindii	h	-		
Sonchus oleraceus	Rough Sow Thistle	h	-		
Sphagneticola trilobata	Singapore Daisy	c	3		
Tagetes minuta	Stinking Roger	h	-		

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
AVICENNIACEAE					
Avicennia marina [n]	Grey Mangrove	t	-		
BORAGINACEAE					
Heliotropium amplexicaule	Blue Heliotrope	h	-		
BRASSICACEAE					
Brassica tourneforii	Wild Turnip	s	-		
Lepidium africanum	Common Peppercress	h	-		
CACTACEAE					
Opuntia sp.	Prickly Pear	s	2		
CAESALPINIACEAE					
Crotalaria paniculata	Poor Mans Gold	h	-		
Senna pendula var *glabrifolia*	Easter Cassia	s	-		
CARYOPHYLLACEAE					
Cerastium glomeratum	Sticky Mouse-eared Chickweed	h	-		
CASUARINACEAE					
*Casuarina equisetifolia**	Coastal Sheoak	t	-		
*Allocasuarina littoralis**	Black Sheoak	t	-		
CONVOLVULACEAE					
Cuscuta campestris	Dodder	v	-		
Convolvulus arvensis	European Bindweed	c	-		
Ipomoea sp. *(alba)*	-	v	-		
Ipomoea cairica	Mile-a-Minute	v	-		
Ipomoea pes-caprae [n]	Goats Foot Convolvulus	v	-		
CYPERACEAE					
Cyperus congestus	Clustered Flatsedge	a	-		
Cyperus eragrostis	Umbrella Sedge	a	-		
EUPHORBIACEAE					
Chamaesyce maculata	Caustic Weed	h	-		
Euphorbia hirta	Asthma Plant	h	-		
Euphorbia prostrata	Caustic Creeper	c			
Euphorbia sp.	Spurge	h	-		
Macaranga tanarius [n]	Macaranga	t	-		
Phyllanthus virgatus	Creeping Phyllanthus	h	-		

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
FABACEAE					
Crotalaria pallida	Rattle Pod	h	-		
Desmodium uncinatum	Silver-leafed Desmodium	v	-		
Macroptilium atropurpureum	Siratro	v	-		
Macroptilium lathyroides	Phasey Bean	s	-		
Medicago polymorpha	Burr Medic	c	-		
Medicago sativa	Lucerne	h	-		
Melilotus indicus	Sweet Melilotus	h	-		
Neonotonia wightii	Glycine	v	-		
Sesbania cannabina	Sesbania Pea	s	-		
Trifolium repens	White Clover	c	-		
LAURACEAE					
Cinnamomum camphora	Camphor Laurel	t	3		
MALVACEAE					
Hibiscus tiliaceus [n]	Cotton Tree	t	-		
Modiola caroliniana [n]	Red Flower Mallow	c	-		
Sida cornifolia	Flannel Weed	h	-		
Sida rhombifolia	Common Sida	h	-		
MIMOSACEAE					
Acacia aulacocarpa [n]	Hickory Wattle	t	-		
MYRTACEAE					
Eucalyptus robusta [n]	Swamp Mahogany	t	-		
Lophostemon confertus [n]	Brush Box	t	-		
Melaleuca linariifolia [n]	Flax-leafed Paperbark	t	-		
Melaleuca quinquenervia [n]	Paperbark Teatree	t	-		
ONAGRACEAE					
Oenothera drummondii [n]	Beach Evening Primrose	h	-		
Oenothera laciniata	Cut-leaf Evening Primrose	h	-		
OXALIDACEAE					
Oxalis corniculata	Creeping Oxalis	c	-		
PANDANACEAE					
Pandanus tectorius [n]	Screw Pine	t	-		
PASSIFLORACEAE					
Passiflora cairica	Stinking Passion Vine	v	-		
Passiflora subpeltata	White Passion Vine	v	-		

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
PLANTAGINACEAE					
Plantago lanceolata	Lamb's Tongue	h	-		
Plantago major	Great Plantain	h	-		
POACEAE					
Brachiaria decumbens	Signal Grass	g	-		
Brachiaria mutica	Para Grass	g	-		
Cenchrus ciliaris	Buffel Grass	g	-		
Cenchrus echinatus	Mossman River Grass	g	-		
Chloris gayana	Rhodes Grass	g	-		
Chloris truncata	Windmill Grass	g	-		
Chloris virgata	Feather-top Rhodes Grass	g	-		
Cynodon dactylon	Couch Grass	g	-		
Dichanthium aristatum	Angleton Grass	g	-		
Digitaria ciliaris	Summer Grass	g	-		
Eleusine indica	Crowsfoot Grass	g	-		
Hemarthria uncinata	Mat Grass	g	-		
Imperata cylindrica [n]	Blady Grass	g	-		
Melinis repens	Red Natal Grass	g	-		
Melinis minutiflora	Molasses Grass	g	-		
Poa annua	Winter Grass	g	-		
Panicum effusum	Hairy Panic	g	-		
Megathyrsus maximus var. maximus	Green Panic	g	-		
Paspalum dilatatum	Paspalum	g	-		
Phragmites australis [n]	Common reed	g	-		
Sorghum halepense [n]	Johnson grass	g	-		
Typha orientalis [n]	Typha	a	-		
Urochloa mosambicensis	Sabi Grass	g	-		
PORTULACACEAE					
Portulaca pilosa	Hairy pigweed	c	-		
PRIMULACEAE					
Anagallis arvensis	Scarlet Pimpernel	c	-		
PROTEACEAE					
Banksia integrifolia [n]	Coastal Banksia	t	-		
SAPINDACEAE					
Cardiospermum halicacabum	Balloon Vine	v	-		
Cupaniopsis anacardioides [n]	Tuckeroo	t	-		

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
Dodonaea triquetra	Hop Bush	s	-		
SOLANACEAE					
Solanum nigrum	Brazilian Nightshade	h	-		
VERBENACEAE					
Lantana camara	Lantana	s	3		
Lantana montevidensis	Creeping Lantana	c	3		
Verbena bonariensis	Purple Top	h	-		
Verbena aristigera	Mayne's Pest	h	-		
Vitex trifolia var *trifolia* [n]	Coastal Vivax	s	-		

Form: t = tree, **s =** shrub, **h =** herb, **g =** grass, **c =** creeper, **v =** vine, **a =** aquatic

[n] = native

Appendix C

Survey Results

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
AGAVACEAE										
Agave sp.	Agave	-	X	-	-	-	-	-	-	-
AIZOACEAE										
Carpobrotus glaucescens	Pigface*	-	X	X	X	X	-	-	-	-
Sesuvium portulacastrum	Sea Purslane*	-	X	X	X	X	-	-	X	X
Tetragonia tetragonioides	New Zealand Spinach*	-	X	-	-	-	-	-	-	-
AMARANTHACEAE										
Alternanthera pungens	Khaki Weed	-	-	-	-	-	-	X	-	-
Amaranthus quitensis	South American Amaranthus	-	-	-	-	-	-	-	-	-
Amaranthus viridis	Green Amaranths	-	X	X	-	-	X	X	X	-
Gomphrena celosioides	Gomphrena Weed	-	-	X	-	-	X	X	X	X
ANACARDIACEAE										
Schinus terebinthifolius	Broad-leaf Pepper	3	X	X	X	X	-	-	X	X
APIACEAE										
Cyclospermum leptophyllum	Slender Celery	-	-	-	-	-	-	-	-	-
Centella asiatica	Pennywort*	-	-	-	-	-	X	X	-	-
ASCLEPIADACEAE										
Gomphocarpus physocarpus	Balloon Cotton Bush	-	-	X	-	-	-	-	-	-
ASPARAGACEAE										
Asparagus aethiopicus cv. *Sprengeri*	Asparagus Fern	3	-	-	-	-	-	-	-	-
ASTERACEAE										
Ageratum houstonianum	Blue Billy-goat	-	-	X	-	-	X	X	X	-
Ambrosia artemisiifolia	Annual Ragweed	2	X	X	-	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
Ambrosia tenuifolia	Lacy Ragweed	-	-	-	-	-	-	-	-	-
Aster subulatus	Wild Aster	-	-	-	X	-	-	-	-	-
Baccharis halimifolia	Groundsel Bush	2	-	-	X	X	-	-	X	-
Bidens pilosa	Cobblers Pegs	-	X	X	X	X	X	X	X	X
Calyptocarpus vialis	Creeping Cinderella Weed	-	X	X	-	-	-	X	-	-
Cirsium vulgare	Spear Thistle	-	-	-	-	-	-	-	-	-
Conyza bonariensis	Flax-leaf Fleabane	-	X	X	-	X	X	X	X	-
Conyza pusilla	Canadian Fleabane	-	-	-	-	-	-	-	-	-
Conyza sumatrensis	Tall Fleabane	-	X	X	X	-	X	-	-	-
Crassocephalum crepidioides	Thickhead	-	X	X	-	-	X	X	X	-
Gamochaeta calviceps	Cudweed	-	X	-	-	-	-	-	-	-
Emilia sonchifolia	Emilia	-	X	X	X	X	X	X	X	X
Hypochaeris radicata	Flatweed	-	X	X	-	-	X	X	-	-
Parthenium hysterophorus	Parthenium Weed	2	-	-	-	-	-	-	-	-
Pseudognaphalium luteoalbum	Jersey cudweed	-	-	-	-	-	X	-	X	X
Senecio madagascariensis	Fireweed	2	X	-	X	X	-	X	X	X
Sonchus oleraceus	Rough Sow Thistle	-	X	X	X	-	X	-	X	-
Sphagneticola trilobata	Singapore Daisy	3	-	X	-	-	-	-	-	-
Tagetes minuta	Stinking Roger	-	X	X	-	-	-	-	-	-
Tridax procumbens	Tridax Daisy	-	X	X	-	-	X	X	X	X
AVICENNIACEAE										
Avicennia marina	Grey Mangrove*	-	X	X	-	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
BORAGINACEAE										
Heliotropium amplexicaule	Blue Heliotrope	-	X	-	-	-	-	-	X	X
BRASSICACEAE										
Brassica tourneforii	Wild Turnip	-	X	-	X	-	X	X	X	-
Cakile maritime	-	-	-	-	-	-	-	-	-	-
Lepidium africanum	Common Peppercress	-	X	X	X	-	X	-	X	X
CACTACEAE										
Opuntia sp.	Prickly Pear	2	X	-	-	-	-	-	-	-
CAESALPINIACEAE										
Senna pendula var glabrifolia	Easter Cassia	-	-	-	-	-	-	-	-	-
CAMPANULACEAE										
Wahlenbergia graniticola	Granite Bluebell*	-	-	-	-	-	-	-	X	-
CARYOPHYLLACEAE										
Cerastium glomeratum	Sticky Mouse-eared Chickweed	-	X	-	X	-	X	X	-	-
Polycarpon tetraphyllum	Four-leaved Allseed	-	-	-	-	-	-	-	-	-
CASUARINACEAE										
Casuarina equisetifolia	Coastal Sheoak*	-	X	X	-	-	-	-	-	-
Casuarina littoralis	Black Sheoak*	-	X	X	X	X	-	-	-	-
CHENOPODIACEAE										
*Atriplex muelleri**	Annual Saltbush*	-	-	-	X	X	-	-	-	-
*Dysphania littoralis**	Red Crumbweed*	-	-	-	X	-	-	-	-	-
Chenopodium ambrosioides	Mexican Tea / Kerosene Plant	-	-	-	-	-	X	-	-	-
Chenopodium sp.	-	-	-	-	-	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
Einadia sp.	-	-	-	-	-	-	X	-	-	-
Enchylaena tomentose	Ruby saltbush*	-	-	-	-	-	-	-	-	-
*Sarcocornia quinqueflora**	Bead Weed*	-	-	-	X	X	-	-	-	-
Suaeda australis	Sea Blite*	-	X	X	-	-	-	-	-	-
COMMELINACEAE										
Commelina benghalensis	-	-	-	X	-	-	-	X	-	-
Commelina diffusa (C. cyanea)	Wandering Jew	-	X	X	-	-	X	X	-	X
CONVOLVULACEAE										
Cuscuta campestris	Dodder	-	-	-	-	-	-	-	-	-
Convolves arvensis	European Bindweed	-	-	X	-	-	-	-	-	-
Ipomoea so (alba)	White Ipomoea	-	-	-	-	-	-	-	-	-
Ipomoea cairica	Coastal Morning Glory	-	X	X	X	X	-	-	X	X
Ipomoea indica	Purple Morning Glory	-	-	-	-	-	-	-	-	-
Ipomoea pes-caprae	Goats Foot Convolvulus *	-	X	-	-	-	-	-	X	-
Ipomoea quamoclit	Cypress Vine	-	-	-	-	-	-	-	-	-
CYPERACEAE										
Carex appressa	Tall Sedge*	-	-	-	-	-	-	-	-	-
Cyperus aggregatus	-	-	-	-	-	-	-	-	-	-
Cyperus congestus	Clustered Flatsedge	-	-	-	-	-	-	-	-	-
Cyperus eragrostis	Umbrella Sedge	-	-	-	-	-	-	-	X	X
Cyperus rotundus	Nut Grass	-	-	-	-	-	-	-	-	-
Cyperus polystachyos	Bunchy Sedge	-	-	-	X	-	-	-	X	-
Fimbristylis dichotoma	Fringe Rush*	-	-	-	X	X	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
Fimbristylis ferruginea	-	-	-	-	-	-	-	-	-	-
Isolepis cernua	Nodding Club Rush*	-	-	-	X	X	-	-	X	X
*Isolepis nodosa**	Knobby Club Rush*	-	-	-	-	-	-	-	X	X
EUPHORBIACEAE										
Chamaesyce maculata	Caustic Weed	-	-	X	-	-	-	X	-	-
Euphorbia hirta	Asthma Plant	-	X	X	-	-	X	-	-	-
Euphorbia prostrata	Caustic Creeper	-	X	X	X	-	X	-	X	-
Euphorbia cyathophora.	Painted Spurge	-	-	X	-	-	-	-	-	-
Macaranga tanarius	Macaranga*	-	X	X	-	-	-	-	X	X
Ricinus communis	Castor Oil Plant	-	-	X	-	-	-	-	X	X
FABACEAE										
*Canavalia rosea**	Coastal Jack Bean*	-	-	X	-	-	-	-	-	-
Centaurium erythraea	Common Centaury	-	-	-	X	-	-	-	X	-
Crotalaria incana	Woolly Rattle Pod	-	-	-	-	-	-	-	-	-
Crotalaria lanceolata	Lance-leaf Rattle Pod	-	X	X	X	X	-	X	X	-
Crotalaria pallida	Rattle Pod	-	-	X	-	-	-	-	-	-
Cullen tenax	Emu Foot*	-	-	X	X	-	X	-	X	X
Desmodium uncinatum	Silver Leafed Desmodium	-	-	-	-	-	-	-	-	-
Indigofera hirsute	Hairy Indigo	-	-	X	-	X	-	-	-	-
*Indigofera linifolia**	-*	-	-	-	-	-	X	X	-	-
Indigofera spicata	Creeping Indigo	-	X	X	X	X	X	X	X	-
Macroptilium atropurpureum	Siratro	-	X	X	X	X	X	X	X	X
Macroptilium lathyroides	Phasey Bean	-	-	X	X	X	X	X	-	X

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
Medicago lupulina	Black Medic	-	-	-	-	-	-	-	-	-
Medicago polymorpha	Burr Medic	-	X	-	-	-	X	X	X	X
Medicago sativa	Lucerne	-	-	-	-	-	-	-	-	-
Melilotus albus	Bokhara	-	X	-	X	-	-	-	X	-
Melilotus indicus	Sweet Melilotus	-	X	-	X	-	X	X	X	-
Neonotonia wightii	Glycine	-	X	X	X	X	-	-	X	X
Sesbania cannabina	Sesbania Pea*	-	-	X	X	X	X	X	X	X
Stylosanthes hamata	Verano Stylo	-	-	-	-	-	-	-	-	-
Stylosanthes humilis	Townsville Stylo	-	X	X	X	X	X	X	-	X
Trifolium repens	Clover	-	-	X	-	-	X	X	-	-
*Vigna marina**	Yellow Beach Bean*	-	-	-	-	-	-	-	X	X
GRAMINEA										
*Paspalum distichum**	Water Couch*	-	-	-	-	-	-	-	X	X
JUNCACEAE										
*Juncus kraussii**	Jointed Rush*	-	-	-	-	-	-	-	X	X
LAURACEAE										
Cinnamomum camphora	Camphor Laurel	3	-	-	X	-	-	-	-	-
LORANTHACEAE										
Amyema sp.	A Mistletoe	-	-	-	-	-	-	-	-	-
MALVACEAE										
Hibiscus tiliaceus	Cotton Tree*	-	X	X	-	-	-	-	-	-
Sida cornifolia	Flannel Weed	-	-	X	-	-	-	-	-	-
Sida rhombifolia	Common Sida	-	X	X	-	-	X	X	X	X

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
MIMOSACEAE										
Acacia disparrima	Hickory Wattle*	-	-	-	-	-	-	-	-	-
Acacia leiocalyx	Curracabah*	-	X	X	-	-	-	-	-	-
MORACEAE										
Ficus elastica	Rubber Tree	-	X	X	-	-	-	-	-	-
MYRTACEAE										
Eucalyptus robusta	Swamp Mahogany*	-	-	-	-	-	-	-	-	-
Lophostemon confertus	Brush Box*	-	X	X	-	-	-	-	-	-
Melaleuca linariifolia	Flax-leafed Paperbark*	-	X	X	-	-	-	-	-	-
Melaleuca quinquenervia	Broad-leaved Paperbark*	-	X	X	-	-	-	-	-	-
Callistemon viminalis	Weeping Bottlebrush*	-	-	X	-	-	-	-	-	-
ONAGRACEAE										
Ludwigia peploides	Water Primrose	-	-	-	-	-	-	-	X	X
Ludwigia peruviana	-	-	-	-	-	-	X	X	X	X
Oenothera drummondii subsp. drummondii	Beach Primrose*	-	X	X	-	-	-	-	X	X
Oenothera laciniata	Cut-leaf Evening Primrose	-	X	-	X	-	X	X	X	-
OXALIDACEAE										
Oxalis corniculata	Creeping Oxalis	-	X	X	-	-	-	-	-	-
PAPAVERACEAE										
Argemone ochroleuca var. *ochroleuca*	Mexican Poppy	-	-	-	-	-	-	-	-	-
PANDANACEAE										
*Pandanus tectorius**	Screw Pine*	-	X	X	-	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
PASSIFLORACEAE										
Passiflora cairica	Stinking Passion Vine	-	-	-	-	-	-	-	-	-
Passiflora suberosa	Corky Passion Vine	-	-	X	-	-	-	-	-	-
Passiflora subpeltata	White Passion Flower	-	-	-	-	-	-	-	-	-
PHYLLANTHACEAE										
Phyllanthus tenellus	-	-	-	X	-	-	-	-	-	-
Phyllanthus virgatus	Creeping Phyllanthus	-	-	-	-	-	-	-	-	-
PLANTAGINACEAE										
Plantago lanceolata	Lamb's Tongue	-	X	X	X	X	X	X	X	-
POACEAE										
Andropogon virginicus	Whisky Grass	-	-	-	-	X	-	-	-	-
Brachiaria decumbens	Signal Grass	-	-	X	X	-	-	-	X	X
Brachiaria mutica	Para Grass	-	-	-	-	-	-	-	-	-
Cenchrus ciliaris	Buffel Grass	-	-	-	-	-	-	-	-	-
Cenchrus echinatus	Mossman River Grass	-	X	X	X	-	X	X	X	X
Chloris gayana	Rhodes Grass	-	X	X	X	X	X	X	X	X
Chloris truncata	Windmill Grass	-	-	-	-	-	-	-	-	-
Chloris virgata	Feather-top Rhodes Grass	-	-	-	X	X	-	-	-	-
*Cymbopogon refractus**	Barbed Wire Grass*	-	-	-	X	X	-	-	-	-
Cynodon dactylon	Couch Grass	-	X	X	X	-	X	X	-	-
Dichanthium aristatum	Angleton Grass	-	-	-	-	-	-	-	-	-
Dichanthium sericeum	Queensland Blue Grass*	-	X	X	X	-	-	-	-	-
Digitaria ciliaris	Summer Grass	-	-	-	-	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
Echinochloa colona	Awnless Barn Grass	-	-	-	-	-	X	-	X	-
Echinochloa telmatophila	Swamp Barnyard Grass	-	-	-	-	-	-	-	-	-
Eleusine indica	Crowsfoot Grass	-	-	-	-	-	-	-	-	-
Eragrostis tenuifolia	Elastic Grass	-	-	-	X	-	-	-	-	-
*Eriochloa crebra**	Cup Grass*	-	-	-	-	X	-	-	-	-
Hemarthria uncinata	Mat Grass	-	-	-	-	-	-	-	-	-
*Imperata cylindrical**	Blady Grass*	-	-	-	-	-	-	-	-	-
Lolium x hybridum	A Ryegrass	-	-	-	-	-	-	-	X	-
Melinis repens	Red Natal Grass	-	X	X	X	X	X	X	X	X
Melinis minutiflora	Molasses Grass	-	-	-	-	-	-	-	-	-
Poa annua	Winter Grass	-	-	-	-	-	-	-	-	-
Panicum effusum	Hairy Panic	-	-	-	-	-	-	-	-	-
Panicum larcomianum	-	-	-	-	X	-	-	-	-	-
Panicum miliaceum	Millet Panic	-	-	-	-	-	-	-	-	-
Megathyrsus maximus var. *maximus*	Guinea Grass	-	X	X	X	X	X	X	X	X
Megathyrsus var. *pubiglumis*	Green Panic	-	-	-	-	-	-	-	-	-
Paspalum dilatatum	Paspalum	-	-	-	X	-	X	-	X	-
*Phragmites australis**	Common Reed*	-	X	X	X	X	X	-	X	X
Polypogon monspeliensis	Annual Beard Grass	-	-	-	-	-	X	-	X	-
Setaria sphacelata	South African Pigeon Grass	-	-	-	-	-	-	-	-	X
Sorghum halepense	Johnson Grass	-	-	X	-	-	-	-	X	-
Sporobolus fertilis	Giant Parramatta Grass	2	X	X	-	-	-	-	X	-
*Sporobolus virginicus**	Salt Couch*	-	-	-	X	X	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
Urochloa mosambicensis	Sabi Grass	-	-	-	-	-	-	-	-	-
POLYGONACEAE										
Persicaria decipiens	Slender Knotweed	-	-	-	-	-	-	-	-	-
Persicaria lapathifolia	Pale Knotweed	-	-	-	-	-	X	-	-	-
Rumex brownii	Swamp Dock	-	-	-	-	-	-	-	X	X
PORTULACACEAE										
Portulaca oleracea	Pigweed	-	X	X	-	X	-	X	-	-
Portulaca pilosa	Hairy Pigweed	-	X	X	-	-	X	X	X	-
PRIMULACEAE										
Anagallis arvensis	Scarlet Pimpernel	-	X	-	X	-	X	X	X	-
PROTEACEAE										
*Banksia integrifolia**	Coastal Banksia*	-	X	X	-	-	-	-	-	-
RUBIACEAE										
Richardia brasiliensis	Mexican Clover	-	X	X	-	-	X	X	-	X
SAPINDACEAE										
Cardiospermum halicacabum	Balloon Vine	-	-	-	X	-	-	-	-	-
*Cupaniopsis anacardioides**	Tuckeroo*	-	X	X	-	-	-	-	-	-
Dodonaea triquetra	Hop Bush	-	-	-	-	-	-	-	-	-
SCROPHULARIACEAE										
Misopates orontium	Lesser Snapdragon	-	-	-	-	-	-	-	-	-
SOLANACEAE										
Datura stramonium	Common Thornapple	-	-	-	-	-	-	X	-	-
Physalis minima	Wild Gooseberry	-	-	-	-	-	-	X	-	-
Solanum chrysotrichum	Devil's Fig	-	-	-	-	-	-	X	-	-

SPECIES	COMMON NAME	LPA CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2010	2011	2010	2011	2010	2011	2010	2011
Solanum seaforthianum	Brazilian Nightshade	-	-	-	X	-	-	-	-	-
Solanum nigrum	Blackberry Nightshade	-	X	X	-	-	X	X	X	X
TAMARICACEAE										
Tamarix ramosissima	Tamarisk	-	-	-	-	-	X	X	-	-
TYPHACEAE										
Typha orientalis	Cumbungi / Typha*	-	X	-	X	X	X	X	X	X
ULMACEAE										
Celtis sinensis	Chinese Elm	3	-	X	-	-	-	X	-	-
VERBENACEAE										
Lantana camara	Lantana	3	X	X	X	X	-	-	-	-
Lantana montevidensis	Creeping Lantana	3	X	-	X	-	-	-	-	-
Verbena bonariensis	Purple Top	-	X	X	-	-	X	X	X	-
Verbena aristigera	Mayne's Pest	-	X	-	-	-	X	-	X	-
Vitex trifolia var. *trifolia**	Coastal Vitex*	-	X	-	-	-	-	-	-	-

Note:
* designates indigenous species
LPA Class – *Land Protection (pest and stock route management) Regulations* 2003, Schedule 2.

Appendix D

GPS Location of Declared Species

The following table lists the GPS location of the declared species listed in Schedule 2 of the *Land Protection (Pest and Stock Route Management) Regulations 2002* that were recorded during the previous and current survey for Lucinda and Port Gate Drains, T1-3 Overflow and Car Precinct. GPS readings recorded during the previous survey that are similar to the current survey reading are in bold.

BOTANICAL NAME	COMMON NAME	LUCINDA DRAIN		PORT GATE		T1-3		CAR PRECINCT	
		2010	2011	2010	2011	2010	2011	2010	2011
LPA CLASS 1									
No species recorded	-	-	-	-	-	-	-	-	-
LPA CLASS 2									
Ambrosia artemisiifolia	Annual Ragweed	-	27.3769, 153.1826	**-**	**-**	**-**	**-**	-	-
Opuntia sp.	Prickly Pear	27.3898, 153.1741 27.3909, 153.1729	**-**	**-**	**-**	**-**	**-**	-	-
Baccharis halimifolia	Groundsel Bush	-	-	**27.4088, 153.1617** **27.4089, 153.1617** **27.4092, 153.1617** **27.4096, 153.1617**	**27.4087, 153.1617** **27.4089, 153.1617** **27.4092, 153.1617** **27.4096, 153.1618**	-	-	27.3904, 153.1655 27.3905, 153.1654 27.3912, 153.1698	-
Senecio madagascariensis	Fireweed	27.3925, 153.1684 27.3924, 153.1689 27.3924, 153.1683	-	**27.4046, 153.1613**	**27.4046, 153.1614**	-	27.3872, 153.1658 27.3874, 153.1657 27.3875, 153.1656 27.3879, 153.1653 27.3882,	27.3856, 153.1688 27.3858, 153.1687 **27.3916, 153.1687** 27.3904, 153.1655 27.3915,	**27.3917, 153.1687**

BOTANICAL NAME	COMMON NAME	LUCINDA DRAIN		PORT GATE		T1-3		CAR PRECINCT	
		2010	2011	2010	2011	2010	2011	2010	2011
							153.1652	153.1691 27.3911, 153.1665	
Sporobolus fertilis	Giant Parramatta Grass	**27.3820, 153.1787**	**27.3819, 153.1787**	-	-	-	-	27.3906, 153.1657	-
LPA CLASS 3									
Schinus terebinthifolia	Broad-leaf Pepper	**27.3920, 153.1714** **27.3910, 153.1732** 27.3838, 153.1774 **27.3833, 153.1778** 27.3827, 153.1782 **27.3820, 153.1787** **27.3801, 153.1804** 27.3919, 153.1707	**27.3919, 153.1714** **27.3909, 153.1731** 27.3925, 153.1690 **27.3833, 153.1778** 27.3802, 153.1802 **27.3815, 153.1787** **27.3801, 153.1805** 27.3802, 153.1804 27.3767, 153.1832 27.3779, 153.1821	27.4045, 153.1612 27.4060, 153.1613 **27.4046, 153.1613** **27.4079, 153.1615** **27.4092, 153.1616** 27.4090, 153.1617 27.4093, 153.1617 27.4097, 153.1618	**27.4046, 153.1614** **27.4079, 153.1616** **27.4094, 153.1617** 27.4103, 153.1629 27.4089, 153.1616	-	-	**27.3906, 153.1654** **27.3913, 153.1696** **27.3922, 153.1657** 27.3921, 153.1649 **27.3923, 153.1653** 27.3909, 153.1700 27.3920, 153.1675 27.3920, 153.1671 27.3917, 153.1653 27.3909, 153.1657	**27.3907, 153.1654** **27.3913, 153.1697** **27.3922, 153.1658** 27.3923, 153.1656 **27.3923, 153.1653**
Lantana camara	Lantana	**27.3924, 153.1697** **27.3923, 153.1703** **27.3921, 153.1709** **27.3921,**	**27.3923, 153.1697** **27.3923, 153.1702** **27.3922, 153.1704** **27.3921,**	**27.4090, 153.1617**	**27.4090, 153.1617**	-	-	-	-

BOTANICAL NAME	COMMON NAME	LUCINDA DRAIN		PORT GATE		T1-3		CAR PRECINCT	
		2010	2011	2010	2011	2010	2011	2010	2011
		153.1711 27.3917, 153.1719 **27.3832, 153.1778** 27.3819, 153.1788 **27.3814, 153.1791** 27.3817, 153.1789 **27.3803, 153.1801** **27.3820, 153.1787** 27.3806, 153.1797 27.3797, 153.1809 27.3786, 153.1818 27.3919, 153.1707	**153.1711** 27.3919, 153.1714 **27.3832, 153.1778** 27.3917, 153.1719 **27.3814, 153.1791** 27.3829, 153.1780 **27.3803, 153.1801** **27.3819, 153.1787** 27.3802, 153.1804						
Lantana montevidensis	Creeping Lantana	27.3906, 153.1734 27.3906, 153.1735	-	27.4090, 153.1617	-	-	-	-	-
Sphagneticola trilobata	Singapore Daisy	-	27.3811, 153.1794	27.4090, 153.1617	-	-	-	-	-
Celtis sinensis	Chinese Elm	-	-	-	-	-	27.3869, 153.1659	-	-

Bold - GPS readings recorded during the previous surveys that are similar to the current survey reading.

Appendix E

LPA Declared Species Fact Sheets

Broadleaved pepper tree

Schinus terebinthifolius

DECLARED CLASS 3

The problem

The broadleaved pepper tree is invading coastal dune areas, wetlands and along stream banks. It harbours a disease which can kill mangroves. The tree is choking out native plants and is becoming a serious problem. Broadleaved pepper tree is a garden escapee and native to Brazil.

The broadleaved pepper tree can also affect human and animal health as it contains toxic resins. Contact with the sap can cause persistent swelling, rashes, welts, running sores, swollen faces, colic and haemorrhages in the eyes. The pollen can cause respiratory difficulty.

Description

Broadleaved pepper trees can grow into a large spreading tree, up to 10 m high and broad. The leaves consist of 5–9 dark green leaflets and at the ends of the branches are small whitish flowers, followed by bunches of glossy, round red fruits 6 mm across. There are male and female trees, so not all bear fruit.

Management

Birds are attracted to the trees bright red berries and are the main method of spread of this tree. Removal should be done in winter. Revegetation of the cleared area should be pre-planned to ensure that other weeds do not gain a foothold in the disturbed area, and should include mulching to keep weeds down.

Hand pull or chip out young plants.

If the tree is chopped down be prepared for it to regrow and the roots to sucker, sometimes for up to six months. Treat these as they occur. Try cutting 2 inches below the soil, chip away all the bark and nail a tin plate down over the stump. Sometimes the plant won't start to regrow until 18 months after initial chopping.

Broadleaved pepper tree can be put through a wood chipper to make mulch.

Declaration details

Broadleaved pepper tree is a declared Class 3 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. The Act prohibits the supply or sale of Class 3 plants and may require their removal from environmentally significant areas.

Further information

Further information is available from the vegetation management/weed control/environmental staff at your local government.

TABLE 1 – HERBICIDES REGISTERED FOR THE CONTROL OF BROADLEAVED PEPPER TREE

Method	Herbicide	Rate	Registration status	Comments
Basal bark spray	fluroxypyr (200 g/L)	35 mL per 1 L diesel or kerosene	PERMIT 7485	Spray or paint the chemical on the full circumference of each stem.
Cut stump	glyphosate (360 g/L)	1 L per 1 L water	PERMIT 7485	Paint within 15 seconds of cutting
Foliar spray	fluroxypyr (200 g/L)	500 mL per 100 L water	Registered	Winter application or while the tree is in berry, providing that no replanting of desirable broadleaf plants is intended for 6 months.

Read the label carefully before use and always use the herbicide in accordance with label directions.

It is a requirement of a permit that all persons using the products covered by this off-label permit comply with the details and conditions listed in the permit. In addition read the herbicide label carefully before use and always use the herbicide in accordance with label directions. The above permit can be used by pest control operations, members of environmental groups such as Bushcare, Catchment Care, Coast Care and people employed as or working under supervision of local and state government officers.

Fact sheet

DECLARED CLASS 3 PEST PLANT

Camphor laurel

Cinnamomum camphora

Camphor laurel was introduced into Australia from Asia in 1822. It has been promoted and planted as a garden ornamental throughout Queensland.

Camphor laurel is an attractive shade tree, but can be very destructive—it aggressively replaces native vegetation. The long-term consequences of its spread may result in the loss of native wildlife and agricultural productivity over large areas of south-east Queensland.

Camphor laurel invades pastures and disturbed riparian systems. It tends to germinate under fences and power lines (wherever birds rest and deposit the seed). As a result, it can push fences over and disrupt power facilities. It is a troublesome weed on dairy farms throughout south-east Queensland and northern New South Wales.

Along the waterways of south-east Queensland, camphor laurels are replacing the native blue gums threatening koala populations.

Old camphor laurel trees develop a massive root system that can block drains and crack concrete structures. The average suburban backyard is far too small to accommodate a mature camphor laurel without problems. Removal of a mature tree can cost hundreds of dollars.

WEEDBUSTERS

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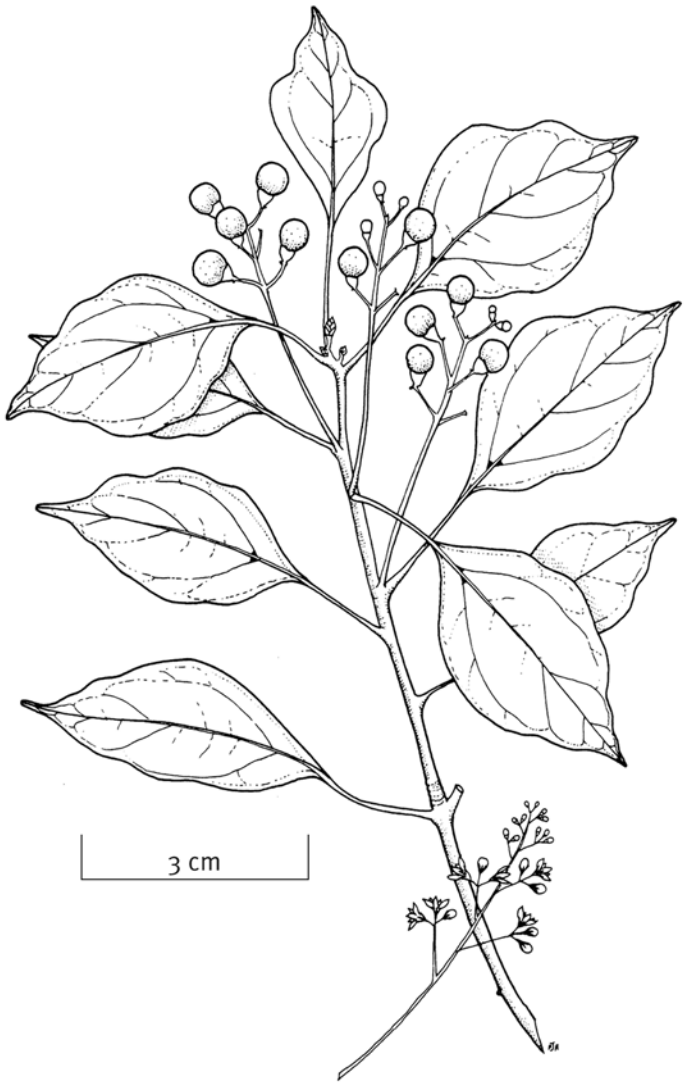
PP46 September 2009



Declaration details

Camphor laurel is a declared Class 3 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. Class 3 plants cannot be sold in Queensland and their removal in Queensland is recommended. Landholders can be required to remove Class 3 plants if they live next to environmentally significant areas such as national parks or reserves.

Description and general information

Camphor laurel is a large evergreen tree, growing up to 20 m tall. The leaves have a glossy, waxy appearance and smell of camphor when crushed. In spring it produces lush, bright-green foliage and masses of small white flowers. The spherical fruits are green (changing to black when ripe) and 10 mm in diameter.

Habitat and distribution

Camphor laurel is native to Taiwan, Japan and some parts of China. Since it was introduced in 1822, it has spread along eastern Australia from the Atherton Tablelands down to Victoria. It is particularly common along watercourses and in soil types that once supported rainforest.

In south-east Queensland, it has the potential to develop dense infestations similar to older infestations that exist in northern New South Wales.

A large camphor laurel tree may produce over 100 000 seeds every year. The seeds are readily spread by a few species of birds.

Control

Mechanical control

Removal of newly established or isolated seedlings by hand pulling or grubbing is effective.

Bulldozing is only suitable for young trees that can be removed crowns and all. Failure to remove roots of mature trees will result in regrowth.

Fire kills plant tops but produces regrowth from the base.

Herbicide control

Selection of a suitable method depends on the size of the target tree and its situation. A standing tree that has been treated may be a serious hazard to human safety or other structures when it falls. Removal of the bulk of the tree before treating the stump is preferred in such situations.

Table 1 details the herbicides registered for camphor laurel control. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the label.

Foliar spray

Foliar sprays can be used for young trees up to 3 m tall.

Basal bark spray

Trees up to 6 m tall with a basal stem diameter up to 30 cm and no multi-stems can be treated using basal bark or cut stump methods, although basal bark is the preferred method.

When using the basal bark method, spray from ground level up to a height of 30 cm or higher than where multi-stems branch.

Stem injection

For trees taller than 6 m, stem injection using a modified axe is the most practical method—leave no more than 2 cm between cuts.

Axe cuts for stem injection of herbicides should be made at regular intervals all around the stem (or stems). Care should be taken to ensure the axe leaves a 'pocket' in the stem, into which the chemical is immediately injected. Cuts should penetrate the sapwood (just under the bark), but not the hard central wood. Cuts made too shallow into the bark or too deep into the stem will result in regrowth. The practice of drilling holes in the stem prior to herbicide application is not recommended.

Further information

Further information is available from your local government office, or from your local primary industries and fisheries biosecurity officer: contact details are available through 13 25 23.

Table 1 Herbicides registered for the control of camphor laurel

Situation	Herbicide	Rate	Comments
Foliar spray	Triclopyr-butotyl + picloram (e.g. Grazon DS®)	350–500 ml/100 L water	High-volume spray for trees up to 3 m tall; higher rate for › 2 m tall (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Foliar spray	Triclopyr-butotyl + picloram (e.g. Grazon DS®)	2.5 L/100 L water	Air blast/mister; foliar spray (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Foliar spray	Triclopyr-butotyl + picloram (e.g. Grazon DS®)	1:20 water	Gas gun or sprinkler sprayer; foliar spray (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Foliar spray	Triclopyr-butotyl (e.g. Garlon$^{600®}$)	170 ml/100 L water	High-volume foliar spray for trees up to 3 m tall (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Basal bark spray	Triclopyr-butotyl (e.g. Garlon$^{600®}$)	1 L in 60 L diesel	Basal bark for trees up to 6 m tall and 30 cm stem diameter or cut stump (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Stem injection	Glyphosate-IPA	2 ml of 1:1 mix with water	Stem injection for trees up to 25 cm in diameter (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Stem injection	Glyphosate-IPA	2 ml undiluted	Stem injection for trees 25–60 cm in diameter (For pasture, non-crop, forestry, right-of-way and aquatic areas)

PR09_4282

Fact sheet

DECLARED CLASS 2 PEST PLANT

Giant rat's tail grass

and other weedy *Sporobolus* species

Sporobolus pyramidalis, S. natalensis, S. jacquemontii, S. fertilis and *S. africanus*

Weedy *Sporobolus* can out-compete desirable pasture grasses.

Giant rat's tail grass is capable of producing up to 85 000 seeds/m^2/year with initial seed viability of about 90%.

Giant rat's tail grass and other weedy *Sporobolus* grasses are invasive grasses that can reduce pasture productivity, out-compete desirable pasture grasses, and cause significant degradation of natural areas.

These species were originally introduced as contaminants in pasture seed and have now adapted well to large areas of eastern Australia.

Five species of introduced *Sporobolus* grasses are declared Class 2 plants in Queensland:

- giant rat's tail grass (*S. pyradmidalis* and *S. natalensis*)
- American rat's tail grass (*S. jacquemontii*)
- giant Parramatta grass (*S. fertilis*)
- Parramatta grass (*S. africanus*).

Declaration details

Under Queensland's *Land Protection (Pest and Stock Route Management) Act 2002*, landholders are required to control Class 2 declared pests on land and waters under their control. Local government may serve a notice upon landholders requiring control of declared pests.

Description and general information

Weedy *Sporobolus* grasses are robust, tufted, perennial grasses growing up to 2 m tall. They are difficult to distinguish from other pasture grasses before maturity. However, the leaves are noticeably tougher than any other species.

They can also be difficult to identify from the other native *Sporobolus* grasses. Native *Sporobolus* grasses tend to be shorter, softer and have less dense seed heads than giant rat's tail grass. The seeds of all species are indistinguishable in pasture seed samples using current seed sample identification techniques.

Weedy *Sporobolus* seeds are spread:

- by livestock (up to 30 000 viable seeds/beast/day) in manure and on fur and hooves
- by both feral and native animals
- on vehicles and machinery (especially slashers and earth moving equipment)
- in hay and untested pasture seed
- by fast flowing water with turf.

PP48 February 2010

Queensland Government

Giant rat's tail grass

Giant rat's tail grass grows to 0.6–1.7 m high, with a seed head of up to 45 cm long and 3 cm wide. Seed heads change shape from a 'rat's tail' when young, to an elongated pyramid shape at maturity. Unlike Parramatta grass and giant Parramatta grass, giant rat's tail grass does not develop 'sooty spike' on its seed heads.

Distribution *S. natalensis*—Rockhampton (Queensland) to Port Macquarie (New South Wales).

Distribution *S. pyramidalis*—Cooktown (Queensland) to Central Coast (New South Wales).

American rat's tail grass

American rat's tail grass grows to 50–75 cm high, with a seed head of up to 25 cm long and 0.5–3 cm wide.

Distribution—Cape York (Queensland and Northern Territory) to South East Queensland.

Giant Parramatta grass

Giant Parramatta grass grows to 0.8–1.6 m high, with a seed head of up to 50 cm long and 1–2 cm wide. The branches of the seed head are pressed against the axis and overlap, although lower ones generally spread at maturity.

Distribution—Mossman (Queensland) to Central Coast (New South Wales).

Parramatta grass

Parramatta grass grows to 0.15–1.1 m high, with a seed head of up to 50 cm long and 1–2 cm wide. The leaves of mature plants are slender and erect, 6–18 cm long. Parramatta grass is not as invasive as giant Parramatta grass.

Distribution—Brisbane (Queensland) to Adelaide (South Australia).

Potential damage

Why are weedy *Sporobolus* grasses bad?

- Have low palatability when mature, and are difficult to control.
- Can quickly dominate a pasture, especially following overgrazing or soil disturbance.
- Can affect cattle health and productivity including finishing times, weaning percentages and a reduction of weights.
- Can set seed throughout frost-free periods with a significant proportion of seed remaining viable for up to 10 years.
- Can become a serious fire hazard in spring months.

Habitat and distribution

Giant rat's tail grass has adapted to a wide range of soils and conditions.

Ecoclimatic modelling suggests giant rat's tail grass is suited to conditions present in 30% of Australia (223 million ha) and 60% of Queensland (108 million ha), including areas receiving as little as 500 mm average annual rainfall.

Control

Prevention

Maintaining pastures in a vigorous and dense condition reduces the chance of invasion and increases competition against weedy *Sporobolus* seed establishment. Heavy grazing will not control weedy *Sporobolus* grasses—research indicates that grazing may actually favour its spread.

Stock movement from infested areas into clean areas is not recommended unless stock are spelled for at least five days in yards. Similarly, purchased stock from known or suspected infested areas should be spelled in the yards before release into larger paddocks. New stock can also be quarantined in a densely pastured, well-monitored holding paddock. Moving stock when there is no dew or rain will decrease the amount of seed sticking to their coats (see Table 1).

Establishment of weed-free buffer strips along boundary or perimeter fences, drainage lines and roadsides will restrict the spread of weedy *Sporobolus* grasses. It is important to clean machinery thoroughly after working in infested areas. Integrated control strategies using herbicides and other control methods, combined with good property hygiene, are essential. Research is underway to find suitable alternative pasture grasses that will restrict the establishment of weedy *Sporobolus* grasses under a range of environmental conditions. The use of higher grass seed sowing rates will increase seedling competition.

The attributes of replacement pasture grasses need to be considered when deciding what to sow. The following attributes are preferred and will increase the likelihood of success:

- well adapted to the local environmental conditions and soil type
- stoloniferous or rhizomatous growth habit
- resistant to heavy grazing
- palatable and productive
- provides competition year round (i.e. does not open up in late winter/spring)
- does not decline as soil fertility decreases
- fast to establish.

If a sown pasture species does not contain most of these attributes it is unlikely to be successful as part of a weedy *Sporobolus* grass control program.

Some pasture species, while providing strong competition once established, are weak competitors with weedy *Sporobolus* grasses in their early stages of establishment (e.g. Koronivia grass or Bisset creeping blue grass). These grasses are most successful against weedy *Sporobolus* when sown with other grasses that are vigorous when young and provide early competition against weedy *Sporobolus* grasses (e.g. Rhodes grass).

A supplier must not supply anything containing reproductive material of a plant that is a Class 1 or Class 2 pest prescribed under the Land Protection (Pest and Stock Route Management) Regulation 2003.

Management strategies

Always commence control programs in areas of light infestation, and work towards the denser infestations. **Apply all herbicides strictly in accordance with the directions on the label.**

Some details of management options are provided below.

1. Scattered plants and light infestations

Either:

- Spot spray with glyphosate.

or

- Spot spray with flupropanate.

or

- Use glyphosate through a pressurised wick wiper.

or

- Hand chip, bag and remove stools from the paddock and burn them.

2. Dense infestations on arable land

(a) Cropping option

First early summer

1. Boom spray with glyphosate @ 6 L/ha and burn prior to ploughing.
2. Spot spray or hand chip fence lines, headlands, drainage lines, shelter belts etc. for weedy *Sporobolus* grasses missed in cultivation. Plant a long season forage sorghum variety using a recommended pre-emergent herbicide.
3. Spot spray or hand chip any surviving weedy *Sporobolus* grasses to prevent reseeding.

Second summer

1. Boom spray with glyphosate to control new seedlings and crop regrowth prior to cultivation.
2. Follow the same procedures and similar cropping as for the first summer.

Third summer

1. Boom spray with glyphosate to control crop regrowth and any weedy *Sporobolus* seedlings.
2. Plant paddock with improved pastures using minimum tillage techniques to restrict bringing buried seed to the surface. Use a direct drill planter or surface broadcasting and rolling techniques. Plant fast growing pasture grasses at triple the standard sowing rates to compete with weedy *Sporobolus* seedlings.
3. Fertilise the pasture for fast pasture establishment.
4. Spot spray or hand chip weedy *Sporobolus* seedlings.

(b) Pressurised wick wiper option

The effective use of a pressurised wick wiper requires a package of three treatments over an 18-month period (Christmas/Easter/Christmas).

First treatment (mid-summer)

1. Make sure there is a 30 cm height difference between weedy *Sporobolus* and other pasture plants by selective grazing of the 'good' pasture.
2. Wick wipe weedy *Sporobolus* grass using glyphosate @ 1 part glyphosate to 2 parts water.
3. Graze using increased stocking rates after wick wiping.

Second treatment (late summer/autumn)

1. Wick wipe weedy *Sporobolus* grass using glyphosate @ 1 part glyphosate to 2 parts water.

Third treatment (next summer)

1. Wick wipe weedy *Sporobolus* grass using glyphosate @ 1 part glyphosate to 2 parts water.

3. Dense infestations on non-arable land

In summer

Either:

- Apply glyphosate through a pressurised wick wiper if terrain and timber allow.

or

- Boom or blanket spray with glyphosate in split applications of 3 L/ha (see Table 2) and replant the pasture using fast-growing pasture grasses at double the standard sowing rates.

or in winter/spring

- Boom or blanket spray with flupropanate at recommended rates. Consult the label for withholding periods.

Further information

Further information is available from your local government office, or from your local Biosecurity Queensland officer: contact details are available through 13 25 23.

Also refer to the *Weedy* Sporobolus *grasses best practice manual* (Queensland Department of Primary Industries, 2001).

Table 1. Best practices for management of weedy *Sporobolus* infested paddocks

Do's	Don'ts
Cattle	
• Manage grazing and stocking rate to maintain good ground cover of pasture.	• Don't overgraze as this will create bare patches that allow weedy *Sporobolus* grass seedlings to emerge.
• Muster only in the afternoon when plant and seed is dry.	• Don't muster on wet days or in muddy soil conditions.
• Restrict cattle to a small paddock or a laneway (on hay) for five days after grazing the weedy *Sporobolus* paddock.	• Don't deliberately overstock weedy *Sporobolus* infested paddocks.
• Muster on foot or on horseback to prevent seed contamination of machinery.	• Avoid creating bare ground from trampling around mineral licks etc.
Machinery	
• Provide a specific hose-down tarmac to clean contaminated machinery.	• Don't slash infested paddocks unless they are part of a wick wiping program.
• Keep roadways, laneways, stock routes and machinery corridors free of weedy *Sporobolus*.	• Don't drive vehicles through infested paddocks.
General hygiene	
• Enclose specimens for identification in a tied fertiliser bag.	• Don't drive around the farm with a suspected weedy *Sporobolus* specimen in the cabin or in the back of the ute.
Pasture management	
• Maintain pasture vigour with maintenance fertiliser program.	• Don't allow soil fertility run-down as this favours weedy *Sporobolus* establishment.
• Band seeding is the 'safest' method to plant legumes into an infested pasture.	• Don't renovate an infested pasture.
• Plant the recommended competitive pasture grasses.	• Don't burn the pasture unless it is part of a wick wiping, pre-cropping pasture replacement strategy.
Hay and pasture seed	
• Determine the origin of hay and ask for a weed hygiene declaration.	• Don't knowingly purchase hay contaminated with weedy *Sporobolus*.
• Feed hay in a yard, feedlot or small holding paddock.	• Don't buy seed without knowing its origin.
• Only purchase seed from a reputable seed merchant.	• Don't buy seed without a Weed Hygiene Declaration.
Control strategies	
• Choose the best control strategy based on the paddock situation and the weedy *Sporobolus* population before starting the job.	• Don't spot spray with glyphosate using a high-pressure gun from the cabin of the ute.
• If spot spraying with glyphosate, operate close enough to step on the plant and spray downwards.	• Don't wave the spray gun around—if the weedy *Sporobolus* is that dense, you should not be spot spraying.
• Low-pressure spray equipment reduces the risk of over spraying.	• Don't over-spray with glyphosate past the point of spray run-off.
• Always spot spray the single 'scout' plants around the perimeter of the infestation first, then work inwards.	

Table 2. Herbicides registered for control of giant rat's tail grass and other weedy *Sporobolus* grasses

(Always read the label thoroughly before using chemical)

Situation	Herbicide	Rate	Comments
Scattered plants/small clumps	Flupropanate[1]	2 ml/L water	**Spot spraying.** Spraying follow-up needed for 'missed' weedy *Sporobolus* grasses and new seedlings. A dye can be added to act as a spray marker. Minimise spray overlap as double application has been known to kill patches of sown pasture.
Scattered plants/small clumps	Glyphosate (360 g/L)	15 ml/L water	**Spot spraying.** Spraying follow-up needed for 'missed' weedy *Sporobolus* grasses and new seedlings. Crystalline ammonium sulphate @ 20 g/L water can be added to improve uptake.
Light and dense infestations	Glyphosate (360 g/L)	1:2 water in wick wiper[2]	**Pressurised wick wiper.** Ensure 30 cm height differential above the other pasture plants. Use increased stocking to ensure this.
Dense infestations	Glyphosate (360 g/L)	two split applications of 3 L/ha	**Blanket spraying.** Split applications a few months apart during summer give good control.
Dense infestations	Flupropanate	2 L/ha	**Boom spraying.** Slow acting (6–12 months). four-month withholding period for stock.

Notes

1. Flupropanate is residual, slow to act, does not adversely affect pasture legumes and most pasture grasses (e.g. Callide Rhodes and paspalum) if used at the recommended application rates. There is a 14-day withholding period for stock after spot spraying. Flupropanate cannot be used where lactating dairy cows and goats are grazing (refer to label).

2. Use of a pressurised wick wiper makes it possible to treat large areas quickly, selectively and most economically. Effective wick wiping entails a package of three treatments over an 18-month period.

Table 3. Giant rat's tail grass and other weedy *Sporobolus* grass control strategies

<table>
<tr><th>Density of weedy Sporobolus grass infestation</th><th colspan="2">Land accessible by tractor</th><th>Land not accessible by tractor</th></tr>
<tr><td>Occasional plants only</td><td colspan="2">Spot spray
Chip out/bag up</td><td>• Spot spray
• Chip out/bag up</td></tr>
<tr><td>Scattered plants/ small clumps</td><td colspan="2">Spot spray (<2000 stools/ha)</td><td>• Spot spray</td></tr>
<tr><td rowspan="2">Dense infestations</td><td>Arable land</td><td>Non-arable land</td><td rowspan="2">• Fence off and restrict stock movement to clean country
• Helicopter spray with glyphosate herbicide and aerially re-sow the pasture</td></tr>
<tr><td>• Fodder pre-crop before pasture replanting
• Direct pasture replacement
• Pressurised wick wiper
• Boom spray—Rhodes grass</td><td>• Pressurised wick wiper
• Direct pasture replacement</td></tr>
</table>

Source: Adapted from the joint DNR/DPI Giant Rat's Tail Grass Project, March 1999.

PR10–4849

Invasive plants and animals

Groundsel bush

Baccharis halimifolia

DECLARED CLASS 2





Description

Groundsel bush is a densely-branched shrub usually no more than 3 m high. Stems are green maturing to brown and woody. Bark of mature plants is deeply fissured. Leaves are dull green, alternate, wedge-shaped, 2.5–5 cm long, 1–2.5 cm broad, with a few lobes in the upper part. Has a deep branching taproot with numerous fibrous laterals in the upper soil.

Male and female flowers are borne on separate plants. Male flowers are pale yellow and open around mid to late March, slightly earlier than the female flowers. Female flowers are white and inconspicuous at the end of branches until seeds are fully developed. Then the plant has a fluffy appearance with tufts of white hair (around late March to early April) that begin to blow the fluffy seeds in the breeze from mid to late April.

Problem

Economic

Groundsel bush rapidly colonises disturbed areas, especially overgrazed pastures. It competes with pasture species for water and nutrients. It spreads rapidly from windbourne seed making clearing groundsel bush from paddocks a very time consuming and expensive task.

Environmental

In native *Melaleuca* wetlands, groundsel bush can form a dense understorey, suppressing growth of native sedges and interfering with the natural ecosystem. Fire management may play an important role in controlling groundsel bush in this environment although no formal research has yet been conducted.

Groundsel bush can become abundant in the vegetation along watercourses and in coastal woodlands and forest areas if not controlled.

Social

The wind dispersed seed can be a nuisance in urban areas where it sticks to insect screens and germinates in home gardens. Urban problems include potential allergies caused by air-borne pollen and the air-borne seed 'fluff'.

Habitat and distribution

Groundsel bush is a native of Florida and coastal areas adjacent to the eastern side of the Gulf of Mexico.

It was introduced into the Brisbane region as an ornamental plant in the year 1900 and has spread along the coastal areas of south-east Queensland (north to Miriam Vale Shire) and down the New South Wales coast. Scattered plants have occurred as far west as the Chinchilla region.

Groundsel bush is a rapid coloniser of cleared, unused land and is particularly suited to moist gullies, salt marsh areas and wetlands. It also does well on high, cleared slopes.

Most germination occurs in the autumn/winter period. Plants normally do not flower in the first year of growth. Two metre tall plants can produce half up to a million seeds.

Seeds from mature plants drift in the breeze like thistle seeds, most falling within a few metres of the parent bush. Wind updraughts can carry seeds many kilometres.

Seeds germinate readily with rainfall, however, if they become buried they can remain dormant for several years.

Seeds are readily transported by wind, running water, vehicles and machinery. Soil disturbance in infested areas usually leads to substantial germination. Further infestation occurs unless the ground is sown to pasture or other competitive ground cover.

Declaration details

Groundsel bush is a declared Class 2 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. A **Class 2** pest is one that has already spread over substantial areas of Queensland, but its impact is so serious that we need to try and **control** it and avoid further spread onto properties that are still free of the pest. By law, all landholders must try to keep their land free of Class 2 pests and it is an offence to keep or sell these pests without a permit. A Local Government may serve a notice upon a landholder requiring control of declared pests.

Prevention

The spread of groundsel bush threatens the sustainability of agriculture and other land uses. Groundsel bush can replace plants and destroy habitat for native wildlife.

The best form of weed control is prevention. Always treat weed infestations when small, do not allow weeds to establish. Weed control is not cheap, but it is cheaper now than next year, or the year after. Proper management planning ensures you get value for each dollar spent.

Look at your weed problem carefully. Can you realistically eradicate it? Or should you contain the weed to stop new infestations developing while you reduce existing ones? What are you required to do by legislation? How does weed control fit into your property management plan? What can you do to restore areas and prevent re-establishment?

The best approach is usually to combine different methods. Control may include chemical, mechanical, fire and biological methods combined with land management changes. The control methods you choose should suit your particular situation.

Management strategies

In grazing situations good pasture management will greatly reduce groundsel bush invasions. Slashing, timely use of fertiliser and management of stocking rates can assist in control by maintaining a healthy pasture. Good pastures provide competition to limit re-invasion of groundsel bushes. Consult the Department of Primary Industries Pasture Agronomists on the best options for your property.

For tall, dense infestations burning can reduce the amount of above-ground material (and even kill the odd plant) making it a lot easier to spray regrowth. Annual burning does not reduce existing plant numbers, but allows grasses to establish more quickly and outcompete groundsel bush seedlings.

Regular slashing over a period of several years will result in a decreased level of infestation. In non-grazing situations re-forestation will eventually assist in control of groundsel bush. However, it is important to ensure that seed production is prevented while trees are establishing.

Mechanical control

Hand pull out small plants. Larger plants dig plants out or cut them off more than 10 cm below ground level.

As groundsel bush is a perennial woody plant with underground growing buds, **slashing or burning will rarely kill plants** and such action will generally result in regrowth occurring. Therefore the regrowth will need to be promptly controlled.

Biological control

Biological control in the process of introducing the natural enemies of the weed to reduce their growth and seed production, or kill them. Biological control agents are specific to that weed, they will not harm native or economically important plants. Biological control agents are released at specific locations from which they will naturally start seeking out more areas of the targeted weed.

Since the biological control program began for Groundsel bush in 1967 over thirty-five different insects have been tested but only six have become permanently established in the field.

The six insects established are:

1. Stem borer *(Megacyllene mellyi).* This beetle is restricted to areas adjacent to salt marshes where the sap flow in the host plant is lower. Newly hatched larvae are drowned by the heavier sap flow in plants growing in non-saline soils. Dense populations of this insect can reduce groundsel bush infestations in suitable habitats.
2. Plume moth *(Oidaematophorus balanotes).* This insect is present in all areas. Damage is caused by larvae tunnelling in the stems and varies from severe dieback to death of individual branches. Populations of the moth appear to be restricted by ant predation on the eggs and young larvae. This in turn restricts plant damage.
3. Gall-fly *(Rhopalomyia californica*). The larvae of this mosquito-like fly feed within development shoots and buds. Initially this insect caused heavy damage when it was released. However, soon after its release it was attacked by a small native wasp that drastically reduced gall numbers. Galls can always be found in low numbers, but occasionally higher numbers are found in patches. Overall damage to the plant is minimal.
4. Groundsel bush leaf beetle *(Trirhabda baccharidis*). This beetle is restricted to similar habitats as the stem borer where the larvae can form suitable cocoons and pupate in the soil. Plants will be totally defoliated in autumn but can recover and are in full leaf next spring. In some years larvae severely damage the buds and flowers.
5. Leaf skeletoniser *(Aristotelia ivae).* The larvae of this moth eat the soft leaf tissue leaving the skeletal woody veins. Though widespread, populations do not become large enough to cause significant damage. It is most commonly found in the spring on new leaves.
6. Leaf miner *(Buccalatrix iveila*). The larvae of this small moth mine in the leaf blades and later skeletonise the leaves in a manner similar to *Aristotelia*. This insect is widespread within the range of groundsel bush and causes minor damage.

Recent research has seen the move away from insect to plant disease biological control agents. Two diseases have been studied in Florida, USA. Experimental field releases of a rust fungus Puccinia evaders from Florida were commenced in 1998 and this pathogen is now established at several sites.

7. Groundsel bush rust (*Puccinia evadens*). This pathogen acts as both a leaf and a stem parasite causing defoliation during summer and winter and stem dieback over summer. The infection process requires a moisture film on the leaf or stem surface. The dry spores are spread by wind.

The presence of these biocontrol agents does not relieve landholders from their responsibility under Queensland legislation to control declared plants.

Herbicide control

Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label.

Table 1 details the herbicides registered for groundsel bush control.

Further information

Further information is available from the vegetation management/weed control/environmental staff at your local government.

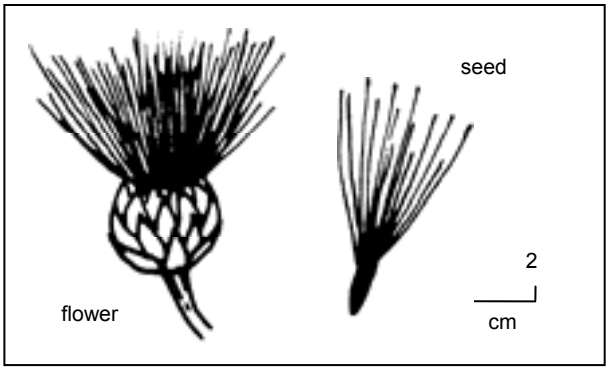


TABLE 1 – HERBICIDES REGISTERED FOR THE CONTROL OF GROUNDSEL BUSH

Situation	Herbicide	Rate	Comments[1,2,3]
pastures; non-agricultural, commercial, industrial land; rights-of-way	2,4-D amine (500 g/L)	3.6-5.5 L/ha 0.4 L/100 L 300 mL/15 L 1.2 L/15 L	air - higher rate for bushes high volume foliar spray cut stump misting
pastures; non-agricultural land	2,4-D acid	10 L/ha 33 mL/ 1 L kero or turps 100 mL/10 L 1 L/10 L	helicopter spraying basal bark or cut stump knapsack foliar spray sprinkler spray - 1 L/100 m^2
pastures	2,4-D ester 800 g/L 600 g/L e.g. AF rubbervine spray	0.25 L/ha 0.37 L/ha 1 L/40 L diesel	Do not spray in "hazardous areas" - consult local DPI office for further information Basal bark or cut stump
Commercial industrial land, pastures, rights-of-way	2,4-D sodium e.g. Tornado DF	0.275 kg/100 L	Spot spray
irrigation channels/banks; non-agricultural commercial industrial land; home gardens, pastures; rights of way; forests	glyphosate[5] - IPA 360 g/L	0.7-1 L/100 L 100 - 150 mL/15 L 1:9 (2x2 mL dose/0.5 m bush height)	handgun - high rate in winter knapsack foliar spray splatter gun foliage
commercial industrial land; pastures; rights-of-way	picloram + 2,4-D 75 g + 300 g e.g. Tordon 75-D®	0.65 L/100 L	spot spray foliage
commercial industrial land; pastures; rights-of-way; forests	picloram + triclopyr (premix) e.g. Grazon DS®* *Cannot be use in hazardous areas without a Department of Primary Industries Permit. Access	0.25-0.35 L/100 L 2.5 L/100 L 30 mL/15 L 1 L/60 L diesel	handgun foliage misting foliage knapsack foliage basal bark or cut stump
recreation commercial industrial land; pastures; rights-of-way; forests	Triclopyr 600g/L e.g. Garlon 600® home garden packs e.g. Defender Chemspray (Garden King)	0.16-0.32 L/100 L water 1 L/120 L diesel 25-50 mL/15 L 50 g/L 120 g/L 0.1-0.2 L/5 L water 0.1 L/0.5 L kerosene	overall spray foliage basal bark or cut stump knapsack foliage overall spray foliage basal bark or cut stump knapsack foliage basal bark or cut stump
grass pasture	dicamba + MCPA (premix) (e.g. Banuel M®)	2.8-4 L/ha 0.19-0.27 L/100 L 60 mL/15 L	 knapsack foliage
pastures; forests; rights-of-way	Clopyralid e.g. Lontrel®	0.33-0.5 L/100 L	handgun foliage
pastures	Tebuthiuron 200g/kg e.g. Graslan®	1 gm/m^2	hand application (use restrictions apply)

Notes:
1. Pasture legumes are susceptible to these herbicides.
2. Cut stump treatments – cut as close to ground as possible and apply mixture immediately (within 15 seconds).
3. Basal bark treatments – paint/spray 25 cm band around base of each stem.
4. Do not apply during summer or winter drought.
5. Glyphosate will kill pasture species.

Fact sheet

DECLARED CLASS 3 PEST PLANT

Lantana

Lantana camara

Currently, lantana covers more than 5 million ha of the east coast from southern New South Wales to Far North Queensland. Small infestations of lantana have also been found in central west Queensland, the Northern Territory, Western Australia, South Australia and Victoria. Efforts are under way to control these.

Lantana is mainly spread by people (as ornamental plants) and fruit-eating birds. It forms dense thickets that smother and kill native vegetation and are impenetrable to animals, people and vehicles.

Research indicates more than 1400 native species are negatively affected by lantana invasion, including many endangered and threatened species. As lantana is a woody shrub that has thin, combustible canes, its presence can also create hotter bushfires.

Declaration details

All lantana species are declared Class 3 plants under the *Land Protection (Pest and Stock Route Management) Act 2002*. Lantana species cannot be sold or distributed and landholders may be required to control these plants if they pose a threat to an environmentally significant area.

Description and general information

Lantana is a heavily branched shrub that can grow in compact clumps, dense thickets or as a climbing vine.

The stems are square in cross section, with small, recurved prickles. Most leaves are about 6 cm long and are covered in fine hairs. They are bright green above, paler beneath and have round-toothed edges. Leaves grow opposite one another along the stem. When crushed the leaves produce a distinctive odour.

Flowers appear throughout most of the year in clustered, compact heads about 2.5 cm in diameter. Flower colours vary from pale cream to yellow, white, pink, orange and red. Lantana produces round, berry-like fruit that turn from glossy green to purplish-black when ripe.

For rural producers, lantana poses problems of stock poisoning and invasion of desirable pasture. An economic impact assessment indicated lantana costs the Queensland grazing sector in excess of $70 million (2005–06 values) per year.

PP34 March 2010

Queensland Government

It is now illegal to sell or distribute any variety of lantana in Queensland. However, garden plantings are still common in many areas and have the potential to cause problems of their own.

Despite being sold and marketed as 'sterile' plants, research indicates some ornamental lantana varieties have the ability to set seed and can spread vegetatively. They also produce some viable pollen and have the potential to cross-pollinate with wild forms, creating new varieties that could naturalise in the environment.

If the number of naturalised varieties increases due to genetic drift from ornamental varieties it will make finding effective biological control agents even more difficult, and potentially extend the climatic tolerances and range of the weed's spread.

Habitat and distribution

Lantana is native to the tropical and subtropical regions of Central and South America.

It is found throughout most coastal and subcoastal areas of eastern Australia, from Far North Queensland to southern New South Wales. It grows in a wide variety of habitats, from exposed dry hillsides to wet, heavily shaded gullies.

Toxicity

Many lantana varieties are poisonous to stock. It is difficult to tell which varieties are toxic so it is better to treat all forms as potentially poisonous. The toxins in lantana include the triterpene acids, lantadene A (rehmannic acid), lantadene B, and their reduced forms.

Most cases of lantana poisoning occur when new stock are introduced into lantana-infested areas. Stock bred on lantana-infested country avoid lantana unless forced to eat it due to lack of other fodder. Young animals introduced to lantana areas are most at risk.

Symptoms of lantana poisoning depend on the quantity and type of lantana consumed and, under some circumstances, the intensity of light to which the animals are exposed.

Early symptoms of depression are noticeable, with head swaying, loss of appetite, constipation and frequent urination. After a day or two the eyes and the skin of the nose and mouth start yellowing with jaundice, and the muzzle becomes dry and warm. The eyes may become inflamed and have a slight discharge. The animal also becomes increasingly sensitive to light. Finally, the muzzle becomes inflamed, moist and very painful ('pink nose'). Areas of skin may peel and slough off. Death commonly occurs 1–4 weeks after symptoms occur. Death from acute poisoning can occur 3–4 days after eating the plant.

If animals show any of the early symptoms, they should be moved to lantana-free areas, kept in the shade and monitored. Veterinary treatment should be sought immediately. Some remedies may include intravenous fluids, treating skin damage with antibiotics, or drenching with an activated charcoal slurry.

Care should be taken when introducing new or young animals into a paddock if lantana is present. Ensure they have enough fodder to stop them eating lantana in quantities sufficient to result in poisoning. During drought, animals should not be placed in lantana-infested areas without alternative food.

Control

Using a mix (integration) of control methods gives the best results. Size, density and geographic location of infestations are important considerations for choosing which control methods to use. A general principle is to commence control programs in areas of light infestations and work towards the denser infestations.

For large lantana infestations, treatment with herbicides by foliar spraying is usually not economically feasible. However, fire, dozing/stick raking, slashing/cutting, aerial helicopter spraying can reduce dense infestations, making follow-up spot treatments with chemicals more economically viable.

Lantana seed banks remain viable for at *least* four years, so follow-up control to kill seedlings before they mature is vital to ensure initial management efforts to control the parent bush are not wasted.

Appropriate fire regimes may become part of a management program to ensure lantana invasiveness is reduced and pasture is maintained.

Removal of lantana within areas of remnant vegetation may require a permit under the *Vegetation Management Act 1999*. Further information should be sought from the Department of Environment and Resource Management before works commence.

Mechanical control

Stick raking or ploughing can be effective in removing standing plants. However, regrowth from stumps and/or increased seedling germination in disturbed soil is common and the site will require follow-up treatment.

Grubbing of small infestations—for example, along fence lines—can be a useful and effective method of removing plants, though this is time consuming.

Repeated slashing can also reduce the vigour of lantana, exhausting its stored resources and reducing its likelihood of re-shooting.

Some locations—for example, very steep inclines or gullies—are not suitable for mechanical control options because of the danger of overturning machinery and soil erosion.

Fire

Regular burning will reduce the capacity of plants to survive; however, initial kill rates are variable.

The effectiveness of this method will depend on the suitability of available fuel loads, fire intensity, temperature, relative humidity, soil moisture and season. Pasture re-establishment can then provide competition to inhibit lantana seed germination.

Fire is not recommended in non–fire tolerant vegetated areas such as rainforest, or wooded or plantation areas.

A typical control program for fire may include:

- exclude stock to establish a pasture fuel load
- burning (may require a permit)
- sow improved pastures—consult your local Biosecurity Queensland officer for advice
- continue to exclude stock until pasture has established and seeded
- burn again in summer before rain and spot spray lantana regrowth when › 0.5 m high and when it is actively growing (see Table 1).

Herbicide control

Herbicide recommendations for lantana are shown in Table 1. Users of herbicides have a legal obligation to read herbicide labels and use only the registered rates. Always use herbicides responsibly; adhere to legislation and safety requirements.

Variation in results can be a result of inconsistent application methods, mix rates or seasonal variation. Red-flowered and pink-edged red-flowered lantana are often considered the most difficult to control because their leaves are often smaller and tougher. However, herbicides can kill these varieties if you carefully follow application procedures.

For single-stemmed lantana, basal bark spraying and cut stump methods also give good results at any time of year (but best when the plant is actively growing). On multi-stemmed varieties, you will obtain best results by carefully applying herbicide to each stem.

When treating actively growing plants less than 2 m high, overall spraying of foliage to the point of run-off is recommended. Splatter gun techniques are also effective and particularly useful in hard-to-access areas. This is best done in autumn—when sap flows draw the poison down into the root stock, but before night temperatures get too cold.

Remove grazing animals from spray areas during and soon after treatment. Stress can cause increased sugar levels in the leaves of lantana plants, making them more palatable.

Landholders and contractors should check if the property is situated in a hazardous area. This prevents the use of some chemicals, as defined in the *Agricultural Chemicals Distribution Control Act 1966*.

Biological control

Since 1914, 31 biological control agents have been introduced into Australia in an attempt to control lantana. Seventeen have established, of which several insect species cause seasonal damage, reducing the vigour and competitiveness of lantana in some areas.

Biosecurity Queensland research programs continue to investigate agents suitable for release in Australia, and test the viability of these agents in an effort to identify more effective biological control agents.

It is important to remember that biological control alone should not be relied upon for managing lantana infestations. Consideration should be given to other available control techniques.

The four most important biological control agents are:

- **sap-sucking bug (*Teleonemia scrupulosa*)**
  Found in dry areas from Cooktown to Wollongong, this small, mottled, bug feeds on the underside of leaves, growing tips and flower buds, causing the leaves to drop early and stopping the plant from flowering.
- **leaf-mining beetle (*Uroplata girardi*)**
  Found in most lantana infestations from Cape Tribulation to Sydney as well as around Darwin, except in very dry or high altitude areas. The adult beetles are dark brown. They shelter in curled leaves and feed on the upper leaf surfaces. Larvae feed in leaves causing blotches to spread across the leaf. This beetle reduces plant vigour and can suppress flowering.
- **leaf-mining beetle (*Octotoma scabripennis*)**
  Found in most lantana infestations from Atherton to Wollongong. Adults of this species feed on the upper leaf surface, while larvae feed and mine the centre of the leaf and cause blotches. This activity reduces plant vigour and can suppress flowering.
- **seed-feeding fly (*Ophiomyia lantanae*)**
  Found from Cape Tribulation to Eden in New South Wales and also around Darwin and Perth. *Ophiomyia* is a small black fly that feeds on flowers and lays eggs on the green fruits. The maggots of the fly eat the seed and make the fruit unattractive to birds, reducing seed spread.

Other agents such as *Aconophora compressa* (a stem-sucking bug) and *Leptobyrsa decora* (a sap-sucking bug) have caused some damage in specific geographic areas.

Note: Landholders are advised not to consume their time collecting established insects for distribution. Due to their own ability to disperse, these insects will be periodically/seasonally present in areas that are climatically suitable for them.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.deedi.qld.gov.au).

Table 1. Herbicides for control of lantana

Method of application: active ingredient (trade name)[a]	Rate	Optimum time[b]	Remarks
Foliar (overall) spray			
Fluroxypyr (Starane® 200)	0.5 L to 1 L/100 L water	December to April	Thorough wetting of plants is required, higher rate should be used for larger plants
Glyphosate (Roundup® 360, Glyphosate 360®)	1 L/100 L water	October to April	Wet plant thoroughly. Glyphosate affects any green plant it comes into contact with. Glyphosate is available in a range of strengths
Picloram + 2,4-D (Tordon® 75-D)	0.65 L/100 L water	February to April	Wet plant thoroughly. Legumes are affected if sprayed
Dichlorprop (Lantana® 600)	0.5 L/100 L water	December to April	Must thoroughly wet all leaves. Please refer to product label for situation details
Picloram + triclopyr + aminopyralid (Grazon Extra®)	0.35 L to 0.5 L/100 L water	February to April	Wet plant thoroughly. Use the higher rate on larger plants. Legumes may be affected if sprayed
2,4-D amine (Amicide® 625)	0.32 L/100 L water	March to May	Red-flowered lantanas are more resistant to 2,4-D. Will kill young legumes
Metsulfuron methyl, (Brush-off®, Brushkiller® 600,Lynx® 600)	10 g/100 L water[b]	March to May	Results variable. Not found effective in tropics. Follow-up sprays are necessary
Metsulfuron methyl + glyphosate (Cutout®)	95 g/100 L water	March to May	Apply to bushes up to 2 m tall. Spray to thoroughly wet all foliage and stems. Spray to penetrate throughout the bush
Metsulfuron methyl + glyphosate (Trounce®)	173 g/100 L water	March to May	Apply when actively growing. Do not apply during periods of stress
Aminopyralid + fluroxypyr (Hotshot®)	0.5 L to 0.7 L/100 L water	October to April	Spray all foliage, including stems, to the point of run-off
(i) Basal bark (ii) Cut stump			
Triclopyr (Garlon 600®)	1 L/60 L diesel	Any time. Best results when actively growing	(i) Apply to lower 40 cm of every stem. Must ensure complete coverage around stem (ii) Cut close to ground level. Immediately apply herbicide
2,4-D ester (AF Rubber Vine Spray®)	2.5 L/100 L diesel	Any time. Best results when actively growing	As above
Picloram + Triclopyr (Access®)	1 L/60 L diesel	Any time. Best results when actively growing	As above
Picloram (Vigilant® Herbicide Gel)	3 mm to 5 mm gel	Any time. Best results when actively growing	(ii) If diameter of stump is › 20 mm, use a minimum of 5 mm gel thickness
Glyphosate (Roundup®, Weedmaster Duo®)	Neat	Any time. Best results when actively growing	Off-label permit
Splatter gun			
Glyphosate (Roundup® 360)	1:9 glyphosate +water	October to April	2 x 2 ml dose per 0.5 m height of lantana
Metsulfuron methyl (Brushkiller® 600, Lynx® 600)	2 g/L water	March to May	As above
Aerial			
Picloram + triclopyr + 2,4-D (Grazon® DS + 2,4-D amine 625 g/L)	1.5 L + 6 L/ha or 10 L/ha (Grazon®)	When plant actively growing	Helicopter only. Minimum of 200 L water per hectare. Follow-up re-spray will be required. Do not burn within six months of treatment
Dichlorprop(Lantana® 600)	6 L to 8 L L/ha	When plant actively growing	As above

a Only some common trade names provided.
b Optimum times are only a guide. Lantana must be actively growing for the herbicide to work.
® = Registered trade name.
Labels often recommend the additional use of a wetting agent or surfactant within the mix. Herbicides types vary in their selectivity against other species and soil residual.

Fact sheets are available from Department of Employment, Economic Development and Innovation (DEEDI) service centres and our Business Information Centre (telephone 13 25 23). Check our website at www.deedi.qld.gov.au ‹file://www.deedi.qld.gov.au› to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should 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 use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DEEDI does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

Prickly pear

Opuntia, Nopalea and Acanthocereus spp.

The introduction and spread of prickly pears into Queensland and New South Wales is one of the greatest environmental invasions of modern times.

Prickly pears were introduced into pastoral districts in the 1840s. By 1900, over 4 million hectares in Queensland and New South Wales was infested by prickly pear. By 1925, the pest had invaded over 24 million hectares. Control costs were prohibitive and the only effective herbicide at the time was hazardous. This resulted in landholders abandoning large tracts of land.

Research for biological control agents commenced in 1912, and in 1914 cochineal insects were released to control one of the minor prickly pear species. Control of this minor prickly pear species by these introduced insects occurred within a few years.

The success of the cochineal insects led to renewed efforts against other types of prickly pear in the 1920s. These efforts resulted in the control of the major pest prickly pear by the moth *Cactoblastis cactorum*; by the mid-1930s, prickly pear was no longer a major problem.

Several prickly pear species have since remained as minor weeds.

PP29 September 2009

Declaration details

Prickly pear (*Opuntia* spp.) is a declared Class 1 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. *O. ficus-indica* is not declared. *O. Stricta, O. aurantiaca, O. monacantha, O. tomentosa* and *O. streptacantha* species are Class 2 declared pest plants and all other species are declared Class 1.

Description and general information

'Prickly pear' is a general term used to describe some plants of the Cactaceae family. The term includes species of *Opuntia, Nopalea* and *Acanthocereus*. All of these plants originate in the Americas. The term 'prickly pear' relates to the fruit that is often spiny and pear-shaped. Plants are normally leafless succulent shrubs. Stems are divided into segments (pads or joints) that are flat and often incorrectly called leaves.

Young shoots have true leaves resembling small fleshy scales that fall off as the shoot matures.

Flowers are large, normally seen during spring and can be yellow, orange, red, pink, purple or white depending on the species. 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.

Life cycle

Prickly pears have several features that enable them to compete and become pests.

Prickly pears are drought resistant because of their succulent nature, their lack of leaves and their thick, tough skins. These features result in plants that use the majority of their internal tissues for water storage and their outer parts to reduce water loss and damage by grazing and browsing animals. They can remain vigorous in hot, dry conditions that cause most other plants to lose vigour or even die. Some species develop underground bulbs that enable the plant to resist fire and mechanical damage.

Prickly pears reproduce both sexually and asexually. Birds and other animals readily eat the many seeded fruits and deposit seeds in their droppings. 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 located on the ground take root and produce shoots. Animals and floods move broken pads long distances. These pads can survive long periods of drought before weather conditions allow them to set roots.

Habitat and distribution

Prickly pears considered pests in Queensland are:

- Common pest pear — *Opuntia stricta* var. *stricta* (= *O. inermis*)
- Spiny pest pear — *Opuntia stricta* var. *dillenii* (= *O. stricta*)
- Tiger pear — *Opuntia aurantiaca*
- Drooping tree pear — *Opuntia vulgaris* (= *O. monacantha*)
- Velvety tree pear — *Opuntia tomentosa*
- Westwood pear — *Opuntia streptacantha*
- Devil's rope pear — *Opuntia imbricata*
- Coral cactus — *Opuntia cylindrica*
- Snake cactus — *Opuntia fulgida* X *O. imbricate*
- Sword pear — *Acanthocereus pentagonus*

Common pest pear (*Opuntia stricta* var. *stricta*)

This bushy, spreading plant grows up to 1.5 m high and forms large clumps. The stems are divided into oval, blue-green spineless pads 20 cm long and 10 cm wide. Areoles are in diagonal lines along the pads 2.5 cm to 5 cm apart and have a cushion of brown wool containing bristles but usually no spines. When spines occur they are stout, yellow and up to 4 cm long.

Common pest pear produces flowers that are 7.5 cm wide, bright lemon yellow and green at the base. The fruit is oval-shaped, has a deep cavity on one end and tapers at the other. Fruit is purple, 6 cm long and 3 cm wide, with carmine-coloured (dark red) seeds and a fleshy pulp.

Common pest pear is found as small to large clumps of varying density. The clumps are usually broken up by the action of *Cactoblastis cactorum*. Common pest pear occurs throughout most of central and southern Queensland and is still spreading westwards. It is often found along beaches and on offshore islands.

Spiny pest pear (*Opuntia stricta* var. *dillenii*)

This succulent shrub grows 1–2 m high. The stems are hairless and bluish-green or dull green. The stems are divided into pads up to 30 cm long, 15 cm wide and 1–2 cm thick. The areoles have tufts of short and finely barbed bristles accompanied by one or two yellow spines between 2 cm and 4 cm long. Small scale-like leaves are found on areoles of immature pads.

Spiny pest pear produces 6–8 cm wide flowers that are lemon yellow with green or pink markings on the back. The fruit is pear-shaped and about 4–6 cm long with a red-purple skin. The areoles located on fruits have fine, barbed bristles. The red flesh of fruits contains rounded seeds that are yellow or pale brown.

While this prickly pear once formed large-scale dense infestations, it is now found as small clumps or as scattered plants. These clumps are usually broken by the action of *Cactoblastis cactorum*. It is found in eastern central Queensland, the Burnett district, the Darling Downs and south-eastern Queensland.

Tiger pear (*Opuntia aurantiaca*)

This succulent low shrub with underground tubers usually grows 30–60 cm high. The stems are divided into very spiny, slightly flattened pads that are 1–30 cm long and 1–5 cm wide. The stems are dark green to purple and red in colour. The areoles have 3–7 brown barbed spines up to 4 cm long surrounded by tufts of short, fine bristles. The pads detach easily and are transported on the skins of animals. Small and scale-like leaves are found on areoles of immature pads.

Tiger pear produces 6 cm wide yellow flowers. The rarely formed fruits are pear-shaped and about 2.5 cm long. When ripe, they are red with purple markings.

Dense tiger pear forms an impenetrable spiny groundcover and is prevalent in southern Queensland but extends into central Queensland.

Drooping tree pear (*Opuntia vulgaris*)

This erect succulent shrub with fibrous roots grows up to 5 m high but is usually 2–3 m high. The branches are divided into glossy light green pads up to 45 cm long, 15 cm wide and 1.5 cm thick. The dark grey trunk grows up to 25 cm in diameter. Drooping tree pear gets its name because the upper segments tend to droop. The areoles on the older pads have 1–5 sharp spines about 5 cm long.

Small, scale-like leaves are found on areoles of very young pads that are quickly shed as the pad grows. Drooping tree pear produces yellow flowers that are 6 cm wide and have red markings on the back. The fruit is pear-shaped and 4–7 cm long with a green skin. The flesh of the fruit is red, pulpy and contains round seeds that are yellow or pale brown. The fruits have areoles with tufts of fine, barbed bristles.

Dense thickets result when drooping tree pear is allowed to grow freely. Small scattered infestations occur in the south-east corner of Queensland and in coastal northern Queensland.

Velvety tree pear (*Opuntia tomentosa*)

This tree-like plant forms a central woody trunk over 40 cm wide and grows up to 5 m high. The stems are divided into oblong pads that are dull green and velvety to touch due to the dense covering of short fine hairs. The pads are 15–35 cm long, 8–12 cm wide and 1.5–2 cm thick.

Young plants have 2–4 white or pale yellow spines located in the areoles with one spine reaching a length of 2.5 cm. The areoles usually become spineless as the plant matures. A more spiny variety does exist and has more than 50 spines in each areole on the trunk.

The flowers are a deep orange. The fruit is egg-shaped, about 5 cm long and 3 cm wide, and dull red. The top of the fruit is saucer-shaped with circular lines that meet in the centre and give the fruit a shrivelled appearance. The fruit produces many seeds within a reddish pulp.

Velvety tree pear is found predominantly throughout the brigalow belt of Queensland and is still extending its range. It is occasionally found as dense shrubs, but more usually as small clumps of trees or as trees scattered over the landscape.

Westwood pear, Cardona (*Opuntia streptacantha*)

Westwood pears are shrub-like or tree-like plants that form clumps by branching from the base. They are usually 2–4 m high. The stems are divided into almost circular dull green pads, 25–30 cm long and 15–20 cm wide. The areoles have white spines that vary in number and size when the plant matures.

Young pads have 2–5 white spines 1–2 cm long, accompanied by two hair-like spines 0.5 cm long in the lower part of the areole. Spines increase in number (up to 20) and size (5 cm long) in areoles along the trunk of the plant.

The flowers are yellow and fruits are barrel-shaped, 6 cm long and 5 cm wide with a flat top. The fruit has a purple skin and a rind that is 1 cm thick. Fruits contain red seeds buried in a dark red (carmine) pulp.

Westwood pear is found in eastern central Queensland as small clumps or as plants scattered over the landscape.

Devil's rope pear (*Opuntia imbricata*)

This open branching shrub grows 1.5–3 m high. The stems are divided into hairless, dull green, cylindrical pads that vary up to 37 cm in length and are 3.5–5 cm thick. The pads have a series of short raised ridges that give them a twined, rope-like appearance. The areoles are found on these ridges and produce 3–11 pale yellow or white spines, with the longest being 2.5 cm long. Papery sheaths cover these spines.

The flowers are a dull, red-purple colour and found at the ends of pads. The yellow fruit resembles a small, 5 cm wide custard apple and has a spineless areole at the top.

Devil's rope pear occurs in Queensland as a small infestation at Gladfield.

Coral cactus (*Opuntia cylindrica*)

Coral cactus grows as a branching shrub 1–1.5 m in high. The stems of coral cactus are divided into green cylinder-like pads that are fist-like and obtuse at their apex. Mature coral cactus pads widen, become distorted and wavy, and resemble a piece of coral. Areoles along the pads have a number of short white spines.

Coral cactus produces small (1–2 mm wide) scarlet flowers. The fruit is yellow-green and 2–5 cm wide.

Coral cactus has been located near Mount Isa, Longreach, Wyandra, Eulo and Hungerford but its potential spread includes all of far western Queensland.

Snake cactus (*Opuntia fulgida* X *O. imbricata*)

This open branching shrub grows 1–2 m high. The stems are divided into hairless, dull green, cylindrical pads that vary up to 20 cm in length and are 3.5–5 cm thick. The pads have a series of short raised ridges that give them a twined rope-like appearance. The areoles are found on the bottom of these ridges and produce 5–10 pale yellow to brown spines, with the longest being 3 cm long.

The flowers are light red to dark rose and commonly 5–7 cm wide. Snake cactus produces fruit that is yellow and 2–5 cm wide.

Snake cactus has been located near Longreach but its potential spread includes all of north-western Queensland.

Sword pear (*Acanthocereus pentagonus*)

This elongated branching shrub grows in clumps up to 4 m high. The stems are erect, up to 1.5 m long, 3–8 cm wide and divided into many joints. Sword pear stems are three-, four- or five-angled and resemble star-picket posts. The areoles are found on the edges of the joints and produce many white spines 1–4 cm long.

The flowers are white, funnel-shaped and 14–20 cm long. The flowers open at night between spring and summer. Sword pear produces bright red sphere-shaped fruits that are 5 cm in diameter. The fruit has a red pulp and black seeds.

Sword pear occurs in the Gogango area west of Rockhampton.

Control

Biological control

Investigations into biological control agents against prickly pears began in 1912. Over 150 insect species were studied throughout the world, with 52 species selected for transport to Queensland. Following intensive host specificity testing, 18 insects and one mite were released in Queensland. Nine insects and the mite remain established in Queensland. These species are:

- *Cactoblastis cactorum*, a stem-boring moth
- *Dactylopius ceylonicus*, a cochineal mealybug
- *Dactylopius opuntiae*, a cochineal mealybug
- *Dactylopius confusus*, a cochineal mealybug
- *Dactylopius tomentosus*, a cochineal mealybug
- *Dactylopius austrinus*, a cochineal mealybug
- *Chelinidea tabulata*, a cell-sucking bug
- *Tucumania tapiacola*, a stem-boring moth
- *Archlagocheirus funestus*, a stem-boring beetle
- *Tetranychus opuntiae*, prickly pear red spider mite.

These biological control agents continue to keep several prickly pears under control. It is important to remember not all the agents attack all prickly pears.

The most successful of these species were the moth *Cactoblastis cactorum* and five cochineal mealybugs—*Dactylopius ceylonicus, D. opuntiae, D. confusus, D. tomentosus* and *D. austrinus*. The other agents are still around but not in sufficient numbers to provide control.

Cactoblastis cactorum (cactoblastis moth)

Larvae of this moth were introduced from Argentina in 1925. Cactoblastis proved to be the most effective agent against the common and spiny pest pears, destroying massive infestations in Australia. Larvae keeps these two pest pears controlled to an acceptable level most of the time, although it is less effective in some coastal and far western areas.

The larvae collectively eat out the contents of the pads leaving empty pad skins and piles of mushy droppings. The orange and black larvae are occasionally observed on the outsides of pads. Cactoblastis also attacks most types of prickly pear but is not effective against them.

Dactylopius spp. (cochineal insects)

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.

Dactylopius ceylonicus (monacantha cochineal, Argentine cochineal)

This South American mealy bug was released in 1914 and 1915 to control drooping tree pear. It destroyed the dense infestations existing at that time. It is specific to drooping tree pear and today remains the only effective biological control agent for drooping tree pear. This insect needs to be distributed manually.

Dactylopius opuntiae (prickly pear cochineal)

This mealy bug was introduced from Mexico and southern United States between 1920 and 1922. It is effective against common pest pear, spiny pest pear, velvety tree pear and Westwood pear and remains the main biological control agent against velvety tree pear and Westwood pear. This insect spreads slowly in nature and can be assisted manually.

Dactylopius confusus (prickly pear cochineal)

This mealy bug was introduced from Florida and released in 1933 against spiny pest pear. It remains effective against spiny pest pear in central Queensland but spreads slowly. This insect can be spread manually.

Dactylopius tomentosus (devil's rope pear cochineal)

This mealy bug was introduced from southern United States in 1925 and 1926. It is effective against devil's rope pear but works slowly.

Dactylopius austrinus (tiger pear cochineal)

This mealy bug was introduced from Argentina in 1932. It is specific to and effective against tiger pear. It rapidly reduces tiger pear populations but dies out in a paddock after the destruction of tiger pear. It needs to be reintroduced after tiger pear regrows.

Chelinidea tabulata (prickly pear bug)

This plant-sucking bug was introduced from Texas in 1921. It was effective against dense common pest pear before *Cactoblastis cactorum* was but is now relatively ineffective. This insect also attacks most other prickly pears. The adult is a pale brown bug up to 20 mm long that leaves characteristic round bleached spots on the surface of the cactus.

Tucumania tapiacola (prickly pear moth-borer)

This moth was introduced from Argentina in 1934 against tiger pear. Its solitary larvae feed internally and eat out tiger pear pads with limited effect. It has been observed attacking common pest pear and harrisia cactus.

Archlagocheirus funestus (tree pear beetle)

This stem-boring beetle was introduced from Mexico in 1935. It was effective against velvety tree pear and Westwood pear but has become rare since the dense stands of these prickly pears have gone.

Tetranychus opuntiae (prickly pear spider mite)

This mite was introduced from southern United States and Mexico in 1922. It was effective against common pest pear but is now rare and difficult to find. It causes distinctive scar tissue formation around areoles.

Distributing biological control agents

Cactoblastis

Cactoblastis can be spread manually by distributing eggs or larvae. Cactoblastis moths lay chains of eggs (eggsticks) on prickly pear pads from January–February and September–November. The eggsticks are distinguished from spines by their curved appearance.

1. Collect the fragile eggsticks carefully.
2. Glue single eggsticks to small pieces of paper using a starch-based adhesive.
3. Pin the egg papers to prickly pear pads. (Eggs take up to one month to hatch.)
4. Collect pads or plants in which larvae are obviously still active.
5. At a release site place all the collected plant material in a small part of the infestation.
6. Subsequent generations of moths will disperse through the infestation.
7. Follow up the biological control with either herbicide or mechanical treatment.

Cochineals

Because several cochineal insects affect some prickly pears and not others, it is essential to know what prickly pear you wish to control.

1. Identify your prickly pear type.
2. Find the same prickly pear type which is being attacked by a cochineal.
3. Collect pads of the prickly pear with the insects.
4. Place affected pads against unaffected prickly pears at the release site.
5. Follow up the biological control with either herbicide or mechanical treatment.

Tiger pear cochineal

Tiger pear cochineal is easy to multiply quickly after collection.

1. Carefully collect a reasonable quantity of unaffected tiger pear in a container (box or bucket).
2. Place a few pieces of cochineal-affected tiger pear into the same container.
3. Cover the container with a cloth and store under cover for a few weeks.
4. Check the cactus occasionally.
5. When most of the tiger pear in the container has cochineal, it is ready to distribute.
6. At the release site place affected pads against unaffected prickly pears.
7. Follow up the biological control with either herbicide or mechanical treatment.

Note: It is best to multiply tiger pear cochineal before release.

Mechanical 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.

Herbicide control

Herbicide options available for the control of prickly pears in Queensland are shown in Table 1.

Landholders and contractors should check if the property is in a hazardous area as defined in the *Agricultural Chemicals Distribution Control Act 1966* prior to spraying.

Further information

Further information is available from your local government office, or from your local primary industries and fisheries biosecurity officer: contact details are available through 13 25 23.

Table 1 Herbicides registered for the control of prickly pears

Herbicide	Situation	Rate	Method	Comments
Triclopyr	Forest—timber production; land—commercial/ industrial, non-agricultural, pastures, rights of way	0.8 L/60 L diesel	Overall spray	For use against common prickly pear, drooping prickly pear, tiger pear
Triclopyr	Forest—timber production; land—commercial/ industrial, non-agriculture, pastures, rights of way	3 L/100 L water	Overall spray	For use against common prickly pear, drooping prickly pear and tiger pear
Picloram + Triclopyr	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	Overall spray	Small plants or regrowth

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