



Annual Plant Assessment

Port of Brisbane

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Summary

RPS has been commissioned by the Port of Brisbane Pty Ltd (PBPL) to participate in an annual weed monitoring program at the Port of Brisbane. The program aim is to undertake a survey of weeds along Lucinda and Port Gate Drains, T1-3 Overflow and the Car Precinct areas at the Port. The monitoring program will specifically target weed species listed by the Australian Quarantine and Inspection Service (AQIS), the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) 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 weed monitoring program is currently conducted annually, during post-summer months (March / April). To date, a total of 21 plant surveys have been conducted along Lucinda Drain, eight along Port Gate Drain and ten along the T1-3 Overflow and Car Precinct areas. This annual report provides the results of the 2012 monitoring program, as well as recommendations with respect to the ongoing management of weeds along Lucinda and Port Gate Drains, T1-3 Overflow and the Car Precinct areas.

Summary of Findings

Lucinda Drain

Appendix C contains a list of flora species recorded at Lucinda Drain for both the 2011 and 2012 surveys. The following points summarise the findings of the recent May 2012 survey:

- 78 plant species were recorded. This consisted of 34 native / planted species and 44 exotic species;
- Out of the 44 exotic species, none were AQIS-listed weed species;
- Broad-leaf Pepper (*Schinus terebinthifolia*), Chinese Elm (*Celtis sinensis*) and Lantana (*Lantana camara*), all declared Class 3 weeds under the LP Act, were recorded during the recent May 2012 survey;
- In the April 2011 survey there was no occurrence of declared weeds. In comparison, Giant Parramatta Grass (*Sporobolus fertilis*), Singapore Daisy (*Sphagneticola trilobata*) and Annual Ragweed (*Ambrosia artemisiifolia*), all declared weeds, were recorded in the 2012 survey;
- Prickly Pear (*Opuntia sp.*) and Groundsel (*Baccharis halimifolia*), which were last recorded along Lucinda Drain in 2010 and 2009 respectively, were recorded in the 2012 survey;
- Rhodes Grass (*Chloris gayana*) was the dominant species on the eastern side of Lucinda Drain. On the western side of the drain, Common Reed (*Phragmites australis*) dominates the unslashed areas and Common Couch (*Cynodon dactylon*) dominates the slashed areas; and
- Exotic species diversity, abundance and coverage have decreased in comparison to the survey results of April 2011.

Port Gate Drain

Appendix C contains a list of flora species recorded at Port Gate Drain for both the 2011 and 2012 surveys. The following points summarise the findings of the recent May 2012 survey:

- 34 plant species were recorded. This consisted of 14 native / planted species and 20 exotic species;
- Out of the 20 exotic species, none were AQIS listed weeds;
- Occurrences of Broad-leaf Pepper, Lantana and Groundsel Bush, all declared Class 3 under the LP Act, were recorded during the recent May 2012 survey;
- Unlike the 2011 survey, Fireweed (*Senecio oleraceus*) was not recorded in the recent 2012 survey;
- Both exotic and native invasive species, particularly Common Reed and Rhodes Grass, dominated the Port Gate Drain; and
- The diversity, abundance and coverage of exotic species present along the drain have decreased since the 2011 survey.

T1-3 Overflow Area

Appendix C contains a list of flora species recorded at the T1-3 Overflow area for both the 2011 and 2012 survey. The following points summarise the findings of the May 2012 survey:

- 42 plant species were recorded. This consisted of nine native species and 33 exotic species;
- Out of the 33 exotic species, none were AQIS listed weeds;
- Fireweed, which is declared under the LP Act was recorded during the May 2012 survey;
- Broad-leaved Peppertree, which was last recorded within T1-3 Overflow area in 2008, was recorded in the 2012 survey;
- Although recorded in the 2011 survey, Chinese Elm was not found at T1-3 Overflow area this year;
- Couch Grass dominated the western landscaped areas of T1-3 Overflow area. The eastern side was dominated by Rhodes Grass and native sedges; and
- Exotic species diversity, abundance and coverage have decreased in comparison to the previous survey results.

Car Precinct Area

Appendix C contains a list of flora species recorded at the Car Precinct Area for both the 2011 and 2012 surveys. The following points summarise the findings of the May 2012 survey:

- 67 plant species were recorded. This consisted of 16 native species and 51 exotic species;
- Of the 51 exotic species, none were AQIS listed weeds;
- Three species listed under the LP Act were recorded during the May 2012 survey - Broad-leaf Pepper, Giant Parramatta Grass and Groundsel;
- Broad-leaf Pepper was recorded in the Car Precinct Area in 2011;
- Giant Parramatta Grass (Class 2) and Groundsel (Class 2) which were last recorded in the Car Precinct area in 2010, were recorded in the 2012 survey; Neither Giant Parramatta Grass nor Groundsel had been recorded in the Car Precinct area since 2010;
- Although recorded during the 2011 survey, LP Act declared Fireweed was not recorded during this year's survey;

- Common Reed dominated the water's edge surrounding the lake, especially on the northern side. On the south-western side, there was an abundance of Morning Glory (*Ipomoea indica*) and Knotweed (*Persicaria decipiens*); and
- Exotic species diversity, abundance and coverage have remained the same when compared to the April 2011 survey.

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. Overall, all maintenance activities are to continue as scheduled and should be extended to include exotic species removal, particularly those declared under the LP Act. Some of the declared species are located on banks, so the method of removal should be sensitive to bank stability (e.g. stem injection or cut and paint).

As previously recommended, all areas within the Lucinda and Port Gate Drain, T1-3 Overflow and Car Precinct areas should be maintained regularly. It is also recommended that more integrated and long-term management of the weed species within the survey area is implemented through continuing to increase the native plant cover.

1.0 Introduction

1.1 Background

RPS has been commissioned by the Port of Brisbane Pty Ltd (PBPL) to undertake an annual weed monitoring program along Lucinda Drain, Port Gate Drain, T1-3 Overflow and Car Precinct Areas at the Port of Brisbane. 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 biannual weed monitoring program since 2001. In 2001, weed surveys were initially conducted along Lucinda Drain, with surveys along Port Gate Drain only 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. To document the weed surveys, RPS has produced detailed weed reports since 2001. Initially, these were presented as two separate documents – one for Lucinda and Port Gate Drains and another for the Car Precinct and T1-3 Overflow Area.

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

This report is the 22nd report that has been prepared for Lucinda Drain and the ninth report for the Port Gate Drain. For the T1-3 Overflow and Car Precinct areas, this is the sixth report to detail the results of the annual weed monitoring program.

1.2 Scope of Works / Objectives

The primary objective of this weed survey is to contribute to a long-term, annual monitoring program at the Port of Brisbane. AQIS listed weed species will be specifically targeted because of their potential to enter the country via containers and other materials shipped and unloaded at the Port of Brisbane. Additionally, the program will monitor other species considered to be exotic or invasive, particularly species declared under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act), those species listed by Brisbane City Council (BCC), and locally occurring weed species (hereafter referred to as exotic species or invasive natives).

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

- Identify species declared or listed by AQIS, LP Act 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 2011 and 2012 survey results; and
- Provide recommendations for 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 adjacent hardstand areas (**Figure 1.1**). This drain discharges through the Lucinda Weir, and experiences tidal influence from the Boat Passage.

Lucinda Drain is a constructed drainage channel comprising of a concrete filled geo-textile sandwich approximately 2.5 km in length. The berms of the channel consist of sand above the geo-textile sandwich. The western bank of the drain (adjacent to Lucinda drain) undergoes regular maintenance involving the spraying of noxious weeds. The eastern bank of the drain has an irregular maintenance program.

Port Gate Drain is located at Port Gate in the south-west section of the Port of Brisbane. The drain provides for stormwater run-off from the adjacent hardstand areas, and partially receives tidal waters from the Boat Passage (**Figure 1.2**). It is separated into two portions by Howard Smith Drive which prevents tidal flow from entering the part of the southern drain. Unlike Lucinda Drain, the top banks 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. Thus, the majority of vegetation is located at the southern end of the drain.

The T1-3 Overflow and Car Precinct areas lie parallel to one another in the south-western portion of Lot 99 on SP238079 (**Figure 1.3**). The Queensland Rail freight line separates the two areas. The T1-3 Overflow area is situated along Port Drive and extends around a large hardstand car parking area. 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 absorb and filter excess stormwater that potentially flows from surrounding hardstand areas. The constructed drain in the northern section consists of a concrete channel, which is designed to pipe stormwater runoff that has entered nearby stormwater drains into the Brisbane River.

The Car Precinct area is directly 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 into the Brisbane River.

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

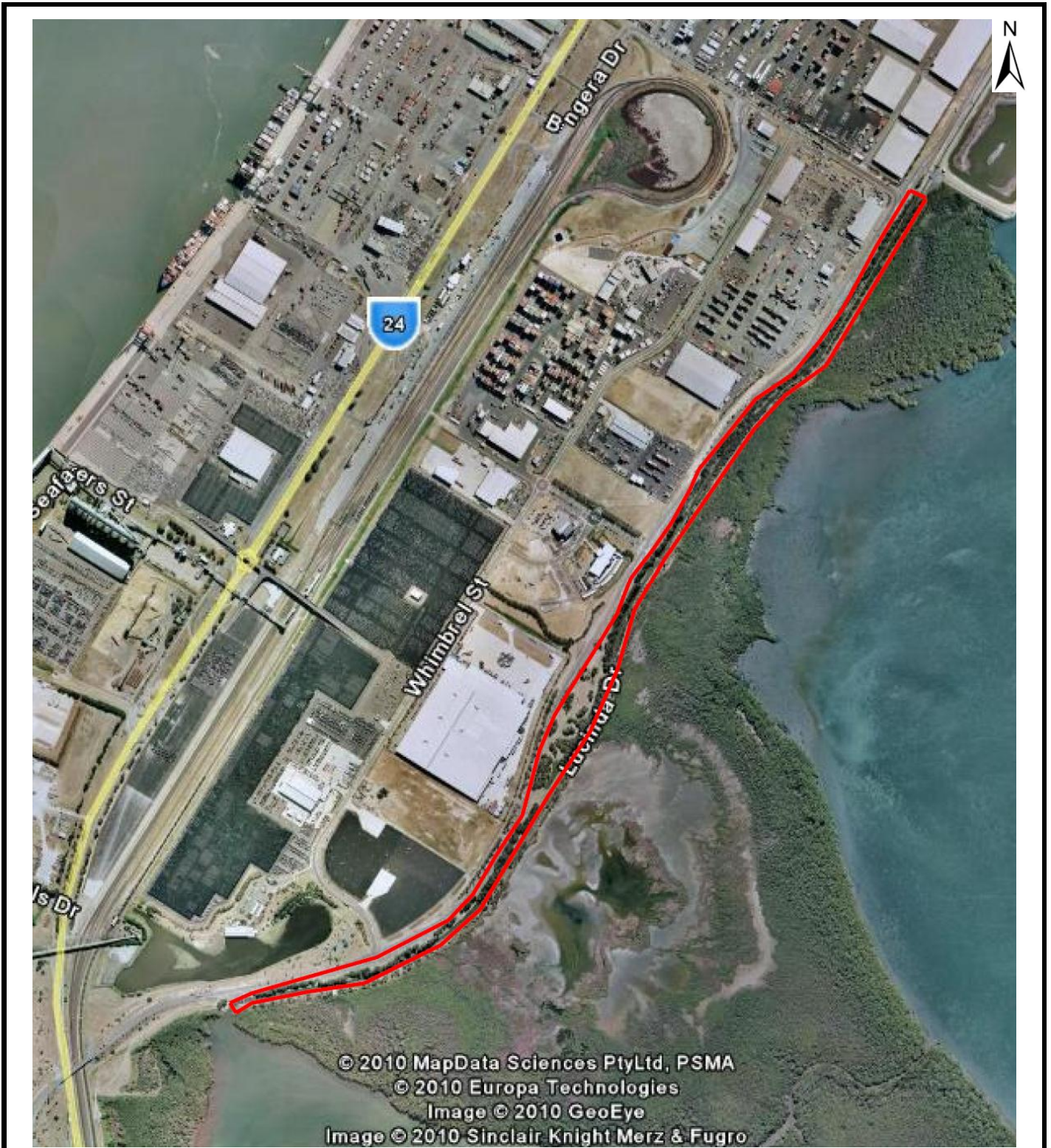


Figure 1.1 – Lucinda Drain Study Area

Client: Port of Brisbane Pty Ltd

Date: 09-04-2010

Compiled by: SS

Project Manager: LF

Scale: Not to scale

Reference: PR112942-1



Source: Google 2008

Legend:
Site Boundary ———

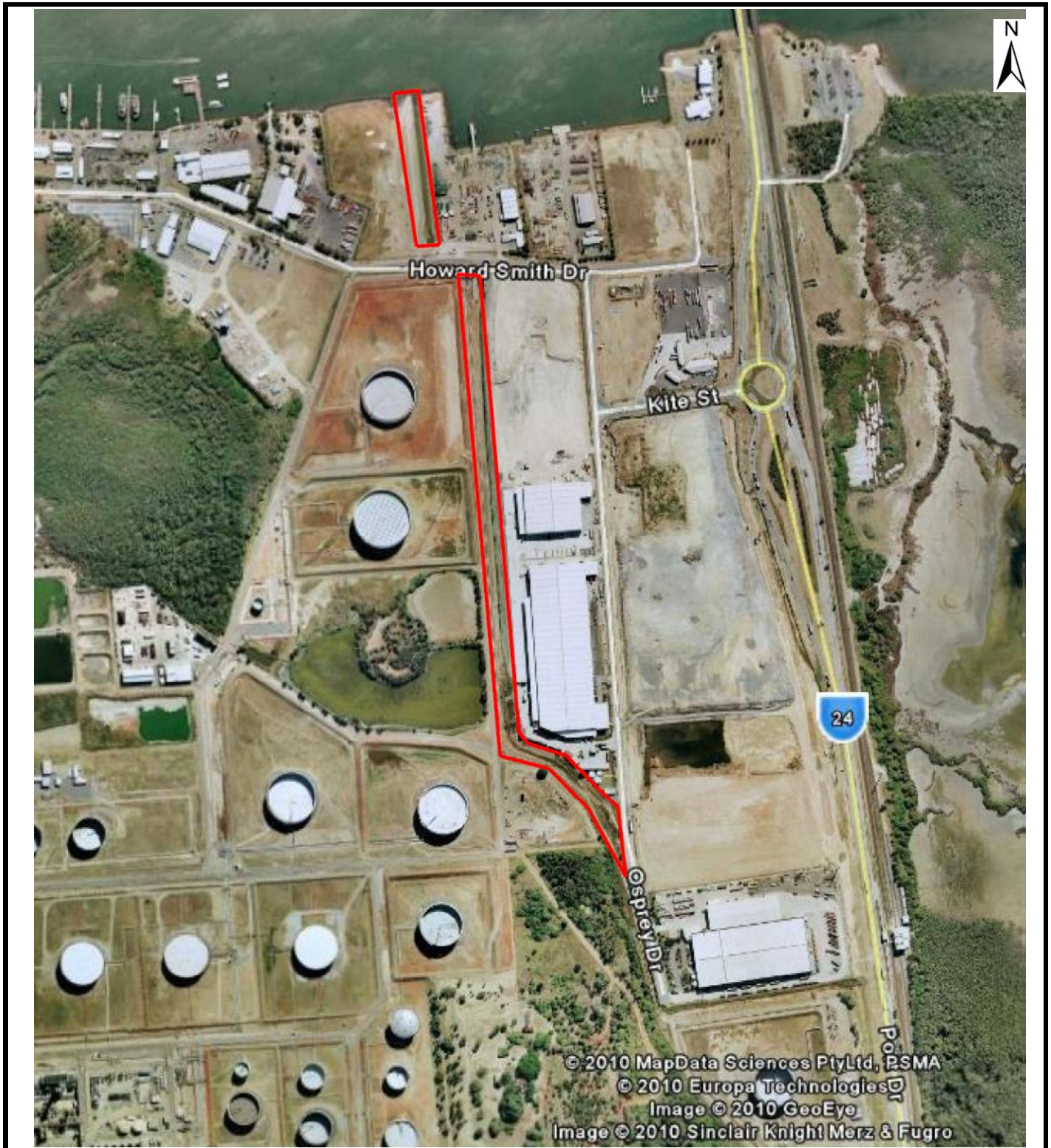


Figure 1.2 – Port Gate Drain Study Area

Client: Port of Brisbane Pty Ltd

Date: 09-04-2010

Compiled by: SS

Project Manager: LF

Scale: Not to scale

Reference: PR112942-1

RPS

Source: Google 2008

Legend:

Site Boundary



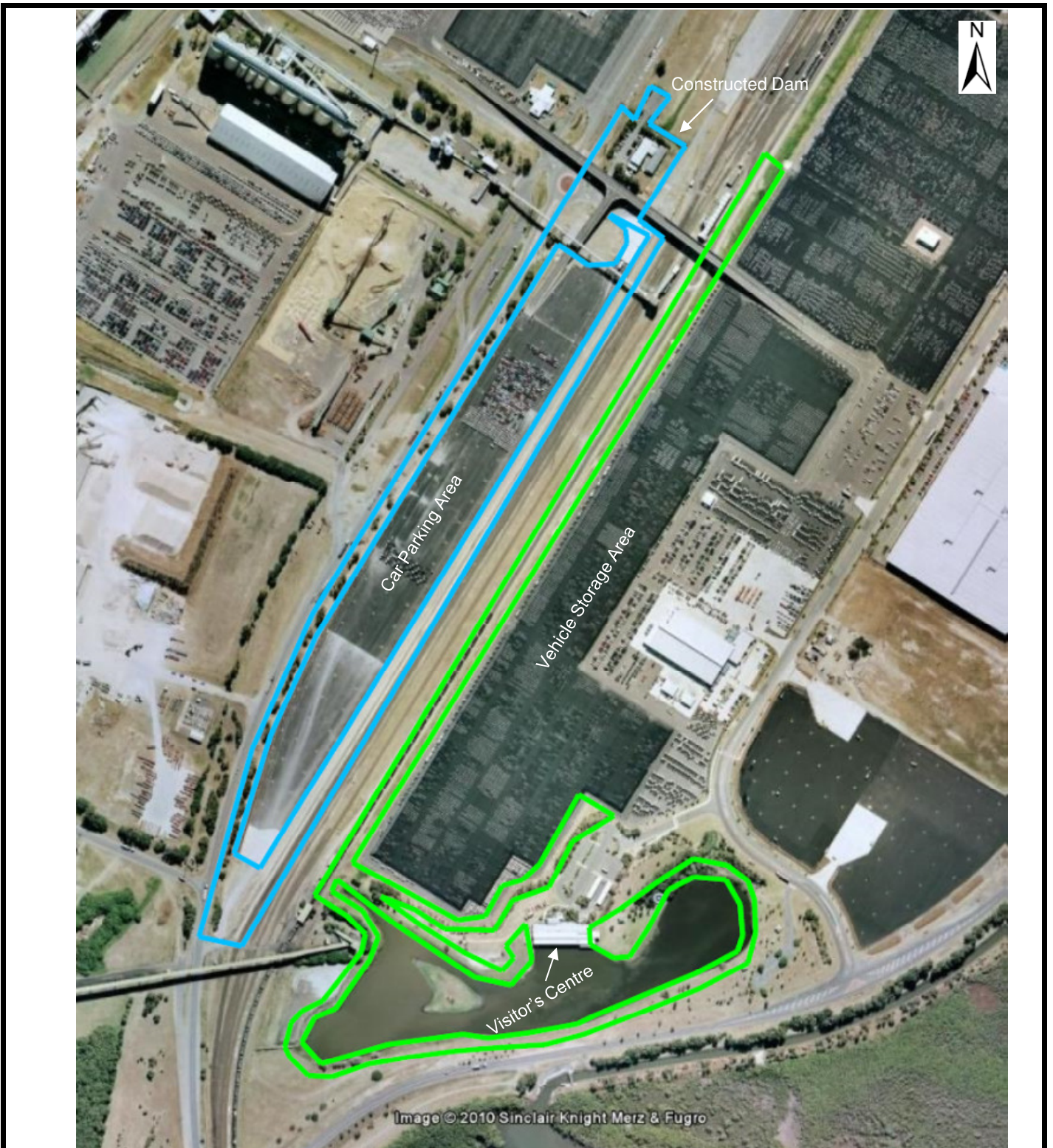


Figure 1.3 – T1-3 Overflow & Car Precinct Study Area

Client: Port of Brisbane Pty Ltd

Date: 09-04-2010	Compiled by: SS	Project Manager: LF	Scale: Not to scale	Reference: PR112942-1
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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 for all four sites, 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**). Early monitoring for T1-3 Overflow and Car Precinct areas was undertaken on a quarterly basis, with a baseline study occurring in the month of February 2008 (**Table 2.1**).

RPS has conducted a total of 22 plant surveys along Lucinda Drain, nine along Port Gate Drain and eleven 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 11th May 2012 and the 21st May 2012.

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	✓	✓	✓	✓
2009	Summer (December)	-	-	✓	✓
	Post-Summer	✓	✓	✓	✓
2010	Post-Winter	✓	✓	✓	✓
	Post-Summer	✓	✓	✓	✓
2011	Post-Summer	✓	✓	✓	✓
2012	Post-Summer	✓	✓	✓	✓

2.2 Target Species

AQIS has identified potential 'weeds of interest' within the Port of Brisbane area, based on potential threats to both natural and agricultural systems (**Appendix A**). Exotic species declared under the LP Act and those species listed by BCC as environmental weeds were 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 survey transects, using the random meander methodology for sampling of all exotic and invasive species encountered. All surveys were 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 2 m 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 2 m wide transect traversing the entire length of the western bank of the Port Gate Drain was established and surveyed successfully. A complete transect along the eastern bank of the 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 possible from the western bank of Port Gate Drain.

The plant survey along the T1-3 Overflow area consisted of a 2 m wide transect, 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 around 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 identification was undertaken using available flora and botanical reference material. Samples of weed species unable to be identified in situ, or with the assistance of field guides, were pressed and sent to the Queensland Herbarium for identification. The presence/absence of any declared AQIS, LP Act, and BCC-listed weeds, and other exotic species that occurred along each transect was recorded (**Appendix B**).

2.4 Survey Limitations

The detectability of plants and the ability to accurately identify plants to species level varies 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, LP Act, or BCC declared / listed plants do not occur within the areas inspected. However, every effort has been made to detect these species in habitat and 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 2011 and 2012 surveys. The following points summarise the findings of the recent May 2012 survey:

- 78 plant species were recorded. This consisted of 34 native / planted species and 44 exotic species;
- Out of the 44 exotic species, none were AQIS-listed weed species;
- Broad-leaf Pepper (*Schinus terebinthifolia*), Chinese Elm (*Celtis sinensis*) and Lantana (*Lantana camara*), all declared Class 3 weeds under the LP Act, were recorded during the recent May 2012 survey;
- In the April 2012 survey, there was no occurrence of declared weeds. In comparison, Giant Parramatta Grass (*Sporobolus fertilis*), Singapore Daisy (*Sphagneticola trilobata*) and Annual Ragweed (*Ambrosia artemisiifolia*), all declared weeds, were recorded in the 2012 survey;
- Prickly Pear (*Opuntia sp.*) and Groundsel (*Baccharis halimifolia*), which were last recorded along Lucinda Drain in 2010 and 2009 respectively, were recorded in the 2012 survey;
- Rhodes Grass (*Chloris gayana*) was the dominant species on the eastern side of Lucinda Drain. On the western side of the drain, Common Reed (*Phragmites australis*) dominates the non-slashed areas and Common Couch (*Cynodon dactylon*) dominates the slashed areas; and
- Exotic species diversity, abundance and coverage have decreased in comparison to the survey results of April 2011.

3.2 Port Gate Drain

Appendix C contains a list of flora species recorded at Port Gate Drain for both the 2011 and 2012 surveys. The following points summarise the findings of the recent May 2012 survey:

- 34 plant species were recorded. This consisted of 14 native / planted species and 20 exotic species;
- Out of the 20 exotic species, none were AQIS listed weeds;
- Occurrences of Broad-leaf Pepper, Lantana and Groundsel Bush, all declared Class 3 under the LP Act, were recorded during the recent May 2012 survey;
- Unlike the 2011 survey, Fireweed (*Senecio oleraceus*) was not recorded in the recent 2012 survey;
- Both exotic and native invasive species, particularly Common Reed and Rhodes Grass, dominated the Port Gate Drain; and
- The diversity, abundance and coverage of exotic species present along the drain have decreased since the 2011 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 2011 and 2012 survey. The following points summarise the findings of the May 2012 survey:

- 42 plant species were recorded. This consisted of nine native species and 33 exotic species;
- Out of the 33 exotic species, none were AQIS listed weeds;
- Fireweed which is declared under the LP Act was recorded during the May 2012 survey;
- Broad-leaved Peppertree, which was last recorded within T1-3 Overflow area in 2008, was recorded in the 2012 survey;
- Although recorded in the 2011 survey, Chinese Elm was not found at T1-3 Overflow area this year;
- Couch Grass dominated the western landscaped areas of T1-3 Overflow area. The eastern side was dominated by Rhodes Grass and native sedges; and
- Exotic species diversity, abundance and coverage have decreased in comparison to the previous survey results.

3.4 Car Precinct Area

Appendix C contains a list of flora species recorded at the Car Precinct Area for both the 2011 and 2012 surveys. The following points summarise the findings of the May 2012 survey:

- 67 plant species were recorded. This consisted of 16 native species and 51 exotic species;
- Of the 51 exotic species, none were AQIS listed weeds;
- Three species listed under the LP Act were recorded during the May 2012 survey - Broad-leaf Pepper, Giant Parramatta Grass and Groundsel;
- Broad-leaf Pepper was recorded in the Car Precinct Area in 2011;
- Giant Parramatta Grass (Class 2) and Groundsel (Class 2) which were last recorded in the Car Precinct area in 2010, were recorded in the 2012 survey;. Neither Giant Parramatta Grass nor Groundsel had been recorded in the Car Precinct area since 2010;
- Although recorded during the 2011 survey, LP Act declared Fireweed was not recorded during this year's survey;
- Common Reed dominated the water's edge surrounding the lake, especially on the northern side. On the south-western side, there was an abundance of Morning Glory (*Ipomoea indica*) and Knotweed (*Persicaria decipiens*); and
- Exotic species diversity, abundance and coverage have remained the same when compared to the April 2011 survey.

4.0 Discussion

4.1 Lucinda Drain

4.1.1 Weed Species Observed

The 22nd weed monitoring survey along Lucinda Drain has identified a total number of 78 flora species, of which 44 are considered exotic. No AQIS listed weed species (**Appendix A**) were recorded during the May 2012 plant survey, however, five LP Act declared species were recorded (**Table 4.1**).

Table 4.1: Class and Abundance of Weed Species (Under LP Act) recorded during Lucinda Drain Survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	<i>Baccharis halimifolia</i>	Groundsel Bush	Low abundance along the eastern bank
	<i>Opuntia sp.</i>	Prickly Pear	Low abundance along the eastern bank
3	<i>Celtis sinensis</i>	Chinese Elm	Low abundance along the eastern bank
	<i>Lantana camara</i>	Lantana	Low abundance along the eastern bank
	<i>Schinus terebinthifolia</i>	Broad-leaf Pepper	Moderate abundance along the eastern bank

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

- **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. There were three individual occurrences of LP Act Class 3 Broad-leaf Pepper, two occurrences of LP Act Class 2 Prickly Pear, one occurrence of LP Act Class 3 Chinese Elm and two occurrences of LP Act Class 3 Lantana identified during this survey. Active treatment to control some of the identified LP Act declared Class 2 and 3 species was evident during the May 2012 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.

In comparison to the previous survey, the overall diversity of LP Act declared species has decreased by two species and the general abundance has decreased. The decrease in weed diversity and abundance may be a result of successful weed management or general survey limitations (i.e. the species is present but not detected).

Under the LP Act, 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 within the survey area are provided in **Appendix E**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LP Act, 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
<i>Agave spp.</i>	Agave	Special Investigation	-
<i>Celtis sinensis</i>	Chinese Elm	Environmental Weed	C
<i>Cenchrus echinatus</i>	Mossman River Grass	Environmental Weed	R
<i>Chloris gayana</i>	Rhodes Grass	Environmental Weed	R
<i>Ficus elastica</i>	Rubber Tree	Environmental Weed	R
<i>Lantana spp.</i>	Lantana (all species)	Environmental Weed	C
<i>Macroptilium atropurpureum</i>	Siratiro	Environmental Weed	R
<i>Megathyrsus maximus var. maximus</i>	Guinea Grass	Environmental Weed	C
<i>Melinis repens</i>	Red Natal Grass	Special Investigation	-
<i>Ricinus communis</i>	Castor Oil Plant	Noxious Weed	C
<i>Schinus terebinthifolius</i>	Broad-leaf Pepper	Environmental Weed	C
<i>Senna pendula var. glabrata</i>	Easter Cassia	Environmental Weed	R
<i>Solanum nigrum</i>	Blackberry Nightshade	Special Investigation	-
<i>Syagrus romanzoffiana</i>	Cocos Palm	Environmental Weed	R

¹Three 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.

²BCC 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 2012 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 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
May 2012 Annual Plant Survey	44

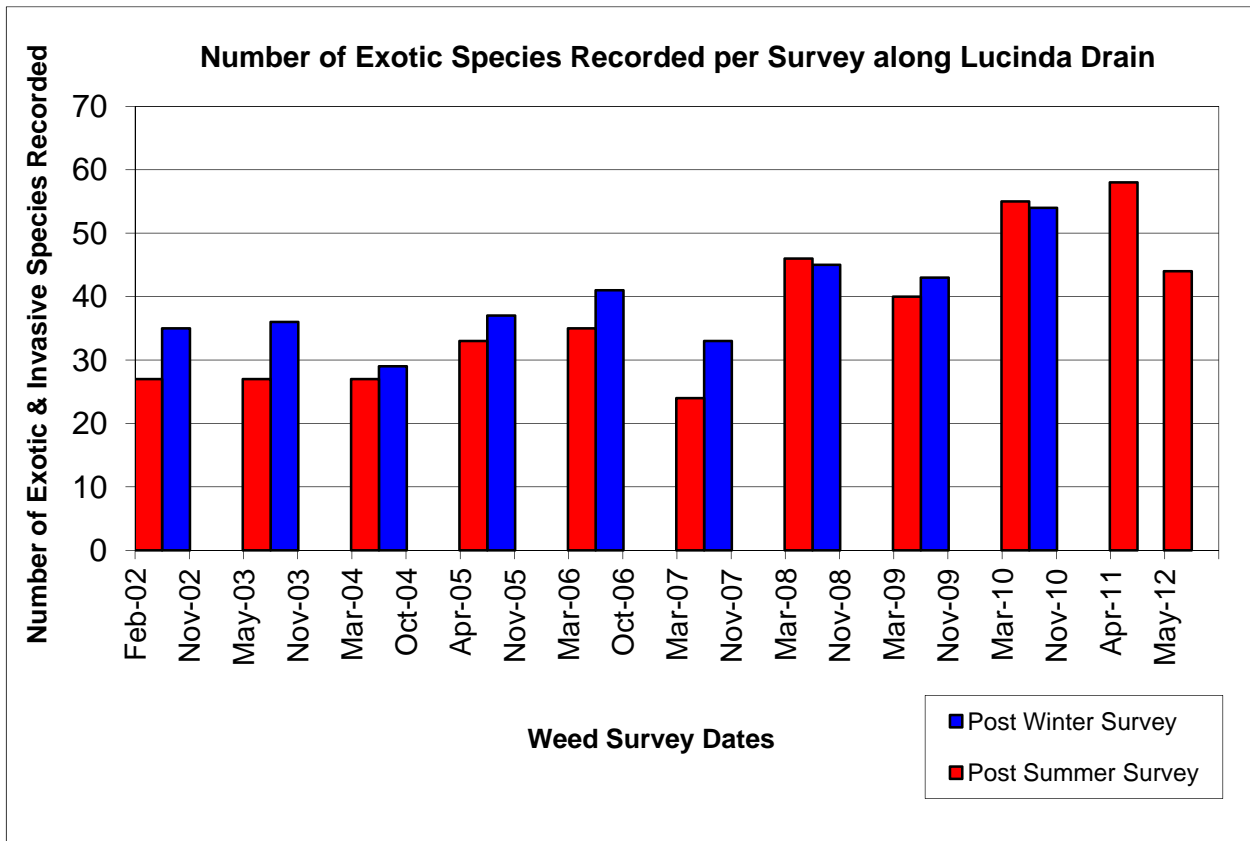


Figure 4.1: Number of Exotic Species Recorded per Survey along Lucinda Drain

Table 4.4 outlines the numbers of exotic species within each family that were recorded this year, as well as previous surveys.

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

Family	Number of Exotic Species Present							
	Annual Survey		Biannual Survey					
	May 2012	April 2011	November 2010	March 2010	November 2009	March 2009	November 2008	March 2008
AGAVACEAE	1	0	1	0	0	0	1	1
AMARANTHACEAE	0	2	1	1	0	1	1	2
ANACARDIACEAE	1	1	1	1	1	1	1	1
ASCLEPIADACEAE	0	1	0	0	0	0	0	0
ASPARAGACEAE	0	0	0	0	0	1	0	1
ASTERACEAE	7	13	14	10	13	9	10	9
BORAGINACEAE	0	0	1	1	0	0	0	0
BRASSICACEAE	0	1	2	1	1	0	1	1
CACTACEAE	1	0	1	1	1	1	1	0
CAESALPINIACEAE	1	0	0	1	0	0	0	0
CAMPANULACEAE	0	0	0	0	0	0	0	0
COMMELINACEAE	1	1	1	2	1	0	0	2
CONVOLVULACEAE	2	2	2	3	1	1	2	1
CUPRESSACEAE	1	-	-	-	-	-	-	-

Family	Number of Exotic Species Present							
	Annual Survey		Biannual Survey					
	May 2012	April 2011	November 2010	March 2010	November 2009	March 2009	November 2008	March 2008
CYPERACEAE	1	0	0	3	0	0	0	1
EUPHORBIACEAE	3	6	3	3	1	1	0	1
FABACEAE	4	12	8	5	6	6	8	6
LAURACEAE	0	0	0	0	0	0	0	0
LORANTHACEAE	0	0	0	0	0	1	0	0
MALVACEAE	1	3	2	2	1	1	1	2
MORACEAE	1	1	1	1	1	0	0	0
ONAGRACEAE	0	1	2	1	2	1	2	1
OXALIDACEAE	0	1	1	1	0	1	1	1
PASSIFLORACEAE	1	1	0	0	0	0	0	0
PLANTAGINACEAE	1	1	1	1	1	0	1	1
POACEAE	11	10	9	8	6	7	7	8
PORTULACACEAE	1	2	2	2	2	2	2	1
PRIMULACEAE	0	0	1	0	1	1	1	1
RUBIACEAE	0	1	1	1	0	0	0	1
SAPINDACEAE	0	1	1	0	0	0	0	0
SOLANACEAE	2	1	1	2	1	2	1	1
ULMACEAE	1	1	0	0	0	0	0	0
VERBENACEAE	2	2	5	4	3	3	4	3

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 has decreased since the last survey (April 2011), which may be attributed to the recent maintenance along the majority of the drain;
- Rainfall in the months preceding the 2012 survey was high, providing optimal conditions for weed growth (**Section 4.5**); and
- The dominant family type recorded this year was different to previous years, with the Poaceae (grasses) providing the greatest number of exotic species. Species from the Poaceae family have pioneer characteristics and are generally the first species to grow back following a disturbance (e.g. maintenance activities). The recent maintenance along the drain would have reduced abundance and coverage as well as removed plant features that allow for species identification.

4.2 Port Gate Drain

The ninth weed monitoring survey along the Port Gate Drain has identified a total number of 34 flora species, of which 20 are considered exotic. No AQIS listed weed species (**Appendix A**) were recorded during the May 2012 plant survey, however, three LP Act declared species were recorded (**Table 4.5**).

Table 4.5: Class and Abundance of Weed Species (Under LP Act) Recorded During Port Gate Drain Survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	<i>Baccharis halimifolia</i>	Groundsel Bush	Low abundance recorded along the eastern drain
3	<i>Lantana camara</i>	Lantana	Low abundance recorded along the eastern drain
	<i>Schinus terebinthifolia</i>	Broad-leaf Pepper	Moderate abundance recorded along the drain

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

- **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 the Port Gate Drain. There were two individual occurrences of LP Act Class 2 Groundsel Bush, five individual occurrences of LP Act Class 3 Broad-leaf Pepper and one individual occurrence of LP Act Class 3 Lantana recorded this year. In comparison to the 2011 survey, the overall abundance and diversity of LP Act declared species has decreased slightly. This may be the result of successful weed management or general survey limitations (i.e. the species is present but not detected).

Under the LP Act, 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 LP Act, 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
<i>Cenchrus echinatus</i>	Mossman River Grass	Environmental Weed	R
<i>Chloris gayana</i>	Rhodes Grass	Environmental Weed	R
<i>Lantana spp.</i>	Lantana (all species)	Environmental Weed	C
<i>Macroptilium atropurpureum</i>	Siratro	Environmental Weed	R
<i>Megathyrsus maximus var. maximus</i>	Guinea Grass	Environmental Weed	C
<i>Melinis repens</i>	Red Natal Grass	Special Investigation	-
<i>Ricinus communis</i>	Castor Oil Plant	Noxious Weed	C
<i>Schinus terebinthifolius</i>	Broad-leaf Pepper	Environmental Weed	C

¹Three 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.

²BCC 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.

4.2.1 Comparison 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
May 2012 Annual Plant Survey	20

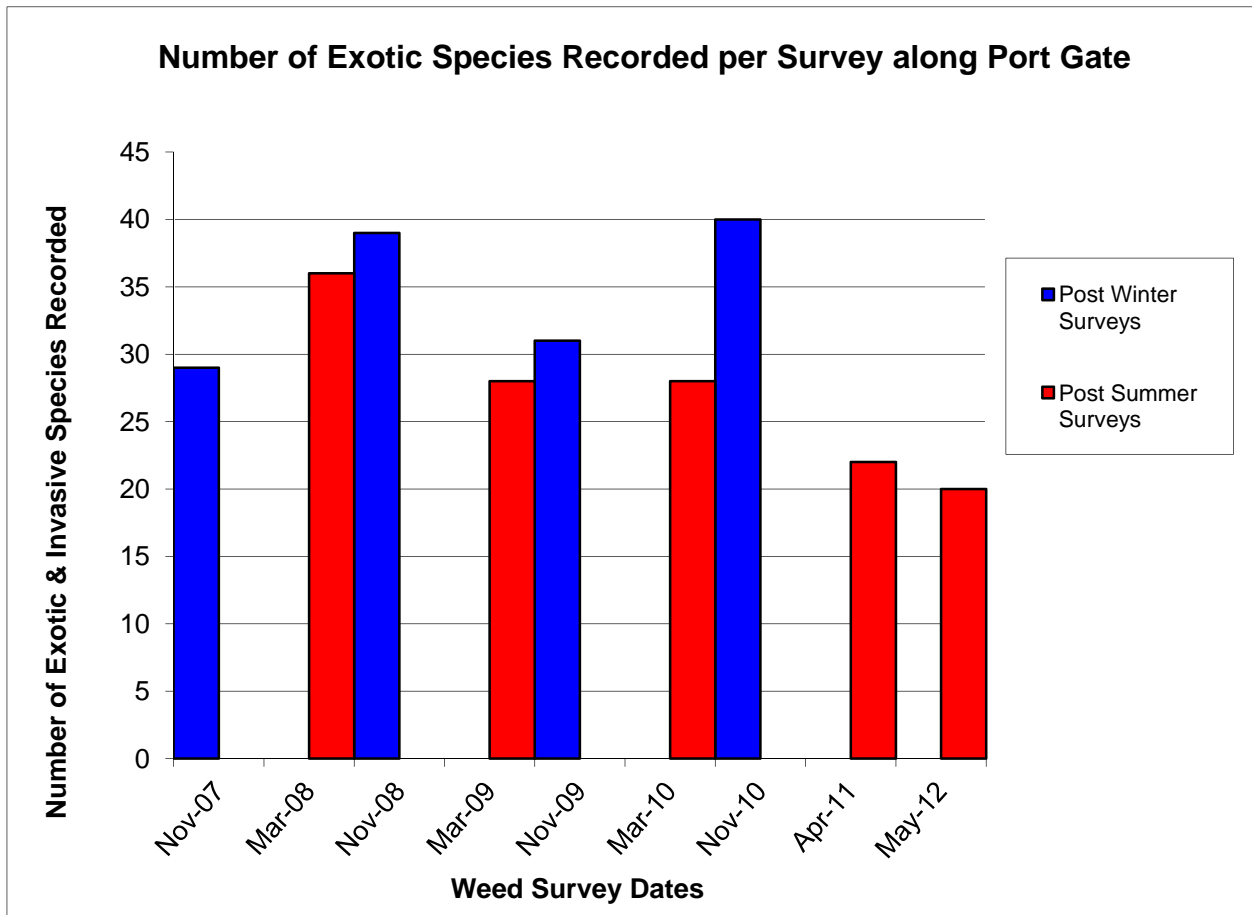


Figure 4.2: Number of Exotic Species Recorded per Survey along Port Gate Drain

Table 4.8 compares the numbers of exotic species within each family that were recorded in the current survey to 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						
	May 2012	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Nov 2008	Mar 2008	Nov 2007
AMARANTHACEAE	0	0	0	0	0	0	0	1	0
ANACARDIACEAE	1	1	1	1	1	1	1	0	0
ASCLEPIADACEAE	1	0	0	0	0	1	1	1	1
ASTERACEAE	4	5	7	7	8	4	9	5	5
BORAGINACEAE	0	0	0	0	0	1	1	0	0
BRASSICACEAE	0	0	2	0	1	1	0	0	0
CONVOLVULACEAE	0	1	1	1	1	1	1	1	1
CYPERACEAE	0	2	3	0	0	0	0	2	0
CUPRESSACEAE	1								
EUPHORBIACEAE	1	0	1	3	1	1	1	2	0
FABACEAE	3	8	10	6	6	8	8	7	6

Family	Number of Exotic Species Present								
	Annual Survey		Biannual Survey						
	May 2012	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Nov 2008	Mar 2008	Nov 2007
LAURACEAE	0	0	1	1	1	0	1	0	0
MYRTACEAE	0	0	0	0	0	0	0	1	1
PAPAVERACEAE	0	0	0	0	0	0	0	0	1
PASSIFLORACEAE	0	0	0	0	0	0	0	1	1
PHYTOLACCACEAE	0	0	0	0	0	0	0	1	1
PLANTAGINACEAE	0	1	1	1	1	1	1	0	0
POACEAE	6	9	14	5	5	7	9	9	7
PORTULACACEAE	1	1	0	1	1	1	1	1	1
PRIMULACEAE	1	0	1	0	1	0	1	0	1
SOLANACEAE	0	0	1	1	2	0	0	1	1
VERBENACEAE	1	1	2	2	2	1	3	2	1

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

- The lowest number of exotic species to date was recorded during the May 2012 survey, plus abundance and coverage have also decreased. This may be attributed to recent maintenance along the drain;
- Rainfall in the months preceding the 2012 survey was high, providing optimal conditions for weed growth (**Section 4.5**); and
- The Poaceae family was again recorded as the dominant family at the Port Gate Drain for the recent 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 eleventh weed monitoring survey along the T1-3 Overflow has identified a total number of 42 flora species, of which 33 are considered exotic species. No AQIS listed species were recorded during the May 2012 survey, however, two LP Act declared species were recorded (**Table 4.9**).

Table 4.9: Class and Abundance of Weed Species (Under LP Act) Recorded During T1-3 Survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	<i>Senecio madagascariensis</i>	Fireweed	Low abundance recorded along the southern drain
3	<i>Schinus terebinthifolia</i>	Broad-leaf Pepper	Moderate abundance recorded along the drain

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

- **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 for the location of declared species within the T1-3 Overflow area. In comparison to the previous survey, the overall abundance, coverage and diversity of LP Act declared species has remained consistent. There was one individual occurrence of LP Act Class 2 Fireweed and five individual occurrences of LP Act Class 3 Broad-leaf recorded this year.

Under the LP Act, landholders are obliged to attempt to remove Class 2 species and are encouraged to remove Class 3 species. If any of these LP Act declared species are found in this area, consideration should be given to remove individuals and control further establishment. Fact sheets for LP Act 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 LP Act, were identified during the current survey and are provided in **Table 4.10**. These species have all been recorded previously in the T1-3 overflow area.

Table 4.10: BCC Listed Exotic Flora Species Recorded During the T1-3 Overflow Survey

Scientific Name	Common Name	BCC Weed Category ¹	BCC Classification ²
<i>Cenchrus echinatus</i>	Mossman River Grass	Environmental Weed	R
<i>Chloris gayana</i>	Rhodes Grass	Environmental Weed	R
<i>Ipomoea indica</i>	Purple Morning Glory	Environmental Weed	C
<i>Ludwigia longifolia</i>	Long-leaf Willow Primrose	Special Investigation	-
<i>Macropitium atropurpureum</i>	Siratro	Environmental Weed	R
<i>Melinis repens</i>	Red Natal Grass	Special Investigation	-
<i>Solanum nigrum</i>	Blackberry Nightshade	Special Investigation	-
<i>Schinus terebinthifolius</i>	Broad-leaf Pepper	Environmental Weed	C

¹Three 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.

²BCC 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

The absence of AQIS listed species is consistent with the findings from previous survey results. An analysis of diversity and abundance of all exotic plants results recorded during the 2012 survey compared to the previous surveys indicates that there is a variation between the number and type of exotic species recorded. **Table 4.11** 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 4.11: 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
May 2012 Annual Plant Survey	33

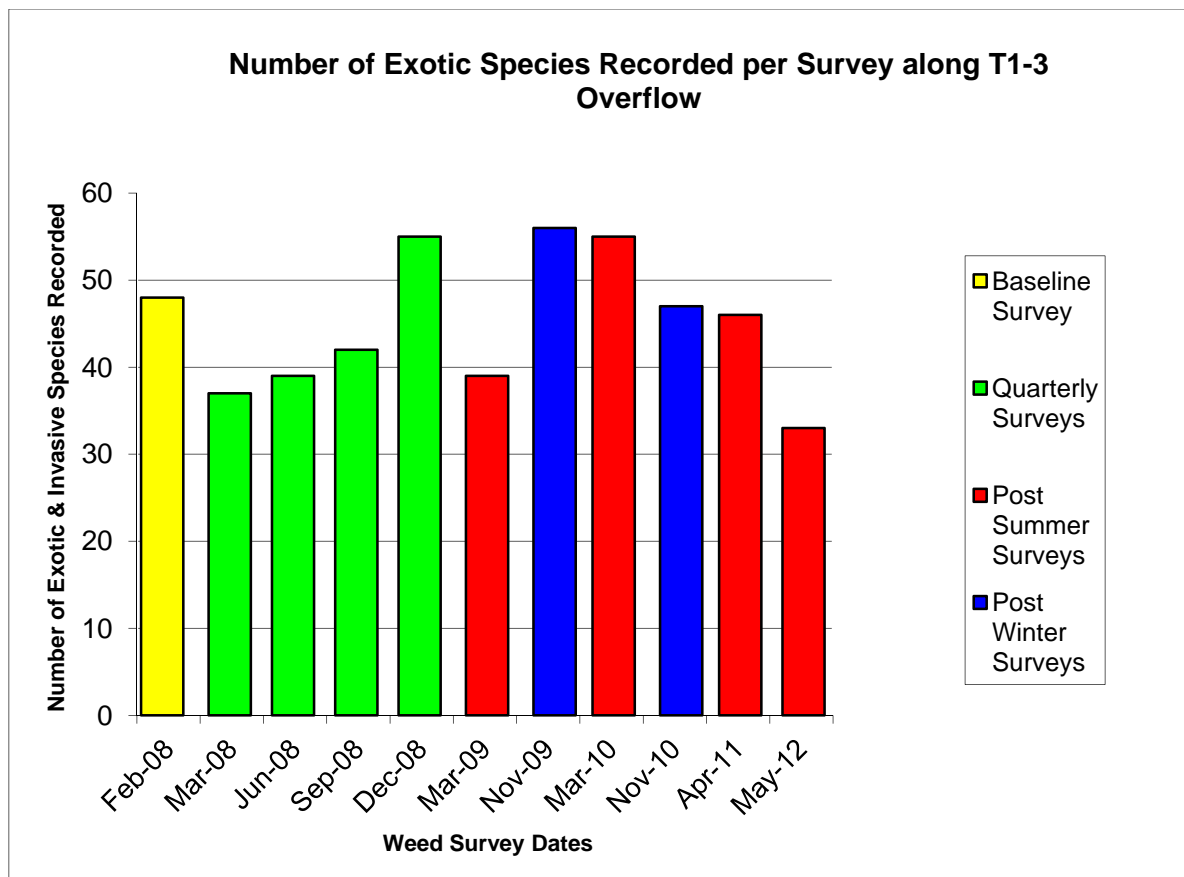


Figure 4.3: Number of Exotic Species Recorded Per Survey Along the T1-3 Overflow Area

Table 4.12 outlines the numbers of exotic species within each family that were recorded in the recent May 2012 survey, in comparison to previous surveys.

Table 4.12: Number of Exotic Species By Family for T1-3 Overflow

Family	Number of Exotic Species										
	Annual Survey		Biannual Survey				Quarterly Surveys				Baseline Survey
	May 2012	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Dec 2008	Sept 2008	Jun 2008	Mar 2008	Feb 2008
AMARANTHACEAE	0	3	2	3	2	1	2	2	2	2	2
ANACARDIACEAE	1	0	0	0	0	0	1	0	0	0	0
APIACEAE	0	1	1	0	0	1	1	1	1	1	1
ASTERACEAE	6	9	10	8	12	6	9	12	9	8	6
BORAGINACEAE	0	0	0	1	0	1	1	0	0	0	1
BRASSICACEAE	0	1	2	2	2	0	2	2	2	1	1
CARYOPHYLLACEAE	0	1	1	0	1	0	1	1	0	0	0
CHENOPODIACEAE	0	0	2	1	1	0	2	0	1	0	1
COMMELINACEAE	0	2	1	1	0	1	0	1	1	1	0
CONVOLVULACEAE	1										
CYPERACEAE	2	0	0	2	4	1	1	1	1	0	3
EUPHORBIACEAE	2	1	2	2	2	2	1	0	1	1	2
FABACEAE	6	10	10	8	10	5	10	5	5	8	11
MALVACEAE	1	1	1	1	1	1	1	1	1	1	2
ONAGRACEAE	2	2	2	3	3	2	3	2	2	1	1
OXALIDACEAE	0	0	0	1	0	0	1	0	0	0	0
PAPAVERACEAE	0	0	0	0	0	0	0	0	0	0	1
PLANTAGINACEAE	0	1	1	1	1	1	1	1	1	1	1
POACEAE	8	5	9	10	8	7	8	8	7	6	8
POLYGONACEAE	0	0	1	1	1	1	1	0	0	0	0
PORTULACACEAE	0	2	1	2	2	1	2	1	1	2	2
PRIMULACEAE	0	1	1	1	1	1	1	1	1	1	1
RUBIACEAE	0	1	1	1	1	1	1	1	1	1	1
SOLANACEAE	2	4	1	1	1	1	1	1	1	1	2
TAMARICACEAE	0	0	1	1	1	1	1	0	0	0	0
VERBENACEAE	1	1	2	2	2	3	2	1	1	1	1

From the data contained within **Table 4.11** and **Table 4.12** as well as **Figure 4.3** the following can be inferred:

- The diversity, abundance and coverage have decreased since the last (April 2011) survey. This could be attributed to the recent maintenance within the T1-3 Overflow area; and
- Rainfall in the months preceding the 2012 survey was high, providing optimal conditions for weed growth (**Section 4.5**).

4.4 Car Precinct Area

4.4.1 Weed Species Observed

The eleventh weed monitoring survey around the Car Precinct area has identified a total number of 67 flora species, of which 51 species are considered exotic. There are no AQIS listed species recorded in the Car Precinct area, however, three LP Act declared species were recorded (**Table 4.13**).

Table 4.13: Class and Abundance of Weed Species (Under LP Act) Recorded During Port Gate Drain Survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	<i>Baccharis halimifolia</i>	Groundsel Bush	Moderate abundance recorded along the southern drain
	<i>Sporobolus fertilis</i>	Giant Parramatta Grass	Low abundance recorded on northern lake shore
3	<i>Schinus terebinthifolia</i>	Broad-leaf Pepper	Moderate abundance recorded along the drain

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

- **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 lists the GPS co-ordinates of the locations of the LP Act declared species identified. In comparison to previous surveys there has been an overall increase in the diversity and abundance of LP Act declared species in the Car Precinct area. There were seven individual occurrences of LP Act Class 2 Groundsel Bush, one individual occurrence of LP Act Class 2 Giant Parramatta Grass and six individual occurrences of LP Act Class 3 Broad-leaf recorded this year.

Under the LP Act, 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 the control of 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 LP Act, were identified during the current survey (**Table 4.14**). These species have been previously recorded in the Car Precinct area.

Table 4.14: BCC Listed Exotic Flora Species Recorded During the Car Precinct Survey

Scientific Name	Common Name	BCC Weed Category ¹	BCC Classification ²
<i>Agave spp.</i>	Agave	Special Investigation	-
<i>Cenchrus echinatus</i>	Mossman River Grass	Environmental Weed	R
<i>Chloris gayana</i>	Rhodes Grass	Environmental Weed	R
<i>Ficus elastica</i>	Rubber Tree	Environmental Weed	R
<i>Ipomoea indica</i>	Morning Glory	Environmental Weed	C
<i>Macroptilium atropurpureum</i>	Siratro	Environmental Weed	R
<i>Megathyrsus maximus var. maximus</i>	Guinea Grass	Environmental Weed	C
<i>Melinis minutiflora</i>	Molasses Grass	Environmental Weed	R
<i>Melinis repens</i>	Red Natal Grass	Special Investigation	-
<i>Neonotonia wightii</i>	Glycine	Environmental Weed	C
<i>Nerium oleander</i>	Oleander	Noxious Weed	R
<i>Ricinus communis</i>	Castor Oil Plant	Noxious Weed	C

Scientific Name	Common Name	BCC Weed Category ¹	BCC Classification ²
<i>Schinus terebinthifolius</i>	Broad-leaf Pepper	Environmental Weed	C
<i>Solanum nigrum</i>	Blackberry Nightshade	Special Investigation	-

¹Three 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.

²BCC 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

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 2012 survey compared to previous surveys, indicates that there is a variation between both exotic species type and the number of exotic species recorded.

Table 4.15 and **Figure 4.4** highlights the number of exotic species identified in the 2011 and previous plant surveys of the Car Precinct area since the commencement of the monitoring program in February 2008.

Table 4.15: Number of Exotic Species Recorded Per Survey around 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
May 2012 Annual Plant Survey	51

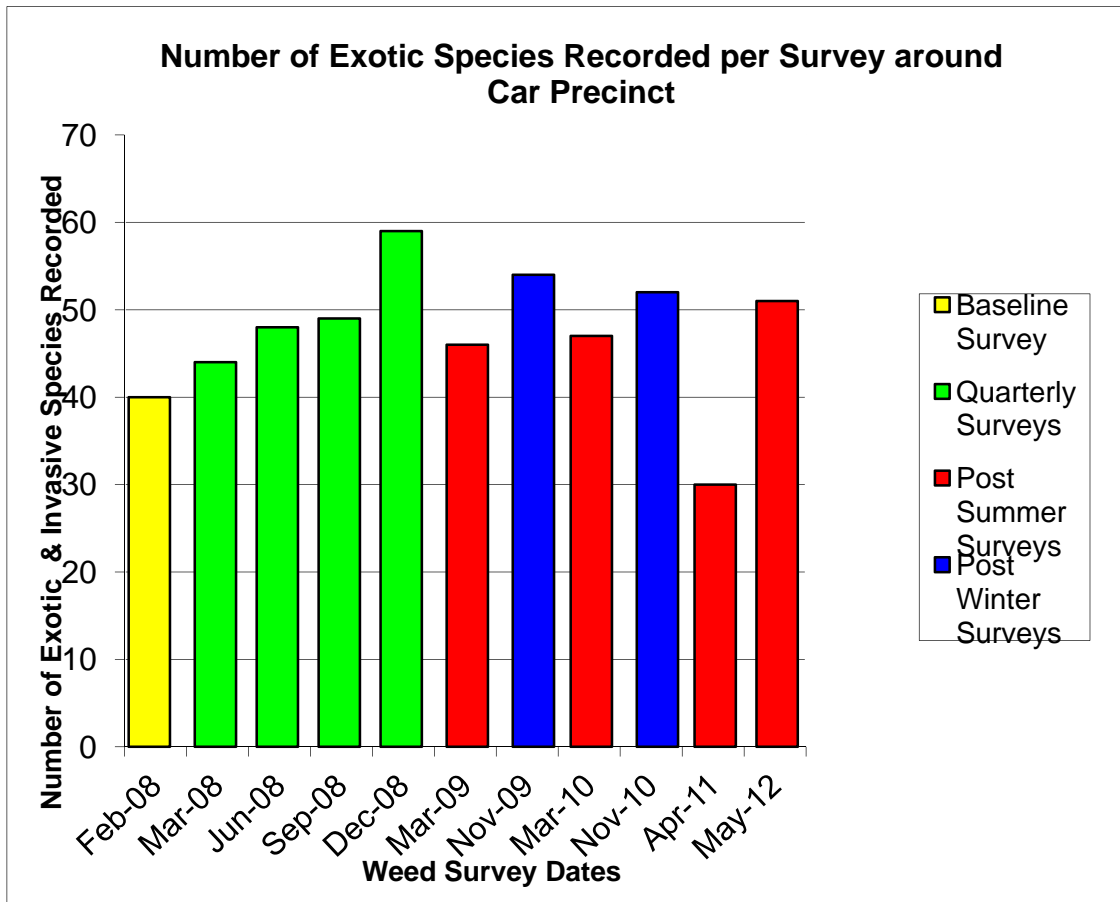


Figure 4.4: Number of Exotic Species Recorded Per Survey around the Car Precinct Area

Table 4.16 outlines the numbers of exotic species within each family that were recorded in the recent May 2012 survey, in comparison to previous surveys.

Table 4.16: Number of Exotic Species by Family for the Car Precinct Area

Family	Number of Exotic Species										
	Annual Survey		Biannual Survey				Quarterly Surveys				Baseline Survey
	May 2012	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Dec 2008	Sept 2008	Jun 2008	Mar 2008	February 2008
AGAVACEAE	1	0	0	0	0	0	0	0	0	0	0
AMARANTHACEAE	2	1	2	2	1	1	2	1	1	2	3
ANACARDIACEAE	1	1	1	1	0	1	1	1	1	1	1
APIACEAE	1	0	0	0	0	0	0	0	0	0	0
APOCYNACEAE	0	0	0	0	0	0	0	0	0	0	1
ASTERACEAE	11	5	10	6	11	9	12	14	13	11	8
BORAGINACEAE	0	1	1	1	0	1	1	1	0	0	0
BRASSICACEAE	0	1	2	1	2	0	2	2	2	0	1
CARYOPHYLLACEAE	0	0	0	0	1	0	0	0	0	0	0
CHENOPODIACEAE	0	0	0	0	0	0	2	0	0	0	0
COMMELINACEAE	1	1	0	1	1	1	1	1	1	1	0
CONVOLVULACEAE	1	1	2	2	2	2	2	2	2	2	2
CYPERACEAE	2	3	4	4	5	4	4	1	2	2	2
EUPHORBIACEAE	2	2	3	3	1	2	1	2	3	0	3
FABACEAE	8	8	11	6	8	6	9	5	5	7	5
MALVACEAE	2	1	1	1	2	1	0	1	1	1	1
MELIACEAE	1	0	0	0	0	0	0	0	0	0	0
MORACEAE	1	0	0	0	0	0	0	0	0	0	0
ONAGRACEAE	1	3	4	3	3	3	3	2	1	1	1
OXALIDACEAE	0	0	0	0	0	0	0	0	0	0	1
PLANTAGINACEAE	0	0	1	1	1	1	1	1	1	1	0
POACEAE	10	7	12	9	9	7	10	10	9	9	6
POLYGONACEAE	1	1	1	1	1	1	1	0	1	1	0
PORTULACACEAE	1	0	1	2	2	2	1	0	1	1	2
PRIMULACEAE	0	0	1	0	1	0	1	1	1	1	1
RUBIACEAE	0	1	0	0	0	0	0	0	0	0	1
SOLANACEAE	2	1	1	1	1	2	2	1	1	1	1
VERBENACEAE	2	0	2	2	2	2	2	3	2	2	0

From the data contained within **Table 4.15** and **Table 4.16**, as well as Figure 4.4, the following can be implied:

- The number of exotic species, as well as abundance and coverage recorded in the recent May 2012 survey has increased in comparison to the April 2011 survey results. The results for the May 2012 survey are the highest results for a post-summer survey in the Car Precinct area. This is most likely attributed to the maintenance schedule and weather conditions preceding the survey;
- Rainfall during the months preceding the May 2012 survey was double the long-term average, which would provide ideal growing conditions (**Section 4.5**). Whilst maintenance activities were undertaken a

few days prior to the weed survey, it was observed that maintenance was restricted to the upper banks of the western drain. Therefore weed growth remained within the drain and around the visitor lake; and

- Unlike the previous survey, the Asteraceae family is the dominant family for the May 2012 survey. The species in this family are resilient and have the ability to grow successfully in disturbed areas.

4.5 Weather Conditions

The following graph (Figure 4.5) shows the rainfall recorded at the Port of Brisbane, as well as the long-term rainfall and temperature averages (taken from the Brisbane Airport). The rainfall records for 2011 were taken from the nearest functioning weather station (Brisbane Aero), as the Port and Fort Lytton weather stations had a number of months of missing data.

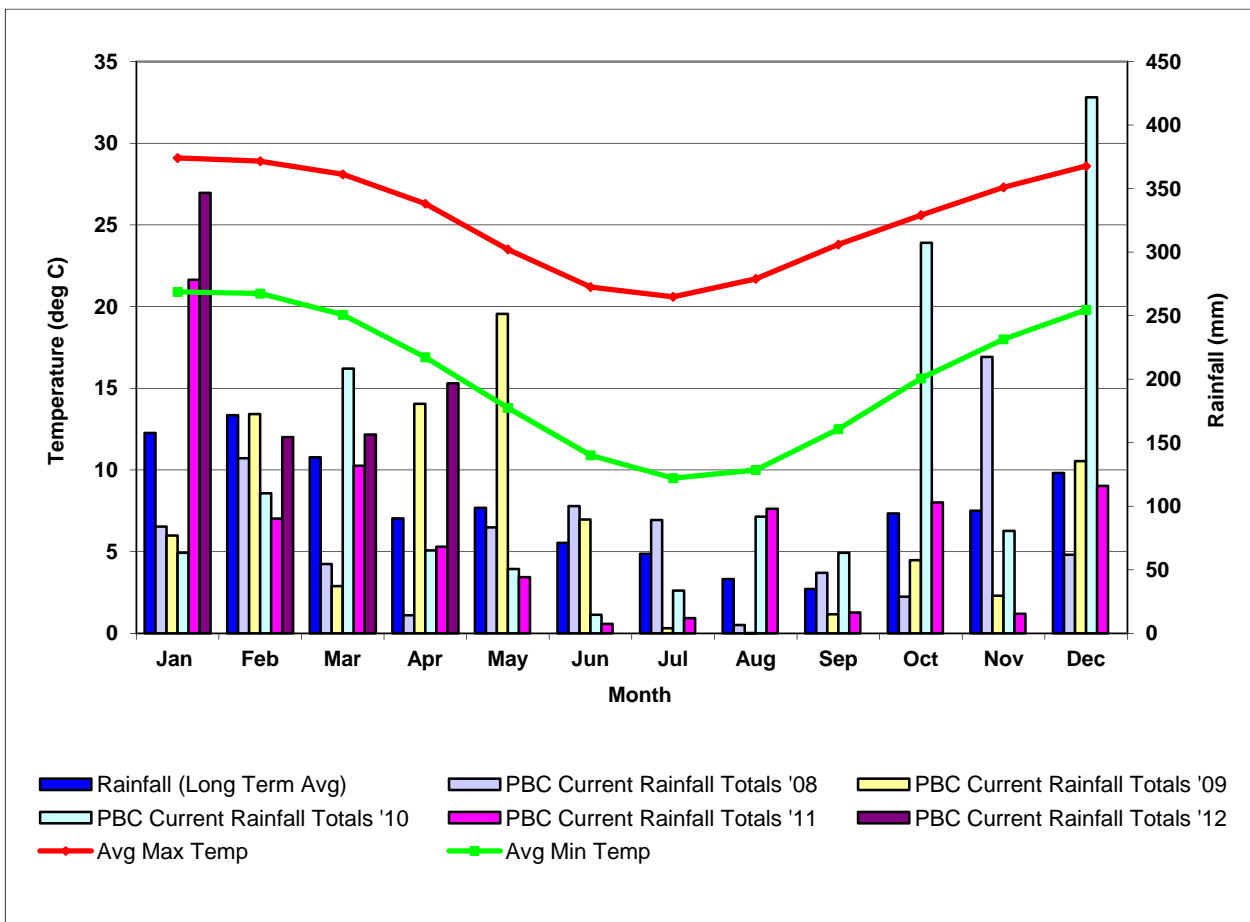


Figure 4.5: Long-term Climatic Averages Compared with the Port of Brisbane Rainfall Data

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 during the last twelve months (April 2011 – May 2012) has been highly variable. In general, the 2011 winter and summer months had extremely low rainfall when compared with the long term average. However, rainfall in 2012 has generally been higher than the long-term average, especially in January and April when it was almost double;
- As the recent survey was conducted in May 2012, the rainfall in the months preceding the survey was double the long-term average rainfall. High rainfall combined with warm temperatures provide conditions that are generally conducive with germination and high plant growth;
- The effect of this on the recent survey results was noted for the Car Precinct area, however was less significant for the Lucinda Drain, Port Gate Drain and T1-3 overflow area due to the maintenance regime across these survey areas.

5.0 Recommendations

Early detection and intervention is the best and most cost-effective way to prevent the establishment of new and emerging weeds, and should be given high priority in weed management programs. The following sections provide recommendations for management of exotic species along the each of the drains. 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:

- Continue existing maintenance programs along the eastern bank and western bank of Lucinda Drain. This should include regular mowing and spot spraying / hand pulling of weeds, as well as other weed removal techniques;
- Ensure attempts are made to remove all declared species listed under the LP Act (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 Department of Agriculture, Fisheries and Forestry (**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 with respect to species from the Casuarinaceae family. These canopy species provide shading and ground cover (from dropped organic material), which aids in decreasing the amount of understorey weed species. 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 that still allows 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 re-establish native species that will ultimately out-compete 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 LP Act (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. Less visible areas (i.e. the eastern side of the T1-3 Overflow and the western side of the Car Precinct Area) should be maintained as often as the other sections of the survey area, where practical and when required;
- Regular maintenance of all survey areas should include mowing and spot spraying / hand pulling of weeds, and other suitable 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 LP Act. Their specific identification and removal should be included as part of routine maintenance and management of the broader area. **Appendix D** lists the GPS locations of LP Act 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
- Programmed monitoring of the diversity and abundance levels of exotic species should be continued 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	<i>Asystasia gangetica</i> subsp. <i>micrantha</i>	Chinese Violet	(Nees) Ensermu	Rubber, coffee, oil-palm plantations, environmental weed.
	<i>Blechum pyramidatum</i>	Browne's Blechum, Green Shrimp Plant, Blackweed	(Lam.) Urb	Pastures, gardens, disturbed areas, rainforest understoreys.
ASTERACEAE	<i>Austro eupatorium inulaefolium</i>	Austro eupatorium	(H.B.K.) King & Robinson	Tea, rubber, rosella and other plantation crops; roadsides; environmental weed in secondary forests.
	<i>Bidens biternata</i>	Yellow Flowered Blackjack, Five Leaved Blackjack	Merr. and Sherff.	Weed of disturbed and cultivated areas, paddy fields.
	<i>Chromolaena odorata</i>	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.
	<i>Hieracium aurantiacum</i>	Orange Hawkweed	CRC Weed Management	Potential threat to alpine country and temperate tablelands of eastern Australia.
	<i>Hieracium pilosella</i>	Mouse-eared Hawkweed	DPIW, TAS	Major weed in pasture and native vegetation and is a serious threat to grasslands and alpine environments.
	<i>Hieracium praelatum</i>	King Devil	-	-
	<i>Mikania micrantha</i>	Mile-a-Minute	H.B.K.	Cocoa, coconut, orchards, rubber, oil palm, sugarcane, vegetables, upland rice, pastures; serious environmental weed
BORAGINACEAE	<i>Cordia curassavica</i>	Black Sage	Roem. and Shult.	Environmental weed.
CAPPARIDACEAE	<i>Cleome ruidosperma</i>	Fringed Spider Flower	Weeds Australia	Environmental weed of crops.
CHENOPODIACEAE	<i>Bassia scoparia</i>	Kochia	CRC Weed Management	Invades crops and pastures.
CYPERACEAE	<i>Cyperus teneristolon</i>	-	CRC Weed Management	Semi-arid agricultural crops and damp grasslands. Environmental weed.
	<i>Schoenoplectus juncooides</i>	-	(Roxb.) Palla	Rice, freshwater and tidal swamps.
	<i>Trianoptiles solitaria</i>	Subterranean Cape Sedge	CRC Weed Management	Grows in seasonally damp areas.
EQUISETACEAE	<i>Equisetum ramosissimum</i>	Horsetail, Scouring Rush	Desf. subsp. debile (Vauch.) Hauke	Rice terraces and bunds, tea plantations.
EUPHORBIACEAE	<i>Croton hirtus</i>	-	L'Herit	Rubber plantations; crops including mung beans, peanuts, soybeans, papaya, vegetables and tobacco.

Family	Botanical Name	Common Name	Author	Comments
FABACEAE	<i>Mucuna pruriens</i>	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.
L R C	<i>Myriophyllum spicatum</i>	urasian atermilfoil	L.	Serious weed of lakes, water-storages, canals and rivers. Affects fish and shellfish production and recreational use of water bodies
HYDROCHARITACEAE	<i>Lagarosiphon major</i>	Lagarosiphon	CRC Weed Management	Aquatic plant that can dominate freshwater lakes, dams and slow-moving streams.
LAMIACEAE	<i>Clerodendrum chinense</i>	Stickbush, Glory Bower, Honolulu Rose, Spanish Jasmine	(Osbeck) Mabb.	Disturbed forests, roadsides, gardens, pastures, plantations, environmental weed.
	<i>Leucas aspera</i>	Pansi-pansi, Feng Chao Cao	(Willd.) Link	Fields, dandy grasslands, wasteland, roadsides, overgrazed areas.
LIMNOCHARITACEAE	<i>Limnocharis flava</i>	Yellow Bur-head, Yellow Sawah Lettuce	(L.) Buchenau	Serious weed of rice and wetlands. Used as a green vegetable.
LYTHRACEAE	<i>Rotala indica</i>	Toothcup	(Willd.) Koehne	Rice fields, river banks, ditches and moist environments
MELASTOMACEAE	<i>Clidemia hirta</i>	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.
	<i>Miconia calvenscens</i>	Miconia, Velvet Tree	DC.	Coastland, disturbed areas, natural forests, planted forests, riparian zones, scrub / shrublands, urban areas, wetlands.
MIMOSACEAE	<i>Acacia karroo</i>	Karoo Thorn	DPIF	Rangelands and open grasslands, suppresses the growth of agricultural productivity.
	<i>Neptunia plena</i>	Water Dead and Awake, Water Sensitive	(L.) Benth.	Wetlands, swamps and marshes, water-logged or flooded areas.
NYCTAGINACEAE	<i>Boerhavia erecta</i>	Erect Tar Vine	L.	Peanuts, sorghum, rice and other annual crops; weed of cultivated land, pastures and coastal environments.
OROBANCHACEAE	<i>Aeginetia indica</i>	Ye Gu	L.	Parasitizes bamboo shoots and crops such as rice, maize and sugarcane. Grassy lowlands, wet, swampy ground, forests, roadsides.
	<i>Orobanche ramosa</i>	Branched Broomrape	DAFF	Serious pest of crops and pastures.

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

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

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
AVICENNIACEAE					
<i>Avicennia marina</i> ⁿ	Grey Mangrove	t	-		
BORAGINACEAE					
<i>Heliotropium amplexicaule</i>	Blue Heliotrope	h	-		
BRASSICACEAE					
<i>Brassica tournefortii</i>	Wild Turnip	s	-		
<i>Lepidium africanum</i>	Common Peppergrass	h	-		
CACTACEAE					
<i>Opuntia</i> sp.	Prickly Pear	s	2		
CAESALPINIACEAE					
<i>Crotalaria paniculata</i>	Poor Mans Gold	h	-		
<i>Senna pendula</i> var <i>glabrifolia</i>	Easter Cassia	s	-		
CARYOPHYLLACEAE					
<i>Cerastium glomeratum</i>	Sticky Mouse-eared Chickweed	h	-		
CASUARINACEAE					
<i>Casuarina equisetifolia</i> *	Coastal Sheoak	t	-		
<i>Allocasuarina littoralis</i> *	Black Sheoak	t	-		
CONVOLVULACEAE					
<i>Cuscuta campestris</i>	Dodder	v	-		
<i>Convolvulus arvensis</i>	European Bindweed	c	-		
<i>Ipomoea</i> sp. (<i>alba</i>)	-	v	-		
<i>Ipomoea cairica</i>	Mile-a-Minute	v	-		
<i>Ipomoea pes-caprae</i> ⁿ	Goats Foot Convolvulus	v	-		
CYPERACEAE					
<i>Cyperus congestus</i>	Clustered Flatsedge	a	-		
<i>Cyperus eragrostis</i>	Umbrella Sedge	a	-		
EUPHORBIACEAE					
<i>Chamaesyce maculata</i>	Caustic Weed	h	-		
<i>Euphorbia hirta</i>	Asthma Plant	h	-		
<i>Euphorbia prostrata</i>	Caustic Creeper	c	-		
<i>Euphorbia</i> sp.	Spurge	h	-		
<i>Macaranga tanarius</i> ⁿ	Macaranga	t	-		
<i>Phyllanthus virgatus</i>	Creeping Phyllanthus	h	-		
FABACEAE					
<i>Crotalaria pallida</i>	Rattle Pod	h	-		

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
<i>Desmodium uncinatum</i>	Silver-leafed Desmodium	v	-		
<i>Macroptilium atropurpureum</i>	Siratro	v	-		
<i>Macroptilium lathyroides</i>	Phasey Bean	s	-		
<i>Medicago polymorpha</i>	Burr Medic	c	-		
<i>Medicago sativa</i>	Lucerne	h	-		
<i>Melilotus indicus</i>	Sweet Melilotus	h	-		
<i>Neonotonia wightii</i>	Glycine	v	-		
<i>Sesbania cannabina</i>	Sesbania Pea	s	-		
<i>Trifolium repens</i>	White Clover	c	-		
LAURACEAE					
<i>Cinnamomum camphora</i>	Camphor Laurel	t	3		
MALVACEAE					
<i>Hibiscus tiliaceus</i> ⁿ	Cotton Tree	t	-		
<i>Modiola caroliniana</i> ⁿ	Red Flower Mallow	c	-		
<i>Sida cornifolia</i>	Flannel Weed	h	-		
<i>Sida rhombifolia</i>	Common Sida	h	-		
MIMOSACEAE					
<i>Acacia aulacocarpa</i> ⁿ	Hickory Wattle	t	-		
MYRTACEAE					
<i>Eucalyptus robusta</i> ⁿ	Swamp Mahogany	t	-		
<i>Lophostemon confertus</i> ⁿ	Brush Box	t	-		
<i>Melaleuca linariifolia</i> ⁿ	Flax-leafed Paperbark	t	-		
<i>Melaleuca quinquenervia</i> ⁿ	Paperbark Teatree	t	-		
ONAGRACEAE					
<i>Oenothera drummondii</i> ⁿ	Beach Evening Primrose	h	-		
<i>Oenothera laciniata</i>	Cut-leaf Evening Primrose	h	-		
OXALIDACEAE					
<i>Oxalis corniculata</i>	Creeping Oxalis	c	-		
PANDANACEAE					
<i>Pandanus tectorius</i> ⁿ	Screw Pine	t	-		
PASSIFLORACEAE					
<i>Passiflora cairica</i>	Stinking Passion Vine	v	-		
<i>Passiflora subpeltata</i>	White Passion Vine	v	-		
PLANTAGINACEAE					
<i>Plantago lanceolata</i>	Lamb's Tongue	h	-		

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
<i>Plantago major</i>	Great Plantain	h	-		
POACEAE					
<i>Brachiaria decumbens</i>	Signal Grass	g	-		
<i>Brachiaria mutica</i>	Para Grass	g	-		
<i>Cenchrus ciliaris</i>	Buffel Grass	g	-		
<i>Cenchrus echinatus</i>	Mossman River Grass	g	-		
<i>Chloris gayana</i>	Rhodes Grass	g	-		
<i>Chloris truncata</i>	Windmill Grass	g	-		
<i>Chloris virgata</i>	Feather-top Rhodes Grass	g	-		
<i>Cynodon dactylon</i>	Couch Grass	g	-		
<i>Dichanthium aristatum</i>	Angleton Grass	g	-		
<i>Digitaria ciliaris</i>	Summer Grass	g	-		
<i>Eleusine indica</i>	Crowsfoot Grass	g	-		
<i>Hemarthria uncinata</i>	Mat Grass	g	-		
<i>Imperata cylindrica</i> ⁿ	Blady Grass	g	-		
<i>Melinis repens</i>	Red Natal Grass	g	-		
<i>Melinis minutiflora</i>	Molasses Grass	g	-		
<i>Poa annua</i>	Winter Grass	g	-		
<i>Panicum effusum</i>	Hairy Panic	g	-		
<i>Megathyrsus maximus var. maximus</i>	Green Panic	g	-		
<i>Paspalum dilatatum</i>	Paspalum	g	-		
<i>Phragmites australis</i> ⁿ	Common reed	g	-		
<i>Sorghum halepense</i> ⁿ	Johnson grass	g	-		
<i>Typha orientalis</i> ⁿ	Typha	a	-		
<i>Urochloa mosambicensis</i>	Sabi Grass	g	-		
PORTULACACEAE					
<i>Portulaca pilosa</i>	Hairy pigweed	c	-		
PRIMULACEAE					
<i>Anagallis arvensis</i>	Scarlet Pimpernel	c	-		
PROTEACEAE					
<i>Banksia integrifolia</i> ⁿ	Coastal Banksia	t	-		
SAPINDACEAE					
<i>Cardiospermum halicacabum</i>	Balloon Vine	v	-		
<i>Cupaniopsis anacardioides</i> ⁿ	Tuckeroo	t	-		
<i>Dodonaea triquetra</i>	Hop Bush	s	-		
SOLANACEAE					

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
<i>Solanum nigrum</i>	Brazilian Nightshade	h	-		
VERBENACEAE					
<i>Lantana camara</i>	Lantana	s	3		
<i>Lantana montevidensis</i>	Creeping Lantana	c	3		
<i>Verbena bonariensis</i>	Purple Top	h	-		
<i>Verbena aristigera</i>	Mayne's Pest	h	-		
<i>Vitex trifolia</i> var <i>trifolia</i> ⁿ	Coastal Vivax	s	-		

* = Native

** = Native Weed

Appendix C

2012 Survey Results

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
AGAVACEAE										
<i>Agave</i> sp.	Agave	-	X	X	-	-	-	-	-	X
AIZOACEAE										
<i>Carpobrotus glaucescens</i> *	Pigface*	-	X	X	X	X	-	-	-	-
<i>Sesuvium portulacastrum</i> *	Sea Purslane*	-	X	X	X	X	-	-	X	X
<i>Tetragonia tetragonioides</i>	New Zealand Spinach	-	X	-	-	-	-	-	-	-
AMARANTHACEAE										
<i>Alternanthera denticulata</i> *	Lesser Joyweed*	-	-	-	-	-	-	-	-	X
<i>Alternanthera pungens</i>	Khaki Weed	-	-	-	-	-	X	-	-	-
<i>Amaranthus quitensis</i>	South American Amaranthus	-	-	-	-	-	-	-	-	-
<i>Amaranthus viridis</i>	Green Amaranths	-	X	-	-	-	X	-	-	X
<i>Gomphrena celosioides</i>	Gomphrena Weed	-	-	-	-	-	X	-	X	X
ANACARDIACEAE										
<i>Schinus terebinthifolius</i>	Broad-leaf Pepper	3	X	X	X	X	-	X	X	X
APIACEAE										
<i>Cyclospermum leptophyllum</i>	Slender Celery	-	-	-	-	-	-	-	-	X
<i>Centella asiatica</i> *	Pennywort*	-	-	-	-	-	X	-	-	-
APOCYNACEAE										
<i>Cynanchum carnosum</i> *	Mangrove Wax Flower Vine*	-	-	X	-	-	-	-	-	-
<i>Parsonsia straminea</i> *	Common Silkpod*	-	-	X	-	X			-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
ASCLEPIADACEAE										
<i>Gomphocarpus physocarpus</i>	Balloon Cotton Bush	-	X	-	-	X	-	-	-	-
ASPARAGACEAE										
<i>Asparagus aethiopicus</i> cv. <i>sprengeri</i>	Asparagus Fern	3	-	-	-	-	-	-	-	-
ASTERACEAE										
<i>Ageratum houstonianum</i>	Blue Billy-Goat Weed	-	-	X	-	-	X	X	-	X
<i>Ambrosia artemisiifolia</i>	Annual Ragweed	2	X	-	-	-	-	-	-	-
<i>Ambrosia tenuifolia</i>	Lacy Ragweed	-	-	-	-	-	-	-	-	-
<i>Aster subulatus</i>	Wild Aster	-	-	-	-	-	-	-	-	X
<i>Baccharis halimifolia</i>	Groundsel Bush	2	-	X	X	X	-	-	-	X
<i>Bidens pilosa</i>	Cobblers Pegs	-	X	X	X	X	X	X	X	X
<i>Calyptocarpus vialis</i>	Creeping Cinderella Weed	-	X	-	-	-	X	-	-	X
<i>Cirsium vulgare</i>	Spear Thistle	-	-	-	-	-	-	-	-	-
<i>Conyza bonariensis</i>	Flax-leaf Fleabane	-	X	X	X	-	X	-	-	-
<i>Conyza pusilla</i>	Canadian Fleabane	-	-	-	-	-	-	-	-	-
<i>Conyza sumatrensis</i>	Tall Fleabane	-	X	X	-	X	-	X	-	X
<i>Cotula australis</i> *	Carrot Weed*	-	-	X	-	-	-	-	-	-
<i>Crassocephalum crepidioides</i>	Thickhead	-	X	-	-	-	X	-	-	X
<i>Gamochaeta calviceps</i>	Cudweed	-	X	-	-	-	-	-	-	-
<i>Emilia sonchifolia</i>	Emilia	-	X	-	X	-	X	-	X	-
<i>Hypochaeris radicata</i>	Flatweed	-	X	-	-	-	X	-	-	-
<i>Nerium oleander</i>	Oleander	-	-	-	-	-	-	-	-	X
<i>Onopordum acanthium</i>	Scotch Thistle	-	-	X	-	X	-	X	-	X

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
<i>Parthenium hysterophorus</i>	Parthenium	2	-	-	-	-	-	-	-	-
<i>Pseudognaphalium luteoalbum</i>	Jersey cudweed	-	-	-	-	-	-	-	X	-
<i>Senecio madagascariensis</i>	Fireweed	2	X	-	X	-	X	X	X	-
<i>Sonchus oleraceus</i>	Rough Sow Thistle	-	X	X	-	-	-	X	-	X
<i>Sphagneticola trilobata</i>	Singapore Daisy	3	-	-	-	-	-	-	-	-
<i>Tagetes minuta</i>	Stinking Roger	-	X	-	-	-	-	-	-	-
<i>Tridax procumbens</i>	Tridax Daisy	-	X	-	-	-	X	-	X	X
<i>Wollastonia biflora</i> *	Yellow Daisy *	-	-	-	-	-	-	-	-	-
AVICENNIACEAE										
<i>Avicennia marina</i> *	Grey Mangrove*	-	X	X	-	X	-	-	-	-
BORAGINACEAE										
<i>Heliotropium amplexicaule</i>	Blue Heliotrope	-	X	-	-	-	-	-	X	-
BRASSICACEAE										
<i>Brassica tournefortii</i>	Wild Turnip	-	X	-	-	-	X	-	-	-
<i>Cakile maritime</i>	-	-	-	-	-	-	-	-	-	-
<i>Lepidium africanum</i>	Common Peppercross	-	X	-	-	-	-	-	X	-
CACTACEAE										
<i>Opuntia</i> sp.	Prickly Pear	2	X	X	-	-	-	-	-	-
CAESALPINIACEAE										
<i>Senna pendula</i> var <i>glabrifolia</i>	Easter Cassia	-	-	X	-	-	-	-	-	-
CAMPANULACEAE										
<i>Wahlenbergia graniticola</i>	Granite Bluebell*	-	-	-	-	-	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
CARYOPHYLLACEAE										
<i>Cerastium glomeratum</i>	Sticky Mouse-eared Chickweed	-	X	-	-	-	X	-	-	-
<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed	-	-	-	-	-	-	-	-	-
CASUARINACEAE										
<i>Casuarina equisetifolia</i> *	Coastal Sheoak*	-	X	X	-	X	-	-	-	-
<i>Casuarina littoralis</i> *	Black Sheoak*	-	X	X	X	-	-	-	-	-
CHENOPODIACEAE										
<i>Atriplex muelleri</i> *	Annual Saltbush*	-	-	-	X	-	-	-	-	-
<i>Dysphania littoralis</i> *	Red Crumbweed*	-	-	-	-	-	-	-	-	-
<i>Chenopodium ambrosioides</i>	Mexican Tea / Kerosene Plant	-	-	-	-	-	-	-	-	-
<i>Chenopodium sp.</i>	-	-	-	-	-	-	-	-	-	-
<i>Einadia sp.</i> *	-	-	-	-	-	-	-	-	-	-
<i>Enchylaena tomentosa</i> *	Ruby Saltbush*	-	-	X	-	-	-	-	-	-
<i>Sarcocornia quinqueflora</i> *	Bead Weed*	-	-	X	X	X	-	-	-	-
<i>Suaeda australis</i> *	Sea Blite*	-	X	-	-	-	-	-	-	-
COMMELINACEAE										
<i>Commelina benghalensis</i>	-	-	-	X	-	-	X	-	-	X
<i>Commelina diffusa</i> (C. <i>cyanea</i>)*	Wandering Jew*	-	X	X	-	-	X	-	X	-
CONVOLVULACEAE										
<i>Convolvulus arvensis</i>	European Bindweed	-	-	X	-	-	-	-	-	-
<i>Cuscuta campestris</i>	Dodder	-	-	-	-	-	-	-	-	-
<i>Ipomoea sp. (alba)</i>	White Ipomoea	-	-	-	-	-	-	-	-	-
<i>Ipomoea cairica</i>	Coastal Morning Glory	-	X	-	X	-	-	-	X	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
<i>Ipomoea indica</i>	Purple Morning Glory	-	-	-	-	-	-	X	-	X
<i>Ipomoea pes-caprae</i> *	Goats Foot Convolvulus *	-	X	-	-	-	-	-	-	-
<i>Ipomoea quamoclit</i>	Cypress Vine	-	-	X	-	-	-	-	-	-
CUPRESSACEAE										
<i>Callitris sp.</i>	Cypress Pine		-	X	-	X				
CYPERACEAE										
<i>Carex appressa</i> *	Tall Sedge*	-	-	-	-	-	-	-	-	-
<i>Cyperus aggregatus</i>	-	-	-	-	-	-	-	-	-	-
<i>Cyperus brevifolius</i>	Mullumbimby Couch	-	-	X	-	-	-	-	-	X
<i>Cyperus congestus</i>	Clustered Flatsedge	-	-	-	-	-	X	-	-	-
<i>Cyperus difformis</i> *	Dirty Dora*	-	-	-	-	-	-	-	-	X
<i>Cyperus eragrostis</i>	Umbrella Sedge	-	-	-	-	-	-	-	X	X
<i>Cyperus haspan</i> *	Flat Sedge*	-	-	-	-	-	-	-	-	X
<i>Cyperus vaginatus</i> *	Stiff Flat Sedge*	-	-	-	-	-	X	-	-	X
<i>Cyperus rotundus</i>	Nut Grass	-	-	-	-	-	X	-	-	-
<i>Cyperus polystachyos</i> *	Bunchy Sedge*	-	-	X	-	-	-	X	-	X
<i>Fimbristylis dichotoma</i> *	Fringe Rush*	-	-	-	X	X	-	-	-	-
<i>Fimbristylis ferruginea</i> *	-	-	-	-	-	X	-	X	-	-
<i>Isolepis cernua</i> *	Nodding Club Rush*	-	-	-	X	-	-	-	X	-
<i>Isolepis nodosa</i> *	Knobby Club Rush*	-	-	-	-	-	-	-	X	-
<i>Isolepis inundata</i> *	Swamp Club Rush*	-	-	-		X				
<i>Schoenoplectus mucronatus</i> *	Scripus Club Rush*	-	-	-	-	-	-	-	-	X
<i>Schoenoplectus validus</i> *	Club Rush*	-	-	-	-	X	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
EUPHORBIACEAE										
<i>Chamaesyce maculata</i>	Caustic Weed	-	X	X	-	-	X	X	-	X
<i>Chamaesyce nutans</i>	Nodding Sponge	-	-	-	-	-	-	X	-	-
<i>Euphorbia hirta</i>	Asthma Plant	-	X	-	-	-	-	-	-	-
<i>Euphorbia prostrata</i>	Caustic Creeper	-	X	X	-	-	-	-	-	-
<i>Euphorbia cyathophora.</i>	Painted Spurge	-	X	-	-	-	-	-	-	-
<i>Macaranga tanarius*</i>	Macaranga*	-	X	X	-	-	-	X	X	X
<i>Phyllanthus tenellus</i>	-	-	X	-	-	-	-	-	-	-
<i>Phyllanthus virgatus*</i>	Creeping Phyllanthus*	-	-	X	-	-	-	-	-	-
<i>Ricinus communis</i>	Castor Oil Plant	-	X	X	-	X	-	-	X	X
FABACEAE										
<i>Canavalia rosea*</i>	Coastal Jack Bean*	-	X	X	-	-	-	-	-	X
<i>Centaurium erythraea</i>	Common Centaury	-	-	-	-	-	-	-	-	-
<i>Crotalaria incana</i>	Woolly Rattle Pod	-	-	-	-	-	-	-	-	-
<i>Crotalaria lanceolata</i>	Lance-leaf Rattle Pod	-	X	-	X	-	X	-	-	X
<i>Crotalaria pallida</i>	Rattle Pod	-	X	-	-	-	-	-	-	-
<i>Cullen tenax*</i>	Emu Foot*	-	X	-	-	-	-	-	X	-
<i>Desmodium uncinatum</i>	Silver Leafed Desmodium	-	-	-	-	-	-	-	-	-
<i>Indigofera hirsute</i>	Hairy Indigo	-	X	-	X	-	-	-	-	-
<i>Indigofera linifolia*</i>	-	-	-	-	-	-	X	-	-	-
<i>Indigofera spicata</i>	Creeping Indigo	-	X	-	X	-	X	-	-	X
<i>Macroptilium atropurpureum</i>	Siratro	-	X	X	X	X	X	X	X	X
<i>Macroptilium lathyroides</i>	Phasey Bean	-	X	X	X	X	X	X	X	X
<i>Medicago lupulina</i>	Black Medic	-	-	-	-	-	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
<i>Medicago polymorpha</i>	Burr Medic	-		-	-	-	X	-	X	X
<i>Medicago sativa</i>	Lucerne	-	-	-	-	-	-	-	-	-
<i>Melilotus albus</i>	Bokhara	-		-	-	-	-	-	-	-
<i>Melilotus indicus</i>	Sweet Melilotus	-		-	-	-	X	-	-	-
<i>Neonotonia wightii</i>	Glycine	-	X	-	X	-	-	-	X	X
<i>Sesbania cannabina</i>	Sesbania Pea	-	X	X	X	X	X	X	X	X
<i>Stylosanthes hamata</i>	Verano Stylo	-	-	X	-	-	-	-	-	-
<i>Stylosanthes humilis</i>	Townsville Stylo	-	X	-	X	-	X	X	X	X
<i>Trifolium repens</i>	Clover	-	X	-	-	-	X	X	-	-
<i>Trifolium fragiferum</i>	Strawberry Clover	-	-	-	-	-	-	X	-	-
<i>Vigna marina</i> *	Yellow Beach Bean*	-	-	X	-	-	-	-	X	-
JUNCACEAE										
<i>Juncus kraussii</i> *	Jointed Rush*	-	-	-	-	-	-	-	X	-
<i>Juncus usitatus</i> *	Pale Reed*	-	-	X	-	-	-	-	-	X
LAURACEAE										
<i>Cinnamomum camphora</i>	Camphor Laurel	3	-	-	-	-	-	-	-	-
<i>Cryptocaria sp.</i> *	Laurel Tree*		-	-	-	-			-	-
LEMNACEAE										
<i>Spirodela punctata</i> *	Duck Weed*	-	-	-	-	-	-	-	-	X
LORANTHACEAE										
<i>Amyema sp.</i> *	A Mistletoe*	-	-	-	-	-	-	-	-	-
LOMANDRACEAE										
<i>Lomandra sp.</i> *	Lomandra*		-	X	-	-		-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
MALVACEAE										
<i>Hibiscus tiliaceus</i> *	Cotton Tree*	-	X	X	-	-	-	-	-	-
<i>Malvastrum americanum</i>	Spike Malvastrum	-	-	-	-	-	-	X	-	X
<i>Sida cornifolia</i>	Flannel Weed	-	X	X	-	-	-	-	-	-
<i>Sida rhombifolia</i>	Common Sida	-	X	-	-	-	X	-	X	X
MELIAECE										
<i>Melia azedarach</i>	White Cedar	-	-	-	-	-	-	-	-	X
MIMOSACEAE										
<i>Acacia disparrima</i> *	Hickory Wattle*	-	-	-	-	-	-	-	-	-
<i>Acacia leiocalyx</i> *	Currahkah*	-	X	X	-	-	-	-	-	-
MORACEAE										
<i>Ficus elastica</i>	Rubber Tree	-	X	X	-	-	-	-	-	X
MYRTACEAE										
<i>Eucalyptus robusta</i> *	Swamp Mahogany*	-	-	X	-	-	-	-	-	-
<i>Leptospermum sp.*</i>	Tea Tree*	-	-	X	-	-	-	-	-	-
<i>Lophostemon confertus</i> *	Brush Box*	-	X	X	-	-	-	-	-	-
<i>Melaleuca linariifolia</i> *	Flax-leafed Paperbark*	-	X	X	-	-	-	-	-	-
<i>Melaleuca quinquenervia</i> *	Broad-leafed Paperbark*	-	X	X	-	-	-	-	-	-
<i>Callistemon viminalis</i> *	Weeping Bottlebrush*	-	X	X	-	-	-	-	-	-
ONAGRACEAE										
<i>Ludwigia longifolia</i>	Longlife Ludwigia	-	-	-	-	-	-	X	-	-
<i>Ludwigia peploides</i> *	Water Primrose*	-	-	-	-	-	-	-	X	X
<i>Ludwigia peruviana</i>	-	-	-	-	-	-	X	-	X	-
<i>Oenothera drummondii</i> subsp. <i>drummondii</i>	Beach Primrose	-	X	-	-	-	-	X	X	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
<i>Oenothera laciniata</i>	Cut-leaf Evening Primrose	-	-	-	-	-	X	-	X	X
OXALIDACEAE										
<i>Oxalis corniculata</i>	Creeping Oxalis	-	X	-	-	-	-	-	-	-
PAPAVERACEAE										
<i>Argemone ochroleuca</i> var. <i>ochroleuca</i>	Mexican Poppy	-	-	-	-	-	-	-	-	-
PANDANACEAE										
<i>Pandanus tectorius</i> *	Screw Pine*	-	X	X	-	-	-	-	-	-
PASSIFLORACEAE										
<i>Passiflora cairica</i>	Stinking Passion Vine	-	-	-	-	-	-	-	-	-
<i>Passiflora suberosa</i>	Corky Passion Vine	-	X	-	-	-	-	-	-	-
<i>Passiflora subpeltata</i>	White Passion Flower	-	-	X	-	-	-	-	-	-
PLANTAGINACEAE										
<i>Plantago lanceolata</i>	Lamb's Tongue	-	X	X	X	-	X	-	-	-
POACEAE										
<i>Andropogon virginicus</i>	Whisky Grass	-	-	-	X	-	-	X	-	-
<i>Brachiaria decumbens</i>	Signal Grass	-	X	X	X	-	-	-	X	-
<i>Brachiaria mutica</i>	Para Grass	-	-	X	-	-	-	-	-	-
<i>Cenchrus ciliaris</i>	Buffel Grass	-	-	-	-	-	-	-	-	-
<i>Cenchrus echinatus</i>	Mossman River Grass	-	X	X	X	X	X	X	X	X
<i>Chloris gayana</i>	Rhodes Grass	-	X	X	X	X	X	X	X	X
<i>Chloris truncata</i> *	Windmill Grass*	-	-	X	-	-	-	X	-	-
<i>Chloris virgata</i>	Feather-top Rhodes Grass	-	-	-	X	-	-	-	-	-
<i>Cymbopogon refractus</i> *	Barbed Wire Grass*	-	-	-	X	-	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
<i>Cynodon dactylon</i>	Couch Grass	-	X	X	X	X	X	X	-	X
<i>Dichanthium aristatum</i>	Angleton Grass	-	-	-	-	-	-	-	-	-
<i>Dichanthium sericeum</i> *	Queensland Blue Grass*	-	X	-	X	-	-	-	-	-
<i>Digitaria ciliaris</i>	Summer Grass	-	-	-	-	-	-	-	-	-
<i>Echinochloa colona</i>	Awnless Barn Grass	-	-	-	-	-	-	-	-	-
<i>Echinochloa telmatophila</i>	Swamp Barnyard Grass	-	-	-	-	-	-	-	-	-
<i>Eleusine indica</i>	Crowsfoot Grass	-	-	-	-	-	-	-	-	-
<i>Eragrostis tenuifolia</i>	Elastic Grass	-	-	-	-	-	X	-	-	-
<i>Eriochloa crebra</i> *	Cup Grass*	-	-	X	X	X	-	-	-	-
<i>Hemarthria uncinata</i> *	Mat Grass*	-	-	-	-	-	-	-	-	-
<i>Imperata cylindrica</i> *	Blady Grass*	-	-	-	-	-	-	-	-	-
<i>Lolium x hybridum</i>	A Ryegrass	-	-	-	-	-	-	-	-	-
<i>Leersia hexandra</i> *	Swamp Club Rush*	-	-	-	-	X	-	-	-	-
<i>Melinis repens</i>	Red Natal Grass	-	X	X	X	X	X	X	X	X
<i>Melinis minutiflora</i>	Molasses Grass	-	-	-	-	-	-	-	-	X
<i>Poa annua</i>	Winter Grass	-	-	-	-	-	-	-	-	-
<i>Panicum effusum</i> *	Hairy Panic*	-	-	-	-	-	-	-	-	-
<i>Panicum larcomianum</i>	-	-	-	-	-	-	-	-	-	-
<i>Panicum miliaceum</i>	Millet Panic	-	-	-	-	-	-	-	-	-
<i>Megathyrsus maximus</i> var. <i>maximus</i>	Guinea Grass	-	X	X	X	X	X	-	X	X
<i>Megathyrsus</i> var. <i>pubiglumis</i>	Green Panic	-	-	-	-	-	-	-	-	-
<i>Paspalum dilatatum</i>	Paspalum	-	-	X	-	X	-	-	-	-
<i>Paspalum distichum</i>	Water Couch	-	-	X	-	-	-	-	-	-
<i>Phragmites australis</i> *	Common Reed*	-	X	X	X	X	-	X	X	X

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
<i>Polypogon monspeliensis</i>	Beard Grass	-	-	-	-	-	-	-	X	X
<i>Setaria sphacelata</i>	South African Pigeon Grass	-	-	X	-	-	-	X	X	X
<i>Sorghum halepense</i>	Johnson Grass	-	X	-	-	-	-	-	-	-
<i>Sporobolus fertilis</i>	Giant Parramatta Grass	2	X	-	-	-	-	-	-	X
<i>Sporobolus virginicus</i> *	Salt Couch*	-	-	X	X	X	-	-	-	-
<i>Urochloa mosambicensis</i>	Sabi Grass	-	-	X	-	-	-	X	-	X
<i>Zoysia macarantha</i> *	Prickly Couch*	-	-	-	-	-	-	-	-	-
POLYGONACEAE										
<i>Persicaria decipiens</i> *	Slender Knotweed*	-	-	-	-	-	-	X	-	X
<i>Persicaria lapathifolia</i> *	Pale Knotweed*	-	-	-	-	-	-	X	-	-
<i>Rumex crispus</i>	Curled Dock	-	-	-	-	-	-	-	-	X
<i>Rumex brownii</i> *	Swamp Dock*	-	-	-	-	-	-	-	X	X
PORTULACACEAE										
<i>Portulaca oleracea</i>	Pigweed	-	X	X	X	X	X	-	-	X
<i>Portulaca pilosa</i>	Hairy Pigweed	-	X	-	-	-	X	-	-	-
PRIMULACEAE										
<i>Anagallis arvensis</i>	Scarlet Pimpernel	-	X	-	X	X	X	-	-	-
PROTEACEAE										
<i>Banksia integrifolia</i> *	Coastal Banksia*	-	X	-	X	-	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
RUBIACEAE										
<i>Richardia brasiliensis</i>	Mexican Clover	-	X	-	-	-	X	-	X	-
SAPINDACEAE										
<i>Cardiospermum halicacabum</i>	Balloon Vine	-	-	-	-	-	-	-	-	-
<i>Cupaniopsis anacardioides</i> *	Tuckeroo*	-	X	-	-	-	-	-	-	-
<i>Dodonaea triquetra</i> *	Hop Bush*	-	-	X	-	-	-	-	-	-
SCROPHULARIACEAE										
<i>Misopates orontium</i>	Lesser Snapdragon	-	-	-	-	-	-	-	-	-
SOLANACEAE										
<i>Datura stramonium</i>	Common Thornapple	-	-	-	-	-	X	-	-	-
<i>Physalis minima</i>	Wild Gooseberry	-	-	-	-	-	X	-	-	X
<i>Solanum chrysotrichum</i>	Devil's Fig	-	-	X	-	-	X	-	-	-
<i>Solanum seaforthianum</i>	Brazilian Nightshade	-	-	-	-	-	-	-	-	-
<i>Solanum dulcamara</i>	Climbing Nightshade	-	-	-	-	-	-	X	-	-
<i>Solanum nigrum</i>	Blackberry Nightshade	-	X	X	-	-	X	X	X	X
TAMARICACEAE										
<i>Tamarix ramosissima</i>	Tamarisk	-	-	-	-	-	X	-	-	-
TYPHACEAE										
<i>Typha orientalis</i> *	Cumbungi / Typha*	-	-	X	X	-	X	X	X	X

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT	
			2011	2012	2011	2012	2011	2012	2011	2012
ULMACEAE										
<i>Celtis sinensis</i>	Chinese Elm	3	X	X	-	-	X	-	-	-
VERBENACEAE										
<i>Lantana camara</i>	Lantana	3	X	X	X	X	-	-	-	-
<i>Lantana montevidensis</i>	Creeping Lantana	3	-	-	-	-	-	-	-	-
<i>Verbena bonariensis</i>	Purple Top	-	X	X	-	-	X	X	-	X
<i>Verbena aristigera</i>	Mayne's Pest	-	-	-	-	-	-	-	-	X
<i>Vitex trifolia</i> var. <i>trifolia</i> *	Coastal Vitex*	-	-	X	-	-	-	-	-	-

Note: * designates indigenous species, LP Act 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	
		2011	2012	2011	2012	2011	2012	2011	2012
LP Act CLASS 1									
No species recorded	-	-	-	-	-	-	-	-	-
LP Act CLASS 2									
<i>Ambrosia artemisiifolia</i>	Annual Ragweed	27.3769, 153.1826	-	-	-	-	-	-	-
<i>Baccharis halimifolia</i>	Groundsel Bush	-	27.3800, 153.1804	27.4087, 153.1617 27.4089, 153.1617 27.4092, 153.1617 27.4096, 153.1618	27.4090, 153.1617 27.4089, 153.1619	-	-	-	27.3907, 153.1657 27.3913, 153.1686 27.3910, 153.1688 27.3903, 153.1695 27.3910, 153.1700 27.3918, 153.1653 27.3915, 153.1655
<i>Opuntia</i> sp.	Prickly Pear	-	27.3798, 153.1741 27.3885, 153.1750	-	-	-	-	-	-

Botanical Name	Common Name	Lucinda Drain		Port Gate		T1-3		Car Precinct	
		2011	2012	2011	2012	2011	2012	2011	2012
<i>Senecio madagascariensis</i>	Fireweed	-	-	27.4046, 153.1614	-	27.3872, 153.1658 27.3874, 153.1657 27.3875, 153.1656 27.3879, 153.1653 27.3882, 153.1652	27.3845, 153.1676 27.3887, 153.1647	-27.3917, 153.1687	-
<i>Sporobolus fertilis</i>	Giant Parramatta Grass	27.3819, 153.1787	-	-	-	-	-	-	27.3910, 153.1689
LP Act CLASS 3									
<i>Celtis sinensis</i>	Chinese Elm	-	27.3832, 153.1779	-	-	27.3869, 153.1659	-	-	-
<i>Lantana camara</i>	Lantana	27.3923, 153.1697 27.3923, 153.1702 27.3922, 153.1704 27.3921, 153.1711 27.3919, 153.1714 27.3832, 153.1778 27.3917, 153.1719 27.3814, 153.1791 27.3829, 153.1780	27.3832, 153.1787 27.3798, 153.1810	27.4090, 153.1617	27.4090, 153.1617	-	-	-	-

Botanical Name	Common Name	Lucinda Drain		Port Gate		T1-3		Car Precinct	
		2011	2012	2011	2012	2011	2012	2011	2012
		27.3803, 153.1801 27.3819, 153.1787 27.3802, 153.1804							
<i>Lantana montevidensis</i>	Creeping Lantana	-	-	-	-	-	-	-	-
<i>Schinus terebinthifolia</i>	Broad-leaf Pepper	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	27.3910, 153.1732 27.3820, 153.1787 27.3800, 153.1804	27.4046, 153.1614 27.4079, 153.1616 27.4094, 153.1617 27.4103, 153.1629 27.4089, 153.1616	27.4015, 153.1604 27.4046, 153.1614 27.4080, 153.1616 27.4094, 153.1618 27.4089, 153.1619	-	27.3845, 153.1676 27.3887, 153.1647	27.3907, 153.1654 27.3913, 153.1697 27.3922, 153.1658 27.3923, 153.1656 27.3923, 153.1653	27.3906, 153.1675 27.3906, 153.1691 27.3904, 153.1694 27.3914, 153.1697, 27.3918, 153.1653 27.3910, 153.1658
<i>Sphagneticola trilobata</i>	Singapore Daisy	27.3811, 153.1794	-	-	-	-	-	-	-

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

Appendix E

LP Act Declared Species Fact Sheets

Invasive plants and animals

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 sheets are available from DPI&F service centres and the DPI&F Information Centre phone (13 25 23). Check our website <www.dpi.qld.gov.au> to ensure you have the latest version of this fact sheet. The control methods referred to in this Pest Fact 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 utilisation 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, the Department of Primary Industries and Fisheries does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

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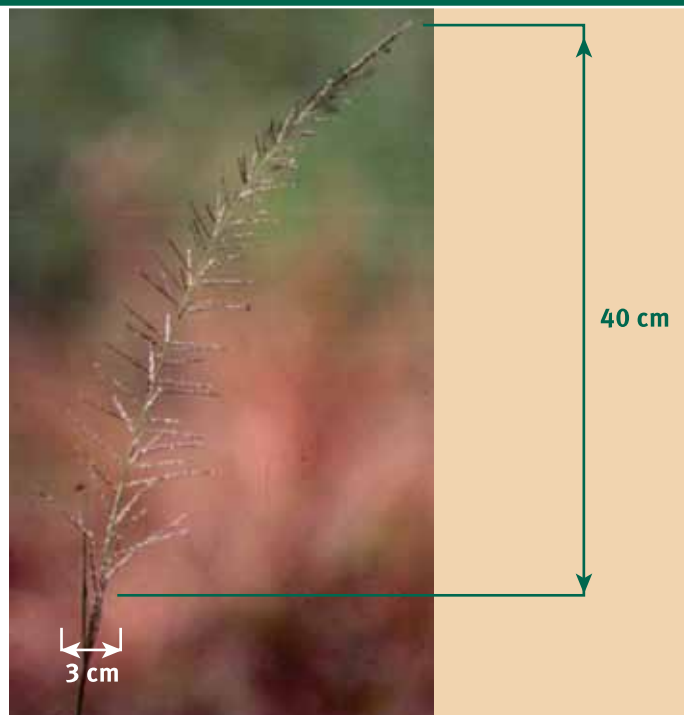
Giant rat's tail grass

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/m²/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.



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
<p>Cattle</p> <ul style="list-style-type: none"> • Manage grazing and stocking rate to maintain good ground cover of pasture. • Muster only in the afternoon when plant and seed is dry. • Restrict cattle to a small paddock or a laneway (on hay) for five days after grazing the weedy <i>Sporobolus</i> paddock. • Muster on foot or on horseback to prevent seed contamination of machinery. <p>Machinery</p> <ul style="list-style-type: none"> • Provide a specific hose-down tarmac to clean contaminated machinery. • Keep roadways, laneways, stock routes and machinery corridors free of weedy <i>Sporobolus</i>. <p>General hygiene</p> <ul style="list-style-type: none"> • Enclose specimens for identification in a tied fertiliser bag. <p>Pasture management</p> <ul style="list-style-type: none"> • Maintain pasture vigour with maintenance fertiliser program. • Band seeding is the 'safest' method to plant legumes into an infested pasture. • Plant the recommended competitive pasture grasses. <p>Hay and pasture seed</p> <ul style="list-style-type: none"> • Determine the origin of hay and ask for a weed hygiene declaration. • Feed hay in a yard, feedlot or small holding paddock. • Only purchase seed from a reputable seed merchant. <p>Control strategies</p> <ul style="list-style-type: none"> • Choose the best control strategy based on the paddock situation and the weedy <i>Sporobolus</i> population before starting the job. • If spot spraying with glyphosate, operate close enough to step on the plant and spray downwards. • Low-pressure spray equipment reduces the risk of over spraying. • Always spot spray the single 'scout' plants around the perimeter of the infestation first, then work inwards. 	<ul style="list-style-type: none"> • Don't overgraze as this will create bare patches that allow weedy <i>Sporobolus</i> grass seedlings to emerge. • Don't muster on wet days or in muddy soil conditions. • Don't deliberately overstock weedy <i>Sporobolus</i> infested paddocks. • Avoid creating bare ground from trampling around mineral licks etc. <ul style="list-style-type: none"> • Don't slash infested paddocks unless they are part of a wick wiping program. • Don't drive vehicles through infested paddocks. <ul style="list-style-type: none"> • Don't drive around the farm with a suspected weedy <i>Sporobolus</i> specimen in the cabin or in the back of the ute. <ul style="list-style-type: none"> • Don't allow soil fertility run-down as this favours weedy <i>Sporobolus</i> establishment. • Don't renovate an infested pasture. • Don't burn the pasture unless it is part of a wick wiping, pre-cropping pasture replacement strategy. <ul style="list-style-type: none"> • Don't knowingly purchase hay contaminated with weedy <i>Sporobolus</i>. • Don't buy seed without knowing its origin. • Don't buy seed without a Weed Hygiene Declaration. <ul style="list-style-type: none"> • Don't spot spray with glyphosate using a high-pressure gun from the cabin of the ute. • Don't wave the spray gun around—if the weedy <i>Sporobolus</i> is that dense, you should not be spot spraying. • Don't over-spray with glyphosate past the point of spray run-off.

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 <i>Sporobolus</i> 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 <i>Sporobolus</i> 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

Density of weedy <i>Sporobolus</i> grass infestation	Land accessible by tractor		Land not accessible by tractor
Occasional plants only	Spot spray Chip out/bag up		<ul style="list-style-type: none"> • Spot spray • Chip out/bag up
Scattered plants/ small clumps	Spot spray (<2000 stools/ha)		<ul style="list-style-type: none"> • Spot spray
Dense infestations	Arable land	Non-arable land	<ul style="list-style-type: none"> • Fence off and restrict stock movement to clean country • Helicopter spray with glyphosate herbicide and aerially re-sow the pasture
	<ul style="list-style-type: none"> • Fodder pre-crop before pasture replanting • Direct pasture replacement • Pressurised wick wiper • Boom spray—Rhodes grass 	<ul style="list-style-type: none"> • Pressurised wick wiper • Direct pasture replacement 	

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

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 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.

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 evaders*). 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.

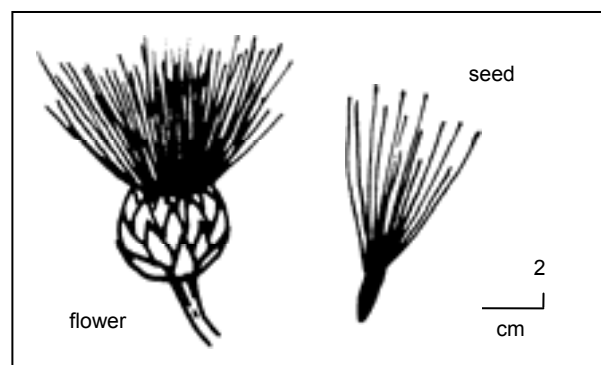


TABLE 1 – HERBICIDES REGISTERED FOR THE CONTROL OF GROUNDSEL BUSH

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 ^R	0.65 L/100 L	spot spray foliage
commercial industrial land; pastures; rights-of-way; forests	picloram + triclopyr (premix) e.g. Grazon DS ^{R*} *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 ^R)	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 ^R	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 sheets are available from DPI&F service centres and the DPI&F Information Centre phone (13 25 23). Check our web site <www.dpi.qld.gov.au> to ensure you have the latest version of this fact sheet. The control methods referred to in this Pest Fact 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 utilisation 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, the Department of Primary Industries and Fisheries does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

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.



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.

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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.



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

Fact sheets are available from Queensland Primary Industries and Fisheries service centres and the Queensland Primary Industries and Fisheries Business Information Centre (telephone 13 25 23). Check our website at www.dpi.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this pest fact 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, Queensland Primary Industries and Fisheries does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

Invasive plants and animals

Chinese celtis

Celtis sinensis



DECLARED CLASS 3



The problem

Chinese celtis is an Asian tree that is naturalised throughout most of south-east Queensland. This fast growing species forms dense infestations along creek banks and prevents regeneration of native riparian vegetation. It also sucks up water and has the potential to affect populations of native animals through habitat destruction. Celtis is very common in and around Brisbane, due to its cultivation as a shade tree and garden plant. Celtis seeds are spread by birds, flying foxes and water.

This deciduous tree grows up to about 12 m tall and flowers in spring. Leaves are quite glossy, with a paler underside and pronounced veins. Thousands of small, orange berries are produced and are dispersed when eaten by birds. Celtis often grows in clay soils associated with alluvial creek flats and gullies. It is an invader of riparian habitats and seems particularly successful in areas where the original vegetation has been disturbed or fenced off from grazing stock.

Description

Management strategies

Prevention is the key and celtis should be removed before it has the chance to grow into a problem. Small seedlings can be hand pulled or dug out. Pre-plan your revegetation so other weeds do not invade the disturbed area. Dozing and burning dense infestations with controlled grazing gives best control. Herbicides may be necessary for killing larger specimens.

Declaration details

Chinese celtis 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 CHINESE CELTIS

Method	Herbicide	Rate	Registration status	Comments
Basal bark	fluroxypyr (200 g/L)	35 mL per 1 L diesel or kerosene	Registered	Young plants up to 2 m high and 20 cm basal diameter
Stem injection	picoloram (100 g/L) + triclopyr (200 g/L)	1 L per 4 L water	PERMIT 7485	
Cut stump	picoloram (100 g/L) + triclopyr (200 g/L)	50 mL per 1 L water	PERMIT 7485	Cut stumps to less than 10 cm above the ground and immediately paint stump after cutting.
Stem injection	glyphosate (360 g/L)	Undiluted at 1 mL per 2 cm of hole or cut	PERMIT 7485	Plants up to 30 cm basal diameter.
Cut stump	glyphosate (360 g/L)	1 L to 12 L water	PERMIT 7485	
Spot spray	fluroxypyr (200 g/L)	500 mL per 100 L water	PERMIT 7485	Overall spray on young plants less than 2 m high.
Foliar spray	2,4-D acid (300 g/L)	1 L per 100 L water	Registered	Overall spray on young seedlings.

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

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 sheets are available from DPI&F service centres and the DPI&F Information Centre phone (13 25 23). Check our web site <www.dpi.qld.gov.au> to ensure you have the latest version of this fact sheet. The control methods referred to in this Pest Fact 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 utilisation 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, the Department of Primary Industries and Fisheries does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

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Fireweed

Senecio madagascariensis



Fireweed is an introduced weed that competes strongly with pasture species and is toxic to livestock. It is responsible for illness, slow growth and poor conditioning of cattle, and can result in death.

Heavy infestations of fireweed often result from neglect of steadily increasing fireweed infestations in previous years, and lack of good ground cover caused by overgrazing, drought, fire or slashing.

Declaration details

Fireweed 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.



Queensland Government

Description and general information

Fireweed is an annual or a short-lived perennial. It is a daisy-like herb that can vary greatly in size and shape depending on environmental conditions. In dry, harsh conditions it may be less than 20 cm tall with narrow leaves, no branching and few flowers. In ideal conditions fireweed will grow to 50 cm tall with multiple branches, long wide leaves (6 cm × 2 cm) and about 100 flowers.

The leaves are alternate, dark green with serrated margins, and are usually 2–6 cm long. The flowers are bright yellow, daisy-like with a diameter of approximately 2 cm, and produce up to 100 seeds each. It is very similar to a range of native *Senecio* species.

Seeds are small, cylindrical in shape, and 2–3 mm long. Each seed has rows of very fine short hairs and a silky pappus (parachute). Flowers and seeds are produced continuously over the growing season. An average plant can produce over 10 000 seeds during this time.

Fireweed has a shallow branched taproot with many fibrous roots. The shallow roots often allow plants to fall over in windy conditions. When this happens the stem will sprout roots wherever it touches the ground.

Life cycle

Fireweed can be an annual but many plants do survive through the summer, so plants of all ages can be present at the same time.

Seeds germinate in mild, warm conditions (15–27 °C) in the presence of light and moisture. Most seedlings appear between March and June then grow quickly to produce their first flowers in 6–10 weeks.

Fireweed usually begins to die back in spring. The top growth dies, leaving the base and roots that can last through the summer and re-grow in the following autumn. Depending on rainfall, some plants continue to grow and produce flowers, and seed through summer.

A dry summer followed by autumn or winter rains leads to heavy fireweed infestations.

Poisoning

Unless fireweed poisoning is severe it can be difficult to detect, because the symptoms (such as reduced weight gain and/or low milk production) can have a variety of causes.

Symptoms of more severe poisoning are loss of appetite, aimless wandering, loss of coordination, sensitivity to sunlight, jaundice and abdominal straining with rectal eversion. Severe poisoning will result in death, and an autopsy will reveal chronic liver sclerosis.

All growth stages contain pyrrolizidine alkaloids that damage the liver. Fireweed is toxic when green or dry, therefore contaminated hay or silage may be toxic.

Fireweed is generally unpalatable to cattle, so poisoning is most likely to occur when fireweed plants are dense and stock can not feed selectively, or when there is a shortage of pasture and hungry stock are less selective about food.

Sheep and goats are less susceptible to fireweed poisoning and can graze in fireweed-infested paddocks for at least one season. Toxins found in fireweed are able to taint the milk of goats that graze this plant. Goats for milk production should not be allowed to graze in fireweed-infested paddocks.

Habitat and distribution

Fireweed is native to Madagascar and southern Africa, and was first recorded in Australia in the Hunter Valley in 1918. It is not known how it was introduced, but it could have been brought in privately as a garden plant. It spread slowly at first, but in the last 30 years it has rapidly increased its range, most likely aided by modern transport and rural practices.

Fireweed is a weed of beef and dairy pasture east of the Great Dividing Range, and is currently established along the entire New South Wales coast and north to Brisbane.

Isolated infestations have been found near Caboolture, Cooroy, Belli Park, Maleny, Yandina, Pelican Waters and as far north as Gympie.

Fireweed is spreading northward and has the potential to infest extensive areas of valuable pasture north of Brisbane. A prediction based on climate and land use suggests that fireweed has the potential to be a serious pest as far north as Rockhampton.

Even light infestations of fireweed can produce 1 million seeds per hectare. Seeds are light and have a pappus that enables them to be carried by the wind. The seeds also have rows of short hairs that can loosely cling to animals. Fireweed can be spread short distances by wind and stock. However, it is spread over greater distances in pasture seed, hay, turf, mulch and with stock transport. Fireweed seed can also be spread as a contaminant in transported materials such as hydromulch and grass seed.

Control

Management strategies

The best approach to fireweed control is to prevent it establishing by ensuring that there is a dense cover of pasture in autumn and winter. Waiting until autumn to begin pasture improvement will worsen the fireweed problem because fireweed (which germinates in autumn) will be promoted ahead of the pasture by fertilising and direct drilling of winter pasture species.

When small infestations of fireweed are identified, act immediately to prevent the situation from becoming worse and to increase the likelihood of eradication.

The best control for fireweed incorporates integrated management strategies, including herbicides and mechanical methods in addition to vigorous permanent pastures that can compete strongly with fireweed seedlings.

Biological control

A number of organisms can be found attacking fireweed, but any effect they have is temporary and isolated. An orange rust (*Puccinia lagenophorae*) is common and often affects fireweed, particularly in lower country. The blue stem borer moth (*Patagoniodes farinari*) is also common, but the larvae usually develop too slowly to have an impact. Two moths imported from Madagascar were host tested. In controlled tests they were found to feed on important non-target plants so no releases were made and all these insects were destroyed.

Other potential biological control agents have been identified, but rigorous testing is needed to ensure that they do not feed on closely related Australian native plants. No new agents are expected to be released in the near future.

Mechanical control

Chip out, bag and burn any isolated plants or dispose of them at council-approved landfill tips. You should not burn any toxic plants in household wood-burning stoves or heaters. Remove chipped-out plants from paddocks because they may still set seed and poison stock.

Slashing is usually not effective as it may lead to increased stock poisoning. Slashing tends to give a good visual effect because it removes the flowers, but at best it delays flowering and seeding and at worst damages the pasture, making conditions more favourable for fireweed.

Fireweed remains toxic after being cut and becomes more attractive to stock and thus more likely to cause poisoning.

Herbicide control

Herbicides are most effective if sprayed before plants reach maturity. However, application during flowering will be effective if higher recommended rates of herbicide are applied.

Research is ongoing at the Alan Fletcher Research Station for herbicide controls against fireweed, including residual control methods. Trials have shown herbicide application in the autumn period during April provides good control. Before undertaking such programs landholders are advised to determine the infestation levels.

An effective application method in an open pasture situation is a boom spray. Follow this up by spot spraying, or pulling and bagging any regrowth or missed plants.

Boom spraying is also suitable for follow-up treatments, as it allows destruction of immature plants, which may otherwise grow to re-seed the area before they can be noticed.

Bromoxynil (trade names Bromicide 200, Brominil 200 and Bucril 200) is suitable for use in pastures containing clovers, medics and lucerne, and it will not affect grass.

Bromoxynil is effective if used on seedlings, which usually appear in autumn and early winter but may appear later following rain. Twice as much bromoxynil is needed if it is applied to plants that are just beginning to flower. Bromoxynil is less effective on mature plants, as it is a contact herbicide only. Mature plants will only be killed off where the bromoxynil comes into contact with the plant, allowing recovery of the plant from lower, untouched portions.

Unfortunately, fireweed control is often not considered until the highly visible flowers appear and it is too late for effective control with herbicide.

Table 1 (overleaf) lists herbicides registered for fireweed control. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label.

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.biosecurity.qld.gov.au).

Table 1 Herbicides registered for the control of fireweed

Situation	Herbicide	Rate	Registration status	Comments
Agricultural non-crop land, bushland, forests, wetlands, coastal and adjacent areas	2,4-D (625 g/L)	300 ml/100 L water or 3 L/ha	PERMIT 11463	Spot spray only.
Agricultural non-crop land, commercial and industrial land, forests, pastures and right-of-way areas	Aminopyralid (10 g/L) + fluroxypyr (333 g/L)	500 ml/100 L water	Registered	Apply as a high-volume or spot spray to flowering plants up to 30 cm tall.
Agricultural non-crop land, commercial and industrial land, forests, pastures and right-of-way areas	Triclopyr (300 g/L) + picloram (100 g/L) + aminopyralid (10 g/L)	350 ml/100 L water	Registered	Apply as a high-volume or spot spray when the plant is flowering.
Agricultural non-crop land and pastures	2,4-D (300 g/L)	700 ml/100 L water	Registered	Apply as a high-volume spray when the plant is actively growing.
Pastures and improved pastures (containing clover and/or lucerne)	Bromoxynil (200 g/L)	1.4 L/ha seedling control, 2.8 L/ha for early flowering plants	Registered	Apply during the autumn–winter period when plants are young and actively growing. Not effective on mature plants.
Improved pastures (containing clover and/or lucerne)	Bromoxynil (250 g/L) + diflufenican (25 g/L)	500 ml/ha	Registered	Seedling control up to the four leaf stage
Improved pastures (containing clover)	MCPA (250 g/L) + diflufenican (25 g/L)	1 L/ha	Registered	Seedling control up to the four leaf stage

It is a requirement of a permit that all persons using the products covered by the off-label permit PER11463 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 operators, 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 sheets are available from Department of Employment, Economic Development and Innovation (DEEDI) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.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.

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