BMT WBM

Port of Brisbane Weed Surveys 2017

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Synopsis: **This report provides the results of the 2017 Annual Weed Monitoring conducted at the Port of Brisbane.**

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Executive Summary

Annual weed monitoring surveys have been conducted at the Port of Brisbane (PBPL) since 2001. The monitoring program aims to identify the introduction and spread of priority weed species on PBPL lands and to recommend management and control measures as required. Priority weeds are those listed by the Commonwealth Department of Agriculture and Water Resources (DAWR), Prohibited and Restricted Matters regulated under the Queensland *Biosecurity Act 2014* and environmental weeds listed by the Brisbane City Council. DAWR listed weed species are specifically targeted because of their potential to enter the country *via* containers and other materials shipped and unloaded at the PBPL.

This report provides the results for the 2017 weed monitoring program for survey sites at Lucinda Drain, Port Gate Drain, Port West Drain, T1-3, Car Precinct and the constructed lake and sites of high environmental value and/or at high risk of weed invasion identified in 2016 pilot survey.

All weed species recorded on PBPL lands are well-established in the Brisbane region and throughout coastal south-east Queensland. No DAWR-listed species were recorded within or directly adjacent to the survey areas and none are likely to occur.

The dominant weed species recorded on PBPL lands included:

- Woody weeds: *Schinus terebinthifolius* which is common in disturbed terrestrial lands and at the upper tidal limit where it can invade saltmarsh communities. *Leucaena leucocephala* is also becoming more widespread in some saltmarsh habitats.
- Vine cover: *Macroptilium atropurpureum* was the most widespread vine species recorded on PBPL lands and was recorded as low infestations (0<5% cover) to dense patches (50-90% cover) which can smother native vegetation.
- Ground cover: The highest weed species richness was recorded in the ground-layer, which is a reflection of the higher richness in groundcover species in the region. Generally high cover (50-90%) recorded in disturbed terrestrial sites and dominated by *Megathyrsus maximus* var. *maximus*, *Chloris gayana* and *Melinis repens*.

Weed invasion on PBPL lands is associated with site disturbance, or in habitats directly adjacent to disturbance, on terrestrial lands and at the limit of Highest Astronomical Tide (HAT). There is no weed invasion within habitats subject to regular tidal inundation. The marine weed species *Rhizophora mangle* has been recorded in Australia, but has not been observed in south-east Queensland and is therefore considered a low risk species. Despite the low risk, regular weed monitoring should be continued to ensure this species, and potentially high risk taxa, do not establish in Port habitats.

Survey sites have remained relatively stable over the monitoring period (2001-2017). No new weed species or sites of significant weed incursion and spread were detected. The weed species recorded on PBPL lands are widespread in Brisbane and the south-east Queensland bioregion, and for that reason will be difficult to control and are unlikely to be eradicated from PBPL lands. Despite this, it is recommended that PBPL continue weed monitoring and control efforts to fulfil landholder obligations under Queensland's *Biosecurity Act*. This includes monitoring the Port Drive corridor and sites of high value habitat, particularly saltmarsh which is vulnerable to indirect and direct land and hydrological disturbance. Ongoing management will also reduce potential future costs associated with delaying weed control, particularly the removal of mature woody shrubs

and dense vine infestations. Active weed control and habitat restoration in disturbed saltmarsh identified in the pilot surveys of 2016 would improve the habitat condition of this locally restricted and nationally recognised habitat of high ecological value.

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1 Introduction

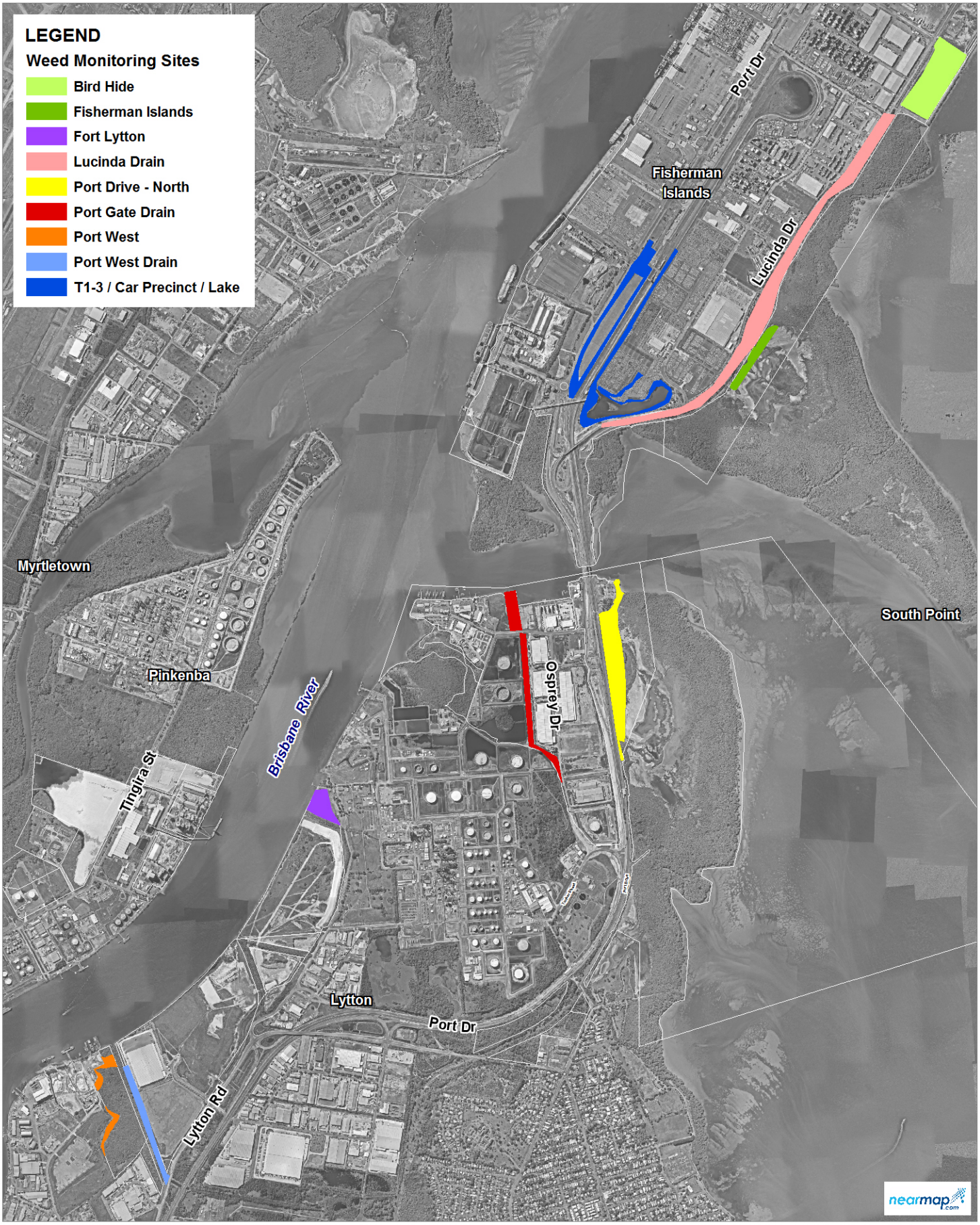
1.1 Background

Annual weed monitoring surveys have been conducted at the Port of Brisbane (PBPL) since 2001. The weed monitoring program aims to detect and assess the potential introduction and spread of priority weed species on PBPL lands and to recommend management and control measures as required. Priority weeds targeted in the surveys include plant species considered to be exotic or invasive, particularly those listed by the Commonwealth Department of Agriculture and Water Resources (DAWR), Prohibited and Restricted Matters regulated under the Queensland *Biosecurity Act 2014* and environmental weeds listed by the Brisbane City Council (BCC). DAWR listed weed species are specifically targeted because of their potential to enter the country via containers and other materials shipped and unloaded at the PBPL.

Surveys have been conducted at Lucinda Drain from 2001-2016, with surveys at Port Gate Drain commencing in 2007 (refer Figure 1-1). In 2013 Port West was included in the survey area due to the identification of pest species by stakeholders. In response to a potential weed incursion threat from imported vehicles, weed survey sites at the Car Precinct and T1-3 Overflow Area were included in the monitoring program in 2008. However, given regular maintenance of the Car Precinct and Overflow Areas the risk of weed invasion and spread is considered low in this area and monitoring was reduced to biennial assessments from 2014. Sites of high environmental value and/or at high risk of weed invasion were included in the program in 2016.

Based on the survey results, weed composition and distribution at the Port have remained relatively stable over the monitoring period. All weeds recorded in the survey sites are widespread in the Brisbane region. No DAWR listed species have been recorded and although approximately 27 new plant species arrive in south east Queensland each year, no new weed species to the region have been recorded on Port lands. Restricted Matters recorded included: Broad-leaf Pepper Tree (*Schinus terebinthifolius*), Camphor laurel (*Cinnamomum camphora*), Chinese Elm (*Celtis sinensis*), Fireweed (*Senecio madagascariensis*), Groundsel (*Baccharis halimifolia*), Lantana (*Lantana camara*), Creeping lantana (*Lantana montevidensis*), Mother-of-millions (*Bryophyllum delagoense*), Prickly Pear (*Opuntia stricta*), Giant Parramatta Grass (*Sporobolus fertilis*), Annual ragweed (*Ambrosia artemisiifolia*), Asparagus ferns (*Asparagus aethiopicus* and *A. africanus*) and Balloon vine (*Cardiospermum grandiflorum*).

Several widespread environmental weeds listed by BCC have also been recorded in the survey sites. All weed species recorded at PBPL are widespread in degraded sites and coastal habitats of south-east Queensland. Refer to Appendix A for a list of dominant weeds recorded.



Title:

2017 Weed Monitoring Sites

Figure: 1-1

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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Approx. Scale

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1.2 Scope and Aims

Weed surveys were conducted in April 2017 at Lucinda Drain, Port Gate Drain, Port West Drain, T1-3, Car Precinct and the constructed lake and sites of high environmental value and/or at high risk of weed invasion identified in the 2016 weed survey. The freshwater wetlands adjacent to Port Drive were not surveyed in 2017 due to road widening and construction.

The scope of works for the weed survey included:

- Record new species or high risk weed infestations at monitoring sites
- Provide recommendations for strategic weed management at the Port.

2 Methodology

In accordance with previous monitoring surveys, weed inspections were undertaken in the post-summer months in April (2017).

The survey was conducted by a qualified botanist with over 15 years pest survey experience in coastal south-east Queensland habitats.

2.1 Targeted Weed Species

Species targeted in the survey included the following:

- Weeds listed by DAWR with the potential to invade south-east Queensland:
  - *Asystasia gangetica*
  - *Bassia scoparia*
  - *Chromolaena odorata*
  - *Cleome rutidosperma*
  - *Equisetum hyemale*
  - *Lagarosiphon major*
  - *Mikania micrantha*
  - *Mucuna pruriens*
  - *Myriophyllum spicatum*
  - *Nassella tenuissima*
  - *Striga asiatica*
- Prohibited and Restricted Matters regulated under the Queensland *Biosecurity Act 2014* (refer https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/383818/IPA-Restricted-plants-of-Qld.pdf)
- Species listed by BCC as environmental pests
- 'High risk' species assessed by Biosecurity Queensland (DAF) such as the potentially invasive mangrove *Rhizophora mangle.*

2.2 Techniques

The weed survey used the random meander technique for recording all exotic and invasive species within the survey sites. All surveys were conducted on-foot to ensure that extensive coverage of the survey sites was achieved. Incidental observations of targeted weed species outside the survey sites were also recorded. The locations of all observed target weed species were recorded on handheld global positioning system (GPS). Weed identification was undertaken on site. Samples of weed species unable to be identified *in situ* were pressed for later verification.

2.3 Survey Sites

Survey sites are indicated in Figure 1-1.

The weed survey along Lucinda Drain consisted of recording exotic and invasive species within a 15 m wide belt transect along the entire length of the drain's eastern bank. A visual inspection of the western bank was taken from the eastern bank.

The weed survey along Port West Drain consisted of recording exotic and invasive species within a 15 m wide belt transect along the entire length of the drain's eastern bank.

The weed survey along the Port Gate Drain consisted of recording exotic and invasive species within a 15 m wide transect along the entire length of the drain's eastern bank. A visual inspection of the western bank was performed from the eastern bank.

The weed survey in the T1-3 Overflow area consisted of recording exotic and invasive species within a 2 m wide transect along the entire eastern, northern, western and southern boundaries of the hardstand area and along both banks of the constructed drain just north of the hardstand area.

The weed survey of the Car Precinct Area consisted of recording exotic and invasive species within the easement between the railway and the western boundary of the hardstand area and the banks of the lake adjacent to the previous Visitors Centre site.

All sites of environmental significance were inspected on foot using the random meander technique.

2.4 Survey Limitations

Whilst every effort has been made to identify targeted weed species in the PBPL survey sites, the detectability of plant species and the ability to accurately identify these in the field varies with seasonal and climatic conditions which influence the presence of reproductive features (flowers, fruits and seeds) which are useful, and in some cases essential, for species identification. Consequently, the survey conducted should not be regarded as conclusive that targeted weeds do not occur within the survey sites or surrounding lands.

3 Results

The following provides descriptions of weed composition and distribution recorded at the survey sites. Appendix A provides a summary of dominant weed species recorded on PBPL lands.

3.1 Lucinda Drain

3.1.1 Site Description

Lucinda Drain is a constructed channel located east of Lucinda Drive on the eastern edge of the Port. It provides drainage for stormwater run-off from hardstand areas to the north and discharges through the Lucinda Weir into Boat Passage.

The channel banks support planted and naturally recruited shrubs and trees comprised of a mix of local terrestrial species such as She-oaks (*Casuarina* spp.), Figs (*Ficus* spp.), Cotton tree (*Hibiscus tiliaceus*), *Melaleuca* spp. and *Macaranga tanarius*. Extensive riparian and bank canopy damage has occurred as a result of severe storms in 2017 (a and b). Introduced shrubs are sparse but widespread and the groundcover is dominated by exotic grasses (refer below). The tidal channel does not contain any extensive aquatic macrophytic cover but supports a low, discontinuous fringe of Grey mangrove (*Avicennia marina*) mangroves. The drain is periodically maintained and mangroves are actively removed to ensure the drain fulfils its primary purpose for stormwater run-off. Extensive mangroves and saltpan lie to the east of the drain associated with the intertidal flats of Boat Passage.

The western bank of the drain adjacent to Lucinda Drive undergoes regular maintenance involving mowing and weed spraying (c). Poor access along the eastern bank of Lucinda Drain limits regular maintenance but weeds are reportedly removed on an annual basis (RPS, 2013).

3.1.2 Weeds

The following observations were made in the 2017 survey:

- Lucinda Drain remains in a stable condition in terms of weed invasion.
- No DAWR-listed species were recorded within or directly adjacent to Lucinda Drain.
- Restricted Matters recorded included: Broad leaved Pepper Tree (*Schinus terebinthifolius*), Camphor laurel (*Cinnamomum camphora*), Lantana (*Lantana camara*), Creeping Lantana (*Lantana montevidensis*), Prickly pear (*Opuntia stricta*) and Giant Rat's Tail Grass (*Sporobolus* sp.) were widespread but sparse along both banks of the channel.
- Exotic species recorded were dominated by environmental weeds well established across Brisbane including: *Opuntia stricta, Schinus terebinthifolius, Cinnamomum camphora, Lantana montevidensis,* Easter Cassia (*Senna pendula* var. *glabrata*), Siratro (*Macroptilium atropurpureum*), Rhode's grass (*Chloris gayana*), Green panic (*Megathyrsus maximus var. maximus*), Brazilian nightshade (*Solanum seaforthianum*) and Blackberry nightshade (*Solanum nigrum*).

- Consistent with previous surveys, the dominant woody weed recorded at Lucinda Drain was *Schinus terebinthifolius* (d). There has been some regeneration of *Lantana camara* and *Senna pendula* var. *glabrata* since the previous survey. Other shrubs included *Sesbania cannabina*
- *Macroptilium atropurpureum,* Mile a Minute *(Ipomoea cairica),* Glycine (*Neonotonia wightii)* and Brazilian Nightshade *(Solanum seaforthianum)* were the dominant vine covers recorded.
- The groundcover was dominated by mown exotic grasses including *Chloris gayana, Megathyrsus maximus* var. *maximus,* Red natal grass (*Melinis repens*) and Mossman River Grass (*Cenchrus echinatus*).
- Other groundcovers, forbs and herbs included *Stylosanthes scabra, Tridax procumbens, Calyptocarpus vialis, Gomphrena celosioides, Cynodon dactylon, Sida* spp., *Capsella bursa-pastoris, Crotalaria pallida, Conyza bonariensis Crassocephalum crepidioides,Bidens pilosa, Portulaca oleracea, Ageratum houstonianum, Oneanthera drummondii* and *Plantago major*.
- No aquatic macrophyte weed species were recorded. The brackish to saline conditions of the channel limits the establishment of exotic macrophytes known from the region.
- Apart from minor *Lantana camara* and *Senna pendula* var. *glabrata* recruitment since the previous survey, no significant differences in weed composition or density between the current and previous monitoring surveys were observed for Lucinda Drain.

Figure 3-1 Lucinda Drain 2017 a) and b) Extensive riparian and bank canopy damage along the eastern bank, c) Western bank looking south d) Large dominant woody weed along Lucinda Drain *Schinus terebinthifolius*

3.2 Port West Drain

3.2.1 Site Description

Port West Drain, located west of Lytton Road approximately 4 km south-west of the Port, comprises a narrow intertidal channel fringed with remnant mangroves dominated by mature *Avicennia marina*. The channel is bounded to the west by extensive mangrove forest (Figure 3-2a) and cleared land for industrial purposes lie to the east (Figure 3-2b). No scheduled maintenance work, including weed removal, is undertaken at Port West Drain (RPS, 2013).

3.2.2 Weeds

The following observations were made in the 2017 survey:

- No DAWR-listed species were recorded within or directly adjacent to Port West Drain.
- Restricted Matters recorded included: *Baccharis halimifolia, Opuntia stricta, Schinus terebinthifolius, Lantana camara* and Madeira Vine *(Anredera cordifolia).*
- Exotic species recorded were dominated by environmental weeds well established across Brisbane including: *Ipomoea cairica, Macroptilium atropurpureum, Chloris gayana, Megathyrsus maximus* var. *maximus, Bidens pilosa*, *Gomphocarpus physocarpus*, *Melinis repens*, *Solanum nigrum*, *Conyza bonariensis, Macroptilium lathyroides, Anredera cordifolia, Asparagus aethiopicus* and *Asparagus africanus.*
- The dominant woody weeds recorded included *Schinus terebinthifolius, Baccharis halimifolia, Lantana camara* and *Sesbania cannabina*. Other woody weeds included *Gomphocarpus physocarpus,* Phasey Bean (*Macroptilium lathyroides),* Castor Oil Plant (*Ricinus communis),* Coral Berry *(Rivinia humilis*), *Senna pendula var. glabrata,* Giant Devil's Fig (*Solanum chrysotrichum),* Wild Tobacco (*Solanum mauritianum*) and *Solanum nigrum.*
- The groundcover was dominated by *Megathyrsus maximus* var. *maximus, Chloris gayana, Melinis repens,* Johnson's Grass (*Sorghum halepense)* and Vasey Grass (*Paspalum urvillei).*
- Dominant vines included *Ipomoea cairica, Macroptilium atropurpureum, Neonotonia wightii* and White Passionflower (*Passiflora alba*). Sparse *Anredera cordifolia* was also recorded.
- Common herbs and forbs included *Bidens pilosa,* Lance leaved Rattlepod (*Crotalaria pallida*), Gomphrena Weed (*Gomphrena celosioides*), *Sida* sp. and Purple- top (*Verbena bonariensis*).
- No aquatic macrophyte weed species were recorded and none are likely to occur given the brackish to saline conditions of the waterways.
- No significant differences in weed composition between the current and previous monitoring surveys were observed for Port West Drain.

Figure 3-2 Port West Drain 2017 a) Channel bounded to the west by extensive mangrove forest b) Cleared land (looking south) for industrial purposes lie to the east of the channel

3.3 Port Gate Drain

3.3.1 Site Description

Port Gate Drain located in the south-west section of the PBPL lies to the south of Boat Passage in the vicinity of Howard Smith Drive. It collects stormwater run-off from the adjacent hardstand areas and drains into (and partially receives) the tidal waters in Boat Passage. The banks of the drain are constructed of concrete, gravel and/or compacted earth, which limits extensive vegetation growth (Figure 3-3a). The tidal reaches of the drain support sparse fringing *Avicennia marina* seedlings, with a sparse groundcover of Common Reed (*Phragmites australis*), River club rush (*Schoenoplectus validus*) and *Fimbristylis* sp. Outside the tidal zone the banks support a sparse groundcover of exotic grasses and shrubs. It is understood that Port Gate Drain undergoes regular maintenance (including mowing and spraying for exotic species) which is facilitated by the PBPL (RPS, 2013).

3.3.2 Weeds

The following observations were made in the 2017 survey:

- No DAWR-listed species were recorded within or directly adjacent to Port West Drain

Restricted Matters recorded included: *Baccharis halimifolia, Schinus terebinthifolius* (Figure 3-3b) and *Lantana camara*

Exotic species recorded were dominated by environmental weeds well established across Brisbane including: *Ipomoea cairica, Macroptilium atropurpureum, Chloris gayana, Megathyrsus maximus var. maximus, Bidens pilosa, Gomphocarpus physocarpus, Melinis repens, Solanum nigrum, Conyza bonariensis,* Leucaena (*Leucaena leucocephala*) (Figure 3-3c), *Passiflora foetida* and *Macroptilium lathyroides*

- The dominant woody weeds recorded included *Schinus terebinthifolius, Baccharis halimifolia, Lantana camara* and *Sesbania cannabina.* Other woody weeds included *Cinnamomum camphora, Gomphocarpus physocarpus, Leucaena leucocephala, Solanum chrysotrichum* and *Solanum nigrum*
- The groundcover was dominated by *Megathyrsus maximus* var. *maximus, Chloris gayana, Melinis repens, Sorghum halepense, Cenchrus echinatus* and *Paspalum* spp.
- Dominant vines included *Ipomoea cairica Macroptilium atropurpureum, Vigna* sp. and Stinking Passionflower (*Passiflora foetida*)
- Common herbs and forbs included *Bidens pilosa, Capsella* sp., *Conyza bonariensis, Gomphrena celosioides, Sida cordifolia,* Singapore Daisy (*Sphagneticola trilobata*) and Tridax (*Tridax procumbens)*
- No aquatic macrophyte weed species were recorded and none are likely to occur given the brackish to saline conditions of the waterways
- No significant differences in weed composition between the current and previous monitoring surveys were observed at Port Gate Drain.

Figure 3-3 Port Gate Drain 2017

3.4 T1-3, Car Precinct and Constructed Lakes

3.4.1 Site Description

The T1-3 and Car Precinct areas east of Port Drive at the Port of Brisbane store imported vehicles and as such are potential vectors for newly introduced weed species.

The T1-3 survey area extends around the car parking hardstand and includes a constructed drain to the north. The survey area consists predominantly of regularly maintained lawn which receives stormwater overflow from the hardstand. Landscaped garden beds front Port Drive. The constructed drain in the northern section consists of a concrete channel which is designed to pipe stormwater runoff into the Brisbane River.

The Car Precinct survey area lies to the south and west of the hardstand vehicle storage area. The survey area consists predominantly of regularly maintained lawn which receives stormwater overflow from the hardstand.

The T1-3 and Car Precinct sites are separated by the Queensland Rail freight line and a cleared and regularly mowed easement. Constructed lakes lie south of the Car Precinct.

It is evident that the T1-3, Car Precinct, railway easement and lands surrounding the lakes undergo regular maintenance including mowing, and RPS (2013) reports that these areas are regularly sprayed for weeds.

3.4.2 Weeds

The following observations were made in the 2017 survey:

- No DAWR-listed species were recorded within or directly adjacent to the survey area
- Restricted Plants recorded included *Baccharis halimifolia,* Fireweed (*Senecio madagascariensis*), Common Ragweed (*Ambrosia artemisiifolia*), *Schinus terebinthifolius* and *Lantana camara*
- Exotic species recorded were dominated by environmental weeds well established across Brisbane including: *Senecio madagascariensis, Schinus terebinthifolius, Lantana camara, Ipomoea cairica, Ricinus communis, Macroptilium atropurpureum, Cenchrus echinatus, Megathyrsus maximus var. maximus, Solanum nigrum.*
- Dominant woody weeds included *Schinus terebinthifolius, Baccharis halimifolia, Ricinus communis, Senecio madagascariensis, Lantana camara, Solanum nigrum* and *Sesbania cannabina*.
- Dominant vines recorded included *Ipomoea cairica, Ipomoea alba* and *Macroptilium atropurpureum*.
- The sparse groundcover was regularly mowed. The most widespread groundcovers were *Megathyrsus maximus var. maximus, Cenchrus echinatus, Melinis repens, Chloris gayana, Digitaria ciliaris, Paspalum urvillei, Setaria spacelata* and *Setaria pumila*.
- Common herbs and forbs included *Ageratum houstonianum, Bidens pilosa, Crassocephalum crepidioides, Eclipta prostrata, Gomphrena celosioides, Lantana montevidensis, Conyza*

bonariensis, Hypochaeris radicata, Oenothera drummondii, Tridax procumbens and *Verbena bonariensis.*

- Aquatic macrophytes recorded on the lakes edge included Umbrella sedge (*Cyperus involucratus*).
- No significant differences in weed composition between the current and previous monitoring surveys were observed at these sites.

Figure 3-4 a) and b) T1-3 and Car Precinct, c) and d) Constructed Lake

3.5 Bird Hide

The bird hide adjacent to Lucinda Drive is located within intertidal flats supporting a mix of mangroves, saltmarsh and mudflats which provide important habitat for a mix of migratory waders. These intertidal conditions prohibit the establishment of most introduced weed taxa with the

exception of minor patches of *Baccharis halimifolia* on elevated sites. As described above, whilst these high value intertidal habitats may be vulnerable to *Rhizophora mangle* invasion this risk is low.

The filled lands above HAT support terrestrial grasslands which are regularly mown and support a range of grass and herbaceous environmental weeds widespread throughout the region. This includes *Macroptilium atropurpureum, Chloris gayana, Megathyrsus maximus* var. *maximus, Cenchrus echinatus, Stylosanthes scabra, Tridax procumbens, Gomphrena celosioides, Cynodon dactylon, Conyza bonariensis Crassocephalum crepidioides, Bidens pilosa, Portulaca oleracea, Ageratum houstonianum, Oneanthera drummondii, Cakileedentula, Sesbania cannabina, Ipomoea cairicam* and *Macroptilium lathyroides.*

Whilst the risk of weed invasion and associated habitat degradation within habitats of environmental value in the northern sector of the Port is considered low, annual to biennial monitoring is recommended to protect the environmental values of these wetlands.

3.6 Port Drive Wetlands

Port lands south of Boat Passage and adjacent to Port Drive support a mix of freshwater and intertidal wetlands of high habitat value which are prone to varying levels of weed invasion.

3.6.1 Intertidal Wetlands

As described in the pilot survey (2016), whilst the majority of the saltmarsh east of Port Drive remains in good condition, several sites are being impacted by weed invasion as a result of past and current land use practices. These sites could be rehabilitated through active restoration of saltmarsh and changing land use practices. Such activities could potentially contribute to an offsets package for proposed marine plant removal and impacts on Coastal Saltmarsh (listed as a Vulnerable community under the EPBC Act) for Port associated activities.

3.6.1.1 Filled Intertidal Land

As described in the pilot survey (2016), approximately 1.0 ha of previous intertidal and low-lying land east of Port Drive has been partially filled and excluded from tidal inundation. Whilst a small area of saltmarsh and *Phragmites* reedland remains (approximately 0.5 ha), the altered hydrology and topography has favoured regrowth dominated by terrestrial weed species (Figure 3-5a).

The degraded grassland at this site is currently dominated by exotic groundcovers including *Megathyrsus maximus var. maximus, Cenchrus echinatus, Melinis repens, Chloris gayana, Digitaria ciliaris, Paspalum* spp., *Pennisetum purpureum* and *Cortaderia selloana*. Patches of *Phragmites australis* also occur in lower lying depressions influenced by freshwater inundation. Whilst this is a native species, *Phragmites australis* can invade disturbed saltmarsh which has reduced tidal inundation and salinity and was also observed invading some intact saltmarsh fringes across this site.

The exotic shrub *Schinus terebinthifolius* occurs as scattered individuals to dense thickets in this area depending on the level of inundation (Figure 3-5a and Figure 3-5b). Other shrubs that occur in this filled and disturbed land include *Stylosanthes scabra, Opuntia stricta,* and *Solanum chrysotrichum.* Sparse vines recorded included *Ipomoea cairica* and *Macroptilium atropurpureum.*

All weed species recorded at this disturbed site are widespread across PBPL lands and are well-established in the Brisbane region and throughout coastal south-east Queensland. No DAWR-listed species were recorded within or directly adjacent to this survey area and none are likely to occur. These weed-dominated habitats are likely to provide limited value for local fauna and estuarine species associated with the adjacent intertidal complex. In addition, these degraded habitats are replacing native communities, including coastal saltmarsh. Coastal saltmarsh could re-establish at this site through the re-establishment of hydrological conditions.

To enhance saltmarsh and reduce weed invasion in this area the ground level could be re-contoured to reinstate tidal inundation within the range suitable for saltmarsh establishment. Some level of variation in topography would need to be maintained during re-profiling to increase habitat diversity and to ensure excessive ponding does not occur. As the proposed works will disturb the ground profile, PASS assessments and mitigation measures would be required prior to any on-ground works. Natural recruitment is the preferred and most cost-effective method of revegetating re-profiled intertidal sites. However, active planting could be carried out to supplement natural regeneration and to fast-track the recovery process, if natural colonisation is slow.

Figure 3-5 Filled Intertidal Land with dense thickets of *Schinus terebinthifolius* and large patches of *Phragmites australis*

3.6.1.2 Saltmarsh Ecotone

An extensive mosaic of mangroves and saltmarsh occurs east of Port Drive. Whilst the mangroves are not prone to weeds due to regular tidal inundation, the saltmarsh-mangrove ecotone and the upper tidal limit are susceptible to disturbance and weed invasion.

The exotic shrub *Schinus terebinthifolius* occurs on pockets of higher ground in the saltmarsh-mangrove ecotone and is generally associated with a groundcover of *Megathyrsus maximus var. maximus*. *Phragmites australis* also forms sparse to localised patches at the upper tidal limit of the saltmarsh (Figure 3-6b). As discussed above, whilst *Phragmites* naturally occurs at the freshwater-saline interface, it can spread rapidly to form extensive stands in saltmarsh and can alter the hydrology, sedimentation, ecology and function of the saltmarsh community with flow on effects to adjacent intertidal habitat.

The landward edge of the saltmarsh at this site ecotone is also regularly slashed for ground maintenance which is removing succulent saltmarsh species, altering local topography and promoting the spread of exotic grasses into saltmarsh habitat.

All weed species recorded at this disturbed site are widespread across PBPL lands and are well-established in the Brisbane region and throughout coastal south-east Queensland. No DAWR-listed species were recorded within or directly adjacent to this survey area and none are likely to occur. However, the weed invasions at the mangrove-saltmarsh interface and at the upper saltmarsh limits are reducing the overall condition of these communities and are providing local sources of weed spread. The regular slashing is also reducing the condition of coastal saltmarsh and promotes habitat conditions more suitable for weed invasion.

It is recommended that *Schinus terebinthifolius* at the upper tidal limit are removed to reduce the source of local seed propagules and the local terrain is re-profiled to the range of saltmarsh and mangrove habitat (see juvenile in Figure 3-6c). In addition, regular slashing for site maintenance should be restricted to the area of terrestrial grasses only with a minimum 10 m buffer provided to saltmarsh habitat.

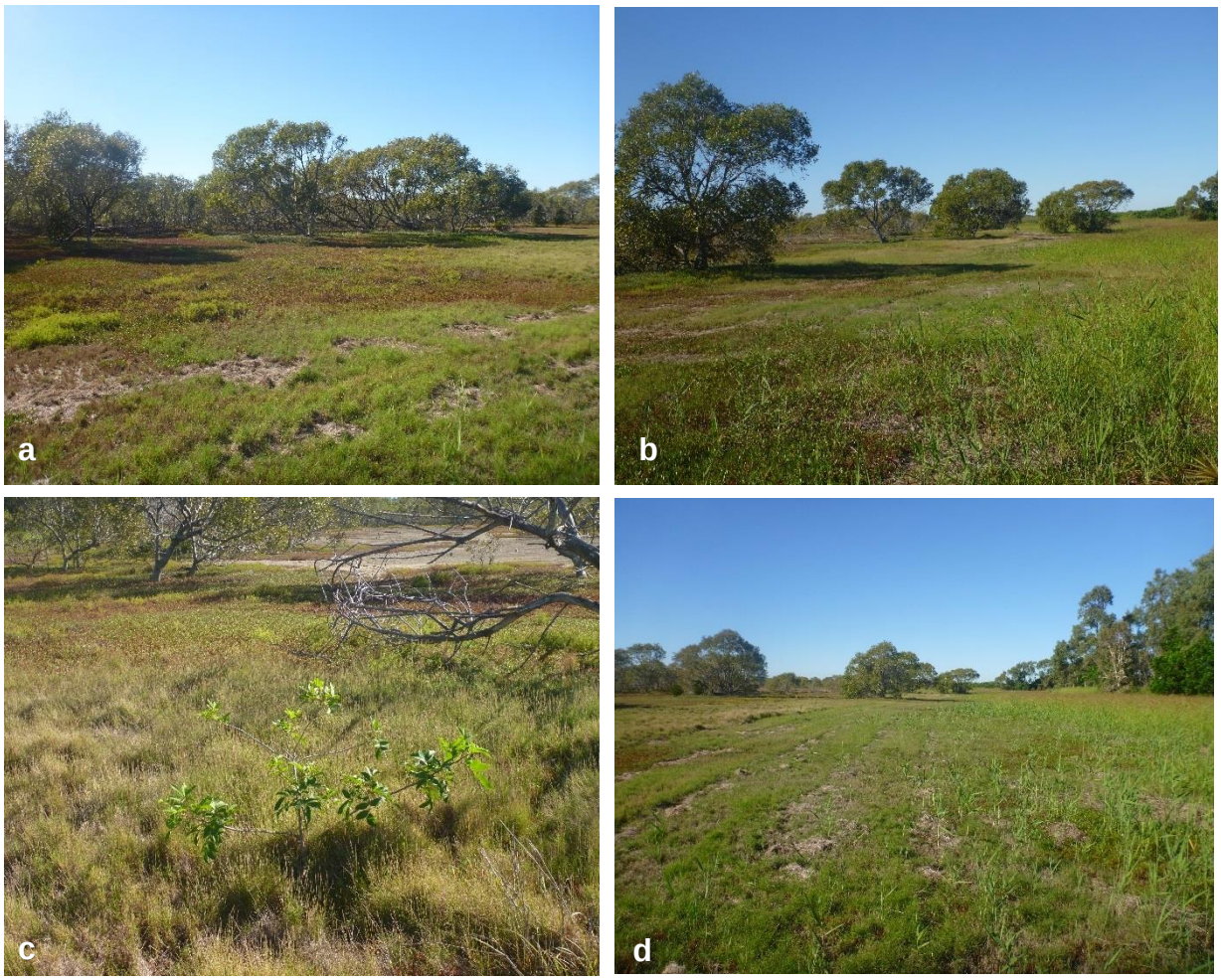

Figure 3-6 Estuarine Ecotone 2017

3.6.2 Freshwater Wetlands

Freshwater wetlands adjacent to Port Drive support remnant *Melaleuca* dominated communities which are poorly represented on Port lands. Given their proximity to the rail and road corridors these wetlands are susceptible to weed invasion and were targeted in the 2016 surveys. However, these communities could not be surveyed in 2017 due to construction of the Port Drive upgrade.

3.7 Port West Estuarine Wetlands

Port West supports an extensive mosaic of mangroves and saltmarsh directly connected to the Brisbane River. Similar to other sites at the Port, the saltmarsh-mangrove ecotone and upper tidal limits, which lie adjacent to industrial land uses, are susceptible to disturbance and weed invasion.

The western landward fringe of closed mangrove forest comprises evenly aged *Avicennia marina* over a dense saltmarsh shrublayer comprising *Sporobolus virginicus, Sesuvium portulacastrum* and *Enchaelaena stricta* (Figure 3-7a). Very sparse weed invasion was recorded under this dense mangrove canopy and comprised mainly isolated *Asparagus aethiopicus, Opuntia stricta, Schinus*

terebinthifolius, Riccinus communis, Leaucaena leucocephala and *Senna pendula* var. *glabrata* on elevated sites.

Locally elevated sites within saltmarsh landward of the mangrove fringe supported sparse *Schinus terebinthifolius* (Figure 3-7b), over a groundcover of *Megathyrsus maximus var. maximus* and *Chloris gayana.* More landward sites also supported *Senna pendula var. glabrata* (Figure 3-7b), *Baccharis halimifolia, Sesbania cannabina, Riccinus communis, Opuntia stricta* and *Asparagus* spp. Some *Phragmites* invasion was also occurring at the landward edge of disturbed saltmarsh subject to freshwater ponding.

All weed species recorded within the saltmarsh-mangrove interface at Port West are widespread across PBPL lands and are well-established in the Brisbane region and throughout coastal south-east Queensland. No DAWR-listed species were recorded within or directly adjacent to this survey area and none are likely to occur.

Figure 3-7 Port West Estuarine Habitat 2017 a) Closed mangrove forest with *Avicennia marina*, *Sporobolus virginicus and Sesuvium portulacastrum,* b) Locally elevated site within saltmarsh landward of the mangrove fringe with *Schinus terebinthifolius* and *Senna pendula var. glabrata*

3.8 Fort Lytton Estuarine Wetlands

In 2015, BMT WBM provided an assessment of a potential habitat improvement area at Fort Lytton on the eastern banks of the Brisbane River. That assessment identified approximately 0.35ha of previously intertidal land at the ecotone between the mangroves and saltmarsh that had been filled and promoted weed invasion (Figure 3-8a).

A survey of the site in 2017 indicated that *Leucaena leucocephala* is becoming more widespread across the site (Figure 3-8a,b,c). Other woody weeds included *Schinus terebinthifolius, Celtis sinense, Baccharis halimifolia, Phoenix* sp., *Lantana camara, Phytolacca octandra, Solanum nigrum, Gomphocarpus physocarpus, Opuntia stricta, Ricinus communis* and *Solanum mauritianum* (Figure 3-8b,c). Dominant exotic groundcovers included *Chloris gayana, Megathyrsus maximus* var. *maximus* and *Sorghum halepense*. Other weeds recorded included *Anredera cordifolia*, *Ageratum houstonianum, Passiflora foetida, Conyza bonariensis, Capsella bursa-pastoris*, *Bidens pilosa, Cynodon dactylon, Gomphrena celosioides, Ipomaea cairica, Paspalum urvillei, Plantago lanceolata* and *Sida* spp. The placement of fill has also reduced tidal flow to approximately 0.06ha of saltmarsh which has promoted Phragmites invasion (Figure 3-8c).

All weed species recorded at this site are widespread across PBPL lands and are well-established in the Brisbane region and throughout coastal south-east Queensland. No DAWR-listed species were recorded within or directly adjacent to this survey area and none are likely to occur.

Figure 3-8 Fort Lytton 2017 a) intertidal land at the ecotone between the mangroves and saltmarsh placed with fill, b) and c) Weed invasion including the increasingly widespread *Leucaena leucocephala, Schinus terebinthifolius, Baccharis halimifolia, Lantana camara, Phragmites australis* and *Megathyrsus maximus var. maximus*

4 Discussion

In terms of weed composition and distribution, the survey sites have remained relatively stable over the monitoring period (2001-2017) and no new weed species, or significant outbreaks of weed invasion, were recorded in the current survey.

Although all weeds recorded adjacent to Port Drive are widespread throughout south-east Queensland and no newly introduced or high risk species have been identified at this location, the road and rail corridors are potential vectors for newly imported species arriving at the Port and are important monitoring sites.

Several sites of saltmarsh disturbance have been recorded across PBPL lands at Port Drive, Port West and Fort Lytton. The Pinkenba saltmarsh pilot site surveyed in 2016 has been removed as a result of pipeline construction and land reclamation. All remaining sites have been subject to disturbance which has altered site hydrology and promoted weed invasion including the spread of *Phragmites australis*. The exotic shrubs *Schinus terebinthifolius* and *Leucaena leucocephala* occur on pockets of higher ground in the saltmarsh-mangrove ecotone and are generally associated with a groundcover of exotic grasses particularly *Megathyrsus maximus var. maximus*. At the Port Drive and Fort Lytton sites the landward edge of the saltmarsh ecotone is also regularly slashed for ground maintenance which is removing succulent saltmarsh species, altering local topography and promoting the spread of exotic grasses into saltmarsh habitat.

Weed removal and re-contouring the ground level at sites compatible with intended future land use could be carried out in disturbed intertidal areas to reinstate tidal inundation within the range suitable for saltmarsh, or near-tidal wetland, establishment. Some level of variation in topography should be maintained during re-profiling to increase habitat diversity and to ensure excessive ponding does not occur. As the proposed works will disturb the ground profile, PASS assessments and mitigation measures will be required prior to any on-ground works. Natural recruitment is the preferred and most cost-effective method of revegetating re-profiled intertidal sites. However, active planting could be carried out to supplement natural regeneration and to fast-track the recovery process, particularly if the aim is to promote native freshwater or terrestrial taxa.

Whilst the sites of saltmarsh disturbance recorded across Port lands are not extensive and occur in disjunct patches, this habitat type is restricted on Port lands due to land development at the terrestrial ecotone. In addition, saltmarsh communities have lost 64% of their 1955 extent within Moreton Bay (Queensland Herbarium, 2016) and Coastal Saltmarsh is listed as a Vulnerable community under the EPBC Act. Restoration activities could potentially contribute to an offsets package for proposed marine plant removal and impacts on Port associated activities.

It is recommended that future annual surveys are carried out at the same sites and in accordance with the rapid biological assessment methodologies described in this report.

5 Conclusion

All weed species recorded on PBPL lands are well-established in the Brisbane region and throughout coastal south-east Queensland. No DAWR-listed species were recorded within or directly adjacent to the survey areas and none are likely to occur.

Weed invasion on PBPL lands is associated with site disturbance, or in habitats directly adjacent to disturbance, on terrestrial lands and at the limit of HAT. There is no weed invasion within habitats subject to regular tidal inundation. The marine weed species *Rhizophora mangle* has been recorded in Australia, but has not been observed in south-east Queensland, and is considered a low risk species. Despite the low risk, regular weed monitoring should be maintained to ensure this species, and potential high risk taxa, do not establish in Port habitats.

Survey sites have remained relatively stable over the monitoring period (2001-2017). No new weed species or sites of significant weed incursion and spread were detected at these sites. Several sites of saltmarsh disturbance were recorded across PBPL lands. All sites have been subject to disturbance which has altered site hydrology and promoted weed invasion including the spread of *Phragmites*. The exotic shrubs *Schinus terebinthifolius* and *Leucaena leucocephala* also occur on pockets of higher ground in the saltmarsh-mangrove ecotone. At some maintained sites the landward edge of the saltmarsh ecotone is also regularly slashed for ground maintenance which is promoting the spread of exotic grasses. Ground works and changing land maintenance practices at these sites could reinstate habitat conditions more suitable for native taxa including saltmarsh species.

The weed species recorded on PBPL lands are widespread in Brisbane and the south-east Queensland bioregion, and for that reason will be difficult to control and are unlikely to be eradicated from PBPL lands. Despite this, it is recommended that PBPL continue weed control efforts to fulfil landholder obligations under the *Biosecurity Act*. This includes monitoring the Port Drive corridor and sites of high value habitat, particularly saltmarsh which is vulnerable to disturbance associated with land use. Ongoing management will also reduce potential future costs associated with delaying weed control, particularly the removal of mature woody shrubs and dense vine infestations. In addition, active weed control and habitat restoration in disturbed saltmarsh would improve the habitat condition of this locally restricted and nationally recognised habitat of high ecological value.

6 References

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Appendix A Dominant Weed Species Recorded at PBPL

Species	Common Name	Lifeform
Ageratum houstonianum	Blue billygoat weed	forb
Alternanthera denticulata	Lesser joyweed	forb
Bidens pilosa	Cobbler's pegs	forb
Commelina benghalensis	Hairy commelina	forb
Conyza bonariensis	Flaxleaf fleabane	forb
Crassocephalum crepidioides	Thickhead	forb
Einadia hastata	Berry saltbush	forb
Emilia sonchifolia	Emilia	forb
Impatiens sp.	Balsam	forb
Lantana montevidensis	Creeping lantana	forb
Ludwigia longifolia	Long-leaved willow primrose	forb
Onopordum acanthium	Scotch thistle	forb
Plantago lanceolata	Ribwort	forb
Senecio madagascariensis	Fireweed	forb
Sida rhombifolia	Common sida	forb
Sonchus oleraceus	Common sowthistle	forb
Sphagneticola trilobata	Singapore daisy	forb
Stachytarpheta jamaicensis	Light blue snakeweed	forb
Tagetes minuta	Stinking Roger	forb
Tridax procumbens	Tridax daisy	forb
Verbena bonariensis	Purpletop	forb
Datura sp.	Thorn apple	forb
Andropogon virginicus	Whisky grass	grass
Cenchrus echinatus	Mossman River grass	grass
Chloris gayana	Rhode's grass	grass
Cynodon dactylon	Green couch	grass
Digitaria ciliaris	Summer grass	grass
Megathyrsus maximus var. maximus	Green panic	grass
Paspalum dilatatum	Paspalum	grass
Paspalum distichum	water couch	grass
Phragmites australis	Common reed	grass
Setaria sphacelata	South African pigeon grass	grass
Sorghum halepense	Johnson grass	grass

Dominant Weed Species Recorded at PBPL

Species	Common Name	Lifeform
Sporobolus fertilis	Giant Parramatta Grass	grass
Sporobolus virginicus	Sand couch	grass
Cyperus exaltatus	Tall flatsedge	sedge
Cyperus involucratus	Umbrella sedge	sedge
Baccharis halimifolia	Groundsel	shrub
Crotalaria pallida	Rattlepod	shrub
Lantana camara	Lantana	shrub
Opuntia stricta	Prickly Pear	shrub
Phytolacca octandra	Inkweed	shrub
Rivina humilis	Coral berry	shrub
Sesbania cannabina	Yellow pea bush	shrub
Solanum chrysotrichum	Giant Devil's fig	shrub
Solanum nigrum	Blackberry nightshade	shrub
Celtis sinensis	Chinese Elm	tree
Cinnamomum camphora	Camphor laurel	tree
Ficus elastica	Rubber fig	tree
Leucaena leucocephala	Leucaena	tree
Ricinus communis	Castor oil tree	tree
Schinus terebinthifolius	Broad-leaf Pepper Tree	tree
Senna pendula var. glabrata	Easter cassia	tree
Solanum mauritianum	Wild tobacco	tree
Anredera cordifolia	Madeira vine	vine
Asparagus aethiopicus cv. Sprengeri	Basket asparagus fern	vine
Cardiospermum grandiflora	Balloon vine	vine
Ipomoea cairica	Mile-a-minute	vine
Macroptilium atropurpureum	Siratro	vine
Neonotonia wightii	Glycine	vine
Passiflora foetida	Stinking passionflower	vine
Passiflora suberosa	Corky passionflower	vine
Solanum seaforthianum	Brazilian nightshade	vine

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