Port of Brisbane Weed Surveys 2019

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Synopsis: **This report presents the findings of the Port of Brisbane Annual Weed Monitoring Program for 2019**

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Executive Summary

The Port of Brisbane Annual Weed Monitoring Program has been conducted on Port of Brisbane Pty Ltd (PBPL) lands 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.

This report provides the results for the 2019 weed monitoring program. Field surveys were undertaken 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.

Consistent with previous surveys, all weed species recorded on PBPL lands are well-established in Brisbane and the south-east Queensland bioregion. No targeted National priority pest plants listed by the Commonwealth Department of Agriculture and Water Resources (DAWR) have been recorded within or directly adjacent to PBPL lands.

The most abundant weed species recorded on PBPL lands were:

- Woody weeds: Broad leaf peppertree *Schinus terebinthifolius,* which was common on disturbed terrestrial lands, and has also invaded saltmarsh communities. Leucaena *Leucaena leucocephala* has also become more widespread in some saltmarsh habitats.
- Vine cover: Siratro *Macroptilium atropurpureum* was the most widespread vine species recorded on PBPL lands. This species had variable abundance where it occurred, and in places formed dense patches (50-90% cover) resulting in smothering of native vegetation.
- Ground cover: The highest weed species richness was recorded in the ground-layer, reflecting the higher richness of groundcover weed species in the region. Highest weed groundcover (50-90%) was generally recorded in disturbed terrestrial sites. The most abundant groundcover weed species were green panic *Megathyrsus maximus* var. *maximus*, Rhode's grass *Chloris gayana* and red natal grass *Melinis repens*.

Weed invasion on PBPL lands generally occurs within and directly adjacent to disturbed lands, including areas subject to hydrological modifications. The marine weed mangrove species *Rhizophora mangle* has been recorded in north Queensland but has not been observed in south-east Queensland and is considered a low risk species on port lands.

With the exception of Lucinda Drain and Port Gate Drain, the survey sites have remained relatively stable in terms of weed composition and distribution over the monitoring period (2001-2019). No new weed species or significant outbreaks of weed invasion were recorded in the current survey. Active weed management along Lucinda Drain has reduced the density of woody weeds within the riparian corridor and weed cover has been significantly reduced along Port Gate Drain due to recent vegetation clearing.

High ecological value estuarine habitat at Port Drive, Port West and Fort Lytton have remained relatively stable over the monitoring period, though *Leucaena leucocephala* may becoming more widespread in saltmarsh ecotonal habitat. *Schinus terebinthifolius, Phragmites australis, Megathyrsus maximus* var. *maximus* and *Chloris gayana* remain the major weeds in wetlands of high ecological significance.

It is recommended that PBPL continue weed monitoring and control efforts to fulfil landholder obligations under Queensland's *Biosecurity Act*. Consistent with previous monitoring results, it is recommended that woody weeds at the upper tidal limit in saltmarsh habitat are removed. Ecotonal habitat supporting exotic grasslands could be re-profiled to the range of estuarine wetland habitat, including swamp oak communities, which are listed as Endangered under the EPBC Act. Regular slashing for site maintenance should also be restricted to

the area of terrestrial grasses only, with a minimum 10 m buffer provided to estuarine habitat.

It is recommended that future annual weed surveys are carried out at the same sites and in accordance with the rapid biological assessment methodologies described in this report, though quantitative surveys may be required to track the potential increase in Leucaena invasion and its impact on estuarine 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, namely:

- Weeds listed by the Commonwealth Department of Agriculture and Water Resources (DAWR). 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.
- Prohibited and Restricted Matters regulated under the Queensland *Biosecurity Act 2014*.
- Environmental weeds listed by the Brisbane City Council (BCC).

Surveys have been conducted at Lucinda Drain from 2001-2019, with surveys at Port Gate Drain commencing in 2007. 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. Additional sites of high environmental value and/or at high risk of weed invasion were included in the program in 2016.

Based on previous 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 paramatta grass (*Sporobolus fertilis*), annual ragweed (*Ambrosia artemisiifolia*), asparagus ferns (*Asparagus aethiopicus* and *A. africanus*) and balloon vine (*Cardiospermum grandiflorum*).

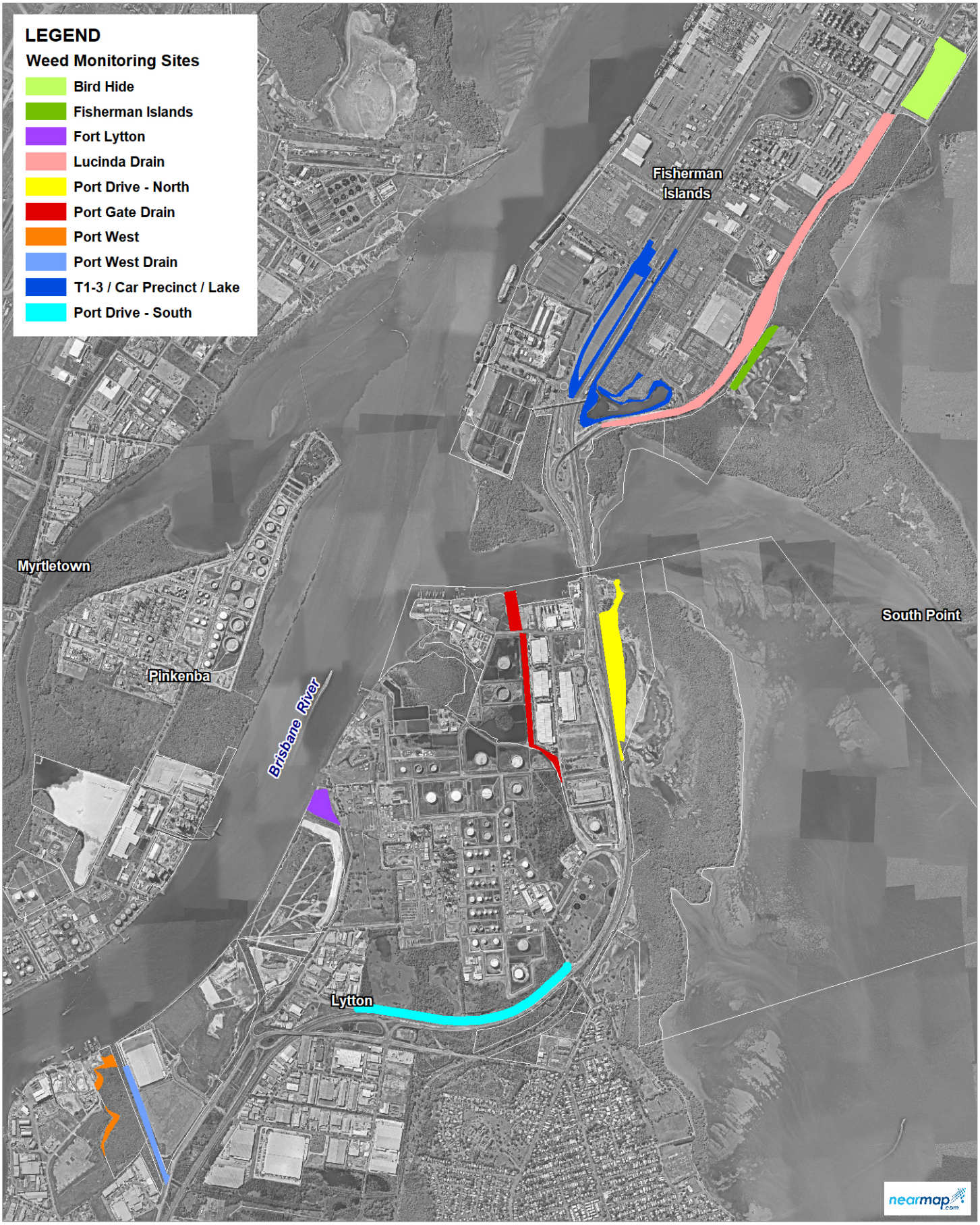
Several widespread environmental weeds listed by BCC have also been recorded in the survey sites. All weed species recorded at PBPL are widespread in degraded sites and coastal habitats of south-east Queensland. Refer to Appendix A for a list of dominant weeds recorded.

1.2 Aims

Targeted weed surveys were conducted in March 2019 at Lucinda Drain, Port Gate Drain, Port West Drain, T1-3, Car Precinct, the constructed lake, and sites of high environmental value and/or at high risk of weed invasion identified by BMT in 2016 (refer to Figure 1-1).

The aims of the PBPL Weed Monitoring Program are to:

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



Title:

2019 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

BMT

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2 Methodology

In accordance with previous monitoring surveys, weed inspections were undertaken in the post-summer months in March (2019). The survey was conducted by a qualified botanist with over 20 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 (i.e National Environmental Alert List / Weeds of National Significance (WONS)), with the potential to invade south-east Queensland, including:
  - Chinese violet (*Asystasia gangetica*).

    http://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/alert/a-gangetica.html
  - Siam weed (*Chromolaena odorata*).

    https://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/alert/pubs/c-odorata.pdf
  - Cyperus sedge (*Cyperus teneristolon*).

    http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=67172
  - Horsetails (*Equisetum hyemale*).

    https://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/alert/pubs/equisetum.pdf
  - Senegal Tea Plant (*Gymnocoronis spilanthoides*).

    http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=12850
  - Lagarosiphon (*Lagarosiphon major*).

    http://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/alert/pubs/l-major.pdf
  - Leaf Cactus (*Pereskia aculeata*).

    http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=12443
  - Praxelis (*Praxelis clematidea*).

    http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=67811
  - Laurel Clock Vine (*Thunbergia laurifolia*).

http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=42844

- Karroo Thorn (*Vachellia karroo*).

  http://www.environment.gov.au/cgi-bin/biodiversity/invasive/weeds/weeddetails.pl?taxon_id=84350

- 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), including 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 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 and western banks.

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.

Sites of environmental significance (Bird Hide, Fisherman's Island, Fort Lytton, Port West, Port Drive North, Port Drive South) were inspected on foot.

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. Such conditions 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. Figure 3-2 summarises the findings from the 2019 weed survey. Only exotic or introduced flora species recorded during the surveys are detailed in the following site descriptions, unless otherwise noted.

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 (refer to Figure 3-1).

The channel banks supported planted and naturally recruited shrubs and trees comprised of a mix of local native terrestrial species such as she-oaks (*Casuarina* spp.), figs (*Ficus* spp.), cotton tree (*Hibiscus tiliaceus*), *Melaleuca* spp. and *Macaranga tanarius*. Introduced shrubs were sparse and the groundcover was dominated by exotic grasses. The tidal channel does not contain extensive aquatic macrophytic cover but supported a low, discontinuous fringe of the native grey mangrove (*Avicennia marina*). 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. Poor access along the eastern bank of Lucinda Drain limits regular maintenance but weeds are reportedly removed on an annual basis.

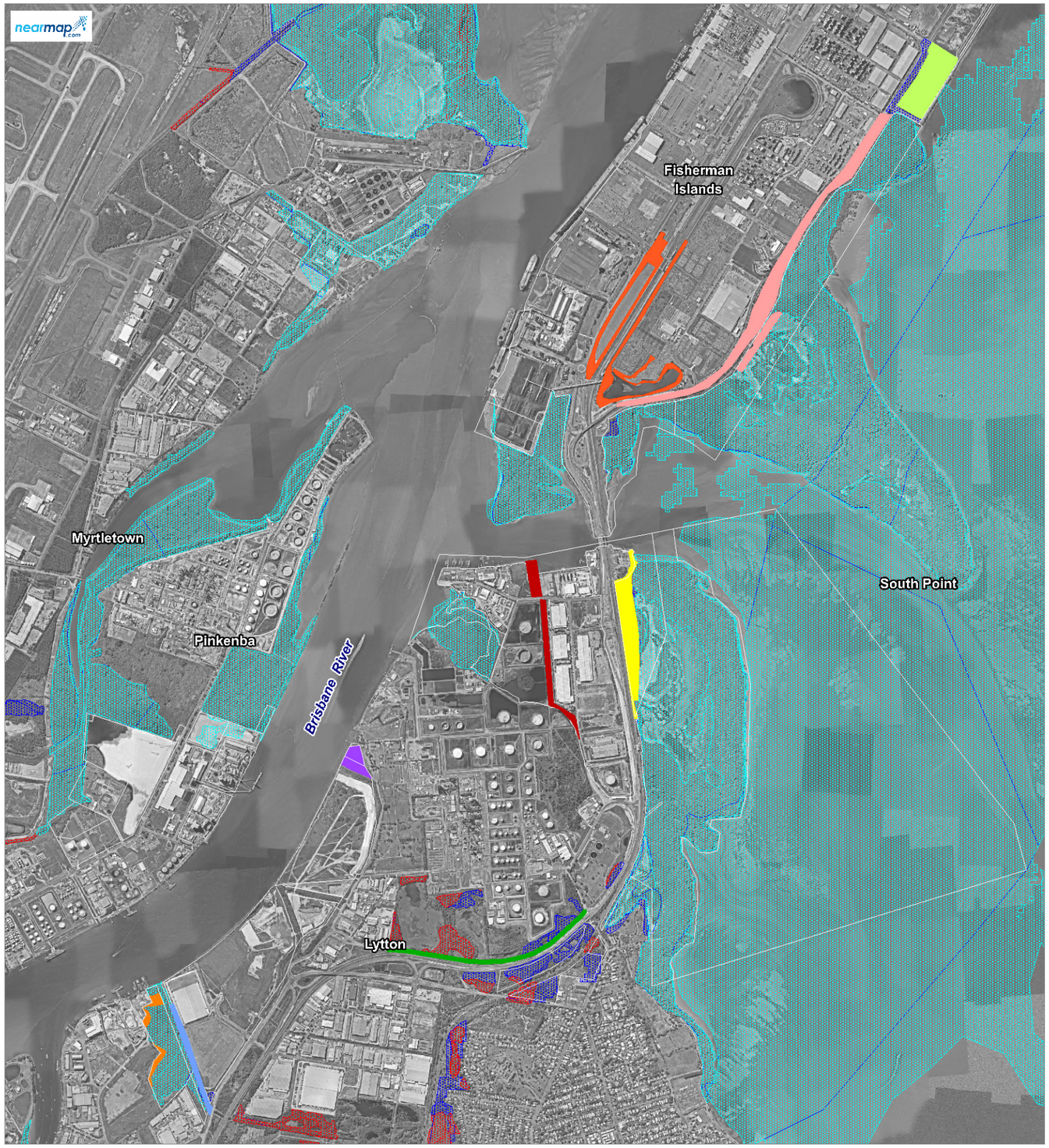
3.1.2 Weeds

The following observations were made in the 2019 survey:

- Woody weed cover has been reduced along Lucinda Drain due to active weed management.
- 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*. Other woody weeds included *Lantana camara, Senna pendula* var. *glabrata* and *Leucaena leucocephala*.
- *Macroptilium atropurpureum,* mile a minute *(Ipomoea cairica),* glycine (*Neonotonia wightii)* and *Solanum seaforthianum* were the most abundant exotic vine species.
- The groundcover was dominated by mown exotic grasses including *Chloris gayana, Megathyrsus maximus* var. *maximus, Melinis repens* and Mossman River grass (*Cenchrus echinatus*).
- Other exotic groundcovers, forbs and herbs included *Stylosanthes scabra*, *Commelina benghalensis, Tridax procumbens, Calyptocarpus vialis, Gomphrena celosioides, Cynodon dactylon, Sida cordifolia, Capsella bursa-pastoris, Crotalaria pallida, Heliotropium amplexicaule, Erigeron bonariensis, Crassocephalum crepidioides, Bidens pilosa, Portulaca oleracea, Ageratum houstonianum, Oenothera drummondii, Plantago major, Sonchus oleraceus, Phyllanthus virgatus* and *Malvastrum coromandelianum.*
- No aquatic macrophyte weed species were recorded. The brackish to saline conditions of the channel limits the establishment of exotic aquatic macrophytes known from the region.
- Woody weed cover has been reduced along Lucinda Drain due to active weed management but no significant differences in weed composition have been observed for Lucinda Drain over time.


Figure 3-1 Lucinda Drain 2019



Site Summary

Bird Hide:
-intertidal saltmarsh providing important habitat for migratory waders
-some Phragmites encroachment into saltmarsh
-Restricted Matters under Biosecurity Act: groundsel

Lucinda Drain:
-constructed intertidal channel with maintained banks
-stable condition
-exotic species dominated by environmental weeds well established across Brisbane
-Restricted Matters under Biosecurity Act: broad-leaved pepper tree, camphor laurel, lantanas

T1-3, Car Precinct and Constructed Lakes:
-constructed lake and regularly mowed easements
-stable condition
-exotic species dominated by environmental weeds well established across Brisbane
-Restricted Matters under Biosecurity Act: groundsel, fireweed, broad-leaved pepper tree, lantana

Port Drive (North) Wetlands:
-mangroves and saltmarsh associated with Boat Passage
-saltmarsh-mangrove ecotone supports localised patches of broad-leaved pepper tree and exotic grasses
-landward edge of saltmarsh is regularly slashed, reducing habitat condition and extent of this threatened community
-Phragmites encroachment into saltmarsh
-re-profiling highly disturbed areas of exotic grassland adjacent to tidal lands could assist saltmarsh resilience to sea level rise and may promote recruitment of nationally threatened swamp oak communities
-exotic species dominated by environmental weeds well established across Brisbane
-Restricted Matters under Biosecurity Act: broad-leaved pepper tree

Port Gate Drain:
-constructed intertidal channel
-instream channel and banks have been extensively cleared
-sparse exotic species due to clearing / dominated by environmental weeds well established across Brisbane
-Restricted Matters under Biosecurity Act: groundsel, broad-leaved pepper tree, lantana

Fort Lytton Estuarine Wetlands:
-mangroves and saltmarsh associated with the Brisbane River
-saltmarsh ecotone supports localised patch of broad-leaved pepper tree, leucaena and exotic grasses
-Phragmites encroachment into saltmarsh
-exotic species dominated by environmental weeds well established across Brisbane
-Restricted Matters under Biosecurity Act: broad-leaved pepper tree, Chinese elm, groundsel, lantana, balloon vine, prickly pear, madeira vine

Port West Estuarine Wetlands:
-mangroves and saltmarsh associated with the Brisbane River
-saltmarsh-mangrove ecotone supports localised patches of broad-leaved pepper tree and exotic grasses
-Phragmites encroachment into saltmarsh
-exotic species dominated by environmental weeds well established across Brisbane
-Restricted Matters under Biosecurity Act: broad-leaved pepper tree, ground asparagus fern, prickly pear

Port West Drain:
-mangroves surrounding constructed intertidal channel
-stable condition
-exotic species dominated by environmental weeds well established across Brisbane
-Restricted Matters under Biosecurity Act: groundsel, prickly pear, broad-leaved pepper tree, lantana, madeira vine

Port Drive (South) Wetlands:
-melaleuca, phragmites and swamp oak wetlands
-Restricted Matters under Biosecurity Act: groundsel, broad-leaved pepper tree, lantana

LEGEND

Sites of High Ecological Value
- Wetlands of High Ecological Significance
- Endangered / Of Concern Remnant Vegetation
- Essential / Wildlife Habitat

Weed Monitoring Sites
- Bird Hide
- Fort Lytton
- Lucinda Drain
- Port Drive - North
- Port Drive - South
- Port Gate Drain
- Port West
- Port West Drain
- T1-3 / Car Precinct / Lake

Title:
2019 Weed Survey Summary

Figure: 3-2

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Approx. Scale

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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, was comprised of a narrow intertidal channel fringed with remnant mangroves numerically dominated by mature *Avicennia marina* (refer to Figure 3-3). The channel is bounded to the west by extensive mangrove forest and cleared land for industrial purposes lie to the east. No scheduled maintenance work, including weed removal, is undertaken at Port West Drain by PBPL.

3.2.2 Weeds

The following observations were made in the 2019 survey:

- No DAWR-listed species were recorded within or directly adjacent to Port West Drain.
- Weed species listed as Restricted Matters that were recorded here included: *Baccharis halimifolia, Opuntia stricta, Schinus terebinthifolius, Lantana camara* and madeira vine *(Anredera cordifolia).*
- Exotic species recorded included *Ipomoea cairica, Macroptilium atropurpureum, Chloris gayana, Megathyrsus maximus* var. *maximus, Bidens pilosa*, *Gomphocarpus physocarpus*, *Melinis repens*, *Solanum nigrum*, *Erigeron bonariensis, Macroptilium lathyroides, Anredera cordifolia, Asparagus aethiopicus* and *Asparagus africanus.* These environmental weeds are well established across Brisbane.
- The dominant woody weeds recorded included *Schinus terebinthifolius, Baccharis halimifolia* and *Lantana camara*. Other woody weeds included *Gomphocarpus physocarpus,* phasey bean (*Macroptilium lathyroides),* castor oil plant (*Ricinus communis),* coral berry *(Rivina humilis*), *Senna pendula var. glabrata,* giant Devil's fig (*Solanum chrysotrichum),* wild tobacco (*Solanum mauritianum*) and *Solanum nigrum.*
- The groundcover was numerically dominated by the exotic grasses *Megathyrsus maximus* var. *maximus, Chloris gayana, Melinis repens,* Johnson's grass (*Sorghum halepense)* and vasey grass (*Paspalum urvillei).*
- Dominant exotic vines included *Ipomoea cairica, Macroptilium atropurpureum, Neonotonia wightii* and white passionflower (*Passiflora alba*). Sparse *Anredera cordifolia* was also recorded.
- Common exotic herbs and forbs included *Bidens pilosa*, lance-leaved rattlepod (*Crotalaria pallida*), gomphrena weed (*Gomphrena celosioides*), *Sida cordifolia*, purple-top (*Verbena bonariensis*), *Verbena litoralis, Sonchus oleraceus* and *Asclepias curassavica.*
- No aquatic macrophyte weed species were recorded and none are likely to occur given the brackish to saline conditions of the waterways.
- Except for recent clearing and associated weed removal for industrial development adjacent to the channel, no major differences in weed composition or density were observed at Port West between the current and previous monitoring surveys.


Figure 3-3 Port West Drain 2019

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 (refer to Figure 3-4). 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. The instream channel and banks had recently been cleared of vegetation.

3.3.2 Weeds

The following observations were made in the 2019 survey:

- No DAWR-listed species were recorded within or directly adjacent to Port West Drain.
- Restricted Matters recorded included: *Baccharis halimifolia, Schinus terebinthifolius, Lantana camara* and *Cinnamomum camphora.*
- 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, Erigeron bonariensis, Leucaena leucocephala, Araujia sericifera, Passiflora foetida* and *Macroptilium lathyroides.*
- The dominant woody weeds recorded included *Schinus terebinthifolius, Baccharis halimifolia* and *Lantana camara*. Other woody weeds included *Cinnamomum camphora, Celtis sinense, Gomphocarpus physocarpus, Leucaena leucocephala, Solanum chrysotrichum, Solanum nigrum* and *Psidium guajava.*
- The groundcover was numerically dominated by exotic grasses including *Megathyrsus maximus* var. *maximus*, *Chloris gayana, Melinis repens, Sorghum halepense, Cenchrus echinatus* and *Paspalum* spp. Other introduced grasses included *Arundo donax, Cynodon dactylon* and *Hyparrhenia rufa.*

- Dominant exotic vines included *Ipomoea cairica, Macroptilium atropurpureum, Vigna* sp., *Passiflora* spp. and *Araujia sericifera.*
- Common exotic herbs and forbs included *Bidens pilosa*, *Capsella* sp., *Emilia sonchifolia, Erigeron bonariensis, Commelina benghalensis, 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.
- Weed cover has been significantly reduced along Port Gate Drain due to the recent vegetation clearing but no significant differences in weed composition have been observed.

2018: **2019:**

Figure 3-4 Port Gate Drain

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 (refer to Figure 3-5).

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 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.

T1-3, Car Precinct, railway easement and lands surrounding the lakes undergo regular maintenance including mowing and spraying for weeds.

3.4.2 Weeds

The following observations were made in the 2019 survey:

- No DAWR-listed species were recorded within or directly adjacent to the survey area.
- Restricted Plants recorded included *Baccharis halimifolia,* fireweed (*Senecio madagascariensis*), *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* and *Solanum nigrum.*
- Dominant exotic vines recorded included *Ipomoea cairica, Ipomoea alba, Vigna* sp., and *Macroptilium atropurpureum.*
- The sparse groundcover was regularly mowed. The most widespread exotic groundcovers were *Megathyrsus maximus var. maximus, Cenchrus echinatus, Melinis repens, Chloris gayana, Digitaria ciliaris, Cynodon dactylon, Paspalum* spp., *Paspalum urvillei, Setaria sphacelata* and *Setaria pumila*.
- Common exotic herbs and forbs included *Ageratum houstonianum, Cyperus eragrostis, Bidens pilosa, Crassocephalum crepidioides, Eclipta prostrata, Phytolacca octandra, Capsella bursapastoris, Gomphrena celosioides, Heliotropium amplexicaule, Euphorbia cyathophora, Lantana montevidensis, Erigeron bonariensis, Hypochaeris radicata, Oenothera drummondii, Tridax procumbens, Verbena bonariensis, Portulaca oleracea* and *Malvastrum coromandelianum.*
- Exotic aquatic macrophytes recorded in the shallow waters on the lakes edge included umbrella sedge (*Cyperus involucratus*) and *Ludwigia longifolia.*

- Whilst weed cover has been reduced around the constructed lake following weed maintenance and landscaping, there has been no significant differences in weed composition between the current and previous monitoring surveys.

Figure 3-5 T1-3, Car Precinct and Constructed Lake

3.5 The Bird Hide

The bird hide adjacent to Lucinda Drive is located on intertidal flats supporting a mix of mangroves, saltmarsh and mudflats which provide important habitat for a mix of migratory waders (refer to Figure 3-6). 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 considered 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, Erigeron bonariensis, Ipomoea cairica, Crassocephalum crepidioides, Setaria sphacelata, Sonchus oleraceus, Bidens pilosa, Portulaca oleracea, Ageratum houstonianum, Oenothera*

drummondii, Cakile edentula, Ipomoea cairica and *Macroptilium lathyroides.* Sparse woody weeds include *Baccharis halimifolia* and *Lantana camara.*

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, with the exception of *Phragmites australis* spread into samphire and saltmarsh communities, site monitoring is recommended to protect the environmental values of these wetlands.

Figure 3-6 Bird Hide 2019

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 ecological value and are prone to varying levels of weed invasion.

3.6.1 Intertidal Wetlands

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 supported localised patches of *Schinus terebinthifolius* on higher ground with a groundcover of *Chloris gayana* and *Megathyrsus maximus var. maximus.*

As identified in previous monitoring surveys, the landward edge of the saltmarsh is regularly slashed for ground maintenance which is removing succulent saltmarsh species, altering local topography and promoting the spread of exotic grasses, particularly *Chloris gayana,* into saltmarsh habitat (refer to Figure 3-7). *Phragmites australis* also forms sparse to localised patches at the upper tidal limit of the saltmarsh. 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.

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. However, the weed invasions at the mangrove-saltmarsh interface and at the upper saltmarsh limits are reducing the overall condition of

these communities and providing local sources for weed spread. The regular slashing also reduces the condition of coastal saltmarsh and promotes habitat conditions more suitable for weed invasion.

3.6.2 Filled Intertidal Land

Approximately 1.0 ha of previous intertidal and low-lying land east of Port Drive has been partially filled and excluded from tidal inundation. The altered hydrology and topography has favoured regrowth dominated by terrestrial weed species 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 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. Other exotic shrubs recorded in this filled and disturbed land include *Stylosanthes scabra, Opuntia stricta,* and *Solanum chrysotrichum.* Sparse exotic 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. 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.

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 3-7 Disturbed Coastal Saltmarsh Port Drive (May, 2019)

3.6.3 Freshwater Wetlands

Freshwater wetlands adjacent to Port Drive support remnant *Melaleuca quinquenervia* 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. Dominant weeds include sparse to dense patches of *Schinus terebinthifolius, Lantana camara, Baccharis halimifolia, Solanum mauritianum, Schefflera actinophylla, Phoenix* sp., *Ligustrum sinense, Celtis sinense, Cinnamomum camphora* and *Senna pendula* var. *glabrata*. The dominant weedy vines included *Araujia sericifera, Cardiospermum grandiflorum, Passiflora* spp. and *Anredera cordifolia*. Sparse exotic groundcovers restricted to disturbed woodlands at the edge of the road reserve included *Melinis repens, Megathyrsus maximus* var. *maximus, Cortaderia selloana, Melinis minutiflora* and *Andropogon virginicus*.

Despite the high diversity of weeds recorded within these wetlands, the exotic species are widespread in coastal wetlands of south-east Queensland, are restricted to the edge of these wetlands typically within 20 m of the road reserve and are not compromising the condition or value of the Melaleuca habitats.

North: Estuarine Wetlands

South: Freshwater Wetlands

Figure 3-8 Port Drive Wetlands 2019

3.7 Port West Estuarine Wetlands

Port West supports an extensive mosaic of mangroves and saltmarsh directly connected to the Brisbane River (refer to Figure 3-9). 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 native saltmarsh shrublayer comprising *Sporobolus virginicus* and *Sesuvium portulacastrum.* Very sparse weed invasion was recorded under this dense mangrove canopy and comprised mainly isolated *Asparagus aethiopicus, Opuntia stricta, Schinus terebinthifolius, Ricinus communis, Leucaena leucocephala* and *Senna pendula* var. *glabrata* on elevated sites.

Locally elevated sites within saltmarsh landward of the mangrove fringe supported sparse *Schinus terebinthifolius* over a groundcover of *Megathyrsus maximus var. maximus* and *Chloris gayana.* More landward sites also supported *Senna pendula var. glabrata, Baccharis halimifolia, Ricinus 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.

Figure 3-9 Port West Estuarine Habitat 2019

3.8 Fort Lytton Estuarine Wetlands

In 2015, BMT provided an assessment of a potential habitat improvement area at Fort Lytton on the eastern banks of the Brisbane River (refer to Figure 3-10). 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.

Re-survey of the site from 2017 to 2019 indicates that *Leucaena leucocephala* is becoming more widespread across this site. 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*. Dominant exotic groundcovers included *Chloris gayana, Megathyrsus maximus* var. *maximus* and *Sorghum halepense*. Other weeds recorded included *Anredera cordifolia*, *Ageratum houstonianum,*

Passiflora foetida, Erigeron bonariensis, Capsella bursa-pastoris, *Bidens pilosa, Cynodon dactylon, Gomphrena celosioides, Ipomoea 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.

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.

Figure 3-10 Fort Lytton 2019

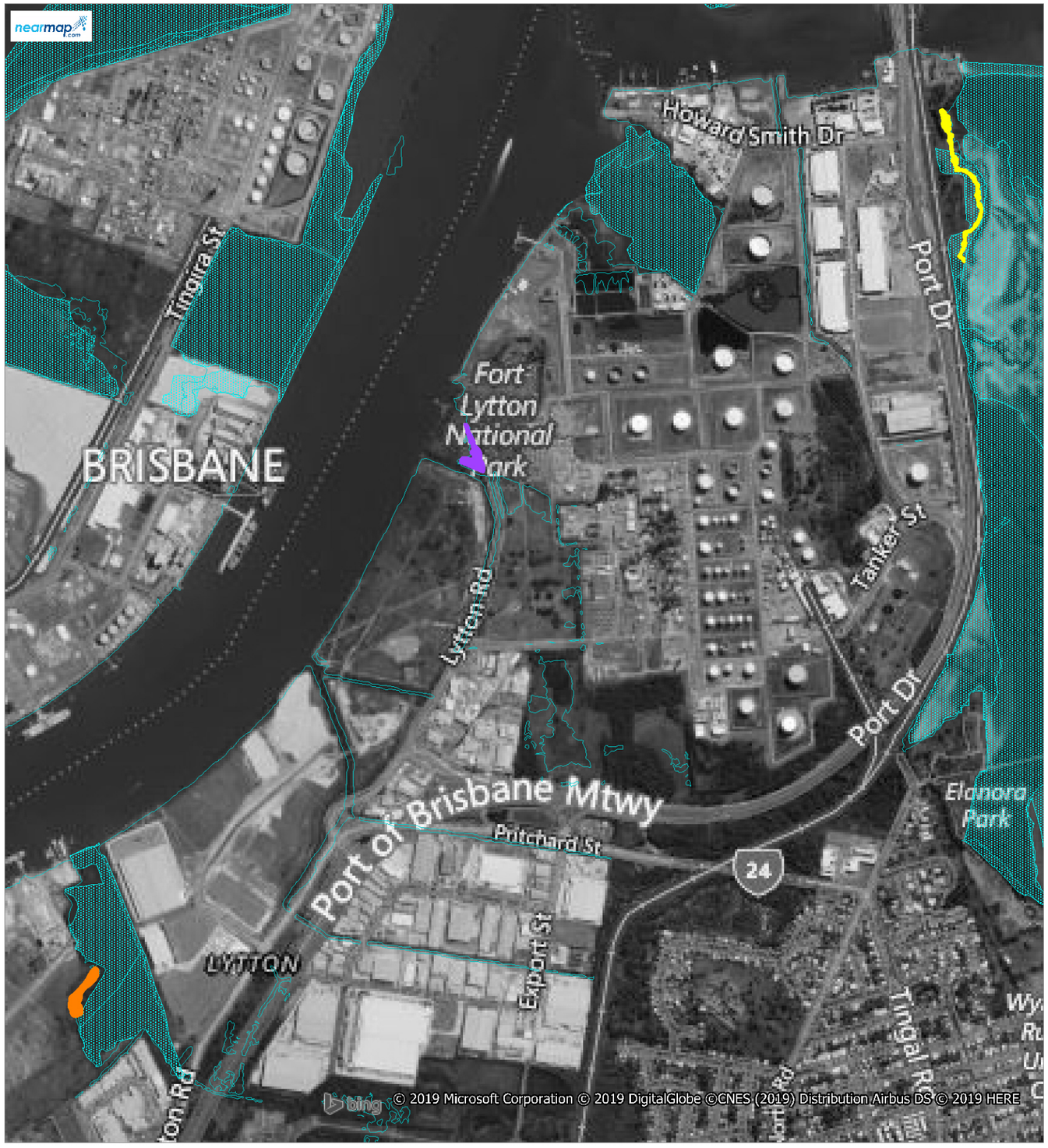
4 Discussion

With the exception of Lucinda Drain and Port Gate Drain, the survey sites have remained relatively stable in terms of weed composition and distribution over the monitoring period (2001-2019). No new weed species or significant outbreaks of weed invasion were recorded in the current survey. Active weed management along Lucinda Drain has reduced the density of woody weeds within the riparian corridor and weed cover has been significantly reduced along Port Gate Drain due to recent vegetation clearing.

High ecological value estuarine habitat at Port Drive, Port West and Fort Lytton have remained relatively stable over the monitoring period, though *Leucaena leucocephala* may becoming more widespread in saltmarsh ecotonal habitat. *Schinus terebinthifolius, Phragmites australis, Megathyrsus maximus var. maximus* and *Chloris gayana* remain the major weeds in wetlands of high ecological significance.

Consistent with previous monitoring results, it is recommended that woody weeds at the upper tidal limit in saltmarsh habitat are removed. Ecotonal habitat supporting exotic grasslands could be re-profiled to the range of estuarine wetland habitat, including swamp oak communities, which are listed as Endangered under the *EPBC Act*. Regular slashing for site maintenance should also be restricted to the area of terrestrial grasses only, with a minimum 10 m buffer provided to estuarine habitat. Figure 4-1 indicates estuarine habitat if high ecological value which may benefit from restoration works.

It is recommended that future annual weed surveys are carried out at the same sites and in accordance with the rapid biological assessment methodologies described in this report, though quantitative surveys may be required to track the potential increase in Leucaena invasion and its impact on estuarine habitat of high ecological value.



Weed Management Recommendations

Port Drive (North) Wetlands:

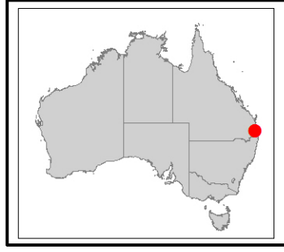
- Active weed management to target Leucaena leucocephala, Schinus terebinthifolius, Phragmites australis, Megathyrsus maximus var. maximus and Chloris gayana
- Quantify and map Leucaena invasion and its impact on estuarine habitat
- Reprofile ecotones within the range of estuarine wetland habitat to promote coastal saltmarsh and swamp oak regrowth
- Restrict slashing to terrestrial grasses only and provide minimum 10 m buffer to estuarine habitat

Fort Lytton Estuarine Wetlands:

- Active weed management to target Leucaena leucocephala, Schinus terebinthifolius, Phragmites australis, Megathyrsus maximus var. maximus and Chloris gayana
- Quantify and map Leucaena invasion and its impact on estuarine habitat
- Reprofile ecotones within the range of estuarine wetland habitat to promote coastal saltmarsh and swamp oak regrowth
- Restrict slashing to terrestrial grasses only and provide minimum 10 m buffer to estuarine habitat

Port West Estuarine Wetlands:

- Active weed management to target Leucaena leucocephala, Schinus terebinthifolius, Phragmites australis, Megathyrsus maximus var. maximus and Chloris gayana



Title:
Recommended Restoration Works in Estuarine Wetlands

Figure: **4-1**

Rev: **A**

N

0km 0.8 1.6

Approx. Scale

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5 Conclusion

With the exception of Lucinda Drain and Port Gate Drain, the survey sites have remained relatively stable in terms of weed composition and distribution over the monitoring period (2001-2019). No new weed species or significant outbreaks of weed invasion were recorded in the current survey. Active weed management along Lucinda Drain has reduced the density of woody weeds within the riparian corridor and weed cover has been significantly reduced along Port Gate Drain due to recent vegetation clearing.

All weed species recorded on PBPL lands are well-established in the bioregion and no DAWR-listed species have been recorded. Weed invasion on PBPL lands is associated with site disturbance, including hydrological modifications on, and adjacent to, intertidal lands. The marine weed species *Rhizophora mangle* has been recorded in north Queensland but has not been observed in the bioregion and is considered a low risk species at the port.

As weed species recorded on PBPL lands are widespread in the bioregion they will be difficult to control and are unlikely to be eradicated from PBPL lands. Priority areas for active weed management include high ecological value estuarine habitat at Port Drive, Port West and Fort Lytton. Although these habitats have remained relatively stable over the monitoring period, *Leucaena leucocephala* may becoming more widespread in saltmarsh ecotonal habitat. Quantitative surveys/species mapping may be required to track the potential increase in Leucaena invasion and its impact on estuarine habitat of high ecological value.

Consistent with previous monitoring results, it is recommended that woody weeds at the upper tidal limit in estuarine habitat are removed. Disturbed ecotonal habitat supporting exotic grasslands could be re-profiled to the range of estuarine wetland habitat, including swamp oak communities, which are listed as Endangered under the EPBC Act. Regular slashing for site maintenance should also be restricted to the area of terrestrial grasses only with a buffer provided to estuarine habitat.

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
Erigeron 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
Hyparrhenia rufa		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

Dominant Weed Species Recorded at PBPL

Species	Common Name	Lifeform
Sorghum halepense	Johnson grass	grass
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
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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