

Intermodal Logistics Centre at Enfield

Green and Golden Bell Frog Management Plan

ILC – E – REP – Frog Management Plan
Rev 4

March 2010

Revision 4

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1 Background

1.1 Introduction

The Green and Golden Bell Frog (GGBF) *Litoria aurea* is an endangered species listed under Schedule 1 of the NSW *Threatened Species Conservation Act 1995*. These frogs have been recorded at several sites in the Enfield - Greenacre area. The measures outlined in the Frog Management Plan (FMP) will assist with the management of the habitat to be created within the Sydney Ports Corporation's (Sydney Ports') ILC at Enfield Site, in accordance with the Project Approval. This proposed habitat is referred to as the "Frog Habitat Creation Area" (FHCA).

This Frog Management Plan will be incorporated in the Landscape and Ecological Area Management Plan prepared for the ILC Site.

A Frog Protection Plan, contained in a separate document, contains measures to protect the frogs during the re-development of the Site. The Frog Protection Plan will be included in the Construction Environmental Management Plans (CEMPs) to be prepared by contractors prior to commencing work on the Site

This Frog Management Plan (FMP) details the issues that must be addressed in managing this species. The Plan contains the following sections:

- Section 2 Status of the Greenacre-Enfield Green and Golden Bell Frogs
- Section 3: Establishment of Green and Golden Bell Frogs in the newly-created Frog Conservation Area on the ILC Site
- Section 4: Long-term management of the ILC FHCA
- Section 5: Frog monitoring regimes for the ILC FHCA
- Appendix A NSW National Parks and Wildlife Service Guidelines for Frog Handling and Frog Hygiene

All management measures recommended in this FMP are based on the available information on the biology and needs of Green and Golden Bell Frogs (Pyke and White, 1996, 2001).

The Plan has been prepared by Sydney Ports' Consulting Herpetologist, Dr Arthur White of Biosphere Environmental Consultants Pty Ltd.

1.2 Project Approval and Environmental Commitments Relating to GGBF

This FMP has been prepared in accordance with the requirement of Conditions 2.48 and 6.3 d iv) of the Project Approval and undertakings provided in the Statement of Commitments in the Environmental Assessment (SKM, 2005) and Preferred Project Report (SKM, 2006).

Condition 2.48 of the Project Approval requires:

The Proponent shall implement all of the relevant actions for the site recommended in the Management Plan for the Green and Golden Bell Frog Key Population at Greenacre (DECC, May 2007), being:

- a) *creation of overwintering habitat as part of the two-hectare improved foraging habitat at the southern end of the site;*
- b) *provision of linkages to the former RailCorp ponds; and*
- c) *restrictions on the use of herbicides in known frog habitat and attainment of water quality standards for water discharged from the site.*

These actions shall be incorporated within both the Construction Environmental Management Plan (refer to condition 6.2) and the Operation Environmental Management Plan (refer to condition 6.4) as relevant, including provisions for monitoring the outcomes of these actions and periodically reporting outcomes to the DECC at a frequency agreed with the DECC.

The implementation of the above actions is discussed in Section 4.

Condition 6.3 d iv) of the Project Approval requires:

As part of the Construction Environmental Management Plan for the project, required under condition 6.2 of the Project Approval, the Proponent shall prepare and implement:

- a) *a **Landscape and Ecological Area Management Plan** to detail how the site will be landscaped and maintained. The Plan shall include:*
 - iv) *measures for the enhancement, revegetation and on-going management of the Ecological Area on the site, including measures to provide suitable habitat for Litoria Aurea.*

The Statement of Commitments relating to Flora and Fauna provided in the Environmental Assessment and Preferred Project Report are provided in Table 1.1 below.

Table 1.1: Statement of Commitments relating to Flora and Fauna in the EA & PPR

Objective	Action
Table 21.1 EA/ Table 4.1 PPR	Construction Environmental Management Measures – Flora and Fauna
Provide secure habitat for the Green and Golden bell Frog	A Frog Habitat Area is proposed to be constructed as part of the Community and Ecological area at the southern part of the site. The area will be designed by qualified personnel and will comprise ponds, foraging and shelter habitat. Frog movement corridors would also be identified to link the new habitat areas with existing frog habitat areas offsite.
Minimise likelihood of direct impacts to threatened species	During site works existing areas of potential frog habitat would be checked and any frogs found removed prior to works commencing. Frog exclusion fences will be provided during construction in areas where there is potential for frog activity.
Table 21.2 EA/ Table 4.2 PPR	Operational Environmental Management Measures – Flora and Fauna
Maintenance of Frog Habitat Area	The Frog Habitat Area will be constructed according to the detailed design prepared, and would be managed according to an appropriate Frog Management Plan. Monitoring of the Frog Habitat Area will be undertaken to ensure it is functioning as designed.

A concept design for the ILC FHCA was prepared by Dr Arthur White in June 2008. Further development and optimisation of the concept design was undertaken during detailed design. The proposed FHCA is discussed in Section 4.

1.3 Consultation

As part of the preparation of the FMP, consultation has been undertaken with DECCW, in accordance with the requirements of CoA 2.48 of the Project Approval.

1.4 Environmental Management Structure and Responsibility

The responsibility and authority of key project personnel pertaining to environmental performance and frog protection is described in Table 1.2.

Table 1.2: ILC Project Environmental Roles and Responsibilities

	Role	Name*	Phone	Responsibilities
Construction	Enabling Works Project Manager	Bruce Royds	0417 278 386	<ul style="list-style-type: none"> ▪ Responsible for delivery of the ILC Site enabling works ▪ Emergency contact ▪ Authorised to stop or direct site enabling works
	Planning and Environmental Manager	Ricardo Prieto-Curiel	0488 220 642	<ul style="list-style-type: none"> ▪ Advises Sydney Ports on environmental and planning matters
	Sydney Ports' Consulting Herpetologist	Dr Arthur White	9599 1161 or 0427 021 059	<ul style="list-style-type: none"> ▪ Preparation of Frog Protection Plan & Frog Management Plan ▪ To be contacted immediately if frogs are found during site construction activities ▪ Responsible for monitoring and reporting on GGBF and habitat in accordance with this plan
	Contractor/s	TBA		<ul style="list-style-type: none"> ▪ Carries out works in accordance with the requirements of the Frog Protection Plan
Operation	Sydney Ports' Environmental Representative	TBA		<ul style="list-style-type: none"> ▪ the primary contact point in relation to the operational environmental performance of the project ▪ responsible for all management plans and monitoring programs required under the Project Approval

* current personnel at the time of writing this version of the FMP in March 2010

1.5 Emergency Contacts and Response

During the construction enabling works, the nominated person who can deal with emergencies is **Bruce Royds 0417 278 386**. During main construction works, Sydney Ports will nominate a representative to deal with emergencies.

2 Status of the Greenacre-Enfield Green and Golden Bell Frogs

2.1 Previous Studies

The Green and Golden Bell Frog *Litoria aurea* has been recorded from several sites in the Enfield-Greenacre area (Greer, 1995, AMBS, 1999, White pers. obs.). This species is known from:

- the Juno Parade brick pit site (White, 2000);
- Cox's Creek Reserve (White, 1993);
- residential sites between the Cox's Creek Reserve and the Juno Parade brick pit (Greer, 1995, White, unpubl. data);
- the RailCorp Marshalling Yards (Greer, 1995) located west of the ILC Site;
- Cooke Park and South Strathfield (White, unpubl. data).

Juno Parade and the RailCorp Marshalling Yards are shown on Figure 1.

Green and Golden Bell Frogs have been monitored in the Cox's Creek reserve since 1993 and in the Juno Parade Brickpit since 1999. Occasional monitoring surveys have also been carried out in the RailCorp Marshalling Yards at the FreightCorp Pond (White, 2008).

Other studies have been carried out on the Green and Golden Bell Frogs in the Enfield area. In 1993, a detailed study of the Bell Frogs in the Cox's Creek Reserve was carried out as part of a Fauna Impact Statement (White, 1993) for the construction of a warehouse complex alongside the reserve. In 1994 a frog survey and tracking study of Bell Frogs in the Cox's Creek Reserve was conducted (White, unpubl. data). Bell Frogs were located in the RailCorp Marshalling Yards and Enfield brick pit and in residences in Hebe Street and Sylvanus Street, Greenacre.

In 1995, Greer undertook a specific survey for Green and Golden Bell Frogs in the same general area. This survey was in response to a Review of Environmental Factors prepared for the re-development of the RailCorp Marshalling Yards by RailCorp. As part of this work, a detention pond on the RailCorp site was modified to become a Bell Frog breeding site.

Irregular surveys were undertaken in 1996 and 1997 (White and Pyke, unpubl. data) in an effort to locate other breeding sites for the Green and Golden Bell Frog in the Enfield/Greenacre area. In 1999, AMBS undertook a frog survey of the Enfield brick pit on behalf of the Hannas Group of Companies.

Surveys for Green and Golden Bell Frogs and habitats in the wider Greenacre area were conducted between December 2007 and February 2008 by Ecology Partners

(June 2008) on behalf of DECC. These surveys, which included the ILC Site, did not find any Green and Golden Bell Frogs.

2.2 Assessment of Bell Frog Populations in the Enfield-Greenacre Area

The various surveys have amassed sufficient information to permit an assessment of the Bell Frog populations in the Enfield-Greenacre area. Several important facts have emerged from this work:

1. The Enfield-Greenacre Bell Frogs appear to be isolated from all other known Bell Frog populations. Potential movement corridors between the Greenacre-Enfield population and their closest neighbours at Homebush were investigated in 1994. Possible corridors beside industrial areas, golf courses, rail easements and power easements were surveyed (White and Pyke, unpubl. data) and were found to be unsuitable for frog dispersal.
2. The Enfield-Greenacre Bell Frog population appears to be small. The maximum number of adult frogs seen in a single evening between 1993 and 1999 was 12. Larger numbers of juvenile frogs have been seen in both the brick pit and marshalling yards (White pers. obs., Greer 1995). The implication of these sightings is that survivorship of tadpoles and/or juvenile frogs is low.
3. There appears to be regular annual movements of Bell Frogs between the brick pit/ marshalling yards and Cox's Creek Reserve (White and Pyke, unpubl. data). Animal exchange between these areas may be critical for the survival of each satellite group.
4. Secure breeding sites are scarce in the Enfield/Greenacre area. To date tadpoles have only been observed in three instances, being in:
 - 1994 in the Cox's Creek Reserve (none of these tadpoles survived to adulthood);
 - 1995 in the modified frog ponds in the New Marshalling Yard (Greer, 1995);
 - 1996 in the Juno Parade brick pit (White).

Juvenile frogs were found above the brick pit in 1995 (Greer 1995, pers. com.) and around the pond in the New Marshalling Yard in the same year (Greer pers. com.).

The data indicates that Bell Frogs move between the brick pit, RailCorp Marshalling Yard and Cox's Creek Reserve. These three groups should be considered as satellite populations (meta-populations) of a common source. Movement between sites, particularly to and from Cox's Creek Reserve, is perilous and some frogs are killed undertaking these movements. Movements may be dispersal events or foraging trips (White pers. obs).

In 2007, the DECC identified the Enfield-Greenacre Green and Golden Bell Frog population as a Key Population. In 2008 a Management Plan was prepared for this population (Molino Stewart, 2008).

At present, the maintenance of Green and Golden Bell Frogs at the Greenacre-Enfield area depends on the existence of the Frog Habitat Area in the Juno Parade brickpit site, which contains the only secure breeding habitat for this species in the local area. Previous studies (e.g. White, 1993) have indicated that the biggest threat to the Enfield Bell Frogs was the absence of safe breeding areas. The Frog Habitat Area at Juno Parade was developed to provide secure breeding habitats and to increase the size of the local Bell Frog population. It has succeeded in both of these requirements.

However, after 2000 Bell Frogs disappeared from the Cox's Creek Reserve and are rarely recorded at the RailCorp pond (White, 2008). The continued threats to the Enfield-Greenacre Bell Frog population make it imperative that additional habitat areas that are contiguous with existing habitat areas are developed. For this reason, ponds, foraging and shelter habitat areas will be developed at the southern end of the ILC Site, as part of the redevelopment of the Site. This area will be known as the ILC Green and Golden Bell Frog Habitat Creation Area (FHCA).

2.3 Interconnectivity of Surrounding Bell Frog Populations

An important component of the long-term management of the Enfield Bell Frogs is the maintenance of interconnectivity between the surrounding populations in the Juno Parade Brickpit and the RailCorp Marshalling Yards and any population to be established in the FHCA. The locations of these habitat areas are shown on Figure 1.

2.3.1 Juno Parade Brickpit Corridor

The FHCA lies approximately 400 m east of the Juno Parade Frog Habitat Area, as shown on Figure 1. The eastern side of the Juno Parade site is enclosed in wire mesh fencing that allows frogs to move through onto the RailCorp Marshalling Yard site next door. Bell Frogs must cross several sets of rail lines before reaching the proposed new frog movement corridor that connects to the FHCA.

2.3.2 New Enfield Marshalling Yards Corridor

Interconnectivity between the RailCorp Pond and the RailCorp Marshalling Yard will be achieved via a new corridor, as shown on Figure 1, that has recently been constructed by RailCorp. This corridor leads north along the inside of the noise wall to new temporary ponds inside the RailCorp Marshalling Yards. From there the frogs can easily move the final 200 m to the RailCorp Pond, which is currently being upgraded.

There will be no direct access from the FHCA to the RailCorp Pond.



Figure 1: Greenacre-Enfield Green and Golden Bell Frog Habitat Areas

3 Establishment of Green and Golden Bell Frogs on the ILC Site

The development of the FHCA at the ILC Site is critical for the conservation of the Greenacre-Enfield Bell Frogs. In the long-term, the FHCA may become a core area for Bell Frogs in the local area. Juvenile and adult frogs will be able to disperse from the FHCA and populate surrounding sites. Similarly, emigrating frogs from outside areas will be able to refuge in the FHCA. The FHCA will thus act as the hub for the surrounding satellite populations.

A concept design for the FHCA was prepared by Sydney Ports' Consulting Herpetologist, Dr Arthur White. Development and optimisation of the concept design has been undertaken as part of the detailed design. The FHCA will comprise:

- three ponds (total surface area of 400 m²), one of which is designed as a water storage pond (Pond 1) to be used primarily for the supply of water to the other two ponds (Ponds 2 and 3);
- a range of diurnal shelter sites;
- over-winter habitat;
- large foraging space;
- a frog movement corridor which connects to the RailCorp Marshalling Yard.

The FHCA and the frog movement corridor will not become operational until completion of the main construction contract, as the permanent water supply to the frog ponds will not be available until completion of the site trunk drainage and the southern bioretention/detention basin. In addition, construction traffic is expected to regularly traverse the future frog corridor movement route to access the southern end of the Site.

The indicative location of the FHCA, including ponds and frog movement corridor, is shown on Figure 1. The concept design is included as Figure 2.

Details of the management of the FHCA are provided in Section 4 below.

4 Long-Term Management of Green and Golden Bell Frogs on the ILC Site

The following sections describe the management procedures that will be utilised for the long-term maintenance of the FHCA and the management of the Bell Frog population at the ILC at Enfield.

4.1 Permanent Frog Ponds Operation and Management

The concept design for the permanent frog ponds in the FHCA is contained in Figure 2 and the draft detailed design is contained in Figure 3. Three ponds (Ponds 1, 2 and 3) of approximately equal size will be provided. Pond 1 will store and supply water to Ponds 2 and 3. Ponds 2 and 3 will be drainable and operate with fluctuating water levels. More details of the pond operation and management are provided in the sections below.

4.1.1 Pond Water Supply and Water Quality

Treated water from the southern stormwater bioretention/detention basin at the Site will be the main source of water to the pond system. The combined stormwater bioretention and detention basin is located about 70 m north-west of the frog ponds and will connect to Pond 1 via a gravity fed pipe. When there is water in the bio-retention basin, the treated low flows from the basin will automatically be directed to Pond 1 to be stored until required for manual top up of Ponds 2 and 3. The flow rate from the bio-retention/detention basin to Pond 1 will be controlled by the size of the supply pipe (110 mm diameter) and the depth of water in the bio-retention basin.

For larger events the bio-retention/detention basin drains via a separate high flow pipe to Coxs Creek and, in extreme events greater than 100 year ARI, overflows via a rock mattress spillway onto the floodplain.

Water will be supplied from Pond 1 to Ponds 2 and 3 by gravity fed pipes manually controlled by separate valves for each pond. If full, Pond 1 is designed to overflow via a rock spillway onto the floodplain rather than drain into the Ponds 2 and 3, thus protecting the habitat in the frog ponds. All inlets to the ponds will also be provided with rock protection to prevent erosion of the pond embankment.

Stormwater will undergo primary and secondary treatment prior to entering the frog pond system. Primary treatment will be provided through gross pollutant traps and an inlet forebay sediment trap installed at the downstream end of the site stormwater collection system prior to discharge into the stormwater bio-retention/detention basin.

Secondary treatment will be provided in the bioretention basin which is integrated within the stormwater detention basin. The bio-retention system achieves the Best Practice Stormwater Targets adopted by the Cooks River Sustainability Initiative and

the targets set by the NSW DECC (2008) in the draft *Managing Urban Stormwater Guidelines*. These targets are the reduction of the following pollutant levels:

- Gross Pollutants 90%
- Total suspended solids 85%
- Total phosphorus 65%
- Total nitrogen 45%.

4.1.2 Pond Water Levels

Unless the pond is being drained (refer Section 4.1.3 below), water should always be present in Ponds 2 and 3 and the depth should, if possible, fluctuate between 0.5 to 1.0 m. Ponds 2 and 3 must be topped up to a maximum of 1.0 m, if possible, from Pond 1 when the water levels in either of these ponds drop below 0.5 m. During normal operation, the top water level in Ponds 2 and 3 will automatically be retained at a level of no greater than 1.0 m through the use of an overflow riser.

Ponds 2 and 3 do not have a large catchment area draining directly to them and are therefore unlikely to overflow unless heavy rain occurs when they are already full. Any overflow from Ponds 2 and 3 will pass via separate spillways onto the adjoining floodplain.

Fluctuation in water levels in Ponds 2 and 3 and the rate of flow received in these ponds will therefore be mainly controlled by the operation of the valves directing flow from Pond 1, enabling protection of the habitat in the ponds. The plantings in Ponds 2 and 3 have been designed for a fluctuation in water level generally between 0.5 to 1.0 m in depth. As discussed in Section 4.1.1, the inlets to the ponds are provided with rock protection to prevent erosion of the pond embankment and damage to pond plants.

Pond water levels will be checked during Sydney Ports' regular site inspections and frog monitoring surveys.

4.1.3 Pond Dewatering

Ponds 2 and 3 will be drainable by a gravity outlet pipe, controlled by a capped drainage outlet, to permit periodic removal of water from the ponds. Recent studies of Bell Frog behaviour (Pyke and White, 1999) have shown that Bell Frogs can be displaced from stable aquatic habitat areas but fare much better when ponds are fluctuating or ephemeral. Because of this behaviour and other aspects of the biology of Bell Frogs, Green and Golden Bell Frogs are considered to be a "colonising species" (White, 1995, Pyke and White, 2001). In newly established aquatic sites, Bell Frogs are better able to survive and out-compete other species whereas in well established and near-permanent ponds other species dominate (Pyke and White, 1999).

By having drainable ponds, it will be possible to ensure that at least one of the ponds is functioning as a newly established pond most of the time. Each winter, or as considered necessary by Sydney Ports in consultation with the herpetologist, one pond will be drained and allowed to become dry, allowing the surrounding emergent vegetation to regress and die. The emptied pond will be refilled in the following August and the natural succession of aquatic plants allowed to proceed.

The choice of pond to drain will depend on the state of the vegetation around the pond and frog activity at the pond. The pond that is more thickly vegetated with only few or no Bell Frogs detected during the monitoring sessions should be drained. If the pond is sparsely vegetated and Bell Frogs are active about the pond it should be retained. The period between pond drainage must preferably not exceed 2 years.

The decision to drain a pond, and any requirements for the draining of the pond, will be made by Sydney Ports in consultation with the project's herpetologist. Any tadpoles present in the pond will be relocated prior to draining the pond.

Pond drainage will also enable removal of unwanted pests from the ponds, in particular Plague Minnows *Gambusia holbrooki*. These small fish are present in the brickpit lake and are known to prey on the tadpoles and eggs of Green and Golden Bell Frogs (Pyke and White 2000). They can be transported by birds between aquatic sites, resulting in future pond infestation. If these fish are allowed to remain in a pond the chance of them being transported to another pond is high. Should *Gambusia* be found in one of the ponds, the pond must be drained during the next winter and the fish killed.

4.2 Emergent Plants

As part of the establishment of the FHCA, emergent plants will be planted in clumps in each of the ponds, as shown on the Concept Design in Figure 2. These plants will:

- provide shelter for frogs during the day;
- provide basking sites for frogs during the day;
- act as insect attractants (i.e. food for the frogs).

The plants chosen for the ponds are all multiple-stemmed, erect rushes. After a few years they will become too thick and need to be reduced. At this stage, the pond should be drained and the plants allowed to die back. It is not anticipated that manual harvesting of the planted emergent plants will be required. If manual harvesting is required, the Consulting Herpetologist will advise Sydney Ports to this effect. The recommended plants are:

- Sedge *Schoenoplectus validus*
- Spike Rush *Eleocharis sphacelata*

4.3 Fringing Vegetation

Fringing vegetation provides shelter habitat as well as foraging areas close to the breeding ponds. As adult Bell Frogs feed mainly on large arthropods, often the most suitable foraging habitat is overgrown grassland. In many of the sites where Bell Frogs occur, these grasses are exotic, such as Kikuyu and Buffalo Grass. These grasses appear to be particularly suitable as they grow quickly, are eaten by a variety of crickets, grasshoppers and other invertebrates, and create their own micro-habitats when allowed to become overgrown.

Native grasses rarely grow thickly enough to create a dense foraging area. If native grasses are to be used, they should be allowed to become long and straggly. The recommended plants for shelter habitat include:

- Kangaroo Grass *Themeda australis*
- Wallaby Grass *Austrodanthonia sp.*
- Matt Rush *Lomandra longifolia.*

4.4 Shelter Habitat

Shelter for Bell Frogs will be provided in the form of:

- emergent plants around the ponds;
- sleepers and/or rock piles around the ponds, which will be relocated from other areas of the ILC Site;
- Mat Rush thickets and rock piles on the grassed area around the pond and at set points along the frog corridor.

At Enfield, the main predators of Bell Frogs will be birds such as White-faced Herons, White Ibis, cormorants and egrets. These birds are likely to inhabit the ponds when vegetation levels are low (ie when a pond is being dried out or refilled).

Birds will prey on tadpoles in the ponds. Logs or long branches laid across the pond will provide some protection for tadpoles (and also basking sites for adult Bell frogs). If the vegetation is low and does not provide adequate protection for the tadpoles, flutter ribbons will be suspended above the ponds to deter the birds (similar to those used at the Marrickville Bell Frog Pond). If bird scaring devices are required, the Consulting Herpetologist will advise Sydney Ports as to the measures required and equipment needed. Foxes constitute the other main potential predator at Enfield. At this stage no measures are considered to be practicable in the control of foxes.

Some areas around the Frog Ponds will need to be periodically mowed. The Consulting Herpetologist will be consulted by Sydney Ports on this matter.

4.5 Frog Movement Corridor

Green and Golden Bell Frogs are a very mobile frog species. They have been recorded undertaking long distance movements overnight and over sustained wet periods (Pyke & White 2001). This mobility allows Bell Frogs to periodically move between neighbouring sites.

Bell Frogs need to be able to move safely between ponds and between foraging areas. At the ILC site the foraging and shelters will be created around the ponds. Dispersal to nearby habitats at Juno Parade and at the RailCorp Pond will be facilitated through the construction of a Frog Movement Corridor in the location shown on Figure 1.

The Frog Movement Corridor consists of an approximately 10 m wide area of sown grass with a central swale, as shown on Figure 2. The corridor will be planted with native tussock grasses or exotic grasses. Sleeper and/or rocks piles, which will be relocated from other areas of the ILC Site, will be established at 50 m intervals along the corridor to provide temporary refuge for dispersing frogs. Some tussocks plants, such as *Lomandra longifolia*, will also be planted near these refuge sites.

The swale will collect water after rain and remain as a damp thoroughfare leading to the frog ponds in the FHCA. The swale would be approximately 1 m wide and 15 - 20 cm below ground.

The swale will need to be mowed periodically. The Consulting Herpetologist will advise Sydney Ports when this is required.

4.6 Use of Herbicides

Herbicides, particularly glyphosate products, are not to be used around the ponds and the movement corridor. If herbicides are required to be used in the FHCA, approval will need to be given by Sydney Ports. Any proposal for pesticide usage in the FHCA will be discussed with the Consulting Herpetologist. In general, spraying of herbicides would not be permitted but cutting and painting weeds may be acceptable under some circumstances. Herbicides may be used on other parts of the site provided that spray drift cannot reach the FHCA and that surface sprays cannot enter surface water run-off and enter the FHCA.

Signs will be erected around the FHCA indicating that herbicides, particularly glyphosate products, are not to be used around the ponds. Responsible land managers will also be briefed regarding this matter.

4.7 Sick or Dead Frogs

Any frogs that die in captivity or are found dead within the FHCA must be retained. The carcass must be picked up with gloved hands and the body preserved in a prepared specimen container filled with buffered formalin. The gloves should be

disposed of after this. Dead frogs may need to be sent away for pathology testing. The treatment of sick frogs must be carried out by Sydney Ports' Consulting Herpetologist. Veterinary advice should be sought by the Consulting Herpetologist when needed. Frogs that are caught and held in captivity because they appear to be sick must be kept isolated on site.

A lockable work shed will be made available by Sydney Ports in the FHCA. Only one frog will be kept in each cage and the frogs will not be handled once they have been placed in the cage. Water bowls and other items placed in the cage must be sterilised in weak bleach when they are taken out. Similarly, when a frog cage is made vacant by the release of a frog, the cage is to be sterilised by washing in bleach and then left in direct sunlight for a few hours.

All water given to sick frogs must contain a 2% solution of Benzalconium.

All handling procedures of frogs must conform to the NSW National Parks and Wildlife Service *Guidelines for Frog Handling and Frog Hygiene* (contained in Appendix A).

If Sydney Ports' staff or contractors encounter sick or dead frogs within the FHCA, they should notify the Site Foreman or the Environmental Representative (ER). If the sick frog can be caught, it should be placed in the frog containers provided by the Consulting Herpetologist. The Site Foreman or the ER will notify the Consulting Herpetologist and the herpetologist will deal with the frog from this point onwards (refer provisions contained in the Frog Protection Plan).

4.8 Access

The Community and Ecological Area, within which the FHCA will be contained, will be fully fenced and access to the general public will be limited. Members of the public will only be allowed on site when escorted by Sydney Ports' staff or the Consulting Herpetologist. Members of the public will be supervised while on site.

4.9 Long Term Management

Management measures are summarised in Table 6.1.

Sydney Ports will investigate, in consultation with relevant stakeholders, strategies for long term management of the FHCA. Sydney Ports' intends to co-ordinate any long term management activities with other stakeholders responsible for the management of GGBF habitats in the Greenacre region. During the course of the development of the ILC, the status of long term management of the FHCA will be reported by Sydney Ports in the regular progress reports to the DECCW.

Sydney Ports does not intend to fund or undertake any breeding or monitoring programs for the GGBF. Sydney Ports' funding commitment is limited to the creation of the habitat area, the land dedication associated with the frog ponds and

surrounding habitat, and the monitoring and reporting program outlined in Section 5 of this plan.

5 Frog Monitoring and Reporting Regime

Effective management of the Bell Frog population will be based on the result of ongoing frog monitoring. The requirements frog and frog habitat monitoring are described in the following section.

5.1 Frog Monitoring

Frog monitoring within the FHCA, including the Frog Movement Corridor, will be carried out by the Consulting Herpetologist monthly between late August and April for three years commencing from the time the FHCA first becomes operational. An additional two nights per year (during the first three years) will be allowed for opportunistic surveys, which; are carried out when breeding activity is likely to be highest and frog population estimates can be carried out. Frog monitoring will comprise:

- **Calling surveys:** an estimate of the number of male Green and Golden Bell Frogs calling at each pond or location will be recorded. If no Bell Frogs are calling, play back recordings are to be used to try to elicit calling.
- **Headlamp searches:** searches using headlamps.
- **Tadpole Survey:** sites containing freshwater will be netted using hand nets and all tadpoles caught will be identified and returned to the site of capture.

All Green and Golden Bell Frogs seen or caught during monitoring surveys will be recorded, measured and sexed. Unchipped Bell Frogs will be micro-chipped. Frog location, activity and micro-chip tag number will also be recorded.

Tagging involves the implantation of the passive-induction transponder (PIT tag) microchip into captured frogs. These tags have been used very successfully in monitoring studies at Homebush Bay and in research studies on Broughton Island and Avoca Lagoon in New South Wales. Population sizes can be estimated from the recapture rates of tagged frogs.

Frogs will be released at the site of capture unless there is concern about the state of health of the frog. Retained frogs will be maintained in captivity in accordance with the procedures outlined in Section 4.7 above until they are fit for release.

The extent of movement between the surrounding habitat areas will also be monitored so that future corridors can be considered and the adequacy of existing frog corridors assessed.

5.2 Frog Habitat Monitoring

In accordance with CoA 2.48 of the Project Approval, provisions must be made for monitoring the outcomes of the actions required under CoA 2.48, that is:

- creation of overwintering habitat as part of the improved foraging habitat at the southern end of the site;
- provision of linkages to the former RailCorp ponds; and
- restrictions on the use of herbicides in known frog habitat (see Frog Protection Plan) and attainment of water quality standards for water discharged from the site. During the three year frog monitoring, some water testing will be undertaken by the Consulting Herpetologist to measure pH, salinity, dissolved oxygen, water temperature, turbidity and conductivity.

5.3 Frog Database

The results of monitoring and opportunistic sightings will be recorded in a database by the Consulting Herpetologist. The database will record the details of each frog, including:

- date of capture;
- initial body size;
- location;
- sex;
- notes.

This information will provide data on frog movements and population estimates.

The results of monitoring surveys will be maintained in a monitoring file. Details to be recorded will include:

- the number of frogs encountered during each monitoring survey;
- location found;
- sex;
- activity.

This data will enable an assessment of habitat use.

5.4 Reporting

In accordance with CoA 2.48 of the Project Approval, the results of the monitoring of the actions listed in Section 5.2 must be periodically reported to the DECCW, at a frequency agreed with DECCW.

In correspondence dated 24 September 2008, DECCW advised that Sydney Ports is to provide an update on the implementation of the of the actions from the Management Plan for the GGBF Key Population at Greenacre immediately following

the construction of the FHCA and thereafter on an annual basis immediately following the frog breeding season (ie. in June or July each year) for three years after construction of the FHCA. DECCW will consult with Sydney Ports to determine the need and frequency of any further reporting beyond this 3 year period.

The results of the monitoring will be provided to Sydney Ports and DECCW in the form of an annual report to be prepared by the Consulting Herpetologist. Annual reports will be issued to the DECCW and Sydney Ports after each frog season has concluded (i.e. in June or July of each year). Reporting will occur for the first three years after the establishment of the FHCA. The annual report will contain information on:

- the arrival of Bell Frogs into the new habitat areas in the FHCA;
- the relative frog numbers in the FHCA over time;
- the number of migrating frogs from satellite populations entering the FHCA;
- the number of frogs dispersing from the FHCA;
- the success of the FHCA including any breeding at the ponds, and success of the over-wintering habitat and the frog movement corridor;
- recommendations regarding management strategies;
- the status of the actions assigned to Sydney Ports under the Management Plan for the GGBF at Greenacre (DECC, 2007).

6 Summary of Management Measures

The following checklist summarises the measures required under this FMP and assigns a responsibility, frequency and timeframe for the various measures.

Table 6.1: Summary of Management Measures

Action	Responsibility	Frequency	Timeframe
<ul style="list-style-type: none"> Inspect ponds to advise on dewatering Identify pond to be drained Identify when draining should commence Relocate tadpoles from pond to be drained if necessary If present, kill <i>Gambusia holbrooki</i> 	Sydney Ports in consultation with the Herpetologist	Annually during first three years following construction, then to be determined by Sydney Ports in consultation with the Herpetologist	Early June
Drain pond	Sydney Ports in consultation with the Herpetologist	Annually or as considered necessary in consultation with the Herpetologist	June/July, or as otherwise required
Monitor water level of ponds If water level less than 0.5 m, top up pond	Sydney Ports	Monthly during first three years following construction, then to be determined by Sydney Ports in consultation with the Herpetologist	From establishment of ponds
Inspect ponds to advise on requirements for flutter ribbons	Herpetologist	Annually	First year only
Install flutter ribbons	Sydney Ports	As advised by Herpetologist and agreed by Sydney Ports	As advised by Herpetologist and agreed by Sydney Ports
Erect signs advising no use of herbicides in FHCA.	Sydney Ports	Once	From establishment of FHCA

Action	Responsibility	Frequency	Timeframe
Include restrictions in use of herbicides in FHCA in environmental inductions of staff.	Sydney Ports	As required	From establishment of FHCA
Pick up dead frogs with gloved hands and preserve body in a prepared specimen container filled with buffered formalin. Contact Herpetologist immediately.	Sydney Ports	As required	From establishment of FHCA
Contact Herpetologist immediately if sick frogs are found.	Sydney Ports	As required	From commencement of site works.
Frog and frog habitat monitoring	Herpetologist	Monthly +2 nights for opportunistic surveys	Between late August and April for 3 years after construction of ponds (see Sections 5.1 and 5.2)
Maintain frog database	Herpetologist	Monthly +2 nights for opportunistic surveys	Between late August and April for 3 years after construction of ponds
Reporting	Herpetologist	Annually	In June/July for 3 years after construction of ponds

7 References

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**Appendix A: NSW National Parks and Wildlife Service
Guidelines for Frog Handling and Frog Hygiene**

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