



6.1 k Cassowary Fencing Strategy Ella Bay

Ella Bay Integrated Resort Proposal

SEIS Submission Response

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Cassowary Fencing Strategy

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1. Cassowary Fencing Strategy

1.1 Cassowary Fencing

The objective of fencing along Ella Bay Road and around Ella Bay Precincts is to exclude cassowaries and other large fauna from areas of potential danger to the cassowaries from human contact and associated activities and to humans. The fencing will enhance the safety of the cassowary and people by funnelling the cassowary and small fauna to safe crossings in dedicated underpasses or along movement corridors and open space.

1.2 Ella Bay Road Cassowary Fencing and Escape Gate

The fence and funnel strategy will utilise a shadecloth fence to direct cassowaries to the fauna underpasses. The fencing will be integrated into the underpasses to funnel cassowaries to habitat continuity. The fencing will be used to exclude cassowaries from the roadway both physically and visually. Cassowary escape gates will be located at strategic locations to allow any bird that enters the road reserve to exit.

1.2.1 Construction and Location

The fence alignment will run within the roadside vegetation, to minimise visibility from the road. The fence will be constructed predominately with only hand pruning of native flora. No significant or EVR species will be cleared. Weeds will be cleared around the path and surrounding area. The fence alignment will be made to fit and go around mature vegetation with the fence weaving between trees. The disturbance width will be minimised and where possible kept less than 1m wide. Inspection of surveyor's clearing paths in the area has indicated that this can be achieved with minimal disturbance.

The fence will be:

- Shadecloth to provide a visual and a softer resilient barrier that will not damage the birds;
- A neutral coloured (dark grey/black/green) shadecloth to blend into the vegetation and will have a shade factor of greater than 40% for visual opacity;
- A height of 1.8m and will be a nominal 100mm from the ground;
- Located 3m to 12m within the vegetation parallel to the road alignment and within the road reserve except at some fauna culverts where the fence will be at the headwall of the culvert and at entrances and exits;
- Not be installed where:
 - the road edge and surrounding slopes are steeper than 1:1 or where the embankment is vertically greater than 1.5m e.g. gabions walls.
 - Other barriers such as guard rails and noise fences provide an exclusion function where the above conditions are met.
- Installed to follow the natural contours to reduce the risk of erosion and visual impact; and aid in construction and maintenance ease; and
- Run with long spans to be able to wind through the vegetation with little clearing or pruning.

The fence will be tensioned from a strainer assembly using high tension wires (refer to Figure 1:1 and Figure 1:2). The lower wire will be tensioned to exclude fauna from lifting up the lower edge of the fence with a nominal 100mm gap and the upper wire tensioned to maintain the fence without sag. The fence will run in panels of up to 300m with typical post spacing of up to 12m depending on topography.

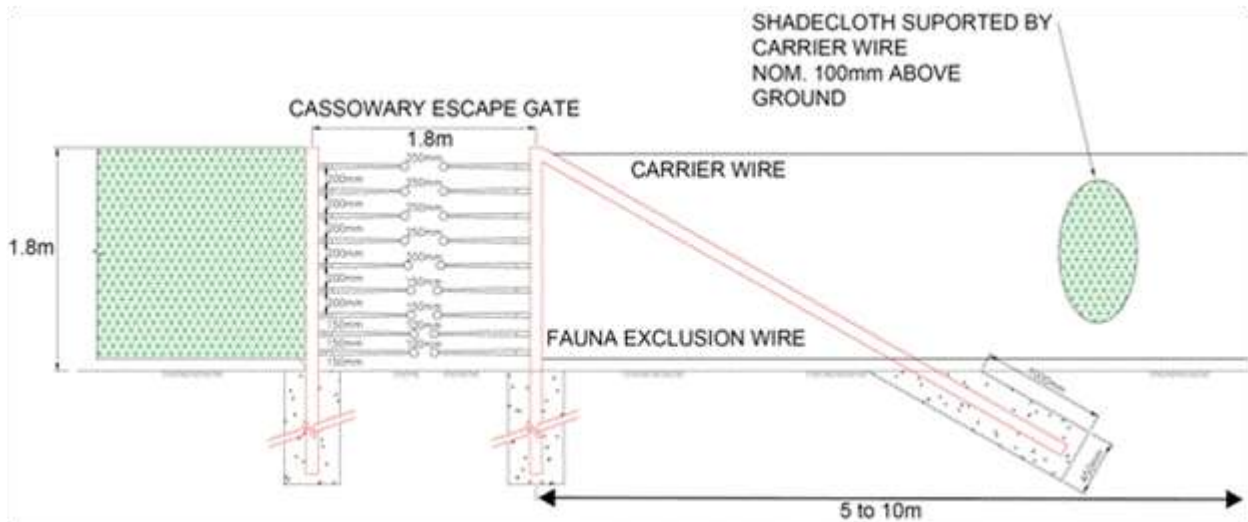


Figure 1:1 Cassowary fence details from Dwg. EBR1CE-DD42.

The fence will be screened either by existing vegetation where the fence alignment is within the existing rainforest or by vegetation planted specifically to screen the fence from cassowaries and from the roadway.

The fence will 'funnel' to encourage crossing at 'safe' crossing points through a specifically designed underpass (Bridge 1, 2, & 3) or overpass (Flying Fish Point tunnel).

The fence will be designed to survive:

- Branches from trees and shrubs dropping on the fence;
- Cyclonic conditions with damage from intense winds and debris;

The carrier wire will be attached by shear clips at each post which are designed to release the wire should a branch or similar debris drop from above with force. In the event a number of clips release the wire, the tension on the carrier wire will be sufficient to maintain that section of fence erect with tolerable sag levels. The clips will also allow for the wire to be easily re-clipped in place by hand. This arrangement has been successfully trialled at Ella Bay (refer to Volume 6.1j).

1.2.2 Cyclone Operating Procedure

In the event of significant cyclone risk, the fence will be pulled to the ground; the top carrier wire will be manually removed from the clip and relocated to the lower wire clip where both wires will be held together. The shade cloth fence will be effectively folded down to the ground and the shade cloth material tied every 2-3m in between posts by use of cable ties or similar to keep it rolled up and safe from damage. The fence will only be pulled down immediately prior, and during cyclonic weather events.

Additional traffic management procedures will be required to minimise the risk of cassowary vehicle strike while the fence is down; temporary warning signs will be used identifying that the fence has been dropped and the vehicle speed limit reduced to 40km/hr.

The reinstatement of the fence will be a high priority post cyclone events. Initially, the debris will be removed from fence area to facilitate the erection where the fence top carrier wire will be placed in clips and inspected for damage. Any fence damage will be repaired locally by either replacing entire sections of the fence from strainer assemblies or only repairing small sections by cutting the wires, threading a new shade cloth section and rejoining the wire using a mechanical wire joiner and sowing the replaced shade cloth. Damage to the tensioning assemblies will be a low risk unless by direct tree strike.



Figure 1:2 Trial Cassowary Fence at Ella Bay Revegetation Site. The Ella Bay fence will be dark grey.

1.3 Cassowary One-Way Escape Gate

The fence will be equipped with one-way escape gates at entrances and exits, bridges and at strategic locations along the roadway (refer to Figure 1:3 and Volume 6.1i). The locations of the escape gates will be within 100m of known crossing points such that should the fence fail then the cassowary will not be trapped on the roadway. The gate will be cassowary specific with pliable spring loaded HDPE fingers which are smooth cut with integral ball end to prevent impalement.



Figure 1:3 Cassowary one way Escape Gate.

The fence combined with strategically placed vegetation will provide a significant differential appearance between the fence and the escape gates to highlight the escape option. At the entrance to the fenced roadway a funnel disguised by vegetation will be used to ensure the cassowaries will have a visual preference to the escape gate. (refer to schematic Figure 1:4)

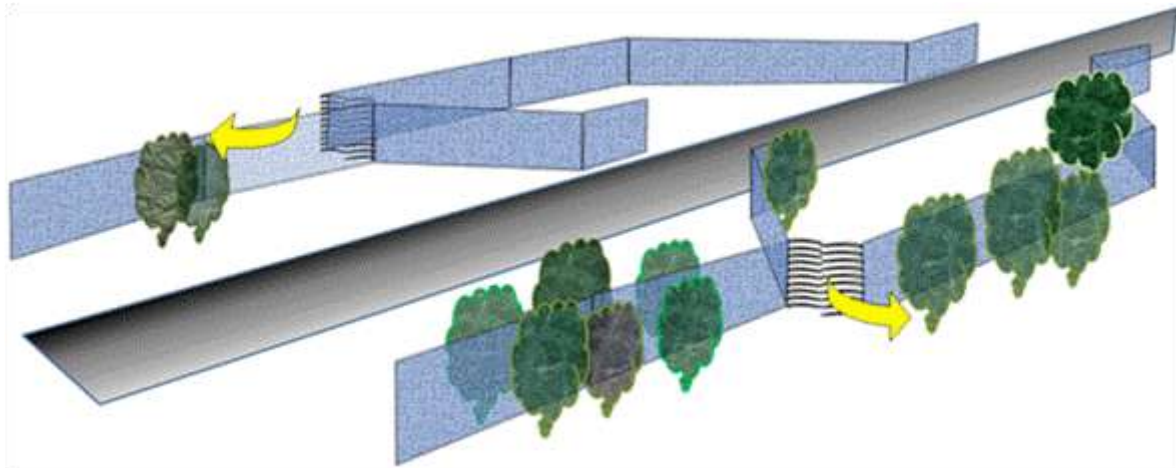


Figure 1:4 Installation of cassowary escape gate at road entrances with strategically placed vegetation.

1.4 Other Barriers

Along the road alignment there are other barriers that will exclude the cassowary from the road.

Gabions and natural cut embankments will exclude the cassowaries from sections of Heath Point Headland. The gabions will be near vertical barriers of rock, whereas the natural cut embankments will be 1:1 when cut in weathered rock. The height and lack of footholds will exclude cassowaries from entering the roadway from above.

Guard rails will be placed where there is a significant risk to the motorist and while the guard rail will not be sufficient as an exclusion fence, the combination of the guard rail and the embankment below the guard rail will be sufficient for exclusion.

The Sea Haven Prawn Farm has a cyclone mesh property boundary fence. While the fence is not desirable as a cassowary fauna fence, the fence has been erected for 30 years and separates a cleared area that has little attractant vegetation. This fence will be renewed in its current location as part of the road upgrade. The fence will form the eastern exclusion barrier in that section of road.

The stage 2 Flying Fish Point Bypass road will include a noise barrier fence for a section of the eastern side of road between the tunnel and Ruby Street. The noise barrier will be a 1.8m high solid structure which will provide effective cassowary exclusion.

1.5 Ella Bay Road Fence Maintenance

1.5.1 Cassowary Fencing

The Cassowary fencing and escape gates along the road will require regular weekly inspection initially during the first year of operation and after extreme natural events. Immediately after erection, the fence will be a barrier to fauna along their usual pathways and will be tested by pushing, digging and chewing until behaviour change and identification of underpasses. The fence will also require inspection post heavy rain or strong winds for erosion and branch drop.

Maintenance of the fence will be predominately regular visual inspection which will be accomplished on foot from the forest edge. Walking along the fence alignment will be avoided as much as possible to minimise weed invasion. Damage or rips in the fence will be detected visually; indirectly through the observance of small fauna paths or through the use of the escape gates. Damage to the fence will be typically be from digging under the fence, cuts/chewing of the fabric or tree branch drop. Repairs to holes made by fauna in the fabric will be made by patching with glued (silicone adhesive) or stitched patches over the shade cloth.

From observation of other fences within rainforest vegetation, the fence will quickly gain a vine covering. These vines where not impacting on the integrity of the fence will be left to disguise



the appearance however regular (quarterly/six monthly) pruning of branches, weed removal and any potentially damaging flora will be required.

Inspections will also check for any issues that may result in cassowaries being hurt by interaction with the fence or the escape gates

The inspection routine will be adaptively increased if required or until confidence in continuous operation is achieved and then on less frequent period (monthly/bimonthly) as determined by review.

Refer to volume 4 chapter 12 Operational Management and Monitoring for details of monitoring programme.

1.5.2 Escape Gates

An important part of the maintenance routine will be ensuring that the escape gates are functional. The escape gates will require inspection on a weekly basis initially and adaptively managed until confidence in continuous operation is achieved. The gates will require checking for free movement and for flora invading the visual path. Each escape gate will have a means of monitoring usage, whether by monitoring camera, counter or sand pad. Evidence of usage is critical to fence maintenance and determining the success of the fence and funnel concept.

The escape gate mechanism is relatively simple; primarily the bending of hinged HDPE fingers and mechanical issues will be rare. The fingers will be more susceptible to vandalism because of visual prominence.

1.6 Temporary Fencing - Ella Bay Road

Temporary fencing will have similar properties to the permanent fencing and will be used along Ella Bay roadway during construction. The temporary fencing will be at least the minimum dimensions of the permanent fencing and will be either 1.8m shade cloth strung between CCA treated pine logs or shade cloth covered steel framed modular hoarding typical of construction sites.

The temporary fence will exclude cassowaries and all small fauna from the roadway and potential interaction with humans, and construction equipment.

The timing of the fence installation will be after road side weed control and tree clearing but prior to the start of civil works. The fence will be erected along the edge of the clearing boundary or in some places a similar alignment to the permanent fence. Locating the temporary fence along the permanent alignment will be avoided as much as possible to avoid weed incursion and introducing construction edge effects further into the vegetation. The temporary fence will be able to be removed or repositioned during works that require access to the area or where a permanent fence may be damaged. The temporary fence will only have escape gates installed near the entrances and near the bridge locations.



2. Ella Bay Development Site Fencing

The primary objective of fencing at Ella Bay is to deter cassowaries and other large fauna from areas of human habitation whilst allowing movement of smaller fauna such as frogs and reptiles. The general alignment of the fencing will encompass the precinct boundaries leaving the Open Space and Conservation Zone areas as free space for fauna movement. The purpose of the fencing will be to enhance the safety of the cassowary and people by excluding access to residential precincts and eliminating issues from human contact and associated activities.

Improving and widening the currently degraded riparian corridors through revegetation and weed removal will also direct fauna away from the precinct areas and will ultimately enhance the cassowary habitat and survival.

2.1 Precinct fencing

Human interaction and inappropriate behaviour with cassowaries is a significant threat. The preferred mitigation is to isolate through fencing. Of the options described in EIS (Volume 4 page 131) the proponent has chosen to fence the precincts. This has also been shown by McWilliam, et al., (2010) that the greatest reduction in edge effect could be achieved by installing precinct fences around development housing and pathways within the vegetation.

Management of the gate system and resident spillage and illegal access into the external area will be managed by the design of fence boundaries so staff and the community can monitor boundaries (McWilliam, et al., (2010).

Positive aspects of this strategy are as follows:

- Significantly increased habitat after revegetation from current use as cattle property;
- High risk areas of cassowary/people interaction are reduced and or eliminated;
- Fencing will not impede the movement of small fauna (using open cassowary specific fencing);
- The current movement corridor along the beachfront is maintained;
- The east/west movement corridor to the beach along the creek is maintained and improved;
- Cassowaries can use vast majority of the site with no “funnelling effect”
- No dead end potential predator traps; and
- Native cassowary fruit trees can be planted in the open space areas including the golf course.

2.2 Construction and Location

The fence alignment will run on the boundary of the precincts (refer to [Figure 2:1](#)). The fence alignment has been chosen predominately on cleared areas for ease of erection and maintenance inspection. Water courses and drainage lines have been avoided. In some places the fence will cross constructed wetlands. In these specific locations the fence will be an all steel construction and will also prevent crocodile access into the constructed wetlands.

Extensive surveillance over the past 2 years with monitoring cameras and surveys has shown that the cassowaries almost exclusively adhere to the riparian areas except when visiting specific isolated fruiting trees; mangos, white apple and figs which remain in the cleared areas. The fence alignment has been chosen offset from the riparian zones to ensure maximum corridor movement. This area between the riparian area and the fence will be revegetated. The isolated trees that are attractant to the cassowaries will be included in the precinct areas and will be the only habitat excluded from access. The natural range and access to remnant cassowary habitat will be maintained.



Figure 2:1 Precinct Plan showing fenced areas and cassowary movement corridors. The fence must be:

- Able to deter and withstand an adult cassowary but need not be impenetrable;
- Have no sharp edges or gaps which can trap cassowary heads, feet and/or feathers;
- Provide access for smaller fauna like frogs, lizards and small mammals;

Unlike the Ella bay Road fence if the precinct fence is breached there is not a risk of imminent cassowary mortality. The fence will not have to be physically higher than a cassowary and a visual barrier. The fence can be visual pleasing, light and breezy, and not be dominant in the landscape.

The fence will be:

- Dark coloured powder-coated aluminium pool fence (with looped closed top or flat top);
- The fence will be 1200mm high with a 100mm gap under; and
- Panel lengths of 2.45m with post spacing of 2.5m centres;



Figure 2:2 Aluminium loop style pool fence

The fence will not have cassowary escape gates installed. The fence will have an open visual appearance and it will be difficult to discriminate a visual window to identify the gate and it is considered that this will make the success of the escape gate less likely. This situation will be monitored to determine if cassowaries are breaching the fence or entrances. The areas that will be closely monitored will be the higher risk areas where frequent interactions between



cassowaries and people would otherwise occur have been identified as the Ella Bay Village Precinct and the Ella Bay Welcome Centre area, and the road crossings. Manual gates will be located close to the entrances and the road crossings such that if a cassowary should breach the entrance, the gates can be opened and funnel the cassowary out.

The fence will also be fitted with child-proof pool lock gates to deter unauthorised access. The fence will also meet the necessary criteria to deter children's unauthorised access to water – 1200mm or greater height, no toe hold or central rail to deter climbing.

The standard gaps between the uprights will be 84mm wide which will be smaller than the width of a cassowaries head and rictal bristles (100-120mm) (refer to Volume 6. 6.1i Cassowary Gate Trial) which will reduce the chance of trapping a cassowaries head and deter feeding through the fence. Juvenile cassowaries will not be able to fit between or under the bars. Other fauna such as frogs and reptiles will not be impeded by the fence.

The fence will be manufactured from aluminium, providing a long life (>20yrs) and will require little additional resource to maintain, however the initial fence installation will have a medium to high environmental footprint.

The fence is available in a powder-coated range of colours; the preference is for a dark colour – Black, Dark Blue, Dark Green or Dark Grey which will 'fade into the background' of the vegetated landscaping.

2.3 Cassowary gates and entrances

The cassowary precinct fencing will be located on the perimeter of each of the precincts. The internal road system will be contained within the precinct fencing. In between the precincts bridges will be used to allow cassowaries to pass along the fauna corridors. Between each of the fenced precinct areas the fencing will continue along the sides of the connecting road and bridges providing a continuous fence border between precincts over the fauna corridors/conservation zones. In these areas a single lane raised bridge will be erected to allow fauna movement underneath the traffic (refer to [Figure 2:3](#)). Along the main spine road a dual lane bridge will be used.

There will be four (4) low traffic locations where bridges will not be used and road crossings will be required:

- The road between the central resort precinct and the resort/residential island within the golf course;
- The road between the northern resort precinct access road and the northern residential precinct across the north south fauna corridor;
- The road between the Village Precinct and the South west Residential Precinct; and
- A road within the southern section of the Village Precinct.



Figure 2:3 Typical single lane bridge crossing over fauna corridor.

Both of these crossings are short length and on flat ground. Gates will be used on either side to restrict cassowary access to the precincts. The gates will restrict cassowary movement into the precinct and slow traffic. The gates will be automatically operated via electronic tags with manual backup. At each of the crossing points traffic calming measures will apply with traffic speed limits set at 20 kilometres per hour in these areas.

Gates will also be required for the internal pathway system for walking, bicycle and buggy. Walking and bicycle only gates will be manually opened and closed. Some of these may be fitted with pass operated locks for security. Buggy gates will be managed similarly to the road crossing gates with automatic opening/closing for high use areas and manually controlled for low use.

2.4 Education and Information

The Welcome Centre will provide information regarding the procedures to be followed on site for visitors accessing various precincts and areas of the development. In resort or residential precincts there will be no contact with cassowaries. The open space areas including golf, the internal path system, beach access and walking paths will be the only areas that visitors and residents will potentially be in proximity with cassowaries.

The Welcome Centre and signage at strategic locations around the site will explain how to react if in close proximity to a cassowary. Visitors using the golf course will be further inducted to cassowary notification methods and how to act if a cassowary is close.

2.5 Maintenance

The fence will be extremely durable and it is envisaged that no routine maintenance will be required. The open design means that the fence will be durable in a cyclone with no damage except for possible impact damage. The fence panels can be individually replaced. The fence is suitable for tropical conditions; able to withstand 'normal grounds maintenance' such as the use of a whipper snipper and occasional chemical application. The fence will be located on cleared land and will be easily inspected by buggy. The fence will initially be inspected on a weekly basis and the inspection frequency adaptively modified if required or until confidence in continuous operation is achieved and then on less frequent period (monthly) as determined by review.

The Ella Bay Development Body Corporate will retain responsibility of maintenance of all fencing and gates within the Ella Bay site.



2.6 Temporary and Construction Fencing

The temporary fencing during construction at Ella Bay will be similar to the temporary fencing along Ella Bay Road either 1.8m shade cloth strung between CCA treated pine logs or shade cloth covered steel framed modular hoarding fencing typical of construction sites. The fencing will be constructed progressively through the stage development such that the cassowaries are excluded from any potential contact with interaction with humans, and construction equipment.

During the first stage construction of the northern precinct, the road from the entry to Ella Bay property through to the Northern precinct will have temporary fencing installed to prevent cassowary access onto the road. During the Northern precinct construction the fauna corridor will be fenced together with both precincts and cassowaries excluded from the cleared areas, the revegetation areas and the northern section of the north south conservation zone.

The temporary fence will sometimes require a lower electric wire to prevent wallabies and pigs from damaging the fence and the trees. The electric wire will only be used where displaced wallabies will require behaviour change to exclude the them from the revegetation.



3. Remote monitoring of cassowary location

A remote monitoring system was proposed in the SEIS (Volume Two 2.2.3) to manage cassowary interaction with people and vehicles. The proponent has funded research into cassowary tracking through Queensland University which will provide further information on cassowary movement patterns and home ranges (refer to volume 5 Offsets) and indirectly contribute to knowledge of the Non Intrusive Management Scheme (NIMS). The knowledge of remote tracking has developed significantly over the past few years such that remote tracking of livestock through active RFID ear tags is now commercially available (Taggle, 2010). The commercial tags plus the research has shown that the proposed NIMS system is feasible. The likely configuration of the NIMS would be to use active RFID tags with the signal picked up by three (3) aerials around Ella Bay. The tagging would provide ongoing long term research into cassowary movement patterns and home ranges with the ultimate aim of determining the anthropogenic impact of the Ella Bay development.

The cassowaries would be monitored from the Welcome Centre Operations Management with a history and current location of each cassowary within reception.

The tracking would help identify:

- Home range of each individual of the Ella Bay cassowary population;
- Courtship timing, movement of females through the male home ranges;
- Cassowary food preferences with seasonal tree fruiting, and indirectly energy requirements;
- Seasonal/weather based home range movement (a fiercely debated subject with the Ella Bay cassowary population)
- Male nest sitting and hatching;
- Cassowary mortality and the survival of the Graham-Seymour range cassowary population and the veracity of the Population Viability Analysis;
- Genetic diversity in conjunction with scat DNA analysis;
- Post cyclone/weather event cassowary recovery;
- The success of fauna corridors, revegetation and fauna underpasses on a real time basis;
- Whether trees planted within the Ella Bay Development are contributing to changed behaviour patterns or have become problematic with interaction to humans; and
- If humans are feeding the cassowaries.

The NIMS would also provide information on cassowary location within the development Open Space. The locating system would warn residents and visitors that are in the proximity and could be impacted by cassowaries through alert systems (signs, audible alarms, text messages).