Review of Environmental Factors for Joes, Wimbie, Short Beach and Surfside Creeks Entrance Management Policies

FINAL REPORT

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Synopsis:	This document presents the Review of Environmental Factors for the adopted Entrance Management Policies of Joes Creek, Wimbie Creek, Short Beach Creek and Surfside Creek, Batemans Bay.

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CONTENTS

LIST OF TABLES

1 REVIEW OF ENVIRONMENTAL FACTORS OVERVIEW

This Review of Environmental Factors (REF) will review and document the magnitude and nature of the potential environmental impacts associated with the entrance management policies recommended in the Creek Management Policies document.

Historically, Eurobodalla Shire Council (ESC) has periodically "opened" these creeks to:

- Relieve potential flooding of adjacent properties;
- Alleviate odours; and
- Address water quality problems resulting from sewage overflows or other spills within the catchment.

The Management Policies for the creeks propose that the creeks are "opened", primarily to alleviate problems associated with flooding or prolonged inundation around the creek/lagoon. As a result it has been determined that the 'State Environmental Planning Policy No. 35 – Maintenance Dredging of Tidal Waterways' (SEPP 35) is not the relevant planning instrument. However, the requirements of Schedule 2 of SEPP 35 are considered to provide guidance to Council on appropriate consultation processes with government agencies.

Clause 35 of the *Environmental Planning and Assessment (EP&A) Act* Model Provisions has been adopted under the ESC Urban LEP. This allows Council to carry out creek openings as a flood mitigation work, and to assess the activity under Part 5 of the EP&A Act. The obligation under Part 5 of the EP&A Act is to consider the likely environmental impacts of the activity and to consider the appropriate level of environmental assessment that is required.

The REF is intended to be the environmental assessment required under Part 5 of the Environmental Planning and Assessment Act. This REF is written without the benefit of knowing what the exact circumstances of opening will be, since time limitations make it impossible to undertake the environmental assessment procedures at the time when the need actually arises. Relevant agencies identified in Schedule 2 of SEPP 35 would ideally still require notification of any proposed entrance opening, but the consideration of matters for granting of approvals would be expedited.

This REF and associated Entrance Management Policy have been considered by all relevant State Government agencies, ESC and the Batemans Bay/Clyde River Estuary Management Committee. The Policy outlines the circumstances under which the creeks can be artificially opened.

The accompanying document "Creek Management Policies for Joes Creek, Wimbie Creek, Short Beach Creek and Surfside Creek, Batemans Bay" contains detailed information about these creeks and their natural resources upon which this REF relies. This REF should be read in conjunction with the Policy and its Background Information document.

2 BACKGROUND

Under natural conditions, prevailing weather conditions primarily influence the frequency of opening, duration of opening and subsequent closure of all small coastal creeks.

With a closed entrance, water levels in the creeks can rise to a height considerably above peak tidal levels. Water levels often rise rapidly (that is, within a day) in response to heavy rainfall.

Urban development has taken place, typically in the lower reaches of the creek catchments. High water levels can cause disruption or damage to human activities and properties by inundating roads, and other infrastructure, or private property. To manage this disruption, Council has adopted an informal policy of opening the creeks prior to when flooding would occur. Wimbie and Short Beach Creeks typically open naturally prior to there being any need for intervention, whereas, Joes and Surfside Creeks have both required artificial opening to prevent damage or disruption from flooding.

When the creek entrances are closed, tidal flushing ceases. Inflowing water (typically natural baseflow and/or stormwater) from the catchment can introduce nutrients (in both dissolved and particulate forms) and other water quality pollutants, such as litter and oil. Sea wrack (i.e. seaweed or kelp) is another source of nutrient that can be washed into these creeks during heavy seas. The typically low assimilative capacity of these creeks (due to their small volume when compared to their relatively large catchment areas and runoff volumes) limits their ability to process these nutrients aerobically. In the absence of aerobic conditions, chemical reactions can occur that result in the generation of hydrogen sulphide gas ('rotten egg gas'). These reactions will continue provided there is a source of nutrients, sulphate and anoxic conditions.

Historically, opening of creeks has been performed to alleviate odour problems that have established. Both Wimbie and Surfside Creeks have been opened artificially to alleviate odour problems, with Wimbie Creek having been the most susceptible to in this regard.

There have been instances in which creeks have been opened to protect aquatic ecosystems and or prevent severe water quality pollution. Separate instances of a sewage pump station failure and the illegal spillage/dumping of a toxic substance via stormwater drains to Short Beach Creek (which resulted in substantial fish kills) have necessitated its opening in the past.

When the creeks are opened to the Bay, there is typically a slow lowering of the creek water level and subsequent reintroduction of tidal flushing. The degree of tidal flushing is influenced by a number of factors, such as the shape (i.e. depth, width) of the entrance channel and duration of opening.

A description of the existing environmental attributes of the creeks including Acid Sulphate Soils, Water Quality, Hydrology, Odour, Flora, Fauna, Cultural Heritage, Landscape and Recreational Quality issues is included in the Background Information document.

3 DESCRIPTION OF PROPOSED WORKS

The Creek Management Policy Report details the proposed management actions for the subject creeks. Of the proposed management actions the excavation of the creek entrances and removal of sea wrack from the entrances were the only two items which were required to be considered in this REF.

3.1 Excavation to Open Creeks

Works proposed in the management policy for the opening of the creek entrances generally includes the excavation of a channel through the unvegetated sand barriers and adjacent shallow shoals of the beaches in front of the creeks. The channels would be excavated in the indicative locations shown in the Management Policy (refer to Figure 2-1, 3-1, 4-1 and 5-1) using mechanical equipment, most likely a dozer. The machine will access the site as much as possible via established tracks and unvegetated areas. Care will be taken to avoid damage to vegetated areas of sand dunes.

The excavated sand will be placed to the side of the channel and will not be removed from site. The exception is Surfside Creek, where the sand will be placed on nearby McLeods Creek Beach, some 150 metres downdrift (to a location where the sand would have otherwise migrated). The preferred excavated channel dimensions are approximately 2 metres wide, with the bed graded to the Bay. Excavation will cease once an outward flow of water has been established. The total excavation time will typically have a duration of a few hours.

The flowing water will scour sand from the excavated channel, causing the channel to enlarge and/or migrate. The degree of enlargement/migration cannot be predicted, however experience at this site and at other estuaries has shown that if excavation is in the area of the natural entrance channel, the artificial channel will rarely exceed the dimensions, or move from the locations, that are attained by natural breakouts.

Channel excavation will generally be undertaken during the early falling stage of the tidal cycle. This should ensure that the maximum water level difference between the water in the creek and the Bay is maintained for the first few hours of outflow, thereby enhancing scour potential.

3.1.1 Creek Opening Criteria

Table 3-1 presents the opening criteria for the creeks. These levels are derived in the Policy document, which contains full details of infrastructure susceptible to flooding.

Table 3-1 Opening Criteria for Creeks

Creek	Excavation will only be undertaken if, one of the following criteria is achieved
Joes	• Creek water level at or exceeding 1.4 m AHD; or • Creek water level is between 1.2 and 1.4 metres AHD and heavy rain is predicted in the catchment.
Wimbie	• Creek water level at or exceeding 2.0 m AHD; or • Creek water level is between 1.8 and 2.0 metres AHD and heavy rain is predicted in the catchment.
Short Beach	• Creek water level at or exceeding 1.3 m AHD **(to be confirmed by survey)**; or • Creek water level is between 1.0 and 1.3 metres AHD and heavy rain is predicted in the catchment.
Surfside	• Immediately prior to when the water level in Surfside Creek reaches the top (i.e. obvert) of the culverts (at approximately 1.5 m AHD).

3.2 Removal of Sea Wrack

Sea wrack may accumulate at the entrances to the creeks assessed most likely as a result of large tides or heavy seas. The accumulation of this material within the creek (i.e. in the water) can lead to the generation of odours due to the formation of anoxic (i.e. no oxygen) conditions in these waterways. As a result sea wrack removal has been proposed to assist in alleviating these odour issues.

Also, sea wrack may be removed as a result of periodic creek opening as described in Section 3.1.

4 PURPOSE OF WORKS

The purpose of the proposed works is to re-establish a temporary tidal connection between the creeks and Batemans Bay. This will allow accumulated water to flush to the Bay and thereby lower water levels below those that cause flooding of public or private infrastructure and access roads.

The intention is not to establish a permanent opening. It is recognised that the entrance channels could well close again within a matter of days, depending on prevailing weather conditions.

5 ALTERNATIVES

Ultimately there are no viable alternatives to artificial openings of these creeks to prevent flooding. High water levels may remain for many months. Not interfering and allowing nature to 'take its course' so that water levels rise until a natural breakout takes place could result in flooding, property damage and associated inconvenience to local residents.

Rather than adopting a fixed trigger level, a variable level could be used. This may have some ecological benefits. However the current intervention levels represent a ceiling, above which it is difficult to maintain creek levels without damage. Variation could only be introduced by opening at lower levels, which would not be ecologically beneficial.

In the absence of a comprehensive Flood Study and Floodplain Management Plan, there have been no viable alternatives proposed. In the longer term, the opening threshold level may be able to be increased, as creek hydrology is better understood and closer examination of flood mitigation options are undertaken. It would be preferable if no intervention were required but it is not known whether this will ever be a practical alternative for all creeks, considering the current configuration of development.

In the longer term, it may be possible to increase the intervention level by selectively flood proofing, removing or relocating those items of infrastructure which are most prone to flooding.

If a development proposal were received for land around these creeks below a nominal 2.0m AHD elevation, Council should ensure, through the Development Application process, that the proposal does not interfere with the ability to raise intervention levels. Furthermore, if it were both reasonable and opportune to do so, Council could consider conditioning these DA's to raise or relocate infrastructure in critical low-lying areas such as:

- Glenhaven Caravan Park (Joes Creek);
- Birdland Animal Park (Joes Creek); and
- Pleasurelea Caravan Park (Short Beach Creek) subject to survey of critical infrastructure levels (not available for this study).

6 RELEVANT LEGISLATION, REGULATIONS AND PERMIT REQUIREMENTS

6.1 Approvals

The following acts have to be considered prior to any opening of a creek:

- Environmental Planning and Assessment Act;
- Crown Lands Act 1989;
- National Parks and Wildlife Act 1974;
- Threatened Species Conservation Act 1995;
- Environment Protection and Biodiversity Conservation Act 1999; and
- Fisheries Management Act 1994 and Fisheries Management Amendment Act 1997.

6.1.1 Environmental Planning and Assessment Act

Clause 35 of the Environmental Planning and Assessment (EP&A) Act Model Provisions has been adopted under Eurobodalla Shire Council's Urban Local Environment Plan (LEP) 1999. This requires Council to assess the impact of flood mitigation works (i.e. creek openings for flood relief purposes) under Part 5 of the EP&A Act.

A determining authority must satisfy the provisions of Section 111 of the Act in determining whether the proposed activity is likely to have a significant effect on the environment. This is generally referred to as a Review of Environmental Factors (REF) and its conclusions may take the following form:

- The proposal is not likely to have a significant effect on the environment and the determining authority can then give approval (if other requirements under other legislation and policy are satisfied).
- The proposal is likely to have a significant effect on the environment and therefore-
  - The preparation of an Environmental Impact Statement (EIS) should be undertaken to enable a more detailed assessment before a decision is made; or
  - Modifications to reduce any likely significant effect are in order; or
  - A decision not to proceed is made.

A determining authority means the public authority (in this case, Council) by or on whose behalf the activity is to be carried out, or any Minister or public authority whose approval is required to enable the activity to be carried out. Therefore, ESC is a determining authority. The Department of Lands is also a determining authority by virtue of the requirement for a licence under Division 4 of the Crown Lands Act (see below). NSW Fisheries would only be a determining authority if marine vegetation is to be directly affected. The National Parks and Wildlife Service (NPWS) would be a determining authority if there were any impacts upon threatened species or Aboriginal archaeological sites and a licence to harm or destroy was required.

6.1.2 Crown Lands Act 1989

Excavation across the beach and intertidal zone to Batemans Bay will be below Mean High Water level and will therefore affect Crown Land. As such, the Department of Lands will be requested to issue a licence to ESC to perform artificial openings of the subject creeks in accordance with the conditions outlined in the Policy. The licence would apply initially for the period up to and including the first review of the Policy, which is a maximum of five years.

6.1.3 National Parks and Wildlife Act 1974

It is an offence to knowingly destroy an Aboriginal site, relic or artefact. Since none are known to exist or are likely to exist within these entrance barriers, this Act will not be triggered by the policy.

There are no Conservation Agreements prepared under this Act for the area. There are no Plans of Management under the Act that are relevant.

6.1.4 Threatened Species Conservation Act 1995

The Threatened Species Conservation Act (TSCA) 1995 requires an assessment of whether threatened species, populations or ecological communities are likely to be affected by the activity. This assessment is in the form of an Eight part test of significance. If a significant impact on threatened species is likely, a Species Impact Statement (SIS) must be completed and a licence obtained. Appendix A provides an eight-part test for the creek opening activity.

In addition, impacts on a number of Key Threatening Processes listed under Schedule 3 are to be considered. The relevant KTP's for these creek openings are considered to be

iii. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands,

xi. Predation by *Gambusia holbrooki (*Plague Minnow*)*.

The proposed actions of creek opening will have no bearing on these Key Threatening Processes as discussed in Section 8.6.

6.1.5 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is Commonwealth legislation that protects matters of national environmental significance. It acts in parallel with the TSCA and requires separate tests of significance, should listed species or processes be potentially impacted by the works.

If it were determined that an action were likely to have a significant impact, then the action would be a controlled action. Approval under the EPBC Act is then required.

The EPBC Act also lists migratory species protected under international agreements (JAMBA and CAMBA). These species are addressed in this REF document in Section 8.

6.1.6 Fisheries Management Act 1994 and Fisheries Management Amendment Act 1997

This Act requires an assessment of whether threatened species of fish and marine vegetation, populations or ecological communities are likely to be affected by the activity. If a significant effect on threatened species is likely, a species impact statement must be completed and concurrence of, or consultation with, NSW Fisheries is required.

No species listed as 'threatened' on the schedules associated with the Fisheries Management Amendment Act is known to occur within any of the subject creeks. Therefore no eight part test or Species Impact Statement for any fish species is required.

Sections 198 and 200 of the Fisheries Management Act require a local Council proposing to undertake dredging works to obtain a permit. However, these sections do not apply if the dredging (i.e. artificial opening) is authorised under the Crown Lands Act or by another relevant authority (other than a Local Government). Therefore, assuming DIPNR issues a licence for dredging (i.e. artificial opening), a dredging permit from NSW Fisheries would not be required.

Sections 204 and 205 (damage to marine vegetation) would only apply if dredging (i.e. artificial opening) extends beyond the unvegetated sands of the entrance barrier. This will not occur and a permit under this section is therefore not required.

6.2 State Environmental Planning Policies (SEPPs)

6.2.1 State Environmental Planning Policy No 14 Coastal Wetlands

Under Clause 7(1) of State Environmental Planning Policy 14 (SEPP 14), draining a wetland is an activity listed as designated development. This would require submission of an EIS and the concurrence of the Director of Planning.

If SEPP 14 wetlands were to be directly affected by a proposed opening, a number of matters must be taken into consideration when a development proposal is considered. These include, but are not limited to:

- The environmental effects of the proposed activity, including effects on plant and wildlife communities;
- Safeguards and rehabilitation measures which have been, or will be made; and
- Whether any feasible alternative exists or has been considered.

There is one SEPP 14 wetland potentially affected by creek openings under the policy. Wetland No. 214 mapped by DIPNR is located in the mid to upper reaches of Surfside Creek. Legal advice from DIPNR confirms that, as excavation for creek opening is not directly within the wetland, the requirements of this SEPP are not triggered. It would only be relevant if the excavation were within the mapped wetland.

6.2.2 SEPP 35 Maintenance Dredging of Tidal Waterways

The maintenance dredging of a tidal waterway to enable it to function as a tidal waterway, or to resume its function as a tidal waterway, may be carried out in accordance with 'State Environmental Planning Policy No. 35 – Maintenance Dredging of Tidal Waterways' (SEPP 35).

In the case of Wimbie, Short Beach, Joes and Surfside Creeks, which are all intermittently open to the Bay, the primary purpose of creek openings is to alleviate problems associated with flooding or prolonged inundation around the creek/lagoon. In this case, dredging is for the primary purpose of flood mitigation, and SEPP 35 has been determined by DIPNR to not apply to the activity.

Rather, Council's LEP is the relevant planning instrument for flood mitigation works. However, the requirements of Schedule 2 of SEPP 35 are considered to provide guidance to Council on appropriate consultation processes with government agencies.

6.2.3 SEPP 71 Coastal Protection

This policy aims for improved state, regional and local planning and encourages management decisions to better protect the coast. It gives the Minister for Planning the consent authority role for specified developments or State significant developments. Proposals for development in sensitive coastal locations fall under SEPP 71 where Development Application is required.

SEPP 71 has no impact on any proposed creek opening activity.

6.3 Local Environmental Plans

Opening of the creeks will be undertaken within the provisions of the Eurobodalla Urban Local Environment Plan (LEP) 1999. This LEP adopts Clause 35 of the EP&A Act Model Provisions, which effectively puts flood mitigation works into Part 5 of the EP&A Act. This allows Council to carry out creek opening activities, with environmental assessment of the opening required under the provisions of Part 5 of the EP&A Act. The policy permits Council to carry out this environmental assessment for a series of openings rather than each time the creek entrance is breached.

6.4 Draft Environmental Planning Instruments on Exhibition

There are no Draft Environmental Planning Instruments on Exhibition that impact on this assessment.

6.5 Draft State Environmental Planning Policies submitted to the Minister

No draft SEPPs are of relevance to this assessment.

6.6 Development Control Plans

No DCPs are relevant to this assessment.

7 DESCRIPTION OF THE EXISTING ENVIRONMENT

The description of the existing environment including Acid Sulphate Soils, Water Quality, Hydrology, Odour, Flora, Fauna, Cultural Heritage, Landscape and Recreational Qualities is included in the Background Information document.

7.1 Creek Entrance Data and Natural Breakout Range

This section presents additional information, specific to this REF on the four creek entrances and interprets their likely natural breakout ranges. This information is useful to gauge the likely impacts of intervention in creek opening, detailed in Section 8 of the REF.

A lack of data does not allow the natural breakout range to be positively determined. The natural breakout range is inferred in three ways:

- By creek height information, where it operates without intervention
- By beach berm survey data, or
- Data from aerial photograph interpretation.

These three sets of information are variable but do provide some reasonable indicators of historical behaviour as follows.

1. Reference to natural creek openings, which will reflect fluctuations of the beach berm at the creek entrance, is a reliable indicator of creek entrance fluctuations. This creek height data is available for Wimbie Creek since December 2000 and indicates a typical range of 0.9m to 1.1m AHD, with additional openings at lower levels a short time after these more 'major' opening events. These subsequent openings, before the berm has had time to re-establish from the previous scour event, are typically over the range 0.6m to 0.75m AHD, just above a Mean High Water Springs tide level. It is concluded that natural berm heights at the Wimbie Creek entrance will vary over this full range i.e. from a level just beyond high tide of 0.6m AHD, which will establish upon closure of the entrance, to an upper limit of about 1.1m AHD. These levels are consistent with the sheltered nature of this entrance. It is also concluded that for those creeks with little buffering capacity, the lower end of the opening spectrum will also be around 0.6m AHD.

   Creek height data for Joes Creek is available but it does not reflect natural beach berm heights, as council routinely opens this creek when it attains a level of about 1.2 to 1.3m AHD.

   There is a lack of firm data on Surfside Creek and Short Beach Creek levels at times of opening.

2. Elsewhere in Batemans Bay, there is historical 'snapshot' data of beach profiles surveyed by Council. Beach berm levels controlling a natural breakout are shown in Table 7-1.

   At Surfside Creek entrance, the beach berm level from observation regularly attains a height near the road above the culvert obvert level. Historical beach profile surveys at a section just east of the Surfside Creek entrance confirm that a berm level of 1.7m AHD is attained regularly. Lower levels in this table indicate a recent opening, with the entrance directed eastwards, scouring out a channel along the beach.

Short Beach Creek is more difficult to interpolate, owing to the presence of the rock seawall at the back of the whole beach, with the exception of the creek outlet. It would be expected that localised sand build-up at the rock wall would be slightly higher than at the creek entrance, due to the wall's sheltering effects. The beach would be expected to grade down to similar beach levels as those near the creek entrance. The behaviour of Caseys Beach at this profile is shown in Table 7-1 to vary from 1.6m to 1.9m AHD at the base of the wall, grading down to 1.4m to 1.7m AHD within a few metres. This is discussed further below.

Table 7-1 Beach Berm Levels from Historical Survey

Location & Survey Date	Beach Berm Level (m AHD)	Level at foot of Rock Wall (Caseys Beach) (m AHD)
SHORT BEACH CREEK		
Caseys Beach 1 (100m north of entrance)		
December 1986	1.7	1.9
March 1988	1.4	1.6
November 1995	1.4	1.8
JOES CREEK		
Corrigans Beach 2 (Old Boat Ramp)		
December 1986	1.7	-
November 1995	1.4	-
Corrigans Beach 3 (Yacht Club Track)		
December 1986	2.1	-
November 1995	2.0	-
Corrigans Beach (just south of creek outlet)		
March 1988	1.7	-
SURFSIDE CREEK		
Wharf Rd 3 (just east of creek entrance)		
December 1986	1.7	-
November 1995	0.8	-
June 1997	1.0	-
January 2002	1.7	-
October 2002	1.7	-

3. The Batemans Bay Vulnerability Study (1996) provides analysis of aerial photographic records by the then Department of Land and Water Conservation for the period 1940 to 1993. A number of sites were analysed including Corrigans Beach. A beach profile south of the Joes Creek mouth showed typical berm levels of 1.7m to 2.0m AHD. This is in good agreement with Table 7-1 and is a reasonable upper limit of natural berm levels at this site, without the influence of regular creek openings by Council at the 1.2 to 1.3m AHD level.

There is little further data to assist our understanding of levels at the Short Beach Creek mouth. Willings & Partners (1989) consider an upper limit to the beach berm level to be 1.5m AHD, attained in dry periods. Willing and Partners also report that for berm levels up to 1.4m AHD, a flood flow will scour out the berm before any noticeable build-up of level occurs for small floods. This information is reasonably consistent with the anecdotal evidence that Short Beach Creek opens most often naturally, before the critical 1.3m level is attained. Only during heavy rainfall does an artificial opening become necessary due to the creek's limited hydraulic capacity for higher flows.

One could assume an upper berm level for Short Beach Creek entrance to be 1.5m AHD, which would be consistent with the creek's largely natural opening behaviour. It is also reasonably consistent with sand levels at the base of the rock wall some 100 metres to the north of the creek entrance (Table 7-1).

The inferred natural range of entrance behaviour is summarised in Table 7-2. The levels reported in this table are the likely natural range of breakout levels for these creeks.

Table 7-2 Inferred Beach Berm Levels Controlling Natural Breakout Levels at Creek Entrances

Creek	Location	Lower Berm Level (m AHD)	Upper Berm Level (m AHD)
Wimbie	Very sheltered, low sand drift	0.6	1.1
Short Beach	Moderately sheltered, minor sand drift	No data (expected to be above high tide level)	1.5
Joes	Exposed, high longshore and onshore sand drift	No data (expected to be above high tide level)	1.7 to 2.0
Surfside	Moderately sheltered, high longshore sand drift	0.6	1.7

The relative rankings of upper berm levels are reasonably consistent with two additional indicators of entrance stability:

- The degree of exposure of the creek entrances to dominant swells, and
- The relative volumes of sand drift, both longshore (along the breach) and onshore, from offshore shoals.

One would expect a general trend of the more sheltered entrances to operate more often at lower levels. This is particularly the case on beaches with low rates of sediment transport. More frequent openings, determined by catchment size and creek buffering capacity, would assist to keep entrance berms lower for longer periods in the more sheltered locations e.g. Wimbie Creek opens more frequently than other creeks.

8 POTENTIAL ENVIRONMENTAL IMPACTS

8.1 Direct and Indirect Effects

The activity will potentially affect the environment of the subject creeks both directly and indirectly.

Direct effects are likely to be localised and restricted to the sand spit, associated with excavation of the entrance channel by machinery. They mainly relate to potential impacts on seabirds nesting on the sand spit (see Section 8.5), and will largely be dependent upon the season of occurrence. For example, if opening is undertaken in spring, summer or early autumn there could be disruption to protected shorebird nesting. Opening in winter is unlikely to cause such problems since it is outside the breeding season. The approach to entrance management recognises the possibility of these impacts within the breeding season. Creek opening works in the breeding season would follow consultation with NPWS if necessary.

Indirect impacts could affect the whole creek system and adjacent ecosystems mainly by altering the hydrology. The hydrology of the creeks, in particular the water level and the frequency and extent of its fluctuation, is one of the main determinants of the flora communities occupying the bed and banks of the creeks. The policy attempts to mimic natural hydrologic regimes as much as possible, within the imposed limits of existing infrastructure. The ability to mimic natural regimes varies from creek to creek, and is discussed further below.

8.2 Water Levels

Clarifying the nature and extent of potential indirect environmental impacts associated with this activity is difficult. This is due to the fact that the activity is not one that is wholly "unnatural", but in most instances, is simply the early facilitation of a natural process. The nature and extent of the environmental impacts will therefore depend upon the extent to which the activity departs from the natural process, which cannot be precisely defined due to a lack of historic data. Therefore, to gain an insight into the nature and extent of the environmental impacts, it would be necessary to understand the natural hydrologic processes that would have operated.

It is likely that under natural conditions, entrance breaching would occur over a relatively narrow range of water levels, depending upon prevailing weather conditions. The 'natural breakout range' is largely governed by the range of behaviour of the beach berm elevation at the time of opening. This 'natural breakout range' will be far less than estuaries located on the open coast, as Batemans Bay experiences a much lower wave climate.

Theoretically, a single artificial opening within the natural range is not likely to have a significant environmental impact since it falls within the expected natural variation. However over the longer term, continued opening at a low level within the natural range may have a cumulative environmental impact. A single artificial opening below the natural breakout range will also have an environmental impact, as this would be outside the natural expected variation. However, the worst scenario in terms of environmental impact is likely to be provided by the circumstances whereby continued opening well below the natural breakout range is practised. This does not apply to the subject creeks.

A lack of data does not allow the natural breakout range to be determined positively, so it is impossible to be definitive about the magnitude of potential environmental impacts associated with manual openings. However Section 7 of this REF provides the following analysis of berm levels, which reflects the natural ranges of entrance breakout. These are compared in Table 8-1 to creek opening levels proposed by the policy to indicate the extent of intervention that is likely to occur under the policy.

Table 8-1 Inferred Beach Berm Levels Controlling Natural Breakout Levels and Proposed Creek Opening Levels

Creek	Lower Berm Level (m AHD)	Upper Berm Level (m AHD)	Proposed Intervention Level (m AHD)
Wimbie	0.6	1.1	2.0
Short Beach	No data	1.5	1.3
Joes	No data	1.7 to 2.0	1.4
Surfside	0.6	1.7	1.5

A need for intervention at Wimbie Creek is most unlikely, and at Short Beach Creek sporadic, only accompanying very heavy rainfall in the catchment or after a long period of dry weather. At Surfside Creek, even with clearing the downstream end of the pipe culvert at 1.5m AHD, it will most likely require slightly higher levels to back up behind the culvert and scour out built-up sand in the pipes themselves. Clearly Joes Creek is most likely to be impacted by the proposed intervention levels. This is consistent with Council's experience over the past 40 years of routine intervention at this location. In many instances at Joes Creek and Surfside Creek, artificial openings preceded by a few hours what would have otherwise occurred naturally.

We conclude that the Creeks Entrance Management Policy aims for natural creek behaviour where possible. Where infrastructure is too low to permit a non-intervention approach, it reinforces opening levels at least as high as those previously experienced for many decades. Further, it recommends, where possible in some areas, measures that may in future permit Council to raise the intervention level.

For the purposes of this REF and in the absence of any substantive evidence to the contrary, it is assumed (based on available historical data) that the intervention levels proposed by the Creeks Entrance Management Policy lies within the natural breakout range. For Wimbie Creek, the intervention level is at the highest limit of the natural range, while for Short Beach Creek and Surfside Creek it lies towards the upper limit of natural behaviour. It is therefore assumed that a single opening at these creeks will have minimal impact, and that continued openings at or close to this level may represent an insignificant departure from the more random natural hydrologic condition over the long term. At Joes Creek, openings will continue to reflect many decades of routine intervention. This is the basis for the analysis and judgements made in the following sections.

8.3 Water Quality

Water quality within the subject creeks is fully described in the Background Document. When closed, these creeks are characterised by naturally higher levels of nutrients and bacteria than exist in

the adjacent waters of Batemans Bay. Creating an artificial opening allows a limited degree of water exchange or flushing. It is expected that, in a similar fashion to many south coast estuaries, these creeks' water quality fluctuations will dominantly be seasonal, rather than related to the state of the entrance and opening levels.

These creeks are naturally vulnerable to an influx of organics and nutrients after heavy rainfall. To date their health is not of undue concern, and indications are that, with sensible land management that recognises the values of the waterways, water quality from catchment issues may show some improvement. Certainly the Entrance Management Policy will have little long-term impact on water quality.

8.4 Marine and Estuarine Communities

Sea wrack is comprised of a range of organisms and anthropogenic generated marine debris (litter). Macroalgae is often the dominant type of debris comprising this wrack. In time, the wrack would be colonized by a range of insects (dipteran larvae) and marine invertebrates (predominantly amphipods). There are several wader species which would use these wracks to feed on invertebrates attracted to the decomposing organic matter. Examples include the Red-necked Stint *Calidris ruficollis*, Greater Sand Plover *Charadrius leschenaultii*, and Ruddy Turnstone *Arenaria interpres*.

The wracks proposed for removal provide an important habitat and food resource for beach communities, but at highly localized spatial scales (measured in meters, but less than 10's of meters). Considering the small proportion of available wrack proposed for removal, there is minimal risk to beach ecosystem functioning, at spatial scales >20-50 meters.

The wracks can also have a major effect on estuarine ecosystems, particularly in small ICOLL's such as those considered in this study. As the wracks decompose, biological oxygen demand increases, resulting in reduced dissolved oxygen concentrations and the production of hydrogen sulfide gas (rotten egg gas). The effect of this increased biological oxygen demand would depend on many factors, including the degree of estuary flushing, the amount (and possibly types) of wrack material, and the volume of water within the estuary.

Anecdotal evidence indicates the wracks are causing major oxygen depletions, and odour issues for nearby residents. Large reductions in dissolved oxygen would be expected to result in the loss of many (possibly most) resident invertebrate and fish species, but would provide suitable conditions for a smaller suite of species that are tolerant of anoxic conditions (e.g. certain polychaete species). Under natural conditions, this would be a cyclic process, with estuary flushing eventually allowing the oxygenation of waters and sediments, and the recolonisation of diverse estuarine fauna assemblages.

The physical removal of wrack material would prevent significant deoxygenating of sediments and waters in the estuary, which would benefit most (but not all) estuarine fauna species.

8.5 Threatened Species Impacts

The Background Information document provides a detailed description of the existing environment. This section presents further detail on threatened species in the local area and potential impacts.

Section 5A of the Environmental Planning and Assessment (EP&A) Act (1979), as amended by the Threatened Species Conservation Act (1995) sets out the factors to be considered in deciding whether there is likely to be a significant effect on threatened species, populations or communities and/or their habitat. These factors are commonly denoted the 'Eight-part test'.

A search of the New South Wales National Parks and Wildlife Service Wildlife Atlas, additional Eurobodalla Shire Council records and studies has been undertaken for this project. This indicates that the Threatened Species listed in Table 8-2 have been detected along the coastal strip of Batemans Bay or in the catchment areas of creeks making up the study sites. The species status under the TSC Act and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is shown.

Table 8-2 Threatened Species recorded within the catchment of local coastal creeks and the Batemans Bay foreshore

Species	Common Name	TSC Act Schedule	EPBC Act
MAMMALS			
Petaurus australis	Yellow-bellied Glider	Vulnerable	-
Petauroides volans	Greater Glider	Vulnerable	-
Myotis adversus	Large-footed Myotis	Vulnerable	-
Falsistrellus tasmaniensus	Eastern False Pipistrelle	Vulnerable	-
BIRDS			
Pandion haliaetus	Osprey	Vulnerable	-
Haematopus longirostris	Pied Oystercatcher	Vulnerable	-
Haematopus fuliginosus	Sooty Oystercatcher	Vulnerable	-
Charadrius rubricollis	Hooded Plover	Endangered	-
Botaurus poiciloptilus	Australasian (Brown) Bittern	Vulnerable	-
Calyptorhynchus lathami	Glossy Black Cockatoo	Vulnerable	-
Ninox strenua	Powerful Owl	Vulnerable	-
Tyto tenebricosa	Sooty Owl	Vulnerable	-
Tyto novaehollandiae	Masked Owl	Vulnerable	-

Table 8-2 lists the protected species that have been detected within the study area. Many of these are forest dependant species and would not be impacted by the artificial opening of the creeks.

As specific survey work has not been carried out for this REF, it is assumed that the protected species previously recorded in the region may potentially be present at the time of creek opening. In order to assess which species would utilise the creeks and entrance areas directly, an assessment of the habitat preference of each species (birds and mammals) is necessary.

Table 8-3 presents habitat preferences in order to lead to conclusions about eight-part test requirements for this REF.

Table 8-3 Habitat Preference of Threatened Species within the study area

Common Name	Habitat	Assessment required?
MAMMALS		
Yellow-bellied Glider	Woodlands, open forests and tall open forests.	No
Greater Glider	Woodlands, open forests and tall open forests.	No
Large-footed Myotis	Lakes, rivers, streams and dams.	Yes
Eastern False Pipistrelle	Dry eucalypt forest and woodland.	No
BIRDS		
Osprey	Coastal lakes and rivers.	Yes
Pied Oystercatcher	Coastal sandy beaches.	Yes
Sooty Oystercatcher	Coastal rocky platforms.	Yes
Hooded Plover	Coastal sandy beaches, mudflats and spits.	Yes
Australasian (Brown) Bittern	Freshwater wetlands, hides in reeds.	No
Glossy Black Cockatoo	Woodlands, open forests and tall open forests.	No
Powerful Owl	Woodlands, open forests and tall open forests.	No
Sooty Owl	Wet old-growth forests & mature eucalypt forest.	No
Masked Owl	Woodlands, open forests and tall open forests.	No

Based on the findings of Table 8-3, the eight-part test is applied to the following-

- Large-footed Myotis, a fishing bat which forages over water to scoop up aquatic insects. Call was reportedly heard at Cullendulla wetland on one occasion.
- Osprey, a fishing hawk utilising the estuary for hunting. Sighted off Wimbie Beach and along the northern foreshores of the bay.
- Pied Oystercatcher, a coastal wader that feeds on the intertidal zone of the bay. It nests between September and December on areas of sand immediately above high water mark. Numerous sightings have been recorded along sandflats near the Batemans Bay marina.
- Sooty Oystercatcher, similar range to the Pied Oystercatcher but more often occupying intertidal rock platforms. Often breed on offshore islands. Sighted near Short Beach Creek entrance and near Wimbie Creek entrance. Numerous sightings recorded around the bay.
- Hooded Plover, an Endangered wader that inhabits and breeds on long beaches with low grassy sandhills. Prefer a wide wave-wash zone for feeding. Up to five birds have been sighted on five occasions at one site on Maloneys Beach in the late 1980's. These were not noted as nesting at this location, and were presumably foraging in the intertidal zone.

These species were either detected on local beach/dune systems around Batemans Bay or, based on habitat preference, are likely to utilise the waters of these creeks on occasions. These species are therefore judged as most likely to experience potential impacts. The 'eight-part test' applied to these species is set out in Appendix A of this document.

We conclude from the eight-part test of significance, that the most likely and important impact on these species would possibly be disruption of beach-based nesting activities of Hooded Plover or Pied Oystercatcher, caused by man-made creek opening operations and by expansion of the entrance channel itself. This disruption would be more likely at Joes Creek based on past records and habitat preference, however shorebird nesting has not been recorded at this location in the past.

To mitigate this possibility, no excavation work across entrance beaches is to be undertaken without clearance from National Parks and Wildlife Service if protected shorebirds, nests or fledglings are found to be present in the potential entrance area.

8.6 Impacts on Migratory Species

Batemans Bay is at times home to migratory species, some of which are protected under international treaty. These species are identified as:

- Little Egret (*Ardea garzetta*), a sedentary and nomadic bird found among intertidal mudflats and shallow wetlands;
- Great Egret (*Ardea alba*), is listed under EPBC Act 1999 as a migratory species protected under the China - Australia Migratory Bird Agreement (CAMBA) and the Japan - Australia Migratory Bird Agreement (JAMBA). This species is found among floodwaters, rivers, shallow wetlands and intertidal mudflats.
- White Bellied Sea Eagle (*Haliaeetus leucogaster*) is also listed under EPBC Act 1999 as a migratory species included in the CAMBA international convention. It inhabits large rivers, fresh and saline lakes, coastal seas and islands.
- Osprey and Hooded Plover, both described in Section 8.5 above.

It is noted that these species would not nest in the creeks' entrance area. Impacts on foraging birds, should they be present while the creeks were artificially opened, would be confined to indirect issues such as local noise disturbance for a matter of hours while machinery was operating. This does not constitute a serious disruption to the bird's life cycle.

Listed migratory birds known to be present in the upper Surfside Creek wetland (SEPP Wetland 214) from a study by Resource Design and Management (1993) include:

- Latham's (Japanese) Snipe, an annual migrant that feeds in wooded swamps.
- Reed Warbler and Little Grassbird, both reed-dwelling, strongly-voiced songbirds associated with freshwater wetlands.
- Members of the *Anatidae* family - species using the wetland include the Black Swan, Black Duck, Grey Teal, Chestnut Teal and White-eyed Duck.

However it is noted that this wetland is separated from the tidal creek at Surfside by a bund wall. Creek openings would have an insignificant impact on this wetland and hence on the bird species that may be present.

With consideration of the EPBC Act guidelines, the adoption of the policy would not have a significant impact on any listed migratory species. Specifically, the proposal will not:

- Substantially modify, destroy or isolate an area of important habitat of the migratory species;
- Result in invasive species that are harmful to the migratory species becoming established in an area of important habitat of the migratory species, or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

8.7 Impacts on Key Threatening Processes

Key Threatening Processes listed under Schedule 3 of the Threatened Species Conservation Act (TSCA) 1995 as of September 2003 are as follows:

i. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

ii. Anthropogenic Climate Change

iii. Bushrock removal

iv. Clearing of native vegetation

v. Competition and grazing by the feral European Rabbit, *Oryctolagus cuniculus*

vi. Competition from feral honey bees *Apis mellifera*

vii. High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition

viii. Importation of Red Imported Fire Ants *Solenopsis invicta* Buren 1972

ix. Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations

x. Infection of frogs by amphibian chytrid causing the disease chytridiomycosis

xi. Infection of native plants by *Phytophthora cinnamomi*

xii. Invasion of native plant communities by *Chrysanthemoides monilifera*

xiii. Invasion of native plant communities by exotic perennial grasses

xiv. Loss or degradation (or both) of sites used for hill-topping by butterflies

xv. Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish)

xvi. Predation by the European Red Fox *Vulpes Vulpes* (Linnaeus, 1758)

xvii. Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)

xviii. Predation by the Ship Rat *Rattus rattus* on Lord Howe Island

Under the TSC Act, impacts on Key Threatening Processes are to be formally considered in this REF.

Of the Key Threatening Processes listed, point i. is relevant to the current proposed activity. Wetlands and floodplains around the creek verge would drain as a result of opening the entrances under this policy. However this activity is largely natural and would not alter natural flow regimes significantly. It is concluded that changes instigated by the policy are minimal, are not permanent and mimic natural events as far as possible.

There have been no sampling exercises to detect Plague Minnow *G. holbrooki* at these creeks (point xv.). This species could conceivably colonise the lagoon and brackish areas of the creeks. Creek openings that mimic as far as possible natural occurrences would have no impact on this Key Threatening Process.

It is concluded that the proposed actions of creek opening will have no bearing on any listed Key Threatening Processes.

9 CHECKLIST - MATTERS FOR CONSIDERATION

Clause 82 of the Environmental Planning and Assessment Act Regulation lists the factors to be taken into account when considering the likely impact of an activity on the environment under Part 5 of the EP&A Act. The following section deals in turn with each of the matters considered to be relevant to the artificial opening of the study creeks in accordance with the Policy.

a) Any environmental impact upon a community

The communities most likely to be affected will be the residents and casual users of the coastal caravan parks at Glenhaven and Pleasurelea Caravan Parks. There will be no significant adverse impact upon these communities. If the activity were not to occur, there would be infrequent potential for flooding of the lower parts of these Caravan Parks.

b) Any transformation of a locality

The locality will not be transformed in any significant manner. The creek entrances will change temporarily, but these changes will be within natural bounds.

c) Any environmental impact on the ecosystems of the locality

The possible impacts have been discussed above under Section 8. It is concluded that the broad impact of the Creek Opening Policy on creek water levels and subsequent ecological responses will be negligible.

d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality

There is not likely to be any reduction in the aesthetic quality or value of the locality as a result of implementing the Policy.

Intervention in the natural breakout process diminishes slightly the scientific value of these creek systems since an element of 'naturalness' has been modified. However ecological processes will continue to operate and the localities could still be suitably used for a wide range of scientific purposes.

e) Any effect on a locality, place or building having aesthetic, anthropological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations

There are no Aboriginal archaeological sites within the entrance areas potential affected by creek openings. It is understood that Batemans Bay has broad significance to Aboriginal people, however no potential adverse impacts of opening the creeks are known.

Batemans Bay and its foreshore beaches have aesthetic and social significance to the local and holidaying community of the region. The process and consequences of opening these creeks do not impact adversely on these values.

f) Any impact on the habitat of protected or endangered fauna

The focus of this section is on those species which are rare, threatened or otherwise restricted in distribution and which could be adversely affected by opening creek entrances.

As noted above, there are species of birds recorded from the Batemans Bay area that may use the creeks' habitats and entrance area that are classified as vulnerable or endangered. A detailed assessment of the potential impact of implementing the policy on these species is considered in the Eight-part test included as an Appendix to this REF.

In general an artificial opening could have a significant adverse impact upon ground nesting species such as Hooded Plover or Pied Oystercatcher by disrupting breeding activity (for example, pair formation, nesting, fledging). Any loss of a breeding colony would be considered significant. This aspect is also considered in detail in the eight-part test in Appendix A.

g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air

There will be no endangering of any species of animal, plant or other life form. The special cases for threatened bird species and the fishing bat Large-footed Myotis are considered in Appendix A of this REF.

h) Any long term effects on the environment

The possible long-term effects of implementing this policy have been discussed above in Section 8. Cumulative effects of irregular intervention in these creek openings are briefly discussed in this document, but as the indicated opening levels would be generally well towards the upper end of the natural breakout range, these impacts are expected to be very slight.

i) Any degradation of the quality of the environment

The quality of the creek environments will be slightly degraded by virtue of the fact that a natural process is being interfered with. In effect the creeks are losing an element of 'naturalness'. Naturalness is a significant environmental attribute. It is often a criteria used to determine environmental or conservation value.

However, Joes Creek in particular has been artificially opened at various intervals for a number of decades, and loss of naturalness will not be a direct result of implementing the policy. Similarly Surfside Creek has an artificial piped entrance, and the Policy will not result in any further degradation of its remaining natural features.

j) Any risk to the safety of the environment

The environment will be no less 'safe' as a result of implementing the Policy. The robustness or ability of the environment to withstand environmental fluctuations should not be compromised.

k) Any reduction in the range of beneficial uses of the environment

There will be no reduction in the range of beneficial uses of the environment apart from those discussed under item d) above.

l) Any pollution of the environment

Pollution of the environment (noise, minor diesel fumes) may be experienced for a matter of hours while construction equipment excavates a channel across the sand at the creek entrances.

m) Any environmental problems associated with the disposal of waste

None are relevant. Sand excavated from the channels will be spread across the beach and may be incorporated into the channels as they expand after opening. Alternatively, it will spread later by natural causes (wind, waves) and will not be lost to the system.

n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply

None are relevant.

o) Any cumulative environmental effect with other existing or future activities

Other activities are likely to be based in the catchment or on the foreshore. Although it is difficult to predict other future activities that may take place, it is unlikely that implementation of the Policy would have a cumulative effect with these other activities.

10 CONCLUSIONS

The proposed activity is unlikely to have a significant environmental impact upon the ecosystems of the four creeks in the short term.

It is assumed (based on available historical data) that the intervention levels proposed by the Creeks Entrance Management Policy lie within or at the highest limits of the natural breakout range.

The Creeks Entrance Management Policy aims for natural creek behaviour where possible. Where at Joes Creek infrastructure is too low to permit a non-intervention approach, it reinforces opening levels at least as high as those previously experienced for many decades.

It is therefore assumed that any single opening will have minimal impact. If in the case of Joes Creek, the intervention level were proven subsequently to be well below the natural breakout range, the impacts may be significant. To mitigate this possibility, it will be necessary to raise the intervention level where practical. This is consistent with the precautionary principle.

Over the long term the proposed activity will have a varying impact on these creeks. In the long term, it will probably have a cumulative environmental impact by causing a very slight hydrologic and ecological shift from the 'natural' condition of Joes Creek. The impact will be mainly related to minimal shifts in fringing vegetation community structure and distribution, which could in turn, cause impacts upon faunal communities. Surfside Creek has an entrance modified by a piped culvert. The policy will not further affect this creek to any extent.

For Wimbie and Short Beach Creeks, continued openings at or close to policy levels may represent an insignificant departure from the more random natural hydrologic condition over the long term. The policy mimics natural hydrologic regimes as much as possible for these creeks.

There are no viable alternatives to the activity in the short term. The Policy can be implemented in the short term recognising that minor cumulative environmental impacts over the long term may be likely on Joes Creek. It should be possible to reduce the extent of impacts by applying the measures recommended in the Management Policy document. Progressive treatment of these constraints should allow the intervention level to be raised, taking the creeks even more towards their natural condition and reducing the potential for intervention.

Adoption of the Policy and the findings of this REF should be conditional upon the implementation of the following mitigation strategies:

- No excavation work across any entrance beaches is to be undertaken without clearance from National Parks and Wildlife Service if protected shorebirds, nests or fledglings are found to be present in the potential entrance area. Disruption of shorebird breeding would be more likely at Joes Creek than at other entrance sites, based on past records and habitat preference, but shorebird nesting has not been recorded at this location in the past.
- If a development proposal were received for land around these creeks below a nominal 2.0m AHD elevation, Council should ensure, through the Development Application process, that the proposal does not interfere with the ability to raise intervention levels. Furthermore, if it were

both reasonable and opportune to do so, Council could consider conditioning these DA's to raise or relocate infrastructure in critical low-lying areas such as:

- Glenhaven Caravan Park (Joes Creek)
- Birdland Animal Park (Joes Creek)
- Pleasurelea Caravan Park (Short Beach Creek) subject to survey of critical infrastructure levels which were not available for this study.

11 DECLARATION

This Review of Environmental factors provides a true and fair review of the proposed activity - implementation of the Joes Creek, Wimbie Creek, Short Beach Creek and Surfside Creek Entrance Management Policy - in relation to its potential effects on the environment.

Having considered this document, and the factors listed in Clause 82 of the Environmental Planning & Assessment Regulations, Eurobodalla Shire Council is of the view that the proposed activity - the implementation of the Joes Creek, Wimbie Creek, Short Beach Creek and Surfside Creek Entrance Management Policy - **will/will not** *(delete one)* have a significant adverse environmental impact.

…….. ……..…

Signed **Date**

for Eurobodalla Shire Council

12 REFERENCES

Refer to the Creeks Management Policies report for a full list of general references for that document. The following references are particular to this REF.

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APPENDIX A: EIGHT PART TEST

The eight-part test for significance is applied to the **Osprey, Pied Oystercatcher, Sooty Oystercatcher and Hooded Plover,** and to the marsupial **Large-footed Myotis** as these species based on habitat preference may utilise various creek entrance areas and/or creek habitats on occasions.

1. ***In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction,***

The Osprey has littoral habits but also occurs in terrestrial wetlands in tropical and temperate Australia and offshore islands (Marchant and Higgins, 1993). Osprey feed mostly on fish but also take small terrestrial vertebrates, seabirds and crustaceans (Marchant and Higgins, 1993). They require extensive areas of clear open water for fishing (Marchant and Higgins, 1993).

Ospreys are mostly sedentary but forage over a large area. They show a high fidelity to nest sites (Marchant and Higgins, 1993). They breed mostly on coasts and islands and the nest is positioned in a prominent position on rocky headlands, stacks, cliffs in dead trees or artificial platforms near the ocean or large waterbodies (Marchant and Higgins 1993). The opening of these creeks would have a minor impact on the foraging habitat for the Osprey.

The Pied Oystercatcher occurs on the coast especially in intertidal mudflats, sandbanks and open beaches (Marchant and Higgins. 1993). They forage on exposed sand, mud, rock or coral for molluscs, worms, crabs and small fish (Marchant and Higgins, 1993).

They nest on areas of sand immediately above the high-water mark of beaches, sand bars and margins of estuaries and lagoons (Marchant and Higgins, 1993). Usually two eggs are laid in an unlined scrape between September and December in southern Australia (Marchant and Higgins 1993).

The opening of these creeks would have a minor impact on the foraging habitat for the Pied Oystercatcher. Should artificial opening become necessary under this Plan during the breeding season, contact prior to channel excavations should be made with National Parks officers to determine whether this species is present in the entrance area and if mitigating actions are available.

The Sooty Oystercatcher is strictly a marine coastal species, which usually occurs within 50m of the shore (Marchant and Higgins 1993). It prefers rocky intertidal shorelines where it forages for molluscs, crustaceans, polychaetes, echinoderms and small fish (Marchant and Higgins, 1993).

Adult Sooty Oystercatchers are territorial and often breed on offshore islands. Sooty Oystercatcher will nest from August to March, but nesting locations would be well removed from the entrance area. The nest is a scrape in the ground where two eggs are usually laid (Marchant and Higgins, 1993). The opening of these creeks would have a minor impact on the foraging habitat for the Sooty Oystercatcher.

In south-east Australia, the Hooded Plover prefers sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding (Marchant and Higgins, 1993). It feeds during the day and at night in the sand at all levels in the zone of wave wash during low and mid-tide for polychaetes, molluscs, crustaceans, insects, turions and seed (Marchant and Higgins, 1993).

In eastern Australia, the Hooded Plover breeds on sandy ocean beaches strewn with beach-cast seaweed in a narrow strip between the high-water mark and the base of the foredunes (Marchant and Higgins, 1993). Usually between 2-3 eggs are laid between August and March in depressions in the sand (Marchant and Higgins, 1993).

The opening of these creeks would have a minor impact on the foraging habitat for the Hooded Plover. Should artificial opening become necessary under this Plan during the breeding season, contact must be made with National Parks officers prior to channel excavations, to determine whether this species is present in the entrance area and if mitigating actions are available.

The Large-footed Myotis forages over fresh and semi-saline water often along creeks for insects and occasionally fish (Robson, 1984). They have been found roosting in caves, mines or tunnels under buildings and bridges, in dense foliage (Dwyer, 1970) and tree hollows adjacent to water. The opening of these creeks would have a minor impact on the foraging habitat for the Large-footed Myotis. There is no effect on vegetation around the creek edges such that this species' potential habitat would be impacted.

2. ***In the case of an endangered population, whether the life cycle of the population that constituted the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,***

   No populations currently listed under Part 2 Endangered populations of Schedule 1 occur in the area. No assessment is required.

3. ***In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed,***

   The region is defined by the NSW NPWS as roughly the area south from Batemans Bay to the NSW/Victorian border.

   Habitat of the Large-footed Myotis, Osprey, Pied Oystercatcher, Sooty Oystercatcher and Hooded Plover has now been included in the Reserve System as a consequence of the Regional Forest Agreement. This proposal does not modify or remove a significant area of habitat.

4. ***Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community,***

   The opening of the creeks will not isolate interconnected habitat of Threatened species.

5. ***Whether critical habitat will be affected,***

   Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. No critical habitat has been listed for these species.

6. ***Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region,***

   The region is defined by the NSW NPWS as roughly the area south from Batemans Bay to the NSW/Victorian border.

Habitat of the Osprey, Pied Oystercatcher, Sooty Oystercatcher and Hooded Plover is represented in conservation reserves in the region and the region adjacent to the north. For the subject Threatened bird species the adequacy of the number within the reservation system is complicated by the large home ranges of these species. Hence, conservation of these species requires the retention of habitat within and outside of the reservation system.

The Large-footed Myotis has been detected primarily along the coastal fringe close to rivers and coastal lagoons. As a consequence of the Regional Forest Agreement habitat of the Large-footed Myotis is represented in conservation reserves. However it is important to conserve potential habitat for these insectivorous bats (hollow bearing trees and roost sites under bridges) over the entire landscape.

7. Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process,

Schedule 3 of the TSC Act (1995) lists "the alteration of rivers and streams and their flood plains and wetlands" as a Key Threatening Process. The proposed development is considered a threatening process under this definition. Section 8 of this report discusses relevant aspects of hydrology and water level impacts.

Three anthropogenic processes have predominantly altered flows in streams, rivers and their floodplains and wetlands in NSW. These are:

a) Building of dams (including all dams and weirs and off-river storages);

b) Diversion of flows by structures or extraction; and

c) Alteration of flows on floodplains with levees and structures (including those on wetlands to allow water storage).

These issues as a Key Threatening Process have little relevance to the species addressed in this test.

8. Whether any threatened species, population or ecological community is at the limit of its known distribution.

The Osprey is found around much of coastal Australia with the exception of Victoria and Tasmania (Simpson and Day 1998). The Osprey is not at the limit of its known distribution.

The Pied Oystercatcher is found in Australia, Irian Jaya and Papua New Guinea (Marchant and Higgins 1993). In Australia it occurs around the entire coast (see Simpson and Day 1998). The Pied Oystercatcher is not at the limit of its known distribution.

The Sooty Oystercatcher is endemic to Australia and occurs mostly along the east, south and western coasts (Marchant and Higgins 1993). The Sooty Oystercatcher is not at the limit of its known distribution.

The Hooded Plover is endemic to Australia and occurs from near Jervis Bay NSW to west Eyre Peninsula SA, Tasmania and Bass Strait Islands and south-west WA (Marchant and Higgins 1993). National Parks suggest that the Hooded Plover is near its limit of its known distribution some 80km further north near Sussex Inlet (L. Shields pers. comm.).

The Large-footed Myotis occurs along the coastal strip of northern and eastern Australia, from northern Western Australia through to the Victorian/South Australia border (Strahan 1995). The Large-footed Myotis is not at the limit of its known distribution.