

5 OBJECTIVES FOR FUTURE MANAGEMENT

A set of well-targeted management objectives has been formulated based on protection of the values and uses of the estuary and remediation of specific issues/problems facing the estuary, as presented in the previous chapter.

The objectives essentially aim to rectify the problems facing the estuary, whilst preserving and enhancing the estuary's inherent values. Eighteen (18) separate objectives have been formulated covering the topics of water quality, entrance management, sedimentation, ecology and upper floodplain management, as per the specific issues in Section 4.4.

5.1 Water Quality Objectives

Objective (1) Reduce the urban pollutants load entering Killick Creek, with particular focus on reducing bacterial loads to the estuary

Addressing Issue A (see Section 4.4.1.1), this objective is aimed at reducing the existing inputs to the estuary via the urban stormwater system. Input loads from the stormwater include sediments, nutrients (nitrogen and phosphorus), petro-chemicals, pathogens / bacteria (exfiltration from the sewerage system, and direct faecal inputs to the catchment, eg dogs and other pets) and litter (particularly from the business area of Crescent Head and the Caravan Park).

Objective (2) Ensure that the water quality of the lower Killick Creek estuary is suitable for primary contact activities, such as swimming

This objective aims to ensure that the water quality of Killick Creek does not compromise the existing recreational uses of the waterway. The main activity that would potentially be compromised is swimming, and this mostly occurs at the downstream end of the creek, adjacent to the Caravan Park. A number of stormwater outlets discharges into Killick Creek at this location, which drain the majority of the Crescent Head urban area. Bacteria and pathogens considered potentially harmful to humans would enter the creek from these drains, particularly during periods of rainfall and catchment runoff.

In addressing Issue B (see Section 4.4.1.2), this objective acknowledges that the potential impacts of stormwater and other inputs on human health are exacerbated when the entrance is heavily shoaled or closed. Under these conditions, there is little or no opportunity for tides to assist with dilution or dispersal of pollutant inputs, meaning that areas close to stormwater outlets would be particularly susceptible to poor water quality.

Objective (3) Manage the discharge of poor quality water from the agricultural drains upstream of the Killick Creek floodgates to prevent detrimental environmental impacts

This objective aims to address Issue C (refer Section 4.4.1.3) through improved control and management of releases to Killick Creek. In particular, releases of water that has poor quality should be better controlled to ensure that impacts on the downstream estuarine environment are avoided. In the past, poor water quality, which has involved low oxygen levels, low pH levels and high organic content, has lead to ecological stress on the estuary (including a number of fish kills), and potentially degrades the recreational amenity of the waterway (particularly when the agricultural releases are organic and tannin-stained).

Objective (4) Minimise the effect of red weed in Killick Creek estuary

Addressing Issue D (refer Section 4.4.1.4), this objective aims to limit the degrading effects of red weed ingress into the estuary. Red weed is a marine macroalgae, which can become trapped in the estuary under particular environmental conditions. The natural decay of the algae can have a significant impact on the local estuarine environment, including depletion of oxygen (which has apparently also contributed to fish kills) and generation of odours.

5.2 Entrance Management Objectives

Objective (5) Minimise risks to swimmers associated with strong tidal currents within the primary recreation area in the entrance of Killick Creek

Issue E (refer Section 4.4.2.1) outlines the concerns of some community members with respect to entrance channel tidal currents. This objective aims to address these concerns through actions to minimise risks to users of the waterway. The risks to users are heightened at particular times, corresponding with larger tidal ranges, which unfortunately coincide with peak tourism times around Christmas.

Objective (6) Manage the entrance of Killick Creek to facilitate agricultural drainage, maximize recreational opportunities and minimize environmental degradation

This objective is aimed to balance the varied and somewhat competing issues regarding how the entrance of Killick Creek should be managed. An open entrance is preferred to facilitate the passage and drainage of agricultural runoff from Belmore Swamp, and also to maximize tidal flushing and thus improve water quality in the lower reaches of the estuary. However, maintenance of an open entrance condition has implications for tidal hydraulics, flooding (refer Issue Q: see Section 4.4.5.5), sediment dynamics (refer Issue G: see Section 4.4.3.1) and the ecological structure of the estuary

(refer Issue J: see Section 4.4.4.1), which also need to be considered from a future management perspective.

This objective should also consider Issue F (refer Section 4.4.2.2), to guide Council in future management of the entrance with respect to a natural meander in the entrance channel that can potentially result in erosion of the adjacent fore dunes.

5.3 Sedimentation Objectives

Objective (7) Ensure that marine and fluvial sedimentation within Killick Creek does not compromise the environmental, social (recreational) or flood-mitigation values offered by the estuary

Addressing Issue G (refer Section 4.4.3.1), this objective aims to maintain the existing values of the estuary, which are currently threatened by increasing accumulation of marine and fluvial sediment at the entrance and upstream locations. Recently, marine sediment accumulation has led to complete closure of the entrance, which has had negative effects on recreational amenity, and consequently has affected local commercial enterprises, such as the caravan park. Accumulation of sand at the entrance, as well as accumulation of finer fluvial sediment at other locations within the estuary is likely to affect flood dynamics of the estuary, and thus its ability to contribute to the overall Lower Macleay Flood Mitigation Scheme.

Objective (8) Facilitate access to the ocean from the boatramp, particularly during peak periods

Although located in the entrance channel, this objective has been listed under Sedimentation as it does not form a key entrance management variable. This objective addresses Issue H (refer Section 4.4.3.2), wherein boating access to and from the small boatramp in the channel is facilitated. Usage of the boatramp is limited except for during the peak tourism season. Therefore, there may be some merit in maintaining access between the ramp and the ocean during particular times of the year only. Works associated with channel maintenance could be co-ordinated to coincide with other entrance management works, however, the works themselves should not serve an entrance management purpose.

Objective (9) Minimise any further accumulation of fine organic sediment in the upper reaches of Killick Creek

Addressing Issue I (refer Section 4.4.3.3), this objective aims to minimise the future accumulation of organics and sediments (ooze) associated with drainage discharges in upper, deeper parts of the estuary. The enlarged section of creek in the upper reaches has exacerbated the settlement of fine sediments and organics washed off the catchment. This objective is closely linked to *Objective 3*,

which aims to prevent poor water quality entering the estuary from the agricultural drains and impacting on the ecological environment.

5.4 Ecology Objectives

Objective (10) Prevent further change in the estuarine tidal hydraulics that may unbalance the present ecological structure of Killick Creek

Addressing Issue J (see Section 4.4.4.1), this objective involves preventing further hydrodynamic change that would have consequences on the estuarine ecology. Significant changes to hydrodynamic in the past (ie from creating an almost permanently open entrance) have resulted in a modified ecology, including an increase in mangroves. It is considered that the system should be managed for current values (that is, a more marinised condition compared to 'natural' conditions).

The existing, marinised system could tolerate short periods of entrance closure, however, extended periods of closure (as predicted given the extensive sediment accumulation in the entrance channel) could impact on existing vegetation communities. Therefore, entrance management and entrance dredging works should be triggered by signs of ecological stress rather than automatically opening the system once it closes. This approach is advocated by HRC who indicate that entrances for 'Healthy Modified Conditions' systems (which would likely be the classification for Killick Creek) should be managed to protect existing critical ecosystems (rather than returned to natural conditions).

Objective (11) Prevent any future degradation of existing aquatic and terrestrial communities and their habitats, and improve habitats in the future through targeted restoration and rehabilitation

This objective aims to address Issue K (refer Section 4.4.4.2) by preventing further decline in environmental health, and preferably, improving the health / condition of the estuary through targeted habitat restoration. Prevention of further decline in environmental health is integrated with addressing inputs of poor water quality and organic sediments from the agricultural drains (Objectives 3 and 9) and from further changes to the hydrodynamics of the estuary (Objective 10).

Objective (12) Prevent future fish kills in the Killick Creek estuary occurring from non-natural processes

Fish kills sometimes occur due to natural processes, including the ingress and subsequent decay of marine algae into the estuary. This objective aims to address Issue L (refer Section 4.4.4.3) in respect to preventing fish kills in the estuary that are the direct consequence of anthropogenic activities, including the discharge of agricultural waters into the estuary via an artificial drainage system, or the increased frequency of ingress and subsequent decay of marine algae.

5.5 Upper Floodplain Management Objectives

Objective (13) Prevent any unnecessary drainage of runoff waters from Belmore Swamp and Connection Creek into the Killick Creek estuary

Issue M (refer Section 4.4.5.1) acknowledges the role of Killick Creek in the land management practices of agricultural land within Belmore Swamp. Without adequate land management, this land would become even more marginal, potentially limiting the economic viability of primary production on the land. Issue R (refer Section 4.4.5.6) also acknowledges the role of Killick Creek in managing the hydraulics of the swamp in order to rehabilitate the lands already degraded by saline water inundation that has further lead to acid sulfate scalding processes.

In light of Issues M and R, Objective 13 aims to ensure that there is not any unnecessary drainage from the Belmore Swamp area into Killick Creek (and thus introducing associated flow and pollutant loads to the estuary).

Objective (14) Ensure that the floodgates and drop-boards are managed effectively to optimize agricultural management and land rehabilitation needs, and to minimize degrading pressures on the downstream estuarine environment

Given the apparent inefficiencies with the existing floodgates on Killick Creek, as discussed in Issue N (refer Section 4.4.5.2), this objective seeks to address the future operation and management of the floodgates as a mechanism for balancing the agricultural needs for inundation and drainage, along with the needs of the estuary not to be exposed to additional flow and pollutant load inputs.

Objective (15) Ensure that active agricultural drains are optimized for hydraulic efficiency and water quality, and inactive drains are removed, as appropriate and necessary

Whilst it is recognised that the drains serve a significant role in maintaining and managing the land within Belmore Swamp, Issue O (refer Section 4.4.5.3) identifies that overly deep drains and redundant drains could be reclaimed or partially infilled. Therefore, this objective aims to ensure that all non-“mitigation” drains (i.e. drains that do not influence the overall performance of flood mitigation in Belmore Swamp) that can be infilled (either partially or completely) are done so. This would also significantly improve access across the lands, which is currently limited to a small number of bridges over the drains.

Objective (16) Ensure that current agricultural land management within the upper Belmore Swamp area is compatible with Best Management Practice for Acid Sulfate Soil lands

As identified in Issue P (refer Section 4.4.5.4), the Upper Belmore Swamp area contains acid sulfate soils and is identified as a 'hot spot' for acid sulfate soil remediation. This objective aims to ensure that agricultural management of this land recognises the importance of the acid sulfate soil potential, and is undertaken in a manner that minimises the potential for acid runoff into the Killick Creek estuary. In accordance with Issue R (refer Section 4.4.5.6), it is recognised that the manipulation of drainage through Killick Creek, as controlled by the Killick Creek floodgates, is critical to the success of rehabilitation of much of this acid sulfate soil land.

Objective (17) Ensure minimum inundation of the Kempsey – Crescent Head main road during frequent and major flood events in the Connection Creek floodplain

In addressing Issue Q (refer Section 4.4.5.5), this objective aims to ensure that the role of Killick Creek (and the drainage of lands from the Connection Creek vicinity) is maintained with respect to mitigation of flooding of the Kempsey – Crescent Head Road (particularly in the vicinity of 'the corduroy').

Objective (18) Ensure that the entrance training wall complies with current engineering standards, and does not compromise the recreational values of the creek.

This objective was included following public exhibition of the draft Estuary Management Plan (February 2006), wherein the new issue (Issue S) was presented (refer 4.4.5.7). The current rock training wall is in a state of disrepair, having reached the end of its effective design life (ie was constructed just over 50 years ago). Smaller rocks within the wall are subject to dislocation during floods or due to high velocity stormwater outflows. Outflanking of failed sections of the wall has resulted in localized areas of bank retreat. Further retreat will compromise the public walkway located immediately behind the top of bank.

5.6 Summary of Objectives

Water Quality

Objective (1) Reduce the urban pollutants load entering Killick Creek, with particular focus on reducing bacterial loads to the estuary

Objective (2) Ensure that the water quality of the lower Killick Creek estuary is suitable for primary contact activities, such as swimming

Objective (3) Manage the discharge of poor quality water from the agricultural drains upstream of the Killick Creek floodgates to prevent detrimental environmental impacts

Objective (4) Minimise the effect of red weed in Killick Creek estuary

Entrance Management

Objective (5) Minimise risks to swimmers associated with strong tidal currents within the primary recreation area in the entrance of Killick Creek

Objective (6) Manage the entrance of Killick Creek to facilitate agricultural drainage, maximize recreational opportunities and minimize environmental degradation

Sedimentation

Objective (7) Ensure that marine and fluvial sedimentation within Killick Creek does not compromise the environmental, social (recreational) or flood-mitigation values offered by the estuary

Objective (8) Facilitate access to the ocean from the boatramp, particularly during peak periods

Objective (9) Minimise any further accumulation of fine organic sediment in the upper reaches of Killick Creek

Ecology

Objective (10) Prevent further change in the estuarine tidal hydraulics that may unbalance the present ecological structure of Killick Creek

Objective (11) Prevent any future degradation of existing aquatic and terrestrial communities and their habitats, and improve habitats in the future through targeted restoration and rehabilitation

Objective (12) Prevent future fish kills in the Killick Creek estuary occurring from non-natural processes

Upper Floodplain Management

Objective (13) Prevent any unnecessary drainage of runoff waters from Belmore Swamp and Connection Creek into the Killick Creek estuary

Objective (14) Ensure that the floodgates and drop-boards are managed effectively to optimize agricultural management and land rehabilitation needs, and to minimize degrading pressures on the downstream estuarine environment

Objective (15) Ensure that active agricultural drains are optimized for hydraulic efficiency and water quality, and inactive drains are infilled, as appropriate and necessary

Objective (16) Ensure that current agricultural land management within the upper Belmore Swamp area is compatible with Best Management Practice for Acid Sulfate Soil lands

Objective (17) Ensure minimum inundation of the Kempsey – Crescent Head main road during frequent and major flood events in the Connection Creek floodplain

Objective (18) Ensure that the entrance training wall complies with current engineering standards, and does not compromise the recreational values of the creek.

5.7 Ranking of Objectives

The objectives of the Estuary Management Plan, as described above, have been ranked in order to assist with prioritisation of future management strategies. In essence, strategies that address the most important issues / objectives, will be implemented first so that maximum benefit to the estuary can be achieved within the timeframe of this Plan (i.e. approximately 5 years before a complete review).

The objectives have been ranked in consultation with the Coast and Estuary Management Committee through the workshop process (as described in Section 3.1). Each committee member was asked to score each objective between 1 and 5 (1 representing a low priority and 5 representing a high priority). The responses from the committee members were collated and the scores for each individual objective averaged.

As Objectives 7 and 18 are new objectives, included in the final report only, they were not ranked formally by the Committee or the community workshop. Given the interest expressed in these particular issues during public exhibition of the document, as well as supplementary field inspections of the study site, these objectives have been allocated a relatively high priority score (ie 4 out of 5).

The ranking of the specific objectives is presented in Table 5.1, in order of priority.

Table 5.1 Prioritised list of Management Objectives

Rank	Objective No.	Objective description	Issues addressed	Relative Score 1 = low, 5 = high
1	16	<i>Ensure that current agricultural land management within the upper Belmore Swamp area is compatible with Best Management Practice for Acid Sulfate Soil lands</i>	P, R	4.3/5
2	11	<i>Prevent any future degradation of existing aquatic and terrestrial communities and their habitats, and improve habitats in the future through targeted restoration and rehabilitation</i>	K	4.1/5
3	14	<i>Ensure that the floodgates and drop-boards are managed effectively to optimize agricultural management and land rehabilitation needs, and to minimize degrading pressures on the downstream estuarine environment</i>	N, R	4.1/5
4	1	<i>Reduce the urban pollutants load entering Killick Creek, with particular focus on reducing bacterial loads to the estuary</i>	A	4.0/5
5	7	<i>Ensure that marine and fluvial sedimentation within Killick Creek does not compromise the environmental, social (recreational) or flood-mitigation values offered by the estuary</i>	G	4.0/5

Rank	Objective No.	Objective description	Issues addressed	Relative Score 1 = low, 5 = high
6	18	<i>Ensure that the entrance training wall complies with current engineering standards, and does not compromise the recreational values of the creek.</i>	S	4.0/5
7	2	<i>Ensure that the water quality of the lower Killick Creek estuary is suitable for primary contact activities, such as swimming</i>	B	3.9/5
8	6	<i>Manage the entrance of Killick Creek to facilitate agricultural drainage, maximize recreational opportunities and minimize environmental degradation</i>	F, G	3.7/5
9	15	<i>Ensure that active agricultural drains are optimized for hydraulic efficiency and water quality, and inactive drains are infilled, as appropriate and necessary</i>	O, R	3.4/5
10	4	<i>Minimise the effect of red weed in Killick Creek estuary</i>	D	3.4/5
11	12	<i>Prevent future fish kills in the Killick Creek estuary occurring from non-natural processes</i>	L	3.3/5
12	13	<i>Prevent any unnecessary drainage of runoff waters from Belmore Swamp and Connection Creek into the Killick Creek estuary</i>	M, R	3.3/5
13	8	<i>Facilitate access to the ocean from the boatramp, particularly during peak periods</i>	H	3.3/5
14	3	<i>Manage the discharge of poor quality water from the agricultural drains upstream of the Killick Creek floodgates to prevent detrimental environmental impacts</i>	C	3.2/5
15	17	<i>Ensure minimum inundation of the Kempsey – Crescent Head main road during frequent and major flood events in the Connection Creek floodplain</i>	Q	3.2/5
16	9	<i>Minimise any further accumulation of fine organic sediment in the upper reaches of Killick Creek</i>	I	2.9/5
17	5	<i>Minimise risks to swimmers associated with strong tidal currents within the primary recreation area in the entrance of Killick Creek</i>	E	2.0/5
18	10	<i>Prevent further change in the estuarine tidal hydraulics that may unbalance the present ecological structure of Killick Creek</i>	J	1.8/5