

Information Directory for Investors: A Site Assessment Survey for Marine Aquaculture Facilities on the NSW Coastline



November 2003

Aquaculture Industry Development Branch

NSW FISHERIES

David Glendenning and Phil Read

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EXECUTIVE SUMMARY

The expansion of a marine aquaculture industry in NSW relies on the supply of juveniles from commercial aquaculture hatcheries and associated facilities.

Marine aquaculture facilities require a reliable supply of high quality, oceanic water and a suitable land-based site; the latter to accommodate a hatchery and associated buildings. Ideally, these two prerequisites should be in close proximity (< 1km) to avoid large construction costs or problems associated with the logistics of pumping water over long distances. Site selection is paramount in determining the success or failure of aquaculture businesses.

The NSW coastline is currently undergoing rapid change as a result of continued pressure to allocate areas for residential development, parks, reserves, recreation and wilderness areas. These pressures have meant the establishment of marine aquaculture sites on the NSW coastline will continue to become more difficult.

The methods used in compiling this report included, a desk-top investigation incorporating reviews of literature, aerial photography, mapping resources and Local Environment Plan (LEP) land zonings. A field survey was then undertaken to record characteristics of each site to verify their suitability for aquaculture development.

This report has identified several sites that satisfy the necessary requirements of an aquaculture marine facility. Sites in the report ranked (***) possessed the attributes of having a reliable source of oceanic water, a suitable land base and were unlikely to impact significantly on urban communities. These sites existed in the southern half of NSW and included Catherine Hill Bay, Bass Point, Eden, and South Munganna Point (Twofold Bay).

The majority of sites surveyed ranked two stars (**). These sites offered a land base and reliable oceanic seawater, although some sites had the potential of water contamination (eg. freshwater, high suspended solids, acid water) during periods of rainfall. The majority of sites satisfied the “secondary” criteria (see page 6) but some existed in close proximity to urban communities; in most cases this would be an advantage for an aquaculture facility because of the proximity of services. These sites included Fingal Peninsula (Tweed), Brunswick Heads, South Wall (Ballina), Evans Head, Iluka, Coffs Harbour, Macleay River, South West Rocks, Crowdy Head,

Port Kembla, Kinghorn Point (Illawarra), Bendalong, Inyadda Point, Shelly Point, O'Hara Head, and Bingie Bingie Point.

Sites ranked one star (*) were characterised by having either variable water quality, unsatisfactory pipe anchorage points and/or adjacent urban communities and were considered less compatible to the establishment of a marine aquaculture facility. These sites included Cudgen, Brunswick Heads, Arrawarra, Racecourse Headland, North Shore, North Haven, Harrington, Camel Rock and Bermagui.

Further survey work is required to establish the existence of suitable sites upstream of estuaries and/or within private lands bordering coastal fringes.

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1. INTRODUCTION

Aquaculture, the commercial production of aquatic plants and animals, is a relatively new industry in Australia. It is one of the fastest growing industries in the world with 27% of seafood produced coming from aquaculture. Major established Australian aquaculture industries include pearl oysters, salmon, prawns, tuna, edible oysters, trout and native freshwater fish. Australian aquaculture has the potential to continue to expand further as new species are researched and trialed, and marketing opportunities, both domestic and overseas, are explored.

Recently, there has been a growing interest from investors to develop marine aquaculture industries in NSW culturing new species, such as Moreton Bay bugs, sea urchins and marine finfish.

The success of an aquaculture industry in New South Wales depends on the reliable supply of juveniles (seedstock) from hatcheries. It is apparent that an impediment to the expansion of the marine aquaculture industry in NSW is the inconsistency or lack of seedstock supply. The restricted production of marine seedstock in some existing hatcheries can be attributed to poor site selection. Factors include a supply of sub-optimal water quality and/or the unreliable anchorage of seawater intakes. Both of these factors have resulted in inconsistent production of seedstock or, in some cases, complete production failure.

Many of the identified aquaculture species require unpolluted seawater for successful culture, particularly in the hatchery phase. A reliable supply of high quality oceanic water and an associated land area in close proximity (to accommodate hatchery buildings, ponds, etc), are essential attributes for an aquaculture site.

Increasing residential, recreational and industrial usage of the NSW coastal zone limits the land area available for marine aquaculture development. An associated degradation of water quality may continue to occur, particularly in areas of intense urbanisation and/or agricultural usage.

The main objective of this document is to identify sites along the NSW coastline that have potential for land-based marine aquaculture development, with a particular

emphasis on potential for hatcheries. A secondary function of this document is to catalogue any constraints on land-based marine aquaculture development for the remaining coastline. This may prevent the need for any future survey for sites additional to those identified in this document.

Further individual site investigations are necessary to address the full operational requirements of any proposed development and the legislative requirements of current planning instruments. The investor must undertake research to determine the freehold or crown zoning of the sites. Additional consideration should also be given to potential of any underground, saline water resources.

2. METHODS

This survey was done in two phases: a desktop investigation and field survey (or ground-truthing) as detailed below.

2.1 DESK-TOP INVESTIGATION

2.1.1 Literature Review

The literature was reviewed for existing site reports and surveys of the NSW coastline.

Key references included:

- Holliday, J.E.; Maguire, G.B.; Nell, J.A., 1991. Evaluation of sites for nursery culture of single Sydney rock oysters (*Saccostrea commercialis*). Fisheries Bulletin 5. NSW Agriculture, Division of Agricultural Services, Sydney, NSW.
- Institute for Coastal Resource Management., 1995. Shoalhaven Region, Aquaculture Technology Park Site Assessment and Feasibility Study, Draft. Shoalhaven City Council, Nowra, NSW.
- Nell, J., Heasman, M., 1997. Marine Mollusc Hatchery Site Evaluation. NSW Fisheries, Port Stephens Research Centre, Taylors Beach, NSW.
- Stone, Y., Ogburn, D., Baulch, I., 2000. North Coast Sustainable Aquaculture Strategy, Land Based Aquaculture. Department of Urban Affairs and Planning, Sydney, and NSW Fisheries, Taylors Beach, NSW.
- Webb, R., 2000 Preliminary Investigation for Industrial Land, Associated with Proposed Multipurpose Wharf, at South Munganno Point, Twofold Bay. Robert Webb Surveying, Eden, NSW.

2.1.2 Mapping Resources

A practical mapping resource available at the time of the survey was the TopoView® New South Wales Topographic Map Series (1969-1991) in compact disc format, produced by Land and Property Information NSW. These disks were used to help eliminate inappropriate areas within the survey region according to the site selection criteria.

High-resolution, colour copies of the TopoView® maps were printed to aid navigation during the survey. The TopoView® disks were also loaded onto a laptop computer as an additional aid to navigation whilst in the field.

2.1.3 Aerial Photography Interpretation

A series of aerial photographs were obtained which covered a high percentage of the coastal regions. These were used to eliminate inappropriate areas within each region before entering the field and to aid navigation in the field.

2.1.4 Land Zoning

Local Environment Plan (LEP) zoning information was obtained from Local Councils, either as hard-copy printed maps or in electronic format, under licence agreement where required. This allowed inappropriate areas to be eliminated and sites with appropriate position and zoning to be identified for subsequent ground-truthing.

2.2 FIELD SURVEY

2.2.1 Selection of Survey Area

The entire coastline of NSW was selected for field survey, excluding the following areas:

- Sydney and metropolitan areas, including the coastal local council areas of Pittwater, Warringah, Manly, Woollahra, Waverley, Randwick and Sutherland. This was because initial investigations indicated a lack of appropriately zoned or sized land portions. The residential nature of these council areas, the cost of realty, and the limited open space or reserve areas means further development is unlikely.
- Nadgee Nature Reserve and Ben Boyd National Park, Far South Coast. The high intrinsic environmental value, inappropriate terrain and the prohibitive distance from sealed roads and services to the coastal fringe preclude any development.

2.2.2 Transport

A four-wheel drive motor vehicle allowed access to sites within undeveloped portions of the coastline. Areas inaccessible to motorized transport were accessed on foot.

2.2.3 Navigation

Navigation was assisted using mapping resources identified in the desktop phase of investigation and a Global Positioning System (GPS).

2.2.4 Field Data

Field data (see 3 following) was taken on any site having potential for aquaculture development. Sites viewed as having some potential were marked as “waypoints” using GPS. A micro-cassette recorder was used to record descriptive comment about the coastal zone in each region. This information was then used during compilation of the report to catalogue areas with hard constraints on development.

3. SITE SELECTION AND ASSESSMENT CRITERIA

3.1 PRIMARY CRITERIA:

The primary criteria are considered to be minimum site requirements.

- Secure oceanic seawater intake anchorage point (eg. wharf, rocks, shelter)
- An appropriate land-base (2 hectares or larger) less than one kilometre from seawater intake point.

At the time of the survey, the existing land zoning under Local Environmental Plans (LEPs) were not considered to be a primary assessment criterion. Many of these LEPs were developed prior to councils understanding fully the nature of an aquaculture development. Therefore local councils should be approached for their current planning instruments or to discuss amendments to LEPs since the date of this report. In exceptional circumstances, the Minister for Infrastructure and Planning is empowered to grant consent for prohibited development in an area regardless of the provisions of the local environmental planning instruments. Thus, zoning impediments, if investigated thoroughly, may not represent a hard constraint to development in the context of this report.

3.2 SECONDARY CRITERIA:

The secondary criteria were used for further assessment and included less rigid constraints to development. These included:

- Access to mains power.
- Access to mains freshwater supply.
- Access to telecommunications.
- Access to suppliers, trade services.
- All weather (sealed) road access.
- Potential water pollutants.
- Pumping head.
- Size of land portion(s).

- Land status (developed/undeveloped).
- Land zoning (as per LEP at time of writing).
- Land topography.
- Aesthetics (visual impacts/proximity to residential/compatibility).

It is regarded that the physical criteria (eg. a reliable supply of good quality and quantity of marine water, suitable topography and road access, etc) are significantly more restrictive to successful hatchery development rather than the land zoning which could be amended if development was to proceed following government negotiations and community consultation.

4. SITE RANKING

Sites recognised as having some potential for aquaculture were subjectively ranked based on the overall primary and secondary criteria assessment (Table 1). Once the details of the aquaculture project have been determined, and prior to lodgement of a Development Application, further assessment under the Sustainable Aquaculture Strategies (see Appendices) may alter the ranking.

Table 1. Ranking of listed sites having some potential.

Ranking	Justification
***	Protected intake anchorage High quality water Associated land area suitable for construction Compliance with majority of “secondary criteria” Unlikely to impact significantly on nearby communities Unlikely to impact on aesthetics of the surrounding region.
**	Protected intake anchorage High quality water Periods of sub-optimum water quality Associated land area suitable for construction Compliance with majority of “secondary criteria”. Some impact on nearby communities Some impact on aesthetics of the surrounding region.
*	Protected intake anchorage High quality water Periods of sub-optimum water quality Associated land area suitable for construction Compliance with some of “secondary criteria” and/or Significant impact on nearby communities and/or Some impact on aesthetics of surrounding region.

5. COMPLIANCE WITH SUSTAINABLE AQUACULTURE STRATEGIES

The Sustainable Aquaculture Strategies (SAS) were developed through a NSW Government initiative to encourage sustainable aquaculture development. It is not possible at this stage to assess the recognised sites under the strategies. This can only be completed when the operational details of an aquaculture project are known (eg. culture system, species, size etc).

Any development of these sites will require further assessment as outlined in the strategies and the incorporated Aquaculture Industry Development Plans (AIDPs). Based on best practice in the AIDPs, a Project Profile Analysis (PPA) is used to determine the level of risk associated with any development proposal. The PPA contains Minimum Performance Criteria and three subsequent tiers of evaluation to enable rigorous assessment of any proposals (Appendix C). Level 3 projects (highest risk) would require the applicant to prepare an Environmental Impact Statement as part of the approvals process. This process requires a level of information beyond the scope of this report.

6. PRESENTATION OF DATA - LOCAL COUNCIL AREAS

Assessments of sites viewed as having some potential for marine aquaculture development are presented by local government area, from north to south. A brief summary on each local council area is provided, followed by site assessments and a catalogue of constraints for the remaining coastline within the council area.

The following councils are included:

- Tweed Shire Council
- Byron Shire Council
- Ballina Shire Council
- Richmond Valley Council
- Maclean Shire Council
- Pristine Waters Council
- Coffs Harbour City Council
- Bellingen Shire Council
- Nambucca Shire Council
- Kempsey Shire Council
- Hastings Council
- Greater Taree City Council
- Great Lakes Council
- Port Stephens Council
- Newcastle City Council
- Lake Macquarie City Council
- Wyong Shire
- Gosford City Council
- Wollongong City Council
- Shellharbour City Council
- The Council of the Municipality of Kiama
- Shoalhaven Shire Council
- Eurobodalla Shire Council
- Bega Valley Shire Council

6.1 TWEED SHIRE COUNCIL

Location:

Far North Coast.

Population:

74942.

Northern Coastal Boundary:

The City of Tweed Heads.

Southern Coastal Boundary:

2 kilometres south of Wooyung settlement.



Coastline:

33 kilometres of long, exposed sand beaches having easterly aspect, separated by small rock headlands and estuaries with training walls; no major embayment.

Coastal Settlements:

Tweed Heads, Fingal Head, Kingscliff, Bogangar, Hastings Point, Pottsville and Wooyung.

Estuaries:

Tweed River, Cudgen Creek, Cudgera Creek and Mooball Creek.

6.1.1 FINGAL PENINSULA

Site Ranking:

GPS Position:

South 28° 10.350' East 153° 33.307'

General Description:

Fingal Peninsula forms the South Head of the Tweed River, within the Tweed Shire Council area on the far north coast. In contrast to the North Head, which is dominated by the City of Tweed Heads, Fingal Peninsular is largely undeveloped. The peninsula is low-lying sand spit, bounded on the western side and the northern tip by an extensive series of training walls to contain the Tweed River during floods. The small community of Fingal Head is approximately six kilometres to the south of the northern tip of Fingal Peninsular. Proximity to highly urbanised areas from Banora Point and Tweed Heads through to the Gold Coast (QLD) means that the area is subject to moderate to high recreational usage.

Site Assessment

Table 2. Ranking of Primary Criteria for Fingal Peninsula

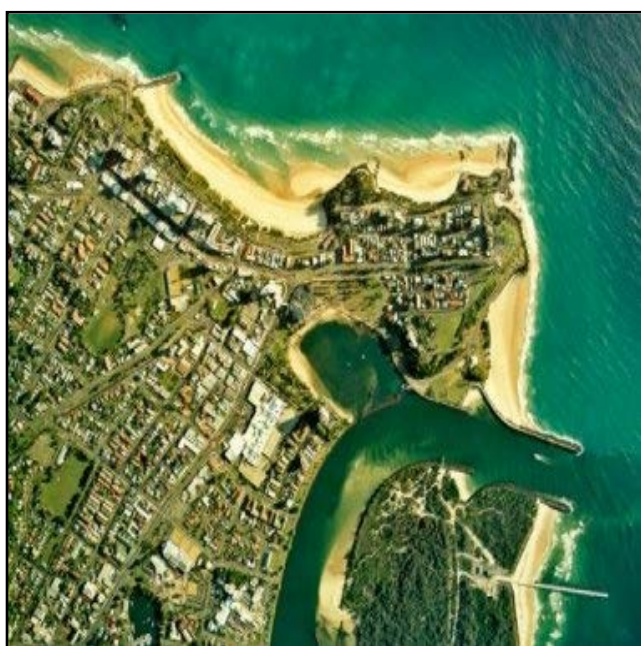
Primary Criteria	Ranking	Comments
Secure access to high quality, oceanic water	Excellent	Sand bypass jetty; re-watering jetty; potential intermittent water quality issues
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 3. Ranking of Secondary Criteria for Fingal Peninsula

Secondary Criteria	Ranking	Comments
Access to mains power supply	Excellent	3-phase power to sand bypass facilities adjacent to potential land-bases
Access to mains freshwater supply	Good	> 1km from potential land-bases
Access to telecommunications	Good	> 1km from potential land-bases
Access to suppliers, trade services	Excellent	Banora Point 10km; Tweed Heads 15km
All weather (sealed) road access	Good	<500m from potential sites then good quality gravel road
Potential water pollutants	Poor	Tweed River discharge is immediate, urban/ agriculture runoff
Protection from prevailing swells	Excellent Good	Re-watering jetty within inlet Utilising bypass jetty infrastructure
Pumping head	Excellent	<5m
Size of land portion(s)	Excellent	>20 ha, potential for hatchery and intensive grow-out
Land status	Good	Potential sites degraded from sand mining
Land zoning	Good	Undeveloped -7a (Environmental Protection Habitat); 7d (Environmental Protection Scenic)
Land topography	Excellent	Potential sites are flat to gently sloped
Aesthetics	Poor	Overlooking residential; moderate to high recreational usage

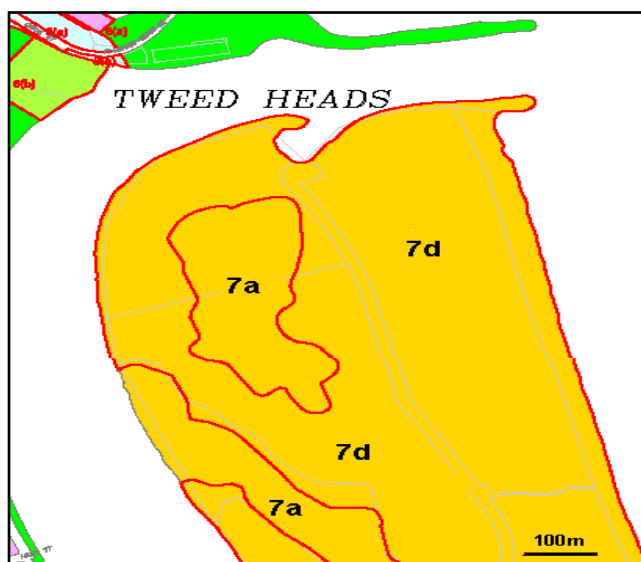
Site Discussion

The existing jetties associated with the Tweed River Entrance Sand Bypassing Project (TRESBP) on the northern tip of the peninsula could provide two suitable intake anchorage points. Of these, the main pumping jetty has the advantages of access to deep water and a southerly position to the river discharge. As the prevailing currents are southerly, this site could possibly allow more consistent access to unpolluted water after rainfall events. The re-watering jetty on the inside of the southern training wall also offers an excellent intake anchorage point and is in a low energy zone compared to the relatively exposed main jetty. Investigation into



Tweed Heads – Coollangatta relative to Fingal Peninsula
Source: TRESBP 2001

water quality during extreme weather (heavy rainfall or large swells) is required to determine whether the deep-water access at the end of main jetty isolates any potential intake from sand ingress. However, it is likely any anchorage utilising either site would be subject to deteriorating water quality during periods of high rainfall. Consequently, any project would require facilities for water storage during these rainfall periods. Alternatively, selection of more euryhaline species (having wider salinity tolerances) or species having the ability to tolerate poorer water quality would increase the potential of this site. Suitable land portions are available within one kilometre of the potential anchorage points.



LEP Mapping of Peninsula
Source: Tweed Shire Council

The land zoning of the peninsula north of Fingal Head community is 7(a), Environmental Protection Habitat, or 7(d), Environmental Protection Scenic Escarpment; both of which prohibit the development of aquaculture. However zoning is not considered to be a hard constraint to development in the context of this survey.

The most north-eastern land portion (Lot 734 DP 48821), is the preferred site for development and zoned entirely 7(d). This Lot is bounded to the west by Letitia Road and to the east by the beach and has an

area of around 22.4 hectares. Development of this site could therefore include an integrated hatchery and grow-out facility (tanks or raceways). The Tweed Byron

Aboriginal Land Council (TBALC), who has identified the area having potential for aquaculture development under their Land Use Management Strategy, owns the land. The focus of the TBALC on aquaculture compliments the objectives of the NSW Fisheries Indigenous Fisheries Strategy.

Alternative land portions to the west of Letitia Road (Lots 733 and 738) are of sufficient size (11.6 hectares and 38 hectares respectively) for development and are within 1 kilometre of the jetty.



Main Jetty, Tweed River Entrance Sand Bypassing Project

Photo: Phil Read



Re-watering Jetty, Tweed River Entrance Sand Bypassing Project

Photo: Phil Read

The provision of amenities to Fingal Peninsula is restricted to 3-phase power associated with the sand bypass development. Mains freshwater, telecommunications, sewerage reticulation and sealed road access are all provided

to northern margin of Fingal Head settlement, a distance of approximately 1.5 kilometres. An extension of services and the upgrading of road access for this distance needs to be investigated further in terms of feasibility and costing.



Aerial photograph of Fingal Peninsula, depicting sand bypass facilities and rewatering jetty (circled).
Scale bar = 100m

Source: Tweed Shire Council



Tweed Heads overlooking peninsula

Source: TRESBP

All land portions described are significantly disturbed from prior sand mining and vegetation is classified as regenerating. Natural height of the land portions is 2 metres AHD and is considered to be flood liable (1 in 100 year flood height of 2.6 metre AHD). Any development on the peninsular would require further assessment regarding flooding.

The site is surrounded by residential development including the communities of Coolangatta and Tweed Heads to the north and Fingal Head, Chinderah and Kingscliff to the south. Potential visual impact on overlooking residential areas of Tweed Heads – Coolangatta will necessitate Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).

6.1.2 CUDGEN HEADLAND

Site Ranking:

GPS Position:

South 28° 15.550' East 153° 35.049'

General Description:

Kingscliff is a small town of approximately 4000 residents, 15 kilometres to the south of Tweed Heads in the Tweed Shire Council Area. The small estuary of Cudgen Creek forms the southern perimeter of Kingscliff. The estuary has twin-training walls constructed on either side of the entrance for a distance of approximately 150 metres. The sand peninsula across the entrance of Cudgen Creek to the south of Kingscliff is Cudgen Headland. Proximity to highly urbanised areas from Banora Point and Tweed Heads through to the Gold Coast (Qld) means the area is subject to moderate to high recreational usage.

Site Assessment

Table 4. Ranking of Primary Criteria for Cudgen Headland

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Potential water quality issues; estuarine influences
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 5. Ranking of Secondary Criteria for Cudgen Headland

Secondary Criteria	Ranking	Comments
Access to mains power supply	Good	< 1km from potential land-base
Access to mains freshwater supply	Good	< 1km from potential land-base
Access to telecommunications	Good	< 1km from potential land-base
Access to suppliers, trade services	Excellent	Banora Point 3 km; Tweed Heads 15km
All weather (sealed) road access	Good	< 500m from potential site then good quality gravel road
Potential water pollutants	Poor	Kingscliff Township and Cudgen Creek discharge are immediate
Protection from prevailing swells	Excellent	Within training walls
Pumping head	Excellent	<5m
Size of land portion(s)	Excellent	>40 ha, potential for hatchery and grow-out
Land status	Good	Sites degraded from sand mining
Land zoning	Good	Undeveloped - 6(a) Open Space
Land topography	Excellent	Potential site is flat to gently sloped
Aesthetics	Poor	Close proximity to residential; high recreation use

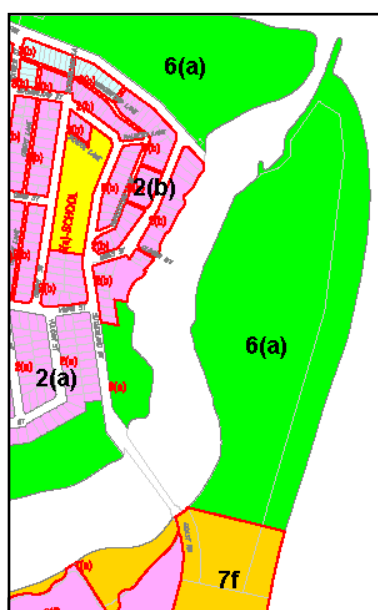
Site Discussion

The existing rock-training wall on the southern side of the inlet would provide a number of suitable intake anchorage points. However, the estuary is relatively small and the entrance is highly infilled (Appendix A) and characterised by a shallow water (1-3 metres). A small rock groyne linking to a channel marker approximately 150 metres within the training walls would provide the most reliable access to water of any depth. The estuarine nature of the anchorage point would expose any development to freshwater and other catchment pollution. Although the estuary is small and shallow, it is likely to receive good tidal exchange. The permanency of a reliable intake would require further hydrological and historical research. A careful tidal pumping regime and storage would need to be implemented at this site to ensure oceanic water quality is maintained.



Aerial Photograph of Cudgen Creek and Kingscliff

Source: DLWC 1999[®]



Adapted from Tweed Shire Council LEP Mapping

A suitable land portion is available within one kilometre of the potential anchorage points. The land zoning of Cudgen Headland is 6(a), Open Space, for the first several kilometres. This zoning would normally preclude the development of any aquaculture.

The site has been identified in a Council Trust Agreement with DLWC for future development of tourism facilities. Any proposed aquaculture development of the site would necessarily involve a tourism component.

The area was previously subjected to sand mining operations and has since been rehabilitated to an extent by the mining company (Currumbin Minerals). The area has reserve status.

The reserve is comprised of two land portions Lot 7030 DP 755701, which forms a narrow strip on the extreme east of the peninsular, and Lot 989 DP 47021, which

comprises the land area to the west; the latter offering most development potential. Both lots total greater than 45 hectares in area.

Development of this site could therefore include an integrated hatchery and grow-out facility (tanks). The site is, however, overlooked by residential suburbs. Development of a smaller facility on approximately 5 hectares of land with community (and tourist) access would be more in keeping with the zoning of the land and the Council Trust Agreement with DLWC.

Access to the Cudgen Headland is restricted to gravel/sand road for a distance of less than a kilometre from the training wall, south to the Tweed Coast Road, a major sealed tourist route. Mains freshwater, telecommunications, and sewerage reticulation are all provided to the southern margin of Kingscliff Township, a distance of less than a kilometre to the site. An extension of services and the up grading of road access for this distance needs to be investigated further.

The communities of Tweed Heads–Coolangatta, Fingal Head, Chinderah and Kingscliff are all within 15kilometres of the identified land-base. Potential visual impact on overlooking residential areas Kingscliff will necessitate Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).



6.1.3 CATALOGUE OF REMAINING COASTLINE

Table 6. Tweed Shire Council – justification of sites as having no current potential.

Site	Justification
North Head	No land-base; developed residential; elevated pumping head; steep headland
Fingal Head	No land-base; developed; exposed anchorage; residential
Norries Head	No land-base; developed; residential; exposed anchorage
Hastings Point	No land-base; developed; residential; exposed anchorage.
Potts Point	No land-base; developed; residential
Black Rocks	No land-base; exposed anchorage; offshore rocks; residential

6.2 BYRON SHIRE COUNCIL

Location:

Far North Coast.

Population:

29556.

Northern Coastal Boundary:

2 kilometres south of Wooyung settlement.

Southern Coastal Boundary:

2 kilometres south of Jews Point, Seven Mile Beach.



Coastline:

30 kilometres of coastline predominated by long, exposed sand beaches having easterly to north-easterly aspect. Cape Byron and Broken Head form the two major rock headlands in the Shire area.

Coastal Settlements:

New Brighton, Ocean Shores, Brunswick Heads, Byron Bay, Suffolk Park and Broken Head.

Coastal Estuaries:

Brunswick River, Belongil Creek and Tallow Creek.

6.2.1 BRUNSWICK HEADS

Site Ranking: *

GPS Position: South 28° 32.304' East 153° 33.049'

General Description:

Brunswick Heads is a small town approximately 15 kilometres to the north of Byron Bay Township within Byron Shire Council area. The estuary of the Brunswick River has twin-training walls constructed on either side of the entrance for several hundred metres. The northern training wall forms the boundary of the Cape Byron Marine Park. Proximity to the urbanised areas of Ocean Shores, New Brighton, Brunswick Heads and Byron Bay means the area is subject to moderate to high recreational usage.

Site Assessment

Table 7. Ranking of Primary Criteria for Brunswick Heads.

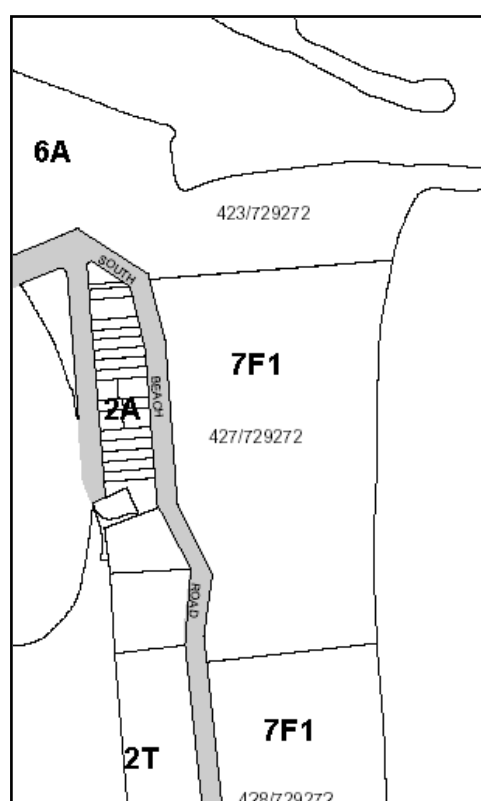
Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Southern training wall; potential water quality issues
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 8. Ranking of Secondary Criteria for Brunswick Heads.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Good	< 1km from potential land-base
Access to mains freshwater supply	Good	< 1km from potential land-base
Access to telecommunications	Good	< 1km from potential land-base
Access to suppliers, trade services	Good	Byron Bay 20km; Ballina 45km
All weather (sealed) road access	Good	< 500m of good quality gravel road
Potential water pollutants	Poor	Brunswick River discharge immediate; sewerage effluent
Protection from prevailing swells	Excellent	Within training walls
Pumping head	Excellent	<10m
Size of land portion(s)	Excellent	>10 ha, potential for hatchery and grow-out
Land status	Good	Partially cleared
Land zoning	Good	7F1(Coastal lands)
Land topography	Excellent	Potential site is flat to gently sloped
Aesthetics	Poor	Residential development adjacent

Site Discussion

The existing rock-training wall on the southern side of the river inlet would provide a number of suitable anchorage points for an intake pipe. The estuary entrance is well flushed and characterised by a shallow depth (1-3 metres). Sand movement may be a problem during seas and/or strong ebbing tides. The estuarine nature of the anchorage would expose any development to freshwater and other catchment pollution. This includes the treated effluent from the three Sewerage Treatment Works of Mullumbimby, Ocean Shores and Brunswick Heads. The water quality of the estuary is classified as poor having high nutrient and bacterial loading (DLWC 2000). A prudent tidal pumping regime would need to be implemented at this site to ensure oceanic water quality is maintained.



LEP Zoning Map
Adapted from Byron Shire Council LEP Map

A suitable land portion is available adjacent to the potential anchorage points. The land zoning of the area immediately south of the break-wall is 7F1, Coastal lands, for approximately 1 kilometre. This land consists of two portions of Coastal Lands totalling 12 hectares (approximately 6 hectares per portion) in a narrow strip bounded by the ocean to the east and South Beach Road to the west.

Development of this site could therefore include an integrated hatchery and grow-out facility (particularly tank-based).

Access to the site is via South Beach Road, a sealed roadway that forms the western boundary of the land. Mains power, mains freshwater, telecommunications, and sewerage reticulation are all provided to Brunswick Heads including the small group of residential blocks on the western side of South Beach Road.

The identified land has residences adjacent to the west (within 400 metres), a block zoned for Tourist purposes (2T) adjacent to the southwest and a nature reserve (8A) to the south.

The site therefore has a number of adjacent land-use issues that would necessitate Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).

The discharge of any effluent from an aquaculture project would be within the boundaries of Cape Byron Marine Park, as the northern break-wall of the estuary forms the northern margin of the Marine Park. This may conflict with any proposed development of the site.



Aerial Photograph of Brunswick Heads

Source: DLWC 1999[®]

Brunswick River Fisherman's Co-operative

An alternative site for development that may be suitable for development and may become available is the one on the southern edge of the harbour. The Fisherman's Co-operative currently leases land associated with the harbour facilities, which could be developed into a small hatchery facility. The northern harbour break-wall would provide both suitable anchorage and protection from swells, being approximately 1 kilometre up-river within the training walls. However, proximity to intensive boating activities within the harbour may present some water quality risk. Similarly the distance up-river will mean exposure to estuarine quality water is increased and selection of more euryhaline species and/or the use of prudent pumping regimes would be needed to overcome any disadvantage of this location.

6.2.2 CATALOGUE OF REMAINING COASTLINE

Table 9. Byron Shire Council - justification of sites as having no current potential.

Site	Justification
Fisherman's Lookout	No land-base; developed residential; environmental protection; elevated pumping head; steep headland
Cape Byron	No land-base; developed residential; environmental protection; elevated pumping head; steep headland
Broken Head – comprising Cocked Hat Rock, Kings Rock, Tabletop, Razorback, Snapper Rock and Jews Point Norries Head	No land-base; mostly undeveloped environmental protection (Broken Head Nature Reserve); elevated pumping; some residential and tourism zones; exposed anchorage

6.3 BALLINA SHIRE COUNCIL

Location:

Far North Coast

Population:

37534

Northern Coastal Boundary:

2 kilometres south of Jews Point,
Seven Mile Beach

Southern Coastal Boundary:

2 kilometres north of Broadwater
settlement on Broadwater Beach



Coastline:

30 kilometres of coastline predominated by long, exposed sand beaches having easterly to south-easterly aspect. Lennox Head through to Ballina Head comprises the only series of rock headlands in the Council area.

Coastal Settlements

Lennox Head and Ballina

Coastal Estuaries:

Richmond River

6.3.1 SOUTH WALL (RICHMOND RIVER)

Site Ranking: **

GPS Position: South 28° 52.609' East 153° 35.01'

General Description:

The South Wall site is immediately south of the southern training wall of the Richmond River. The estuary has twin-training walls constructed on either side of the entrance. The suburbs of Ballina dominate the northern bank of the Richmond River. Distance to Ballina by road is approximately 40 kilometres. A ferry service is available linking Ballina and the southern side of the river. The relative isolation of the site from urbanised areas means the area is subject to moderate recreational usage.

Site Assessment

Table 10. Ranking of Primary Criteria for South Wall (Richmond River).

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Southern training wall; potential water quality issues; deep-water access
Land-base < 1km to intake point	Good	Zoning and aesthetic impact issues

Table 11. Ranking of Secondary Criteria for South Wall (Richmond River).

Secondary Criteria	Ranking	Comments
Access to mains power supply	Good	< 1km from potential land-base
Access to mains freshwater supply	Poor	> 1km from potential land-base
Access to telecommunications	Poor	> 1km from potential land-base
Access to suppliers, trade services	Good	Ballina
All weather (sealed) road access	Good	< 1km from potential site then good quality gravel road
Potential water pollutants	Poor	Ballina City and Richmond River discharge are immediate; sewerage effluent; major agriculture catchment
Protection from prevailing swells	Excellent	Within training walls
Pumping head	Excellent	<5m
Size of land portion(s)	Excellent	>40 ha, potential for hatchery and grow-out
Land status	Good	Undeveloped, revegetating
Land zoning	Good	7F Coastal Lands
Land topography	Excellent	Potential site is flat
Aesthetics	Good	Undeveloped land areas; existing aquaculture facility nearby; some impact on overlooking margins of Ballina

Site Discussion

The existing rock-training wall on the southern side of the inlet would provide a number of suitable anchorage points for an intake pipe. The estuary is moderately infilled (Appendix A) with mobile sandbars present between the training walls, particularly 1-2 kilometres up-river, around Mobbs Bay. The most favourable anchorage points would therefore occur along the first 1 kilometre of the training wall. Further investigation is required to profile water depths of the inlet adjacent to the wall to enable more accurate identification of an appropriate anchorage point.

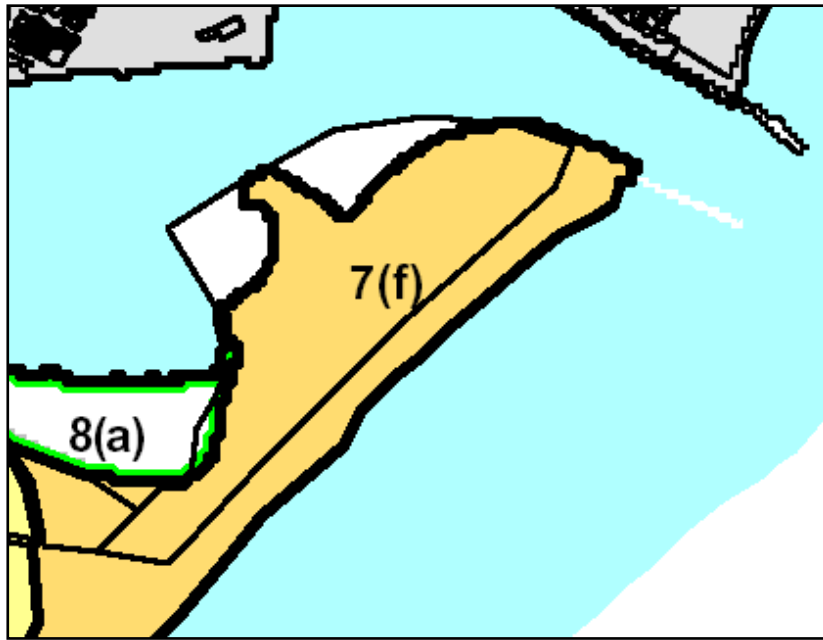


Aerial Photograph of Richmond River and Ballina

Source: DLWC 1999[©]

An anchorage point on the wall would be susceptible to freshwater and other catchment pollution. Approximately three thousand megalitres of sewage effluent per year (DLWC 2000) is discharged into North Creek Canal, approximately 6 river kilometres from the entrance.

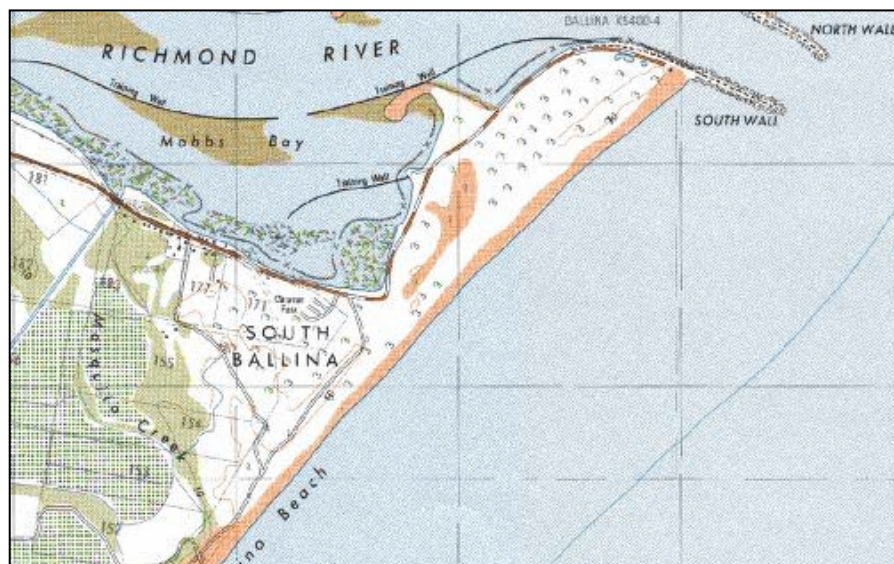
The anchorage point would receive good tidal exchange, however any development would be subjected to estuarine water quality on a tidal basis. A prudent tidal pumping regime would need to be implemented at this site to ensure oceanic water quality is maintained. Alternatively, use of static forms of culture or selection of a more euryhaline species for culture will reduce reliance on oceanic quality water.



A suitable land portion is available in one kilometre of the potential anchorage points. South Head is zoned mainly 7(f), Coastal Lands, for the first several kilometres. This area totals more than 40 hectares and would enable integration of a hatchery and a grow-out facility.

Source LEP Zoning Map Adapted from Ballina Shire Council LEP Maps

Access to South Wall is restricted to gravel road access for a distance of less than a kilometre, and the Pacific Highway is approximately 15 kilometres distance at Wardell. Mains power, mains freshwater, telecommunications and sewerage reticulation are all more than one kilometre from the site. An extension of services and the upgrading of road access for this distance needs further investigation.



Topographic Map of South Wall and Richmond River

Source: TopoView© 2000

Residential development and recreational areas on northern side of the river overlook the site. The potential for visual impact on these areas will necessitate Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C). Comparatively, the southern side of the river is undeveloped.

Estuarine Sites

Estuarine Aquaculture Maps included in the North Coast Sustainable Aquaculture Strategy identify extensive areas within the estuary that are regarded as suitable under Tier 1 Assessment Criteria of the Strategy (Appendix C). Operationally, these areas may be suitable for the culture of the more euryhaline species, particularly for the grow-out phase of production.

Existing Marine Hatcheries

A disused, existing aquaculture hatchery is sited several kilometres to the southwest of the proposed South Wall site. The hatchery facility occupies approximately 7 hectares of a former prawn farm site totalling 80 hectares. The site is not currently operating and has an existing intake running due east from the facility (approximately 1 kilometre) to South Ballina Beach. Historically, beach intakes have been unreliable due to high-energy seas under storm conditions. Anchorage failure and sand ingress have both created problems in maintaining seawater supply. Resurrection of this site could be possible utilising intakes from the southern wall or from the river west of the hatchery (approximately 2 kilometres distance).

The facility has good access via cane plantation roads however the facility itself is in disrepair and a full redevelopment program would need to be implemented. Hatchery effluent has in the past been deposited via cane field drainage channels. Valved floodgates control effluent disposal prior to entering the Richmond River.

6.3.2 CATALOGUE OF REMAINING COASTLINE

Table 12. Ballina Shire Council – justification of sites as having no current potential.

Site	Justification
Lennox Head	No land-base; developed, residential; elevated pumping head; steep headland
Iron Peg	No land-base; undeveloped, low-lying, environmental protection; exposed anchorage
Skennars Head	No land-base; developed, residential land; exposed anchorage; elevated pumping head
White Head	No land-base; developed, residential land; exposed anchorage; elevated pumping head
Angels Flat Rock	No land-base; developed, overlooking residential; exposed anchorage
Pontoon Rocks	No land-base; residential; environmental protection; very exposed anchorage
Black Head	No land-base; developed, residential; elevated pumping head; proximity to river effluent
Ballina Head	No land-base; developed, residential; elevated pumping head; proximity to river effluent

6.4 RICHMOND VALLEY COUNCIL

Location:

Far North Coast

Population:

20328

Northern Coastal Boundary:

2 kilometres north of Broadwater settlement on Broadwater Beach

Southern Coastal Boundary:

6 kilometres north of Woody Head on Ten Mile Beach



Coastline:

38 kilometres of coastline predominated by long, exposed sand beaches having south-easterly aspect. The rock headlands in the Shire area are Evans Headland and Joggly Point.

Coastal Settlements:

Broadwater, Evans Head and Evans Head South

Coastal Estuaries:

Evans River

6.4.1 SOUTH EVANS HEAD

Site Ranking: ** (estuary site)

GPS Position: South 29° 07.148' East 153° 26.125'

General Description:

Evans Head is a small town of approximately 3000 residents, 50 kilometres to the south of Ballina in the Richmond Valley Council area. The small estuary of the Evans River divides the township into Evans Head and South Evans Head. The estuary has twin-training walls constructed on either side of the entrance for several hundred metres and a small boat harbour further within the estuary. The area is subject to moderate recreational usage due to proximity to Woodburn (10 kilometres), Coraki (25 kilometres), Ballina and Lismore (45 kilometres).

Site Assessment

Table 13. Ranking of Primary Criteria for South Evans Head.

Primary Criteria	Ranking	Comments
Secure access to high quality, oceanic water	Good	Harbour break wall; bridge pylons; Potential water quality issues; estuarine influences
Land-base < 1km of intake point	Poor	Zoning, adjacent land-use and aesthetic impact issues

Table 14. Ranking of Secondary Criteria for South Evans Head.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Excellent	Immediate
Access to mains freshwater supply	Excellent	Immediate
Access to telecommunications	Excellent	Immediate
Access to suppliers, trade services	Good	Lismore 45km, Ballina 50km
All weather (sealed) road access	Excellent	Immediate
Potential water pollutants	Good	Estuarine water quality, but no commercial activities within catchment, large proportion of catchment within National Parks
Protection from prevailing swells	Excellent	Within training walls
Pumping head	Excellent	<5m
Size of land portion(s)	Good	2 - 5 hectares (south of harbour)
Land status	Good	Undeveloped, vegetated with low coastal scrub (south of harbour site)
	Excellent	Cleared but undeveloped (boat ramp site).
Land zoning	Good	Undeveloped Residential 2(v); National Park and Nature Reserve 8(a)
Land topography	Excellent	Potential sites are flat; low lying (south of harbour)
Aesthetics	Poor	Close proximity to residential; moderate/high recreational usage

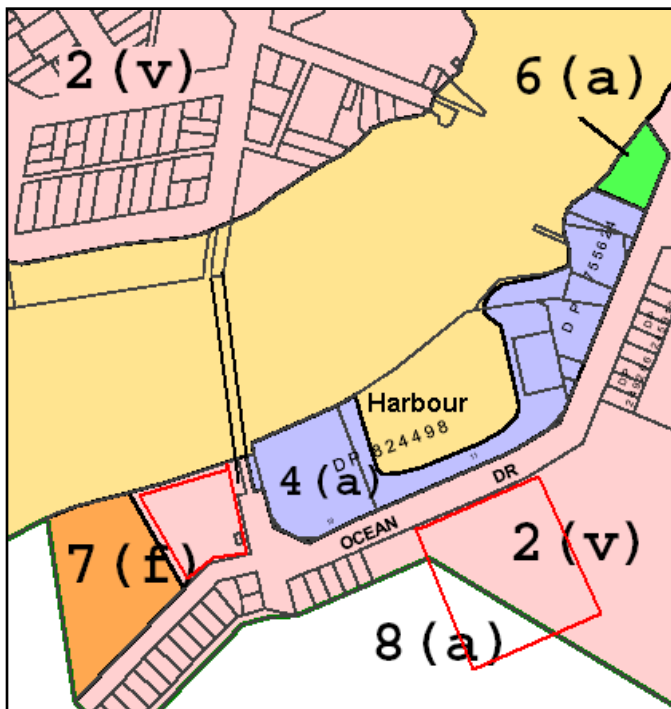
Site Discussion

The existing rock training walls on either side of the inlet would provide a number of suitable intake anchorage points. However, there are no associated land-bases until approximately 1 kilometre within the estuary. Anchorage points closer to potential land-bases include the rock wall of the boat harbour and the pylons of the bridge crossing the estuary. However, proximity to intensive boating activities within the harbour may present some water quality risk.



Aerial Photograph of Evans Head and the Evans River

Source: DLWC 1999[®]



LEP Zoning Map, depicting potential sites (red outline)
Adapted from Richmond Valley Council LEP Maps

The estuary is relatively small and the entrance is highly infilled (Appendix A). The estuarine nature of the anchorage point would increase risks to freshwater and other catchment pollution. However, the majority of the catchment is situated within National Parks and there are no commercial activities within the catchment (DLWC 2000). Although the estuary is small and shallow, it is likely to receive good tidal exchange. Further investigation of tidal amplitude is required.

Due to the distance of any up-stream anchorages, a careful tidal pumping regime and storage of water would need to be

implemented on site to ensure oceanic water quality is maintained.

Suitable land portions are available within one kilometre of the potential anchorage points. The zoning of land due south of the Harbour, on the opposite side of Ocean Drive, is Residential 2(v) Village Zone, or National Park and Reserve 8(a). Both zoning types would normally prohibit animal facilities. Similarly the land to the direct south-west of the bridge is zoned Residential 2(v) Village Zone. Both sites are currently undeveloped, excepting a public toilet block on the north-west corner of the boat ramp.

The site to the south of the harbour is within 150 metres of the harbour wall or within 300 metres of the bridge for potential intake anchorage. The available land area is unknown, pending investigation of height datum, but an estimated area of between 2 and 5 hectares would not require a major excision of area. This would only be sufficient to allow for development of a tank-based hatchery or grow-out facility. Status of the land is undeveloped and vegetated with coastal scrub.

The boat ramp site is a small area (approximately 1-hectare) of cleared but unimproved, level land subject to moderate usage associated with the boat ramp. Development would be restricted to a small tank-based tourist or educational facility.



Boat ramp site looking north-west towards Evans River Bridge

Photo: Phil Read

All-weather access, mains power, mains freshwater, telecommunication and sewerage reticulation are all within 50 metres of the site associated with the boat harbour.

The close proximity of fishery-related industrial activities within the harbour (zoned 4(a) Industrial) to both sites, particularly the larger, southern site may be favourable for negotiating aquaculture development.

Residential development occurs within 200 metres, without line of sight, to the east and west of the site south of the harbour. Overlooking residences on higher portions of the headland are within 400meters. The area appears to be very low-lying and flood liability needs to be further investigated.

The boat ramp site also has residential properties, with line of sight, within 400m. Both identified land-bases therefore have potential for visual impact and associated adjacent land-use issues which would necessitate Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).

6.4.2 CATALOGUE OF REMAINING COASTLINE

Table 15. Richmond Valley Council – justification of sites having no current potential.

Site	Justification
Joggly Point	No land-base within 1 km; developed, residential; elevated pumping head; steep headland
Goanna Headland (Evans Headland)	Undeveloped, environmental protection; power, water etc > 2 kms from headland; moderate recreational usage of reserve

6.5 MACLEAN SHIRE COUNCIL

Location:

Mid North Coast

Population:

16991

Northern Coastal Boundary:

6 kilometres north of Woody Head on Ten Mile Beach.

Southern Coastal Boundary:

Plover Island, northern headland of Sandon River Inlet.



Coastline:

48 kilometres of coastline predominated by long, exposed sand beaches having E to SE aspect; numerous small rock headlands; two major estuaries with training walls (Clarence and Sandon).

Coastal Settlements:

Iluka, Yamba, Angourie and Brooms Head.

Estuaries:

Clarence River, Lake Arragan, Cokora Lagoon and Sandon River.

6.5.1 NORTH BREAK WALL, ILUKA

Site Ranking: **

GPS Position: South 29° 25.203' East 153° 21.358'

General Description:

Iluka is a small town of approximately 1850 residents, on the northern side of the Clarence River within Maclean Shire Council area on the Mid North Coast. The Clarence River estuary is the largest of all NSW coastal rivers, extending approximately 250 river kilometres inland. The river is extensively trained on the northern side, mid-channel and on the southern side. The area is a popular tourist centre subject to moderate to high recreational usage, due to proximity to Yamba (southern side of entrance), Maclean (32 kilometres) and Grafton (80 kilometres).

Site Assessment

Table 16. Ranking of Primary Criteria for North Break Wall, Iluka.

Primary Criteria	Ranking	Comments
Secure access to high quality, oceanic water	Good	Northern training wall; potential water quality issues (major estuarine influences)
Land-base < 1km of intake point	Good	Aesthetic impact issues

Table 17. Ranking of Secondary Criteria for North Break Wall, Iluka.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Good	< 500m from potential land-base
Access to mains freshwater supply	Good	< 500m from potential land-base
Access to telecommunications	Good	< 500m from potential land-base
Access to suppliers, trade services	Good	Iluka (< 1km), Maclean (32km), Grafton (80km)
All weather (sealed) road access	Good	< 500m from potential land-base
Potential water pollutants	Poor	Estuarine water quality, large freshwater influence from catchment, agriculture, sewerage
Protection from prevailing swells	Excellent	Within training walls
Pumping head	Excellent	<10m
Land status	Good	Undeveloped, vegetated with low coastal scrub
Land zoning	Good	Rural (Investigation) 1(i) and Environmental Protection (Coastal Foreshore) 7(c)
Land topography	Excellent	Potential sites are flat to gently sloping
Aesthetics	Good	Close proximity to residential; no line of site on Iluka side; overlooking residential from Yamba; high recreational usage

Site Discussion

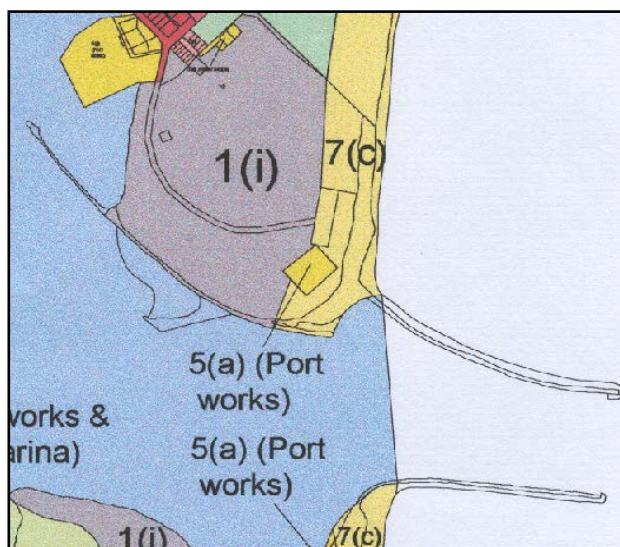
The existing rock training walls on either side of the inlet would provide a number of suitable intake anchorage points. However, there are no associated land-bases on the southern (Yamba) side within 1 kilometre of the entrance. The northern break wall has suitable land within a kilometre and would provide a number of suitable points for anchorage, either in the estuary or the oceanic side. The inlet side would be more immediately affected by estuarine discharge during ebb tide than the oceanic side. However, prevailing currents are southerly so an intake on the oceanic side would be affected by river discharge as well. The oceanic side is also more exposed. Further investigation of water quality variation between the two sides in different conditions (flood, high seas, tides etc) is required in order to evaluate the preferable anchorage point.



Aerial Photograph of the Clarence River estuary

Source: DLWC1999[®]

The Clarence River is the largest coastal river in NSW with an average annual discharge of 3.7 million megalitres with flows of up to 16.8 megalitres per second measured at Grafton during flood (DLWC, 2000). The estuary is regarded as moderately to highly infilled (Appendix A) with depths across the entrance a maximum of 5 metres below low water (DLWC, 2000).

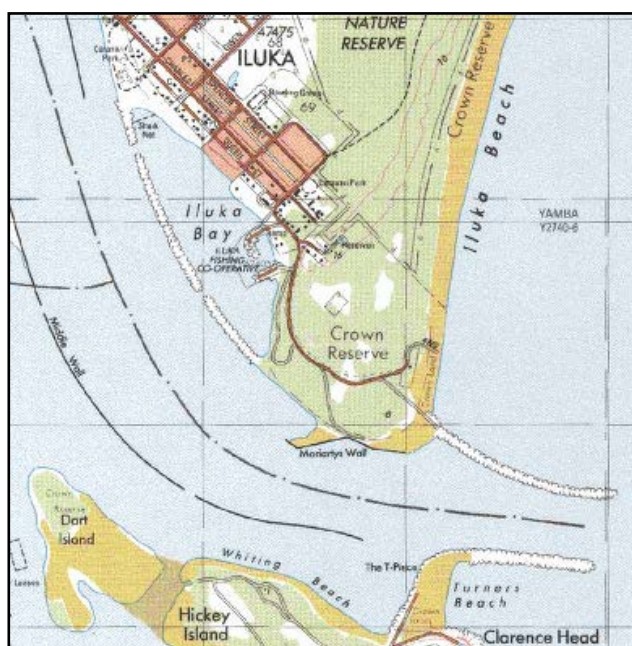


The Clarence River estuary has large areas of agriculture within the catchment and is the major estuary for prawn production (farmed and wild-caught) in NSW. Approximately half of the population is serviced by reticulated sewerage, the effluent of which is discharged into the river. Due to the large freshwater discharges and catchment pollution a careful tidal pumping regime and storage of water would need to be implemented at this site to ensure oceanic water quality is maintained.

A suitable land portion is available within one kilometre of the potential anchorages provided by the northern break wall. Aquaculture is permitted in both Rural (Agricultural Protection) 1 (a) and Rural (General Rural Land) 1(b) under Maclean Shire Council's LEP. The zoning of land adjacent to the western end of the break wall is Rural (Investigation) 1(i) and Environmental Protection (Coastal Foreshore) 7(c). Both zoning types prohibit the development of intensive animal husbandry facilities.

The entire site is largely undeveloped, excepting a small land-base with existing usage by the oyster industry on the western extremity of this portion. A gravel road also services the break wall and the coastguard station (Port works) 5 (a).

The Rural (Investigation) 1(i) land to the south of the gravel road would allow development of approximately 5 hectares between the coastguard station and the oyster shed, with buffer zones on either side. The land to the north and east of the gravel road (both 1(i) and 7(c) zoned) totals more than 25 hectares, although development incorporating appropriate buffer zones to adjacent land-use would reduce the available land considerably. Therefore the development of a land-base on either side of the access road would be restricted to a tank-based hatchery or grow-out system.



Topographic Map of Clarence Inlet
Source: Topoview© 2000

All-weather road access, mains power, mains freshwater and tele-communication services are within 500 metres of the proposed site(s).

The close proximity of fishery-related industrial activities within the harbour (zoned 4(a) Industrial) to both sites, particularly the larger, southern site may be favourable for negotiating aquaculture development.

Residential development occurs within 200 metres, without line of sight, to the north-west of the site. There are overlooking residences on the Yamba side of the inlet, particularly on higher portions of Clarence Head. Identified land-bases therefore have potential for visual impact and associated adjacent land-use issues which

would necessitate Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).

Estuarine sites

Estuarine Aquaculture maps included in the North Coast Sustainable Aquaculture Strategy identify extensive areas within the estuary that are regarded as suitable under Tier 1 Assessment Criteria of the Strategy (Appendix C). Operationally these areas may be suitable for the culture of the more euryhaline species, particularly for the grow-out phase of production.

Other estuarine sites of some potential catalogued during the coastal assessment include:

Johnsons Lane Industrial Area, North Iluka

Zoned Industrial 4(a) this area totals over 70 hectares with lots ranging up to 1.5 hectares in size. Access to estuarine water with rock anchorage is approximately 500 metres distance at the western end of Johnsons Lane, across from Arris Island. Approximately 5 river kilometres distance from river entrance.

Disused Prawn Farm, Goodwood Island

Situated on the southern side of Goodwood Island, east of the Goodwood Island Wharf, this site is not currently operating. The existing intake accesses relatively shallow water across substantial sand flats. More secure, deep-water access lies within 1 kilometre west at Goodwood Island wharf. The site is approximately 7 river kilometres from entrance. Access to water of oceanic salinity for hatchery purposes would be highly variable, according to river flows and tidal influences. The site would be most suitable for applications using euryhaline species.

This site and a considerable portion of the western half of Goodwood Island are included in the Estuarine Aquaculture maps of the North Coast Sustainable Aquaculture Strategy. Deepwater access with rock anchorage occurs on both the northern side of the island and southern side of the island near Browns Rock, although anecdotal evidence suggests the southern side receives the best flushing (Liz Evans, pers. comm).

Nearby Existing Aquaculture Facilities

Several aquaculture projects exist in the lower Clarence region. These include operational prawn farms and hatcheries sited on the Clarence estuary and a disused oyster/marine fish hatchery situated north west of Brooms Head on Main Beach. The latter site is currently not operating as a hatchery, however some marine finfish and oysters were produced in the facility over the past several years. The site has a current aquaculture permit. The existing seawater intake (in disrepair) runs due east from the facility for several hundred metres to Main Beach.

Historically in NSW, beach intakes have been unreliable due to high-energy seas under storm conditions. Anchorage failure and sand ingress have both created problems in maintaining seawater supply. More reliable access to oceanic water is required for resurrection of this site. This may be achievable utilising an intake from Buchanans Rock at Brooms Head, (a distance of approximately 2 kilometres) or by re-engineering the deep-water anchorage off the beach.

The Brooms Head site is approximately 4 hectares in size, with an adjacent site of 4 hectares reserved for aquaculture purposes. The facility has good road access, via approximately 150 metres of gravel road off Brooms Head Rd (sealed). The site is provided with all utilities and services.

6.5.2 CATALOGUE OF REMAINING COASTLINE

Table 18. Maclean Shire Council – justification of sites having no current potential.

Site	Justification
Shark Bay (headland)	No land-base; undeveloped, National Park with walking tracks; high recreational usage; pipeline security issues, sand-spit to anchorage
Woody Head	No land-base; developed National Park site with camping sites and amenities; high recreational usage; exposed anchorage
Middle Bluff, Fraser Point	No land-base; undeveloped, National Park with walking tracks; high recreational usage; exposed anchorage
Iluka Bluff	No land-base; developed, National Park site with picnic areas; World Heritage Rainforest adjacent; high recreational usage; exposed anchorage
Clarence Head	No land-base; developed, residential; elevated pumping head; steep headland; exposed anchorage
Yamba Point	No land-base; developed, residential
Barrie Point	No land-base; developed (sewerage works); exposed anchorage
Green Point	No land-base; undeveloped National Park and Reserve areas; exposed anchorage
Blue Pools	No land-base; developed, residential; tourist attraction with high recreational usage; exposed anchorage
Angourie Point	No land-base; developed, residential; undeveloped National Park; high recreational usage; exposed anchorage
Woody Bluff, One Man Bluff, Shelley Beach Head, Buchanan's Head	No access; undeveloped, National Park; exposed anchorage
Rocky Point	Undeveloped, National Park; exposed anchorage; high recreational usage
Brooms Head (Cakora Point), Buchanan's Rock	No land-base; developed, residential; tourism area with high recreational usage
Plover Island	No land-base; developed, National Park camping area; high recreational usage; pipeline security issues, sand-spit to anchorage

6.6 PRISTINE WATERS COUNCIL

Location:

Mid North Coast

Population:

10631

Northern Coastal Boundary:

Settlement of Sandon

Southern Coastal Boundary:

1 kilometre south of Corindi Beach
settlement on Corindi Beach



Coastline:

40 kilometres of exposed sand beaches having easterly to south-easterly aspect, separated by small rock headlands and small estuaries; no major embayment

Coastal Settlements:

Sandon, Minnie Waters, Diggers Camp, Wooli, Red Rock and Corindi

Estuaries:

Wooli River, Station Creek, Corindi River

6.6.1 Wooli Wooli

Site Assessment

The majority of the Pristine Waters Council coastline suffers from a lack of accessibility, due to the predominance of undeveloped National Park and Coastal Reserve areas. Those sites with access are either constrained by the size of available land portions within 1 kilometre of suitable anchorages or the absence of appropriate anchorages (see Catalogue of Remaining Coastline).

The best site in the Council area is situated at Wooli, but the available land is extremely limited and below the stipulated land requirement for marine aquaculture development under this assessment (2 hectares). Therefore a full site assessment report is not included.

The northern training wall of the Wooli Wooli River would provide a suitable anchorage point for a seawater intake with protection from prevailing swells. However the associated land within 1 kilometre is a very narrow (maximum width of 200 metres including beach) sand peninsular, with limited available space.

Unless the development were to dominate the peninsular in the vicinity of the northern wall, without appropriate buffer zones, the size of the land portion would limit any development to a small tank-based hatchery.

Water quality effects from the catchment would be minimal, due to the undeveloped nature and small size of the catchment, and the highly infilled status of the estuary. However, as with other estuarine anchorages, employment of a tidal pumping regime is recommended. Siltation of the estuary and entrance is a major management issue, which may affect access to oceanic quality water for any proposed development.

The estuary is an intensive spat collection and oyster culture area, with stocks free from QX disease. Investigation of land associated with the Fishermen's Cooperative or oyster grower land-bases, may provide small, estuarine alternatives for land-bases, approximately 2 kilometres to the north of the entrance.

Access to mains power, telecommunication services and town water are all within 1 kilometre of the southern end of the peninsular.

The area is subject to moderate to high recreational usage.



Wooli River estuary

Source: DLWC 2000

6.6.2 CATALOGUE OF REMAINING COASTLINE

Table 19. Pristine Waters Shire Council – justification of sites having no current potential.

Site	Justification
Sandon Head, Sandon Bluffs	No access (10km of 4 wheel drive, unsealed road through National Park); no power; no mains freshwater; no telecommunications; developed, limited residential; surrounded by National Park
Illaroo / Rocky Point	No land-base; developed, limited residential, National Park area with parking and camping (Illaroo Rest Area); undeveloped National Park; high recreational usage
Tree Point	No land-base; developed, residential; undeveloped National Park and Environmental Protection zone; elevated pumping; steep cliff; exposed anchorage
Bare Point, Wilsons Head	No land-base; developed, limited residential (Diggers Camp); undeveloped, National Park; elevated pumping; steep cliff; exposed anchorage
South Wooli break wall, The Black Wall	No access, 25km of gravel and dirt road to Pacific Highway, Halfway Creek; no land-base, undeveloped National Park; elevated pumping; steep sided gully with low-lying swamp areas
Station creek	No access, 17km of gravel road to Pacific Highway Station Creek; undeveloped National Park; elevated pumping
Red Rock	No land-base, developed residential; exposed anchorage

6.7 COFFS HARBOUR CITY COUNCIL

Location:

Mid North Coast

Population:

60898

Northern Coastal Boundary:

1 kilometre south of Corindi Beach settlement, on Corindi Beach

Southern Coastal Boundary:

2 kilometres north of Mylestom settlement, on North Beach



Coastline:

50 kilometres of exposed sand beaches having easterly to south-easterly aspect, separated by numerous rock headlands; no major estuaries; no major embayment

Coastal Settlements:

Arrawarra, Mullaway, Safety Beach, Woolgoolga, Sandy Beach, Emerald Beach, Moonee Beach, Mid Sapphire Beach, Sapphire Gardens, Korora, Coffs Harbour and Sawtell

Estuaries:

Arrawarra Creek, Woolgoolga Lake, Hearn's Lake, Moonee Creek, Coffs Creek, Boambee Creek

6.7.1 ARRAWARRA HEADLAND

Site Ranking: *

GPS Position: South 30° 03.777' East 153° 11.880'

General Description:

Arrawarra is a small settlement of approximately 1500 residents, 6 kilometres to the north of Woolgoolga in the Coffs Harbour City Council area. The intermittently open estuary of Arrawarra Creek lies adjacent to the west of Arrawarra. Proximity to highly urbanised areas of Woolgoolga (6 kilometres) and Coffs Harbour (33 kilometres) means that the area is subject to moderate to high recreational usage.

Site Assessment

Table 20. Ranking of Primary Criteria for Arrawarra Headland.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Arrawarra Headland; Aboriginal heritage issues; Marine Park issues
Land-base < 1km of intake point	Good	Aesthetic impact issues

Table 21. Ranking of Secondary Criteria for Arrawarra Headland.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Excellent	Adjacent to site
Access to mains freshwater supply	Excellent	Adjacent to site
Access to telecommunications	Excellent	Adjacent to site
Access to suppliers, trade services	Excellent	Woolgoolga (6km), Coffs Harbour (33km)
All weather (sealed) road access	Excellent	Forms eastern boundary of site
Potential water pollutants	Good	Intermittent low estuarine discharge; residential areas to south (prevailing currents)
Protection from prevailing swells	Good	Protection from easterly to south-easterly prevailing swells
Pumping head	Good	<15m
Size of land portion(s)	Good	Approx. 3ha (Agricultural); > 40ha (Habitat and Catchment)
Land status	Excellent	Cleared and low coastal scrub respectively
Land zoning	Excellent	Rural 1A (Agriculture) and Environmental Protection 7A (Habitat and Catchment)
Land topography	Good	Potential site is gently sloped
Aesthetics	Poor	Close proximity to residential; overlooking properties; high recreational usage

Site Discussion

Arrawarra Headland would provide a suitable seawater intake anchorage point for potential aquaculture development. A tidal boulder reef extends north-west of the main headland, incorporating Aboriginal fish traps of major cultural and heritage significance. Any potential anchorage would have to avoid this part of the reef by being positioned further to the east. The water depth off the boulder reef is relatively shallow and despite the favourable aspect of the headland, long-shore drift of sand from south to north may affect water quality. Alternatively a well-type intake could easily be concealed beneath the boulder reef, with minimal disturbance and visual impact on the area.



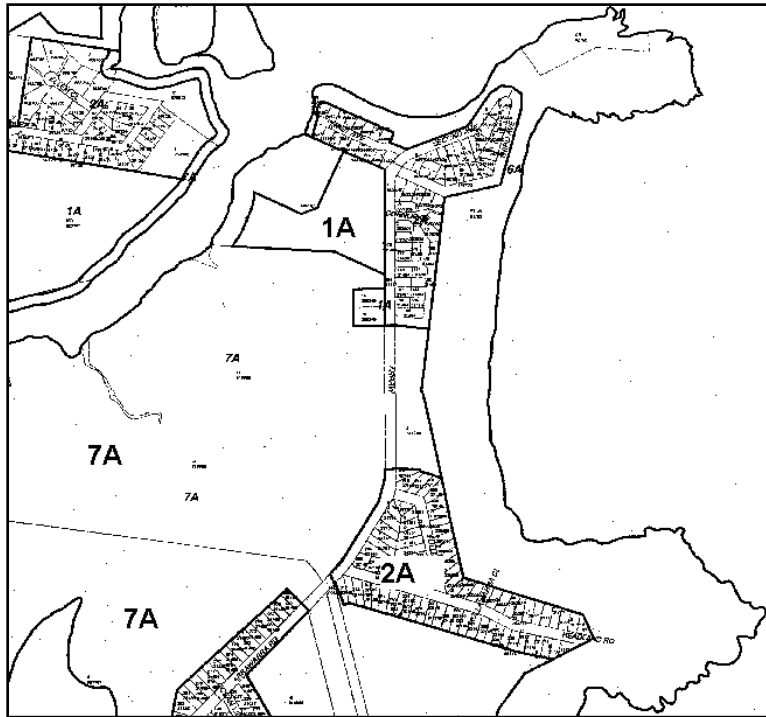
Aerial Photograph of Arrawarra, including headland and creek

Source: DLWC 2000



Boulder reef, Arrawarra Headland, with Aboriginal fish traps

Photo: Phil Read



LEP Zoning Map

Adapted from Coffs City Council LEP Maps

Suitable land portions are available within one kilometre of the potential anchorage point. A portion of approximately 3 hectares is situated to the west of the access road behind residential properties. The land is zoned Rural 1A (Agriculture), which permits aquaculture development subject to development consent.

A large portion (> 40 hectares) of Environmental Protection (Habitat and Catchment) zoned land encloses the Rural portion to the south and west and extends approximately 1.5 kilometres south along

the access road with Arrawarra Creek as the western boundary. According to the LEP, aquaculture development can also occur in this zone subject to development consent. Development of the Rural portion alone is restricted to a tank-based hatchery or grow-out facility. However if partial development of the Environmental Protection zoned portion is sought (separately or in conjunction) for an area of approximately 20 hectares, an integrated hatchery and grow-out facility could be developed. The construction of dams is allowed with development consent in this zone.

The Solitary Islands Marine Park incorporates the waters to the mean high water mark surrounding Arrawarra Headland, including any anchorage point for an intake. The area from the mean high water mark and 200 metres seaward is zoned Special Purpose Zone 4 (Arrawarra Headland) the objective of which is to provide for traditional use and research. The waters beyond this zone are Habitat Protection areas. Both special purposes and Habitat Protection zones can allow aquaculture subject to the consent of the relevant Ministers.

Access to the site is provided by the sealed access road forming the eastern boundary of both zone types. Mains power, mains freshwater and telecommunications are all provided immediately adjacent to the site. At present sewerage treatment is on-site (septic tanks or similar) however plans are in place to construct a reticulated system by September 2004.

The communities of Corindi Beach, Mullaway, Safety Beach, and Woolgoolga are all within 15 kilometres of the identified land-base, with Coffs Harbour approximately 33 kilometres to the south. The area is therefore subjected to high recreational usage. Potential visual impact on overlooking residential areas that surround the site to the north and east will necessitate Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).

6.7.2 SOUTH BREAK WALL, COFFS HARBOUR

Site Ranking: **

GPS Position: South 30° 18.750' East 153° 08.750'

General Description:

Coffs Harbour is the major settlement within Coffs Harbour City Council Area, with approximately 23500 residents. An airport to the south services the city and a large harbour and port area are prominent to the east of the city area. The harbour has twin break walls, the northern break wall connects Jetty Beach with Muttonbird Island and the southern break wall extends north-east from the tip of Corambirra Point. The large local urban population and proximity to the settlements of Woolgoolga, Sandy Beach, Emerald Beach, Moonee Beach, Sapphire and Korora means that the area is subject to high recreational usage.

Site Assessment

Table 22. Ranking of Primary Criteria for South Break Wall, Coffs Harbour.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Excellent	Break wall anchorage; potential water quality issues (urban run-off)
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues; Aboriginal heritage issues

Table 23. Ranking of Secondary Criteria for South Break Wall, Coffs Harbour.

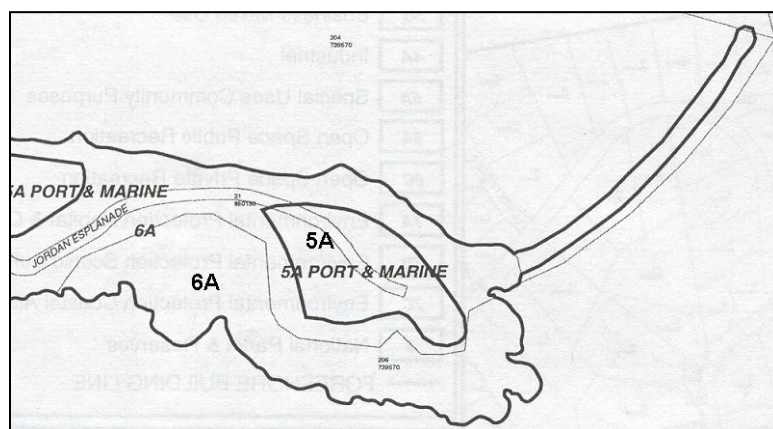
Secondary Criteria	Ranking	Comments
Access to mains power supply	Good	< 1km from potential land-base
Access to mains freshwater supply	Good	< 1km from potential land-base
Access to telecommunications	Good	< 1km from potential land-base
Access to suppliers, trade services	Excellent	Coffs Harbour City immediate
All weather (sealed) road access	Good	< 1 kilometre of good quality gravel road, then sealed
Potential water pollutants	Poor	Sewerage; urban /agricultural stormwater run-off, shipping activities within harbour
Protection from prevailing swells	Excellent	Within training walls
Pumping head	Excellent	<5m
Size of land portion(s)	Good	Approximately 2 hectares, potential for small tank-based hatchery or grow-out facility
Land status	Excellent	Cleared, degraded, quarry site for break wall
Land zoning	Good	5A Special Uses Community Purposes (Port and Marine) and 6(a) Open Space Public Recreation
Land topography	Excellent	Potential site is flat
Aesthetics	Poor	Close proximity overlooking residential areas; high recreational usage

Site Discussion

The existing rock break wall on the southern side of Coffs Harbour harbour (Corambirra Point) would provide a number of suitable intake anchorage points along its length. Potential impacts on water quality are related to the proximity of sewerage effluent discharge, highly residential areas, surrounding intensive agriculture (banana production) and associated stormwater run-off.

At present the sewerage effluent discharges of both Sawtell and Coffs Harbour occur to the south of the proposed site. Effluent from Sawtell is discharged at the northern side of Boambee Creek, approximately 5 kilometres to the south. Coffs Harbours' effluent is discharged at Gallows Beach on the southern side of Corambirra Headland, less than a kilometre along rocky shoreline and break wall to the proposed site. Discussions with Council indicate that a proposed deep-water outfall for sewerage effluent is scheduled for completion by September 2004. This outfall will be situated approximately 1 kilometre to the south of the existing Gallows Beach outfall and effluent will be discharge at depth approximately 1 kilometre off-shore. This should mediate pollution issues associated with sewerage for the proposed aquaculture development site. A substantial wharf structure is currently under construction (August 2003) to facilitate the deep-water outfall. It is planned the structure will be decommissioned on completion of the project.

The proximity to boating and shipping activities around Coffs Harbour Jetty (within 1 kilometre) may also expose the site to potential pollutants. However, prevailing southerly currents across the harbour mouth are likely to provide the southern break wall access to the highest quality water within the harbour walls. Investigation of the water quality and hydrology of the harbour are required to confirm this. It is worthwhile noting that at the time of ground-truthing, some sand drift was apparent along the base of the rock wall. Sand dredging of the harbour has become common in recent times. Investigation into sand movement along the wall is also required to further assess the suitability of the site.



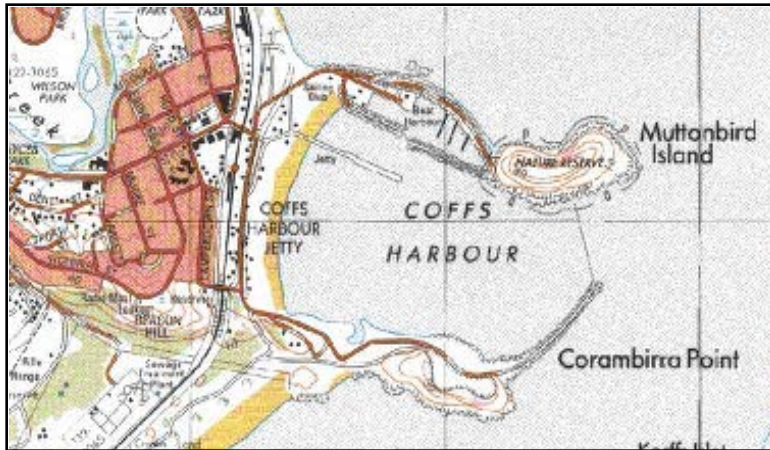
LEP Zoning Map

Adapted from Coffs Harbour City Council LEP Maps

A suitable land portion is available adjacent to the west of the break wall. Anchorage of an intake towards the northern end of the break wall is within 750 metres of the site.

Anchorage could occur anywhere along the length of the break wall to within 200 metres of the site, pending investigation of depth profiles and water quality.

The land zoning of Corambirra Point is predominantly 6(a) Open Space, surrounding a portion of 5A Special Uses Community Purposes (Port and Marine) zoned land of approximately 2 hectares. This portion of 5A land is the identified site for proposed aquaculture development. The area is degraded from quarrying operations associated with construction of the break walls of the harbour. Discussions with Council indicate that ongoing access to the quarry is required for the maintenance of the break wall.



Topographic Map of Coffs Harbour

Source: TopoView© 2000

Development of this site would be restricted to a small tank-based hatchery or similar. Incorporation of a tourism or education component to any development would be compatible with associated harbour developments.

Access to the site is restricted to gravel road for several hundred metres. Beyond this, the

area is well serviced with sealed roads and other transport infrastructure including the North Coast Railway, which runs between the harbour and surrounding suburbs.

Mains power, freshwater, telecommunications, and sewerage reticulation are all provided to within approximately 1 kilometre of the site. An extension of services and the upgrading of road access for the required distance needs to be investigated further.

The coastal communities of Woolgoolga, Sandy Beach, Emerald Beach, Moonee Beach, Mid Sapphire Beach, Sapphire Gardens, Korora, Coffs Harbour, Sawtell and Urunga are all within 30 kilometres of the identified land-base. The area therefore receives moderate to high recreational usage.



South Break Wall and the Corambirra Point quarry site

Photo: David Glendenning

Potential visual impact on overlooking residential areas and harbour facilities of Coffs Harbour will necessitate Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).

Discussions with Council also indicate that the headland is of Aboriginal significance and the Local Aboriginal Land Council has not supported previous proposed development of the site. If an agreement can be reached between Aboriginal groups and proponents for development of the site, Level 2 assessment under the Project

Profile Analysis of the SAS is required. If an agreement is not reached, Level 3 assessment is necessary.

Development of the site may compliment the objectives of the NSW Fisheries Indigenous Fisheries Strategy.

6.7.3 CATALOGUE OF REMAINING COASTLINE

Table 24. Coffs Harbour City Council – justification of sites having no current potential.

Site	Justification
Ocean View Headland	Developed, residential; elevated pumping head; steep headland
Mullaway Headland	No land-base; developed, residential; exposed anchorage
Woolgoolga Headland	No land-base; developed; residential; elevated pumping
Bare Bluff	No land-base; developed; residential
Diggers Point	No land-base; developed; residential; exposed anchorage
Dammerals Head	No land-base; developed, residential; steep cliff; exposed anchorage
Look At Me Now Headland	No land-base; Nature Reserve area; developed residential < 500m; elevated pumping
Green Bluff	No land-base; Nature Reserve area; estuarine discharge immediate (Moonee Creek); exposed anchorage
White Bluff	No land-base; developed, residential; exposed anchorage
Diggers Head	No land-base; developed, tourism (resort); steep headland; exposed anchorage
Macauleys Head	No land-base; developed, residential; exposed anchorage
Boambee Head	No land-base; developed, residential; exposed anchorage; estuarine discharge (Boambee Creek)
Bundagen Headland	No land-base; undeveloped, (flora) reserve and environmental protection (habitat and catchment); limited access (>4km gravel and 4wd road); exposed anchorage

6.8 BELLINGEN SHIRE COUNCIL

Location:

Mid North Coast

Population:

12506

Northern Coastal Boundary:

2 kilometres north of Mylestrom settlement, on North Beach

Southern Coastal Boundary:

3 kilometres north of Valla Beach settlement, on Valla Beach



Coastline:

16 kilometres of exposed sand beaches having easterly aspect, 3 rock headlands and an estuary with training walls; no major embayment

Coastal Settlements:

Mylestrom and Urunga

Coastal Estuaries:

Bellinger River, Dalhousie Creek and Oyster Creek

6.8.1 CATALOGUE OF BELLINGEN SHIRE COUNCIL COASTLINE

Bellingen Shire Council incorporates less than 20 kilometres of coastline and within this area there are limited potential anchorages: the south training wall of the Bellinger River, Hungry Head and Wenonah Head. These sites are either constrained by the lack of available land portions within 1 kilometre of suitable anchorages or the exposed nature of the anchorage (see Catalogue of Remaining Coastline).

Estuarine Sites

Estuarine sites of some worth were viewed on either side of the Bellinger River. Approximately 3 river kilometres from the river entrance, up-stream from the junction of Back Creek and the Bellinger River, on the western side of the river there are several kilometres of riverfront land that appear suitable for estuarine aquaculture development. Similarly, land appears suitable on the eastern side of the river, up-stream from Mylestrom, around Tuckers Island. Operationally these areas may be suitable for the culture of the more euryhaline species, particularly for the grow-out phase of production.

These areas are included in the Estuarine Aquaculture map for the Bellinger and Kalang River Estuary in the North Coast Sustainable Aquaculture Strategy. This map identifies extensive areas within the estuary that are regarded as suitable under Tier 1 Assessment Criteria of the Strategy (Appendix C).

Remaining Coastline

Table 24. Bellingen Shire Council – justification of sites having no current potential.

Site	Justification
South training wall (Bellinger River)	No land-base, limited access (walk way / bridge across Urunga Lagoon) no power; no mains freshwater; no telecommunications within 1 kilometre
Hungry Head	Exposed anchorage; no land-base; developed, residential with environmental protection zones
Wenonah Head	No land-base, moderate slope for > 1km distance behind headland; limited access, >2km of gravel road; no services; exposed anchorage

6.10 KEMPSEY SHIRE COUNCIL

Location:

Mid North Coast

Population:

27512

Northern Coastal Boundary:

Northern end of Middle Beach,
Scotts Head

Southern Coastal Boundary:

Immediately north of Point Plomer on
beach



Coastline:

75 kilometres of predominantly long, exposed sand beaches having north-easterly to south-easterly aspect; numerous steep rock headlands; 2 estuaries with training walls; no major embayment

Coastal Settlements:

Stuarts Point, South West Rocks, Arakoon, Hat Head and Crescent Head

Coastal Estuaries:

Macleay River, South West Rocks Creek, Saltwater Creek, Korogoro Creek and Killick Creek

6.10.1 New Entrance, Macleay River

Site Ranking: **

GPS Position: South 30° 52.791' East 153° 01.527'

General Description:

New Entrance is the main inlet of the Macleay River estuary within the Kempsey Shire Council area on the mid north coast. The estuary has twin-training walls for several hundred metres on both sides of the inlet. The community of South West Rocks comprising of around 4500 residents lies several kilometres to the south. Proximity to South West Rocks, Kempsey (40 kilometres) Nambucca Heads (80 kilometres) and Port Macquarie (85 kilometres) means the area is likely to be subject to moderate to high recreational usage.

Site Assessment

Table 26. Ranking of Primary Criteria for New Entrance, Macleay.

Primary Criteria	Ranking	Comments
Secure access to oceanic water	Good	Southern training wall; potential water quality issues (estuarine discharge)
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 27. Ranking of Secondary Criteria for New Entrance, Macleay.

Secondary Criteria	Ranking	Comments
Access to mains power	Good	< 1km from potential land-base
Access to mains freshwater supply	Good	< 1km from potential land-base
Access to telecommunications	Excellent	Immediate
Access to suppliers, trade services	Good	South West Rocks (immediate), Kempsey (40km)
All weather (sealed) road access	Good	<500m from both potential sites then gravel
Potential water quality pollutants	Poor	Manning River discharge immediate
Protection from prevailing swells	Excellent	Within training walls of estuary
Pumping head	Excellent	<10m
Size of land portion(s)	Excellent	>100 ha, integrated development possible
Land status	Good	Cleared recreation area surrounded by low coastal scrub and undulating sandhills
Land zoning	Good	6A(open space)
Land topography	Excellent	Potential site flat to gently sloped
Aesthetics	Good	No nearby residences.

Site Discussion

The existing training wall on the southern side of the Macleay River entrance would provide a number of suitable anchorage points for an intake pipe. The wall provides excellent protection from prevailing swells, excepting the eastern-most portion, which is exposed to swells from the north and north-east.

The Macleay River estuary is classified as highly infilled. A survey of sand bars and depth profiles along the first kilometre of the training wall is required to determine the best position for anchorage to avoid siltation of the pipeline. The estuarine nature of this position would expose any development to freshwater and other catchment pollution. Implementation of a tidal pumping regime is advised for this site. It is likely that intake anchorage along the training wall would be subject to deteriorating water quality during periods of high rainfall. Consequently any project would require facilities for water storage during these periods. Alternatively, selection of more euryhaline species (having wider salinity tolerances) for culture would increase the potential of the site.



Aerial photograph of the Macleay River estuary with South West Rocks in the foreground;

Source: DLWC 2001[©]

Sewerage is discharged to a rectangular effluent disposal area immediately to east of the training wall on Back Beach. Groundwater around the effluent disposal area is monitored to detect any change in quality or level. Sewerage effluent discharges are therefore effectively isolated from the surface waters and pose a limited risk to water quality for any development.

There is a potential land-base within 1 kilometre of the specified anchoring point. A largely undeveloped portion of land (Lot 339, DP 754396) with an area totalling over 100 hectares lies adjacent to the training wall. However, the portion has extensive low-lying swamp and mangrove areas associated with South West Rocks Creek, which would considerably reduce the portion available for development. The portion is zoned 6A (Open Space), which prohibits aquaculture development under the Council's LEP. However zoning is not considered to be a hard constraint in the context of this report. The development of a large

portion of the block is unlikely due to low-lying areas to the south of the block, associated with South West Rocks Creek, and proximity to residential areas. Further investigation into the contours of the portion is required to determine how much of the portion is suitable for development. An area of 20 hectares or more would be required for pond-based development or development of an integrated tank-based hatchery and grow-out system.



LEP zoning map
Source: Kempsey Shire Council LEP Maps



Topographic map, showing proposed site (outlined in red)
Source TopoView® 2000, respectively

A cleared, recreational amenities area (with a pit toilet, benches and a water tank) occurs on the riverside of the portion, where New Entrance Road turns to the north-east. The immediate surrounding area is cleared and degraded in portions. Development of a small area (<10ha) near the existing amenities block would provide large buffer zones to the creek and reduce visual impact of the development on residents of South West Rocks. Development of an area, less than 10 hectares would limit aquaculture development to a tank-based hatchery or grow-out facility.

The provision of services to New Entrance is restricted to sealed road access and telecommunications, both of which run through the portion. Mains freshwater, mains power and reticulated sewerage are all within several hundred metres of the southern boundary of the site. Extension of these services to the proposed area near the amenities block needs further investigation.

6.10.2 EX-CALTEX TERMINAL, FRONT BEACH, SOUTH WEST ROCKS

Site Ranking: **

GPS Position: South 30° 53.602' East 153° 03.25'

General Description:

Front Beach is a crescent shaped beach with northerly aspect forming the eastern part of Trial Bay at South West Rocks. The community of South West Rocks has around 4500 residents. Proximity to Kempsey (40 kilometres) Nambucca Heads (80 kilometres) and Port Macquarie (85 kilometres) means the area is likely to be subject to moderate to high recreational usage.

Site Assessment

Table 28. Ranking of Primary Criteria for Ex-Caltex Terminal, South West Rocks.

Primary Criteria	Ranking	Comments
Secure access to oceanic water	Excellent	Existing pipeline to Trial Bay
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

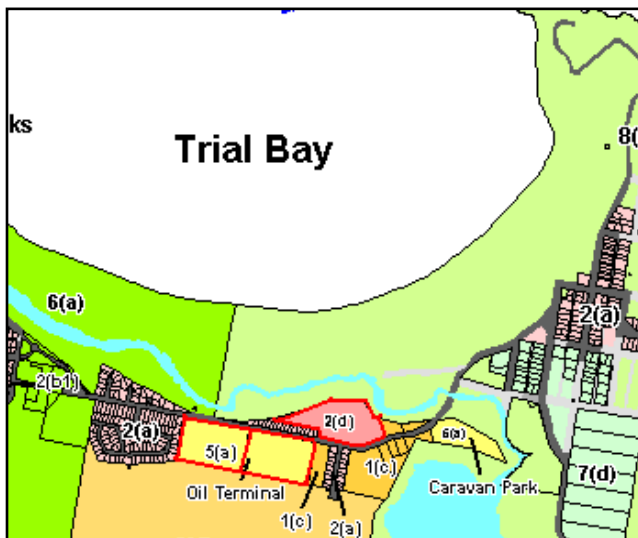
Table 29. Ranking of Secondary Criteria For Ex-Caltex Terminal, South West Rocks.

Secondary Criteria	Ranking	Comments
Access to mains power	Excellent	Immediate
Access to mains freshwater supply	Excellent	Immediate
Access to telecommunications	Excellent	Immediate
Access to suppliers, trade services	Good	South West Rocks (immediate), Kempsey (40km)
All weather (sealed) road access	Excellent	Immediate
Potential water quality pollutants	Good	Deep water, oceanic access; Manning River discharge > 2km
Protection from prevailing swells	Good	Northerly aspect; deep water access
Pumping head	Excellent	<10m
Size of land portion(s)	Good	<5 ha, tank-based development only
Land status	Poor	Cleared, very degraded, ongoing bioremediation of petrochemicals.
Land zoning	Good	Special Uses 5A; Residential (Tourist Facility) 2D
Land topography	Excellent	Potential site flat to gently sloped

Site Discussion

The existing pipeline associated with the decommissioned Caltex oil terminal is suitably anchored and constructed to be useful as an intake point for aquaculture development. Extending approximately 2 kilometres from the terminal into Trial Bay, anecdotal evidence from former Caltex employees suggests the pipeline remains in excellent condition. Depending on the current condition of the pipeline, which requires verification via survey, the existing pipeline could be used for the intake or alternatively a new, designated pipe for seawater could be retrofitted to the existing structure.

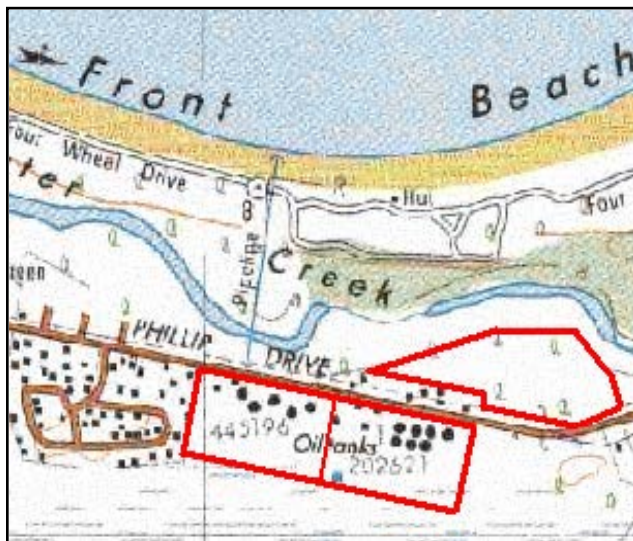
Use of the pipeline will allow access to deep water and may isolate the intake from the water quality influences of the Macleay River estuary, ensuring consistent access to oceanic-quality water.



LEP zoning map showing proposed sites (outlined in red)
Source: Kempsey Shire Council LEP TopoView® 2000,

The land-base associated with the Caltex development and pipeline is reportedly small, at less than 0.5 hectare. The development occurs on a small area on one of two portions zoned Special Uses 5A, totalling approximately 7.5 hectares. The size of the portions plus the petrochemical contamination of the site, restrict any aquaculture development to a tank-based hatchery or grow-out facility.

Alternatively, a portion of vacant land with an approximate area of 5-hectares lies directly north (across the road) in close proximity to the pipeline easement. The land is zoned Residential (Tourist Facility) 2D, which prohibits aquaculture. However zoning is not considered to be a hard constraint in the context of this report.



Topographic map, showing proposed sites (outlined in red)
Source: TopoView® 2000, respectively

The provision of services to the ex-Caltex site is excellent. As an ex-industrial site in an urban area all services are immediate including mains freshwater and power, telecommunications, reticulated sewerage and sealed road access.

Lands of both zoning have adjacent overlooking residential areas and potential for considerable visual impact. Development of the site will require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.10.3 RACECOURSE HEAD

Site Ranking: *

GPS Position: South 31° 15.242' East 152° 57.725'

General Description:

Racecourse Head is a prominent rock headland approximately 6 kilometres to the south of Crescent Head in the Kempsey Shire Council area on the Mid North Coast. The community of Crescent Heads has around 4500 residents. Proximity to Kempsey (40 kilometres) Nambucca Heads (80 kilometres) and Port Macquarie (85 kilometres) means the area is likely to be subject to moderate to high recreational usage.

Site Assessment

Table 30. Ranking of Primary Criteria for Racecourse Head.

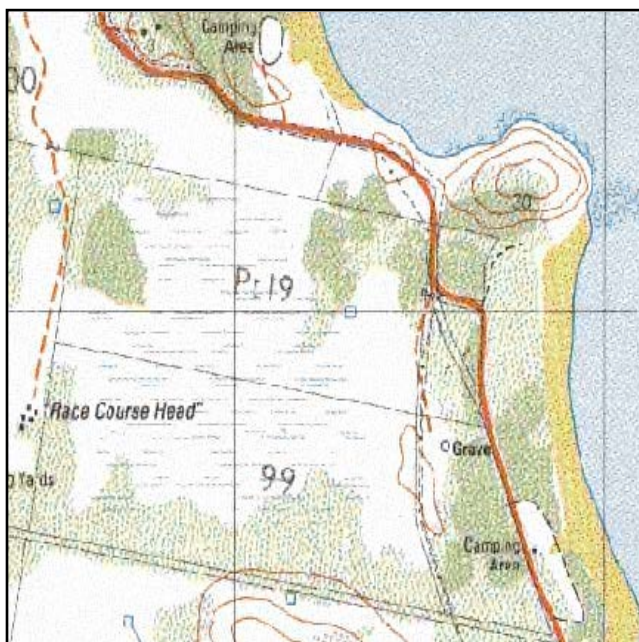
Primary Criteria	Ranking	Comments
Secure access to oceanic water	Good	Rock headland; exposed aspect
Land-base < 1km of intake point	Good	Access and aesthetic impact issues

Table 31. Ranking of Secondary Criteria for Racecourse Head.

Secondary Criteria	Ranking	Comments
Access to mains power	Poor	>5km from potential site (3-phase supply)
Access to mains freshwater supply	Poor	>5km from potential site
Access to telecommunications	Poor	>5km from potential site
Access to suppliers, trade services	Good	Crescent Heads (6km), Kempsey (30km)
All weather (sealed) road access	Poor	>5km from potential site
Potential water quality pollutants	Good	Hastings River discharge >15km
Protection from prevailing swells	Poor	Protected from southerly swells only
Pumping head	Good	<20m
Size of land portion(s)	Good	>40ha, potential for integrated development
Land status	Good	Partially cleared farmland (paddocks)
Land zoning	Excellent	Rural 1A
Land topography	Good	Potential site flat to gently sloped
Aesthetics	Good	Remote from residential; rural setting

Site Discussion

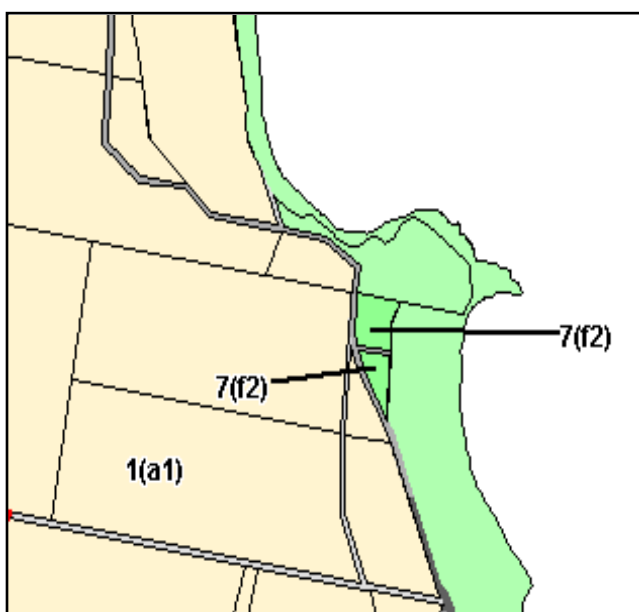
The northern side of Racecourse Head would provide a suitable anchorage point for a seawater intake. The headland is quite exposed, with limited protection from prevailing swells provided on the northern side. Potential water pollutants associated with the exposed nature of the anchorage include drift sand and detritus. Investigations into water quality during various conditions (swell size and direction) are advised to further assess the suitability of the site and to determine the most appropriate placement for any anchorage.



Topographic Map
Source: Topoview©2000

There are several land-bases within a kilometre of Racecourse Head, suitable for aquaculture development.

The headland and a narrow strip to the north and south are zoned for Environmental Protection (7(f1) and 7(f2)). To the west of these areas a large band of Rural 1(a) zoned land extends to the north and south. Aquaculture development is permissible in this zone with development consent, according to the Council's LEP and the North Coast SAS. There are several portions within a kilometre of the headland with more than 40 hectares and some suitability for aquaculture development. All lots range from flat to gently sloped and most have large cleared areas associated with farming.



LEP zoning map
Source: Kempsey Shire Council

The rural zoned portions within a kilometre of the headland total approximately 150 hectares. There is sufficient land in proximity to the headland for development of an integrated hatchery and grow-out facility. Development of any portion is dependent upon availability for sale or lease.

The provision of services to the Racecourse Head site is poor and one of the main constraints to development. Road access is restricted to approximately 6 kilometres of degraded gravel road to Crescent Head. Sewerage treatment is on-site (septic tank or similar). Freshwater mains reticulation is approximately 6 kilometres distance from the site on the southern margins of Crescent Head. Mains electricity is supplied to the

farms in the vicinity of Racecourse Head, however 3-phase supply (recommended for intensive aquaculture) only extends to the southern margins of Crescent Head (>5kilometres). Further investigation into the likelihood and cost of extension of these services to the land portions at Racecourse Head is needed.

The presence of over-looking residences is restricted to neighbouring farmland. Depending on which portion is selected for development there may or may not be over-looking residences or residences in proximity (<400m) to development. The Environmental Protection zones to the west of the rural land at Racecourse Head have numerous camping grounds and the area is subject to high recreational usage. Identified portions are all visible from the road (Point Plomer Road) and other prominent sites in the vicinity (Racecourse Head). Development of these sites will require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.10.4 CATALOGUE OF REMAINING COASTLINE

Table 32. Kempsey Shire Council – justification of sites having no current potential.

Site	Justification
Middle Head	Exposed unsuitable anchorage, headland receded onto beach; no land-base, inappropriate slope or low-lying
Grassy Head	No land-base; developed, tourist park and residential; swamp area to south
Northern training wall, Macleay River	No access to land-base (Shark Island)
Point Briner / Monument Point	No land-base; developed, tourist park, business centre and residential; exposed anchorage
Laggers Point to Smoky Cape	No land-base; developed, tourist park; undeveloped, environmental (Arakoon State Recreation Area and Hat Head National Park); steep headlands; elevated pumping
Korogoro Point to The Jew Bite	No land-base; undeveloped, (Hat Head National Park); steep headlands; inappropriate slope; elevated pumping
Crescent Head (comprising Little Nobby, Big Nobby and Crescent Head)	No land-base; developed, tourist park and residential; steep headland; inappropriate slope; elevated pumping
Big Hill Point	No land-base; undeveloped, (Limeburners Creek Nature Reserve); steep headlands; inappropriate slope; elevated pumping; low-lying swamp areas; no access to services

6.11 HASTINGS COUNCIL

Location:

Mid North Coast

Population:

63835

Northern Coastal Boundary:

Immediately north of Point Plomer on beach

Southern Coastal Boundary:

6 kilometres north of Crowdy Head on Kyllies Beach



Coastline:

65 kilometres of predominantly long, exposed sand beaches having south-easterly aspect; numerous rock headlands; 2 estuaries with training walls; no major embayment

Coastal Settlements:

North Shore, Port Macquarie, Lake Cathie, Bonny Hills, North Haven, Laurieton and Camden Head

Coastal Estuaries:

Hastings River, Lake Innis, Lake Cathie and Camden Haven Inlet

6.11.1 NORTH BREAK WALL, NORTH SHORE (HASTINGS RIVER)

Site Ranking: *

GPS Position: South 31° 25.50' East 152° 54.65'

General Description:

North Shore is a small residential community on the northern side of the Hastings River, approximately 2 kilometres from the river entrance, within the Hastings Council area. The City of Port Macquarie lies on the opposite bank of the Hastings River from North Shore and is the largest population centre within the Council area, with approximately 45000 people. The area is a popular tourist centre subject to moderate to high recreational usage, due to the proximity to Port Macquarie (southern side of entrance), Kempsey (59 kilometres) and Taree (80 kilometres), although access from Port Macquarie to North Shore is restricted to vehicular ferry.

Site Assessment

Table 33. Ranking of Primary Criteria for North Break Wall, North Shore, Hastings River.

Primary Criteria	Ranking	Comments
Secure access to high quality, oceanic water	Poor	Northern break wall; potential water quality issues (major estuarine influences)
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 34. Ranking of Secondary Criteria for North Break Wall, North Shore, Hastings River.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Poor	> 1km from potential land-base
Access to mains freshwater supply	Poor	> 1km from potential land-base
Access to telecommunications	Poor	> 1km from potential land-base
Access to suppliers, trade services	Good	Port Macquarie < 5km (vehicular ferry access only)
All weather (sealed) road access	Poor	> 500m from potential land-base, vehicular ferry access only to Port Macquarie
Potential water pollutants	Poor	Estuarine water quality, urban stormwater run-off, sewerage effluent (<3km)
Protection from prevailing swells	Excellent	Within training walls
Pumping head	Excellent	<10m
Land status	Good	Partially cleared, revegetating
Land zoning	Good	Environmental Protection – Coastal 7(f1)
Land topography	Excellent	Potential sites are flat
Aesthetics	Poor	Overlooking residential from Port Macquarie; recreational usage

Site Discussion

The existing rock training walls on either side of the inlet would provide a number of suitable intake anchorage points. However, there are no associated land-bases on the southern (Port Macquarie) side within 1 kilometre of the entrance. The northern break wall (Pelican Point) has suitable land within a kilometre and would provide a number of suitable points for anchorage, either on the inlet side or the oceanic side. The inlet side would be more immediately affected by estuarine discharge during ebb tide than the oceanic side. However, prevailing currents are southerly so an intake on the oceanic side would be affected by river discharge as well. The oceanic side is also more exposed. Further investigation of water quality variation between the two sides in different conditions (flood, high seas, tides etc) is required in order to evaluate the preferable anchorage.

A suitable land portion is available within one kilometre of the potential anchorages provided by the northern break wall.

The zoning of the majority of the sand peninsula comprising Pelican Point is Environmental Protection – Coastal 7(f1) Reserve. Development for the purpose of Aquaculture is prohibited in this zone under the Council's LEP.

The site is a flat sand-spit with low coastal vegetation surrounding several degraded and cleared portions, most notably near the south-western tip. A good quality gravel road services the break wall and land to the west has several 4-wheel drive tracks leading through to the western training wall of the peninsular. The area to the west of the gravel road, within a kilometre of anchorage along the northern break wall, would provide a site of approximately 15 hectares. This would provide sufficient area for the development of a large tank-based hatchery or grow-out system.

Alternatively, the positioning of an intake along the extensive western training wall would allow access to a larger portion (> 30hectares) of the peninsular and development of integrated hatchery and grow-out systems. The western training wall also provides an excellent discharge point for effluent during ebb-tidal flows for any proposal using the northern break wall as an intake point. It should be noted that any intake anchorage along the western training wall of the peninsular would be between 1 - 2 river kilometres from the entrance and have a reduced capacity to access oceanic quality water.

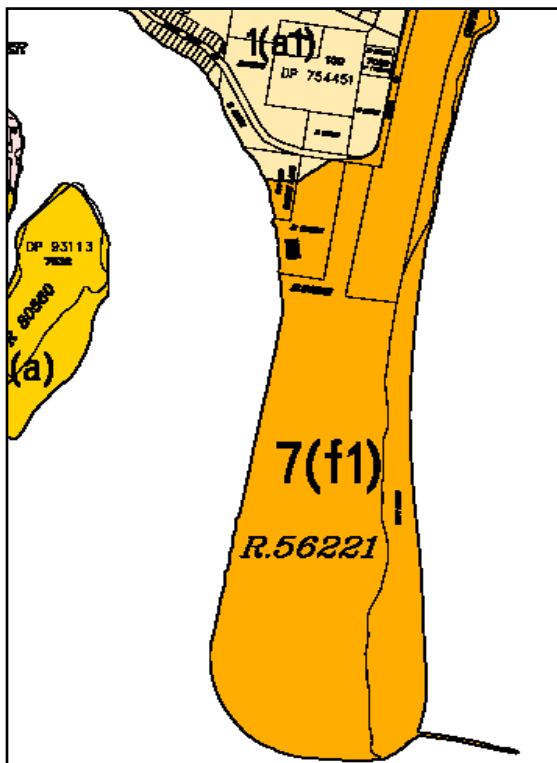


Aerial Photograph of the Hastings River estuary

Source: DLWC 1999®



Topographic Map
Sources: TopoView® 2000



LEP Zoning Map of Pelican Point, North Shore
Source: Hastings Council LEP Maps

A suitable land portion is available within 1 kilometre of the potential anchorages provided by the northern break wall.

The zoning of the majority of the sand peninsula comprising Pelican Point is Environmental Protection – Coastal 7(f1) Reserve. Development for the purpose of aquaculture is prohibited in this zone under the Council LEP.

The site is a flat sand-spit with low coastal vegetation surrounding several degraded and cleared portions, most notably near the south-western tip. A good quality gravel road services the break wall and land to the west has several 4-wheel drive tracks leading through to the western training wall of the peninsular. The area to the west of the gravel road, within a kilometre of anchorage along the northern break wall, would provide a site of approximately 15 hectares. This would provide sufficient area for the development of a large tank-based hatchery or grow-out system.

Alternatively, the positioning of an intake along the extensive western training wall would allow access to a larger portion (> 30hectares) of the peninsular and development of integrated hatchery and grow-out systems. The western training wall also provides an excellent discharge point for effluent during ebb tidal flows for any proposal using the northern break wall as an intake point. It should be noted that any intake anchorage along the western training wall of the peninsular would be between 1-2 river kilometres from the entrance and have a reduced capacity to access oceanic quality water.

All-weather (sealed) road access to the site is more than 500 metres from the site and access to Port Macquarie is restricted to a vehicular ferry from Settlement Point to North Shore. Crescent Head, to the north, provides the only non-ferry road access via Maria River Road (35 kilometres) or Point Plomer Road (unsealed, 4-wheel drive only). Mains power, mains freshwater and telecommunication services are more than 1 kilometre from the proposed site(s).

North Shore is serviced by on-site sewerage treatment (septic tanks or similar).

Residential development occurs within 1 kilometre at North Shore (rural residential) and Port Macquarie. Tourism and business areas of Port Macquarie are within 400 metres of the proposed site, directly across the river. The potential for visual impact of any site development is high, with the site overlooked by residences and prominent sites associated with Port Macquarie. Identified land-bases would therefore require a minimum of Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).

6.11.2 NORTH BREAK WALL, NORTH HAVEN

Site Ranking: *

GPS Position: South 31° 38.05' East 152° 49.85'

General Description:

North Haven is a small residential community on the northern side of Camden Haven Inlet, within the Hastings Council area on the mid north coast. Laurieton, Camden Head and Dunbogan comprise the neighbouring communities around the inlet, with a combined population (including North Haven) of 6500 people. The area is a popular tourist centre subject to moderate to high recreational usage, due to the proximity to Port Macquarie (30 kilometres) and Taree (60 kilometres).

Site Assessment

Table 35. Ranking of Primary Criteria for North Break Wall, North Haven.

Primary Criteria	Ranking	Comments
Secure access to high quality, oceanic water	Poor	Northern training wall; potential water quality issues (estuarine influences)
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 36. Ranking of Secondary Criteria for North Break Wall, North Haven.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Good	< 1km from potential land-base
Access to mains freshwater supply	Good	< 1km from potential land-base
Access to telecommunications	Good	< 1km from potential land-base
Access to suppliers, trade services	Good	North Haven, Laurieton immediate; Port Macquarie (30km)
All weather (sealed) road access	Good	< 500m from potential land-base
Potential water pollutants	Poor	Estuarine water quality, urban stormwater run-off, sewerage effluent (<3km), agriculture (dairy)
Protection from prevailing swells	Excellent	Within training walls
Pumping head	Excellent	<10m
Land status	Good	Mostly undeveloped (coastal vegetation), with partial clearing and revegetation
Land zoning	Good	Open Space 6(a) and Environmental Protection - Coastal 7(f1)
Land topography	Excellent	Potential site is flat
Aesthetics	Good	Potential to merge any infrastructure in existing vegetation and isolate from park

Site Discussion

The existing rock training walls on either side of the inlet would provide a number of suitable intake anchorage points. However, there are no associated land-bases on the southern (Camden Head) side within 1 kilometre of the entrance. The northern break wall has suitable land within a kilometre and would provide a number of suitable points for anchorage, either on the inlet side or the oceanic side. The inlet side would be more immediately affected by estuarine discharge during ebb tide than the oceanic side. However, prevailing currents are southerly so an intake on the oceanic side would be affected by river discharge as well. The oceanic side is also more exposed to prevailing swells. Further investigation of water quality variation between the two sides in different conditions (flood, high seas, tides etc) is required in order to evaluate the preferable anchorage point. The Camden Haven estuary is classified as moderately infilled (Appendix A).



Aerial Photograph of the Camden Haven estuary

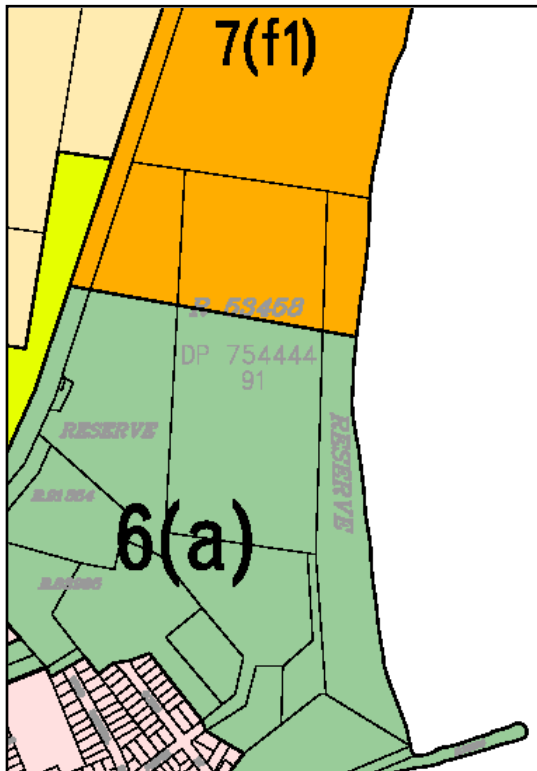
Source: DLWC 1999[®]



Topographic Map
Sources: TopoView[®] 2000.

Issues with sand movement along the training walls at the entrance need to be investigated as part of any water quality assessment for the intake site. Sewerage for North Haven, Laurieton, Dunbogan and Camden Head is reticulated, with treated effluent discharged at the southern edge of Camden Head, approximately 3 kilometres by water from the north break wall. Due to the influence from freshwater and other catchment pollution a careful tidal pumping regime and storage of water would need to be implemented at this site to ensure oceanic water quality is maintained.

A suitable land portion is available within one kilometre of the potential anchorage point provided by the northern break wall. Undeveloped land to the north of the break wall has both Open Space 6(a) and Environmental Protection – Coastal 7(f1) zoning. Development for the purpose of



LEP Zoning Map of North Haven
Hastings Council LEP Maps

Aquaculture is prohibited in these zones under the Council's LEP.

The most appropriately sized and positioned portion of land is Lot 91 of DP 754444. This lot has an approximate area of 19 hectares, zoned mostly Open Space 6(a) with the northern third zoned 7(f1). This would provide sufficient area for the development of an integrated hatchery and grow-out system, using tanks; or a designated hatchery, using ponds.

All-weather (sealed) road access, mains power, mains freshwater, reticulated sewerage and telecommunication services are all within 500 metres of the proposed site. An extension of services and the upgrading of road access for this distance need to be investigated further.

Residential development occurs within 1 kilometre, without line of sight, at North Haven. The site is also over-looked by

some Camden Head residences and prominent tourist lookouts in the area (Camden Head and North Brother). The identified land-bases would therefore require a minimum of Level 2 assessment under the Project Profile Analysis of the SAS (Appendix C).

Estuarine sites

Estuarine Aquaculture maps included in the North Coast Sustainable Aquaculture Strategy identify extensive areas within the estuary that are regarded as suitable under Tier 1 Assessment Criteria of the Strategy (Appendix C). Operationally these areas may be suitable for the culture of the more euryhaline species, particularly for the grow-out phase of production.

No additional estuarine sites were catalogued during ground-truthing for this Council area.

6.11.3 CATALOGUE OF REMAINING COASTLINE

Table 37. Hastings Council – justification of sites having no current potential.

Site	Justification
Point Plomer / Queens Head	No land-base, undeveloped (Limeburners Creek Nature Reserve); limited access (> 10 km unsealed road, north or south); no power, no telecommunications, no mains freshwater within 1 kilometre
Southern Training Wall (Hastings River) to Tacking Point	No land-base; developed, residential and business; undeveloped (Sea Acres Nature Reserve)
Middle Rock Point	No land-base, developed residential; exposed anchorage, tidal rock platform
Grants Head	No land-base, developed residential; exposed anchorage; steep headland; elevated pumping
Perpendicular Point / Camden Head	No land-base, developed residential; undeveloped (Kattang Nature Reserve); steep headland; elevated pumping
Diamond Head	No land-base, undeveloped (Crowdy Bay National Park); limited access; steep headland; elevated pumping

6.12 GREATER TAREE CITY COUNCIL

Location:

Mid North Coast

Population:

44297

Northern Coastal Boundary:

6 kilometres north of Crowdy Head on Kylies Beach

Southern Coastal Boundary:

Diamond Reef, northern end of Nine Mile Beach



Coastline:

45 kilometres of predominantly long, exposed sand beaches having easterly to south-easterly aspect; numerous rock headlands; 1 estuary with training walls; no major embayment

Coastal Settlements:

Crowdy Head, Harrington, Manning Point, Old Bar, Wallabi Point, Diamond Beach, Red Head and Hallidays Point

Coastal Estuaries:

Manning River and Khappinghat Creek

6.12.1 CROWDY HEAD

Site Ranking: **

GPS Position: South 31° 50.594' East 152° 44.597'

General Description:

Crowdy Head is a prominent rocky headland six kilometres north of the Manning River estuary within the Greater Taree City Council (GTCC) area on the north coast. The associated community of Crowdy Bay is very small, comprising of around 80 residents, a small school and a harbour servicing a small commercial fishing industry. Crowdy Bay National Park dominates the coastline north of Crowdy Head to Diamond Head and south to Harrington. Although Crowdy Head has limited options for tourist accommodation the area is a popular destination, with Port Macquarie, Forster and Taree all within a one-hour drive.

Site Assessment

Table 38. Ranking of Primary Criteria for Crowdy Head.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Excellent	Harbour break walls; boulder beach
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 39. Ranking of Secondary Criteria for Crowdy Head.

Secondary Criteria	Ranking	Comments
Access to mains power	Good	3 phase lines <500m from both land-bases
Access to mains freshwater supply	Good	<500m from both potential land-bases
Access to telecommunications	Good	<500m from both potential land-bases
Access to suppliers, trade services	Good	Harrington 6km; Taree 35km
All weather (sealed) road access	Good	<500m from both potential sites then gravel
Potential water quality pollutants	Good	Manning River >5km; harbour activities
Protection from prevailing swells	Excellent	Existing harbour with northerly aspect
Pumping head	Excellent	<10m
Size of land portion(s)	Good	2-5 ha, limited to hatchery development
Land status	Good	Both potential sites cleared, degraded
Land zoning	Good-Poor	6A(open space); 7F2(coastal protection)
Land topography	Excellent	Both potential sites flat to gently sloped
Aesthetics	Poor	Overlooking residential

Site Discussion

The existing rock-walls and wharves associated with the harbour on the northern side of the headland would provide a number of suitable anchorage points for an intake pipe. The northerly aspect of the outer harbour walls would protect any intake anchored on the seaward side from southerly to easterly prevailing swells and minimise issues of longshore sand drift. Anchorage within the harbour walls would provide more protection, but activities within the harbour may compromise water quality.

Alternatively, the boulder beach to the west of the harbour (see overleaf) could provide reasonable anchorage and protection of a well-type intake, buried below the boulders.

Rocks on the southern side of the headland near the quarry (see overleaf) would provide suitable anchorage as well, but the aspect is unfavourable and the intake would be exposed to prevailing swells and sand drift from the south.



Crowdy Head looking south towards Harrington Inlet

Source: GTCC 2001[®]

Although space at Crowdy Head is limited, due to the surrounding Crowdy Bay National Park, there are some potential land-bases within 1 kilometre of the specified anchoring points. A tract of degraded land with an approximate area of five (5) hectares lies to the south west of the residential zone (see LEP Zoning map) and an adjacent car and boat-trailer parking area. The area is a mixture of 6A (Open Space) and 7F1 (Environmental Protection Coastal Lands) zoning under which conditional consent for development can be given by the Council for 6A or the Director of Planning for 7F2, according to the scale, nature and how appropriate the development will be. Alternatively zoning can be amended to make the activity more allowable.



Crowdy Head Harbour

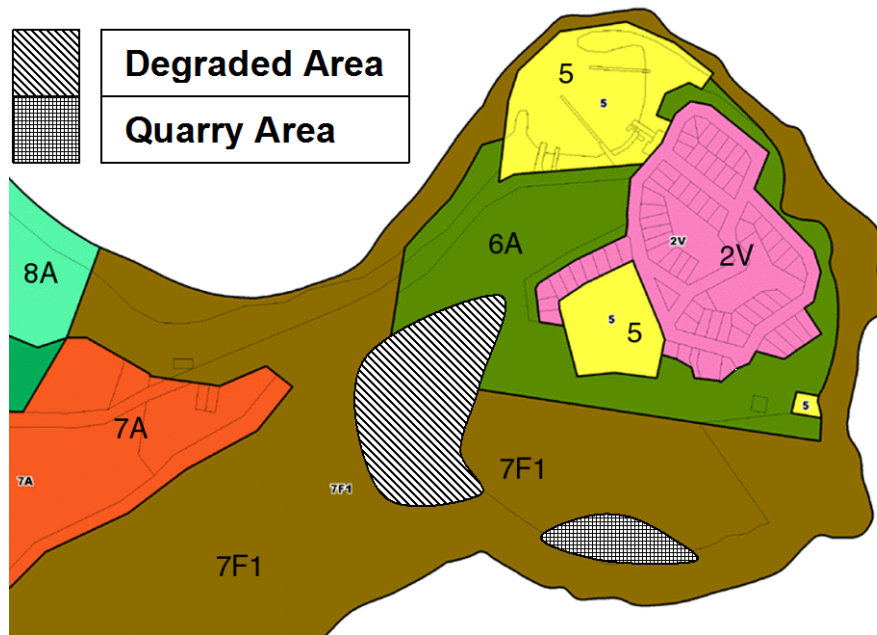
Photo: D Glendenning



Crowdy Head quarry, looking east

Photo: P Read

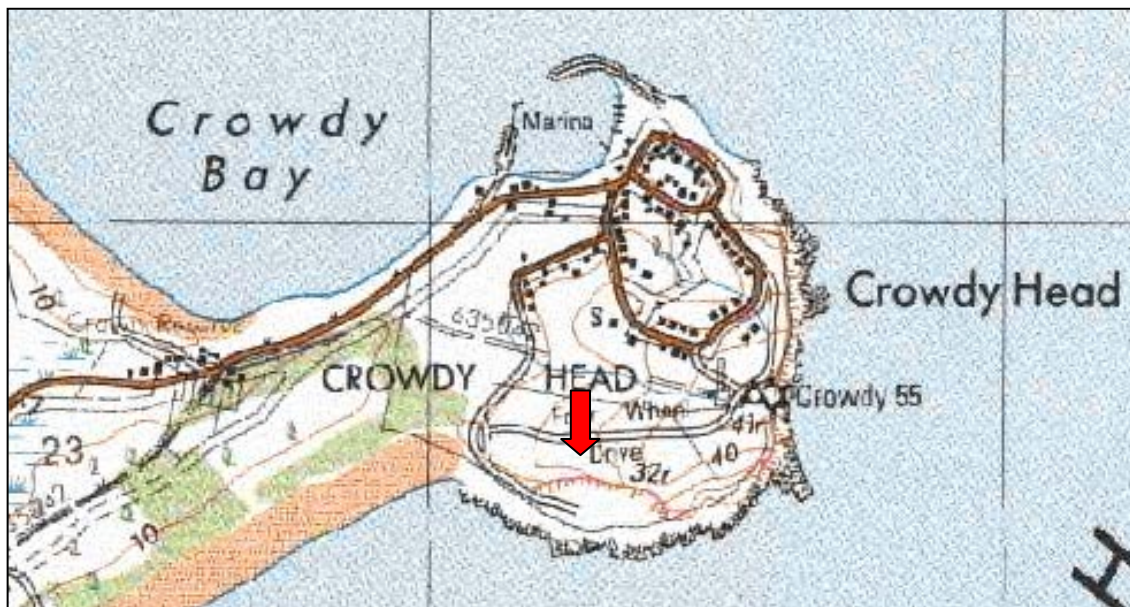
The degraded area is directly adjacent to the harbour and surrounding infrastructure, and aquaculture development would be consistent with the existing fisheries-based community. However, development of this land parcel would have potential visual aesthetic impact on a small number of overlooking houses (see below), some within 200 metres with line of sight. Development of this portion would therefore require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS (Appendix C)



LEP zoning map, showing proposed land areas Source: Adapted from GTCC LEP (1995)

A second option for a small land-base exists on the southern side of the headland in the quarry. The quarry contours and access roads can be clearly seen on topographic maps (see below). Although the site is small, approximately 2 hectares, the absence of overlooking houses would reduce any potential visual impact. However neighbouring land is still residential, with houses approximately 200 metres north of the quarry cliff.

The quarry site is very degraded and despite being zoned 7F1 (Environmental Protection Coastal Lands) any development would improve the areas aesthetics. Access to at least a portion of the quarry wall may be required periodically to maintain the harbour break-wall.



Topographic Map of Crowdy Head, showing quarry contours and access.

Source: TopoView© 2000



Land portion with overlooking residential properties

Photo: D Glendenning

The provision of services to Crowdy Head is good, excepting sewerage that is treated on-site (septic tank or similar). Three-phase power, sealed road access, mains freshwater supply and telecommunications are all provided to the settlement. An extension of services for less than 500 metres and the upgrading of road access are required for both identified areas. Both areas are either cleared or partially cleared.

Development of either of the identified sites is limited to tank-based, hatchery-only development due to the small size of the land portions. Proximity to residential areas means that development of either site will require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.12.2 HARRINGTON

Site Ranking: *

GPS Position: South 31° 52.00' East 152° 42.08'

General Description:

Harrington is a small town of 1450 residents on the northern side of the Manning River estuary, within the Greater Taree City Council (GTCC) area on the north coast. Crowdy Bay National Park dominates the coastline north of Harrington to Diamond Head. The area is subject to moderate to high recreational usage, with Port Macquarie, Forster and Taree all within a one-hour drive.

Site Assessment

Table 40. Ranking of Primary Criteria for Harrington.

Primary Criteria	Ranking	Comments
Secure access to oceanic water	Poor	Northern break wall; potential water quality issues; estuarine influences
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 41. Ranking of Secondary Criteria for Harrington.

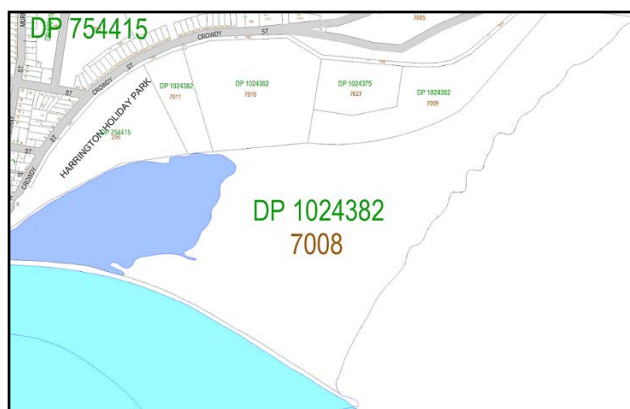
Secondary Criteria	Ranking	Comments
Access to mains power	Good	<500m from potential land-base
Access to mains freshwater supply	Good	<500m from potential land-base
Access to telecommunications	Good	<500m from potential land-base
Access to suppliers, trade services	Good	Harrington (immediate); Taree 30km
All weather (sealed) road access	Excellent	Adjacent to site
Potential water quality pollutants	Poor	Manning River discharge immediate
Protection from prevailing swells	Poor	Break wall exposed to prevailing swells
Pumping head	Excellent	<10m
Size of land portion(s)	Excellent	>40 ha, hatchery and/or grow-out
Land status	Good	Undeveloped vegetated with degraded portions
Land zoning	Good	Environmental Protection Coastal Lands Acquisition (7F1); Environmental Protection Habitat (7A)
Land topography	Excellent	Potential sites flat to gently sloped

Site Discussion

The existing rock break wall on the northern side of the Manning River would provide a number of suitable anchorage points for an intake pipe. The break wall runs approximately south-east. This means that both the southern (estuarine) side and the northern (oceanic) side of the break wall are exposed to prevailing swells from the south to south-east. The oceanic side would also be exposed to swells from the north. Water quality on both sides of the break wall is likely to be affected by estuarine discharge. Sewerage effluent for Harrington is discharged to groundwater. Further investigation of water quality variation between the two sides in different conditions (flood, high seas, tides etc) is required in order to evaluate a preferable side for anchorage.



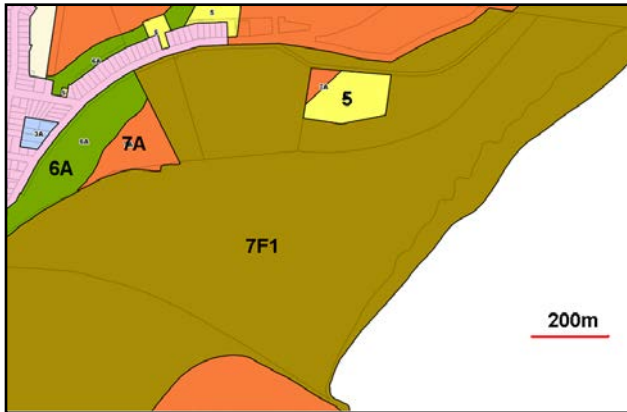
Harrington and the Manning River estuary

Source: DLWC 1998[©]

LEP Zoning Map of Harrington, north of northern break wall
Source: GTCC LEP Maps (2003)

Suitable land portions are available within 1 kilometre of the break wall. The area is mainly a mixture of Environmental Protection Habitat (7A) and Environmental Protection Coastal Lands Acquisition (7F1) zoning. Both zones prohibit aquaculture development under the Greater Taree LEP (1995), however zoning is not considered to be a hard constraint to development for this report.

The largest portion (DP 1024382 Lot 7008) available comprises more than 40 hectares of suitable Environmental Protection Coastal Lands Acquisition



Zoning Map of Harrington, North of Breakwall
Source GTCC LEP Maps (2003)

(7F1) land directly adjacent to the break wall. The western portion of the block is dominated by a shallow lagoon (not included in block size) and shares a common boundary with Harrington Holiday Park.

Development of a large portion of the identified site could include an integrated hatchery and grow-out development. However inclusion of wide buffer zones to adjacent land-use and the lagoon would reduce the available land area considerably so that development is restricted to either a hatchery (tanks or ponds) or a grow-out (tanks only) facility.

Development of other smaller 7F1 portions adjacent to the north, between the holiday park and a cemetery (zoned 5A), is also restricted to hatchery only or grow-out only facilities.

The proximity of the identified site to residential areas (<400m) and the potential for visual impact from prominent sites means that development of the site will require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS (Appendix C).

Estuarine sites

Estuarine Aquaculture maps included in the North Coast Sustainable Aquaculture Strategy identify areas within the estuary that are regarded as suitable under Tier 1 Assessment Criteria of the Strategy (Appendix C). Operationally these areas may be suitable for the culture of the more euryhaline species, particularly for the grow-out phase of production.

No additional estuarine sites were catalogued during ground-truthing for this Council area.

6.12.3 CATALOGUE OF REMAINING COASTLINE

Table 42. Greater Taree City Council – justification of sites having no current potential.

Site	Justification
Wallabi Point	No land-base; developed, residential; undeveloped, cultural significance (Saltwater Reserve); exposed anchorage
Red Head/Black Head/ Hallidays Point	No land-base; developed, residential; undeveloped (Darawank Nature Reserve); inappropriate slope; elevated pumping

6.13 GREAT LAKES COUNCIL

Location:

Hunter Coast

Population:

31739

Northern Coastal Boundary:

Diamond Reef, northern end of Nine mile Beach

Southern Coastal Boundary:

Yacaaba Head, 2 kilometres south of Hawks Nest



Coastline:

95 kilometres of long, exposed sand beaches having easterly to south-easterly aspect; numerous rock headlands; no estuaries with training walls; 1 major embayment

Coastal Settlements:

Tuncurry, Forster, Tiona, Elizabeth Beach, Boomerang Beach, Blueys Beach, Cellito, Sandbar, Seal Rocks and Hawks Nest

Coastal Estuaries:

Wallis Lake, Smiths Lake and Port Stephens

6.13.1 CATALOGUE OF GREAT LAKES COUNCIL COASTLINE

Great Lakes Council incorporates approximately 95 kilometres of coastline and within this area there are several long beaches (Mungo, Seven Mile and Ten Mile). There are numerous potential anchorages however these sites are either constrained by the lack of available land portions within 1 kilometre of suitable anchorages or the exposed nature of the anchorage (see Catalogue of Remaining Coastline).

Estuarine Sites

Port Stephens is a large estuary with 6 major creeks and 2 rivers discharging into a large embayment that in turn discharges between Yacaaba and Tomaree Heads. The hydrology of the Port is such that oceanic water enters and circulates in a clockwise direction around the embayment. The best quality water in the Port is found on flood tides, immediately inside the southern headland (Tomaree), due to prevailing southerly currents. This water cycles around the Port and becomes increasingly estuarine by the time the water passes along the northern shore (Steve McOrrie, pers. comm.).

Estuarine sites of some worth were viewed along the northern margin of Port Stephens at Carrington and Pindimar. However both areas are well within the estuary and subject to estuarine quality water as described. Pindimar and Carrington are 7 and 17 kilometres within the heads of Port Stephens respectively.

A proposed hatchery site at Pindimar has a number of site attributes suited to aquaculture development, such as available flat land in close proximity to the water, access to power and sealed road access. However the site is adjacent to extensive sand flats and a pipeline would have to extend several hundred metres to access good water quality.

Catalogue of Remaining Coastline

Table 43. Great Lakes Council – justification of sites having no current potential.

Site	Justification
North and South Break Walls (Wallis Lake Entrance)	No land-base; developed, residential and tourism; water quality issues
Bennetts Head to Burgess Beach	No land-base; developed, residential; exposed anchorage
Cape Hawke	No land-base; undeveloped, environmental (Booti Booti State Recreation Area); exposed anchorage; steep headland; inappropriate slope; elevated pumping
Flat Rock to Bald Head	No land-base; undeveloped, environmental (Booti Booti State Recreation Area); developed, residential; steep headlands; inappropriate slope; elevated pumping
Number One Beach to Treachery Head (Seal Rocks)	No land-base; developed, residential and tourist park; undeveloped, environmental (Myall Lakes National Park); limited road access (gravel >5km); elevated pumping
Yagon Gibber Headland, Big Gibber Headland and Dark Point	Limited access; no land-base; undeveloped, environmental (Myall Lakes National Park); no services; exposed anchorage
Yacaaba Head	No land-base; developed, residential; limited access (>1km of sand spit) to headland

6.14 PORT STEPHENS COUNCIL

Location:

Hunter Coast

Population:

57804

Northern Coastal Boundary:

Yacaaba Head, 2 kilometres south of Hawks Nest

Southern Coastal Boundary:

5 kilometres north of Oyster Bank on Stockton Beach



Coastline:

50 kilometres comprising of sand beaches having easterly to south-easterly aspect; numerous rock headlands; no estuaries with training walls; 2 major embayments

Coastal Settlements:

Nelson Bay, Shoal Bay, Fingal Bay, Boat Harbour, Fisherman's Bay, Anna Bay and Fern Bay

Coastal Estuaries:

Port Stephens (including Myall River Karuah River and Tilligerry Creek)

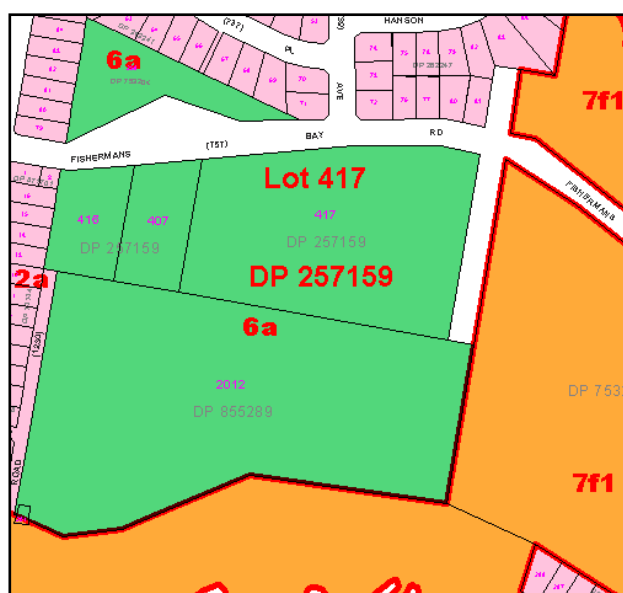
6.14.1 CATALOGUE OF PORT STEPHENS COUNCIL COASTLINE.

Port Stephens Council incorporates approximately 50 kilometres of oceanic coastline (within Port Stephens not included). The area is dominated by Stockton Beach running more than 30 km. Numerous potential pipe anchorage sites exist however these sites are either constrained by the lack of available land portions within 1 kilometre or the exposed nature of the anchorage (see Catalogue of Remaining Coastline).

NSW Fisheries identified a potential site for a marine mollusc hatchery at Anna Bay (Nell and Heasman, 1997). At the time, it was recommended negotiations occur between NSW Fisheries and DLWC commence in an effort to acquire the land for hatchery development. However, the acquisition of the portion did not proceed.

The portion (Lot 417 DP 257159) is relatively small at less than 3 hectares, which would restrict development of the site to a tank-based facility, either for hatchery or grow-out purposes. Access to good oceanic quality water is provided through a narrow strip of National Parks to the south. Provision of all amenities and services is immediate. The site is surrounded by neighbouring residential areas; residences occur within 200 metres with line of site. These adjacent land-use issues would mean

that the site would require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.



Discussions with Council indicate that the status of the land is unchanged. The portion is Crown Land and still zoned as General Recreation 6A, which permits aquaculture with development consent, according to the Council's LEP. The land is currently under the control of DLWC.

LEP Zoning Map of the Anna Bay site
Source: Port Stephens Council LEP Maps

Estuarine Sites

Port Stephens is a large estuary with 6 major creeks and 2 rivers discharging into a large embayment that in turn discharges between Yacaaba and Tomaree Heads. The hydrology of the Port is such that oceanic water enters and circulates in a clockwise direction around the embayment. The best quality water in the Port is found on flood tides, immediately inside the southern headland (Tomaree), due to prevailing southerly currents past the entrance.

NSW Fisheries operate an abalone hatchery on a very small part of a land portion of approximately 9 hectares (Lot 453 DP 705463) on the western side of Tomaree Head. This land is zoned 7(f1) Environmental Protection – Coastal Lands, which permits aquaculture with development consent, according to the Council's LEP. The

majority of the land portion to the south has been developed as a facility to provide respite care for the mentally disabled (Tomaree Lodge). The land portion is listed as owned by the Stockton Centre, which forms part of a conglomeration of care providers called Hunter Residences, under the jurisdiction of the Department of Ageing, Disability and Home Care.

The available area for the existing abalone hatchery to expand is limited. However, if Tomaree Lodge were to be decommissioned and the land became available, the portion would be an appropriate size (<8ha) for hatchery development. Competition for development rights to this land would be strong due to the waterfront nature of the site and high realty value.

Catalogue of Remaining Coastline

Table 44. Port Stephens Council – justification of sites as having no current potential.

Site	Justification
Stephens Peak to Box Beach	No land-base; developed, residential; undeveloped, environmental (Tomaree National Park); steep headlands, inappropriate slope; exposed anchorage.
Point Stephens	No access, island joined to mainland by tidal sand spit; No land-base; undeveloped, environmental (Tomaree National Park)
Fingal Head	No land-base; developed, residential; undeveloped, environmental (Tomaree National Park); exposed anchorage; steep headland; inappropriate slope; elevated pumping
Fingal Point to One Mile Beach	No land-base; undeveloped, environmental (Tomaree National Park); Limited access (4wd only)
One Mile Headland to Birubi Point	No land-base; developed, residential and tourist park; undeveloped, environmental (Tomaree National Park); aesthetic impact issues

6.15 NEWCASTLE CITY COUNCIL

Location:

Hunter Coast

Population:

142046

Northern Coastal Boundary:

5 kilometres north of Oyster Bank on Stockton Beach

Southern Coastal Boundary:

Northern margin of Glenrock Lagoon



Coastline:

12 kilometres consisting of one long sand peninsular having south-easterly aspect; grouped rock headlands; 1 estuary with training walls; no major embayment

Coastal Settlements:

Stockton and Newcastle City

Coastal Estuaries:

Hunter River

6.15.1 CATALOGUE OF NEWCASTLE CITY COUNCIL COASTLINE

Newcastle City Council incorporates approximately 12 kilometres of coastline and there are numerous potential anchorage points for an intake pipe. However, these points are either constrained by the lack of available land portions within 1 kilometre or the exposed nature of the anchorage (see Catalogue of Remaining Coastline).

Estuarine Sites

Estuarine sites of some potential were viewed from Walsh Point, along the eastern side of Kooragang Island, towards Stockton Bridge. Kooragang Island is a major industrial zone with port facilities on the western side, associated with shipment of coal. There are a range of potential water quality issues associated with the site, due to the estuarine nature of any anchorage and adjacent industrial activities. Any development of these areas would require a preliminary water analyses.

The decommissioned Steelworks site on the southern side of the Hunter River South Channel would also provide a suitable area for a land-base for aquaculture development. However the anchorage would be exposed to any potential estuarine pollution in a largely industrial area.

Catalogue of Remaining Coastline

Table 45. Newcastle City Council – justification of sites having no current potential.

Site	Justification
Oyster Bank, Stockton	No land-base; developed, residential and tourism; water quality issues
Southern break wall / Nobbys Head	No land-base; developed, tourism and recreation;
South Nobbys Beach to Merewether	No land-base; developed, residential; exposed anchorage; steep headland; inappropriate slope; elevated pumping

6.16 LAKE MACQUARIE CITY COUNCIL

Location:

Hunter Coast

Population:

186020

Northern Coastal Boundary:

Northern margin of Glenrock Lagoon

Southern Coastal Boundary:

Desoto Inlet, Catherine Hill Bay



Coastline:

28 kilometres consisting of one long sand beach having south-easterly aspect; with numerous small beaches separating grouped rock headlands; 1 estuary with training walls; no major embayment

Coastal Settlements:

Dudley, Redhead, Belmont, Pelican Flat, Blacksmiths, Swansea, Caves Beach, Middle Camp and Catherine Hill Bay

Coastal Estuaries:

Glenrock Lagoon and Lake Macquarie

6.16.1 EX-COLLIERY, CATHERINE HILL BAY

Site Ranking: ***

GPS Position: South 32°09.552 East 151°37.819

General Description:

The Wallarah Colliery site is situated on a prominent rock headland approximately 8 kilometres south of Lake Macquarie entrance, near the settlement of Catherine Hill Bay, within the Lake Macquarie City Council (LMCC) area on the Hunter Coast. Decommissioning of the site leaves considerable infrastructure, most notably a large loading wharf that would provide suitable anchorage point for a deep-water intake. The small communities of Catherine Hill Bay and Middle Camp are within 2 kilometres of the site. Proximity to the highly residential suburbs of Newcastle, Belmont and Swansea to the north; and The Entrance, Toukley and Gosford to the south means that the area is subject to moderate to high recreational usage.

Site Assessment

Table 46. Ranking of Primary Criteria for Ex-colliery, Catherine Hill Bay.

Primary Criteria	Ranking	Comments
Secure access to sea water	Excellent	Existing wharf structure with access to deep oceanic water; protection from headland
Land-base < 1km from intake point	Good	Zoning, heritage and aesthetic impact issues

Table 47. Ranking of Secondary Criteria for Ex-colliery, Catherine Hill Bay.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Excellent	Immediate
Access to mains freshwater supply	Excellent	Immediate
Access to telecommunications	Excellent	Immediate
Access to suppliers, trade services	Good	Swansea 10km; Newcastle 35km
All weather (sealed) road access	Excellent	Immediate
Potential water pollutants	Good	Lake Macquarie discharge >10km north; Tuggerah Lake discharge >30km to south
Protection from prevailing swells	Excellent	North-easterly aspect of wharf, headland extends eastwards of site
Pumping head	Poor	20 - 40m within 1km radius of wharf
Size of land portion(s)	Good	2-6 ha, potential for tank-based facility
Land status	Good	Cleared; existing industrial usage
Land zoning	Good	Industrial – special industry 4A; Environmental Protection - Scenic 7A
Land topography	Good	Potential site is gently to moderately sloped
Aesthetics	Good	Low visual impact on residential neighbours

Site Discussion

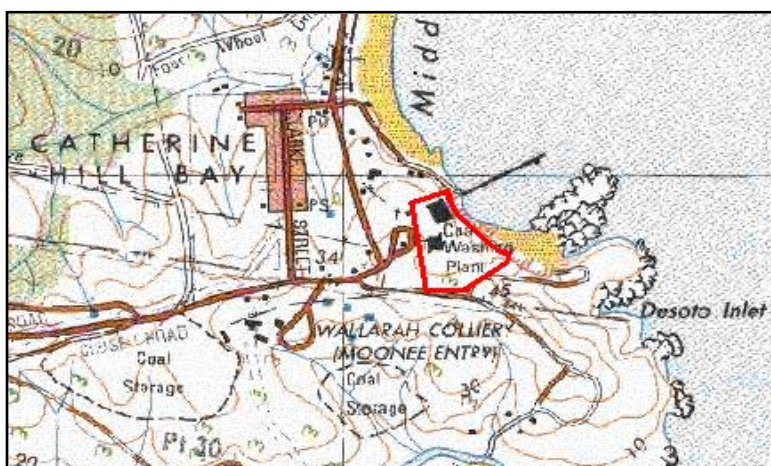
The existing loading wharf at the southern end of Catherine Hill Bay, associated with Wallarah Colliery coal washing facility, would provide a suitable intake anchorage point. This anchorage point enables access to deep water, having reliable oceanic-quality. The wharf points in a north-easterly direction and is protected from prevailing swells from the south and south-east by an adjacent rock headland, approximately 150 metres to the east. The surrounding foreshore consists of rock outcrops and coarse boulder beaches, with some evidence of sand movement past the headland.



Coal Loading Wharf, Catherine Hill Bay

Photograph: Phil Read

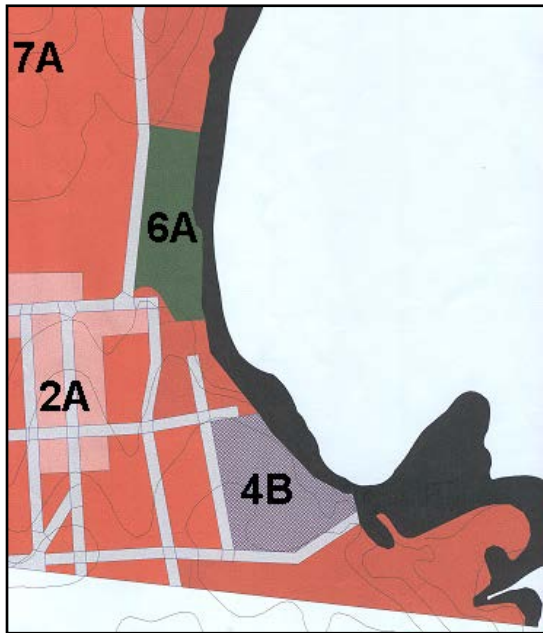
Potential water pollutants for the site are associated with the estuarine discharge from Lake Macquarie and Tuggerah Lake. Lake Macquarie is the closest potential source of pollution, approximately 10 kilometres to the north. However prevailing coastal currents are from the south that would limit the risk of pollution from Lake Macquarie. Tuggerah Lake entrance is approximately 25 kilometres to the south and therefore has low potential for impacting on water quality at the site.



Topographic Map of Catherine Hill Bay, with potential land-base out-lined in red.

Source: Topoview® 2000

Suitable land portions are available within one kilometre of the potential anchorage point. The coal washing facility serviced by the wharf lies adjacent to the south and west, on Lot 203 DP 702669, a portion of approximately 3.5 hectares. The land is zoned Industrial - Special Industry 4B



LEP Zoning Map Of Catherine Hill Bay
Source: LMCC LEP Maps (1984).

under the Council's current LEP (1984) and zoned Environmental – Coastline 7(4) under the Council's Draft LEP (2002). According to both LEPs (Draft and current) aquaculture development is prohibited in these zones. However zoning is not considered to be a hard constraint to development in the context of this report.

The small size of the portion would limit aquaculture development to a hatchery or grow-out facility (tanks). The land is gently to moderately sloped with existing buildings and infrastructure with apparent heritage value. The effect of re-development on the heritage value of the site must be considered before development consent is approved. Discussions with the Council indicate that much of Catherine Hill Bay has intrinsic heritage value.

An alternative option for a land-base lies directly to the south of the coal washing facility on land with an area of approximately 2 hectares. The majority of the portion is levelled land with a number of sheds and a degraded open storage area for coal and workshop materials. Development of the site would most probably be restricted to hatchery or tank-based grow-out system due to the small area available. This land although within a kilometre of the wharf appears to be part of the neighbouring Council area (Wyong Shire), which may complicate any development application.

Access to Catherine Hill Bay is excellent, with the Pacific Highway approximately 1.5 kilometres to the west along good quality sealed road. Provision of amenities is excellent, with three-phase mains power, mains freshwater and telecommunications



Degraded workshop and storage area, Wallarah Colliery, Catherine Hill Bay

Photo: Phil Read

provided to the coal washing facilities and Catherine Hill Bay Community site. Sewerage treatment for Catherine Hill Bay is on-site (septic tank or similar). Proximity to the communities of Swansea, Belmont and Newcastle offers a good source of services, trades and labour.

The north-western margin of Lot 203 is within 200 metres of residential zones of Catherine Hill Bay, with potential line of sight for the southern-most residential blocks. Potential for visual impact is associated with these residential blocks and the access (tourist) road. Development of this site would require a minimum of Level 2 assessment under the Project Profile Analysis of the SAS.

Alternatively, development of the degraded portion to the south may alleviate both the potential for visual impact and issues associated with proximity to residences.

A major residential development has been proposed for the Catherine Hill Bay site and some community concerns have already been expressed.

6.16.2 CATALOGUE OF REMAINING COASTLINE

Table 48. Lake Macquarie City Council – justification of sites having no current potential.

Site	Justification
Leggy Point / Little Redhead Point	No land-base; undeveloped, recreation (Glenrock State Recreation Area); inappropriate slope; elevated pumping; exposed anchorage
South Dudley Beach to Red Head Point	No land-base; undeveloped, environmental (Awabakal Nature Reserve); developed, residential; inappropriate slope; elevated pumping; exposed anchorage
Northern Training Wall, Swansea Channel (Blacksmiths Point)	No land-base; developed, residential, tourist park; water quality issues, estuarine discharge immediate (Lake Macquarie), sewerage effluent < 1km
Southern Training Wall, Swansea Channel / Reids Mistake Head	No land-base; developed, residential, sewerage treatment works; steep cliff; exposed anchorage
The Caves / Stinky Point / Spoon Rocks	No land-base; developed, residential; steep cliffs; elevated pumping; inappropriate slope
Quarries Head to Middle Camp Head	No land-base; undeveloped; exposed anchorage; inappropriate slope; limited access (4wd road >1km)

6.17 WYONG SHIRE COUNCIL

Location:

Central Coast

Population:

135379

Northern Coastal Boundary:

Desoto Inlet, Catherine Hill Bay

Southern Coastal Boundary:

Yumbool Point, Bateau Bay



Coastline:

32 kilometres including 2 long, exposed sand beaches having south-easterly aspect; numerous rock headlands; no estuaries with training walls; no major embayments

Coastal Settlements:

Lake Munmorah, Budgewoi, Toukley, Noraville, Norah Head, The Entrance, Toowoona Bay, Long Jetty and Bateau Bay

Coastal Estuaries:

Tuggerah Lake

6.17.1 CATALOGUE OF WYONG SHIRE COUNCIL COASTLINE

Wyong Shire Council incorporates approximately 32 kilometres of coastline and within this area there are two long beaches (Birdie and Tuggerah). There are numerous potential anchorages however these sites are either constrained by the lack of available land portions within 1 kilometre of suitable anchorages or the exposed nature of the anchorage (see Catalogue of Remaining Coastline).

Catalogue of Remaining Coastline

Table 49. Wyong Shire Council – justification of sites having no current potential.

Site	Justification
Flat Rocks Point / Bongan Head / Snapper Point / Little Bumpy, Big Bumpy, Wybung Head	No land-base; undeveloped, recreation (Munmorah State Recreation Area); steep headlands; inappropriate slope; elevated pumping; limited access; no services <1km
Norah Head	No land-base; developed, residential; elevated pumping
Soldiers Point	No land-base; developed, residential and tourist park; exposed anchorage
Pelican Point	No land-base; undeveloped, environmental (National Park); no access to headland >1km; exposed anchorage
The Entrance Headland / Toowoona Point / Bateau Bay (northern headland)	No land-base; developed, residential and tourist park
Crackneck Point / Yumbul Point	No land-base; developed, residential; undeveloped, environmental (Bateau Bay Flora Reserve); exposed anchorage; elevated pumping

6.18 GOSFORD CITY COUNCIL

Location:

Central Coast

Population:

162213

Northern Coastal Boundary:

Yumbool Point, Bateau Bay

Southern Coastal Boundary:

Middle Head, Pearl Beach



Coastline:

35 kilometres including numerous short sand beaches having southerly to south-easterly aspect; numerous steep rock headlands; no estuaries with training walls; 1 major embayment

Coastal Settlements:

Forresters Beach, Wamberal, Terrigal, Avoca Beach, Copacabana, MacMasters Beach, Killcare Heights, Hardys Bay, Pretty Beach, Wagstaff, Daleys Point, Gosford (Umina, Ettalong Beach, Blackwall) and Pearl Beach

Coastal Estuaries:

Wamberal Lagoon, Terrigal Lagoon, Avoca Lake, Cockrone Lake, and Broken Bay (Brisbane Water, Hawkes River and Pittwater)

6.18 CATALOGUE OF GOSFORD CITY COUNCIL COASTLINE

Gosford City Council incorporates approximately 32 kilometres of oceanic coastline and within this area there are numerous potential anchorages. However, these sites are either constrained by the lack of available land portions within 1 kilometre of suitable anchorages or the exposed nature of the anchorage (see Catalogue of Remaining Coastline).

Catalogue of Remaining Coastline

Table 50. Gosford City Council – justification of sites having no current potential.

Site	Justification
Cromarty Head	No land-base; developed, residential; undeveloped, environmental (Bateau Bay Flora Reserve); exposed anchorage; elevated pumping
Wamberal Point	No land-base; developed, residential; undeveloped, environmental (Wamberal Lagoon Nature Reserve); exposed anchorage; elevated pumping
Broken Head / The Skillion	No land-base; developed, residential and recreational (playing field); steep cliff; elevated pumping
South Avoca Headland / Tudboring Head	No land-base; developed, residential; very steep headland; exposed anchorage; elevated pumping
Maurawaring Point to Gerrin Point	No land-base; developed, residential; undeveloped, environmental (Bouddi National Park); exposed anchorage; steep headland; elevated pumping; estuarine discharge <10km (Broken Bay)
Bouddi Ridge (Tallow Headland, Box Head and Little Box Head)	No land-base; developed, residential; undeveloped, environmental (Bouddi National Park); exposed anchorage; steep headland; elevated pumping; estuarine discharge immediate
Mount Ettalong, Green Point and Middle Head	No land-base; developed, residential; undeveloped, environmental (Brisbane Waters National Park); exposed anchorage; steep headland; elevated pumping; estuarine discharge immediate

6.19 WOLLONGONG CITY COUNCIL

Location:

Illawarra Coast

Population:

188276

Northern Coastal Boundary:

Little Garie Point, Garie Beach

Southern Coastal Boundary:

Berrwarra Point, Windang



Coastline:

50 kilometres consisting of 2 long sand beaches having easterly to south-easterly aspect; numerous small beaches separating grouped rock headlands; no estuary with training walls; no major embayment

Coastal Settlements:

Fernhill, Otford, Helensburgh, Helensburgh West, Stanwell Tops, Stanwell Park, Coalcliff, Clifton, Scarborough, Wombarra, Coledale, Austinmer, Thirroul, Bulli, Woonona, Russellvale, Corrimal, Bellambi, Fernhill, Towradgi, Fairy Meadow, Gwynneville, North Wollongong, West Wollongong, Mangerton, Figtree, Coniston, Unanderra, Cringila, Berkeley, Warrawong, Lake Heights, Port Kembla, Kemblawarra, Primbee and Windang

Coastal Estuaries:

Lake Illawarra

16.19 OUTER HARBOUR, PORT KEMBLA

Site Ranking: **

GPS Position: South 34°28.495' East 150°54.685'

General Description:

Outer Harbour is the eastern most portion of a large commercial shipping harbour associated with Port Kembla Steelworks and other heavy industry. The harbour boasts extensive transport infrastructure and several jetties. Port Kembla is a large industrial centre directly south of Wollongong. Residential development surrounds the Steelworks and harbour industries. Despite the industrial nature of the harbour, the presence of a public boat ramp and an extensive eastern breakwater means the area is subject to moderate usage by recreational fishers and boaters.

Site Assessment

Table 51. Ranking of Primary Criteria for Outer Harbour, Port Kembla.

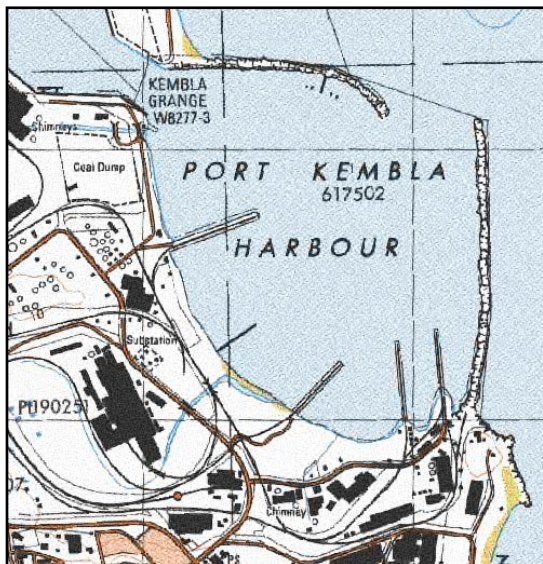
Primary Criteria	Ranking	Comments
Secure seawater intake anchorage	Good	Existing jetty and break-wall structures; pollution and WQ issues
Land-base < 1km from intake point	Excellent	Existing industrial usage

Table 52. Ranking of Secondary Criteria for Outer Harbour, Port Kembla.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Excellent	Immediate
Access to mains freshwater supply	Excellent	Immediate
Access to telecommunications	Excellent	Immediate
Access to suppliers, trade services	Excellent	Immediate
All weather (sealed) road access	Excellent	Immediate
Potential water quality pollutants	Poor	Storm water run-off over Industrial land; Shipping and boating activities; sewerage
Protection from prevailing swells	Excellent	Within eastern breakwater
Pumping head	Excellent	<5m
Size of land portion(s)	Good	2 ha, potential for tank-based hatchery or grow-out
Land status	Good	Cleared industrial land
Land zoning	Excellent	5A (Special Uses – Port) or 4B (heavy industry)
Land topography	Excellent	Potential site is flat
Aesthetic impact	Excellent	Existing industrial development

Site Discussion

The existing jetties (Jetties 3 and 4) in the south-eastern part of the Outer Harbour would provide several secure anchorage options for a seawater intake pipe. Similarly, the Eastern Breakwater adjacent to the jetties would provide a range of anchorage points, with



Port Kembla Harbour Topographic Map
Source: Topoview© 2000

secure anchorage possible along the entire one kilometre length of rock wall. The shipping and boating activities associated with the jetties may compromise water quality by introducing pollutants (petroleum products, antifoulants and bilge water). Situating the anchorage as far north on the breakwater as possible would allow access to better quality water, due to proximity to the harbour mouth and prevailing southerly currents. Further investigations into the Outer Harbours.

Suitable land portions are available within one kilometre of the potential anchorage points discussed. The majority of the land associated with the jetties and breakwater is zoned 5A (Special Uses – Port) or 4B (Heavy Industry). There is no provision for, or exclusion of, aquaculture development within these zones according to Council's LEP.



LEP Zoning Map

Source WCC LEP Maps 1990

The minimum performance criteria of the North Coast Sustainable Aquaculture Strategy identify 4 (Industrial) zones as suitable for tank based aquaculture development. Development of a draft SAS for the Hunter and Central Coast Region has identified a range of Industrial (4) zoning classifications within local council LEPs, some of which prohibit any aquaculture development. Until an SAS for the region is finalised and SEPP 62 is applied to this council area it is uncertain if the development of aquaculture facilities within these zones will be permitted.

Disused portions of land are apparent within both zones, particularly the Special Uses – Port areas. Further investigation is needed to identify any suitable land portion within 1 kilometre of the potential anchorages that may be or may become available.

Unless one of the major companies in the area was to decommission a site at Outer Harbour, aquaculture development would be restricted to the existing cleared land around the jetties.

The maximum cleared block is approximately 2 hectares of 5A (Special Uses – Port) zoned land, adjacent to the west of the jetties. Development of the site would therefore be restricted to a tank-based hatchery or tank-based grow-out system.

Access to Port Kembla Harbour is excellent with sealed roads, shipping and a railway line servicing the harbour. 3-phase mains power, mains freshwater, reticulated sewerage and



Jetty No.3, Outer Harbour Port Kembla, looking north-west towards the steelworks

Photo: Phil Read

telecommunications services are all provided. Access to services, trades and staff is excellent due to the proximity of Lake Illawarra, Port Kembla and Wollongong. Sewerage is discharged approximately 3 kilometres to the north and 3 kilometres to the south at present. However, current construction and development of a new sewerage treatment system with deep-water ocean outfall aims to consolidate the Bellambi, Wollongong and Port Kembla treatment facilities, which currently discharge from shore.

There are few issues associated with adjacent land use at Outer Harbour, due to appropriate zoning and the surrounding industrial developments. A potential issue is visual impact associated with building height. The construction of a new building above a certain height (7.2m in the North Coast SAS) requires a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS (for tank-based development).



Cleared portion of 5A (Special Uses – Port) land adjacent to Jetty No. 3

Photo: Mark Fackerell

6.19.2 CATALOGUE OF REMAINING COASTLINE

Table 53. Wollongong City Council – justification of sites having no current potential.

Site	Justification
Little Garie Point / Thelma Head / Mid Era Point / Semi Detached Point / South End	No land-base; undeveloped, environment (Royal National Park); very steep, inappropriate slope; elevated pumping; exposed anchorage; limited access
Stanwell Park / Coalcliff / Scarborough (Cape Horn)	No land-base; developed, residential; very steep headlands and cliffs; inappropriate slope; elevated pumping; exposed anchorage
Wombarra / Coledale / Brickyard Point / Bells Point / headland series to south of Austinmer	No land-base; developed, residential; steep headlands; inappropriate slope; elevated pumping; exposed anchorage
Bulli Point / Waniora Point / Collins Rock	No land-base; developed, residential; exposed anchorage
Bellambi Point	No land-base; developed, residential, playing field, sewerage treatment works; water quality issues
Sandspit Point / Towradgi Point	No land-base; developed, residential; exposed anchorage
Wollongong Harbour / Flagstaff Point	No land-base; developed, residential, business, harbour facilities, lighthouse
Red Point	No land-base; developed, residential

6.20 SHELLHARBOUR CITY COUNCIL

Location:
Illawarra Coast

Population:
58755

Northern Coastal Boundary:
Berrwarra Point, Windang

Southern Coastal Boundary:
Minnamurra Point, Minnamurra



Coastline:
15 kilometres consisting of 5 short sand beaches having easterly to southerly aspect, separating 4 small rock headlands and one very prominent rock headland; no estuary with training walls; no major embayment

Coastal Settlements:
Lake Illawarra, Warilla, Mount Warrigal, Barrack Heights, Barrack Point, Balarang, Oak Flats, Albion Park Rail, Shellharbour and Dunmore

Coastal Estuaries:
Lake Illawarra and Minnamurra River

6.20.1 BASS POINT

Site Ranking:

GPS Position:

South 34°35.664 East 150°52.849

General Description:

Bass Point is a large rock headland approximately eight kilometres to the south of Lake Illawarra entrance in Shellharbour City Council area, on the Illawarra Coast. The headland extends eastwards several kilometres providing good protection from prevailing southerly swells. Bass Point is predominantly coastal reserve with distant residential development. An operating concrete plant is situated within the coastal reserve area. The residential suburbs of Shellharbour are west of the reserve areas. Residential development also dominates Lake Illawarra, Port Kembla through to Wollongong. The proximity of Bass Point to these highly urbanised areas means that the area is subject to moderate to high recreational usage.

Site Assessment

Table 54. Ranking of Primary Criteria for Bass Point.

Primary Criteria	Ranking	Comments
Secure access to sea water	Excellent	Existing jetty structure with access to deep oceanic water; protected rock shoreline
Land-base < 1km from intake point	Good	Zoning and aesthetic impact issues

Table 55. Ranking of Secondary Criteria for Bass Point.

Secondary Criteria	Ranking	Comments
Access to mains power supply	Excellent	Immediate
Access to mains freshwater supply	Excellent	Immediate
Access to telecommunications	Excellent	Immediate
Access to suppliers, trade services	Excellent	Immediate
All weather (sealed) road access	Excellent	Immediate
Potential water pollutants	Excellent	Urban run-off issues; boat ramp; Minnamurra River discharge < 5km
Protection from prevailing swells	Excellent	Northerly aspect of jetty, headland extends eastwards of site
Pumping head	Good	<20m within 500m radius of jetty
Size of land portion(s)	Good	Total portion >150ha, proportion developed is subject to negotiation
Land status	Good	Cleared reserve with developed portions associated with concrete plant
Land zoning	Good	6A Open Space; 7F2 Coastal Lands
Land topography	Good	Potential site is gently to moderately sloped
Aesthetics	Good	Residents distant to wharf; existing infrastructure and buildings

Site Discussion

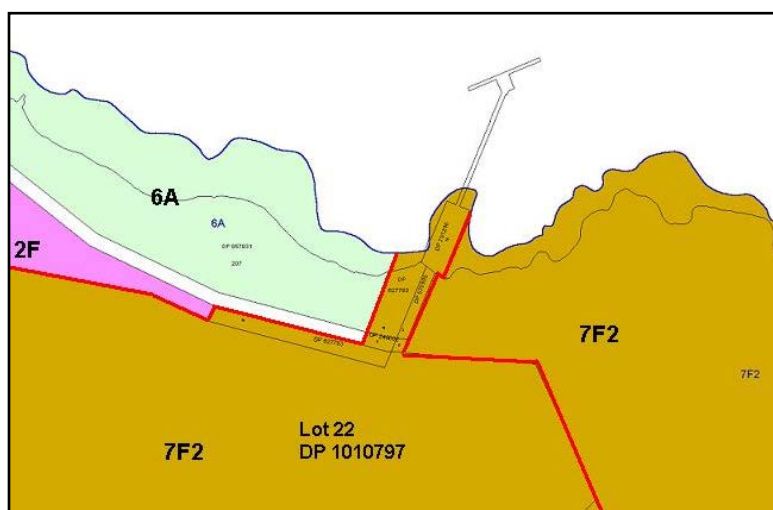
The existing loading wharf on the northern side of Bass Point associated with the quarry and concrete plant (Pioneer Construction Pty Ltd) would provide a suitable seawater intake anchorage point. This option would enable access to deeper water having reliable oceanic-quality. However, investigations into the materials loaded from the jetty, any chemicals used in the concrete plant, frequency of jetty usage and type of vessel using the jetty are required to determine whether concrete plant operations pose a risk to any proposed aquaculture development.



Bass Point Loading Jetty, Shellharbour

Photo: Phil Read

The surrounding foreshore of Bass Point consists of rock outcrops and coarse boulder beaches, which would also provide suitable anchorage for an intake pipe. There was no evidence of sand migration around Bass Point to this area at the time of ground-truthing. Investigations into water quality during extreme weather (large north-easterly swells, high rainfall) need to be undertaken to ensure the intake point is isolated from sand ingress.

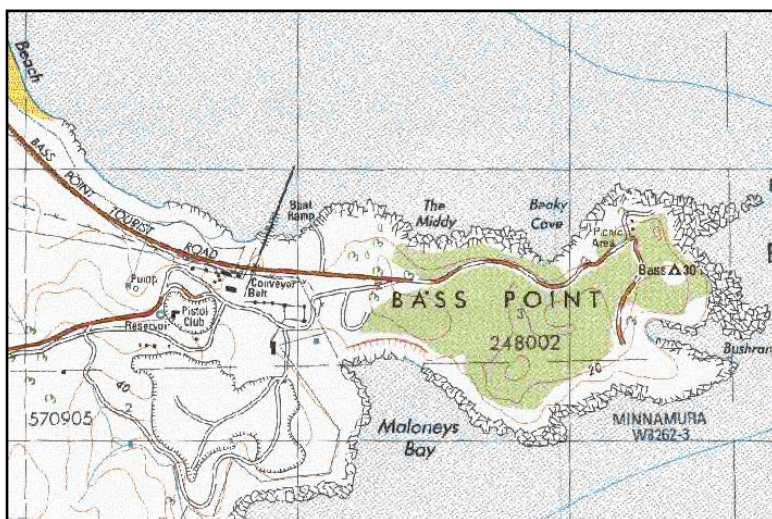


Suitable land portions are available within one kilometre of the potential anchorage points discussed. The majority of the headland is zoned 7(f) 2 Coastal Lands, including the portions associated with the concrete plant (see LEP Mapping of Bass Point). Foreshore areas to the west are zoned 6a Open Space and comprise “The Shallows Reserve”.

Bass Point Bass Point LEP Zoning Map with site outlined in red
Source: SCC LEP Maps 2000

An option for a land-base, leasing any vacant portion of the concrete plant area, should be investigated. The total area of land owned by Pioneer is approximately 160 hectares. Alternatively, a suitable land portion (between 2-5 hectares in size) could be excised from either the 7(f) 2 Coastal Lands zone to the east of the concrete plant or the 6A Open Space zone to the west. The scale of any aquaculture development of the site could vary widely due to the large size of the total land portion. Until further investigations determine the likelihood of leasing a specific sized portion, recommendations on the type and scale of any proposed aquaculture development cannot be made.

The land in the immediate vicinity of the loading wharf is flat to gently sloping. To the east of the loading wharf the slope of the land increases and a height above sea level of 20 metres is reached approximately 500 metres to the east along Bass point Tourist Road (bottom).



Topographic Map

Source: TopoView 2000

Potential water pollutants include: stormwater discharge from surrounding suburbs, discharge from Lake Illawarra, discharge of the Minnamurra River, recreational boating and shipping activities associated with the concrete plant. The discharge of Lake Illawarra is approximately 7 kilometres to the north and prevailing southerly longshore currents would be likely to isolate Bass Point from this source of pollution in all but extreme circumstances.

Minnamurra River discharges approximately 4 kilometres to the south of Bass Point but in contrast to Lake Illawarra the catchment is small and relatively undeveloped. A public boat-ramp, approximately 100 metres to the east of the loading wharf may provide minimal risk of water pollutants associated with recreational boating.



Residential areas overlooking Bass Point in the Distance
Source: DLWC 2000

Access to Bass Point is excellent. Bass Point Tourist Rd, a good quality sealed road, services the concrete plant and Bass Point Reserve to the east. Provision of amenities is excellent, with 3-phase mains power, mains freshwater and telecommunications provided to the plant site. Sewerage reticulation is provided within 500 metres, to the new residential development. The communities of Shellharbour, Lake Illawarra and Port Kembla offer a good source of trade services.

The north-eastern margin of the new residential development is within 400meters of land-bases associated with the concrete plant or land-bases to the west of the plant. Areas to the east of the concrete plant are greater than 400 metres from the new residential development and the existing structures of the concrete plant would provide more immediate visual impact. It should be noted that the limited slope of the land associated with the residential development would limit line-of-sight visual impact to the northernmost rows of houses adjacent to Bass Point Tourist Road. The site is overlooked, albeit from a distance, by established residential areas to the west towards Jamberoo Rd. Development of the site will therefore necessitate a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.20.2 CATALOGUE OF REMAINING COASTLINE

Table 56. Shellharbour City Council – justification of sites having no current potential.

Site	Justification
Barrack Point	No land-base; developed, residential, tourist park, bowling club; exposed anchorage; discharge from small estuary immediate (Little Lake)
Shellharbour (Cowrie Island)	No land-base; developed, residential, recreation (golf course); undeveloped low-lying swamp area
Boston Point, Bass Point to north Minnamurra Beach, Bass Point (including Bushrangers Bay and Maloneys Bay)	Exposed anchorage; steep rock headlands; elevated pumping; conservation area (Grey Nurse Critical Habitat Zone near Bushrangers Bay); some potential land-bases (see previous assessment)

6.21 THE COUNCIL OF THE MUNICIPALITY OF KIAMA

Location:

Illawarra Coast

Population:

19635

Northern Coastal Boundary:

Minnamurra Point, Minnamurra

Southern Coastal Boundary:

Beach Rd Picnic Area, Seven Mile Beach



Coastline:

30 kilometres consisting of a long sand beach having a south-easterly aspect; numerous small rock headlands and small beaches; no estuary with training walls; no major embayment

Coastal Settlements:

Minnamurra, Kiama Downs, Bombo, Kiama, Beachside, Kiama Heights, Werri Beach, Gerringong and Gerroa

Coastal Estuaries:

Minnamurra River, Spring Creek, Munna Munnoro Creek, Werri Lagoon and Crooked River

6.21.1 CATALOGUE OF THE MUNICIPALITY OF KIAMA COASTLINE

The Municipality of Kiama has approximately 30 kilometres of coastline and there are numerous potential anchorage points for an intake pipe. However, these points are either constrained by the lack of available, suitable land portions within 1 kilometre, or the exposed nature of the anchorage (see Catalogue of Remaining Coastline).

Catalogue of Remaining Coastline

Table 57. The Council of the Municipality of Kiama – justification of sites having no current potential.

Site	Justification
Minnamurra Point	No land-base; developed, residential; exposed anchorage; steep cliff; elevated pumping; water quality issues (Minnamurra River immediate)
Cathedral Rocks	No land-base; developed, residential; steep cliff; elevated pumping; southern portion of rocks exposed
Pheasant Point / Blowhole Point (Kiama Harbour)	No land-base; developed, residential, tourism (tourist park, information services and lighthouse), recreation (improved park area)
Church Point / Kendalls Point / Kaleula Head / Marsden Head / Easts Beach (Southern Headland)	No land-base; developed, residential, tourist parks; Steep headlands; inappropriate slope; elevated pumping
Bare Bluff to Red Cliff	No land-base; developed, cleared farmland; steep headlands; inappropriate slope; elevated pumping; limited access across South Coast Railway line
Werri (Gerringong) Headland	No land-base; developed, residential, tourist park; Steep headlands
Gerringong Harbour to Black Head	No land-base; developed, residential, recreation (golf course); steep headlands; inappropriate slope; elevated pumping

6.22 SHOALHAVEN CITY COUNCIL

Location:
Illawarra Coast

Population:
84719

Northern Coastal Boundary:
Beach Road, Seven Mile Beach

Southern Coastal Boundary:
Northern side of Durras Lake Entrance



Coastline:
110 kilometres of predominantly exposed, rocky shore with numerous short beaches having easterly to south-easterly aspects; 2 long beaches with easterly aspect; 2 estuaries with training walls; one major embayment

Coastal Settlements:
Shoalhaven Heads, Greenwell Point, Orient Point, Crookhaven, Culburra, Currarong, Callala Bay, Callala Beach, Woollamia, Huskisson, Vincentia, Hyams Beach, Erowal Bay, St Georges Basin East, Sanctuary Point, Sussex Inlet, Swan Haven, Cudmirrah, Berrara, Bendalong, Manyana, Cunjurong, Lake Conjola, Narrawallee, Mollymook, Milton, Ulladulla, Burrill Lake, Dolphin Point, Tabourie Lake, Termeil, Bawley Point and Kioloa

Coastal Estuaries:
Shoalhaven/Crookhaven River(s), Wollumboola Lake, Carama Creek, Currarong Creek, Callala Creek, Currumbene Creek, Moana Moana Creek, St Georges Basin, Swan Lake, Berrara Creek, Nerrindillah Creek, Conjola Lake, Narrawallee Creek, Burrill Lake, Tabourie Lake, Termeil Lake, Meroo Lake, Willinga Lake and Durras Lake

6.22.1 KINGHORN POINT

Site Ranking: **

GPS Position: South 34° 57.974' East 150° 46.726'

General Description:

Kinghorn Point is a low rock headland approximately 6 kilometres to the north of the township of Currarong within the Shoalhaven City Council area on the Illawarra coast. Proximity to Currarong, Nowra (30 kilometres) and Wollongong (100 kilometres) means that the area is subject to moderate to high recreational usage.

Site Assessment

Table 58. Ranking of Primary Criteria for Kinghorn Point.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Rock platform; exposed, potential impact of sand ingress
Land-base < 1km of intake point	Good	Zoning, Marine Park and aesthetic impact issues

Table 59. Ranking of Secondary Criteria for Kinghorn Point.

Secondary Criteria	Ranking	Comments
Access to mains power	Poor	> 1km from potential land-base
Access to mains freshwater supply	Poor	> 1km from potential land-base
Access to telecommunications	Poor	> 1km from potential land-base
Access to suppliers, trade services	Good	Nowra (30km)
All weather (sealed) road access	Poor	> 1km from potential land-base
Potential water quality pollutants	Good	Sewerage discharge >4km north; sand movement issues
Protection from prevailing swells	Poor	Very exposed platform on long sand beach
Pumping head	Good	<20m
Size of land portion(s)	Excellent	>100ha, integrated development possible
Land status	Good	Mostly undeveloped with cleared portions
Land zoning	Good	Environmental Protection 7(f3) (Foreshores Protection); 7(a) (Ecology)
Land topography	Good	Potential site flat to gently sloped
Aesthetics	Good	Site surrounded by bushland > 3km

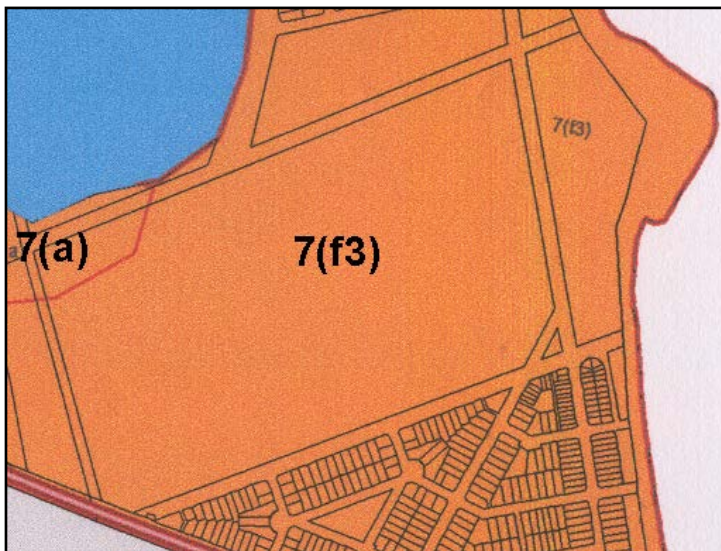
Site Discussion

The rock platform at Kinghorn Point would provide a suitable anchorage point for a seawater intake pipe. Although some protection from direct southerly swells is afforded by Beecroft Head, the rock platform is intertidal and extends less than 100meters from the beach and headland, which affords minimal protection from prevailing swells. The platform is also at the northern end of a long (7kilometres), high-energy beach (Warrain Beach) having east to north-easterly aspect. Further investigation is required into the issue of sand movement around the rock platform and over the rock platform, which may compromise water quality and pumping ability. Other potential water quality issues include discharge from Currarong Creek to the south (7kilometres) and Lake Wollumboola to the north (2kilometres). However, both these sources only discharge intermittently and in the case of Lake Wollumboola, this would normally require manual opening of the entrance (Appendix A). The sewerage discharge from Culburra township discharges approximately 4 kilometres to the north. The impact of these sources of pollution on water quality needs further investigation.



Kinghorn Point rock platform, looking north

Photo: Phil Read



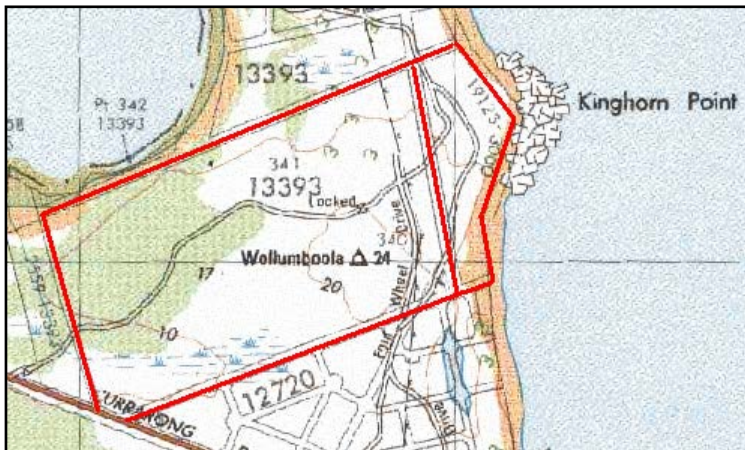
LEP zoning map

Source: Shoalhaven City Council LEP Maps.

There is a potential land-base within 1 kilometre of the specified anchoring point. A largely undeveloped portion of land (Lot 341, DP 13393) with an area totalling over 55 hectares lies within 1 kilometre to the west of the rock platform. The land is currently privately owned and discussions with Council indicate that the owner is amenable to partial development of the area for aquaculture purposes. This land is separated from the beach and rock platform by a narrow strip of land (Lot 339, DP 13393)

totalling over 9 hectares that is owned by the Shoalhaven City Council and could be incorporated into development of Lot 341. Development could therefore include an integrated hatchery and grow-out facility, dependent upon the proportion of Lot 341 that current owners designate for aquaculture development.

Both portions are zoned Environmental Protection 7(f3) (Foreshores Protection) with a small north-west corner of Lot 341 zoned Environmental Protection 7(a) (Ecology). Both land zones prohibit the development of land-based aquaculture under the Council's LEP, however zoning is not considered to be a hard constraint in the context of this report.



Topographic map showing proposed site (outlined in red)
Source: TopoView® 2000

It is worth noting that in previous reports (ICRM 1995), the zoning for this Lot was reported as Rural 1(a) (Agricultural Production), which permits aquaculture development.

The land is flat to gently sloped, with the majority of both portions between 10 and 20 metres above sea-level. Further surveying of the site is required to determine the most appropriate area for pond-based aquaculture development. An area of 20 hectares or more

would be required for pond-based development or development of an integrated tank-based hatchery and grow-out system. Development of an area, less than 10 hectares would limit aquaculture development to a tank-based hatchery or tank-based grow-out facility.

The provision of services to Kinghorn Point is poor. High pressure freshwater mains, mains power and telecommunications lines run along Currarong Road, approximately 1.2 kilometres from potential anchorage on the northern side of the rock platform. Access for this distance is restricted to an existing unsealed road, suitable only for four-wheel drive vehicles. No sewerage reticulation system is provided in proximity to the site. Extension of all services to the proposed area needs further investigation.

The northern side of the rock platform at Kinghorn Point marks the northern boundary of the Jervis Bay Marine Park. The area including the rock platform is part of a Habitat Protection Zone, which prohibits intensive aquaculture development. Low-impact aquaculture (forms which do not use supplementary food to grow the product) such as long-line mussels is permitted, subject to Marine Park Authority approval. This may conflict with any proposed development of the site. It should be noted that the anchorage would in effect be on the boundary of the Marine Park and prevailing currents would carry discharged effluent away to the north in most conditions. Negotiations with the Marine Park Authority are required to determine the likelihood of approval for this site for intensive aquaculture purposes.

Depending on which part of the identified site is developed there may be some potential for visual impact on overlooking residences of Culburra several kilometres to the north. This would require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.22.2 FLAT ROCK BEACH, NORTH BENDALONG

Site Ranking: **

GPS Position: South 35° 14.044' East 150° 31.736'

General Description:

Flat Rock is an intertidal rock platform immediately to the north of North Bendalong village within the Shoalhaven City Council area on the Illawarra coast. Proximity to Bendalong, Mollymook (30 kilometres), Ulladulla (35 kilometres) and Nowra (60 kilometres) means the area is subject to moderate to high recreational usage.

Site Assessment

Table 60. Ranking of Primary Criteria for Flat Rock Beach, North Bendalong.

Primary Criteria	Ranking	Comments
Secure access to high quality, oceanic water	Good	Rock platform; shallow anchorage, exposed, potential impact of sand ingress
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 61. Ranking of Secondary Criteria for Flat Rock Beach, North Bendalong.

Secondary Criteria	Ranking	Comments
Access to mains power	Excellent	Adjacent to site
Access to mains freshwater supply	Excellent	Adjacent to site
Access to telecommunications	Excellent	Adjacent to site
Access to suppliers, trade services	Good	Ulladulla (30km), Nowra (60km)
All weather (sealed) road access	Excellent	Adjacent to site
Potential water quality pollutants	Good	Estuarine discharge (Lake Conjola and Nerrindillah Creek); sewerage; sand ingress
Protection from prevailing swells	Good	Protected from south to south-easterly swells by Red Head (2km south)
Pumping head	Good	<20m
Size of land portion(s)	Good	>5 ha, tank-based development only
Land status	Good	Mostly undeveloped with cleared portions and pipeline easement
Land zoning	Good	Residential 2(e) (Village)
Land topography	Good	Potential site slightly to moderately sloped

Site Discussion

Rock structures at either end of Flat Rock Beach would provide suitable anchorage points for a seawater intake pipe. The rock platform (Flat Rock) to the north of Flat Rock Beach is intertidal and extends less than 100 metres east from the beach. This means that limited protection from prevailing swells is provided by the platform, even if an intake is situated on the northern edge of the platform.

Similarly, the small headland to the south of the beach extends approximately 100 metres east, which affords minimal protection from prevailing swells. Not being intertidal, the headland does provide some limited additional protection when compared to the rock platform, however this anchorage would require an intake pipe several hundred metres longer to service the identified potential land-base. Some protection from southerly and south-easterly swells for both anchorages is afforded by Red Head, approximately 2 kilometres to the south-east.

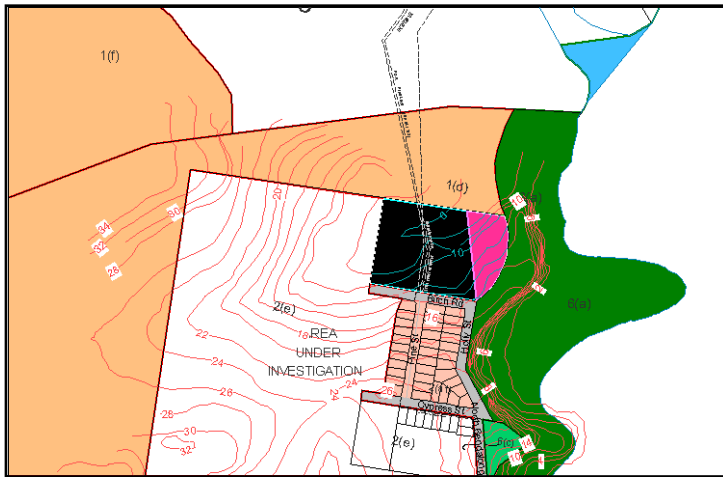


North-eastern edge of Flat Rock, North Bendalong

Photo: Phil Read

The relatively exposed nature of both anchorages and the shallow (<3meters) nature of the anchorage present some risk of contamination with sand and organic debris. Other potential sources of pollution are estuarine and sewerage discharge from Lake Conjola, approximately 6 kilometres to the south and stormwater runoff from the settlements of North Bendalong, Bendalong and Manyana. The intermittently opened Nerrindillah Creek also lies within 500 metres of the anchorage point on the rock platform. Investigations into water quality provided to both potential anchorages in a range of conditions (high rainfall, various swell size and direction) is required to determine whether the anchorages can provide oceanic-quality water in most conditions.

There are potential land-bases within 1 kilometre of the specified anchoring points. A largely undeveloped portion of land directly adjacent to the north and west of North Bendalong village is currently zoned Residential 2(e) (Village) and has an area totalling approximately 30 hectares. The residential zoned land is separated from the ocean by a narrow strip of Open Space 6(a) (Recreation) reserve. Both land zones prohibit the



LEP Zoning Map Flat Rock Beach, North Bendalong showing contour lines and Birch Rd site (filled black)
Source: Shoalhaven City Council LEP Maps

development of land-based aquaculture under the Council's LEP, however zoning is not considered to be a hard constraint in the context of this report.

Development could therefore include an integrated hatchery and grow-out facility, dependent upon a majority of the 2(e) area being rezoned. It should be noted that approximately half this area is greater than 20 metres in height above sea level and moderately sloped. A small portion of this area (approximately 5hectare) immediately to the north of Birch Rd, North Bendalong has been

identified as a more appropriately scaled and positioned land-base alternative by Council and the authors. Development of this portion alone would limit development to tank-based aquaculture.

A steep cliff up to 25 metres above sea level runs to the east of the site within the adjacent 6(a) Open Space area. This is mentioned as problematic when the site was identified previously (ICRM 1995). However the pumping head can be reduced by constructing the pipeline to the north of the highest point of the cliff. This would require a diversion of approximately 100 metres to achieve a pumping head of approximately 15 metres, which is similar to the highest portion of the identified site, otherwise direct drilling could be used to access the lower areas behind the cliff without diverting the pipeline.



Topographic map Flat Rock Beach

Source: TopoView® 2000

Alternatively, several hundred hectares of Rural 1(d) (General) and Rural 1(f) (Forest) zoned land surrounds the Residential 2(e) (Village) area. However, the slope of the land and the distance and height of pumping from the intake make development of this land for aquaculture purposes more difficult and less appropriate. It is worth noting that in previous reports (ICRM 1995) the zoning for this Lot was reported as Rural 1(a) (Agricultural Production), which permits aquaculture development.

The land is flat to moderately sloped, with the majority of both portions between 10 and 20 metres above sea level. Further surveying of the site is required to determine the most appropriate area for pond-based aquaculture development. An area of 20 hectares or more would be required for pond-based development or development of an integrated tank-based hatchery and grow-out system. Development of an area, less than 10 hectares

would limit aquaculture development to a tank-based hatchery or tank-based grow-out facility.

The provision of services to the Flat Rock site is excellent. Easements for a high-pressure freshwater mains (Ulladulla/Milton main supply) and a reticulated mains power associated with North Bendalong village run through the identified portion north of Birch Road. A good quality sealed road also forms the southern boundary of the identified area. A rough unsealed road follows the easement through the site and the neighbouring Cudmirrah National Park to Nerrindilla Creek.

The area currently relies on on-site sewerage treatment (septic or similar). However, there is a draft management plan to provide reticulated sewerage to North Bendalong, Bendalong and Manyana, with a treatment plant to the south of Bendalong Road and a pipeline discharging in a dune exfiltration area on the southern side of Lake Conjola inlet. This may present some water quality risk that requires further consultation with Shoalhaven Water and the Council. Part of this plan is to situate a Wastewater Pumping Station (WwPS) in North Bendalong to transfer wastewater to the proposed treatment plant on Bendalong Road. The positioning of the WwPS at this stage is at the southern end of the identified block on the intersection of Birch Road and the easement for mains water. This is on the high side of the block and more appropriate positioning of the WwPS for any proposed aquaculture development will require immediate negotiations with Council to amend the draft plan.

Development of the site has the potential for visual impact on several overlooking residences of North Bendalong village, which are also in close proximity (<200m for tank-based development). This site would therefore require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.22.3 INYADDA POINT, MANYANA

Site Ranking: **

GPS Position: South 35° 15.297' East 150° 31.573'

General Description:

Inyadda Point is a prominent rocky headland with high cliffs forming the eastern portion of Manyana village within the Shoalhaven City Council area on the Illawarra coast. Below the cliffs on the northern side a boulder beach and reef extends for several hundred metres before Inyadda Beach continues as sand. Proximity to Manyana, Mollymook (30 kilometres), Ulladulla (35 kilometres) and Nowra (60 kilometres) means the area is subject to moderate to high recreational usage.

Site Assessment

Table 62. Ranking of Primary Criteria for Inyadda Point, Manyana.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Rock boulder beach and reef; exposed, potential impact of sand ingress
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 63. Ranking of Secondary Criteria for Inyadda Point, Manyana.

Secondary Criteria	Ranking	Comments
Access to mains power	Excellent	Adjacent to site
Access to mains freshwater supply	Excellent	Adjacent to site
Access to telecommunications	Excellent	Adjacent to site
Access to suppliers, trade services	Good	Ulladulla (30km), Nowra (60km)
All weather (sealed) road access	Excellent	Adjacent to site
Potential water quality pollutants	Good	Estuarine discharge (Lake Conjola); sewerage; sand ingress
Protection from prevailing swells	Poor	Protected from due southerly swells only
Pumping head	Good	<20m (for most of site)
Size of land portion(s)	Excellent	>60 ha, integrated development potential
Land status	Good	Mostly undeveloped with cleared portions
Land zoning	Good	Residential 2(a2) and 2(c); Open space 6(a) and 6(b)
Land topography	Good	Potential site slightly to moderately sloped
Aesthetics	Poor	Nearby residences; lower elevation

Site Discussion

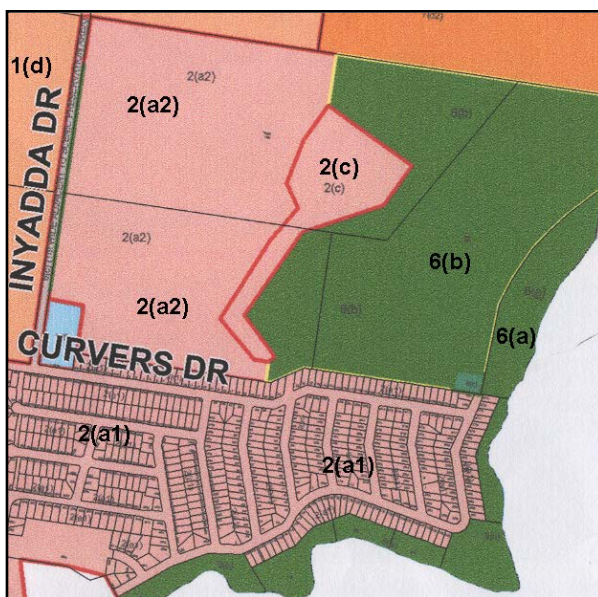
The boulder beach and reef adjacent to Inyadda Point on the northern side would provide suitable anchorage points for a seawater intake pipe. A pipeline to the north along Inyadda beach for several hundred metres is required to avoid the cliff face of the headland, before the pipeline turns west to access the land-base.



The northern side of Inyadda Point, showing extensive reefs and boulder beach

Photo: Phil Read

Inyadda Point has a south-easterly aspect, meaning that even the northern face of the headland is relatively exposed to prevailing swells. The relatively exposed and shallow (<3meters) nature of the anchorage presents some risk of contamination with sand and organic debris, despite suitable anchorage. Other potential sources of pollution are estuarine and sewerage discharge from Lake Conjola, less than two kilometres to the south and stormwater runoff from the settlements of Manyana, Cunjurong Point and Berringer Lake.

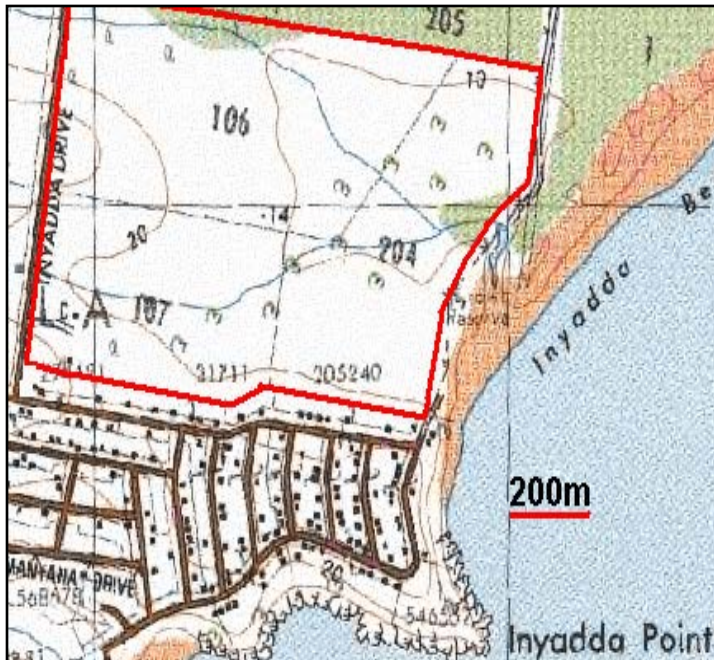


LEP Zoning Map Inyadda Point
Source: Shoalhaven City Council LEP Maps

Investigation into the water quality provided to the potential reef anchorages in a range of conditions (high rainfall, various swell size and direction) is required to determine whether the anchorage can provide oceanic-quality water in most conditions.

There are potential land-bases within 1 kilometre of the specified anchoring points. As reported previously (ICRM 1995) a large undeveloped land area of more than 60 hectares lies adjacent to the north of Manyana village. The area is under various zoning. The eastern portions are zoned either Open Space 6(a) Recreation (Existing) or 6(b) Recreation (Private) and the western portions of all current zones prohibit the development of

land-based aquaculture under the Council's LEP, however zoning is not considered to be a hard constraint in the context of this report.



Topographic Map Inyadda Point
Source: Topoview© 2000

Development could therefore include an integrated hatchery and grow-out facility, dependent upon the majority of all portions being rezoned. It should be noted that some parts of the western portions are more than 20 metres above sea level. A small proportion of this area (<10 hectares), would be easier to re-zone and develop, by avoiding areas requiring elevated pumping (>20meters AHD) and any low-lying areas associated with a small creek running through the portions. Buffer zones around existing residential areas and the creek further restrict the proportion of the total area available for development. An area of less than 10 hectares is restricted to development of a hatchery or tank-based grow-out facility.

The land is flat to moderately sloped, with the majority of the area less than 20 metres above sea level. Further surveying of the site is required to determine the most appropriate area for aquaculture development.

The provision of services to the site is excellent. Mains freshwater, mains power (3-phase) and telecommunications services associated with Manyana village are adjacent to the site. A power easement and an associated unsealed road also run through the eastern portion of the block, connecting Manyana and Bendalong villages.



South-eastern portion of potential land-base; note small car park, toilet block and three-phase power lines

A good quality sealed road (Inyadda Drive) forms the western boundary of the identified area and another (Curvers Drive) runs parallel to the southern boundary, with a row of existing residences between. The area currently relies on on-site sewerage treatment (septic or similar). However, there is a draft management plan to provide reticulated sewerage to North Bendalong, Bendalong and Manyana, with a treatment plant to the south of Bendalong Rd and a pipeline discharging into a dune exfiltration area on the southern side of Lake Conjola inlet. This may present some water quality risk that requires further consultation with Shoalhaven Water and the Council.

Development of the site has potential for major visual impact on many overlooking residences of Manyana village, which are also in close proximity (<200m for tank-based development). This site would therefore require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.22.4 SHELLY POINT, KIOLOA

Site Ranking: **

GPS Position: South 35° 32.348 East 150° 23.134'

General Description:

Shelly Point is a rocky headland with south-easterly aspect approximately 2 kilometres north of Kioloa village within the Shoalhaven City Council area on the Illawarra coast. Proximity to Nowra (100 kilometres), Mollymook (38 kilometres), Ulladulla (33 kilometres) and Batemans Bay (44kilometres) means that the area is subject to moderate to high recreational usage.

Site Assessment

Table 64. Ranking of Primary Criteria for Shelly Point, Kioloa.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Rock headland with boulder beach; exposed, potential impact of sand ingress
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 65. Ranking of Secondary Criteria for Shelly Point, Kioloa.

Secondary Criteria	Ranking	Comments
Access to mains power	Excellent	Adjacent to site
Access to mains freshwater supply	Excellent	Adjacent to site
Access to telecommunications	Excellent	Adjacent to site
Access to suppliers, trade services	Good	Ulladulla (33km), Batemans Bay (44km)
All weather (sealed) road access	Excellent	Adjacent to site
Potential water quality pollutants	Good	Estuarine discharge (Durras lake <10km); sand ingress; stormwater from village
Protection from prevailing swells	Poor	Protected from due southerly swells only
Pumping head	Good	<20m
Size of land portion(s)	Excellent	>30 ha, (area of site within 1km of anchorage) integrated development potential (hatchery and tanks)
Land status	Good	Mostly cleared farmland

6.22.5 O'HARA HEAD, KIOLOA

Site Ranking: **

GPS Position: South 35° 33.499' East 150° 22.995'

General Description:

O'Hara Head is a prominent rocky headland due east of Kioloa village within the Shoalhaven City Council area on the Illawarra coast. Proximity to Nowra (100 kilometres), Mollymook (38 kilometres), Ulladulla (33kilometres) and Batemans Bay (44 kilometres) means the area is subject to moderate to high recreational usage.

Site Assessment

Table 66. Ranking of Primary Criteria for O'Hara Head, Kioloa.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Rock headland and boulder beach; potential impact of boating activities on water quality
Land-base < 1km of intake point	Good	Aesthetic impact issues

Table 67. Ranking of Secondary Criteria for O'Hara Head, Kioloa.

Secondary Criteria	Ranking	Comments
Access to mains power	Excellent	Adjacent to site
Access to mains freshwater supply	Excellent	Adjacent to site
Access to telecommunications	Excellent	Adjacent to site
Access to suppliers, trade services	Good	Ulladulla (35km), Batemans Bay (45km)
All weather (sealed) road access	Excellent	Adjacent to site
Potential water quality pollutants	Good	Estuarine discharge (Durras lake <10km); boating activities; stormwater from village
Protection from prevailing swells	Poor	Protected from due southerly swells only
Pumping head	Good	<20m
Size of land portion(s)	Good	10 ha hatchery or tank-based growout
Land status	Good	Cleared, undeveloped
Land zoning	Good	Vacant Crown Land (V)
Land topography	Good	Identified site is flat

Site Discussion

The boulder beach and reefs adjacent to Kioloa boat ramp on the northern side of O'Hara would provide suitable anchorage points for a seawater intake pipe. The Head provides protection from southerly to east-south-easterly swells. Both Belowla and Brush Islands also provide some protection from north-easterly swells to the north.

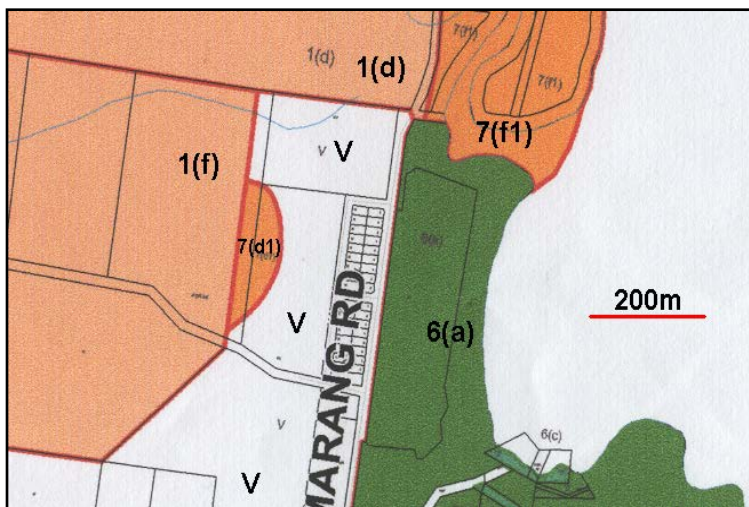
Potential sources of pollution include boating activities associated with the ramp (petroleum spillages etc), estuarine discharge from Durras Lake, less than 10 kilometres to the south and stormwater runoff from Kioloa settlement.



Boulder rock platform, Kioloa boat ramp

Photo: Phil Read

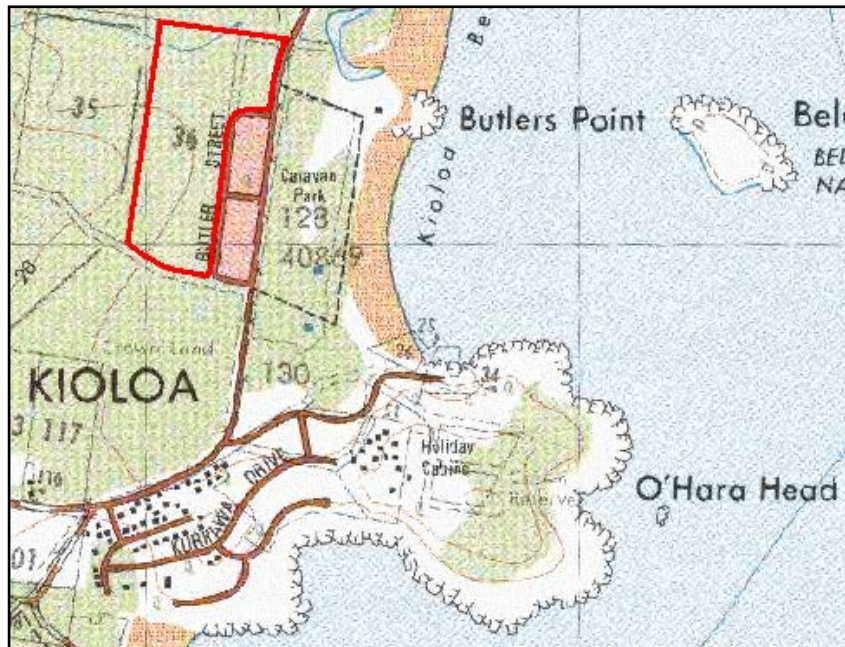
Investigation into the water quality provided to the potential anchorage under various conditions (high ramp usage, high rainfall, various swell size and direction) is required to determine whether the anchorage can provide oceanic-quality water in most conditions.



LEP Zoning Map Ohara Head
Source : Shoalhaven City Council LEP Maps

There is a potential land-base within 1 kilometre of the specified anchoring point. As reported previously (Butler St site, ICRM 1995) an area of vacant crown land under ownership of the Batemans Bay Aboriginal Land Council (BBALC) lies approximately 600 metres to the north-west of the boat ramp. However it should be noted that any easement for a pipeline would need to follow the existing sealed roads to the site. This would increase the pumping distance to between 1 kilometre and 1.5 kilometres,

depending on which end of the portion is developed. This undeveloped land area of approximately 10 hectares lies between Murramarang National Park to the west and overlooking residential blocks (despite Vacant Crown - (V) zoning) to the east. The previously identified ANU site is adjacent to the north). The area is zoned Vacant Crown (V) on LEP maps, which does not specifically prohibit aquaculture development. Any unspecified usage of this land requires development consent.



Topographic map O'Hara Head

Source: TopoView® 2000

Development of the site is restricted to a hatchery or tank-based grow-out facility due a portion size of approximately 10 hectares.

The land is flat to slightly sloped moderately sloped.

The provision of services to the site is excellent. Mains freshwater, mains power and telecommunications services associated with Kioloa village are adjacent to the site on Murramurung Road and Butler Street, both sealed roads. The area currently relies on on-site sewerage treatment (septic or similar).

Development of the site has potential for visual impact on overlooking residences of Kioloa village, which are also in close proximity (<200meters for tank-based development). This site would therefore require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.22.6 CATALOGUE OF REMAINING COASTLINE

Several additional sites were identified for final feasibility analysis in a previous report (ICRM 1995). The sites are: Red Point, Callala; Myola; Woolamia-Huskisson and Murrays Beach. Please see table below for details.

Table 68. Shoalhaven City Council – justification of sites having no current potential.

Site	Justification
Crookhaven Heads	No land-base; high cliffs; steep narrow headland; developed residential; major estuarine discharge
Penguin Head	No land-base; high cliffs; steep narrow headland; developed residential; major estuarine discharge
Hammerhead Point	Exposed anchorage; inappropriate zoning (NP); Jervis Bay Marine Park Sanctuary Zone
Beecroft Peninsula (including Whale Point to Green Point)	No land-base; undeveloped, environmental (Abrahams Bosom Reserve, Currarong Flora Park) special uses (Beecroft Gunnery Range); Commonwealth Territory; Jervis Bay Marine Park (surrounding)
Callala Point	No land-base: developed, residential; Jervis Bay Marine Park (surrounding) estuarine influences
Red Point, Callala	No land-base; undeveloped, environmental (Jervis Bay National Park); Jervis Bay Marine Park (surrounding)
Myola	Inappropriate anchorage; developed (residential); Jervis Bay Marine Park (surrounding); estuarine influences
Woolamia - Huskisson	Developed, residential; Jervis Bay Marine Park (surrounding); estuarine influences;
Plantation Point	No land-base; developed, residential; Jervis Bay Marine Park (surrounding)
Hyams Point	No land-base; developed, residential; inappropriate slope; Jervis Bay Marine Park (surrounding)
Captains Point	HMAS Creswell, Commonwealth Territory; security and access issues; Jervis Bay Marine Park (surrounding)
Bristols Point to Hole-In-The-Wall	Commonwealth Territory; undeveloped; inappropriate zoning (Jervis Bay National Park); remote from services and labour force; Jervis Bay Marine Park (surrounding)
Murrays Beach	Commonwealth Territory; undeveloped; inappropriate zoning (Jervis Bay National Park); remote from services and labour force; Jervis Bay Marine Park (surrounding)
Governors Head to Ryans Swamp (headland)	Commonwealth Territory; undeveloped; inappropriate zoning (Jervis Bay National Park); remote from services and labour force; Jervis Bay Marine Park (surrounding)
Sussex Inlet (headland)	No land-base; inappropriate slope; exposed anchorage; estuarine influences; limited access to services
Berrara Headland	No land-base; developed, residential; undeveloped, environmental (Cudmirra Nature Reserve); exposed anchorage; steep headland
Red Head, Bandalong	No land-base: developed, residential, tourism: steep headland; elevated pumping
Cunjurong Point	No land-base; developed, residential, tourism; exposed anchorage; estuarine influences
Buckleys Point	Exposed anchorage; undeveloped, environmental (Narrawallee Reserve); limited access; no services
Narrawallee Head	No land-base; developed, residential; steep headland; estuarine influences; exposed anchorage
Bannister Point to Warden Head, Ulladulla	No land-base; developed, residential; steep headland; elevated pumping
Racecourse Beach Headland	Exposed anchorage; no land-base; developed residential; elevated pumping; sewerage effluent discharge immediate

Table 68. (continued). Shoalhaven City Council – justification of sites having no current potential.

Site	Justification
Dolphin Point	Exposed anchorage; no land-base; developed residential; elevated pumping; steep cliff
Lagoon Head	Exposed anchorage; no land-base; undeveloped, environmental protection; elevated pumping; limited access; no services
Crampton Island (Tabourie Point)	Restricted access (tidal sand spit to anchorage); developed, residential, tourism; estuarine influences
Stokes Island, Termeil Point, Meroo Head, Nuggan Point	Limited access; no services; undeveloped, environmental (Meroo National Park); exposed anchorages
Willinga Point to Bull Pup Point	No land-base; developed, residential; undeveloped, cultural (Bull Pup Beach Aboriginal Reserve)
Snapper Point	No land-base; developed, residential, tourism; steep headland; elevated pumping; exposed anchorage
Pretty Beach to Depot Beach	Limited access; no services; undeveloped, environmental (Murramarang National Park); inappropriate slope; elevated pumping; exposed anchorages

6.23 EUROBODALLA SHIRE COUNCIL

Location:
South Coast

Population:
32338

Northern Coastal Boundary:
Northern side of the Durras Lake entrance, Durras North

Southern Coastal Boundary:
Southern end of Wallaga Beach



Coastline:
100 kilometres characterised by extensive lengths of steep rocky shoreline, with short sand or boulder beaches; several medium length exposed sand beaches with south to south-easterly aspect; 3 estuaries with training walls; 1 major embayment

Coastal Settlements:
Durras North, Tranquility Bay, Maloneys Flat, Long Beach, Surfside, Batemans Bay, Catalina Heights, Batehaven, Denhams Beach, Lilli Pilli, Malua Bay, Rosedale, Tomakin, Mossy Point, Broulee, Moruya, Moruya Heads, Congo, Maringo, Tuross Head, Potato Point, Dalmeny, Kianga, Narooma, Mystery Bay, Central Tilba, Tilba Tilba and Akolele

Coastal Estuaries:
Durras, Cullendulla Creek, Clyde River, Joes Creek Tomaga River, Candlagan Creek, Moruya River, Congo Creek, Meringo Creek, Coila Lake, Tuross Lake, Lake Tourourga, Lake Brou, Lake Mummuga, Lake Kianga, Wagonga Inlet, Little Lake, Bullengella, Nangudga, Corunna Lake, Tilba Tilba Lake, Little Lake, and Wallaga Lake

6.23.1 Bingie Bingie Point

Site Ranking: **

GPS Position: South 36° 00.621' East 150° 09.642'

General Description:

Bingie Bingie Point is a prominent rock headland 5 kilometres north of the community of Tuross Heads within the Eurobodalla Shire Council area on the south coast. The area is relatively isolated with the closest township by road at Moruya and Tuross Head, both approximately 15 kilometres distance. The surrounding land-use is a mixture of segments of Eurobodalla National Park, coastal reserves and rural properties. The small rural communities of Meringo and Bergalia are 6 kilometres by road to the north-west and north respectively. Proximity to Moruya (15kilometres), Batemans Bay (45 kilometres), Tuross Head (15 kilometres) and Narooma (40 kilometres) means that the area is subject to moderate recreational usage.

Site Assessment

Table 69. Ranking of Primary Criteria for Bingie Bingie Point.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Good	Southern rocky headland; potential water quality issues (estuarine discharge)
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 70. Ranking of Secondary Criteria for Bingie Bingie Point.

Secondary Criteria	Ranking	Comments
Access to mains power	Good	< 1km from potential land-base
Access to mains freshwater supply	Good	< 1km from potential land-base
Access to telecommunications	Excellent	Immediate
Access to suppliers, trade services	Good	Moruya (15km), Batemans Bay (45km), Tuross Head (15km) and Narooma (40 km)
All weather (sealed) road access	Excellent	Adjacent to site
Potential water quality pollutants	Good	Coila Lake (<5km), Tuross Lake (<7km) discharge; urban runoff Tuross head (<5km); sewerage works (<2km)
Protection from prevailing swells	Good	Protected from southerly to E-SE swells
Pumping head	Poor	10 - 50m
Size of land portion(s)	Excellent	>30 ha, integrated development possible
Land status	Excellent	Cleared farmland
Land zoning	Good	Environmental Protection 7(f1)
Land topography	Poor	Slope of land moderate to high (7-15%)

Site Discussion

The rock reefs and headland of Bingie Bingie Point would provide a number of suitable anchorage points for an intake pipe. The point extends approximately 400 metres in a due easterly direction from the beach berms on either side, providing good protection from prevailing swells from the south and south-east.

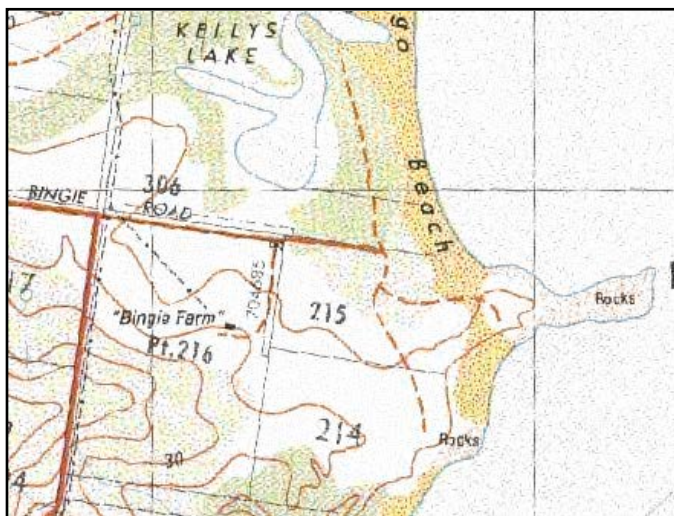
Potential water quality pollutants include estuarine discharge from Coila Lake (<5kilometres south) and Tuross Lake (<7kilometres south) and urban run-off from Tuross Head, which forms a narrow peninsular between the two lakes.



Bingie Bingie Point, viewed from Mullimburra Point

Photo: Phil Read

Sewerage from Tuross Head is discharged to a sand exfiltration site approximately 2.2 kilometres to the south-west behind Bingie Beach. Groundwater around the effluent disposal area was monitored to detect any change in quality or level up until 1997 and an environmental study within Coila Lake (2002) also monitored key parameters including faecal coliforms. Results indicate that sewerage effluent discharges are effectively isolated from the surface waters and pose a limited risk to water quality for any development.



Topographic Map Bingie Bingie Point
Source: TopoView® 2000

There is a potential land-base within 1 kilometre of the specified anchoring point. A rural property called Bingie Farm (Lot 216 DP 723413) lies approximately 700 metres to the west of the potential intake anchorage. The portion is approximately 32 hectares in size however the majority of the southern part of the farm has inappropriate slope (>15%) for tank and pond development. An area of approximately 10 hectares on the northern portion of the block adjacent to Bingie Road has more appropriate slope and would be more suitable for development.

Some terracing of the area would be required for development to occur. In consideration of the available area and the slope, development would be limited to tank-based development. A small number of ponds associated with hatchery development would be possible, however construction costs may be high. Appropriate slope and geotechnical consultation would need to be sought to ensure secure construction of ponds on the site is possible. The portion consists of cleared farmland, with unimproved pasture and several small buildings.



LEP zoning map and topographic map, showing proposed site (outlined in red)

Source: Eurobodalla Shire Council LEP Maps

Alternatively the two blocks of land to the east of Bingie Farm and adjacent to Bingie Point total approximately 30 hectares and have more appropriate slope but development would have greater visual impact due to removal of extensive areas of coastal vegetation. These blocks (Lots 214 and 215) and Bingie farm (Lot 216) are zoned Environmental Protection 7(f2) and 7F1 respectively, neither of which refer specifically to aquaculture as an allowable or prohibited development. Zoning is not considered to be a hard constraint in the context of this report.

Further investigations into the contours of the portion are required to determine how much of these portions are suitable for development. Development of an area, less than 10 hectares would limit aquaculture development to a tank-based hatchery or grow-out facility.

The provision of services to Bingie Bingie Point is good. Sealed road access, telecommunications and 3-phase mains power are supplied to approximately 1.4 kilometres from the potential anchorage point, along the road serving as the western boundary of Bingie Farm. Bingie Farm is supplied with 2-phase mains power only. Mains freshwater and reticulated sewerage are also supplied to western margin of the site, servicing the Tuross Heads Sewerage Scheme. Extension of these services for less than a kilometre to the alternative land-base to the east of Bingie Farm needs further investigation. An existing good quality gravel road provides access to Bingie Bingie Point and would allow development of an easement for a pipeline with minimal impact on the surrounding coastal vegetation.

The isolation of the site means that the potential for visual impact is limited to a small number of rural properties to the north-west and west. Development of the site will require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

Estuarine sites

Sites within the Moruya River estuary may be suitable for the culture of more euryhaline species, particularly for the grow-out phase of production. Mapping under the Draft Sustainable Aquaculture Strategy (SAS) for the area has not been completed. Once completed, maps will depict areas regarded as suitable under Tier 1 of the SAS Project Profile Analysis (Appendix C).

During the survey, land on the northern side of the estuary near Moruya Aerodrome and Garlandtown was noted as having a number of suitable attributes for aquaculture development, including good road access and provision of services, reasonable proximity (within several kilometres) to the ocean and appropriate topography. However, further investigation of estuarine areas was not performed as part of this survey.

6.23.2 CATALOGUE OF REMAINING COASTLINE

Table 71. Eurobodalla Shire Council – justification of sites having no current potential.

Site	Justification
Point Upright	Limited access and services; no land-base; undeveloped (Murramarang National Park); developed, residential (Durras North); exposed anchorage; inappropriate slope; elevated pumping
Beagle Bay (Durras Head)	No land-base; developed, residential; low-lying swamp area to west; inappropriate slope
Mill Point to Reef Point	Limited access and services; no land-base; undeveloped (Murramarang National Park); limited access; exposed anchorage; inappropriate slope; elevated pumping
Acheron Ledge to Square Head (Batemans Bay)	No land-base; developed, residential; steep headlands; inappropriate slope; low-lying swampy areas (Maloney's Flat, Cullendulla Creek); exposed anchorage
Observation Head (Batemans Bay) to Broulee Island	No land-base; developed, residential and tourism; steep headlands; inappropriate slope; elevated pumping
Toragy Point, Moruya Heads	No land-base; developed, residential; coastguard and weather station; steep headland; inappropriate slope; elevated pumping
Pedra Point	Exposed anchorage; no land-base, undeveloped (Eurobodalla National Park); limited services
Congo Point	No land-base; developed, residential; undeveloped (Eurobodalla National Park); limited services and access
Mullimburra Point	No land-base; developed, residential; undeveloped (Eurobodalla National Park); inappropriate slope; elevated pumping; limited services and access
Tuross Head (including Tarandore Point and Boogumgoridge Point)	No land-base; developed, residential and tourism; steep headland; elevated pumping; estuarine influences
Blackfellows Point, Jabbarah Point	No land-base; developed, tourism; undeveloped (Eurobodalla National Park); inappropriate slope; elevated pumping; limited access and services
Potato Point	No land-base; developed, residential; undeveloped (Eurobodalla National Park); inappropriate slope; elevated pumping
Jemisons Point	No land-base; developed, residential; undeveloped (Eurobodalla National Park); inappropriate slope; elevated pumping; limited services and access
Mummuga Head to Duesburys Point (Dalmeny)	No land-base; developed, residential; inappropriate slope; elevated pumping; limited services and access
Kianga Point	No land-base; developed, residential; inappropriate slope; elevated pumping; limited services and access; exposed anchorage; estuarine influences
Wagonga Head, Wagonga Break Walls	No land-base; developed, residential and recreational (golf course); exposed anchorage; steep headland; elevated pumping
Glasshouse Rocks	Private access only, not visited; steep cliffs; elevated pumping; exposed anchorage
Barunga Point	No land-base; developed, aircraft landing strip; undeveloped (Eurobodalla National Park); steep cliff; elevated pumping; limited services
Bogola Head	No land-base; developed, aircraft landing strip; undeveloped (Eurobodalla National Park); steep cliff; elevated pumping; limited access and services
Corunna Point	Private access only, not visited; exposed anchorage; steep headland; developed, rural; inappropriate slope

Table 71. (continued) Eurobodalla Shire Council – justification of sites having no current potential.

Site	Justification
Boat Harbour Point to Cape Dromedary	No land-base; developed, residential; undeveloped, environmental protection (Eurobodalla National Park and coastal reserve); exposed anchorage; steep cliff

6.24 BEGA VALLEY SHIRE COUNCIL

Location:

South Coast

Population:

29257

Northern Coastal Boundary:

Southern end of Wallaga Beach

Southern Coastal Boundary:

Cape Howe, NSW - Victorian Border



Coastline:

110 kilometres characterised by extensive lengths of steep rocky shoreline, with short sand or boulder beaches; several medium length exposed sand beaches having easterly to south-easterly aspect; 1 estuary with training walls; 1 major embayment

Coastal Settlements:

Wallaga Lake Heights, Beauty Point, Bermagui, Tanja, Bega, Jellat Jellat, Tathra, Wolumla, Tura Beach, Merimbula, Pambula, Pambula Beach, Lochiel, Eden, Boydtown, Kiah, Edrom and Wonboyn

Coastal Estuaries:

Wallaga Lake, Bermagui River, Barragoot Lake, Cuttagee Lake, Murrah Lagoon, Bunga Lagoon, Wapengo Lake, Middle Lagoon, Nelson Lagoon, Bega River, Wallagoot Lake, Bondi Lake, Bournda Lagoon, Merimbula Lake, Pambula Lake, Curalo Lagoon, Cocora Lagoon, Nullica River, Towamba River, Fisheries Creek, Saltwater Creek, Woodburn Creek, Wonboyn River, Merrica Creek, Wirra Birra Creek, Table Creek, Little Creek, Nadgee River/Wombal Creek and Nadgee Lake

6.24.1 CAMEL ROCK

Site Ranking: *

GPS Position: South 36° 22.592' East 150° 04.444'

General Description:

Camel Rock is one of a group of rocks associated with a recessed rock headland 5 kilometres north of the township of Bermagui within the Bega Valley Shire Council area on the south coast. Proximity to Bermagui, Cobargo (25 kilometres) and Narooma (35 kilometres) means that the area is subject to moderate recreational usage.

Site Assessment

Table 72. Ranking of Primary Criteria for Camel Rock.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Poor	Camel Rock and submerged reefs; potential water quality issues (sand and organic debris)
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 73. Ranking of Secondary Criteria for Camel Rock.

Secondary Criteria	Ranking	Comments
Access to mains power	Excellent	Adjacent to potential land-base
Access to mains freshwater supply	Excellent	Adjacent to potential land-base
Access to telecommunications	Excellent	Adjacent to potential land-base
Access to suppliers, trade services	Good	Bermagui (5km), Cobargo (25km) and Narooma (35km)
All weather (sealed) road access	Excellent	Adjacent to potential land-base
Potential water quality pollutants	Good	Wallaga Lake (<2km), Bermagui River (5km); sewerage works (<8km)
Protection from prevailing swells	Poor	Exposed anchorage, minimal protection afforded by rocks
Pumping head	Good	10 - 25m
Size of land portion(s)	Good	>30 ha, integrated development possible
Land status	Excellent	Cleared farmland
Land zoning	Good	Environmental Protection 7(f1) and 7(f2)
Land topography	Good	Slope of land slight to moderate (<6%)

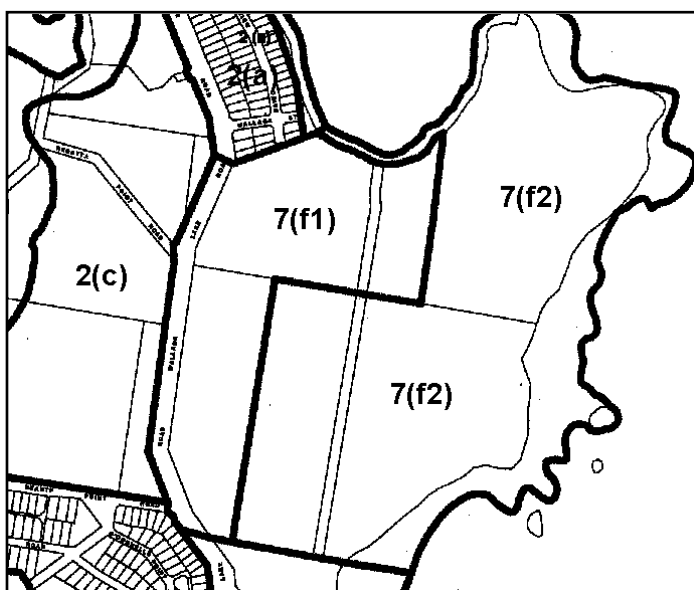
Site Discussion

Camel Rock and associated rock reefs would provide a number of suitable anchorage points for an intake pipe. However the site is very exposed with minimal protection from prevailing swells afforded by the rocks. The anchorage is also at the northern end of approximately 5 kilometres of easterly facing beach. Therefore further investigation is required into the degree of sand movement around the headland and reefs, which may compromise water quality and pumping ability. Other potential water quality influences include the discharge from Wallaga Lake to the north (<2kilometres), Bermagui River to the south (5kilometres) and Bermagui sewerage works to the south (<8kilometres). The Impact of these sources of pollution on water quality needs further investigation.



Camel Rock, looking south to Bermagui

Photo: Phil Read



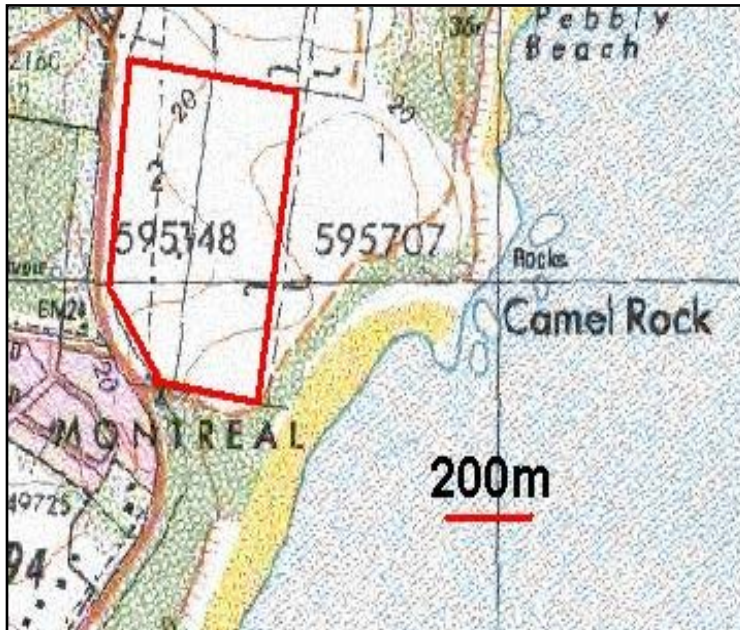
LEP zoning map

Source: Bega Valley Shire Council LEP Maps

There is a potential land-base within 1 kilometre of the specified anchoring point. An area comprising of cleared farmland and uncleared coastal vegetation, zoned Environmental Protection (Coastal Lands Protection zone) 7(f1) and (Coastal Lands Acquisition zone) 7(f2) respectively, lies due west of Camel Rock. In the Council's LEP neither zones specifically refer to aquaculture as an allowable or prohibited development. However, both zones will allow "animal establishments" with development consent. The combined area of the 2 zones totals over 20 hectares, however the land height exceeds 20 metres towards the western

side of the block along Wallaga Lake Road and to the north. Similarly the western side of the block (7(f1) zoning) has an approximate slope of 6%, which reduces in the uncleared 7(f2) portion. Development in either of the zones would be restricted to a hatchery or tank-based grow-out facility. Whereas development of both zones would provide sufficient area for an integrated hatchery and tank-based growout.

Further investigations into the contours of the portion are required to determine how much of these portions are suitable for development.



The provision of services to the proposed land-base is excellent. Sealed road access, mains freshwater, telecommunications and three-phase mains power are supplied adjacent to the western edge of the site, along Wallaga Lake Road. The Wallaga Lake area, including Beauty Point is only supplied with on-site sewerage treatment (septic tanks or similar). However there is a current plan to develop a reticulated sewerage system for the area. A poor quality gravel road provides access between the 2 proposed zones to the northern side of the headland.

Topographic map

Source: TopoView© 2000

The site is surrounded by residential zoning (Low Density 2(a) and Medium Density 2(b), which includes an existing caravan park on the western side of Wallaga Lake Road and the residences of Wallaga Lake Heights and Beauty Point. Development of the site will require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.

6.24.2 BERMAGUI HARBOUR

Site Ranking: *

GPS Position: South 36° 25.604' East 150° 04.342'

General Description:

Bermagui Harbour is defined as the area to the east of Bermagui River Bridge to the inlet of Bermagui River estuary at Bermagui Point. The harbour has extensive training walls on both sides and port facilities on the southern side, including a number of jetties, a shipwright and boat ramps. The harbour and estuary separate Bermagui and Bermagui South, within the Bega Valley Shire Council area on the south coast. Proximity to Bermagui, Cobargo (20 kilometres) and Narooma (30 kilometres) means that the area is subject to moderate recreational usage.

Site Assessment

Table 74. Ranking of Primary Criteria for Bermagui Harbour.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Poor	Southern training wall; potential water quality issues (estuarine discharge and port activities)
Land-base < 1km of intake point	Good	Zoning and aesthetic impact issues

Table 75. Ranking of Secondary Criteria for Bermagui Harbour.

Secondary Criteria	Ranking	Comments
Access to mains power	Excellent	Adjacent to potential land-base
Access to mains freshwater supply	Excellent	Adjacent to potential land-base
Access to telecommunications	Excellent	Adjacent to potential land-base
Access to suppliers, trade services	Good	Bermagui immediate, Cobargo (20km) and Narooma (30km)
All weather (sealed) road access	Excellent	Adjacent to potential land-base
Potential water quality pollutants	Poor	Bermagui River discharge and port activities immediate; sewerage treatment works (<2km)
Protection from prevailing swells	Excellent	Within training walls of estuary
Pumping head	Excellent	<5m
Size of land portion(s)	Good	<5ha, tank-based development only
Land status	Excellent	Cleared open space with degraded areas
Land zoning	Good	Special Uses 5(a) (Port Purposes, Tourist Facilities & Open Space)
Land topography	Excellent	Land flat to slightly sloped
Aesthetics	Poor	Overlooking residential; lower elevation

Site Discussion

The training walls associated with Bermagui Harbour provide a number of positions that would be suitable anchorage points for an intake pipe. Positioning of the intake downstream of the port facilities, towards the inlet on the eastern side of the harbour would be preferable to anchorage up-stream of port facilities. This would allow a tidal pumping regime to be implemented and isolate the intake from potential pollutants associated with the port facilities to an extent. Close proximity to the inlet is also favourable for any intake to allow more reliable access to oceanic water. Other potential water quality influences include the Bermagui sewerage works, which discharges approximately 2.5 kilometres to the south at the southern end of Beares Beach. The impact of all sources of pollution on water quality needs further investigation



Bermagui Harbour, looking south to the shipwright sheds and adjacent vacant land

Photo: Phil Read

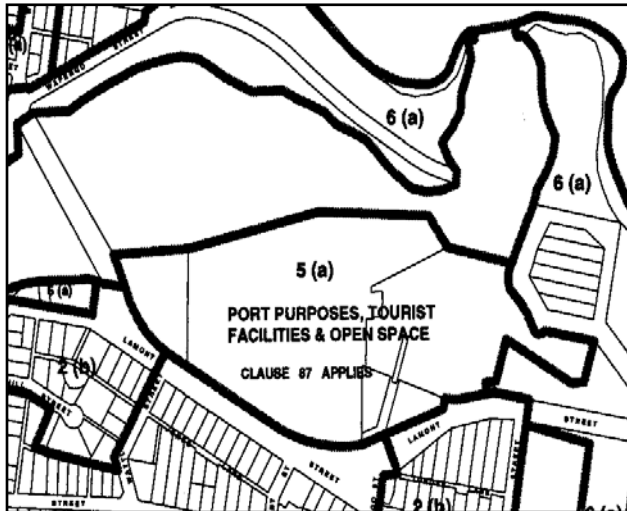


Topographic Map of Bermagui.
Source: TopoView® 2000

There is a potential land-base within 1 kilometre of the specified anchoring point. A portion of the land associated with the port facilities to the west of the shipwright buildings and east of Bermagui River Bridge lies approximately 500 metres within the estuary training walls, by river. A pipeline from the tip of the western training wall along the harbour edge to Lamont Drive (Bridge Street) and along the road towards the site would measure approximately 1 kilometre. Anchorage on the training wall to the west of the port entrance would be immediately adjacent to the site and suitable for positioning of an effluent pipe. As discussed previously, potential pollution from port activities may make this an unsuitable intake point. The size of

the available land is approximately 5 hectares that restricts development to a tank-based hatchery or grow-out facility. The portion consists of cleared, grassed open space and a degraded sand flat.

The land has suitable topography for aquaculture development, being flat to gently sloping with a maximum height above sea-level of less than 5 metres.



LEP Zoning Map of Bermagui Harbour
Source: Bega Valley Shire Council LEP Maps 2002

The area is zoned Special Uses 5(a) (Port Purposes, Tourist Facilities and Open Space) which does not specifically prohibit aquaculture development. Zoning is not considered to be a hard constraint in the context of this report.

The provision of services to Bermagui Harbour is excellent, being an area of existing industrial activity with surrounding residential zones. Sealed road access, telecommunications, 3-phase mains power, reticulated sewerage and mains freshwater are supplied along Lamont Drive adjacent to the site and to the adjacent shipwright business.

The proximity of the site to many overlooking residences, prominent roads, the Bermagui Bridge and tourist facilities on Bermagui Point renders the site to some visual impact. Development of the site will require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.



Bermagui River

Source: DLWC© 2000

6.24.3 EX-BP TERMINAL, EDEN

Site Ranking: ***

GPS Position: South 37° 04.271' East 149° 54.510'

General Description:

The decommissioned petroleum terminal, previously operated by BP, is situated on the northern side of the Eagles Claw, a prominent rocky headland forming part of the township of Eden. Eden is the largest town within the Bega Valley Shire Council area on the south coast, with approximately 3000 residents. Proximity to Pambula (20 kilometres), Merimbula (25 kilometres) and Bega (60 kilometres) means that the area is subject to moderate recreational usage.

Site Assessment

Table 76. Ranking of Primary Criteria for Ex-BP Terminal, Eden.

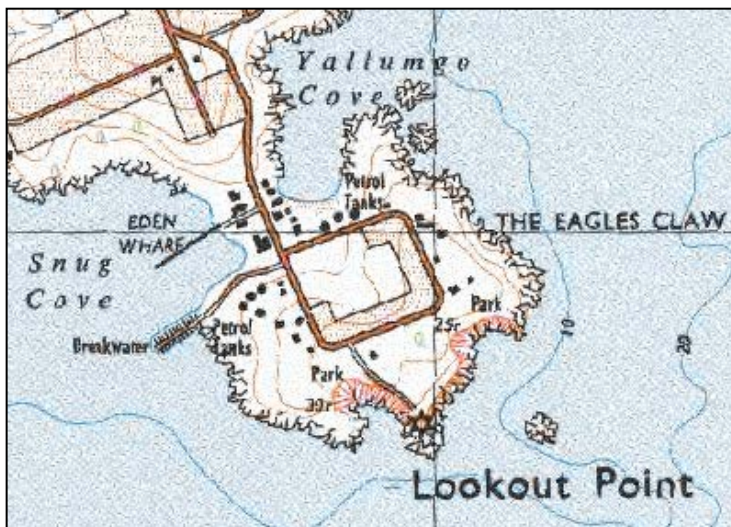
Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Excellent	Rock headland; limited potential water quality issues (urban runoff and port activities)
Land-base < 1km of intake point	Excellent	Aesthetic impact issues

Table 77. Ranking of Secondary Criteria for Ex-BP Terminal Eden.

Secondary Criteria	Ranking	Comments
Access to mains power	Excellent	Immediate
Access to mains freshwater supply	Excellent	Immediate
Access to telecommunications	Excellent	Immediate
Access to suppliers, trade services	Excellent	Eden immediate, Merimbula (25km) and Bega (60km)
All weather (sealed) road access	Excellent	Adjacent to potential land-base
Potential water quality pollutants	Good	Sewerage discharge (<500m); port activities (<2km); urban runoff
Protection from prevailing swells	Excellent	Protected from all swell directions
Pumping head	Good	<20m
Size of land portion(s)	Good	Approx. 2ha, tank-based development only
Land status	Excellent	Cleared open space with degraded areas
Land zoning	Excellent	Industrial (I)
Land topography	Good	Land slightly to moderately sloped
Aesthetics	Poor	Within residential area.

Site Discussion

The rock headland and reefs of Yallumgo Cove to the north of the terminal would provide a number of positions that would be suitable anchorage points for an intake pipe. Yallumgo Cove has a northerly aspect so is protected from prevailing swells from the south to east. Worang Point, several kilometres to the north-east, also provides protection from north to north-easterly swells. Twofold Bay is a large, deep coastal embayment receiving oceanic-quality water. Potential water quality influences at the Yallumgo Bay site are limited to sewerage effluent, urban runoff from Eden township and activities associated with the port facilities to the west (on the other side of the Eagles Claw). The sewerage treatment plant is situated south-west of Eden Golf Course, which uses the majority of treated effluent for irrigation. A discharge pipe to the ocean releases any effluent that is additional to the needs of the golf course on the northern side of Yallumgo Bay, within 500 metres of the proposed site. The wharf and port facilities are within 2 kilometres by water from Yallumgo Cove. The impact of all sources of pollution on water quality at Yallumgo Cove needs further investigation.

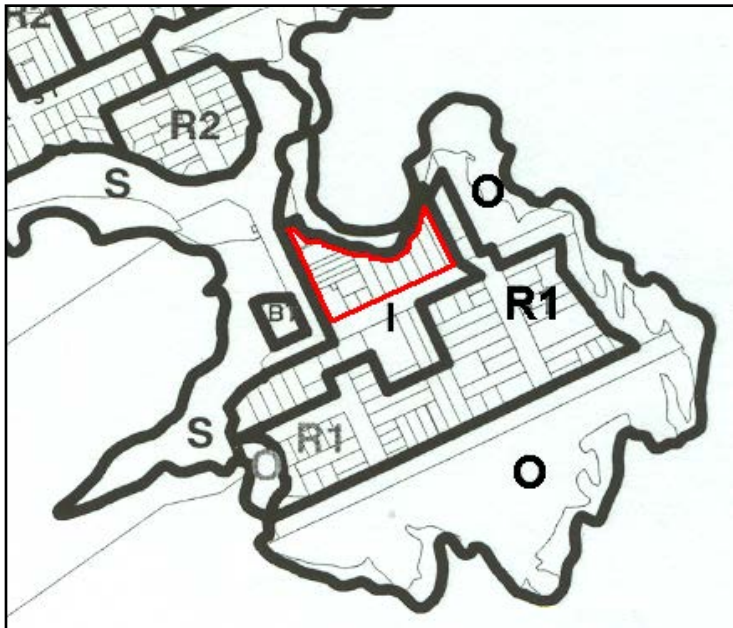


LEP zoning map

Source: Bega Valley Shire Council Maps

There is a potential land-base within 1 kilometre of the specified anchoring point. A number of portions comprising the decommissioned BP terminal lie adjacent to the south of Yallumgo Cove. The total land area is approximately 2 hectares, the majority of which is dominated by two large petroleum storage tanks at present.

Aquaculture development of this site is therefore restricted to a tank-based hatchery or grow-out facility. The land is slightly to moderately sloping, with a



Topographic map showing proposed sites (outlined in red)
Source: TopoView© 2000

maximum height approaching 20 metres above sea-level of the eastern-most portions of the land. The majority of the site is less than 10 metres above sea-level.

The area is zoned Industrial (I), although aquaculture is not specifically mentioned in the LEP. Under the existing SAS tank based aquaculture development is permitted on industrial zoned land. Zoning is not considered to be a hard constraint to development in the context of this report. It should be noted that the entire site is within the boundary of SEPP 71 Coastal Protection areas.

The provision of services to the site is excellent, being an area of existing industrial activity with surrounding residential zones. Sealed road access, 3-phase mains power, telecommunications, reticulated sewerage and mains freshwater are provided along Imlay Street and Weecoon Street on the western and southern sides of the site respectively. The port facilities are located across Imlay Street to the south-west, which contains additional infrastructure and complementary fisheries-based developments.

The proximity of the site to overlooking residential areas, businesses and tourist facilities means that development of the site would necessitate some visual impact. Development of the site will require a minimum of Level 2 Assessment under the Project Profile Analysis of the SAS.



Aerial photograph of Yallumgo Cove and ex-BP site

Photo: Libby Hepburn 2003

6.24.4 TWOFOLD BAY MULTIPURPOSE WHARF, SOUTH MUNGANNO POINT

Site Ranking: ***

GPS Position: South 37° 06.421' East 149° 55.704'

General Description:

South Munganno Point is on the southern side of Twofold Bay approximately 35 kilometres by road from Eden within the Bega Valley Shire Council area on the south coast. The area is largely undeveloped, excepting the Harris Daishowa Australia Wood Chip Mill (HDA), the developing Multipurpose Wharf and Edrom Lodge. Proximity to Kiah (22 kilometres), Boydtown (30 kilometres) and Eden (35 kilometres) means that the area is subject to moderate recreational usage.

Site Assessment

Table 78. Ranking of Primary Criteria for Twofold Bay Multipurpose wharf, South Munganno Point.

Primary Criteria	Ranking	Comments
Secure access to high quality oceanic water	Excellent	Multipurpose wharf; limited potential water quality issues (industry (HDA), shipping activities, discharge from Towamba River)
Land-base < 1km of intake point	Excellent	Zoning and aesthetic impact issues

Table 79. Ranking of Secondary Criteria for Twofold Bay Multipurpose wharf, South Munganno Point.

Secondary Criteria	Ranking	Comments
Access to mains power	Good	<500m from potential land-base
Access to mains freshwater supply	Poor	No mains supply, HDA private supply only
Access to telecommunications	Good	<500m from potential land-base
Access to suppliers, trade services	Good	Eden (35km), Bega (60km)
All weather (sealed) road access	Good	<500m from potential land-base
Potential water quality pollutants	Good	Shipping activities (immediate); Towamba River (<2km), industrial activities (HDA)
Protection from prevailing swells	Good	Protected from south to easterly swells
Pumping head	Good	<20m
Size of land portion(s)	Good	Various, <2-ha to 10-ha
Land status	Good	Various, uncleared, vegetated to cleared, open space
Land zoning	Good	1(a) Rural General Zone, 1(f) Rural Forestry Zone, 7(f2) Coastal Lands Acquisition Zone
Land topography	Good	Land slightly to moderately sloped

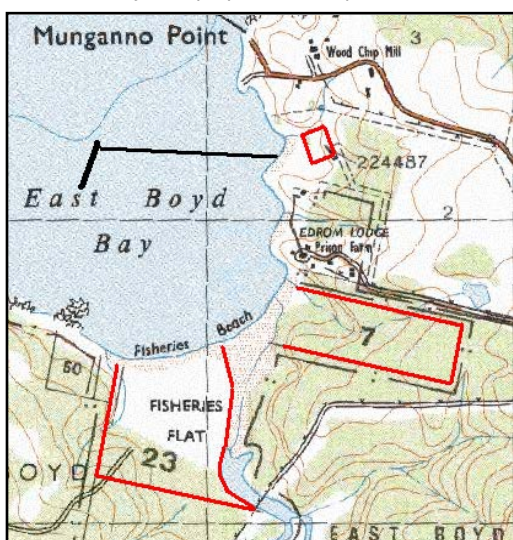
Site Discussion

The Twofold Bay Multipurpose Wharf at South Munganno Point is a 200-metre long, dual lane structure, under construction by the Department of Defence as an ammunition berth. Access will be allowed to the wharf for commercial purposes outside of ammunition loading times (estimated at a maximum of 70 days a year). The wharf would provide a number of positions that would be suitable anchorage points for an intake pipe. Positioning of the intake at the end of the structure would allow access to water up to 10.5 metres deep and is likely to provide best quality water. However, any of the pylons along the length of the wharf would provide suitable anchorage, with access to varying water depth. Munganno Point has a northerly aspect and extends several hundred metres to the north of the wharf. The wharf is therefore protected from southerly to easterly prevailing swells. Twofold Bay is a large, deep coastal embayment receiving oceanic-quality water. Potential water quality influences at the Wharf site are limited to pollutants associated with shipping activities, estuarine discharge from Towamba River and adjacent commercial practices (HDA). Investigation into the impact of any of these sources on water quality is required.



Twofold Bay Multipurpose Wharf (under construction)

Photo: Phil Read



Topographic Map of Munganno Point
Source: Topoview©2000

There are a number of potential land-bases within 1 kilometre of the wharf anchorage points. A small portion of land immediately to the east of the wharf belongs to HDA (Lot 1 224487) and contains a recreation cottage and limited picnic facilities. The area is less than 1 hectare, so development would be limited to a small tank-based facility only. The area is zoned 1(a) General Rural Zone. The rear of the portion approaches 20 metres above sea-level and the site is slight to moderately sloped. Negotiations with HDA are required to determine the likelihood of leasing or purchasing the land.

Another potential land-base (Lot 1 DP 198217) lays less than 500 metres to the south of the

6.24.5 CATALOGUE OF REMAINING COASTLINE

Several sites identified previously in the vicinity of the multipurpose wharf (Webb, R. 2000), although suitable for general industrial usage, are inappropriate for aquaculture development. Those not included in the above section had extreme elevation (>50meters), inappropriate slope or were too distant from the anchorage at the wharf.

Table 80. Bega Valley Shire Council – justification of sites having no current potential.

Site	Justification
Hayward Point	Exposed unsuitable anchorage, headland receded onto beach, small intertidal rocks only; no land-base, inappropriate slope or low-lying
Keatings Headland	Exposed unsuitable anchorage, headland receded onto beach, large intertidal rocks; small land-base only (<2-ha); inappropriate slope (requiring excavation/levelling) or low-lying
Point Dickinson, Blue Point	No land-base; developed, residential, tourist park; exposed anchorage; steep cliff; elevated pumping
Jerrinbut Point, Barragoot Point	No land-base; developed look-out; undeveloped Biamanga National Park; high cliffs; elevated pumping
Cuttagee Point	Exposed unsuitable anchorage, headland receded onto beach; no land-base, inappropriate slope or low-lying
Barragga Point	No land-base; developed, rural residential; moderate to steep slope; elevated pumping
Barragga Bay, southern headland	Small land-base only (<2-ha); moderate to steep slope; (requiring excavation/levelling); some protection from prevailing swells; some services
Armondy Bay Headland to Murrah Head	No land-base; exposed anchorage; high cliffs; elevated pumping; inappropriate slope
Goalen Head to Mogareeka Inlet (including Bunga Head, Bengunnu Point, Picnic Point and Bethry Inlet)	No land-base; undeveloped, environmental protection (Mimosa Rocks National Park); exposed anchorage; elevated pumping; inappropriate slope; limited access and services
Tathra Wharf, Tathra Head	Small existing land-base only (<2-ha); existing usage and heritage values; excellent anchorage; surrounded by high cliffs; elevated pumping; good access and services
Tathra Head to the entrance of Kianinny Bay	No land-base; developed, residential, tourism; amenities (boat ramp); exposed anchorage; steep cliff; elevated pumping
Kianinny Bay	Small existing land-base only (<2-ha); existing usage and potential heritage values (Tathra Amateur Fishing Club and boat ramp area); excellent anchorage; surrounded by high cliffs; good access and services
Kangarutha Point to Bournda Island	No land-base; undeveloped, environmental protection (Bournda National Park); exposed anchorage; elevated pumping; inappropriate slope; limited access and services
Tura Head	No land-base; developed/developing, residential; steep headland; elevated pumping
Short Point to Merimbula Point	No land-base; developed, residential, tourist park; steep headlands; elevated pumping; estuarine influences (Merimbula Lake)
Merimbula Aquarium and Restaurant (Merimbula Point)	Small existing land-base only (<2-ha); existing usage and potential heritage values; excellent anchorage point (existing wharf); existing sea-water intake (in operation); estuarine influences (Merimbula Lake); site surrounded by cliffs; good access and services
Haycock Point to Worang Point	No land-base; undeveloped, environmental protection (Ben Boyd National Park); exposed anchorage; elevated pumping; inappropriate slope; limited access and services

Table 80. (continued) Bega Valley Shire Council – justification of sites having no current potential.

Site	Justification
Eden Fishermens Cooperative, Eden	Small existing land-base only (<2-ha); existing usage and potential heritage values; excellent anchorage points (rocks, existing wharf); site in industrial area surrounded by residences; excellent access and services
Ex-Tuna Cannery, Cattle Bay	Excellent site with existing infrastructure and anchorage point; designated for tourist resort development; aesthetic impact issues
Cocora Point to Brierly Point (including Oman Point, Quandoo Point and Northcote Point)	No land-base; developed, residential and community (boat ramps, wharves, camping areas); undeveloped, vegetated (Coastal Lands Acquisition); inappropriate slope; elevated pumping
Jews Head to Cape Howe	Not surveyed; no land-base; undeveloped, environmental protection (Ben Boyd National Park); exposed anchorage; elevated pumping; inappropriate slope; limited access and services

7. SUMMARY

The state of NSW and particularly the coastal regions are currently undergoing rapid demographic change. Over the past 25 years the NSW coastal fringe has experienced increasing pressure from development and urbanisation. This is strongly reflected in current land values. Concurrently, urban pressure has necessitated the establishment of reserve, wilderness and National Park areas. Some agriculture and forestry industries also dominate some coastal regions. As a result of these varied pressures, it is likely there will be significant challenges to establishment of a marine hatchery development on the NSW coast.

A high percentage of the NSW coastline was surveyed in the scope of this report. The coastline geography is dominated by a pattern of sandy beaches interconnected by rocky headlands, small coastal reserves, National Parks and the larger “enclosed” water bodies of Twofold Bay, Jervis Bay, Port Jackson, Port Stephens and several lakes. Those headlands not gazetted as Reserves or Parks more often than not, were zoned (2a) residential and were dominated by housing development having beach, river or ocean views. Caravan and camping parks often dominated areas at the northern and southern end of beaches and river mouths. Many of these areas, including Parks and Reserves, satisfied the primary and secondary criteria for hatchery development in the scope of this report.

Current coastal urbanisation and land conservation trends, together with the limited number of identified hatchery sites sets some clearly defined challenges for the development of a commercial, aquaculture facility.

7.1 Sites in industrial and commercial areas.

Some sites identified within this report exist in areas currently designated industrial and/or commercial. These sites include: 1) Ex-Caltex site, South West Rocks (Kempsey Shire Council); 2) Ex-Colliery Catherine Hill Bay (Lake Macquarie City Council); 3) Outer Harbour, Port Kembla (Wollongong City Council); 4) Bass Point (Shellharbour City Council); 5) Ex-BP site, Eden (Bega Valley Shire Council). They offer some real opportunities in terms of zoning and existing infrastructure.

7.2 Other Identified sites

Sites identified within this report as having a high degree of potential, namely those ranked with three or two stars (***), (**) should be investigated further. Sites ranked with one star (*) should not be omitted outright as some of these sites have potential. However, these sites have fewer attributes, namely periods of sub-optimal water quality, and/or the requirement of significant community consultation. Negotiations for any site should commence sooner than later as the current demographic coastal trends could result in a failure to secure these areas. These negotiations should include participants from all relevant government departments and agencies, local indigenous groups, council and various stakeholder groups of the local community.

7.3 Reserves and National Parks

Some sites identified in the report are within lands zoned for conservation, for example, Bingie Bingie Point (Eurobodalla Shire Council). Investigating the possibility of excising or leasing those sites demonstrating existing potential (i.e. reliable seawater access and shelter; road and power access; nearby labour force, etc) needs to be considered. This option would require some extensive inter-governmental and community negotiations. The relatively low impact that aquaculture hatchery operations would have on conservation values of the area is an important factor.

7.4 Aquaculture/tourism facilities

There are several sites identified within this report that provide an opportunity for the development of a combined aquaculture and tourism facility.

The general public have had little opportunity to experience the operation of a commercial aquaculture facility. Existing government and commercial aquaculture facilities service a large number of visitors and/or enquiries. A combined aquaculture and tourism facility within NSW would address this need. A tourism business incorporating regulated guided tours, eatery, aquaria and aquaculture products offer alternative income and cater for an increased public awareness about aquaculture.

7.5 Site Decommissioning; Realty

It is relatively uncommon for aquaculture sites to become available through the decommissioning of existing businesses. These sites (industrial in nature or an existing aquaculture business) can provide opportunity to utilise some existing infrastructure. Sites identified within this report include Ex-BP Terminal, Eden (Bega Valley Shire Council) and Ex-colliery, Catherine Hill Bay (Lake Macquarie Shire Council). The proximity of this land to the water means the land has high realty value and therefore will be in demand.

7.6 NSW Aboriginal Land Councils (ALC)

The NSW Aboriginal Land Council (ALC) network operates throughout NSW. It is a 3-tiered system, consisting of the peak body, NSWALC and its branches, 13 Regional ALCs and 120 Local ALCs. The NSWALC is a self-funded statutory authority and is responsible for protecting and promoting the rights and interests of the Indigenous people of NSW.

State Government departments, agencies and local councils have a responsibility to acknowledge the rights and interests of Indigenous people when considering aquaculture proposals, including those identified within this report. A list of NSWALC contact details is included (Appendix B).

7.7 Estuarine site study

It was not in the scope of this report to identify aquaculture sites on coastal estuaries within 2 kilometres of the coast. Further investigation of these sites should be undertaken with regard to neighbouring land use and water quality. Estuarine sites often present the opportunity to construct a manageable and reliable seawater intake. However these sites may require seawater storage facilities to assist with the provision of water during times of flood and subsequent episodes of poor water quality. Also of note, is that some sites may present an opportunity to construct ponds in association with a hatchery. Much of this work is being done as a mapping exercise under the regional SAS's.

7.8 Private Land

It became evident during the survey that private, agriculture land still existed on some parts of the NSW coastline. It was not in the scope of this report to investigate these lands for aquaculture sites. It is likely however, these lands have site potential and further negotiations with landholders should be pursued.

7.9 Conclusion

The Site Assessment for Marine Aquaculture Facilities on the NSW Coastline is a valuable tool for investors, educational institutions and government looking to locate and develop land with access to oceanic quality seawater. It should be used as a guide along with the Project Profile Analysis of the Sustainable Aquaculture Strategies to appropriately site viable and sustainable aquaculture facilities.

APPENDIX A

Regional Physical Data

Characteristics of relevant estuaries

Adapted from West, R.J.; Thorogood, C.; Walford, T. and Williams, R.J. Fisheries 1985 Bulletin 2: An estuarine inventory for New South Wales, Australia

Estuary	Estuary Type ^φ	Entrance Status [°]	Map Water Area (km ²)
Far North Coast			
Tweed River	1B/C	OT	17.9
Cudgen Lake	3B	OT	1.427
Brunswick River	2D	OT	2.222
Richmond River	1B/C	OT	19.071
Evans River	1B	OT	1.787
Mid North Coast			
Clarence River	2D (Yamba)	OT	89.243
Ararwarra Creek	3B	I	0.123
Boambee Creek	2D	O	0.573
Bellinger River	2D	OT	6.567
Nambucca River	2D	OT	7.738
Macleay River	2D	OT	18.169
South West Rocks Creek	No data	O	0.118
Hastings River	2D	OT	17.287
Camden Haven River	2C (Laurieton)	OT	27.833
Hunter Coast			
Manning River	2D	OT	25.348
Karuah River	1C	O	7.541
Myall River	No data	O	3.876
Port Stephens	1A	O	125.970
Hunter River	2C/D	OT	30.421
Lake Macquarie	2A	OT	115.112
Sydney/Central Coast			
Tuggerah Lake	2A/B	IX	70.299
Brisbane Water	2A/B	O	27.241
Hawkesbury River	1A (Gosford)	O	100.005
Pittwater	1A	O	17.314
Port Jackson	1A	O	49.667
Botany Bay	3B/C	O	49.100
Georges River	1B	O	12.466
Port Hacking	1A	O	11.298

^φ 1-drowned river valley; 2-barrier lagoon; 3-coastal lagoon; 4-open embayment; A-D refer to the degree of maturity or infilling of the estuary. A-little infilling, D-very infilled.

[°] O-open to sea; I-intermittently open or closed; C-primarily closed; X-mechanically opened; T-training walls constructed

Estuary	Estuary Type ^φ	Entrance Status [°]	Map Water Area (km ²)
Illawarra Coast			
Port Kembla Harbour	No data	OT	0.098
Lake Illawarra	2A/B	IX	36.270
Minnamurra River	2C	O	0.601
Shoalhaven River	2D	*	12.889
Crookhaven	2C	O	7.883
Lake Woolumboola	3A	IX	6.211
Jervis Bay	4	O	102.129
St. Georges Basin	2A	O	38.859
Nerrindillah Creek	No data	I	0.065
Lake Conjola	2A	O	4.280
Kioloa Lagoon	No data	I	0.037
South Coast			
Clyde River	1B/C	OT	19.898
Batemans Bay	4	O	5.301
Moruya River	2D	OT	4.222
Coila Lake	3A	IX	6.341
Tuross Lake	2C	O	13.229
Wagonga Inlet	2A	OT	6.276
Wallaga Lake	2A	IX	7.806
Bermagui River	2C/D	OT	1.390
Bega River	2D	I	2.657
Merimbula Lake	2A/B	O	4.556
Pambula Lake	2B/C	O	2.949
Nullica River	No data	O	0.244
Twofold Bay	4	O	77.049
Towamba River	2D	O	1.427
Fisheries Creek	No data	O	0.024

^φ 1-drowned river valley; 2-barrier lagoon; 3-coastal lagoon; 4-open embayment; A-D refer to the degree of maturity or infilling of the estuary. A-little infilling, D-very infilled.

[°] O-open to sea; I-intermittently open or closed; C-primarily closed; X-mechanically opened; T-training walls constructed

More detailed estuary profiles can be obtained from the Department of Natural and Sustainable Resources at

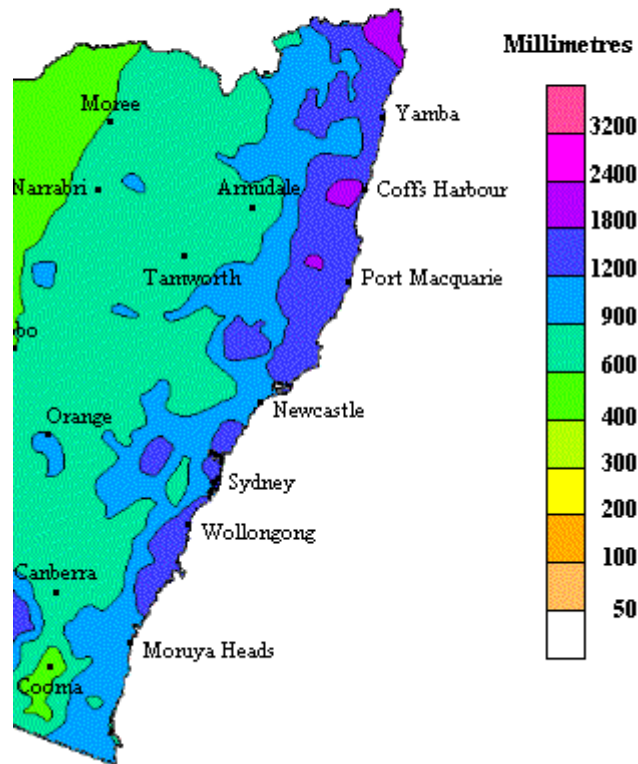
www.dlwc.nsw.gov.au/care/water/estuaries/Inventory

Rainfall Data*

Rainfall (mm)				
Station	Estuary	Mean Annual	Highest Mean Monthly	Highest Recorded Daily
Murwillumbah	Tweed	1631.9	231.0 (February)	321.0 (March)
Yamba	Clarence	1464.6	185.3 (March)	300.0 (March)
Coffs Harbour	Coffs Harbour	1646.7	232.0 (March)	309.9 (March)
South West Rocks	Macleay	1503.5	195.9 (March)	343.7 (April)
Port Macquarie	Hastings	1546.1	176.2 (February)	298.2 (April)
Harrington	Manning	1345.8	158.7 (March)	260 (June)
Nelson Bay	Port Stephens	1342.4	155.2 (June)	257.8 (February)
Newcastle	Hunter	1141.9	121.9 (March)	283.7 (March)
Wollongong	Port Kembla, Lake Illawarra	1373.5	176.0 (March)	316.0 (August)
Jervis Bay	Jervis Bay	1244.3	131.8 (April and June)	316.7 (March)
Moruya	Moruya	964.8	110.1 (March)	275.3 (May)
Narooma	Narooma, Bermagui	914.1	108.4 (March)	362.4 (September)
Green Cape	Twofold Bay	754.3	79.3 (January)	370.1 (January)

*Data obtained from the Bureau of Meteorology Website (www.bom.gov.au/climate/map/climate_avgs) and based on a minimum of 20 years of records for each site.

Climatic data for a number of additional parameters can be obtained from this website to enable more thorough analysis of regional rainfall and temperature profiles. The parameters included above serve only to provide a very basic picture of the rainfall in each location.



Graphic showing 30 year climate averages
(Bureau of Meteorology at
www.bom.gov.au/climate/map/climate_avs)

APPENDIX B

Contact Details:

Local Government

Contact details for all represented Local Councils can be obtained from the NSW Department of Local Government at www.dlg.nsw.gov.au

NSW Fisheries

Aquaculture Management Branch
Port Stephens Research Centre
Taylors Beach Road, Taylors Beach NSW 2316
Tel: (02) 49163919; Fax: (02) 49819074

NSW Aboriginal Land Councils (Coastal Regions)

Far North Coast Regional Branch

25 Orion Street
PO Box 494
Lismore NSW 2480
Councillor: David Brown

Tweed Byron LALC

9 Moreton Street
Chindera NSW 2487
PO Box 6160
Sth. Tweed Byron Heads NSW 2486
Ph: 0266743600
Fax: 0266743603
Co-Ordinator: Clarence Phillips

Jali LALC

Cabbage tree Island
PO Box 24
Wardell NSW 2477
Ph: 0266834413
Fax: 0266834679
Co-Ordinator: Gail Turnbull

Birrigan Gargle LALC

Youth Stadium – Pippie Beach
PO Box 62
Yamba NSW 2464
Ph: 0266461664
Fax: 0266469097
Co-Ordinator: Judy Eamens

Grafton Ngerrie LALC

50 Wharf Street
PO Box 550
Grafton NSW 2460
Ph: 0266426020
Fax: 0266426994
Co-Ordinator: Maurie Maher

Central Coast Regional Branch

Suite 7, 2nd Floor
Cnr John and Belgrave Streets
Kempsey NSW 2440
Ph. 0265625496
Fax: 0265624223
Councillor: Manul Ritchie

Coffs Harbour LALC

House 1, Wongala Estate
301-329 Pacific Highway
Coffs Harbour NSW 2450
Ph: 0266528740
Fax: 0266525923
Co-Ordinator: Janet Layton

Nambucca Heads LACL

16-42 Bowra Street
Nambucca Heads NSW 2448
Ph. 0265689281
Fax: 0265689161
Co-Ordinator: Dean Jarrett

Unkya LALC

Suite 7-9 Skylite Arcade
Wallace Street
PO Box 319
Macksville NSW 2447
Ph. 0265682786
Fax. 0265682886
Co-Ordinator: Cheryl Donovan

Kempsey LALC

Richard Archibald Street
PO Box 540
Kempsey NSW 2440
Ph. 0265628688
Fax.0265631293

Chairperson: Dorsey Smith

Birpai LALC

Aston Street
Port Macquarie NSW 2444
PO Box 876
Ph. 0265849066
Fax. 0265838172
Co-Ordinator: Richard Dacker

Bunyah LALC

214 High Street
PO Box 287
Wauchope NSW 2446
Ph. 0265853882
Fax. 0265852550
Co-Ordinator: Mathew Swadling

Purfleet/Taree LALC

Pacific Highway
Purfleet
PO Box 346
Taree NSW 2430
Ph. 0265524106
Fax. 0265510847
Co-Ordinator: Gillian Donovan

Foster LALC

Cabarita Community Hall
Cabarita Avenue
Forster NSW 2428
Ph. 0265555411
Fax. 0265555532
Chairperson: Janice Paulson

Karuah LALC

12 Mustons Road
PO Box 30
Karuah NSW 2324
Ph. 0249975733
Fax. 0249975750
Co-Ordinator: David Feeney

Sydney and Newcastle Regional Branch

Worimi LALC

Lot 355/187 Lemon Tree Passage Road
Tanilba Bay NSW 2319
Ph. 0249823405
Fax. 0249823596
Co-Ordinator: Lenny Smith

Awabakal LALC

127 Maitland Road
Islington NSW 2296
PO Box 437
Hamilton NSW 2296
Ph. 0249654532
Fax. 0249654531
Co-Ordinator: Ron Gordon

Bartahbah LALC

PO Box 18
Blacksmith NSW 2281
Lake view Parade
Belmont NSW 2280
Ph. 0249714800
Fax. 0249715224
Co-Ordinator: Michael Green

Darkinjung LALC

Shop 3/61 Howarth Street
PO Box 401
Wyong NSW 2259
Ph. 0243512930
Fax. 0243512946
Administrator: Mark Hoddinott

Metropolitan LALC

72 Renwick Street
Redfern NSW 2015
PO Box 1103
Strawberry Hills NSW 2012
Ph. 0293196955
Fax. 0293196461
Co-Ordinator: Jeff Bradford

La Perouse LALC

Cnr Elaroo and Yarra Bay
La Perouse NSW 2036

PO Box 365
La Perouse NSW 2036
Ph. 0293114282
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APPENDIX C

Project Profile Analysis

Draft Hunter and Central Coast Sustainable Aquaculture
Strategy

Land Based Aquaculture

A NSW Government Initiative

Hunter and Central Coast Sustainable Aquaculture Strategy

A NSW Government initiative of NSW Fisheries, PlanningNSW, Department of State and Regional Development, Environment Protection Authority, Department of Land and Water Conservation, National Parks and Wildlife Services and NSW Premiers Department to encourage sustainable aquaculture in New South Wales

Project Profile Analysis

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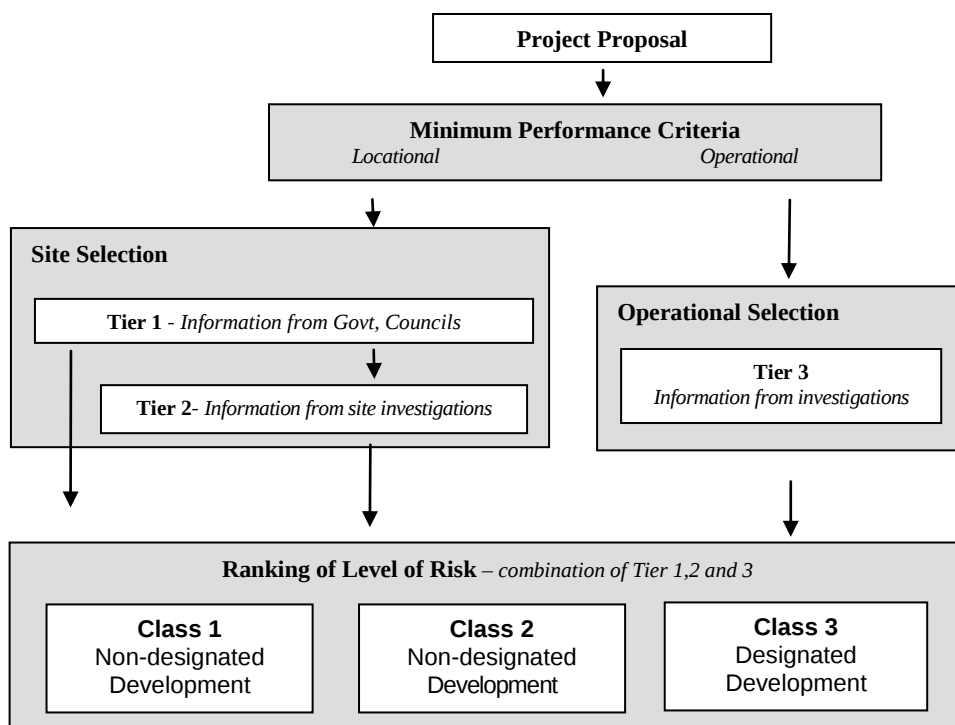
Overview of Project Profile Analysis

The Aquaculture Industry Development Plan (AIDP) sets out best practice for the establishment and operation of land based aquaculture projects. Based on this information, a Project Profile Analysis has been developed to enable a preliminary evaluation of the risks associated with site selection, species, design and planning and operational criteria. These criteria allow the applicant and the consent authority to evaluate the likely risks associated with a project and to establish the level of assessment to match the likely risks to the environment.

The Project Profile Analysis provides three “sieves” to evaluate options.

- The **Minimum Performance Criteria** provides the first environmental sieve for selecting sites and project characteristics. These must be met in order for the project to proceed.
- The **Site Selection Criteria** (Tier 1 and Tier 2) provide the next two environmental sieves to determine the acceptability of risks. Tier 1 information is available from Government or Council sources. Tier 2 information will need to be obtained from site investigation or studies.
- Following the selection of a site, **Operational Selection Criteria** (Tier 3) provide the next “sieve” to evaluate various options including species, layout and operation factors. The Tier 3 evaluation can serve as a cost effective device to determine the relative risk associated with species, design and operational options and to assist in deciding if certain options should be excluded from further consideration.

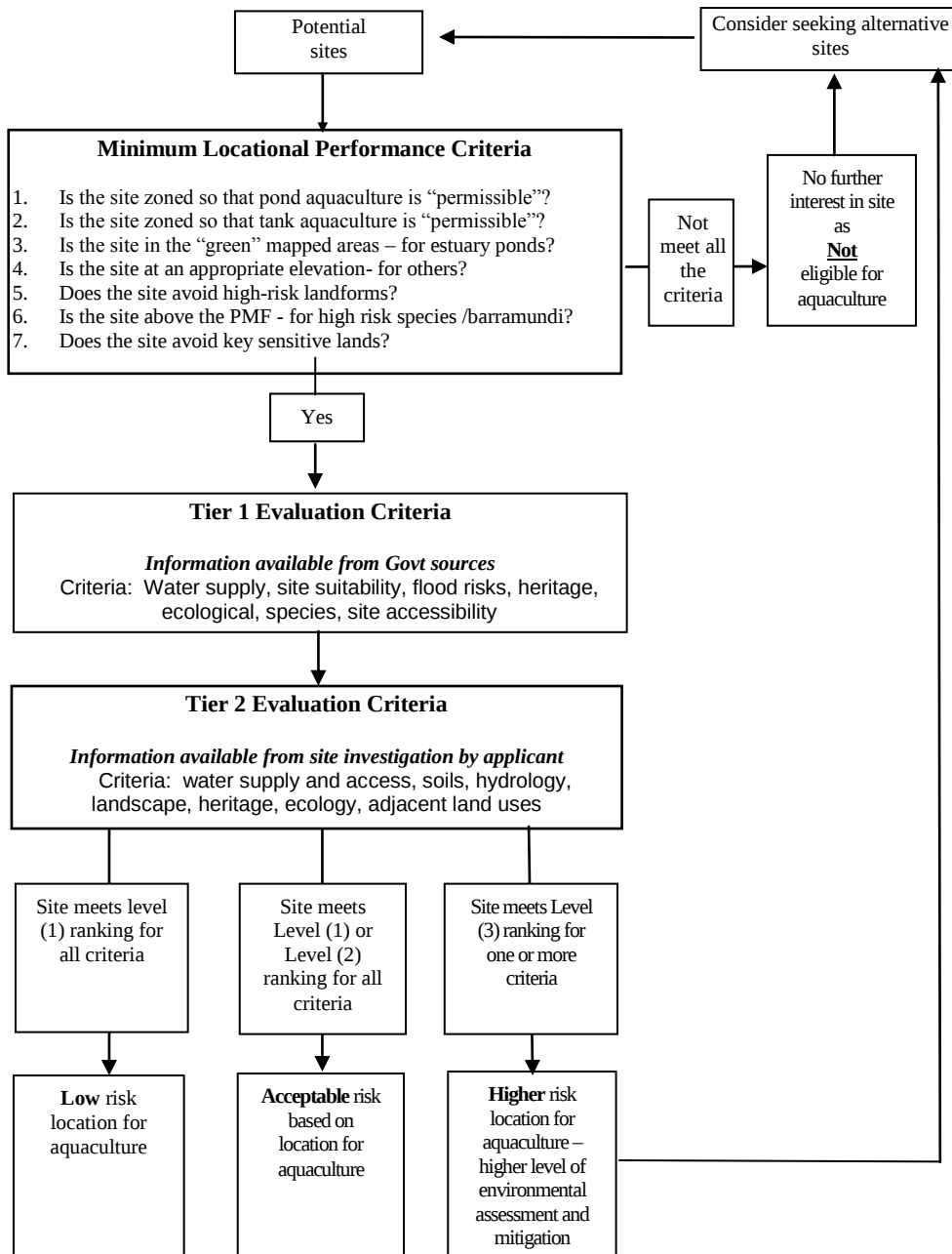
Figure 9. “Sieves” in Project Profile Analysis



Site Evaluation Criteria

The Site Selection Section of the AIDP has identified environmental and other factors that should be considered when selecting a site for aquaculture. These factors can be used to rank the likely risks associated with establishing an aquaculture facility in a particular location, e.g. as representing a Level 1, 2 or 3 risk.

Figure 10. Site Selection



Minimum Site Performance Criteria

It is essential at the outset, that the ***Minimum Performance Criteria for Land-based Aquaculture in the Hunter and Central Coast Region*** (see Project Profile Analysis) is considered, as aquaculture projects that cannot meet these minimum performance criteria are not permissible on the Hunter and Central Coast. Information regarding the minimum locational performance criteria is readily available from Council or DLWC maps and the ***Aquaculture Land Suitability Maps*** for the region provide a quick evaluation to determine if a potential site meets these minimum locational criteria. For estuarine pond sites, the site must be within the areas coloured green on the Estuarine Aquaculture Map.

Tier 1 Evaluation

For sites that meet the Minimum Locational Performance Criteria, the Tier 1 information should be sourced to determine the relative acceptability of the site for aquaculture. The Tier 1 criteria can be sourced from information held by Council, NSW Fisheries, NPWS and DLWC. The ranking of Level 1, 2 or 3 for individual criteria will begin to provide a picture of the potential hurdles in developing a site and the likely level of environmental assessment and regulation which could apply – the lower the level of risk, the lower the level of assessment and regulation required. Whenever possible, higher risk sites should be avoided at the Tier 1 evaluation level.

Tier 2 Evaluation

For sites that are not eliminated as a result of Tier 1 evaluation, the next layer of information should be sourced. Tier 2 investigations may involve significant expenditure with site investigations by technical experts, and in some cases, laboratory analysis. For example, investigations by consultants may be required:

- to confirm the levels of acid sulfate soils or soil contamination and develop management options,
- to determine soil suitability for dam construction,
- to identify threatened species, populations or ecological communities or their habitat (both flora and fauna surveys required),
- to identify any Aboriginal sites, areas of high potential to contain sites, areas of cultural sensitivity or other values of cultural significance to the Aboriginal community (e.g. bush foods),
- to assess of potential water supply quality and security of supply.

It should be noted that the level of analysis, at this stage, need not be as detailed as would be required once the site has been selected and the detailed project design is being undertaken. However, it should provide sufficient information for an informed decision to be made so that there will be no unpleasant surprises later, resulting in costly management options.

The level of risks associated with the location along with the risks levels associated with operational constraints (see section 3) will decide the assessment regime for the project. The lower the risks, the lesser the level of assessment complexity, the lower the costs in assessment and mitigation, and the lower the level of environmental supervision by councils and government agencies.

Aquaculture Land Suitability Maps

Sound site selection is particularly important in estuarine areas where problems related to suitable water quality, drainage and acid sulfate soils could impose costly constraints on the long-term aquaculture viability in those areas.

The Estuarine Aquaculture Map (see enclosed map) has been developed for those estuarine areas in which saline pond culture is potentially suitable within the Hunter and Central Coast Region.

This map will play a pivotal role in identifying sites that meet the minimum locational performance criteria for estuarine pond aquaculture. The map has been developed using GIS information and identify potential locations based on attributes including

- elevation above Australian Height Datum,
- spatial salinity for the estuary and bathymetry assessment,
- acid sulfate soil profile,
- land use zoning, and
- conservation exclusion zones.

This map identifies land that meets the Minimum Locational Performance Criteria for estuarine aquaculture. Other evaluation criteria must still be considered in assessing the suitability of a particular site for aquaculture. The Tier 1 and Tier 2 selection criteria are in the Project Profile Analysis provides details of the site selection factors.

While a version of the Estuarine, Aquaculture Land Suitability Map is included in the AIDP, the Hunter and Central Coast Office of the Department of State and Regional Development and the Aquaculture Division of NSW Fisheries can provide access to full scale Estuarine Aquaculture Maps for estuaries on the Hunter and Central Coast from south of the Manning to the Hawkesbury which identify potentially suitable areas as well as in some cases, specific sites with potential for estuarine aquaculture.

Because of the extent of locational possibilities for freshwater tank and ponds, a detailed mapping approach to identify land that meets the Minimum Locational Performance Criteria has not being taken. However, a general overview map of the Hunter and Central Coast Region is enclosed to provide an indication of potentially suitable sites. Therefore, criteria should be applied at the preliminary stage to eliminate any sites that do not meet these criteria.

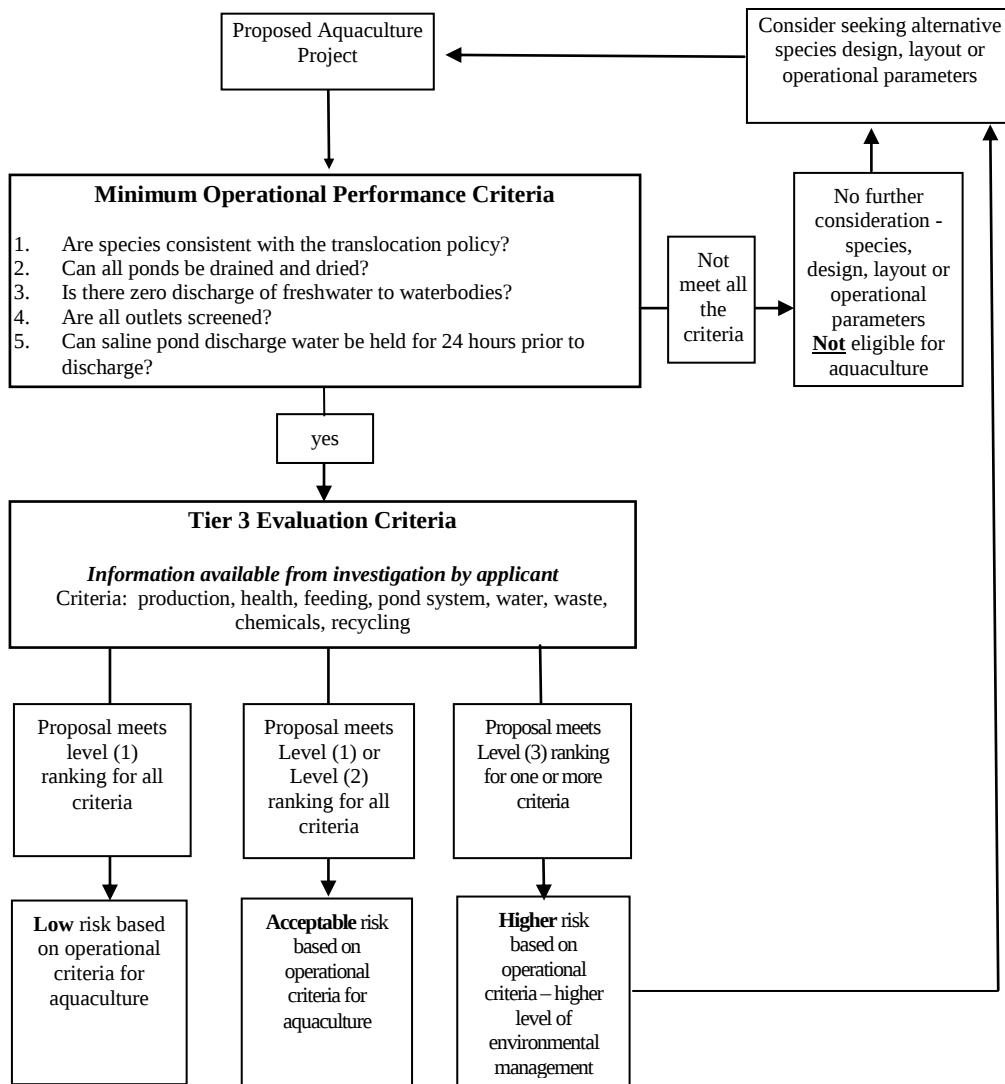
It should be noted that the Aquaculture Land Suitability Maps were compiled based on data available at the time of production and only represent areas that may have potential for aquaculture. Detailed site assessment is still required and current LEP and other mapping information may need further investigation.

The site selection factors are discussed in more detail in the Site Selection section of the AIDP.

Operational Evaluation Criteria

While Tier 1 and Tier 2 Site Selection Criteria provide guidance in the selection of a preferred site, the Tier 3 evaluation criteria aim to provide guidance on the evaluation of alternative operational regimes. Information from planning and design investigations will lead to a project profile ranking which will assist in identifying the likely risks to the environment of various operational alternatives.

Figure 11. Operational Selection



Minimum Operational Performance Criteria

It is essential at the outset, that the Minimum Performance Criteria for Aquaculture in the Hunter and Central Coast Region be considered, as aquaculture that cannot meet these minimum performance criteria, are not permissible on the Hunter and Central Coast.

Tier 3 Operational Evaluation

Following the selection of a site, and confirmation that the proposed design and planning parameters meet the Minimum Operational Performance Criteria, Tier 3 evaluation criteria provides the next “sieve” to determine the relative level of risk associated with the aquaculture proposal.

The Tier 3 evaluation can serve as a cost-effective device to determine if any of the proposed operational parameters are likely to lead to longer term costs associated with expensive mitigation measures and should be excluded from further consideration. The ranking of Level 1, 2 and 3 operational criteria will begin to provide a picture of the potential hurdles and the likely level of environmental assessment and regulation which could apply; the lower the level of risk, the lower the level of assessment and regulation required.

Interpreting the Rankings

The Rankings

The tables associated with Tier 1, 2 and 3 provide a ranking in relation to the criteria and the level of risk associated with the project characteristics. These rankings assist in evaluating individual sites and operational options as well as providing for a comparison between alternative options. The values are not to be added up and should result in an aggregate reading of the acceptability of the site for aquaculture.

Table 31. Interpreting the Rankings

Project Profile Analysis	Class of development	Development Assessment	Assessment Document
Minimum Performance Criteria Not Met	Prohibited		
Minimum Performance Criteria met and all the rankings are Level (1)	Class 1	Non-designated Development	SEE
Minimum Performance Criteria met, any of the rankings are Level (2) and none are Level (3)	Class 2	Non-designated Development	SEE
Minimum Performance Criteria met and any of the rankings are Level (3)	Class 3	Designated Development	EIS

It must be reinforced that for aquaculture projects to be undertaken on the Hunter and Central Coast, they must meet the Minimum Locational and Operational Performance Criteria.

Who makes the decision

It is essential that the consent authority (the local council or the Minister for Urban Affairs and Planning) and NSW Fisheries are consulted prior to lodging the development application.

The applicant should submit sufficient information to the consent authority so that the consent authority can decide whether the project meets the Minimum Performance Criteria and the level of assessment required based on the level of risk according to the Project Profile Analysis. This must be done prior to submitting the development application. It is the responsibility of the consent authority to determine if a proposal is a Class 1, 2 or 3 development.

Transitional Provisions

Where there is an existing aquaculture enterprise or a site of an abandoned aquaculture enterprise and there is a proposal to upgrade or re-establish an aquaculture operation on that site, the Hunter and Central Coast Sustainable Aquaculture Strategy will apply.

For proposals that do not comply with the best practice in the AIDP and do not meet the Minimum Performance Criteria, the applicant must formally seek and obtain agreement of the Minister for Urban Affairs and Planning to be exempted from the Minimum Performance Criteria that would have otherwise made the proposal not permissible.

In making a decision for an exemption from the Minimum Performance Criteria, the Minister shall take into consideration whether the proposal will lead to:

- improved environmental outcomes despite non or partial compliance with the Site Location Minimum Performance Criteria; and
- total compliance with the Operational Minimum Performance Criteria.

Project Profile Analysis for Ponds, Raceways and Tanks

Minimum Performance Criteria

The following are Minimum Performance Criteria that proposals must meet to be permissible development within the Hunter and Central Coast Region.

Information available from Government Sources

Locational Criteria	Minimum Performance
1. LEP zones for ponds	Within zones listed in Column 2 of Zoning Table
2. LEP zones for tanks and raceways	Within zones listed in Column 3 of Zoning Table
3. Estuarine pond based aquaculture	Within an area coloured green on an Estuarine Aquaculture Map
4. Flood liability	Above level of Probable Maximum Flood for high security species, eg. Barramundi.
5. Conservation exclusion zones	NPWS protected areas (e.g. National Parks, Nature Reserves, Aboriginal Areas, Historic Sites, Karst Conservation Reserves) Aquatic Reserves or Marine Parks (excluding general use zones) Vacant Crown Land ¹
Operational Criteria	
6. Species	Species selection must be consistent with the NSW Fisheries Policy on Translocation of Live Aquaculture organisms. No non-indigenous species shall be cultured in saline pond culture.
7. Grow-out Pond design	Capable of gravity draining and completely drying ponds
8. Freshwater culture (except for species approved for flow through systems eg. Salmonoids)	Zero discharge of pond water to a natural water bodies or wetlands
9. Outlets from ponds	All outlets must be screened to avoid escape of stock
10. Outlet from estuarine pond farms (does not include tanks and raceways)	All saline discharge water must be held in a sedimentation system for a minimum of 24 hours prior to discharge and must be returned to saline tidal reaches of the waterway.

LEP Zoning Table For Locational Criteria 1 and 2

Column 1	Column 2	Column 3
Local Environmental Plan	Zones for Ponds	Zones for Tank and Raceway
Cessnock Local Environmental Plan 1989	1 (a) Rural "A"	1 (a) Rural "A" 1 (a1) Rural "A1" 4 (a) Industrial 4 (b) Light Industrial
Dungog Local Environmental Plan 1990	1 (b) General Rural 1 (d) Rural Farmlets	1 (b) General Rural 1 (d) Rural Farmlets 4 (a) General Industrial 4 (b) Light Industrial
Gloucester Local Environmental Plan 2000	1 (a) Rural 7 (d) Environment Protection (Scenic)	1 (a) Rural 4 (a) Industrial 7 (d) Environment Protection (Scenic)

¹ This provision will not apply to the use of such land required for gaining access to water that will be subject an assessment by the appropriate authority for each situation on its merits.

Gosford Interim Development Order No 122 1979	1 (a) Rural (Agriculture) 1 (b) Rural (Highway Protection) 7 (b) Conservation and Scenic Protection	1 (a) Rural (Agriculture) 1 (b) Rural (Highway Protection) 4 (a) Industrial
Gosford Planning Scheme Ordinance 1968		4 (a) Industrial (General) 4 (b) Industrial (Light)
Great Lakes Local Environmental Plan 1996	1 (a) Rural	1 (a) Rural 3 (d) Special Business Waterfront 4 (a) Industrial
Lake Macquarie Local Environmental Plan 1984	1 (a) Rural ``A" 1 (b) Rural ``B"	1 (a) Rural ``A" 1 (b) Rural ``B" 1 (c) Rural ``C" 4 (a) General Industry 4 (b) Special Industry
Lake Macquarie Draft Local Environmental Plan 2002	1 (1) Rural 9 Natural Resources	1 (1) Rural 1 (2) Rural 4 (1) Industrial Core 4 (2) Industrial General 9 Natural Resources
Maitland Local Environmental Plan 1993	1 (a) Prime Rural Land 1 (b) Secondary Rural Land	1 (a) Prime Rural Land 1 (b) Secondary Rural Land 4 (a) General Industrial 4 (b) Light Industrial
Merriwa Local Environment Plan 1992	1 (a) General Rural Zone	1 (a) General Rural Zone 4 (a) Industrial Zone
Murrurundi Local Environmental Plan 1993	1 (a) Rural ``A" Zone	1 (a) Rural ``A" Zone
Muswellbrook Local Environmental Plan 1985	1 (a) Rural ``A" Zone 5 (a) Special Use (power station)	1 (a) Rural ``A" Zone 4 (a) General Industrial Zone 4 (b) Light Industrial Zone 5 (a) Special Use (power station) 7 (L1) Environmental Protection General (Alluvial Areas) Zone
Newcastle Local Environmental Plan 1987		1 (a) Rural Zone 4 (a) Light Industrial Zone 4 (b) General Industrial Zone 4 (c) Eco-industrial Zone
Newcastle Draft Local Environmental Plan 2002	7(a) Conservation	4 (a) Light Industrial Zone 4 (b) General Industrial Zone 4 (c) Eco-industrial Zone
Port Stephens Local Environmental Plan 2000	1 (a) Rural Agriculture ``A" Zone 1 (c1) Rural Small Holdings Zone 6 (a) General Recreation ``A" Zone 6 (c) Special Recreation ``C" Zone 7 (a) Environment Protection Zone 7 (f1) Environment Protection ``F1" (Coastal Lands) Zone	1 (a) Rural Agriculture ``A" Zone 1 (c1) Rural Small Holdings Zone 1 (c2) Rural Small Holdings Zone 4 (a) Industrial General ``A" Zone 6 (a) General Recreation ``A" Zone 6 (c) Special Recreation ``C" Zone 7 (f1) Environment Protection ``F1" (Coastal Lands) Zone
Scone Local Environmental Plan 1986	1 (d) Rural Holdings Zone 1 (e) General Agricultural Zone 1 (i) Intensive Agricultural Zone 1 (s) Small farm zone	1 (d) Rural Holdings Zone 1 (e) General Agricultural Zone 1 (i) Intensive Agricultural Zone 1 (s) Small farm zone 4 (a) General Industrial Zone)
Singleton Local Environmental Plan 1996	1 (a) Rural Zone	1 (a) Rural Zone 4 Industrial Zone
Wyong Local Environmental Plan 1991	1 (a) Rural Zone 1 (c) Rural Holding Zone 7 (b) Scenic Protection Zone	1 (a) Rural Zone 1 (c) Rural Holding Zone 4 (a) General Industrial Zone 4 (b) Light Industrial Zone 4 (e) Regional Industrial and Employment Development Zone 7 (b) Scenic Protection Zone

Project Profile Analysis for Ponds

Tier 1 - Site Evaluation for Ponds

As a first step in the site evaluation process, a “desk-top” study should be undertaken of potential sites using readily available information in maps and other data sources held by Councils, DLWC and government agencies. This desk-top study will provide a quick and efficient approach to weeding out unsuitable sites and for focusing in on those sites which would justify a more intensive site evaluation. Tier 1 Evaluation Criteria are used to as a first “sieve” to identify areas that are likely to be suitable for aquaculture.

Information available from Government Sources

SITE EVALUATION CRITERIA FOR PONDS	TIER 1 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
1. Water Supply based on DLWC information			
Estuarine - Tidal amplitude	> 600mm	100 - 600mm	< 100mm
Fresh - Water availability	- Existing irrigation licence approved for bore or river extraction, or - Irrigation licence available for purchase.	- New licence required for bore or river extraction, or - Reliant upon on-farm dam and 10% run-off	
Freshwater projects that plan to pump water from a river – Environmental flows	No access restrictions based on flows in normal conditions	Access permitted only during high flows in normal conditions	
Drinking Water supply protection [†] :	Not located in a drinking water catchment	Located within a drinking water catchment	
Acid Sulphate Soils			
If site is < 2metres AHD based on survey data, ASS soil profile based on ASS Risk Maps ¹	ASS Landform Process Class A with Landform Element Class b, l, t, p, y or w	ASS Landform Process Classes A, W, B, E, L, S with other Landform Element than b, l, t, p, y or w	
Heritage issues			
Heritage sites based on LEP or REP maps and State Heritage Inventory	No listings on the proposed site	Listings onsite	
Aboriginal heritage based on NPWS Aboriginal Sites Register and Local Aboriginal Land Council	No recorded sites or places and the NPWS advises that no archaeological assessment is required	Sites or places recorded on the land and/or the NPWS advises that an archaeological assessment is required.	Sites/places of regional or national significance present and likely to impact on sites/places.
Native Title Issues			
	- Crown Land, previous determination - Native Title extinguished	Crown Land Native Title interest needs to be determined	
Conservation issues²			
NPWS protected areas, Aquatic Reserves and Marine Parks (except “General Zone”)	Not located adjacent these areas and no potential to impact these areas	Adjacent to but no potential to drain into or extract water from these areas or impact on the conservation values.	Activity may impact on these areas.
SEPP 14, SEPP 26, Marine Parks (“General Zone”), World Heritage Areas, Ramsar Wetlands, Critical Habitat	Not located in or adjacent these areas and no potential to impact these areas	Adjacent to but no potential to drain into or extract water from these areas but may involve water pipe access across the areas.	Activity located in areas or draining into these area or may impact on the conservation values
Stock species			
Species cultivated in Estuarine ponds <i>Note: Non-indigenous species to NSW are not permissible</i>	Indigenous to NSW		
Species cultivated in freshwater ponds. <i>Note: Species inconsistent with translocation policy especially pest or/and noxious species are not permissible</i>	Indigenous to catchment	Species consistent with NSW Fisheries Translocation Policy	

[†] Note: a drinking water catchment means the restricted areas prescribed by the controlling water authority

SITE EVALUATION CRITERIA FOR PONDS	TIER 1 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
Site accessibility i. Vehicle & electricity accessible based on LEP maps & power suppliers information	Existing access and services or access and services can be readily provided	Access or services limited or difficult – e.g. across a wetland (other than SEPP 14 wetlands dealt with above)	Access or services across SEPP 14 or SEPP 26 areas

¹ Sourced from the Acid Sulphate Soil (ASS) Risk Maps

² This provision will not apply to the use of land required for gaining access to water

Tier 2 - Site Evaluation for Ponds

The next step in site evaluation is to undertake more detail site assessment including investigations by technical experts and in some cases, laboratory analysis. The purpose of this level of investigation is to eliminate sites that have inherent management problems that could result in increased costs during assessment and approval, construction or operation. The information gained from this investigation can provide the basis for preliminary design and operation planning.

Information sourced from site investigations by applicant

SITE EVALUATION CRITERIA FOR PONDS	TIER 2 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
Water Supply Quality			
Water quality risks from nearby land uses	Grow-out water quality is consistently suitable for aquaculture. No agricultural or horticultural activity likely to involve pesticide spraying within 1km	Grow-out water quality is mostly suitable for aquaculture. Agricultural or horticultural activity likely to involve pesticide spraying within 1km	Grow-out water quality is not generally suitable for aquaculture and requires treatment OR does not have a low risk of contamination. For estuarine, inlet within 1km of sewage treatment plant outlet
Potable water for processing, etc	- Mains water; or - Onsite existing reliable water of potable quality	- Onsite water of potable quality but may need to be supplemented during drought; or - No existing potable water supply on site	
Water Supply Access from rivers or estuaries			
Estuarine ponds - pump station site	Not require sump pit or any deepening of bed of estuary or waterway	Require sump pit in estuary or waterway or need to cross an ocean beach	
Estuarine - Estuary Circulation	Flushing time < 15 days	Flushing time 15 – 30 days	Flushing time > 30 days
Fresh water ponds - pump station site	Not require sump pit or any deepening of bed of river	Require sump pit in river	
Mean Site Elevation			
Mean elevation of the land to which the DA applies for Estuarine growing ponds	2-10m AHD ³	1-2m AHD ³ if less than 5 ha of pond area	1-2m AHD ³ if more than 5 ha of pond area
Mean elevation of the land to which the DA applies for Freshwater growing ponds	>1 metre AHD		<1 metre AHD
Topography			
Estuarine ponds - slope of land	< 2% slope	>2% and < 5 % slope	> 5% slope
Freshwater ponds - slope of land	<5% slope.	>5% and <10% slope.	> 10 % slope
Irrigation area landform limitations*	slight	moderate	severe
Soils			
Soil Characteristics - Suitability for Pond/Dam Construction	Clayey with mixture of soil/sand and low erosion potential and suitable for dam construction	Sandy/gravelly with erosion potential and/or limited water holding capacity – may need to import most pond clay for lining material or an artificial liner	
Soil Characteristics - Suitability for Irrigation for freshwater ponds	Soils suitable and/or adequate land to irrigate/use recycled water on site or off-site near-by	Soils potentially unsuitable and/or inadequate land to irrigate or use recycled water	
Irrigation area soil limitations*	slight	moderate	severe
Soil Contamination based on SEPP 55 criteria	Suitable for residential use or for animal occupation	Exceed levels safe for animal or residential uses and the contaminated area is less than 3ha	More than 3ha of land exceed levels safe for animal or residential uses
Hydrology issues			

* see Table 17 in Site Selection chapter for more details.

³ note:- Proposals which disturb more than 1 tonne of acid sulfate soils will be required to prepare an Acid Sulfate Soils Management Plan consistent with the ASS Manual.

SITE EVALUATION CRITERIA FOR PONDS	TIER 2 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
Potential to affect groundwater	No underlying potable or high quality fresh groundwater within 3m	Underlying groundwater within 3m is not of high quality or potable.	Underlying potable water within 3m
Catchment Stormwater Drainage	- No catchment related stormwater drainage across site, or - If present, measures to manage across site flows not likely to affect surrounding area	- Important catchment stormwater drainage across site; or - Change in drainage of stormwater likely to affect surrounding properties	
For Fresh Water Ponds: Flood liability	Site not flood liable (above the PMF level)	Below PMF but above 1:100 year floods	Below 1:100 year floods but can construct ponds so unlikely to be inundated by 1:100 year flood
For Estuarine Ponds: Flood liability	Site above 1:100 year flood	Below 1:100 year floods	
For flood liable ponds: Potential effect on passage of flood waters	Some flood management required but no potential effect to passage of flood waters	Flood flows likely to be impeded or change local flooding pattern	Flood management likely to alter the course of the river
Excess water disposal			
Management of excess water	- non-irrigation reuse scheme eg hydroponics; OR - irrigation re-use scheme and discharge receival site has adequate area and suitable soils		- no non-irrigation reuse scheme, AND - no identified discharge receival site that has an adequate area and suitable soils.
Ecology			
Type of existing vegetation on the actual development site (flora survey required)	Cultivated land, improved pasture, or predominantly cleared. No need for a consent to clear or disturb native vegetation under Native Vegetation Conservation Act or Rivers and Foreshore Improvement Act	Predominantly native vegetation – trees, shrubs, grasslands. Clearing vegetation requires a consent under Native Vegetation Conservation Act or Rivers and Foreshore Improvement Act	
Likely occurrence of threatened species, populations or ecological communities or their habitats (flora & fauna survey required)	No threatened species, populations or ecological communities or their habitats known or likely to occur – 8 Part Test not required	Threatened species, populations or ecological communities or their habitats known or likely to occur – 8 Part Test required	Likely to significantly affect threatened species, populations or ecological communities or their habitats. ¹
Likely impact on aquatic habitats and mangroves.	No likely disturbance or impact	Disturbance or impact on aquatic habitat or mangroves – approval or permit needed to disturb mangroves or seagrasses, reclamation or dredging works or impeding fish passages.	
Aboriginal heritage			
Consultation with Aboriginal community (Call NPWS for appropriate contacts)	No values of cultural significance to the Aboriginal community identified.	Values of cultural significance to the Aboriginal community identified. Agreement reached between Aboriginal community, NPWS and proponent on the management of these values.	Values of cultural significance and no agreement reached with Aboriginal community, NPWS on the management of these values.
Location of Aboriginal Sites	No recorded Aboriginal site/place and NPWS advises that no archaeological assessment is required	Recorded Aboriginal site/place and/or the NPWS advises that an archaeological assessment is required	

⁴ Note: approval from NPWS is required.

SITE EVALUATION CRITERIA FOR PONDS	TIER 2 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
Likely impact on Aboriginal heritage.	No impact on Aboriginal sites/places or values of cultural significance to Aboriginal community	Impact on Aboriginal sites/places or values of cultural significance to Aboriginal community	Sites/places of regional or national significance present and likely to impact on sites/places.
<i>Adjacent land use to pond culture</i>			
Potential for conflict with neighbours	Neighbouring lands utilised for compatible purposes e.g. agriculture/industrial development	Neighbouring land zoned for residential or rural residential purposes or has been identified as suitable for this purpose in an LEP or REP	
Potential visual impact	Site not visible or predominantly obscured from neighbours or from prominent vantage points (e.g. highway)	Site clearly visible to neighbours or from prominent vantage points (e.g. from highway)	
Proximity to residences (not part of the site)	No residences within 400m of the ponds or pumps if line of sight	Residences within 400m of the ponds or pumps if line of sight	

Tier 3 - Operational Evaluation Criteria for Ponds

The next sieve in the evaluation process is to consider the operational criteria – species, design, layout and operating regime and the likely risk to the environment from various options. Avoidance of environmental impacts on the community or the environment should be paramount. Where avoidance is not possible, impact minimisation must be considered. The lower the level of environmental risk, the lower the costs of mitigation and the simpler the assessment and approval process

Information sourced from investigations by applicant

OPERATIONAL CRITERIA FOR POND CULTURE	TIER 3 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
Location of Ponds – Distance from the top of the high bank of a natural waterbody or wetland and the edge of the pond water surface.	> 50 metres		< 50 metres
Health Management			
Period of total farm dryout after every production cycle for prawns	>6 weeks between crops	3 - 6 weeks between crops	<3 weeks between crops
Arrangements for the timely identification and treatment of disease	- On site trained staff with appropriate facilities, or - Demonstrated arrangement with accredited laboratory or veterinary practice	No onsite provision for analysis of stock health problems and no backup arrangements with an accredited laboratory or veterinary practice	
Predators management of fingerling ponds	All ponds screened or equivalent systems		No screening for fingerling ponds
Predators management of grow out fish ponds	Combination of systems which may include screening, scare and other management systems not intending harm to predators	Only “scare” systems. May trigger need for 8 Part Test if affect threatened bird species	No control for predators
Feeding Management			
Feed storage to prevent odour emissions or vermin problems	Facilities to store feed (e.g. enclosed shed)	Feed stored outdoors or so as not to minimise odour or other problems	
Pond design includes feeding adjustment system	- System to monitor feeding and adjust feed quantities accordingly; or - System can adjust feed via feeding guide schedule	No system to monitor feeding and adjust feed quantities	
Feeding system including mechanical feeders, systematic dispersal equipment and feeding program	- System to broadcast feed homogenously to prevent the creation of “dead” areas; or - System can broadcast feed in defined feeding strips	No system to broadcast feed homogenously	
Water Monitoring			
Capacity to measure DO, temperature, ammonia and pH.	Provisions for regular daily monitoring; e.g. with good quality hand-held meter or test kit;	No provisions for regular daily monitoring	
Capacity to analysis water for N, P, Alkalinity, NFR, BOD	On site facilities for basic water quality analysis, or dependent on accredited laboratory for water analysis	No provision for regular water analysis	
Pond water management			
Supply pipe or channel capacity	Largest growout pond can be filled in 1 day or less	Largest growout pond can be filled in 1 - 3 days	Largest pond can be filled in > 3 days
Pond Outlet system	No pumping required to drain pond completely	Requires pumping from an external sump to drain pond	

OPERATIONAL CRITERIA FOR POND CULTURE	TIER 3 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
Recycling System capacity for estuarine pond systems which discharge to water bodies expressed in terms of: (i) Retention period of water prior to reuse or discharge; or (ii) Surface area of water in recycling pond (including drainage channels) relative to total water surface area of growing ponds	- Retention period of >6 days; or - Surface area of recycling pond > 20% of total water surface area of the growing ponds	- Retention period of 1-6-days; or - Surface area of recycling pond 10-20% of total water surface area of the growing ponds	- Retention period of <1 days; or - Surface area of recycling pond <10% of total water surface area of the growing ponds
Estuarine pond discharge limits (averaged over the growing season when measured above the background) based on 4% daily water exchange rate	Nil discharge	< 12kg/ha/day TSS < 0.48 kg/ha/day Total N < 0.06 kg/ha/day Total P	> 12kg/ha/day TSS > 0.48 kg/ha/day Total N > 0.06 kg/ha/day Total P
Storage capacity of recycling pond system (excluding growing ponds) for freshwater ponds	> 2 times the volume of largest growing pond	1-2 times the volume of largest growing pond	< the volume of the largest growing pond
Organic Waste Mgt (eg. dead fish, processing waste and other putrescible waste)			
Temporary storage of organic waste prior to disposal	- Daily disposal; or - Held prior to disposal so no odour generated (e.g. in freezer in sealed container)	Held in covered containers prior to intermittent disposal	No specific arrangements
Disposal of organic waste on-site or off-site	- Disposed at an approved off-site recycling or landfill facility; or - Buried (with lime) in an area which is > 100m from a waterways and where the groundwater is > 3m. and the soil has low permeability	- Buried (with lime) in an area which is < 100m from a waterways or where the groundwater is < 3m or the soil is not low permeability; or - Composted (with lime)	No specific arrangements
Disposal of stock in the event of a mass mortality, on-site or off-site	Arrangements in place for disposal at an approved off-site recycling or landfill facility.	Buried (with lime) in an approved onsite disposal area.	No specific arrangements
Planning and building issues			
Buildings or structures Set back from nearest road boundary	> 5 metres	< 5 metres	
Building height excluding any parapet	< 7.2 metres	> 7.2 metres	
Driveways with regard to access, widths and turning circle	Complies with the local government's standards and no s.138 permit required from the RTA.	Modifications required to the public road to comply with the standards required by the local government and or a s.138 permit required from the RTA.	
Truck loading and unloading space on site	No queuing or waiting on public roads	Queuing or waiting required on public roads	
Compliance with Building Code of Australia	Meet the "deemed to satisfy" provisions	Modifications required	
If unsewered site, on-site human sewerage system	Reticulated sewerage connection or adequate licensed on-site treatment system installed which complies with the approval requirements of the Local Govt Act	Modifications required to comply with the approval requirements of the Local Government Act	

Project Profile Analysis for Tanks & Raceways

Tier 1 - Site Evaluation for Tanks & Raceways

As a first step in the site evaluation process, a “desk top” study should be undertaken of potential sites using readily available information in maps and other data sources held by Councils, DLWC and government agencies. This desk-top study will provide a quick and efficient approach to weeding out unsuitable sites and for focusing in on those sites which would justify a more intensive site evaluation. Tier 1 Evaluation Criteria are used to as a first “sieve” to identify areas that are likely to be suitable for aquaculture.

Information available from Government Sources

SITE EVALUATION CRITERIA FOR TANKS & RACEWAYS	TIER 1 LEVEL OF ASSESSMENT FOR TANKS & RACEWAYS		
	Level 1	Level 2	Level 3
1. Grow-out Water Supply Based on DLWC information			
Saline - if dependent on Estuarine – Tidal amplitude	>300mm	100 - 300mm	< 100 mm
Fresh - Water availability	- Existing irrigation licence approved for bore or river extraction; or - Irrigation license available for purchase.	- New licence required for bore or river extraction; or - Reliant upon on-farm dam and 10% run-off	
Projects that plan to use a mains water supply		All projects that plan to use a mains water supply for grow-out, nursery or hatchery	
Fresh - raceway production eg, Salmonoids.	Not within a domestic water supply catchment or above a conservation zone (i.e. National Park or Forest)		Within a domestic water supply catchment or above a conservation zone (i.e. National Park or Forest).
Freshwater projects that plan to pump water from a river – Environmental flows	No access restrictions based on flows in normal conditions	Access permitted only during high flows in normal conditions	
For Fresh Water Tanks: Drinking Water supply protection [†]	- Not located in a drinking water catchment; or - With a trade waste agreement for the disposal of discharge water	Located within a drinking water catchment.	
Acid Sulfate Soils			
If site is < 2 metres AHD based on survey data; ASS soil profile based on ASS Risk maps ¹	ASS Landform Process Class A with Landform Element Class b, l, t, p, y or w	ASS Landform Process Classes A, W, B, E, L, S with other Landform Element than b, l, t, p, y or w	
Heritage issue			
Heritage sites based on LEP or REP maps and State Heritage Inventory	No listings on the proposed site	Listings on-site	
Aboriginal heritage based on NPWS Aboriginal Sites Register and Local Aboriginal Land Council	No recorded sites or places and the NPWS advises that no archaeological assessment is required	Sites or places recorded on the land and/or the NPWS advises that an archaeological assessment is required.	Sites/places of regional or national significance present and likely to impact on sites/places.
Native Title Issues			
	- Crown Land, previous determination - Native Title extinguished	Crown Land Native Title interest needs to be determined	
Conservation issues²			

[†] Note: a drinking water catchment means the restricted areas prescribed by the controlling water authority

* see Table 17 in Site Selection chapter for more details.

SITE EVALUATION CRITERIA FOR TANKS & RACEWAYS	TIER 1 LEVEL OF ASSESSMENT FOR TANKS & RACEWAYS		
	Level 1	Level 2	Level 3
NPWS protected areas, Aquatic Reserves and Marine Parks (except "General Zone")	Not located adjacent these areas and no potential to impact these areas	Adjacent to but no potential to drain into or extract water from these areas or impact on the conservation values.	Activity may impact on the conservation values of these areas.
SEPP 14, SEPP 26, Marine Parks ("General Zone"), World Heritage Areas, Ramsar Wetlands, Critical habitat	Not located in or adjacent these areas and no potential to impact these areas	Adjacent to but no potential to drain into or extract water from these areas but may involve water pipe access across the areas.	Activity located in areas or draining into these area or may impact on the conservation values
Stock species <i>Note: Species that are inconsistent with translocation policy are not permissible</i>	Indigenous to catchment	Species consistent with translocation policy	
Site accessibility Vehicle & electricity accessible based on LEP maps & power suppliers information	Existing access and services or access and services can be readily provided	Access and services limited or difficult – may involves disturbance of a wetland (other than SEPP 14 wetlands dealt with above)	

¹ Sourced from the Acid Sulphate Soil (ASS) Risk Maps

² This provision will not apply to the use of land required for gaining access to water

Tier 2 - Site Evaluation for Tanks & Raceways

The next step in site evaluation is to undertake more detail site assessment including investigations by technical experts and in some cases, laboratory analysis. The purpose of this level of investigation is to eliminate sites that have inherent management problems that could result in increased costs during assessment and approval, construction or operation. The information gained from this investigation can provide the basis for preliminary design and operation planning.

Information sourced from site investigations by applicant

SITE EVALUATION CRITERIA FOR TANKS & RACEWAYS	TIER 2 LEVEL OF ASSESSMENT FOR TANKS & RACEWAYS		
	Level 1	Level 2	Level 3
Water Supply Quality			
Water quality risks from nearly land uses	Grow-out water quality is consistently suitable for aquaculture and has a low risk of contamination	Grow-out water quality is mostly suitable for aquaculture and has a low risk of contamination	Grow-out water quality is not generally suitable for aquaculture and requires treatment OR does not have a low risk of contamination For estuarine, inlet within 1km of sewage treatment plant outlet
Potable water for processing or other purposes	• Mains water; or • Onsite existing reliable water of potable quality	• Onsite water of potable quality but may need to be supplemented during drought; or • No existing potable water supply on site	
Water Supply Access from rivers or estuaries			
<i>Estuarine</i> - pump station site	Not require sump pit or any deepening of bed of estuary or waterway	Require sump pit in estuary or waterway or need to cross an ocean beach	
<i>Estuarine</i> - Estuary Circulation	Flushing time < 15 days	Flushing time > 15 days	
Fresh water - pump station site	Not require sump pit or any deepening of bed of river	Require sump pit in river	
Soils			
For freshwater tanks culture: Area to irrigate for agriculture, plantation, horticulture or landscaping if: - no trade waste agreement for disposal of discharge water or - no non-irrigation reuse scheme e.g. hydroponics	• Soils suitable; and/or • Adequate land to irrigate/use recycled water on site or off-site near-by	• Soils potentially unsuitable; and/or • Inadequate land to irrigate or use recycled water- dependent on neighbours or other arrangements for use of water	
Irrigation area soil and landform limitations*	slight	moderate	severe
Excess water disposal			
Management of excess water	• non-irrigation reuse scheme eg hydroponics; OR • irrigation re-use scheme and discharge receival site has adequate area and suitable soils		• no non-irrigation reuse scheme, AND • no identified discharge receival site that has an adequate area and suitable soils.
Hydrology issues			

SITE EVALUATION CRITERIA FOR TANKS & RACEWAYS	TIER 2 LEVEL OF ASSESSMENT FOR TANKS & RACEWAYS		
	Level 1	Level 2	Level 3
Catchment Stormwater Drainage	- No catchment-related stormwater drainage across site; or - With provision to manage across-site flows not likely to affect surrounding area	- Important catchment stormwater drainage across site; or - Change in drainage of stormwater likely to affect surrounding properties	
Flood liability for non-indigenous species to the catchment (except high security species, e.g. barramundi which must be located > PMF)	Site not flood liable (above the PMF level)	Below the PMF and above 1:100 year flood	Below the 1:100 year flood but can be constructed so that unlikely to be inundated by 1:100 year flood
Ecology			
Type of existing vegetation on the actual development site (flora survey required)	Cultivated land, improved pasture, or predominantly cleared. No need for a consent to clear or disturb native vegetation under Native Vegetation Conservation Act or Rivers and Foreshore Improvement Act	Predominantly native vegetation – trees, shrubs, grasslands. Clearing vegetation requires a consent under Native Vegetation Conservation Act or Rivers and Foreshore Improvement Act	
Likely occurrence of threatened species, populations or ecological communities or their habitats (flora & fauna survey required)	No threatened species, populations or ecological communities or their habitats known or likely to occur – 8 Part Test not required	Threatened species, populations or ecological communities or their habitats known or likely to occur – 8 Part Test required	Likely to significantly affect threatened species, populations or ecological communities or their habitats. ¹
Likely impact on aquatic habitats and mangroves	No likely disturbance or impact	Disturbance or impact on aquatic habitat or mangroves – approval or permit needed to disturb mangroves or seagrasses, reclamation or dredging works or impeding fish passages.	
Aboriginal heritage			
Consultation with Aboriginal community (Call NPWS for appropriate contacts)	No values of cultural significance to the Aboriginal community identified.	Values of cultural significance to the Aboriginal community identified. Agreement reached between Aboriginal community, NPWS and proponent on the management of these values.	Values of cultural significance and no agreement reached with Aboriginal community, NPWS on the management of these values.
Location of Aboriginal Sites	No recorded Aboriginal site/place and NPWS advises that no archaeological assessment is required	Recorded Aboriginal site/place and/or the NPWS advises that an archaeological assessment is required	
Likely impact on Aboriginal heritage	No impact on Aboriginal sites/places or values of cultural significance to Aboriginal community	Impact on Aboriginal sites/places or values of cultural significance to Aboriginal community	Sites/places of regional or national significance present and likely to impact on sites/places. ¹
Location for tank and raceway farms			
Mean elevation of the land to which the DA applies for tanks and raceways	>1 metre AHD		<1 metre AHD
Location of inlet pipe for tank and raceway farms (Estuarine or Marine)	Suitable existing infrastructure to carry inlet pipe	Estuary or rock anchoring of pipeline	Established across ocean beach
Adjacent Land use to tank culture			

⁴ Note: approval from NPWS is required.

SITE EVALUATION CRITERIA FOR TANKS & RACEWAYS	TIER 2 LEVEL OF ASSESSMENT FOR TANKS & RACEWAYS		
	Level 1	Level 2	Level 3
Potential for Conflict with Neighbours	Neighbouring land zoned for compatible purposes, eg. agricultural or industrial development,	Neighbouring land zoned for residential or rural/residential purposes or has been identified as suitable for this purpose in an LEP or REP	
Potential Visual Impact	• In an existing building; or • In a new building < 7.2 metres in height; or • Meets local government design requirements. • Site not visible or predominantly obscured from neighbours or from prominent vantage point (e.g. highway)	• In a new building >7.2 metres in height; or • In a new building in rural area and site is clearly visible to neighbours or from prominent vantage point (e.g. from highway)	
Proximity to residences	• In industrial zone; or • In rural zone with no residences within 200 m of buildings or pumps	Residences in rural zone < 200m of the buildings or pumps	

Tier 3 - Operational Evaluation Criteria for Tanks & Raceways

The next sieve in the evaluation process is to consider the operational criteria – species, design, layout and operating regime and the likely risk to the environment from various options. Avoidance of environmental impacts on the community or the environment should be paramount. Where avoidance is not possible, impact minimisation must be considered. The lower the level of environmental risks the lower the costs of mitigation and the simpler the assessment and approval process.

Information sourced from investigations by applicant

OPERATIONAL CRITERIA FOR TANK & RACEWAY CULTURE	TIER 3 LEVEL OF ASSESSMENT FOR TANKS & RACEWAYS		
	Level 1	Level 2	Level 3
Health Management			
Arrangements for the timely identification and treatment of disease	- On site trained staff with appropriate facilities, or - Demonstrated arrangement with accredited laboratory or veterinary	No on-site provision for analysis of stock health problems and no backup arrangements with an accredited laboratory or veterinary	
Clean in Place (CIP)	Systems are designed to ensure total disinfection and dry-out of all facilities to break pathogen cycle	Difficulty in ensuring total disinfection and dry-out of all facilities	No CIP provision
Food and Feeding Management			
Feed storage to prevent odour emissions or vermin problems	Facilities to store feed (eg. enclosed shed)	Feed stored outdoors or so as not to minimise odour or other problems	
Feeding system	- Facilities to monitor food consumption and adjust feed; or - Provision of a system to adjust feed quantities via feeding schedule	No system to monitor feeding and adjust feed quantities	
Water Monitoring			
Capacity to measure DO, temperature & pH	Provisions for regular daily monitoring	No provisions for regular daily monitoring	
Capacity to analysis water for N, P, Alkalinity/acidity, NFR, BOD and other required parameters.	- On site facilities for basic water analysis; or - Only dependent on contract with accredited laboratory for water analysis	No provision for regular water analysis	
Grow-out Water Management			
Tank or raceway systems with water recycling	Recycle system with biofiltration and/or mechanical filtration or better	No mechanical filtration system	
Tank and Raceway Water Management			
Storage capacity of recycling ponds	> 2 times the volume of largest growing tank	1 - 2 times the volume of largest growing tank	< the volume of the largest growing tank
Recycling system for salmonoid production.	Zero discharge		No recycling of water
Flow through Water Management			
Species approved for freshwater raceway culture eg. Salmonoids.	Zero discharge	Mechanical filtering <1000 microns or retention dam >10% of growout volume	Mechanical filtering >1000 microns or retention dam <10% of growout volume
Saline tank and raceway culture	Zero discharge	Mechanical filtering <1000 microns or retention dam >10% of growout volume	Mechanical filtering >1000 microns or retention dam <10% of growout volume
Daily Discharge limits for species approved for freshwater raceway culture eg. salmonoid production.	Zero discharge	< 60mg/l TSS < 0.30mg/l Total N < 0.05mg/l Total P	> 60mg/l TSS > 0.30mg/l Total N > 0.05mg/l Total P
Total Discharge load limits for species approved for freshwater raceway culture eg. salmonoid production.	Zero discharge	< 55kg N/tonne of fish produced < 12kg P/tonne of fish produced	> 55kg N/tonne of fish produced > 12kg P/tonne of fish produced
In stream water quality objectives	Zero discharge	In stream water quality objectives met.	In stream water quality objectives not met.
Organic Waste Management (e.g. dead fish, processing waste and other waste)			

OPERATIONAL CRITERIA FOR TANK & RACEWAY CULTURE	TIER 3 LEVEL OF ASSESSMENT FOR TANKS & RACEWAYS		
	Level 1	Level 2	Level 3
Temporary storage of organic waste prior to disposal (e.g. dead fish, processing waste and other putrescible waste)	- Daily disposal or - Held prior to disposal so no odour generated (e.g. in freezer in sealed container)	Held in covered containers prior to intermittent disposal	No specific arrangements
Disposal of organic waste	- Disposed at an approved off-site recycling or landfill facility; or - Buried (with lime) in an area which is > 100m from a waterways and where the groundwater is > 3m and the soil has low permeability	- Buried (with lime) in an area which is < 100m from a waterways or where the groundwater is < 3m or the soil is not low permeability; or - Composted (with lime)	No specific arrangements
Disposal of stock in the event of a mass mortality, on-site or off-site	Arrangements in place for disposal at an approved off-site recycling or landfill facility.	Buried (with lime) in an approved onsite disposal area.	
Planning and building issues			
Buildings or structures Set back from nearest road boundary	>5 metres	< 5 metres	
Building height excluding any parapet	< 7.2 metres	> 7.2 metres	
Landscaping with trees and shrubs on each street frontage or surrounding buildings (except in industrial sites where space is a limiting factor)	> 3 metres in width	< 3 metres in width	
Driveways with regard to access, widths and turning circle	Complies with the local government's standards and no s.138 permit required from the RTA.	Modifications required to the public road to comply with the standards required by the local government and or a s.138 permit required from the RTA.	
Truck loading and unloading space on site	Queuing or waiting not required on public roads	Queuing or waiting required on public roads	
Compliance with Building Code of Australia	Meet the "deemed to satisfy" provisions	Modifications required	
If unsewered site, on-site human sewerage system	Reticulated sewerage connection or adequate licensed on-site treatment system installed which complies with the approval requirements of the Local Government Act	Modifications required to comply with the approval requirements of the Local Government Act	