

OPTION 1 & 3: Seawall (400m & 1200m)

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

OPTION 1 SEAWALL 400M

- Vertical concrete seawall to protect Illaroo Road.
- Life Cycle Cost \$8.3M.
- Reduce the coastline hazard risk.
- Protects Illaroo Road properties.
- Seawalls reflect wave energy and can erode the beach.
- Detract from visual and recreational amenity.
- Large structure footprint.
- Increases erosion rate at edges of seawall.
- Only partly consistent with ESD principles.
- Requires ongoing maintenance.



OPTION 3 SEAWALL 1200M

- Vertical concrete seawall to protect entire beach (Lake Cathie entrance to Middle Rock).
- Life Cycle Cost \$14.3M.
- Seawalls reflect wave energy and can erode beach.
- Reduce the coastline hazard risk.
- Protects Illaroo Road and Chepana Street properties.
- Detract from visual & recreational amenity.
- Large structure footprint.
- Increases erosion rate at edges of seawall.
- Only partly consistent with ESD principles.
- Requires ongoing maintenance.

- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTION 2 & 4: Revetment (400m & 1200m)

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

OPTION 2 REVETMENT (400M)

- Rock wall to protect Illaroo Road.
- Life Cycle Cost \$6.0M.
- Revetments absorb wave energy.
- Reduce the coastline hazard risk
- Protects Illaroo Road properties.
- Detract from visual and recreational amenity but can be covered in sand to reduce visual impact.
- Large structural footprint.
- Increases erosion rate at edges of revetment.
- Only partly consistent with ESD
- Require ongoing maintenance



OPTION 4 REVETMENT (1200M)

- Rock wall to protect protect entire beach (Lake Cathie entrance to Middle Rock).
- Life Cycle Cost \$14.6M.
- Revetments absorb wave energy.
- Reduce the coastline hazard risk.
- Protects Illaroo Rd & Chepana St properties.
- Detract from visual & recreational amenity but can be covered in sand to reduce visual impact.
- Large structural footprint.
- Increases erosion rate at edges of revetment.
- Only partly consistent with ESD.
- Require ongoing maintenance.

- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie

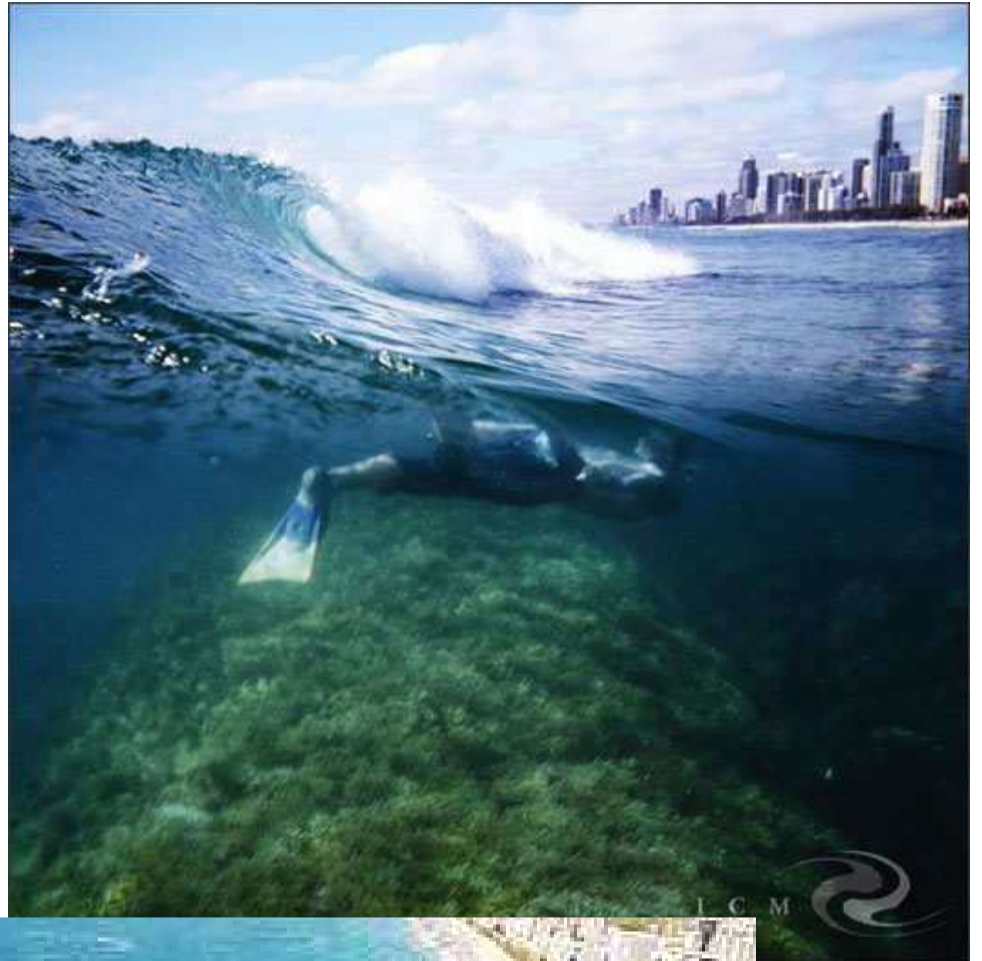


OPTION 5: Artificial Reefs

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Parallel to coast – emergent or submerged.
- Modifies near-shore wave climate and promotes beach accretion (sand build-up).
- Life Cycle Cost \$18.4M.
- Can lead to build up of sand in lee (down wind) of structure.
- Can enhance surfing conditions if properly designed.
- Visually unobtrusive if underwater.
- Can smother benthic (bottom dwelling) flora and fauna.
- Navigation &/or swimming hazard.
- Can cause beach erosion either side of the structure.
- Require maintenance.
- Development controls on properties still needed.
- Only partly consistent with ESD.



• **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

• Submissions close Wednesday, 7 October 2009.
• Online forum at www.pmhclisting.com.au

• The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie

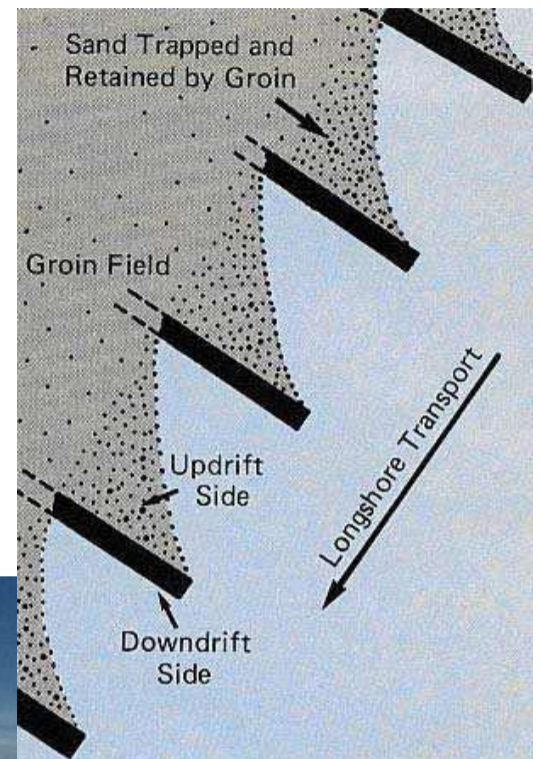


OPTION 6: Groynes (rock)

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Permanent rock groyne(s).
- Approximately 50m long perpendicular to shoreline.
- Traps sand and holds it within groyne compartment.
- Life Cycle Cost \$2.1M (for one groyne only).
- Can create a usable beach on up-drift side and improve recreational amenity.
- Provides a buffer of sand to reduce storm erosion.
- Structure can detract from visual and recreational amenity.
- Can cause erosion on down-drift side.
- Hazard to swimmers.
- Careful design and understanding of coastal processes is needed.
- Can increase loss of sand from beach system if too long.
- Can destabilise estuary if built too close to entrance.
- Do not guarantee protection – development controls for properties still needed.
- Only partly consistent with ESD.



- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie

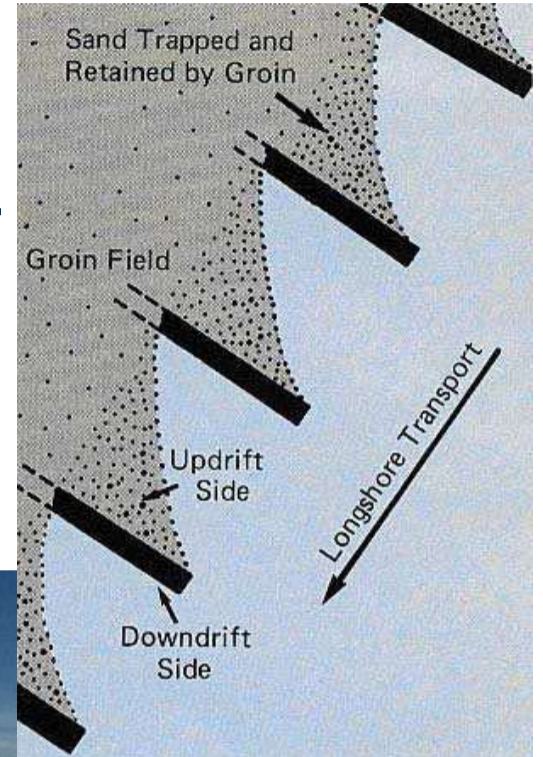


OPTION 7: Groynes (geotube)

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Geotube groyne(s)
- Approximately 50m long perpendicular to shoreline.
- Traps sand and holds it within groyne compartment.
- Life Cycle Cost \$1.6M (for one groyne only).
- Can create a usable beach on up-drift side and improve recreational amenity.
- Provides a buffer of sand to reduce storm erosion.
- Can be temporary structures to study their effectiveness.
- Structure can detract from visual and recreational amenity.
- Can cause erosion on down-drift side.
- Hazard to swimmers.
- Careful design and understanding of coastal processes is needed.
- Can increase loss of sand from beach system if too long.
- Can destabilise estuary if built too close to entrance.
- Do not guarantee protection from storms – development controls for properties still needed.
- Only partly consistent with ESD.



- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTION 8: Beach Nourishment

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Placement of sand from lake to create a dune.
- Life Cycle Cost \$15.5M (based on annual frequency).
- Works with rather than disrupts natural coastal processes.
- Provides a buffer of sand to reduce impact of coastal erosion.
- Can improve recreational amenity – both for beach and Lake Cathie lower estuary.
- Allows re-vegetation of dune.
- Consistent with Council's existing Entrance Management and Dredging Strategies.
- Sand would be lost in storms and would need periodic replenishment.
- Sand would be rapidly transported by long-shore drift.
- Ongoing cost for maintenance.
- Development controls for properties still needed.
- Currently enough sand in lake to provide buffer to protect Illaroo Road against present-day storm erosion hazard.



• **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

• Submissions close Wednesday, 7 October 2009.
• Online forum at www.pmhclisting.com.au

• The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTION 8: Beach Nourishment

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum



- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTION 9: Beach Nourishment + Groyne

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Combination of Option 8 plus 6 or 7 (refer to these options for details).
- Life Cycle Cost \$7.5M.
- Placement of sand from lake to create a dune.
- Rock or geotube groyne(s).
- Development controls needed.
- Land management options would be done irrespective of option ie, stormwater outlets, vegetation management, recreational management.

• **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

• Submissions close Wednesday, 7 October 2009.
• Online forum at www.pmhclisting.com.au

• The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTION 10: Beach Nourishment + Groyne + 400m Revetment

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Combination of Option 8 plus 6 or 7 plus 2 (refer to these options for details).
- Life Cycle Cost \$13.7M.
- Placement of sand from lake to create a dune.
- Rock or geotube groyne(s).
- Rock wall to protect Illaroo Road.
- Land management options would be done irrespective of option ie. stormwater outlets, vegetation management, recreational management.
- Groyne reduces frequency of beach nourishment therefore lower overall costs.

• **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

• Submissions close Wednesday, 7 October 2009.
• Online forum at www.pmhclisting.com.au

• The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTION 11: Beach Nourishment + 400m Revetment

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Life Cycle Cost \$21.5M.
- Combination of option 8 plus 2 (refer to these options for details).
- Placement of sand from lake to create a dune.
- Rock wall to protect Illaroo Road.
- Land management options would be done irrespective of option ie. stormwater outlets, vegetation management, recreational management.

- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



COMBINED OPTIONS

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum



- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTION 12: Planned retreat with voluntary purchase

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Life Cycle Cost \$19M.
- Return at-risk private land to public ownership and rehabilitate.
- Voluntary purchase of affected homes.
- Allows for natural processes.
- Allows a staged approach.
- Consistent with the principles of ESD.
- Improved public access and recreational amenity.
- Alternative access may be required for Illaroo Road properties – short term.
- High emotional impact on affected property owners.
- Valuation/purchase mechanism would need to be determined (ie. how much and when).
- Leaseback or modular home may allow owners to stay longer.

HOW COULD IT WORK?

- Inform beachside owners of risk to property (short term).
- Adopt planning controls (short term).
- Upgrade stormwater outlets (short term).
- Reduce width of beachside road (medium term).
- Move services inland (medium term).
- Provide rear access to properties (medium term).
- Voluntary purchase of affected homes (medium term).

• **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

• Submissions close Wednesday, 7 October 2009.
• Online forum at www.pmhclisting.com.au

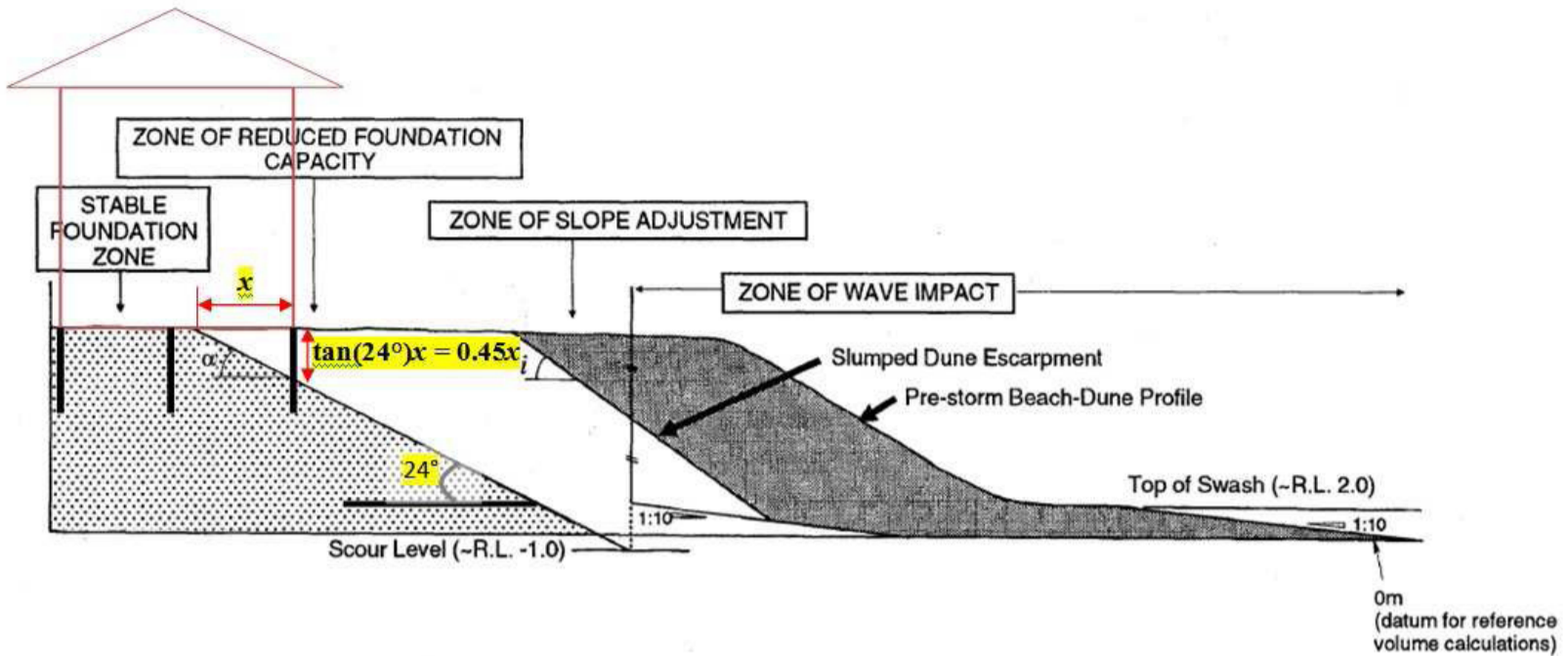
• The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



Planning Control Example

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum



Angle of repose of dune sand: $i \sim \phi \approx 34^\circ$

Safe angle of repose of dune sand: $\alpha = \tan^{-1}\{(\tan \phi)/1.5\} \approx 24^\circ$

All levels to AHD

DRAFT COASTAL ENGINEERING PLANNING CONTROLS

Within 50 year Stable Foundation Zone (SFZ) –

- no coastal engineering constraints

Within 50 year Zone of Reduced Foundation Capacity (ZRFC) –

- Refer to above diagram
- New development to be on piles extending into the Stable Foundation Zone. Depth of piles is given by $0.45x$ where x is the horizontal distance seaward of the landward boundary of the Zone of Reduced Foundation Capacity
- For additions or alterations no building footprints to extend seaward of existing footprint
- Minor development allowed under Exempt & Complying Development (SEPP) (i.e. interior renovations, sheds, decking etc.)

Within 50 year Zone of Wave Impact and Slope Adjustment (ZWISA) -

- No development allowed within Zone of Wave Impact and Slope Adjustment except for development covered under Exempt & Complying Development (SEPP) (ie. interior renovations, outdoor sheds, decking etc.)

- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTION 13: Reactive management without vountary purchase

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Life Cycle Cost (LCC) \$1.7M.
- Remove road and services in response to erosion.
- Properties would not be purchased.
- Current benefit or future loss at landowners risk.
- Allows for natural processes.
- Allows a staged approach.
- Consistent with the principles of ESD.
- Improved public access and recreational amenity.
- High emotional and financial impact on affected property owners.
- Land management options would be done irrespective of option ie. Stormwater outlets, vegetation management, recreational management.

• **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

• Submissions close Wednesday, 7 October 2009.
• Online forum at www.pmhclisting.com.au

• The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



OPTIONS ASSESSMENT

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Triple Bottom Line Assessment - Economic, Social & Environmental
- Initial assessment and ranking by Coast & Estuary Committee
- Ranking to provide guidance on most likely scenarios – not recommendations
- Council will determine preferred option(s) after exhibition and consideration of submissions.

CRITERIA

Economic

Impact on house property values

- Favorable impact on house prices scored higher
- Unfavorable impact on house prices scored lower

Cost to Community

- Cheapest option scored higher
- Expensive option scored lower

CRITERIA

Social

Impact on Property Owners

- High benefit to landowners scored higher
- Low benefit to landowners scored lower

Impact on Broader Community

- High benefit to wider community scored higher
- Low benefit to wider community scored lower
- Reflects equity and ESD principles

Impact on Recreational amenity

- Improved beach amenity and access scored higher
- Reduced beach amenity and access scored lower

CRITERIA

Environmental

- Complementary to Coastal Processes scored higher
- Disruption to Coastal Processes scored lower

Preservation of the natural character of the beach

- Natural beach character maintained scored higher
- Natural beach character detracted scored lower

Ecological impacts

- Positive impacts to ecology scored higher
- Detrimental impacts to ecology scored lower

- **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

- Submissions close Wednesday, 7 October 2009.
- Online forum at www.pmhclisting.com.au

- The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie



COAST & ESTUARY COMMITTEE

www.pmhc.nsw.gov.au/lakecathie

www.pmhclisting.com.au – online forum

- Established to advise Council on coast and estuary management plans.
- A NSW government requirement.
- Council has used such a committee since the early 1990s.
- Stakeholders include community members, regulatory agencies and Council staff.
- The Committee is an advisory group that provides recommendations to council – it is not a decision-making body.
- Recommendations are made by consensus (ie. general agreement) not by formal voting.

• **Draft Lake Cathie Coastline Management Study (2009)** is on public exhibition for 10 weeks until Wednesday, 7 October 2009

• Submissions close Wednesday, 7 October 2009.
• Online forum at www.pmhclisting.com.au

• The Study is available for inspection at Council offices or www.pmhc.nsw.gov.au/lakecathie

