

APPENDIX 4
HISTORICAL ENTRANCE CONDITION

Table detailing the historical condition of the entrance to Lake Illawarra.

Date	Entrance State
1919	Major Flood (>1.5m AHD)
1930	Major Flood (>1.5m AHD)
29 September 1932	Lake opened by Fishermen
During 1934	Closed
September 1934	Lake opened by Council
April 1935	Closed
1936	Closed
April – May 1937	Closed
1 July 1937	Lake opened by Council
November 1942	Closed
19 May 1943	Lake opened by Council
1943	Major Flood (>1.5m AHD)
1944	Closed
1 July 1946	Closed
1947	Closed
January 1948	Lake opened by Council
22 March 1955	Closed
5 February 1958	Closed
1959	Major Flood (>1.5m AHD)
September 1968	Closed
December 1968	Lake opened by Council
March 1969	Almost closed
Late 1971	Closed
30 December 1971	Lake opened by Council
January 1974	Lake almost closed
April 1974	Major Flood (>1.5m AHD)
March 1975	Major Flood (1.8m AHD)
March 1977	Major Flood (1.8m AHD)
March 1978	Major Flood (1.6m AHD)
February 1984	Major Flood (1.9m AHD)
April 1988	Major Flood (1.5m AHD)
August 1990	Moderate Flood (1.4m AHD)
June 1991	Major Flood (1.8m AHD)
January – May 1995	Closed.

May 1995	Lake opened by LIA
August 1997 – July 1998	Closed
28 July 1998	Lake opened by LIA
August 1998	Moderate Flood (1.2m AHD)
August 2002	Closed

NOTES

1938 – Wooden bridge constructed across entrance channel.

During the 1960s : Shellharbour Council constructs southern retaining wall along Reddall Reserve. Area previously covered by reeds.

1972 : DMR constructs new bridge across entrance channel. Work included filling in the southern (Back) channel.

1988 – 1989 : Shellharbour Council reclaims area around southern approach to Windang Bridge

1999 – 2001 : LIA constructs southern training wall connecting to Windang Island. Work included dredging of the channel, which kept lake open during period.

APPENDIX 5

SUMMARY OF PUBLIC SUBMISSIONS

(The names have been omitted because of privacy issues)

No.	NAME	COMMENTS / SUGGESTIONS
1		<ul style="list-style-type: none"> ▪ Resident of 70 years. ▪ In 1940's entrance had two channels the main and the back. The placement of the embankment across the back channel resulted in silting of the area and impacted on flow. ▪ Support the proposed northern wall. ▪ Sale of sand fraught with danger as sand will infeed. ▪ Support periodic nominal dredging of channel.
2		<ul style="list-style-type: none"> ▪ Dredge entrance to 7 metres and main channel to 5m. ▪ Wide entrance as per Option 9 – depth to rock bottom. ▪ Dredging to bridge and back channel around island. ▪ Sand to Warilla Beach. ▪ Sand extraction and other dredging around lake. ▪ Diagram attached.
3		<ul style="list-style-type: none"> ▪ Supports Option 9. ▪ Consider a tunnel under Shellharbour Road embankment. Lake was ruined by not building new bridge across back channel. ▪ Further dredging in other areas of lake. ▪ Diagram attached.
4		<ul style="list-style-type: none"> ▪ Main concern is the small low level wall that dams off the lagoon area. ▪ Water now murky and smelly. ▪ Low level wall should either be dismantled or pipes installed to allow constant flow of water. ▪ Diagram attached.
5		<ul style="list-style-type: none"> ▪ Agrees with Option 9.

	<ul style="list-style-type: none"> ▪ Agree to construction of 2 seawalls located at southern end of Windang beach provided seawalls extend to ocean a good distance. ▪ Depth should be maintained inland to lake mouth (4 – 6 mtrs). ▪ Dredging should start now at lake mouth while water flow is minimal. ▪ Diagram attached.
6	<ul style="list-style-type: none"> ▪ No real suggestions just wants the lake opened up.
7	<ul style="list-style-type: none"> ▪ Discusses history of two bridges. ▪ Would like new six lane bridge, long causeway removed, and a reduction in the number of bridge pylons to restore the back channel. ▪ Dredge in between bridge and entrance. ▪ Rock walls should not have been built at 45 degrees to the water flow.
8	<ul style="list-style-type: none"> ▪ Open the mouth of the lake so it flows properly. ▪ The barriers of the lake and beaches restrict flow to the lake. ▪ Stop residents and businesses polluting around the lake.
9	<ul style="list-style-type: none"> ▪ New breakwall needs relocating to deep water. ▪ Dredge whole beach section in between break walls to rock (or 6m). ▪ Diagram attached
10	<ul style="list-style-type: none"> ▪ Any changes must retain a lake level of 0.3 metre AMSL. ▪ Otherwise risk changes to totality of the lake's features / ecology, physical structure that will disadvantage / disappoint / devastate the majority of people interested in the lake.
11	<ul style="list-style-type: none"> ▪ Dredge lake to 20 metres from Kully Bay to lake entrance.
12.	<ul style="list-style-type: none"> ▪ Not enough sand on Warilla Beach to buffer against SE gales and high seas. ▪ Northern end of Warilla Beach needs to be made as strong as possible. ▪ Dredge lake entrance. ▪ Return sand to Warilla Beach.

	<ul style="list-style-type: none"> ▪ Every entrance on east coast has two walls. ▪ Construct northern wall past surf break and extend existing southern wall. ▪ Agrees with Option No 9. ▪ Diagram attached.
13	<ul style="list-style-type: none"> ▪ Agrees with Option No 9. ▪ Construct northern wall. ▪ Dredge channel 1-2m and entrance 4m deep. ▪ Remove sand around perimeter of lake at same time as building the wall. ▪ Lake shallowing due to runoff. ▪ Sell sand to raise money to fund project (\$20M - \$30M). ▪ Diagram attached.
14	<ul style="list-style-type: none"> ▪ Comment on lack of water in lake. ▪ Compares situation at Lake Illawarra to that at The Entrance (Tuggerah Lake). ▪ Plenty of water in the lake at The Entrance, why not at Lake Illawarra?
15	<ul style="list-style-type: none"> ▪ Should be two rock walls. ▪ Problems with flooding – what will happen to residents with all the sand blocking the entrance. ▪ Diagram attached.
16	<ul style="list-style-type: none"> ▪ Construct northern wall. ▪ Open up the back channel. ▪ Rebuild the old wall along Reddall Reserve and join to Windang Island. ▪ Remove upstream sections of southern wall. ▪ Make whole of entrance and channel bigger. ▪ Sell off sand to fund project. ▪ Diagram attached.

17	<ul style="list-style-type: none"> ▪ Agrees with Bill Heycott's idea to pump water into lake. ▪ Require something to keep lake open and aid circulation on western side of lake around Koonawarra.
18	<ul style="list-style-type: none"> ▪ 3-4 stormwater drains, drain into the swimming area. After rain the lagoon becomes very dirty and dangerous to health. ▪ Drains should not discharge into designated swimming area. ▪ Wall at western end of swimming area has meant less flushing. ▪ Diagram attached.
19	<ul style="list-style-type: none"> ▪ Southern wall not aesthetically pleasing and has done little to change entrance shoals. ▪ Rain runoff into the swimming area is a possible health problem when no tidal flushing. ▪ Sand in the entrance came from Warilla Beach after years of commercial dredging and mining. ▪ Against any modification to the entrance that will remove sand shoals as this will have detrimental effect on wader feeding and bird roosting habitats. ▪ Schedule 1 species, Little Terns and Schedule 2 species, Pied Oyster Catcher use the entrance area as a feeding ground, the former in summer and the latter all year. ▪ Inflow from creeks and drains is the main problem facing the lake. The effect of the catchment needs more management. More wetlands needed to reduce nutrient inflow. ▪ Bill Heycock's plan – concerned about increased salinity during drought and amount of non-green power to pump water into lake. ▪ IBOC is in favour of low maintenance methods to reduce the amount of nutrients / sediments into the Lake. ▪ Entrance modifications are unnecessary, let nature take its course, but as this is probably not an option considering the political pressure, then option 9 with minimal amount of sand removed would be supported. ▪ A University study of the impact large scale sand disturbance in tidal entrance zone on supply of food for wading birds would be helpful to determine the time taken for these systems to fully recover.
20	<ul style="list-style-type: none"> ▪ Closure of lake for past 8 months – no end in sight. Having a devastating effect on businesses in the area and should be fixed now. ▪ Option 9 seems to address resident's concerns, however, there could be a problem with 100m wide entrance needed for flooding – would not receive required water flow from the blocked channels that feed the lake to maintain 100m wide permanent entrance.

	<ul style="list-style-type: none"> ▪ The Group provided a number of other possible options (5 off) for consideration. ▪ Diagrams attached.
21	<ul style="list-style-type: none"> ▪ The Alpha-Omega Wave is a modular concrete structure, weighing around 300T. ▪ The structure covers a footprint of about 15-20m long x 3-7m wide x 3-4m in height. ▪ The structure is designed to utilise wave energy to elevate seawater to a height in the structure that is sufficiently above the desired optimum water level of the lake. The seawater then drains by gravity and kinetic energy of the water collected within the structure during each wave cycle via a pre-cast pipe (1.8m dia x 200m –500m long) into the lake. ▪ The structure would be located below the low water mark in a mean water depth of about 1m with between 2-3m of the structure above the water. At high tide only 1m of the structure is visible. ▪ The structure should deliver around 500 – 700 Gigalitres of water per day, given the wave and tidal characteristics. For Lake Illawarra this would have the effect of raising the level of the lake by around 10mm per day, until the optimum lake level is reached and the outflow exceeds the inflows, thereby maintaining a permanent opening to the sea. ▪ The structure and discharge point should be located within the area of tidal influence near the entrance. ▪ It is considered that introducing seawater into other areas of the lake, such as near Warrawong could impact adversely on the salinity of the water in that area with possible impacts on seagrasses and marine life. ▪ The facility can be temporary or permanent. It does not require external energy sources. The facility should eliminate the need for ongoing dredging. The facility requires minimal maintenance. ▪ Recommend that LIA commission the Alpha-Omega Wave facility as a priority – to give a permanent lake entrance, save millions of dollars and cost less than proposed alternative solutions ▪ Outcomes for community include improved amenity, certainty in operating tourism, recreation and assoc. businesses around lake entrance, improved employment and profitability and reduced costs to local councils.
22	<ul style="list-style-type: none"> ▪ Pacific Inlet Project – Involves construction of a 300m long steel jetty including a 125m section from Port Kembla Beach into the Tasman Sea, placement of 8 x 500mm dia polyethylene pipes at RL -2m AHD in a cradle under the jetty to deliver seawater to a 50m dia hydraulic (retention) pond, 4 pumps affixed to pipes 1,2,7 and 8 to raise the hydraulic pond level from -2m AHD to 2.5m AHD (ensuring a constant ocean source water supply without tidal variation), 6 x 2400mm dia concrete pipes extending over 1km to deliver 900 ML seawater per day to the lake. ▪ Budget \$20-\$30M.

23	<ul style="list-style-type: none"> ▪ Support Option 9 as an interim measure. ▪ Need a pipe and pump system similar to the proposal by Bill Heycott powered by wind or wave action.
24	<ul style="list-style-type: none"> ▪ Entrance channel deteriorated since the early 1970's. ▪ Filling in the southern approach of the bridge was a mistake, reducing water flow to the back channels. ▪ Middle training wall is a complete failure and has only exacerbated the intrusion of sand. ▪ Remove middle wall. ▪ Construct northern wall and remove excess sand and silt from the entrance to Bevans Island.
25	<ul style="list-style-type: none"> ▪ Second wall would have some important benefits. ▪ Existing wall extending to Island is not high enough to stop wind blown sand. ▪ Level of lake cannot be guaranteed with 2 walls. ▪ Propose a secondary entrance (along with the 2 walled option) – taking fresh seawater one way into the Back Channel and helping to flush the lake out back through the main channel. ▪ Construct a long weir structure, like a narrow sea pool just off the rocks on the northern side of the Island allowing water above 0.3m AHD into the channel which would run west along the side of the Reddall Reserve wall into the southern (Back) channel. ▪ The new channel would need to be kept separate from the main channel with a new section established under the bridge. ▪ Diagram attached.
26	<ul style="list-style-type: none"> ▪ Support Option 9 subject to further assessment / consideration.
27	<ul style="list-style-type: none"> ▪ Breeding ground for many marine species ▪ Natural migratory pattern of all coastal species depends heavily on environment ▪ Lake must be able to flush itself in most natural way and keeping entrance open is most natural method

28	<ul style="list-style-type: none"> ▪ Urgent – footbridge from mainland to Windang Island ▪ Lake opened in early 1970s equipment worked 7 – 10 days 24 hours day. Sand never removed but banked up either side to form a channel ▪ Remove sand allowing lake to flush naturally ▪ Allow channel between mainland and Windang Island to wash down depositing sand on Warilla Beach as it used to do.
29	<ul style="list-style-type: none"> ▪ Replenish the lake with fresh ocean water pumped from the top of Windang Island to three points under Windang Bridge. Will keep alive prawns and fish life as well as breeding grounds and help flow of water ▪ Remove sand from entrance so can act naturally ▪ Replace the previous channel between Windang Island and mainland allowing water and sand to continue on to Warilla Beach ▪ NE winds carry sand from Perkins Beach to entrance blocking entrance ▪ Dredge sand out, clear entrance, put back channel to Warilla Beach ▪ The entrance must be kept open to allow migratory fish to breed ▪ Flooding concerns ▪ Windang Island was separate from mainland allowing water and sand to go from north to south to Warilla Beach
30	<ul style="list-style-type: none"> ▪ Likes a combination of slide 8 and 9 ▪ A low guidewall across the entrance to the swimming area so tidal flush can go along the outside of pool as well as into pool ▪ Northside should be stabilised further to the west ▪ Regular dredging and natural cleaning and catchment management for creeks, drains and rivulets ▪ Like idea of pumping water in to create a flow as proposed by B Hancock ▪ Dredge the pool area regularly ▪ Would be good if bridge could be extended and more water was to go through ▪ Rat and mice plaque on causeway and in the rock wall

31	<ul style="list-style-type: none"> ▪ Concerned re effect of closed entrances on tourism ▪ Clear the sand completely from the entrance to allow water level to come in to replenish stock and make lake healthy environment
32	<ul style="list-style-type: none"> ▪ Option 9 the only real option
33	<ul style="list-style-type: none"> ▪ Bring back to natural state, remove blockage and let nature take its course
34	<ul style="list-style-type: none"> ▪ Clear the main channel and let this lake take its course

APPENDIX 6

LETTER FROM THE LIA

Contact: Doug Prosser
(p) 4261 1342



Prof. Bruce Thom
Independent Review Panel
Lake Illawarra Entrance
PO Box 867
WOLLONGONG NSW 2520

15 April 2003

Dear Sir


Lake Illawarra Entrance Improvements

Reference is made to the Panel's request for comments / suggestions on improvements to the entrance at Lake Illawarra.

As you are aware, the Authority commissioned Lawson & Treloar to undertake an investigation of options for a possible northern wall at the entrance to the lake. Through detailed discussions and interaction with Lawson and Treloar and other areas of expertise, the Authority has determined that the preferred cause of action to improve the entrance to the lake would involve work as defined in Option 9 of the Lawson and Treloar Report. Clearly further work is needed to define the precise nature and extent of work however Option 9 offers the outcomes considered essential by the Authority.

I remain willing to discuss the Authority's position or other aspects of your work at your convenience.

Yours faithfully


for: S D Prosser
Chairman