Tuggerah Lakes estuary Monitoring and Management

Vanessa McCann's (Ecologist, Waterways and Coastal, Central Coast Council) presentation to CEN's Waterwatch QA Day on 20th September, 2016 at Bill Sohier Park Community Hall, Shirley Street Ourimbah

love our living lakes

CARING FOR OUR COUNTRY

Wyong Shire Council
CENTRAL COAST

NSW
nswnationalparks.com.au

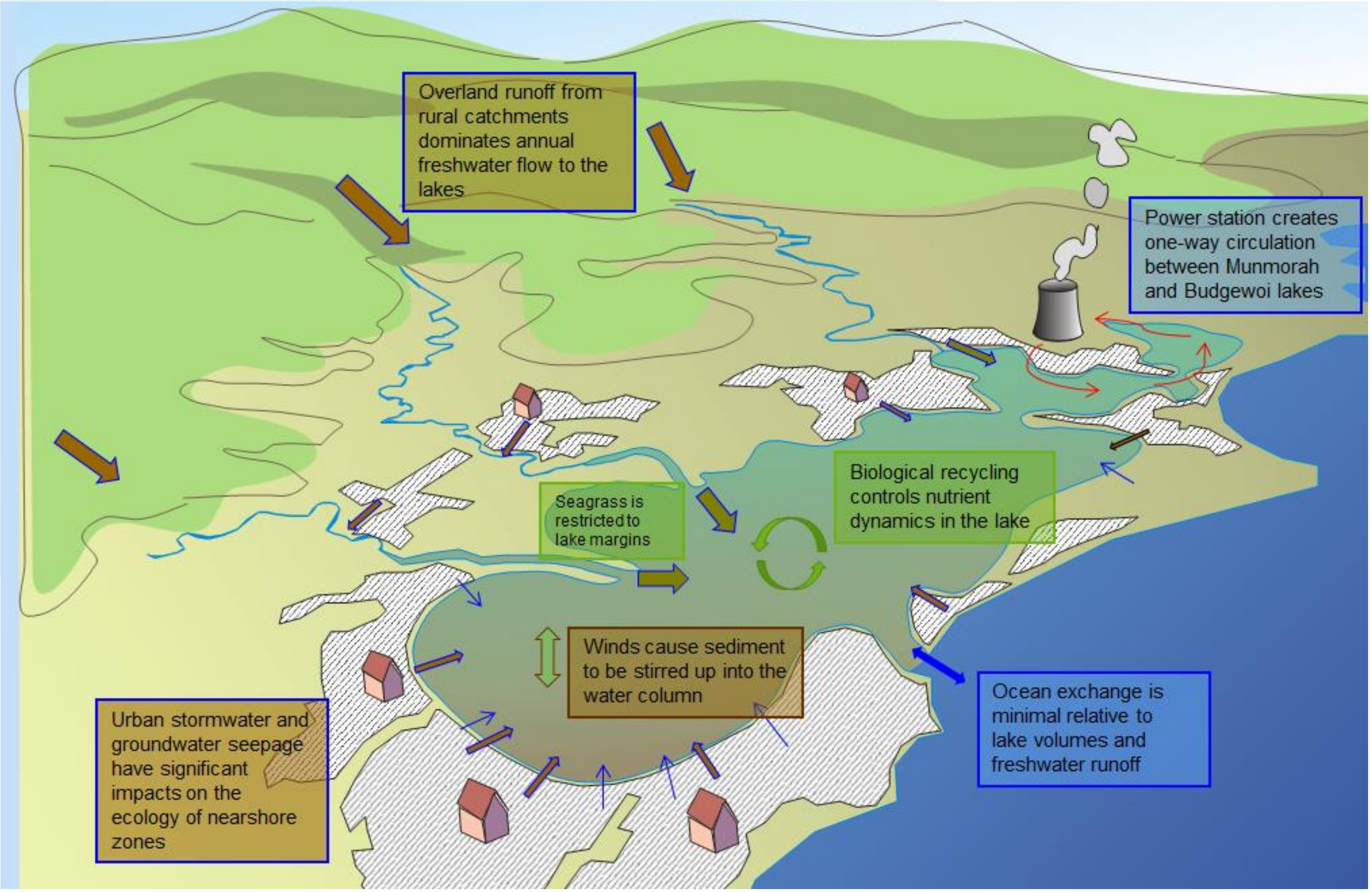
tuggerah lakes estuary

Tuggerah Lakes basics

- 3 interconnected coastal lagoons
- Small permanently maintained opening at the Entrance
- 80 km^2 surface area
- 670 km^2 catchment area
- Average depth 1.6m
- 0.2-0.3m AHD average water level
- 11.6km^2 of seagass - 3 main sp. - *Zostera muellieri* (subs. *capricorni*), *Halophila ovalis*, *Ruppia megacarpa*
- 0.01km^2 of saltmarsh, few mangroves
- Limited tidal influence & exchange (ART: TL: 220 days BL:460 days LM: 520 days), wind driven circulation
- 5 major tributaries – Wallarah Creek, Wyong River, Ourimbah Creek, Tumbi Creek & Saltwater Creek

Extensive developed areas contributing stormwater runoff

Basic drivers of estuarine ecology in Tuggerah Lakes



Tuggerah Lakes estuary Monitoring & Report Card

- Annual data collection in Lake Munmorah, Budgewoi Lake and Tuggerah Lake since 2010
- Indicators: chlorophyll-a, turbidity & seagrass depth range
- Healthy estuaries have low levels of microalgae and turbidity and strong seagrass communities

2016 results

- Lake Munmorah

B 2016	C 2015	B 2014	A 2013

- Budgewoi Lake

C 2016	C 2015	C 2014	C 2013

- Tuggerah Lake North

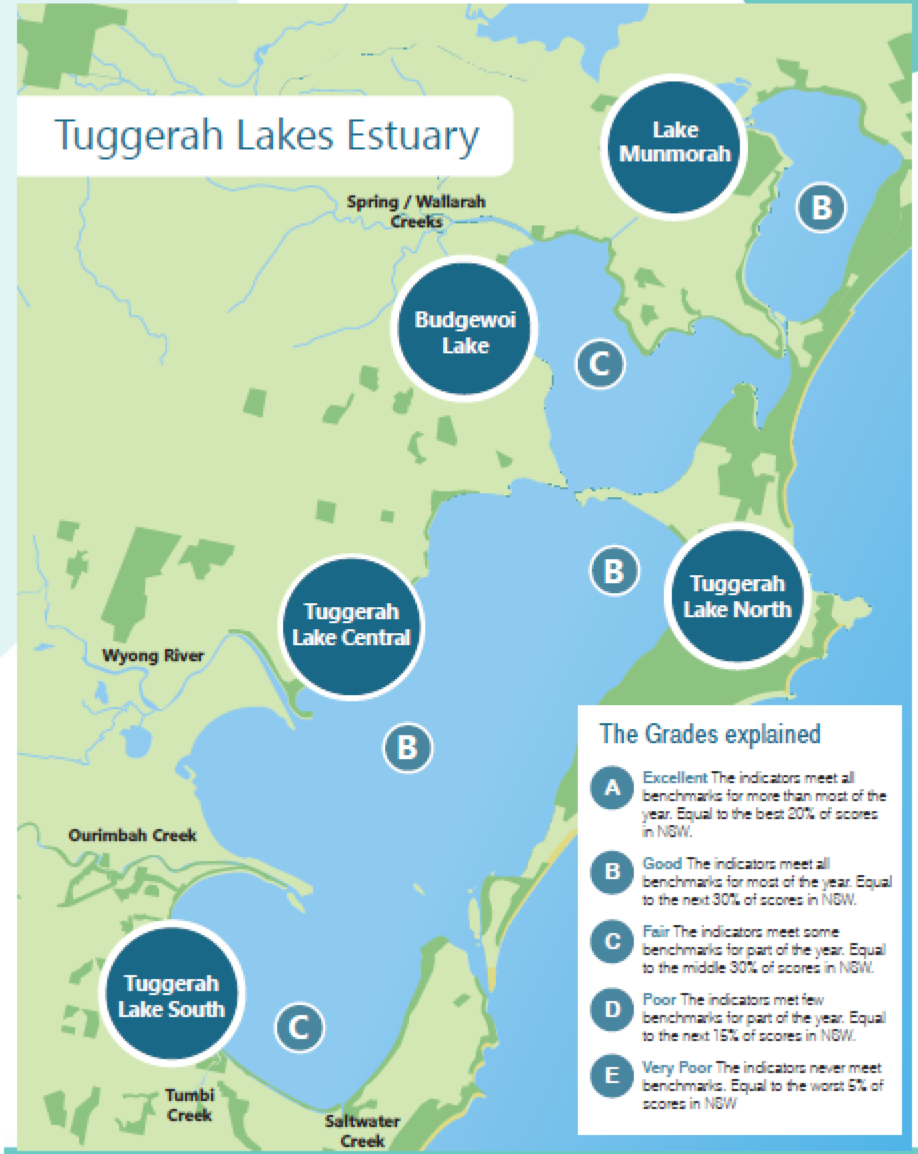
B 2016	C 2015	C 2014	B 2013

- Tuggerah Lake Centre

B 2016	C 2015	C 2014	C 2013

- Tuggerah Lake South

C 2016	C 2015	C 2014	B 2013



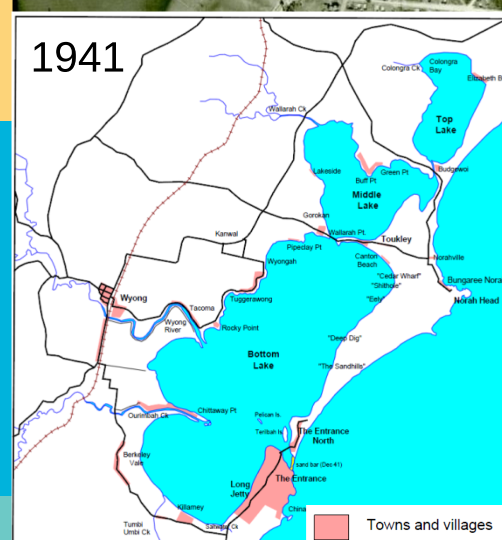
Long Jetty foreshore

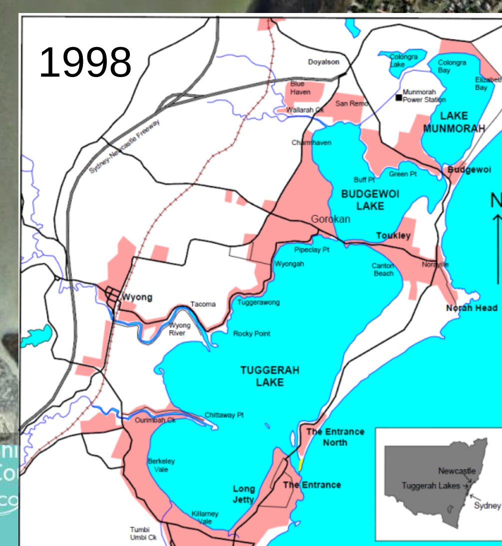
A case study

Case Study - Long Jetty

Aerial photos from the 1940s show a sandy nearshore zone along much of the eastern and northern shores. Today, these areas are characterised by seagrass, wrack accumulations, macroalgae and smelly ooze.

Two views of the Long Jetty shoreline. In 1941, the nearshore zone was dominated by clean sands, exposed to strong currents (note sand ridges running perpendicular to the shoreline). By 2006 the nearshore zone had become colonised by seagrass and macroalgae which serve to reduce currents and trap particulates from urban runoff and resuspended lake sediments.

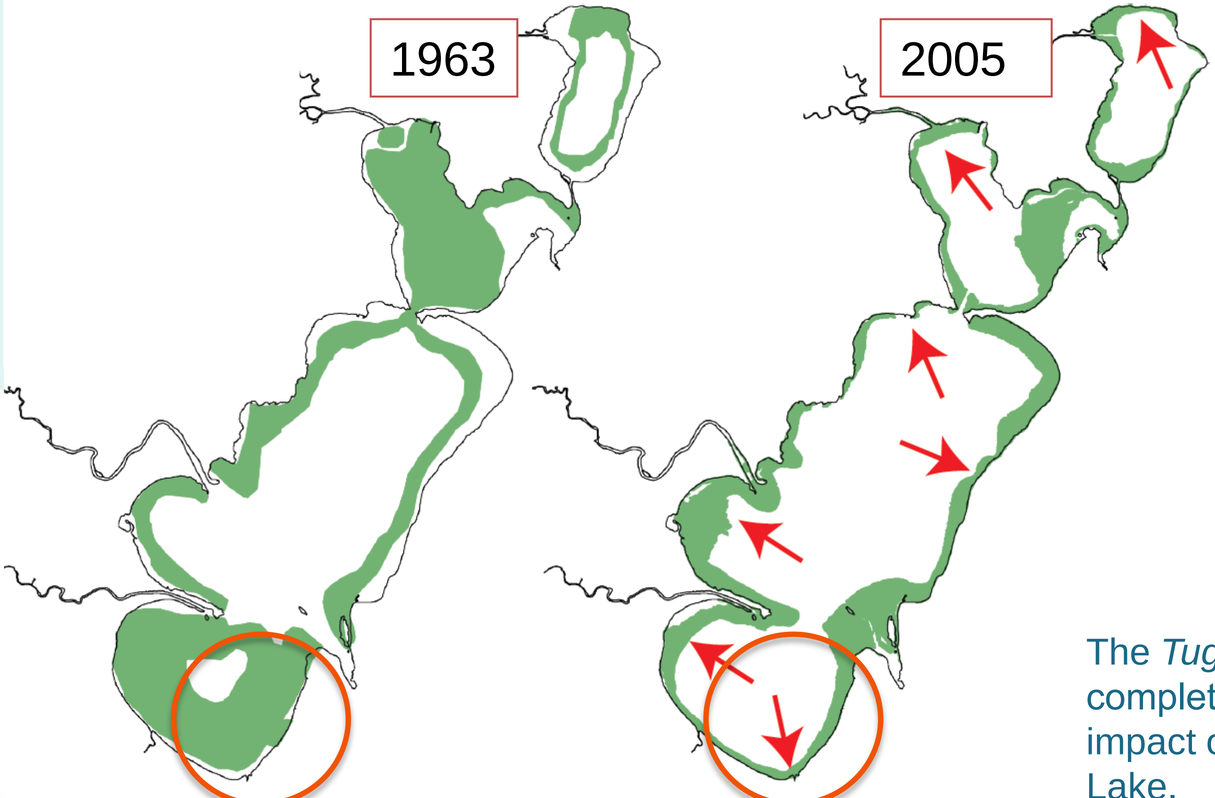




Causes

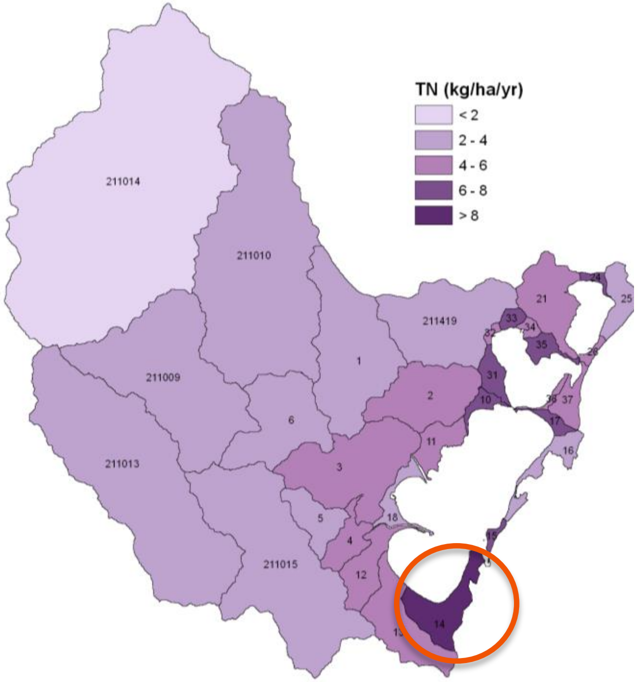
These changes have most likely occurred due to a combination of increased fine sediment and nutrient loads from the catchment (in particular the urbanised fringing catchments), entrance management and shoreline alterations, superimposed on long-term climatic cycles. Some of these issues will be explored more fully in this presentation.

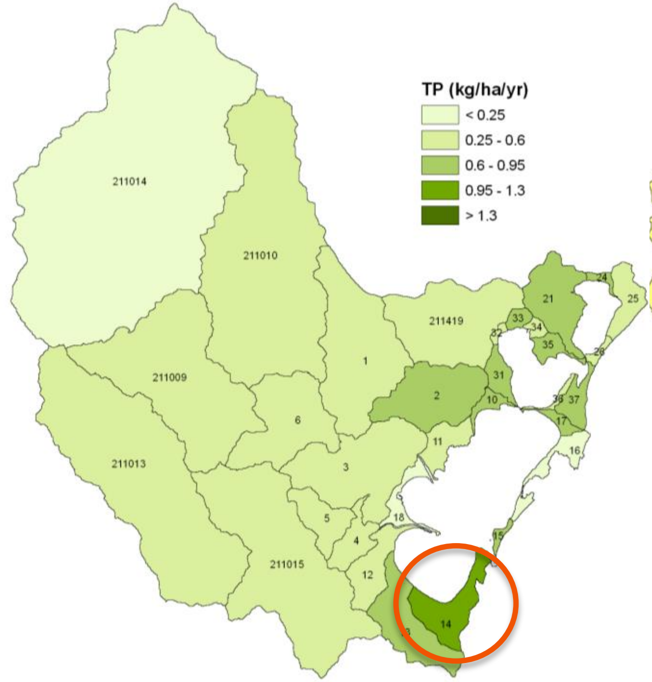
Seagrass survey data and anecdotal accounts indicate that seagrass in Tuggerah Lakes has shifted from deeper lake basins to the shallower lake fringes. This shift was most likely in response to a decline in water quality, in particular water clarity.

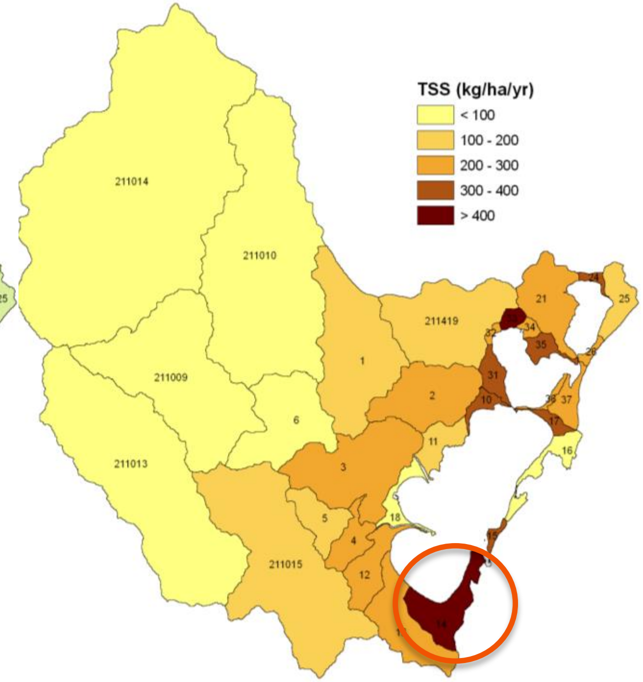


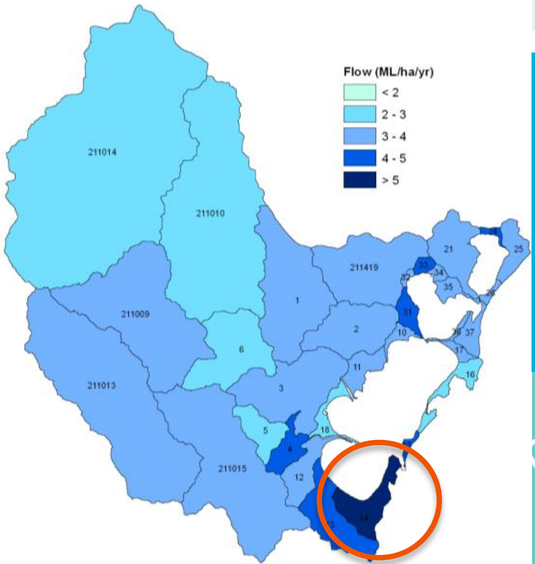
Seagrass has shifted into shallow areas in order to receive sufficient light for growth. The loss of seagrass from deeper lake basins has likely resulted in greater resuspension of sediment due to wind waves, thereby causing further reductions in water clarity. This is referred to as a "feedback loop" and can be very difficult to reverse.

The *Tuggerah Lakes Restoration Project* completed in the 1990's had a significant impact on seagrass extent in Tuggerah Lake.









Modelled export rates (kg/ha/yr)

The amount of material (nutrients and sediments) produced per hectare is generally much higher per unit area in the urban sub-catchments fringing the lake.

This is expected as the hard surfaces (roads, driveways etc.) don't allow rainfall to penetrate so everything is washed off.

The rural catchments deliver the greatest overall load of material based on their size…

but, QUALITY matters, nutrients from upper catchment not readily bio-available, but from urban areas are highly reactive. Thus very different effects on the ecology of the ecosystem!

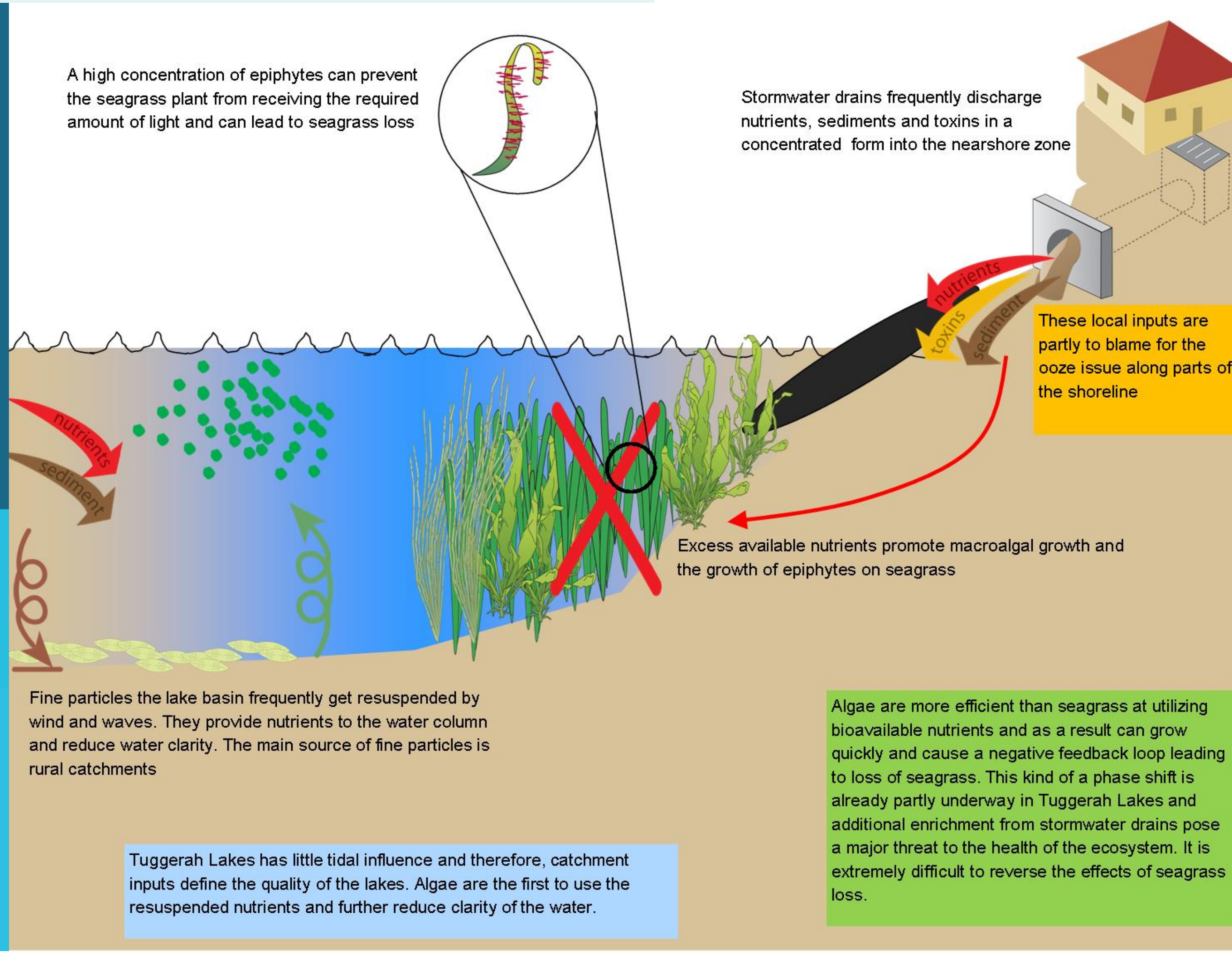
Gradual enrichment of the nearshore zone

The gradual enrichment of the nearshore zone is widespread, but appears to be particularly bad adjacent to heavily urbanised areas. This implicates persistent sources of bio-available nutrients from urban runoff and groundwater.

This series of images show the progressive colonisation of the nearshore zone by macrophytes adjacent to the Killarney Vale and Long Jetty shoreline. This colonisation is accompanied by an increase in fine sediments and organic loading of sediments.

When there is excess nutrients & sediments

The most bio-available nutrients from the catchment are taken up by algae (phytoplankton and benthic types). An excess of nutrients favours algal growth and an increase in sediments reduces water clarity.



Managing urban stormwater

Urban environments deliver nutrients, sediments and toxins to the nearshore zone of the lake. The hard surfaces such as roads, driveways and rooftops prevent capturing and filtering of rain which leads to concentrated runoff and much more flow than is natural.

Reducing urban stormwater

• Rainwater tanks collect water from the roof to be used for watering the garden or washing the car. Not only does it save money in water costs but reduces the flow, nutrients, sediments and toxins to the lake.

• Permeable surfaces such as the lawn allow the filtration of water through the soil where nutrients and sediments will be trapped and the amount of discharge is reduced.

• Green waste is great for compost. Composting green waste will reduce the nutrient load entering the lake

• Using the right amount of fertilisers and applying during dry weather will prevent excess nutrients entering the lake.

Contributing to urban stormwater

• Roofs not capturing rain water increase the amount of water delivered during a rain event and flush nutrients and sediments from other hard surfaces into the stormwater system

• Washing cars on hard surfaces add water, nutrients, sediments and toxins to the stormwater system

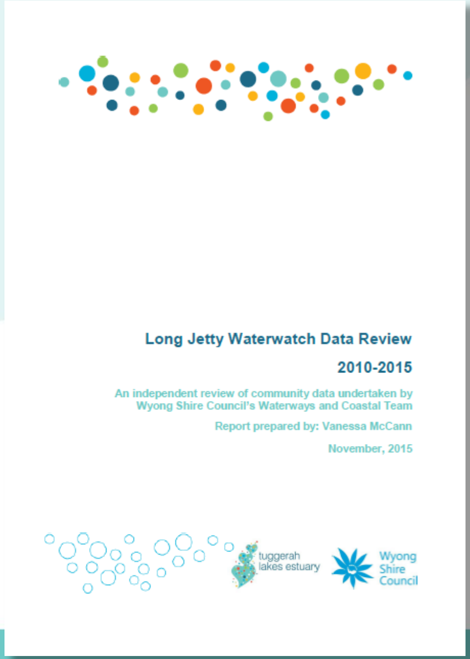
• Green waste (leaves, sticks and dirt) on the driveway and roof add to the organic discharge to the lake which contributes to smelly ooze. They also block the stormwater management systems.

• Using too much fertiliser and garden chemicals increases the nutrient and toxin load to the lake

Long Jetty Waterwatch

- Collecting samples at 40 sites since 2010
- Good quality, long-term data set
- DO, pH, Turbidity, Available P

- Council’s Waterways and Coastal Section undertook a Review of Long Jetty Waterwatch Results in 2015



Long Jetty Waterwatch Data Review

2010-2015

An independent review of community data undertaken by Wyong Shire Council's Waterways and Coastal Team

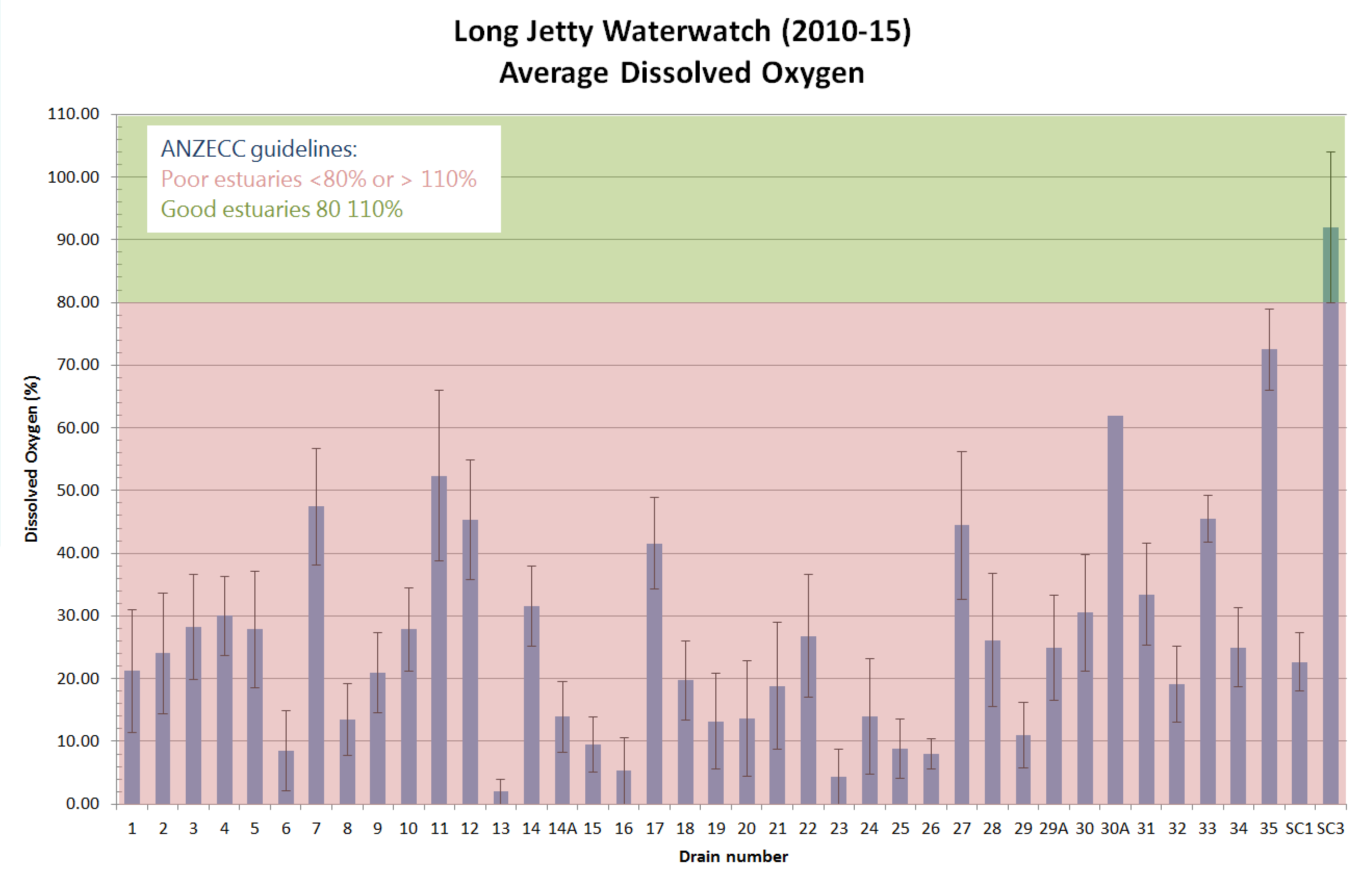
Report prepared by: Vanessa McCann

November, 2015

tuggerah lakes estuary

Wyong Shire Council

Dissolved oxygen



love our living lakes

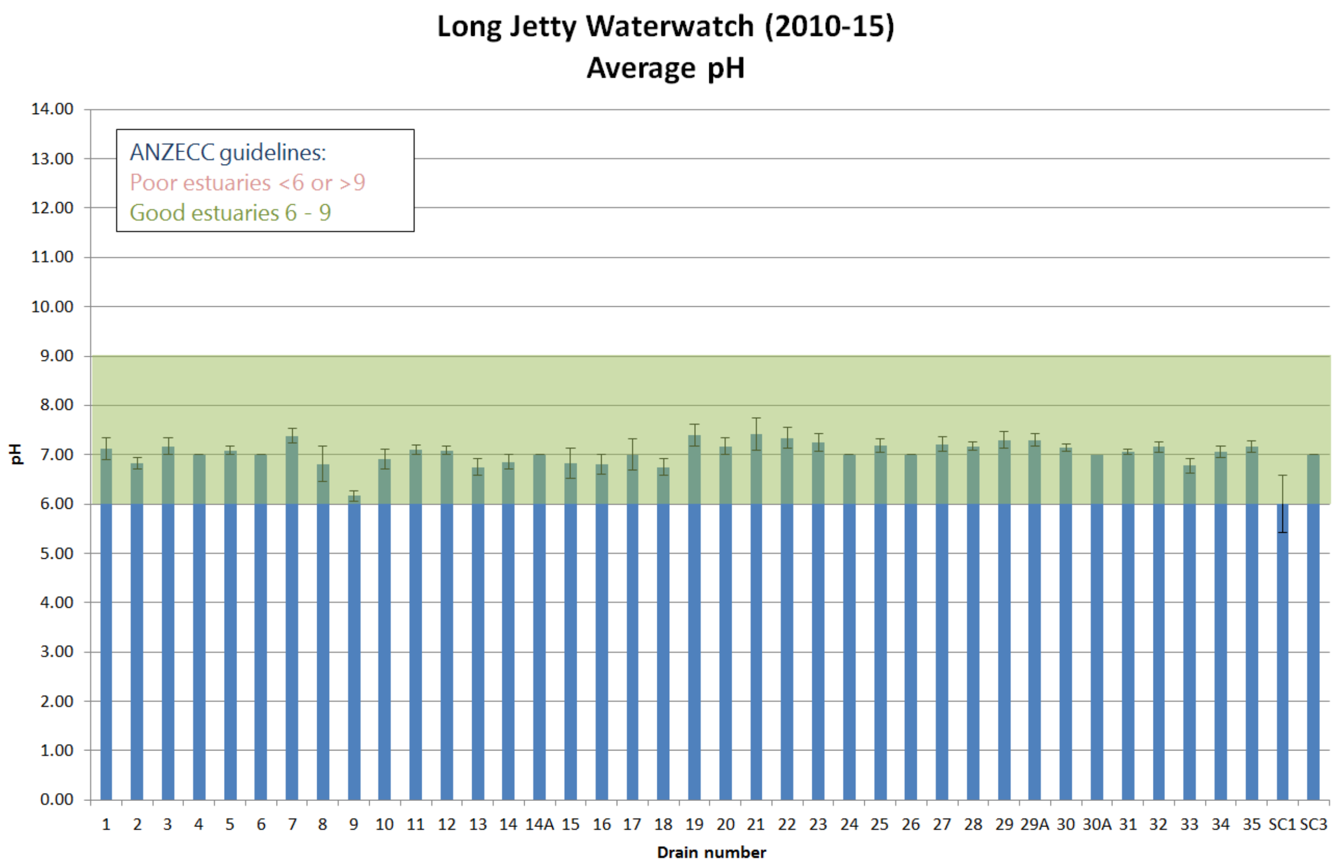
CARING FOR OUR COUNTRY

Wyong Shire Council CENTRAL COAST

NSW nswnationalparks.com.au

tuggerah lakes estuary

pH



love our living lakes

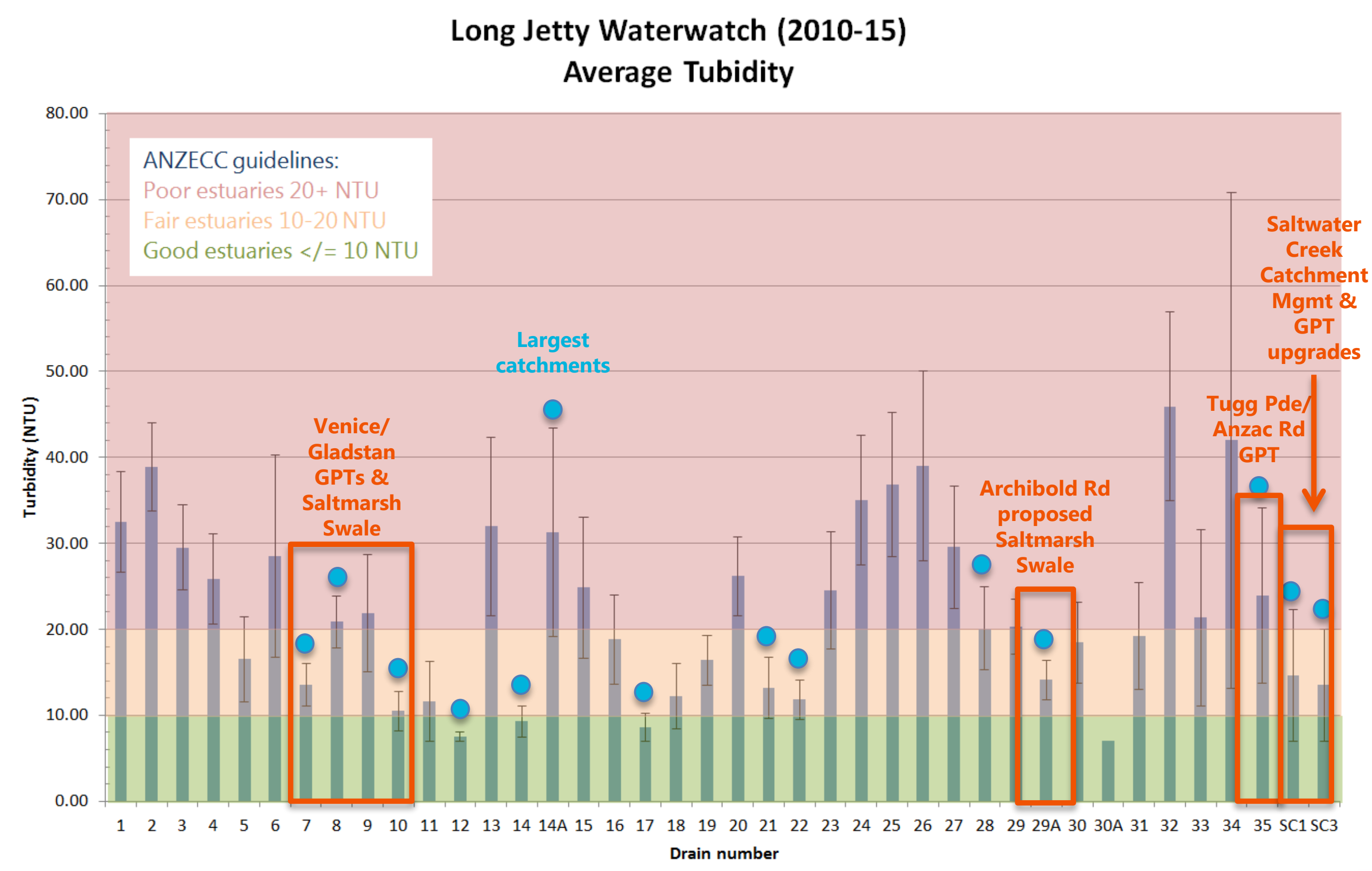
CARING FOR OUR COUNTRY

Wyong Shire Council CENTRAL COAST

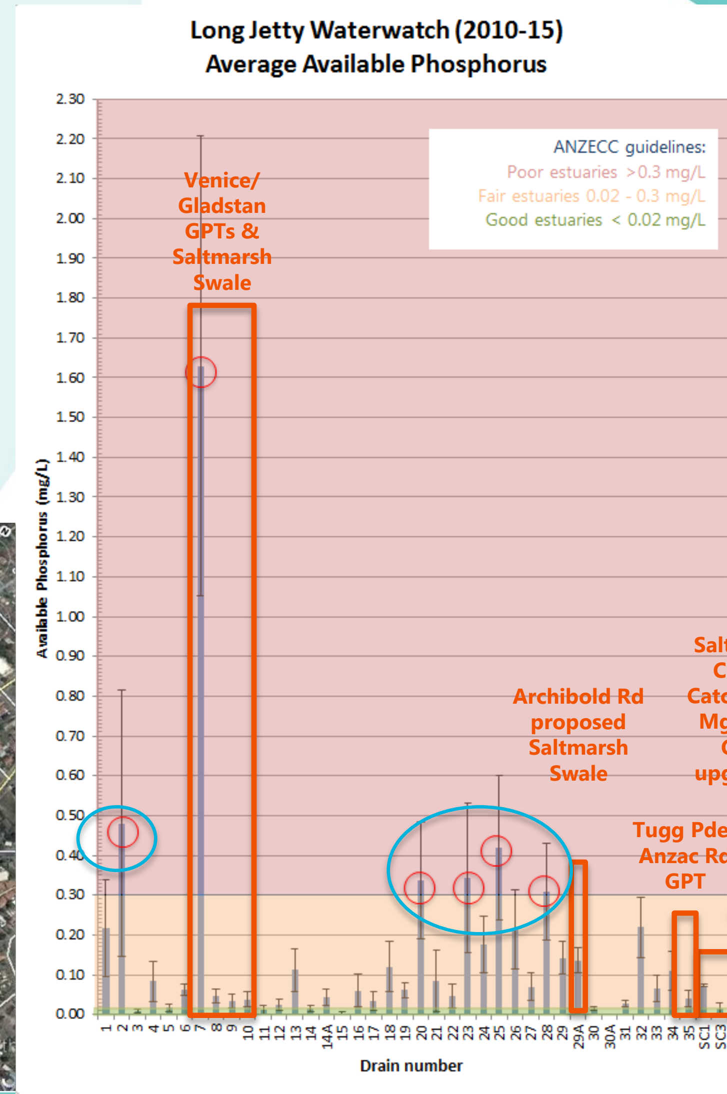
NSW nswnationalparks.com.au

tuggerah lakes estuary

Turbidity


Long Jetty Waterwatch (2010-15)
Average Tubidity
ANZECC guidelines:
Poor estuaries 20+ NTU
Fair estuaries 10-20 NTU
Good estuaries </= 10 NTU
Largest catchments
Venice/ Gladstan GPTs & Saltmarsh Swale
Archibold Rd proposed Saltmarsh Swale
Tugg Pde/ Anzac Rd GPT
Saltwater Creek Catchment Mgmt & GPT upgrades
Turbidity (NTU)
Drain number
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 14A 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 29A 30 30A 31 32 33 34 35 SC1 SC3

Available phosphorus



love our living lakes

CARING FOR OUR COUNTRY

Wyong Shire Council CENTRAL COAST

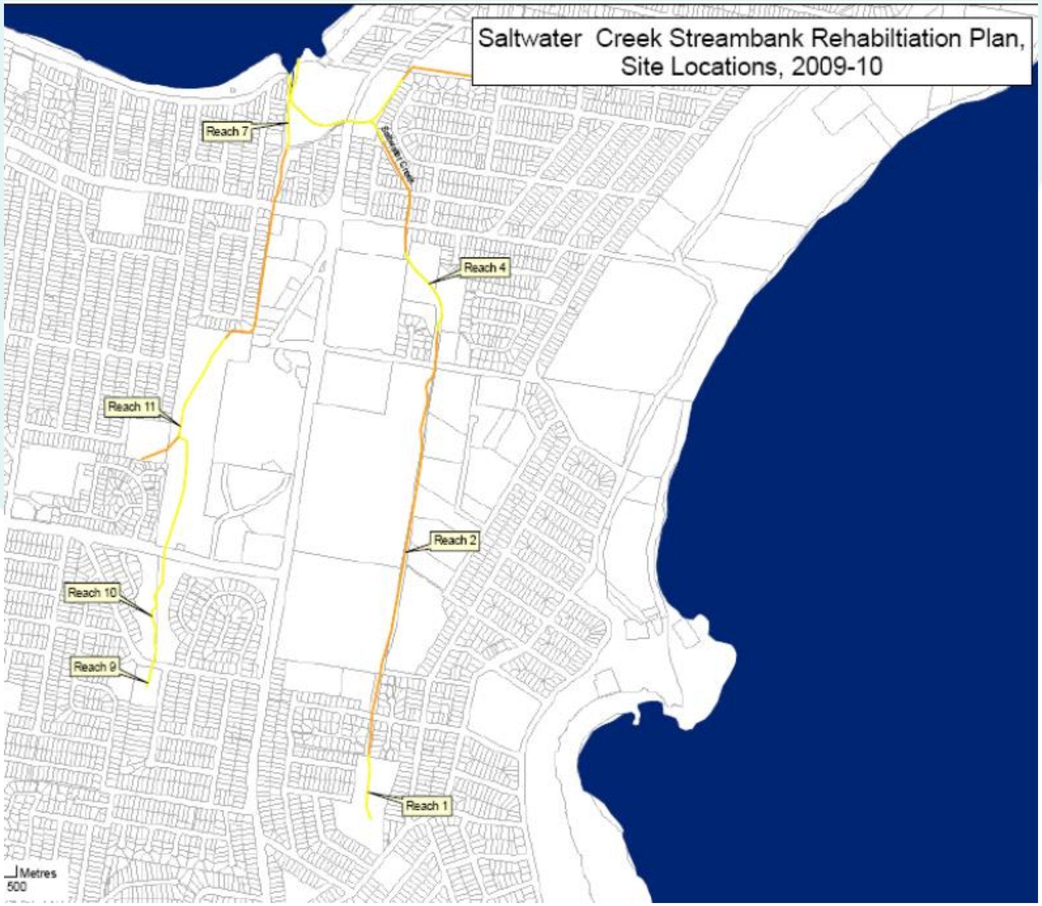
NSW

nswnationalparks.com.au

tuggerah lakes estuary

Recent stormwater improvements works

Recent stormwater upgrades – Long Jetty



2010 – Streambank Rehabilitation and Stormwater Upgrades – Saltwater Creek catchment – 2.2km

Recent stormwater upgrades – Long Jetty

2010 - Tuggerah Pde/ Anzac Ave Baramy GPT

Recent stormwater upgrades – Long Jetty

2015 – Venice St/
Gladstan Ave
GPTs and
Saltmarsh Swales

Recent stormwater upgrades – Long Jetty

2016 – Willow St to Battley Ave – 6 drains upgraded

Future stormwater upgrades – Long Jetty

Coming soon…

2017 – Tuggerah Pde/ Archibold St stormwater consolidation, saltmarsh swale and foreshore saltmarsh regeneration

Sites for further investigation

- Several sites have been identified for further investigation based on relative input or catchment area (potential pollutant load)
- These are currently under investigation for potential management works.

- Best 6 sites: 10, 12, 14, 17, 30a, 11
- Worst 6 sites: 2, 7, 20, 23, 25, 28

- Performance of largest catchments

Site	Average turbidity (NTU)	Average available P (mg/L)
7	13.5	1.63
8	20.9	0.05
10	10.5	0.04
12	7.5	0.03
14	9.3	0.02
14A	31.3	0.04
17	8.6	0.03
21	13.2	0.09
22	11.8	0.05
28	20.1	0.31
29A	14.1	0.14
35	23.9	0.04

Key: Green = healthy, orange = fair, red = poor

Thanks for you time!

Questions…?