

# Effects-based management of estuaries

## Water, Wetlands and Coastal Science Branch



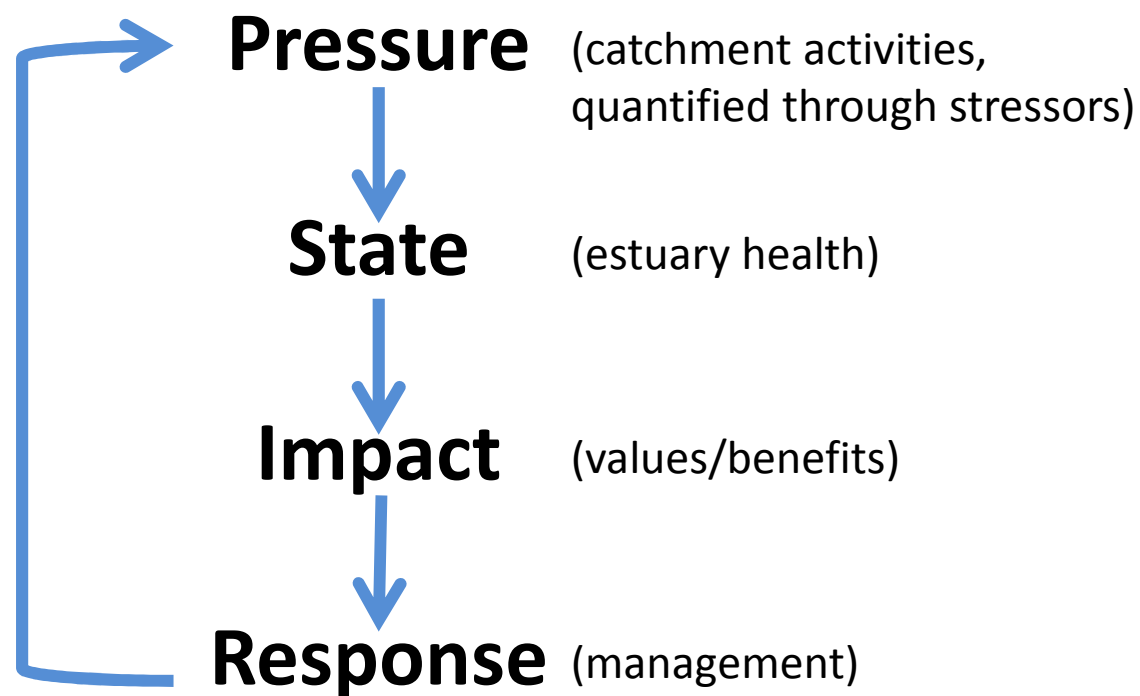
Jocelyn Dela-Cruz, Peter Scanes and Tim Pritchard

## What we want to achieve:

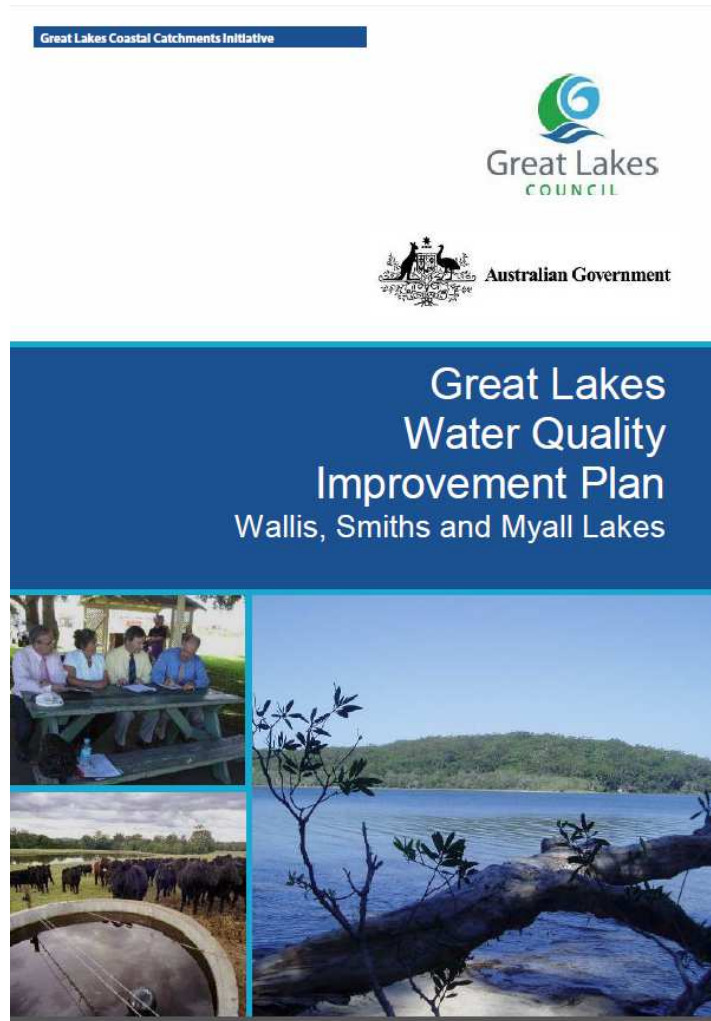
- link between stormwater management and waterway outcomes



- structured approach for considering stormwater in combination with strategic planning decisions



# Approach translated into Plans and Policies



Great Lakes Water Quality Improvement Plan: Wallis, Smiths and Myall lakes

## Draft Great Lakes Development Control Plan 2013

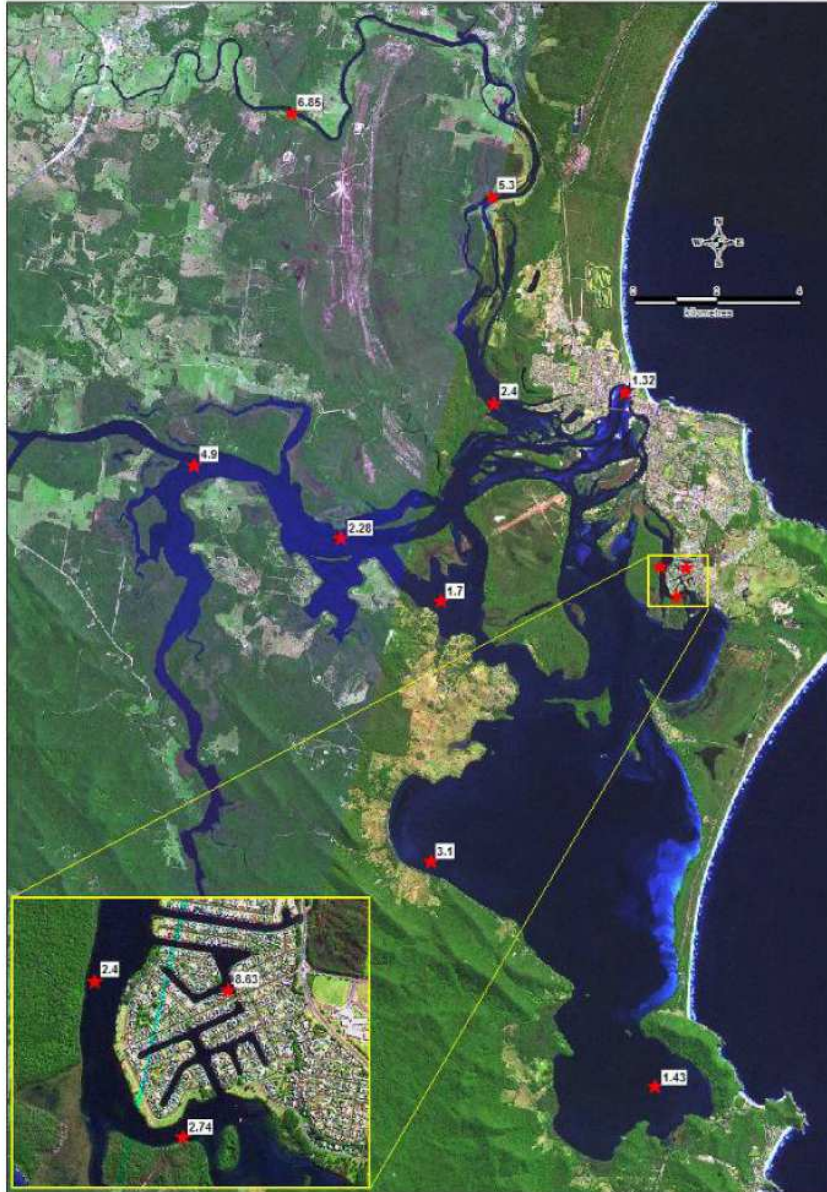
### Chapter 11: Water Sensitive Design

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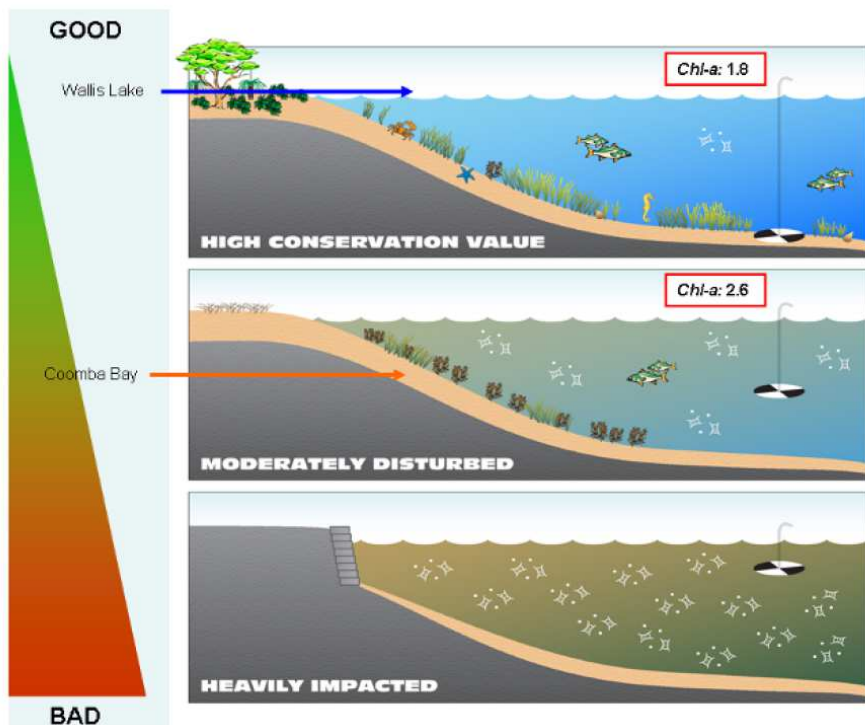
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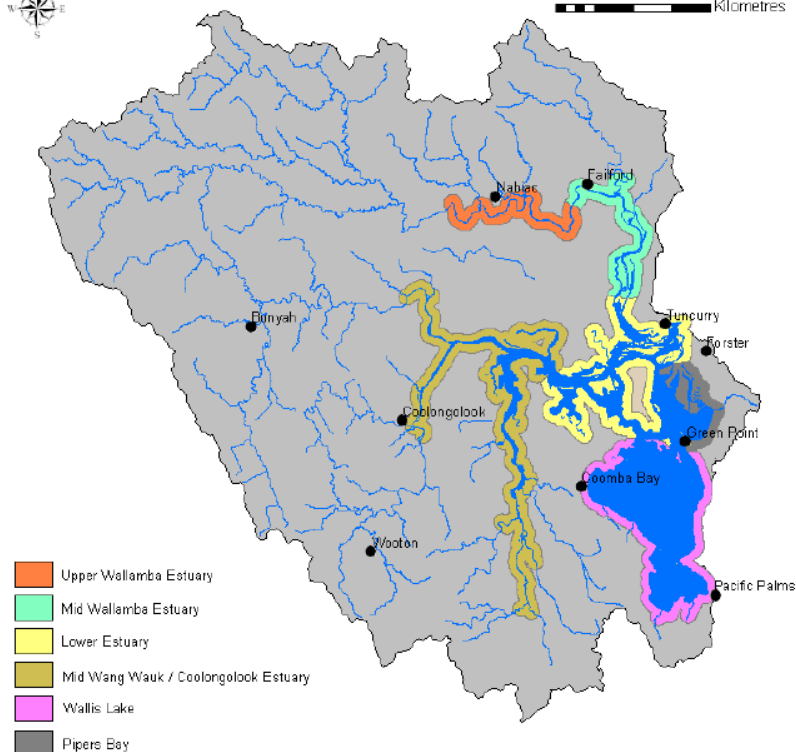
## Ecological condition targets



## Ecological condition targets



0 2.5 5 7.5 10  
Kilometres



## Monitoring, Evaluation and Reporting Strategy



## State Plan target

By 2015 there is an improvement in the condition of estuaries and coastal lake ecosystems

## Background

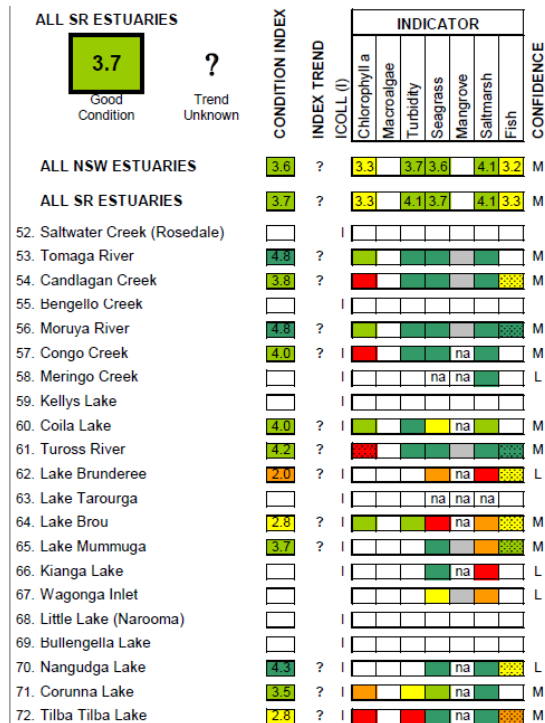
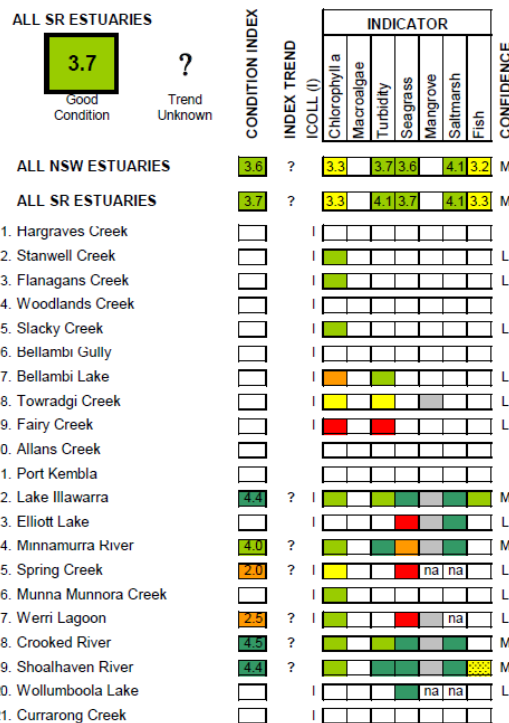
An estuary is any semi-enclosed body of water having a permanently or intermittently open connection with the ocean. Water levels inside the estuary vary in a periodic way in response to the ocean tide at the entrance. The upstream boundary is defined as the limit of tidal influence and will typically be found in the lower reaches of the creeks and rivers draining to the estuary.

A detailed technical report describes the methods used to derive the information contained in this report. At the time of publication of the *State of the catchments (SOC) 2010* reports, the technical reports were being prepared for public release. When complete, they will be available on the DECCW website: [www.environment.nsw.gov.au/publications/reporting.htm](http://www.environment.nsw.gov.au/publications/reporting.htm)

Note: All data on natural resource condition, pressures and management activity included in this SOC report, as well as the technical report, was collected up to January 2009.



### State of the catchments 2010



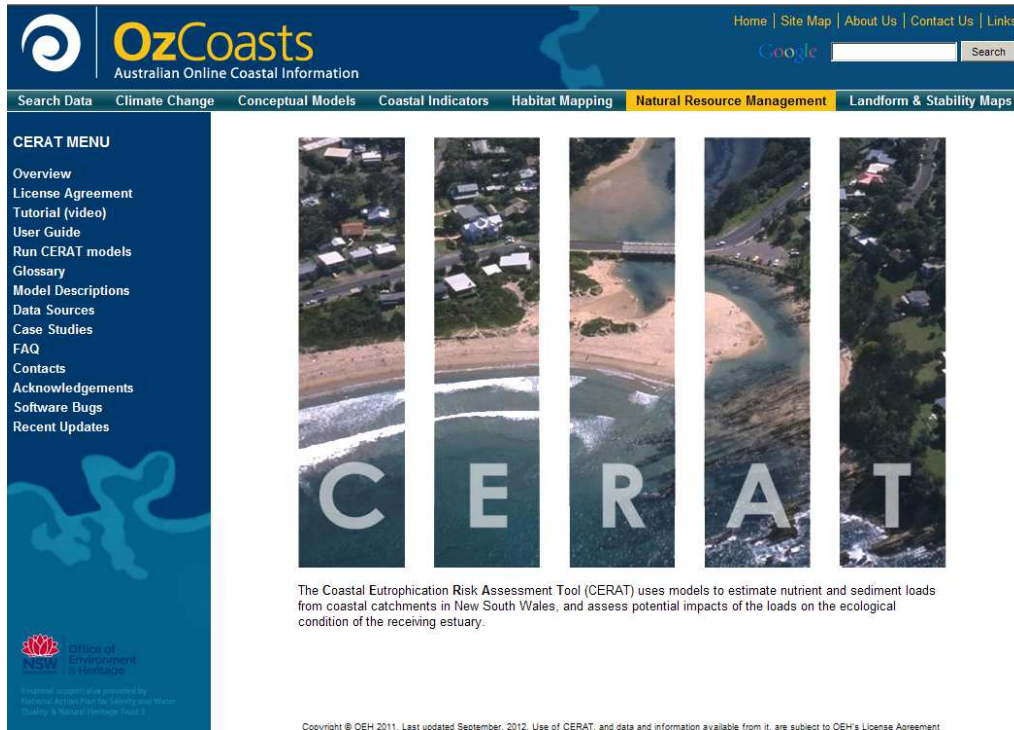


## Revised ANZECC triggers

	Creek	Lagoon	Lake	Rivers Lower (>25 psu)	Rivers Mid (10 – 25 psu)	Rivers Upper (< 10 psu)
Chl <i>a</i>	1.9	2	3.6	2.3	2.9	3.4
Turbidity	2.2	3.3	5.7	2.8	3.5	6.6
Ammonia	21	13	15	8	32	51
NOx	5.9	12	3	5.1	36.6	46
DON	260	460	670	176	260	425
TN	349	636	746	205	380	608
PO4	2	4	1.2	2.8	4.9	3.5
DOP	4.5	8.5	8.5	3.7	3.1	2.9
TP	15	25	22	10.3	18	15
Si	1321	950	424	638	1268	2488



## First-pass assessment tools



**OzCoasts**  
Australian Online Coastal Information

Home | Site Map | About Us | Contact Us | Links

Search Data | Climate Change | Conceptual Models | Coastal Indicators | Habitat Mapping | **Natural Resource Management** | Landform & Stability Maps

**CERAT MENU**

- Overview
- License Agreement
- Tutorial (video)
- User Guide
- Run CERAT models
- Glossary
- Model Descriptions
- Data Sources
- Case Studies
- FAQ
- Contacts
- Acknowledgements
- Software Bugs
- Recent Updates

**C E R A T**

The Coastal Eutrophication Risk Assessment Tool (CERAT) uses models to estimate nutrient and sediment loads from coastal catchments in New South Wales, and assess potential impacts of the loads on the ecological condition of the receiving estuary.

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Explicitly linked:

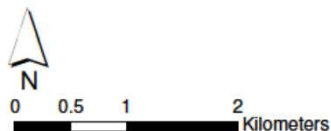
**Catchment Model**



**Hydraulic Model**



**Ecological Response Model**



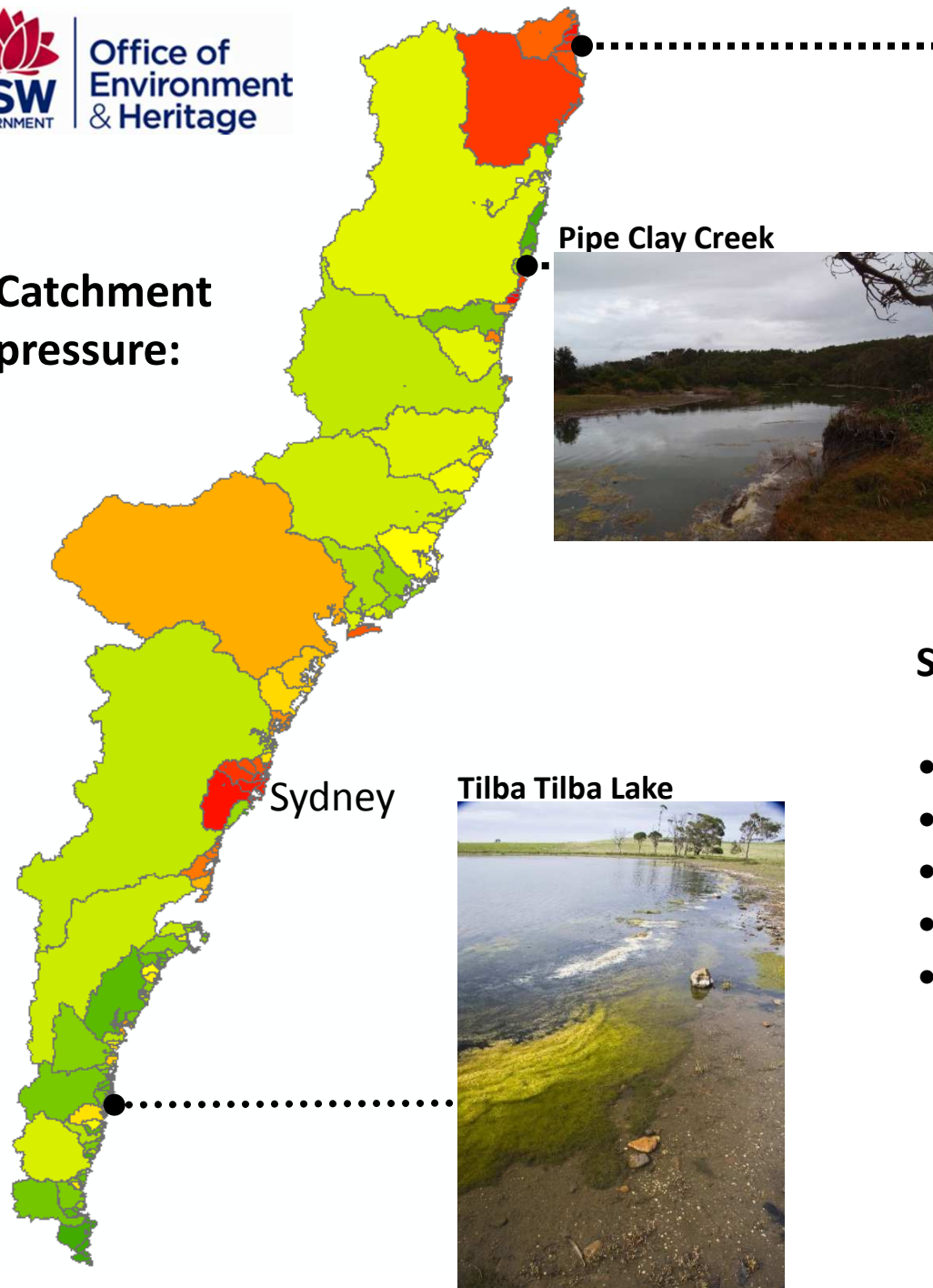
Verons Estate, Sussex Inlet

- Assess rezoning from current to rural residential
- Advice in light of the South Coast Regional Strategy

### OUTCOME:

- ✓ lake is sensitive to land use change
- ✓ further assessments on feasibility and extent of stormwater management

**Catchment  
pressure:**



**Cudgera Creek**



**Pipe Clay Creek**



**Sydney**

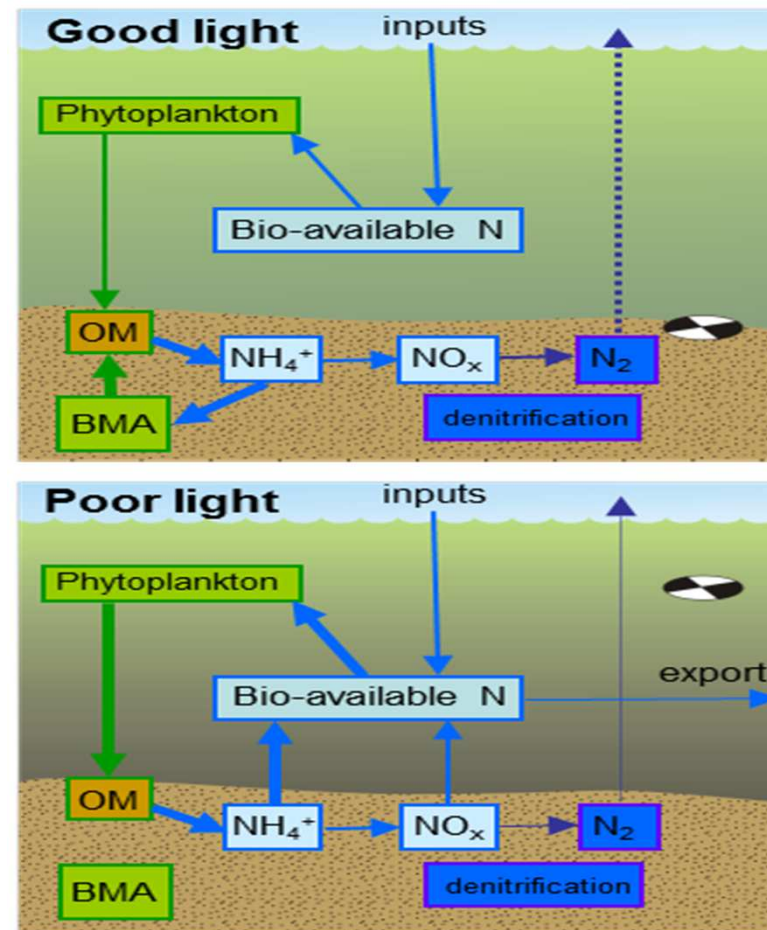
**Tilba Tilba Lake**



### **State and regional applications:**

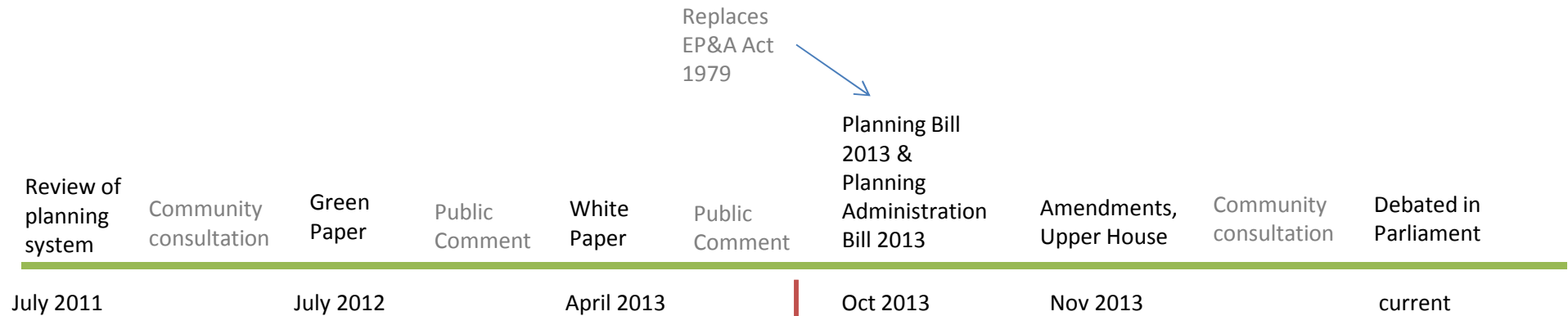
- MER and State of Catchment reports
- OEH Estuary Management Program
- Councils
- Sydney Climate Story line
- MEMA Threat and Risk Assessments

## Enhancements to models



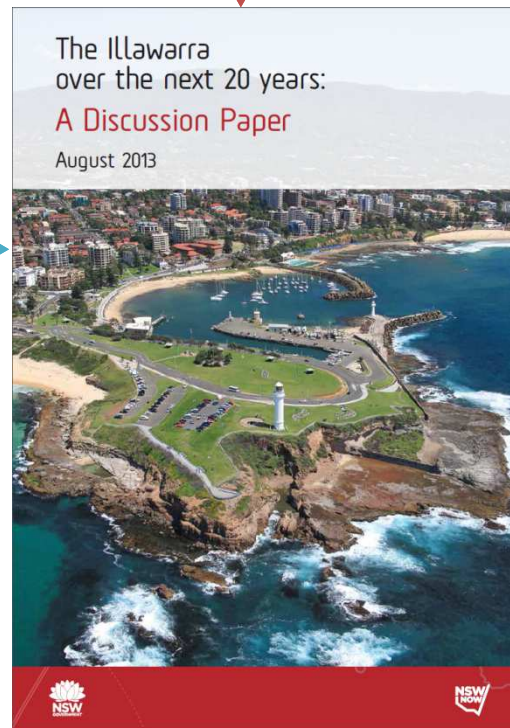


# NSW Planning Reforms?



EPA and ROG-South  
submissions to  
consider stormwater  
impacts

↓  
ROG-EPB and WWCSB



# Current ecological health of lake:

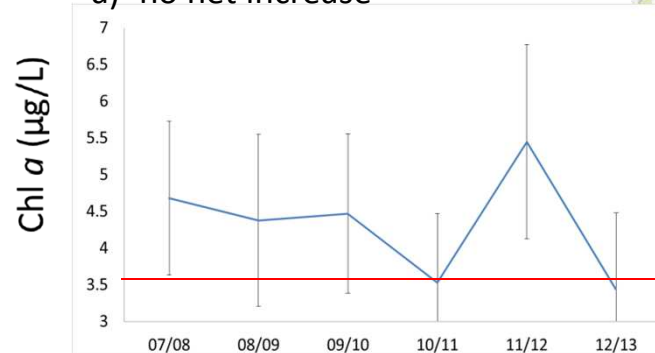
Chl *a* (µg/L)



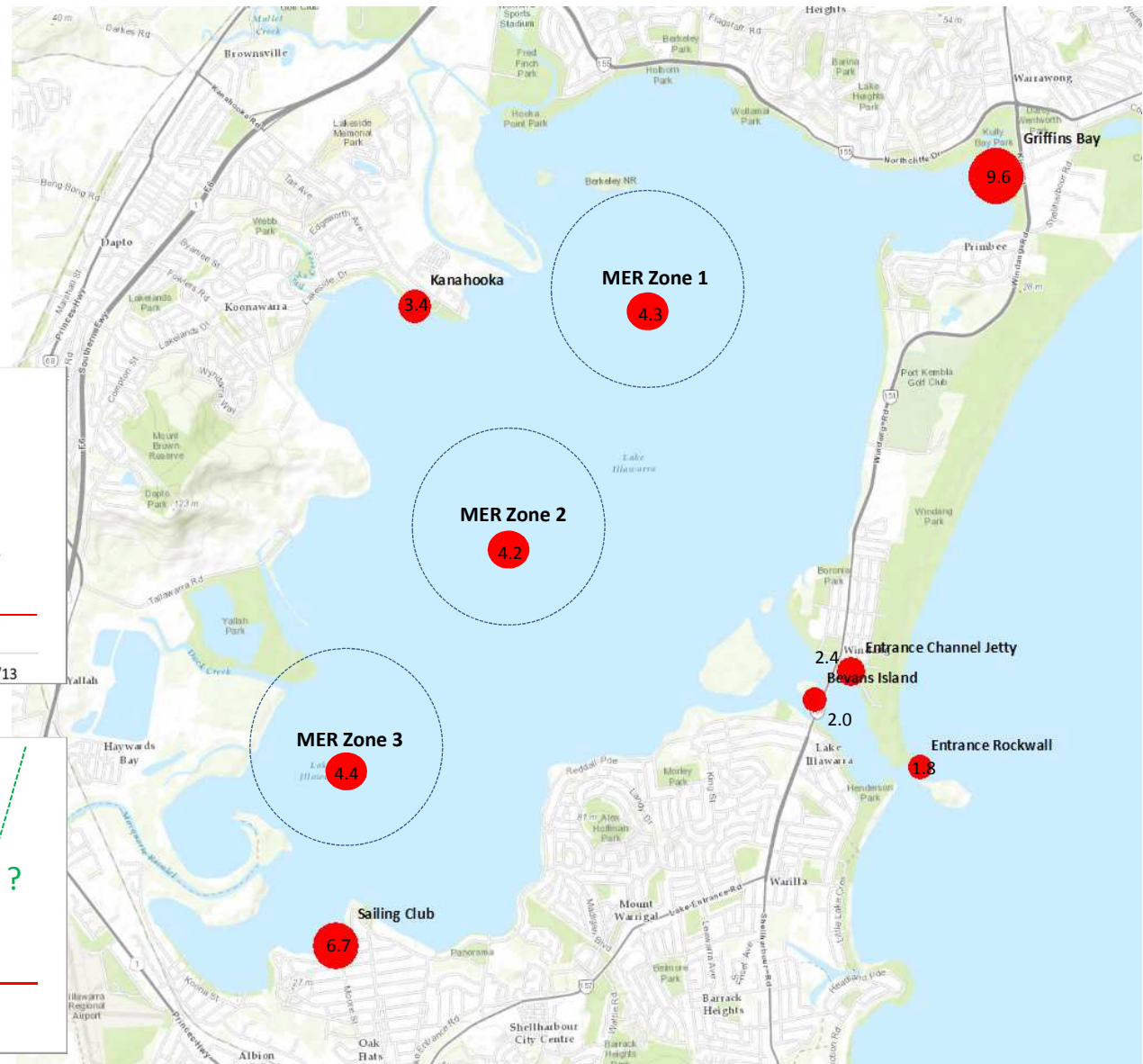
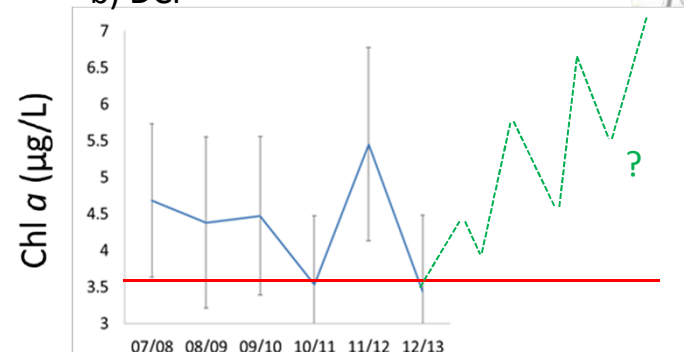
triggers – 3.6  
(ANZECC)

Lake Health :

a) no net increase



b) DCP



# First pass assessment:



EXIT SYSTEM

## Lake Illawarra

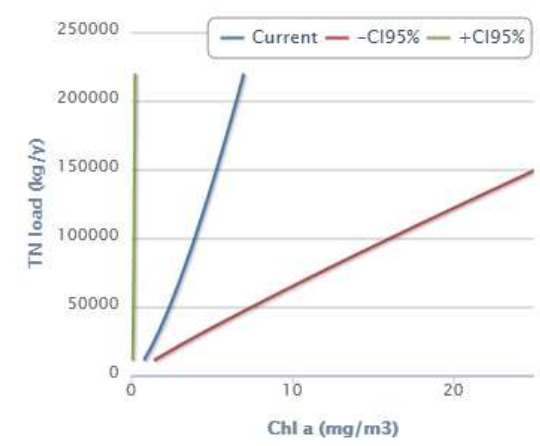
Risk Assessment
**Sustainable Load**
Catchment Model
Estuary Model

**Current Situation Model:**

Chl a (mg/m<sup>3</sup>)

TN load (kg/y)

PE (mg N/m<sup>3</sup>)



**Target:**

Chl a (mg/m<sup>3</sup>)  Run Model

TN load (kg/y)

% reduction  ←

**Guidelines:**

- Where the current load is below the sustainable load, it should be maintained
- Where the current load exceeds the sustainable load, activities should work towards achieving the sustainable load over time

The guidelines are consistent with the [Water Quality Objectives](#) for a waterway, when assessing and managing the likely impact of activities

To capture this screen as an image to the clipboard press 'Alt+PrtScn', then paste into an image editor or email.

**Download Data:**

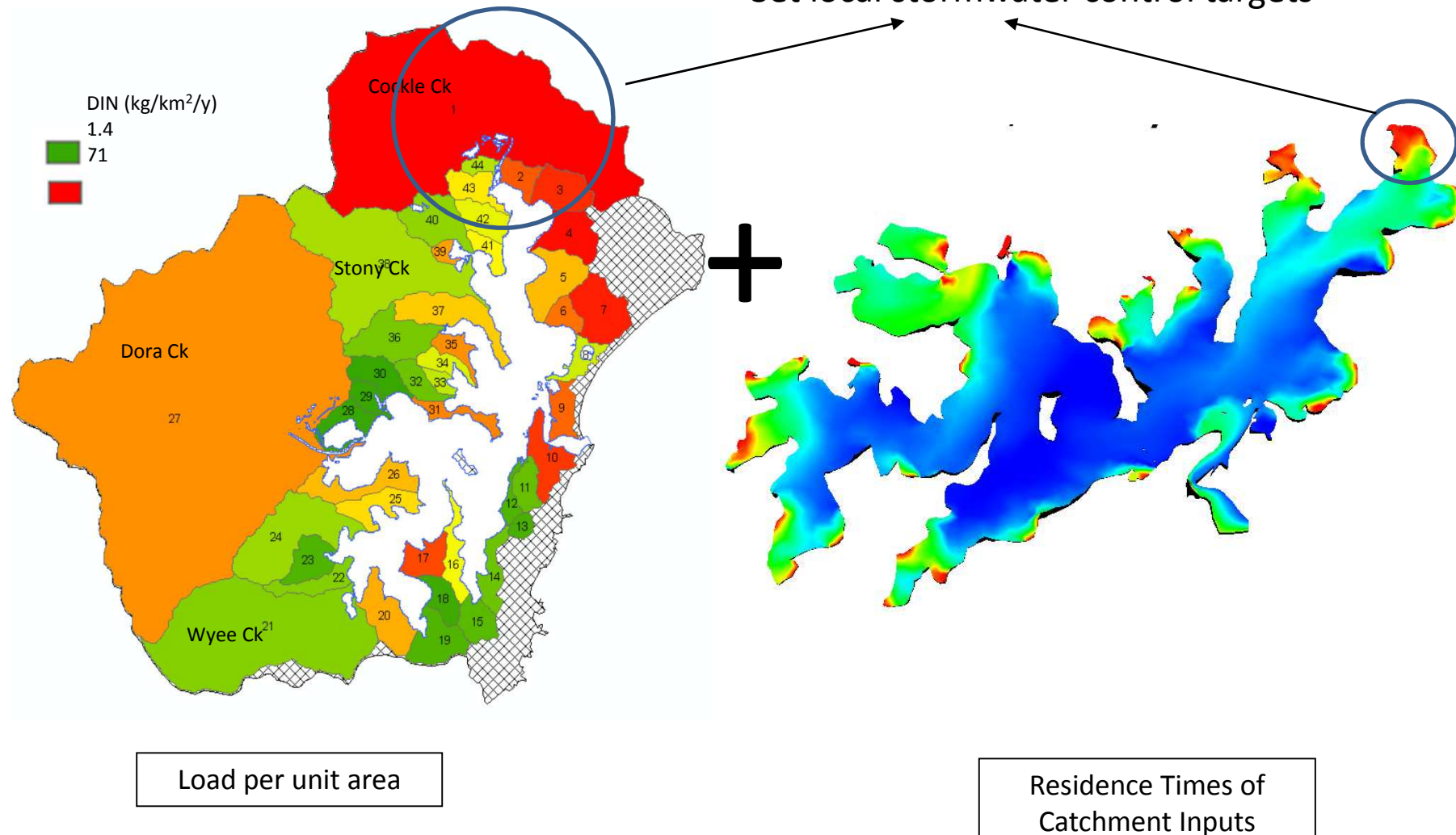
☐ current model input
 ☐ target model output
 Download
RESET ALL

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## Effects based management:

e.g. Lake Macquarie

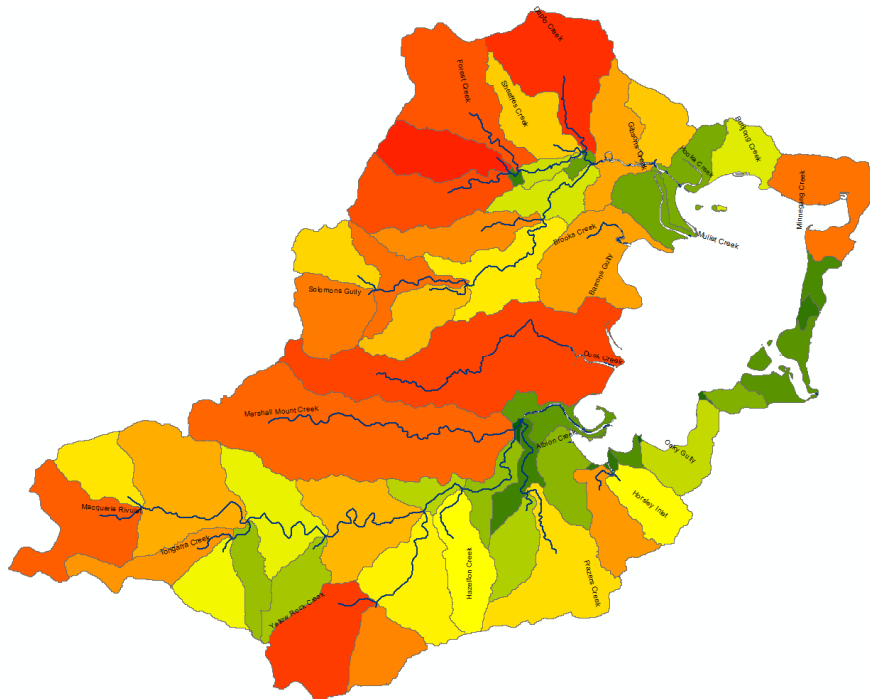
- Prioritise resources for stormwater management options
- Set local stormwater control targets





# Effects based management: current situation Lake Illawarra

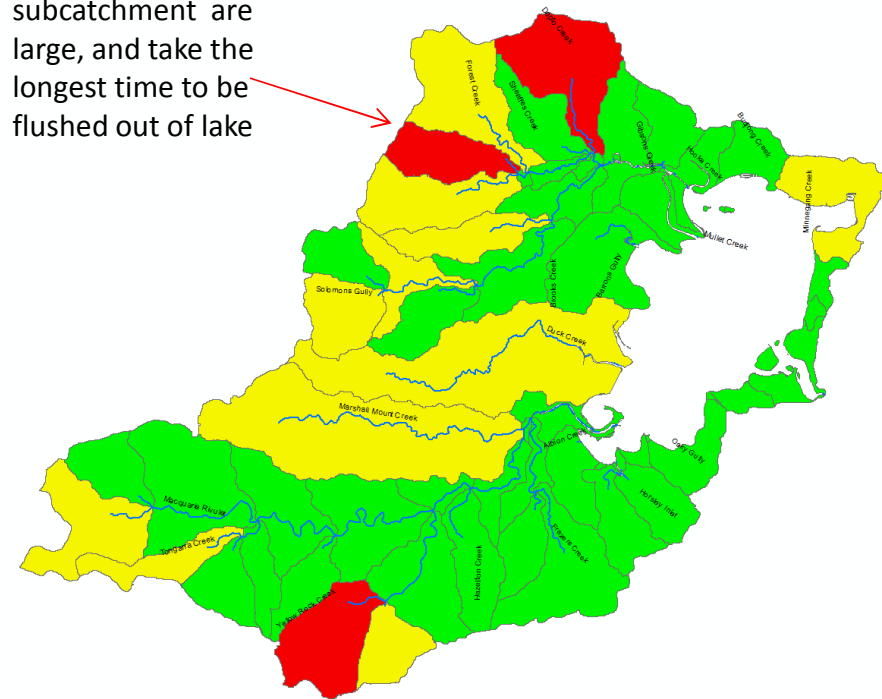
TN load (kg/y)



catchment model output

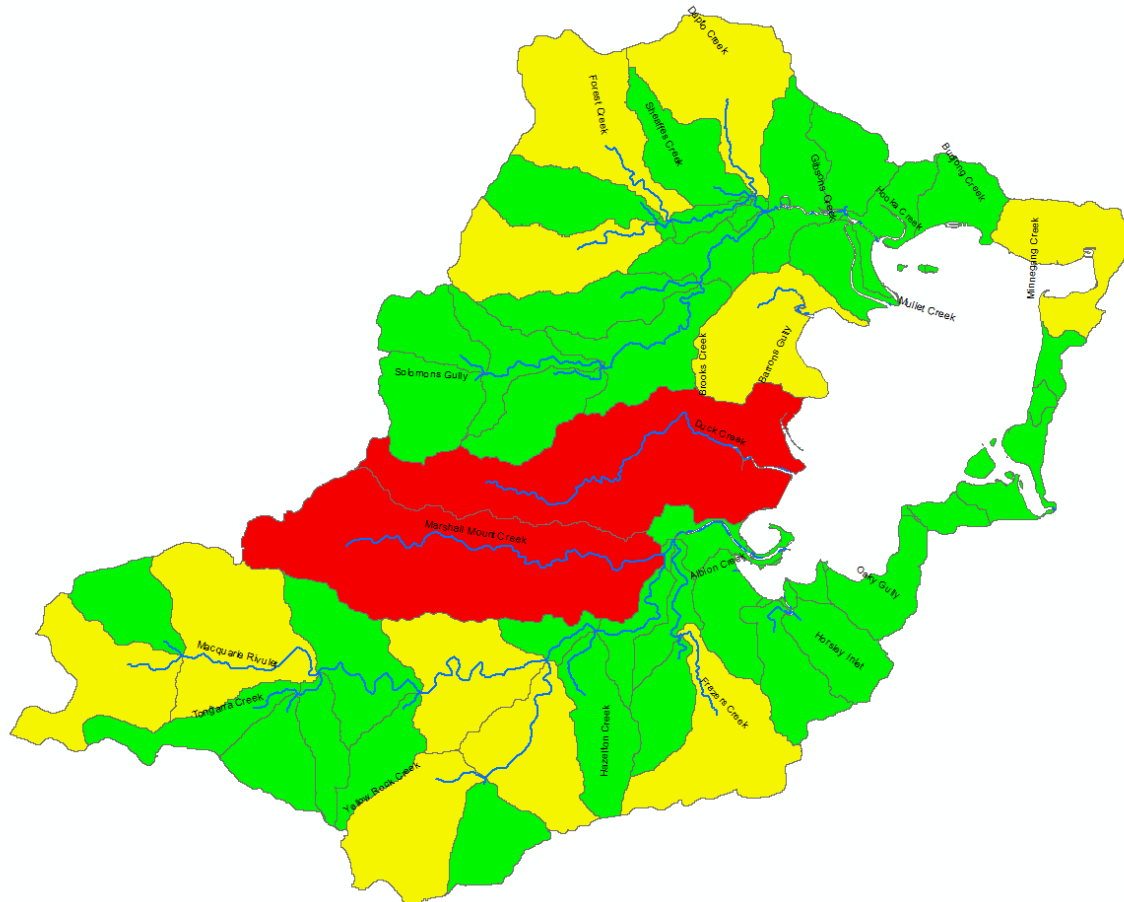
TN loads from this  
subcatchment are  
large, and take the  
longest time to be  
flushed out of lake

'threat' to estuary



integrated outputs from catchment and estuary model  
(how long it takes for subcatchment loads to clear from lake)

# Proposed tangible outputs for Planning:



## RED:

EIS to help meet ~20% load reduction required? (will depend on management objective for lake and tributaries)

## YELLOW:

NoRBE

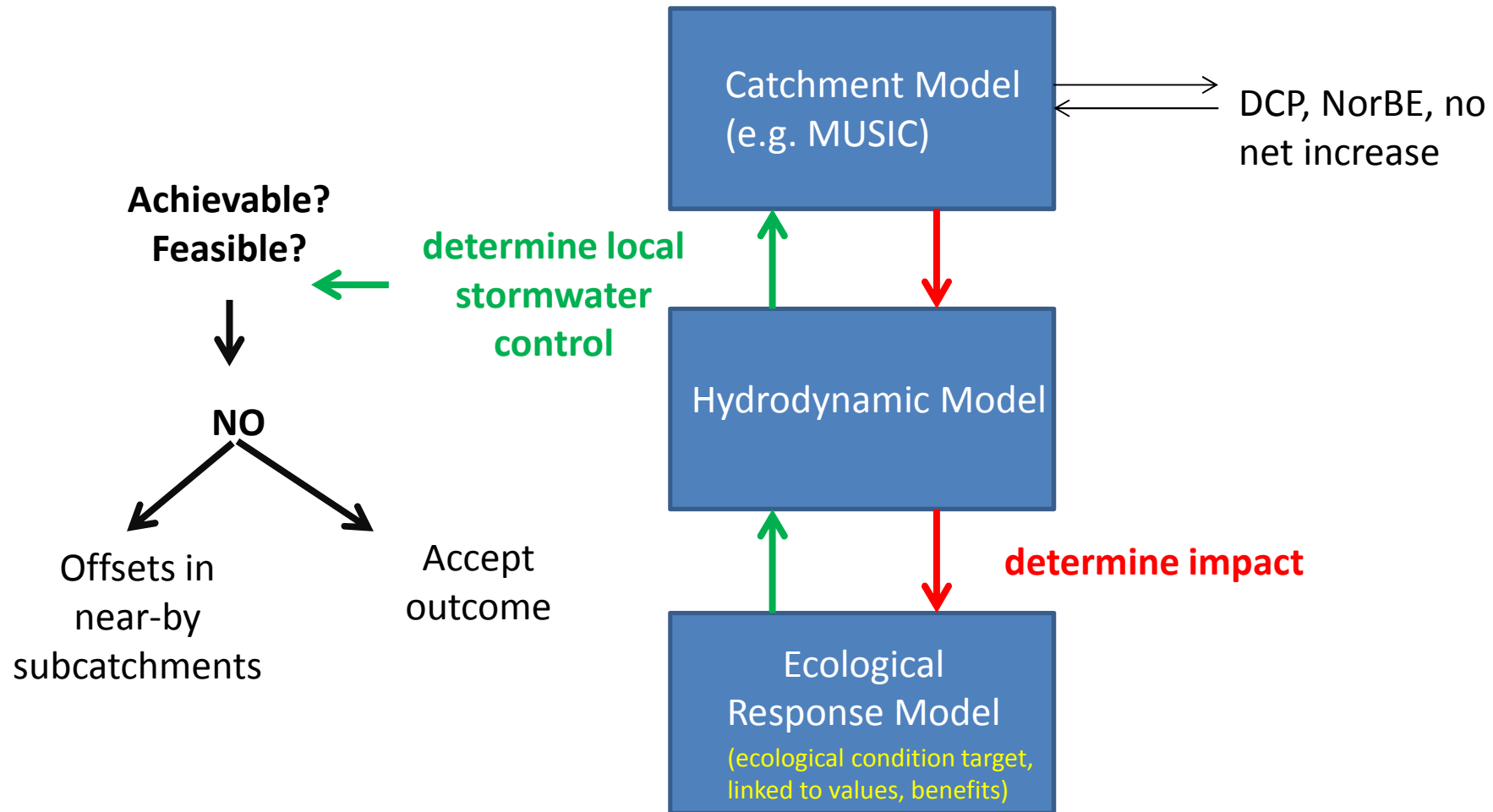
## GREEN:

minimum performance standards (e.g. existing DCP)

OR SIMPLY, COLOUR CODING TO ID 'BENEFITS'

DRAFT

## What to do in a 'RED Zone'?



- **Revise catchment modelling – LEP zones, MUSIC constituent concentrations?**
- **Outcomes re-mapped based on risk assessment approach (ISO 31000, 2009)**
- **Proof of concept – go through a DA in a red zone**
- **Cost/benefit analysis (feedback from Industry, practitioners etc)**
- **Application to freshwater systems (different models but same approach)**