Background

Examples of pollution:

– Nutrients (nitrates/phosphates)

– Turbidity and suspended solids

– Chemical input (e.g. fuel oil, pesticides, household cleaners)

– Waterborne pathogens, viruses, parasites, protozoa and bacteria

Poor water quality can be associated with:

– Urban runoff

– Stormwater

– Sewage

– Animals (birds, dogs, livestock etc)

Bacteria indicators - Beachwatch

- Partnership Program - Council and the NSW Office of Environment and Heritage's (OEH) Beachwatch team

- Samples collected/tested for Enterococci (bacteria common to the faecal matter of warm blooded animals). These bacteria can be an indicator of sewage and/or stormwater contamination.

- Legacy – Poor grading's not investigated

- Now staff are assigned to follow up on poor results – E.g. Terrigal is now the focus of a catchment audit (along with other sites)

Possible sources of contamination seen internationally

- A point source is a single, identifiable source of pollution, e.g. industrial waste discharged into a river, usually discharged through a dedicated discharge structure
- 'Diffuse' pollution refers to inputs of pollution that are not deliberate, which occur over a wide area and are not easily attributed to a single source activity. Diffuse source pollution may be collected and discharged through drains (e.g. stormwater)

Cont. Possible sources of contamination seen internationally

- Cracked sewer pipes or septic tanks - direct infiltration into stormwater or groundwater
- Infiltration of contaminated groundwater into stormwater or waterway
- Illegal connections - sewer to stormwater
- Illegal connections - stormwater to sewer – overloads
- Wildlife faeces via direct input and overland flow (birds etc)
- Domestic and agricultural faeces (dogs, cats, horses, cows etc)
- Sediment – reservoir and resuspending
- Seaweed – reservoir
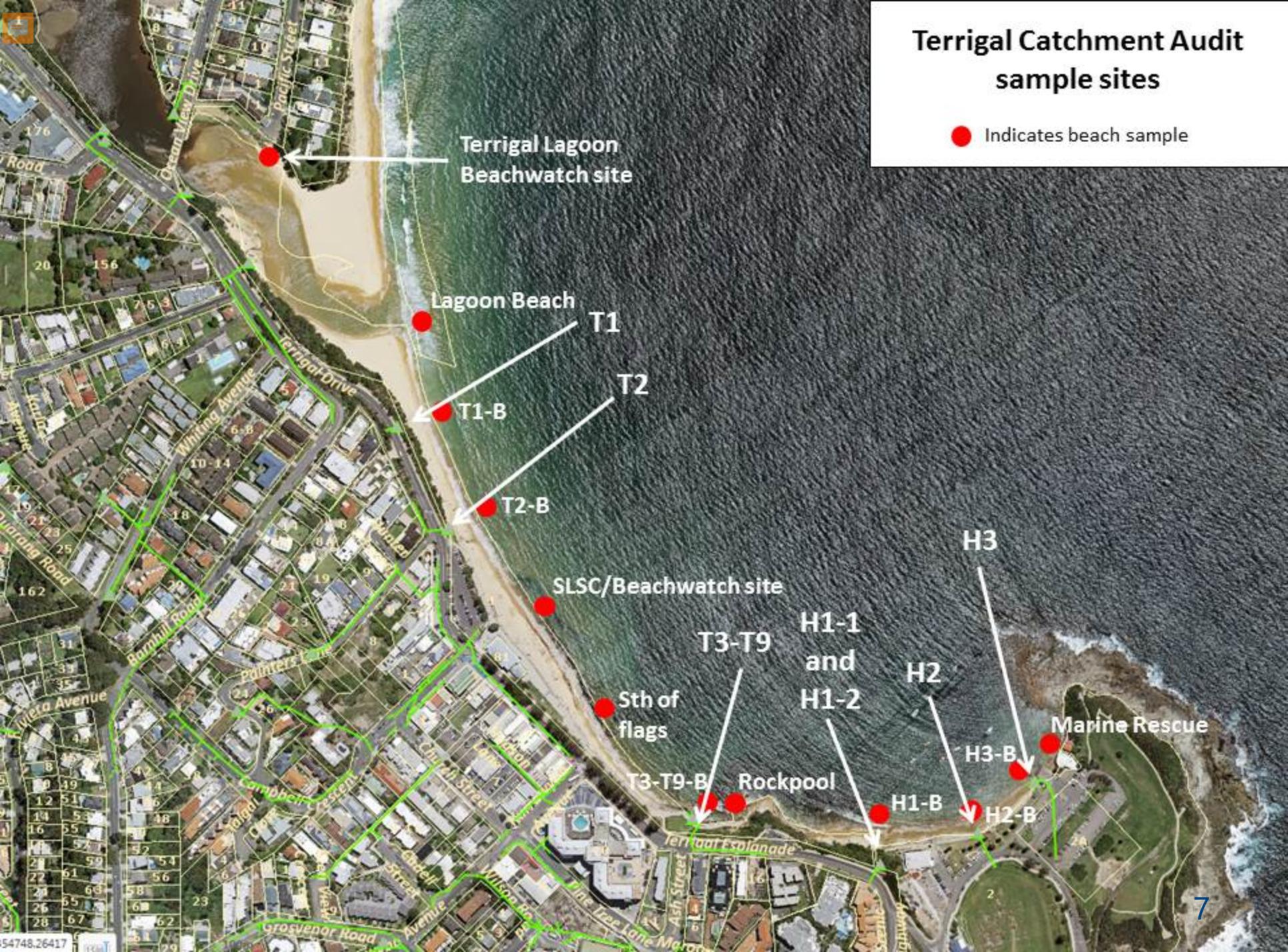

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Investigation methods

Currently sampling:

- Pipe outlets and at the beach
- Controls (neighbouring beaches Forresters and Avoca/North Avoca)
- Catchment sampling in stormwater pipes

Terrigal Catchment Audit sample sites

● Indicates beach sample

Terrigal Lagoon Beachwatch site

Lagoon Beach

T1

T1-B

T2

T2-B

SLSC/Beachwatch site

T3-T9

H1-1 and H1-2

H2

H3

Sth of flags

T3-T9-B

Rockpool

H1-B

H3-B

H2-B

Marine Rescue

7

Water sample tests

Testing for	What does this show?
Enterococci	Quantity of bacteria
Ammonia Trace pharmaceuticals	Combined are an indicator – differentiates if bacteria is from catchment input or sewage input Y/N
DNA/rNA qPCR	If the bacteria caused by e.g. birds/dogs etc. Y/N

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Investigation methods

Photos removed due to confidentiality. Currently Council is not releasing photographic evidence of smoke testing due to the sensitive nature of the project. The data may directly or indirectly identify houses or businesses with illegal connections. If private property is implicated throughout the audit, Council is looking to help people do the right thing. It is hoped that bringing these issues to light with the landowners will instigate fixes through information and education. If private landowners do not fix illegal connections or cracks affecting stormwater, Council will commence regulatory actions. These actions will be reported as number of investigations undertaken, number of issues detected and number of issues rectified.

Smoke testing in the coastal lagoons

Trace pharmaceutical testing within Terrigal catchment

CCTV within Terrigal catchment

Using dye to assess connections within the catchment

Dye tests - Ensuring unmapped connections are only stormwater

Central Coast Council

centralcoast.nsw.gov.au
www.centralcoast.nsw.gov.au/errigalwaterquality

Terrigal Catchment Audit web page

Website: www.centralcoast.nsw.gov.au/terrigalwaterquality

Key documents:

- Council meeting notes
- Terrigal Catchment Audit - Initial Summary Report
- Terrigal Water Audit - FAQs

Short video overview (1.5 minutes)

Comprehensive video overview (8 minutes)

Initial report and ocean results

Background information

Key definitions

Information on the catchment and pollution risks

Outcomes from ocean sampling

- % safe for swimming from ocean samples
- Mapped averages for ocean samples
- Graphed data points for all ocean samples (not averages)
- Ocean water quality data will be made available (website)

Report map - dry weather

Figure 11: Average water quality

Report map - wet weather

Figure 12: Average water quality

Report map - lagoon opened

Figure 14: Water quality (single day sample 3/4/2019).
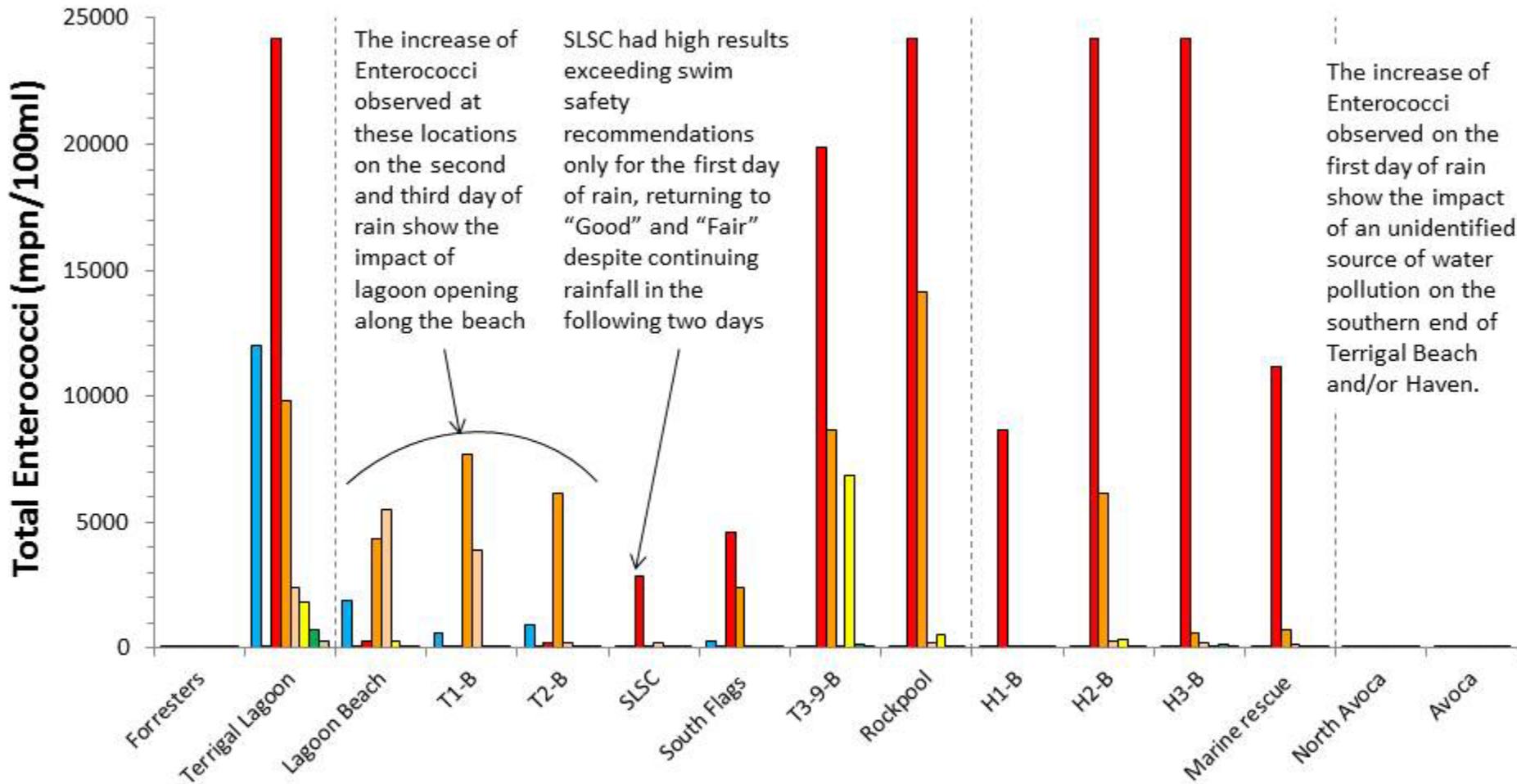
Report map – Extreme rainfall event June 2019

Figure 15: Water quality after large rainfall event and lagoon opening (single day sample 24 June 2019).

Lagoon opened   Normal sample   Large rainfall event and lagoon opening   Recovery of system

- 3/4/2019   ■ 11/06/2019   ■ 24/06/2019   ■ 25/06/2019   ■ 26/06/2020   ■ 27/06/2019   ■ 28/06/2019   ■ 29/6/2019

Total Enterococci (mpn/100ml)

The increase of Enterococci observed at these locations on the second and third day of rain show the impact of lagoon opening along the beach

SLSC had high results exceeding swim safety recommendations only for the first day of rain, returning to "Good" and "Fair" despite continuing rainfall in the following two days

The increase of Enterococci observed on the first day of rain show the impact of an unidentified source of water pollution on the southern end of Terrigal Beach and/or Haven.
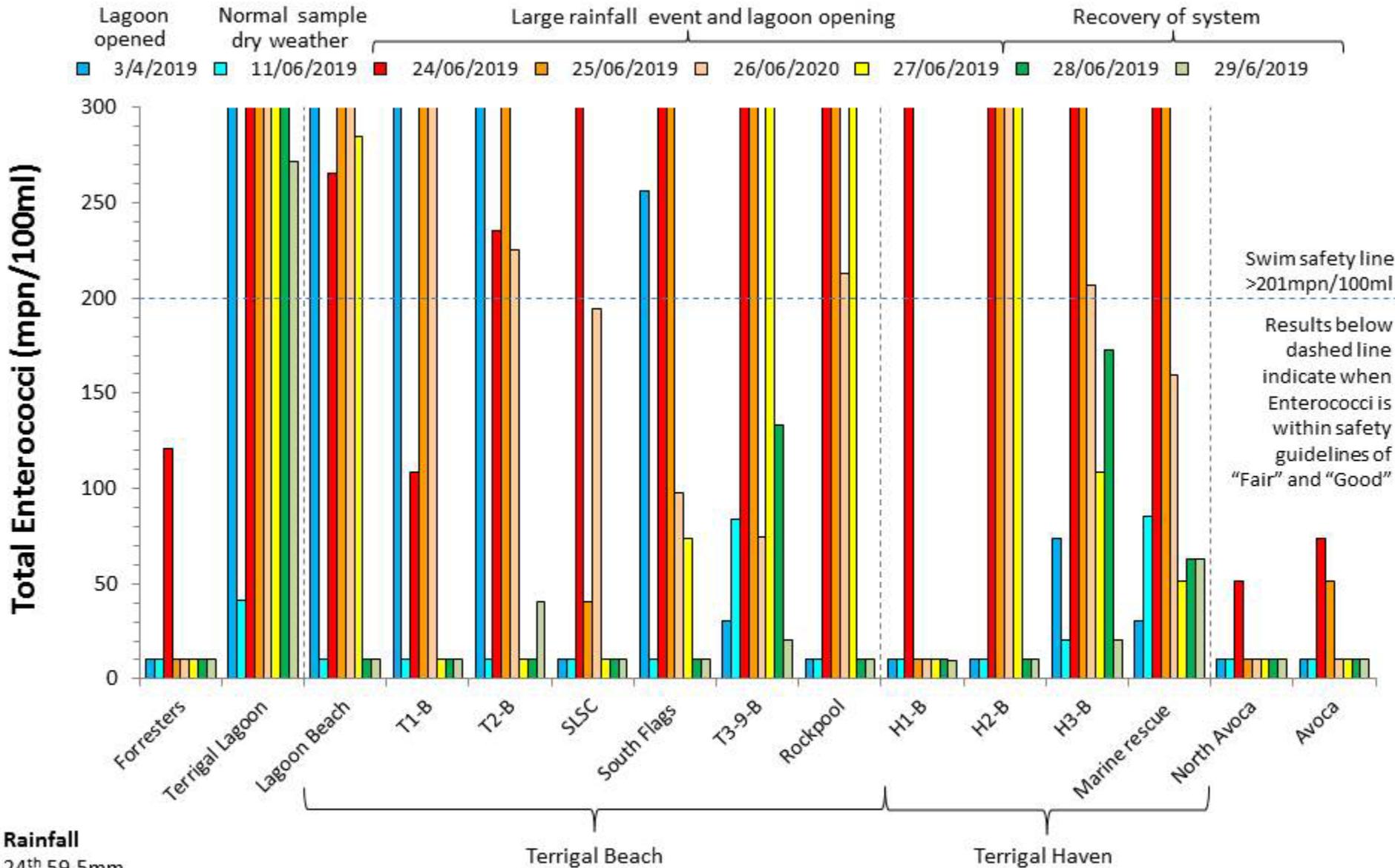
Locations: Forresters, Terrigal Lagoon, Lagoon Beach, T1-B, T2-B, SLSC, South Flags, T3-9-B, Rockpool, H1-B, H2-B, H3-B, Marine rescue, North Avoca, Avoca

Terrigal Beach   Terrigal Haven

Rainfall
24th 59.5mm
25th 18mm
26th 25.5mm
27th 2.5mm
28th 0mm

Lagoon opened by the 25th June

centralcoast.nsw.gov.au
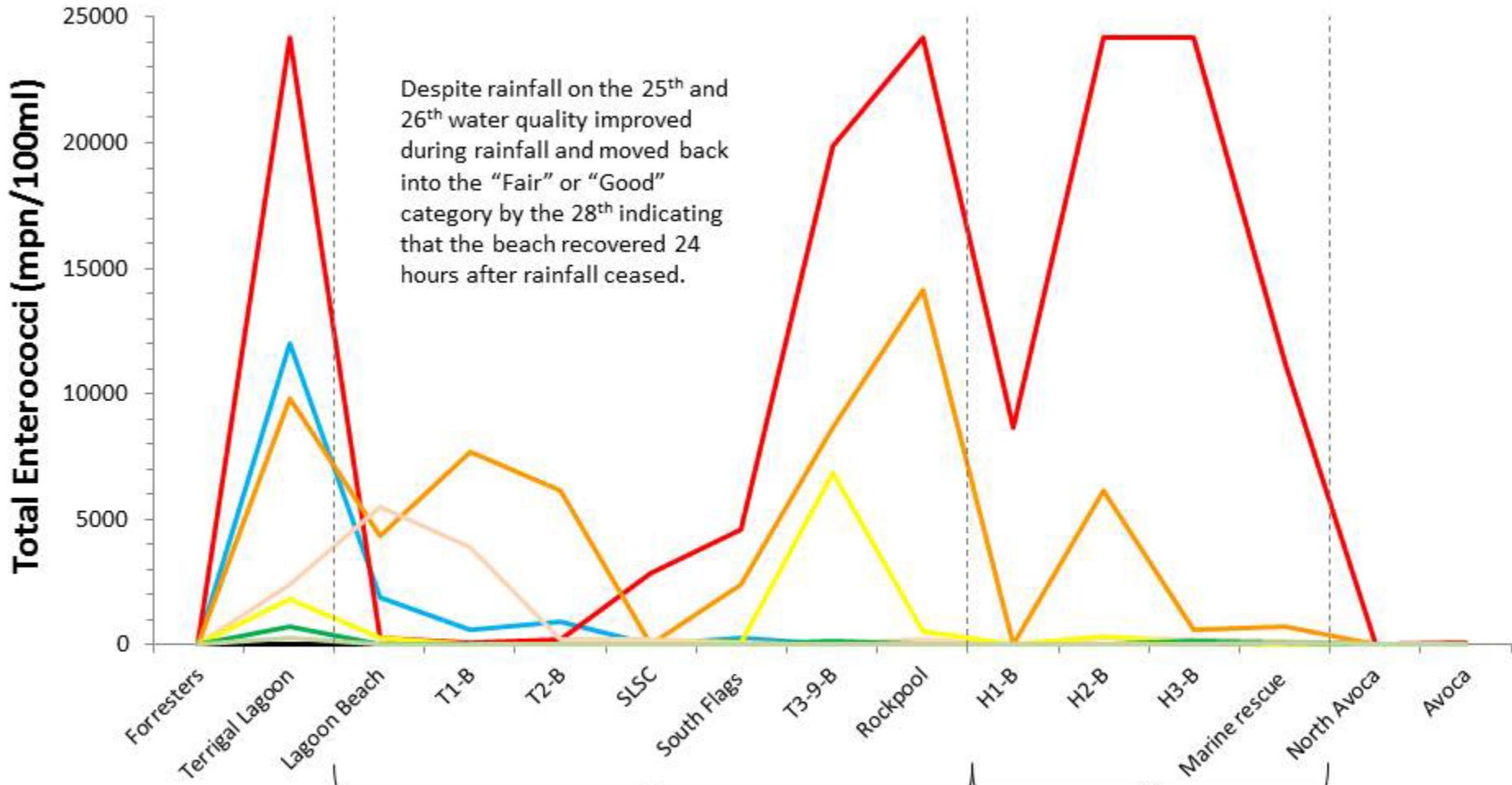www.centralcoast.nsw.gov.au/terrigalwaterquality

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Extreme rainfall event June 2019

Extreme rainfall event June 2019

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Supplementary information not presented at committee meeting
– to provide raw data for slides 16, 17 and 18

Raw data and swim safety grades for the wet weather event

	3/04/2019	11/06/2019	24/06/2019	25/06/2019	26/06/2020	27/06/2019		28/06/2019	29/06/2019
Conditions	Rain	Dry	Rain	Rain	Rain	Dry <5mm of rain		24 hr after rain	48hrs after rain
Rainfall	13mm	0mm	59.9mm	18mm	25.5mm	2.5mm		0mm	0mm
Lagoon Beach	1917.9	10	265.5	4351.7	5475	284.7		10	10
T1-B	598.3	10	108.9	7701	3873.2	10		10	10
T2-B	933.5	10	235.1	6131.4	225.5	10		10	40.9
SLSC	10	10	2851	40.5	194.6	10	24 hours after rainfall	10	10
South Flags	255.9	10	4611.1	2382.2	97.9	73.8		10	10
T3-9-B	30.6	83.6	19862.9	8664.4	74.5	6866.7		133.6	20.2
Rockpool	10	10	24195.7	14136.1	213.3	555.5		10	10
H1-B	10	10	8664.4	10	10	10		10	9.9
H2-B	10	10	24196	6131.4	301.3	377.4		10	10
H3-B	73.8	20.1	24196	587.8	206.4	108.9		173.1	20.2
Marine rescue	30.6	85.2	11198.7	722.7	159.6	51.6		63.2	62.6

The Grades explained	
Green	**Good** - Bacterial levels are safe for bathing
Yellow	**Fair** - Increased risk of illness to bathers with lower immune function
Orange	**Poor** - Bacterial levels indicate a substantially increased risk of illness to bathers. Swimming is not recommended at this site at this time.
Red	**Bad** - Bacterial levels indicate a high risk of illness. It is recommended to avoid swimming at this site at this time.

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Cont. Pollution event June 2019

Ocean samples

- The ocean took 1 day to recover after the last rainfall event on the 26th (>5mm MHL) to move back into the "Good" or "Fair" category for <u>all</u> 11 sites (all beach sites in "Good" or "Fair" by the 28th) (review data on slide 21)
- On this instance the SLSC took <1 day after rain to return to "Good" and "Fair" despite rain on the 25th and 26th (review data on slide 21)

Rockpool findings

- All 20 samples during dry weather, wet weather and lagoon opening (3 April) showed 100% of samples in the rockpool were in the "Good" category
- Samples during the extreme rainfall event 24 June showed the rockpool had an increase in bacteria with the rest of the beach, and took 1 day to move back into the "Good" category after rainfall
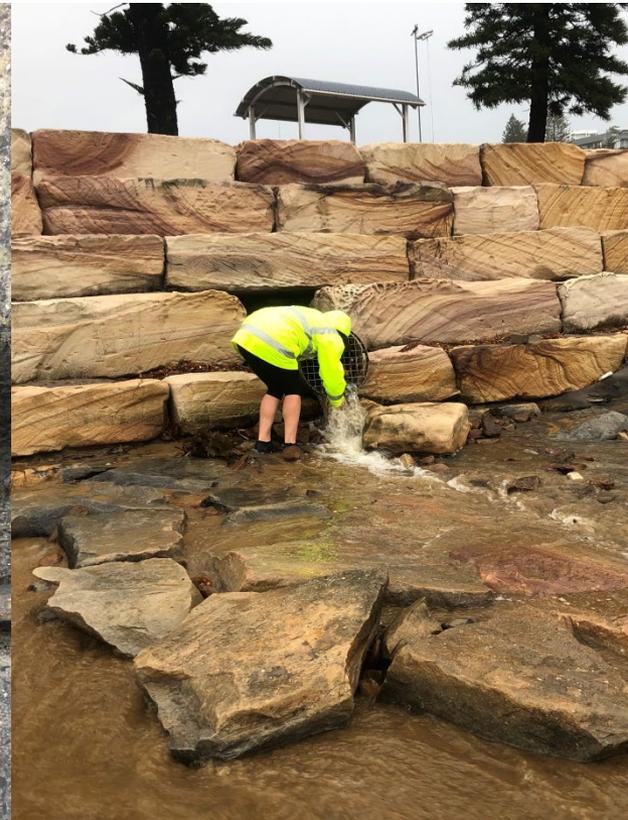
Cont. Pollution event June 2019

General findings

- Data from extreme rainfall events indicate that the audit needs to have a major focus on the catchment and lagoon in extreme wet weather

- During recent extreme rainfall events in Terrigal, the Pine Tree Lane pump station sensors indicate no significant impact from infiltration (no stress on pump performance) therefore there is no indication of overflows from the pump station – however high bacteria results indicate something is happening further up in the catchment and this needs more investigation (method discussed later)

Wet weather sampling

Sampling throughout the catchment in wet weather targeting sub catchments to track down pollution sources

Update to Table 4 in the initial report - Priority pipe CCTV investigation and pipe relining schedule.

- Cracked and disjointed sewer pipes are common issues for infrastructure management internationally
- Cracked or disjointed sewer pipes may leak sewage into groundwater and contaminate stormwater either directly or via subsurface drainage
- Council has ongoing sewer network programs, and the Terrigal Catchment Audit has brought more focus on inspections for Terrigal, including:
  - o Pump station monitoring
  - o Ongoing CCTV to assess cracked or disjointed infrastructure
  - o The 'Reveal and Seal' program which inspects manholes for tree root intrusion or other issues
- The report identified 14 cracked and disjointed pipes www.centralcoast.nsw.gov.au/terrigalwaterquality
- These pipes need to be fixed but we cant definitively say they are a contributing factor (no way to assess if they are a cause of poor water quality) – continued monitoring needed on long-term trends

Photo provided by a community member

Reveal and seal program – root intrusion

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Update to Table 4 in the initial report - Priority pipe CCTV investigation and pipe relining schedule.

Priority zone	Location/pipe	Approximate timeframe (month)	Activity in stormwater	Activity in sewer network
1	Terrigal Haven	April 2019		Preliminary CCTV assessment of sewer mains in Terrigal Haven Catchment **(100% complete)**
1	Terrigal Haven	June 2019		Relining of 1 pipe recommended to commence as soon as realistically possible. **(100% complete)**
2 (A and B)	Terrigal Beach	June 2019	**Update by Roads and Drainage provided separately**	Recommendation - 2 (A and B) - Relining of 13 pipes recommended to commence as soon as realistically possible. Contractor engaged and works to be undertaken during the first and second quarters of 2019-2020 financial year. **(Underway)**
1	Terrigal Haven	July-Sept 2019		Relining of sewer pipe in Terrigal Haven. **(100% complete)**
2 (B) (C) (D)	Terrigal Beach "7 drains" T3-5	July - September 2019		Reviewing choke history for relevant sewer sub-catchments **(100% complete)**
2 (B) (C) (D)	Terrigal Beach "7 drains" T3-5	July - September 2019 **December**		Assessing sewer network condition **(Underway)** In Terrigal bowl

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Turbidity

(A measure of water clarity or cloudiness)

- Wet weather sediment plume

- Catchment stormwater turbidity being monitored throughout wet weather sampling

- CCTV camera work may help to identify sediment in stormwater infrastructure

Photo provided by a community member

Turbidity

(A measure of water clarity or cloudiness)

- Wet weather sediment plume

- Catchment stormwater turbidity being monitored throughout wet weather sampling

- CCTV camera work may help to identify sediment in stormwater infrastructure

Photo provided by a community member

DPIE and CCC sampling sediment

- Ocean turbidity

- Sediment as a reservoir for bacteria?

- Sediment size

- Metals, pesticides/herbicides, micro plastics and organics

Targeting long weekend and school holidays

Dates	Event
21/9/2019 to 4/10/2019	September school holidays
5/10/2019	Labour Day long weekend
6/10/2019	Labour Day long weekend
7/10/2019	Labour Day long weekend
21/12/2019 to 28/1/2020	Christmas school holidays

Dates	Event
27/12/2019	After boxing day
28/12/2019	After boxing day
25/1/2020	Australia Day long weekend
25/1/2020	Australia Day long weekend
25/1/2020	Australia Day long weekend

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Conclusions

- Progress is being made – details will be updated in later reports
- All directorates working together well with regular update meetings and scheduled fieldwork
- Audit program fully funded by Council
- Working closely with NSW Government - partnership investigations with an additional budget managed by the NSW Government
- Two types of sources, diffuse sources and direct sources, both with different methods used to detect issues
- Stormwater investigations are complex and take time to undertake

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Discussions with community representatives indicate that Council communication needs to be improved:

Solutions discussed:

- Provide Waterways and Coastal Protection's committee presentations with notes which explain brief dot points (confidential material removed). Presentation to be available to the public – provided on the website within 1 week of the presentation

- Provide raw data from initial audit report ocean sampling on the website, and as 6 monthly reports are released provide new ocean data on the website

- Update FAQ's with new trends in community questions and communicate more closely with community representatives to ensure questions are fully understood and are fully answered

- Provide an email update to advisory group when website is updated with new content, and includes a list of changes

- Review staff capacity to report on Council infrastructure remediation on the website in the form of a pinpoint map of works. This content would have been reported in 6 month reports – now proposing fortnightly updates to content

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