Catchment to Coast
Terrigal Catchment Audit
Sub-Committee Meeting
19-9-2019

Central Coast Council

Water Quality Investigations
Catchment Audits

Publically available slides and notes

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
Investigation methods

Currently sampling:
• Pipe outlets and at the beach
• Controls (neighbouring beaches Forresters and Avoca/North Avoca)
• Catchment sampling in stormwater pipes
Terrigal Lagoon Beachwatch site
Lagoon Beach
T1
T1-B
T2
T2-B
SLSC/Beachwatch site
Sth of flags
T3-T9
T3-T9-B
Rockpool
T3-T9-B
T3-T9-B
H1-1 and H1-2
H1-B
H2
H2-B
H3
H3-B
Marine Rescue
Terrigal Catchment Audit sample sites
● Indicates beach sample
## Water sample tests

<table>
<thead>
<tr>
<th>Testing for</th>
<th>What does this show?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterococci</td>
<td>Quantity of bacteria</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Combined are an indicator – differentiates if bacteria is from catchment input or</td>
</tr>
<tr>
<td>Trace pharmaceuticals</td>
<td>sewage input Y/N</td>
</tr>
<tr>
<td>DNA/rNA qPCR</td>
<td>If the bacteria caused by e.g. birds/dogs etc. Y/N</td>
</tr>
</tbody>
</table>
Photographs 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.
TERRIGAL CATCHMENT AUDIT WEB PAGE


**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

Dry weather

- Good
- Fair
- Poor
- Bad

Wet weather <5mm rainfall within 3 days, Lagoon closed.
Report map - wet weather

Figure 12: Average water quality
Report map - lagoon opened

Figure 14: Water quality (single day sample 3/4/2019).
Figure 15: Water quality after large rainfall event and lagoon opening (single day sample 24 June 2019).
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.

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

Lagoon opened by the 25th June
Extreme rainfall event June 2019

Total Enterococci (mpn/100ml)

- **Swim safety line**: >201mpn/100ml
- Results below dashed line indicate when Enterococci is within safety guidelines of "Fair" and "Good"

**Rainfall**
- 24\(^{th}\) 59.5mm
- 25\(^{th}\) 18mm
- 26\(^{th}\) 25.5mm
- 27\(^{th}\) 2.5mm
- 28\(^{th}\) 0mm

**Lagoon opened by the 25\(^{th}\) June**

Results in green for the 28\(^{th}\) June indicate that Enterococci results were below 201mpn/100ml at ocean locations.
Despite rainfall on the 25th and 26th, water quality improved during rainfall and moved back into the “Fair” or “Good” category by the 28th, indicating that the beach recovered 24 hours after rainfall ceased.
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

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Rainfall</td>
<td>Rain</td>
<td>Dry</td>
<td>Rain</td>
<td>Rain</td>
<td>Rain</td>
<td>Dry &lt;5mm of rain</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13mm</td>
<td>0mm</td>
<td>59.9mm</td>
<td>18mm</td>
<td>25.5mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagoon Beach</td>
<td>1917.9</td>
<td>10</td>
<td>265.5</td>
<td>4351.7</td>
<td>5475</td>
<td>284.7</td>
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<tr>
<td>T1-B</td>
<td>598.3</td>
<td>10</td>
<td>108.9</td>
<td>7701</td>
<td>3873.2</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2-B</td>
<td>933.5</td>
<td>10</td>
<td>235.1</td>
<td>6131.4</td>
<td>225.5</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLSC</td>
<td>10</td>
<td>10</td>
<td>2851</td>
<td>40.5</td>
<td>194.6</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Flags</td>
<td>255.9</td>
<td>10</td>
<td>4611.1</td>
<td>2382.2</td>
<td>97.9</td>
<td>73.8</td>
<td></td>
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<tr>
<td>T3-9-B</td>
<td>30.6</td>
<td>83.6</td>
<td>19862.9</td>
<td>8664.4</td>
<td>74.5</td>
<td>6866.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rockpool</td>
<td>10</td>
<td>10</td>
<td>24195.7</td>
<td>14136.1</td>
<td>213.3</td>
<td>555.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1-B</td>
<td>10</td>
<td>10</td>
<td>8664.4</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2-B</td>
<td>10</td>
<td>10</td>
<td>24196</td>
<td>6131.4</td>
<td>301.3</td>
<td>377.4</td>
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<td></td>
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<tr>
<td>H3-B</td>
<td>73.8</td>
<td>20.1</td>
<td>24196</td>
<td>587.8</td>
<td>206.4</td>
<td>108.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marine rescue</td>
<td>30.6</td>
<td>85.2</td>
<td>11198.7</td>
<td>722.7</td>
<td>159.6</td>
<td>51.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditions</th>
<th>24 hr after rain</th>
<th>48hrs after rain</th>
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</thead>
<tbody>
<tr>
<td>Rainfall</td>
<td>0mm</td>
<td>0mm</td>
</tr>
<tr>
<td>Lagoon Beach</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>T1-B</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>T2-B</td>
<td>10</td>
<td>40.9</td>
</tr>
<tr>
<td>SLSC</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>South Flags</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>T3-9-B</td>
<td>133.6</td>
<td>20.2</td>
</tr>
<tr>
<td>Rockpool</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>H1-B</td>
<td>10</td>
<td>9.9</td>
</tr>
<tr>
<td>H2-B</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>H3-B</td>
<td>173.1</td>
<td>20.2</td>
</tr>
<tr>
<td>Marine rescue</td>
<td>63.2</td>
<td>62.6</td>
</tr>
</tbody>
</table>

### The Grades explained

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Good - Bacterial levels are safe for bathing</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>Fair - Increased risk of illness to bathers with lower immune function</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>Poor - Bacterial levels indicate a substantially increased risk of illness to bathers. Swimming is not recommended at this site at this time.</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Bad - Bacterial levels indicate a high risk of illness. It is recommended to avoid swimming at this site at this time.</td>
<td></td>
</tr>
</tbody>
</table>
Cont. Pollution event June 2019

**Ocean samples**
- The ocean took 1 day to recover after the last rainfall event on the 26\textsuperscript{th} (>5mm MHL) to move back into the “Good” or “Fair” category for all 11 sites (all beach sites in “Good” or “Fair” by the 28\textsuperscript{th}) (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 25\textsuperscript{th} and 26\textsuperscript{th} (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
Sampling sub-catchments in wet weather

Publically available slides and notes
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:

- Pump station monitoring
- Ongoing CCTV to assess cracked or disjointed infrastructure
- The ‘Reveal and Seal’ program which inspects manholes for tree root intrusion or other issues

The report identified 14 cracked and disjointed pipes. These pipes need to be fixed but we can't 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.
Update to Table 4 in the initial report - Priority pipe CCTV investigation and pipe relining schedule.

<table>
<thead>
<tr>
<th>Priority zone</th>
<th>Location/pipe</th>
<th>Approximate timeframe (month)</th>
<th>Activity in stormwater</th>
<th>Activity in sewer network</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Terrigal Haven</td>
<td>April 2019</td>
<td>Update by Roads and Drainage provided separately</td>
<td>Preliminary CCTV assessment of sewer mains in Terrigal Haven Catchment (100% complete)</td>
</tr>
<tr>
<td>1</td>
<td>Terrigal Haven</td>
<td>June 2019</td>
<td>Relining of 1 pipe recommended to commence as soon as realistically possible. (100% complete)</td>
<td></td>
</tr>
<tr>
<td>2 (A and B)</td>
<td>Terrigal Beach</td>
<td>June 2019</td>
<td>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)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Terrigal Haven</td>
<td>July-Sept 2019</td>
<td>Relining of sewer pipe in Terrigal Haven. (100% complete)</td>
<td></td>
</tr>
<tr>
<td>2 (B) (C) (D)</td>
<td>Terrigal Beach “7 drains” T3-5</td>
<td>July - September 2019</td>
<td>Reviewing choke history for relevant sewer sub-catchments (100% complete)</td>
<td></td>
</tr>
<tr>
<td>2 (B) (C) (D)</td>
<td>Terrigal Beach “7 drains” T3-5</td>
<td>July - September 2019 December</td>
<td>Assessing sewer network condition (Underway) In Terrigal bowl</td>
<td></td>
</tr>
</tbody>
</table>
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
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
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

<table>
<thead>
<tr>
<th>Dates</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>21/9/2019 to 4/10/2019</td>
<td>September school holidays</td>
</tr>
<tr>
<td>5/10/2019</td>
<td>Labour Day long weekend</td>
</tr>
<tr>
<td>6/10/2019</td>
<td>Labour Day long weekend</td>
</tr>
<tr>
<td>7/10/2019</td>
<td>Labour Day long weekend</td>
</tr>
<tr>
<td>21/12/2019 to 28/1/2020</td>
<td>Christmas school holidays</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dates</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/12/2019</td>
<td>After boxing day</td>
</tr>
<tr>
<td>28/12/2019</td>
<td>After boxing day</td>
</tr>
<tr>
<td>25/1/2020</td>
<td>Australia Day long weekend</td>
</tr>
<tr>
<td>25/1/2020</td>
<td>Australia Day long weekend</td>
</tr>
<tr>
<td>25/1/2020</td>
<td>Australia Day long weekend</td>
</tr>
</tbody>
</table>
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
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