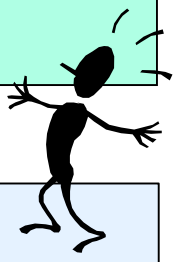
**Science outcome 5.19 and 5.22.2**

A student:
5.19 uses critical thinking skills in evaluating information and drawing conclusions.
5.22 independently plans, implements and evaluates the effectiveness of a variety of tasks as an individual and as a team member.



**Teacher's Notes – Exercise 25: Oyster Bay Mystery**

This introduction to water quality monitoring is a classroom exercise designed to prepare students for the excursion to study their catchment.
Students are divided into groups. They are told in the "Introduction to Oyster Bay" that Streamwatchers have been testing water at 4 sites in the local catchment but have lost the labels on the samples. The groups need to determine from which site each sample of water came. There are 3 lines of evidence:

**25A** **Buckets of Bugs –** simulating the use of bio - indicators

**25B** **Water samples** – a water testing simulation

**25C** **Newspaper reports –** research

**When the groups have completed the three exercises they will relate their findings to the land use shown on the map of Oyster Bay.**

**Assessment Task**

**Oyster Bay Mystery – Resource Kits**
This module is accompanied by 10 Oyster Bay Mystery Resource Kits. Each kit contains:

- 1 x laminated map of Oyster Bay
- 1 x laminated Bucket of Bugs - Samples
- 1 x laminated Water Sample A
- 1 x laminated Water Sample B
- 1 x laminated Water Sample C
- 1 x laminated Water Sample D

Students should also be given a copy of the "Bucket of Bugs – Recording Sheet" and "Water Samples – Results Sheet"

## Exercise 25: Oyster Bay Mystery

### An Introduction to Oyster Bay

by Kate Kennedy
Year 9

*Oyster Bay is a beautiful place to live. It's on the edge of the lake surrounded by bush and a few farms and it's also close to the beach. I've got lots of friends and we go horse riding, sailing, fishing, surfing – there's always things to do. It seems that people have just discovered how much nicer it is to live here than in the city. There are lots of new houses being built, a new industrial estate and heaps of roadwork. We even have a new golf course and a picture theatre.*

*Dad has lived here all his life. He's an oyster farmer and although he likes the golf course he worries about the pollution that comes with having so many more houses in the catchment. If his oysters get polluted someone might get sick – and that could put an end to our oyster business! He hopes that everyone in the catchment is doing the right thing otherwise there will be a lot of oyster farmers and fishermen out of work. If that happened I don't think I'd like to live here anyway because if the water's too dirty for the fish, oysters and prawns then it wouldn't be very healthy.*

*Our school has a Streamwatch kit that we use to test the water around our district. Sometimes we find that the water is polluted and we can go and do something about it before people get sick or fish start to die. Some people don't even know they're polluting the water or else they think a little bit of pollution won't hurt. We explain that lots of little bits of pollution adds up to heaps and this ends up spoiling the environment for everything that lives here including us.*

## Oyster Bay Catchment

The local newspaper has reported a few problems that have occurred in the waterways around Oyster Bay. Some kids at Oyster Bay (not as smart as you) have been out to take some samples from these trouble spots and elsewhere in the catchment. It is your job to analyse these samples.

Unfortunately the labels have come off the samples so you will have to do a bit of detective work to match each of the samples to the places marked on the map where they were collected.

1. **Locate the 4 sites on the map of Oyster Bay. Describe the activities around each site.**
2. **Testing the Water**
3. **Buckets of Bugs Activity.**
4. **Questions based on Newspaper articles**
5. **Write a report identifying which samples came from each site. Give reasons for your decisions**.

## Teacher's Notes – Exercise 25A: Testing the Water

Best done as a hands on activity. 'Mix up' four hypothetical water samples using coloured sequins to represent the composition. Students dip into the samples and count the sequens in their sub sample.

**Composition of Water Samples** – Note: it is important that proportions are maintained

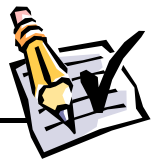
| | Sample | | | |
|---|---|---|---|---|
| | A (Golf Course ponds) | B (Rocky Ponds) | C (Catfish Creek) | D (Smiths Spring Falls) |
| Blue (water) | 62 | 63 | 63 | 83 |
| Green (nitrates) | 10 | 7 | 5 | 1 |
| White (oxygen) | 10 | 1 | 3 | 15 |
| Brown (suspended solids) | 2 | 6 | 10 | 1 |
| Yellow (salt) | 3 | 2 | 4 | 0 |
| Orange (phosphorous) | 7 | 8 | 4 | 0 |
| Purple (faecal coliform) | 4 | 10 | 10 | 0 |
| Black | 2 | 3 | 1 | 0 |

**OR**

Use the laminated diagrams in the Resource kit representing the 4 water samples – students then need to count up the different components represented (using the colour chart given) and fill out the table in their books.

## Teacher's Notes – Optional Focus Questions

1. Is one sample from each site sufficient to get reliable results?
2. If sewage was entering a waterway how would you expect it to show up in a water test analysis?
3. What actions by humans could lead to high suspended solids readings?



If we could see pollutants in the water it might make us more aware of the problems we create. Unfortunately polluted water often looks the same as healthy water. Oil and dirt are obvious but water might be polluted because it doesn't contain enough oxygen or it might contain toxic chemicals, salt or harmful bacteria. We can't see these things and so special techniques are needed to detect and measure them – that's what Streamwatch kits are for.

In this activity you are going to imagine that you have microscopic eyes that can actually see the different pollutants in water. With this superhuman vision you will be analysing the water samples that Kate and her friends collected in the Oyster Bay area.

**Step 1** Count the different coloured things in your sample and record the numbers of each in a table in your book. (The key below tells you what each of the colours represents).

**Step 2** Repeat this procedure with samples from the other 3 sites.

**Step 3** Compare the sample results and decide where each of the samples came from. Write a short explanation to justify each of your decisions.

**Step 4** A representative from each group describes their findings to the class and takes questions from the floor.

## Water Samples - Results

| | Samples | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Water | | | | |
| Dissolved oxygen | | | | |
| Chlorides | | | | |
| Pesticides | | | | |
| Nitrogen compounds | | | | |
| Suspended solids | | | | |
| Phosphates | | | | |
| Faecal bacteria | | | | |

### Colour Key

Blue ---------- Water
White ---------- Dissolved Oxygen
Yellow ---------- Chlorides
Black ---------- Pesticides
Green ---------- Nitrogen Compounds
Brown ---------- Suspended Solids
Orange ---------- Phosphates
Purple ---------- Faecal Bacteria

**Teachers Notes – Exercise 25B.**
**Buckets of Bugs**

This table is to be used to score the 'buckets of bugs' diagrams on the following page.

Some bugs can tolerate pollution, others are more sensitive and will not be found in polluted water. The Freshwater Bug Guide table gives each type of bug a value depending on how sensitive it is to pollution. The highest numbers are given to the most sensitive bugs. For each type of bug found in bucket 1, enter its value in the bucket 1 column alongside its picture. (Points are given for types not numbers e.g. 10 tadpoles scores the same as one tadpole, if there are three types of water beetles give 9 points). Repeat for each of the buckets then add up the scores to get a stream quality index.

Note that the latest index method includes a weighting to allow for the numbers of each species. This method is detailed on the streamwatch website. www.streamwatch.org.au/bugs/index.html

| Pollution Index | Stream Quality Rating |
|---|---|
| 20 or less | Poor |
| 21-35 | Fair |
| 36-50 | Good |
| 51 or more | Excellent |

## Buckets of bugs table

**Teacher's Notes: Exercise 25B - Buckets of Bugs**

Suggested that an overhead transparency is made of the Buckets of Bugs sheet for students to work from.

# Exercise 25B: Buckets of Bugs

Water bugs from 4 sample sites in the Oyster Bay Catchment

**Teacher's Notes – Exercise 25C**

Suggested that this be used as a homework sheet.

## Answers – Exercise 25C: Newspaper Articles

**Green River of Death**

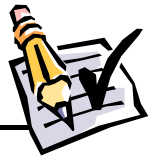
1. Fish suffocated because algae used up available oxygen.
2. Early morning
3. excess phosphates
4. Less use of fertilisers, ways to stop runoff into creeks; vegetation on banks.

**Creek Disappears**

1. Clearing of land to build houses
2. Left vegetation strip along banks of creek; left vegetation corridors in estate; sedimentation traps.
3. Looks better; slows down runoff and sedimentation; holds soil together.
4. Return it to the way it was.
5. cost; takes a long time for changes.
6. plant gardens, mulch, not litter.

**Missing Frog Mystery**

1. To eat mosquito larvae.
2. No
3. Frogs
4. Carp, rabbit, lantana, bitou bush, cane toads.
5. Don't empty into waterways; ensure no fish eggs in aquarium.



## Green River of Death

A big haul of fish is something you'd expect fishermen to boast about. But Jack Wells was not happy. Returning from his fishing trip with over twenty good-sized fish he headed straight for the NSW Fisheries Department. Jack described a 'green river of death' where fish were floating on the surface barely able to move, others were belly up. "I think this shows that we have a slight problem" he said holding up a couple of good sized estuary perch for a photo that he wouldn't be hanging on his wall. He said that in all the years he had been coming to the river he had never seen it in such an unhealthy state. "The green water and the stench of dead fish made a depressing scene, especially if you knew how clear the water used to be."

The EPA's Dr. Chris Lean said that an overgrowth of algae was causing the fish to suffocate. She said that although the algae produce oxygen during the day, at night they use it up again and so by the next morning there isn't enough oxygen in the water for the fish. To make matters even worse, because of all the algae there is a lot more rotting vegetation at the bottom of the creek. The microbes living in this use up lots of oxygen. Another problem is that in the summer the water gets warmer and it can't hold as much oxygen.

Water samples taken at the site and further upstream showed that the cause of the 'algal bloom' is high phosphate levels. Dr Lean said that fertilizers are a common source of phosphates but if they end up in waterways fertilizing algae they become pollutants.

### Focus Questions

1. How did algae cause the fish to die?
2. When would you expect the oxygen content of the water to be lowest?
3. What caused the overgrowth of algae?
4. Suggest a long-term solution to this problem.

## Creek Disappears

Stan Goodman feels sorry for the young kids of today as he straddles the creek that seventy years ago was one of his favourite fishing and swimming holes. "In those days we could row a boat up here but today its so silted up even the ducks get stranded. The water was so clear we could see the catfish on the bottom and platypus were common. It was about 4 feet deep with steep banks and tall trees all around – never thought it would end up like this. It all seemed to happen when the housing estate was built. I don't know why they couldn't have looked after this creek so that the families who move here could enjoy it like I did when I was a boy".

Today Council environment officers met with local residents, some claim the creek is a health hazard and have requested that concrete drains be installed. Others believe that it should be fixed up so that it is more like it used to be when Stan was a boy.

Council's environment officer said that the clearing of land to build houses had allowed tonnes of soil to wash into the creek. Not only had this buried plants that once grew in the creek but it had also caused the water to become muddy so that not enough light reaches the bottom for new plants to grow. She said that as a result the creek was as barren as a desert.

### Focus Questions.

1. Where did the sediment come from?
2. How could the developers of the housing estate have looked after the creek?
3. What are some of the advantages of retaining vegetation along the side of the creek?
4. What are the advantages of rehabilitating the creek?
5. What would be some of the problems of rehabilitating the creek?
6. What can the residents of the housing estate do to prevent sediment entering the creek?

## Missing Frog Mystery

Frog populations have crashed in recent years and the reasons are not at all clear. Frogs that were once common are now rare or endangered and some species may already be extinct. The once widespread green and gold bell frog (that has been promoted as our Olympic Mascot) is once that has taken a real nosedive in recent times. Its numbers have dwindled to the point where they now need our help to prevent their extinction.

Viruses, an increase in U.V radiation, herbicides and pesticides have all been blamed and now an introduced predator is being put under the spotlight.

Gambusia (also known as the Plague Minnow or Mosquito Fish) is a small fish (2-4cm) that was brought from North America and put into our waterways to eat mosquito larvae. The mosquitoes are still here and the Gambusia have spread like rabbits. They are incredibly hardy and eat anything from plants to larger fish that they've ganged up on – and this includes tadpoles and frog's eggs. In some places only old adult frogs remain because the tadpoles are not making it to froglet stage.

In the district, local frog watchers are busy putting in frog ponds so that species like the Green and Gold Bell Frog can breed beyond the reach of the Plague Minnow.

### Focus Questions.

1. Why were plague minnows introduced?
2. Did they do the job they were brought here for?
3. What animals do we know have been affected by the Plague Minnow?
4. What is another introduced species that has become a major problem in Australia?
5. What precautions should people take when emptying aquariums?