CHEMISTRY

Water Quality and Field Trip Report

Impact of Human Activity on Waterways

Describe the Location and Features of the Catchment area

The Catchment comprises of mainly the Upper Murray River, the Mitta Mitta River, Lake Dartmouth and ends at Lake Hume. (Highlighted in red below) It is mainly all freshwater rivers and streams that flow through to Lake Hume.

Map of Catchment: Google Maps

Along the catchment area, there are very trees and vegetation, allowing rain water from roads etc. to be filters before entering the water. Water levels are generally low, as water is being used up and rain is fairly rare in times of drought. This is evident particularly at Lake Hume.

Currently at 4% full, the most polluted part of the catchment, Lake Hume is very dry and vast; there is not much vegetation or plantation around the actual water (as you can see in the images below), and it is surrounded by man-made structure and infrastructure, Such as Bethanga Bridge, Bethanga and the many Roads. The lack of trees and vegetation allows rain water to flow directly into the catchment, without being filtered through biological processes. This allows petrol and other dangerous pollutants to be washed directly into the catchment from surrounding areas. The combination of low, still water levels, plentiful sun and additional pollution make it the perfect for algal bloom.

Above : A Very Dry Lake Hume: picture by Suburban Bloke
http://www.flickr.com/photos/suburbanbloke/

Below: Lake Hume from Bethanga Bridge: picture by Suburban Bloke
http://www.flickr.com/photos/suburbanbloke/

Identify possible sources of contamination in this catchment

- Excessive use of boats in the Catchment leads to fuel contamination in the water.
- People who camp and fish on the body of water may litter around the area, and leave hooks/ sinkers and other fishing gear in the water.
- Lake Hume is practically surrounded by roads, in which petrol and other contaminants may be washed directly into the water by rain, as there is no natural vegetation to filter it out.
- Townships located around the catchment area can cause land degradation and pollution of the water, for example of Bethanga is right on the edge of Lake Hume, where the citizens may litter around the area, or even dispose of chemicals directly into the catchment.
- There are some storm water drains which lead into the catchment area, which are direct run offs from roads, which was petrol and other chemicals in to the water.
- General littering.
- Low water levels, warmth, and increasing phosphorus and nitrate levels cause algal bloom, which although are natural, are a form of contamination.

Bethanga Bridge: picture by Suburban Bloke http://www.flickr.com/photos/suburbanbloke/

Describe physical and chemical processes used to purify water to make it potable. Explain the reasons for the use of chemical additives.

Chemical additives are used as most of the water contains pathogens and micro-organisms, for example Salmonella and e coli, which cannot be removed through physical procedures such as filtration. These pathogens and micro-organisms can be harmful to human health if consumed, so chemicals are added to create conditions in the water where they cannot survive, but is still safe for the consumption of humans.

Name of Process	Physical/Chemical	Method and Purpose
Filtration	Physical	Uses large filters with very small or even microscopic pores to collect any larger particles from passing through the filter, leaving "clean" water. The forms of filtration are known as: microfiltration, ultra filtration, nanofiltration or reverse osmosis membranes, these depend on the size of the pore. Some water is filtered through sand. This works in the same way as screen filters ranging from course to fine sand particles.
Sedimentation	Physical	Settles flocculates to form sludge which is removed for other industrial and agricultural uses. This method is effective in that it can reuse materials, however, this is also potentially dangerous as it alone does not destroy the harmful products which lie in the water and may contaminate other sources.
Addition of Aluminium Sulfate aka Alum	Chemical	Alum is added to the water to flocculate particles of dirt and other substances together, to allow them to be removed by the filters/ sedimentation. It treats "hard" water and turbid water in that it flocs the particles (usually carbonates) together so they may be removed through filters and/or sedimentation. It drops the pH of drinking water to approximately 6.6
Addition of Chlorine	Chemical	Chlorine a highly disinfectant chemical that is used to kill or denature disease-causing bacteria that the water or the pipes used to transport said water may contain. Only .2 ppm Chlorine residual is used as it is quite corrosive and poisonous.
Addition of Fluoride	Chemical	Although fluoride has no actual benefits of purifying or disinfecting the water, it is added to drinking water as it is believed to have orthodontic benefits of preventing tooth decay by strengthening enamel. It is added at 1ppm or below as more that 1.5 ppm can destroy bones.
Addition Of Lime	Chemical	Lime is dosed into the water simply to raise the pH to a safe drinking level, after chlorine and fluoride have been added.
Polyelectrolyte	Chemical	These act as flocing agents mainly to remove colour. They contain charges which allow them to flocculate ionic compounds so they are able to be removed.

Chlorine Tank

Alum Tank

Assess the effectiveness of the methods used to purify and sanitise mass water supplies

In current times, the methods used to purify and sanitise mass water supplies have been very effective. In the Albury/ Wodonga region, water is constantly monitored and tested upon to ensure that it is safe to consume. The technology used to monitor the water is great as it allows the observation and operation of every water pump around the catchment area to be controlled from one central location. Each pump is able to pump water at 300L/s and over 12 mega litres are treated each day.

Pump Control Center

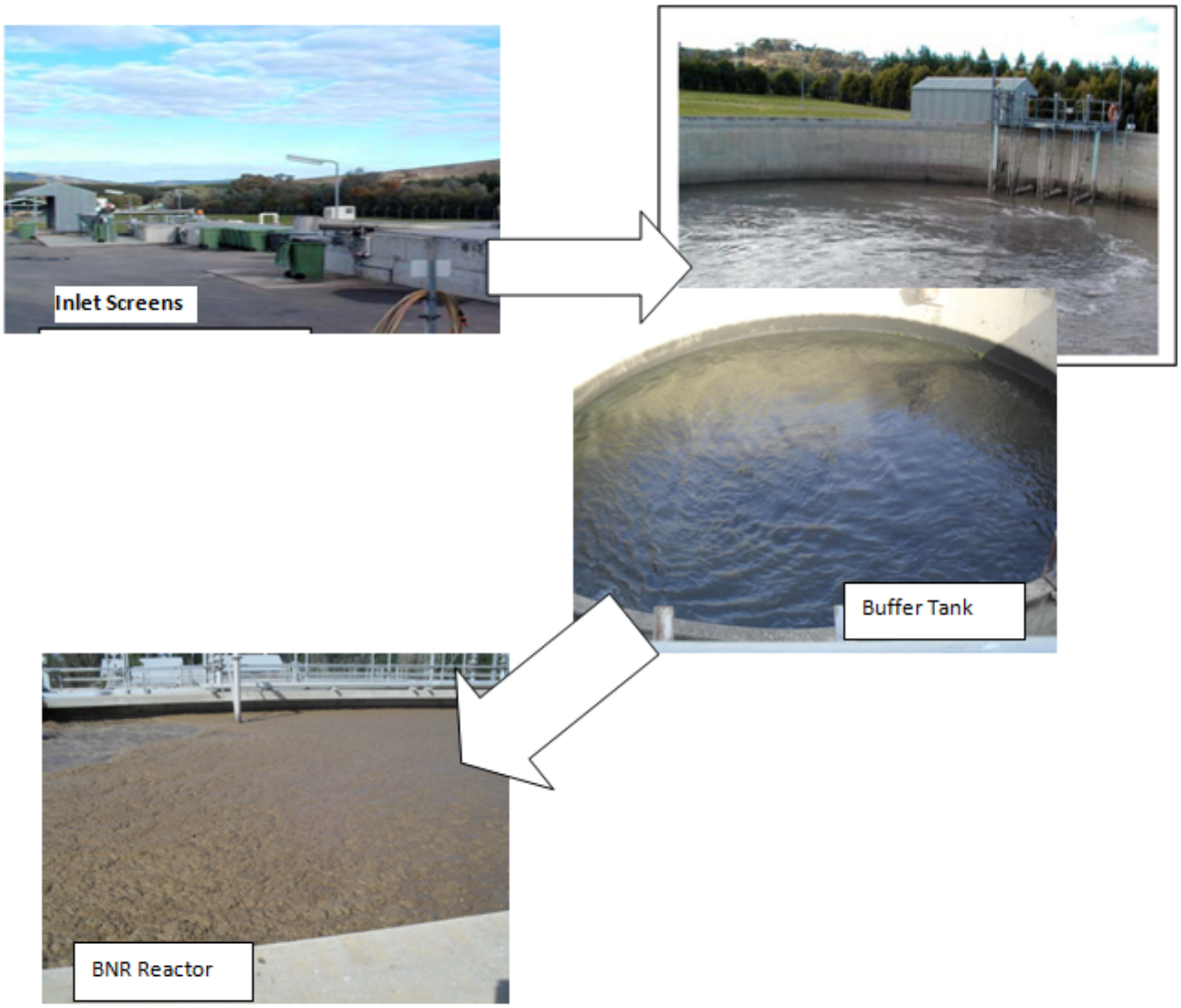
Water samples are tested daily, and doses of raw water (water directly from the river) are also tested. The water is tested for pH, turbidity, suspended solids, conductivity, fluoride concentration, colour and both free and total chlorine concentration. Free chlorine is the amount of chlorine that is still able to kill germs, and total chlorine is the total amount of chlorine.

The quality of Albury/ Wodonga's drinking water is at a high level and this is evident as there are virtually no cases of illnesses caused by drinking tap water in the area. As the water is supplied to over 50,000 people daily, this is a very good record as there are no recent reported cases of tap water related illnesses. This means that the water purification/ sanitising methods adapted by Albury/ Wodonga are great. Although there are restrictions due to drought, clean water is still plentiful.

Water Filtration Cells

Describe briefly the main steps used to treat waste water

The Steps used to treat water are as follows:


Inlet Screens
Buffer Tank
BNR Reactor

Relate the treatment of waste water to the prevention of eutrophication of waterways. Discuss the effectiveness of this process.

Eutrophication is defined by the Encarta Dictionary as "*the process by which a body of water becomes rich in dissolved nutrients from fertilizers or sewage, thereby encouraging the growth and decomposition of oxygen-depleting plant life and resulting in harm to other organisms*".

This growth leads to the rapid consumption of dissolved oxygen in the body water and as a result, suffocating other aquatic organisms and poisoning water ways.

The treatment of waste water has had a significant impact on the prevention of eutrophication of water ways. It allows us to return water back into our waterways, keeping a constant flow which reduces the rick of eutrophication as algal blooms mainly occur in still water.

The increase in phosphate and nitrate levels in water allow for optimum conditons for algal blooms. Using the phosphorus and nitrate conusming microbes used in waste treatment helps prevent eutophication in our rivers, streams and dams when water re-enters the catchment, as they remove some of the contributing factors to algal blooms. After removing the phosphorus and nitrates, the microbes can be simply removed, and the water can be returned to the river system. Although Blue-green Algae and other oxygen depleting plant life are still quite plentiful, without the processes used in waste water treatement, the problem will be far greater than what it is now.

The concentrated UV light also kills any remaining bacteria to prevent them from returning to our waterways.

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Encarta Dictionary- Microsoft Word

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