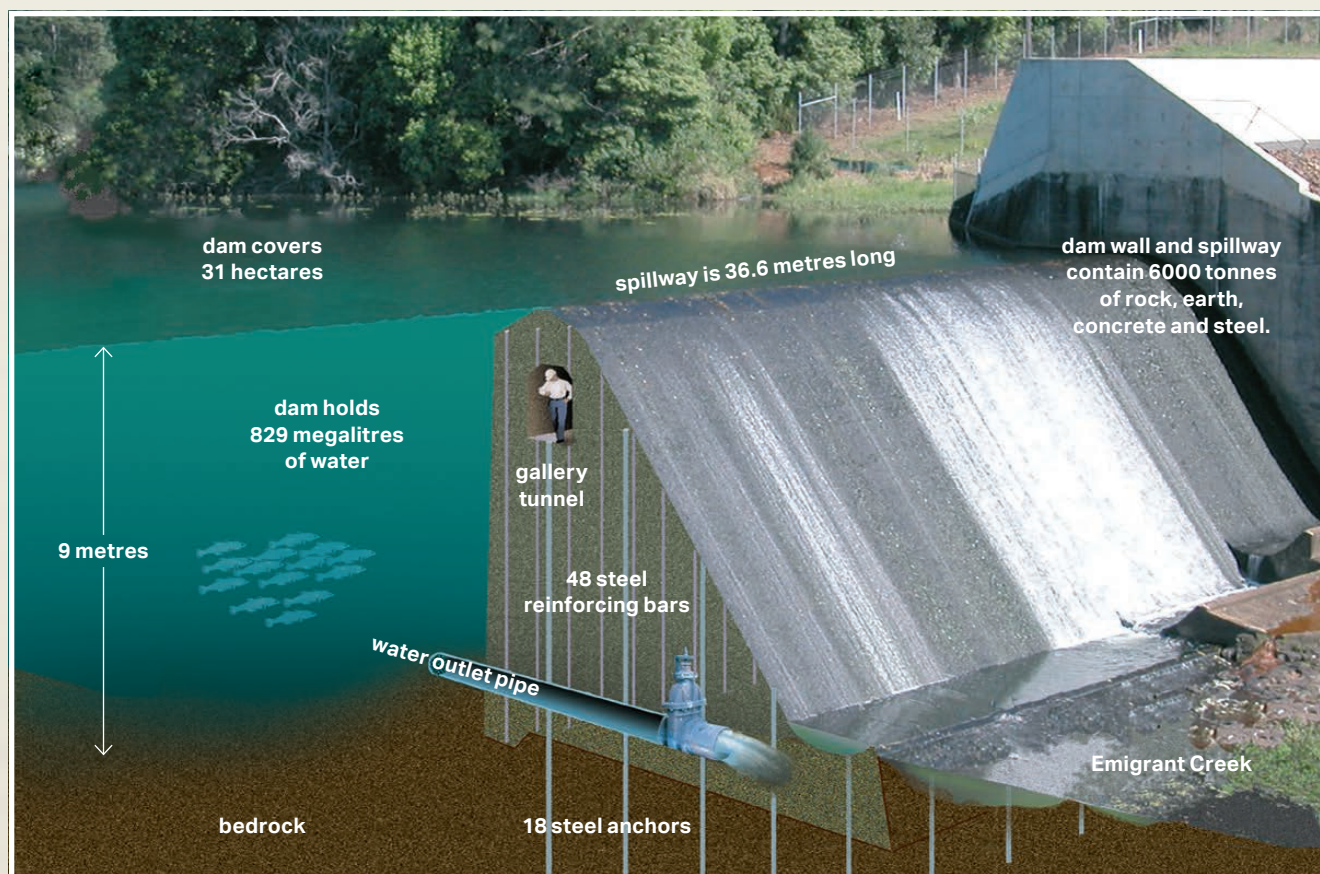


# EMIGRANT CREEK DAM

## DAM TECHNOLOGY...

You might think of the dam as just a big structure made out of concrete and steel that stops water from flowing down a creek and makes a lake behind it. Well, you're right!



The dam was constructed in 1968 and, together with the pumping station and rising main, cost about \$500,000. It flooded 31 hectares (that's 77 acres) of farmland that had been previously used for grazing cattle. The average depth of the dam is 2.7 metres, with a depth of 9.14 metres at the dam wall. When the dam is full, it holds 829 megalitres of water (that's about 415 Olympic swimming pools!).

The dam also plays some very important roles in managing all the other things you're learning about on this walk.

It provides our **water supply**. It holds enough water for local people's needs such as drinking, cooking, washing, watering gardens and industry.

It creates an **aquatic habitat**. The water held back behind the dam creates an artificial lake, which, if it is healthy enough, can support many plants and animals in their natural ways of life.

It controls **environmental flows**. The outlet pipe from the dam wall releases water into the creek downstream. This helps create a healthy Emigrant Creek.

Read on to find out how the technology of Emigrant Creek Dam allows it to play these important roles....

*The dam also plays some very important roles in managing all the other things you're learning about on this walk.*





**Together, the dam wall and spillway is made of about 6,000 tonnes of rock, soil, concrete and steel. (That's over 1000 concrete trucks full!)**



## Technical Specifications

### The Dam Wall and Spillway

The dam wall or embankment is 130 metres long, stretching from one bank of Emigrant Creek to the other. The purpose of the dam wall is to obstruct the flow of water in Emigrant Creek and safely store the water in the dam itself. The dam wall contains a spillway, which is a passageway through which surplus water escapes from the dam. The spillway is about 10 metres high.

The embankment that forms the majority of the dam wall consists mainly of rock and soil. The spillway, which provides for controlled release of water from the dam, consists mainly of concrete and steel. Together, the dam wall and spillway is made of about 6,000 tonnes of rock, soil, concrete and steel. (That's over 1000 concrete trucks full!) The spillway is shaped with a vertical wall on the 'full' side of the dam and a 68 degree slope on the 'downstream' side. The shape of the top of the spillway is a pointed curve called an 'ogee'.



This shape is so that when there has been so much rain that the water level in the dam is higher than the crest level of the spillway, it will flow smoothly over the spillway. This reduces the chances of a flood washing the dam away or damaging land on either side of the dam. The land

next to the dam wall has also been protected by placing large rocks in a special pattern called 'rip rap'.

Towards the top of the dam wall, inside the concrete, there is a tunnel called the 'gallery'. It is 1.8 metres high and 1.2 metres wide. The gallery was originally constructed to allow the water main to pass from the old pump station, through the dam wall to the other side of Emigrant Creek and up to the old water treatment plant at Knockrow. This gallery now provides access for technicians inside the dam for undertaking regular inspections to ensure the safety of the dam and spillway structure.

### Improving the Dam

In 1995, the safety of the dam was investigated. Rous County Council organised this study because new standards for dam design had been developed, and because environmental scientists had made new estimates of the "Probable Maximum Flood" (PMF).

*"PMF = the flood resulting from the theoretically greatest amount of rainfall for a given duration that is physically possible over the Emigrant Creek catchment". This means the amount of water that would flow from Emigrant Creek catchment into the dam in the largest flood event that is likely to occur.*



This Probable Maximum Flood would theoretically create about 5.5 metres of water flowing over the spillway.

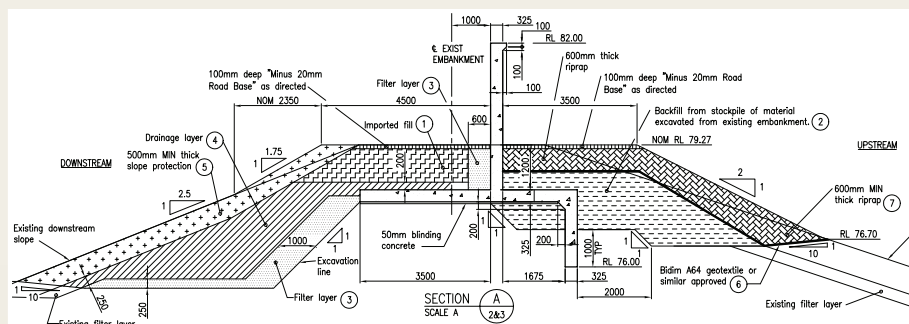
The highest level flood recorded for Emigrant Creek Dam was on 9th July 1985, when 280 cubic metres per second was flowing past the dam. That is about an Olympic swimming pool every 7 seconds! It was flowing about 2 metres above the spillway.

Based on the results of that study, the dam was worked on to bring it up to design standards and to make sure that it would safely withstand a "Probable Maximum Flood". This way, people living close to Emigrant Creek at Kirklands Crossing and Tintenbar, would be protected from the possibility of the dam becoming unstable.

### This involved:

**Reinforcing** the spillway with vertical steel rods that are drilled through the concrete. There are 48 rods, placed less than a metre apart. Each rod is 7 metres long, and reaches from the top of the wall into the concrete.

**Anchoring** the spillway to the 'bedrock' that lies approximately 30 metres below the creek bed. This was done by drilling 18 steel rods through the dam wall, between the floor of the gallery and into the bedrock below the dam wall. This makes the length of each anchoring rod about 50 metres.



### Emigrant Creek Dam Cross-section of Upgrade Embankment

The **embankments** on either side of the spillway were raised, so that water would flow over the spillway rather than over or around the dam wall embankments.

This was achieved by constructing concrete side walls to increase the depth of flow over the spillway before the embankments are overtopped. The dam and spillway are now capable of passing the floodwaters that would occur during the level of the 'Probable Maximum Flood'. This work was completed in 2001.

Water is released through the dam for environmental flow purposes via a 375 mm **scour valve**. The rate at which this scour valve releases water downstream is dependent upon how far the valve is opened. The outflow has been calibrated so that Rous County Council knows how much water is being released downstream based on how far the valve is opened – this release is adjusted manually.



## Inside the Dam

### The Lake behind the Wall

Most lakes such as Emigrant Creek Dam tend to be well mixed and therefore isothermal (all depths having similar temperature) in early spring. As summer begins, heat from the sun tends to warm the upper layers of the water, which becomes less dense than the cooler, denser layers in which they float, and the lake can become stratified.

The stratification process can have significant water quality implications. The surface layers of a stratified lake are well

oxygenated and, with a good supply of nutrients, will provide an opportunity for the growth of algae. By contrast the deeper, cooler layers may have very low dissolved oxygen levels, and the anaerobic conditions can lead to the solution of iron and manganese.

As the temperature lowers in autumn, the surface cools and eventually the lake reaches an isothermal condition again. It is at this time that overturning may occur (mixing of layers) and the poor quality water can rise to the surface, sometimes causing fish kills.

## If the whole dam was to be constructed today ... it would probably cost about \$10,000,000

About 200 metres from the dam wall, towards the centre of the water storage area, there are two **diffusers**. These are made of two 2 metre pipes, 2 metres apart. They pump compressed air into the dam as a stream of bubbles which aims to break down and prevent temperature/density stratification in the lake which is conducive to poor water quality. This process of **mixing** and **aeration** improves water quality and promotes the health of the aquatic ecosystems inside the dam.

This aeration aims to keep the maximum temperature difference between top and bottom layers in the dam shall be less than 2 degrees Celsius.



The raw water intake structure on the western side of the dam.

## The Edge of the Dam

The location of the raw water intake and pump station is on a jetty-like structure extending out into the water from the treatment plant site which is on the peninsula on the western side of Emigrant Creek Dam. The raw water pump station includes provision for pumping water at two different levels of the dam. Water is pumped at sufficient flow rates that allow the membrane filtration plant to produce a net throughput of 7.5ML/day and 25% less in the winter months.

If the whole dam was to be constructed today, including all improvements and technological infrastructure, it would probably cost about \$10,000,000.

## TRY THIS!

### Learn with your...



"How many metres of steel are used to reinforce the dam? How many metres of steel are used to anchor it to the rock underneath the creek? How many metres of steel does this make in total? Where does steel come from and what is needed for its manufacture? What effects does this have on the environment? Now think about the 6000 tonnes of concrete, rock and soil in the dam and its environmental effects."



"When you say the word 'technology', how do you feel? What is your first reaction? Do you like it or not? Why? Now carefully think through the roles that technology plays in this dam? How do you feel about it now, in this context?"



"When you look down at the dam wall, what do you notice first? What is it made of? How does it work? Why do you think you have noticed it? Why is it important? What role does it play in the 'bigger picture' of the local environment, and the health and safety of local people?" (Hint: Some of these questions might not be relevant, just answer the ones that are)

**Learning objective:** To understand the technical specifications of Emigrant Creek Dam; and how the technology of the dam plays important roles in managing structural safety in flood events, water supply, aquatic habitat, environmental flows; the economic and environmental cost/impacts of the provision of this technology.

(Sources: 'Emigrant Creek Dam – Dam Strengthening Works, Review of Environmental Factors. Report prepared for NSW Department of Public Works and Services on behalf of Rous County Council (the environment works, 2000); Hunter Water Corporation (1993). Grahamstown Dam Augmentation Environmental Impact Statement. Report prepared by Kinhill Engineers Pty Ltd.)

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These information sheets were originally prepared for Rous County Council by Sustainable Futures Australia in liaison with Widjabul elders. © Rous County Council and Sustainable Futures Australia 2007. This is an educational project for the protection of water land, and for reconciliation.

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