



Adventures in Engineering!

if only
animals
could
talk...



QUEENSLAND NORTHERN TERRITORY

IPWEA

INSTITUTE OF PUBLIC WORKS
ENGINEERING AUSTRALASIA





Adventures in Engineering: If Only Animals Could Talk

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Our thanks to our featured public works engineer,
Clarissa Campbell for sharing her engineering project.

Written by Juliet Schaffer, in the course
of her employment with IPWEA-QNT.

Illustrated by Narissa Amies.



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If Only Animals Could Talk

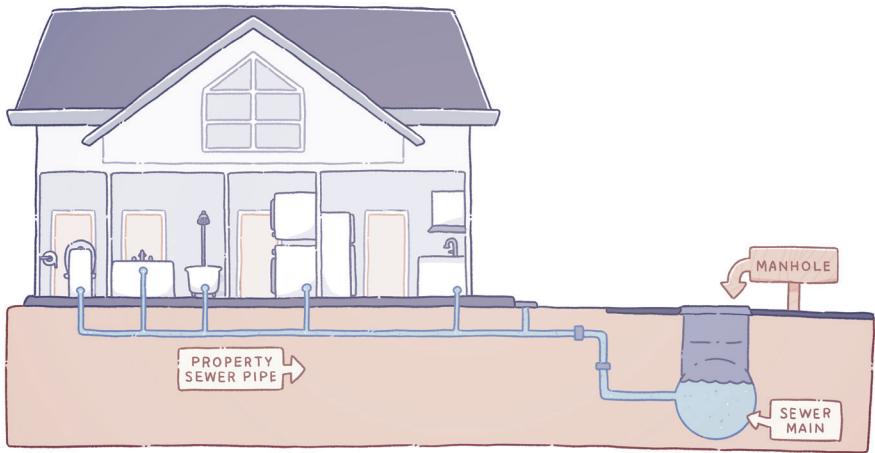
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First Edition

With thanks to the National Careers Institute

Chapter 1

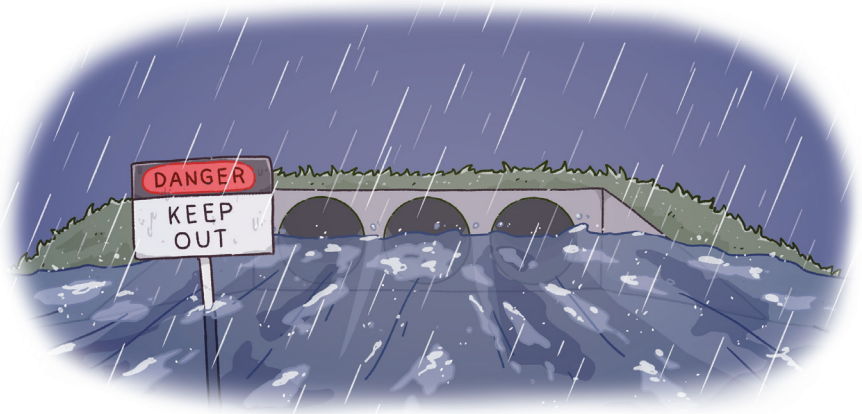
Cities and towns are full of movement and activity on the surface – cars travelling on roads, people in their houses and gardens, and children walking and cycling to parks and schools. But do you ever think about what goes on underneath?



There are man-made networks under the earth's surface. Pipes are built like mini highways that carry rain under the ground, away from the roads and buildings. These pipes are invisible support structures. Pipes that carry rain and runoff are called stormwater pipes. Even more pipes are used to carry **sewage** from our toilets, drinking water from water treatment plants to our houses, and others carry electricity and communication cables. Underground a whole other world exists. Pipes function like the veins in our bodies, to keep the built environment working and healthy.

Have you ever seen the openings to large pipes that travel under the roads and wondered where they go and what they are for? Mostly these are stormwater pipes. Like lots of **infrastructure**, we often only become aware of these things when they don't work as they should.

When stormwater pipes and drains get blocked, they can create dangerous bodies of water. If there is a huge downpour, people can be swept away, and sometimes even drown. It is very important to stay away from stormwater pipes during storms. If stormwater pipes and drains don't work, houses and other buildings can flood.



Roads, parks, pipe networks and public places belong to everybody in our community. There is an organisation that is responsible for keeping these places and all of its people safe – our local councils.

This is Clarissa. She is a **civil engineer**. Her job is to design, build, and maintain structures that people use every day like roads, bridges, and dams. She has studied and worked with

stormwater networks and floods ever since she began studying to be an engineer. Clarissa's first job after she finished her engineering degree at university was at a Queensland council.



One day Clarissa was out inspecting the stormwater pipes in her council area. She noticed that a pipe which ran underneath a road was cracked. She climbed down and shone her torch to light the darkness. Four sets of eyes glowed back at her. Clarissa jumped in surprise. A mother possum crept **tentatively** out of the pipe. It had a baby possum holding tight to her back. Clarissa wasn't an expert, but she thought they might be brushtail possums. Both sets of eyes remained fixed on Clarissa, warily. She fell back onto the grass and laughed in relief.

'If only you could talk,' she said. 'You could tell me how badly that pipe is cracked, or if it has any blockages.' The possum mother and baby scampered toward the safety of the nearest tree.

Clarissa thought hard as she headed back to her ute. It was her job as an engineer for the council to make sure that the stormwater network was working properly. With 250,000 parts that made up the council's stormwater network, this was one big and very important job. Fortunately, Clarissa had an idea that could be used to examine every stormwater pipe in the network.

Chapter 2

Clarissa discussed her ideas with her workmates and researched on the internet. Once she was confident that she had explored many options, Clarissa was ready to put her idea into action. She knew the possums or other animals could not tell her what the pipes were like underground. However, she could have a look herself by using video cameras!

Most of the pipes in the council's stormwater network were smaller than 900 mm, or 90 cm, not even 1 metre wide. They were certainly not big enough for any adult human to climb into. Even if they were bigger, stormwater pipes were too dangerous for anyone to be in. Cameras were in many locations above the ground, to help keep the towns and cities secure – why not put them underground? Clarissa decided that she would also use them to see what was happening under the ground, in the stormwater pipes.

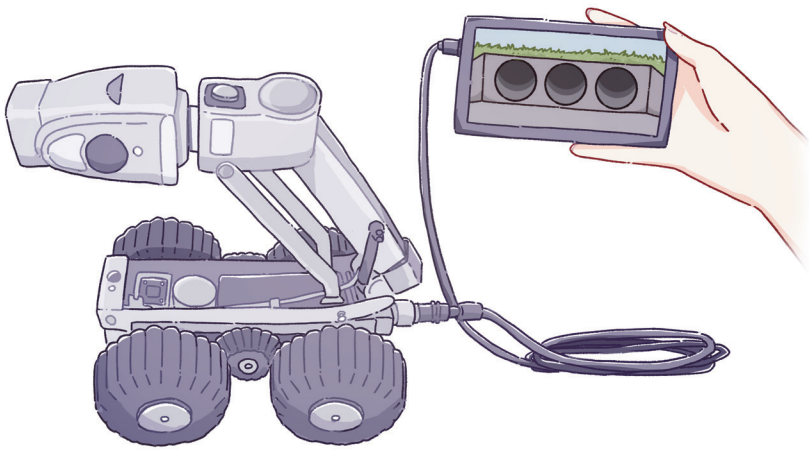


There were many questions that Clarissa and her teammates had to consider when deciding on what kind of camera to use. Firstly, what size camera? Should it be a small camera that can only be used in small sewer or roof water pipes? Or should it be larger so that it can be used in bigger stormwater pipes? How would the camera move? Should it be pushed along the ground with a cable over short distances? Or would it need to be like a remote-controlled car, able to travel over sand and through mud across longer distances? Could it be packed up into a briefcase or would it need a van to move it around? Should the council spend \$10,000 on the camera, or \$250,000? Clarissa knew there were thousands of kilometres of pipe in the Council network. Choosing the right kind of camera was very important. She had to present a convincing **argument** to be allowed to spend this much money on equipment.

After weeks of discussion and working out the advantages and disadvantages, a remote-controlled camera on wheels was the final choice. Clarissa couldn't wait to try it out.

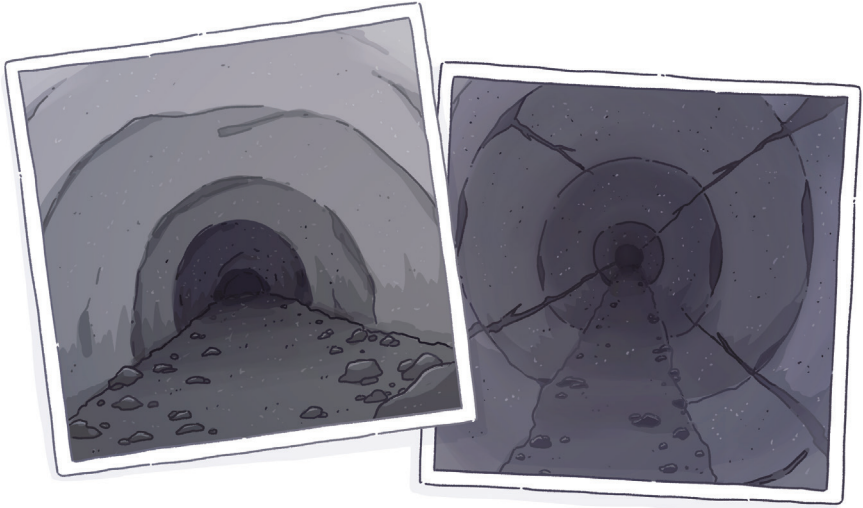
Chapter 3

Clarissa and her workmates returned to the pipe under the road. She drove their new remote-controlled camera into the pipes. Her colleagues watched the camera monitor, looking out for any cracks in the concrete, or for dirt or tree roots that had broken through.



Damaged pipes could be dangerous. After a heavy rainstorm, stormwater can move very fast through pipes – like water slides at a water park. Little cracks could be forced open by the pressure of the water, and water could leak everywhere. Clarissa had seen badly damaged pipes cause the earth beneath a road to wash away. It created a deep hole in the road called a sinkhole. It was so large it swallowed up a car! A large crane had to winch the car out of the hole. It was very inconvenient for the people in the street, and it also took time and money for the council to fix. Clarissa knew that preventing

problems was better than having to fix them. She hoped the remote-controlled camera would help them find cracks in the pipes before they caused any serious damage.



Chapter 4

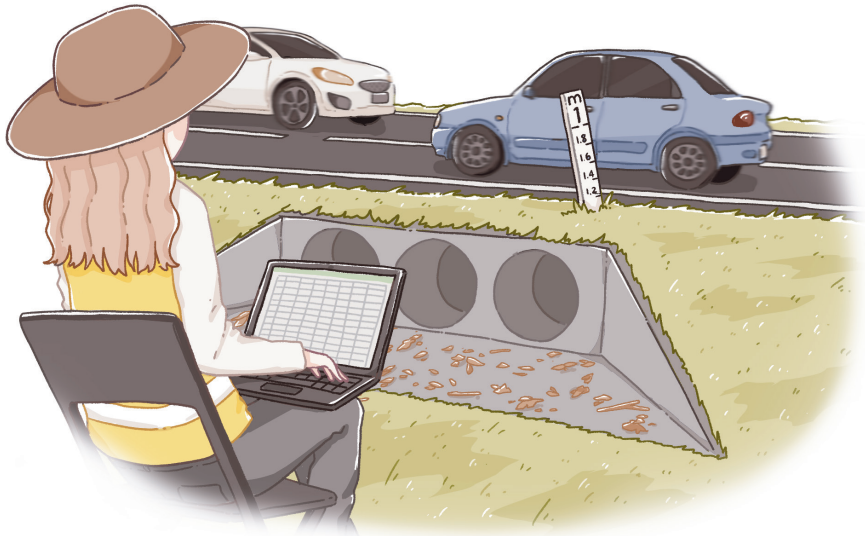
One day late in the afternoon, Clarissa was doing her field observations. She was sitting by the pipe watching the camera monitor checking the condition of the pipes. She had seen photos that her workmates had taken in other pipes nearby. Clarissa was stunned to see the wide variety of wildlife that used these pipes like their own road network.

She had noticed that over the years more bushland was cleared away for houses, schools, and shops. She knew that this meant people had somewhere to live. However, it also meant that often the **habitat** for the local wildlife was destroyed. The animals were losing their homes. No wonder there were so many animals using the pipes. They had less of their own space to live in and travel through. Sometimes there were animals travelling in the pipes by day and it seemed to be very busy in the pipes at night-time. **Nocturnal** animals, those who sleep in the day and are awake at night, scurried back and forth. She had seen many possums in photographs and footage recorded by the camera. That mother and baby possum weren't the only Australian **fauna** using the pipes. Clarissa's colleagues had taken a photo of a bearded dragon, and one even of a crab! She thought that crab must have been very lost to be heading so far away from the beach.



Although it was cute to see so many animals using the pipes like a highway, Clarissa was worried. She knew it was dangerous for the animals. If there was a significant rainstorm, the stormwater could rush through the pipes and wash the animals out to sea. Crabs could swim, but she wasn't sure that possums or lizards could. Clarissa also realised that having so many animals in the pipes increased the risk of the pipes breaking.

Clarissa sat and thought and looked up to the road. It was almost peak hour and there were many cars whizzing by. She realised that the animals were traveling through the pipes because it was safer. Maybe they were scared of the traffic noise. This was lucky, because it wasn't safe for animals to be on the same road as cars. That wasn't safe, for the animals, or the humans driving the cars. She had to come up with a solution, again. 'Engineers are always solving problems', Clarissa thought to herself. She really liked that about her job.



Clarissa packed up her camera and her laptop and got back into her car. Heading home she realised how many creeks she had to drive over, and how much pipes and bridges helped the traffic to move around safely. She thought of tunnels too. Being a spread-out city where vehicles are required to travel around, there were many tunnels in Brisbane. She had driven through most of them, just like the animals travelled through the pipes. One of the tunnels was even under the river. She knew that took a great deal of problem solving and engineering to achieve.

'If only animals had bridges or tunnels of their own to travel through' thought Clarissa.



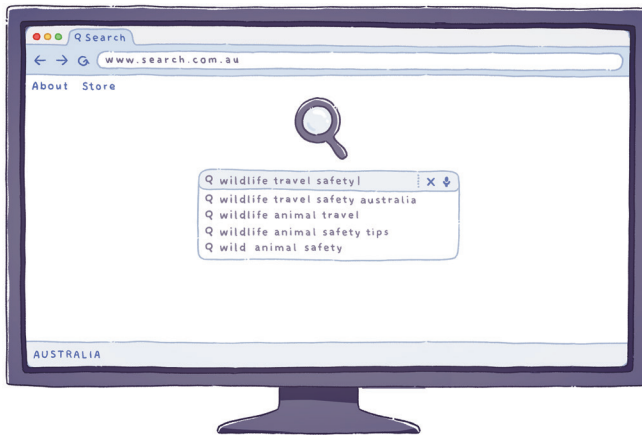
Hmmm... thought Clarissa, surprised at her idea. Bridges and tunnels for animals sounded a little **far-fetched**. Could animals have bridges and tunnels just for themselves?

Clarissa decided that this idea needed more investigation, and she was just the engineer to do it.

Chapter 5

Back at her office the next day, Clarissa was typing key words into the search engine on her laptop. She thought her search had to include 'animals', 'travel', 'safely', because she wanted the animals to be able to travel safely. This meant that they needed separate ways of travelling than what humans used. Her first results showed how to help people's pets travel by car and on aeroplanes. That wasn't what she wanted. It wasn't pet animals that she was trying to help, it was wild native animals that needed her assistance.

Clarissa replaced the word 'animal' with 'wildlife'. Now that brought up very interesting results! Clarissa decided that she would start at the top of the screen and work her way down. She grabbed her pen and paper and started to write her research notes.

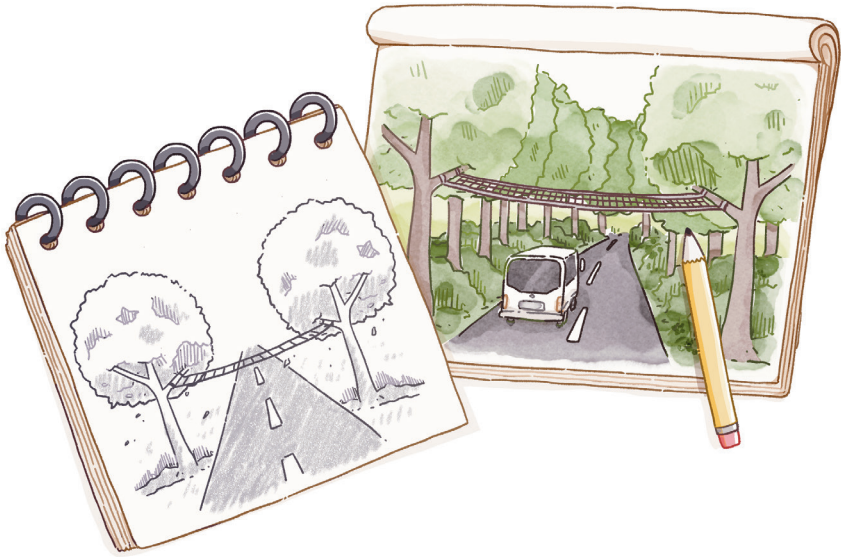


Hours later Clarissa stood up from her desk and rubbed her eyes. There had been pages and pages of information to read through, but it had been worth it, because she felt she had a solution to the problem.

Clarissa's research showed that many places in Australia and around the world had similar problems with animals and humans using the same **infrastructure**. Engineers in other places had already invented the kind of solutions that she had thought about. There were 'wildlife' corridors, such as pipes and tunnels. Clarissa discovered that tunnels just for animals had already been built in another Brisbane suburb to help keep animals safe from a new railway line. There were even wildlife rope bridges. This meant that wildlife had ways to travel that were safe and didn't damage the roads and pipes that humans needed.

Clarissa was very relieved.

She grabbed a piece of paper and pencil and listed all the animals that she and her colleagues had photographed in the pipes – possums, lizards, and crabs. None of these animals were large. Clarissa didn't think they would need anything as large or complicated to build as a tunnel. The rope bridge idea, however, looked to be very useful. It would be less expensive, quicker and easier to design and construct. She typed 'wildlife rope bridge images' into her computer search engine. There were many ideas to choose from.



Clarissa pulled out her drawing pad and pencil. She started to design a rope bridge that could reach across the road like the pipes ran under it. There was no time to waste. That mother possum and her baby, and all the other native animals, needed a solution and they needed it soon.

Chapter 6

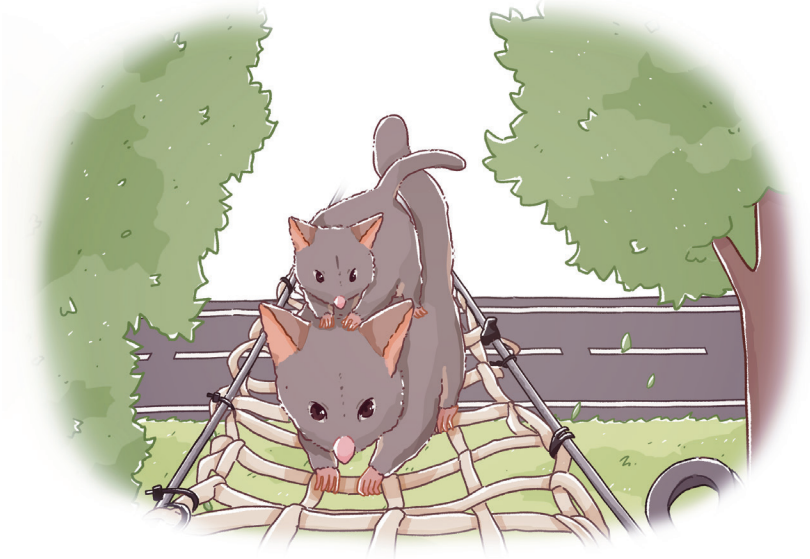
After some months, and countless hours of measuring, the rope bridge was installed. Clarissa and her team had conducted weeks of research, planning and design to construct the bridge. They had to measure how long the rope bridge should be to cross the road below. They had to calculate the dimensions of the inside of the rope bridge so that the animals likely to use it could fit. Clarissa remembered the mother possum with her baby on her back and realised that there would have to be enough room for them in a rope bridge.

They also had to work out how far off the ground the rope bridge should be to be clear of the traffic noise. They didn't want the animals to be too frightened to use the bridge.

Clarissa had really enjoyed working on this project. She knew that the rope bridge would be beneficial for the animals and good for the residents. The stormwater pipes would have less unwanted animal traffic through them and would now be less likely to be damaged.

Clarissa and her team had installed a camera at the top of the pole that held up the rope bridge. The favourite part of Clarissa's morning was to check the photos taken overnight, to see which animals were using the bridge. This information would help inform the council as to how useful the rope bridge was. If it was busy, then other rope bridges could be built in other locations. Clarissa knew that around Australia and the world, other engineers like her might be researching ways to

protect their wildlife. By publishing their research, Clarissa and her colleagues would be helping animals all over the world.



Clarissa smiled and looked at her favourite rope bridge photo. She had saved it as her laptop screensaver – it was a possum with a baby on its back. Being a **civil engineer** was certainly never boring.

Glossary

argument	(n) a reason or set of reasons that somebody uses to show that something is true or correct.
civil engineer	(n) a person whose job involves the design, building and repair of roads, bridges, etc.
far-fetched	(adj) very difficult to believe
fauna	(n) all the animals living in an area or in a particular period of history
habitat	(n) the place where a particular type of animal or plant is normally found
infrastructure	(n) the basic systems and services that are necessary for a country or an organisation to run smoothly, for example, buildings, transport water and power supplies
nocturnal	(adj) (of animals) active at night
sewage	(n) used water and waste substances that are produced by human bodies, that are carried away from houses and factories through special pipes
tentatively	(adverb) in a way that is not definite or certain because you may want to change it later

Glossary definitions sourced from
<https://www.oxfordlearnersdictionaries.com/>

Activities

Chapter 1

'She climbed down and shone her torch to light the darkness. Four sets of eyes glowed back at her. Clarissa jumped in surprise. A mother possum crept **tentatively** out of the pipe'.

Why do you think the mother possum emerged from the pipe **'tentatively'**?

Chapter 3

Why do you think it is better to 'prevent' problems than needing to 'fix' problems?

Chapter 4

What might happen to the animals traveling through the stormwater pipes if the pipes are cracked or if it is raining?

Discuss

The book is called 'If Only Animals Could Talk'. If you were one of the animals in the story, what would you tell Clarissa about life in the stormwater pipes or using the rope bridge? Write a letter or a conversation as if you were an animal talking to Clarissa. Describe what it would look and feel like inside the pipes, and on the rope bridge. What kinds of things would your animal want a human like Clarissa to know?

What kind of tasks did Clarissa perform in her job as a **civil engineer**?

What skills did Clarissa use to help solve the problem?

Are there any parts of Clarissa's job you think you would like to do?



Adventures in Engineering!

Clarissa is responsible for checking thousands of kilometres of underground pipe network. How can she cover it all, and what should she do to help the Australian fauna that travel through these pipes?



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