New Zealand Hydrological Society

Hydrological Histories: The Whanganui Dam That Wasn't

Two stories on the early days of New Zealand's hydro-electric engineering, told by Hugh Thorpe

In the 1960s, the Ministry of Works were considering putting up a hydro dam on the Whanganui River. They had spent a significant amount of money drilling tunnels in hills at a place called Atene, no more than 30–40 kms up from Whanganui. They abandoned the idea for various reasons, one of which would have been the concern about the issue of dam failure. If the dam failed, what would happen to Whanganui?

We built a physical model of the Whanganui catchment. These were the days before you had sophisticated computer modelling of flood routing. The Whanganui catchment is gigantic, and although we had a huge laboratory there, an old warehouse, it was still not big enough. It's such a long, long catchment, and such a gentle gradient by New Zealand standards that there was just a vast volume of water.

At the very top end we put in a tank. I had a look at all the catchment contours, estimated the land elevation and water that would have been stored, and attempted to reproduce that in this tank. We were attempting to study what would have been a hyper, mega flood if the dam broke.

There was not a lot of actual flood data collected, but we looked at the best data we had, looked at the flood way, and we roughened our model at the lower parts of the channel so that we could reproduce that particular flood event. We made a gross assumption that we could extend that roughness up the side of the valley walls to the height of the dam.

We built our model with all these assumptions and caveats built into it. The actual dam itself was made out of a mixture of sand and heavy grease so we could hand mould it to the correct height. We filled the reservoir in behind it – and then we broke the dam.

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Then, we broke it gently. We just sort of scooped it out, scooped it out, scooped it out. There was so much water in the reservoir that Whanganui got drowned again. I think that would have been a major factor as to why they never ever went ahead with that dam on the Whanganui.

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The Whanganui job had an unusual spinoff. About 1968, there was a big earthquake over on the West Coast, the Inangahua earthquake, which resulted in a large landslide that blocked the Buller River. I remember it quite well because we felt that earthquake in Wellington, early morning. That night I was at home, and the phone rang. It was Bill Duncan, the chief power engineer. He knew I'd done this dam break analysis in Whanganui, and said, "Look Hugh, we're a bit worried about the Buller River. It's blocked, and Westport's down at the mouth. We want to know the risk to Westport, because we might have to evacuate the town."

I jumped into my car and went down to the lab, got the topographic maps out, sat down and did a bit of hard thinking and some very, very rough calculations. Then rang Bill Duncan and said, "I think it will be all right Bill, even if it goes in a hurry I don't think there's going to be enough water stored behind that landslide to worry Westport. At worst, it would be a serious flood."

It turned out, and not surprisingly, that that landslide did not fail catastrophically. It came down as a mixture of huge rocks and little rocks and sand and mud, all mixed up. The fine stuff washed away first, then the sand, and then the small rocks. Today I think there are still some big rocks there in the bottom of the Buller River. But the dam failure was slow, so the release of water was slow, so I don't think Westport even noticed what had happened.

Canal surge and the drowned Land Rover

Also in the late 1960s, the Ministry of Works and Development was designing the Upper Waitaki power development, including the Tekapo/Maryburn canal, the first true power canal in the country. They became concerned about what's called a 'canal surge'. If you've got a lot of water flowing down a canal steadily, and there's an emergency that means they have to shut the gate at the bottom end, then you've got all this water running down towards the gate. It's got nowhere to go, so it piles up against the gate and creates a wave that travels back up the canal. The engineering question was, how high will that wave be and how far will it go? How high do we have to build the banks on the canal?

That problem was put through to me. At that stage, there were some analytical techniques, but they were nowhere near as sophisticated as they are now. To check the analysis, I had the idea to use the only other large canal we had in the country at the time, the Rangitātā Diversion Race (RDR), which has the 25MW Highbank Power Station at its lower end on the Rakaia River.

I got in touch with the New Zealand Electricity Department (NZED) and asked, "Will you be prepared to do an emergency shutdown of the Highbank Power Station so we can see what happens in the RDR?". They said, "Yes, we'll do that for you."

Figure 1. Construction of the Rangitata Diversion race, 1937–44. Photo: Facebook | Ashburton NZ: History plus, Photos of Places & Groups, Classes to 1985

I was in Wellington at the time, so I arranged for the Christchurch technical staff to give me a hand. We went out and put in gauge poles at intervals up the canal, and I was going to position a technician at each gauge pole with a synchronised stopwatch so that at time zero, NZED would close the gate, the wave would be generated, and somebody sitting by a gauge pole would see the wave coming by and record the time and the height of the water. That was the theory.

We were setting ourselves up and putting out these gauging holes. Alongside the RDR there is a maintenance track up on the bank, just wide enough to take a single vehicle. We were driving up there, coming on midday, with a Land Rover containing a couple of technicians behind us. I was in a truck at the front – I was not driving it – and fortunately, there was a guy sitting on the back under the canopy while we were trundling along. All of a sudden, he pounded on the cab of the truck. "The Land Rover's gone into the canal, woah!"

We stopped and looked and sure enough it had, some way behind us. We had to drive till we found a place we could turn around, then race back down to where it had happened. There were two very saturated technicians on the bank – one of them wearing thigh waders, would you believe? We looked down into the RDR, which is that sort of milky alpine water, and you could see this Land Rover roof and a wave going over the top of it. We arranged for a crane to come up from Ashburton and drag the Land Rover out.

The next day, we completed the putting out of the gauging poles and did our experiment. I was expecting a foaming wave coming up the canal, but it was really disappointing actually, because it was just a smooth swell that died out within a kilometre-and-a-half.

These recollections from Hugh Thorpe in an interview on 14 May 2016 are part of a New Zealand Hydrological Society series that documents the times and memories of New Zealand's senior hydrologists.