NEW ZEALAND INFRASTRUCTURE COMMISSION
Te Waihanga

TRANSCRIPT

Stormwater and resilience

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This podcast is part of our work to understand the severity of the January 2023 Auckland Anniversary weekend storm resulting in stormwater flooding in Auckland, the impact of the storm on Auckland's infrastructure and the issues or weaknesses this event has raised about stormwater management and our infrastructure system. This sits alongside our report, The 2023 Auckland Anniversary weekend storm: An initial assessment and implications for the infrastructure system.

Nik Green: It's been a rough time in New Zealand with storms and weather disrupting large parts of our country and inundating our largest city in January with some severe floods. This has raised some questions and concerns about how adequate and how resilient our infrastructure systems are, particularly in regards to stormwater. So, we thought it'd be worth having a chat about what stormwater is, how we manage it, and what the sort of challenges we're facing over the medium term. To do that I have with me, Christian Gamst, who is a senior advisor here at Te Waihanga but prior to joining us, was a civil and environmental engineer who specialised in three waters. Morning Christian, how are you?

Christian Gamst: Morning. Really good, thanks.

Nik Green: Should we start with the basics, like what is stormwater? And why do we manage it? Or try to manage it?

Christian Gamst: Yeah, it's probably good to start with the basics. Stormwater is just rainfall that lands on the ground and runs off. And why do we manage it? First, context setting, in the natural environment, runoff just flows from land, to rivers, and then out to the ocean. We manage it because we modify the natural environment. We build houses, factories, and warehouses. We live and work and play on the land and we interrupt, oftentimes, the natural flow of stormwater. So, we manage it to make sure that it doesn't disrupt our day-to-day lives, doesn't cause damage to our property, and ultimately cause loss of human life in the most severe of instances. That's why we manage it.

Nik Green: What are the ways in which we manage it? Most of us think of pipes and drains, but that's actually only one part of it, isn't it?

Christian Gamst: There's essentially it falls out into two categories of management – what we call built and non-built solutions. The built solutions are what we typically think of when we think of stormwater management with our pipes, our culverts, big channels, that sort of stuff. The visible side of stormwater management – and that is what has traditionally been thought of as stormwater management. More recently, I would like to say the last 20 to 30 years, but gaining significantly more prominence are the non-built solutions for managing stormwater, otherwise known as green infrastructure. We talk about swales quite a lot, but that's only one part of it. There's a lot of technologies that we can use. And it's generally centred around mimicry of the natural systems. So, re-daylighting streams that we might have culverted in the past is a common way of doing that. And, like I say, swales and infiltration, so reinstating green and pervious areas – that is basically an attempt to minimise the amount of actual runoff that is generated. And the thought there is that we transition from the traditional way of managing stormwater, which is the built function and that is typically end-of-pipe solutions if we wanted to go further and reduce stormwater flows or reduce peak flows towards source management or at-point management. So, that is essentially about reducing generation and retaining stormwater runoff within the catchment and releasing it over a slower time.

Nik Green: So, the gist is you try and soak up as much as you can where it falls rather than have it back up into the pipes. Is that the aim?

Christian Gamst: Yes, basically reinstating the natural systems as much as possible. Obviously, as we saw recently, it doesn't matter how much you try to capture, you will always reach a tipping point where you will generate runoff. So, you're trying to slow the stormwater down as much as possible, and to reduce the burden on our built infrastructure.

Nik Green: The Auckland floods have raised some questions about how well we are managing stormwater? Is it difficult to do?

Christian Gamst: It is very difficult to do actually, for a number of reasons. The first and foremost is you never really know how much it's going to rain, right? It's all probabilistic. You never really know. You can forecast and that's only one side of it. There's a question of how much it rains and how you manage it will obviously depend on how much it rains. It isn't feasible to manage every rain event. That's the one side of the stormwater equation. The other side of it is what I refer to as the generation. That is, once it rains and hits the ground, how much of that rainfall then becomes runoff and how quickly does it become runoff? And the reason that that becomes really difficult is because it isn't just one system, or one agency, or one point of responsibility or accountability. It sits under the likes of councils for stormwater management, but they also deal with land-use planning, you've got private development, you've got the growing imperviousness of our catchments, which increases the amount of runoff that is actually generated, you have historically combined sewers, so you've got this interface with wastewater networks as well. You've got the roadway network, which typically under normal design scenarios, you'll have a pipe network, which is designed usually for up to about a 1 in 10 year event. And then we utilise overland flow paths. And that by-and-large general principle is that that's a road corridor that will carry those larger events. Obviously, then you've got an interface with a road controlling authority and the way that roadways are designed. So, there's a lot of different players and aspects in the stormwater management space, and they all have different priorities and usually not to manage stormwater.

How do you get all these different players working together to manage stormwater? That's one of the challenges. The other challenge as well is that no one generates stormwater that falls from the sky. It lands on the ground and then it might land on your property. And it's usually not a problem when it just lands on one person's property. But as it proceeds down the stream, it accumulates and eventually it reaches this critical mass where it becomes a problem. Where you start to realise the problems of stormwater is downstream. And you might have it be a problem because of a constriction in the network. Or it might be a problem because of upstream causes, such as intensification and increased runoff generation. How do you identify what the what the point of cause of the problem is? As opposed to just being runoff and no big deal.

Nik Green: This coordination problem between all the different players, the road controlling authorities, the councils, the water service providers? Is that what was the source of the trouble in Auckland? I mean, what made the flooding in Auckland in January [2023] so bad?

Christian Gamst: I think the first thing to state with the Auckland floods is it was an unprecedented amount of rainfall that had Auckland. I haven't seen any latest publication as to the actual classification of this storm event size. But we refer to storm events as a 'recurrence interval' – that's basically like how likely is it to occur over a given time timespan and the Auckland flood event. The storm there exceeded a 1 in 250 year event even for forecasts and climate models in the worst-case scenario. By how much I couldn't say, but it exceeded to 1 in 250 year event and it is the largest storm event that Auckland has ever had on record. To say that this was an unprecedented event for Auckland, it absolutely was. And to make it worse, it was incredibly widespread throughout Auckland. Historically we've had fairly large storm events, again, not of the size, but they tend to be more isolated so they don't hit the whole Auckland region at once. And that is one of the reasons why this event was particularly bad: A. It was huge and then B. It was regionwide. Those are sort of like the scene-setting things.

There's obviously the question around what I alluded to earlier, which was around the actual use of the catchment. Auckland has obviously seen quite a lot of population growth over the years that has come with intensification and increased impervious areas. Obviously, if this storm event had hit Auckland, let's say 100 years ago, we probably would have seen quite a different outcome. Auckland as it is today, with much greater and pervious areas, the flooding or the stormwater response to the rainfall is quite different to what it was. And again, that will be one of those contributing factors as to why it was so bad.

Nik Green: The Auckland floods were a very, very rare event you mentioned 1 in 250 years. What do we build stormwater systems to? Are there particular standards? National standards? Regional standards? What are we aiming to manage in terms of the severity of events?

Christian Gamst: That's a great question, I draw parallels to the way that we design buildings for earthquakes as an example. Typically, we would set a design standard. Stormwater, we have typically designed piped systems – so our built infrastructure – to accommodate a 1 in 10 year event. But these standards are generally set at a regional level. There isn't a national standard for what a piped system should accommodate. And that's for what we convey inside pipes. Then we look at overland flow ponds. And those are typically designed for 1 in 100 year events. We do have occasions where we might consider larger events. I know some substations and critical infrastructure, such as utility providers, might elect to design for a higher flooding event. I know CRL (City Rail Link up here in Auckland), for example, the entry and exit portals for the tunnel there, those elevations have been set for a higher inundation level than the 1 in 100 year. But in my experience, I haven't seen a whole lot of consideration outside of the 1 in 100 year as general practice.

Nik Green: Climate change obviously raises some questions about how adequate things are now and what we should be building to. Is climate change going to make flooding more common? And, if so, how should we be thinking about our response?

Christian Gamst: Interesting to see what climate change actually ends up doing. So, NIWA has a rainfall modelling programme [High Intensity Rainfall Design System (HIRDS): https://niwa.co.nz/information-services/hirds] and they accommodate various climate change scenarios. And that results in larger amount of rainfall for all storms sizes. And just taking a step back, when we talk about storm sizes, the way that we classify them is based on historical events. So that is to say that with climate change changing the size, severity, and frequency of storm events, it's likely that what we call a 1 in 200 year event might become defined as a 100 year event in the future. It's a bit of a moving target as to how we talk about these things. But essentially, if we talk about the same size storm event, what is less frequent now is likely to become more frequent in the future. And as to will that result in more flooding, that is kind of down to how we respond to it. We can say with a high degree of certainty that storm events will become larger and more frequent. But the flooding that really is within our

control. How we respond to that is going to be critical as to whether we see more flooding, It's probably likely that because of the infrastructure that we have in place and our topography that we will get flooding, whether it causes problems and damage. That is part of the response.

Nik Green: The Auckland floods were clearly a massive event, severe impacts on the people up in Auckland. It's something that we've been thinking about and have produced a paper which is available on our on our website. What were the key findings from that work when we looked at the impacts of the floods?

Christian Gamst: I just want to start by acknowledging that the floods have had a huge impact – a devastating impact – on a large number of people here in Auckland and their families still going through the ramifications of what happened. But one of the key findings is that our infrastructure held up remarkably well for such an unprecedented storm event. We did have flooding and there were impacts, but many services were restored relatively quickly. Some of the longer-lasting damage was associated with slips, obviously caused by the rainfall and the flooding events. But again, the flooding in and of itself was handled or Auckland bore the brunt of it relatively well, all things considered.

Nik Green: That's a reassuring way to end. Clearly there's some more work to do, but on the on the other hand, we are perhaps more resilient than we expected. Thanks for your time, Christian. That was a really good chat.

Christian Gamst: Thank you.