Napier Rainfall Event November 2020

Hazard Report

September 2021
Hawkes Bay Regional Council Publication No. 5551

HAWKES BAY
REGIONAL COUNCIL
TE KAUNIHERA Ā-ROHE O TE MATAU-A-MĀUI

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HAWKES BAY REGIONAL COUNCIL
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Disclaimer

This report has been prepared by Toa Consulting on behalf of Hawke's Bay Regional Council. The information contained within the report is based upon information provided by personnel involved in the event and from data collected during, and following, the response. Every effort has been made to ensure the accuracy of the information contained within this report. The information within this report is current at the time of issue and may have subsequently changed since issue and should not be used for purposes other than enabling a record of the event to be maintained. No liability can be accepted for any error in the information, misprint, or misuse.

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Executive summary

The rainfall event that occurred on 9th November 2020 in the Napier City area is one of the worst flooding events to impact the city in recent times. The event was the result of an extreme rainfall event that resulted in over 240mm of rain falling in less than 20 hours, with the majority of rain falling in a very short period from 3pm to 8pm and over 58mm/h recorded at the Nelson Park rain gauge in a single hour. While rainfall occurred across a large part of Hawke's Bay, the most intense rainfall was experienced in a very small area of approximately 15sq kilometres, centred over Napier City and this overloaded the capacity of the city's drainage network.

The main impacts of the event were seen in the suburbs of Maraenui, Napier South and Pirimai, where 117 homes were damaged beyond repair and many more suffered flood damage. In addition, flooding was also experienced in parts of Marewa, Onekawa, the Napier CBD, Taradale and Tamatea. Several homes were severely impacted, and a number of utility assets damaged as a result of landslides on the Napier Hill. There was good initiative taken by Napier residents especially as the severity of event wasn't anticipated, with the majority of evacuations self-initiated. While there were some minor injuries reported, there were no losses to life as a result of this event. In addition, the community worked very well together in the wake of the flood, and there were many offers of help from all over the city and region. It is unknown exactly how many people evacuated from impacted areas during the event, but 35 family groups were provided with emergency accommodation in the Nelson Park Campground and a number of family groups remain there over six months later.

This report reviews the causes of the event, the design capacity of the key assets to control drainage and flooding and the impacts of the event on the community and built environment. It does not seek to determine issues in the operational response that occurred, as these are covered within the separate operation debriefs conducted as part of the event review.

The report makes a number of conclusions. These include:

- The warnings provided for this event gave some indication for the potential of heavy rainfall, however, the locations provided within warnings were not accurate and did not provide enough information regarding the potential for such severe rainfall intensities within the city.
- The intensity of the rainfall experienced was far beyond the design capacity or capability of the Napier City drainage scheme. While the scheme experienced some issues in regard to pumping capacity, it is unlikely that these would have made a significant difference to the outcome of the event.
- The extent of damage to properties was potentially exacerbated by the continued use of roads by vehicles, which created bow waves that increased water heights in surrounding properties.
- The management and operation of drainage assets by Hawke's Bay Regional Council and Napier City Council requires effective co-management in events to ensure that the network is able to operate to maximum capacity and issues are quickly resolved.

This report has been made possible through the contribution of information from staff involved in the response. This includes the Hawke's Bay CDEM Group, Napier City Council, Hawke's Bay Regional Council, Fire and Emergency New Zealand, St. John Ambulance, Ministry of Social Development, Earthquake Commission, Ministry of Education, and Insurance Council of New Zealand. Without this valuable input, this review would not have been possible.

1 Introduction

The purpose of this report is to create a record of the flooding event that occurred on the 9th November 2020 in Napier, the impacts to Hawke's Bay Regional Council (HBRC) assets and infrastructure, Napier City Council assets and infrastructure and the effects of the event upon Napier communities. This report does not review the operational response which is the subject of a separate process and report. The two reports did inform each other.

The report presents data and event analysis in order to convey the magnitude of the event and related impacts. This is supported with information provided by key agency representatives involved in the response to the event and anecdotal evidence collected during and post event.

The report has been structured to be consistent with the template for consistent hazard event reporting BY New Zealand Civil Defence Emergency Management (CDEM) Groups provided by the National Emergency Management Agency (NEMA).

This report serves two main purposes:

- To provide detailed data and analysis on the event and its causes to aid scientific research, calibration of hazard models to improve their robustness and aid scenario development for historic and pre-historic events
- To provide a record of the hazard impacts and so allow a database of hazard impacts to be developed and integrated for future decision making.

2 Pre-event and forecasting

2.1 Warnings

At 9.37am on Sunday 8th November 2020 the HBRC Duty Manager received a severe weather warning from the MetService. The warning noted potential heavy rainfalls in the region, however, these were noted for north of Napier, as per the text below:

HEAVY RAIN WARNING - ORANGE

Area
Gisborne south of Muriwai and Hawke's Bay north of Napier

Valid *24 hours from 10:00 pm Sunday to 10:00 pm Monday*

Forecast
Heavy rain with 120 to 160mm accumulating, mainly about the ranges. Heaviest falls are likely from late Monday morning to Monday evening, when intensities may reach 20 to 25mm per hour.

This warning was forwarded via the Hawke's Bay CDEM regional warning system (RWS) to all parties on the regional warning list (Police, Fire, Ambulance, MSD, HBRC, HDC, NCC, CHBDC, WDC, Defence, Port of Napier, Eastland Energy, Unison, Genesis) at 9.40am as an email.

A subsequent warning was issued at 8.37pm on Sunday 8th November, which noted some increase in the potential intensity of rainfall, but no change to the location.

HEAVY RAIN WARNING

Area
Gisborne south of Gisborne City to Matawai, and Hawke's Bay north of Napier, including the Kaweka Range

Valid *18 hours from 5.00 am to 11.00 pm Monday*

Forecast
Heavy rain with 100 to 140mm accumulating, mainly about the ranges. Heaviest falls are likely from late Monday morning to Monday evening, when intensities may reach 20 to 35mm per hour in possible thunderstorms.

Change note: Timing for onset of heavy rain delayed.

This updated warning was again issued by the HBRC Duty Manager to all parties on the regional warning list at 8.40pm via the RWS as an email. This was followed up by a telephone call to warning recipients who had not responded to the warning message to ensure it had been received.

At the same time (8.37pm, 8th November), the MetService issued a Heavy Rain Watch which identified the potential for heavy rain south of Napier on the Monday afternoon.

HEAVY RAIN WATCH

Area

Hawkes Bay about and south of Napier and the Tararua District, including the Ruahine Range

Valid *21 hours from 1.00 pm Monday to 10.00 am Tuesday*

Forecast

Periods of heavy rain, with possible thunderstorms. Rainfall amounts may approach warning criteria especially about the eastern hills and ranges.

This additional heavy rain watch was sent out via the RWS to all parties on the regional warning list at 8.40pm as an email.

At 10.12pm on the 8th November the Metservice issued a Thunderstorm forecast map for New Zealand. This indicated a moderate risk for thunderstorms and rainfall of 10-25mm/h and a low risk of severe thunderstorms with 25-40mm/h rainfall the following evening in Napier (9th November).

At 7.45am the HBRC engineering Team sent out an email to the HDCDEM Duty Advisor and Wairoa flood warning Group to note that they would be monitoring the event. At this point the focus of the forecast was on northern Hawke's Bay and this is reflected in the actions that were taken.

At 8.20am on the 9th November the HBRC Duty Officer received a phone call from MetService to advise that the Heavy Rain warning was moving from northern Hawke's Bay to Southern Hawke's Bay. It is unclear from records if this information was passed on any further.

At 10.01am on Monday 9th November MetService issued an updated Heavy Rain Warning. This noted that the area for warning had moved, however, the wording was not clear that this was now south of Napier. It

also suggested that the heaviest rainfall would be in the ranges, with the forecast noting the heaviest rainfall from Te Haroto southwards, although it did note the potential for 70-100mm in other parts and 25-40mm/h in thunderstorms.

HEAVY RAIN WARNING - ORANGE

Area

Hawkes Bay, and Gisborne south of Gisborne City to Matawai

Valid *13 hours from 10.00 am to 11.00 pm Monday*

Forecast

Expect 100 to 130mm of rain to accumulate about the ranges from Te Haroto southwards, with 70 to 100mm elsewhere. Peak intensities are expected from this afternoon when hourly rates could reach 25 to 40mm/h in thunderstorms. Please note, another burst of heavy rain is possible on Tuesday.

This warning was again forwarded to all parties on the regional warning list at 10.05am via the RWS as an email.

As a result of these forecasts both Napier City Council (NCC) and Hawke's Bay Regional Council (HBRC) staff undertook preparatory work on drainage and stormwater systems (pump checks, debris grate clearance etc), although the focus at the time was largely northern Hawke's Bay and the river systems within the region.

At 4.11pm the MetService issued a further heavy rain warning, which continued to identify the main area of impact as the ranges of Hawke's Bay.

HEAVY RAIN WARNING - ORANGE

Area

Hawkes Bay south of Wairoa

Valid *9 hours from 4:00 pm Monday to 1:00 am Tuesday*

Forecast

Expect a further 70 to 100mm of rain to accumulate about the ranges, with 40 to 70mm elsewhere. Peak intensities are expected from this afternoon when hourly rates could reach 25 to 40mm/h in thunderstorms. Please note, another burst of heavy rain is possible on Tuesday.

This additional heavy rain watch was sent out via the RWS to all parties on the regional warning list at 4.17pm as an email.

At 8.45pm the Heavy Rain Warning was lifted for areas north of the Napier-Taupo Road (SH5), however, the warning remained in place for areas to the south.

HEAVY RAIN WARNING - ORANGE

Area

Hawke's Bay south of the Napier-Taupo Road

***Valid** 7 hours from 8.00 pm Monday to 3.00 am Tuesday*

Forecast

Expect a further 30 to 70mm of rain to accumulate. Rainfall intensities may reach 10 to 20mm per hour. Please note, another burst of heavy rain is likely later on Tuesday - see Watch for details.

At 9.00am on the 10th November the heavy rain warning was lifted for the areas south of the Napier-Taupo Road.

2.2 Evacuations

The majority of the rainfall that resulted in the flooding occurred in a very short period of time. Key agencies were unable to foresee the need for evacuations from areas of Napier until flooding had already occurred, therefor no pre-emptive evacuations were conducted prior to the event. The majority of the evacuations in the event were self-initiated, although some people were assisted to evacuate by the emergency services, including some elderly residents and a number of people with health issues.

3 Rainfall data and analysis

3.1 Rainfall summary

The intense rainfall that was experience in Napier on 9th November fell in a relatively short period of time. Whilst it had been raining for the majority of the day, no major issues had been experienced in the region until late afternoon when a band of intense rainfall passed over the Napier area. The satellite imagery below shows the band of intense rainfall at 5.00pm (0400UTC) south of the Napier Hill crossing over the city.

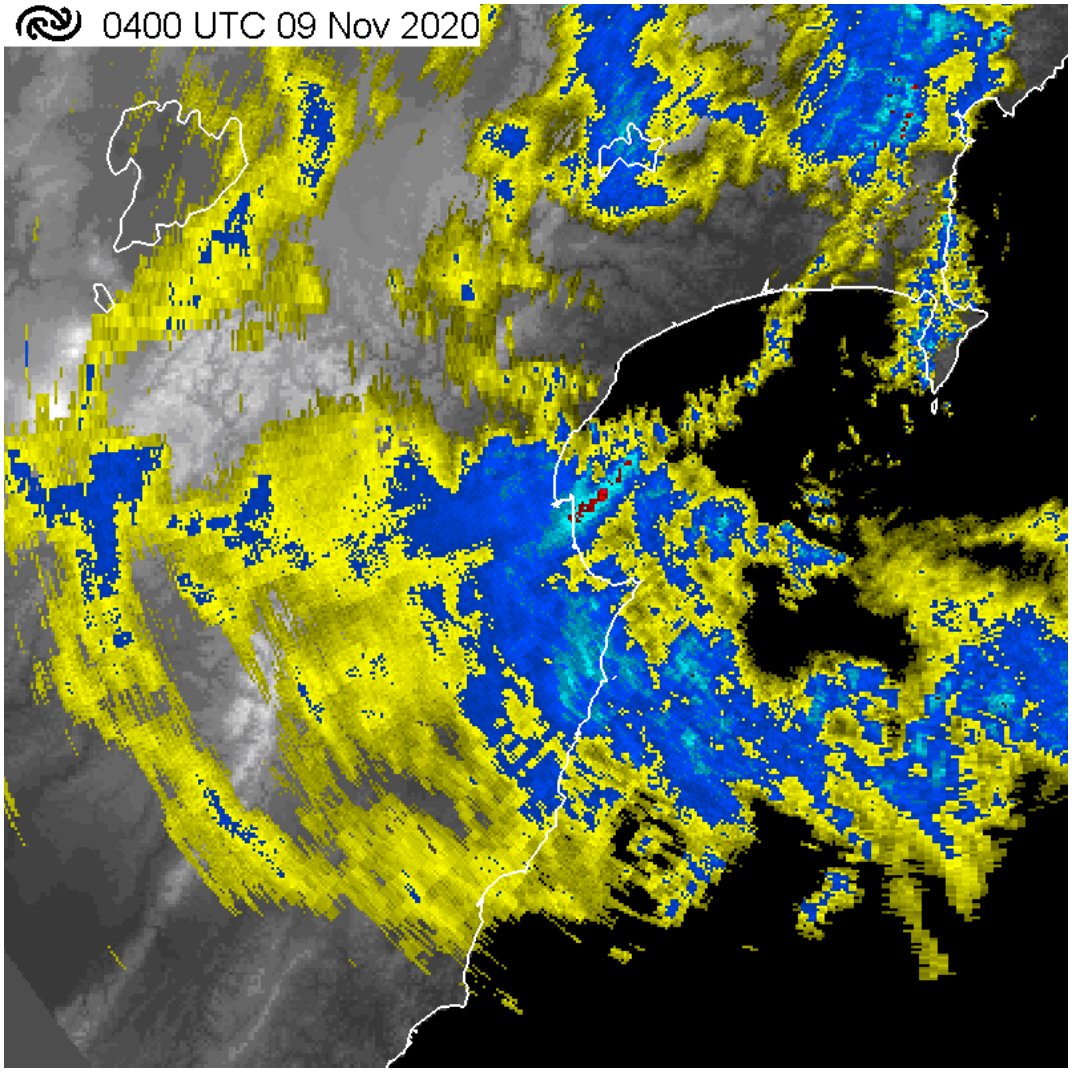


Figure 1 Satellite imagery from 5.00pm 9th November

Several sites throughout the region recorded high rainfall and when compared to other sites within the region they clearly show the very localised nature of the event.

Significant rainfalls were recorded at sites within the city, with the Nelson Park recording station showing 241mm of rainfall between midnight and 7.30pm on the 9th November and the Napier CBD gauge at HBRC showing 219.5mm in the 12-hour period from 9.00am to 9.00pm. Localised short duration rainfalls in the Napier CBD and Nelson Park areas of Napier showed in excess of 60mm/h between 4.00pm and 6.00pm. To contrast this, the Napier Airport recording station located to the north of the city recorded rainfall of 119mm between 10.00am and 10.00pm on the 9th November.

Figure 2 below provides further insight into the very localised and intense nature of this event. The two images below show the accumulated hourly rainfall at 5.00pm (0400UTC) and 6.00pm (0500UTC) on the 9th November.

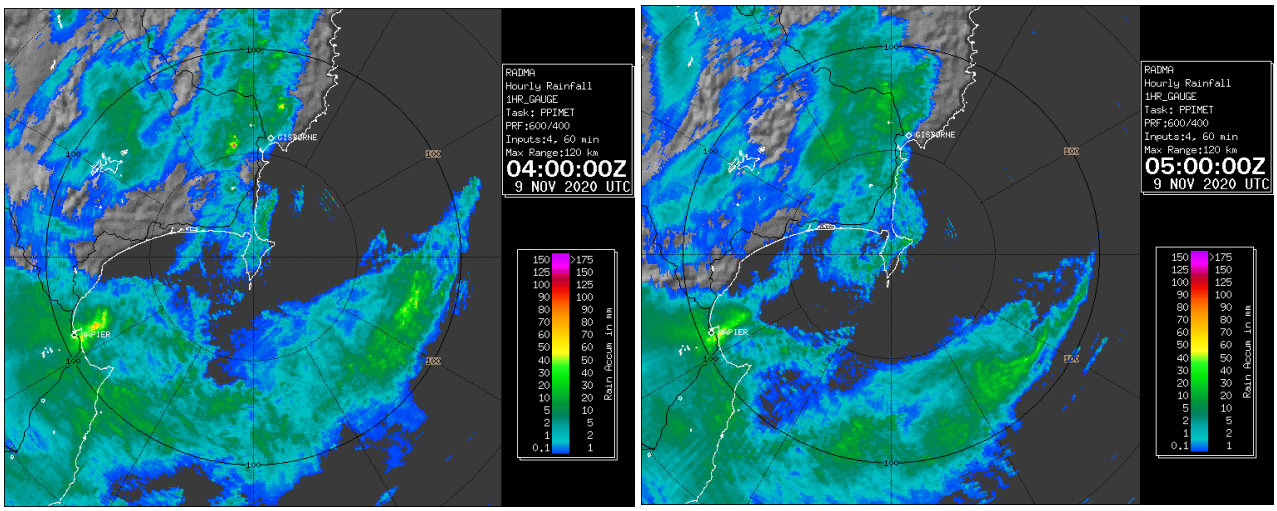
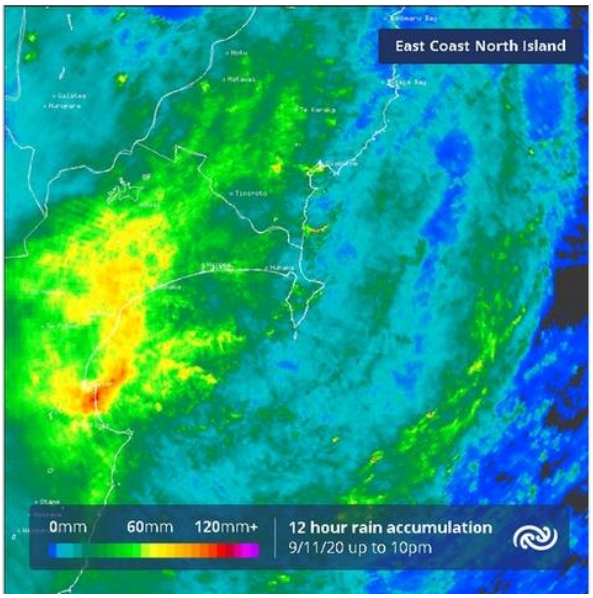


Figure 2: Hourly rainfall at 5.00pm and 6pm, 9th November

In addition, the images below (figure 3 & 4) showing accumulated rainfall for the 12 and 24hour period clearly demonstrates the intense nature of the rainfall impacting the Napier area.

Figure 3 shows the accumulated rainfall over a 12-hour period from 10am to 10pm on the 9th November 2020. While the image shows widespread rainfall across Hawke's Bay, the intense rainfall within Napier can be clearly seen.

Figure 4 shows the estimated rainfall amounts derived from the rain radar images over a 24-hour period, from 6am 9th November to 6am 10th November 2020. This further demonstrates the intense localised nature of this event, with the heaviest rainfall (~250mm in 24 hours) occurring in an area of approximately 15sq km.



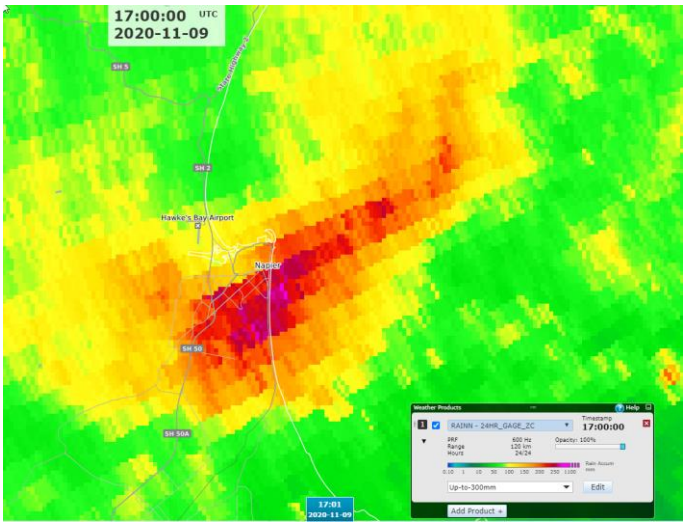


Figure 3: 12 hourly rainfall accumulation 10am to 10pm 9th November 2020

Figure 4: 24-hour rainfall accumulation ending at 6am, 10th November 2020

3.2 Rainfall recording site data

Four sites within the impacted area provided data regarding the rainfall associated with this event and give some insight into the short duration and intensity of the event. Each rainfall gauge records at different time intervals, so for consistency the data has been shown as hourly accumulations for each site.

3.2.1 Napier CBD (HBRC Rain gauge)

The Napier CBD rain gauge is located on the roof of the HBRC Offices on Dalton Street, Napier.

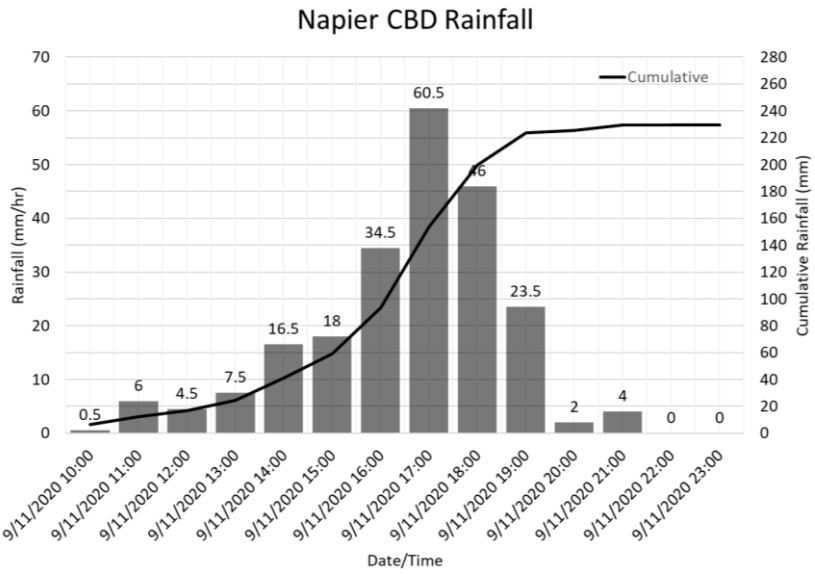


Figure 5: Rainfall data for the HBRC rain gauge 12am 9th November to 12am 10th November 2020

As can be seen from the rainfall plots from this station, the most significant rainfall was observed from 4pm to 6pm, with peak hourly depth of 60.5mm/h falling between 4pm to 5pm. The gauge recorded a cumulative total of 229.5mm over a 24-hour period from midnight on the 8th to midnight on the 9th November.

Mersey Street Rain Gauge (NCC asset)

The Mersey Street rain gauge is owned and operated by NCC. It is located in the Thames / Tyne industrial area, to the west of the Napier CBD.

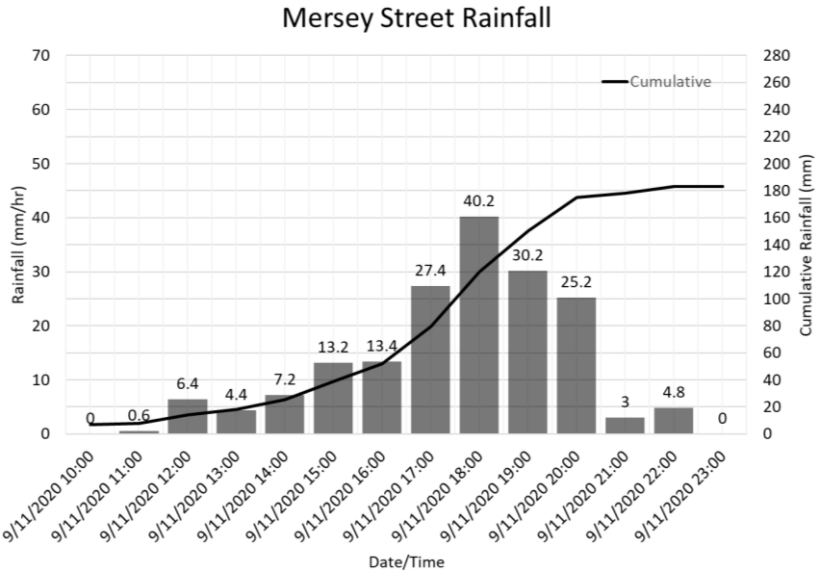


Figure 6: Rainfall data for the Mersey Street rain gauge 10am to 10pm 9th November 2020

The Mersey Street rainfall gauge recorded peak rainfall of 40.2mm/h between 5pm and 6pm. The cumulative total rainfall at this site was 184.6mm over a 24-hour period, however, the majority of the total rainfall occurred in a short period from 4pm to 8pm.

3.2.2 Hawke's Bay Airport rain gauge

The Hawke's Bay Airport rain gauge is operated by the MetService and is located to the northwest of the Napier CBD.

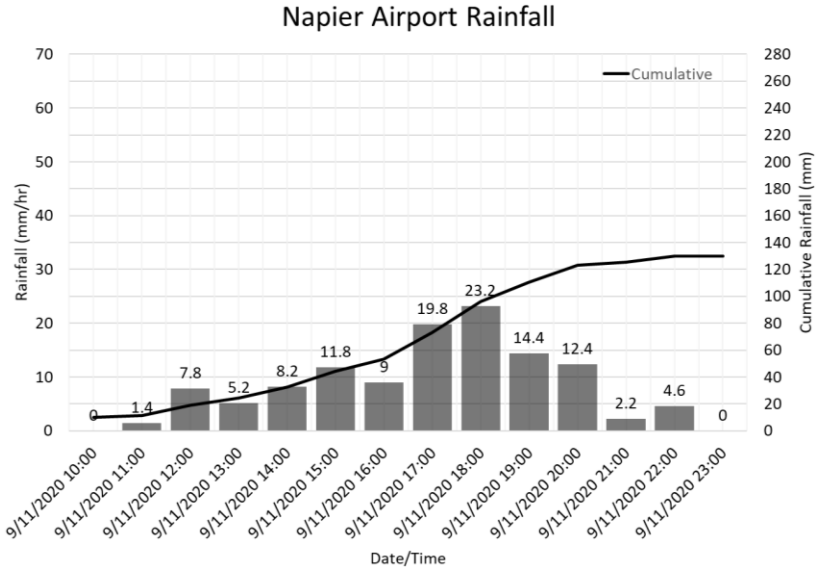


Figure 7: Rainfall data for the Hawke's Bay Airport rain gauge 9am to 11pm 9th November 2020

The HB Airport rain gauge did not experience the intensity of rainfall as other sites within the city and peak rainfall was recorded at 23.2mm/h at 6pm on the 9th November. The cumulative total rainfall over the 24-hour period was 129.8mm, which is significantly lower than sites within the city.

3.2.3 Nelson Park rain gauge (MetService)

The Nelson Park rainfall gauge is located in the Napier South suburb of the city and is owned and operated by the MetSevice.

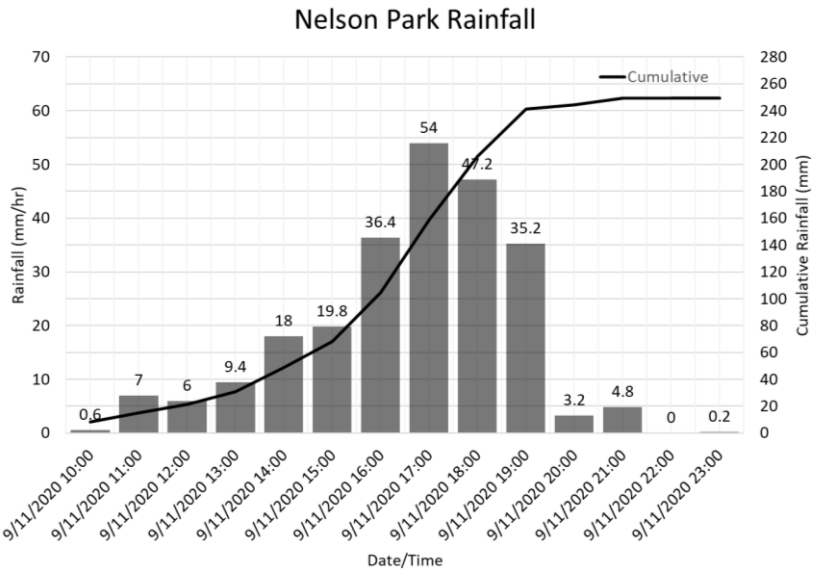


Figure 8: Rainfall data for the Nelson Park rain gauge 9am to 11pm 9th November 2020

Rainfall at this site peaked at 54mm/h at 5pm on the 9th November. The cumulative total rainfall over a 24-hour period was 250.2mm. The 6 hourly rainfall recorded at this site was between 2pm and 8pm on the 9th was 201.6mm, more than twice the maximum depth recorded at the site since installation in the 1990's.

3.3 Rainfall analysis

The National Institute of Water and Air (NIWA) has provided an analysis of the rainfall statistics for this event (November 2020 Napier Rainfall Event, T. Carey-Smith, June 2021). There are several comments and discussion in the NIWA report which highlight the various problems associated with determining the return period of a rainfall event, in particular when using data from sites with short time periods of record. Carey-Smith showed how the inclusion of several historic events can change the 6-hour rainfall return period from around 500 years to around 200 years, with error bounds still ranging from 100 years to 500 years.

In general, rainfall statistics should not be used to quantify the return period of a flood event. Auckland Council (Stormwater Code of Practice, 2015) provide a description relating to Annual Exceedance Probability (AEP), stating the definition is "*The probability of exceeding a given storm discharge or flood level with a period of one year.*" The emphasis in this case is that the AEP is determined by discharge, i.e., m^3/s in a river, stream or drain, or flood level, i.e. depth in m, or elevation of the flooded surface. The association of rainfall return period equating to flood return period is one that in most cases does not hold true. This can be attributed to several issues, one being the standard rain gauge is collecting rain falling on the small area of the gauge only, i.e., a collector with a diameter of 203 mm, while rainfall generally varies quite significantly across a catchment. There is an implicit assumption that the gauge collected the maximum rainfall for the particular event. The variable nature of rainfall distribution can be very apparent, particularly in localised high intensity events such as occurred on November 9, where in a distance of about 2-3 km, rainfall went from 200 mm in 6 hours to less than 100 mm in 6 hours. This variation is not uncommon. In the HBRC rain gauge network, it is common for particular sites to have a main rain gauge and a check gauge sited within 10m of the main gauge. Rainfall depths from the same event no more than 10m apart occasionally differ by up to 50%. The historic readings that make up the data set used in the rainfall analysis are thus also subject to these variations, i.e. a reading of maximum yearly 6 hour rainfall of 30 mm may have underestimated the true rainfall in the catchment for that event, yet that value of 30 mm is included in the data set, and will have the effect of skewing the rainfall statistics to indicate the 200 mm rainfall in 6 hours has a higher return period

than if the data were a true representation of the maximum rainfall, i.e. it is quite likely the 200 mm of rainfall in 6 hours has a return period of less than 200 years.

The problem with curve fitting to limited data can be seen in the chart provided by Cary-Smith, shown in Figure 9, where the highest 4 values recorded in the area do not plot on the curve generated from the Generalised Extreme Value (GEV) fit to the data.

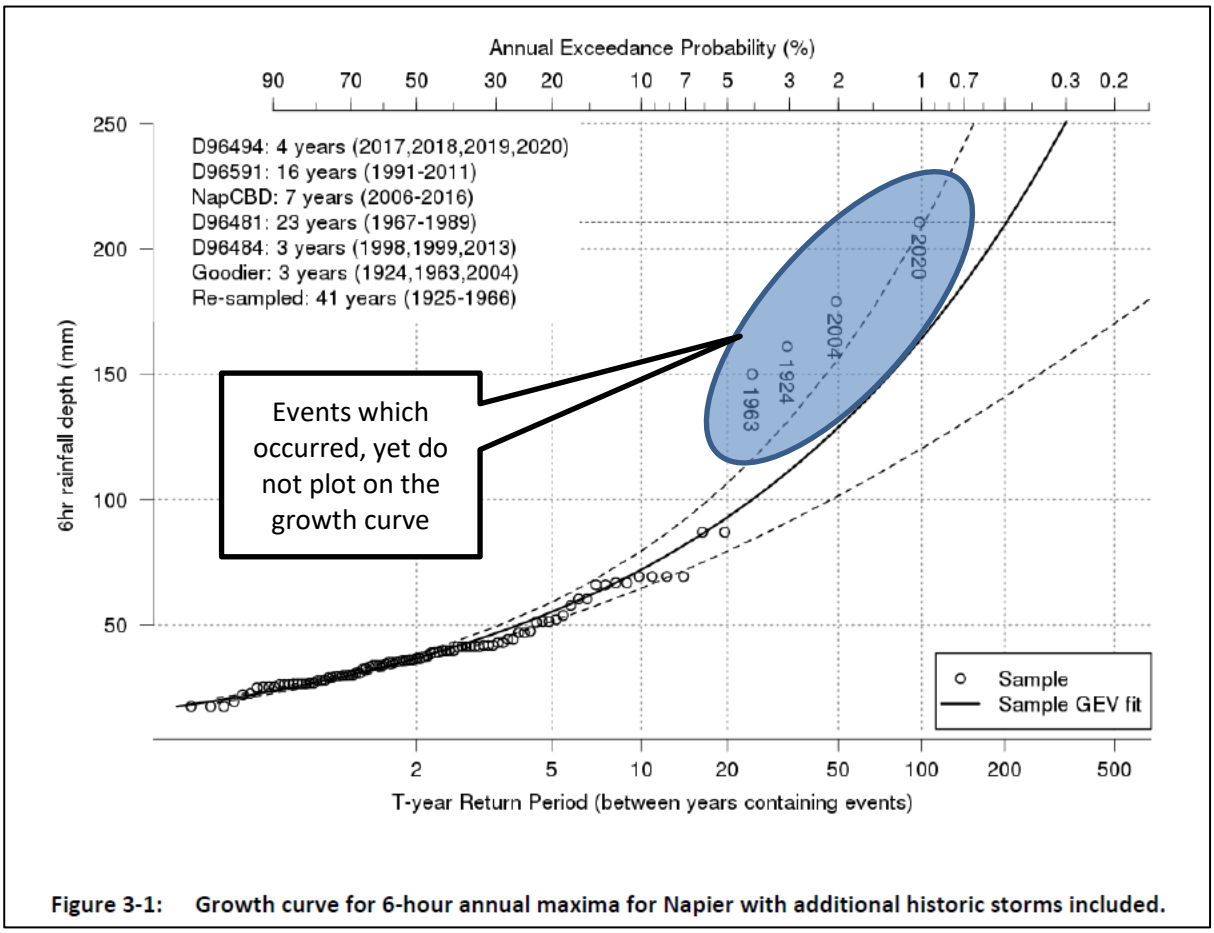


Figure 3-1: Growth curve for 6-hour annual maxima for Napier with additional historic storms included.

Figure 9: Growth curve for 6-hour annual maxima for Napier with historic storms included (NIWA, 2021)

It can be seen from Figure 9 that the return period for the 6-hour maxima November 2020 event may have a range from 100 years to well over 500 years. This variation shows the difficulty in allocating a return period for an event based on rainfall statistics.

Despite the above analysis and comments, it is important to note the severity of the rainfall was extreme, and in terms of conveying the information to the public about the likelihood of a similar event occurring again is considered more important. Considering there have been several events where similar flooding has occurred in Napier in the past 50 years, it is important to realise that flooding of this nature can and does occur much more often than the rainfall statistics would indicate. A conclusion about flood return periods is included in the description of the flood event.

4 Flood affected areas

The main areas of flooding are shown in the image below. The areas shaded in light blue show where ponding of flood waters occurred during the event. In some areas the flood waters filled the streets but did not inundate homes or properties. Flooding on properties in some areas was exacerbated by vehicles creating waves as they tried to travel along flooded streets.

The extent and magnitude of flooding in these areas is discussed further in section 5 of this report.

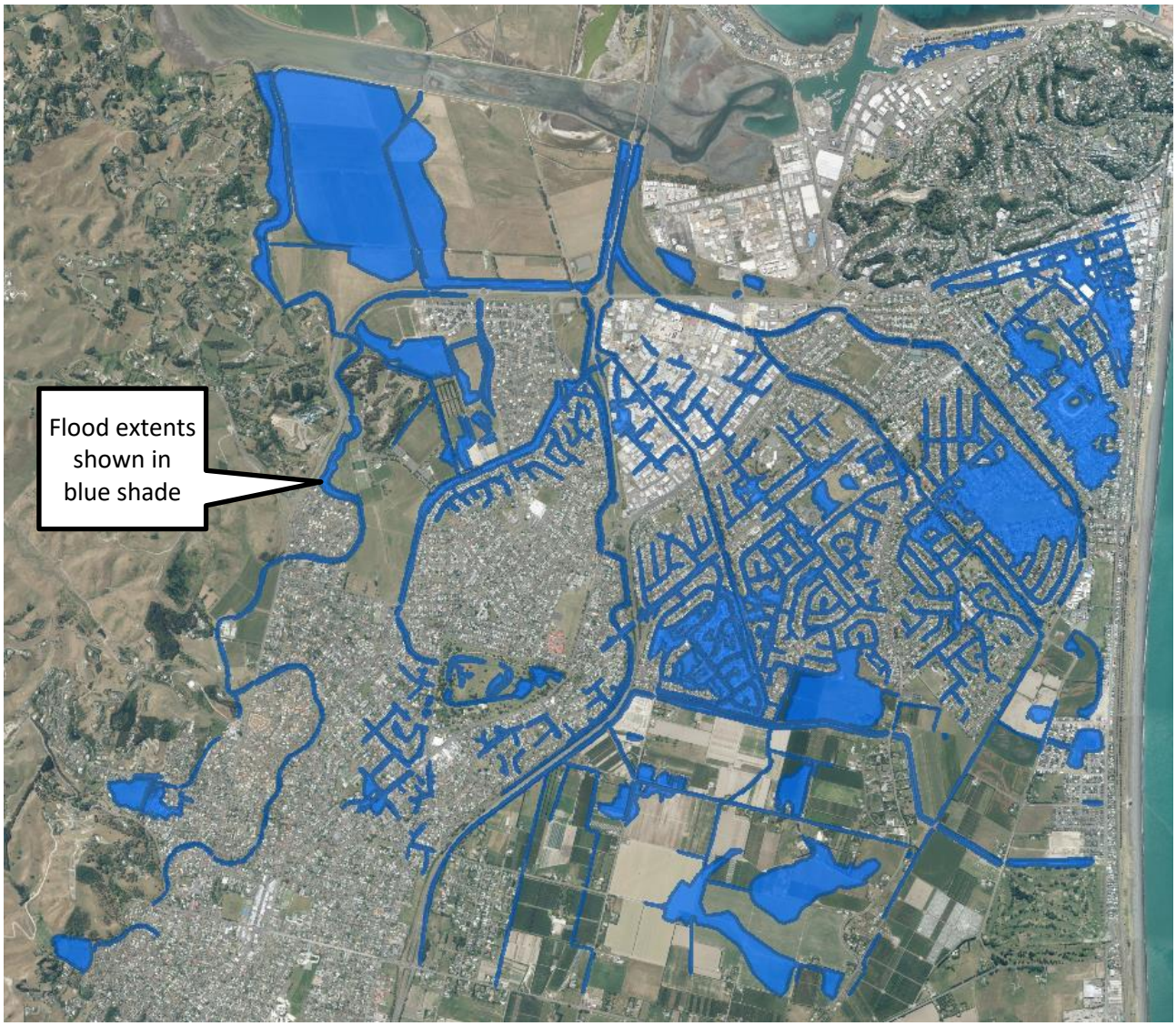


Figure 10: Flood extents from the 9th November rainfall event

Six suburbs of Napier were significantly impacted by flooding and several others suffered surface flooding during the event.

4.1 Maraenui

Maraenui was the worst area of flooding, with large areas inundated. The water remained for several days following the initial rainfall and many areas were unable to be accessed until nearly 36 hours after the event occurred. This area experienced peak flood levels between 1.4m and 2.2m (NZVD2016 vertical datum) during the event, with water depths up to 0.75m experienced in parts. A large majority of the impacted homes were in this area of the city.

Figure 11: A person crosses Nuffield Avenue during the event, 9th November 2020

4.2 Napier South

The suburb of Napier South was also severely impacted by the event, particularly in areas near Latham Street and along George's Drive. These areas experienced peak flood levels of up to 2.8m (NZVD2016), with water depths between 0.6m and 0.75m in some parts.

Figure 12: Latham Street and McLean Park flooding, 10th November 2020 (Photo credit – Peter Scott)

4.3 Marewa

Flooding was experienced in the suburb of Marewa, particularly in the areas adjacent to the main drainage channel and pump station on Kennedy Road.

4.4 Napier CBD

The Napier CBD experience severe rainfall and widespread surface flooding late in the afternoon of the 9th November. The worst surface flooding occurred in a number of streets including Thackery Street, Carlyle Street, Tennyson Street, Emerson Street, Munroe Street and Dalton Street. Water depths within the Napier CBD ranged between 0.2 – 0.7m, with the higher depths experienced in the south of the CBD.

Figure 13: Emerson Street flooding, 9th November 2020

4.5 Onekawa

The industrial area of Onekawa experienced severe flooding in the vicinity of Ford Rd, Wakefield Street and Niven Street, resulting in flooding of several commercial properties. Water depths between 0.3m – 0.8m were experience in the area.

Figure 14: flooding on Niven Street, 10th November 2020

4.6 Pirimai

The suburb of Pirimai was impacted worst in the south of the suburb in the areas of Harold Holt Avenue and Bill Hercock Street. Flood levels in this area reached up to 0.9m in parts.

Figure 15: Flooding in southern Pirimai, 10th November 2021 (Photo credit – Peter Scott)

4.7 Taradale / Greenmeadows

Parts of Taradale experienced flooding as a result of the overflow of the Taipo Stream. Significant ponding of stormwater was also experienced in the overflow area adjacent to Kent Rd and around Churchill Drive. Parts of Greenmeadows suffered from flooding in the low-lying area at the start of Saltwater Creek. Water depths up to 0.5m were experienced in some parts of Taradale and up to 0.4m in parts of Greenmeadows.

4.8 Tamatea

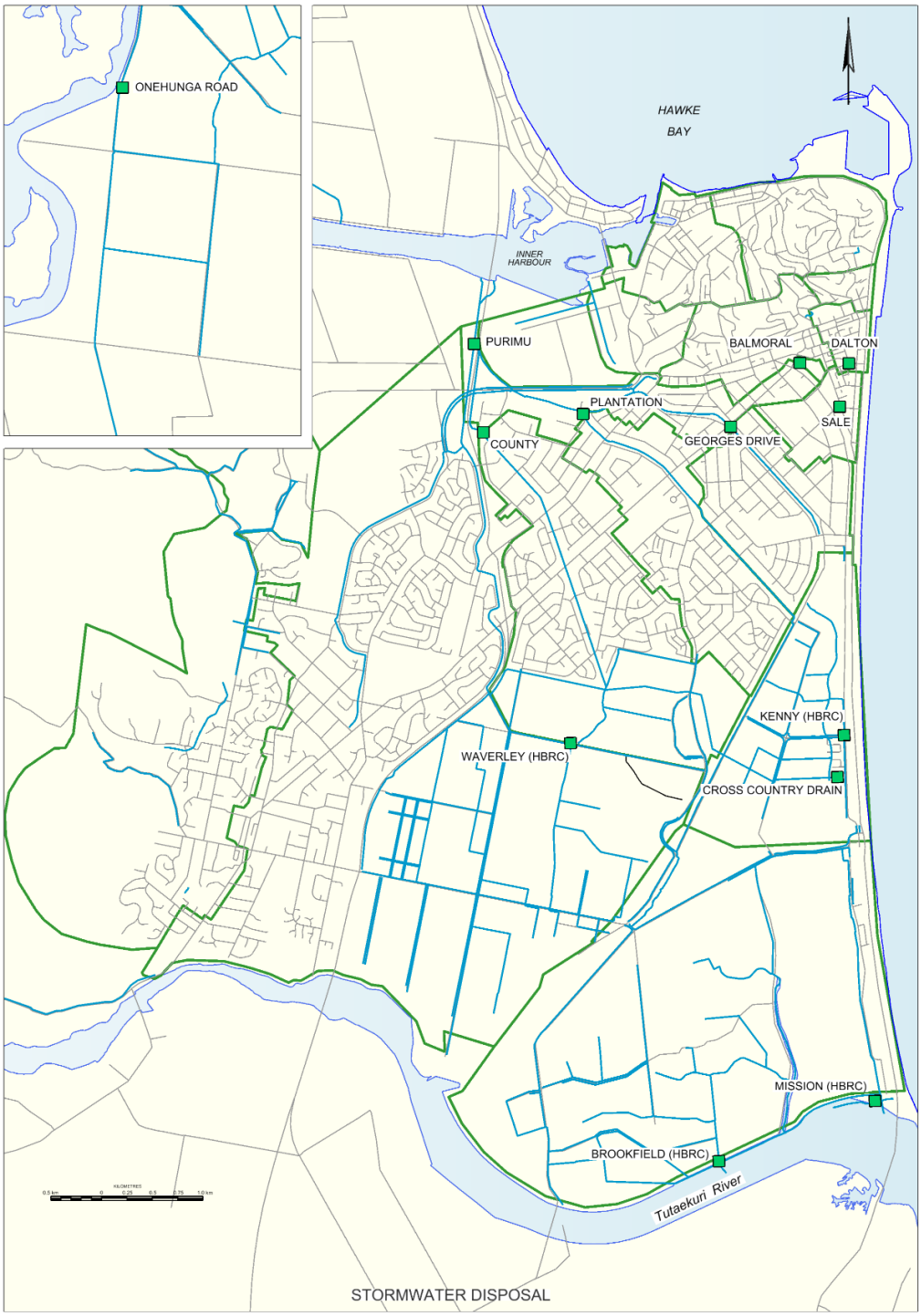
The area of Tamatea experienced surface flooding on a number of streets in the vicinity of Westminster Avenue and the Saltwater Creek. Water depths up to 0.2m were experienced in these areas.

Figure 16: Flooding in Exeter Street, 9th November 2021

5 Flood extent and magnitude

5.1 Stormwater network overview

The Napier stormwater and drainage scheme is operated by both HBRC and NCC. The system is almost entirely pumped, with roads providing storage of flood waters until it can be pumped out. The stormwater pipe network has a 1 in 10-year capacity and the drainage network a 1 in 50-year capacity. The map below shows the main drainage scheme and pump stations that support the pipe network.



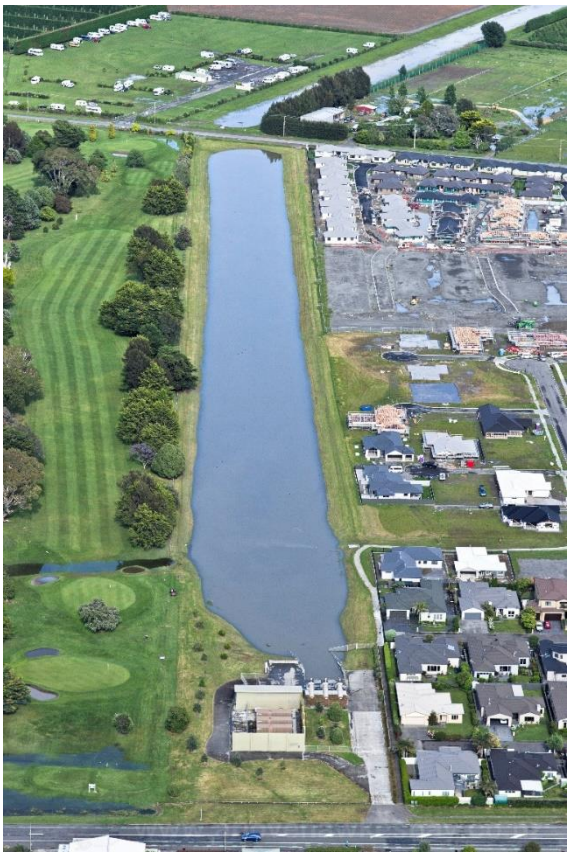


Figure 18: Cross Country pumping station, 10th November 2020 (Photo credit – Peter Scott).

Figure 17: Napier stormwater / drainage scheme

HBRC owns seven pump stations within the scheme:

- County (4 pumps owned by HBRC, all 7 pumps operated by NCC)
- Plantation (operated by NCC)
- Mission (Drains to Tutaekuri River – not part of study)
- Brookfield (Drains to Tutaekuri River – not part of study)
- Waverley
- Kenny Road

NCC owns eight pump stations within the scheme:

- County (3 pumps owned by NCC, All 7 pumps operated by NCC)
- Balmoral
- Cross Country
- Purimu
- Onehunga
- Sale
- Dalton
  Georges Drive

The drainage network is also supported by several detention dams and storage ponds, which help to control the flow of water into the network and provide storage capacity.

The majority of the drains within the scheme flow north towards the Ahuriri Estuary, assisted by several pump stations located within the city. 75% of the stormwater within the scheme is pumped into the Ahuriri Estuary from the Purimu pump station. The remaining part of the scheme is discharged directly into the sea via the Kenny and Cross-Country Drain pump stations, The Ahuriri Estuary at Onehunga Road and into the Tutaekuri River at the Brookfields and Mission pump stations.

Figure 19: Stormwater storage pond, Te Awa, 10th November 2020 (Photo credit – Peter Scott).

5.2 Description of Flooding by Catchment

5.2.1 Summary/Overview

The intense rainfall was not widespread in the broader Hawke's Bay sense, but covered a large area of Napier City in the localised sense. Most suburbs of Napier experienced surface ponding and overland flow in the streets, and several suburbs had many properties and houses inundated to varying degrees, ranging from nuisance flooding on grassed areas, to deep flooding within houses, some to a level that required evacuation and eventual significant remediation to repair the flood damage. Figure 20 shows the catchments of Napier, along with the pump stations, major waterways/drains, and the flood extents for the event.

The flood extents presented in this report were derived from several sources, including surveyed flood levels based on debris marks, photos from public and council staff, descriptions of flood levels from public and council staff, and photos taken by Peter Scott (Above Hawke's Bay Ltd.) from an airplane on 10th November, between 8am and 9 am. It is important to note that the flood extents shown on private property does not necessarily indicate that any building on the property was flooded. There are instances where the floor levels of buildings were high enough above ground to prevent the building from being inundated, but the surrounding property may have been inundated.

Note all elevations presented in this report use the NZVD2016 vertical datum.

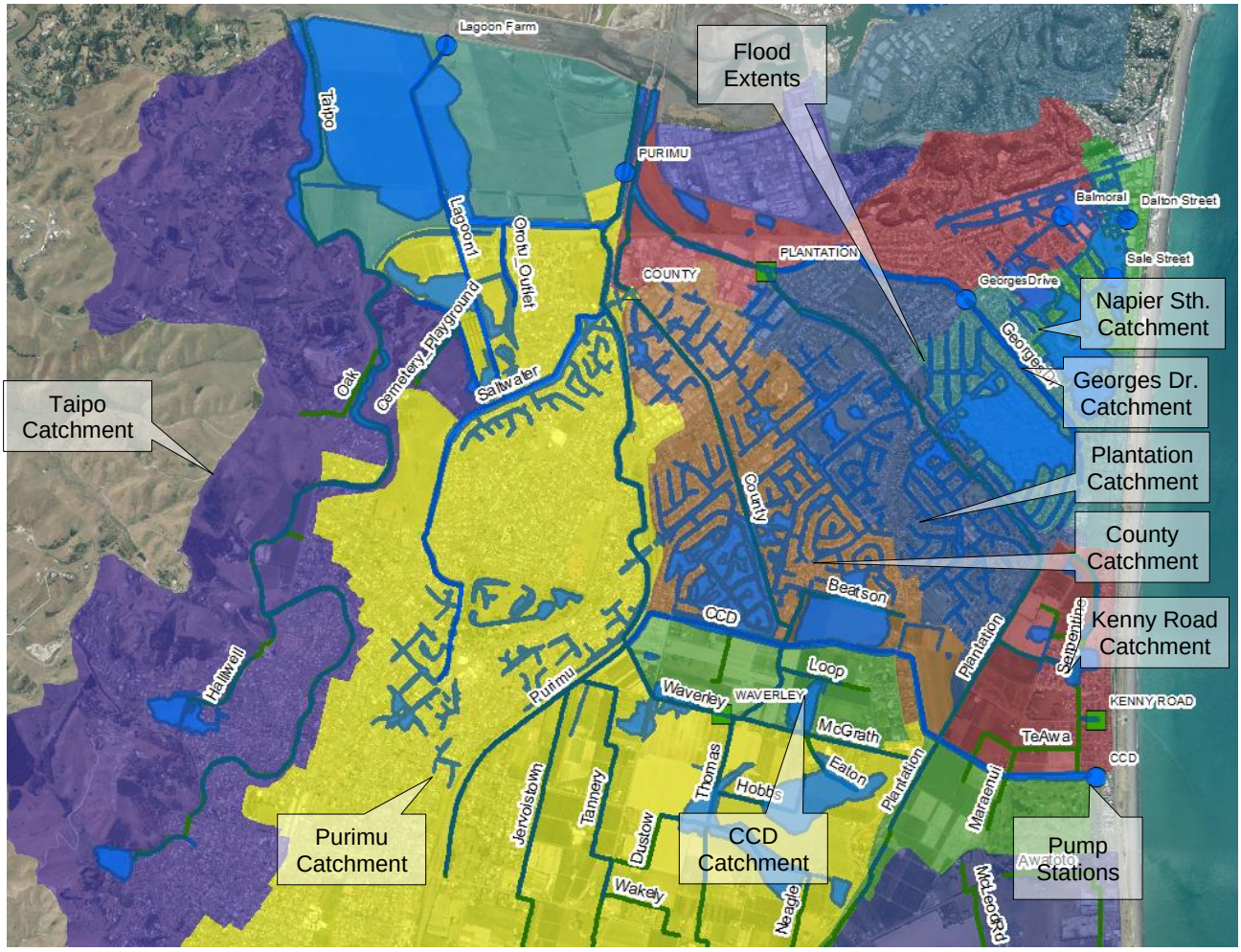


Figure 20: Catchments and flood extents

The maps within this report show both the water depth and flood levels from the event. These figures are based on different reference points, as shown Figure 21 below.

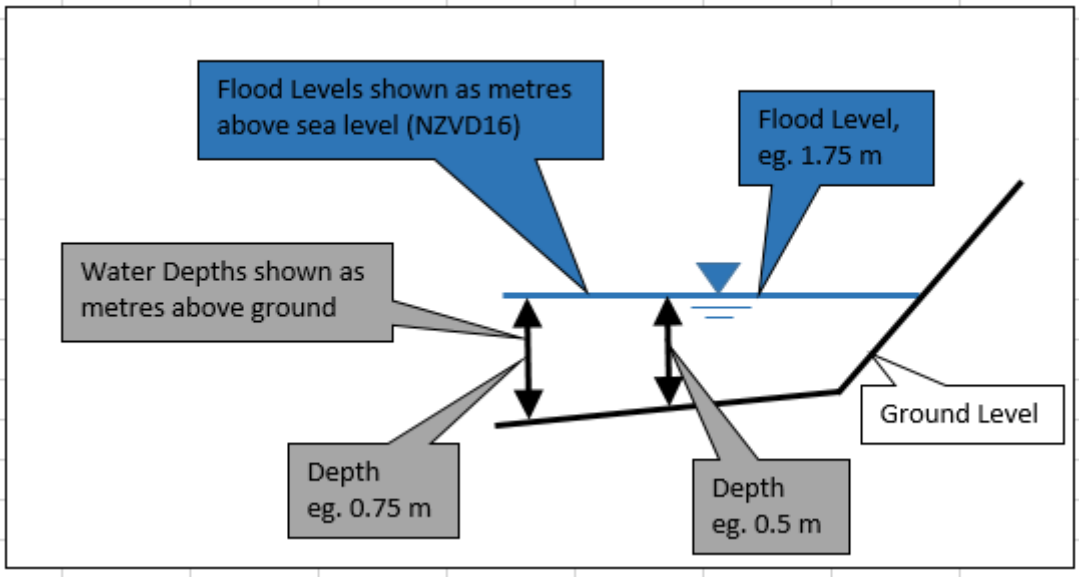


Figure 21 Reference points for water depth and flood level

Figure 22 shows the 24 hour Met Service rainfall accumulation and rainfall gauges between 6 am 9th November to 6am November 10th, along with 24 hour accumulated rain gauge totals for 00:00 am – 11:59 pm on the 9th November.

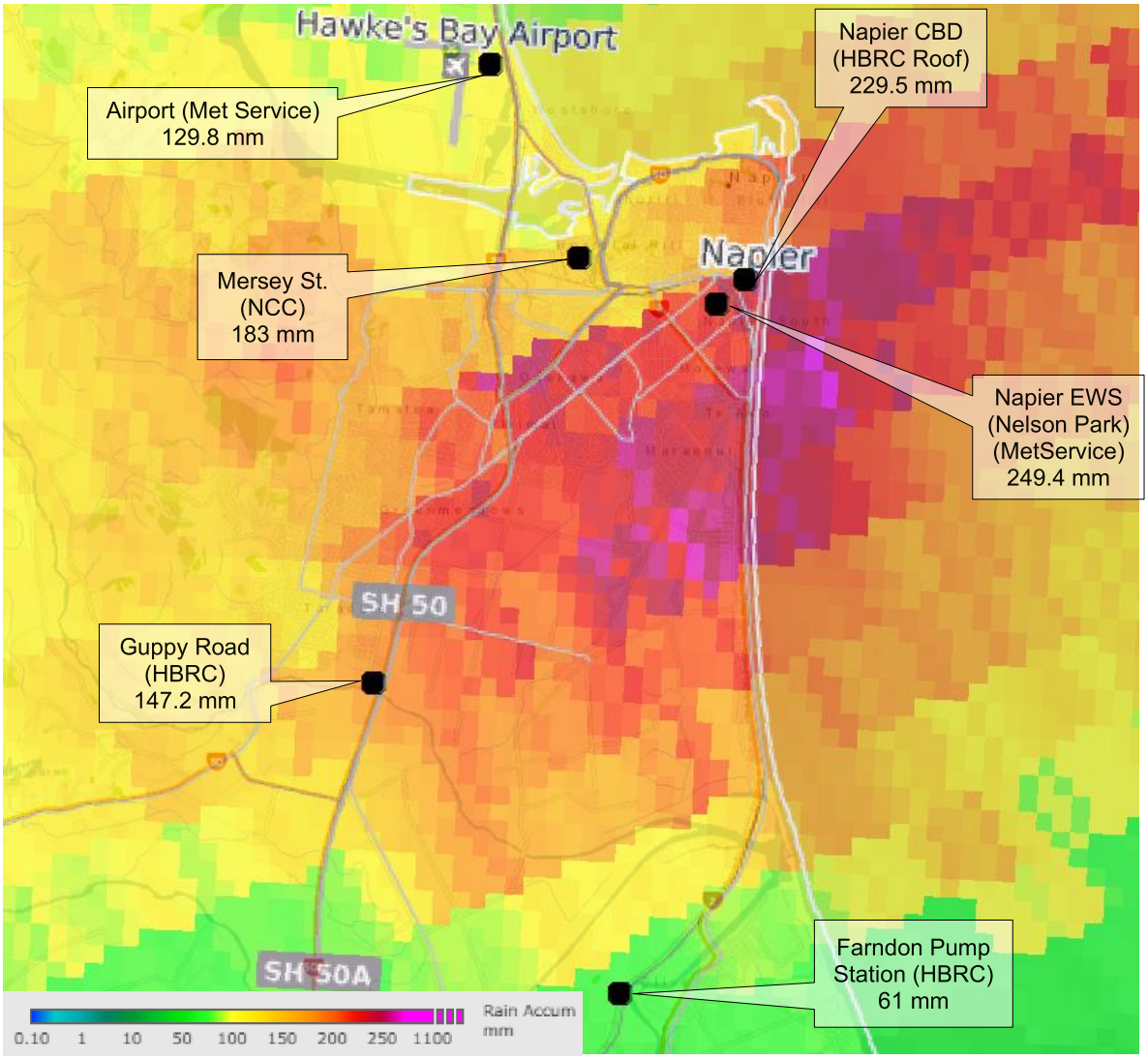


Figure 22*:* Rainfall accumulation from Radar (courtesy of Met Service) and local rain gauges.

The radar image shows areas of purple (>250 mm) that indicate greater accumulation than the observations from the rain gauges. This is an important consideration when estimating return periods of events, in particular historic events prior to radar being available, which may have caused similar flooding, but were not observed in the rain gauge network.

5.2.2 Taipo Stream

The Taipo catchment is the largest non-pumped (i.e. gravity) flowing system in Napier, with the outlet in the Ahuriri Outfall channel, which is tidal. During high tide, the flow from the Taipo is reduced, which has the potential to cause flooding in the lower reaches of the stream. The catchment boundaries and the flooding overview are shown in Figure 23.

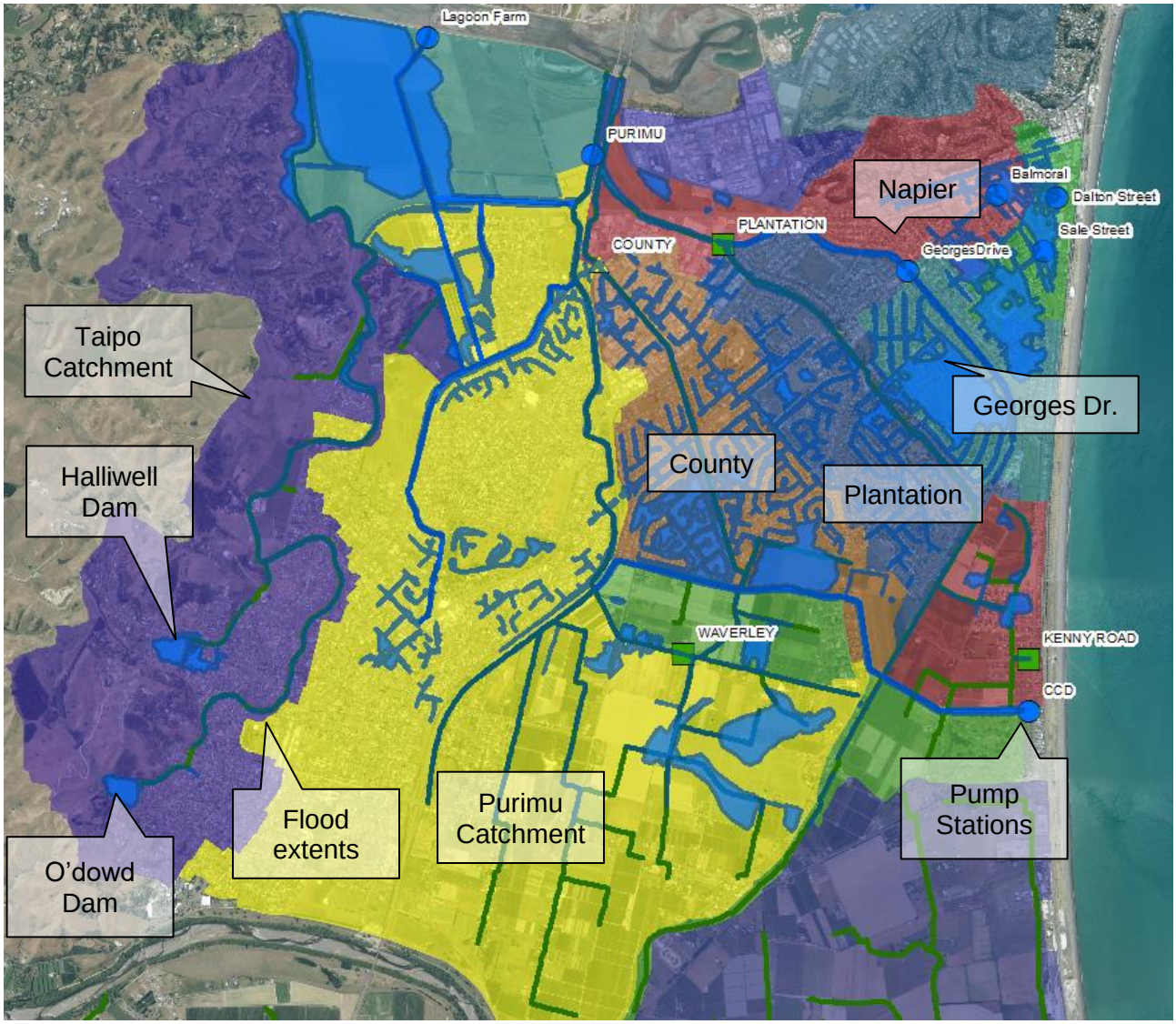


Figure 23*:* Taipo and other Catchments and flood extents

The Taipo Stream catchment was on the fringes of the major rainfall, with approximately 150 to 200 mm rainfall in 6 hours falling on the catchment. Figure 24 on the next page shows the distribution of the cumulative rainfall for the 24 hours between 6 am 9th November to 6 am 10th November.

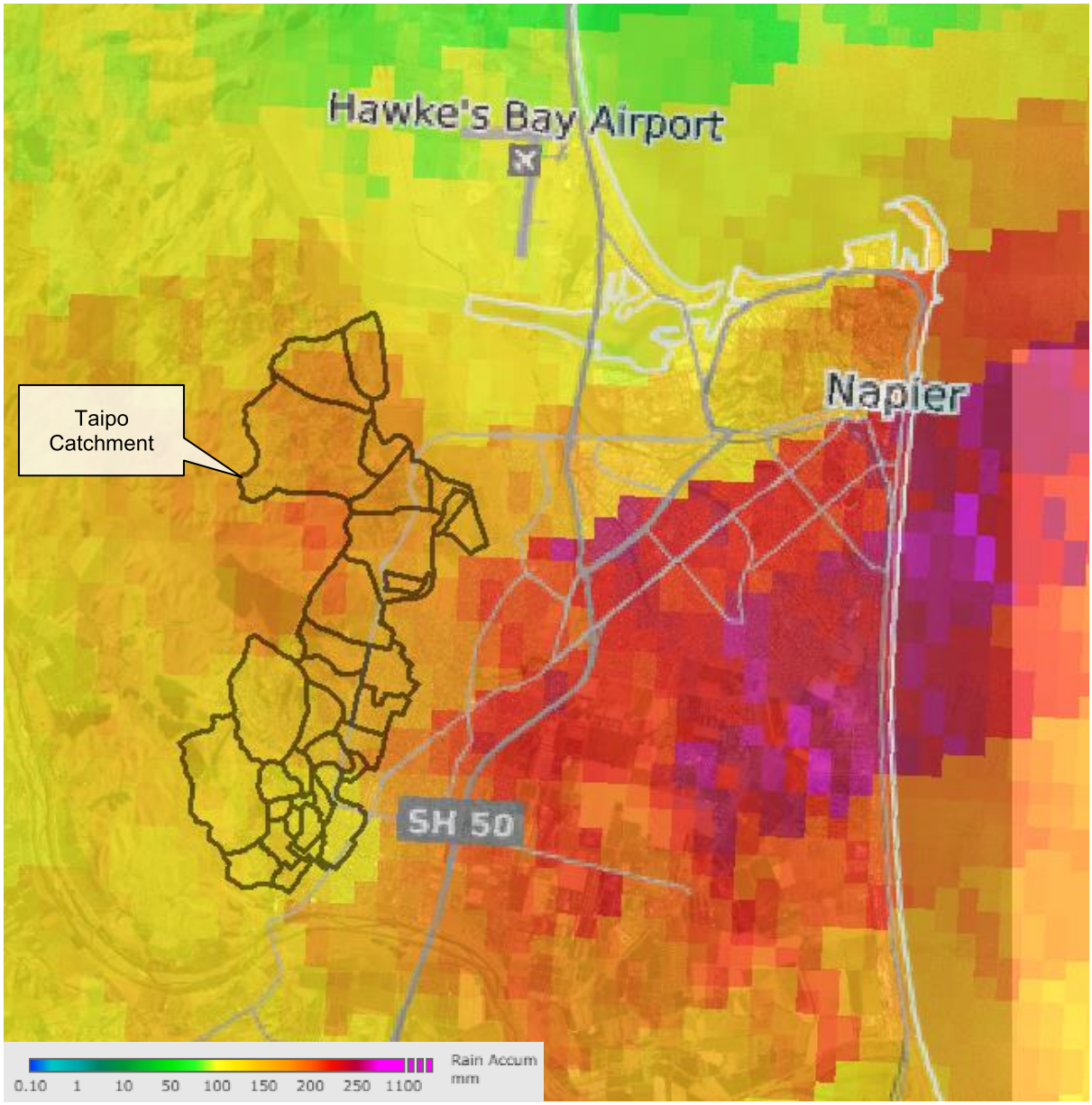


Figure 24*:* Rainfall totals based on Met Service Radar

Two detention dams (Halliwell and O'Dowd – see Figure 23) provide flood attenuation for the Taipo Catchment. During the event, the capacity of the dams was well utilised, with their control gates being changed from the normal 30% open to fully closed in order to limit the downstream outflow. After the bulk of the rain had passed, the gates were opened in order to reduce the level in the dams. This is critical to allow for storage to be available in the event of a second burst of rain, which happens frequently.

Immediately downstream of Halliwell Dam, a group of properties on Birdwood Street were flooded, with several houses and garages becoming inundated. The contours in Figure 25 show the ground levels in the area as low as elev. 4.75m while the surrounding land rises to around elev. 5.5m. Flood levels in this area reached approximately elev. 5.25m.

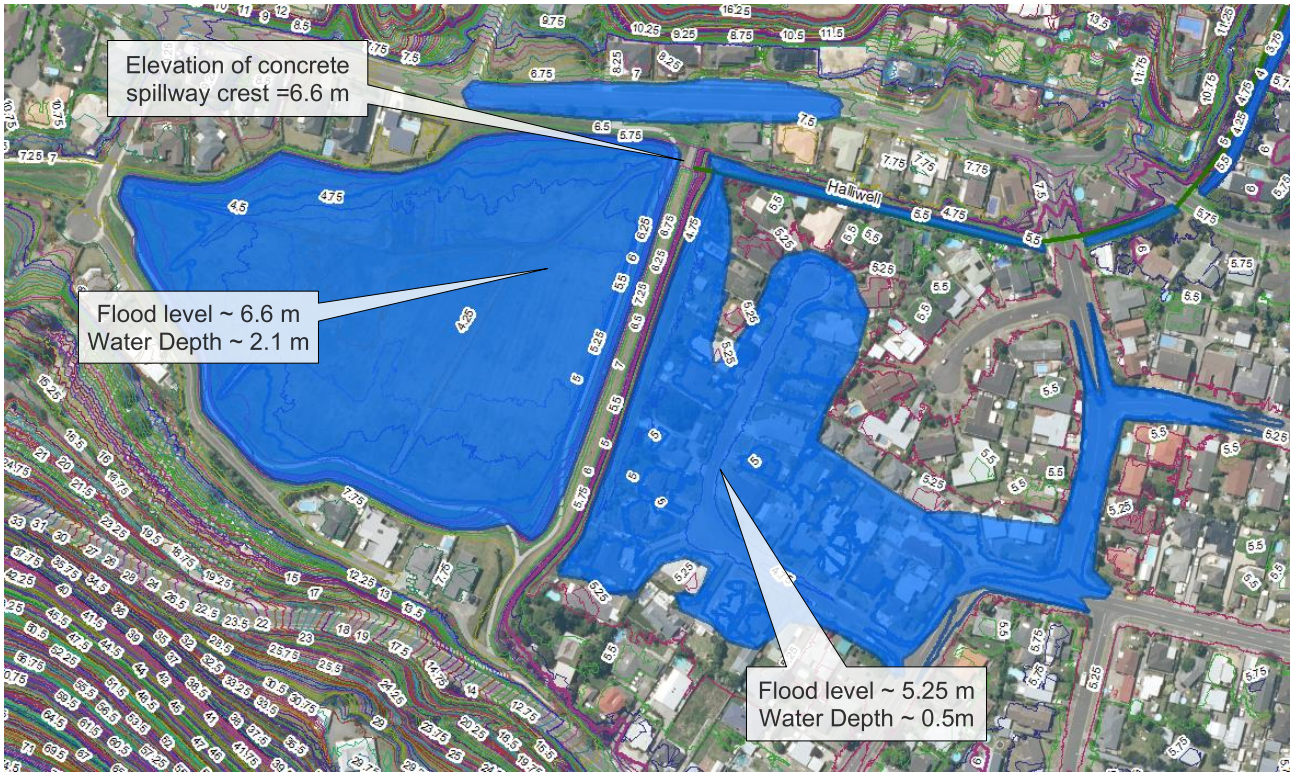


Figure 25: Halliwell Dam – flood extents within dam and downstream on Birdwood Street (contour datum NZVD16)

The flood level within the dam impoundment area reached just to the spillway crest level (~elev. 6.6m (NZVD16). Figure 26 shows the dam partly full on the morning after the flood (10th Nov.), while Figure 27 shows the record of the water level in the dam, and the times when the gate position was altered.

Figure 26 Halliwell Dam post flood, 9am 10th November (Photo credit – Peter Scott).

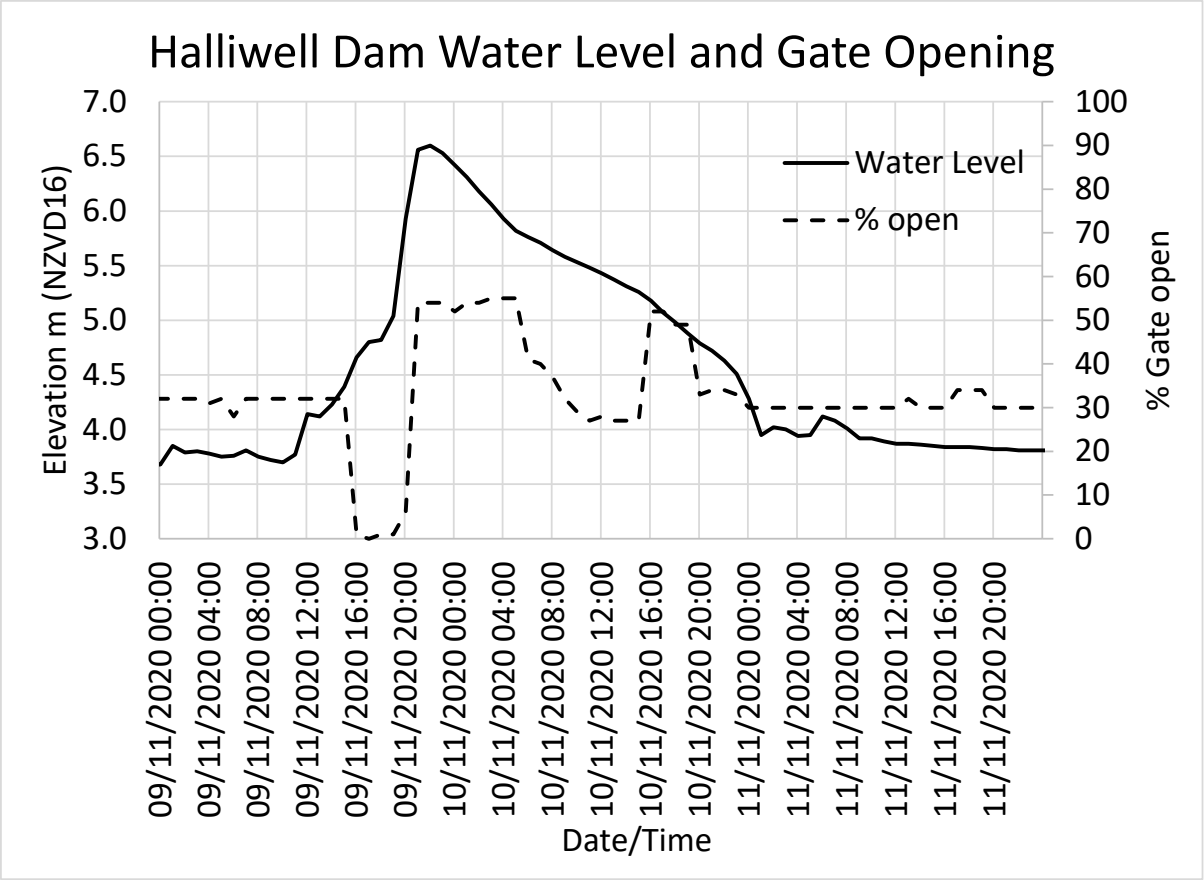


Figure 27*:* Halliwell Water level in dam, and % gate open

Figure 28 shows O'Dowd dam partly full on the morning after the flood (10th Nov.), while Figure 29 shows the record of the water level in the dam, and the times when the gate position was altered.

Figure 28*:* O'Dowd Dam post flood, 9am 10th November (Photo credit – Peter Scott).

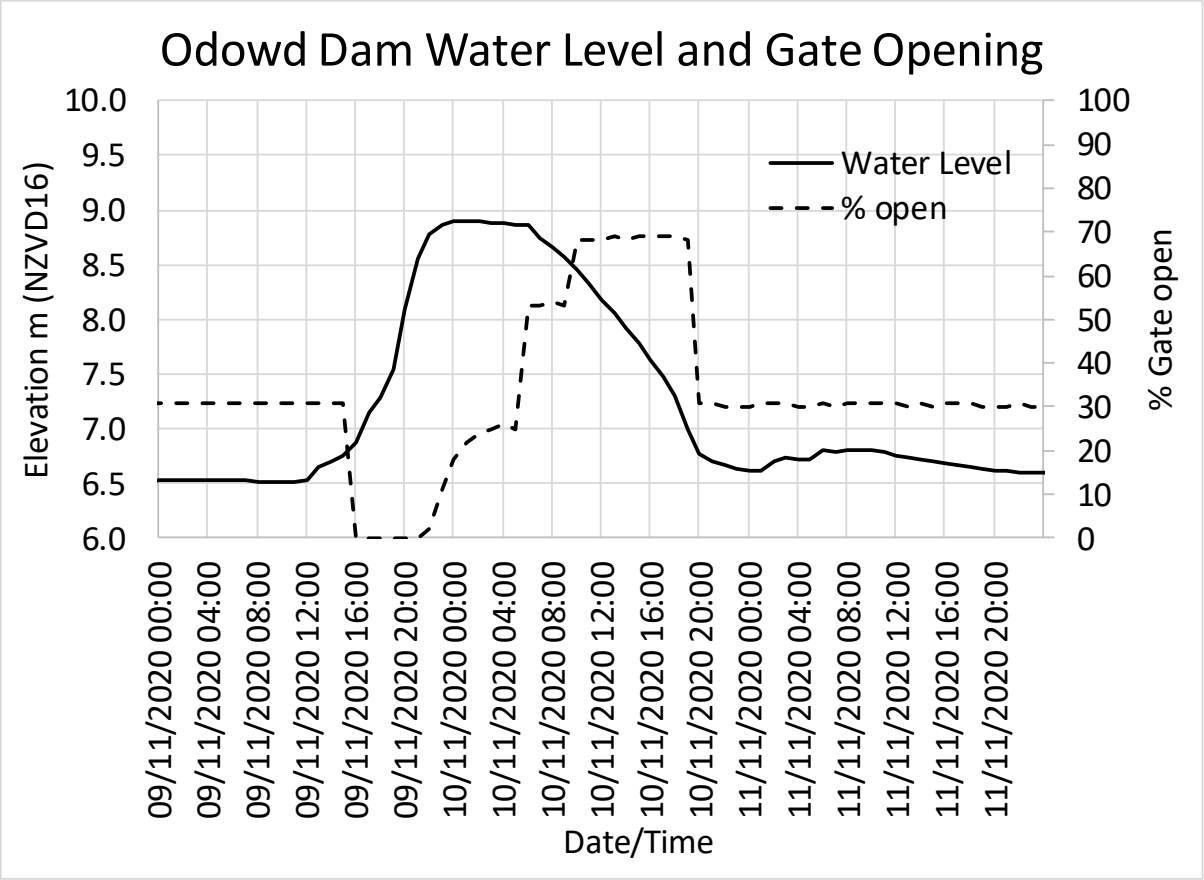


Figure 29*:* O'Dowd water level in dam and % gate opening

Along the Taipo Stream, water levels were high, with flood levels above the normal low flow channel, rising to cover the berm areas in most places. A comparison of observed flood levels to modelled flood levels at the lower Church Road bridge indicates the return period for the flooding along the Taipo stream is in the order of 10 years in this location. At the Ngarimu Road/Church Road crossing the observed flood level was approximately elev. 4.5m. At this location, the modelled 50-year flood level is elev. 4.85m, indicating the event likely had a return period of less than 50 years in this location. Figures 30 and 31 show the details of this location.

Figure 30*:* Taipo Stream u/s of Church Road, near Ngarimu Cres. Flood Level ~ 4.5 m (NZVD16)

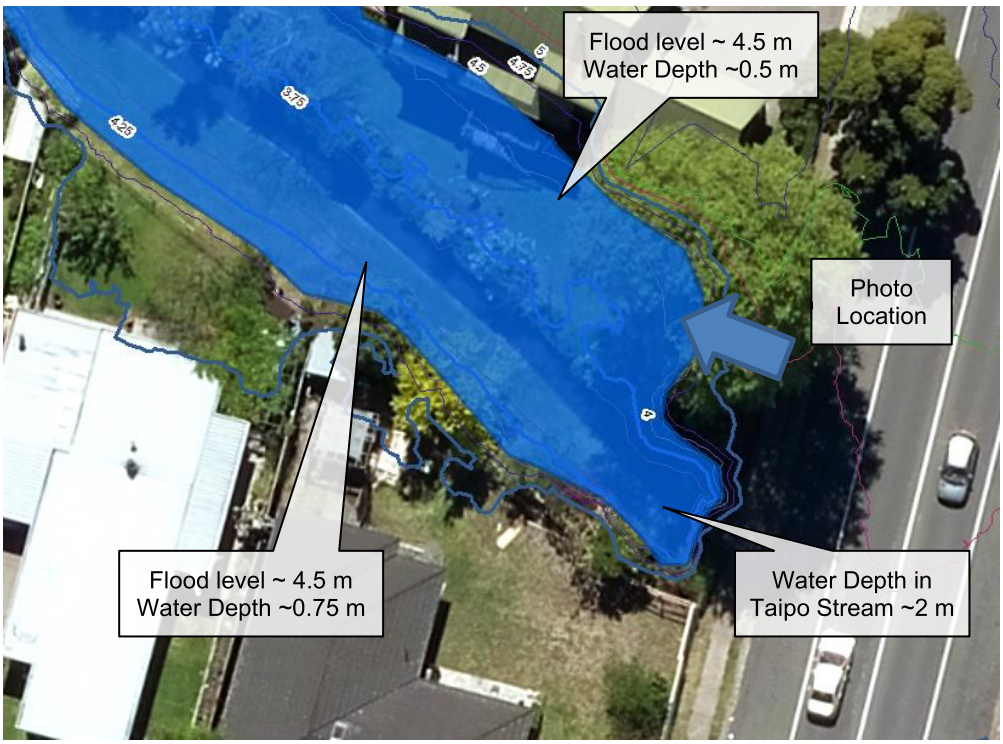


Figure 31: Taipo Stream flood extents u/s Church Road near Ngarimu Cres.

The lower part of the Taipo Stream is influenced by the tide, which was noticeable in this event, with the normal outflow at low tide being delayed from the bulk of the water coming down the Taipo. Figure 31 shows the tidal chart in Ahuriri outfall channel plotted with the rainfall in Napier CBD. The tidal plot shows the peak levels did not appear to be influenced by the rainfall, however, the low tide values were higher than normal.

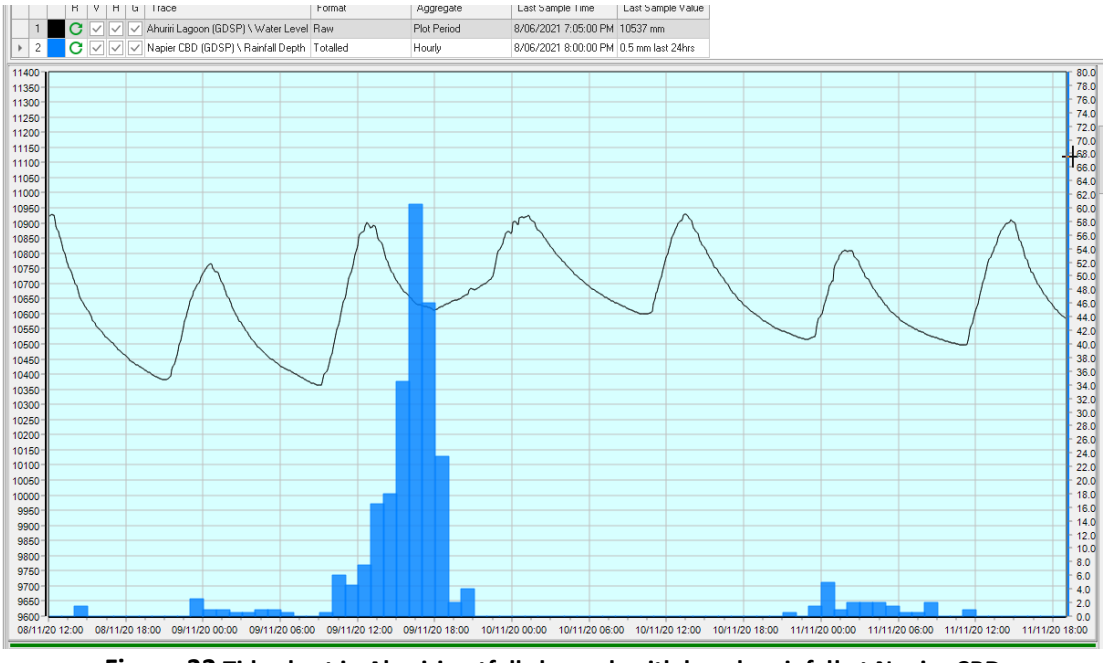


Figure 32 Tide chart in Ahuriri outfall channel, with hourly rainfall at Napier CBD

5.2.3 Purimu Catchment (includes part of Taradale, Greenmeadows, Tamatea and Meeanee)

The Purimu catchment had several areas which experienced significant flooding. These include rural areas in the Meeanee portion of the catchment, which flow into Waverley Pump Station, as well as portions of Taradale/Greenmeadows, in particular the Osier Road, Gloucester Street area, and portions of Tamatea as shown in Figure 33. In this figure, the overflow from Purimu catchment to Cross Country Drain (CCD) catchment is also shown. Significant amounts of water flowed to CCD in this event.

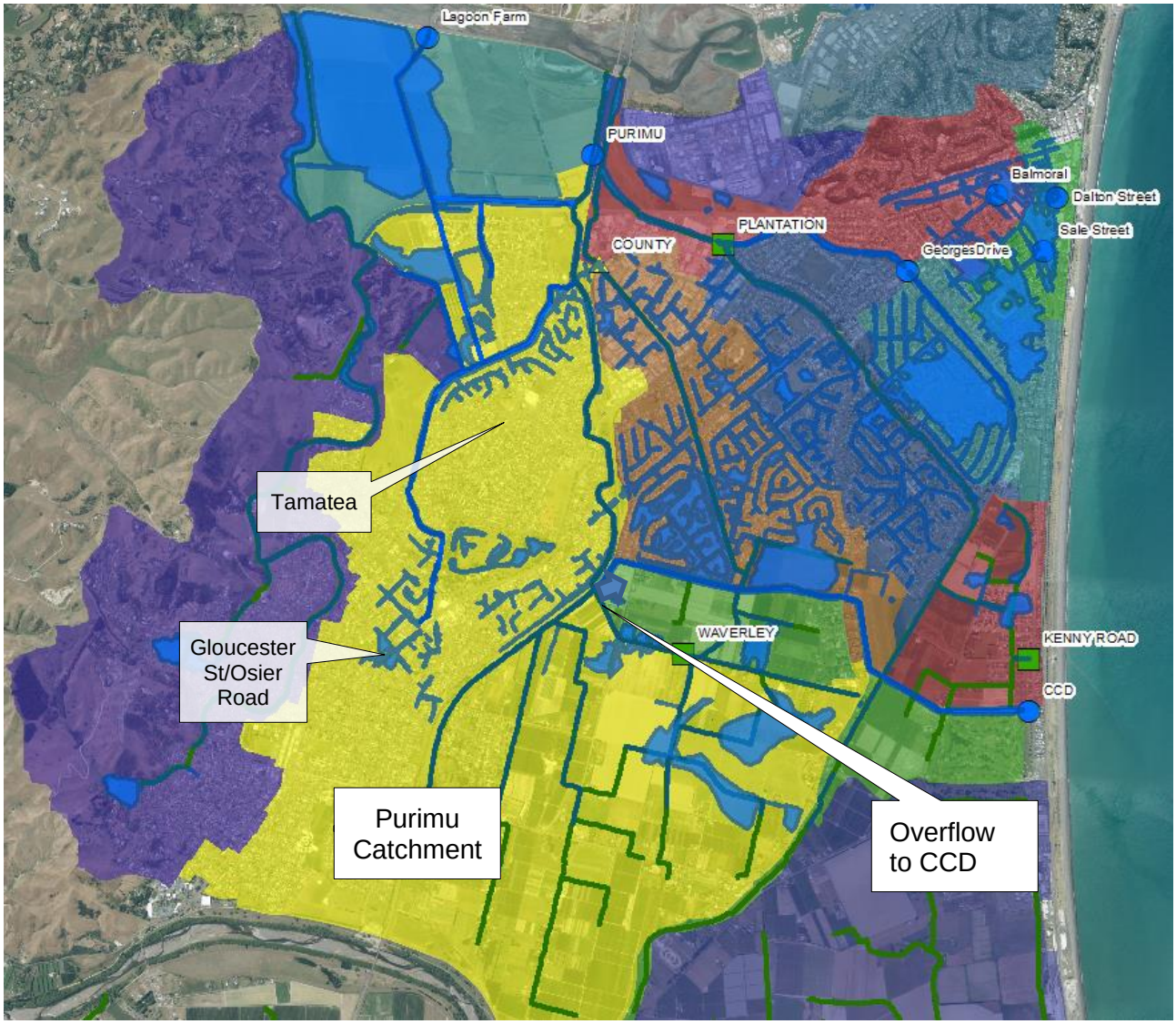


Figure 33*:* Purimu Catchment and flood extents

The rainfall distribution shown in Figure 34 shows areas, such as south-east of the Waverley pump station, which received the most intense rain (possibly over 250 mm over the whole event) with most of this falling in the 6-hour period between 1pm and 7pm. The majority of the catchment received between 100 mm and 200 mm, with the gradient most intense in the east, and lessening in the west part of the catchment.

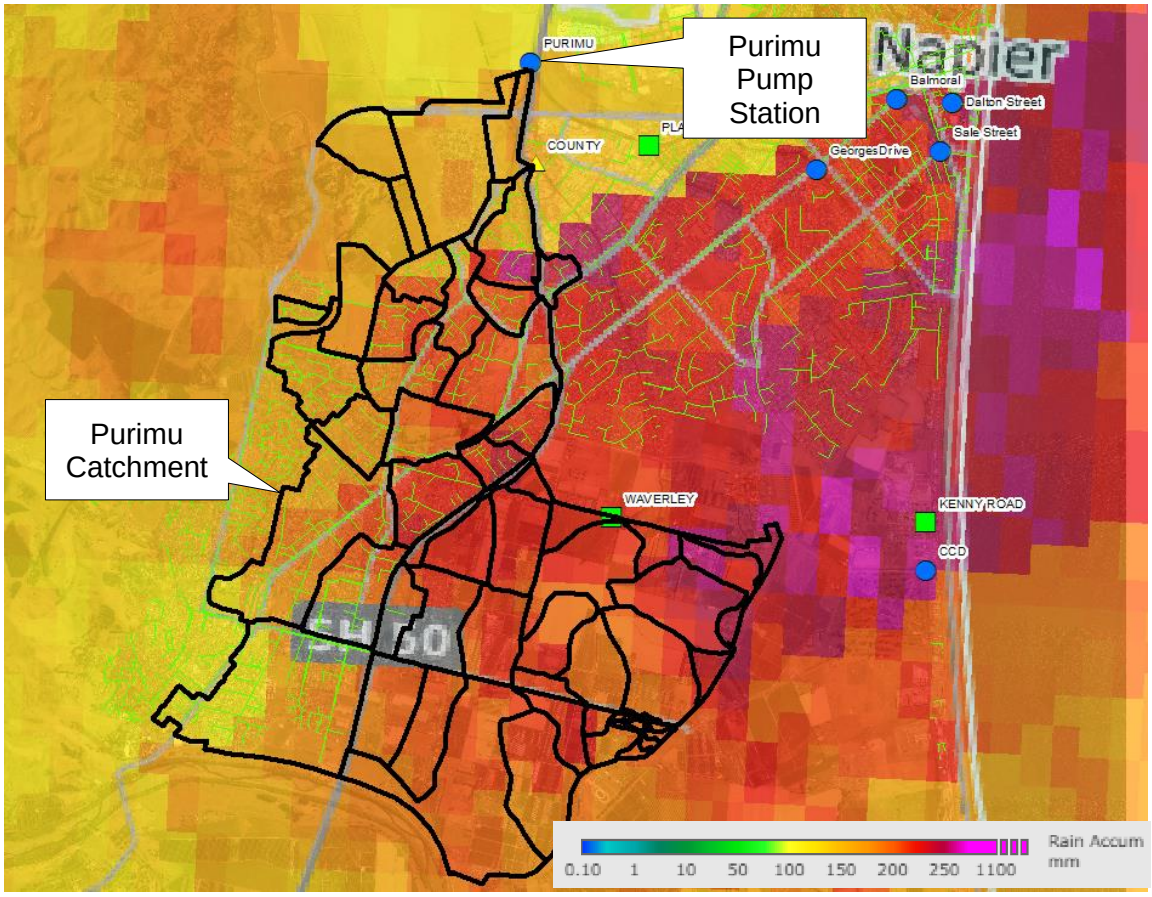


Figure 34*:* Rainfall totals based on Met Service Radar

In the Meeanee area, upstream of the Waverly pump station, there was significant flooding of the rural land as seen in Figure 35 and Figure 36.

Figure 35*:* Flooding in Meeanee Catchment (taken 9:30 am, 10th November) (Photo credit – Peter Scott).

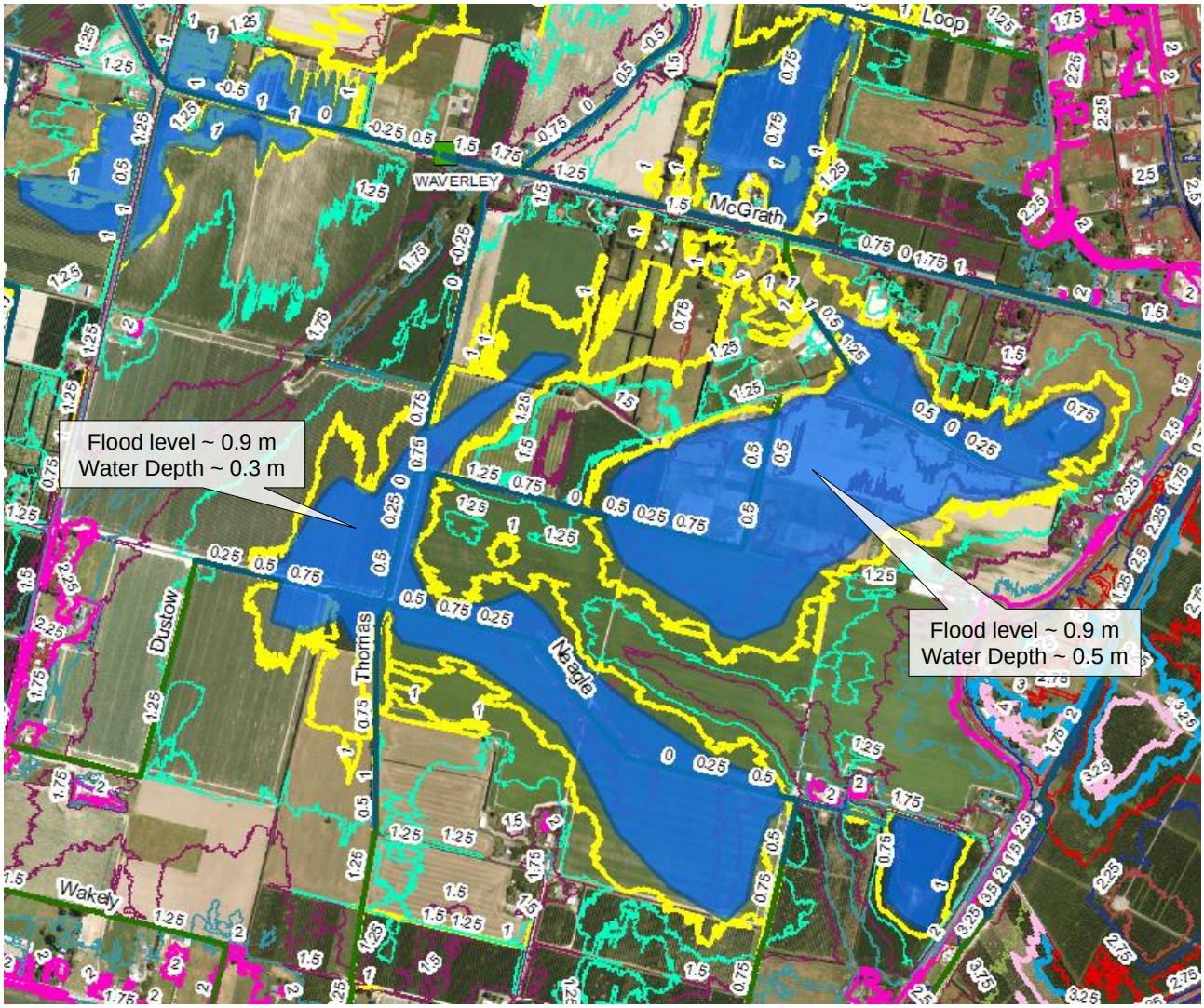


Figure 36*:* Flood extents in Meeanee catchment

The Waverley pump station suffered a power outage at 8:53pm 9th November until 6:05 am 10th November. A generator was brought in to power the station and three mobile pumps were also temporarily located at the Waverly pump station in order to help speed the clearance of the flooded rural areas (Figure 36).

Figure 37 Mobile pumps and generator at Waverely pump station

Considering the amount of rain that fell in this portion of the catchment, the flood extents appear to be contained to the low-lying areas. Flooding in these areas has happened several times in the recent past, indicating this type of event was not uncommon for this portion of the catchment.

The Purimu Stream has an overflow to the Cross-Country Drain (CCD) just upstream of the Hawke's Bay Expressway, as shown in Figure 38. The overflow starts activating when the water level rises above elevation -0.3m (NZVD16). Note the elevation of this overflow is below sea level (-0.3m), as are most of the inverts of the drainage system in the Napier/Meeanee catchment. Figure 39 shows the observed flood extents and the surveyed flood level of elevation 1.175 m (NZVD16). Figure 40 shows the area from the air the following morning.

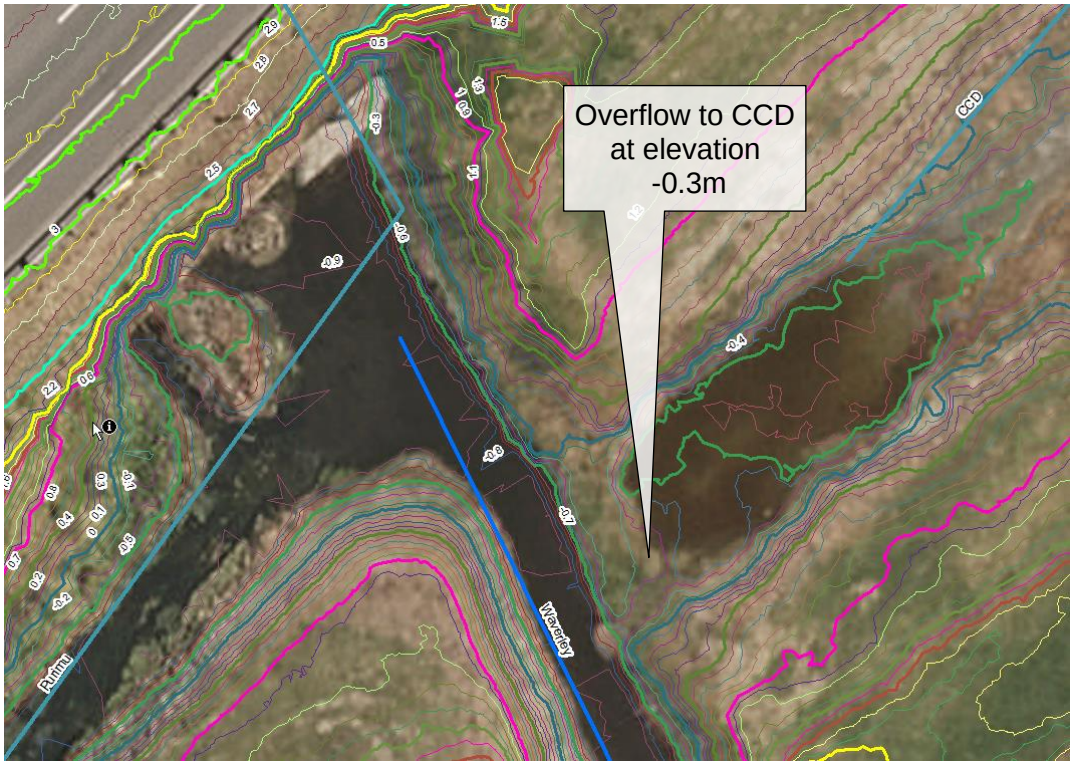


Figure 38*:* Purimu overflow to CCD (contour datum NZVD16)

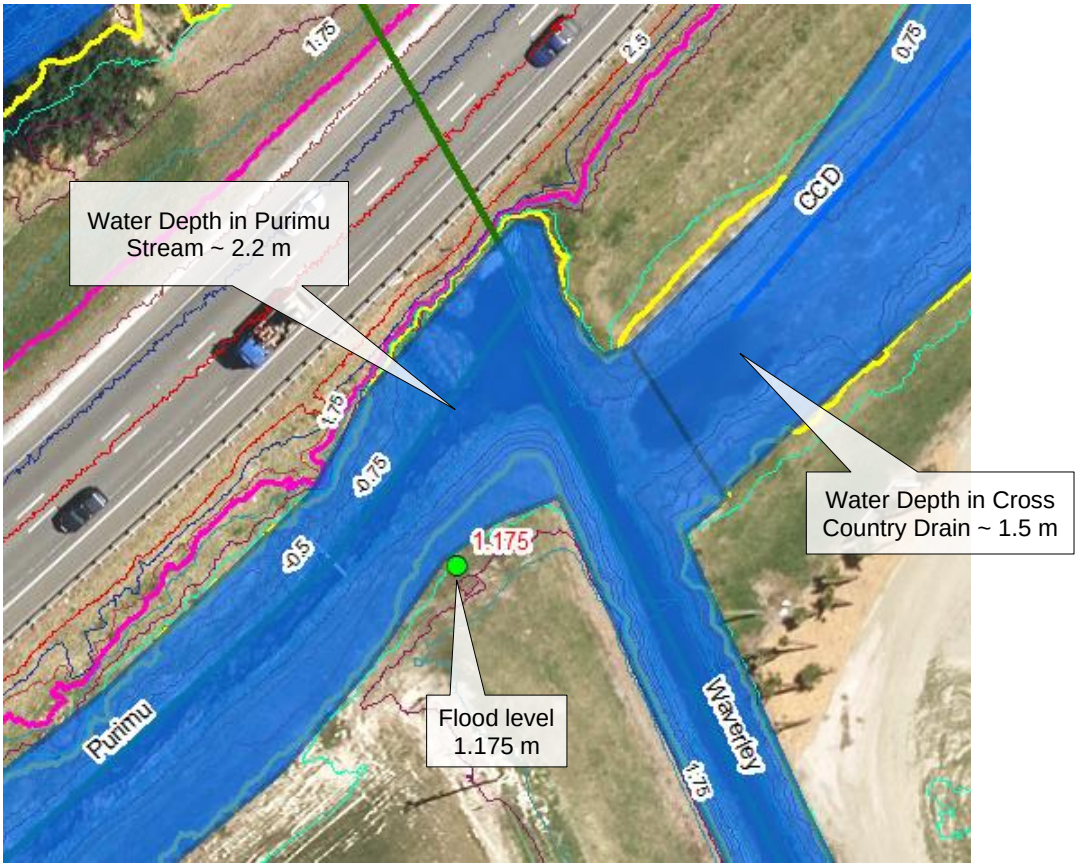


Figure 39*:* Flood extents and level at Purimu overflow to CCD (contour datum NZVD16)

Figure 40*:* Purimu overflow to CCD Nov. 10, 9am (Photo credit – Peter Scott).

In the Taradale/Greenmeadows area, flooding occurred around the Gloucester, Osier, Avenue Road area, which as seen in Figure 41, is a relatively low area with elevations around 2.5m (NZVD16). This area flows to Saltwater Creek, which has a relatively low gradient and discharges to the Purimu Stream upstream of the Purimu pump station. Flooding in this area occurring mostly in the road reserve, however several properties and houses were also inundated.

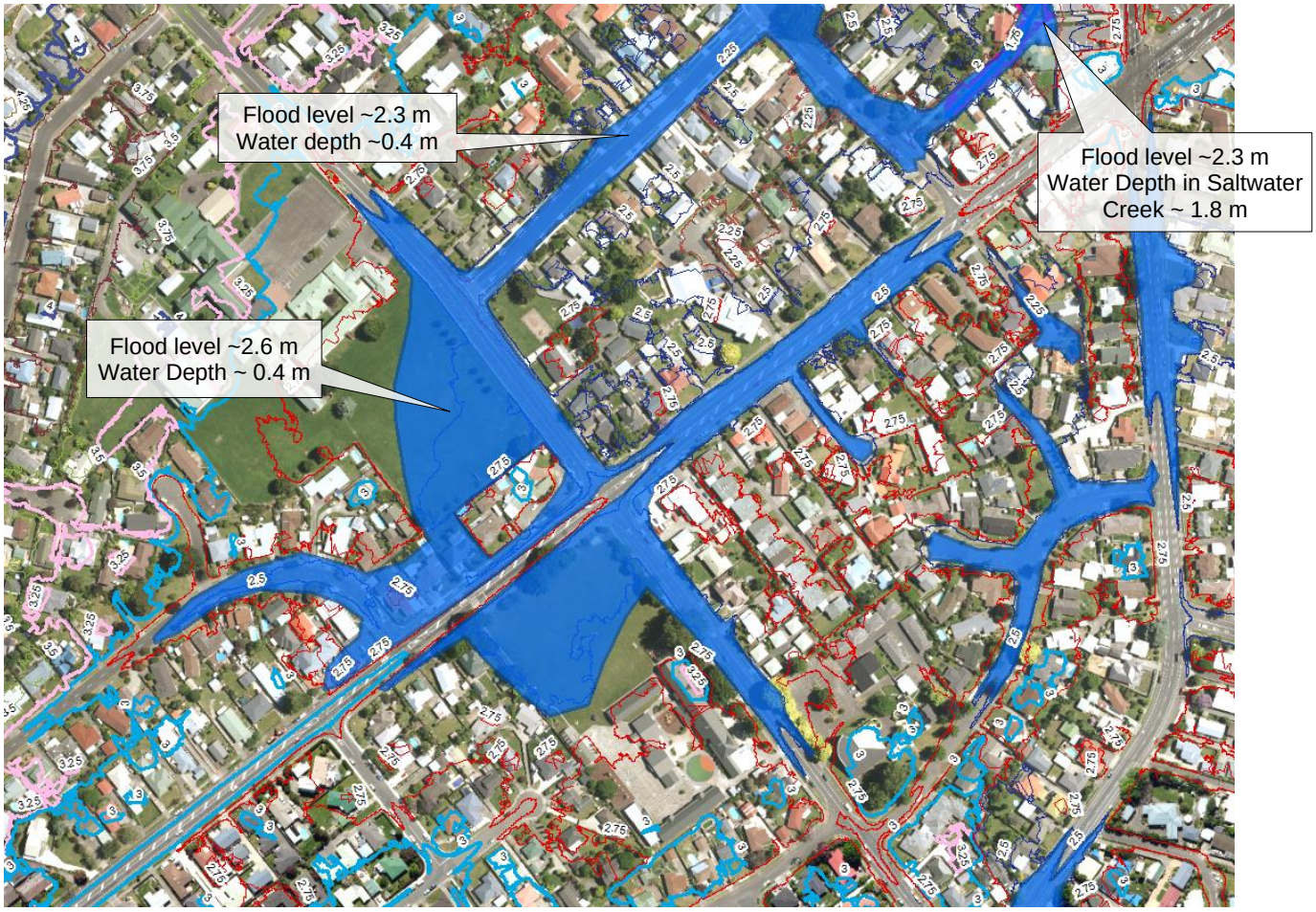


Figure 41*:* Flood extents in Taradale/Greenmeadows also showing contours (datum NZVD16)

Figure 42*:* Flooding along Avenue Road with photo also showing the increased flood level due to vehicles travelling in the flood waters.

Figure 43*:* Flooding along Avenue Road

In Tamatea, where the lower reach of Saltwater Creek flows beside Westminster Avenue, the road reserve became inundated as shown in Figure 44. Flooding in this area is not uncommon, with more severe flooding occurring in this area in the October 2004 event. It should be noted this area of Tamatea has been designed with the roads relatively low to hold the flood waters flowing to the Purimu pump station. There did not appear to be any inundation of private property in this area. The 50 year modelled flood extents are greater than the flood extents which occurred during the 9th November event, indicating the return period for the event in this location is likely to be less than 50 years.

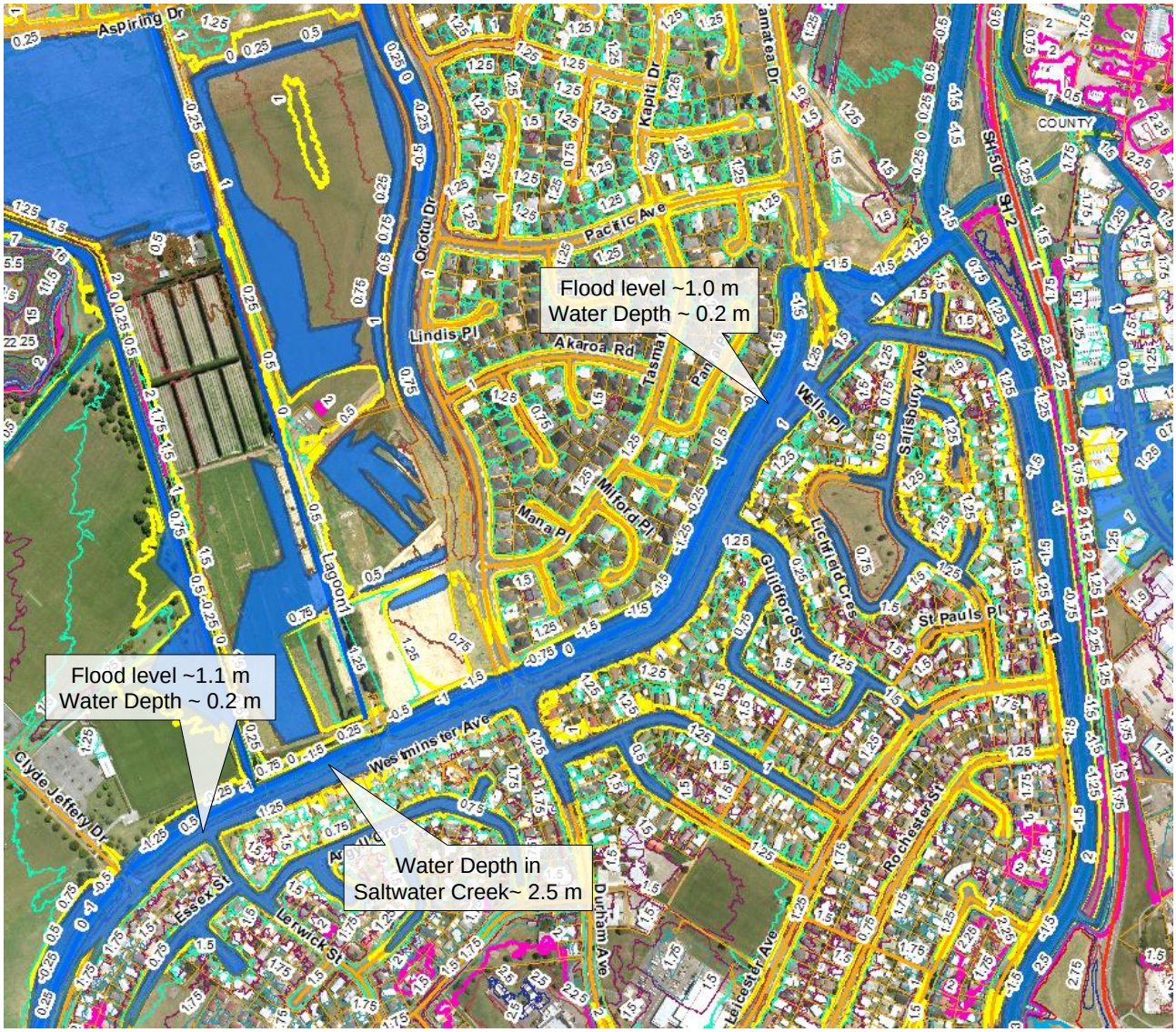


Figure 44: Flood Extents in Tamatea (datum NZVD16)

As part of the design of the open drain network at the Purimu pump station, stormwater is able to overflow to the west into the Lagoon Farm area, with flood extents show in Figure 45.

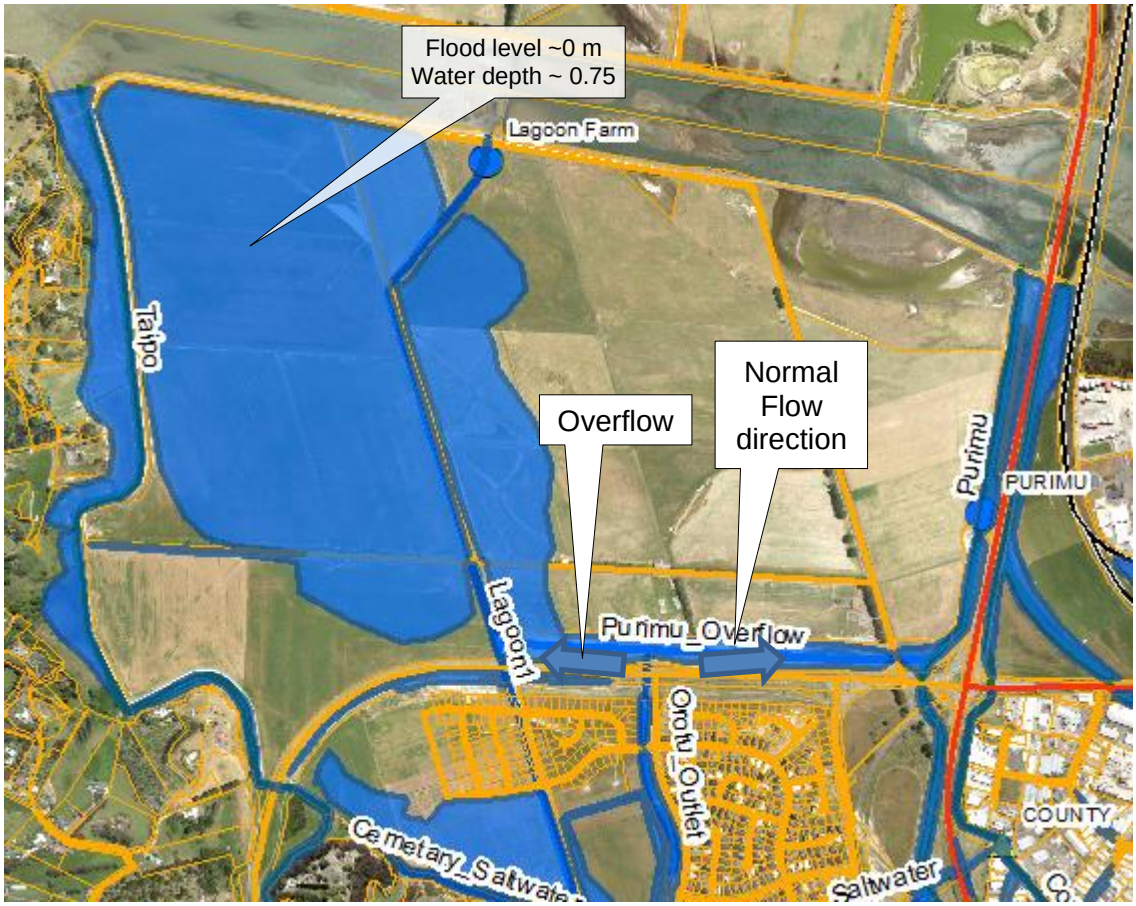


Figure 45*:* Flood Extents in Lagoon Farm (lower Purimu)

Figure 46*:* Flooding in Lagoon Farm (photo taken 8.17am 10th November)

Figure 47 shows the northwestern portion of Lagoon Farm with elevation data. The general ground level is 0.75m below sea level, with the drain inverts approximately 1.5m below sea level. This area is protected from permanent inundation by the Ahuriri Outfall Channel stop bank and the Lagoon Farm pump.

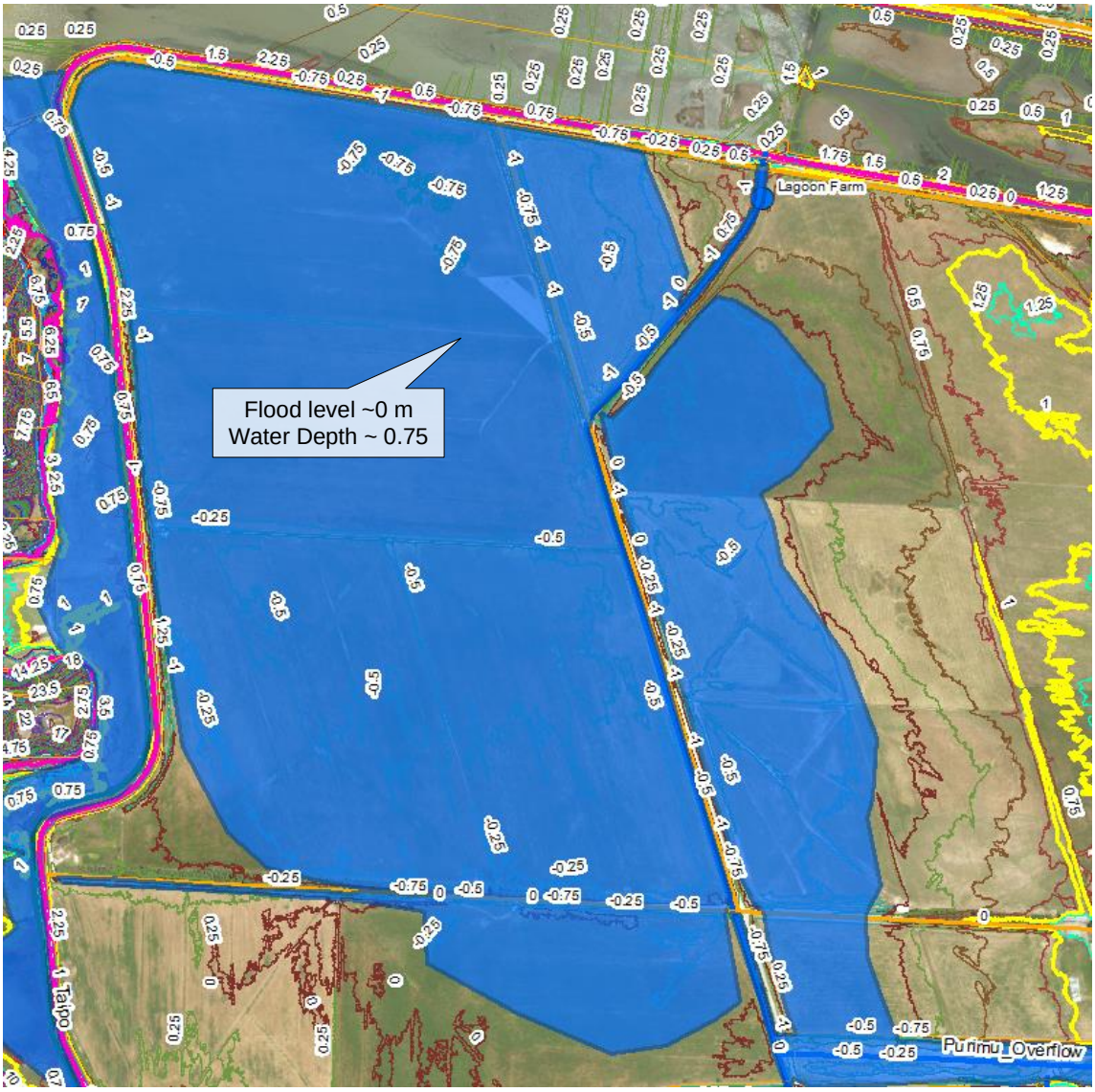


Figure 47: Flooding extent in Lagoon Farm with contours (datum NZVD16)

The Purimu pump station was operating through the event, with typical weed clearance issues which reduced the efficiency of the station. The run times of the pumps are shown in Figure 48.

Purimu Daily Runtimes

Date	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5
01/11/2020	0	0	0	0	115
02/11/2020	0	0	0	0	118
03/11/2020	0	0	0	279	0
04/11/2020	0	0	0	255	0
05/11/2020	0	0	0	0	108
06/11/2020	0	0	0	0	110
07/11/2020	0	0	0	265	0
08/11/2020	0	0	0	717	0
09/11/2020	525	479	561	1125	556
10/11/2020	876	926	1171	1023	1193
11/11/2020	1059	151	601	1054	48
12/11/2020	766	0	0	853	0
13/11/2020	171	0	0	750	344
14/11/2020	0	0	0	0	1275
15/11/2020	0	0	0	0	755
16/11/2020	0	0	0	557	272
17/11/2020	0	0	0	919	0

Figure 48*:* Purimu Pump Station run times (minutes)

Based on the nominal peak pump rates from the manufacturer's theoretical pump curves the rates are P1 = 5.7 m^3/s, P2 = 6.3 m^3/s, P3 = 5.7 m^3/s, P4 = 1.3 m^3/s, P5 = 0.82 m^3/s. The volume pumped at Purimu pump station over the period from 9th November to 13th November is approximately 3 million m^3. This may be an overestimate, since the pumps use variable speed drives which have a 'ramp-up' period and may run at lower peak rate if inflow to the station is less than the outflow.

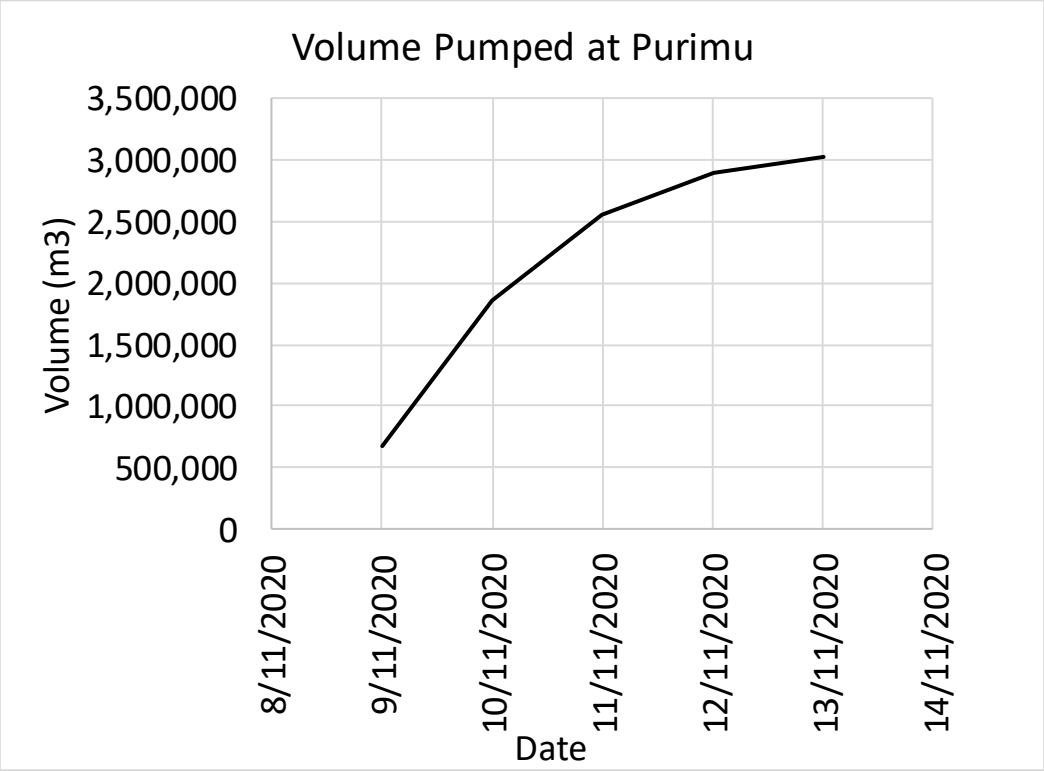


Figure 49*:* Purimu Pump Station volume pumped

The catchment area which flows to the Purimu pump station is approximately 17.4 km^2 under normal flow conditions. During high flow, some of the water flows into the Cross-Country Drain at the overflow location described earlier, and some water will flow to the Lagoon Farm overflow area, also described earlier. As a very rough calculation, the volume pumped (3 mil m^3) divided by the catchment area (17.4 km^2) equates to a runoff depth of 0.172 m, which is at least in the correct order of magnitude for the possible rainfall depth (200 mm to 250 mm). This calculation does not take into account the volume of water which overflowed to CCD or Lagoon Farm and is only considered a rough estimate to corroborate the rainfall depth.

5.2.4 County Drain Catchment (Pirimai, Onekawa)

Flooding in the County Drain catchment was significant, with inundation occurring in most roads, as well as many houses in Pirimai, businesses in Onekawa Industrial area, and the large rural area between Beatson Drain and Cross-Country Drain.

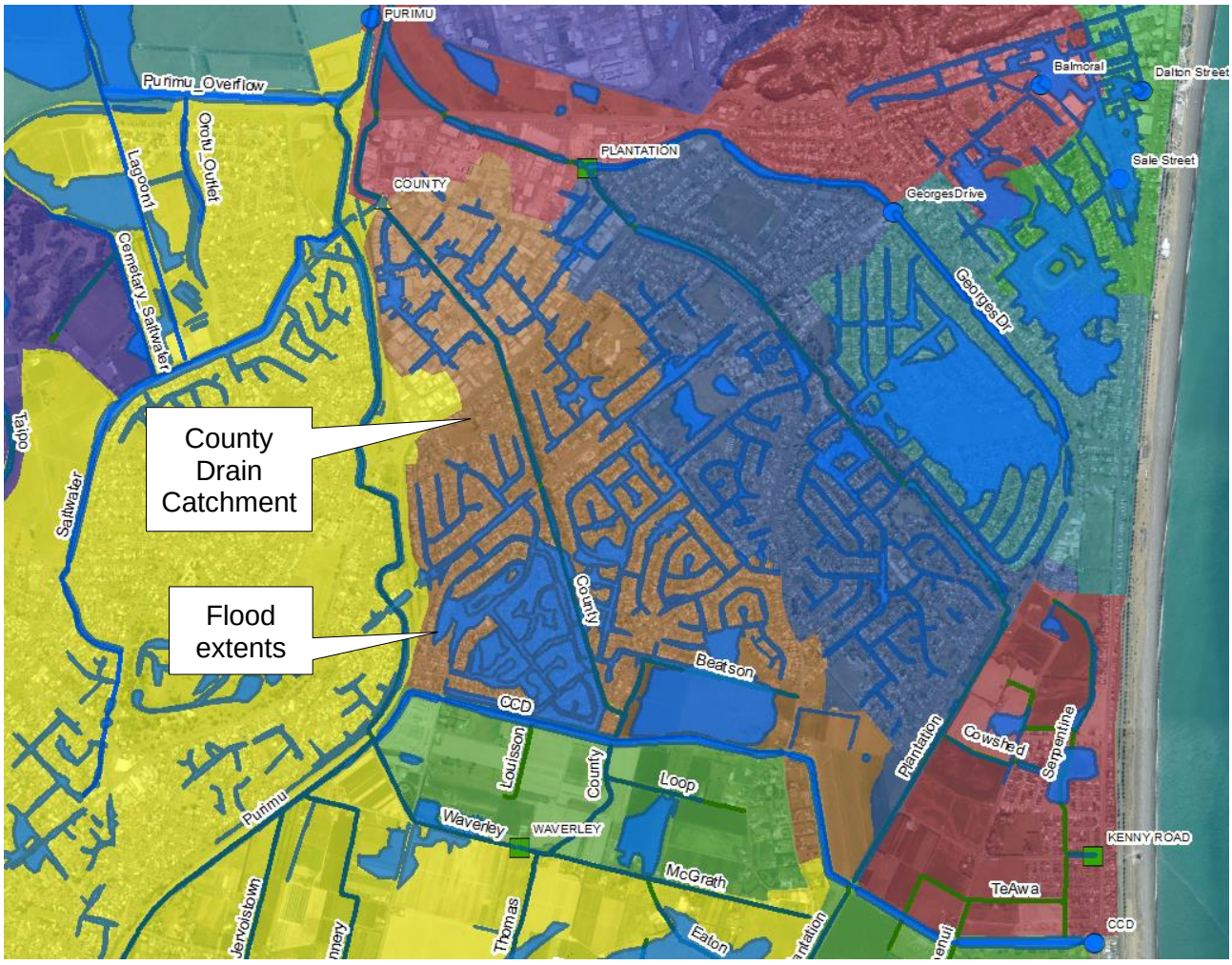


Figure 50: Country Drain catchment and flood extents

The rainfall distribution shown in Figure 51 indicates severe rainfall over the southern portion of the catchment (Pirimai) and the central portion (Onekawa), then a very steep gradient of rainfall in Onekawa Industrial with totals ranging from around 100 mm to over 250 mm in a very short distance.

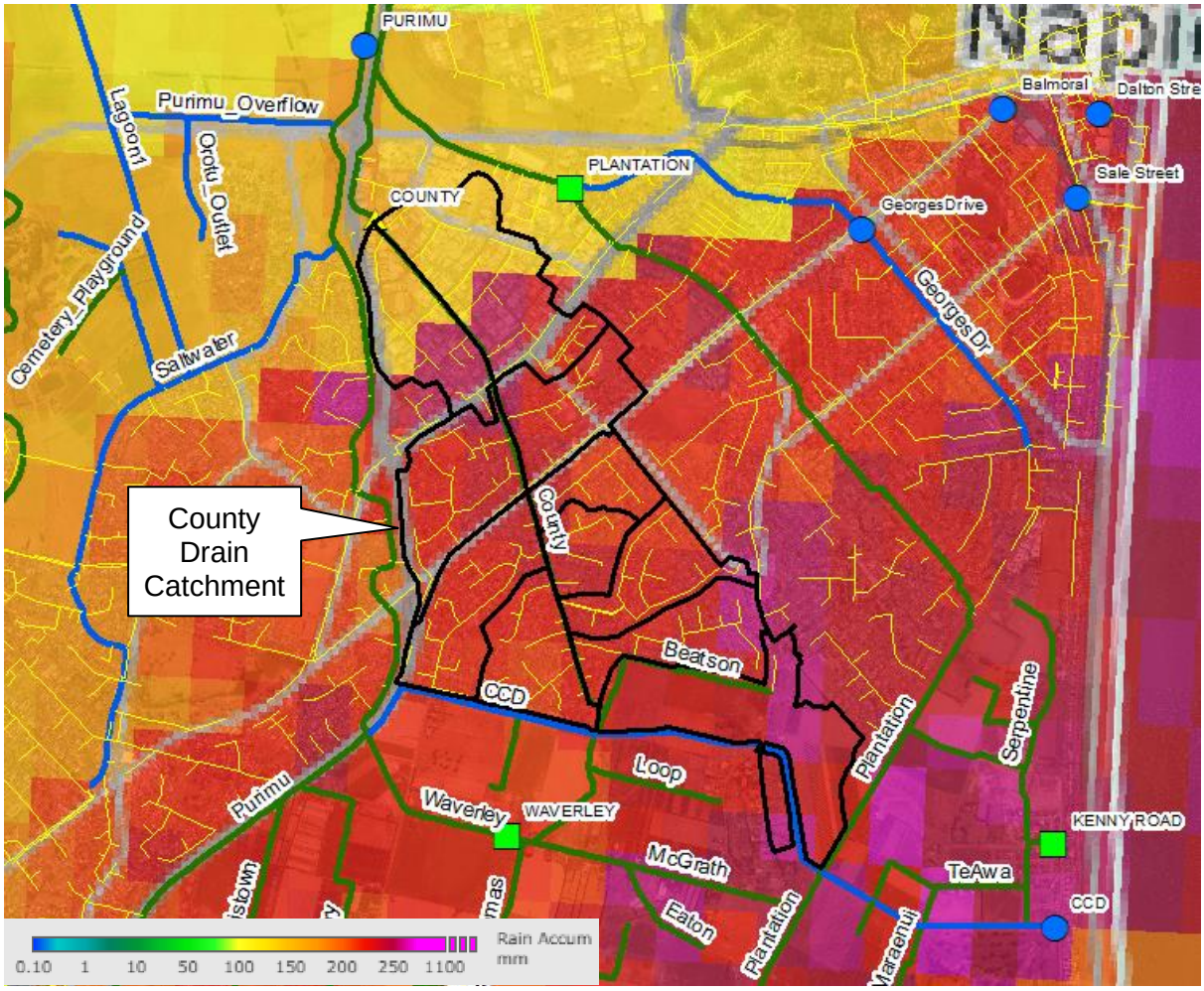


Figure 51*:* Rainfall totals based on Met Service Radar

Figure 52 shows the flood extents in the Pirimai area. This area is relatively low lying, with a large portion of the streets and some properties below elevation 1m (datum NZVD16). The outlet for stormwater is the County Drain, which flows north to the County Pump station. As the drain flows to the north, it passes through ground elevations at Taradale Road which are approximately elevation 2m.

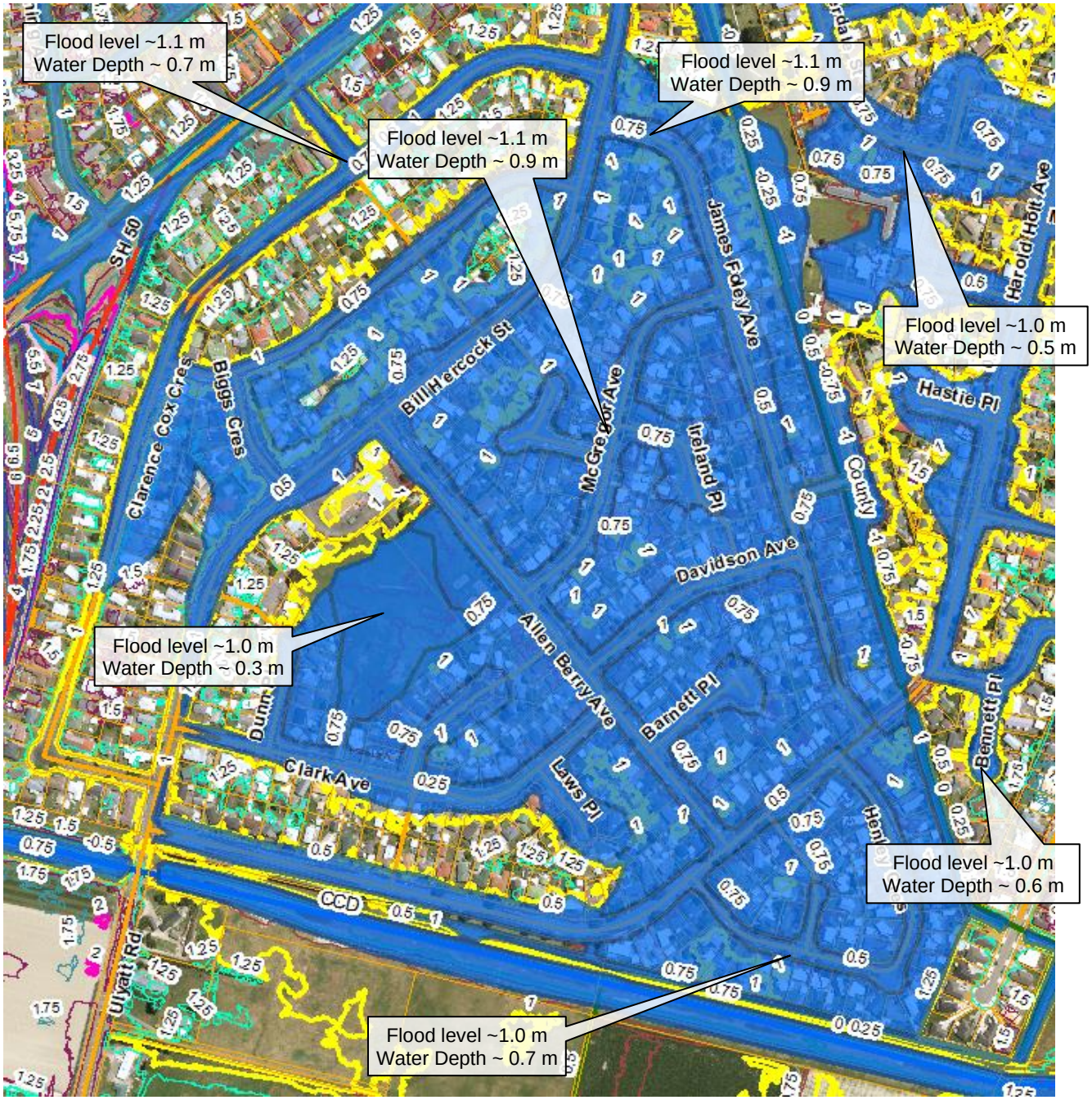


Figure 52*:* Flood extents in Pirimai (contour datum NZVD16)

Flooding of the streets is not unusual in this area, with flooding noted in 1963, 1974, 1976 and 2004. Actual flood levels for these events are not known, however, anecdotal evidence, and several old photographs of flooding in the area indicate similar flooding, but slightly less than the 9th November flood. Figure 53 shows the modelled 50-year flood extents created in 2003 (HBRC Hydrodynamic Model).

Figure 53*:* Modelled 50-year return period flood extents in Pirimai (datum NZVD16) (HBRC 2003 model)

Figure 54 shows the comparison between the modelled 50-year flood extents and the 9th November observed flood extents. The extents are very similar and considering there has been at least four flood events in the past 58 years (1963 to 2021) giving credibility to assigning a return period to the 9th November event to be approximately 50 years in this area of Pirimai.

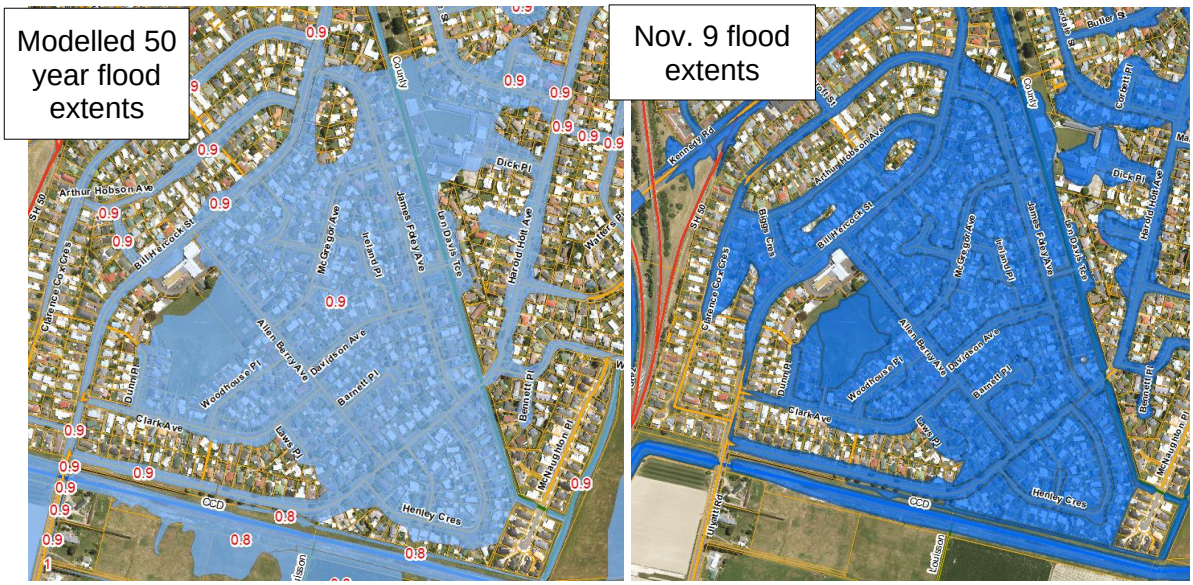


Figure 54: Comparison of Modelled 50-year return period flood extents to observed flooding in Pirimai (datum NZVD16).

Figure 55 shows the flooding extents in Pirimai at 8 am 10th November, well after the peak flood levels were lowered through the action of the County Pump Station.

Figure 55: Flooding in Pirimai – photo taken 8am 10th November (Photo Credit – Peter Scott).

The Onekawa Industrial area had significant surface flooding, with flood extents shown in Figure 56, and an example of flooding with a floating container along Niven Street in Figure 57.

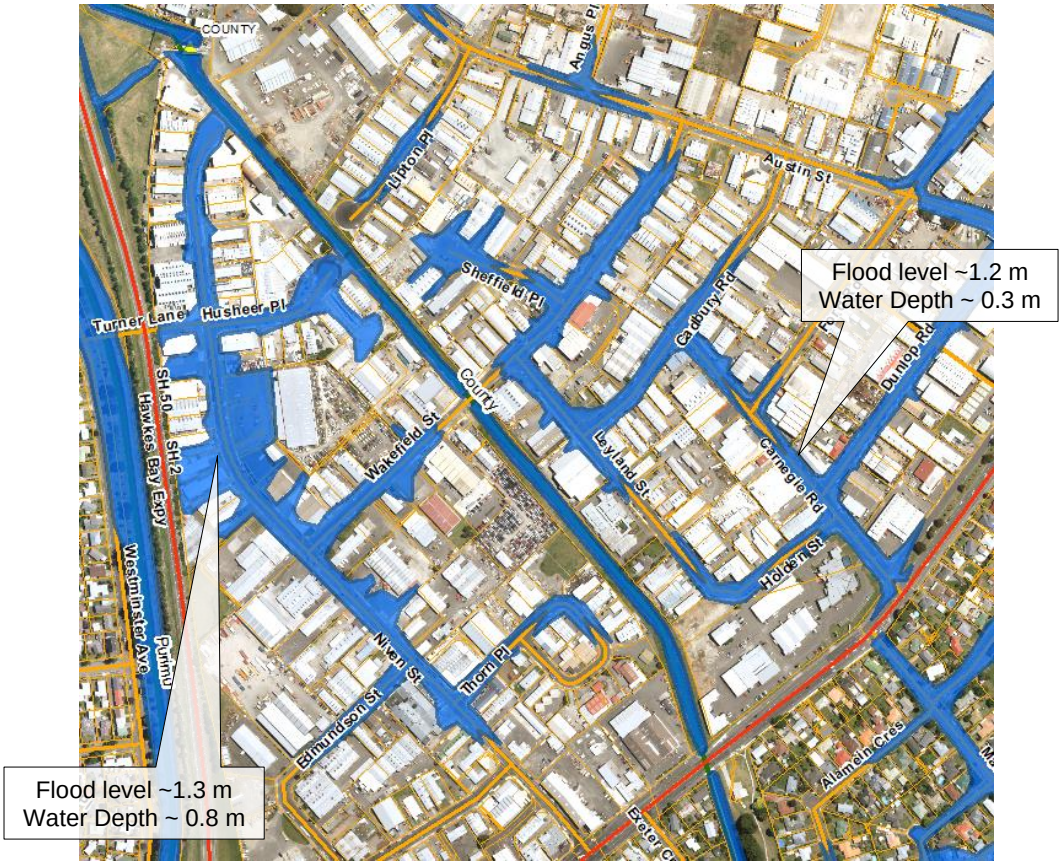


Figure 56*:* Flood extents Onekawa Industrial (datum NZVD16)

Figure 57: Flooding on Niven Street, Onekawa Industrial

Flooding with similar extents was experienced in October 2004. Stormwater disposal in the area is via the County pump station. The station configuration consists of three 1.9 m^3/s pumps on one power supply, and four 0.95 m^3/s pumps on a different power supply. During the 2004 event, power to the four 0.95 m^3/s pumps was interrupted. Portable generators were used to power two of the four pumps until mains power was restored after a delay of about three hours. In the 9th November 2020 event, power to the three 1.9 m^3/s pumps was interrupted at 6.30pm on the 9th November. The power supply company, Unison, was not able to restore power to this section of the network until 4:44 am on the morning of the 10th November. Weed and debris build-up on the screens to both sets of pumps was also an issue, with typical reduction in pump efficiency occurring as the build-up occurs. Clearing the debris from the screens is required almost continuously during these severe events, and while several clearing rounds took place, the pump efficiency therefore varied during the event, with a reduction in efficiency as the debris collected on the screens.

Due to the severe intensity of the rain, which results in water arriving at the station at a rate in excess of the pumping capacity, it is likely the power outage did not result in a significant increase in the flood level; however, it is certain the power outage increased the duration of the flooding of the event. Considering a similar event in this area occurred in 2004, and historic records indicate flood events in 1963 and 1974, the flood levels in the Pirimai portion of the catchment were assigned a return period of approximately 50 years, and the same flood level return period, i.e., 50 years is considered legitimate for the Onekawa Industrial area.

The Beatson Drain catchment is the lowest lying area in the County catchment, with ground levels starting at elevation 0.25m (NZVD16), as shown in Figure 58. The overland flow is from east to west, with outflow to the County Drain.

Flooding in this portion of the catchment was significant, with the extents shown in Figure 58, and evidence of overflow to the Cross Country Drain shown in Figure 59.

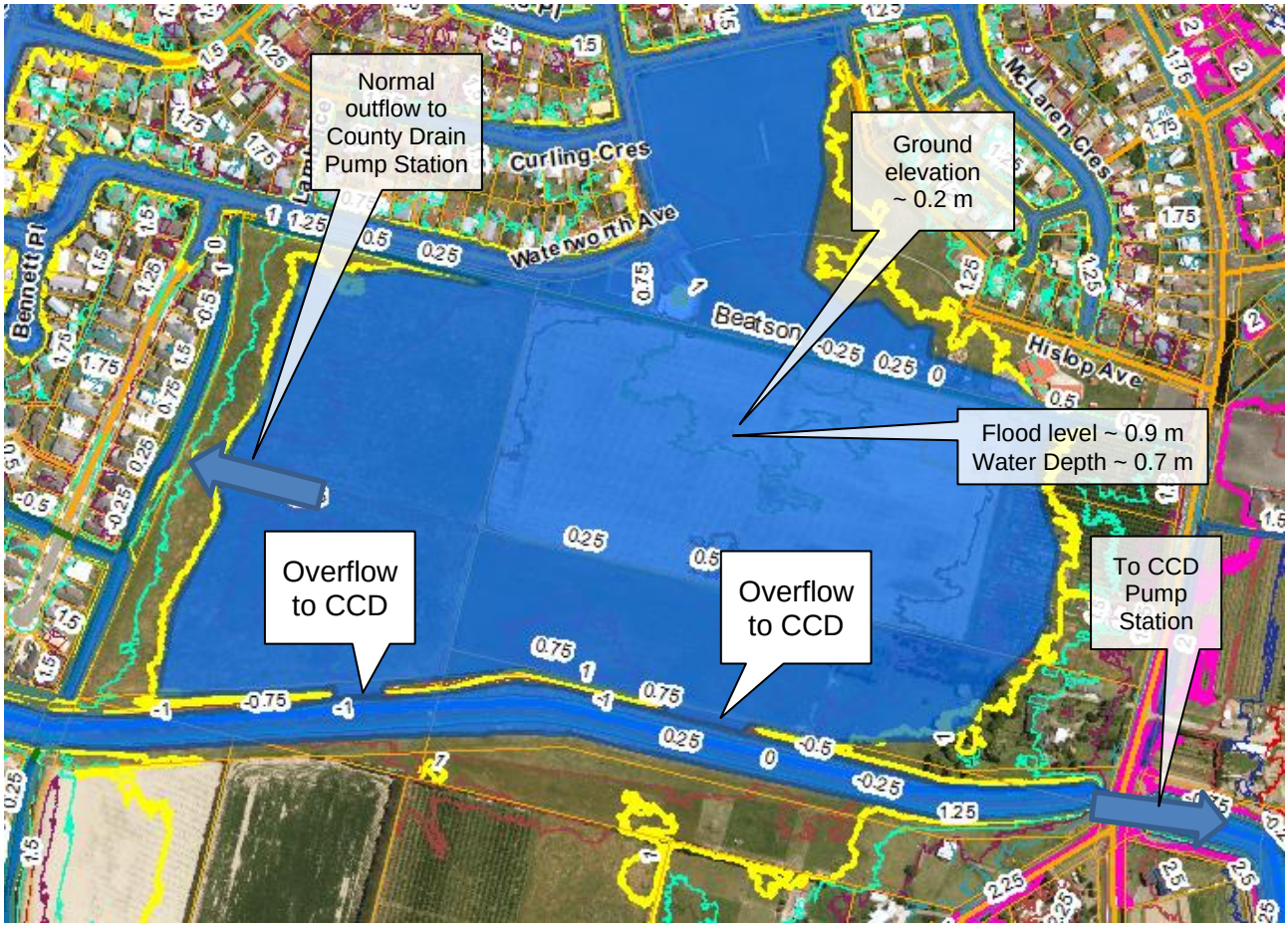


Figure 58*:* Flood extents, Beatson Drain (contour datum NZVD16)

Figure 59: Photo of Flood extents, Beatson Drain 8am, 10th November (Photo Credit – Peter Scott)

The overflow evidence indicates the peak water level in the area reached just below elevation 1.0m (NZVD16), with water overtopping the CCD stop bank in the areas where the bank is just below elevation 1m.

The amount of water that appeared in the Beatson Drain catchment is far in excess of the rain that fell in the direct Beatson Drain catchment, indicating there was likely to have been overland flow into the area. It is likely that the stormwater pipe network in the Onekawa area was full, and not able to discharge due to high water levels in the County and Plantation Drains, which resulted in overland flow occurring in the street

network. The general slope of the land is from the north to south, resulting in a much larger catchment flowing into the Beatson Drain area, as shown in Figure 60 and Figure 61.

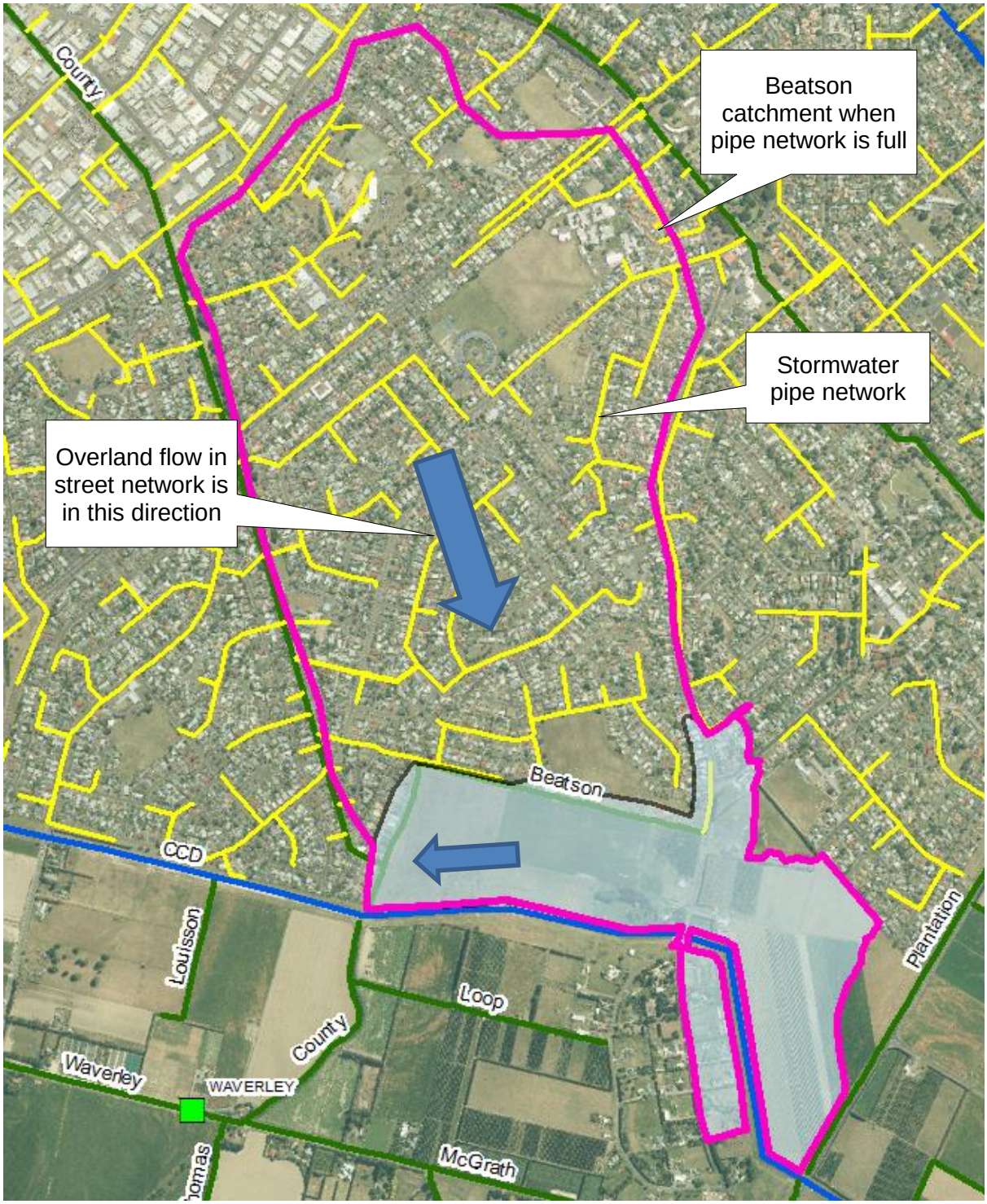


Figure 60: Catchment Area of Beatson Drain when pipe network is full and overland flow occurs

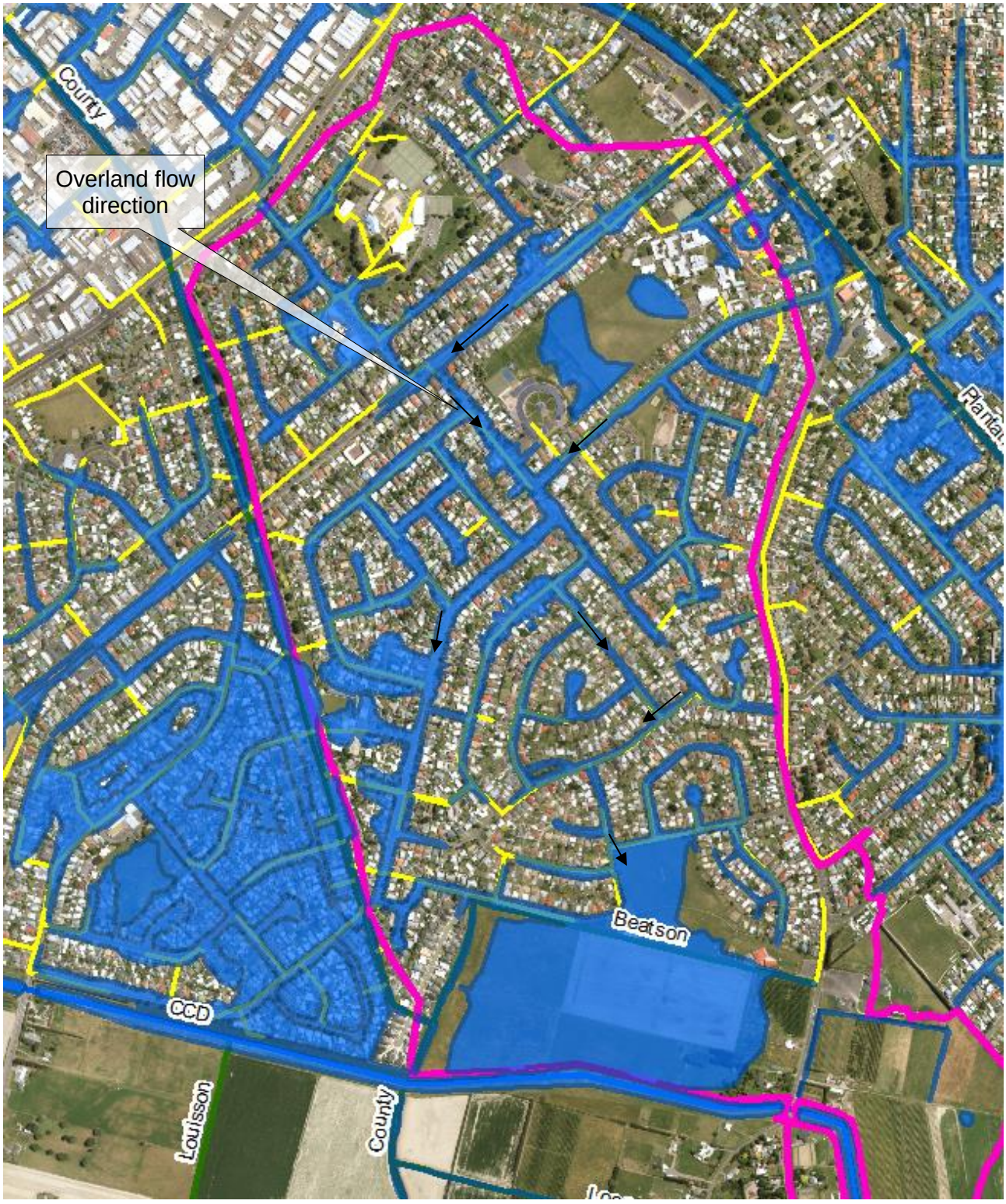


Figure 61: Flooding extents within extended Beatson Catchment

5.2.5 Plantation and Georges Drive Catchments (Marewa)

The Plantation Drain and Georges Drive Drain are both pumped catchments (see Figure 62), with some interaction in overland flow that could flow to either drain depending on the circumstances.

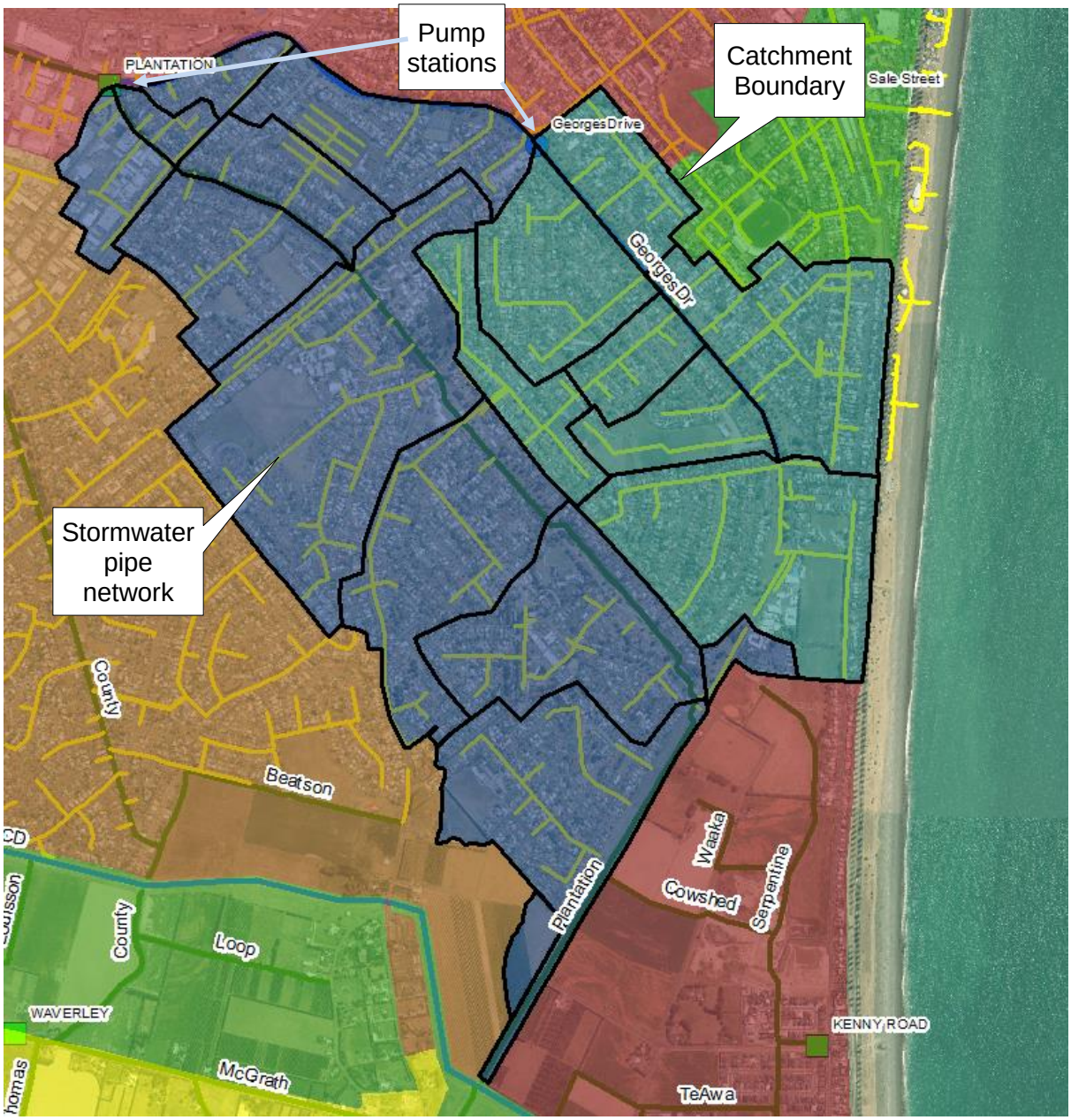


Figure 62: Plantation and Georges Drive Catchments

The rainfall in this catchment (see Figure 63) was severe, with totals ranging up to 250mm for the entire event, most of which fell in the time between 1pm and 7pm 9th November.

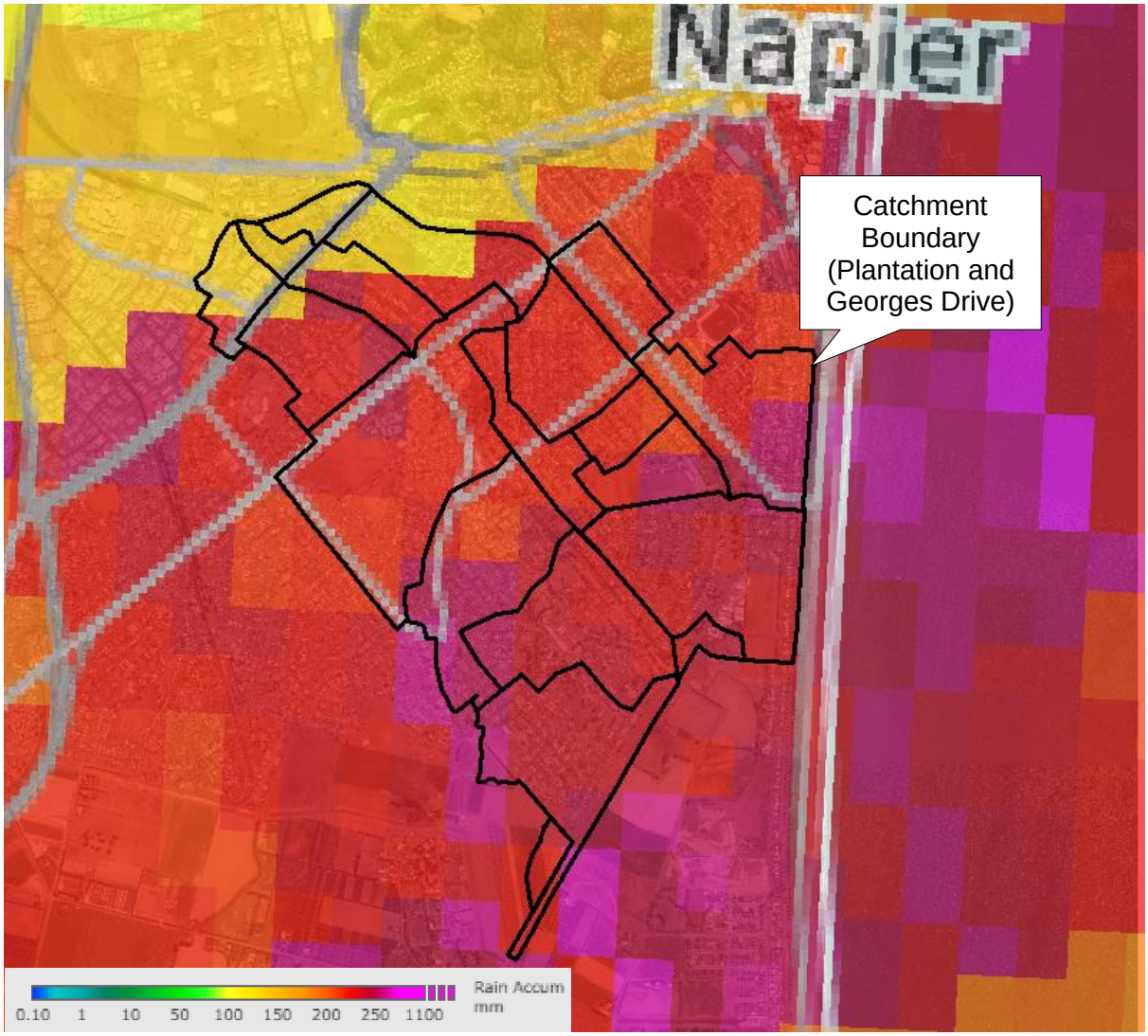


Figure 63: Rainfall totals based on Met Service Radar

Flooding in this area was severe, in particular in the Whitmore Park and surrounding suburbs, as shown in Figure 64. Numerous properties suffered from surface ponding, and many houses and other buildings were inundated to various levels.

Figure 64: Flood extents in Plantation and Georges Drive Catchments

Figure 65 shows the ground level contours in this area, with the lowest elevations being at 1m above sea level (NZVD16) around Whitmore Park. Flood levels in this area peaked around elevation 1.75m.

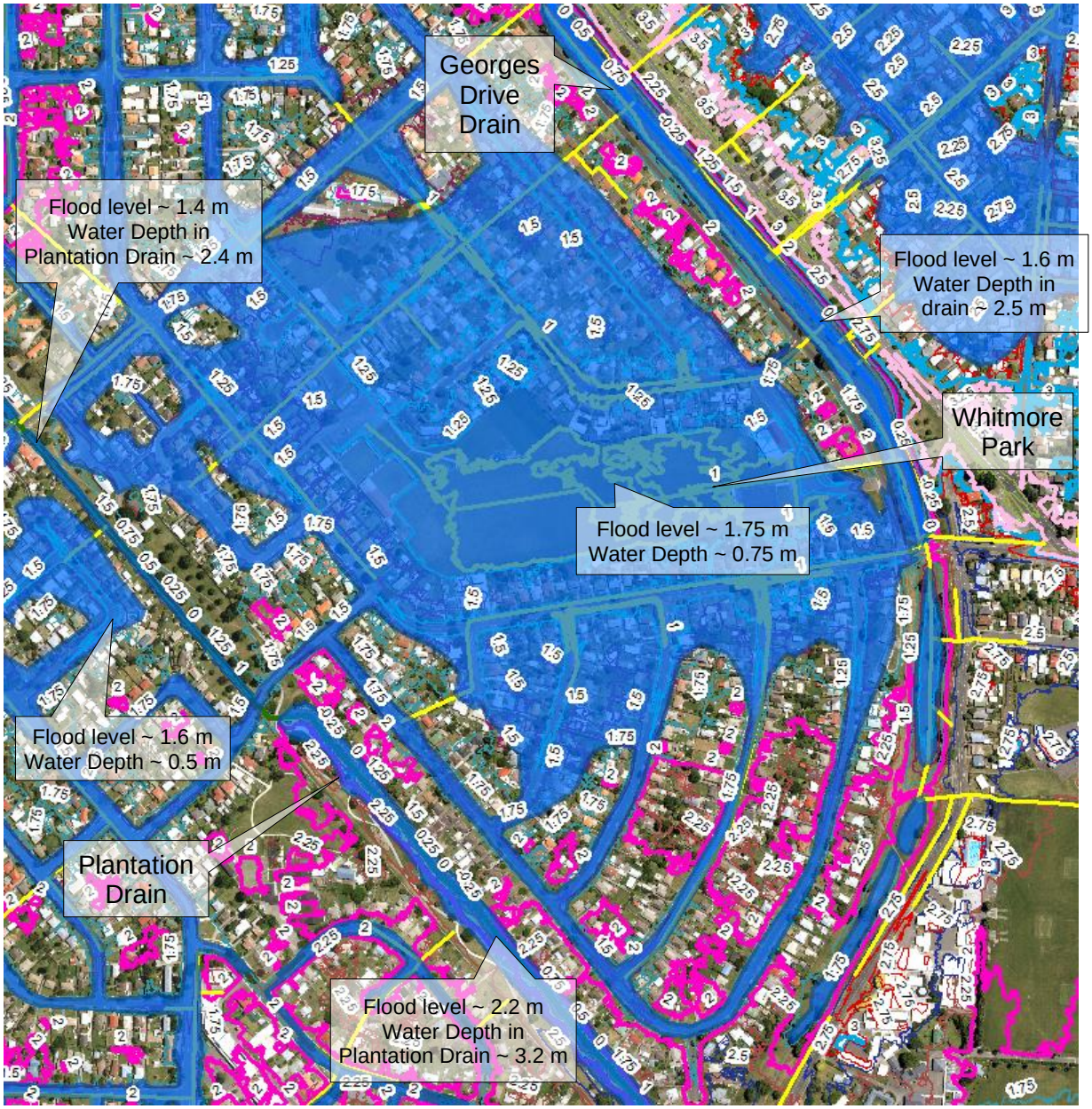


Figure 65: Flood extents in Plantation and Georges Drive Catchments (contour datum NZVD16)

Figure 66: Photo of flooding near Whitmore Park Nov. 10, 8 am. (Photo credit – Peter Scott)

The modelled 50-year flood level in this area has a peak water surface elevation of 1.5 m (NZVD16), as shown in Figure 67. Considering this level compared to the observed peak water levels in this area (approximately elev. 1.75 m), it can be concluded that the return period for the event in this location was greater than 50 years.

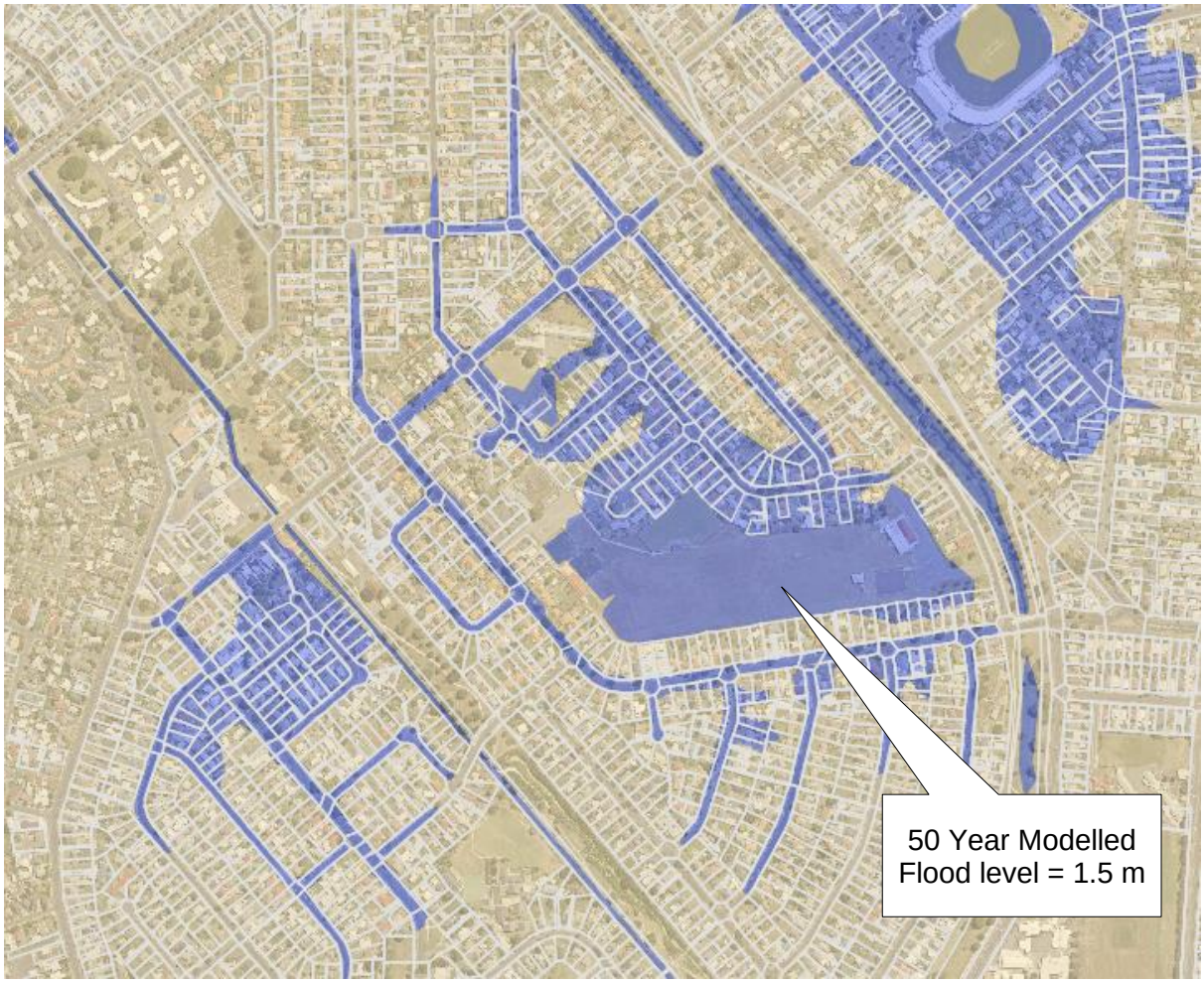


Figure 67: Modelled 50-year return period Flood extents near Whitmore Park (datum NZVD16)

5.2.6 Napier City Catchments (CBD and Napier South)

The area within Napier City central business district received severe rainfall, ranging up to approximately 250 mm for the entire storm (see Figure 68), with most of this rain falling between 1pm and 7pm on the 9th November.

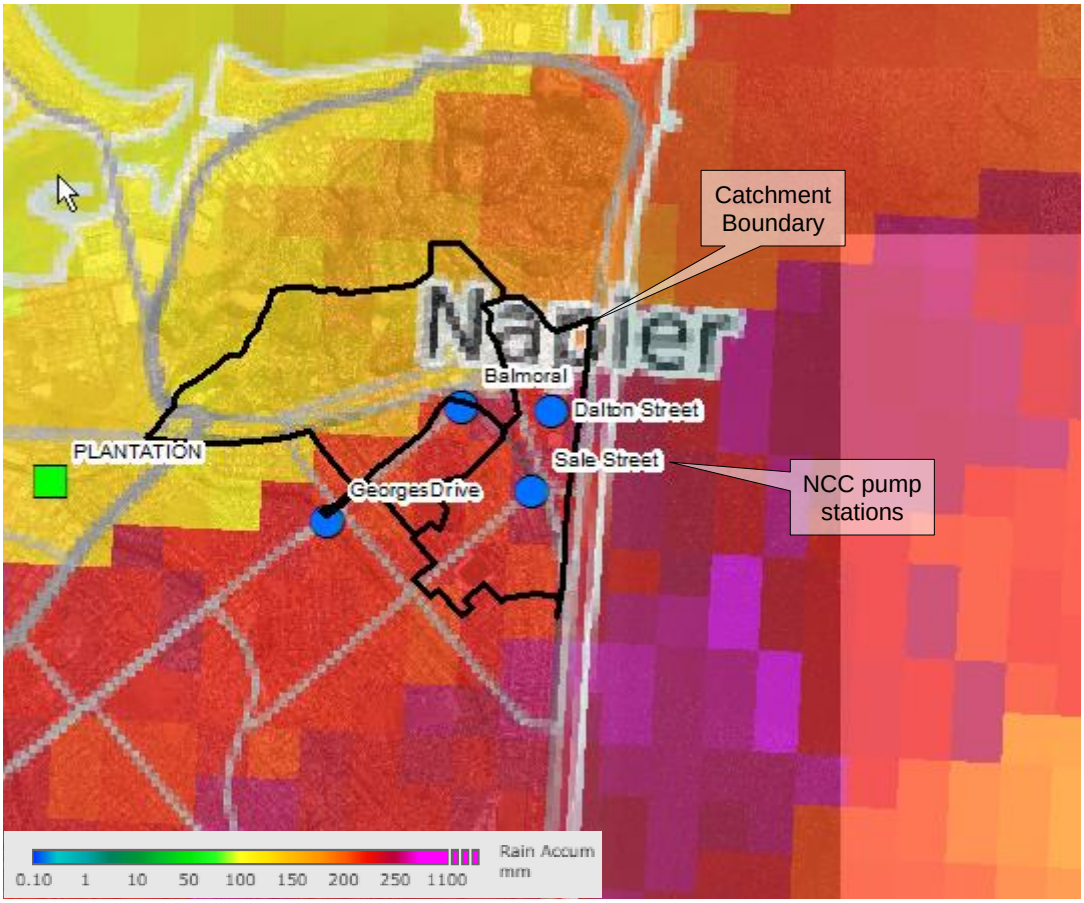


Figure 68: Rainfall totals based on Met Service Radar

The CBD is mostly impervious surfaces, and surface flooding occurred very quickly as the stormwater flowed off the southern part of Napier Hill and into the streets. Flooding extents are shown in Figure 69.

Figure 69: Flood Extents for Napier CBD and Napier South (datum NZVD16)

In Napier south, extensive flooding of property including many houses occurred in the area from Nelson Park to the south of McLean Park, as shown in Figure 70.

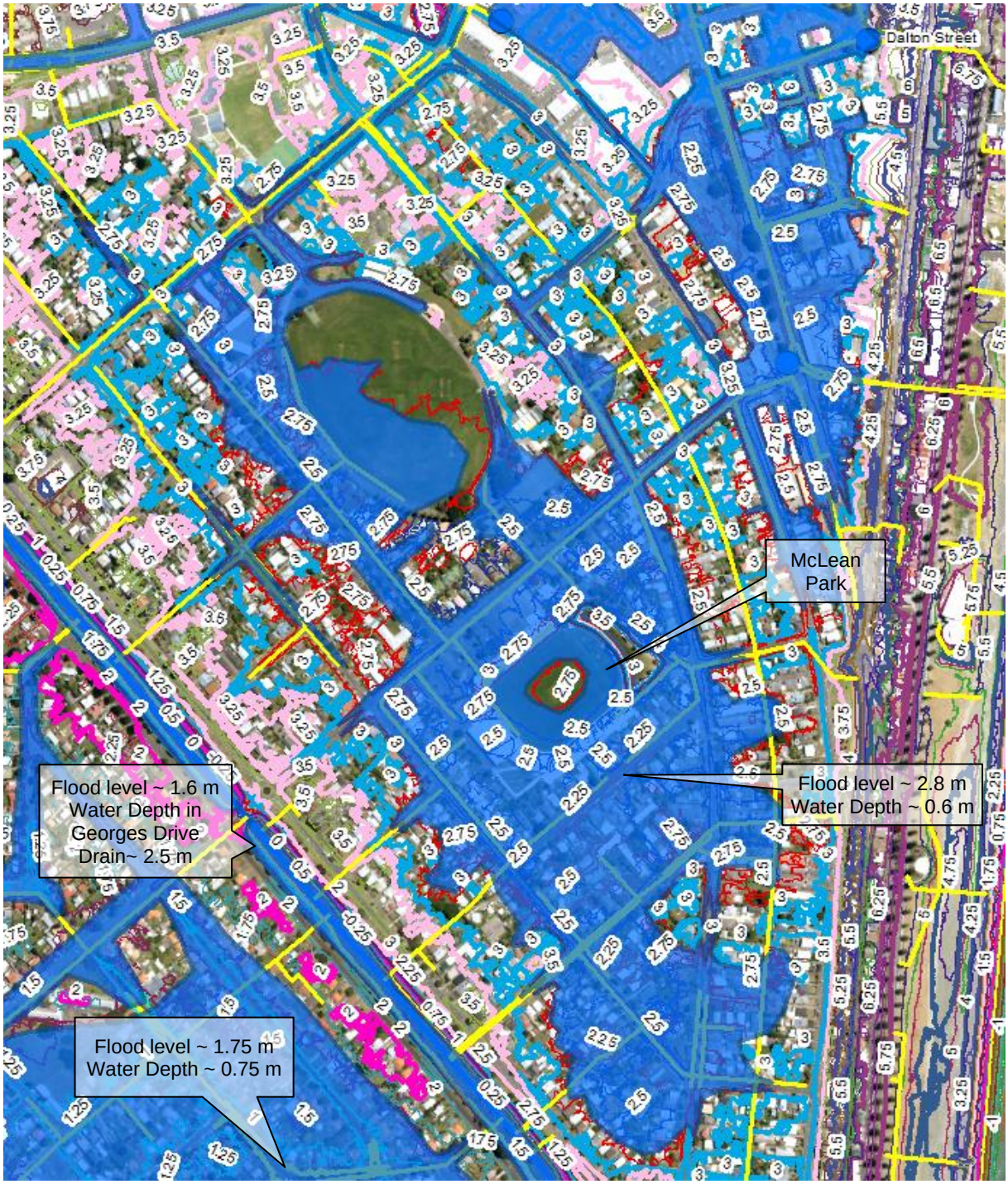


Figure 70: Flood Extents Napier South – (contour datum NZVD16)

It can be seen clearly from the contours the area around McLean Park is a basin surrounded by land at about elevation 3m (blue contour). The exits for stormwater from this area are from the pump station at Sale St, or by the pipe network connected by gravity to Georges Drive drain, which is then pumped. The combination of water from this area of Napier South and Marewa arriving at Georges Drive pumping station results in delays in removing the stormwater in the area. It is quite likely that the delays in removing the flood waters from the Whitmore Park area (peak flood level ~1.75m) would have been exacerbated from the higher flood waters from around McLean Park (peak flood level ~ 2.8m). The approximate 1m higher water levels would essentially continue to hold the Whitmore levels high, until the McLean Park levels were reduced.

Figure 71 and Figure 72 shows the location and profile of the ground levels across Napier suburbs from the Motorway to the sea. The profile shows the various flood levels across Napier, including the issue described above where flood water from Napier South is higher in elevation, and would flow to Georges Drive Drain and maintain the high levels around Whitmore Park.

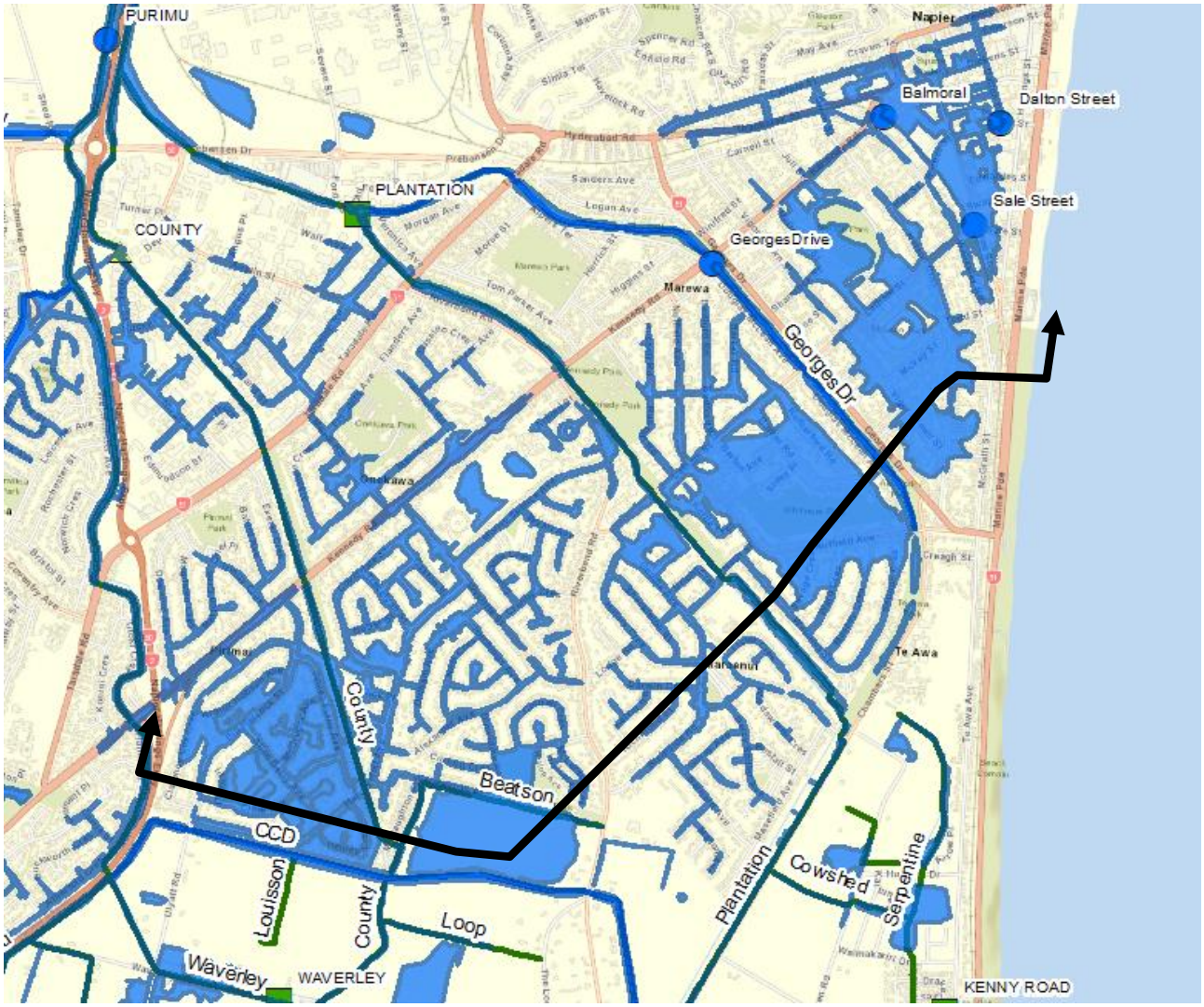


Figure 71: Location of Profile across Napier Suburbs

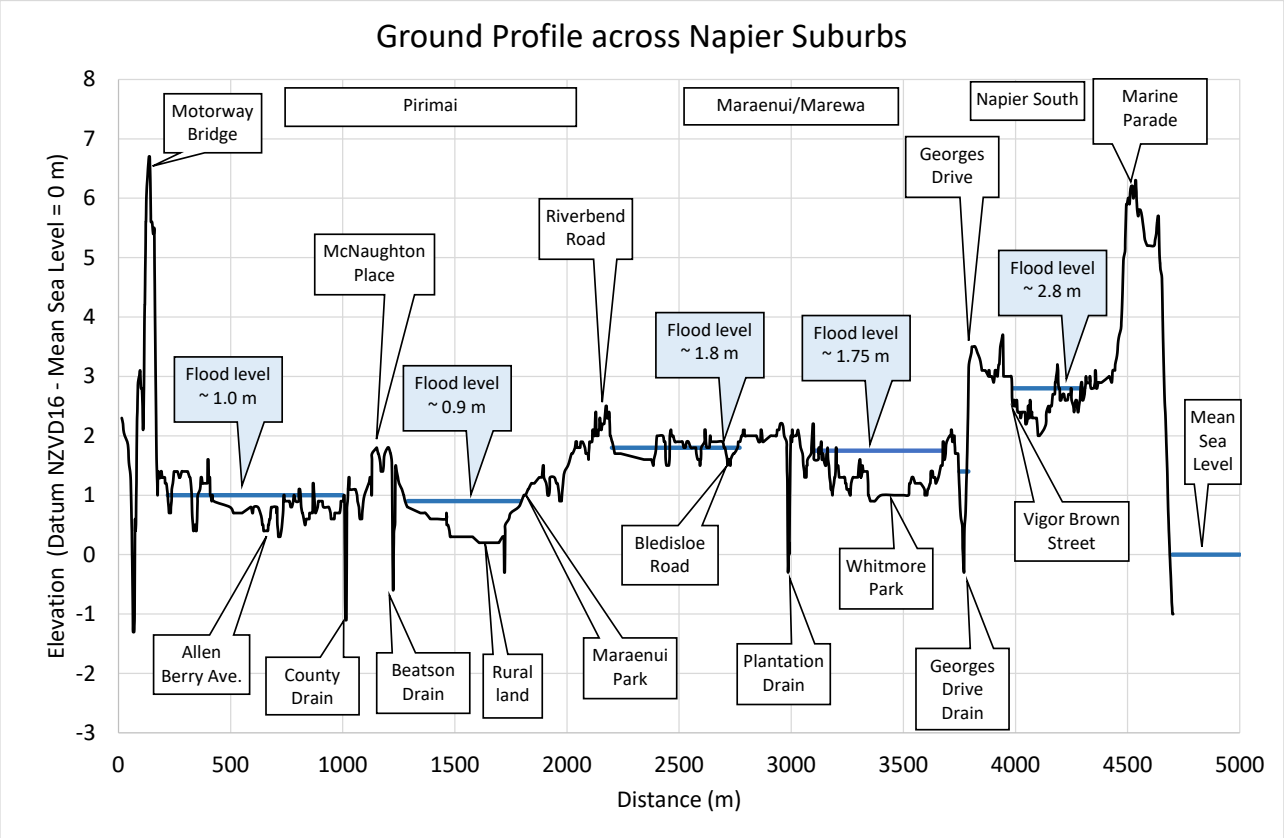


Figure 72: Ground Profile and Flood Levels across Napier Suburbs–(contour datum NZVD16)

The modelled 50-year flood level in this area has a peak water surface elevation of 2.7m (NZVD16), as shown in Figure 73. Considering this level compared to the observed peak water levels in this area (approximately elev. 2.75m), it is reasonable to estimate that the return period for the event in this location was in the order of 50 years or slightly higher.

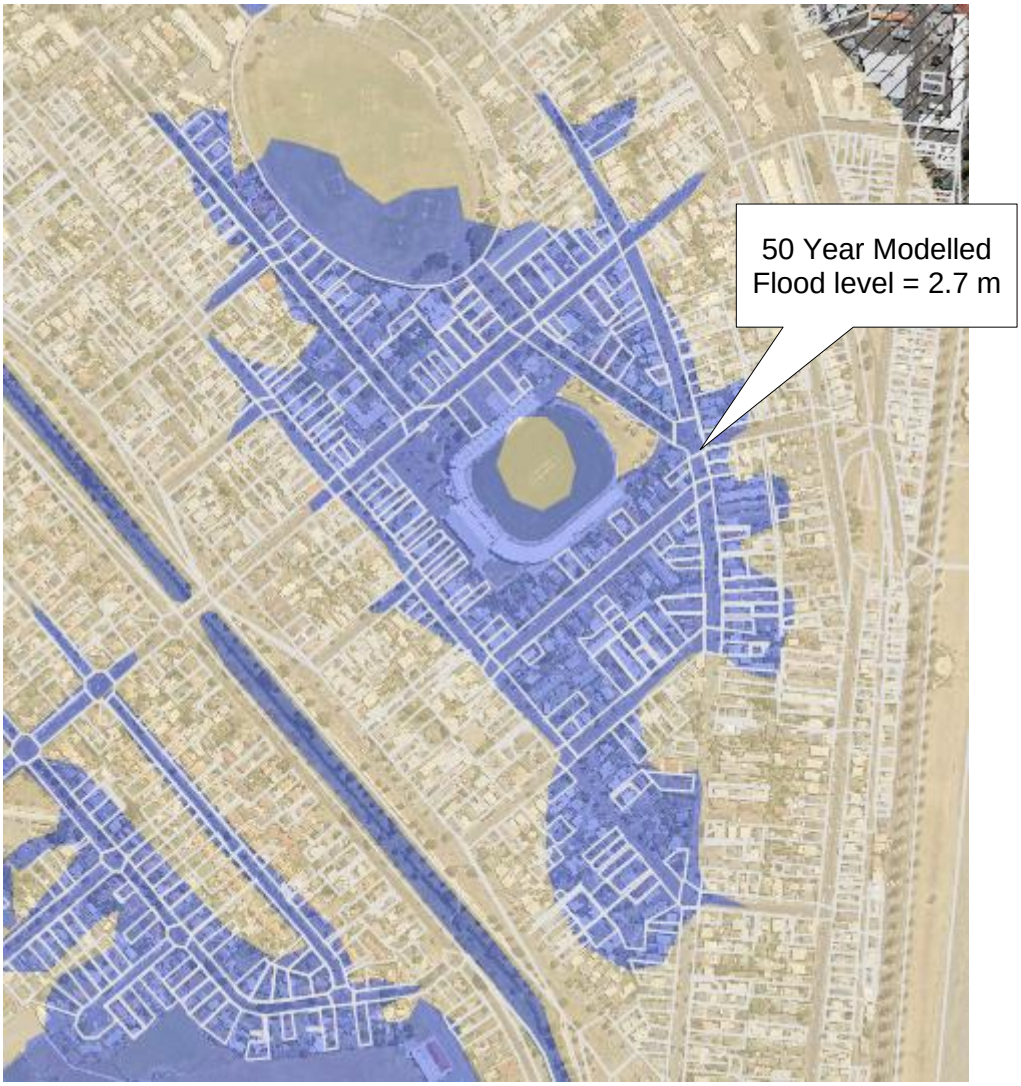


Figure 73: Modelled 50-year return period flood extents in Napier South (datum NZVD16)

5.2.7 Te Awa Catchment (Kenny Road)

The detention pond in the Te Awa subdivision filled to capacity, which is consistent with the design. The stormwater is then pumped out to the ocean via the Kenny Road pump station. Figure 74 shows the rainfall on this catchment, which appears to be at least 250 mm over most of the catchment.

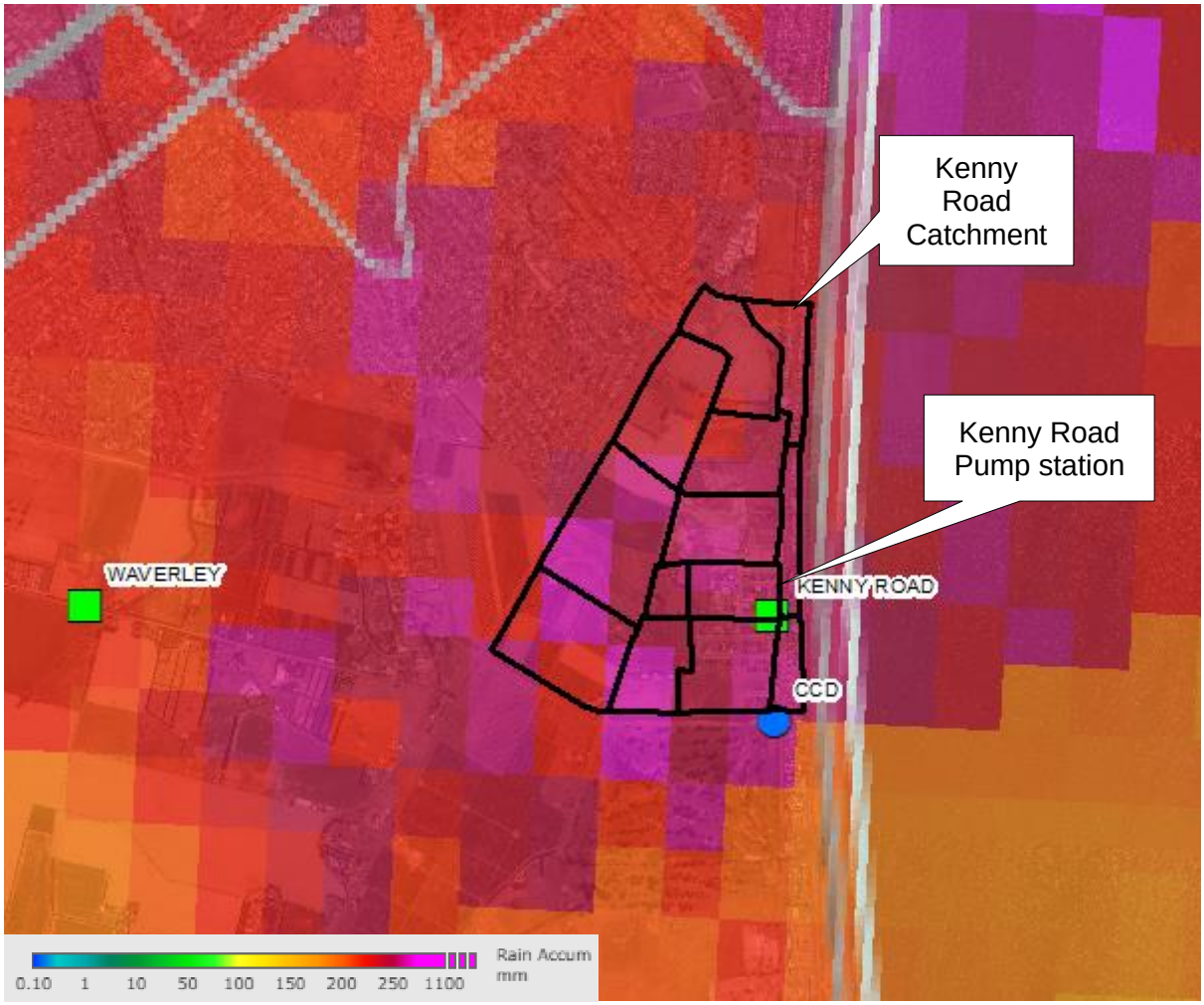


Figure 74: Rainfall totals based on Met Service Radar

Figure 75 shows the area in the morning after the event. While the pond area filled quickly, there were no reports of inundation of houses in this area.

Figure 75: Te Awa subdivision showing detention pond, 8am 10th November (Photo Credit – Peter Scott)

5.2.8 Ahuriri

Waghorne Street in Ahuriri suffered significant flooding, with many properties and several houses inundated, as shown in Figure 76.

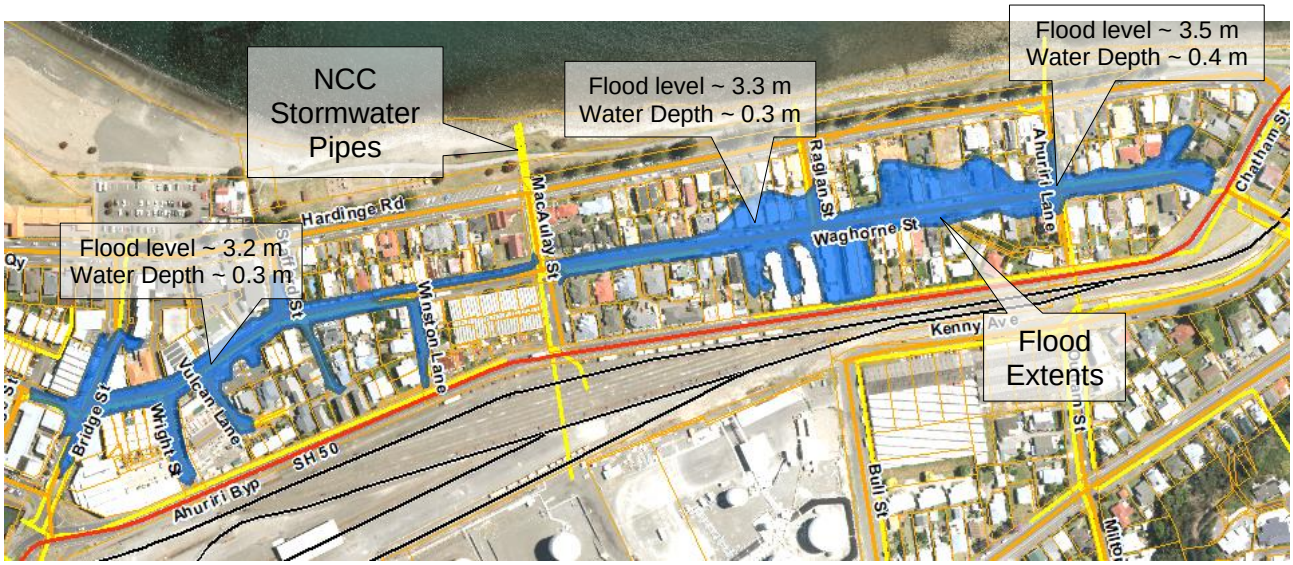


Figure 76: Flood extents in Ahuriri (contour datum NZVD16)

The Ahuriri catchment includes the northern portion of Napier Hill, (see Figure 77) which appears to have received up to around 200 mm of rainfall over the entire storm period, with the bulk of it falling in the 6 hours from 1pm to 7pm. The steep gradient of the hill delivers the overland flow to the Ahuriri area very quickly, and the water accumulated in Waghorne Street, before flowing out the stormwater pipe system to the ocean. The nominal design standard for the pipe network is to convey a 10-year event, with overland flow occurring after the pipes are full. Due to the low-lying nature of Waghorne Street, with the high beach crest of Hardinge Road to the north, and the high land of railway land to the south, there is no specific overland flow path able to convey stormwater away from the area, and ponding occurs until such a time as the pipe network is able to convey the flow to the sea.

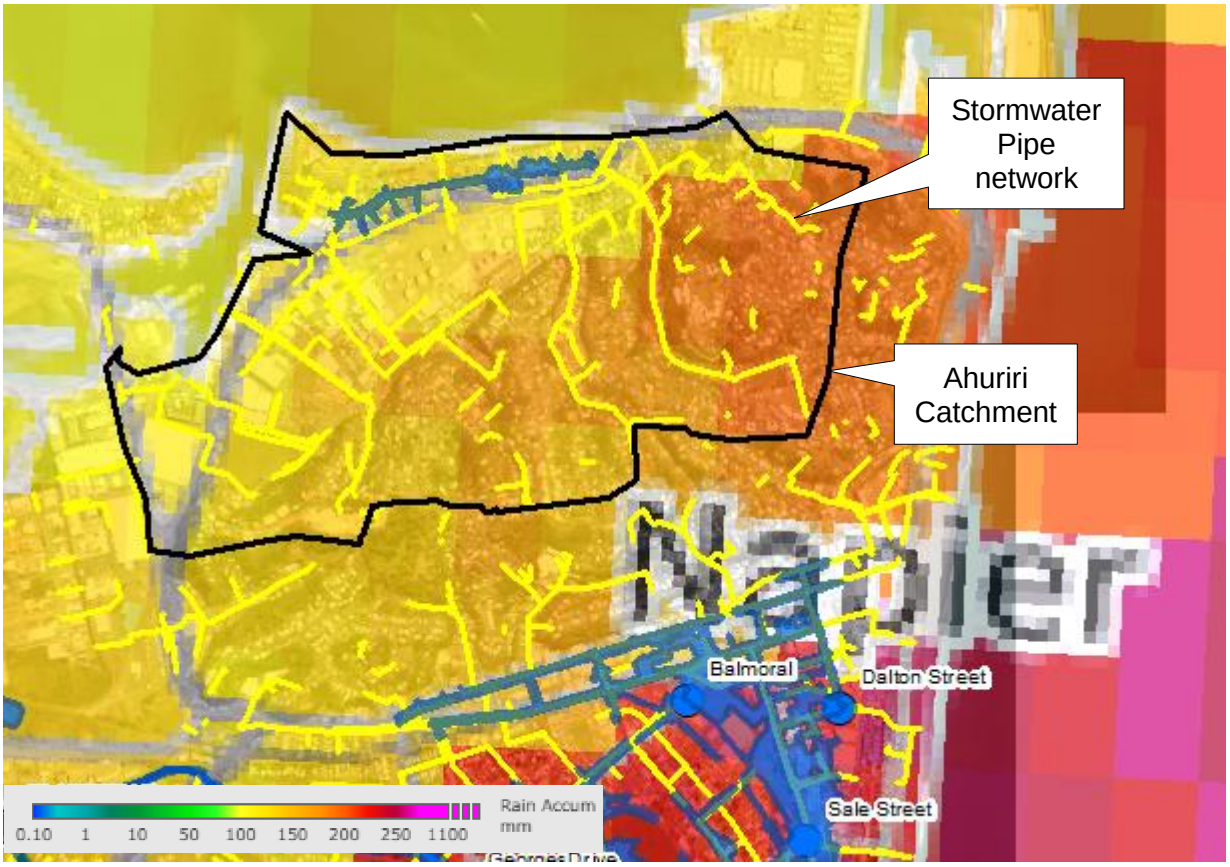


Figure 77: Rainfall totals based on Met Service Radar

5.2.9 Summary

Intense rain fell on the Napier area for approximately 6 hours from 1pm to 7pm on November 9, 2020. The rainfall was not distributed evenly across the area, with the most intense portion in the coastal area, and lesser intensity as the storm moved inland towards Taradale. Flooding extents were severe in some locations, and many properties and houses were inundated to levels which made the houses uninhabitable. The return period of the flood levels has been estimated using observed levels, as well as historic information and computer modelling results. The estimated return periods are shown in Figure 78. Note these will differ from the rainfall return periods.

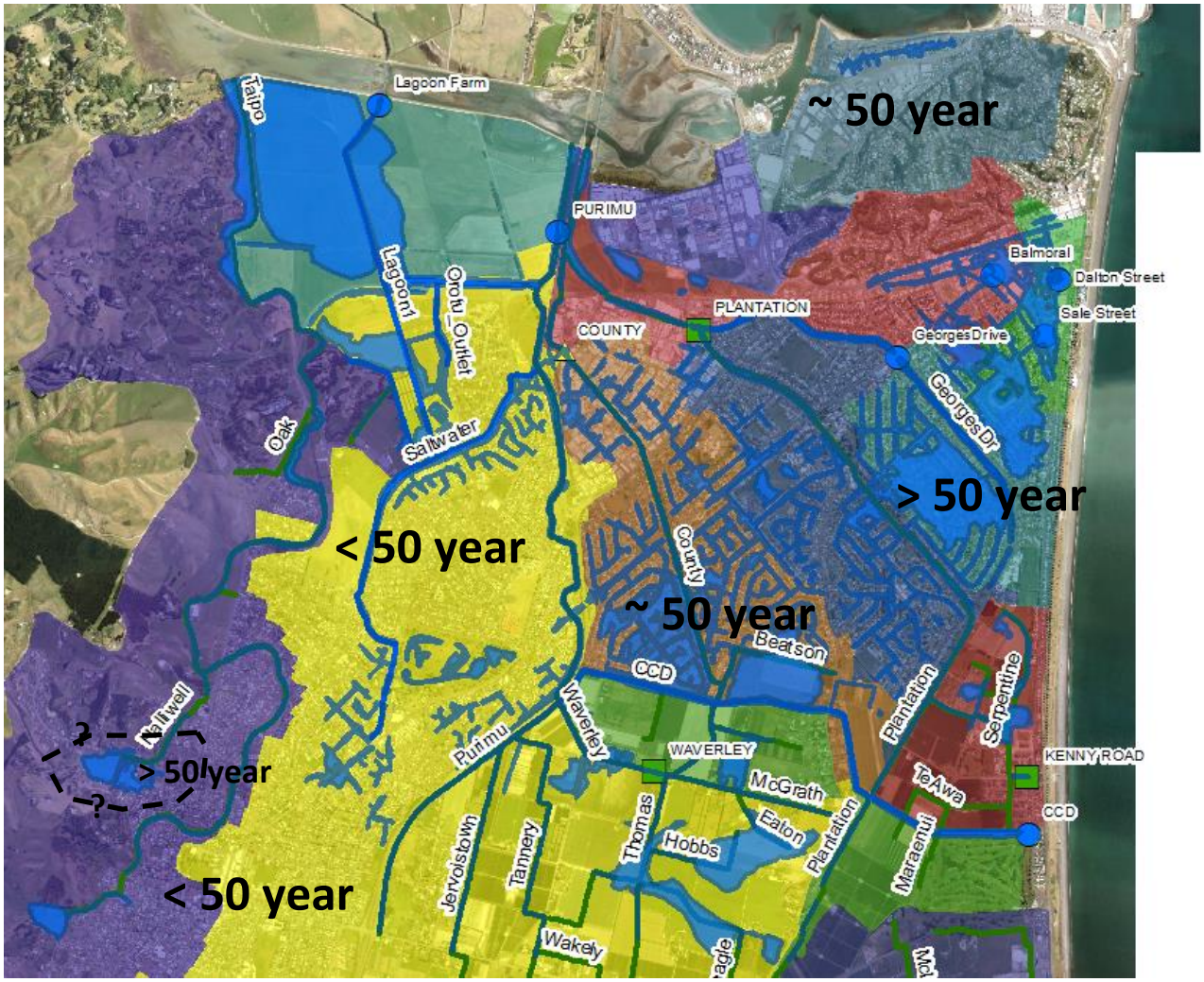


Figure 78: Flood extents and flood level return period for 9th November 2020 storm event in Napier

5.2.10 Overall drainage scheme performance

As this report focuses on the causes and consequences of the event, it is useful to comment briefly on the consequences of the performance of the over drainage scheme, recognising that any detail analysis of performance should be considered as part of a formal scheme review.

The stormwater network and drainage scheme that serves Napier was not designed for an event of this magnitude. It is fair to say that most stormwater and drainage networks in New Zealand are not designed or able to cope with the influx of water that was experienced during this event.

Upon receipt of the warnings, both authorities mobilised staff from works departments to prepare the network for heavy rainfall. This entailed ensuring stations were operating as required, and debris grates cleared and able to remove water. It is not clear exactly what activities were done at each part of the network in preparation, or the level of coordination and prioritisation that was given to critical assets within the system by the two authorities. Anecdotally, it appeared that much of the pre-event preparatory work is conducted in isolation from each other at the operational level, but nevertheless both authorities worked well together with the Regional Council providing assistance to support co-management. The status of the drainage scheme prior to the event and the on-going maintenance conducted, such as debris and weed clearance undertaken in the months preceding the event, is not clear from the interviews or resources supplied during the process of developing this report.

The Napier drainage system relies on pumps with roads acting as storage for stormwater until it can be pumped away. The pipe network is a 1 in 10-year capacity and the drainage network has a 1 in 50-year capacity. Despite some issues with power supply and debris management at times during the event, the drainage scheme performed to its design capability most of the time, and at times in some places beyond its capability. However, the short duration and intense magnitude of the rainfall had a return period in some parts of the city, which was likely to be greater than 100 years, and produced volumes of water that far exceeded the design capability of the system and resulted in ponding of water beyond that allowed for in roads and storage sites. With 75% of the stormwater network requiring pumping, ponding of stormwater was experienced until it was able to be removed.

The majority of the flood water was removed in three days, with pump stations operating continuously. Power interruptions at some sites during the event may have resulted in some additional ponding within areas, but even without these interruptions it is highly likely the flooding would have still occurred on a similar scale. Debris clearance was an ongoing issue from the start of the event, and this required continual maintenance at sites to keep debris grates clear and pumps operating to their full capacity.

Napier has previously experienced several stormwater related events in the recent past that have resulted in flooding of areas of the city (2004, 2016) as a result of overloading to the scheme from intense rainfall. While each organisation has processes in place for the management of assets in heavy rainfall events, it appears that there is no overall response plan for the management of the network. The development of aligned processes and procedures for the management of the scheme may resolve some of the potential issues regarding the prioritisation and coordination of assets and resources in future events.

Figure 79: Debris removed from the inlet grates at the Purimu pump station, 9th November 2020

6 Land instability issues

In addition to the significant flooding that occurred within Napier, the event also resulted in significant land instability issues around the Napier Hill and some in the hills surrounding the suburb of Taradale. The impacts ranged from damage to retaining walls, impacts to residential properties as a result of landslides and damage to roading and infrastructure assets. Initially this was the main focus of the event as significant life safety issues were present prior to the significant flooding that occurred in other areas.

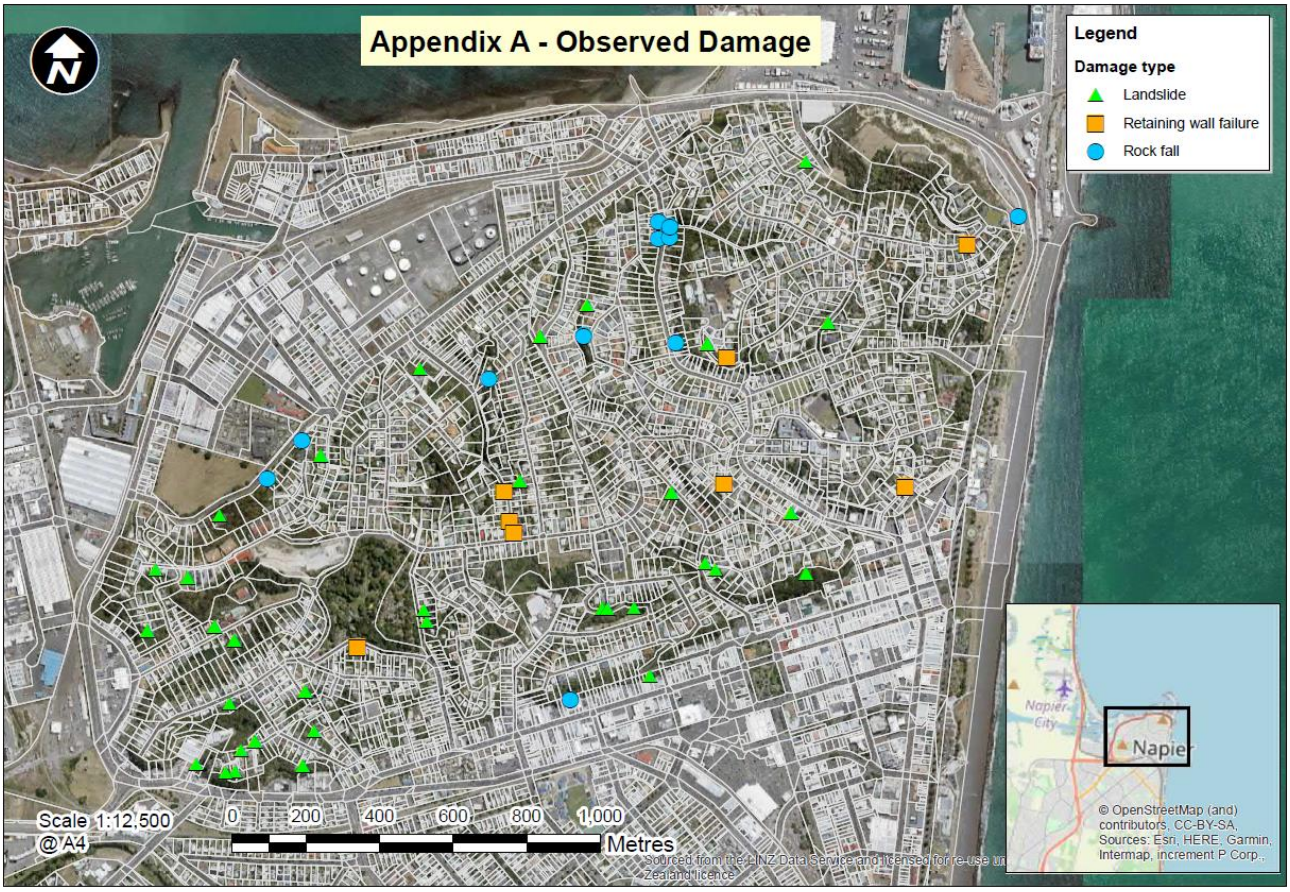


Figure 80: Observed damage on the Napier Hill, taken from WSP Engineering Reconnaissance Report, 12th November 2020

Approximately 45 residents evacuated homes on the Napier Hill due to the risk of further damage and potential life safety issues.

Figure 81: Damage to a property on Napier Hill from landslide, Tuesday 10th November 2020

7 Response

Initial issues from the rainfall began to be observed around 4.30pm. Several representatives of key agencies involved noted that drainage within the city was already full and there was concern that it may result in further issues with continued rainfall.

NCC and HBRC staff diverted resources to manage stormwater assets in an effort to reduce the impact of high flows into the network. At this time, the response was not being coordinated with agencies responding individually to any issues.

Fire and Emergency New Zealand (FENZ) contacted NCC to check if there were any issues as a result of the rainfall shortly after 4.30pm and at that time nothing significant had occurred and NCC were managing the event within business as usual structures. They also contacted the HB CDEM Group Controller, who at that point had not activated due to no significant issues having occurred, or notification of issues being received from the NCC Controller.

The first significant issues from the event occurred around 5.30pm, which were responded to by FENZ as a result of 111 calls. These were largely related to flooding on properties and requests for pumping assistance.

By 6pm NZ Police, FENZ and St. John Ambulance were beginning to get a large volume of calls related to flooding in the Napier CBD, Maraenui and Napier South. In addition to calls about flooding, several calls were received regarding land slips on the Napier Hill, with one in particular resulting in a person becoming trapped. Other calls related to medical emergencies were also received and these were largely related to anxiety based issues.

NCC activated the Incident Management Team (IMT) around 6.00pm to coordinate the NCC response to the event, due to the increasing issues associated with land instability on the Napier Hill and managing stormwater and sewage infrastructure. By this point there was significant flooding throughout Napier CBD, Napier South, Maraenui, Pirimai, Marewa, Onekawa and parts of Tamatea, Greenmeadows and Taradale.

A full CDEM response was activated around 6.30pm to manage the multi-agency response to the event from the Group Emergency Coordination Centre (GECC), which was fully operational by 7.15pm. By this time, a large part of Napier was flooded, and multiple slips had occurred on the Napier Hill. A State of Emergency was declared at 8.15pm on the 9th of November by the Napier Mayor, Kirsten Wise, to support the response to the event and enable emergency powers to be used where necessary.

The rainfall continued for several hours and finally abated late in the evening. The emergency Services and CDEM Group continued to work throughout the night, supporting people to evacuate from areas of flooding, providing emergency accommodation and support, pumping flood water from impacted areas and stabilising properties and infrastructure impacted by landslides. In total FENZ had 90 personnel operational and received 352 calls for assistance to the 111 call centre between 5.50pm and 1.00am and 720 calls in total related to the event.

The next day the rainfall had abated, and the response focussed on supporting people impacted by the event, carrying out rapid assessments of impacted areas to create a clear picture of the situation and the continued removal of flood waters. FENZ Urban Search and Rescue (USAR) staff conducted rapid building assessments to identify properties impacted by the flooding and these were followed by NCC building assessments to determine if properties were habitable or not. Utility providers continued work on restoring power to the impacted areas, which took several days due to damage caused to key infrastructure.

The community itself banded together in the wake of the flood, and there were many offers of help from all over the city, as people worked together during the event and on into the clean-up.

The State of Emergency remained in place until 6pm on the 13th November. The CDEM Group response was stood down on Friday 20th November and transitioned to Recovery led by Napier City Council.

Figure 82: A New Zealand Defence Force Unimog supports people in flooded areas, Tuesday 10th November 2020

8 Social impacts

8.1 Casualties

Given the severity of the event and the extent of land damage on the Napier Hill, there were few significant casualties resulting from the event. St John Ambulance received 35 calls between 5.00pm and 2.00am, with the majority of these related to anxiety issues. One person was extricated with minor injuries from a building damaged by a landslide on Napier Hill and another from a flood impacted area with severe chest pains.

8.2 Rescues and evacuations

The vast majority of evacuations in the event were self-evacuation. Assisted evacuations were carried out in some areas using 4x4 and NZ Defence Force Unimog vehicles. One person was rescued from a home impacted by a landslide on Napier Hill and several elderly people were supported to evacuate their homes in flooded areas.

Many of those who evacuated and whose homes were damaged were housed temporarily at Kennedy Park Holiday Park or with relatives and friends. 35 family units were utilised at the holiday park to temporarily house impacted people and some evacuees are still residing there at the time of this report.

The true extent of evacuations is not known from this event due to the majority being self-evacuation and no records available for who evacuated because of the event.

8.3 Emergency payments

The Ministry of Social Development activated Napier Flood Line and Civil Defence Payments. The Flood line took 2314 calls, provided information, and made 1,837 payments totalling $351,227.

8.4 Impacts to housing

The event resulted in widespread impacts to housing in the areas of worst flooding. Approximately 600 properties were visited by FENZ/NCC and the Earthquake Commission (EQC) in the days following the event (this includes some commercial and industrial sites.) Of these, 117 residential buildings were deemed uninhabitable. In addition, two properties in Jervoistown were also impacted by the flooding.

On the Napier Hill, nine buildings were issued with dangerous building notices due to land stability issues. Several others were identified as having minor slips on land, but this did not affect the safety of the building,

In total, 2994 claims were lodged for damage to residential properties and contents. This equates to a total insured sum losses of $42,014,755. (Information from Insurance Council NZ website and correct as at 01/06/2021). Given there are likely to be a high number of people who were not insured, this figure is likely to be far higher in reality.

EQC also provide insurance for land impacted by landslide or flood events. In total, 280 claims were lodged, with 126 for building damage and 278 for land exposure. 280 claims have been closed to date, with an average claim of $19,130. Of the 280, 203 were accepted as EQC cover.

A number of other costs linked to housing included temporary accommodation provided at the Nelson Park Holiday Park and other facilities. However, at the time of writing the report these costs were not available.

Figure 83: Damage to a property from a landslip on Napier Hill

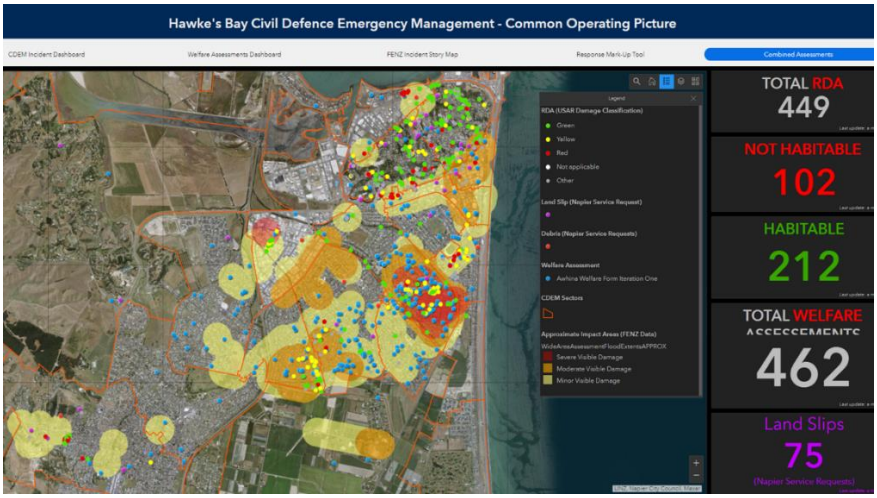


Figure 84: Hawke's Bay Common Operating Picture displaying number of assessed and damaged buildings, 10th November 2020

8.5 Impacts to commercial and industrial buildings

Commercial premises within the Napier CBD, Napier South, Maraenui and Onekawa were impacted by the event. The exact number of buildings impacted is not recorded, however, anecdotal evidence from NCC staff suggested most was related to flood damage from water entering properties, or as a result of guttering systems becoming overwhelmed.

In total, 745 claims were lodged for damage to commercial premises, which equated to $33,371,855 in insured losses.

Figure 85: Damage to a commercial building on Vautier Street as a result of heavy rainfall, 9th November 2020

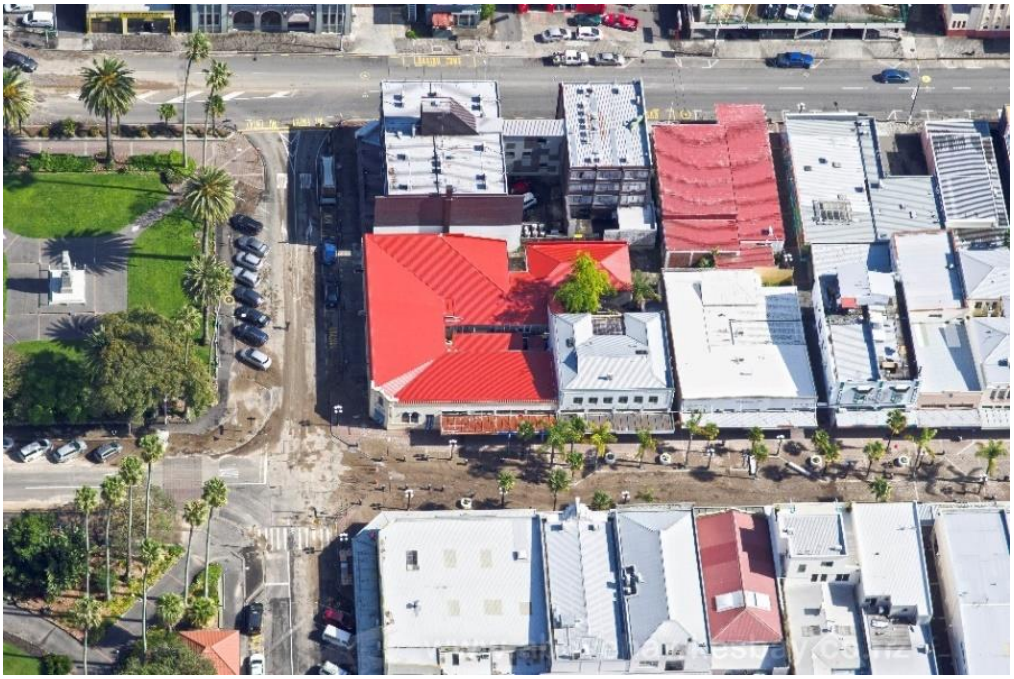


Figure 86: Silt left by flood water in lower Hastings Street, Napier CBD, Tuesday 10th November

8.6 Impacts to community buildings and services

Several community facilities were impacted by the event. These included council owned assets within the Napier CBD and some in the wider Napier area. In addition to the NCC assets, a number of schools and early education Centres were impacted by flooding.

The community assets impacted by the event included:

Facility	Damage
MTG Gallery, Napier CBD	Damaged as a result of flood waters
McLean Park, Napier South	Kitchen seriously damaged by flooding
Maraenui Rugby Club rooms	Club rooms seriously damaged by flooding

Table 1: Damaged community assets

Damage to schools in the area is listed in the table below:

School	Damage
Henry Hill	Flooding in Blocks C, D, E, Pool Pump and Caretakers Shed.
Porritt	Roof leakage / spouting flooding has affected Blocks A, C, D, E, F and N – all minor. Roof leakage / spouting flooding at Block B
William Colenso	Roof leaks in the Block A dance room at the hall, RTLB office at Block N, ECE facility and the gymnasium. Ground water penetration through foundations in the library lobby area.
Napier Intermediate	Roof leaks Hall - ceiling panels wet
Arthur Millar	Water ingress to rms 10,12,13.
Marewa	Roof leak to one classroom and toilets in Block A. Overflowing spouting to ex dental clinic caused minor internal damage to wall linings and carpet.

School	Damage
Maraenui	Block D – Water leaks through windows – wet carpet and wall linings Block C – Roof leaks – damaged ceiling tiles Block H – spouting overflow back into classrooms and roof leak - ceiling tiles damages Block M – Caretakers shed flooded Block G – Water underneath block Drainage full of silt
Nelson Park	Library flooded and roof leaks in a classroom and office in the main teaching block A causing damage to ceiling and flooring
Tamatea High	Block C - Chemical Storage Rm - spouting overflow, wet ceiling.
Napier Boys High	P1, B, PA: roof leaks

Table 2: Damage to schools from the event

In addition to the schools within the area that had damage from the event, several early childhood education centres were also impacted by flooding. These are shown in the table below:

Facility	Damage
City Children's Centre	Severe Flooding
Little Magpies Childcare Centre	Severe Flooding
Sunny Days	Flooded - driveway and water up to door.
YMCA Early Childhood Centre	Main office was flooded, rest of space was ok
Te Kōhanga Reo o Te Kūpenga o Te Mātauranga	Severe Flooding
Te Kōhanga Reo o E Tipu E Rea Taraia	Severe Flooding

Table 3: Damage to Early Childhood Centres from the event

8.7 Impacts to infrastructure

8.7.1 Impact to roading and associated assets

Many roads throughout the CBD, Napier Hill. Maraenui, Marewa and Onekawa were closed during the event due to both flooding and land instability issues. The main longer-term impacts to roading occurred in the Napier Hill area, where a number of roads were significantly impacted by land instability issues. The table below shows the significant damage that occurred to roading infrastructure and pathways as a result of the event.

Road Name	Description of damage
Brewster Lane	• Failure of slope below concrete footpath.
Brewster St	• Overslip and rock wall collapse.
Burke Street	• 5 Burke Street Overslip with areas that have cracks and large rocks/clay that will collapse Tree overhanging edge Street light at base of toe (MED pole) • No.16 BURKE STREET RAMPS & STEPS Small slip below sewer main 2m wide x 5m deep x 2m high. Little risk to public apart from slipping on detritus material. Risk to sewer main if more material slips and hits main, but not big boulders
Cameron Road Steps	• Landslip on private property above Cameron Rd/Milton Rd steps destroying fence, handrail and leaving debris on steps.
Convent Road	• 9 Convent Road Vegetation overslip
FITZROY STEPS	• Slip from property above onto steps.
France Rd	• Rockfall overslip from a near vertical face
Hooker Ave	• Opposite 32 Hooker Avenue, Underslip, undermining footpath. Series of older retaining falls (crib, concrete face, sandbag repairs) visible in slip material/scarp. Very weak rock exposed in the base of the failed area • Opposite 9 Hooker Ave, Small overslip • Opposite 36 Hooker Ave, Large overslip, removing support to 800mm high timber residential retaining wall

Road Name	Description of damage
Karaka Rd	• Overslip occurred high above road with debris flow breaching road and into dwelling below the road. Residual debris caught up in vegetation.
Kowhai Rd	• Rockfall overslip from a near vertical face
MAY AVENUE STEPS/RAMP	• Faraday - May Steps. Large but shallow landslide below steps. Debris deposited on private land damaging vehicles. Significant trees at top of slope Hole under walkway Drainage and utilities run alongside of the steps
Milton Road	• 2 small failures below driveway to 94 Milton Rd flats. Unison cables exposed, possibly damaged (electrical smell). Water/scouring from slope above flowing over the driveway edge.
Onslow steps	• Mid section of middle set of steps has slipped Some movement felt when walking on the steps
Puketitri Road	• Scour of Culvert outlet caused by overtopping of water flow (Blocked drain) • Edge break, shoulder slump with cracking in pavement over 4m length • Undermining of low concrete block Retaining Wall and scour caused by overtopping of drain across side
Sealy Rd	• Overslip and rock wall collapse.
Spencer Road	• No.11 Failed concrete retaining wall. Height varies up to 3.5m. Section remaining is rotated and at high risk of failing.
Thompson Road	• Shallow Overslip 8m high putting large volume of debris on road. Water main exposed. Stormwater main/connection from properties has been washed away.

Table 4: Damage to roading infrastructure from the event

The estimated cost to fully re-instate assets damaged by the event is approximately $2.8 million. In addition, some costs will fall to landowners where the impacts to roading assets were as a result of land instability at a property.

For more information on impacts to the roading network, please refer to the Napier City Council Report on Flooding in Napier 9 November 2020.

Figure 87: Roading damage on Brewster Rd, Napier Hill.

Picture from https://www.stuff.co.nz/dominion-post/news/hawkes-bay/123346600/second-night-in-the-dark-for-some-napier-residents-as-800-remain-without-power-while-rain-continues

8.7.2 Impact to wastewater network

The Napier wastewater network experience an influx of stormwater during the event that reached around 110mm by 8pm on the 9th November. The impact of this influx of stormwater was to release raw sewage into the already flooded streets, so the decision was taken at 5.45pm to release the sewer into the Atherfold Channel opposite Wilkie Place, then to the Pūrimu Stream, which flow into the Ahuriri Estuary. This reduced the risk of further sewage entering properties via flood waters and relieved the pressure on the system. The release of the sewage system lasted for more than 36 hours in total.

Some parts of the sewer network were impacted by power disruptions throughout the event. Portable generators were utilised in Latham Street and Taradale Road to power the sewage pumps during the event.

In total, 47 properties were impacted by damage to the sewer system. The council network has largely been repaired, either temporarily, or permanently. Five private connections required permanent or temporary repair to re-instate.

For more information on impacts to the wastewater network, please refer to the Napier City Council Report on Flooding in Napier 9 November 2020.

8.7.3 Impact to drinking water supply

The drinking water supply was largely unaffected by event. Several pumps in impacted areas were affected by floodwaters resulting in disruptions to distribution, However, contamination of water supplies did not occur, although residents were initially advised not drink tap water.

The main concern around the water supply was the additional impacts to the sewage network. Residents were advised not to flush toilets, take showers or baths and limit water usage to prevent overload on the network.

For more information on impacts to the drinking water supply, please refer to the Napier City Council Report on Flooding in Napier 9 November 2020.

8.7.4 Impact to electricity network

At the peak of the event power supply was disrupted to more than 3300 homes. Power was restored to more than 2000 homes the next day (10th November), however more than 800 homes were without power for a further 24 hours and some for several days following the event.

The majority of power supply issues were as a result of damage to supply infrastructure in flooded areas. This included damage to high voltage assets, such as transformers and switch units.

8.8 Additional impacts

8.8.1 Vehicle damage

A high number of vehicles were damaged as a result of the flooding. Many were simply as a result of the depth of flooding where they were parked, however, some of these were as a result of the event occurring at the end of a weekday, when many people were in the process of returning home. This resulted in additional flooding of some sites due to inundation from wake caused by vehicles moving flood waters in an attempt to reach their homes or safety.

A high number of vehicle damage claims as a result of water damage were lodged following the event. In total 1447 claims were made for vehicle damage totalling $12,214,302 in insured losses.

Several responding agencies also experienced vehicle damage as a result of responding to issues within flood affected areas. Fire and Emergency New Zealand suffered damage to two fire appliances, requiring new engines and totalling $100,000 in expenditure. St. John ambulance also had damage to an appliance and a vehicle resulting in $100,000 in expenditure.

Figure 88: A car attempts to drive down Nuffield Avenue, 9th November 2020

8.8.2 Environmental and public health impacts

The discharge of flood waters into the Ahuriri Estuary and along the Hawke's Bay coast potentially released contaminants due to the inundation of industrial sites, vehicles and residential properties where potentially hazardous materials could be released into flood waters. In addition, the inundation of the sewage network and the release of untreated effluent into the marine environment may have resulted in localised

contamination. Environmental monitoring of water in the streams and estuary was conducted during the release and is still ongoing to ensure that levels are acceptable.

During the event Public Health and Napier City Council issued warnings regarding potential contamination within the flood waters and advised residents to keep out of the water. Many children and adults were seen within the flood waters over the following days. It is unknown if any illnesses occurred as a result of this.

Figure 89: A couple play with their child in the flood water.

Picture from https://www.stuff.co.nz/dominion-post/news/hawkes-bay/123346600/second-night-in-the-dark-for-some-napier-residents-as-800-remain-without-power-while-rain-continues

8.8.3 Waste management

The event resulted in the generation of approximately 2100 tonnes of flood related waste. The majority of this was deposited at the Redclyffe Transfer Station where it was sorted for transportation to landfill. This was provided for free to residents in affected areas.

9 Anecdotal evidence

The following articles provide an overview of the event and the impacts. These support many of the impacts noted by those interviewed as part of collating information on the response and impacts for this report.

This article provides an overview of the initial response, rescue activities undertaken and the extent of the event.
https://www.nzherald.co.nz/hawkes-bay-today/news/napier-flooding-elderly-people-rescued-from-their-homes-mayor-declares-local-state-of-emergency/4FGLWVGXRKMZUJWFVVSVLROW4Y/

This article provides an overview of the rainfall and some impacts of the event, including power outages.
https://www.nzherald.co.nz/hawkes-bay-today/news/napier-flooding-deluge-the-second-wettest-day-on-record-in-150-years/COFGRLBXIOKNEBZAIWDKOZBCNI/

This article provides an overview of the response and the event's impacts.
https://www.stuff.co.nz/dominion-post/news/hawkes-bay/123346600/second-night-in-the-dark-for-some-napier-residents-as-800-remain-without-power-while-rain-continues

This article provides an overview of the response and the event's impacts.
https://www.stuff.co.nz/national/300153612/state-of-emergency-declared-in-napier-as-floods-cause-landslips-evacuations-and-power-cuts?rm=a

This article provides an overview of the event and rainfall.
http://floodlist.com/australia/new-zealand-flood-napier-november-2020

This article provides an overview of the initial assessment of damage to residential properties.
https://www.stuff.co.nz/dominion-post/news/hawkes-bay/123406523/future-of-homes-damaged-in-napier-floods-in-the-hands-of-insurance-companies

This media release provides details regarding the emergency declaration.
https://www.hbemergency.govt.nz/news/article/68/local-state-of-emergency-declared-in-napier-in-response-to-napier

This media release provides information for people impacted by the flood event.
https://www.hbemergency.govt.nz/news/article/70/media-advisory-napier-flood-update-date-101120-730pm

This media release provides information for people impacted by the flood event.
https://www.hbemergency.govt.nz/news/article/69/media-advisory-napier-flood-update-date-101120-1pm-

This media release provides information for people impacted by the flood event.
https://www.hbemergency.govt.nz/news/article/71/napier-floods-update-wednesday-11-november-2020

This media release provides information for people impacted by the flood event regarding clean up.
https://www.hbemergency.govt.nz/news/article/72/flood-clean-up-underway

This media release provides information regarding the lifting of the emergency declaration.
https://www.hbemergency.govt.nz/news/article/75/napiers-state-of-emergency-lifted

This article provides an overview of the damage to residential properties.
https://www.rnz.co.nz/news/national/430536/napier-flooding-more-than-100-homes-uninhabitable

This article provides an overview of the damage to residential properties.
https://www.rnz.co.nz/news/national/430384/more-napier-homes-declared-uninhabitable

This article provides an overview of the damage to properties from the event.
https://www.rnz.co.nz/news/national/432332/about-600-napier-properties-flood-damaged-report

This article provides information regarding the rainfall event and the flooding within Napier.
https://www.rnz.co.nz/news/national/430190/flooding-in-napier-as-heavy-rain-sweeps-across-north-island

This article provides an overview of the impacts upon people within flooded areas.
https://www.rnz.co.nz/news/national/430310/napier-flooding-family-tells-of-awful-night-fleeing-in-waist-deep-water

This article provides an overview of the damage to properties.

https://www.stuff.co.nz/dominion-post/news/hawkes-bay/123358868/30-napier-properties-uninhabitable-with-13-significantly-damaged-after-floods?rm=a

This article provides an overview of the damage to properties from the event.
https://www.stuff.co.nz/national/300177351/about-600-napier-properties-flood-damaged--report

This article provides information on the longer-term welfare impacts to people from the event.
https://www.stuff.co.nz/dominion-post/news/hawkes-bay/123928642/fortyfive-families-remain-in-temporary-accommodation-since-napier-floods

This article provides information on the welfare response to the event.
https://www.stuff.co.nz/business/123651047/napier-holiday-park-cancels-bookings-to-look-after-displaced-flood-victims

10 Conclusions and recommendations

The flooding event on the 9th November 2020 was the result of an extreme rainfall event that was centred over a small area of the region. This intense rainfall over a very short duration resulted in the widespread flooding that was experienced, and the land instability issues around the Napier Hill.

The warnings received for this event provided a very mixed message to those who were leading the response. The initial issuing of warnings for the area of Northern Hawke's Bay resulted in some focus being put on response arrangements in that area. It is clear that at no point the warning messages specifically indicated what might occur in the area of Napier and still focussed on areas outside the city. The use of Te Haroto as a location also caused the focus of the attention to be away from Napier City, as this is located in the ranges to the west of Napier and placed focus on the region's river systems. It was only late into the event that true indications were given of the potential for severe rainfall in the city, but by this time the event had already begun to impact the lowest lying areas of Napier.

CDEM in New Zealand is based on communities being ready and able to make the initial response to an emergency without waiting for something official, and there was good initiative taken by Napier residents especially as the severity of event was not anticipated, with the majority of evacuations self-initiated. In addition, the community worked very well together in the wake of the flood, and there were many offers of help from all over the city and region.

Determining accurate rainfall and flood level return periods for this event are problematic due to a number of reasons. The main reasons are that the rainfall amounts fluctuated across several different sites and the historical data available is limited spatially and temporally. The methods utilised to calculate the return periods initially varied between organisations. While initial estimates of rainfall return period indicated the value may be 1 in 250 year for the 24 hour duration at Nelson Park, the statistics used to generate this value did not include the 9th November rain, which is required to be added to the data set in order to be valid. This is an issue with extreme events where the inclusion of the extreme event changes the distribution estimates significantly, yet it is impossible to include it until the event is over. For this case, once the 9th November data was included, the 24-hour duration return period was estimated to be approximately 100 years. A more detailed examination of the 6-hour duration return periods indicate a possible rainfall return period of approximately 200 years, however, due to the limited amount of data for the 6-hour duration, this return period could also be as low as 100 years. The overall the return period for the flood levels (which is different from the return period of the rainfall) may be far less and is likely to be in the order of 1 in 50 to 1 in 100 years, depending on location, as similar flooding has occurred several times since around 1963. Conferring between organisations, and perhaps utilising an external organisation to review the rainfall data would help ensure that a standard method of calculation is utilised for events.

The Napier City drainage network is built nominally to a 1 in 10-year event capacity for the pipe network, with overland flow paths designed to take the flow from a 1 in 50-year event. This event far exceeded the design capacity and capability of the system, which resulted in many private properties becoming inundated. This issue was exacerbated by the requirement to pump the majority of stormwater from impacted areas and the back up in the system that was caused by the high influx of water into the network in such a short period of time. Further issues were caused by the loss of power and debris build up at some pumping assets, which reduced the capability to remove flood waters.

The Napier roading network forms a core part of the stormwater network, providing additional storage capacity until the water can be removed. While for the most part this was sufficient and did not adversely impact upon surrounding homes, it did result in issues to some properties where traffic continued to move around and cause water levels to be higher due to bow waves from vehicles. It is hard to say how many properties were impacted directly by waves created by moving vehicles, but it is clear from anecdotal

evidence that some homes that were flooded may not have been had traffic not increased the level of the water within adjacent properties.

The drainage scheme is made up of assets owned by both Napier City Council and Hawke's Bay Regional Council. The maintenance and management of these assets by each organisation is largely independent from each other during normal operations. Anecdotally, it appears this was also the case throughout the event, with each organisation focussing on their individual assets within the scheme. It is unclear how issues within the scheme were co-managed to ensure any potential flow-on effects could be pro-actively managed between the two organisations.

The management of the drainage network by both Napier City Council and Hawke's Bay Regional Council requires significant communication and integration to ensure it is operating as effectively as possible in events such as these. If either party experiences issues with operating their part of the system this can have adverse impacts on other parts of the network's operation. Some of the issues regarding power supply to pump stations and the clearance of debris from flood gates had the potential to result in more severe impacts to parts of the scheme and better co-management of these issues in the future may reduce potential impacts elsewhere.

The following recommendations are made as a result of this report:

- Warnings received from Metservice for severe rainfall should be followed up with a phone call to the duty forecaster to clarify likely locations and potential intensities. This will ensure that there is no misinterpretation of the forecast information, noting that it is not always possible to predict the exact location of rainfall events such as these.

- Alternative power supplies should be sought for all key flood pumping assets within the Napier City to ensure that any loss of power is minimal and does not adversely affect the performance of the drainage network.

- Napier City Council and Hawke's Bay Regional Council should review the existing arrangements for management of the flood scheme to ensure the most effective integration and coordination of the assets where possible. This includes arrangements for the conducting of operational activities, both in readiness and response. This may be achieved through the development of a plan that clearly details the roles and responsibilities of all parties involved in the management of the scheme, including maintenance, forecasting, data sharing, response priorities and activities, reporting lines and structures and resource requirements.

- Hawke's Bay local authorities should utilise an independent organisation to review rainfall data and determine the return period of rainfall events within the region. The return period of rainfall and flooding should not be determined during the event to enable all possible data sources to be utilised and provide an accurate result.

11 Acknowledgements

The production of this report has been supported by the following people.

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Brendan Hutchinson Area Manager	**St. John Ambulance**
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Liezel Esterhuizen Stakeholder Engagement Advisor	**Earthquake Commission**
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Brown T, Papesch D, Hosie D, 2021, Independent Operational Review Napier Floods, Fire and Emergency New Zealand

Appendix A – NIWA Napier Rainfall Event Report

November 2020 Napier Rainfall Event

Prepared for Hawke's Bay Civil Defence and Emergency Management Group

June 2021

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	Formatting checked by:	
5 July 2021	Approved for release by:	Andrew Tait

Contents

Tables

Figures

Executive summary

On the 9th and 10th of November 2020, central Napier received record-breaking rainfall which resulted in extensive flooding. Between 2pm and 8pm on Monday 9th, 210 mm of rainfall was recorded at the Nelson EWS gauge in Nelson Park. This depth is more than twice as large as any past 6-hour event recorded since sub-daily measurements began at this location in the early 1990s. Due to its extraordinary nature, estimating an accurate return period for this event at this location is very difficult. However, by including other historical events observed at other Napier rain gauge sites, we can more confidently say that this 6-hour event could be expected to occur somewhere in Napier city with a return period of around 200 years.

1 Introduction

On the 9th and 10th of November 2020, central Napier received record-breaking rainfall which resulted in extensive flooding. On the 8th of November a cut-off low in the upper troposphere moved over the North Island (see Figure 1-1). This resulted in the rapid development of a surface low pressure system to the north west of the North Island on the 9th of November. This surface low pressure system contained an abundance of moisture within a strong south-easterly gradient wind flow across the Hawkes Bay region. The topography of southern Hawkes Bay resulted in a strong convergence zone of these moist low-level winds, which in turn generated upward motions over the Napier region. The outcome was a highly localised area of intense rainfall lasting several hours.

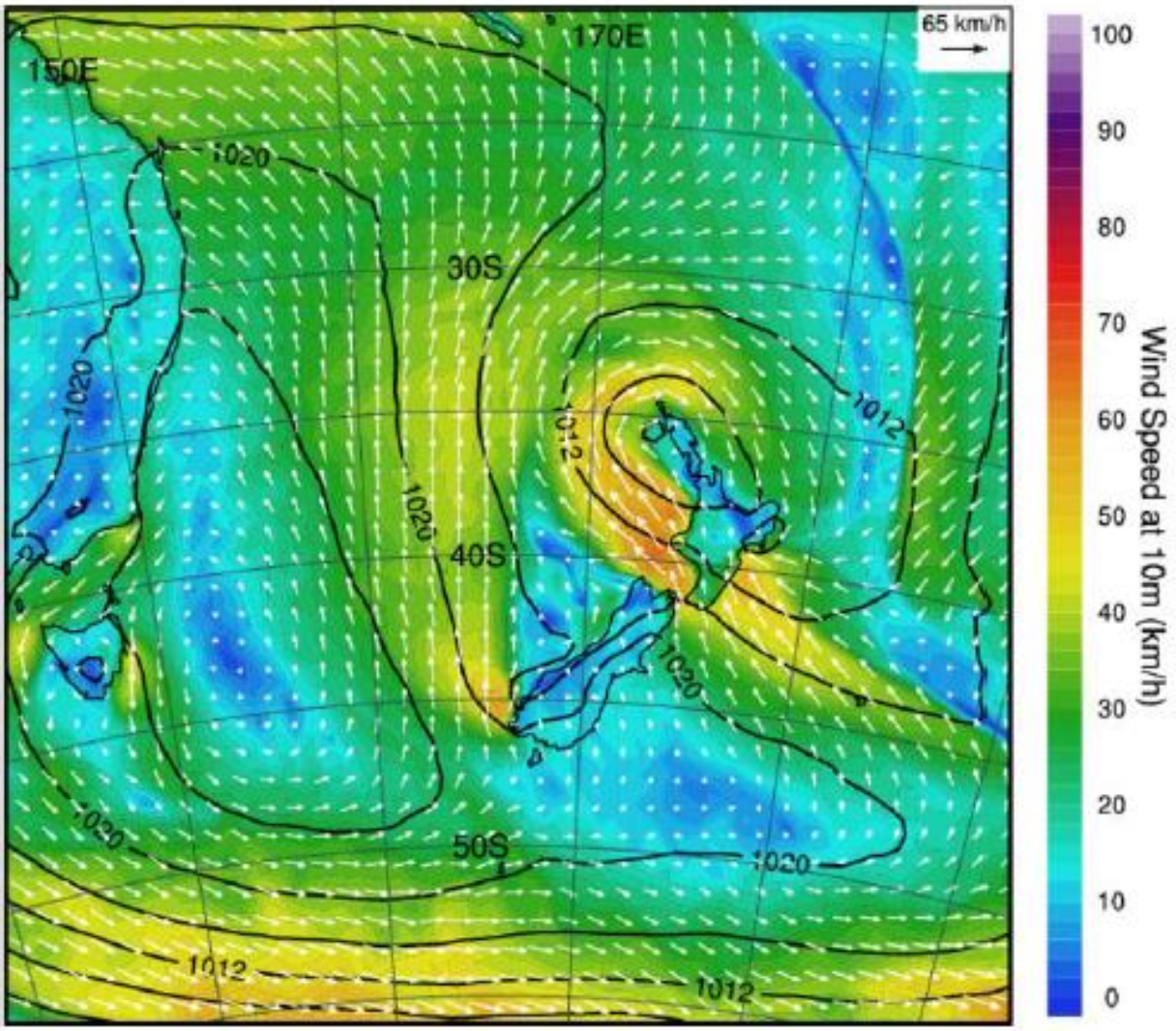


Figure 1-1: Surface analysis fields from the NZLAM numerical weather prediction model valid at 7pm November 9, 2020.

Rain radar observations for this event showed that the intense rainfall cell was localised over central Napier. Figure 1-2 contains 24-hour rainfall depths estimated from the radar and shows that the heaviest rainfall (~250mm in 24 hours) covering an area of about 15 sq km.

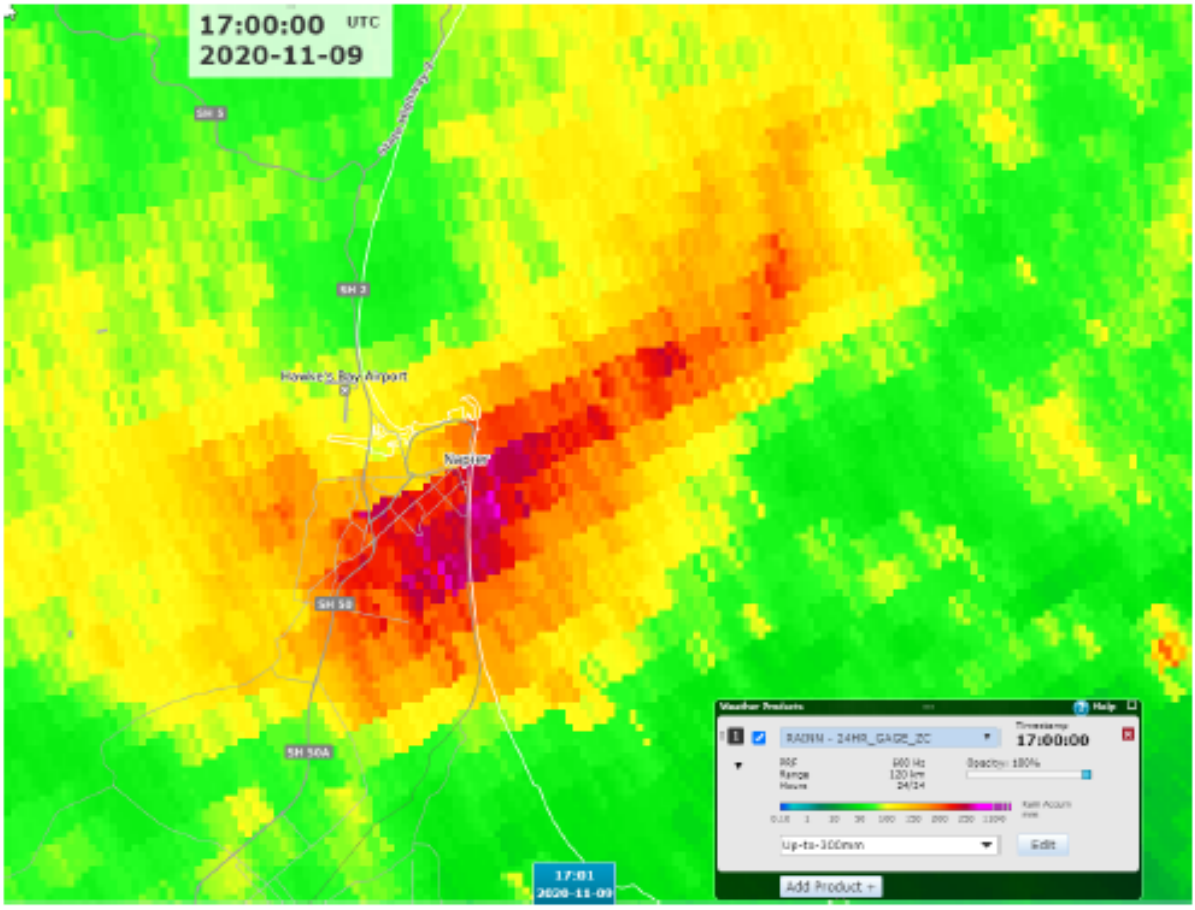


Figure 1-2: Gauge adjusted radar derived 24-hour rainfall accumulation ending at 6am (NZDT) November 10, 2020.

The main intense storm-cell was observed by two rainfall gauges in central Napier; Napier EWS and Napier CBD. The most intense part of the rainfall event was the 6-hour period ending around 9pm on November 9th. The gauge at Napier Airport also captured the event, but it was far less intense despite being only 5 km from the storm cell centre. The temporal evolution of the rainfall event at these three gauges is shown in Figure 1-3.

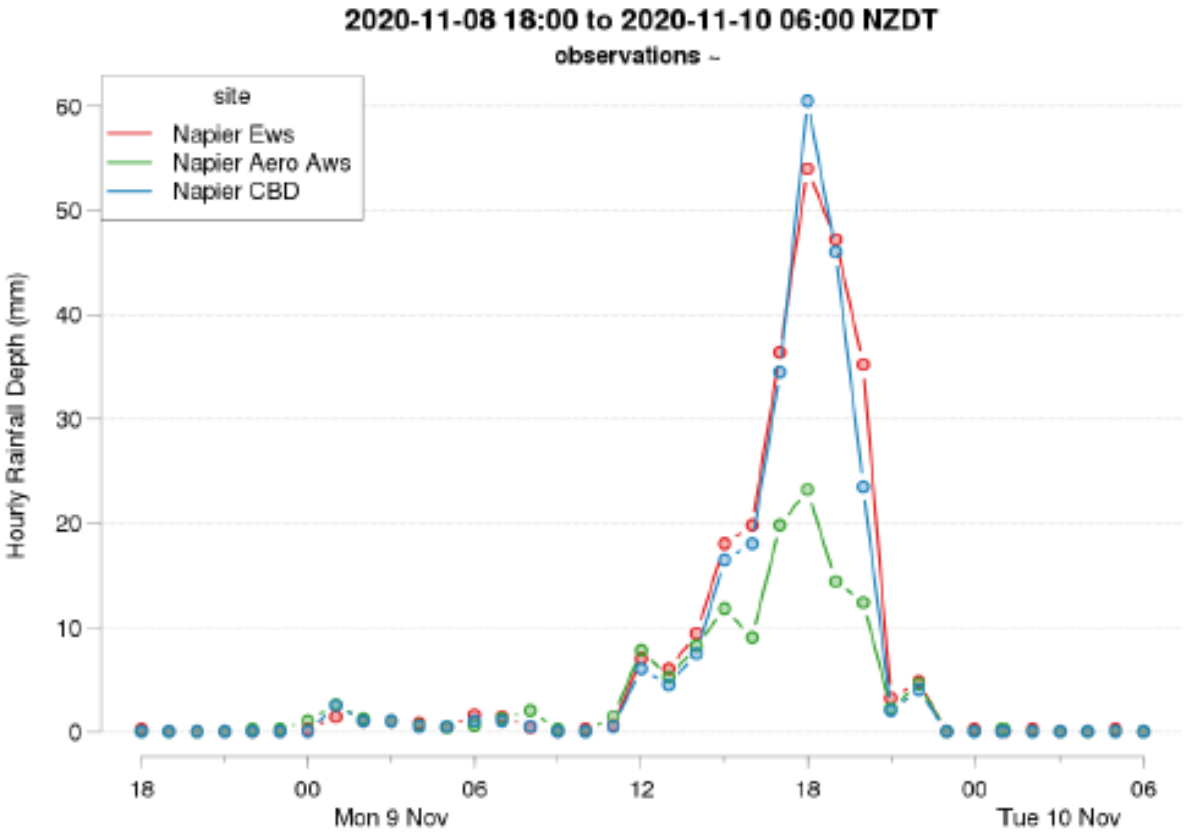


Figure 1-3: Hourly rain gauge observations during the November 2020 storm. Observations shown are from Nelson Park (Napier EWS), HB Regional Council Office (Napier CBD) and Napier Airport.

2 Extreme value analysis

In order to get a reasonable sample size (particularly for the 6-hour duration) we have combined the annual maxima series (AMS) from a few nearby gauges listed in Table 2-1. Annual maxima series from all of these gauges are shown in Figure 2-1 for 24-hour duration storms and Figure 2-2 for 6-hour duration storms. Combining the records from these gauges appears reasonable judging by the similarity of the AMS where they overlap.

Table 2-1: Rain gauges used in this study.

Name	Network No	Latitude	Longitude
Napier EWS	D96494	-39.4985	176.9119
Nelson Park (closed)	D96591	-39.4985	176.9119
Napier CBD	NapCBD	-39.4933	176.9167
Napier Waititerau (closed)	D96492	-39.483	176.919
Napier Aero (closed)	D96481	-39.468	176.872
Napier Aero AWS	D96484	-39.461	176.859

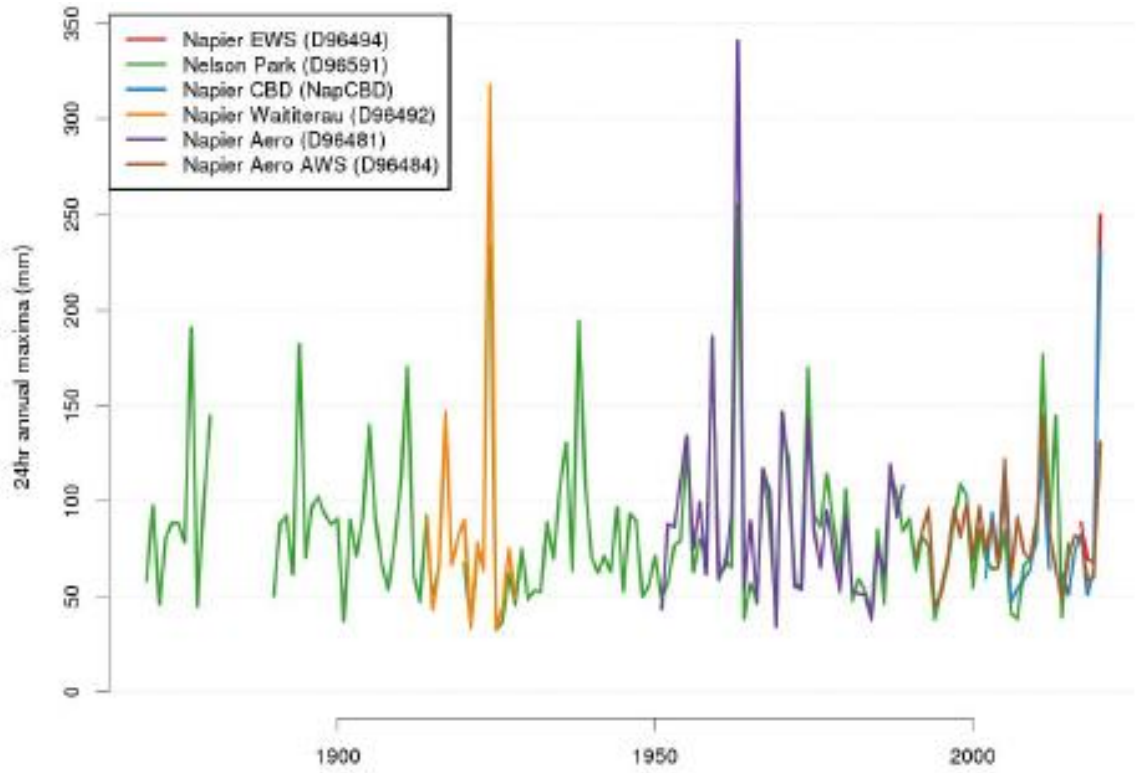


Figure 2-1: Annual maxima series from 1870 to 2020 for gauges nearby to Napier for the 24-hour duration.

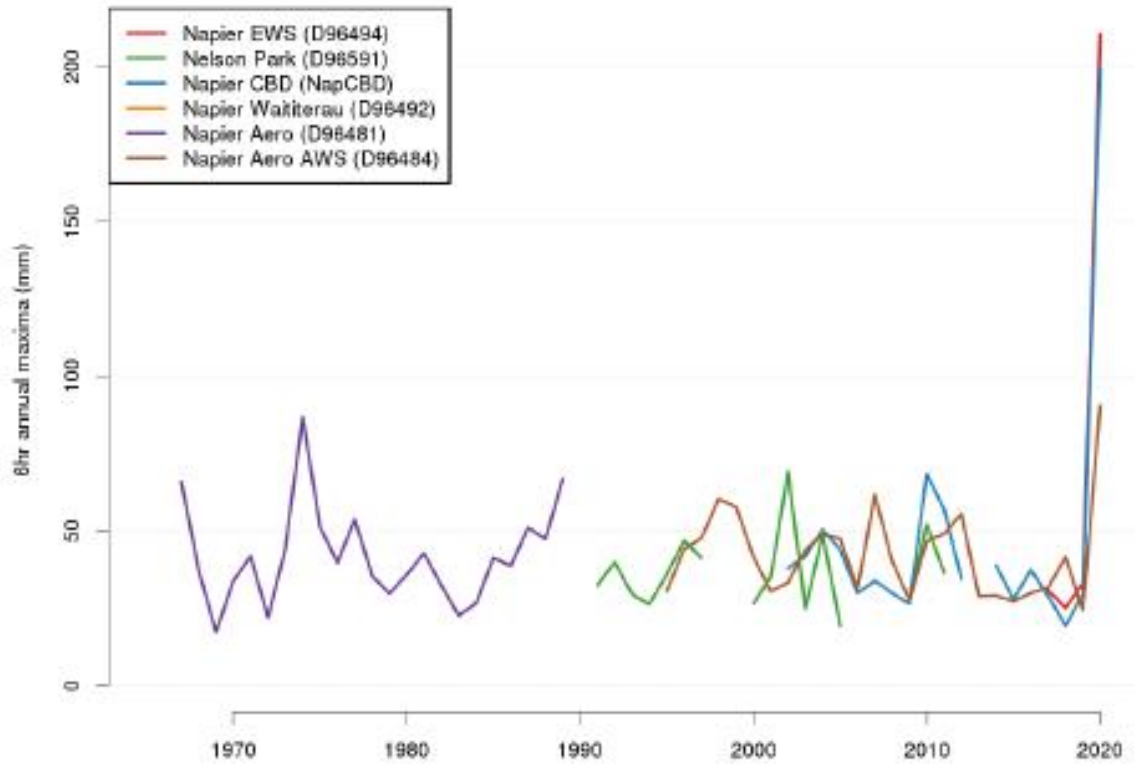


Figure 2-2: Annual maxima series from 1967 to 2020 for gauges nearby to Napier for the 6-hour duration.

For each duration, a single AMS has been created by taking values from the above sites in priority order, based on their distance from Nelson Park. A GEV distribution is then fitted to these data to estimate the return period for different durations. For the 24-hour duration, shown in Figure 2-3, this looks very sensible and gives a return period for the 250mm recorded at Napier EWS as 110 years (the 24hr, 231mm depth at Napier CBD gives an ARI of 80 years).

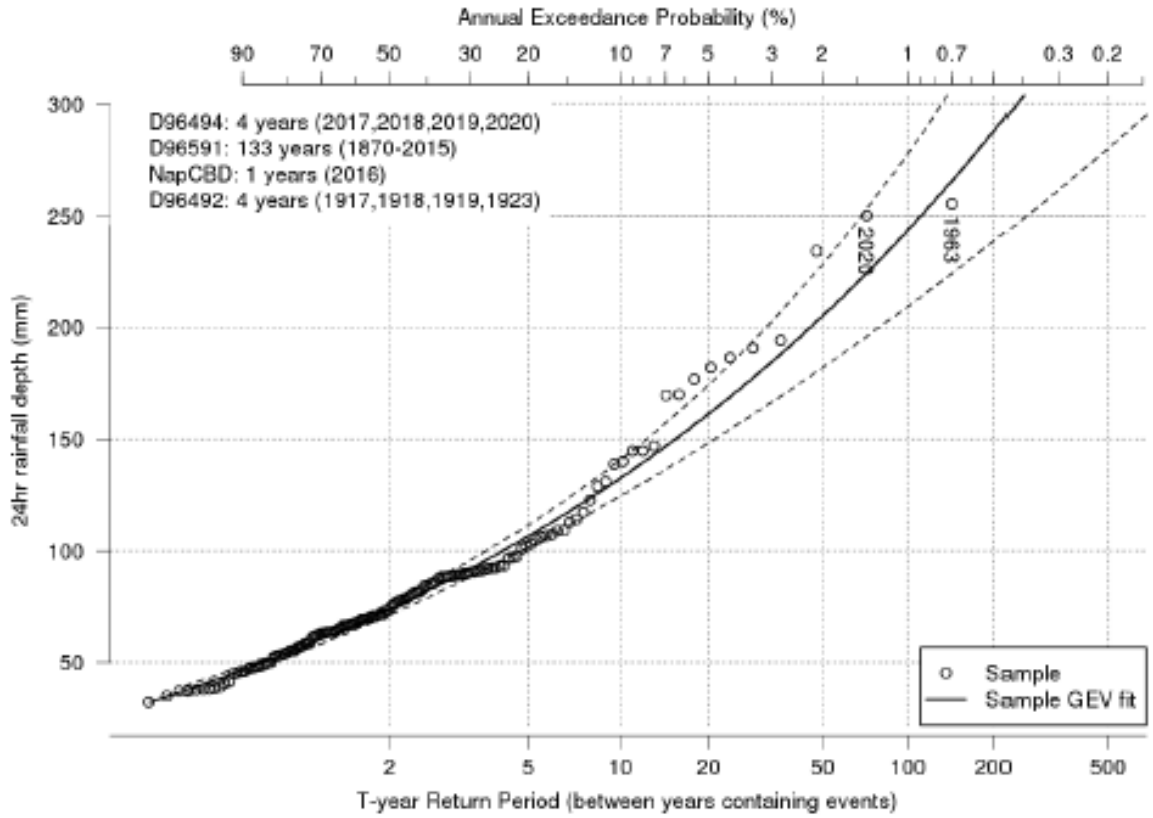


Figure 2-3: The growth curve for 24-hour annual maxima for Napier with a fitted GEV distribution. The list of stations on the figure shows them in the priority order used to create the merged annual maxima series.

For the 6-hour duration, shown in Figure 2-4, things are not so straight forward as the 2020 event is an outlier, and far exceeds any other previously recorded event in this series which starts in the late 1960s. The fitted GEV puts the return period of the 6-hour, 210mm depth at 500 years (with standard error bounds of 100 to 2200 years). Due to the poor fit of the GEV distribution to this 6-hour AMS, we can have very little confidence in the accuracy of the return period derived from the GEV fit, however it's clear that this 6-hour depth is extraordinary.

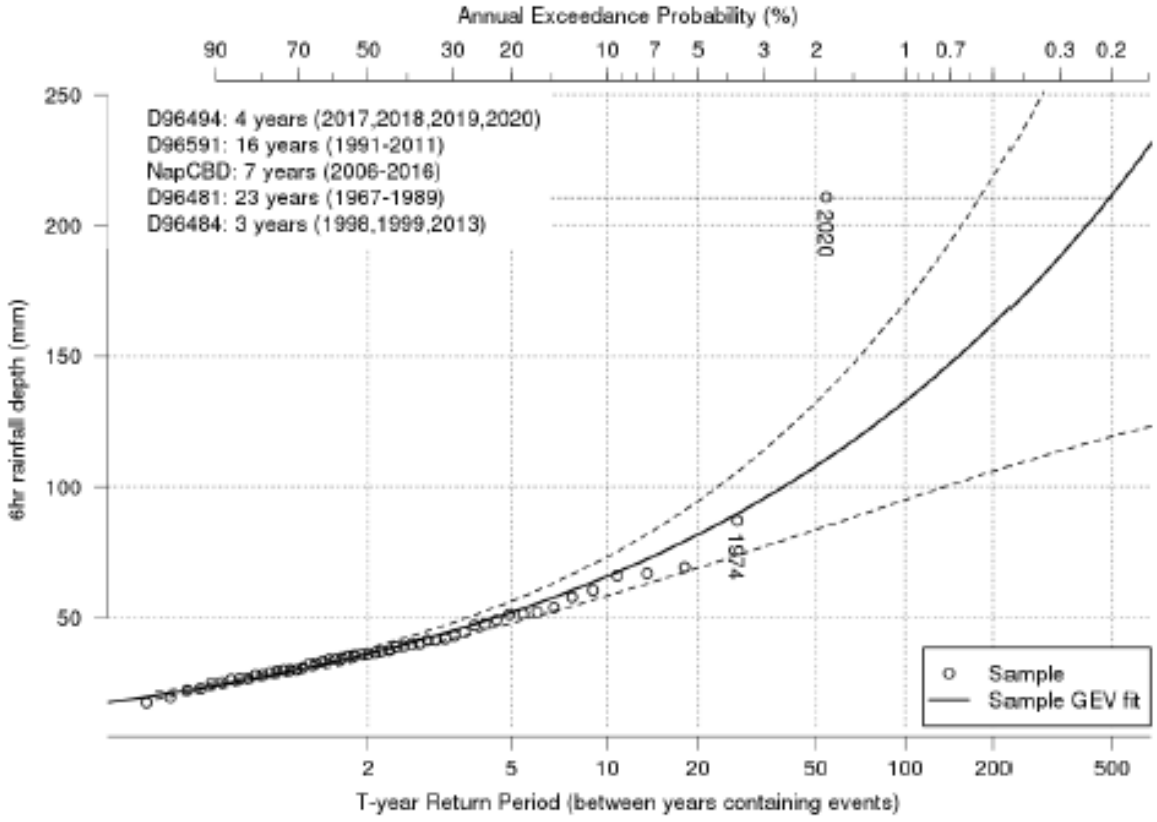


Figure 2-4: Growth curve for 6-hour annual maxima for Napier with a fitted GEV distribution. The list of stations on the figure shows them in the priority order used to create the merged annual maxima series.

Return period estimates for the 2020 event based on these fitted GEV distributions and the equivalent fits for 2-hour and 12-hour durations are shown in Table 2-2. For the sub-daily durations, the errors associated with these estimates are all very large indicating, as discussed above for the 6-hour duration, that we have low confidence in these values.

Table 2-2: Observed rainfall maxima and return periods for the Napier EWS and Napier CBD gauges for four different durations. Return periods estimated from GEV distributions fitted to merged annual maxima series as depicted in Figure 2-3. Standard error on the return periods is estimated from based on the fitted GEV. See Discussion Section for an explanation of the final row.

Site Name	Duration	Rainfall (mm)	ARI (year)	ARI Std Err Range (years)
Napier EWS	2 hr	101.2	328	84 - 1288
	6 hr	210.6	492	109 - 2230
	12 hr	241.6	292	76 - 1130
	24 hr	250.0	111	61 - 203
Napier CBD	2 hr	108.0	413	98 - 1758
	6 hr	199.5	407	97 - 1727
	12 hr	223.5	227	64 - 805
	24 hr	231.5	81	48 - 139
Napier EWS + Historic Storms	6 hr	210.6	200	80 - 520

3 Discussion

The most severe aspects of this November 2020 event were felt over a 6-hour period and over a relatively small area. Due to this small spatial extent, events like this are not always observed (by instrument) and so assessing their expected frequency is often difficult. In the rain gauge records described above, no event of this magnitude has occurred previously; in fact, the next largest 6-hour depth is less than half of the 2020 event magnitude. This fact and the above analysis suggests that the probability of an event like this occurring at any single location is very low (between a 1% and 0.05% annual exceedance probability or AEP).

For context, the 3 June 2018 event in the Gisborne district (whose most extreme duration was also between 4 and 6 hours), had a similar 6-hour depth of 206mm (at the Panikau/Reed Rd gauge). This was estimated as a 1 in 150 year event, but the 6-hour median annual maximum (~2-year ARI) at that location is more than twice that of Napier, making an event of this magnitude more likely. Apart from 2020, only the 1974 maximum at Napier is larger than the median annual maxima at Panikau/Reed Rd.

As mentioned, the above analysis assesses the likelihood of an event occurring at a particular location. However, the chance of such an event occurring somewhere within a larger region (e.g. Hawkes Bay) is likely to be significantly higher. For example, Goodier (2006)[1] noted three large 6-hour events near Napier that were not in the gauge records analysed above:

- 161mm at Napier Aero, 1924
- 150mm at Napier Aero, 1963
- 179mm in Tamatea, Napier, 2004

These values can be included in the 6-hour AMS used earlier to create a more complete "Napier" AMS if we also fill missing years between 1924 and 1966. The missing years can be filled by re-sampling the post-1966 series, excluding the 2004 and 2020 events under the assumption that it is large events like these that have been anecdotally included. If the GEV analysis is then performed on this resultant series, as shown in Figure 3-1, the 2020 event is now classified as having a 200-year return period (with a standard error ranging from 80 to 520 years, see Table 2-2).

By including these large events from different gauges, the calculated event frequency is no longer applicable at a single location. Rather, the 200-year return period is an estimate of the expected frequency of such an event occurring somewhere in Napier city.

[1] Goodier, C., Hawke's Bay Region: Rainfall Frequency Analysis, Hawke's Bay Regional Council, AM 06/06, 2006.

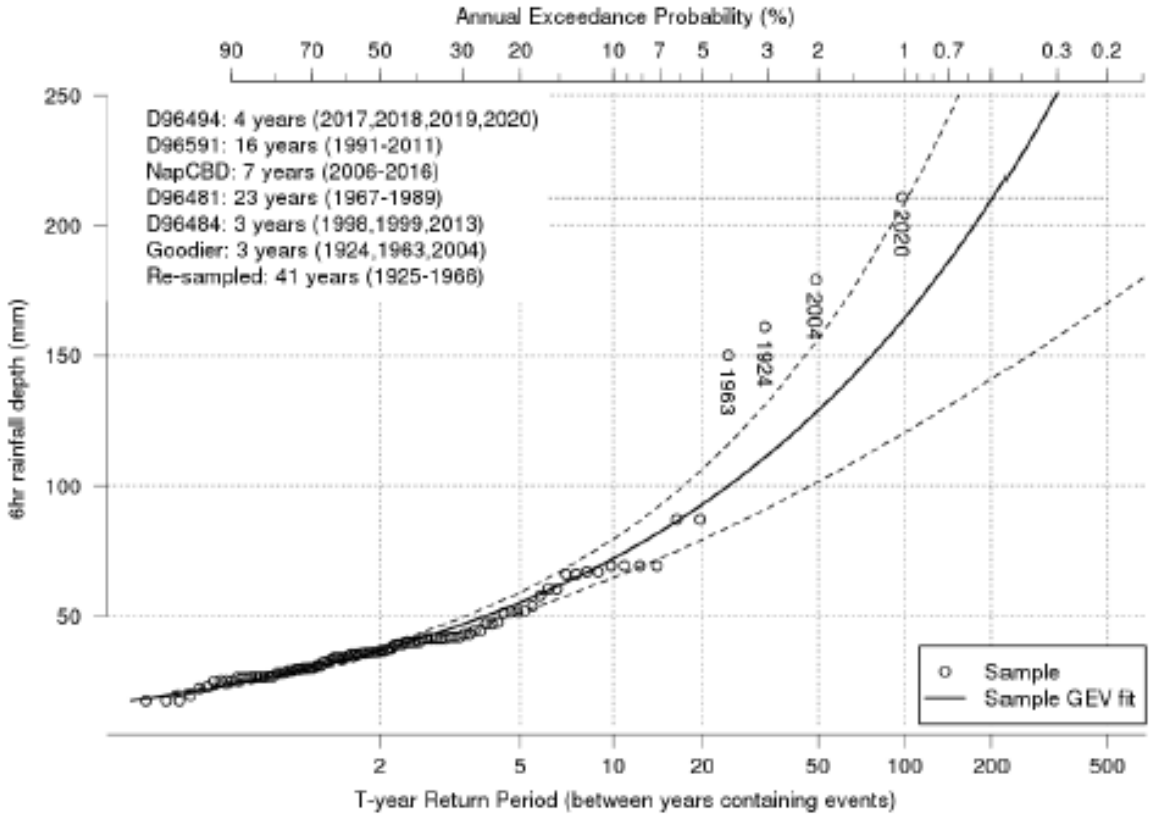


Figure 3-1: Growth curve for 6-hour annual maxima for Napier with additional historic storms included.

Appendix B – HBCDEM Group Sitrep, 12.00pm, 10th November 2020

HB CDEM Group Napier Flooding Situation Report #002 Issued: 12:00, 10 November 2020	R2

Activation status:	**Activated 15:00, Tuesday 10 November 2020**
Period covered:	**22:00, Monday 09 November 2020** to **12:00, Wednesday 10 November 2020**

New text is in blue.

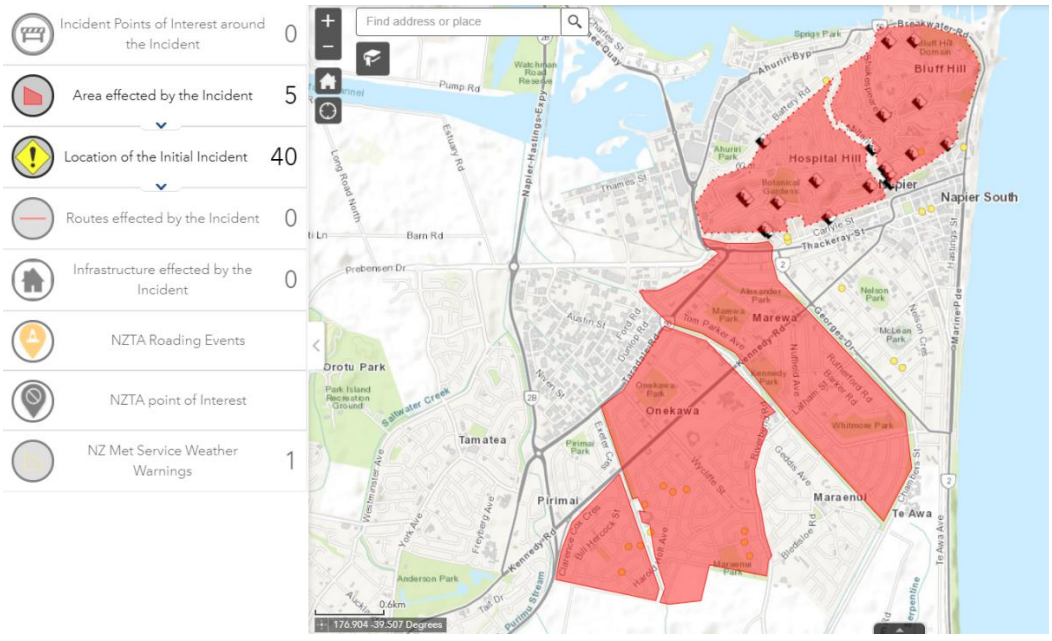
Summary of event

- Napier City Council has declared a local state of emergency – 2020hrs 9th November
- A one-in-250 year event for rain return period.
- Actual rainfall as at Nelson Park: 250.2 mm • Mersey Street: 184.6 mm • Airport: 129.8 mm
- High Tide: Tuesday 1335hrs and 0204hrs Wednesday
- No issues in Wairoa, Hastings, or Central Hawke's Bay require CDEM attention.
- Met Service forecast:
    - 59mm from 1700hrs Tuesday through to 1400hrs Wednesday.
    - Heavy Rain Watch: 1500hrs Tuesday through to 2000hrs Wednesday
    - Average wind speed will range between 11-24km/h
- Suburb of Maraenui is inaccessible (FENZ Sitrep 9/11 at 0930hrs)

Further rain is predicted for the afternoon of Tuesday Nov. 10, however at a lower intensity. The combined rainfall totals is not expected to cause any significant river flooding, however, if the localised rainfall occurs in Napier, the already saturated ground and overloaded stormwater system will be stressed again causing overland flow paths to reactivate.

Priorities

- FENZ have developed a map of priority areas as at Tuesday 10 November 1030.



Intended actions

1. Establishing welfare processes
2. Refining situational awareness, particularly around long-term accommodation needs
3. Public information management
    - Ensuring the public know where to get help
    - Providing assurance to the community that we are responding
    - Having a coordinated response across organisations

Risks and issues

- Health remains an issue with potential sewage contamination of drinking water and reports of people swimming in flood waters.
- Emergency services have been advised to treat all power transformers as live due to some being flooded or water-logged.
- Driving in flooded areas.
- Slips and landslides.
- Forecasted rain for afternoon.

Impacts and predicted event progression

Social environment

- Approximately 40-50 residents have evacuated from Napier Hill. The majority of residents have self-evacuated. Approximately 15 people have been accommodated at Kennedy Park.
- HBCDEM are anticipating long-term accommodation needs will increase during the week as the impact of flooding damage is assessed.
- 0800 number for welfare assistance has been established and advertised. Calls are beginning to be received.
- Police have responded to sporadic disorder because of vehicles travelling down flooded roads causing waves onto people's properties.
- Anecdotal reports from Police of children swimming in flood waters in Maraenui.
- NCC Housing team contacting all villages today – getting capable tenants to do a walk around. Housing Team member to do a walk around at Henry Charles village to check on residents and identify damage.
- Red Cross conducting welfare checks at Kennedy Park

Economic environment

- NCC have reported on several Trade Waste customers who are not able to operate or in process of assessing ability to operate following flooding.

Built environment

- Approximately 500 households remain without power as at 0945hrs. Hoping to restore by 1600hrs today (unison.co.nz).
- Power transformers in some places may be underwater or water-logged causing health and safety risks.
- Halliwell's detention Dam (Kent Terrace) operating, spillway activated around 2000hr to 2100hrs but dropped below the spillway since.
- Police report that there are no issues on SH2 and SH5. Road policing staff will remain on SH5 during the day.
- NCC have reported the following roading issues as at 1000hrs on 10 November:

Flooding | Slips

Latham Street	Nelson to Vigor Brown	Flooded - including Side Streets
Latham Douglas Mclean to Barton		Flooded - including Side Streets
Austin Street		Flooding
Coverdale		Flooding
Lancaster		Flooding
Maraenui South		Localised flooding various streets
Anzac Place	Riverbend to Galipolli	Flooding
Harold Holt		Flooded - including Side Streets
Kennedy Rd	Restrictions now opened	Flooded - near expressway overpass
Milton Rd		Slips / footpath damage various sties
12 Chaucer Rd Sth		Footpath damage
4 Chaucer Rd		
Chaucer Rd / Carlyle Rd		Tomo
Shakespeare Rd		debris and "dirty water" on road – road closed as precaution.
Thompson Rd		Slip - Tree across road, channelling water into property. Tree moved, part of slip material removed. 3 x properties still with limited access.
Hooker Avenue		part of Hooker pavement has slipped into Gleeson Park. Hooker Ave closed to traffic. Napier Central School notified. Site will need assessing tomorrow.
Karaka Rd		slip at top of Hornsey / Karaka.
Kowhai Rd		small slip, one lane traffic opened.
Puketapu Rd		slips cleared to allow traffic through. Signs installed.
Spencer Rd		retaining wall has collapsed. One lane opened. Stop/Go 8am Tuesday morning, then assess safety / best way to clear site.
Puketitiri Rd		small slip 500m East of Quarry Ridge
Breakwater Rd		rock / debris falling from Bluff cliffs. Road closed. Requires assessment before reopening.
Brewster Rd		slip on road (including downed lamp post). Awaiting for the lamp to be de-energised before clearing to commence. Will clear a path for access tonight then assess Tuesday.
31 Havelock Rd		House evacuated, needs sandbags across frontage
Springfield Rd		2 x slips (not yet evaluated) Pa and Powerstation
Nelson Crescent		Flooding
McVay	Nelso Cres	Flooding
Geddis Ave		Flooding
Nelson Crescent		Road open/ footpath closed
Morris Avenue		Road open/ footpath closed
4 Kavanagh		Slip on property
33 Milton Rd		Slip on bottom of road near the steps
Oldman		Flooding
Alexander		Flooding
Hastie		Flooding
Lowrey Tce		Flooding
Nuffield	Lowrey to Latham	Flooding
Nash St		Flooding
Williams St		Flooding
Flemming Cres		Flooding
Venables		Flooding
Cottrell Crew		Flooding
Mclaren		Flooding
Hislop		Flooding
Burns Rd		Failing retaining wall
Carlyle St		Flooding

- Railway: Train lines out of Napier have been inspected and are under assessment this morning for ability to utilise again

- Kerbside waste services have resumed and have been advised to avoid driving through standing water to reduce wave impacts.
- NCC transfer station:
    - Leachate pond was at overtopping level – pumping has now commenced, however pumping onto saturated landfill cap
    - Preparing for increase in waste, e.g., wet household waste, ruined carpets etc.

Natural environment

- Section 330A Resource Management Act Emergency Declared to discharge wastewater to the stormwater network.
- Baseline monitoring of effects carried out prior to discharge. Will use this to ascertain when levels of ecoli have dropped back to the baseline levels.
- Monitoring of the affected waterways will occur after 1100hrs.
- Courier depot flooded so no couriers out to lab. Using Water Testing Hawkes Bay. Second priority analysis after drinking water quality

Resources

Resources in place

- FENZ duty crews being dispatched by ComCen. Responding to commercial flooding, vulnerable community assistance, public reassurance, UAS team deployed on Napier Hill to assess slips.
- RAPID disaster wide area assessments:
    - Fire and Emergency volunteers
    - Red Cross
    - NZ Defence unimog being utilised to access flooded areas.
    - Napier Fire Station utilised as assembly area for all responders
- Red Cross Rapid relief team providing food for response teams.

Report approved by:	**ECC Controller**
Report prepared by:	**ECC Intelligence function**
Next report due at:	**09:00, Wednesday 11 November 2020**

Appendix C – News article – Hawkes Bay Today, 10th November 2020

Hawkes Bay Today, 10th November

Napier flooding: Elderly people rescued from their homes, Mayor declares local state of emergency

A local state of emergency has been declared and some schools will be closed today (Tuesday) in Napier after wild weather battered the city, sparking evacuations, landslides, and power cuts.

There has been widespread flooding, slips and evacuations after 100mm of rain fell between 12pm and 8pm last night.

Napier Mayor Kirsten Wise declared a state of emergency just before 10pm and urged residents to shelter at home and avoid driving where possible.

"If you feel unsafe at home, self-evacuate to family and friends first," she shared on the city's Emergency Defence website.

"If you have no other options, evacuate to Kennedy Park at 11 Storkey St, Marewa."

A large landslide swept away a structure on Hospital Hill, near Havelock Rd. Photo / Warren Buckland

Anyone in danger should call 111.

Some schools to close on Tuesday

At least four schools in Tamatea will be closed today - Tamatea Primary, Porritt Primary, Tamatea Intermediate, Tamatea High and Fairhaven.

Widespread downpours have affected more than 90 homes, with dozens of people, including elderly residents, being rescued from flooded houses.

The council was forced to discharge wastewater in the sodden region, prompting warnings that contaminated floodwaters could make residents sick.

Recordings from Napier Airport show more than 110mm of rain fell in the city between midnight on Sunday and 8pm yesterday - 100mm of which fell between 12pm and 8pm.

Elderly woman rescued from flooded home

Firefighters rescued a 75-year-old woman trapped in her flooded home as torrential rain wreaked havoc in Napier.

Police confirmed officers and Fire and Emergency were at the home in Lighthouse Rd, Bluff Hill.

Firefighters elsewhere have rescued elderly residents trapped in their homes and taken them to the safer houses of family in the area, a Fire and Emergency spokeswoman said.

A large slip has affected houses on Brewster Street, Napier. Photo / RNZ

Panicked residents have called emergency services saying water was seeping underneath their front doors and into their homes, she said.

"We've had reports of flooding and leaking roofs, mostly in the Napier CBD," she said.

"Hawkes Bay's Urban Search and Rescue team is assessing a number of landslips on Napier Hill caused by the heavy rain."

Hawke's Bay Emergency Management controller Ian Macdonald said last night more than a dozen people had been evacuated.

People were being rescued and evacuated on a case-by-case basis, he said.

A massive landslide on Hospital Hill, in Napier, viewed toward Havelock Rd.

Cars were stranded in flooded waters and residents were urged to stay inside as roads in the city were no longer driveable.

"At one stage crews were responding to 150 calls for help in the city, mostly flooding and some leaky roofs and there were some gas leaks reported," the Fire and Emergency spokeswoman said.

"We're advising people to stay at home and keep dry. Stay inside your house."

Residents needing urgent help should call 111 - instead of the overwhelmed local Hawke's Bay Fire brigade, the spokeswoman urged.

The local Civil Defence branch warned residents against rubbernecking, saying it caused further headaches for emergency services.

"Driving through floodwater creates bow waves, which drive water into homes," the agency shared online.

Fourteen crews from the city and region were kept busy responding to calls from stranded residents.

Power outages have hit much of the city, as Unison confirms almost 3000 customers have been left in the dark tonight.

A large landslide was also reported near Havelock Rd, on nearby Hospital Hill.

Much of central Napier is in flood after heavy rainfall in the city. Photo / Warren Buckland

A Napier City Council spokeswoman urged the public to only flush their toilet when necessary, and hold off using showers, dishwashers and washing machines to prevent stormwater overflowing.

Lashing rain in the city caused manhole covers to lift, forcing the council to discharge wastewater into the Purimu stormwater stream, which flows out to sea through the Ahuriri Estuary, shortly before 6pm.

Medical Officer of Health Nick Jones said floodwaters could carry bugs that cause disease from the ground surface and sewerage systems.

"Children should be kept away from flood waters and from playing in puddles, which may have been contaminated by sewage," he said.

Residents should not eat any food that had been in contact with flood waters, Jones warned.

Heavy rainfall, thunderstorms and even hail is forecast to stay across the region until mid-week, with up to 130mm of rain expected to fall in some areas of Hawke's Bay.

By mid-afternoon yesterday, surface flooding was evident at several roads and highways in the region.

A Waka Kotahi NZ Transport Agency - Hawke's Bay and Gisborne spokeswoman encouraged drivers to switch on headlights, slow down, increase following distances and drive to the weather conditions in order to be prepared for unexpected hazards.

MetService meteorologist Rob Kerr said the broad low-pressure system currently over the North Island is expected to linger until it's pushed eastwards by a ridge of high pressure.

"From now through to later on Wednesday, parts of the North Island will see heavy rain or showers, with thunderstorms and hail possible, while strong or gale south to southeast winds affect the lower North Island," he said.

The effects of the heavy rainfall were evident on Marine Parade. Photo / Paul Taylor

Kerr said the main area of concern is the ranges of Hawke's Bay and southern Gisborne.

A heavy rain warning is in place for those areas, with 100mm to 130mm of rain expected to accumulate about the ranges from Te Haroto southwards, with 70 to 100mm elsewhere.

A number of slips have been reported across Napier. Photo / Warren Buckland

Peak intensities were expected from this afternoon when hourly rates could reach 25 to 40mm an hour in thunderstorms.

"This is a large amount of rain in a short period and isolated downpours could see totals exceed that range," Kerr added.

Macdonald of Civil Defence warned that heavy rain can cause streams and rivers to rise rapidly, with surface flooding and slips also possible. Driving conditions may be hazardous.

"It's always good for anyone driving to take extra care on days like this and keep an eye on the weather forecast," he said.

"As little as 30cm of water can cause people to lose control of their vehicles, so the usual cautions apply: Slow down, drive to the conditions and stay safe."

A logging truck ended up in a ditch on SH2 in wet road conditions on Monday morning. Photo / Warren Buckland

The northbound lane of State Highway 2, near Tangoio, was blocked after a logging truck slid into a roadside ditch.

Emergency services were called to the crash about 8.09am, but nobody was injured.

Surface flooding also caused the Mohaka Township Rd, Mohaka, to be closed at the Nakis Rd intersection this afternoon.

NCC said Kennedy Rd, at the intersection of SH2 and Downing Ave, was also closed from 4pm due to severe flooding.

Eastern District Police said surface flooding was causing multiple issues with vehicles "breaking down" when driving through floodwater.

The police requested the public keep vehicle traffic to a minimum until the flooding eases.

A tree had fallen onto a caravan on Shakespeare Rd in Bluff Hill, Napier, on Monday. Photo / Daniel Bryant

A Fire and Emergency spokesman said a tree had fallen on to a caravan in Bluff Hill, Napier, due to the weather at 2.32pm.

Kerr said a "further burst of heavy rain" may be expected in Hawke's Bay on Wednesday before the low pulls away.

Hastings District Council and Central Hawke's Bay District Council said they had not experienced any weather-related issues.

Firefighters responded to at least 150 weather-related callouts across the city. Photo / Warren Buckland

Waka Kotahi NZTA warned motorists to take extra care as surface flooding pooled over now impassable roads in the region.

"There is significant flooding on Taradale Rd, so take extra care in this area," the agency tweeted.

Some manhole lids had been lifted on roads in the city - but motorists likely wouldn't be able to spot that through the downpour and surface flooding.

Appendix D – News article – Radio New Zealand, 7th December 2020

About 600 Napier properties flood damaged - report

Tom Kitchin of RNZ20:58, Dec 07 2020

About 600 Napier properties flood damaged - report

Nearly 600 properties in Napier have been officially flood damaged, and there are fears more have gone unreported.

Trees and slips blocked roads, lamp posts toppled over, debris fell from cliffs and walls crumbled onto cars in the flood four weeks ago today.

The chaos caused by the flood has been detailed in a new Napier City Council report which will be presented to the audit and risk committee this week.

READ MORE:
***** **A climate for change: Napier flooding just a taste of what's to come**
***** **30 Napier properties 'uninhabitable', with 13 'significantly damaged' after floods**
***** **State of emergency declared in Napier as floods cause landslips, evacuations and power cuts**

As of late last month, 115 properties were uninhabitable and 386 were damaged but still liveable.

Napier Mayor Kirsten Wise thought the numbers could be higher.

"That is the ones that we are aware of, so there will be a number of flood affected in particular private residences that wouldn't have necessarily been reported through to council for any reason."

Large parts of Napier's water system are only built to deal with a one-in-five-year rain event - this year's was a one-in-250-year deluge.

Sewer manhole covers popped up in the worst affected areas, releasing heavily diluted raw sewage into already flooded streets.

Napier had not been able to upgrade all of its systems since new regulations came into force in the 1990s.

Wise said the impact was difficult to cope with.

"We experienced an event far beyond what we within our network had the capacity to deal with... so obviously there's no way we were ever were able to cope with a one-in-250 year event."

Some buildings in the town were lucky to escape serious damage, but the MTG (Museum Theatre Gallery) was flooded, although no catalogue was hit.

The Centennial Hall by McLean Park would be closed for up to 18 months, Wise said.

The number of flood evacuees peaked at 173.

As of the end of last month, 147 people were still staying at the council's emergency accommodation with nowhere else to go.

Dee Penno from Hawke's Bay Properties looked after rental homes and said the aftermath of the floods had hit housing hard, especially with more tradespeople in town for flooding repairs.

"The motels are full from all the beneficiaries that can't find accommodation and tradies coming from Auckland to fix. There's just nothing to rent."

Appendix E– News article – Stuff.co.nz, 9th December 2020

Napier holiday park cancels bookings to look after displaced flood victims

Catherine Harris15:22, Dec 09 2020

John Cowpland/Stuff

Last month's floods damaged about 600 properties, leaving many households still in short-term accommodation.

More than 900 summer holiday bookings at Napier's Kennedy Park have been cancelled because victims of last month's flooding are still needing shelter.

Sixty-eight units have been set aside at the well-known holiday park as temporary accommodation and 58 are currently being used, according to Napier City Council and the Ministry of Business, Innovation and Employment (MBIE).

MBIE activated its temporary accommodation service (TAS) on November 16 to provide short-term housing to people displaced from their homes by the November 9 deluge.

The latest council assessments show some 386 properties were damaged by the flood, and 115 homes have been deemed uninhabitable.

READ MORE:
* **'We feel forgotten about': Lives still in tatters four weeks after the Napier floods**
* **About 600 Napier properties flood damaged - report**
* **Crowded car yard of written-off cars shows extent of Napier floods damage**

Just over 170 people were taken to Kennedy Park at the time and Napier City Council said those still there had no alternative accommodation options.

‘’It is difficult to predict how long some residents might be needing to stay at the resort, but we are working with MBIE to find a solution for these people,'' a spokeswoman Kate Penny said.

‘’We had cancelled 195 bookings up to November 30. For December and January, we have cancelled a total of 748 reservations.''

Kennedy Park has long been Napier’s dedicated emergency housing location and many guests whose plans had been changed had been ''understanding of the circumstances,'' she said.

''We are working closely with our colleagues at Napier i-SITE who have been fully briefed and are working with these guests to provide alternative accommodation options so they can enjoy their visit to Napier.’’

John Cowpland/Stuff
Written off cars from the Napier floods await their fate in Hawke's Bay car yards.

MBIE said it had keeping a few extra units at the park unoccupied in case people needed them late in the piece.

''There may be a number of households who have been staying with friends or whānau until now and may discover the repairs to their property will take longer than first anticipated and recognise the need to register with TAS for help finding a longer term accommodation solution.''

MBIE's TAS programme provides slightly longer-term temporary accommodation than the ’’shelter'' or ''emergency accommodation'' for up to two weeks provided by civil defence and emergency agencies.

It includes a fleet of portable cabins purpose built for disaster relief.

As of Wednesday, TAS had helped 78 flood-stricken households, of which 40 are in TAS housing, three are in private rentals and the rest are being worked with or have exited the system.

''For a number of households in Napier, [Kennedy Park] has been the best option available and we are working to place nine portable units at registrants' properties," a spokesperson said.

Anyone who needed support following the flooding could register with MBIE to discuss their requirements, the department said.

John Cowpland/Stuff
A Napier resident slogs their way through floodwaters on November 9.