

# Independent Review and Gap Analysis of the Gisborne District Council Flood Warning Manual

*Prepared for Gisborne District Council*

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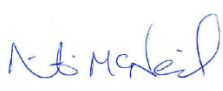

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## Executive summary

Gisborne District Council has a flood warning manual designed to guide Flood Warning Officers (FWOs) in assessing rainfall, river and other flood warning data and then advising the Tairāwhiti Emergency Management Organisation (TEMO) leading up to and during declared flooding events. The manual is an internal document that gets updated on an ad-hoc basis.

The extreme weather associated with Cyclone Gabrielle in February 2023 caused region-wide flooding that tested the manual's practical effectiveness. Following the event, GDC FWOs reviewed the manual and provided some updates. In addition to this effort and as part of its ongoing commitment to improving preparedness for flood response, GDC sought funding to support an external review of the flood warning manual.

GDC subsequently engaged NIWA to conduct this external review and gap analysis of the GDC flood warning manual via a Ministry of Business, Innovation and Employment (MBIE) Extreme Weather Recovery Advice Fund (WRAF) grant. The main tasks of this review were to:

- Compare the pre- and post- Cyclone Gabrielle versions of the flood warning manual.
- Interview key council staff about their perspectives of the effectiveness of the flood warning manual.
- Assess the core competencies and required training for Flood Warning Officers (FWOs).
- Recommend any improvements to the FWO role leading up to and during declared flooding events.

To accomplish the above tasks, we took the following approaches:

- Side-by-side comparative analysis of the pre- and post- Cyclone Gabrielle versions of the flood warning manual.
- Comparison of the GDC flood warning manual to flood warning documents from other New Zealand Regional Councils, as available.
- Comparison of the GDC flood warning manual to the Flood Warning Infrastructure Standard developed by the National Flood Warning Infrastructure Working Group of the Australia New Zealand Emergency Management Committee.
- Phone conversations with key GDC staff and a follow-up, in-person workshop with additional pertinent GDC staff.

The outcomes and recommendations included in this review are largely a reflection of the perspectives of participating GDC FWOs and other staff. Throughout this review process, it was clear that FWOs and other GDC staff involved in event response are dedicated to and engaged with improving their organisational flood response procedures.

The main outcomes and recommendations from this review are as follows:

- Provide greater imperative to the FWO role by stipulating in the manual the requirement for FWO duties to take priority during incident response.

- Provide guidance for resource upscaling when event magnitude (spatial and/or temporal) escalates.
- Clarify the roles and responsibilities of FWOs and other staff involved in incident management, including what people *are* and *are not* responsible for and how the roles interact.
- Make the manual a dynamic document: require post-event updates to the manual, make the manual more impact focused.
- Ensure that current and future FWOs have the necessary core competencies.
- Ensure that current and future FWOs have the appropriate support and opportunity to attend required training.
- Align the flood warning manual with national approaches to flood management: this item will likely need to be dynamic through time and will be informed by the outcomes of work to review Regional Council and Unitary Authority flood procedures across New Zealand as well as any updates to the CIMS framework into the future.

# 1 Introduction

On 14 February 2023, the New Zealand Government declared a National State of Emergency in response to the extreme weather conditions associated with Ex-Tropical Cyclone Gabrielle. The New Zealand MetService issued Red Warnings<sup>1</sup> for rain in Northland, Auckland, Coromandel, Gisborne and Hawke's Bay, and also issued Red Warnings for wind in Northland, Auckland, Coromandel and Taranaki (MetService 2023). Ex-Tropical Cyclone Gabrielle (herein referred to as Cyclone Gabrielle), represents the costliest weather-related event in New Zealand history, with the estimated cost of the event estimated to be about \$14.5 billion NZD (Wilson et al. 2024).

Cyclone Gabrielle was just one of many heavy rain events in Tairāwhiti over the last 8-9 years (Cave 2024), and it resulted in extensive flooding, damage to critical infrastructure, and widespread evacuations. The magnitude of the event put GDC's flood response systems to the test. Reflecting on how the event response unfolded during Cyclone Gabrielle has thus presented the opportunity to consider improvements for future extreme weather events.

As part of the post-event review and through a Ministry of Business, Innovation and Employment (MBIE) Extreme Weather Recovery Advice Fund (WRAF) grant, Gisborne District Council (GDC) engaged NIWA to conduct an independent assessment of GDC's flood warning manual (herein referred to as the manual) and the internal review conducted by GDC following Cyclone Gabrielle. The manual is used to guide Flood Warning Officers (FWOs) in assessing rain gauge, river gauge and other flood warning data, and in communicating their recommendations to the Tairāwhiti Emergency Management Office (TEMO) during event response. Following Cyclone Gabrielle, GDC recognised that there may be opportunities for improving operational implementation of the flood warning manual.

## 1.1 Purpose, scope and research approach

Cyclone Gabrielle presented challenging circumstances for maintaining efficient delivery of information between key decision makers involved in response efforts in the Tairāwhiti region. GDC and TEMO wish to identify opportunities to improve efficiency and to ensure that shared information is timely, effective and accurate.

The purpose of this scope of work is to assess the GDC flood warning manual (both pre- and post-Cyclone Gabrielle versions) and work in partnership with GDC to understand the procedures that occurred as part of the post-Cyclone Gabrielle internal review.

The scope tasks, associated research approach and report section describing the outcomes of each task are outlined in Table 1-1.

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<sup>1</sup> Red Warnings are issued by the New Zealand MetService for the most extreme of weather events, where substantial disruptions are expected. Red Warnings indicate that people need to take immediate action to protect their personal safety and/or their property, and that they should be prepared to receive and follow advice from official authorities and emergency service coordinators. [info from MetService, accessed via: [Severe Weather Warnings and Watches » About MetService](#)]

**Table 1-1: Scope tasks and research approaches.**

Scope Task	Approach	Report Section
1. Review the latest iteration of the manual and changes made following Cyclone Gabrielle and the internal review.	Side-by-side comparison of the pre- and post-Gabrielle versions of the manual to identify changes.	Section 2
2. Interview key GDC staff to obtain their perspectives of the purpose and effectiveness of the manual.	Initial phone conversations with key GDC staff, followed by an in-person workshop with additional attendees to further explore staff perspectives	Section 3
3. Review other flood warning manuals and for context the flood warning Infrastructure standard developed by the Australia Flood Warning Infrastructure Working Group established by the Australia New Zealand Emergency Management Committee.	Comparison analysis of the GDC flood warning manual with relevant sections of other flood warning manuals (where available). Comparison analysis of the GDC flood warning manual with the Australia Flood Warning Infrastructure Standard.	Section 4
4. Assess the core competencies required of Flood Warning Officers and recommend any improvements in their training, and their use of the data and information available.	Seek perspectives from experienced flood warning officers about required competencies and training for efficiently delivering flood warning services.	Section 5.1 and 5.2
5. Assess and present recommendations for the operational improvement of the Flood Warning Officers role leading up to and during a state of emergency or lower-level TEMO activation.	Seek perspectives from experienced flood warning officers about required competencies and support for efficiently delivering flood warning services. Synthesise findings from all previous scope items to identify recommendations for improvements.	Sections 5.3



## 2 Review of the GDC flood warning manual following Cyclone Gabrielle

The GDC flood warning manual is a document held internally within GDC. The manual gets updated on an ad-hoc basis, with its most recent update taking place in July 2023 following Cyclone Gabrielle. The revisions were undertaken by GDC Flood Warning Officers.

Here, we list observed changes made between the pre- and post- Cyclone Gabrielle versions of the flood warning manual (Table 2-1; Scope Task 1; GDC 2021 and GDC 2023 respectively). We then explore the effectiveness of those changes.

**Table 2-1: Observed changes in the pre- and post-Gabrielle versions of the Flood Warning Manual.**

Section of Manual (post- Cyclone Gabrielle version)	Change	Implications of change	Outcome
1.2 Staff Issued with Flood Warning Manual	“Area Controller” changed to “Group Controller”	Transition to new term to be consistent across CDEM roles. “Group Controller” is a statutory role with a well-understood meaning.	Streamline communications
	Add Principal Scientist to list of staff issued with the Flood Warning	Ensure all staff involved in event response have access to the manual to strengthen understanding of incident response procedures.	Streamline communications
2.2 Key Weather Sites	Removed NZ Weather and MetVuw as a ‘key weather sites’	Reduce variability of weather predictions by utilising one, rather than multiple, weather prediction models. While removing key weather sites may give more clarity, there is a risk of missing a weather event if one of these now-removed providers forecasts an event that others do not. In the future, moving towards ensemble forecasting may enable integration of multiple forecasts.	Streamline communications
	Added MetService homepage as ‘key weather site’	Indicate that MetService homepage is a key source of weather information.	Streamline communications
2.5 Flood Warning Officer’s Key Procedures	Change “Heavy Rain forecast, be it a Warning or a Watch” to “Heavy Rain Warning” as the trigger for initiating contact between FWO and CDEM	Reduces ambiguity around whether the FWO needs to initiate actions at either the warning or watch level (there are different event severities attached to the two levels). Clarifies that the FWO needs to take action during “warnings”. Does not distinguish between “Orange” or “Red” Weather Warnings. May require clarification around what actions to take leading up to these two different warning levels.	Clarify FWO action triggers

Section of Manual (post- Cyclone Gabrielle version)	Change	Implications of change	Outcome
	Removed “Civil Defence” from point 2 – FWO now to inform Duty CDEM Controller and GDC CEO	Streamlines warnings communications directly to response/recovery decision-making levels.	Streamline communications
	Gauge locations added to point 3, which lists the trigger levels of different rivers	Adds clarity around which gauge to use as the trigger level indicator for each of the four catchments included in the manual.	Clarify FWO action triggers
	Point 6 – now solely the FWO’s job to provide CDEM with advice	Reduces number of people at different operations levels who give/receive communications.	Streamline communications
3.8 Waipaoa River Historic Flood Hydrographs at Kanakanaia	Update to Kanakanaia gauge hydrograph for Cyclone Bola (1988) to include Gabrielle (2023).	Places the Cyclone Gabrielle hydrograph in context with the Cyclone Bola hydrograph.	Historic context
5.9 Waimata/Taruheru River Historic Flood Hydrographs at Goodwins Road Bridge (Major Waimata events)	Update the Goodwins Road Bridge hydrograph to include water levels from high flow events in 2015 and 2023 (Gabrielle).	Places the Gabrielle hydrograph in context with other large flow events.	Historic context
6.4 Hikuwai Historic Flood Hydrographs at Willow Flat (Major Hikuwai events)	Update the Willow Flat hydrograph to include Cyclones Hale and Gabrielle.	Places the Gabrielle hydrograph in context with other large flow events.	Historic context
6.4.1 Hikuwai Historic Flood Hydrographs at Willow Flat (1996-2018)	Add historic hydrograph of high-flow events between 1996-2018 (e.g., excluding Bola and Gabrielle)	Shows other large flow events at the Willow Flat gauge.	Historic context

Section of Manual (post- Cyclone Gabrielle version)	Change	Implications of change	Outcome
6.4.2 Hikuwai Historic Flood Hydrographs at Willow Flat (Bola Vs recent events)	Present Willow Flat hydrograph record from Cyclone Bola in comparison to events since 2020	Places recent events (2020-2023) in the context of Cyclone Bola.	Historic context
Appendix 2 – Issue Flood Warning eTXT	Change to a new eTXT platform	Improved communications.	Streamline communications
Appendix 3 – Review eTXT message success (in pre- Gabrielle Manual)	Appendix 3 removed	Removal of instructions of how to check message success. TEMO/CDEM still reviews the delivery success post-message. May require clarification between FWOs and TEMO/CDEM around who “owns” eTXT platform.	Streamline communications

The above changes to the pre- and post-Gabrielle versions of the flood warning manual appear to contribute to one of three outcomes:

1. To streamline communication pathways;
2. To improve clarity of flood warning officer (FWO) action triggers, or;
3. To place the manual’s procedural guidance in the context of historical high flow events.

All of the outcomes listed above seem to aim to improve efficiency of the manual in some way. However, there are some items in Table 2-1 that may need revisiting to ensure they provide improved efficiency. The items we encourage GDC to reassess are outlined in Table 2-2.

**Table 2-2: Items changed in the post-Gabrielle version of the flood warning manual (GDC 2023) that may need revisiting.**

Item to Review	Considerations
Removed NZ Weather and MetVuw as ‘key weather sites’	While we recognise the utility of reducing variability in weather forecasts, there is a risk of missing an event if not all weather models are monitored. As discussed with GDC, we recommend considering an ensemble forecasting system that can incorporate numerous weather models and help communicate uncertainty.
Change “Heavy Rain forecast, be it a Warning or a Watch” to “Heavy Rain Warning” as the trigger for initiating contact between FWO and CDEM	While MetService Severe Weather “Watch” levels are lower-level alerts to encourage people to stay informed, we wonder if any preparation steps are lost with the FWO not needing to take any actions until a “Warning” is issued. If there are any preparatory steps during the Watch level, we recommend identifying those steps in the manual.

Item to Review	Considerations
Appendix 3 (Review eTXT message success) removed	We understand that TEMO/CDEM still check the success of eTXT delivery, so we wonder if Appendix 3 was removed to indicate that the FWO is not responsible for checking eTXT delivery. We recommend that GDC discuss and clarify in the manual who 'owns' the eTXT system; the manual indicates that FWOs are responsible for issuing eTXTs, but we understand from discussions with GDC that TEMO/CDEM are responsible for checking message delivery. If this system works, it will be fine to retain it, however it could be more clearly outlined in the manual.

In addition to the changes made by the FWO team following Cyclone Gabrielle, and this side-by-side gap analysis, there remains further opportunity to continue revising the manual as informed by those who use it during event response and incident management. We explore possible future improvements in Section 4.

### 3 On-the-ground perspectives: how do operational staff perceive the effectiveness of the flood warning manual?

Initial phone conversations and a follow-up, in-person, workshop were held with key GDC staff<sup>2</sup> to gather and discuss perspectives relating to the utility of the flood warning manual. Topics identified during initial phone calls were further explored during the workshop.

In general, GDC staff perceived the flood warning manual as a useful tool for flood response. However, they also noted numerous potential improvements. GDC staff generally agreed that the flood warning manual performs well in the following areas:

- Ease of use (e.g., the manual is straightforward to follow)
- Formalising the relationship between GDC staff (e.g., the FWOs) and Civil Defence Emergency Management (CDEM)
- Providing prescriptive operational guidance to reduce staff members' interpretation of what actions to take while being flexible enough to allow for innovation and quick-thinking when required.

GDC staff indicated that they would like to see the manual become a more dynamic document that gets regular updates and that provides the mandate for the FWO role to take precedence during incident management. For the remainder of this section, we discuss possible alterations to current content in the manual, or additions to the manual, that GDC staff identified. The details of some of that content (e.g., core competencies, training) are discussed in Sections 5.1 and 5.2, respectively.

#### 3.1 Mandate for the precedence of flood response activities

GDC staff indicated that the current flood warning manual does not explicitly provide the mandate for flood response activities to take precedence over other work responsibilities during an event. Providing the directive for FWOs to focus solely on their flood response activities is critical to their functioning.

GDC staff indicated that during event response, flood response activities should take precedence over the FWO's business as usual (BAU) role. We recommend that GDC consider how they might be able to support the FWOs to act on this priority by articulating in the manual that their FWO duties take precedence over any other roles during event response.

As part of providing the mandate for event response, GDC staff feel like FWOs' managers could be more involved in understanding and supporting staff time in the FWO role (from an administrative standpoint). Managers should work with current and future FWOs to approve time for staff to dedicate to the FWO role and to identify and manage any potential operational conflicts. GDC staff indicated that some members of the current FWO team may face operational conflicts between their FWO roles and their business as usual (BAU roles). This concern is pertinent because there are some staff whose BAU roles provide critical support or information during event response. For example, if a staff member's BAU role involves collecting field data like river flow measurements or checking that instrumentation is functioning correctly during an event, they might not be able to fulfil that role if

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<sup>2</sup> GDC staff included members of the Flood Warning Officer team (including the on-duty FWO during Cyclone Gabrielle), other staff in the science, environmental and planning teams, a representative from TEMO, and a representative from the GDC iwi engagement team. We henceforth refer to this group as GDC staff but recognise that the perspectives here may not represent all of those across GDC.

they are the on-duty FWO, because they need to be present in the Emergency Coordination Centre (ECC) to fulfil their FWO duties. Potential ways to manage such a situation may be to

- Deem certain BAU jobs/roles incompatible with the FWO role.
- Only allow a certain number of staff from a given team or department to be a FWO.
- Nominate other staff to take over critical BAU roles when the FWO is on active duty.
- Encourage staff from non-flood related council departments to become FWOs (e.g., encourage staff who would not have BAU and FWO role conflicts to become FWOs).

GDC staff would also like to see managers approving a proportion of full-time-equivalent (FTE) to be dedicated to FWO duties, including training (Section 5.2) and event response (Section 5.3).

GDC staff also indicated that the manual does not articulate the need for staff to partake in a post-event debrief. They indicated that the manual should stipulate that post-event debriefs are a critical component of event response, thus also the FWO role. GDC staff would like to see the manual state that event debriefs and “lessons learned” should be discussed and documented within 4-6 weeks of the event and that FWOs be required to be involved in that discussion (and supported with the necessary FTE allowance). It is likely that all FWOs – both any on-duty FWOs during the event and the rest of the FWO team – would benefit from being involved in post-event debriefs and corresponding updates to the manual following the event. As such, this activity should be supported by dedicated time committed to the FWO role.

### 3.2 Event escalation, resource requirements and formalised shift rotation

GDC staff feel like the flood warning manual could better outline a system for upscaling resources as the severity of an event increases. Currently, the manual does not describe a process for calling upon additional FWOs when an event becomes too large for a single FWO to manage, nor does it detail shift rotation and handover procedures when a new FWO comes on duty.

During the workshop, GDC staff indicated that once more than two catchments are flooding, it becomes difficult for the FWO to keep up with data updates and relay that information to CDEM. GDC may wish to consider what kind of resource upscaling will work best for the FWO team (noting that currently, they only have six FWOs and there are human wellbeing factors to consider) during events that have large spatial (e.g., multiple catchments in flood) and/or temporal (e.g., multiple days of extreme weather) extents.

It will be important for the manual to distinguish between shift rotation (e.g., for long-duration events) versus having a second FWO on duty for spatially widespread events. The manual should also stipulate that, if two FWOs are on duty to respond to an event, both of those FWOs need to be competent and capable of fulfilling the FWO role. Having a second on-duty FWO is not the same as having a less-experienced FWO ‘shadow’ a more experienced FWO; shadowing should be considered training (Section 5.2).

GDC staff indicated that a flow chart or action table detailing how and when to upscale resources for event response would be a useful component of the manual. This tool could outline how to determine different resourcing needs for different levels of response, as well as how roles and responsibilities evolve as events escalate.

During long-duration events that require shift rotation (shifts are defined as lasting twelve hours, starting and ending at eight o'clock), FWOs should participate in a formalised handover procedure. GDC staff suggested that during long-duration or complex events that require shift rotation, the incoming FWO needs to arrive an hour earlier than their scheduled shift to ensure they have sufficient time for a formalised handover. They need to hear the most recent briefing or receive an update from the outgoing FWO around what advice has been given to CDEM and what actions have been taken. GDC staff would like to see the manual provide both the mandate for a formalised shift handover (including the 13-hour shifts during an active incident to allow time for the handover) as well as a handover template for key information that needs to be passed on to the incoming FWO(s).

### 3.3 Role clarification

GDC staff feel that the manual needs to revisit role descriptions, clarify role responsibilities, and better outline how the various roles interact to more clearly identify what FWOs and other response staff *are* and *are not* required to do. Currently, Appendix 5 – “Job Descriptions” of the flood warning manual (GDC 2023, p. 57) provides descriptions for following job/role titles:

- Flood Information Officer (FIO)
- Flood Warning Officer (FWO)
- Team Leader Land, Rivers & Coastal
- Flood Control Operational Teams & Contractors (Fulton Hogan & GDC BioSecurity)
- Civil Defence Team.

We recommend identifying which of these titles correspond to jobs (e.g., those that are also BAU jobs) versus those which refer to roles (e.g., non-BAU roles like the FWO). Though perhaps a minor detail in semantics, it may help GDC to clarify who is responsible for what by identifying whether the items above align with a person's BAU job, or if they are a role associated specifically with event response.

There appear to be some similarities or duplications of descriptions across some of these roles, notable across the FIO and the FWO. As an example, the manual states that the FWO should “monitor & analyse the ARROWS.2 Flood Forecasting Model” (GDC 2023, p. 10). The manual also states that the Flood Information Officer (FIO) “interprets the output of the ARROWS.2 model and [conveys] relevant information to the Flood Warning Officer” (GDC 2023, p. 57). We also understand that from the workshop that GDC staff would like more clarity around who is responsible for data reporting, which is pertinent to numerous roles listed above.

We also recommend clarifying responsibilities around the eTXT platform. The manual states that the FWO is responsible for issuing eTXT warning messages to the public, yet it is our understanding that TEMO/CDEM monitor the success of eTXT delivery. Moreover, GDC FWOs indicated that the manual could outline a communication pathway between FWOs and TEMO/CDEM to inform the FWO about what actions TEMO/CDEM have taken. One GDC FWO indicated that, during an event for which they were on-duty, they issued advice to TEMO/CDEM and did not receive timely a notification from TEMO/CDEM about what decision(s) had been made. The FWO had to trust/assume actions had been taken. It would be a benefit to FWOs to clarify that there needs to be a communication loop between FWOs and TEMO/CDEM.

Clarifying roles and responsibilities will likely result in increased protection for staff, because the manual would provide more accountability for specific responsibilities and could also specify that the advice and decisions made by staff can only be as good as the information they receive. Revising the flow diagram in Appendix 6 (GDC 2023) could help to clarify and establish communication pathways. Illustrating the relationship across the roles will indicate what information needs to be passed between staff to what level of detail, accuracy and uncertainty<sup>3</sup>. Uncertainty is a key component of information transmission, and staff need to be adequately equipped with the right communication tools to be able to convey uncertainty in their advice; the manual could outline how to manage different levels of uncertainty.

Aligned with role descriptions, GDC staff identified that a lot of key roles included in the manual are listed by individual staff names. Listing people by name poses challenges when the manual is not updated regularly; for example, if a listed key contact has left their role or is unavailable for event response, then there is no guidance on who to contact in lieu of that person. We understand that it is important to know the individual who fulfils a certain role; as such, perhaps an updated list of staff names could be included as an Appendix to the manual, while reference to roles in the main manual document should be made to the role title. This task could be undertaken following role clarification.

Given there are some uncertainties or overlap between roles and responsibilities, we anticipate that reviewing and clarifying roles will provide benefit to the manual and to staff involved in flood response. The manual should also outline the key competencies or baseline proficiencies of FWOs and the other roles in the role description. Key competencies and baseline proficiencies are further discussed in Section 5.1.

### 3.4 A dynamic and comprehensive document

GDC staff indicated that they would like to see the manual be updated following every event. One way to make the manual more dynamic would be to include a table of key event details – such as peak river flows, rainfall intensity and duration measurements, etc. – and observed impacts associated with an individual event. Observed impacts might include names of streets that were flooded, areas that needed to be evacuated, etc. It might be appropriate for an event-impact register to be kept as an appendix or as an external document with a reference ID within the manual, to keep the manual from growing cumbersome.

If there is a period of time without extreme weather events, the manual should still be reviewed on a semi-regular basis so as to stay up to date. GDC staff will need to agree an appropriate timeframe, but we recommend a basic manual review should be undertaken at least annually. This basic review could be as simple as ensuring that roles, responsibilities and technology available to accompany those roles are updated, and that any staff listed out by name are also up to date.

To become a more comprehensive document, GDC staff would like to see more catchments included in the flood warning manual. Currently, there are only four catchments with action plans: the Waipaoa, Te Arai, Waimata/Taruheru, and Uawa/Hikuwai River catchments. GDC staff indicated that other large catchments, such as the Waiapu, are not included in the manual but often require some response efforts when in flood.

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<sup>3</sup> GDC staff indicated that they would like the manual to discuss uncertainties in weather forecasting models, the flood forecasting model, responsibilities for looking after data, and communication pathways between staff who are responsible for checking asset data (e.g., stopbank strength, telemetry network performance) because that data impacts the advice that FWOs need to convey to CDEM.



## 4 Comparison analysis: how does the GDC manual compare to others?

### 4.1 Other New Zealand flood warning manuals

Regional and district councils across New Zealand vary greatly in terms of the size of community they serve and the amount of funding they have available to support their various initiatives. The different councils also manage river systems of different size and character. Due to such differences in resourcing (e.g., staff numbers), available funding, and the size and type of landscape that councils look after, there are considerable variations in the scope, style, and structure of flood warning manuals across all the councils. Information in this section is limited to the information we had available; it is not an exhaustive review of other New Zealand councils' flood warning manuals but provides a few examples of what other councils are doing in their flood response spaces that could help guide GDC in improving their manual. We also acknowledge that there is a great amount of work happening to revise flood response systems across the country. As such, this section is written to the best of our ability at the time of publication but may be subject to change in the future.

Some of the larger councils, such as Greater Wellington Regional Council (GWRC), have stand-alone documents outlining the flood response procedures for each of their major catchments. The Hutt Catchment Guide, for example, contains information pertinent to flood response in the Hutt Catchment such as a catchment summary, telemetry networks in the Hutt Catchment, duty officer action tables for flood events in the Hutt Catchment, rainfall frequency data and flood frequency data (GWRC, n.d.A). They have a separate document specifying the operational procedures of their flood response (GWRC, n.d.B). This document includes action cards and procedural flow-charts for various staff working in flood response roles.

Waikato Regional Council (WRC) structure their flood response by catchment zones<sup>4</sup>, each of which have their own zone management plan. While a thorough review of each of the zone management plans was not conducted, the plans appear to provide an overview of river and catchment management for each of the zones<sup>5</sup>, including some discussion around flood hazard and management strategies, but they do not appear to be designed as operational guidance documents for staff to follow during flood event response (e.g., WRC 2011). WRC has a "Regional flood response management plan" which guides coordination of council staff involved in flood response, defines governance roles, and establishes a framework for consistent response (WRC 2016). WRC also has stand-alone role descriptions for the Regional Flood Coordinator (Flood Manager) and their Regional Flood Liaison Officer (WRC 2023A&B). We also understand that they have a set meeting agenda for all key players in flood response and they publish major notifications via the WRC website page called Flood Room Live. WRC's Regional flood response management plan stipulates that an event debrief and review is critical to continued improvement of flood response, and provides the mandate for the Regional Flood Coordinator to coordinate "regional event report, debrief process, any flood manual updates and recommended operational improvements following the response" (WRC 2016, pg. 24). WRC also maintains numerous data portals for communicating environmental data.

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<sup>4</sup> WRC provides river and catchment services within eight zones: Coromandel, Waihou-Piako, Lake Taupo, Waipa, Upper Waikato, Central Waikato, Lower Waikato and West Coast. The Coromandel, Waihou-Piako and West Coast zones align with major catchments. The Waikato River catchment contains the other five zones (WRC 2011).

<sup>5</sup> Zone management plans are available on the WRC website: <https://www.waikatoregion.govt.nz/council/policy-and-plans/hazard-and-catchment-management/zone-management-plans/>

The Hawke’s Bay Regional Council flood manual provides some guidance on general flood response procedures. It has an action checklist but does not provide comprehensive procedural guidance on how to carry out those actions. The manual does provide high level information on the various stages of flood response but refers to other documentation – such as the Emergency Procedure Manual<sup>6</sup> – for role descriptions, staff functions, communications, and other items. The flood manual does provide the mandate for “all concerned personnel” (HBRC 2015, pg. 9) to provide post-event data and summary reports. We note that the version of the HBRC flood manual to which we had access is in draft form and is considered out-of-date, so may be subject to differences in more recently produced documents.

We are aware of ongoing work to review Regional Council and Unitary Authority flood procedures across New Zealand. This work was initiated by the National Flood Warning Steering Group and the River Managers Group, and is contracted to Tonkin & Taylor Ltd. As this work is ongoing and evolving, we cannot explicitly reference this work. However, we are aware that GDC is a willing participant in this review and that results from Version 2 of the assessment are expected to be ready in July 2024 (likely only available to the National Flood Warning Steering Group). We recommend that GDC utilise the findings of that work to further identify opportunities to improve their flood warning manual.

## 4.2 International (Australia-NZ) flood warning infrastructure standards

The Flood Warning Infrastructure Standard (FWIS) developed in 2019 by the National Flood Warning Infrastructure Working Group of the Australia New Zealand Emergency Management Committee (ANZEMC) provides a set of measures intended to guide the standardisation of flood warning services for sustainable and effective use (ANZEMC 2019). Flood warning services comprise networks of infrastructure, data collection and data communication used for flood forecasting and warning.

The FWIS is an infrastructure standard manual that mainly identifies performance requirements for flood forecasting and warning infrastructure and data communication. The GDC Flood Warning Manual is a procedural document that outlines the course of action that FWOs should take in response to flooding in the Tairāwhiti Gisborne region. As such, the information in the GDC Flood Warning Manual and the FWIS are largely different, but there are components of the FWIS that relate to components of the GDC Flood Warning Manual.

Here, we compare the relevant parts of the two documents to analyse whether any improvements could be made to the GDC Flood Warning Manual to better align with the FWIS (Scope task 3; Table 1-1). For this analysis, we identified the two most relevant parts of the FWIS as being:

1. Understanding river response;
2. Infrastructure performance requirements and verification methods.

### 4.2.1 Understanding river response

The FWIS describes river response as “water level rise from base flow to peak flow” (ANZEMC 2019; p.9). River response categories are either “flash” or “riverine” and are estimated using the metrics of time-to-peak (TTP); time of concentration (TOC) rain-to-river peak time; or catchment area upstream of the site (ANZEMC 2019). Functional and effective flood warning infrastructure relies on river response characteristics, because river response dictates how quickly data needs to be

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<sup>6</sup> We did not have access to this document.

communicated and interpreted for effective management response. River response also dictates the sampling interval performance requirements for effective data communication.

Currently, the GDC Flood Warning Manual does not describe the river response categories for the four included river catchments. However, in sections that outline the flood warning procedures for the different rivers, there is mention of “lag” times, which give some information about the speed of river response in these locations. For example, when the river stage at the Kanakanaia gauge is 3.5 m and rising, the FWO must initiate communications with certain parties. The manual identifies a consequence of “Te Wairau bend 0.75-1.5M [right bank] (7.5 hr lag)”. The “7.5 hr lag” component relates to the timing of river response/flooding, depending on tide, along Te Wairau bend right bank when the Kanakanaia stage reaches 3.5 m and rising (Figure 4-1). It may be useful for GDC to consider ways to classify river response categories using the data and information they currently have around lag times for river response.

Waipaoa River Flood Warning Procedures		
River stage/level at Kanakanaia	Action by Flood Warning Officer	Consequence
Met Office Alert Severe weather Warning or heavy rain Warning	<ul style="list-style-type: none"> <li>Check ARROWS Model.</li> <li>Notify FH Tiaki Wai Department Manager to start floodgate checks.</li> <li>CDEM will send out group email.</li> </ul>	
3.5m and rising	<ul style="list-style-type: none"> <li>Notify and Liaise with CDEM</li> <li>Notify Pam Ross's Estate: Cath Carter on 027 78 11 000.</li> <li>Notify License holder of Lot 3: Carl Hamlin 021826360</li> <li>Notify Glen Forrest: 06 863 3214 / 0212282535</li> </ul>	Depending on tide: <ul style="list-style-type: none"> <li>flooding of river mouth berms</li> <li>Te Wairau bend 0.75-1.5M RB (7.5 hr lag).</li> </ul>

**Figure 4-1: Example of lag times noted in the Waipaoa River Flood Warning Procedures table in the GDC flood warning manual.** Taken from Section 3 Waipaoa River.

One of the items discussed by GDC staff as a potential improvement to the FWO’s role includes a better understanding of the catchments included in the manual (and the wider region). As such, river response categories could be useful information to include in the GDC flood warning manual for each of the catchments as a way to not only provide more background information to the FWO, but also to provide guidance on how frequently data reporting needs to occur to make the best decision based on each catchment.

We acknowledge that the rivers in the Tairāwhiti Gisborne region are different to many rivers in Australia. Most of the rivers in Tairāwhiti Gisborne are likely to be classified as ‘flash’ because of their short, steep catchments. However, we recommend following a process to understand and better stipulate in the manual the different ways rivers in the region respond to extreme rainfall events (e.g., establishing critical rainfall to flood peak durations relative to different catchment saturation

conditions). For example, GDC could explore different levels of ‘flash’ response for their gauged, and potentially ungauged, catchments<sup>7</sup>.

#### 4.2.2 Infrastructure performance requirements and verification methods

Based on a river’s response type (Section 4.2.1), there will be different data latency reporting (e.g., data transfer) requirements from the site to the user (e.g., the FWO). The FWIS suggests the following data reporting timeframes for different river response categories:

**Table 4-1: Latency of reporting table from the Australian Flood Warning Infrastructure Standard. Page 10.**

River Response	TOC (time of concentration; hours)	Latency (of reporting; minutes)
Flash	<1 hour	5
	<6 hour[s]	15
Riverine	<12 hours	15
	<24 hours	60
	>24 hours	1440 (24 hours)

Data users or operational teams need to ensure that flood warning infrastructure networks communicate data to the required performance standards, and the data needs to be in a form that is understood and usable by the user.

Infrastructure for collecting rainfall data should be capable of measuring rainfall equal to or greater than a specific maximum design intensity for its specific location. The FWIS stipulates that, unless otherwise stated, the maximum design intensity should represent the 1% annual exceedance probability (AEP) for the sampling interval (ANZEMC 2019, pg. 12). Similarly, river level monitoring infrastructure needs to be sensitive enough to capture initial stages of level rises, but have a large enough range to accommodate the highest expected flows (also 1% AEP). Both rainfall and river stage/level monitoring infrastructure need to meet certain accuracy, sampling interval and resolution standards (see the FWIS).

To our knowledge, the GDC Flood Warning Manual does not currently identify the required intervals of data transfer for each of the included catchments. This information may be known to other parts of GDC, but GDC might wish to consider including this information in the flood warning manual to provide another point of reference, including the appropriate data update intervals from their telemetry networks for each catchment. We understand that the Kanakanaia gauge on the Waipaoa River logs data every 5 minutes, and communicates that data every 10 minutes. It may be useful to document similar data recording and transmission intervals for the other catchments included in the manual.

<sup>7</sup> Determining accurate levels of ‘flash’ response across the different catchments will likely depend on the density of rain and river gauges. We understand that as of 2019, GDC has 38 telemetered river level gauges and 60 telemetered rainfall gauges (GDC 2023). We have not explored the required density and distribution of gauges that would be required to determine accurate levels of ‘flash’ response.

## 5 Recommendations to help improve Flood Warning Officer preparedness for event response

This section is informed by all preceding sections, as well as by Chapter 31 of the Pitt Review which provided a comprehensive review of the 2007 floods that impacted the United Kingdom (Pitt 2008). The Pitt Review was commissioned by the UK government to identify the “lessons to be learned” from the flooding events. Many of those lessons learned are applicable to the GDC flood warning manual context (Appendix A).

### 5.1 Core competencies required for successful event response

The GDC FWOs who were involved in the initial phone conversations and/or the workshop indicated that all current and future FWOs should have baseline core competencies. Because FWOs can join from any part of the council, they often bring different knowledge, experience and skills to the role. As mentioned in Section 3.1, it can be an advantage to have FWOs from outside of the river management/environmental teams because they are less likely to have operational conflicts, which means there will still be people available to perform critical BAU roles during an event in support of the FWO. Regardless of an FWO’s background, it is recommended that all FWOs have the following core competencies:

- Basic understanding of hydrological principles.
- Understanding of how to read and interpret weather forecast models.
- Understanding of the inputs to and limitations of the ARROWS.2 flood forecasting model and how to interpret the outputs (or other flood forecasting models that may be used in the future) and communicate associated uncertainties.
- Understanding of the catchments in the region – how they respond to rainfall, the communities or assets located in different catchments, and the locations of gauges where trigger levels are recorded.
- Know how to communicate uncertainties to CDEM and other decision-makers.

If GDC undergoes flood response staff role clarifications (Section 3.3), we recommend that GDC take that as an opportunity to also review core competencies required for FWOs and other roles associated with flooding response.

### 5.2 Pre-event training

As indicated in Section 3.1, GDC FWOs would like to receive formalised onboarding for new FWOs, as well as training for continuous improvement of current and future FWOs. Prior to an event, FWOs should have the opportunities to attain the skills required for effective event management.

The GDC FWOs involved in the phone conversations and/or workshop indicated that the following items would be helpful onboarding or training items:

- Training with MetService: how they run and interpret their weather models, including uncertainty.
- Training with the ARROWS.2 flood forecasting model (or any other flood forecasting model that may be used in the future): how to input weather data input and to

interpret model results, including understanding uncertainties and limitations associated with the model.

- Data training: understanding what data is available (e.g., rainfall, river flow, telemetry data), where data comes from, how it is used in the FWO role, and how to interact with the FIO for more information when needed.
- Mock events: scenario training with all key players, including TEMO/CDEM and other emergency services providers either at the local scale or as part of a larger, cross-region or nationally organised event (if applicable).
- Out-of-region training: shadowing of, support for, or joint training with other councils.
- Shadowing of experienced FWOs by junior FWOs during an event (e.g., allow more junior FWOs to observe more experienced FWOs during an event, without being responsible for taking actions).

The FWOs indicated that their team needs someone to be responsible for organising training each year. At present, the FWOs do not have a ‘team leader’ or other personnel who might be given the role of planning and facilitating training events for the team each year. We recommend that someone – either inside or outside of the FWO team – take on this responsibility.

The FWOs would like to see all training be supported by an FTE component of their jobs (Section 3.1). Training should be supported and expected, as a requirement for being an FWO, so that staff can keep up to date with best-practice procedures and be adequately prepared to respond should an event arise.

### 5.3 Operational role leading up to and during flooding events

As stated in Section 3, the FWOs involved in phone conversations and/or the workshop indicated that the manual is straightforward to follow during events. In terms of the operational role of the FWO leading up to and during declared flooding events for which response is needed, the main additions that could be made to the manual include:

- Guidance on the lead-up to Severe Weather “Warning” alerts (discussed in Section 2 and Table 2-2).
- Guidance on how to upscale resources during large spatial (e.g., widespread) or temporal (e.g., long-lasting) events (discussed in Section 3.2).
- Formalised shift handover when a new FWO comes on duty (discussed in Section 3.2).
- Better alignment of incident control meetings with incoming data updates.
- Better integration of technology to take some actions off the FWO (e.g., automated scripts for eTXT messages; automated issuance of eTXT messages when trigger levels are reached).

One FWO indicated that in a previous event, the team had a few update meetings using ‘old’ data (e.g., weather data), and ‘new’ data would arrive shortly after the meeting. The new data had to be communicated to various parties, but delivering advice out of alignment with the newest data posed a challenge. We understand that GDC have been in contact with MetService to discuss ways to

increase frequency of data communication, as well as to gain clarity around when to expect incoming data to better allow for aligning meetings. River response time (Section 4.2.1) may be a useful tool to guide FWOs in informing MetService how quickly they need data updates, e.g., for rivers that respond more quickly, the FWOs may need more frequent forecasting or data updates.

The manual currently provides the trigger point at which FWOs are to issue messages to the community via the eTXT platform (GDC 2023). The manual suggests that the eTXT platform contains standard messaging text for the different rivers (GDC 2023, Appendix 2) but the manual does not include the text for the different templates. It might be useful if the templates are included in the manual so that FWOs know ahead of time what those messages say. eTXT templates could be included as part of Appendix 2 in the manual. Additionally, one FWO indicated it might be helpful if the eTXT system could automatically issue eTXT at trigger points. We recommend that GDC consider this option, however, it must be considered that the trigger points often occur when a river reaches a specific stage *and* is expected to continue rising. There might be some potential for miscommunication by automatically issuing eTXTs if a river reaches the trigger stage but does not then continue to rise. Additionally, as discussed in Section 3.3, there seems to be some overlap in ownership of the eTXT platform, with the FWO issuing eTXTs and TEMO/CDEM monitoring the success of eTXT delivery. It may be worth FWOs and CDEM discussing if any changes to eTXT ownership could streamline the eTXT service. If FWOs and TEMO/CDEM are happy with the current setup, then it can be retained, but may require clarification in the manual.

As mentioned in Section 3.1, FWOs indicated that post-event debrief should be a mandated component of their role. As such, holding a post-event debrief is considered as an operational improvement to the role, but we recognise that this role component would take place after a declared flooding event ended.

## 5.4 Other recommendations

In addition to the recommendations outlined above as per Scope Items 3-5 (Table 1-1), additional recommendations identified during conversations with key GDC staff include:

- Growth of the FWO team: currently, there are six FWOs. In a large event that requires a second on-duty FWO and shift rotation, most of the FWO team will end up being involved in event response.
- Consider how external people (e.g., FWOs or similar staff from unaffected regions) could assist in event response (i.e., incoming support) and how GDC FWOs or similar staff could assist during out-of-region events (i.e., outgoing support/possible training for GDC staff) in a reciprocal relationship.
- Recommend formalised support for FWO role (Section 3.1) and, if appropriate, increasing the incentive for more staff to join the FWO team (e.g., Cave n.d.).
- Review of the stage level trigger points in the manual: ensure the trigger stages are still relevant and account for any changes to flood protection infrastructure or natural changes in the river systems. Assess if trigger stages are still relevant under changing river flow, climate, and sea level conditions (as applicable). Also consider including other catchments in the manual and how to determine trigger points (use existing gauges, establish new gauges, or determine another method if the catchment is ungauged).

- Considering measures for redundancy in the flood observation system and protocols for what to do if communications lines (e.g., telemetry) shut down.
- Consider upgrading the flood flow forecasting capabilities to a system that can incorporate forecasts over the entire catchment and integrate ensemble forecasts from different providers.
- Ensure the flood warning manual is aligned with New Zealand’s official framework for incident management, the Coordinated Incident Management System (CIMS) third edition (e.g., where the FWO fits into the CIMS structure and who they may be providing information to at different levels of response).
- Further update to the flood warning manual following this external review.
- Review recommendations in the 2008 Pitt Review (Pitt 2008) to determine if there are any points that could be applied to the GDC flood warning manual or other operational documents.

The above recommendations are intended to contribute to GDC’s ongoing commitment to improving their flood warning and response services. As mentioned in Section 4.1, we also encourage GDC to incorporate findings from the work being carried out by the National Flood Warning Steering Group and the River Managers Group to review Regional Council and Unitary Authority flood procedures across New Zealand. We understand that results from this work (contracted to Tonkin & Taylor Ltd.) are expected in July 2024.



## 6 Conclusions

This report aimed to assess the GDC flood warning manual (both pre- and post- Cyclone Gabrielle versions) by working in partnership with GDC. To achieve this review, we identified changes to the manual made following Cyclone Gabrielle, assessed the GDC flood warning manual against other flood warning documents from other select councils and against the FWIS, and through conversations with key GDC staff.

As a result of the review, we recommend the following overarching items to contribute to ongoing improvement of the flood warning manual and associated activities:

- Provide greater imperative to the FWO role by stipulating in the manual the requirement for FWO duties to take priority during incident response.
- Provide guidance for resource upscaling when event magnitude (spatial and/or temporal) escalates.
- Clarify the roles and responsibilities of FWOs and other staff involved in incident management, including what people *are* and *are not* responsible for and how the roles interact.
- Make the manual a dynamic document: require post-event updates to the manual, make the manual more impact focused.
- Ensure that current and future FWOs have the necessary core competencies.
- Ensure that current and future FWOs have the appropriate support and opportunity to attend required training.
- Align the flood warning manual with national approaches to flood management: this item will likely need to be dynamic through time and will be informed by the outcomes of work to review Regional Council and Unitary Authority flood procedures across New Zealand as well as any updates to the CIMS framework into the future.

Throughout this review process, it has been clear that FWOs and other GDC staff involved in event response are dedicated to and engaged with improving their flood response procedures. Many of the recommendations provided in this report were identified directly by GDC FWOs and other staff, indicating sound knowledge of the requirements for effective flood response. Other recommendations were determined in collaboration between GDC staff and NIWA staff who specialise in flooding hazard and river geomorphology. We recommend that the FWO team be involved in any future updates to the flood warning manual, given their collective knowledge and expertise, as well as being the main users of the document. The manual needs to be workable and achievable in order to provide the best possible outcomes for both response staff and the wider community.

## 7 Acknowledgements

We express our gratitude to the following councils for sharing some of their flood warning documentation with us for the purposes of this work (e.g., Section 4.1): Greater Wellington Regional Council, Waikato Regional Council, and Hawke's Bay Regional Council. We also thank Teresa Simcox of Toa Consulting for facilitating knowledge-sharing between us and these councils.

We also thank the GDC staff who were involved in the phone conversations and workshop for their time and contributions to this work.

## 8 Glossary of abbreviations and terms

AEP	Annual exceedance probability
ANZEMC	Australia New Zealand Emergency Management Committee
CIMS	Coordinated Incident Management System
CDEM	Civil Defence Emergency Management
ECC	Emergency Coordination Centre
FIO	Flood Information Officer
FWIS	Flood Warning Infrastructure Standard
FWO	Flood Warning Officer
GDC	Gisborne District Council
GWRC	Greater Wellington Regional Council
HBRC	Hawke's Bay Regional Council
MBIE	Ministry of Business, Innovation & Employment
TEMO	Tairāwhiti Emergency Management Organisation
TOC	Time of concentration
TTP	Time to peak
WRC	Waikato Regional Council

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## Appendix A Recommendations of the 2007 UK flood review and applicability to the GDC Flood Warning Manual

The Pitt Review (Pitt 2008) includes a comprehensive list of recommendations informed by the 2007 UK floods. Here, we provide an abridged list of the recommendations in the Pitt Review that we interpret as most applicable to the GDC flood manual and/or the FWO role. We acknowledge that there may be additional recommendations in the Pitt Review that GDC finds useful, but also acknowledge that many of the recommendations lie beyond the scope of the GDC flood manual or of GDC as an organisation. We recommend that GDC review the Pitt Review to identify which recommendations might be used as guides for potential improvements, either specifically to the manual or to the wider organisation.

Recommendation (Pitt Review)	Applicability to GDC Flood Warning Manual and/or FWO role
(1) Given the predicted increase in the range of future extremes of weather, the Government should give priority to both adaptation and mitigation in its programmes to help society cope with climate change.	This point could feed into the manual's mandate that flood response duties (prior to, during and after an event) are of critical importance to society.
(3) The Met Office should continue to improve its forecasting and predicting methods to a level which meets the needs of emergency responders.	Improved frequency of MetService data to councils, including the timing of data/forecast information.
(4) The Environment Agency should further develop its tools and techniques for predicting and modelling river flooding, taking account of extreme and multiple events and depths and velocities of water.	Improvement to flood flow forecasting tools that can incorporate ensemble forecasting.
(5) The Environment Agency should work with partners to urgently take forward work to develop tools and techniques to model surface water flooding.	NIWA has a prototype national flood flow forecasting capability that could potentially be used by councils in the future, but this requires further national level funding. GDC is looking at updating ARROWS.2; they could consider developing their own flood forecasting system.
(16) Local authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and condition.	Include flood asset maps as part of the manual, as an appendix, or as an external document with a reference ID that sits within the manual. FWOs would likely benefit from some knowledge of the flood risk management assets in the region.
(19) Local authorities should assess and, if appropriate, enhance their technical capabilities to deliver a wide range of responsibilities in relation to local flood risk management.	For GDC to discuss across the FWO and CDEM teams, to incorporate into future training requirements.
(28) The forthcoming flooding legislation should be a single unifying Act that addresses all sources of flooding, clarifies responsibilities and facilitates flood risk management.	If any new legislation related to flooding is released, the flood warning manual may need to refer to this legislation in role descriptions to align with national approach.

Recommendation (Pitt Review)	Applicability to GDC Flood Warning Manual and/or FWO role
(33) The Environment Agency should provide a specialised site-specific flood warning service for infrastructure operators, offering longer lead times and greater levels of detail about the velocity and depth of flooding.	The flood warning manual already describes communication requirements between FWOs and infrastructure/asset managers. Possibly consider reviewing if the information shared is sufficient for infrastructure/asset managers to accomplish any required tasks.
(34) The Met Office and the Environment Agency should issue warnings against a lower threshold of probability to increase preparation lead times for emergency responders.	The 2023 version of the manual indicates that FWOs take their first action when the MetService issues a “Heavy Rain Warning”. Could consider providing more information about if FWOs need to be preparing during lower threshold notifications.
(35) The Met Office and the Environment Agency should issue joint warnings and impact information on severe weather and flooding emergencies to responder organisations and the public.	Potentially relevant to the messages that are sent to the public via the eTXT system. GDC to review if there are opportunities to align messages with MetService warnings and expected impacts if not already applicable.
(37) The Environment Agency should work with its partners to progressively develop and bring into use flood visualisation tools that are designed to meet the needs of flood-risk managers, emergency planners and responders.	Flood visualisation data should be made available, where possible, to response staff. The manual could stipulate who is responsible for providing this data to whom.
(41) Upper tier local authorities should be the lead responders in relation to multi-agency planning for severe weather emergencies at the local level and for triggering multi-agency arrangements in response to severe weather warnings and local impact assessments.	Ensure that roles and responsibilities, including communication pathways, are clearly identified.
(44) Category 1 and 2 responders should assess the effectiveness of their emergency response facilities, including flexible accommodation, IT and communications systems, and undertake any necessary improvement works.	Relates to training, e.g., mock events, to ensure that the systems in place are sufficient to respond to events.
(66) Local authority contact centres should take the lead in dealing with general enquiries from the public during and after major flooding, redirecting calls to other organisations when appropriate.	Specify who the appropriate person is for managing public enquiries during an event (e.g., CDEM).
(75) For emergencies spanning more than a single local authority area, Government Offices should ensure coherence and coordination, if necessary, between recovery operations.	Consider integrating CIMS framework into the manual, where appropriate.

Recommendation (Pitt Review)	Applicability to GDC Flood Warning Manual and/or FWO role
(78) Aims and objectives for the recovery phase should be agreed at the outset by Recovery Coordinating Groups to provide focus and enable orderly transition into mainstream programmes when multi-agency coordination of recovery is no longer required.	Post-event debriefs to be included as a necessary role during event recovery.
(81) There should be an agreed framework, including definitions and timescales, for local/central recovery reporting.	A template or framework for post-event debriefing could be included in the manual.
(92) Local Resilience Forums should evaluate and share lessons from both the response and recovery phases to inform their planning for future emergencies.	Allow public information to be included in event debriefs, where appropriate. Allow event response staff to share their own lessons-learned as part of planning for future event response.