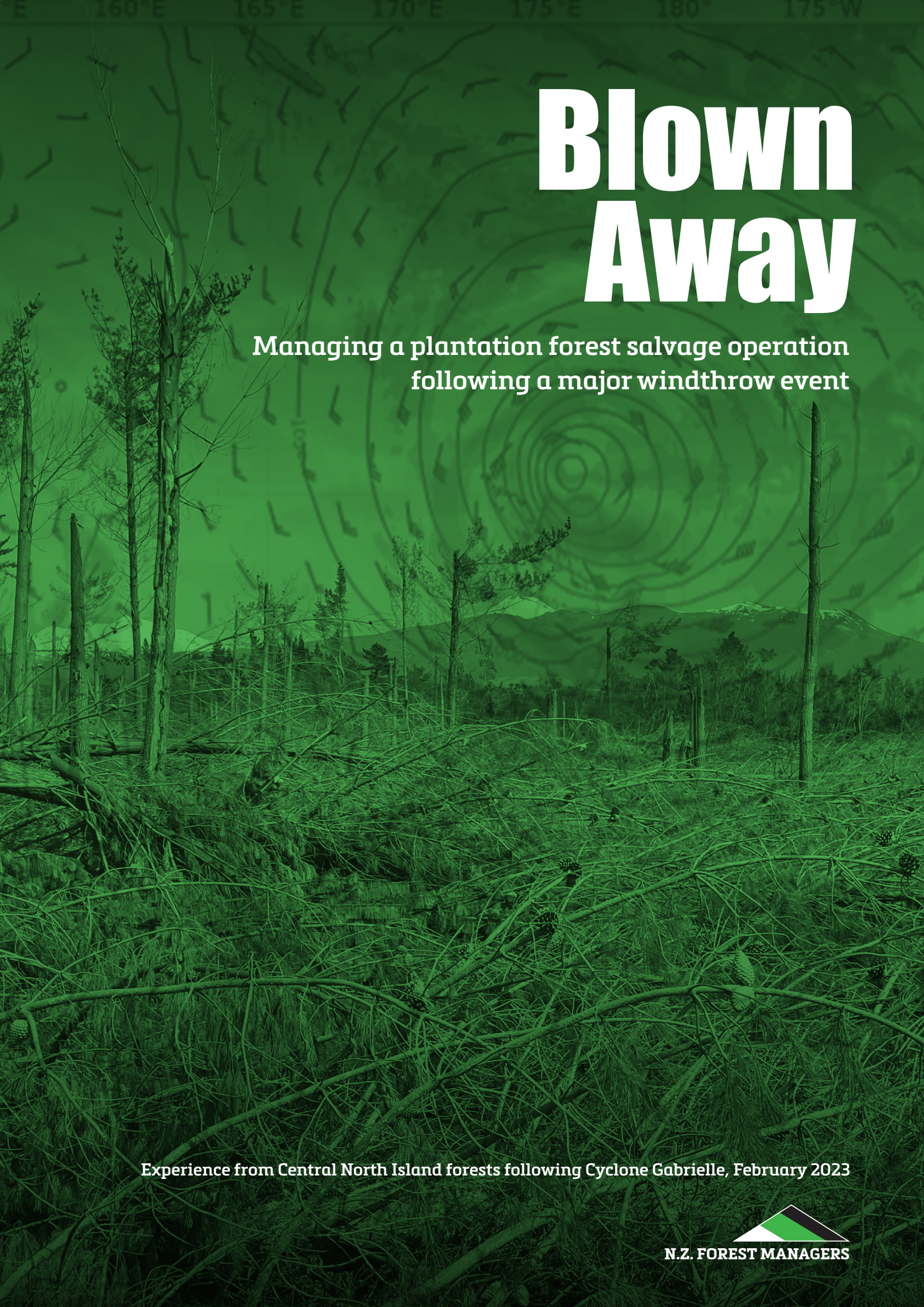

Blown Away

Managing a plantation forest salvage operation following a major windthrow event

Experience from Central North Island forests following Cyclone Gabrielle, February 2023

N.Z. FOREST MANAGERS

FOREWORD

From the morning of February 14 2023, through to the end of June 2024, New Zealand Forest Managers staff and contractors operated at up to five times our normal capacity in an effort to minimise financial losses for our forest owners following the devastating impact of Cyclone Gabrielle.

The salvage operation demanded a sustained and coordinated effort from many people. All the usual complexities of forest harvesting and marketing were amplified many times over. We were fortunate to have not only an exceptional in-house team, but also the support of others with relevant experience who readily stepped in to assist.

The operation was ultimately judged a success, and we felt it was important to document our experiences. We hope that future forest managers can benefit from the lessons we learned—what went well, and what we could have done better.

Above all, I want to sincerely thank everyone who contributed to this extraordinary effort. Whether you were on the ground, behind the scenes, or offering support in any way—your commitment, resilience, and teamwork made this achievement possible. We couldn't have done it without you.

John Hura
General Manager
New Zealand Forest Managers

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CONTENTS

EXECUTIVE SUMMARY

New Zealand Forest Managers (NZFM) is a forest management company based in Turangi in the Central North Island of New Zealand. The company is owned by the commercial arm of Lake Taupō Forest Trust, Tupu Angitu, and Lake Rotoaira Forest Trust. NZFM's management portfolio is medium-size by New Zealand forestry standards. It includes Central North Island forests owned by two Māori trusts, Lake Taupō Forest Trust and Lake Rotoaira Forest Trust, where social and cultural considerations are integral to forest management activities. Other forests managed by NZFM are owned by the Crown, other iwi entities, corporate and private owners.

Normal annual harvest volume is around 1,000,000 cubic metres (m^3) or up to around 100,00 m^3 per month, produced by eight or nine harvesting crews working across the NZFM estate.

Cyclone Gabrielle struck localised northern, eastern and central parts of New Zealand's North Island over February 13th and 14th 2023. Very heavy rain caused severe flooding, land slips and damaging debris flows, especially in parts of Auckland, Tairāwhiti, Hawkes Bay and Wairarapa. Extremely high east/south-east winds, delivered at the tail-end of the cyclone in the early hours of Tuesday 14th February, severely impacted parts of the southern Central North Island. The maximum gust speed recorded at Turangi was 170km/hr.

These winds caused widespread and severe damage to plantation forests, with trees either blown down in swathes or snapped off mid-stem. Some 6,700 hectares of trees managed by NZFM - mainly radiata pine over 20 years old - were damaged to the point where a large-scale salvage operation was the only option available to recover some value.

NZFM began salvaging the damaged timber immediately after the cyclone. The operation ran for 16 months, finishing in June 2024. At its peak, the company was operating at four to five times its normal capacity. The operation was deemed highly successful by the affected forest owners and the wider forest industry. It was completed by its target date, with no lost-time injuries to harvesting contractors, and with relatively good financial outcomes.

The social and cultural needs of local communities were respected. Both Lake Taupō Forest Trust and Lake Rotoaira Forest Trust ensured workers coming into the forests were culturally safe when working within the forests, arranging a formal welcome (whakatau) to the forests and local iwi's permission (whakawātea) when working around culturally significant sites.

Wind damage on this scale and in such a localised area is very rare in New Zealand. Much was learnt over the 16 months of salvage operations. When the enormity of the job at hand first became apparent, a literature search revealed little in the way of helpful information for NZFM's management team.

This report provides a summary of how the NZFM team approached and managed the salvage operation, and some of the key learnings from it. Forest managers faced with a major windthrow event in future may find this record of NZFM's experiences useful.

TIMELINE OF KEY EVENTS FEBRUARY 2023 - JUNE 2024

February 10th-14th 2023

Friday 10th: awareness of the threat of the cyclone grew. Safety concerns were raised at a NZFM managers' meeting. Harvesting contractors were contacted and told to follow standard safety protocols, including parking machines away from standing trees over the weekend.

The NZFM management team settled into 'wait and see' mode over the first part of the weekend.

Sunday 12th evening: NZFM managers had a joint Zoom call. The decision was made to close forests based on safety concerns.

Contractors were informed that there would be no access, and no work, on Monday 13th.

Monday 13th: conditions were eerily calm.

Tuesday 14th early hours: devastating east/-south-easterly winds were delivered by the tail-end of the cyclone. By the time daylight arrived, there was no doubt that damage to local forests was widespread and extensive.

The first few days: management priorities

The focus was on six key areas as the scale of damage to forests managed by NZFM became evident:

- safety – paramount from the get-go
- communications – internal and external
- assessing the damage
- opening up access; assisting neighbours; assisting utilities companies with access, especially to powerlines
- quantifying the damage
- starting the salvage operation.

From Day 1, it was obvious that a major salvage effort was the only option. More harvesting contractors would be needed, so efforts to find additional crews began immediately. All other parts of the system would also need to expand to deal with the volume of wood to be salvaged.

Fundamental decisions made and communicated were:

i. safety is our top priority – mechanised operations only; certified contractors only

ii. our aim is to minimise value loss to owners – i.e., salvaging as much as possible as quickly as possible.

The onus was then on enabling existing harvesting contractors to get back to work. Salvage operations began as soon as contractors were able to reach their machines and road access was cleared.

The first few weeks: management priorities

The scale of damage was clarified: four main forests belonging to five main owners were affected; initial estimates were of around 6,500 ha of toppled or snapped trees (later increased to 6,700 ha). Over 50% of stands aged 20 years and older were damaged, the majority of which were pruned radiata pine.

An overall estate harvest plan was created, covering all the damaged forests and identifying priority areas for the salvage operations to begin.

An incident response spreadsheet was also set up so that community needs could be addressed.

Around 12-13 new harvesting crews moved into damaged forests. Many of these were crews displaced from cyclone-ravaged parts of Hawkes Bay and Tairāwhiti.

March – June 2023

March 2023 - the NZFM Board laid the challenge to complete the salvage operation as quickly as possible. A target completion date of June 2024 was set later, once operations started to gather momentum.

Salvage operations moved into full swing with around 21-22 crews harvesting. Planning, distribution and sales operations all scaled up to deal with harvesting activity.

June 2023 – NZFM General Manager John Hura went on a reconnaissance flight over damaged forests. John realised that, despite everyone's hard work, "we've hardly made a dent in it" and operations needed to expand significantly to meet the June 2024 completion target.

July – December 2023

Production ramped up again, peaking at around 300,000 m^3 /month. Forty-one harvesting crews now active, generating up to 500 truck movements a day. All parts of the system were under stress at times.

Log quality deteriorated but not as quickly as expected. Distribution continued to both domestic markets (pruned logs), export markets (via four North Island ports), and one domestic pulp mill.

A 'salvage grade' was introduced – any logs with over 50% surface area showing staining went straight to export or pulp markets. Material drying out and brittleness/breakage became an issue for contract rates and customers alike.

Targeted drug and alcohol testing of truck drivers was escalated as the number of truck movements increased significantly and some near-miss incidents and accidents arose.

January – June 2024

Deteriorating log quality now a major consideration. All logs going for export and pulp.

June 2024

Salvage operation completed on target.

Planning for restocking across the four affected forests underway.

The Numbers

- Of the total forest area of around 44,000 ha, approximately 15% (6,700 ha) was damaged.
- Around 88% of the damaged area comprised trees over 20 years old, the majority of which was pruned radiata pine.
- Around 3.3 million m^3 of toppled, snapped or otherwise damaged wood was salvaged.
- Of the 3.3 million m^3 of logs salvaged, 2.4 million m^3 went for export, 0.9 million m^3 went into domestic sales.
- NZFM staffing levels, normally at around 26-27, peaked at 39.
- Harvesting crews, normally at 8-9, peaked at 41.
- Logging truck movements went from 100 to 500 per day at peak.
- Exports went via 16 sales points at four North Island ports.
- Logging truck dockets continued to be processed manually throughout.
- A company record was set for annual harvest volume in Financial Year (FY) 23, and was beaten in under five months in FY24. The salvage was finished mid-June 2024, 16 months after the cyclone.
- A positive stumpage was achieved in each forest and there were no lost-time injuries directly associated with the harvesting operations. Four lost-time injuries did occur in distribution operations however.

NZFM forests and forest owners most affected by Cyclone Gabrielle

The four different forests managed by NZFM, involving five different forest owners, which were most impacted were:

- Lake Taupō Forest – owned by Lake Taupō Forest Trust
- Lake Rotoaira Forest – owned by Lake Rotoaira Forest Trust and Crown Forestry
- Taupō Estates Forest – owned by New Forests (an Australian investment management company)
- Wairakei Forest (further north near Taupō), owned by Land Information New Zealand (LINZ).

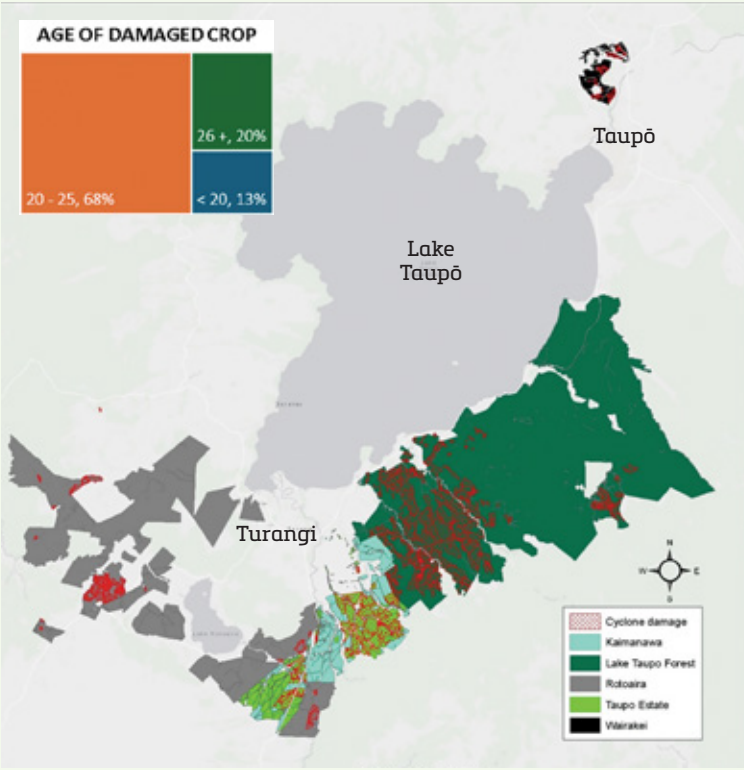


Fig 1: NZFM-managed forests damaged by Cyclone Gabrielle

Some good luck with the bad

The timing of the cyclone and state of the wider forest industry in 2023

Despite the bad luck delivered by Cyclone Gabrielle, NZFM benefitted from a number of serendipitous elements of good luck throughout the salvage operation. These combined to shape the salvage operation to a significant extent:

- the timing of cyclone (late summer) in relation to wood quality was highly fortuitous – if it had hit at the beginning of summer, wood quality would have declined much more quickly
- the damage caused to forests and infrastructure by the cyclone in Hawkes Bay and Tairāwhiti meant contractors from those regions were available immediately
- the down-turn in the log export market during 2023, and other forestry companies' reduced operations, which freed up harvesting contractors
- going into winter, further contractors were freed up from woodlot operations
- the log market down-turn and reduction in harvesting activity elsewhere increased the availability of logging trucks and port capacity, both of which could have been major choke points. Cartage rates were also relatively good
- demand for pruned logs in the domestic market was helped by the export market downturn and resulting harvest reduction elsewhere. A significant proportion of pruned volume was able to be sold domestically (which in turn helped with trucking capacity).

Other beneficial circumstances

Other factors that contributed significantly to making the salvage operation easier than it otherwise would have been:

- most of NZFM's damaged forests are on flat land, enabling fully mechanised ground-based harvesting. The salvage was much faster than if it had been on steeper country requiring hauler operations
- two key domestic customers –Tenon and Oji Fibre Solutions – were very supportive from the outset, temporarily re-negotiating some quality criteria to provide on-going markets for salvaged wood
- extra staff with recent experience of NZFM's forests and systems were brought on-board very soon after the cyclone, smoothing the immediate ramp-up of operations.

"DEVASTATING WINDS WERE DELIVERED BY THE TAIL-END OF THE CYCLONE...

BY THE TIME DAYLIGHT ARRIVED, THERE WAS NO DOUBT THAT DAMAGE TO LOCAL FORESTS WAS WIDESPREAD AND EXTENSIVE."

SECTION 1

THE LEAD UP AND IMMEDIATE RESPONSE TO THE CYCLONE

By daylight on February 14th, it was obvious that the cyclone had caused widespread and significant damage to forests in the Central North Island. The NZFM management team moved into action rapidly, and by the end of the day, some key areas of activity were underway:

- communications – internal and external
- damage assessment
- opening up access; assisting neighbours; assisting utilities companies (especially power-lines) with access
- quantifying the damage
- recruiting extra resources – harvesting crews being the first priority
- salvage operations begin.

The framework for the salvage operation was defined by two basic principles: (i) safety for all concerned, and (ii) loss minimisation for forest owners.

1.1 Communication in the lead-up to the cyclone

NZFM has a culture of good, open communication amongst staff. In addition, communications and protocols with contractors and forest owners around closing the forest in adverse weather or for other safety reasons were well-established. In other words, standard safety protocols existed which could be implemented without any major drama.

It was evident by Friday afternoon (February 10th) that a significant weather system was on its way. From past experience, the NZFM team knew that strong winds from the east/south-east were likely to be damaging to forests in the Taupō-Turangi area. An adverse weather warning was sent out to harvesting crews on the Friday, advising them to monitor weather conditions and ensure environmental risks were managed where applicable – this included moving all harvesting machinery to skid sites or other safe areas.

The track of the cyclone was monitored over the weekend. By Sunday afternoon (February 12th) it looked highly likely to arrive in the area late Monday or early Tuesday. NZFM General Manager John Hura contacted other local forest companies on Sunday afternoon to confer on plans to close forests and suspend activities. Some were planning to close their forests, others were continuing to operate as normal.

A Zoom meeting between the NZFM management team on the Sunday evening resulted in the decision to suspend all forest access on Monday 13th. Staff and forest workers were notified using established communications networks. It was agreed that it would be easier to close and re-open forests later than to deal with problems if they remained open and the cyclone did arrive.

Monday 13th was uneventful in the forests, and the weather was calm. The forecast for Tuesday was reviewed and the decision made to suspend forest access until further notice, with a review midday Tuesday 14th.

The cyclone struck the southern Taupō area in the early hours of Tuesday 14thFebruary 2023.

SECTION 1: THE LEAD UP AND IMMEDIATE RESPONSE TO THE CYCLONE

1.2 After the cyclone: assessing the damage

It was apparent from before dawn on Tuesday 14th that damage to forests around Turangi was significant. The initial plan was to find out what was damaged and focus clean-up operations on the worst-hit areas. Once staff started trying to access forests on the ground it became obvious that access was very limited in many forests, with most forest roads blocked by fallen trees.

Images from planes and helicopters doing powerline survey work started coming through mid-morning, and pictures were appearing on other social media. The first satellite images became available by around 1pm on Tuesday afternoon, and this was when the scale of damage became apparent. Aerial surveys confirmed the extent of the damage from Wednesday onwards.

"At 10.00am on Tuesday the instruction to the team was to 'find out what's damaged'. By 1.30pm, it had changed to 'find out what's still standing'. No-one truly appreciated the scale until we saw the images."
Thomas Crosse, Planning Manager

Forests managed by NZFM which suffered most damage were in southern Taupō area (Te Mātāpuna):

- Lake Taupō Forest – owned by Lake Taupō Forest Trust (4,400 ha damaged of 24,000 ha total area)
- Lake Rotoaira Forest – owned by Lake Rotoaira Forest Trust and Crown Forestry (500 ha damaged of which 470 ha belonged to Crown Forestry of 9,800 ha total area)
- Taupō Estate Forest – owned by New Forests (an Australian investment management company) (1,700 ha damaged of 3,900 ha total area)
- Wairakei Forest (further north near Taupō), owned by LINZ (100 ha damaged of 700 ha total area).

1.3 Priority operations: Tuesday 14th February

The immediate priority was to re-open key access routes within the forest. Arterial roads, powerline access, and threats to public safety, such as damaged and leaning trees near public roads, were top priorities. Any neighbours who needed help were also treated as a priority.

Most of the harvesting crews had been working in Lake Rotoaira Forest, and were able to access their machines and begin clearing roads. Crews in Lake Taupō Forest were flown in to their machines by helicopter on Wednesday 15th. Crews needed clear guidelines from NZFM's Harvesting Manager, Matt Owen, on where to start and what to do. Right from the start, strict emphasis was placed on safety in what are inherently dangerous working conditions.

An incident spreadsheet was established at NZFM's office, and as people called in reporting access or other issues, jobs were logged and actions recorded.

1.4 Quantifying the damage

Finding as much imagery as possible was the first objective of the NZFM planning team, led by Planning Manager Thomas Crosse. As quality satellite imagery became available during the first day, a mapping exercise identified damaged areas, and that first cut revealed around 6,500 ha of damage.

"NO-ONE TRULY APPRECIATED THE SCALE UNTIL WE SAW THE IMAGES."

From this, quick and dirty volume estimates were calculated – inventory estimates for the older material were available, which helped. The team built a big worksheet which acted as a database of what needed to be salvaged – where, what and how much. This exercise confirmed that damage had occurred across four main different forests belonging to five different owners.

There was limited ability to ground-truth estimates because of restricted access. The only way to see most of the forests was either by aircraft or drone.

1.5 Immediate external communications after the cyclone

Priority external communications in the immediate aftermath of the cyclone were with (i) harvesting crews with a view to opening up road access, making roads safe and assisting neighbours; (ii) powerlines companies who needed access to their networks in the forests; and (iii) our forest owners.

1.6 Salvage operations begin

By the afternoon of Tuesday 14th, salvage operations within Lake Rotoaira Forest had already begun. The management team had also very quickly realised that extra resources were going to be needed to deal with the salvage – even before the full scale of the damage was clear.

Things we learnt: Day 1

- The team was ready for the cyclone and had some standard protocols in place. This meant we could act immediately once the winds died down.
- Good communication amongst the management team, and between the management team, the NZFM Board, and forest owners, was paramount. Fortunately all staff have offices in the same building, making it relatively easy to meet and make decisions quickly.
- Setting clear objectives right from the start – 'minimising value loss' and 'getting the work done safely and as quickly as possible' - were both decisions that were clearly communicated and well received.
- From Day 1 the impacts on the local community were evident. Prioritising the recovery to minimise the effects on local people – clearing roads and making roads safe, helping neighbours with trees on houses and fences (even if not our trees) – the company had an important role to play.

"We knew we had to act quickly. It was important to know whether other forestry companies were affected as there would be competition for resources. On that first day it was obvious Hawkes Bay was badly affected, and that there was going to be major disruption to harvesting activities. So we quickly got on the phone to Pan Pac and forestry companies over there, to find out about resource availability. We were able to get Pan Pac and Rayonier contractors early in the piece. From then on, contractors were ringing us asking for work."

John Hura, General Manager

SECTION 2

THE 16-MONTH SALVAGE OPERATION

2.1 Clear objectives defined at the start of the operation

Managing a successful forest harvest involves coordinating a number of interdependent activities:

- planning the order and scale of operations
- managing harvesting and distribution operations
- marketing and sales of logs produced to meet financial objectives
- monitoring and control of all processes
- ensuring compliance with health and safety and environmental standards.

NZFM was faced with four-to-five-fold increase in the scale of all operations. The management team also operating within a complex ownership framework, with four damaged forests and five different owners. Maintaining the company's high health and safety and environmental standards was deemed paramount, and the external environment was ultimately very important in shaping the salvage operation.

The framework for the salvage operation was quickly set in the form of the following objectives:

- get it done as quickly as possible
- do everything safely – no compromises
- minimise value loss for forest owners
- develop a response plan and share it with forest owners.

2.2 Priority external communications as salvage gets underway

Communication with stakeholders in the first few days was a key focus. Forest owners needed to know that their forests had been damaged, the extent of the damage, and plans for salvage operations.

Owners also had to be asked to provide working capital, so that salvage operations could be kick-started at pace. Daily Zoom or Teams meetings were held with some owners in the days and weeks following the cyclone to keep them abreast of progress in their forests.

> "It was a case of explaining 'We've got some bad news for you – your trees have blown over and we're going to need a whole lot of money if you want us to pick them up.'"
> ***John Hura, General Manager***

Working within a Māori cultural framework is a big part of how NZFM operates. NZFM managers had to make sure they understood how local people were reacting to the disaster and what their cultural needs were. Some locals were in shock, and described feelings of grief at the loss of the forest which many had been involved with all their lives. A significant amount of time was needed to work through community, workforce and salvage-related issues. This including suspending owners' access to the land for recreation while salvage operations were underway.

For some time, NZFM managers held daily meetings with Lake Taupō and Lake Rotoaira Forest Trusts, updating them as more and better information about the nature of the damage and early salvage activities became available.

Forest maps proved to be very valuable during these meetings, providing a visual resource that helped people understand what was happening. Arrangements were made for groups of local people to visit the forest and pay their respects through karakia and other cultural protocols.

The owners of the two non-Māori forests reacted differently to the Māori trusts: their staff generally had good forestry management experience, were happy to be hands off and leave everything to NZFM. Their attitude was one of 'tell us what you need and we'll make sure you're resourced'.

Other external communication priorities for the public in the first few days after the cyclone included:

- the NZFM website was used to inform people that forests were closed until further notice, and that a Cyclone Gabrielle Response Plan was being developed
- satellite imagery was also provided on the website later on, so that people could see the scale of the damage
- a notice announcing the partial reopening of Lake Taupō and Lake Rotoaira Forests for recreational access was posted, once it was ascertained which parts of the forest were safe and no salvage operations would be happening.

Communications put out by the forest owners on their own networks also helped to inform people about what was happening – for example, information was available on both the LTFT website and their Facebook page. A key aspect was making sure the local forest owners understood that, until further notice, they could not enter the forest for their normal hunting or firewood collecting activities.

Two-way communication between NZFM and powerlines companies Transpower, The Lines Company, and Genesis was essential in the early days. Relevant regional councils (Waikato and Horizons) were notified immediately under National Environment Standards (NES-CF) requirements that windthrow salvage would be taking place across entire forests.

2.3 Planning the salvage operation

Planning for the salvage began right away. The objective of minimising value loss for owners rather than maximising revenue generated was identified as the overarching goal – although this was hotly debated around the management table.

The conundrum of deteriorating wood quality

The NZFM team between them had some experience of small-scale windthrow events in Central North Island forests including in earlier major events such as Cyclone Bola in 1988. In addition, there had been a relatively recent 800-hectare windthrow in a neighbouring forest, where they had been able to observe the salvage operation.

But the team found there was a paucity of factual information on how quickly snapped and toppled trees would deteriorate. Their best guess was that there might be around a 12-16 month window before log quality deteriorated to a point where the trees became very difficult to handle and of very low, if any, value.

SECTION 2: THE 16-MONTH SALVAGE OPERATION

Three main threats to wood quality were identified:

i. **sapstain** – fungal attack which leads to the wood turning blue and hence becoming unacceptable for appearance-grade timber (the market for most of NZFM's pruned logs) and for industrial lumber and some pulp customers – for example, near-by Winstone Pulp – one of two relatively close pulp mills

ii. **phytosanitary – i.e. insects** – populations build up under the bark of dead trees, and the wood becomes unacceptable to some export markets and/or requires additional fumigation before export

iii. **wood drying out and becoming brittle** – logs become difficult to saw and are prone to breaking when handled by machinery.

Predicting wood quality decline over time proved to be very difficult. As NZFM discovered, a number of variables, including the type of damage (toppled or snapped), age of trees, weather conditions and site aspect, can all contribute to the rate at which wood quality deteriorates.

"By end of May we had just about reached 'set and forget': Matt [Harvesting Manager, Matt Owen] could come in and we could see where he should go next. Having the model for decision support was really valuable – we didn't have to go back and work things out every time. We monitored progress closely – we made sure we knew how things were going, and that we didn't get behind in any of the forests. We used a combination of satellite imagery and manual mark-up to monitor progress – all supervisors would provide feedback every month. We had to be flexible and use a range of data sources to make sure we captured all the areas each month."
Thomas Crosse, Planning Manager

The threat of wood quality deteriorating to the point where logs became unsaleable was pivotal to the decision to 'go hard' right from the outset by bringing in extra harvesting crews. Once logs are unsaleable, salvage becomes a land-clearing exercise with no opportunity to offset the clearing cost, so an expensive proposition. A 16-month time-frame was set for the salvage operation to be completed.

It was decided to focus on salvaging the most valuable crops first – these were mature pruned logs primarily destined for domestic customers such as the Tenon sawmill in Taupō. In general harvesting crews had already been working in these stands, so the salvage was able to begin as soon as the crews had opened road access to the sites.

The planning team used existing tools and information to build an estate model based on salvage areas. The model had to incorporate operational and environmental constraints, and also the early recognition that resources should be shared equitably across the four forests. This model proved to be a crucial decision-support resource for the salvage operation - it allowed the harvesting management team to prioritise stands in their planning process. Crews were moving into new blocks very regularly, needing the next block planned and ready for them. Aspects such as roads, skids, and the relevant paperwork all had to be in place.

Mapping activities were ramped up as the salvage operations got underway, moving from the normal quarterly remap of clear-fell areas across 8-9 crews covering around 200 ha, eventually to a monthly remap of 50-60 different harvest areas, re-mapping 600-700 ha each time. The harvesting, and hence mapping, focus was 100% on salvage operations, with everything else 'parked'.

All the harvesting that had been scheduled to happen before the cyclone was in the forests that were damaged, so at least the owners had an expectation of harvesting taking place, even if in a somewhat different way to the salvage that ensued.

A great deal of additional reporting was required – a key item being monthly progress reporting against targets by forest for both internal performance tracking and for forest owners.

With NES-CF regulatory reporting, the normal 20-day harvesting notification is fortunately reduced to a two-day notification for salvage. Notifying of harvest across all four forests was deemed the simplest approach, rather than on a stand-by-stand basis. Waikato and Horizons Regional Councils were good to deal with, as their staff understood the scale of the event, although there was no lessening of standards.

It rapidly became clear that 'business as usual' activities can't necessarily be put off even after an event such as this. A routine Forest Stewardship Council (FSC) surveillance was due, which couldn't be delayed any longer. This was handled by NZFM Environmental Planner, Jackie Egan.

Similarly Worksafe made a five-day visit as part of their regional forestry circuit, focussing on compliance with safe work practices, working from heights, and machinery guarding in harvesting operations. With the substantial increase in crew numbers, and having some crews that had only arrived very recently, this created a significant amount of additional work for the harvesting team, both in advance of the visit and while hosting Worksafe personnel.

"The main issue relating to FSC was risk to their chain of custody reporting – with a lot more people, and a lot more dockets, the chance of something going wrong increases. We had three certified and one uncertified forest – so the right docket books had to get to the right crew in the right forest. You have to be able to rely on your systems to make sure that sort of thing goes right. But we proved we could maintain FSC standards even in a crisis."

Thomas Crosse, Planning Manager

Ultimately, all FSC and WorkSafe want to know is that their standards are being complied with, regardless of NZFM's very high workload at the time.

2.4 Managing harvest operations

A reconnaissance flight over the damaged forests on Wednesday 15th confirmed the scale of the destruction to John Hura and Matt Owen, NZFM Harvesting Manager. Many more resources - not just harvesting crews, but also logging trucks, supervisors and administration staff – would be needed if the majority of the windthrow was to be salvaged. Matt Owen's task was to figure out who was available, where they were, and what gear they had.

"We just had to start at the start. I made a lot of lists in those early days. But we made some bold calls early on about where to start, and we backed ourselves."

Matt Owen, Harvesting Manager

"THE BIG UNKNOWN WAS DETERMINING HOW QUICKLY WOOD QUALITY WOULD DETERIORATE."

Above: Logs rejected by Assure Quality at port due to fungal decay.

Right: Logs seen at five months post-cyclone (top) and eight months post-cyc;one (bottom)

Two overarching early decisions that shaped the whole salvage operation were:

i. **safety is paramount** – mechanised operations only; certified contractors only.

ii. **minimise value loss to owners** – salvage as much as possible as quickly as possible. Aim for salvage to be completed by June 2024.

Initial priorities were to get existing contractors back to work, access routes cleared, and then to identify where and how to scale up operations. Then it was a case of making the most of contacts in the industry, and getting calls out to other forestry companies and contractors. Initially, known local contractors were contacted, as well as crews from Hawkes Bay and Tairāwhiti. Fairly soon contractors began contacting NZFM looking for work.

Some minimum standards for recruiting additional crews were quickly established:

- fully mechanised ground-based set-up
- SafeTree (or equivalent) certification
- contractors must make initial contact with Matt Owen by email – this acted as an initial 'drafting gate' in employing contractors, preventing time-consuming conversations
- history of good environmental performance – NZFM did their own due diligence checks (internet and social media searches) to ensure crews had good health, safety and environmental records
- all new crews must go through a full NZFM induction and Health and Safety audit by independent contractor on arrival.

Getting crews and their machines out of damaged forests in Hawkes Bay and Tairāwhiti and across to the Central North Island was a massive job for some, as many roads were closed and bridges destroyed.

More management and supervisory staff were needed. Two recently retired harvesting supervisors were persuaded to come back to work – a move which proved very helpful, given their familiarity with the forests and NZFM's systems. New staff were taken on in all areas of NZFM's operations,, with priority given to known people, especially those with relevant experience, because there simply wasn't time to train people up.

Together with the planning team, the harvesting team worked on the order of stands to salvage. Along with operational and log value factors, harvesting output had to balance with dispatch capacity and market availability. The majority of the windthrow occurred in stands of pruned radiata pine over 20 years old: work started where existing crews had already been harvesting and then generally continued from older to somewhat younger stands. The core team of existing NZFM crews was directed to continue producing NZFM's own grade mix for domestic customers; new crews were put onto run-of-the-mill China lengths for export.

On-going challenges around the harvesting operations were:

i. balancing safety criteria with costs – keeping cashflow ticking over while trying to run a safe and successful salvage operation

ii. balancing production and uplift – while it proved relatively easy to employ new harvesting contractors, logging trucks proved a real pinch point. All harvesting decisions inevitably affect cartage. Because export

markets were further away, more trucks were needed for a given volume of logs, and cartage contractors under-estimated journey times

iii. the big unknown of how quickly wood quality would deteriorate.

"A key factor was always how much time have you got and what is going to happen to wood quality. We were continually gambling about how long the wood was going to last, and what was going to cause it to degrade – insects, stain etc. In fact we never had any insect problems. We really needed some tools to help us identify factors that would affect rates of degrade."
Matt Owen, Harvesting Manager

Operations ramp up again - July 2023

After another surveillance flight in mid-2023, it was realised that harvesting operations needed to ramp up significantly if the target of completing the salvage by June 2024 was to be met. Again Matt Owen set about recruiting suitable contractors – although by this time many had been touch with him looking for work as the wider industry continued to slump. All the parts of the system similarly had to scale up to what was a further doubling of output.

As market conditions deteriorated over the course of 2023, more harvesting and trucking capacity became available. In some cases, crews who were prepared to upskill to reach SafeTree certification were taken on. Crews came with a wide range of commitment periods, with some available for set timeframes, others keen to stay until the end of the salvage operation. Eventually the point was reached where any new contractors were only taken on if they could bring logging trucks with them. Cartage crews were allocated to specific harvesting crews, and given the responsibility of moving that crew's output.

At the peak of the salvage, during the second half of 2023, some 41 crews were employed, 27 of which were in Lake Taupō Forest, the remainder spread across the three other forests. Several crews were operating two shifts in 24 hours. Out-turn peaked at around 330,000m^3 per month, generating some 500 truck movements a day.

Arrangements were made with some forestry companies to supply supervisors along with harvesting crews, which proved an effective way of matching supervision capacity with crew numbers. One supervisor was generally allocated to 5-6 crews.

When a backlog developed on the skid, priority for up-lift was given to the highest value logs. If necessary, lower-value logs were left on the skid and returned to later when cartage capacity increased. On some occasions, harvesting crews were shifted into lower productivity areas to slow them down until cartage capacity could be increased again.

As time went on, a further challenge was to adjust harvesting rates (i.e., payment to contractors) as wood dried out. Conversion factor scaling was the basis of these adjustments and became very important as time went on. Rates vary anyway according to terrain and other variables, and setting rates proved difficult with the many unknowns associated with a salvage operation.

Matt's personal strategy included delegating roles wherever possible, giving him scope to react to problems as they arose and spend time on planning. The harvesting team met fortnightly to share as much information as possible including weekly production reports (something that has continued post-salvage). All team members took holidays over the 16-month operation.

What went well as planning and harvesting progressed

- Clear standards and communication around who was going to be employed to work in the forests – local people were still given priority, but everyone had to meet certification criteria and this was clearly communicated.
- 100% mechanisation rule, with very strict restrictions on working out of machines.
- Fairness in sharing resources between different forests – clearly communicated and consistent approach, supported by owners.
- Introducing voiceless dispatch and inventory management systems and expanding the number of radio channels.
- Monthly Health, Safety and Environmental contractor breakfasts were very valuable – 'no blame' reporting; encouraging crew members to talk about concerns; encouraging robust discussions; highlighting things that have been done well or gone well; actively responding to concerns raised (not just in meetings but afterwards).
- Removing one tree length of trees from all roads – meant no further road blockages, safer and easier assessment.

Things we learnt

- Salvage was prioritised by value, focussing on older pruned stands and areas that couldn't be worked in winter. In hindsight north-facing slopes should've been added into the mix, as wood on these dried out quicker.
- Log scaling for conversion factors needs to be done all the time and contractor rates then reviewed from time-to-time. By the time it got to September-October, the wood was getting light. This affected a lot of things leading to a lot of differences to be reconciled – something that took until well after the salvage was finished to complete.

> **"Everything that went well, we wished we'd done it earlier. But we brought the same approach to the salvage as we do to managing forests every day – health and safety, environment, maximising value recovery from each tree."**
> ***Matt Owen, Harvesting Manager***

- It would have been good to monitor wood quality from Day 1, giving a better understanding of how quality changed over time.
- Clearer road signage and more kilometre markers would have helped new drivers find their way around the forests. Most road signs had been smashed by falling trees.
- More induction videos especially for new operators would have been helpful – SafeTree videos were very good but weren't available from Day 1. An internal contractor induction video would've been good too but would've needed several updates as we tweaked our own systems.
- More aerial surveys would have been helpful - for example, fly every couple of months. Boundaries of windthrown areas kept expanding as more trees fell down; other areas could have perhaps waited longer before salvage. Satellite images don't have the resolution needed. Even though we were mapping all the time, a visual perspective is very helpful.
- More drone and LiDAR data could have increased the accuracy of salvage planning, and might have resulted in some different decisions on whether or not to salvage based on tree damage and stocking.

2.5 Health and safety for staff, contractors and the public

Right from the start there was a heightened focus on health and safety for all in-forest operations, instigated by harvesting manager Matt Owen but implemented by a team including NZFM's Health and Safety specialist Veronica McDonald, Distribution Manager Manager Stephen Holdsworth, harvesting crew supervisors, and a number of independent contractors.

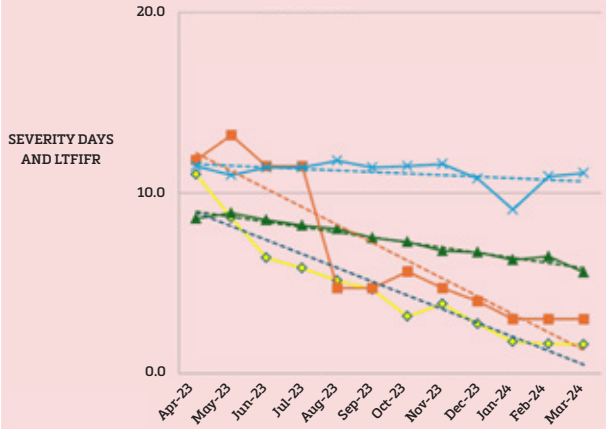
The net result was that there were no lost-time injuries (LTIs) directly related to the windthrow salvage – an impressive outcome, and one for which crews, supervisors and managers can all take credit.

The main safety risks proved to be around the big increase in log truck movements, which went from the normal 100 to 500 movements per day. A total of four LTIs were recorded during the16-month salvage, nearly all of which were cartage-related. In both of the two years leading up to the cyclone there had been two harvesting LTIs and no transport ones.

NZFM already had a strong reputation for fostering relationships amongst managers, supervisors, and crews, and for having a strong safety ethic. NZFM's core contractors are subject to relatively high levels of monitoring by their supervisors, but new crews had to adjust to this.

NZFM holds monthly Health, Safe and Environment meetings with harvesting and distribution contractors, with breakfast provided. The meetings' aim is to celebrate successes, and encourage contractors to speak openly, put forward ideas and voice concerns to management. Existing contractors know they can speak up and that managers will listen and, importantly, respond. Again, new contractors had to adjust to these open meetings. During the salvage, meeting attendance peaked at over 100 people and the events were highly successful in strengthening two-way communication and collaboration.

NZFM and industry Lost Time Injuries and severity data, April 2023-March 2024



	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24
NZFM LTIFR	11.0	8.6	6.4	5.8	5.1	4.7	3.2	3.9	2.8	1.8	1.6	1.6
Industry LTIFR	8.6	8.9	8.5	8.2	8	7.5	7.3	6.8	6.7	6.3	6.5	5.6
NZFM Severity	11.8	13.2	11.5	11.5	4.8	4.8	5.7	4.8	4.0	3.0	3.0	3.0
Industry Severity	11.5	11	11.4	11.4	11.8	11.4	11.5	11.6	10.8	9.1	10.9	11.1

Fig 2: NZFM Lost Time Injuries (LTIFR) and injury severity rates (orange and yellow lines) during the salvage compared with industry averages.

While the harvesting supervisors' job focused on ensuring harvesting was carried out safely and effectively, additional independent specialists were also employed to visit new crews and check not only on safety practices but also on the well-being of crew members. Some crew members from Hawkes Bay and Tairāwhiti had lost their homes or suffered other trauma in the floods, and were away from their families at a difficult time.

One issue that had to be sensitively handled was bringing new Māori crews from out of the area onto another Iwi's tribal lands. Both Lake Taupō Forest Trust and Lake Rotoaira Forest Trust ensured workers coming into the forests were culturally safe when working within the forests, arranging a formal welcome (whakatau) to the forests and permission (whakawātea) when working around culturally significant sites.

Accommodation was needed for crews from out of the area, and the local community responded generously, offering baches and other spare accommodation.

A series of SafeTree short videos were made – these featured contractors and supervisors describing how they approached certain tasks, some of which were unique to the salvage operation. The videos proved a good way to communicate best practice to harvesting crews, and in hindsight it was felt that they should have been made earlier. A bespoke induction video for new crews joining the salvage operation would also have been very useful, but was never made.

New protocols had to be introduced around any manual falling because of the inherent dangers of windthrown trees. Basically no-one was allowed out of a cab with a chainsaw unless approved by a NZFM harvesting supervisor. Tree rootballs and the holes created by the rootballs when a tree toppled proved to be the biggest operational hazard for harvesting crews, but techniques were developed by machine operators to minimise risks.

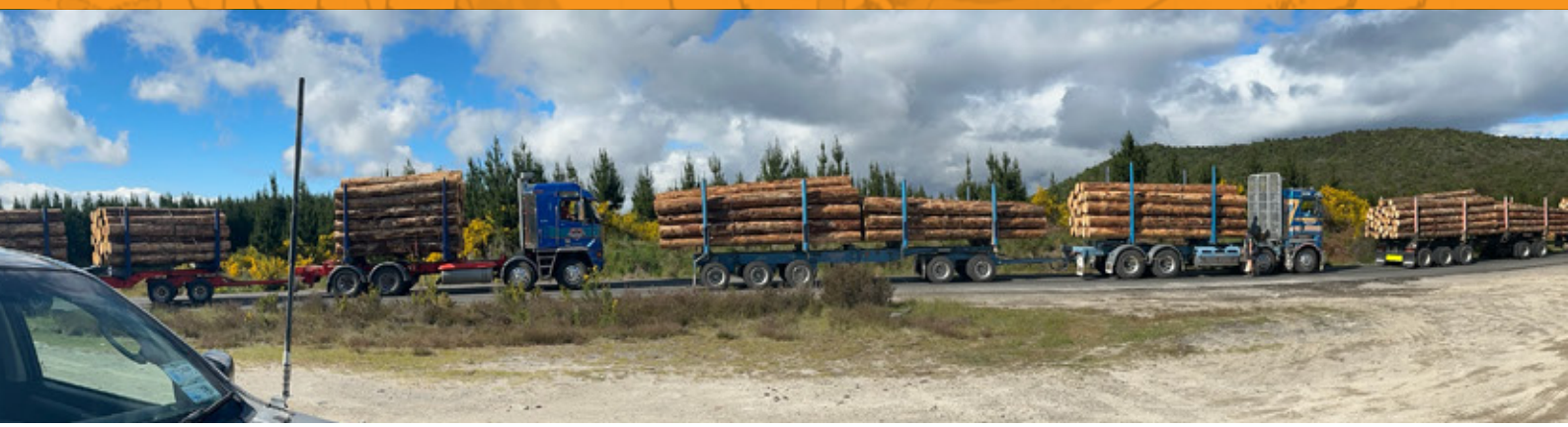
Random targeted drug and alcohol testing

Random targeted drug and alcohol testing is standard procedure for harvesting crews in forestry operations. NZFM normally test two of their crews at random per month; this doubled to testing four crews per month during the salvage. Testing is paid for by NZFM, and carried out by an independent specialist company.

Random targeted testing of logging truck drivers was also increased as the numbers of trucks on forest roads grew and accidents and near-misses were reported. The testing was initiated and overseen by Veronica McDonald, NZFM's Health and Safety specialist, and Stephen Holdsworth, Distribution Manager.

Testing was undertaken on two half-days a month, and during these periods, every driver coming into forest was tested. This was the first time logging truck drivers had been subjected to this increased level of random testing, and the result was significant numbers of non-negative tests. If drivers tested non-negative, their boss was informed, and they were escorted out of forest. Their truck got left in forest, or another driver found to deliver the logs if the truck was loaded. Drivers with non-negative tests were not allowed back into the forest until they had a clear test.

Despite receiving little support from the trucking industry around drug testing for truck drivers, NZFM is continuing its random testing of truck drivers coming into their forests.



2.6 Log distribution

Matching trucks to log production and maintaining the flow of logs from the skid to market is a fundamental element of a well-integrated forest system. Even under normal circumstances, trucking capacity can be a constraint, and initially not having enough trucks to distribute the salvaged logs was a major challenge. However, as log prices nationwide slumped and other companies reduced harvesting, extra trucks from other parts of the North Island became available as NZFM's production ramped up.

There were often more than 40 active skids with different log grades and mixes waiting for dispatch. Many crews were loading out on nightshift and Saturdays at peak times. Managing logging truck drivers proved to be a big factor in successful log distribution, and the many new truckies coming into NZFM forests brought extra challenges.

Logs initially were distributed to both export and domestic markets. After December 2023, logs went only to export and pulp markets, simplifying things. Export logs went to four North Island ports - Tauranga, Napier, Taranaki and Wellington (accessed via rail from Palmerston North). Journey times were long, reducing truck utilisation rates.

Extra resources were quickly brought in in the form of software and logistics company Trimble, who took over managing the dispatch process, previously done in-house. This included introducing a new voiceless dispatch system. Truck drivers would now use a device in their cab to enter dispatch information. This not only sped up dispatch and captured data but also cleared radio channel congestion, and 'had to be done' according to Distribution Manager Stephen Holdsworth. The same voiceless system was used by loader drivers as accurately managing inventory became essential. Managing stock levels on skids was very challenging, especially when pulp was not moving and space on the skid was at a premium.

Support for new drivers learning to use the voiceless system needed to be available whatever the day or time. Considerable effort was put into making sure crew felt comfortable asking questions about how to work things, ensuring fewer delays and accurate data capture.

The number of radio channels available to truck drivers and harvesting crews was also expanded, enabling much better cab-to-cab communication and improving the flow of operations in the forest. Ensuring drivers knew how to use the technology, and making it clear that they were expected to use it, was again essential and took time and regular reminders.

NZFM was in the early stages of automating their docketing system when the cyclone struck, but decided it was better to stick with the manual system rather than trying to introduce something new under pressure. Handling five times as many dockets as usual proved to one of the biggest stressors in the whole system. Dockets, issued as trucks leave the forest over a weighbridge, are the foundation for all the cash flows within the system, such as payment of contractors, payment for transport, and sales income.

Handling dockets promptly created a large strain on back-office staff, who were working round the clock to keep up. Extra, experienced office staff who needed minimal training were recruited. Staff flexibility was important - everyone understood the magnitude of the task at hand and got on with whatever needed to be done.

Public exposure to the salvage operation basically was all about logging trucks on the roads. Truck drivers needed to understand that they were responsible for public perceptions. Problems arose as the number of cartage contractors steadily increased, and drivers unfamiliar with NZFM's forests and unspoken codes of conduct began working in the forest.

The monthly breakfast meetings for all contractors proved good at improving communication flows with truckies; Stephen Holdsworth also spent time in the cab with drivers, ensuring he was being seen in the forest at various times from early morning until late in the evening, observing drivers' behaviour and also helping him see things from the drivers' perspective.

> "Things look very different from a truck at 4am in the morning..."
> ***Stephen Holdsworth, Distribution Manager***

Integrating new drivers (as well as harvesting crews) into the existing network turned out to be a challenge. Existing drivers felt threatened, so interactions needed to be managed. Again, the monthly meetings, where guys were brought together in the same room and expectations made clear, proved to be successful.

What went well and things we learnt: health and safety and log distribution activities

- Great value in having a major and consistent focus on health and safety – on the welfare of existing and incoming crews; high levels of supervision and extra welfare checks – we had a really successful health and safety protocol thanks to a good team in charge.

- Important to set expectations and insist people stick to them – 'you're supposed to do this, so you will do it'.
- Many new harvesting crews were Māori, coming onto others' lands. Welcoming ceremonies were really valuable, thanks to the input by some of our forest owners.
- Assisting new crews to find accommodation was important; also to recognise that some crew were traumatised and very stressed about what was happening at home.
- Outsourcing crew inductions to an independent contractor worked well; also on-going crew tail-gate welfare meetings were valuable.
- Rigorous drug and alcohol testing for harvesting crews and truck drivers has to be done and the increased testing of truckies should've started earlier. Strict stand-down rules for non-negatives applied.

2.7 Sales and marketing

Log marketing and sales at NZFM has been the domain of Ian Shapland, Sales and Marketing Manager, for many years.

"The job didn't change much, we were just dealing with bigger numbers. The decimal point just shifted."
Ian Shapland, Sales and Marketing Manager

Ian was assisted by another experienced staff member, Don McMurray, whose role was to coordinate the day-to-day flow of product to market.

As with other aspects of the overall salvage operation, the timing of the cyclone brought opportune benefits – low prices and a general market decline helped hugely, as log exporters still wanted volume to push into the market, spare trucks became available, and cartage rates were good because of the lack of demand elsewhere.

Sales increased by a factor of 3-4 times. NZFM took the view that a better return for the forest owners could be achieved by selling into low markets rather than by waiting for market conditions to improve (while log quality inevitably deteriorated). Ultimately, all forests returned a positive financial result and initial stumpage estimates proved conservative.

A close eye was kept on weekly product flows to make sure customer commitments were being met; also balancing customers' shipping requirements, space at ports, and the ability of ports to handle additional product volumes. Choke points arose from time-to-time: domestic market conditions, the salvaged wood quality, and sapstain meant export was the only avenue for much of the volume.

Before extra trucks came available, NZFM explored various options for multi-staging wood, using other people's storage areas etc., but these all proved too expensive or unviable in other ways. Considerable effort went into researching sprinkler systems and 'surge/transfer' yards to improve shelf-life and logistics. Ideas included the potential for re-establishing a railhead at Waiouru. Issues were lack of suitable sites at the right location, high cost of setting up sprinklers, resource consenting, and double handling costs.

It was important to explore these options but as it turned out, market conditions and the new supply chains that were opened up meant NZFM was able to transport and sell everything produced and could basically stick to business as usual. Had the market capacity been tighter, then the story might have been different.

NZFM normally only exports through Tauranga and Napier ports, and had limited wharf space available there. Port space was identified as a major likely constraint early on in the salvage operation, as export volumes were far in excess of what NZFM's normal export channels could cope with. The salvage operation meant quickly going outside the normal customer base and supply chains. It transpired that, because of the downturn in the wider industry, exporters could take all the wood NZFM could produce, and find space at two additional North Island ports (Wellington and Taranaki).

Sales changed from mainly Free on Board (FOB - NZFM selling directly to overseas customers) to mainly At Wharf Gate (AWG - selling to export agents). Export volume sold across the four North Island ports peaked at a rate of more than 250,000 m³ per month.

"We went to nearly every exporter to spread the load wide – the theory here was to dilute our product with product from undamaged forests, and spread our risk. We couldn't risk restricting ourselves to one or two ports or export channels because we had so much product to move and because we needed flexibility."

Ian Shapland, Sales and Marketing Manager

The potential for things to go wrong was amplified by the volume of sales and multiple destinations and clients. At peak there were 16 export sales points in total across the four ports. Sometimes logs were going in wrong direction, or in right direction but to the wrong client. Reconciliation was hard because so much wood was being shifted, and the load on the administration team was enormous.

"THE THREAT OF BOTTLENECKS WAS ALWAYS A PRIORITY CONSIDERATION."

Above: Fungal decay - non-exportable logs.

"Things had to be kept moving, and we didn't always have time to stop and sort things out as we went along, so we ended up with a team coming along behind to sort out unders/overs, credits/debits etc."
Ian Shapland, Sales and Marketing Manager

Some work was done on whether to slow down production as market prices continued to decline, but the decision was made to keep going flat out, conscious of the volume still to be shifted and the need to view the salvage as a loss minimisation exercise. It was also recognized that if crews were laid off, bringing them back in response to an improving market could be difficult. This generated some robust internal debate, but was proved correct with hind-sight.

What went well and things we learnt: sales and marketing

- The decision to create a salvage grade after nine months gave confidence to customers.
- Strategy of spreading risk by using multiple exporters worked well and involving these exporters early on in the piece was crucial – it gave greater access to Chinese markets (NZFM only sold Douglas-fir and minor species into China beforehand); also it opened up access to space on wharves.
- Shortage of port space, scaling and stevedoring at ports could've been a major bottleneck, but because we used multiple exporters this problem was avoided. Port of Tauranga was unable to lease us anymore wharf space which further drove us towards the 'multiple exporter strategy'.
- Whilst many organisations (e.g., customers, forest owners, ports, chipping/hogging contractors, rail etc.) offered assistance in the aftermath of the cyclone, it was a little disappointing and surprising that when it came down to the details, not many were in fact able to come to the party.

2.8 Managing wood quality throughout the salvage operation

Throughout, the various ways and speed at which wood quality might deteriorate was front of mind for the NZFM management team. Sapstain was always anticipated as a problem for domestic pruned log markets, but less of a problem for export logs.

A salvage grade was introduced in November 2023 to segregate the most stained material and protect standard export grades. This worked, as standard export grades retained their value throughout the 16-month period. Salvage grades were Export pruned, A and K grades with greater than 50% sapstain. Salvage grade logs were priced as for KI grade logs, and nearly all logs were exported without any problems.

The rate of sapstain development proved difficult to predict. Main drivers were:

- whether trees were snapped (faster sapstain development) or toppled (often with some live roots remaining)
- log diameter - small logs develop sapstain faster, and sapstain affects a larger proportion of total log volume in smaller logs
- site aspect – sapstain developed faster on warmer sites.

Some work was done with the University of Canterbury on monitoring sapstain development but this started fairly late in the programme and produced limited useful data.

As wood got older and drier, brittleness increased. This became the major quality issue of the salvage, leading to handling and loading problems and the wood becoming less suitable for some markets. As with sapstain, identifying areas with a north-facing aspect and prioritising harvest of these areas would have reduced this problem – something that was not realised when the original salvage harvest planning was done.

Phytosanitary concerns (insect build-up) also increased over time, but these were less of an issue than anticipated. An experienced forestry entomologist, Associate Professor Steve Pawson, University of Canterbury, was engaged to provide information on what to expect, what to look for, and what the risks of large populations of insects might be for both logs going into the market and for healthy stands of trees in the forest.

A couple of loads had to be re-fumigated on arrival in China due to huhu grubs being found but there were no real phytosanitary problems. Some claims for breakage did have to be assessed however. The fact that, after 16 months of salvage operations, there had been no significant quality claims lodged from China was considered a big success.

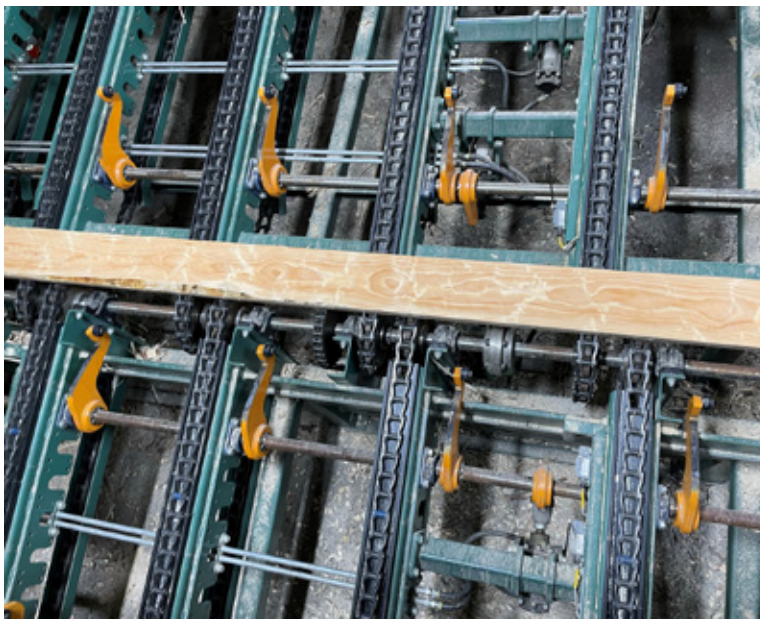
Within a few months of the cyclone, the only domestic sales of any significance were pruned and pulp. NZFM benefitted from the fact that their southern Taupō forests have always been considered well-managed and have a reputation for producing good quality logs. The majority of NZFM forests are also FSC-certified. NZFM is known as a consistent, reliable and fair supplier of logs to the domestic market and this was a factor in most domestic customers being prepared to assist by accepting logs that were less than ideal from a quality perspective.

NZFM's approach was to sell as much of the pruned volume domestically as possible for two main reasons:

i. logs processed in less time than if they were exported (with no need for end-spraying or other anti-sapstain treatment)

ii. the shorter lead distance to domestic mills as opposed to ports helped with trucking capacity.

NZFM worked closely with pruned log customers, Tenon in particular, on the quality of the logs being supplied. Cell collapse and stress failures are impossible to detect until after logs are sawn, which made segregation in-forest difficult.



An example of compression failures in timber sawn from a salvaged log

NZFM operated a 'high-trust' model with existing pruned log customers prepared to take salvaged wood, in that these customers' assessment of internal quality was accepted. Both NZFM and Tenon have had experience with wind damage before and had well-document procedures for down-grading timber. Tenon can use some internally damaged wood for certain product lines if they re-saw it, and they came up with a pricing formula to adjust the price according to quality. This formula was used as a price-setting benchmark for other pruned log customers.

As harvesting moved from mature stands into younger pruned stands (under 25 years old) other quality issues arose, and logs had to be discounted both for age and cell collapse.

After about eight months, in December 2023, sapstain took over and the pruned log market came to an end. All logs except pulp then went for export. Only one domestic pulp customer, Oji Fibre Solutions, would accept the salvaged logs. This market was not concerned about sapstain or wood quality, but product flow into the market was limited, meaning some problems with pulp building up on skids.

Log grade out-turn

Log grade mix gradually changed over time:

- pruned proportion stayed around 20% right through until the end of 2023, much longer than anyone expected
- the proportion of A-grade decreased over time over time, due to a combination of down-grading as sapstain increased, and a gradual move into younger stands with smaller piece size
- salvage grade tapered off toward the end as more volume was diverted to pulp to minimise risk of phytosanitary issues at the port.

The decline in log quality over time wasn't linear. This was due to changes in season, time between wind-throw and salvage, and reflection of moving into progressively younger/smaller diameter wood.

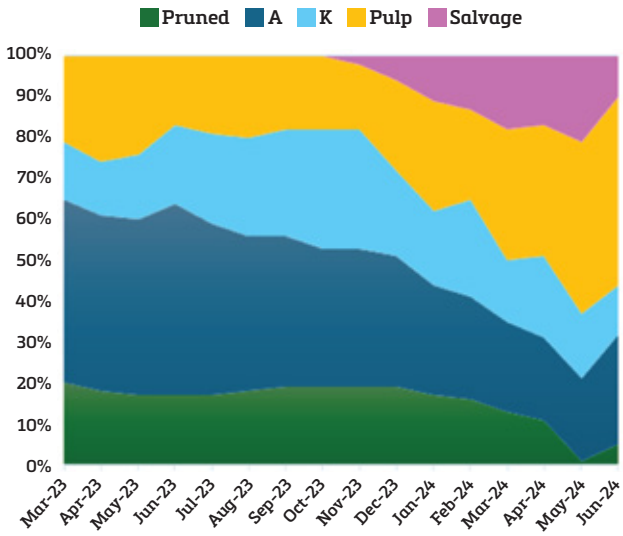


Fig 3: Change in log grade proportions over the course of the salvage.

Below: Logs three months post cyclone in good condition.

SECTION 3

PLANNING FOR THE FUTURE

AND THE LONG-TERM IMPLICATIONS OF A LARGE-SCALE WINDTHROW EVENT

An on-going challenge for NZFM is to work with forest owners on decisions around how to adjust harvesting programmes and plan for restocking following the cyclone to meet the needs of future generations. All forests owners have suffered significant financial losses – the estimated loss of value to Lake Taupō Forest Trust alone is $120 million.

Virtually all the damaged forest was on pre-1990 land, and restocking must be undertaken within four years of clearing to avoid a deforestation liability. As the windthrow met the definition of a clearing event and none of the area was able to be replanted in 2023, only three planting seasons remained in which to complete replanting without incurring a liability.

Hence the ability to spread planting over a longer period and build at least some resilience into the next rotation is lost. As well as considering a more mixed age-class mosaic for the replanting, there are pockets of residual trees which have yet to be harvested. It may take longer than four years to get round all these areas and rationalise compartment boundaries for the next rotation.

NZFM is currently discussing with the Ministry for Primary Industries (MPI) what options might be available in this situation, with the aim of obtaining an extension to the replanting window. MPI understand the scale of the issue and recognise that the Climate Change Response Act (CCRA) doesn't account that well for climate-related disturbance events. There are discussions about amendments to the Act or new exemptions to accommodate these situations should they arise again.

Each of the affected forest owners needs assistance to develop a replanting strategy for their forests. This involves a raft of decisions, some of which normally would have been made over a lengthy period but now must be made relatively quickly. Decisions made on the timing and extent of replanting, species choice and future management regimes, have complex long-term social and economic implications for NZFM's forest owners and the wider community.

The windthrow will have a significant effect on future workflows and harvest volumes. Much of the approximately 3.3 million m^3 harvested over the 16-month salvage period would normally have been harvested over the next decade. And NZFM's overall annual cut will be as low as nearly half what it would've been in the coming years, taking up to ten years to recover to levels predicted pre-cyclone. This creates problems for everyone – forest owners, managers, silviculture crews, harvesting contractors and cartage contractors alike. While the extra harvesting crews who came to help with the salvage operation have now all gone, a reset of regular harvesting and cartage contractors will be required due to reduced harvest levels in the foreseeable future.

Furthermore, there is still a lot of uncertainty about the impact of the pockets of wind damage amongst the mid-rotation stands where salvage was not practical. Past experience suggests the remaining trees may grow more without the competition from their neighbours, but this comes with poorer grade outturn. Wood quality may also be affected, with internal stress fractures and cell collapse evident in samples of younger trees analysed as part of a trial series hosted in the forest. It is too early to know how significant this will be to overall available volumes and value.

SECTION 3: PLANNING FOR THE FUTURE AND THE LONG-TERM IMPLICATIONS OF A LARGE-SCALE WINDTHROW EVENT

Creating a mosaic of stands of different ages across the replanting area may help reduce risk of damage to the same extent if such a wind event happens again. Staggering the replant also will help ease cash flow and work programmes now and into the future, as well as ensuring enough high-quality planting stock is available.

So while some forest owners (e.g. Lake Rotoaira Forest Trust) have opted for windthrown areas to be replanted over 2024 and 2025, for the large expanses of cutover in Lake Taupō Forest and the adjacent Kaimanawa, NZFM is working with the forest owners on a strategy where the replant is spread out over a longer time (if allowable). The annual replant area will be capped at 15-20% more than the long-term average, anticipating the following benefits:

i. it will help maintain a consistent silvicultural programme. Local employment is important to the forest owners, and completing planting, pruning, thinning programmes 3-4 times the usual size would not be possible without bringing in additional crews, creating shortfalls of work in following years

ii. it will give time to harvest islands of trees left standing enabling re-planting to sensible boundaries. Minimising the amount of holes in stands where there has been out-of-sync harvesting is desirable.

In terms of species choice and regimes, most of the areas affected by Cyclone Gabrielle were pruned radiata pine; there may be some merit in limiting risk by changing forest systems or shortening rotations. More research is needed into the resilience of pruned and unpruned stands at different stocking rates; also into adopting shorter rotations to limit the window of highest risk to crops from wind damage.

Alternative species options have been discussed with forest owners, both before and after the cyclone. While there is evidence of some other species being more wind-tolerant than radiata pine, damage is unavoidable if the event is severe enough. The area of mature alternative species in the damaged parts of the forests was small, but still enough to demonstrate that no species is immune from wind damage. This extends to native forest – some mature beech and podocarp south of Lake Rotoaira Forest was quite badly damaged. Another important consideration around alternative species is what markets, if any, would exist for salvaged material in another windthrow event.

SECTION 4

ADDITIONAL COMMENTS

The following section summarises some comments made during interviews with NZFM's management team and others involved in the salvage operation.

"We had to act quickly; be nimble on our feet. We changed a lot of things, stepped into the unknown quite often. There will be things you don't think of, and you have to act quickly to deal with them."
John Hura, General Manager

4.1 Good decisions and actions

'What others should do' in future similar events will be very dependent on the specific circumstances. For NZFM, the magnitude of increase in our activities was the biggest thing. So a first question should be: 'what is the scale of this event to us?'

There was a lot of serendipity in NZFM's response. Market decline and resultant decreased activity elsewhere contributed to the success of NZFM's salvage operation in more ways than one, especially once winter came. But good managers make the most of opportunities, however these arise, and this is exactly what NZFM's managers did.

- We had to make bold decisions; sometimes these might be counter-intuitive. But we backed ourselves.
- Because we were all in the same building, there was very rapid communications between team, quick decisions could be made and implemented.
- Be open to new ideas, and be gracious when proved wrong : "I'd have never thought we would sell logs to Wellington, but we did."
- We worked together well as a team because we all knew each other; we all put in ridiculous hours in the first few weeks.
- It was useful to have a mix of younger and older guys (Cyclone Bola and other experience); young guys tended to push the boundaries whereas older guys were more conservative.
- Everyone encouraged everyone else, there was a bit of sporting rivalry between different teams. We had robust conversations, respectful conversations, but good outcomes. There was a lot of professional respect between team members.
- Our ability to get the right people when we scaled up was a key factor in our success – timber sales, accounts, harvesting supervisors – getting people familiar with our systems, and dropping them in. Experience was really valuable. We just didn't have time to train anyone.
- Also the people we took on knew it was for a short time, and their expectations were managed.
- Having a General Manager (John Hura) who is a clear, calm communicator, gave confidence to our Board and forest owners. Owners had to come on board, understand the situation. We had to try and keep things simple, even when the owners were asking for analyses. Eventually the Board gave John the mandate to get on and get job done.
- New ideas do have to be tested: for example, we spent a lot of time on getting a resource consent for a railhead out of Waiouru, which we never used, and looking at options for sprinkler systems to preserve wood for longer. So we went down a few rabbit holes and these tied up resources.

SECTION 4: ADDITIONAL COMMENTS

- We employed an independent consultant to do some of this exploratory work and 'test the thinking' from a distance, which was very valuable.
- Over time it became obvious what was going to work and what wouldn't work. Generally we learned that it is better to stick to what you do well, and keep doing it, all the time.

'Most forestry supply chains are already well optimized. Putting effort into doing more of the same is a good place to start, then look for alternatives as bottlenecks start to appear.'
Thomas Crosse, Planning Manager

- People like and understand maps. NZFM produced regular maps for owners that were easy to understand – this helped a lot.
- We used resources we had around us effectively –for example, outside providers who we already knew and who could step into roles quickly; 'new' staff who were local and/or had worked here before and knew our systems.
- When resources are stretched, you just have to make do with what you have on the day.
- Communication throughout the production chain is all-important, between all those involved – managers and contractors.
- Remember that contractors are motivated differently to managers. Fundamental and respectful understanding of other's perspectives right through the system is important.
- It is easy to overlook the fact that crews value feedback, and that the guys out in the forest were putting in the mahi too.
- Don't be afraid to change things. If some thing isn't working, change it. This could include simply saying 'stop'.

"We looked at bringing in a new timber sales system but made the decision to put this on hold half way through – it would've been too disruptive. Sometimes you just need to stand back and review what you're doing."
Stephen Holdsworth, Distribution Manager

- One good outcome at the end of the day was that it justified some changes we were already thinking about or had started on, and made a strong case for automating some things.

4.2 Main challenges

Communications

- Increased scrutiny from the public, mainly because of increased logging truck movements.
- Dealing with misinformation amongst local communities, fire-fighting bad rumours.
- Restricted access to forests – a big thing for some locals – but the situation was improved by opening parts of forest as soon as deemed safe.

In an event of this magnitude, employing a dedicated communications person would have been justified and would've taken a lot of the weight off [General Manager] John Hura. John would still have had to go to all the meetings with owners etc, but someone else could've done the wider communications work, and at least dispelled some of the myths that were flying around.
Andrew Peddie, independent consultant

SECTION 4: ADDITIONAL COMMENTS

Meeting the needs of forest owners

- What owners needed were early forecasts of volumes and values of logs and the likely impact on cash flows. These were very difficult to predict – unknowns included (i) value of logs (ii) costs to get to market, and (iii) how long logs would last and how values would change over time. (As it turned out, our early forecasts of stumpage were much too conservative - $3/tonne when in fact ended up averaging $17/tonne).
- Different owners have different knowledge, different needs, measures of value and different attitudes to risk.
- Changes in future workloads and cashflow all need to be signalled from early on.
- Reporting went up exponentially; with a lot more analysis demanded by owners.
- Don't underestimate complexities of planning for the next rotation.

Internal systems and workload

- Our main internal bottleneck was docket processing (manual) .
- Don't think you can neglect some elements of business as usual – you will not be allowed to (for example, FSC and WorkSafe auditing).
- The sheer volume of work was a challenge for everyone.

"When everyone's under pressure, conversations get heated – go away and sleep on things, and ensure everyone has a laugh from time-to-time. And if something's keeping you up at night, get it sorted."
Matt Owen, Harvesting Manager.

SECTION 5

ACKNOWLEDGEMENTS & INDUSTRY RECOGNITION

5.1 Acknowledgements

The following groups of people all played a part in the NZFM salvage operation:

- NZFM Management Team
- NZFM Board
- All other NZFM staff – permanent and temporary
- Forest owners and their representatives (including Geoff Thorp, LTFT Forest Manager)
- External consultants: Andrew Peddie, Steve Pawson (Associate Professor, University of Canterbury), NIWA
- All operations and other contractors
- NZFM domestic customers, particularly Tenon and Oji Fibre Solutions
- NZ log exporters - CFG, DKNZ, Fortuna, Matariki, PFP, TPT, Tenco and UFL
- All other forestry companies who lent resources (supervisors and contractors) to assist us.

5.2 Industry recognition

The wider forest industry recognised the outstanding effort made by NZFM in completing the salvage operation safely and within the 16-month target timeframe. Several awards were forthcoming:

- John Hura, General Manager, was awarded NZ Institute of Forestry **Forester of the Year 2024.**
- NZFM was awarded a special industry award for **Exceptional Industry Collaboration** by the Central North Island Wood Council in August 2024. This achievement was a testament to the outstanding teamwork and contributions of verybody at NZFM over the 16 months of the salvage operation.
- Matt Owen, Harvesting Manager, was awarded CNI Wood Council's **2024 Hero of the Year** award.
- Te Amo Kingi (Dispatch - NZFM/Trimble) was awarded CNI Wood Council's **2024 Dispatcher of the Year.**


N.Z. FOREST MANAGERS