Report No.	15-125
Decision Required	

RIVER AND DRAINAGE ENGINEERING REPORT (PRD 01 02)

1. PURPOSE

1.1. The purpose of this item is to report on progress with river and drainage activities for the period of 1 May to 17 July 2015.

2. RECOMMENDATION

That the Committee recommends that Council:

a. receives the information contained in Report No. 15-125 and annexures;

b. approves the expenditure of scheme and infrastructure reserves on flood damage reinstatement works over the next 12 months as follows:

Estimated Cost of High Priority Damage Reinstatement Requiring Use of Reserves	Scheme Reserves (80%)	Infrastructure Reserves (20%)
$3,360,595	$2,688,476	$672,120

c. approves an Environmental Grant of $27,500 towards the installation of a flood water egress gate in the Makirikiri Stream stopbank.

3. FINANCIAL IMPACT

3.1. Funding provision for all activities reported on in this item is either included in the River and Drainage General or River and Drainage Schemes Activity sections of the 2014-15 Annual Plan and 2015-25 Long-term Plan; is covered by an approved carry-forward of unexpended budget in 2013-14; or additional approval will be specifically sought by way of recommendation in the item.

4. COMMUNITY ENGAGEMENT

4.1. Various matters contained in this item either have been, or will be, communicated with scheme ratepayers through their respective Scheme Liaison Committees. As necessary, other issues will be the subject of media release.

5. DISCUSSION

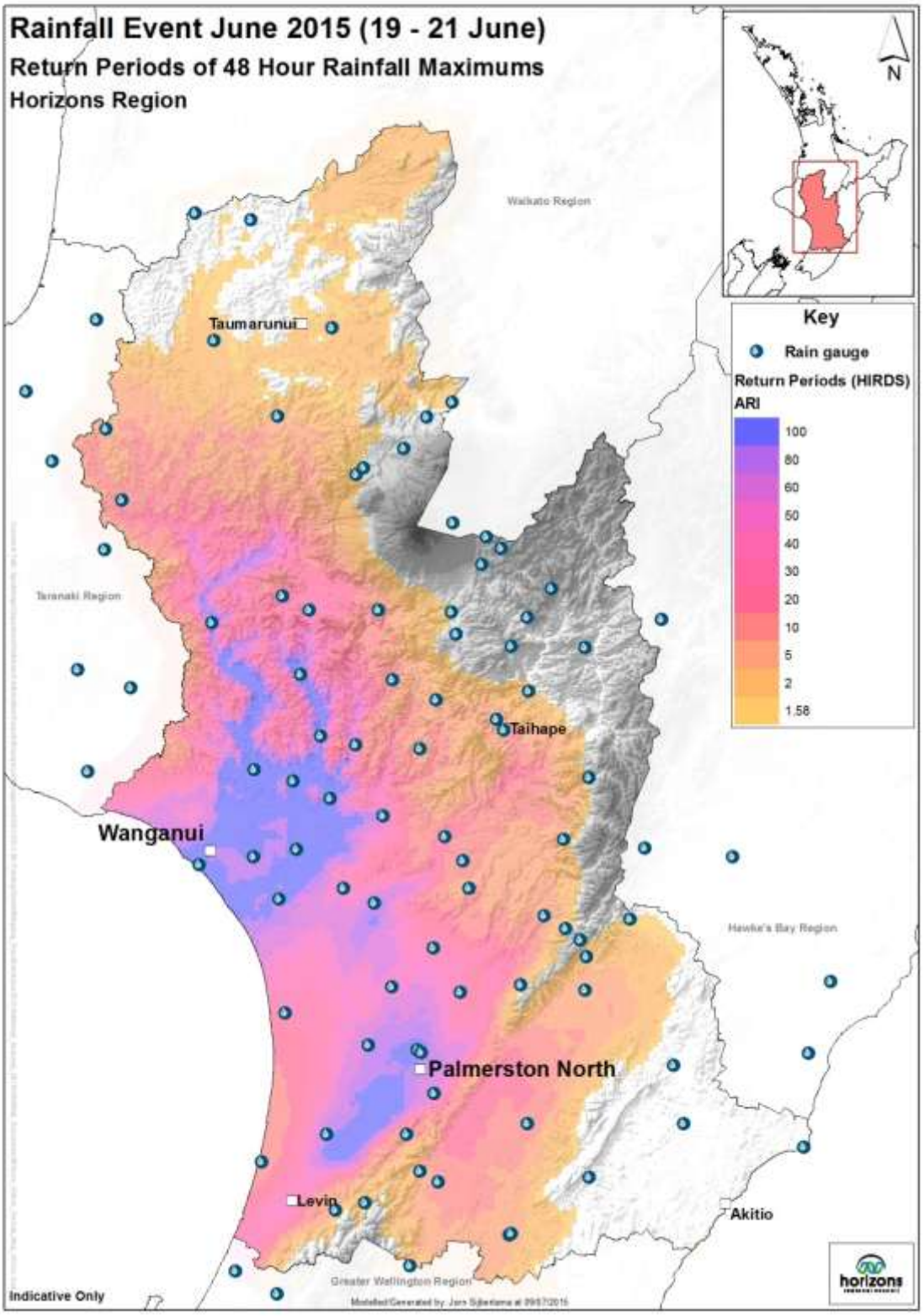
5.1. The early onset of wet weather conditions in April, frustrated the completion of a small number of capital earthworks projects and while conditions did improve sufficiently in mid

May to allow completion, that occurred later than desirable in that the establishment of a good cover of grass was not achieved going into the winter period.

5.2. Maintenance programmes were however very substantially completed for all schemes, with a particular focus on drain spraying and mechanical cleaning during the period.

5.3. The period was however punctuated by two heavy rainfall/run-off events – the first on 16 May, when the Mangaone, Makino and Oroua catchments were particularly affected, and the second on 20-21 June when extremely heavy rainfall impacted across much of the Region.

5.4. The map below indicates the return periods for 48 hour rainfalls across the Region. As can be seen, rainfall having a return period of 50 years or greater extended across much of the western and lower part of the Region, where most of Council's flood control and drainage schemes are located. 100-year rainfalls occurred across much of the Whanganui catchment and on a significant part of the Manawatu plains. When it is considered that most of that rainfall occurred within a 36 hour period, the magnitude of flooding and extent of damage becomes understandable.


Rainfall Event June 2015 (19 - 21 June)
Return Periods of 48 Hour Rainfall Maximums
Horizons Region
N
Key
Rain gauge
Return Periods (HIRDS)
ARI
100
80
60
50
40
30
20
10
5
2
1.58
Waikato Region
Taumarunui
Taranaki Region
Taihape
Wanganui
Hawke's Bay Region
Palmerston North
Levin
Akitio
Greater Wellington Region
Indicative Only

5.5. As a result of those very high rainfalls, significant floods occurred in many of the Region's river systems as indicated in the table below.

River	Discharge (Cumecs)	Return Period (Years)
Wanganui at Te Rewa	4755	1:85
Whangaehu at Kauangaroa	1370	1:120
Mangawhero at Oreore	732	1:120
Turakina at O'Neill's	565	1:75
Rangitikei at Mangaweka	957	1:5
Rangitikei at McKelvie's	1185	1:30
Tutaenui at Hammond Street	70	1:60
Matarawa at Diversion	58	60% greater than 100yr
Manawatu at Teachers' College	2290	1:7
Makino at Rata Street	82	1:100
Mangaone West	86	1:100
Kiwitea at Haynes Line	150	1:20
Oroua at Awahuri	558	1:50
Mangaone at Milson Line	163	1:25
Mangatainoka at Pahiatua	586	1:8
Manga-Atua at Hopelands	104	1:15

5.6. The 85 year return period flood flow in the Whanganui River significantly exceeded the capacity of the recently completed stopbanks at Kowhai Park. However, given that water overflowed the stopbank crest to a depth of up to 400 mm for a period of 12 hours, there was surprisingly little damage to the stopbanks. What damage occurred, is largely superficial and repairs will largely involve resurfacing the crest pathway and harrowing/re-seeding the batter slopes.

5.7. The flood in the Matarawa Stream was the largest experienced since the scheme was completed in 1987. Flow in the Matarawa Stream through Wanganui East was effectively controlled at the Gordon Park structure, however it appears that inflows downstream of the control resulted in the channel capacity being exceeded in some locations and it is understood that some houses flooded as a result. The 58 cumec flow in the Mateongaonga diversion channel exceeded the design capacity by 16% and substantial scouring of the channel resulted in the partial collapse of two bridges – one being on No. 3 Line and the other being a farm bridge near the control structure.

5.8. In the Central Area, particularly high return period floods in the Oroua, Makino, Mangaone and Kiwitea catchments caused a significant amount of damage. Various sections of stopbank on the Oroua River that had not yet been upgraded within the Lower Manawatu Scheme Rural Flood Protection Upgrade Project, were unable to contain peak flows. The

worst situation was downstream of Hoihere Road, where overtopping followed by a major breach resulted in extensive flooding and multiple consequential breaches of Main Drain stopbanks. All of those breaches were either permanently or temporarily repaired within two weeks of the event.

5.9. A very rapid rise in the Makino Stream, combined with extremely high run-off below Reids Line, put the operation of the diversion sluice gates to their greatest test since commissioning in March 2009. The inability to fully lower one of the gates on account of a debris obstruction, resulted in a slightly higher than design peak flow through the control structure and that, combined with the high inflows downstream, resulted in flows leaving the channel and flooding some houses. Significant asset damage, mainly in the form of under-scoured rock and rubble linings, resulted. The installation of a debris arrester upstream of the gates, previously not supported, will need to be further considered following this recent experience. A further review of the operating protocols is also underway.

5.10. Very high flows in the Mangaone Stream resulted in the operation of the Flygers Line Spillway for only the third time since the spillway gates were constructed in 1985. Prolonged high flows in the Mangaone through Palmerston North caused extensive bank slumping and while some of that is of little concern, at some sites the stream has encroached within the generally accepted minimum berm width at the stopbank toe. Some temporary works have been undertaken and a very significant amount of bank armouring is planned.

5.11. The flood in the Kiwitea Stream was the largest experienced since the Lower Kiwitea Scheme was established post the 2004 floods. Despite the degree of channel control and vegetation establishment achieved since then, protection works were subjected to considerable pressure and some sections of the stream have assumed undesirable alignments.

5.12. On the Manawatu River, damage was generally minor, with the exception of the scouring of a 70 m length of the newly upgraded stopbank on Whitelock's property at Opiki. Urgent works were undertaken to reinstate the stopbank, together with berm shaping to mitigate what appears to have been irregular flow conditions along the stopbank batter.

5.13. Peak flows in each of the Matarawa, Porewa and Tutaenui catchments exceeded scheme design and as a consequence all but two or three of 50 detention dam spillways operated. Relatively minor damage to spillways and outlet channels resulted and some significant siltation occurred within the ponding areas.

5.14. Peak discharges in the Upper Manawatu River and tributaries were not unusually high and accordingly only moderate damage resulted. The worst affected was the Mangatainoka Scheme, which experienced an 8 year return period flood.

5.15. The worst affected scheme was again the Rangitikei, which experienced a 30 year event within the scheme reach. Damage to a recently upgraded section of stopbank at Parewanui, initially suffered earlier in the year, was substantially aggravated. Other damage comprised slumping of rock linings and aggravation of previous damage to tied tree works at many sites. Repairs to the damaged stopbank are unable to be practicably effected at this stage so the situation will be closely monitored over the next few months.

5.16. Inspections of all schemes have now been completed and a schedule of damage is enclosed at Annex A. While the total damage repair cost is estimated at $5.6 million, $1.37 million of that essentially reflects previous damage awaiting treatment, which has now been aggravated. The reinstatement cost of damage directly attributable to the recent event can therefore effectively be taken as being $4.3 million.

5.17. Damage to insured assets is assessed at $1.92 million and is therefore significantly less than the $3 million deductible that applies to Council's infrastructure insurance. Damage to insured assets is 34% of total damage, compared with 45% experienced in 2004. That likely reflects the many new higher standard assets built in the interim period.

5.18. It is proposed to lodge a claim for essential infrastructure reinstatement costs under the National Civil Defence and Emergency Management Plan 2009. There are a number of criteria to be met for a claim to be successful, however given the widespread nature of the event and the resulting major community disruption, the prospect of a favourable outcome must be good. Assuming a total claim of $4.3 million; the applicable deductible for Horizons Regional Council of $871,000; and an assistance rate of 60%, a total claim of approximately $2 million is possible. Co-incidentally, the maximum claim that can be approved without Cabinet approval is $2 million. With the claim threshold satisfied by way of a claim for infrastructure reinstatement, other eligible event response costs incurred by the wider organisation should also be reimbursable.

5.19. From past experience, the claim process will be very demanding of time and resources, however staff will now initiate that process.

5.20. In the meantime, high priority repairs will be commenced as soon as river and weather conditions allow. However, given the worst of the winter could still be ahead of us, the likelihood of further damage aggravation before repairs can be effected, cannot be discounted. As is indicated in the table at Annex A, it is intended to fund a significant portion of reinstatement costs from approved scheme budgets, through re-prioritizing programed works. The balance of high priority works costs would then be funded from scheme emergency reserves in the interim. With only minor exceptions, each affected scheme has sufficient reserves to cover estimated costs. Council's approval is sought for the expenditure of scheme and infrastructure reserves over the next 12 months as follows:

Estimated Cost of High Priority Damage Reinstatement Requiring Use of Reserves	**Scheme Reserves (80%)**	**Infrastructure Reserves (20%)**
$3,360,595	$2,688,476	$672,120

5.21. The previously reported process for the sale of a house purchased by the Lower Manawatu Scheme to facilitate the construction of the new Kopane Bridge, has now been successfully concluded. The sale price achieved exceeded a market valuation obtained by Horizons, by an amount that covered all commission and marketing costs, together with a significant portion of deferred maintenance costs.

5.22. In May 2015 Council approved a special rate of environmental grant to assist with erosion control works in the Mangawhero River immediately downstream of Ohakune. Despite that grant and further assistance offered by Ruapehu District Council (RuDC), the landowner concerned has been unable to fund the local share of costs and accordingly the proposal has lapsed.

6. DESIGN SECTION

LOWER MANAWATU SCHEME

6.1. The substantive job was the completion of a consent application in respect of all outstanding Lower Manawatu Scheme (LMS) Rural Upgrade Project earthworks on the Manawatu River, Tokomaru Stream, Mangaore Stream and Kara Creek. Consent is already held for outstanding works on the Oroua River and Linton Main Drain and the consent now sought should be the last required for the 12-year Upgrade Project. Meetings were held with affected landowners to discuss the consent and Land Entry Agreement processes, together with the programme of works for the next three years.

LOWER WHANGANUI RIVER

6.2. Design flood levels were modelled to assess the impacts of tide levels on the 20-21 June 2015 flood. This peaked at the Town Bridge in Wanganui at close to low tide in the early hours of 21 June.

ARAWHATA SEDIMENT TRAP

6.3. The sediment trap design was refined to maximise effectiveness and information provided for the consent application on the expected efficiency.

UPPER MANAWATU-LOWER MANGAHAO GRAVEL REPORT

6.4. The peer review comments were incorporated into the draft report. The finalised report is presented as a separate report to this agenda.

HIMATANGI COASTAL HAZARDS ASSESSMENT

6.5. Again, the peer review comments were incorporated into the draft report and a careful ground truthing check was made. The conclusion is that there is no risk to houses in Himatangi from coastal hazards in the 1% AEP event either now or with the impacts of 100 years climate change. The finalised report is presented as a separate report to this agenda.

NON-SCHEME INVESTIGATIONS – OHAKUNE FLOOD RISK AND MITIGATION OPTIONS

6.6. Following the completion of a re-run of the 1% AEP and 0.5% AEP storms by Entura Consultants, a detailed flood risk and mitigation assessment has been completed. An investigations report is included as a separate paper to this agenda.

TE KAWAU SCHEME AUDIT

6.7. Work was completed on the programmed audit of the Te Kawau Drainage Scheme and is presented in a separate paper to this agenda. This scheme in its present form was established in 2004 by the amalgamation of the Sluggish River Drainage Scheme and the Oroua Drainage Scheme, following a review of the two schemes in 2001.

DESIGN STAFF ADVICE PROVIDED DURING AND AFTER THE 19-21 JUNE FLOOD

6.8. A large input was provided by design staff to the Horizons EOC from first setup at approximately 5 am on Saturday 20 June to the end of the event. Some advice was also provided on the night of Friday 19 June, initially with more regard to the Horowhenua flooding.

6.9. Staff were also present in the Wanganui District EOC throughout the Wanganui flood event and provided advice on projections and monitoring of levels and risks.

6.10. Advice has subsequently been provided on flood recording requirements in respect of numerous watercourses.

6.11. Following the flood numerous matters have been addressed, with some that will require more detailed advice once all needs are collated.

6.12. A detailed initial assessment has been carried out to analyse the peak flood levels in the Oroua River. This has indicated a couple of areas where flood levels were above design due to site specific factors. Mitigation of these levels is currently being addressed.

6.13. An initial assessment has also been carried out on the very high flood levels in the Whanganui River. A slope-area assessment at the Matarawa diversion yielded flows initially assessed at 60% above the 1% AEP flood. This is indicative of the quantum of the very large flows that occurred in the downstream catchments of the Whanganui River.

6.14. The performance of the Makino Stream during the flood is presently being assessed, with flood levels recorded through Feilding. There were very significant inflows from the western hillside catchments into Feilding and further downstream a large flood in the West Mangaone catchment. The estimated size of this will be quantified shortly.

6.15. Detailed investigations will assess the elevated flood levels in several other areas including Hunterville, Makowhai Stream and Marton. Again it appears that, whilst flows in the Tutaenui at Marton were significant at around 1.7% AEP (60 year), they were significantly greater near the confluence with the Rangitikei River. Modelling of the Tutaenui and Makowhai Streams is included in the Horizons Regional Council long-term flood hazard modelling project for 2015-16 and 2016-17 respectively.

AMS SOFTWARE UPDATE

6.16. Further testing of an updated version of the Asset Management System (AMS) software has been completed and a number of issues forwarded to Datacom to action. The new software should be ready to go live shortly.

AMS REVALUATION REPORT

6.17. Errors in the revaluation report calculation of depreciation have been identified. This is not a key reporting tool so is a low priority to remedy along with a number of other reports.

6.18. A macro enhanced Excel spreadsheet has been developed by Catchment Information (CI) staff to help allocate historic revaluation reserves to each asset as requested by Audit NZ.

DESIGN ADVICE

6.19. During this period ongoing design advice has continued to be given to Operations Group project and scheme management staff and other department's and TLAs staff in relation to several matters. The following significant jobs were completed:

- A 1.3 m high flood wall was designed to protect the Palmerston North City Council (PNCC) Pumpstation.

- Further design information was provided to Kauangaroa Marae on flood mitigation options. A site visit will be shortly necessary to review advice following the recent 0.83% AEP (120

year) flood on the Whangaehu River at Kauangaroa. Again the Marae flooded, as it did in the 2004 floods.

- A site visit was undertaken to provide advice to a landowner who had a flooding problem at Sutton Place. The only viable solution to the flooding is a pump and this is being advanced by PNCC, as a stormwater matter.

- Design calculations in conjunction with Hydrology staff to confirm the rating of the new recorder at the Oroua River at Kopane Bridge. This rating appears close to the mark in the recent floods.

- Design advice given to Southern Area staff on the required dimensions for a new bridge to be installed over the Koputaroa Stream.

- The design and cost estimates of flood protection work for the Pohangina River on the true right bank at Raumai (upstream of the road bridge) were completed. This will need to be further reviewed for additional erosion during the recent floods, though the design concept will be unaltered.

- A flood frequency analysis was completed on mitigation options to address the flooding of farmland and the Turakina Beach Road.

- A rock design was completed for a 20 m length of erosion upstream of a bridge on the Kiwitea Stream. This erosion occurred in the recent flood.

- A rock design was completed for protection of the house at 60 North Street Feilding. This house was built in a location very vulnerable to both flooding and erosion from the Makino Stream.

REGULATORY ADVICE

6.20. An above average amount of regulatory work was completed with advice on 46 substantive matters required during this reporting period. In total there were 228 recorded substantive matters for 2014-15.

6.21. This regulatory work involved specialist advice on flood risks and technical reports for consent applications, rezonings and subdivisions including:

- Advice on 28 flood risk and related enquiries. These included two rural subdivisions near Kelvin Grove (in Henaghans Road and Roberts Line).

- An assessment was required of a proposed seven lot rural residential subdivision north of Feilding. Parts of the lots were vulnerable to flooding from the Makino Stream and tributaries.

- Further detailed discussions with staff at Manawatu District Council (MDC) continued successfully on stormwater mitigation to achieve “hydraulic neutrality” and not materially alter cumulative flood risks to the Makino Stream and Taonui Basin. MDC have made good progress on their assessment of options for communal retention as a superior mechanism to isolated detention locations.

- A meeting was held with PNCC staff and consultants on “Recommended Taonui Basin Flood Mitigation Assessment Criteria” for development of the Braeburn Industrial Area under their proposed Plan Change 15.

- Further designs were received from the consultants on the proposal to discharge stormwater to soakage in the major redevelopment of the old Kimberley institution near Levin. This is a massive development including 85 new residential dwellings in Stage One (for which consent is now sought from Horowhenua District Council (HDC) and around 400 new dwellings over the next 2 years. Horizons' staff responded with a reasonably detailed soakage design assessment and have now confirmed that soakage of this site is feasible. However, we have recommended to HDC that they implement a consent requirement that a detailed stormwater soakage design is prepared prior to each stage commencing.

- A site visit was completed and advice provided that a proposed house site in Pohangina Road was highly vulnerable to both flooding and erosion and the egress requirements could not be provided.

- Flood risk and/or minimum floor level advice was provided to 5 lots in Tangimoana and three lots in or near Scotts Ferry.

- A detailed minimum floor level assessment was provided for a proposed house in Godley Street Halcombe. Part of the property is vulnerable to flooding from a tributary of the Rangitawa Stream.

- Again several of bridge consent applications were received with five bridges assessed. These included Bridge 207 in the Kiwirail upgrade project near Taumarunui, where Kiwirail has now agreed to remove a pier from the middle of the Ongarue River within a 5-year sunset period. This was a difficult consenting matter to progress, as the removal of the pier fell outside budgets. However, it is located between the piers of the immediately adjacent new bridge and poses a debris build-up hazard. On the balance of risks a 5-year sunset for removal was appropriate.

- Detailed advice was provided to PNCC on options for upgrading/replacing a bridge over the Turitea Stream. This including minor hydraulic modelling.

- Advice was provided on measures to ensure the coastal hazards on the proposed replacement Waitarere Beach Surf Club building were appropriately mitigated. This included consultations with Tonkin & Taylor Consultants Ltd – who set the erosion hazard lines in this location.

- Advice was provided on a proposal to realign the Mangamania Stream in two places to increase the capacity of the dump site for Manawatu Gorge slip material. One of the realignments was supported with careful protection works design and will lower erosion risks to the highway. The other realignment was advised against as it would threaten channel stability; however the expansion can still proceed.

- The impacts of infilling of old meander loops on the Rangitikei River near Flock House was assessed and deemed to not have any measurable adverse impacts on flooding.

- Agreement was provided on the proposed flood protection to the Bulls Wastewater Treatment Plant ponds as part of the upgrade.

- Advice was provided on three gravel consent applications. These included the proposal by the sole extractor on the Kawhatau River to combine their consents into a single site delineated global consent. This is being further assessed.

- Advice was provided on the undermining of a wingwall on a relatively new bridge over Te Mangapapa Stream near Woodville.

7. CENTRAL AREA

GENERAL

7.1. This reporting period saw two significant rain events occurring in a period that had already recorded above average rainfall. The rain events on the 15-16 May and the more severe event on the 19-21 June on the saturated ground resulted in significant damage in most rivers and streams in the Central Area.

7.2. Up until the 19 June event, annual inspections of all assets were progressing well. Since then, staff have been busy inspecting for flood damage and undertaking emergency repairs.

7.3. The severe rainfall event on the 19-21 June saw the Moutoa Sluice Gates operate. This attracted a lot of attention from members of the public, with the carpark at Moutoa filled to overflowing at times. The Makino diversion structure was also used to control the flows through Fielding, diverting water down the Reids Line Spillway and into the Kiwitea Stream.

7.4. Staff worked continuously from early Saturday morning to Monday on a roster basis to provide 24/7 service to the community. The notable area of staff involvement in the Central Area was the breach of the Oroua stopbank at Gary Knight's property, contributing to five breaches of the Main Drain stopbank. The breaches in the Main Drain were attended to by staff and contractors, who attempted unsuccessfully to shore up the failing stopbank with concrete blocks in the early hours of Monday morning.

7.5. Subsequent inspections of assets found that in addition to the breaches on the Oroua, there was significant scouring of a stopbank on the Manawatu at Whitelock's property; several breaches of the stopbank on the Makino below Feilding; widespread damage to the berm on the Mangaone, with two sites of particular concern to the stopbank; and major damage to erosion protection works on the Lower Kiwitea.

7.6. Work on the Whitelock stopbank begun on Tuesday 23 June, with contractors clearing the site of debris. Fill was carted in from the Tokomaru quarry. The bank was reconstructed, a culvert repaired, trees cleared and the berm reshaped to reduce the risk of a reoccurrence of the scour. The repair was finished in a week, with 2,266 m^3 of material carted in.

7.7. While the Whitelock's work was underway, contractors were also working at Knight's, clearing the site of debris. A hole 60 m long by 45 m wide, 5 m deep had been scoured on the berm where the stopbank was sited. Access to the site was difficult due to the breaches of the Main Drain Stopbank washing out the Main Drain Road at three sites. Local harvesters using tractors and trailers were therefore engaged to cart fill in from a nearby dune to fill the bottom half of the scour hole. MDC temporarily reconstructed the road to restore limited access allowing the cartage of fill on Tuesday 30 June from the silt stockpiled at the Moutoa Sluice Gates. During the works, 14 truck and trailers were on simultaneously carting over 11,000 m^3 of silt to repair the total of six breaches. The repairs where completed within a week.

7.8. Meanwhile, work was also progressing on the Lower Kiwitea, where extensive emergency channel clearance activities were undertaken to prevent any additional damage to property. The breached banks on the Makino were repaired.

7.9. On the Mangaone, one scour hole was of particular concern, reducing the competence of the stopbank. Unfortunately, a repair was not possible due to elevated river levels. Staff closely monitored the situation to ensure the erosion did not worsen and as soon as river levels dropped, a temporary repair was undertaken. A permanent repair will be undertaken in the summer.

7.10. In addition to inspecting the rivers and repairing damage, staff also pegged river heights for later analysis and recorded the extent of ponding in the Taonui Basin, and how it reduced over the week.

7.11. The exceptional river flows in the Lower Kiwitea, Oroua, Makino, Mangaone, Turitea and Kahuterawa have caused a significant amount of damage, as summarised in the table at Annex A. If this damage was to be incorporated into the existing maintenance budget, the maintenance programme which is still in catch-up mode after the 2010 floods, would be pushed even further back, thereby placing assets at risk of damage in moderate floods. Accordingly, it is strongly recommended that the high priority damage suffered in the recent event be separately addressed through the use of emergency reserves.

7.12. PNCC have been contacted over the damage to the Mangaone, and provisional agreement has been reached as to their contribution to erosion repairs, particularly those in the immediate vicinity of bridges.

7.13. Capital works have been completed at Burkes Gates, next to Burkes Pumpstation, to mitigate the risk of a sliding failure of the very large concrete structure.

7.14. Annual inspections of schemes were well underway before the flood event on 19-21 June. Due to the continued wet ground conditions, an ATV was hired to allow access along the tops of stopbanks and to floodgates which would have otherwise been inaccessible by vehicle at this time of year. The ATV was deemed very useful and effective in accessing the areas required without causing damage to the stopbanks or berms due to its relative light weight. Tablets were also used for the first time to undertake inspections and, combined with the ATV, resulted in inspections in some areas being completed much faster than in previous years.

LOWER MANAWATU SCHEME

7.15. Works undertaken on the various rivers within the scheme during this period include the following:

MANAWATU RIVER

7.16. Maintenance continued on edge protection works, including layering and mulching and channel maintenance. Foxton Beach and Foxton Loop walkway were mown and other miscellaneous maintenance tasks were completed.

7.17. Scheduled maintenance including mowing of Manawatu River Stopbanks within the city reaches has taken place, along with spraying of most stretches of rock riprap and a 1 km length for Old Man's Beard along Ashhurst walkway. Due to the wet conditions, the last mow of the financial year throughout the city reaches was unable to be undertaken, and the next mow will be completed as soon as conditions allow. Compost was spread around the area of native plantings downstream of Fitzherbert Bridge adjacent to the Esplanade as the ground material is not very fertile and is limiting plant growth.

7.18. A meeting was held with Ngati Whakatere to discuss an extension of native tree planting on the Manawatu River opposite the Tokomaru confluence. It was decided that the willows would be mulched, leaving them as front line protection but allowing the upper bank to be planted with natives.

7.19. A total of 1600 cubic metres of gravel was extracted from two sits on the Manawatu River in this reporting period. There has been some interest from the Higgins Group at Jackeytown Road to extract a large amount of gravel from a beach located on J Tocker's property. Extracting gravel from this beach would take pressure off the opposite river bank

on B Whitelock's property which suffers extensive lateral erosion in flood events. Consent requirements are yet to be considered.

7.20. Stopbank inspections are underway with 20 km of stopbanks inspected to date. Some stopbanks, such as those of the Makino Stream below Rata Street, will need to be re-inspected due to the large amount of damage caused by the floods of 20 June.

OROUA RIVER

7.21. Flood damage in the Oroua River has identified 21 sites totalling 1765 m of erosion. Of these, the worst site is located at Livestock Improvement Corporation (LIC), downstream of Awahuri Bridge on the true right bank at river distance 29.8 km. This site last suffered the same type of erosion in 2004. Approximately 250 m of tied tree works and supporting summer bank have been eroded away, with over 8 ha of LIC's farming operation being taken out of production.

7.22. A 35 m section of summer bank has been temporarily repaired on the true left bank at Kuhne's property. The 35 m section of bank was made up of three separate breaches.

7.23. Other major damage sites include a 150 m length at B Guy's property located at 40.4 km on the true left bank. This site is one we had repaired previously and was in need of maintenance prior to the flood. A 100 m erosion site opposite the Kiwitea confluence on B Johnston's property located at 41.7 km will need river realignment and back-filling with river gravels to complete the repair.

7.24. Vegetation spraying continued in the Oroua River from Boness Road down to Hoihere Road Bridge. Mulching continued from Kopane Bridge down through to Kaimatarau Road end, and was undertaken on excessive willow re-growth growing on the outside river bends.

7.25. No gravel or silt has been extracted from the Oroua River in this reporting period.

MANGAONE STREAM

7.26. Programmed spraying work, tree trimming and fencing, was undertaken within the Palmerston North city reach, however due to the continued wet conditions the last stopbank mow of the financial year has had to be deferred until weather and ground conditions allow. Excessive vegetation growth within the channel needs to be controlled to maintain channel capacity.

7.27. There is an increasing occurrence of fly-tipping of refuse within the Stream Reserve. There are several access points in this area which are easily accessible by vehicle and these will require bollards or gates to help reduce the dumping of large amounts of waste.

7.28. As a result of the June 20 flood event, approximately 600 m of rock riprap protection is required in the city reaches of the Mangaone Stream. Much of this damage has occurred around PNCC assets and as referred to above, discussions with PNCC have been held regarding contributions to the costs of repair.

7.29. There has also been a substantial amount of slumping of channel banks which has resulted in large sections of berm being eroded away in some places. Even though these erosion sites look alarming, the integrity of the stopbank in the vast majority of cases is not threatened. An extensive program of berm reshaping will be undertaken and will commence when conditions become suitable as damage would be aggravated by trying to fix the problems during saturated ground conditions. In the meantime, these areas will be

monitored and if the integrity of the adjacent stopbank becomes an immediate issue then emergency works will be undertaken.

7.30. The Mangaone Stream suffered quite bad slumping from Flygers Line to the Bunnythorpe Railway Bridge. A total of 25 sites were identified covering 765 m in length. A floodgated culvert has fallen into the channel at Dignam's and two landowners in the Flygers Line Spillway will need several hundred meters of new fencing. A farm crossing over Whisky Creek at Richard Pratt's property will need to be repaired as well.

7.31. Urgent repairs to the Mangaone Stream stopbank are required at a site located 100 m upstream of the Milson Line Bridge on the true right ban and lower priority repairs are required at various other sites.

MAKINO STREAM

7.32. A routine inspection and test operation of the Makino Sluice Gates was undertaken on 10 June and a small amount of tree material that had the potential to foul the gates was removed.

7.33. Following the very high flows of 20 June, erosion problems have been identified at approximately 35 sites.

7.34. The existing stopbanks on both banks between Rata Street and Kitchener Park, have been so badly damaged from overtopping that they will struggle to contain another moderate flood event. Four specific breaches have been temporarily repaired.

KIWITEA STREAM (LMS)

7.35. A flood damaged site on the Kiwitea Stream 300 m downstream from the Kimbolton Road Bridge on the true right bank has seen a 175 m hole open up. This land is grazed by Selwyn Mead. The hole, which was previously an inside river bend, has turned into an outside bend. Significant back-filling with river gravels will be required to repair this site, along with river training groynes.

MOUTOA FLOODWAY

7.36. Annual inspections of the floodgates along the Moutoa Floodway were completed prior to its operation on 21 June and they will now require re-inspection.

STONEY CREEK / JACK'S CREEK

7.37. Very high flows in Stoney Creek have resulted in 165 m of erosion being identified. Although most of the damage is minor, there is one large erosion area at Teague's property downstream of the State Highway Bridge. Fixing this site will involve the redistribution of stream gravels from around the bridge.

ASHHURST STREAM SCHEME

7.38. The inaugural Annual General Meeting (AGM) for the Ashhurst Stream Scheme was held on 5 May. It has been agreed that future meetings will be held bi-annually.

7.39. The scheme has recently been upgraded to now provide a 1 in 100 year (1% AEP) flood protection. Upgrade construction works commenced in 2011 and were completed in February 2015.

7.40. Assets managed by the scheme significantly increased from $54,500 in 2005 to $545,500 in 2015.

7.41. As an outcome of the AGM, all stock gates within the scheme have been inspected and a programme put together to repair and / or replace as required.

7.42. The flood of 20 June passed through the scheme area without any identified problems.

LOWER KIWITEA STREAM SCHEME

7.43. All programmed maintenance works had been completed prior to this reporting period.

7.44. Gravel extraction (700 m^3) was completed downstream of Bell Road.

7.45. On 20 June, the scheme experienced the largest flood event (198 cumecs) since the 2004 floods. The 2004 flood caused catastrophic damage, destroying a road bridge and sweeping houses downstream. With the help of Government assistance, the Lower Kiwitea Scheme was formed, and undertook a very substantial channel clearance, channel training and planting programme. The planting works undertaken by the scheme have by and large done their job in the flood of 20 June, however new areas of erosion that were not previously protected have been opened up.

7.46. A special meeting was arranged and nine landowners attended, with only two apologies. This was the best attendance to any scheme meeting since the 2004 floods. Discussions centred on the cause and extent of damage and repair options. The unanimous view of those present was that the damage should be repaired as soon as possible; that all the money from the maintenance budget and the emergency reserves be used for that purpose and if that is not sufficient, the existing loan should be increased and the term lengthened. The view from the landowners was that there were certain pinch points in the channel that caused debris blockages and gravel deposition and these pinch points should be removed. It is proposed that a follow-up meeting be held once the Catchment Operations Committee's decision on the use of emergency reserves is known, and that a detailed prioritised work programme be available for discussion at that meeting.

7.47. Overall, the meeting was very positive, with landowners very appreciative of the work Horizons had done since the flood event. They also made it very clear that they expected works to begin immediately.

KAHUTERAWA STREAM SCHEME

7.48. The AGM for the Kahuterawa Stream Scheme was held on 6 May. It has been agreed that future meetings will be held bi-annually.

7.49. The flood on 20 June caused significant damage in the upper reach of the Kahuterawa Stream (63 cumecs event).

7.50. Five sites totalling 570 m of erosion require some form of repair.

7.51. The scheme funding mechanism requires that landowners fund 75% of the cost of new works. The damage on the Kahuterawa is currently estimated as being $85,500. This year's works budget is $11,845. There are no emergency reserves. If the estimates are correct and all the landowners wish to proceed with works, the 25% share of the costs for the scheme amounts to $17,100.

7.52. Notwithstanding this, there were two sites where a property access bridge had been outflanked and to restore access to these properties, emergency works have been undertaken.

7.53. Staff propose to meet with affected property owners once the Committee's decision of flood damage funding is known.

7.54. A site visit was also held with the Defence Force to discuss significant erosion through Linton Army Camp. The Kahuterawa has caused significant erosion through the camp, and staff will be providing expert advice in respect of works to be funded in their entirety by the Defence Force.

LOWER MANAWATU SCHEME (LMS) – CITY REACH PROJECT

7.55. Progress with the rock placement along the new channel alignment at the Anzac Cliff site continued into early May.

7.56. Fluctuating river levels during May resulted in a lot of downtime for the contractor and accordingly the decision was made in late May to suspend the contract. Suspension officially commenced on 1 June for a three month period with the options of re-establishing and starting works earlier if the long -term weather forecast looked favourable.

7.57. There is approximately only one month required to complete the river alignment work. That is to place, shape and compact approximately 17,000 cubic metres of gravels, place the remaining 120 m length of rock lining, and place bed armouring. This would complete 90% of Horizons work of Separable Portion A of the contract. The remaining works Horizons is responsible for, is the placement of rock against the new cliff buttress batter slope, up to the 100-year flood level, and any restoration work required at the site.

7.58. Following the decision to suspend the work for the winter period, temporary works were put in place to minimise potential damage from floods that may be of a higher level than the finished design level of the partially completed embankment and rock lining. The temporary works were mainly at the downstream end of the rock lining.

7.59. During May and up until June 20, rock delivery continued to the right bank. Up until suspension as much rock as possible was transported to the left bank when river levels permitted, ready for subsequent placement.

7.60. As at 20 June, 23,774 tonne of the 28,815 tonne of graded rock required for the works had been delivered to the site. Some of this rock has been used for the temporary work and is all accounted for and recoverable.

7.61. By 3 June the contractor, had dis-established and removed all machinery and containers from the site. This left only the site fencing and signage in place. It is the contractor's responsibility to keep the site safe and tidy during suspension.

7.62. On 20 June, the Manawatu River rose to a level of 7.18 metres, equating to a one in seven year flood event. The flood level was approximately 1.40 m above the rock lining and embankment finished level.

7.63. Inspections confirm that the partially completed rock lining has worked well with no damage to the works. There is also no evidence of gravel losses from the embankment, indicating that the gravels placed within the embankment have been well compacted and the temporary work has minimised any loss.

7.64. There is evidence of high silt deposits on the embankment and also high silt deposits on the right bank through and around the rock stockpiles and up into the site compound. This has temporarily suspended rock delivery to the site until ground conditions improve and silt can be removed from the access tracks. There is also some damage to site fencing at the upstream and downstream ends of the site that will require replacement and repair, but this is minor.

STATUS OF THE ANZAC CLIFFS CHANNEL REALIGNMENT CONTRACT

7.65. With the project well advanced and the river realignment work approximately 90% completed, delays in rock delivery that had been an issue during the entire project, finally necessitated contract suspension on 1 June for the winter period.

7.66. During the March - April period when the majority of the gravel was moved from the central stockpile into the old river channel to form an embankment for the rock lining and foundation for the fill buttress, it became apparent that the embankment fill area would require substantially more gravels than had been calculated and scheduled for in the contract. The Contract Schedule Item is for 109,050 cubic metres of gravels from the cut to the fill. The majority of that was to be double handled.

7.67. At the end of April when the survey of the cut was undertaken for payment for that period, the volume in the fill area had already exceeded the scheduled volume.

7.68. At the end of May, the claimed surveyed volume of gravels from the cut had increased to 132,494, cubic metres. That is at the stage at which the works have been suspended for the winter period. Further surveys show that approximately another 17,000 cubic metres of compacted gravel is required to complete the embankment fill. This equates to a total of approximately 40,000 cubic metres of gravel fill required in excess of the scheduled volume of 109,050.

7.69. Horizons staff have received all the contractor's survey information and have checked the claimed totals against our internal information and the comparisons are very close. Horizons have calculated a slightly higher volume than has been claimed.

7.70. Horizons undertook an initial survey of the beach in late 2008, then a resurvey of the beach and river bed (by boat) in September 2011. The closest either survey could measure the river bed against the toe of the cliff was approximately 10 m on account of safety considerations. The river bed information beyond that point was then interpolated.

7.71. The area and volume for fill for the embankment, as scheduled in the contract, was determined from the September 2011 surveyed information.

7.72. Following the granting of the consent for the project, a long delay was encountered while foundation investigations were undertaken. The contract to realign the river and contour the cliff was ultimately awarded in September 2014.

7.73. Scaling off from Google Earth aerial photos indicates that the cliff face has retreated approximately 20 m since the river bed survey undertaken during September 2011. Calculations show that such a retreat would account for all but 10,000 cubic metres of the now measured volume.

7.74. The volume for payment is taken from the surveyed measure of the cut and this is accurate. The surveyed cut measure is from an insitu volume to a fill volume in the embankment which is a solid volume. The volume from the cut is not a solid measure and may vary in compaction from a solid measure by between 10 and 15%. Another factor is the compaction of the embankment. Some of the test results indicate compaction of

greater than 100% has been achieved. A significant portion of the 10,000 cubic metres unaccounted for could largely be explained by the difference between the 100% compaction allowed for and that actually achieved.

7.75. Other losses could be explained by river erosion of the gravel stockpile during the 11 December flood and by double handling of material. In any event, the volume now claimed, together with the estimated 17,000 cubic metres yet to be placed, is what is required to backfill the old channel to the required compaction standard.

KNOWN COSTS AND ESTIMATES

7.76. The price difference in the contracted volume of 109,050 cubic metres of gravels required and a probable additional 40,000 cubic metres is substantial and equates to $276,000.

7.77. As to be expected in major contracts of this nature, there have been other variations that result in increased costs. Variations known and valued to date include:

- A design change to incorporate a rock apron and return on the upstream side of the rock groyne;
- Extensions to the necks of the rock groyne and rock lining due to erosion of the channel bank;
- Placement of added rock and bank battering at the confluence of Bryant's Creek to minimise future erosion;
- Temporary works to secure the site during suspension; and
- Dis-establishment and re-establishment by the main contractor and subcontractor during the works contributed to by the delays in the rock supply.

7.78. Total costs of known variations to date, in addition to the increased gravel quantity amount to $61,212.

7.79. There will also be further costs to the Principal for the contractor's re-establishment at the site following the period of suspension. These include transporting machinery and containers and setting up the site again. Re-establishing the river ford and recovery of rock used in the temporary works to secure the site. Estimate for those items is $53,500.

7.80. Also costs to extend the bonds and insurance until the contract is completed and other P & G and daily rates that may be applied by the contractor. Estimate for those items is $8,000.

7.81. There is also potential to make significant savings on a number of items in the main contract and within the rock supply contract. An estimate of potential savings is $285,000.

FINANCIAL SUMMARY

• Tendered Price by the Contractor Goodmans Contracting Ltd	$2,001,420
• Awarded Contract Price following Post Tender Negotiations	$1,749,067
• Known Variations and Estimate of Overruns	$398,712
• Possible Savings on Contract Items	$285,000
• Anticipated Adjusted Contract Price To Date	$1,862,779

CONCLUSION

7.82. It is disappointing that the in-river component of the project was unable to be completed within the 2014-15 low flow period. The difficulty encountered through the liquidation of the rock supply contractor could not have been anticipated and even without that occurrence it is very likely, given what we now know, that the contracted rock supply rates would not

have been achieved. Nevertheless, work completed to date appears to be well secured and there is every prospect that the works will be completed by the end of 2015. Good control of costs has been maintained and given the scale and complexity of the project, the anticipated additional costs are not excessive**.**

TURITEA SCIENCE CAMPUS

7.83. The final section of work is now underway adjacent to the Batchelor Centre to complete the protection of the Science Campus from the 0.2% AEP Manawatu River flood.

7.84. Following discussions with PNCC, the original design for this section has been modified such that the PNCC Pumpstation (situated partially in the flood fairway), is able to be afforded the same standard of flood protection as the adjoining campus. The pumpstation building will now form part of the flood barrier, however in order to meet PNCC earthquake design standards, the building requires some strengthening work.

7.85. It has been formally agreed that PNCC will at their cost strengthen the pumpstation and in doing so, will incorporate a flood proof wall to at least the 0.2% AEP flood level.

7.86. Horizons will construct a concrete flood wall between the recently completed earth stopbank and the downstream corner of the pumpstation. Horizons will then construct another concrete flood wall for approximately 15 m from the corner of the south side of the pumpstation. A short embankment comprising imported compacted earth fill will then link that wall to nearby high ground. This section of the work will be funded by the City Reach Project. It is anticipated that all work will be completed by the end of July.

LOWER MANAWATU SCHEME RURAL FLOOD PROTECTION UPGRADE PROJECT

7.87. With all Upgrade Project Works scheduled for 2014-15 substantially completed within the previous reporting period, the focus has shifted to preparing for a very full programme of works for the next construction season. The following table schedules all programmed works and provides commentary on present project status.

Project Title	Description	Status
Manawatu River Right Bank Stopbank Upgrade, Karere Road, Longburn	Upgrade 5,100 m of the Manawatu River right bank stopbank in the vicinity of Karere Road, Longburn	All affected landowners have been met on site to discuss works. Land Entry Agreements have been posted.
Manawatu River Left Bank Stopbank Upgrade, Akers Property, Linton	Upgrade 550 m of the Manawatu River left bank stopbank at the Akers property immediately upstream of Akers Roadd, Linton	The affected landowner has been met on site to discuss works. A Land Entry Agreement has been posted.
Manawatu River Right Bank Stopbank Upgrade, Ervine Property, Rangiotu	Upgrade 3,600 m of the Manawatu River right bank stopbank immediately downstream of the Opiki Bridge and on the Ervine property adjoining Highway 56	The affected landowner has been met on site to discuss works. A Land Entry Agreement is currently being drafted.
Manawatu River Left Bank Stopbank Upgrade, BM 486, Funnell Lease, Poplar Road	Upgrade 1,600 m of the Manawatu River left bank stopbank on Council-owned land currently leased by Mr Funnell adjoining Poplar Road, Opiki	A meeting will be arranged with the lessee in August to discuss the scope of works and potential impacts on his farming operation.
Manawatu River Right Bank Stopbank Upgrade, Whirokino Road	Upgrade 17 short sections of stopbank on the Manawatu River right bank in proximity to Whirokino Road upstream of State Highway 1.	Landowners will be contacted during August-September to discuss the scope of works and potential impacts on their farming operations.

Manawatu River Right Bank Stopbank Upgrade, Higgins & Tait-Jamison, Whakarongo	Upgrade 4,880 m of the Manawatu River right bank stopbank at Whakarongo	Landowners have been contacted. This project may not be undertaken this financial year.
Protect Individual Property, Hopkins Farming Group, State Highway 56	Construct bunds around two houses owned by Hopkins Farming Group on State Highway 56, Tiakitahuna	The Farm Manager has been contacted to discuss details of the protection works. Further discussions will next occur in early August 2015.
Protect Individual Property, S. Bond, 767 Lockwood Road	Protect the Bond house at 767 Lockwood Road	Two recent meetings have been held with the owner. A solution has been agreed in principle and preliminary design work is in progress.
Protect Individual Property, R. Astwood, 802 Lockwood Road	Raise the Astwood house at 802 Lockwood Road	A meeting with the landowner is scheduled to occur in early August.
Protect Individual Property, Van Oostveen, 691 Lockwood Road	Construct a bund around the Van Oostveen house at 691 Lockwood Road	This property is on the market and further consultation will be delayed pending the outcome of a sale offer.
Protect Individual Property, V. Muncey, 821 Lockwood Road	Protect the Muncey house at 821 Lockwood Road	Discussions have been held with this landowner. Investigation work is currently in progress to raise this house if possible.
Protect Individual Property, G. Lynch, 892 Lockwood Road	Raise the Lynch's Farm Manager's house at 892 Lockwood Road	The landowner has been met with on site and preliminary work to raise this house is underway.
Protect Individual Property, Strahan Property, Rangiotu Road	Construction 65 m of concrete floodwall on Strahan farm to protect dairy buildings	Documentation is complete. The landowner has requested that works be undertaken in May 2016.
Oroua River Left Bank Stopbank Upgrade, Hoihere Rd to Rangiotu	Upgrade 5,200 m of stopbank on the left bank of the Oroua River downstream from the Hoihere Road bridge to Highway 56, Rangiotu	Consultation has commenced with some landowners. Further meetings and Land Entry Agreements will progress during August.
Oroua River Right Bank Stopbank Upgrade, Hoihere Road To Rangiotu	Upgrading 5,300 m of stopbank on the Oroua River right bank downstream from the Hoihere Road Bridge to Highway 56, Rangiotu	Consultation has commenced with one landowner. Further meetings and Land Entry Agreements will progress during August.
Oroua River Right Bank Stopbank Transition At Hoihere Road Bridge	Raise Hoihere Road on the left bank. Construct retaining wall, upgrade stopbank and install road stoplog on the right bank	Affected landowners have been contacted. Design work and Land Entry Agreements will progress during August.

8. NORTHERN AREA

GENERAL

8.1. Prior to the 20 June flood event staff were busy completing their end-of-year asset inspections and updating the AMS. This important task enables scheme engineers to assess the condition of their schemes and prioritise the next years work programme.

8.2. As part of a resource consent settlement agreement, Operations staff installed five rock bed control structures at Alex Glasgow's property. Alex had experienced a deepening of the water courses through his property that resulted from an increased volume of run-off generated from an upstream dairy conversion. This caused increased channel scour through his paddocks and a lowering of the water table. The bed control installation is

intended to return the waterway to its original channel depth. It is understood that the structures performed well during the recent heavy rainfall event.

FLOOD EVENT 20-22 JUNE 2015

8.3. The Northern Area experienced significant flood damage in a number of its river and drainage schemes. Aerial inspections were completed for the Pohangina-Oroua, Rangitikei, Turakina, Pakihi, and Whangaehu–Managawhero Schemes. On the ground inspections have also been completed on a number of schemes and flood heights have been marked so that levels can be surveyed later.

8.4. The Whanganui River experienced its highest river flows and levels on record. The flood return period has been assessed as 1 in 85 years. River levels exceeded the design height of the newly constructed Kowhai Park Stopbanks, overflowing into the park, Anzac Parade and houses. The stopbanks at Anzac Parade/Kowhai Park are designed to provide protection from a 30 year flood event with allowance for freeboard, which equates to 50 year flood level without freeboard.

8.5. Of all the Northern Schemes, the Rangitikei River Scheme has suffered the greatest flood damage. Unfortunately weather conditions and elevated river flows have not allowed a comprehensive inspection of all sites but a reasonably accurate estimate of damage is $41.8 million, including what is described as lower priority aggravated previous damage. The major insured assets sustaining flood damage are to the Hastings rock linings and the recently completed stopbank upgrade at Walmac Farm.

8.6. The Pohangina-Oroua River Scheme has only sustained minor flood damage estimated at $54,000 which can be repaired under the current scheme budget. Other schemes, such as the Porewa, Tutaenui and Matarawa Schemes, while only having minor damage to scheme assets, have sustained heavy debris deposits with considerable channel clearing work required. There are other schemes without any assets such as the Whangaehu–Mangawhero and Turakina Schemes where large amounts of flood debris have been deposited in channels.

ENGINEERING ADVICE

8.7. During the last two months there has been an increased number of requests for advice including three requests for verifying catchment boundaries for dairy farm units seeking new or amended consents for their dairy operations; investigating flooding complaints at several sites; advising on channel congestion issues; inspecting land drainage problems; and checking that resource consent conditions had been met for non scheme river bank protection works pertaining to a sub-division.

RANGITIKEI RIVER CONTROL SCHEME

8.8. Maintenance work completed during the period included checking all floodgates on the Tangimoana and Parewanui Stopbanks, clearing a blockage from the Amon Drain Flood Gate, mechanical cleaning of the Parewanui Drains, removing a number of trees that had established themselves on river beaches, and spraying for noxious weeds at a number of locations.

8.9. In preparation for winter, a small section of slumped rock work at Willis' was repaired to ensure protection was maintained during winter flood events.

8.10. The scheme suffered substantial damage during the 20 June 2015 flood event. A summary of damage is given in the table below.

Flood Damage Structure	High Priority Work	Lower Priority to fund from budget
Stopbank	$6,000	S180,000
Rock Lining	$492,600	
Groynes	$107,500	$8,800
TBPW		$963,500
Channel Clearance		$8,100
Floodgate		$1,000
TOTAL	**$606,100**	**$1,161,400**

PAREWANUI STOPBANK UPGRADE

8.11. The Practical Completion Certificate for the contract works was issued on 7 May 2015. Following the contract completion the Rangitikei River experienced a significant flood event on 15 May which recorded a stage height at the McKelvie Hydrological Site of 6.1 m. The flood waters flowed 1 m deep against the new stopbank causing relatively minor damage to a 400 m length of the stopbank toe. That damage was substantially aggravated during the 20 June event. Repairs, which will include considerable reshaping of the berm to mitigate the channelling of flow against the toe, cannot practicably be undertaken in present conditions so the situation will be closely monitored in the interim.

RANGITIKEI RIVER ENHANCEMENT

8.12. For a number of years now Operations staff have been involved with the Bulls River User's Group in enhancing the Rangitikei River berm immediately upstream of the SH1 Bridge at Bulls. Plant pests have been sprayed and the area planted out mainly with native trees to provide a recreational and picnic area for the public. GEM staff have also been involved in this project.

POHANGINA-OROUA RIVER CONTROL SCHEME

8.13. The scheme performed well in the latest flood event with post-flood inspections identifying only minor damage requiring repair. For the Pohangina River, this work is focused mainly around the clearing of trees from the channel. For the Oroua River, there are some areas of river bank slumping, but more importantly there are scour holes developing on each of the Hoggard, Christie, and Robert properties. All three landowners are keen to act quickly and have asked staff to prepare cost estimates for the repair work.

8.14. Total scheme flood damage is estimated at $53,750 broken down to the following areas.

River	Description	Lower priority to fund from budget
Oroua	Channel clearance	$10,000
	Christie property TBPW repairs	$4,500
	Hoggard property TBPW repairs	$5,250
	Roberts property TBPW repairs	$1,000
	Smyth property Channel clearance	$10,000
Pohangina	Rutherfords property TBPW repairs in prograess	$8,000
	Various Bank erosion repairs	$15,000
	TOTAL	**$53,750**

8.15. The following gravel returns were received for the period:

- Tim McColl Contracting April – June 2015 1,750 m^3 Oroua River
- Chris Gommans April – June 2015 0 m^3

UPPER WHANGANUI RIVER MANAGEMENT SCHEME

8.16. With the planned removal of polar trees along the Ongarue River complete for the year, time was spent undertaking general vegetation maintenance work that included weed spraying, pruning, and mulching.

8.17. Flood flows through Taumarunui reached full channel capacity with water just lapping onto the river berms. Damage was restricted mainly to plantings between Cherry Grove and Victory Bridge with all hard assets reported to be in good condition.

MATARAWA FLOOD CONTROL SCHEME

8.18. All five dams within the scheme were inspected and 5.2 km of drain sprayed. In preparation for winter, the diversion channel was mechanically cleaned removing a build-up of silt from the bed increasing the system's hydraulic capacity.

8.19. The 20 June flood was particularly intensive. All five dams experienced a spillway overflow, along with widespread flooding along the valley floor. The No 3 Line Bridge had its eastern approach washed out. Extensive hill country land slippage in the detention dam catchments has resulted in the deposition of large quantities of sediment in the respective ponding areas, that will require removal at some stage.

8.20. Flood damage is estimated at $71,680 with the high cost items being dam desilting as shown in the table below.

Site	**High priority work**	**Lower priority to fund from budget**
Dam 1.1. Desilt dam and stock access track	$13,350	
Dam 1.2. Desilt dam and stock access track	$10,850	
Dam 1.2. Remove trees from channel d/s of dam		$5,400
Dam 3.1. Repair spillway scour	$18,950	
Dam 3.1. Repair headwall	$4,480	
Dam 3.1. Desilt	$6,000	
Repair diversion channel scour	$10,450	
Repair diversion channel rock		$2,200
TOTAL	**$64,080**	**$7,600**

TUTAENUI FLOOD CONTROL SCHEME

8.21. For this scheme all 18 dams were inspected and any debris deposits cleared from the ponding area and intakes.

8.22. The 20 June flood event produced a 70 year return period flow as measured at the Hammond Street Hydrometric Station in Marton. Extensive flooding was experienced throughout the Tutaenui Valley and Marton Township with the Horizons Office being one of the casualties when 50 mm of water flowed through the building. Of the 18 dams, all but two overflowed into their spillways and these were the ones closest to town and located lowest down in the catchment. While the flood event substantially exceeded the scheme design standard, which is nominally 4% AEP, the storage provided by both scheme dams and the Marton water supply C Dam, substantially mitigated the impacts.

8.23. Flood damage is estimated at $26,700 as shown in the table below with the main items being the clearing of gravel and trees from the channel.

Site	High priority work	Lower priority to fund from budget
Channel clearing - trees		$7,650
Channel clearing - gravel		$9,000
Dam W1. Repair topsoil and grass	$1,050	
Dam W1. Remove trees from channel	$9,000	
TOTAL	**$10,050**	**$16,650**

MAKIRIKIRI FLOOD CONTROL SCHEME

8.24. The 75 year return period flood experienced in the Turakina River again caused extensive ponding on approximately 75 ha of river flats and on Turakina Beach Road. Road access to Koitiata for most vehicles was cut for approximately four days. Clearance of the water was aided by the deliberate breach of a section of the Makirikiri Stream stopbank. Repair costs to reinstate the cut stopbank are estimated at $4,000 and will proceed as soon as conditions allow, at cost to the non scheme's emergency works budget.

8.25. This event has again raised the possibility of installing a flood water egress structure in the Makirikiri Stream stopbanks to facilitate the safer and more efficient clearance of the affected area in future Turakina River floods. The recent event is the third occasion on which the stopbank has had to be breached over the past 11 years and is the sixth occasion that the area has been flooded in the past 80 years. The problem is not one for the Makirikiri Scheme to deal with and the Turakina Scheme does not provide a flood protection service. Accordingly a solution is unable to be funded through either scheme. The provision of a flood water egress structure does however clearly satisfy the community benefit criterion for Environmental Grant assistance in that approximately 150 residents of the Koitiata Village are affected by the prolonged road closure. A meeting was held with the Rangitikei District Council (RDC) Mayor and the primarily affected landowner on 16 July to discuss mitigation options. It was agreed by all parties that there are significant benefits to be had from the installation of a structure. The estimated cost is $75,000 and if an Environmental Grant of 30% was applied, that would leave $52,500 to be funded by RDC and the affected landowner. The landowner has agreed to contribute and RDC are to consider their position in the near future. In the meantime, given the significant impact that funding for this particular project would have on the overall Environmental Grant budget, the Committee's approval is sought for the commitment of $27,500 of grant funding.

POREWA FLOOD CONTROL SCHEME

8.26. For this scheme all 27 dams were inspected and any debris deposits cleared from the ponding area and intakes.

8.27. The 20 June flood event produced a significant flow in the catchment resulting in all 27 dams overflowing their spillways. In Hunterville, a number of houses were flooded and the hill country experienced extensive land slippage. Approaches to two road bridges were lost, one at Te Hou Hou Road and the other on Onepuhi Road. Inspections have identified severe bank erosion along reaches of the river, high levels of gravel build-up in many of the side streams, numerous trees in the channel, and siltation of dam ponding areas.

8.28. Flood damage is estimated at $27,485 as shown in the table below with the main items being channel clearing and the removal of silt from Dam 100.

Site	High priority work	Lower priority to fund from budget
Repair Dam 62 spillway		$875
Dam 100 desilting	$10,000	
Dam W1. Repair topsoil and grass	$1,050	
Dam W1. Remove trees from channel	$9,000	
TOTAL	**$10,050**	**$16,650**

WHANGAEHU-MANGAWHERO RIVER MANAGEMENT SCHEME

8.29. No work was undertaken during the period.

8.30. Following the 20 June flood event an aerial inspection of the scheme area showed extensive areas of flooding along the river flats and large areas of land slippage in the hill country. There was no evidence of river channel blockages as has often been observed in the past following similar events.

TURAKINA RIVER MANAGEMENT SCHEME

8.31. Prior to the flood event work was completed removing and burning 875 m of dead willows on the Myer property.

8.32. Following the 20 June flood event, an aerial inspection of the scheme area showed extensive areas of flooding along the river flats, river bank slumping and large areas of land slippage in the hill country. While no debris blockages were observed within the cleared reaches of the river, there were accumulations against bridge structures that will need to be cleared by the asset owners.

LOWER WHANGANUI SCHEME

8.33. Regular monthly maintenance works included Upokongaro Jetty maintenance, inspection of stormwater culverts, gates and valves through Kowhai Park and Balgownie, and general edge vegetation maintenance.

8.34. Staff were fully involved in the response to record flooding in the river on 20 June. Tasks involved monitoring, and assistance with the deployment of temporary flood barriers at five sites.

8.35. Once the flood peak had passed, contractors were engaged to effect a controlled breach of the new stopbank to allow trapped water to find egress to the main river channel. This allowed emergency personal access to the Anzac Parade area to commence their damage assessments.

8.36. Following this flood event staff have been involved in post-flood inspections; have provided assistance with pumping trapped flood water; have cleaned up and re-packed the flood barriers; and have made temporary repairs to the breached stopbank to ensure the design level of flood protection is returned to the community.

8.37. The Kowhai Park Stopbanks performed very well during the flood event and the significant overtopping without suffering any structural damage. However, the large volume of water passing over them has caused scour round some hard features like concrete and wooden walls; the loss of limestone from the pathway; and superficial damage to the earth embankments. In total, scheme damage from the floods is estimated at $50,000 made up as follows.

Location	**High priority work**	**Lower priority to fund from budget**
Upokongaro Jetty		
Remove silt		$5,000
Kowhai Park Stopbank		
Reinstate stopbank breach	$10,000	
Stopbank repairs	$27,500	
Pathway repairs	$7,500	
TOTAL	**$45,000**	**$5,000**

PAKIHI SCHEME

8.38. The pre-cleaner structures for both dams have been repaired and the intake grill to the Wallace Pearson Dam replaced.

FOREST ROAD DRAINAGE SCHEME

8.39. Drain spraying was completed prior to the June flood and the drainage system performed well subsequently with no reports of damage.

HAUNUI DRAINAGE SCHEME

8.40. RDC lowered the road culvert across Haunui Road in late May following the re-grading of the Ruatangata Road drain by Horizons. The new upsized 450 mm culvert performed well during the 20 June floods with no complaints received from locals. Post-flood inspections of the drain and culvert have shown no damage to either asset although upstream siltation

OTHER PROJECTS – MOAWHANGO RIVER

8.41. The last of the willow clearing for this seasons' works programme has been completed with the removal of two large blockages at the Waikakahi Road Bridge.

9. EASTERN AREA

GENERAL

9.1. As with much of the Region, the July storm has had a big impact on the Eastern Area and Tararaua District. For this area the event began when heavy rain started falling in the Tararuas on Friday 19 July. This rainfall peaked at 19 mm/hr in the early hours of Saturday morning and caused the Mangahao, Mangatainoka and the Makakahi to flood before moving north to the Ruahines on Saturday 20 June. On Saturday evening, many of the South Eastern Ruahine Streams and the Manawatu River had flooded. With floodwaters unable to flow through the gorge fast enough, the upper gorge area began to pond on Sunday morning. At its peak, close to 550 ha of farmland would have been underwater.

9.2. The highest total rainfall recorded in the eastern catchment over the last two and a half month period was close to 800 mm and this was recorded at the Upper Mangahao Hydro Recording Site in the Tararuas. At this same location, the total rainfall during the recent flood was 263 mm. While this is not a huge amount, the rainfall accumulation out in the valleys was similar and this is what caused the relatively high river flows.

9.3. Many of the streams and rivers reached levels consistent with an 8 to 15 year event and the Manawatu at the upper gorge peaked with a stage height of 12.3 m. This is the highest level the gorge has reached since September 2010, where it rose only slightly higher to 12.9 m. At its peak, the flow rate was over 1,700m³/sec at this location.

9.4. Over the last few weeks staff have been busy undertaking flood inspections, prioritising and managing emergency works and offering general river and drainage advice while also completing estimates to update works programmes for the coming season. Prior to the flood, staff were busy updating the AMS, working on the Annual Report, processing Environmental Grant requests while also offering advice regarding non scheme enquiries.

9.5. With much of the scheme's works areas now inspected, it is clear that there has been a fair amount of damage sustained to scheme assets. Most of the damage has been spread across a lot of small sites rather than instances of substantial loss. Generally, damage has been to the less resilient, but highly utilised tree type assets, such as plantings and tree bank protection work, rather than the hard assets of the schemes.

9.6. The value of high priority flood damage is currently estimated to be just over $967,000, and while these numbers are reasonably high for what is considered somewhere around a 10 year event, it must be remembered that in the eastern channels these are bank full flows, which given the steep nature of the streams concerned, are the most likely to cause damage. The damage sustained is also in line with that indicated by the flood loss curves for the respective schemes.

9.7. Following the recent rain and the subsequent flooding, there has been a marked increase in general river and drainage enquiry and some of these may qualify for Environmental Grant assistance. Generally, these have been on the Mangahao from above the scheme works area with one other from just north of Pahiatua. This is where a house and the neighbouring Riding for the Disabled Arena are being flooded by a creek which is being swamped by floodwaters from the Mangaramarama. An application for these will be processed later this season.

9.8. Gravel has continued to be extracted at a fairly consistent pace over the last two and a half months with over 16,000 m³ in total taken from various locations in the Mangatainoka, South Eastern Ruahine and Upper Manawatu/Lower Mangahao Schemes. And a lot of

this material has been taken for the various roading projects which are currently underway within the Tararua District.

AKITIO SCHEME

9.9. As mentioned in the last bi-monthly, 20 ha of aerial spraying was undertaken in March to control not only the willow re-growth, but also other weeds (such as Broom and Old Man's Beard). The effects of this work have recently become obvious with the treated plants completely browned off. Ratepayers are pleased with the result as it will help control congestion, while slowing the spread of weeds down the waterway, something which had been accelerating due to the recent stock exclusion.

9.10. Because Metsulfuron is now included in the spray mix to help treat the woody weeds we are targeting, water testing has been undertaken to ensure that the discharge of this chemical does not breach the recommended EPA specifications, as per the new consent variation. Pleasingly, the result of the testing shows that there wasn't a noticeable elevation in the quantity of Metsulfuron in the waters of the Akitio as a result of our work. Most importantly it also shows that the scheme works are going to have little or no effect on the environment, and this fact will be useful when applying for the upcoming consent renewal.

9.11. The recent storm had little effect on the Akitio catchment and as such the river hardly rose past a fresh, with no damage evident.

9.12. With the willow re-growth and other weeds having now been treated, inspections show that the channel is in good condition with much of the dead willow now broken down and either decomposing or washed out to sea.

EASTERN MANAWATU SCHEME

9.13. During the recent storm the Manawatu River at Dannevirke rose to 6.7 m at Weber Road, compared to its normal height of 1.5 m. While this is not extraordinarily high, it is as high as we have seen it in the past 12 months and is high enough to mobilise the willow debris which is breaking down following scheme works.

9.14. Inspections to date have identified one large debris dam situated just above Maunga Road Bridge. However this has already been cleared and the debris will be ready for burning in summer. Given a reasonable amount of this season's works budget was allocated for general debris clearance anyway, this work will be accommodated within the current budget.

9.15. Because the Manawatu is very incised in its upper reaches, not all of the channel has been inspected as yet, however given that the usual hot spots have, and there has been a lot of good communication with landowners, the Scheme Managers are confident that there are unlikely to be any issues of significance yet to find.

9.16. Last season a decision was made to save as much of the works budget as possible in order to increase the emergency reserve contribution to $9,000. This was to help the fund recover from a large draw down made to clear debris in the 2014 financial year. This has meant that the balance coming into the 2016 season will be close to $14,000, well over the $12,500 balance which the 2014 audit recommended. Ultimately, this means that the scheme is once again in a relatively good position to carry-on with the programmed works and be able to address any further debris dams should they develop.

MANGATAINOKA SCHEME

9.17. All 2014-15 programmed works for the Mangatainoka Scheme were completed by early June. This included repairs to sites damaged in the April fresh as well as the last of the programmed drain maintenance. This originally left the scheme in a healthy position at the end of the financial year, with no outstanding high priority sites and the works budget approximately 1% underspent.

9.18. The flood event on 20 June however caused significant flows in both the Mangatainoka and Makakahi Rivers. Both rivers rose to stage heights not seen since September 2010, and this caused a considerable amount of damage to both scheme assets and the planted river bank.

9.19. Unfortunately, during this event the Hamua Stopbank overtopped and then breached, causing approximately 30 m of bank to be destroyed at Pukewhai Road on the Saturday morning. While this was the most urgently concerning piece of damage found in the Tararua Schemes, it only caused minor damage to the adjacent farmland and no houses or significant property was flooded. The excess water simply flowed back into the Mangatainoka on the northern side of the Pukewhai Road Bridge.

9.20. Current inspections and works programming show that the total cost of the flood to the Mangatainoka Scheme has been approximately $535,000, with $389,000 of this classed high priority. With existing high priority work also considered, it is likely that the scheme will need to access $230,319 from reserves assuming that no insurance funding will be available. Only $143,000 worth of the damage is to insured assets.

9.21. The most significant damage resulting from this event is concentrated into three sites, which together account for over half of the estimated repair cost. Two of these have required immediate attention to prevent further significant loss of assets, and are the stopbank breach at Pukewhai Road, and a 60 m bank erosion site below a private guidebank on Fonterra's Tui Farm. Emergency works on these sites are well underway following notification to Fish & Game and Horizons' Consents Monitoring Team.

9.22. There has also been a lot of enquiry regarding the overland flow of floodwaters escaping the Mangaramarama which flows into the Mangatainoka a long distance downstream. This will need to be followed-up with a thorough investigation into a series of options and will require survey and design work. Some of the options may ultimately require an increase in service and an adjustment to the rating system to help fund works. Obviously, such changes need to be properly investigated and consulted on.

9.23. Following this recent event, the feedback from the ratepayers has generally been positive with most impressed by the level of service provided by Horizons across all areas of business. The vast majority of ratepayers have also been very happy with the performance of the scheme.

9.24. Gravel extraction on the Mangatainoka Scheme this period has been limited to only three small takes, with the total amount extracted 1,250 m^3. Staff have been working with extractors to ensure compliance with the scheme's resource consent conditions.

SOUTH EASTERN RUAHINE SCHEME

9.25. All works programmed for the 2014-15 season were completed by June and this had the scheme in a good position going into winter. However, the recent storm caused substantial flooding in most scheme streams situated between Woodville and Dannevirke. The Mangapapa and the Manga-Atua were the worst hit and these reached levels consistent with a 15 year event.

9.26. Most of the scheme works areas have now been inspected and early inspections show that most of the damage is spread across about 65 small sites of erosion or channel congestion. While sites require work of some level, it is important to note that across the 18+ streams that make up the South Eastern Ruahine Scheme works area, the total length of these streams is 199 km, meaning there has been on average only one site of erosion every 3 km.

9.27. Of particular concern however, has been the deposition of gravel. This is gravel which has been washed out of the headwaters and upper reaches of several of the channels, which then falls out of suspension in the flatter plains. In many cases this has caused the streams to semi-permanently flow out into the adjoining paddocks, and while in many cases this can be simply cleared from the channel (which had to be completed as notified emergency works on the Raparapawai and Kumeti), special attention may be needed on the Manga-Atua.

9.28. The extra build-up of gravel in the Manga-Atua is of particular concern because of the sheer quantity that needs to be removed and because it is further exacerbating the existing flooding issue upstream at SH2. During the flood, the Manga-Atua was ponding upstream of SH2 to the point of flowing over the highway and scouring the adjoining rail lines. This causes the floodwaters to then flow into a rail loop where a house was only millimetres from flooding.

9.29. Inspections and works programming to date have identified that the total cost of the flood to the scheme is approximately $519,500, however only $397,500 of this is of a high priority nature. Most of the damage was to tree type assets and although the scheme no longer has insurance, the total damage to hard assets was only $97,500. With existing high priority work also considered, it is likely that the scheme will need to access as close to $358,000 from reserves as possible.

9.30. A fair quantity of gravel (9,935 m³) was extracted under the scheme's consent this bi-monthly period. A lot of this was taken from the Tamaki, in a reach where the bed load coming out of the ranges naturally drops out above a district council bridge. It is expected that Higgins will also extract approximately 5,000 m³ from the Tamaki further downstream over the coming months. Metal extraction helps manage the over supply of gravel into the scheme, and the metal has been extracted from locations which will benefit the scheme.

IHURAUA SCHEME

9.31. The Ihuraua Stream did not flood greatly during the recent storm, however with the high rainfalls of winter, water levels are elevated and recent inspections show that last season's works have left the channels clear and free flowing. The work to clear several blockages and small constrictions, as identified in the 2011 Scheme Audit, have clearly been of benefit.

TAWATAIA - MANGAONE SCHEME

9.32. As with the Ihuraua, the Tawataia and Mangaone Streams also did not flood greatly during the recent storm. However, with the high rainfalls of winter, water levels are elevated and again, inspections show that last season's works have left the channels clear and free flowing.

UPPER MANAWATU – LOWER MANGAHAO SCHEME

9.33. The 2014-15 scheme works programmed for this scheme was completed in May and this put the scheme in a good position going into winter. However, the flood event on 20 June did cause damage in both the Manawatu and Mangahao Rivers. As mentioned earlier, the

river level at the Upper Gorge Recording Site rose to 12.3 m, about half a meter less than the 12.6 m it rose to in September 2010.

9.34. Because the bulk of the rain fell in the southern part of the eastern catchment, the bulk of the flooding and damage in the Manawatu was downstream of the Tiruamea confluence. Inspections show that, typically, a lot of this damage was to the tree type assets such as planting and tree bank protection work, with only a small number of hard assets actually damaged.

9.35. Also as mentioned earlier, a large part of this scheme was flooded to the point of causing ponding, this occurs as the Manawatu ponds-up behind the restriction of the gorge. Approximately 550 ha of farmland is covered by this ponding water.

9.36. Inspections and works programming to date have identified that the total cost of the flood to the scheme will be approximately $247,000, however only $179,000 of this is of a high priority nature. Most of the damage was to tree type assets and although the scheme no longer has insurance, the total damage to hard assets was only $86,000. With existing high priority work also considered, it is likely that the scheme will need to access approximately $128,000 from reserves.

9.37. The results of the aerial spraying which was completed in late March is now quite clearly visible and it appears to have already been helpful during the flood, with floodwaters washing away large inside bends which had for a long time been supported by the weed growth on top of them. This offers support to keep-up the spraying works and the Scheme Managers look forward to utilising this tool.

9.38. Very little gravel extraction has taken place over the last two and a half months. Only 500 m^3 has been extracted and this was taken from the Mangahao for use at Fonterra. With much of the consented allocation now utilised, contractors have been in touch to organise an allocation for the new consent period when it rolls over in September. This has been organised for locations which will benefit the scheme, in accordance with the recently completed Upper Manawatu and Lower Mangahao Gravel Resource Study. An item discussing this study has been included separately to this agenda.

10. SOUTHERN AREA

GENERAL

10.1. Unsettled weather for much of this period has kept staff busy responding to ratepayer enquires and clearing weed build-up in front of screens at the various pumpstations.

10.2. Very heavy rainfall over the weekend of 20-21 June caused major flooding in a number of the schemes and significant damage was suffered in the Koputaroa, Ohau-Manakau, Manawatu and Te Kawau Schemes.

10.3. Staff have had several meetings with representatives from Horowhenua District Council (HDC) to discuss issues regarding, working within the roading corridor, flooding around the northern parts of Levin, and pumping options around Stansells Drain.

10.4. Ongoing flooding issues around Fairfield Road and Kennedy Drive in Levin continue to be a major concern for HDC. A recent report from Beca Consultants has identified various improvement options which would see drainage from these areas being redirected back towards the Koputaroa Drainage Scheme. A preliminary meeting between HDC and Horizons' staff was held on 12 June to review the report and to discuss the impact this may have on the Koputaroa Drainage Scheme. A Working Group of local residents and Council

staff has now been set up to review the various options and to provide feedback to the various affected parties.

10.5. HDC's utilities service contractor currently provides the manpower to operate the tractor pump that is set-up at the end of Stansells Street as part of the consent requirements for their Shannon Waste Water Treatment Plant. With the contract for the utilities services coming up for renewal, HDC are reviewing the option of installing a permanent pump at the end of Stansells Street and have asked Horizons to provide some technical assistance around the various pumping options.

10.6. Staff have met with representatives from Tukorehe Marae, NZTA and HDC to discuss the ongoing flooding issues that are occurring outside the Marae. As a result of the meeting, NZTA have agreed to review the drainage arrangement around the Marae and the State Highway.

10.7. Staff continue to be heavily involved in providing information and support for the consent applications currently underway for the work around Lake Horowhenua.

OHAU-MANAKAU SCHEME

10.8. A period of unsettled weather has been topped off with a heavy rainfall event occurring over the weekend 20-21 June. The maximum flows that occurred during this event were Ohau River: 323 m^3/s (2.9 m), Manakau Stream: 69 m^3/s (3 m), and Waikawa Stream: 213 m^3/s (2.4 m). The event resulted in some minor overtopping of stopbanks on the Ohau River and a significant amount of surface flooding across the scheme. However, due to the topography of the area, the majority of the ponding was gone within a couple of days.

10.9. In spite of the size of the event, the majority of the scheme has come through the period with only minor bank erosion which will be repaired as part of the scheme's annual maintenance work over the next six months. However the Waikawa Stream has seen significant channel realignment upstream of the State Highway as well as the loss of the southern approach to the State Highway Bridge and the reallocation of gravels throughout the channel. Aerial photographs of the area are due to be flown over the next couple of weeks to help determine if any channel realignment works are required.

10.10. Several large erosion sites have also occurred on the Ohau River upstream of the State Highway. The worst of these, which is located adjacent to the Ohau Quarry, was where the river exposed the head of a line of concrete riprap. Repairs have subsequently been completed. The remaining damage, which includes four large concrete riprap linings, one tied tree work, as well as a section of stopbank toe scour, will be repaired over the next couple of months.

10.11. Prior to the flood event, work was carried out on the Waikawa Stream at the Miritana property to remove some large willows growing over and into the stream. Concrete riprap was placed in areas that were eroding.

10.12. During this period 16.3 km of scheme drains were sprayed with herbicide and 3.3 km were machine cleaned to remove weed.

MANAWATU DRAINAGE SCHEME

10.13. During the heavy rainfall event in June, all three spillways that discharge into the scheme operated and resulted in significant surface flooding and water ponding behind stopbanks which, in some cases, took up to 10 days to clear either by gravity or temporary tractor pumping.

10.14. With many drains being elevated for long periods significant slumping has occurred, in particular, along roadside drains. These drains will be inspected over the coming weeks to determine what work is required. Priority ratings will then be assigned.

10.15. Overtopping of the Main Drain Stopbanks, upstream of the Whiskey Creek confluence, has resulted in approximately 100 m of damage to the bank. Clay overburden has since been carted in to the site and used to reconstruct the bank.

10.16. On 15 May the Burkes Pumpstation was fired up for the first time in response to heavy rainfall. Initially, the two mains supplied pumps were fired-up late Friday evening with the two diesel generator pumps being fired-up early Saturday morning. As the day progressed, the two mains driven pumps faulted as a result of moisture being detected in the junction box. The two diesel pumps were finally switched off early Sunday morning once the gravity gates had opened.

10.17. Tests undertaken by both Max Tarr Electrical and the Flygt pump agents confirmed that a fault had occurred with the pumps and a decision was made to withdraw the two affected units so they could be inspected. Subsequent inspection identified damage to the casing of the main power cables which has allowed water to seep down the cable and into the junction box. Both pumps have since been shipped to Auckland where they have been stripped down for repair. Replacement seals and cables are expected to arrive in the country on 22 July from Sweden and the pumps are expected to be re-installed by the end of July.

10.18. During the event on 19 June, the two remaining diesel pumps were fired up again in response to rising drain levels. As the event unfolded and the spillways on the Mangaone and Oroua started to operate, a decision was made to switch the pumps off. While on site staff noticed seepage coming out from the bank near the surge chamber. Inspection of the pipeline, once water levels had receded, showed that the pipe seal immediately downstream of the surge chamber had failed. Temporary repairs have since been made to the pipeline and a report on the situation has been requested for the station's designers to determine if any further work is required. An independent review of that report will then be undertaken.

10.19. The Defects Liability Period for the pumpstation design/build contract extends through until 3 March 2016 and accordingly all costs associated with the above problems are the responsibility of the contractor.

10.20. During this period the annual visual inspection of floodgate and stopbank assets within the scheme has been carried out. From this a works list has been complied to address all the minor repair works that were identified. No major issues were identified and the minor repairs have been prioritised and are expected to be completed over the coming months.

10.21. Approximately 8.3 km of roadside drains have been machine cleaned during the period and the cleanings carted away.

10.22. During this period 36.2 km of scheme drains were sprayed with herbicide to control weed growth.

MAKERUA DRAINAGE SCHEME

10.23. Heavy rainfall in June saw many of the scheme drains elevated for long periods and scheme pumpstations operating continuously for long periods of time. While most pumpstations operated successfully, ongoing problems at Boundary and Birnie Coombes Pumpstations have seen two submersible pumps withdrawn and sent away for servicing.

10.24. Staff and machinery were called out on 16 May after debris had become jammed in the floodgate on Subway Drain allowing water to back flow through the gate from the Tokomaru Stream. Staff were able to stem the flows enough to enable the local pumpstation to prevent any further flooding of farm land. Once the levels in the Tokomaru had dropped low enough, staff returned to the gate to remove the blockage.

10.25. A meeting was held on 11 June with landowners on the eastern side of Linton Main Drain upstream of Mabins Drain to discuss the finding of Graham Doull's report to Council dated 10 December 2014, regarding the standard of stopbanking along the Linton Main Drain.

10.26. During this period 4.2 km scheme drains were machine cleaned.

KOPUTAROA DRAINAGE SCHEME

10.27. Heavy rainfall in June saw many of the scheme drains elevated for long periods and scheme pumpstations operating continuously for long lengths of time.

10.28. Both the Aratangata and Koputaroa Streams filled-up to their maximum with all spillways operating and spilling water onto adjacent farmland and ponding areas. On the Koputaroa Stream as the ponding areas filled-up, water started to overtop the stopbanks at the lower sections. A local contractor who was on site at the time was able to top up several sections to stem the overtopping, however the extent of the overtopping became too great and ultimately a section of stopbank on the left hand bank down stream of the railway bridge failed.

10.29. The floodwaters from the Koputaroa Stream, extended through the Pump No.2 and Pump No.3 areas as far as the Aratangata Drain. In order to assist with the removal of the floodwaters, temporary pumping was brought in to work along side with scheme pumping and gravity.

10.30. Once water flows had receded sufficiently, a temporary repair was made to the hole in the stopbank. This will need to be pulled down and rebuilt in the summer.

10.31. CCTV culvert inspections were carried out on the floodgated culverts in the Aratangata area. Identified issues were dealt with at the time. Hewitt culvert pipe and floodgate were replaced.

10.32. The main Aratangata Gates were de-watered and inspected with no big issues. The contractor was also able to take the opportunity to place some concrete blocks by the outlet to reduce the amount of slumping occurring.

10.33. During this period 16.3 km of scheme drains were sprayed with herbicide and 3.3 km were machine cleaned.

MOUTOA - WHIROKINO DRAINAGE SCHEME

10.34. A majority of the scheme pumpstations, including Cooks operated for extended periods. While staff were inspecting the Cook's Pumpstation, water was observed leaking from the connection between Pump No.2 and the surge chamber. Closer inspection of the site revealed that a hole had developed on the underside of the pipe allowing water to go back into the pump chamber whilst pumping. A decision was made to turn the pump off while a sleeve was manufactured and installed.

10.35. Subsequently Pump No.1 was found to have seized and has been withdrawn. Temporary measures have been taken to ensure that two pumps are available for service in the interim. Repairs have since been carried out to the discharge pipe on No.2 Pump.

10.36. Due to large amounts of surface water, landowners in the Whirokino area assisted the Whirokino Pumpstation with a tractor pump.

10.37. During this period 2.8 km of drains were machine cleaned and 55 km of drains were sprayed with herbicide.

TE KAWAU DRAINAGE SCHEME

10.38. Heavy rainfall in June resulted in many scheme drains running at full capacity including the Te Kawau Main Drain. While the scheme appeared to be coping with the event, a failure of a stopbank on the left bank of the Oroua River behind Gary Knight's property, resulted in an additional in-flow of water into the scheme which ultimately resulted in multiple breaches of the Sluggish Main Drain Stopbanks and the inundation of farmland, houses and Dixons Pumpstation.

10.39. During an attempt in the early hours of 22 June to stem the flow from a breach on the left bank of the Sluggish Main Drain near Raupo Road Pumpstation using concrete blocks, a staff member stepped out of his vehicle into a hole in the road and broke a leg. At the same site a contractor's excavator fell on its side when the road was washed from under one track.

10.40. Over the next couple of weeks contractors and land owners were kept busy, initially trying to stem the inflow of water and then removing the ponded water off the paddocks using multiply tractor pumps sourced from around the Region and from the Hawkes Bay Regional Council.

10.41. By the end of June, conditions allowed for work to commence on the repairs to the banks and by the second week in July, all repairs had been completed.

10.42. During the event, Dixons Pumpstation was completely submerged under flood water, saturating all of the electrics and causing damage to the pump. Repairs to the electrics and the pump are expected to be completed by mid July.

10.43. Pumpstation condition reports have now been completed for both Dixons and Raupo Road. The purpose of these condition reports is to serve as a snap shot in time and provide information on any deficiencies the pumpstations have and any improvements and renewals that need to be carried out to ensure they continue to provide the agreed level of service to the area.

10.44. The main deficiency identified at Raupo Road was the lack of guard rail across the weed screen platform. This matter has subsequently been addressed. Other issues addressed in this report have been prioritised and works will be completed in due course.

10.45. A weed block that had formed in a section of the Te Kawau Main Drain in McKinnon's property was removed.

10.46. During this period 25.0 km of scheme drains were sprayed with herbicide.

FOXTON EAST DRAINAGE SCHEME

10.47. Heavy rainfall across the scheme resulted in significant overtopping of scheme drains including the banks along Kings Canal which are currently designed to handle a 5-10 year rainfall event. This overtopping and localised drainage issues resulted in a number of houses within the Foxton Township being inundated with stormwater.

HOKIO CATCHMENT DRAINAGE SCHEME

10.48. Blockages from drains were cleared on the Arawhata stream and at Whelans Road and debris emanating from Hokio Stream clearance works was burnt.

10.49. Preliminary discussions have been held with HDC as regards the upgrade of culverts under roads within the scheme as part of the Southern Drainage Network Upgrade. Staff are presently arranging a meeting of the Working Party which will involve staff from Horizons and HDC, market gardeners (John Clark and Travis Sue), Geoff Kane and Sards Ranchhod representing small blockholders.

10.50. A total of 4 km of drains have been sprayed with herbicides and 2.5 km machine cleaned as part of the drain maintenance program.

HIMATANGI DRAINAGE SCHEME

10.51. Several farm crossing culverts on Palmer Road Drain have been cleared to assist with the removal of ponded stormwater.

11. ENVIRONMENTAL GRANT WORK

11.1. Two new projects were approved for Environmental Grants during the reporting period. The status of grants approved during the 2015-16 year to date, together with those approved last year but deferred, is as shown in the table below:

Name	River	Type of Work	Date Approved	Work Status	Estimated/ Actual Works Cost ($)	Value of Grant
N Tripe and T Mathews	Mangatipona Stream	Grade control	30/4/2015	Yet to commence	$15,440 estimated	$4,632 estimated
G Bennett	Upper Mangahao River	Erosion protection	12/6/2015	Yet to commence	$22,370 estimated	$6,710 estimated
K Norman	Upper Mangahao River	Erosion protection	17/7/2015	Yet to commence	$7,360 estimated	$2,208 estimated

11.2 A number of other potential Environmental Grant works are presently being investigated and it is very likely that there will be a high demand for grants following the June flood event.

12. SIGNIFICANCE

12.1. This is not a significant decision according to the Council's Policy on Significance.

Allan Cook
GROUP MANAGER OPERATIONS

ANNEXES

A River and Drainage Schemes - Flood Damage Arising from 20 June 2015 Storm Event

B River and Drainage - Schedule of Completed Works