Hawkes Bay Gravel Management Study
RMA Issues and
Gravel Demand Drivers

Hawkes Bay Regional Council

June 2016

HBRC Plan No. 4918
HBRC Report No. AM 17-02

Environmental Management Services

Executive Summary

This report is part of a wider gravel management review project that began in 2010, which consists of 13 separate sub-projects. This report completes "Issues" 11 and 12 of the gravel review, being:

- Issue 11 - Consideration of RMA issues that influence gravel management
- Issue 12 – Review of allocation and financial mechanisms that influence gravel management

The objectives of this report are twofold; first, to assess the Resource Management Act 1991 and other relevant legislation in respect to the management of the Hawkes Bay riverbed gravel resource; and second, to assesses the financial and market demand issues that influence gravel extraction operations.

This report only deals with the management of the "riverbed" gravel resource in Hawkes Bay, as this is under the direct management control of Hawkes Bay Regional Council (HBRC). Other sources of gravel aggregate, such as land based quarries and river terrace deposits, are assessed within this report due to their influence on the demand for the riverbed gravel resource.

The management of riverbed gravel resources by a Regional Council is a 'balancing act' of multiple considerations including:

- Maintaining channel capacity;
- Avoiding over extraction and destabilising protection works;
- Quality of gravel source;
- Avoiding unintended outcomes of promoting land based abstraction;
- Financial and practical availability for extractors (transport economics, haul roads etc.);
- Resource management and stakeholder management.

The Hawkes Bay Gravel Resource

The Hawkes Bay regional riverbed gravel resource is characterised by generally high quality gravel, but is subject to significant variability in both its natural supply and commercial demand. The following summarises the gravel status for each of the main Hawkes Bay Rivers where commercial gravel demand exists.

Northern Hawkes Bay Rivers

No issues have been identified in the northern Hawkes Bay river systems including the Mohaka, Wairoa or Waiau rivers, in respect to their gravel resources. Historically, demand is reasonably low and as such, no concerns exist over the sustainability of the resource and no significant channel capacity issues exist. Of special note are the specific provisions for the Mohaka River resulting from a recent Treaty of Waitangi Settlement which provides for hangi stones values for local iwi.

Esk River

The Esk River has historically been over extracted and therefore no major extraction currently occurs.

Tutaekuri River

The Tutaekuri River has also historically been over extracted and future significant extraction would be unsustainable from this resource. Currently, only small volumes are consented on an annual basis in recognition of this.

Ngaruroro River

The Ngaruroro River is the most important gravel resource in Hawkes Bay due to the quality and suitability of its gravel for a range of engineering end uses, and its proximity to demand centres. The Ngaruroro River has been carefully managed in recent years and consented extraction is consistent with current natural supply. Demand for the Ngaruroro gravel resource remains high and is in excess of consented volumes.

Waipawa River

The Waipawa River is showing a moderate aggradation trend, particularly in the middle reaches. Increased gravel extraction in the coming years will be required in the Waipawa River, but current demand is low. This is especially important as the Waipawa gravel is particularly large and proving too difficult to beach rake. The potential construction of the Ruataniwha Dam will cease sediment supply to the Waipawa River from the major Makaroro tributary; however, considerable other tributary inputs do exist that are unaffected by the potential dam project.

Tukituki River

The upper and mid reaches of the Tukituki River are showing the greatest evidence of aggradation of any river in the region and gravel extraction demand has markedly declined in recent years. Conversely, the lower Tukituki has been significantly over extracted and only small localised amounts of gravel are allocated below Red Bridge. Analysis shows that approximately 800,000 cubic metres of gravel exists above the defined 'grade line' in the upper Tukituki; and a significant 14 million cubic metres above 'grade line' in the mid Tukituki reaches. However, the aggradation is not uniform across these long reaches, with some cross sections recording at or lower than grade line levels. Hence, the aggradation is at times localised and often associated with flat channel grades where the sediment drops out.

Summary of Current Position

Historically, between 500,000 to 700,000 cubic metres per annum was extracted from all Hawkes Bay riverbed sources at the demand peak, but over the last five years this has decreased to just over 400,000 cubic metres per year. These figures do not include coastal gravel extraction at Awatoto and adjacent to Marine parade in Napier that totals approximately 45,000 cubic metres per year. Demand exceeds supply for the Heretaunga riverbed gravel resources, while the Central Hawkes Bay gravel resources are experiencing low demand and riverbeds are aggrading, causing localised channel capacity and drainage issues. Excess demand on the Heretaunga Plains is being met by land based quarry or river terrace sources.

Legal Framework Review

This study carried out a review of all legislation that governs HBRC's mandate to manage flood hazards and gravel resources. This review summarises the suite of relevant legislation and in particular, the Soil Conservation and Rivers Control Act 1941, that gives Regional Councils a specific set of responsibilities to manage rivers to avoid or mitigate flooding including the management of gravel to aid in this objective.

The Resource Management Act 1991 is the key Act that governs the resource consent and administrative charging processes for riverbed gravel.

Review of HBRC's Existing Gravel Management Approach and Benchmarking with Other Regional Councils

An in-depth review has been conducted in this study relating to the existing Hawkes Bay Regional Council approach to managing gravel, including RMA plan provisions, resource consenting processes and the work program to monitor and allocate the gravel resource.

In addition, this study reports on a benchmarking exercise with other Regional Councils, including a comprehensive questionnaire, to identify best practice and lessons learnt in the management of gravel resources in other regions that share similar gravel management issues. This benchmarking approach was used to evaluate the existing HBRC approach and aid in the options assessment for consideration of alternative gravel management approaches.

The key findings of the HBRC review and benchmarking with other Regional Councils are:

- No critical or urgent amendments are required to the Hawkes Bay Regional Policy Statement or Regional Resource Management Plan although changes at the next appropriate plan review opportunity will assist in future gravel management.
- Some process improvements could be made to strengthen the existing HBRC gravel consent process.
- In all Regional Councils surveyed, the Engineering Departments apply for, and hold, resource consents for gravel extraction, while all consents are held by commercial gravel extractors in Hawkes Bay.
- The Consent Authority function is undertaken by the Regulatory 'arms' of all other Regional Councils surveyed while HBRC has delegated its operational 'arm' as the Consent Authority.
- A degree of regulatory duplication and increased compliance costs exists between the regional and district plans in Hawkes Bay.
- Gravel extraction is an activity funded by some flood schemes across the Regional Councils surveyed, but not by Hawkes Bay flood schemes which rely on commercial extractor demand.

Demand Analysis and Financial Drivers

It is important to understand the past and possible future gravel demand and financial drivers that are influencing the commercial market for gravel in Hawkes Bay.

Gravel is used for a diverse range of aggregate uses in Hawkes Bay with only very small amounts 'exported' outside the region. The over-riding commercial imperative for the aggregate market is to secure access to suitable material as close as possible to demand. In Hawkes Bay, approximately 400,000 to 450,000 cubic metres (m^3) of gravel is extracted from rivers on average in recent years, which is equivalent to approximately 60,000 truckloads. Of this, approximately 100,000 - 150,000 m^3 has historically been from the Tukituki and Waipawa rivers; but in recent years this has reduced to less than 20,000 m^3/year. The remaining 400,000 m^3 per annum has been from rivers on the Heretaunga Plains, with the vast majority from the Ngaruroro River.

The most significant issue identified in this section is the downturn in demand from the Tukituki and Waipawa rivers. However, opportunities for future riverbed extraction do exist. These opportunities are associated with the potential Ruataniwha Dam project and associated development; future roading upgrade projects and commercial discussions with a number of parties including Central Hawkes Bay District Council.

Iwi Issues in Relation to the Gravel Resource

Across New Zealand, iwi have long standing interests in freshwater, including the bed and banks of rivers and lakes that together make up the "*mauri*" or 'life-force' of the water body. To date, Treaty of Waitangi Settlements across the country have recognised iwi interest in freshwater in a range of ways specific to the area involved.

To date, Hawkes Bay Iwi has been involved in managing Hawkes Bay's freshwater resources via an agreed process on individual resource consents, during regional plan changes and more recently through the joint planning committee. The ongoing work of the joint planning committee and its consideration of the suggested recommendations of this report will further strengthen iwi co-management of the gravel resource.

In 2010, a Hui was held at Kohupatiki Marae with iwi members from across Hawkes Bay attending. The Hui minutes record useful discussion on gravel management issues and an improved understanding by all participants of the challenges that surround gravel management in Hawkes Bay. An extensive range of recommendations are presented for Hawkes Bay Iwi ongoing and strengthened role in gravel management.

Iwi in Hawkes Bay now have a key policy input role in managing Hawkes Bay's freshwater resources via an agreed process for input on individual resource consents, during regional plan changes and more recently through the Joint Planning Committee, which gives Mana Whenua input to plan change review processes.

Options Assessment and Recommendations

It is clear that challenges exist in the management of the Hawkes Bay gravel resource and in particular, in the Central Hawkes Bay catchments, given the aggradation and low commercial demand in the area.

A variety of options have been considered for improving the existing gravel management approach in Hawkes Bay, including:

1. Financially based options
2. Regulatory options
3. Non-regulatory options

While the options analysis identified only a limited number of 'levers' across the three options for improving the management of gravel in the region, this report has identified a range of recommendations to improve gravel management outcomes. A comprehensive list of 32 short, medium, and long term recommendations are presented, with the key recommendations of this report as follows:

1. Draft a Hawkes Bay Gravel Management Strategy involving key stakeholder input before initiating a Special Consultative Process under the Local Government Act for its adoption by Council.

2. Commence discussions with a range of key gravel users to discuss options and opportunities for future gravel extraction from the Central Hawkes Bay catchments.
3. Formally recommend to Council and Upper Tukituki Scheme ratepayers that gravel extraction be added to the programme of works for maintenance of the flood scheme (given that gravel extraction has not previously been funded by Flood Scheme funded works in the past).
4. Undertake a review of localised problematic areas within the upper Tukituki Scheme and establish how much gravel is required to be extracted and what associated channel management works would complement gravel extraction. Use this information to prepare a schedule of works for future years that balances flood risk and drainage issues with cost.
5. Formally review the upper Tukituki Scheme rating to ascertain whether scheme funded gravel extraction can be financed by either diverting existing scheme rates, or increasing scheme rates, to fund this new activity.
6. That HBRC Assets Section develops suitably detailed resource consent applications for a requested duration of 10 years and becomes the consent holder for all major gravel extraction in the region, starting with the Ngaruroro catchment.
7. That the Consent Authority function for gravel is internally transferred to the Regulatory Department of Council to avoid conflict of interest and separation of statutory functions, and all necessary internal system and process changes are made to facilitate this. Ensure that any new permitting processes adhere to the Guiding Principles developed in Section 6.3 of this report.
8. Assuming long term consents are successfully granted to the Engineering Department, offer long term access via an authorisation processes to commercial operators in the Tukituki and Waipawa catchments (as opposed to annual consented volumes). Some form of competitive tendering maybe in order to award the gravel allocations. Where advantageous, HBRC consider coordinating all land access agreements and other arrangements (e.g. stockpile sites etc.) in the Tukituki and Waipawa catchments.
9. Continue to decline resource consents for gravel extraction in rivers where evidence shows that gravel extraction is not sustainable, except in particularly localised reaches that are causing significant channel management issues (e.g. flood banks erosion). This includes the Esk, Tutaekuri, and lower Tukituki rivers.
10. Undertake a funding options study for a mid-Tukituki flood scheme that considers the costs and benefits for:
    - mid Tukituki riparian landowners;
    - lower Tukituki riparian landowners;
    - coastal hazard issues;
    - increasing gravel availability for extraction in the lower Tukituki;
    - The region as a whole.

No one recommendation can work in isolation of other initiatives and no approach can guarantee a better outcome given flood events and market demand (the key matters that influence the gravel resource) are both outside the control of HBRC.

Research Strategy

The report presents a research strategy for ongoing monitoring and investigations into the regions gravel resources, which is considered important for its prudent management.

Contents

APPENDICES

FIGURES

REPORT INFORMATION

Report Status	**File Location**	**Our Reference**
Final	Napier	DFL012
Author Darryl Lew **Reviewer** Alexandra Johansen	**Signed**	

1 Introduction

1.1 Gravel Management – 'The Balancing Act'

This report is part of a wider gravel management review project that began in 2010, which consists of 13 separate sub-projects. This report completes "Issues" 11 and 12 of the gravel review, being:

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The management of a gravel resource by a Regional Council is a 'balancing act' of multiple considerations including:

- Maintaining channel capacity
- Avoiding over extraction and destabilising protection works
- Quality and suitability of gravel sources for end uses
- Avoiding unintended outcomes of promoting land-based abstraction
- Financial and practical availability of a gravel resource for the economic development of a region
- Avoiding and mitigating environmental effects of gravel extraction
- Resource management and stakeholder management

Throughout New Zealand, the availability of good quality riverbed gravel that meets a range of engineering specifications for construction, ease of extraction and often close proximity to end uses, has ensured lower costs of development and construction of public infrastructure, particularly roads, for many decades. As catchment erosion processes have markedly decreased, with control of grazing animals and in some areas of New Zealand, a lack of significant flood activity; this has resulted in a lack of available gravel resource. In some cases, this has been compounded by historical over-extraction of the gravel resource or conversely, due to a lack of new development projects, gravel demand has reduced significantly or even ceased, posing issues for Council river engineers and flood scheme ratepayers wanting to maintain channel capacity. Lastly, the importance of gravel supply to coastlines, given coastal erosion issues, has also become well understood.

Hence, the management of a region's gravel resource is a multi-faceted, 'whole of region' issue.

1.2 The Hawkes Bay Gravel Resource

Historically, the main river systems in Hawkes Bay that have been in demand for their gravel resource are:

- Northern Hawkes Bay rivers (Mohaka, Wairoa or Waiau rivers)
- Esk
- Ngaruroro
- Tutaekuri
- Waipawa
- Tukituki

Figure 1 shows that over the last five years most gravel has been extracted from the Ngaruroro River (approximately 300,000 m^3/year). Of note is the relatively small amount that has been extracted from other rivers compared to the Ngaruroro and the general reduction in gravel extraction from the Waipawa, mid and upper Tukituki rivers.

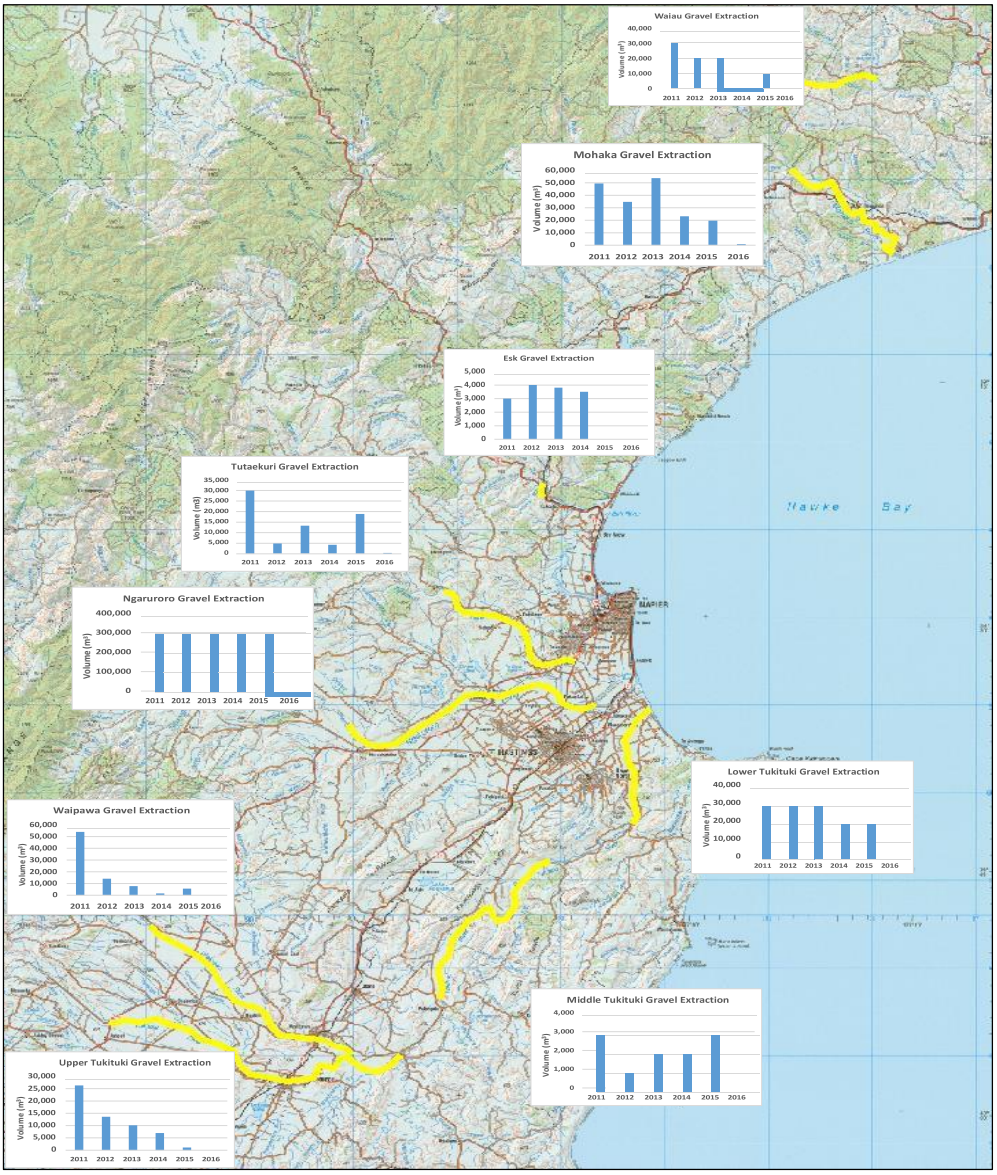

Figure 1. Main Gravel Extraction Rivers and Amounts Extracted in Last Five Years

Gravel supply to these Hawkes Bay River systems has been highly episodic, and based on storm events and flood activity to erode, entrain and transport gravel from the Ruahine and Kaweka ranges to the coast. The most extreme example was Cyclone Bola in 1988 which resulted in significant sediment input into the northern Hawkes Bay River systems. More historically, the Hawkes Bay flood events in the 1930's were a major catalyst for the enacting of the Soil Conservation and Rivers Control Act in 1941, during the World War II years, which is an indication of the significance of the issue. The main Hawke's Bay rivers have not experienced significant flood events for some decades, resulting in a reduced gravel supply from headwater areas and reduced movement of sediment through the river systems. For instance, in the Ngaruroro River, there has only been approximately 1.5 km of natural downstream gravel movement in the last 40 years. This is also compounded by invasive vegetation species, such as lupins, in Hawkes Bay's semi-braided riverbeds and banks which are preventing sediment movement and leading to aggradation. Invasive vegetation can also threaten native bird habitat.

Riverbed 'beach raking' breaks up the surface layer of interlocked gravel (known as the 'armour layer'), which is undertaken by HBRC in areas where there is no gravel extraction to encourage downstream movement of gravel through the river systems. However, this still requires flood events (albeit of lower flood magnitudes) to move this sediment.

Seismic activity has also been observed as causing major sediment input into river systems, or conversely, as occurred in the 1931 Napier earthquake, uplift on the plains which flattened river gradients, has decreased the region's rivers' hydraulic ability to transport gravel through to the lower reaches and coast.

Some Hawkes Bay river reaches, in areas of high gravel demand, have historically been over extracted and this over extraction is now apparent within longer term monitoring records. In such rivers, gravel extraction has now largely ceased – the result of very small amounts or no gravel being allocated via the RMA resource consent process.

1.3 Status of the Hawkes Bay Gravel Resource

The following summarises the gravel resource status of each of the main Hawkes Bay river systems:

Northern Hawkes Bay Rivers

No issues have been identified in the northern Hawkes Bay river systems including the Mohaka, Wairoa or Waiau Rivers, in respect to their gravel resources. Historically, demand is reasonably low and as such, no concerns exist over the sustainability of the resource and no significant channel capacity issues exist. Of special note are the specific provisions for the Mohaka River resulting from a recent Treaty of Waitangi Settlement which provides for hangi stone values for local iwi.

Esk River

The Esk River has experienced significant channel degradation (lowering of the bed) since the mid 1970's partly through over extraction and partly through willow clearance work to maintain flood capacity. The degraded reach is from the SH2 Bridge near the coast, to past the Waipunga Bridge (cross sections 1 to 11) therefore no major consented extraction occurs. A minor amount of extraction occurs at the Whirinaki Pulp Mill water intake site.

Tutaekuri River

The Tutaekuri River has also historically been over extracted within the vicinity of Waiohiki and downstream with two fixed aggregate plants operating for local supply. These have long since ceased operation but nevertheless recovery of the gravel resource has been slow and as a result practically no extraction (other than for river maintenance) takes place below Puketapu where there is currently some surplus. Future significant extraction would be unsustainable from this resource.

Ngaruroro River

The Ngaruroro River is the most important gravel resource in Hawkes Bay due to the quality and suitability of its gravel for a range of engineering end uses, and its proximity to demand centres. The Ngaruroro River has been carefully managed in recent years and consented extraction is consistent with current natural gravel supply. Demand for the Ngaruroro gravel resource remains high and is in excess of consented volumes.

As part of this study, a gravel resource inventory was carried out and the findings are in the report *"Gravel Resource Inventory (Issue 3) by Stevens and Larsen 2015".* This report summarises the current state of the gravel resource in the region and should be referred to for more in depth information. However, of note is the implication by Stevens and Larsen (2015) that there could be as little as 5 years' supply remaining in the main extraction reach depending on the demand estimates assumed for the next five year period. Further work by Gary Clode (*pers comm*) demonstrates that the methodology used to reach the conclusion that the current rate of extraction is unsustainable is not entirely accurate when applied to past extraction and surveyed gravel volumes. Furthermore, it also demonstrates that there is evidence of an under estimation of transport rates used in the assessment, as there must be more gravel moving into the extraction reach to allow the rate of extraction to continue at present volumes and not fall below the design grade line. Importantly, it is essential that good monitoring of the gravel resource in the Ngaruroro continues and that extraction rates and sustainability are closely aligned to avoid problems in the future and to give some certainty to the gravel extraction industry.

Waipawa River

The Waipawa River is showing a moderate aggradation trend, particularly in the middle reaches. Increased gravel extraction in the coming years will be required in the Waipawa River, but current demand is low and has been markedly declining in the last five years (Figure 2). This is especially important as the Waipawa gravel is particularly large above State Highway 50, and is proving too difficult to beach rake. However, potential construction of the Ruataniwha Dam will cease sediment supply to the Waipawa River from the major Makaroro tributary, which will allow the current aggradation to be transported downstream over time.

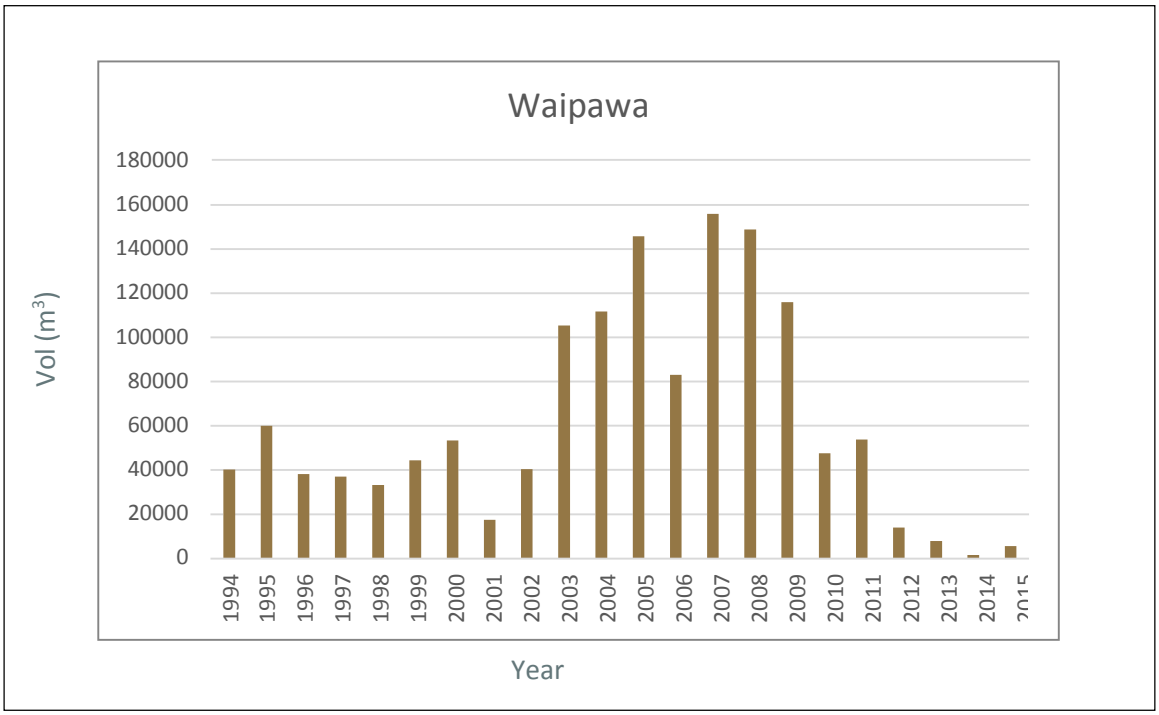

Figure 2. Gravel Volumes Extracted from Waipawa River between 1994 and 2015

Tukituki River

The upper and mid reaches of the Tukituki River are showing the greatest evidence of aggradation and gravel extraction demand has been declining in recent years (Figure 3). Conversely, the lower Tukituki has been most significantly over extracted and only small localised amounts of gravel are allocated below Red Bridge.

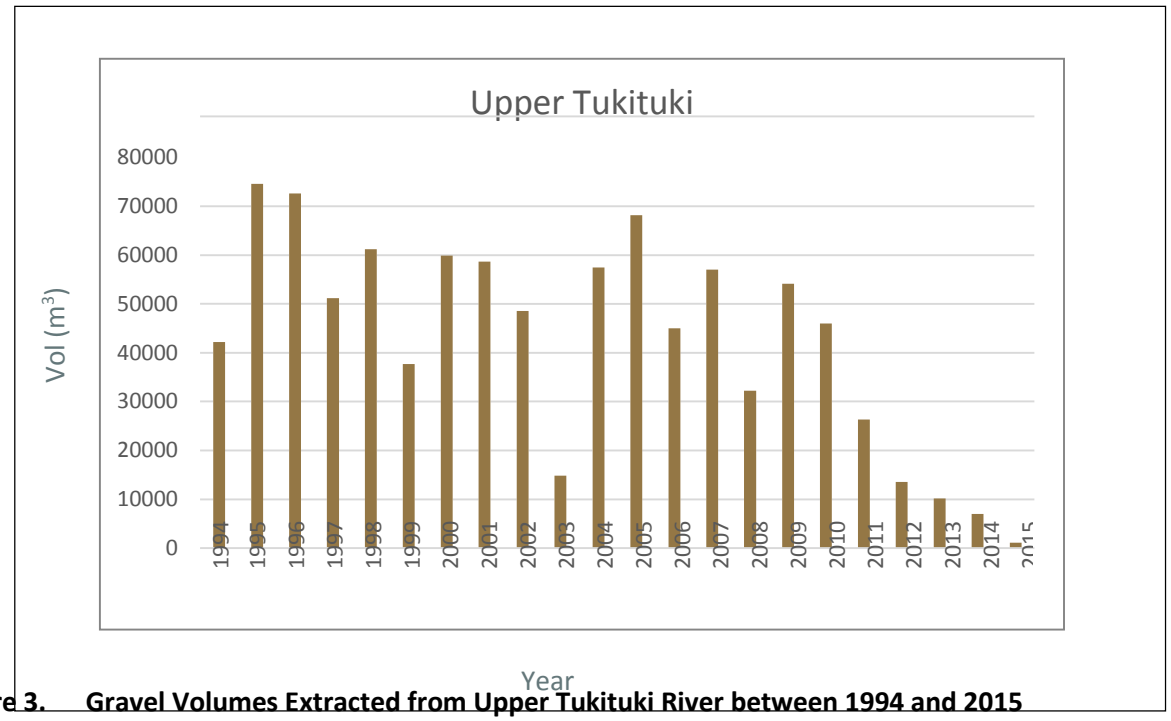

Figure 3. Gravel Volumes Extracted from Upper Tukituki River between 1994 and 2015

Analysis shows that approximately 800,000 cubic metres of gravel exists above the defined 'grade line' in the upper Tukituki; and a significant 14 million cubic metres above 'grade line' in the mid Tukituki reaches. However, the aggradation is not uniform across these long reaches, with some cross sections recording at or lower than grade line levels. Hence, the aggradation is at times localised and often associated with flat channel grades where the sediment drops out. This is particularly evident in some tributaries and at their confluences. This issue is covered in greater detail in Section 7, which considers opportunities for combined gravel extraction/channel management approaches.

1.4 Coastal Beach Extraction

In addition to the riverbed gravel sources, HBRC has issued historic resource consents for extraction of beach gravel to Winstones at Awatoto, and Napier City Council adjacent to Marine Parade. In recent years, the volumes extracted at these locations have been approximately 30,000 cubic metres per annum by Winstones, and 12,000 - 15,000 cubic metres per annum by Napier City Council. Some concern over the sustainability and effects of this extraction have been raised and will be considered upon consent expiry if renewal applications are lodged.

1.5 Summary

In summary, the Hawkes Bay regional riverbed gravel resource is characterised by high quality gravel that is in high demand from the Ngaruroro River, with this demand successfully managing channel capacity for flood management purposes for this river. Conversely, low demand for gravel exists from the upper and mid Tukituki and Waipawa rivers which are showing aggradation trends, and in some reaches resulting in channel capacity and drainage issues. All other rivers are either subject to low levels of gravel extraction due to sustainability concerns of the resource, or low demand (e.g. Northern Hawkes Bay rivers).

1.6 2010 Scoping Report

In 2010, Tonkin and Taylor published a scoping report review of riverbed gravel management that defined a medium term work program for the management of the regional gravel resource. The report highlighted 13 issues and recommended that each issue be the subject of specific investigations and reports, leading up to the drafting of an overall gravel management plan for the Hawkes Bay region. This report responds to issues 11 and 12, being:

- Issue 11 - Consideration of RMA issues that influence gravel management
- Issue 12 – Review of allocation and financial mechanisms that influence gravel management

Issues 1 to 10 have either been completed or are in progress. Issue 13 is a recommendation to prepare a gravel management plan for Hawkes Bay, which this report will inform and provide a basis for.

2 Legal Framework

There are a number of statutes of specific relevance to floodplain management and by extension gravel management. These are:

- Resource Management Act 1991
- Building Act 2004 (and Building Code 1992)
- Local Government Act 2002
- Land Drainage Act 1908
- Soil Conservation and Rivers Control Act 1941

Each of these statutes performs a distinct role in managing flood risk and provides a range of legislative mechanisms to enable effective flood management across local and central government.

To a lesser degree, a number of other statutes also influence flood risk management. These include:

- Public Works Act 1981
- Local Government Official Information and Meetings Act 1987
- Earthquake Commission Act 1993
- Environment Act 1986
- Local Government (Rating) Act 2002
- Rivers Board Act 1908
- Civil Defence Emergency Management Act 2002

This suite of statutes allows for a wide range of approaches to be applied to managing flood risk as follows:

- Hazard control measures
- Flooding information and education
- Flood hazard preparedness, response and recovery
- Flood loss insurance and financial assistance

The specific provisions from the most relevant of these Acts and as they relate to the management of riverbed gravel are outlined below.

2.1 Local Government Act 2002

Section 11A of the Local Government Act states:

In performing its role, a local authority must have particular regard to the contribution that the following core services make to its communities:

a) network infrastructure:

b) public transport services:

c) solid waste collection and disposal:

d) the avoidance or mitigation of natural hazards:

e) libraries, museums, reserves, recreational facilities, and other community infrastructure

As the gravel management functions primary purpose is for flood control, the activity is consistent with Section 11A(d).

2.2 Resource Management Act 1991

In respect to gravel management, the RMA has six broad legislative areas of relevance:

1. Natural hazards
2. Resource consents for gravel extraction
3. Charging regime
4. Section 1049(c)
5. National Instruments
6. Iwi management plans

2.2.1 Natural Hazards

Under Section 30 (iv), the functions of a Regional Council extend to the control of the use of land for the avoidance or mitigation of natural hazards. The Regional Policy Statement (RPS) and Regional Resource Management Plan (RRMP) either directly, or by requiring District Plans, are the main statutory instruments to exercise this function.

At an operational level, gravel extraction is one of HBRC's principle approaches to mitigating flood hazards.

2.2.2 Resource Consents for Gravel Extraction

The legal responsibility of Regional Councils to issue resource consents for gravel extraction comes from Section 13(b) which states no person can....*disturb the bed of a river…unless expressly allowed by a rule in a regional plan or by resource consent.* The RMA definition of 'bed' in relation to a river is…*the space of land which the waters of the river cover at its fullest flow without overtopping its banks*.

As the HB RRMP and the four District Plans have regional and district rules pertaining to gravel extraction activities, consents are required in Hawkes Bay for this activity (apart from very small volumes which is a permitted activity).

2.2.3 Section 36 Charges

Section 36 enables a local authority to fix charges for carrying out its functions under section 35 of the RMA and other relevant sections. Specifically under s36(1)(c), a local authority may fix charges payable by holders of resource consents, for the carrying out by the local authority of its functions in relation to the administration, monitoring, and supervision of resource consents, and for the carrying out of its resource management functions under section 35.

When it fixes charges under s36, a local authority must have regard to a number of criteria including the following:

1. The sole purpose of a charge is to recover the reasonable costs incurred by the local authority in respect of the activity to which the charge relates (s36(4)(a) RMA). The word "activity" is used to mean the local authority's activity to which the charge relates (that is, the activity of administering, monitoring or supervising the resource consent), not the applicant's proposed activity (the extraction of gravel).

2. A particular person should only be required to pay a charge "where the need for the local authority's actions to which the charge relates is occasioned by the actions of those persons (s36(4)(b)(ii) RMA). In other words, HBRC can only require a consent holder to pay a charge if the consent holder did something which required HBRC to take action and the charge being recovered relates to that action.

As is the case with New Zealand's freshwater resources, the Section 36 charge is not a unit charge for the quantity of gravel extracted (i.e. a price for the resource) but rather a charge for the administration, supervision and management of the resource.

The charging of S36 fees is not mandatory, that is, a Council can choose to charge or not. Hence, in relation to gravel, charges may be levied for some catchments and not others, dependant on Council resolutions.

(c) charges payable by holders of resource consents, for the carrying out by the local authority of its functions in relation to the administration, monitoring, and supervision of resource consents (including certificates of compliance and existing use certificates), and for the carrying out of its resource management functions under section 35:

2.2.4 Section 108

Section 108 of the RMA deals with 'conditions on resource consents'. Section 108 is relevant to gravel management as it deals with financial contributions, which are a current feature of the existing HBRC process. The relevant specific provisions of s108 are as follows:

(9)

In this section, **financial contribution** means a contribution of—

(a) money; or

(b) land, including an esplanade reserve or esplanade strip (other than in relation to a subdivision consent), but excluding Maori land within the meaning of Te Ture Whenua Maori Act 1993 unless that Act provides otherwise; or

(c) a combination of money and land.

(10)

A consent authority must not include a condition in a resource consent requiring a financial contribution unless—

(a) the condition is imposed in accordance with the purposes specified in the plan or proposed plan (including the purpose of ensuring positive effects on the environment to offset any adverse effect); and

(b) the level of contribution is determined in the manner described in the plan or proposed plan.

HBRC has the relevant plan provisions with the RRMP.

2.2.5 Section 104(1)(c)

When considering any application for resource consent, or associated submission, a consent authority must have regard to any other matter the consent authority considers relevant and reasonably necessary to determine the application. Effectively this enables a non-RMA document to be given 'weight' in a resource consent process. This is expanded upon further in Section 6 of this report.

2.2.6 National Instruments under the RMA

National Policy Statements (NPS), prepared under Part 5 of the RMA, can provide direction to local government on how competing national benefits and local costs should be balanced. National Environmental Standards (NES) are regulations that set baseline nationwide minimum standards for particular issues. To date, there are no NPS or NES for flood hazards in general, or specifically for gravel management. The New Zealand Coastal Policy Statement (NZCPS) 2010, identifies coastal erosion and other natural hazards as a key issue facing the coastal environment. The NZCPS includes policies on the identification of coastal hazards: subdivision, use and development in areas of coastal hazard risk; natural defences against coastal hazards; and strategies for protecting significant existing development from coastal hazard risk.

The Minister for the Environment has announced that national direction in relation to natural hazards will be in place by 2018. HBRC will need to remain aware of developments at the national level in the event that new NPS and NES are developed.

2.2.7 Iwi Management Plans/Planning Documents

Sections 61(2A) and 74(2A) of the RMA require that regional and district plans take into account relevant planning documents recognised by an iwi authority and lodged with the council.

An iwi management plan is a policy document that identifies important issues to iwi regarding the use of natural and physical resources within their area. As evident in the Treaty of Waitangi Settlement for the Mohaka River, Māori can have a unique interest in the management of a rivers gravel resource, and such plans can be developed as one avenue to have these cultural considerations incorporated into statutory Plan and resource consent processes.

2.3 Soil Conservation Rivers Control Act 1941

The overriding purpose of the Soil Conservation and Rivers Control Act 1941 is to make provision for the conservation of soil resources, the prevention of damage by erosion and to make better provision for the protection of property from damage by floods. While the Act has been largely superseded by the provisions of the Resource Management Act 1991, the current provisions of the Soil Conservation and Rivers Control Act 1941 still provide the legal mandate to Regional Councils to protect communities from flooding using the most appropriate methods. The mandate that this Act confers to Regional Councils

serves to differentiate a Council's gravel extraction operations from a commercial entity extracting gravel. This is an important legal distinction that has a bearing on the recommendations of this report.

2.4 Land Drainage Act 1908

This Act establishes drainage districts and boards and powers of local authorities relating to watercourses and drains. This Act does not convey powers in respect to natural rivers and gravel extraction but does give a legal mandate for formation and management contracted watercourses.

2.5 Summary of Existing Acts

In summary, the suite of legislation gives the statutory mandate to HBRC to carry outs its duties and functions to avoid and mitigate the effects of flooding on the regions community. While HBRC must still comply with the RMA, where required, the wider statutory context can be used within RMA processes to give primacy to the HBRC flood protection and gravel management function. Examples of how this has been undertaken by other Regional Councils is identified in the benchmarking section (Section 4) and is the basis of some recommendations of this report.

3 HBRC Existing Approach to Gravel Management

3.1 Regional Policy Statement and Regional Resource Management Plan

Appendix A lists all key provisions of the HBRC RPS and RRMP as they relate to management of the gravel resource.

The RPS issues, objectives and Policies relating specifically to gravel cover the range of issues to be considered in managing a regional gravel resource. These specific provisions are complimented by the flood hazard provisions of the RPS which are aimed at avoiding and mitigating flood hazards.

Except where very small quantities are involved, which are a permitted activity, the extraction of gravel from the bed of a river requires resource consent under RRMP Rule 74. Rule 74 has a Restricted Discretionary activity status, meaning that the council as decision-maker in respect of an application can only consider those matters over which it has restricted its discretion in the RRMP. Those matters are:

- Location of extraction sites and stockpile areas;
- Volume of gravel extracted;
- Rate of removal of gravel;
- Period of extraction;
- Use of the gravel;
- Dust management;
- The matters set out in Policy 53 of the RRMP;
- Financial contributions;
- Duration of consent;
- Review of consent conditions; and
- Compliance monitoring.

Of note is the fact that Rule 70 of the RRMP, which allows flood protection works to be carried out as a permitted activity by the HBRC, does not legally extend to gravel extraction activities. Therefore, HBRC like other commercial extractors, must obtain Restricted Discretionary consent if it wishes to undertake gravel extraction as part of its channel management functions.

HBRC has an Environmental Code of Practice in place which provides clear standards of practice for river control and drainage works. It also documents the environmental enhancement or conservation protection, identifies areas for public access and recreation, and identifies future enhancement or protection requirements. The 1999 version of this code is referred to in Rule 70 of the RRMP, but notably is not referred to in Rule 74 pertaining to gravel extraction. In addition, two updated versions of the Code have been produced since 1999, which highlight the difficulty in lengthy and costly plan change processes to keep up to date with referenced document version changes. Due to the legal requirements of the RMA, it is not possible to 'automatically' update successive versions of such documents in a Plan.

3.2 Resource Consent Process

The current HBRC gravel permitting process is administered by the Asset Management Team of HBRC. The process steps are as follows and were documented following an interview with the responsible staff member.

1. A "Gravel/Silt Requirements 1 July to 30 June" form is issued to extractors for their completion and returned to the HBRC.
2. Input is received from various Asset Management staff on how much of the submitted requirement should be allocated based on surveyed cross sections and local knowledge.
3. Following an assessment of the "Gravel/Silt Requirement" form, a document is issued to the extractor advising them of the gravel availability at the requested locations for their information, but it is noted that this is not the resource consent authorisation.
4. At any time throughout the year an extractor can contact HBRC and request resource consent based on step 3 above.
5. The resource consent application form is prepared and signed by the Asset Management staff member on behalf of the extractor and then consent is issued with conditions.
6. Compliance monitoring of the consent conditions is undertaken by the Works Group staff member.
7. HBRC recovers the cost of managing gravel extraction through s36 and s108 of the RMA. Each year, these charges are set through the council's annual plan or long term planning process. Consent holders (commercial operators who have been granted resource consent to extract gravel) pay charges that reflect the cost of compliance monitoring and administration of those consents based on the volume of gravel extracted and its quality. An 80c per cubic meter charge is levied on all extractors apart from the upper Tukituki area, where 20c per cubic metre is charged. Previously, the gravel charge was 60cents per cubic meter and was raised to 80 cents to enable the gravel investigations program outlined in the 2010 Scoping Report.
8. Any money charged and not spent is returned on a pro rata basis back to the gravel extractors.
9. A formal RMA delegation is in place to the Council officer issuing gravel consents
10. Legal declaration
11. The consent process is very efficient with generally consent decisions issued within one day of receipt and only an $80 processing fee is charged.

Appendix B contains examples of the relevant forms and documents used in this process.

The following observations are made in relation to this process:

- Essentially the system involves extraction companies applying for and holding individual resource consents.
- The resource consent conditions are generally well worded and meet legal condition drafting requirements.
- The fact that the resource consent application is signed by the Asset Management staff member on behalf of the applicant and then the resulting resource consent is signed by the same staff member is not an ideal process.
- Internal system and process documentation surrounding the permits could be improved.
- While the ability to impose financial contributions for damages and effects caused by gravel extraction activities exist in the RRMP, no conditions exist on the granted permits for this, which

legally results in such charges not being able to be imposed. However, financial contributions are charged as a proportion of the administration fee charged per cubic metre of gravel extracted.

- While the compliance delegation for this function is correctly in place, no specific training under the RMA has been conducted to ensure the correct legal approach to compliance and enforcement is undertaken.
- As with water permits, the "first come first served" principle exists for issuing gravel consents. Given the high demand from sources such as the Ngaruroro River, it is unclear how this legal principle is being administered.

3.3 District Plans

The District Plans of Wairoa and Hastings district councils and Napier City Council have rules in relation to earthworks for various quantities and matters of control. Central Hawkes Bay District Council only has such rules in relation to certain cultural/archaeological sites. The respective district plan rules apply to gravel extraction also as an 'earthwork' which creates regulatory duplication and increased compliance costs. Other earthwork controls that are more legitimately the prevue of a district/city council are traffic safety, vehicle movements and noise etc.

As District Plans have no jurisdiction over fresh water bodies, they cannot be used to encourage gravel extraction from rivers. Rather, this is an RPS matter.

4 Benchmarking with other Regional Council Approaches

A benchmarking exercise has been undertaken across selected Regional Councils in an attempt to identify best practice and lessons learnt. The Regional Councils were selected on the basis of having similar gravel issues to Hawkes Bay or were known to have completed significant work in terms of gravel management. The Regional Councils selected were:

- Otago Regional Council
- Environmental Canterbury
- Greater Wellington Regional Council
- Horizons Regional Council
- Bay of Plenty Regional Council

Initially each Regional Councils regional plan provisions for gravel were reviewed, followed by a questionnaire and in some cases a follow-up interview.

4.1 Regional Plan Analysis

Appendix C lists key regional plan provisions from selected Regional Plans. This analysis has identified the following key observations:

Greater Wellington Regional Council (GWRC) Proposed Natural Resources Plan, Waikato Regional Council (WRC), Bay of Plenty Regional Council (BOPRC) Proposed Land and Water Regional Plan all have a fully discretionary activity status for gravel abstraction, over a small volume which is permitted. BOPRC also have an operative 'first generation' regional plan specifically for gravel dating from the 1990's. This will be rescinded when the Proposed Land and Water Plan becomes operative, but even in this Plan the activity status is discretionary. ECANs Proposed Natural Resources Plan has a permitted activity status, if the gravel extraction is undertaken by the Council itself, and is justified on the basis of its Soil Conservation Rivers Control Act 1941 mandate.

The Horizons Regional Council One Plan, while also having a discretionary activity status for gravel extraction, has a more detailed set of plan provisions. The One Plan specifies in Policy the annual average volume that can be extracted from a given river reach. Other parts of this policy give the consent authority flexibility in respect to increasing and decreasing these volumes for the purposes of flood protection. The extraction of gravel above a permitted threshold is a discretionary activity except in areas of rare or threatened habitat where a 'tailored' discretionary activity rule applies.

The key finding of this regional plan benchmarking analysis is that HBRC's restricted discretionary status for gravel extraction and the limited extent of its discretion is inconsistent with all other regional plans analysed that have a fully discretionary activity status. The Horizons One Plan provisions are the most advanced of any council in respect to gravel management. It should be noted that even with a fully discretionary activity status, a resource consent application for gravel extraction must still be assessed as to its environmental effects. Hence, declining consent for an easy to access abundant gravel resource that avoids environmental effects in favour of an area where gravel is required to be extracted for river control reasons is not a valid reason for the decline of consent.

4.2 Questionnaire

Appendix D contains the questionnaire circulated to the selected Regional Councils and their responses. Key documents supplied as part of the questionnaire responses are listed within the bibliography. All Regional Councils who were requested to take part in the survey participated and provided full answers and associated documentation to each question. In some cases, follow up phone calls were made for clarification. This has enabled the approaches undertaken by Regional Councils with similar gravel issues to be fully understood and evaluated for best practice, and proved to be critical base information for the recommendations of this report.

4.3 Otago Regional Council

ORC hold some gravel extraction resource consents, but to date most have been held by other organisations or individuals. However ORC state that while to date they have principally relied on commercial operators to extract gravel, ORC will need to directly fund extraction in some areas in the future.

Gravel extraction is used in a limited way within some flood control scheme areas by ORC but comment that there is an increasing expectation is some parts of Otago that they will take a more active role in managing river form (rather than capacity) using gravel extraction as a tool.

Further, ORC make the comments:

"Decision-making on resource consents must take account of matters that are broader than "engineering" considerations.

There must also be clear separation between regulatory and operational functions within an organisation. For these reasons ORC's consents section have the responsibility for deciding and issuing resource consents for gravel extraction."

While ORC does not have a specific regional gravel management strategy, ORC is preparing River Morphology and Riparian Management Plans for some rivers in Otago. The rivers being targeted are those where river morphology is dynamic over short time scales and where there is high community interest in how the river and its margins should be managed. The plans are prepared in consultation with the community and stakeholders. Whilst the plans have no statutory basis they act as a guide for ORC's river management activity and help inform the Annual Plan process. The plans help ensure that community expectations around river control and gravel extraction are managed and that the respective roles of ORC and landholders are clear. They also ensure that decision-making takes account of wider community values and that river are not simply seen as gravel quarries.

4.4 Environment Canterbury

ECAN manages gravel extraction via a variety of methods including:

- Resource Consents held by commercial extractors

- Gravel Authorities (Permits issued under a permitted rule of the Land and Water Regional Plan)
- Resource Consents held by the council (Permits under a resource consent held by Regional Engineer),
- Extraction via a permitted activity Rule in the Land and Water Regional Plan.

This system is described below.

4.4.1 Gravel Demand

In 2006, a Regional Gravel Management Report predicted increasing gravel demand in the Canterbury Region. The demand then eased in line with the global financial climate, but the 2010/2011 Canterbury earthquakes have meant that a significant quantity of gravel has been required as the rebuild progresses. Until recently, rural areas also experienced an increase in demand for gravel associated with dairying and growth in farming activities across Canterbury. Demands from central government and territorial authorities for the development and maintenance of their infrastructural assets have also increased.

4.4.2 Key Documents

ECAN manages gravel in its region via the following documents:

- Canterbury Gravel Management Strategy
- Canterbury River Gravel Extraction Code of Practice
- Gravel Liaison Committee
- South Canterbury Gravel Agreement (Gravel MOU)

4.4.3 Gravel Management Strategy

The Canterbury Regional River Gravel Management Strategy (GMS) was adopted by ECAN in November 2012. The GMS was written to inform decision makers about the management of gravel sourced from Canterbury's rivers. The GMS was prepared in accordance with sections 82 and 83 of the Local Government Act's Special Consultative Process, and was adopted following a consultation, submission and hearing process.

The GMS provides the framework for sustainable management of gravel extraction from rivers throughout Canterbury and is aimed at achieving affordable flood hazard protection and sustainable economic development without compromising cultural, social, environmental outcomes and values.

This Strategy, prepared under the Local Government Act, was used to inform RMA processes and decision making, and in particular the Proposed Land and Water Regional Plan. Importantly, it also enabled ECAN to meet the responsibilities for hazard mitigation defined in the Soil Conservation and Rivers Control Act (1941).

4.4.4 Canterbury River Gravel Extraction Code of Practice

The Canterbury River Gravel Extraction Code of Practice sets out good practice guidelines for managing the physical extraction of gravel from riverbeds. Development of the Code was a recommendation in the Gravel Management Strategy. The Code is designed as a guide to contractors so that they can extract gravel whilst avoiding, or where possible mitigating or remedying, adverse environmental effects.

The Code of Practice consolidates commonly used resource consent conditions with the aim of simplifying the authorisation process. The Code also sets out guiding principles and objectives and standard rules for gravel extraction. The Gravel Authorisations refer to the Code of Practice, and require extraction to occur in accordance with the Code.

4.4.5 South Canterbury Gravel Agreement (Gravel MOU)

In South Canterbury (Rangitata River and south), Environment Canterbury and the industry signed the South Canterbury Gravel Agreement (MOU). The agreement limits all Consents and Authorisations to a maximum volume of 30,000m^3 and duration of 12 months, enabling better flood management in rivers and creates a level playing field for signatories.

To ensure the success of the Agreement, ECAN requires that any new gravel extractors to become signatories prior to applying for a Consent or Authorisation.

Additional discussions with ECAN are required to fully understand the basis for this agreement.

4.4.6 Gravel Liaison Committee

There is a Gravel Liaison Committee made up of 12 elected stakeholders (elected by commercial extractors themselves) to assist in the management of river gravel in the region.

4.4.7 Allocation Method

Within the GMS, ECAN recorded that section 124A – 124C of the RMA would not apply to resource consents for gravel extraction. This is referred to in the Strategy as 'Method 1 – Annual Extraction Rate Based Allocation'. Prior to the GMS being adopted, when assessing new applications for gravel extraction under the RMA, ECAN was required to consider existing consent holders and give priority to them in regard to reallocating gravel that was not extracted under a previous consent.

A number of submitters to the GMS process, particularly those with large investment in fixed plant, expressed concerns at the hearing on this matter. The reasons provided by Council officers and supported by some submitters for excluding the consideration of section 124A – 124C, included:

- The ability of ECAN to meet its flood hazard management responsibilities;
- Reduction in the quantity of gravel "tied up" in under-utilised resource consents;
- Community benefit through reduced gravel costs and provision of increased flood capacity;
- The need to provide a more formalised setting for the successful South Canterbury MoU which relied on a "gentlemen's agreement".

Hence, the exclusion of s124A-124C is a legal means of giving ECAN greater control over "gravel banking" and anti-competitive behaviour.

The South Canterbury Extractors Group supported the removal of section 124A-C provisions on the basis that it would create a level playing field across the region.

The reasons given by those submitters in favour of the retention of the section 124A-C were as follows:

- Certainty of supply over a longer duration, particularly in regard to the Waimakariri River which is in close proximity to Christchurch;
- Recognition of long term consent holders and the wider role they play in the management of rivers;
- Recognition of investment in fixed plants;
- Recognition of supply contracts that extend beyond a 12 month period.

The ECAN hearings panel came to the conclusion that the removal of the section 124A-C provisions of the RMA was the most appropriate mechanism to enable ECAN to manage gravel extraction for the purpose of maximising flood carrying capacity in the region, and reducing flood risk to people and properties. They also accepted that the approach will enable ECAN to better align consented (allocated) volumes with actual extraction volumes which goes some way to avoid 'gravel banking'. The approach also ensured that the river gravel resource was not over-allocated or over-extracted in the future.

Since the adoption of the GMS, this approach has been codified within the notified Land and Water Regional Plan (Rule 5.124).

4.4.8 Permission Method

The draft Strategy set out two "Permission" options, which are summarised as follows:

- Option 1. ECAN's Regional Engineer to have Permitted Activity status under the Proposed Land and Water Regional Plan, or hold a 'global' resource consent for the extraction of gravel for flood management purposes;
- Option 2. Continue the current individual long term resource consent approach under the RMA, where individual operators were the applicants and consent holders.

The issues raised by submitters in regard to these options, particularly in regard to Option 1 included:

- Why ECAN as an extractor, should be treated differently from other extractors in regard to the Permitted Activity status?
- If ECAN held a global resource consent, how would other extractors be able to apply to extract gravel from the same reach of a river?
- How would the permissions system actually be implemented?

In its hearing decision, the panel accepted ECAN being treated differently to other extractors in holding Permitted Activity status for gravel extraction, and while the Panel recognised this as ultimately an RMA issue to be considered within forthcoming regional plan hearings, this status was appropriate recognition of ECAN's wider statutory functions for flood management.

The Panel also accepted that the Permitted Activity status had an advantage in allowing lower cost entry to extractors and faster access to the resource, when extractors were operating under the ECAN permitted activity rule.

However, the Panel rejected the proposal for ECAN to hold global resource consent for all gravel extraction in Canterbury, as this would not allow for commercial extractors to apply for resource consents over areas where the global consent applied.

In general, gravel extractors supported ECAN holding the gravel permits and the authorisation process as the existing resource consent and land ownership processes took too long and this meant the commercial operators were often unable to rely on getting consents to extract gravel when placing competitive tender bids for work.

While commercial operators are able to individually apply for resource consent, the onus is on the applicant to prove a comprehensive consent application and evidence to prove sufficient gravel is available.

4.4.9 Questionnaire Responses

ECAN makes the following comment regarding their previous system of relying on commercial operators gaining resource consents, before the introduction of the 'authorisation' system:

> *"This approach has had marginal success in the past due to inability to target extraction - but the newly imposed authorisation process under the Land and Water Regional Plan will improve our ability to target gravel extraction to maintain flood capacity."*

A further useful comment for directing extractors into problematic areas is:

> *"Gaining access to the riverbed over private land is often a constraint that the contractor must work through. The Gravel Authorisation process discussed above is an incentive to extract from those areas because the costs associated with gaining that permission is significantly less than resource consent. "*

ECAN do not finance gravel extraction from scheme rates and currently rely on commercial extractors. However, they do comment that this may be required in future in problematic areas where incentives will be considered.

In relation to 'gravel banking' Ecan comment:

> *"This was a problem in all rivers before the Regional Gravel Management Strategy – and remains a problem with larger & strategically located rivers such as the Ashley & Waimakariri which have long term large volume consents. The policies in the Land and Water Regional Plan are now giving stronger direction to consents officers to only issue short duration consents to ensure the gravel is taken over shorter durations (in alignment with our Gravel Management Strategy). Copy of policy 4.95A is below. The Gravel Authorisations are also ensuring gravel banking does not occur due to their short durations.*
>
> *The Regional Plan now directs that sections 124A to 124C of the RMA do not apply to gravel extraction in Canterbury. This means that upon the expiry of gravel consent, the un-used portion of the original allocation is now available for any party to apply to take, rather than the original consent holder having first priority to that resource. This incentivises extractors to take their full allocation within their consented timeframe, or else they may lose that allocation."*

Ecan also report poor alignment between Regional Council and District Council planning documents in terms of river bed definition. The gravel management fee charged to commercial extractors is for the entire consented volume and not just on a per cubic meter that is used basis.

4.4.10 Summary

In summary, the 'permission' process administered by the River Engineering Section and the Resource Consent process administered by the Regulatory 'arm' of ECAN have the following features:

- Section 124A to section 124C of the RMA do not apply to gravel extraction in Canterbury;
- Written authorisations (under a Permitted Activity rule) and resource consents will be issued to parties on a first in, first served basis;
- All extraction will be governed by a Gravel Extraction Code of Practice;
- Applications for written authorisations and resource consents will be required to include a statement of reasonable need for the volume sought;
- Resource consents and written authorisations to extract river gravel will not be granted in areas where a deficit of gravel has been identified or where proposed extraction may cause a deficit in gravel volumes i.e. gravel cannot be over-allocated;
- Written authorisations will be issued for a maximum duration of 12 months and a maximum volume of 60,000 cubic metres per consent
- Resource consents will be issued for a maximum duration of 12 months and a maximum volume of 60,000m^3 across the entire region, except on the Waimakariri River where durations of up to 5 years and volumes of up to the maximum available. This is because of the considerable infrastructure for gravel processing already present on the Waimakariri River;
- Quantity will be considered.

Figure 4 illustrates a flow chart of the ECAN process. This process applies to authorisations or resource consent applications for any volume or duration.

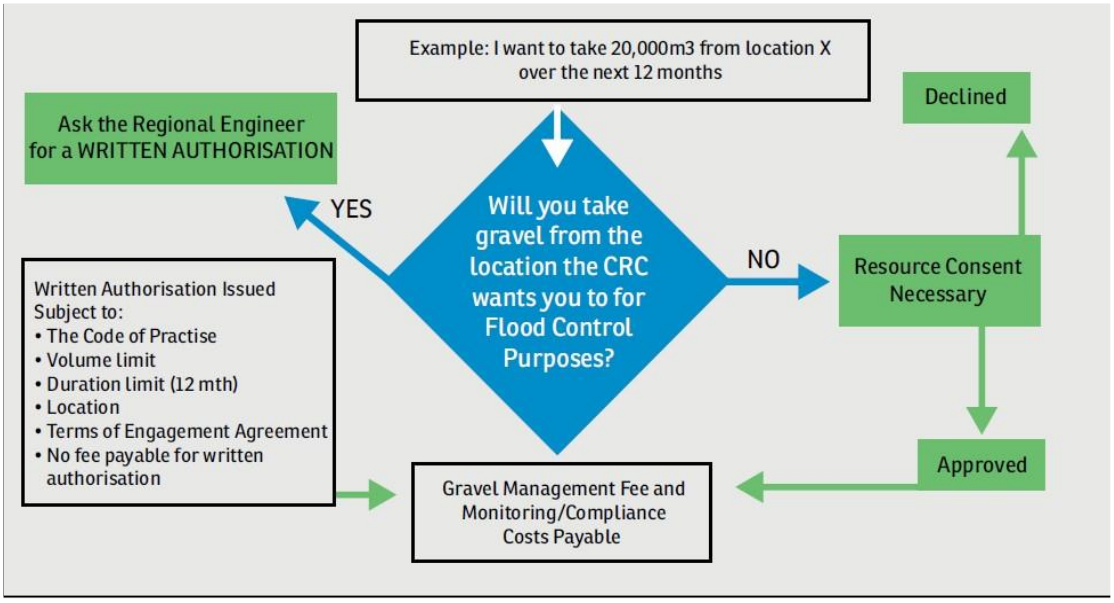

Figure 4. ECAN Gravel Allocation under the 'Permission' and Resource Consent Processes - Flow Chart

<QUESTIONNAIRE STILL TO BE PROVIDED>

4.5 Greater Wellington Regional Council

GWRC Flood Protection (FP) applies for, and holds, resource consents to extract gravel from all rivers in which operative river schemes exist and are administered by GWRC. Hence, the permitting system is administered by the regulatory 'arm' of GWRC. The volume, location and timing of permitted gravel extraction operations varies depending on the specific river. GWRC FP then issues 'licences' to individual contractors to extract a certain volume for a specified period. A fee is charged by the FP team to 'administer' the licenses.

Consent applications are generally a "consent suite" package which includes gravel extraction activities in addition to all other consented river management activities. This is due to no permitted activity status being afforded to the FP team by the Regional Plan.

GWRC is working on a Gravel Management Plan for their region, similar to the Strategy being recommended by this report.

GWRC has also produced a document entitled *Floodplain Management Guidelines w*hich provides guidance on the floodplain management planning process, and on the preparation of Floodplain Management Plans. The purpose of the guidelines are to apply international best practice, along with consistent principles and approaches in preparing Floodplain Management Plans throughout the region, based on good practice lessons in floodplain management planning, and to aid GWRC in meeting its legislative responsibilities.

The Floodplain Management Plans are developed for each river, and documents the approaches for avoiding and mitigating flood risk. This includes the use of gravel extraction where deemed necessary.

To date, GWRC has not funded gravel extraction but this is a future possibility, particularly for areas where commercial demand is low. There are significant budget and river management issues to consider if this is pursued. GWRC make the comment that even waiving the s36 charge is not a sufficient incentive, given haulage costs from such areas.

GWRC is one of the few Regional Councils in NZ that has defined 'River Corridors' in most District Plans in their Region and gravel extraction/river management activities are permitted by TA planning instruments. River corridors are defined through the FDFMP process.

Interestingly, as a concluding comment GWRC state:

> *"We are increasingly finding that we're not able to consider gravel volumes/levels in isolation and must consider them in relation to overall river management (e.g. how design channels and buffers work). We are addressing this through Floodplain Management Plans currently in development and review, and through our Gravel Strategy."*

This issue is also a part of this reports scope of work as HBRC is facing similar issues. This is further discussed in Section 7 of this report.

4.6 Horizons Regional Council

As outlined above, Horizons has a comprehensive set of regional plan provisions that specifies gravel volumes for allocation in a policy. The Regulatory Department of the Council undertakes the consent

authority functions in respect to gravel. The Engineering Department is an applicant and often holds 'global consents' for gravel extraction in some rivers. Gravel extraction companies also hold their own resource consents in some situations.

While gravel extraction is not currently financed from Scheme funds, low demand in some areas, or poor quality gravel that is not suitable for end uses leading to aggradation may see this policy reviewed in future.

While not a widespread issue, gravel extractors have been required to gain gravel permits from Horizons and earthworks permits from a District Council in river berm areas.

Horizons make the following comment in terms of land based sources within their region:

> *"The latest gravel mining trends operated by large gravel extractors on private land is limiting the ability of river operations to effectively, and cost efficiently, utilise gravel extraction for channel management."*

4.7 Bay of Plenty Regional Council

BOPRC have three methods for undertaking gravel extraction:

- The River Engineering Department holds its own resource consents for gravel extraction and carries out this work itself;
- Commercial gravel extractors exercise permits on behalf of BOPRC and extract gravel from areas they are directed to;
- Commercial gravel extractors apply for their own consents.

Gravel consents are issued to the Regional Council for a 10 year duration. When BOPRC itself extracts gravel, this is funded by scheme rates.

Of note is the fact that iwi have applied for and hold resource consents for gravel extraction. This matter is further addressed in Sections 8.0 and 10.0 of this report.

The report - Natural Environmental Regional Monitoring Network (NERMN) - identifies the locations and amounts of gravel that require extraction to maintain channel capacity.

4.8 Conclusions

The following conclusions can be drawn from the benchmarking questionnaire exercise, but overall, a considerable amount of consistency has been identified across the Regional Councils surveyed.

- All Regional Council 'Engineering Sections' surveyed hold their own gravel extraction consents along with resource consents held by commercial extractors.
- In all Regional Councils surveyed, gravel extraction consents are administered by the Regulatory 'arms' of each Council along with all other resource consent processes.

- For consents held by Regional Councils, some form of non-RMA authorisation process is used that effectively 'contracts' commercial operators to undertake the extraction on behalf of the Regional Council.
- Most Regional Councils have not funded extraction from scheme rates but almost all report that this is being considered given low demand and localised aggradation.
- All regional Plans have a Discretionary activity status for gravel extraction, however some plans have a Permitted status for activities carried out by the Regional Council themselves.

These conclusions are further considered within the options analysis and report recommendations sections below.

5 Demand Analysis and Financial Drivers

It is important to understand the past and possible future gravel demand and financial drivers that are influencing the commercial market for gravel in Hawkes Bay. The extent of this analysis has been limited by commercial sensitivity of the gravel extraction companies who are understandably unwilling to declare who their clients are and what volumes of aggregate are being sold for what purpose.

The Stevens and Larsen (2015a) report on Gravel Demand Forecast is very comprehensive and this report does not attempt to reanalyse their analyses. However, the following demand analysis is presented with reference to RMA s36 charging issues and what financial drivers are (or are not) available to HBRC. The Stevens and Larsen (2015a) report recommends the low to mid 5 year riverbed gravel forecasts be used for planning purposes which predicts riverbed gravel demand increasing from 432,000m3 actually extracted in 2013, to a predicted range between 494,000m3 - 660,000m3 in 2019. Hence, it will be important to encourage this lift in demand over the next 5 years to be sourced from Central Hawkes Bay sources, as little additional supply is available from Heretaunga river sources, with the main 'competitor' being land based sources.

Drawing on additional information gained at a gravel extractor workshop held in 2010; HBRC operational staff knowledge of the industry; and recent discussions with key gravel extraction companies, has enabled the following understanding of gravel demand and financial drivers for gravel in Hawkes Bay.

The over-riding commercial imperative for the aggregate market is to secure access to suitable material as close as possible to demand. In Hawkes Bay, approximately 550,000 m^3 of gravel is extracted from rivers on average in recent years, which is equivalent to approximately 60,000 truckloads. Of this, approximately 100,000 - 150,000 m^3 has historically been from the Tukituki and Waipawa rivers; but in recent years this has reduced to less than 20,000 m^3/year. The remaining 300,000 to 350,000 m^3 per annum has been from rivers on the Heretaunga Plains, with the vast majority from the Ngaruroro River. This figure does not include the gravel sourced from the beach source at Awatoto consented to Winstone Ltd.

Gravel is used for a diverse range of aggregate uses in Hawkes Bay and includes:

- State Highway and local roading
- Forestry roads and tracks
- Network utility trenching
- Concrete and concrete products
- Landscaping
- Fill

There is some differentiation in market demand from commercial operators. For instance, at times, Winstones source smaller material but the majority of demand is for material that is 30 - 40mm in size. At times, gravel extraction companies 'swap' gravel based on client demand and supply at hand.

Of the total New Zealand aggregate resource, approximately 70% are non-carbonaceous. Most are greywacke (divided into 6 sub-categories), and 30% are volcanic. All of Hawkes Bay riverbed gravel is

greywacke based. Significant contractual requirements surround the quality standards. River sourced gravel is a preferred supply option, as alluvial processes sort the gravels by removing the lower quality material. Land-based extraction is a more expensive source, putting aside any transport economics. Hawkes Bay has some of the highest quality aggregates in New Zealand, especially from the Ngaruroro River catchment.

Almost all of the material extracted is used in Hawkes Bay, with the amount leaving the region varying from year to year, which is usually bound for Gisborne. To date, no demand from the major North Island urban centres has occurred due to transport economics. This is in spite of some Auckland quarries (that are closest to market) yielding lower quality material, along with urban expansion resulting in the closure of quarries; while in Wellington, due to vastly diminished river yields, demand is serviced largely by Horokiwi and other land based quarries.

5.1 Gravel Extraction Companies

Stevens and Larsen (2015a) report:

"In the year to June 2014, there were currently more than 50 companies or organisations with river gravel extraction allocations, covering northern, central and southern parts of the region. Many of these are small operators with less than 10,000 m^3 extracted annually. The 3 largest extractors based in the central region (Winstone, Holcim and Higgins) have extracted on average 60% of the total reported Hawke's Bay regional river gravel allocation since 2000, although it has been up to an estimated 70% in peak years. In the 2013 calendar year 432,193 m^3 were extracted from the region's rivers."

Stevens and Larsen (2015a) also record that Winstone's coastal extraction plant at Awatoto has been extracting approximately 30,000m^3/year and this long term consent expires in May 2017. If this consent is not re-granted then every effort should be made to ensure this aggregate is not sourced from a new land based operation, but rather sourced from river sources. This situation also presents a potential risk to HBRCs management of the riverbed gravel resource as Winstones could legally mount a resource consent application for the entire amount currently extracted at Awatoto from the Ngaruroro River, and this would create legal allocation issues in terms of the current consent process used by HBRC.

5.2 Gravel Demand in Central Hawkes Bay

The demand from the Central Hawkes Bay area is worthy of more specific discussion given the issues in this area's rivers. Gravel extraction from Central Hawkes Bay river sources has been characterised by 'boom and bust' cycles over the last 30 years, whereas Heretaunga Plains' sources have had more consistent ongoing demand. In the 1980's and 1990's, demand did exist from the neighbouring Manawatu and Taranaki regions, being the result of 'backfill' transport opportunities, ease of access and consenting, but an over-riding reason of high market demand.

Up until 4 - 5 years ago, approximately 80,000 to 160,000 cubic metres per year was extracted from Central Hawkes Bay sources, with between 50,000 to 70,000 cubic metres per year specifically from the upper Tukituki River. This has diminished significantly in the last 4 – 5 years, and coincides with the receivership of three companies who were extracting this gravel - Infracon, Calais and Hurlstone. It is understood that the majority of end use of this gravel was for private development and gravel was being transported long

distances by all three companies both north and south of Central Hawkes Bay. It is further understood that the long haul distances undertaken by these companies contributed to their receivership, along with the global financial downturn.

Infracon had a presence in Hastings, Dannevirke, Tararua and Palmerston North, with their base being in Central Hawkes Bay where the main quarry operations were situated. As such, a lot of material went in each direction to service these locations.

Several stockpiles Infracon left behind post receivership, were largely inferior or reject product which are not impacting on current extraction rates to any degree. Other stockpiles were purchased by the Port of Napier and are being slowly used for port and other developments over time.

Discussions with Horizons Regional Council has identified that demand exceeds supply in the southern extent of their region due to demand from the Roads of National importance projects in the Kapiti and Wellington areas. Demand in other parts of their region is now being at times compromised due to more land based sources being targeted.

Current extraction from the Central Hawkes Bay sources now only serves the Central Hawkes Bay area.

The Central Hawkes Bay District Council (CHBDC) demand for gravel has not changed since approximately 2004 and is small (due to budgetary constraints and NZTA subsidy regime) at approximately 15,000 cubic metres per year. Historically, this material was extracted from river sources, but in an effort to reduce costs (primarily haulage costs), this demand is now being met from land-based red metal and 'paddock- stripping operations. While previously CHBDC used the NZTA and then a South African based aggregate standards for local roads which required riverbed gravel quality aggregate sources, this proved too expensive in terms of haul costs, hence localised aggregate specifications are now being used that enables the red metal/paddock stripping sources to be used as a fit for purpose option. This approach has resulted in haul distances at times decreasing from 60 - 70km for river sources to less than 5km, and the resultant cost savings.

An opportunity does however exist to have a commercial discussion with CHBDC to identify cost effective opportunities for again extracting riverbed gravel sources, but this may require some financial offsetting of costs. This option is especially relevant for localised problem reaches where future flood scheme-financed works maybe required.

No significant NZTA projects are planned in the area that would create new demand for the gravel resource. Even if future NZTA projects go ahead, aggregate reuse and recycled material use have significantly diminished historical demand volumes for such works. However, opportunities do exist to supply gravel from this area to NZTA programmed roading projects on the Heretaunga Plains.

While reasonable numbers of subdivision consents are being issued by CHBDC, these are not being developed in any major way, resulting in low private demand for gravel.

The potential Ruataniwha Dam project represents the single most significant opportunity for future gravel extraction demand. However, this demand is not generated by the dam construction itself as only tens

rather than hundreds of thousands of cubic metres will be required for the dam and this will be sourced from the constructed reservoir ponding area. Modern excavation and construction techniques require relatively small volumes for ancillary works associated with the dam (e.g. canal construction).

The potential major demand generated by the Ruataniwha Dam project is the on-farm development and the general economic upturn the scheme construction and operation will generate in Central Hawkes Bay. While this cannot be accurately quantified, it could be up to 100,000 cubic metres or more.

Major roading projects that will generate gravel demand such as the Whakatu Arterial and Napier/Karamu Rd intersection upgrade also provides an opportunity to supply this gravel from the Central Hawkes Bay sources. However, it is acknowledged that in respect to the Whakatu Arterial project, this project is facing some budget constraints and HBRC is already working collaboratively to source bulk fill from the Karamu Stream as part of a flood improvement scheme.

5.3 Gravel Demand by Other Councils

Stevens and Larsen (2015a) report that Wairoa, Napier and Hastings Councils are sourcing the majority of their aggregate from land based sources, and in the Hastings District Council case this equates to approximately 30,000 m^3/year. It is recommended that more proactive discussions be undertaken, particularly with Napier and Hastings councils, to understand the price point differences from their land based sources versus river sources.

5.4 Commercial Certainty

Feedback from some gravel extractors suggests that the current HBRC system of annual allocations can in some cases, not give commercial security required for companies. Land-based supplies are sometimes used because of long-term uncertainty associated with river supplies/allocations that are close to demand centres. If there are significant changes in allocation from year to year, this then impacts on the industry's supply chain security and ability to respond to tenders, whereas land-based supplies can flatten out the peaks and troughs of the current system.

For example, Holcim has had a 35 year consent for land-based operations and QRS sources approximately 60% of their supply from long term land-based consented sites.

Typically, a 10 year investment profile would be taken for the quantum of investment necessary to finance plant infrastructure. However, a longer consent term from riverbed sources would require a more comprehensive assessment of environmental effects to accompany a resource consent application, and a more rigorous consent authority process to ensure the requested allocations would be sustainable over such a longer term.

5.5 Influences on 'Price Points' for Gravel

Gravel demand is not sensitive to the S36/108 charge currently levied by HBRC. This is because the current charges are small in comparison to the transport and processing costs. Hence, if transport costs increased to a certain price point for riverbed sources, the relative economics of either land-based hard rock quarries

or river terrace gravel 'stripping' can become viable. Such price point changes are purely dependant on the volume and location of the demand relative to the supply location. It is commercially advantageous for commercial operators to overstate this price point to retain cheaper riverbed sources. Increased price of land in Hawkes Bay now raises this price point for both new land based quarries, particularly for river terrace gravel stripping operations; hence, if industry purchases the land, then that becomes a significant proportion of the on-sold gravel cost.

The number and volumes being extracted from either existing land-based quarries or river terrace stripping operations is unavailable.

5.6 Summary

A detailed, quantitative analysis of gravel uses cannot be undertaken due to lack of information and commercial sensitivity. Hence, a largely qualitative assessment has been presented. Notwithstanding this, even if a more detailed understanding of gravel use was available, this would not be in itself a critical factor in addressing the current issues. Despite, Rule 74 of the RRMP requiring an assessment of "use" of the gravel, this is carried out at an operational level (e.g. to ensure high quality gravel is being used for a commensurate purpose such as state highway roading, as opposed to fill), this information is not routinely recorded. This is in contrast to resource consents for fresh water where the consent document and metering compliance reporting enables analyses of water use across the region.

Furthermore, HBRC has no technical information on the quality of the gravel resource, and this is left to the commercial companies to collect. Thus, HBRC is reliant on advice from gravel extractors when matching allocation to use.

The overriding issue that has been identified in this section, is the downturn in demand from the Tukituki and Waipawa rivers, however opportunities for future riverbed extraction do exist. These opportunities are associated with the Ruataniwha Dam project and associated development; future roading upgrade projects and commercial discussions with CHBDC; and a potential gravel extractor consortium interested in transporting and stockpiling gravel onto the Heretaunga Plains. If demand from these initiatives eventuates, the challenge then becomes having the ability to direct extraction from problematic locations and reaches. This is addressed in the following sections of this report.

6 Options Analysis

The central issue identified by this report is how to sustainably fund maintenance of channel capacity in the Waipawa and mid and upper Tukituki Rivers given the low commercial demand for gravel, while continuing to manage sustainable allocation of the gravel resource from other Hawkes Bay rivers, particularly the Ngaruroro River where demand exceeds supply. Three approaches with varied options are assessed:

- Financial -based options
- Regulatory options
- Non-regulatory options

6.1 Financial-Based Options

The financial levers that HBRC have are:

- Subsidising commercial gravel extraction
- Waiving or reducing S36 charges
- HBRC financing its own gravel extraction program and storing extracted gravel in long term storage areas close to source reaches

6.1.1 Subsidising Commercial Gravel Extraction

An estimated cost of $16/m^3 has been provided to extract and transport gravel from the mid/upper Tukituki to demand centres on the Heretaunga Plains. As it is estimated that 882,000m^3 has aggraded in the upper Tukituki, this equates to over $14 million at the $16/m^3 estimated rates for transporting to the Heretaunga Plans. These costs are obviously exponentially higher for the mid Tukituki that has an estimated 14 million m^3 of gravel above the grade line.

This would be a 'one off' cost over a number of years to deal with the above grade line gravel and does not account for additional gravel supply to the system which would become an ongoing cost, or future flood activity that may transport gravel to downstream reaches. This option obviously assumes no improvement in market demand for this gravel, and that the entire gravel resource above grade lines is required to be extracted which is not the case. Hence, this is a worst case scenario.

6.1.2 Waiving or Reducing Section 36 Charges

It has been demonstrated that this is unlikely to exert a significant influence on gravel extraction given the legal limitations of S36 and what price can be levied, versus the dominant price controls of market demand and transport economics. Hence, this option is largely discounted.

6.1.3 HBRC Financed Gravel Extraction Program

An upper estimate of $6/m^3 has been made for HBRC to undertake its own operation to extract and 'store' gravel locally upon neighbouring land outside the flood banks. Again, just using the upper Tukituki

example, the estimated 882,000 m^3 equates to over $5 million to extract and store on neighbouring land owned by HBRC. Given the quantum of material, it would be challenging to find sufficient land for all of this material.

However as noted above, this is largely a theoretical analysis, as extremely localised tributary and main river stem reaches are causing the most significant problems for landowners, and if quantities in the order of 20,000 m^3/year were extracted using flood scheme funds, this immediately becomes more affordable and worthy of consideration.

Caution needs to be taken with this option as large stockpiles of gravel could distort future demand and compromise ongoing channel management operations for the region's rivers, especially if future flood activity results in an increase supply of gravel. Hence, extraction at the lower quantities suggested, of around 20,000 m^3 per year, would avoid this situation. Alternatively, a decision could be made to never use such stockpiles to ensure ongoing extraction occurs.

The upper Tukituki Flood Scheme is funded by a combination of direct and indirect beneficiary-targeted rates and general rates. A total of 6344 valuation numbers make up the direct and indirect targeted rate contribution with 5312 properties paying less than $100 per annum targeted rates, but some properties paying in excess of $16,000 per annum. Total scheme assets are valued at $28.35 million. Ten land classes make up the scheme area with a total scheme rating from all classes of just under $700,000 (exc. GST) per annum. Hence, at this level of scheme rating and given existing scheme maintenance requirements, a very large increase in scheme rates would be required to internalise the cost of a large scale gravel extraction operation, and it is unlikely that this is either needed or would be agreed to by scheme ratepayers. However, a modest increase or redirecting existing scheme funds into gravel extraction at localised areas should be considered. A more detailed investigation of these localised areas and quantities to be extracted with a potential works program and associated funding requirements is recommended however, before this option is adopted.

6.2 Regulatory Options

The following regulatory options have been assessed:

1. RMA plan options
2. RMA permitting options

6.2.1 RMA Plan Options

From the analyses of the existing HBRC plan provisions and the benchmarking analysis with other Regional Councils, the following section evaluates a range of possible regulatory options.

6.2.2 Regional Policy Statement

The review of the Hawkes Bay Regional Policy Statement Issues, Objectives and Policies has found that these plan provisions adequately cover the range of matters to manage the regionals gravel resources at an RPS level. Hence, no immediate amendments to the RPS are deemed necessary, although consideration to giving regional priority to riverbed gravel extraction over land-based operations does seem a more

sustainable and 'wise' use of resources. This would require HBRC to use its statutory advocacy function in respect to district plan and TA consenting matters. This is because it is unlikely that this would be expressed as a Rule in a District Plan, and more likely be a Policy, and past experience would suggest a reliance on HBRC reinforcing such a Policy through its statutory advocacy formal submission function. This could even extent to a court appeal stage in an effort to establish a Hawkes Bay precedent on this issue.

6.2.2.1 Development of a Specific Regional Plan for Gravel Management

In 1994, HBRC adopted its first regional plan under the RMA – the *Regional Riverbed Gravel Extraction Plan*. This regional plan contained a full suite of plan provisions specifically for the gravel resource. In 2007, this Regional Plan was rescinded when the RRMP was adopted. An option exists to again formulate a specific regional plan for gravel; however, this is not recommended for the following two reasons:

1. Any changes or new provisions can be incorporated into the existing RRMP via the Schedule 1 process; and
2. Considerable efforts are being made across the country to eliminate 'single issue' regional plans in favour of integrated regional plans that enable the inter-relationships between natural resources and environments to be managed holistically.

6.2.3 Regional Resource Management Plan

The following observations have resulted from the review of the RRMP and benchmarking with other Regional Councils:

1. HBRC is the only one of five Councils surveyed that has a Restricted Discretionary activity status for gravel extraction above the permitted activity level. All other Regional Councils have a fully Discretionary activity status.

2. Some Regional Council River Engineering Departments have an explicit permitted activity rule for gravel extraction in recognition of their legal mandate under particularly the Soil Conservation and Rivers Control Act 1941. The existing permitted activity Rule 70 does not include gravel extraction; hence HBRC required consent under Rule 74. It is recommended that Rule 70 be amended to also include gravel extraction in a future plan change.

3. The matters in the RRMP that discretion is restricted to, do not explicitly include flood capacity or availability of the gravel resource, but rather records "location" as a matter of restricted discretion.

4. The RRMP does not provide any policy guidance on availability/allocation limits of the gravel resource to guide resource consent allocation decisions. Under Section 30 (iv) this opportunity does exist. The Horizons Regional Council One Plan lists by way of Policy, gravel allocations for given reaches and rivers, to inform the relevant rules. A disadvantage of this approach is the resource availability can change quickly based on storm/flood activity, whereas plan changes are lengthy processes. This is the reason for the One Plan policy status for the gravel allocation amounts rather than using a Rule. Consideration of other Councils' feedback on this, is the reason

for not using an 'allocation' approach within a Regional Plan, rather relying on the fully discretionary rule status combined with 'non-regulatory' documents.

5. While the current HBRC Rule 74 refers to the "use" of the resource, explicit discretion is not given to matching the quality of the gravel to its end use. As part of the current consent process, this is undertaken in an operational way, however, this is not documented in any way.

6. A plan change could also be used to incorporate a non-RMA Gravel Management Plan (see below) by reference, and update the reference to the current version of the code of practice. Rule 74 should also include a reference to the code of practice as this is a method employed by other Councils to achieve best practice for gravel extraction operations.

7. The ECAN approach of exempting gravel permits from RMA S124 has merit and is a good approach along with other methods to avoid gravel banking anti-competitive behaviour. This would require a plan change.

Notwithstanding these potential changes to the RRMP to enable HBRC to more effectively manage the region's gravel resource, all of the potential plan changes are not considered 'urgent', and can be considered during the next programmed plan change process scheduled to begin in 2020 or sooner if such changes are undertaken within the TANK plan change process. Given the relative importance of other plan changes required by HBRC, a stand-alone and earlier plan change for gravel management could not be justified or even practically achieved.

In conclusion, any amendments to the RRMP would be beneficial, but not urgently required in the short term; and a stand-alone plan change for these matters cannot be justified or even is a practical solution. The key issue in relation to this conclusion is this in turn requires the Assets Section to obtain resource consents for gravel extraction rather than relying on a permitted activity status (if this indeed was the outcome of a schedule 1 process). The section below entitled 'non-regulatory options' presents an alternative way forward to address some matters outlined in this section.

6.3 Permitting System Options

As a result of the legal framework review, analysis of the existing HBRC permitting regime and benchmarking analysis with other Regional Councils, this section evaluates the options and presents recommendations for an optimal permitting system. The overall aim of this section is twofold. The first is to ascertain whether any alternative permitting system can be used to overcome the gravel issues in central Hawkes Bay, and secondly a general review to ensure the current permitting system is legally robust and meets statutory requirements of the RMA.

It is stressed from the outset that the existing permitting system has performed adequately to date and no significant problems have been experienced; however, an evaluation of the options that are 'fit for purpose' given the present day issues that are now apparent, is warranted.

In undertaking an evaluation of 'fit for purpose' options, the following principles will be used to determine an optimal permitting process:

- Regulatory efficiency and reasonable regulatory and compliance costs;
- Commercial certainty for extractors;
- Avoidance of gravel 'banking' and monopoly situations;
- Appropriate consideration of environmental matters and respectful consideration of cultural interests;
- Ensuring the design flood carrying capacity of the river channel;
- Ensuring coastal processes and coastal erosion is not exacerbated by gravel extraction;
- A system free of conflicts of interest and has transparency;
- Using a system that is considered 'best practice' identified from the benchmarking analysis with other Regional Councils.

6.3.1 Who should be the Applicant?

Three options exist for who could hold the resource consents:

1. The gravel extraction company (status quo);
2. HBRC;
3. The gravel extraction company, but assisted by HBRC in their preparation of a more comprehensive application and assessment of environmental effects to gain longer duration consents;
4. HBRC holding consents just for the Central Hawkes Bay sources.

The current system whereby gravel extraction companies are the consent holders, has worked well until recent years. However, the current system is not delivering the channel management objectives in the Central Hawkes Bay river systems. Notwithstanding this, even if the current system is retained, improvements to robustness of the current system should be made.

On the Heretaunga Plains, when demand exceeds supply, the current system continues to be reasonably successful in delivering the Council's flood scheme objectives.

An alternative option is for the HBRC Assets Section to become the applicant and consent holder of all major gravel extraction resource consents in the region. This approach is used by ECAN, GWRC BOPRC and Horizons Regional Council. Based on these consents, the Assets Section can then allocate the consented gravel volumes to extractors via a variety of means from competitive tendering to 'authorisations' as used by ECAN.

This will require the Assets Section to prepare longer term and more detailed consent applications and accompanying Assessment of Environmental Effects. Under this option the 'consent Authority' function would be required to move to HBRC's Regulatory Department to avoid a conflict of interest and provide clear separation of functions as required by the Local Government Act. This option recognises that HBRC has the statutory role of "river manager" with specific legislative requirements to avoid and mitigate flood hazards, which separates it from the commercial gravel extractors. Hence, to a greater extent, the flood control imperative of the Council could be better performed by HBRC holding the consents.

Some risks and liabilities of this option will fall on the Assets Section as the consent holder, if the company exercising the consent is non-compliant with consent conditions; although this risk can be managed via

appropriate supervision of the companies as currently occurs and having agreements in place with the HBRC Compliance Section as to how this situation will be managed. This is no different to many other situations where organisations hold consents and contractors undertake the works.

This option allows HBRC to give greater direction to where gravel should be taken as once it holds the consents itself, it is unencumbered by the RMA consent process. This option also allows the potential of gravel banking to be better managed.

The third option is to retain the gravel extraction company as the applicant but, particularly for longer duration consents, HBRC Assets Section to assist in the more detailed preparation of the required consent application. Again the 'Consents Authority' function would be required to move to HBRC's Regulatory Department under this option.

A fourth 'hybrid' option exists that retains status quo from all sources other than the Waipawa and mid/upper Tukituki, where HBRC could become the applicant. Under this option, it would be difficult for the Assets Section of HBRC to retain its delegation for processing some applications and not others where it becomes the applicant. Hence, the 'Consent Authority' function would be required to move to HBRC's Regulatory Department.

It should be noted that the ECAN hearings Panel did not preclude individual companies applying for their own consents; but for long term consent durations, the requirements of the consent process and ongoing channel monitoring often proved prohibitively expensive for individual companies to meet the ongoing monitoring costs. This is due to the S36 charges not being available to private companies to fund the activity. Hence, in practice, Canterbury extraction companies are applying for short duration (1 year) consents, for lower quantities in aggraded areas.

All four options are valid and have specific advantages and disadvantages as outlined. On balance, it is recommended that Option 2, where HBRC Assets Section apply for all major gravel extraction resource consents in Hawkes Bay and for longer duration consent terms, is adopted. This cannot in law preclude any commercial operator from applying for such consents. However, if the commercial extractor application was for a longer duration than say, 1 year, particularly robust consent applications would be required with ongoing monitoring consent conditions. If this recommendation was pursued by HBRC, this would ideally be a collaborative approach agreed with the gravel extraction industry.

Legal advice specifically obtained to inform this report, has confirmed that HBRC is legally unable to issue a resource consent under the RMA that requires a portion of the total amount of consented gravel to be extracted, over an amount considered necessary to demonstrate the consent has been 'exercised' under S125 (the "use it or lose it" section). The advice concludes that a commercial agreement under consents held by HBRC is the best way forward which is the same and an independent conclusion as the one reached above.

6.3.2 Consent Duration

Feedback from several gravel extractors has suggested the current annual resource consent process does not give sufficient commercial security to undertake site establishment and locate expensive infrastructure

(e.g. crushing plants), particularly in Central Hawkes Bay. Hence, resource consents with longer consent durations commensurate with the commercial investment required should be facilitated. This could possibly extend to 10 year consent durations. The use of a consent review clause (e.g. at regular intervals throughout the consent duration) can be used to ensure the continued sustainability of the gravel resource for the remainder of the consent duration. Given the amount of gravel above the grade lines in the Tukituki and Waipawa River, it is difficult to envisage the consent review would significantly curtail the original gravel allocation.

Under the 'authorisation method' a longer term access to the gravel resource could be offered to gravel extractors. This is particularly relevant for the Central Hawkes Bay sources but also for the Northern Hawkes Bay rivers, given the land-based quarries that exist in that area.

If longer duration consents are sought, ongoing monitoring, consideration of environmental effects and review clauses would become important; and gravel allocations and consent conditions could become more conservative if the applications are not well supported by robust Assessments of Environmental Effects. The research strategy section presented later in this report will be important in this respect. Despite this, the many years of annual gravel consents has not resulted in any major adverse environmental effects that are known to date, hence, the issues may be more focused on gravel resource sustainability over the longer term.

6.3.3 Avoidance of 'Gravel Banking'

'Gravel banking' is a term used to describe when a gravel extractor holds resource consent for gravel extraction with no or little intention of exercising the consent in full or part, and does not surrender the consent. This allows a commercial advantage over competitors who may genuinely want the gravel from the same location or conversely does not allow market pricing to occur and a monopoly situation. Gravel banking can be managed in the following ways:

- Always having two companies able to supply gravel from a similar geographic area;
- Specifically exempting the use of S124 which recognises existing investment upon renewal of existing consents within a Regional Plan as used by ECAN. This does require a plan change;
- HBRC holding the resource consent and having a commercial contract with an extraction company with penalty and termination clauses for non-extraction;
- For consents held by extractors, using a very short consent lapse date which is a legal mechanism for 'use it or lose it' of the gravel resource. A lapse date of any duration can be imposed by the consent authority. Hence, if the gravel extraction is not exercised to a significant extent the consent lapses and can be granted to another extraction company upon application. This is a well-established legal process used by HBRC and other Councils in respect to water permits and may involve a formal Lapse Date Hearing if the consent holder wishes to contest the lapsing;
- The existing practice of short term consents does not allow gravel banking to persist for any length of time and is equally a valid way of avoiding anti-competitive behaviour; but as outlined, other disadvantages of annual consents exist, and a move to longer term consents should trigger pre-emptive remedies to be used.

All of the above options are valid and legally robust; hence, a 'fit for purpose' approach is recommended and appropriate selection of a preferred option for any given situation can be made.

In terms of the recommendation for utilising consent lapse dates, the consent authority can impose a shorter (or longer) lapse date than the statutory default period of 5 years. However, a shorter date can be appealed. To minimise appeal risk and to be valid in law, a lapse date condition must:

- Be for a resource management purpose, not for an ulterior one;
- Fairly and reasonably relate to the activity authorised by the consent to which the conditions attach;
- Not be so unreasonable that a realistic planning authority, duly appreciating its statutory duties, could not have approved it; and
- Be the most appropriate condition to achieve the purpose of the RMA.

While the consent authority should also consider whether it should grant consents but for a relatively short duration rather than relying on a shorter lapse date, the specific circumstances that surround gravel management would not prevent a shorter lapse date being used in conjunction with a longer duration consent term.

Although gravel banking has not been a significant issue to date in Hawkes Bay, the prospect of longer term consents and any lift in demand, can quickly create a gravel banking situation, and the above measures should be used pre-emptively to avoid this.

6.3.4 Legal Delegations

At present, the RMA consenting and compliance functions are formally delegated to HBRC staff by Council and this is a legal requirement. This review has found all necessary delegations to be in place with the current staff exercising these functions; however, it is recommended that any new consent/compliance process undertaken by new departments receive the appropriate delegations, and rescinding of existing delegations carried out.

6.3.5 Resource Consent Processing Efficiency

The following initiatives are recommended to maintain an efficient resource consent system. These recommendations are equally relevant irrespective of where the consent authority delegation resides or who the consent holder is, as they will ensure a best practice approach to this activity.

Pro Forma Application and AEE

For longer term consents, it is recommended that a catchment specific set of *pro forma* resource consent applications and AEE's be developed for gravel extraction across Hawkes Bay. These applications are required to address the overall sustainability of the resource, effects on flora and fauna, cultural values and coastal processes in association with addressing the positive environmental effects of mitigating the regions flood hazard exposure.

Under the option of moving the consent authority function to the Regulatory Department, concern has been expressed that for short term (e.g. 1 year) consents, that the current efficient system of being able to issue a consent in one day will be compromised. This can also be avoided for short term consents by the agreement of *pro forma* applications for short term consents. The development of internal Key Performance Indicators to govern this should also be undertaken.

Pro-Forma Consent Documents

Pro forma and standard consent conditions currently apply to resource consents for gravel extraction for short term (1 year) consents; this system works well and should continue. In some cases, consent conditions may require minor tailoring to specific catchments and/or rivers (e.g. for specific native fish and bird species). The most significant decisions surrounding the gravel consent process is from a river engineering perspective and whether the gravel should be extracted for flood management purposes which is based on the cross-section survey information. Hence, it is recommended that catchment-specific pro forma consent documents are prepared in addition to pro forma reasons for granting the resource consent to allow a 2 day processing and issuing of resource consents to be achieved for short term consents. This fully utilises the RMAs 'streamlining' amendments from 2013, and completely avoids the time and cost associated with a Section 42a officer's report, and the process should be largely administrative in nature.

For long term consents of up to 10 years, the normal consenting processes employed by the Regulatory Department should apply.

Consent Processing Charging

Given the streamlined approach recommended for resource consenting, the charging for processing of short term consents should be fixed pursuant to S36 of the RMA, or conversely covered by the general S36 charging regime such as currently in place, whereby the s36 charge covers all costs of processing, compliance and monitoring.

For longer term consents, the existing charging policies of Council should apply.

HBRC Resource Consent Database

It is recommended that all gravel resource consent applications and issued resource consents be stored electronically on the HBRC consent database along with all other resource consents issued by Council. This is regardless of where the consent authority function is exercised from. It is also recommended that the "use" of the resource be more formally recorded on a field inside the consent database.

6.3.6 Section 36 Charging

HBRC expenditure to manage and administer gravel extraction in the region has been approximately $270,000/year and is currently funded via s36 (75%), s35 (15%) and s108 (10%) of the RMA. This funds 100% of the following "activities":

- Staff input to the annual allocation assessment and its management throughout the year;
- Investigations necessary to understand the sustainability of gravel extraction;
- The provision and maintenance of access ways and stockpile areas;
- State of Environment monitoring.

Cross section monitoring costs are an ongoing programme and costs approximately $145,000/year Cross-sections are surveyed at 3 yearly intervals in the reaches where gravel is extracted, and at 6 yearly intervals elsewhere, and with the total survey cost apportioned in the following way:

- Gravel extraction 39%.
- Flood forecasting and flood hazard mapping and management 43%.
- Scheme design and level of service monitoring (Heretaunga Plains Scheme and Upper Tukituki Scheme) 18%.

The differential level of charges between the Upper Tukituki and other extraction areas has been the decision of successive Council annual plan/long term plan processes in an effort to minimise any barriers to gravel extraction from the Upper Tukituki River. This is consistent with the legal requirement of s36 stating that such costs "may" be charged, hence a Council has discretion in this area and HBRC's transparent exercise of this discretion via an annual plan process is considered best practice.

Hence, no changes or recommendations are made in respect to what the S35, 36 and 108 charges are levied for, but if the Consent Authority function is moved to the Regulatory 'arm' of HBRC, technically they should levy the charges and then reimburse the respective budgets that incur costs in other parts of Council. This is a purely administrative matter and makes no material difference to gravel extractors or other stakeholders.

6.3.7 Regulatory Efficiency between District Council HBRC Consent Requirements

The regulatory duplication between regional and district councils in respect of gravel permits and land use consents is a common issue across New Zealand and an area of inefficient planning practice, that can often result in unnecessary and excessive regulatory compliance costs for applicants. This can be avoided by demarcating river beds via a mapping exercise and either reaching an agreement that the district councils use their discretion in not requiring consent for earthworks in river beds, or following a more formal process of transferring the function to the HBRC. This does not apply to vehicle movement, traffic safety and noise considerations, which should remain a consenting function of the relevant district council.

This is not an issue in Central Hawkes Bay District as earthworks is a permitted activity.

6.4 Non-Regulatory Options

An option exists to develop a non-RMA Gravel Management Strategy and using Section 104(1)(c) of the RMA to consider such a strategy when deciding on resource consent applications. Such a strategy can be used to effectively guide the permitting process and was a recommendation of the 2010 scoping study. The key advantage of this option is that a non-RMA plan can be developed faster than a Regional Plan change via the Schedule 1 RMA process. This option is often used as an interim approach while a regional plan change process is followed. In practice, if there is good acceptance of the non-RMA plan and it is not subject of significant disagreement throughout its development or evidential challenges during successive resource consent process, then there may be no need for a full regional plan change to take place.

The key aspect of a Gravel Management Strategy is that it records, following formal consultation and submissions, the gravel management and allocation process particularly under the scenario where a Regional Council holds the resource consents.

The benchmarking exercise in Section 4 of this report has shown that such an approach has been employed very successfully for gravel management and more general floodplain management by ECAN and GWRC.

A further, successful example of a non-regulatory management strategy approach is Otago Regional Council's *Code of Practice for the Management of Vegetation Burning in the High Country of Otago* which has been adhered to for many years without the need for a formal regional plan process. This has had the advantage of allowing flexibility of approaches and not being tied to prescribed regulation while ensuring the outcomes of the Code are adhered to. In this case, it has been understood by the high country community that successive failures to comply with the Code would result in a more prescriptive planning regime being initiated via a regional plan process.

However, it is stressed that a high degree of commitment to such an approach is required by stakeholders from the outset for this approach to be successful.

The existing HBRC Code of Practice is a further example but goes to the next level of formality by being incorporated via reference within the RRMP Rule 70, and effectively guides work in and around freshwater. However, Rule 70 refers to the 1999 version of the code and since this time, two further versions of the Code have been produced. An option also exists for using the same Special Consultative Process under the LGA for the latest version of the Code as well as the Gravel Management Strategy at the same time.

With the next programmed review of the RRMP not scheduled to begin until 2020, and RMA Schedule 1 processes taking many years to become operative, the use of the LGA process is the most time efficient and pragmatic way forward to giving such a documents some legal weight within RMA processes. The process also allows any practical and operational implementation matters to be worked through and hopefully result in a less contentious plan change process if this is deemed necessary.

Legal advice has confirmed that management plans or strategies prepared by local government can be considered as 'another matter' under s104 (1)(c) of the RMA and further can be afforded significant or even 100% weight during resource consent decisions. This is conditional upon the following matters:

- That a robust public consultation process is followed during the strategy's development;
- That the Strategy is consistent with Regional Policy Statement and Regional Plan provisions;
- It is made clear in the Strategy that it is intended to 'sit alongside' the statutory RMA documents and it will be a factor taken into account in resource consent decisions under s104(1)(c);
- 'Weight' is further strengthened by incorporation by reference within a regional plan.

6.5 Conclusion

It is now clear that relying on a solely market based approach to gravel extraction has not been entirely successful in achieving HBRC's river management objectives in a climate of low demand, in Central Hawkes Bay catchments.

Hence, it is recommended that the option of the HBRC Assets Section becoming the consent holder and shifting the consent authority function to the Regulatory part of Council should be pursued.

The advantages of this approach are summarised as follows:

- The approach will give HBRC greater ability to direct (although not instruct) extraction to preferred locations;
- It removes the legal constraints of the RMA and enables a more contractual approach to managing the gravel resource if this is deemed desirable;
- Successful precedent exists from all other Regional Councils surveyed;
- The approach provides further security against gravel banking behaviour, especially if longer term consents are pursued;
- HBRC Assets Section is best placed to undertake comprehensive AEE's for long term consent durations, which gives greater commercial certainty for new operations to set up in Central Hawkes Bay;
- In the absence of a range of other major 'levers', this approach represents a tangible course of action to encourage extraction within Central Hawkes Bay;
- From a secondary perspective, this option will also ensure a more robust consenting approach.

It is acknowledged that such an approach could draw the criticism that HBRC is inappropriately interfering with the market and should not assume this role. In addition, a stronger direction to gravel extractors of where to take gravel from could result in higher gravel prices and resultant criticism of Council. However, this needs to be balanced by HBRC's role in respect to the wider community and its legal functions under the suite of Acts in respect to flood management.

While no permitting system can be perfect, on balance and given the current issues, the recommended approach is the best way forward for HBRC and its flood management objectives.

If market demand changes significantly, or major flood activity occurs that challenges the efficacy of this recommended approach, no barriers exist in changing the approach or even reverting back to the existing approach. However, the recommended approach does provide considerable flexibility to deal with changing future conditions.

Given it will be impractical to develop and gain new long term resource consents for all catchments at once, it is recommended that the consent process be initiated for Ngaruroro catchment first, and any lessons learnt can then be applied to the remaining consent processes.

7 Holistic Approach to Gravel Management and Flood Scheme Works

HBRC maintains the major flood schemes of the Heretaunga Plains and Upper Tukituki along with 13 other smaller flood schemes. Figure 5 illustrates the areas covered by these flood schemes.

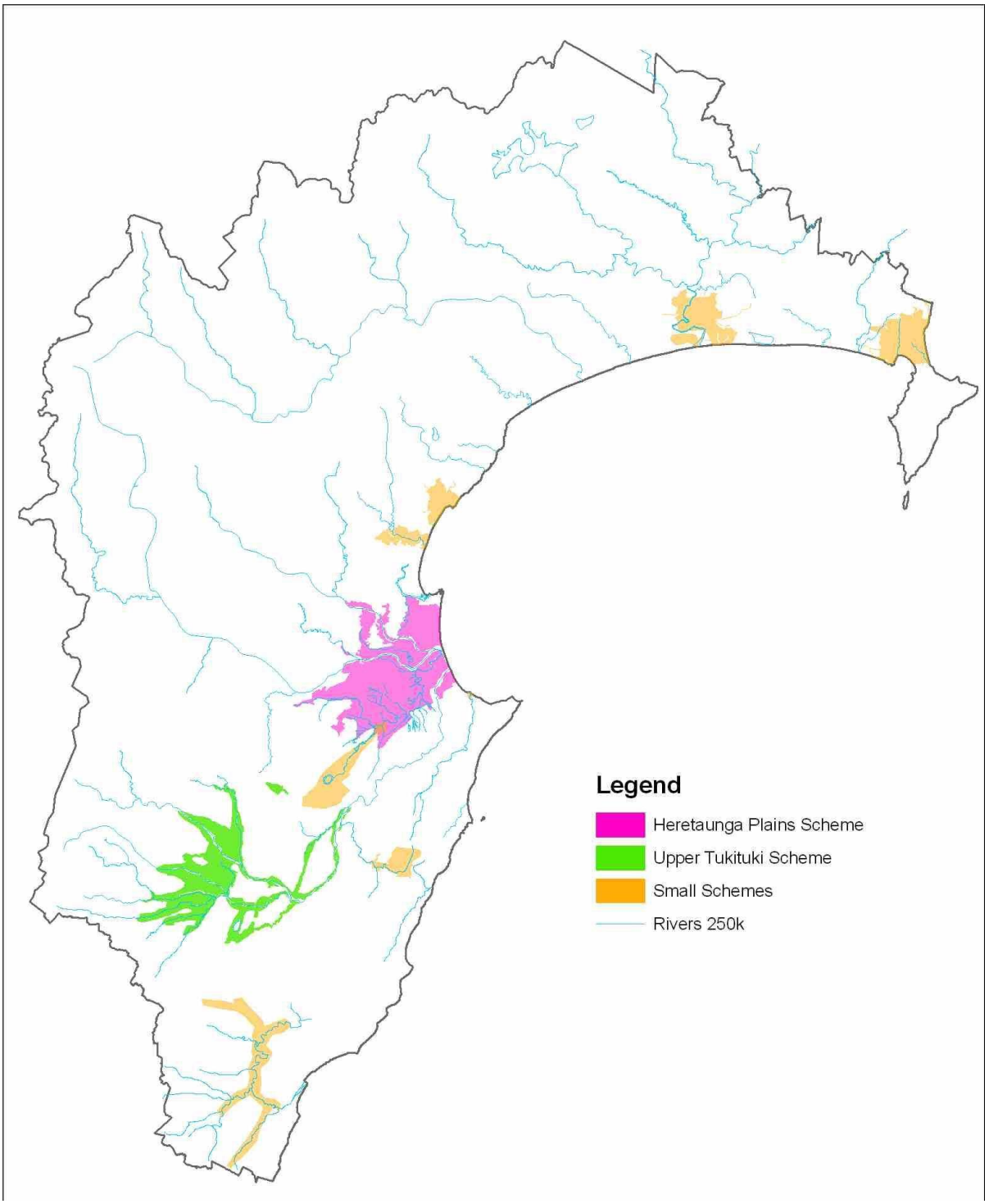

Figure 5. Hawkes Bay Flood Scheme Areas

Within these designated flood scheme areas, HBRC undertakes the following works financed primarily by targeted rating:

- Channel training
- Beach raking
- Flood bank maintenance
- Edge protection planting and maintenance
- Invasive vegetation control
- Land drainage

Gravel beach raking is a gravel-bed river management technique that uses a tractor to drag large metal ripping blades across exposed channel bars, mechanically disrupting the coarse armour layer. A study on the Tukituki River by Reeve (2016) entitled *Impact of gravel raking on surface grain size and channel morphological change: Tukituki River, Hawke's Bay, New Zealand* concluded that the study "provided strong evidence that gravel raking promotes marked changes in sediment transport capacity along the Tukituki River", and gives specific evidence for the Tukituki River that corroborates evidence from other parts of New Zealand and Hawkes Bay river engineering staff.

Gravel raking is carried out in the upper Tukituki scheme annually at a cost of approximately $100,000 per year and funded by scheme rates. Hence, it follows that the gravel raking program within the upper Tukituki is one factor leading to the aggradation in the mid Tukituki. Other significant factors are the lack of recent flood activity and the wider channel widths of the mid Tukituki channel.

It is noted that the aggradation within the mid Tukituki reaches is the most significant of all the Hawkes Bay River reaches, with 14 million cubic metres of gravel above the calculated grade line, and continued aggradation at the historical rates will result in less channel capacity and consequential flood and drainage issues. Hence, a gravel raking program within the mid Tukituki reaches would be beneficial to promote gravel transport to the lower Tukituki reaches. Transport economics of commercial gravel extraction are more favourable if the current gravel that exists in the mid reaches is transported by floods into the lower reaches.

The key issue with such a program is the mid Tukituki River is not within a rated flood scheme area and all current works are on a user pays basis. Legal advice was sought on the legality of using RMA s36 charges to fund a beach raking program in non-scheme areas to promote downstream transport of gravel, and in turn making this gravel available for extraction in an area that is in higher market demand. This legal advice has confirmed that it is not possible to use s36 charges revenue to fund channel management and a beach raking program.

Given the new sediment transport modelling capability, it is recommended that hydraulic and sediment transport analyses be used to predict the effectiveness of lesser probability flood events following beach raking to move sediment into the lower Tukituki River (or put another way - a smaller flood is necessary to mobilise the gravel because the armour layer has been broken up). This will require a better understanding of particle size distribution in these reaches. The extent of such a program should not be underestimated as the aggrading reaches in the mid Tukituki are over 60km in length, although not every kilometre will require raking. The key is to decide if the beach raking lowers the magnitude of future flood events to a

significant level to justify the cost. .It is stressed that even if a beach raking program is deemed technically feasible and affordable, this does not guarantee that the desired sediment transport will occur, as it is solely dependent on the lower magnitude flood events occurring at their predicted probabilities of occurrence.

Such a program, if deemed technically feasible, will require a works program to be developed, and a costing analysis and formal consultation with prospective scheme ratepayers and gravel extractors.

If gravel raking and associated flood activity was successful in promoting sediment transport into the lower Tukituki reaches, it follows that this will increase sediment transport to the coast. From a coastal processes perspective this is an extremely positive outcome. Also, given this 'benefit', other funding options for the gravel raking program may be considered under the Local Government Act.

Given the currently very high costs of extracting the entire or a substantive portion of the gravel resource above the grade lines from the upper Tukituki River, the current comprehensive program of beach raking is recommended to continue on an annual basis. It is not considered that any increase in raking frequency, for example to twice a year raking, would be beneficial, as sediment transport is still dependant on close to an annual probability flood event occurring following the raking operation.

7.1 Conclusion

It is clear that the upper Tukituki scheme is under some pressure in terms of consistently achieving its scheme design standards due to the gravel build-up. This is not the entire scheme, but rather localised reaches, usually coinciding with channel grade changes and tributary confluence performance. In fact reasonably long reaches of the upper Tukituki scheme are at or even below the design grades, while in other reaches where bed levels are above grade, channel width and slopes and other hydraulic parameters mean that minor or no issues exist.

Hence, focusing either commercial gravel extraction or scheme funded extraction on specific localised problem areas (e.g. Makaretu, Tukipo and certain reaches of the Tukituki main channel) should be the forward strategy in conjunction with the ongoing beach raking program.

The potential construction of the Ruataniwha Dam and the resultant gravel entrapment within the reservoir will stop downstream sediment transport from the Makaroro to downstream reaches of the Waipawa River, which over time, will allow existing aggradation to be moved downstream. Having greater control and ability to direct demand generated from the Ruataniwha Dam and associated development, or any other major developments into localised problematic reaches is the most promising 'lever' available to HBRC, and is a key finding of this report. The recommendation for HBRC to hold the resource consents for gravel extraction and use an 'authorisation' approach to allocating and directing gravel extractors into required areas will enable the opportunities created by the dam to be capitalised on.

Given demand often exceeds allocated gravel supply in the Heretaunga Plains, it is recommended that commercial interest is canvassed on transporting and stockpiling high quality aggregate from Central Hawkes Bay sources to Heretaunga stockpile areas for future use over time. This will inevitably be a commercial negotiation between HBRC and interested companies or consortium of companies.

It must be kept in mind that the Hawkes Bay rivers are very much shorter in length and smaller than the fully braided river systems of the Canterbury region. This results in faster changes in gravel status. Hence, the current consenting approach of annual consents has given the most flexible method for accommodating such changes. However, a correctly designed authorisation process can accommodate the variable supply over the medium and long term horizons.

It is clear that the situation of considerable aggradation in the mid Tukituki River cannot be allowed to continue indefinitely. Even if gravel extraction could be directed into the mid Tukituki reaches, this alone and without other channel management works will lead to future flood hazard and drainage issues. At a minimum, a beach raking program within the mid Tukituki reaches is required.

While the formation of a flood scheme has been raised with ratepayers on a number of occasions and rejected, this should be considered again. In the past, a flood scheme has been discussed in a context of mid Tukituki channel capacity, and while this is a primary driver of a future scheme, the lower Tukituki and coastal erosion issues along the Hawkes Bay coastline (given the south to north longshore drift) are now new factors that could help justify and indeed fund a flood scheme for the mid Tukituki River.

8 Iwi Issues in Relation to the Gravel Resource

Across New Zealand, iwi have long standing interests in freshwater, including the bed and banks of rivers and lakes that together make up the "*mauri*" or life-force of the water body. To date, Treaty of Waitangi Settlements across the country have recognised iwi interest in freshwater.

To date Hawkes Bay Iwi has been involved in managing Hawkes Bay's freshwater resources via an agreed process on individual resource consents, during regional plan changes and more recently through the joint planning committee.

In 2010, a Hui was held at Kohupatiki Marae with iwi members from across Hawkes Bay attending. The Hui minutes record useful discussion on gravel management issues and an improved understanding by all participants of the challenges that surround gravel management in Hawkes Bay. More specifically, the following points from the Hui are noted:

- The concepts of whakapapa, maunga, mana whenua and atua values need to be recognised and adopted into both gravel management and river management;

- There is a need for a better method for involvement of iwi in gravel management;

- It would be useful to have Waahi Tapu and key Mahinga Kai sites identified for key rivers so effects upon these sites can be avoided or managed during works operations;

- The consent process for Winstone's coastal extraction was a good example of Tangata Whenua input into consent conditions that allows Tangata Whenua to participate and monitor the activity. This has allowed the development of a good relationship between parties and this approach could be used elsewhere;

- An opportunity was requested for Maori to gain hands on experience on the management of gravel in Hawkes Bay.

The formation of a Joint Planning Committee is a key avenue which gives Mana Whenua input to plan change review processes and allows the articulation of cultural values in respect to holistic waterway management including management of the gravel resource. In turn, any such values can be incorporated into resource consent condition where appropriate. Examples of this already exist stemming from the Treaty of Waitangi Settlement for the Mohaka River and the resultant specific arrangements within the RRMP, and the Statutory Acknowledgement for Maungaharuru.

9 Gravel Management Research Strategy

It is very evident that a good understanding of the gravel resource is vital to its ongoing management. The following research strategy for gravel management builds on and refines the comprehensive recommendations presented in all previous reports and outcomes from this report. This research strategy is not intended to contain detailed scopes of work, methodologies or costings, but rather present a comprehensive and consolidated strategy for all aspects of gravel management. The research strategy can be considered in six areas of research that cover:

- Geomorphological Monitoring and Investigations
- Sediment Transport Prediction
- River bed Level Monitoring
- Petrological and Geotechnical Studies
- Cultural Investigations and Monitoring
- Environmental Monitoring
- Aggregate Source Inventory

9.1 Geomorphological Monitoring

Geomorphological monitoring of upper catchment areas is recommended to ascertain the status of primary slip and erosion areas that are the key gravel supply areas for the Hawkes Bay Rivers. In later years, such riparian slip areas have become the main sources of gravel supply, as browsing animal control has allowed upper catchment vegetation to successfully regenerate and remove these areas as gravel sources. Such monitoring is also often undertaken for emergency management purposes, as landslides can partially or completely block river channels in their upper reaches and the resultant water level build-up can result in a catastrophic 'dam break' that poses significant downstream flood risk.

Essentially this involves updating the work of Black (1992) by identifying and mapping key slips and landslides. Once mapped, aerial reconnaissance by helicopter following each major flood event, or at three to five year intervals should be undertaken. This is standard practice by other Regional Councils.

9.2 Sediment Transport Prediction

This work essentially requires the ongoing maintenance and refinement of the sediment transport 'GRATE" model constructed by NIWA and now administered by HBRC. Appendix E contains a proposal from NIWA to the Ministry of Business, Innovation and Employment to continue New Zealand-wide research in the sediment modelling area, including specific field studies in Hawkes Bay. It is recommended that HBRC support this research either on an in-kind basis or financially, as the GRATE model is fundamental to the ongoing management of the resource.

Once sufficient confidence surrounds the GRATE model, it should be used to specifically analyse the following matters:

- The potential for a beach raking program in the mid Tukituki River. This should ascertain the benefit of such a program in terms of potential transport into the lower Tukituki reaches versus the costs of such a program;
- The effects of climate change on sediment transport processes. Essentially this involves using existing climate change scenarios of high intensity and duration rainfall to predict the frequency and magnitude of 'threshold of motion' sediment transport events;
- The degree of abrasion with distance downstream. Field inspection suggests this will be very significant in the Tukituki River and could have a bearing on a potential mid Tukituki beach raking program;
- The potential for greater sediment transport to reach the coast, particularly from the Tukituki and Waipawa rivers given the coastal erosion affecting the Hawkes Bay coastline.

9.3 River Bed Level Monitoring

River bed level monitoring is the most critical database for gravel management and required by the GRATE model and other computations to determine the amount of gravel to allocate or how much aggradation is occurring. While Stevens and Larsen (2015b) recommend that a more intensive cross-section monitoring network at a 250 m spacing interval is undertaken and monitored, recent work by HBRC has shown that LIDAR missions are giving at least comparable results and yield continuous spatial bed level information. Hence, a final decision should be made on the method of bed level monitoring once these initial investigation results are confirmed. Relative costs and associated resourcing will also be a factor in this decision.

9.4 Petrological and Geotechnical Studies

At present, little or no systematic particle size or petrological analyses exists for the Hawkes Bay rivers that is available to HBRC. It is likely that commercial operators collect such data at specific extraction sites, but this information is considered commercially sensitive and not generally released. This makes HBRC reliant on gravel extractors' advice on where suitable gravel sources for end uses exist. Hence, HBRC should undertake thin section and x-ray diffraction analysis at the key abstraction sites, particularly at sites where localised aggradation problems are occurring and where HBRC wants to direct commercial extraction. The key objectives from HBRC's river management perspective is to hopefully demonstrate that high quality gravel sources, with lower processing costs in aggrading reaches, is available, in an effort to promote these locations to extractors.

This should also include an investigation into mudstone sources and abrasion (via lithology Wolman counts) and associated modelling, as the presence of mudstone in the gravel is important to the extractors as it adversely impacts gravel quality.

Particle size monitoring of river sediments is used in sediment transport predictions and modelling, and is also valuable to understand the resource's suitability for end uses. While sediment particle size naturally decreases with distance downstream, extractors targeting the coarse fractions for key uses, results in smaller sizes occurring at extraction sites and also downstream. Within aggrading rivers, selective extraction of the larger particle sizes actually improves the sediment transporting capacity of smaller flood

events. Hence, understanding particle size may inform critical gravel management and assist financial decisions; therefore, it is recommended that particle size data collection is undertaken. These samples should be taken at repeatable cross-section network locations and annual samples be taken for the first three years to create a baseline of information; and then every three to five years or after major flood events.

The sampling of the 'armour layer', beneath the armour layer and a 'whole of bed' analysis should be undertaken and resultant grading curves for the three categories calculated at each site. A sampling methodology is required to be carefully selected to ensure repeatable results. This will also enable informed decisions to be made when allocating gravel in different areas, and not be solely reliant on the commercial extractors' advice on gravel size as a reason for only taking gravel from immediate local sources.

In 2006, Transit New Zealand (TNZ), now the New Zealand Transport Authority (NZTA), developed a set of aggregate specifications for New Zealand's state highways, denoted as M/4: 2006, details of which are presented in Appendix F. Local councils generally default to using the TNZ specifications in lieu of developing their own, particularly when high quality aggregate is readily available and transport costs do not prohibit its use, as is the case for the Napier City Council. HDC engages independent contractors to carry out pavement sealing work, and specifies that TNZ M/4 aggregate specifications must be adhered to, along with evidence of aggregate testing and M/4 compliance at the commencement of every contract.

In Central Hawkes Bay, the district council also engages contractors to carry out resealing, who must meet the TNZ M/4 aggregate specification. For local roads administered by the council however, alternative materials (red metal and rotten rock) are used, due to transport costs associated with high quality aggregate. The council do not hold specifications for this alternative roading material.

In other areas with limited access to high quality aggregate, for example Northern Hawkes Bay, where sources of good quality aggregate are too distant and therefore expensive to transport, the local council has developed its own set of aggregate specifications for rural roads. These specifications appear more relaxed and less rigorous than the TNZ M/4 specifications which cater for high volume state highways. Lower volume roads, particularly rural roads and unsealed surfaces, can be successfully constructed using alternative materials such as aggregates with a lower testing threshold than TNZ M/4.

Examples of local councils' aggregate specifications are also included in Appendix F.

As discussed above, in order for HBRC to obtain a better understanding of the resource they control, source qualities of the gravels at extraction points is a key consideration. Much of this information is already known by individual contractors. A regional ratings system for the different gravel sources across the region needs to be assigned through using TNZ standards for:

- California Bearing Test;
- Sand/Clay Equivalent;
- Crushing Resistance; and,
- Weathering index.

Testing would be repeated at regular intervals (not exceeding 2-yearly), or should it be noted that source quality was changing, to verify that representative aggregate source properties have not significantly changed and still comply with the assigned 'rating'. Test strips may be installed on roads for standard periods of time to evaluate performance of lower quality aggregate or alternative materials.

9.5 Cultural Investigations and Monitoring

The Cultural Health Index and other similar approaches are useful tools for Māori, especially in resource consent issues. It is understood that HBRC is keen to assist iwi to undertake these studies and to provide resource kits to asset the work.

Waahi Tapu and Mahinga Kai mapping within riverbeds has been identified as a possible work stream where scheme operations or gravel extraction activities occur.

9.6 Environmental Monitoring and Research

Work to date on environmental issues associated with the gravel resource, have progressed to the stage where future monitoring and research requirements in Hawkes Bay are understood. This includes the following:

- Monitoring threatened species of river bird colonies and ways to protect such species from river gravel operations;
- Specific monitoring of river bird activity in relation to gravel management activities carried out within the river bird protection (works exclusion) period;
- Tree lupin effects study and control strategy;
- Study of riverbed morphology change from flood control activities;
- Monitoring of river berm vegetation;
- Willow under planting and direct seedling trial (builds on bitter willow trial findings);
- Undertake an assessment of potential effects from riverbed gravel extraction to both indigenous fish and trout and mapping of the sensitivity of river reaches according to fish values.

9.7 Aggregate Source Inventory

Stevens and Larsen (2015).recommended that an inventory of land based gravel resources was needed including details on:

- Location
- Aggregate Quality
- Quantities extracted

This was considered necessary to better understand the total aggregate supply and demand within, the region.

9.8 Section 36 Charges

Once the recommended areas of further research are scoped in detail and then costed, the research program will be consulted upon via a Long Term Plan/Annual Plan Council process. Once the final research

strategy and associated costs are known, the section 36 charges will require recalculation and its own Long term Plan/Annual Plan consultation.

10 Recommendations

No single recommendation will be successful in isolation in achieving the 'balancing act' outcomes for the Hawkes Bay gravel resource. Instead, it is when the various recommendations are used in unison and over the most optimal timeframes that the desired outcomes have the best chance of being realised. Notwithstanding the recommendations presented below, gravel management will always be 'weather dependant' as large flood events (or earthquakes) exert a dominate control over sediment transport processes along with 'market dependant' factors as economic activity directly drives gravel demand. The following recommendations are grouped into short, medium and long term actions to take advantage of the synergistic nature of the combined recommendations over time.

10.1 Short Term

It is recommended that within the next 1 to 3 years, the following is undertaken:

1. Draft a Hawkes Bay Gravel Management Strategy and attempt to obtain a high degree of stakeholder support before initiating a Special Consultative Process under the Local Government Act for its adoption by Council.

2. Consider using the same Local Government Act, Special Consultative Process, to adopt the current version of the Engineering Code of Practice.

3. Consider including by reference the Gravel Management Strategy and latest version of the Engineering Code of Practice within the next scheduled plan change process.

4. Commence commercial discussions with Central Hawkes Bay District Council to evaluate if gravel can be extracted from localised problematic areas for their roading program.

5. Commence discussions with the consortium of gravel extractors that have previously expressed interest in transporting Central Hawkes Bay gravel to the Heretaunga Plains for stockpiling and resale over time.

6. Commence discussions with NZTA on future State Highway projects and resultant gravel demand in an effort to influence where this gravel is sourced from before tenders are let for such projects.

7. Commence a commercial discussion with Winstone Ltd. regarding a future riverbed aggregate source, if the coastal extraction consent at Awatoto is not re-consented on its expiry in 2018.

8. That more proactive discussion is undertaken with particularly Napier and Hastings Councils to understand the price point differences from their land based sources versus river sources.

9. Formally recommend to Council and Upper Tukituki Scheme ratepayers that gravel extraction be added to the programme of works for the flood scheme (given that gravel extraction has not previously been funded by Flood Scheme works in the past).

10. Undertake a review of localised problematic areas within the upper Tukituki Scheme and establish how much gravel is required to be extracted and what associated channel management works would complement gravel extraction. Use this information to prepare a schedule of works for future years that balances flood risk and drainage issues with cost.

11. Formally review the upper Tukituki Scheme rating to ascertain whether scheme funded gravel extraction can be financed by either diverting existing scheme rates, or increasing scheme rates, to fund this new activity.

12. That HBRC Assets Section constructs suitably detailed resource consent applications, initially for the Ngaruroro catchment and then for all other major extraction sites across the region, for a requested duration of 10 years and becomes the consent holder for all major gravel extraction in the region.

13. That the Consent Authority function for gravel is internally transferred to the Regulatory Department of Council to avoid conflict of interest and separation of statutory functions, and all necessary internal system and process changes are made to facilitate this. Ensure that any new permitting processes adhere to the Guiding Principles developed in Section 6.3 of this report.

14. That any formal internal delegations are reassigned and the legal charging basis for the permitting activity contained within the Long Term Plan and successive Annual Plans is checked for accuracy.

15. That internal Key Performance Indicators are developed and agreed, to ensure efficient and timely consent processing is delivered particularly for short term gravel permits.

16. Begin to formally record information on 'gravel use' during the permitting process.

17. That 'pro forma' consent documents are prepared within the Regulatory Department for short term (1 year) consent decisions to maintain the current systems service level for such consents.

18. Assuming long term consents are successfully granted to the Assets Section, offer long term access via an 'authorisation processes to commercial operators in the Tukituki and Waipawa catchments (as opposed to annual consented volumes). Some form of competitive tendering maybe in order to award the gravel allocations. Where advantageous, HBRC consider internalising all land access agreements and other arrangements (e.g. stockpile sites etc.) in the Tukituki and Waipawa catchments.

19. Consider waiving any 36 or 108 charges for gravel extraction from the Waipawa and Tukituki for the next 3 years and then review.

20. Continue to decline resource consents for gravel extraction in rivers where evidence shows that gravel extraction is not sustainable, except in particularly localised reaches that are causing significant channel management issues (e.g. flood banks erosion). This includes the Esk, Tutaekuri, and lower Tukituki rivers.

21. Develop costings and a details program for the research strategy outlined in Section 9 of this report, and submit the program to the next annual plan/long term plan process. Following this develop detailed methodologies and project plans for each component of the research.

22. Once the final research strategy and associated costs are known, recalculate the section 36 charges and undertake consultation on these charges via the Long term Plan/Annual Plan process.

23. As recommended within the Research Strategy, undertake geotechnical and petrological analysis of initially the Central Hawkes Bay river sources to establish if this material matches the standards contained in Appendix F, in an effort to 'market' the quality of this resource.

24. Publish an annual riverbed gravel report that includes amounts of gravel taken from catchments, the use of this gravel and the bed level status of the Regions Rivers.

10.2 Medium Term

It is recommended that within the next 3 to 5 years, the following is undertaken:

1. Undertake a funding options study for a mid Tukituki flood scheme that considers the costs and benefits for:
    - mid Tukituki riparian landowners;
    - lower Tukituki riparian landowners;
    - coastal hazard issues;
    - increasing gravel availability for extraction in the lower Tukituki;
    - The region as a whole.

2. Within the regional plan review, commencing in 2020, include plan change provisions that address the matters outlined in Section 6.2 of this report.

3. Consider a plan change to the Regional Policy Statement (and possibly to the Regional Plan and District Plans) to give priority to river based aggregate sources over land based quarries and 'paddock stripping' operations.

4. Commence discussions with Hawkes Bay Territorial Authorities to address the RMA regulatory duplication in respect to earthworks and gravel permits and develop better planning practice in this area that reduces unnecessary compliance costs.

5. Complete a study similar to Black (1992) of sediment supply areas to the Heretaunga and Ruataniwha Plains and commence monitoring of sediment supply sources and for gravel management and Civil Defence purposes.

6. Undertake and maintain an inventory of land based gravel sources to better understand total aggregate demand in the region.

7. That 5 year gravel forecasts are regularly produced, consistent with the methodology outlined in Stevens and Larsen (2015a).

10.3 Long Term

It is recommended that within the next 10 years, the following is undertaken:

1. That a mid Tukituki Flood Scheme is set up and maintained, particularly focused on channel capacity maintenance.

10.4 Future Iwi Involvement in Gravel Management

Given the agreed outcomes of the 2010 Gravel Management Hui, the recommendations of this report and existing HBRC/Iwi process already in place, the following is recommended:

- Iwi input and consultation on the Gravel Management Strategy is undertaken;
- That the ongoing work of the joint planning committee consider the suggested plan changes for gravel management issues raised in this report;
- Combined gravel management stakeholders meetings with iwi are programmed;
- Iwi involvement is sought in the resource consent processes for long term gravel consents;
- A gravel 'Hikoi' is organised to key gravel extraction sites where gravel management operations are explained and feedback given from a cultural perspective;
- Consideration of Waahi Tapu and Mahinga Kai identification and mapping and resultant scheduling in future regional plan changes in respect to riverbeds;
- As in the Bay of Plenty Region, Hawkes Bay iwi could consider applying for resource consents for gravel, either as a commercial proposition or for a 'cultural purpose' (e.g. hangi stones), given the precedent that already exists for iwi holding a water permit from the Ngaruroro River for a 'cultural purpose'.

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APPENDICES

Appendix A. HBRC Regional Policy Statement and Regional Plan Analysis

Hawkes Bay Regional Policy Statement

3.11 River Bed Gravel Extraction

ISSUE

3.11.1 River gravels provide a supply of a valuable resource utilised in a multiplicity of ways by the community. In extracting from rivers the risk of an imbalance between the natural supply of and the rate at which gravel is extracted, and of adverse effects as a consequence of extraction in the river bed needs to be managed.

This issue recognises the region wide importance of the regions gravel resource, but at the same time, the necessity to sustainability manage the resource. This is reflected in the holistic objectives of this study.

OBJECTIVES

OBJ 28

The avoidance of any gravel extraction at a rate which exceeds the rate of natural supply, except in areas where there are stored reserves which may be removed in a controlled manner such that flood protection and river control assets are not compromised.

OBJ 29

The facilitation of gravel extraction from areas where it is desirable to extract excess gravel for river management purposes and the minimisation of flood risk, or to maintain or protect the functional integrity of existing structures, whilst ensuring that any adverse effects of gravel extraction activities are avoided, remedied or mitigated.

OBJ 30

The maintenance of the use and values of the beds of rivers and the avoidance of any significant adverse effects on the river bed resulting from the extraction of gravel.

POLICIES

POL 50 RESOURCE ALLOCATION - GRAVEL ALLOCATION ASSESSMENT

3.11.7 To assess the availability of river bed gravel by:

(a) Defining both annual and long-term extraction rates for the regional gravel resource for each river bed within the region where major extraction takes place. These rates will be based on regular monitoring of the rate of extraction, and an assessment of the river design profile, supply of gravel to the coast, and supply of gravel from upstream sources (including land use activities).

(b) Ensuring that as far as practicable, long-term gravel extraction is undertaken at a level consistent with maintaining the rivers close to their design profiles, while maintaining compatibility with other resource management and environmental values.

Explanation and Reasons

3.11.8 Policy 50 establishes the approach to be taken by the HBRC when assessing the availability of river bed gravel for extraction and determining both annual and longer term levels of gravel allocation. This policy recognises that the quantity of gravel available for extraction from within the region's rivers may fluctuate depending on the rates of supply and the qualities of the individual river. This policy also seeks to ensure that, as far as practicable, long term gravel extraction is undertaken at a level that enables the natural flow and path of the river to be maintained.

Policy 50 has been diligently implemented by the ongoing and now long term activities of the River Engineering Department of HBRC.

POL 51 RESOURCE ALLOCATION - GRAVEL ALLOCATION PROCESS

3.11.9 To allocate gravel from river beds in Hawke's Bay generally on an annual basis, in accordance with the following approach:

(a) Determining by 15 April each year the likely demand for river bed gravel. Gravel extractors will be contacted at the beginning of March each year, and required to provide notice of their requirements for gravel by 15 April. Requests for gravel allocation will be required to specify the proposed end use of the gravel.

(b) Carrying out an assessment and allocation process between 15 April and 30 June each year, in accordance with Policy 50.

(c) Notifying gravel extractors of their annual allocation by 1 July each year.

Explanation and Reasons

3.11.10 Policy 51 establishes the approach to be taken by the HBRC when allocating the gravel reserves of the region's rivers. The HBRC will allocate gravel to resource users on an annual basis, based on the gravel extractors' requirements, the gravel resource determined to be available in accordance with Policy 50, the proposed end use of the gravel, and an assessment of the effects of extraction. Council will determine the appropriate location for sourcing the gravel especially where demand for gravel in a particular location exceeds supply and alternative locations are required.

Policy 51 describes the HBRC gravel management approach that has been in place for some years. The policy is very detailed and prescribes the current steps that are followed each year under the current system. As this is a policy, there is no issue with using a different approach to allocating gravel that is not fully consistent with Policy 51. However, it is recommended that a less prescriptive policy be drafted for any future plan change process.

POL 52 RIVER BED GRAVEL EXTRACTION – MOHAKA RIVER

3.11.11 In relation to the Mohaka River, the:

(a) annual total volume of extraction for the Mohaka River below the Te Hoe junction;

(b) location of any extraction sites; and

(c) periods and rates of extraction at each site are to be negotiated and agreed to prior to 30 June each year between the Hawke's Bay Regional Council and nominated representatives of Ngati Pahauwera.

Explanation and Reasons

3.11.12 Policy 52 implements a recommendation of the Waitangi Tribunal.

This is a reasonably recent change to reflect the Treaty Settlement and no practical issues have been experienced in its implementation.

POL 53 DECISION-MAKING CRITERIA - RIVER BED GRAVEL EXTRACTION

3.11.13 In considering consent applications for the extraction of river bed gravel, to have regard to the following criteria:

(a) The capability to restore the extraction site upon completion of the extraction operation, and to repair any damage caused to any banks, access roads, fences, gates, or other structures.

(b) The avoidance of any contaminants from machinery use entering water bodies.

(c) The avoidance of any increases in sediment discharge or water turbidity, particularly during the fish spawning period of May to October.

(d) The continuation of existing fish passage.

(e) The avoidance of any adverse effects on flood control assets or river protection works.

(f) The avoidance of any activity that would cause flood control measures or river protection works to be required.

(g) The avoidance of any offensive or objectionable discharge of dust.

(h) The end uses of the gravel, in order that high quality gravel is allocated to uses which require such gravel.

(i) The location of, and potential effect on, any downstream water takes/users.

(j) The effect on the ecology of the river.

(k) The extent to and the time over which natural processes will be capable of returning the river bed to a state of equilibrium following extractive activity.

Explanation and Reasons

3.11.14 Policy 53 provides guidance to resource consent applicants and decision makers in respect of applications to undertake gravel extraction within the region's rivers. This policy establishes criteria which the resource consent application will be assessed against. In addition any resource consent application to extract river bed gravel should have regard to Objective 45 and Policy 79 when assessing the adverse effects of any proposed extraction activity.

The Decision Making Criteria of Policy 53 cover some of the key aspects of gravel management and are routinely reflected in standard consent conditions. The majority of the criteria deal with effects upon the environment with the exception of (h), which deals with allocating high quality gravel to those end uses that require such quality, which is considered good resource management. No criteria exist on the use of gravel extraction as a critical method for maintenance of channel flood capacity, or sustainable allocation of the gravel resource. These criteria could be reviewed as part of a future plan change to encompass these matters.

POL 54 PROBLEM SOLVING APPROACH - INTEGRATION WITH RIVER CONTROL WORKS

3.11.15 To integrate the management of gravel extraction with river control works by:

(a) Encouraging gravel extraction where there is the potential to minimise flooding or the risk of damage to protection works or essential structures.

(b) Undertaking specific works to control erosion and encourage gravel movement where appropriate.

Explanation and Reasons

3.11.16 Policy 54 sets out the approach to be taken to integrate the management of gravel extraction with river control works in order to minimise flooding, erosion and the risk of damage to works and essential structures (e.g. bridges). This policy recognises the positive influence that the managed extraction of gravel can have on minimising flood risk and assisting with the overall management of the river.

Policy 54 is central to the management of the current regional gravel issues, and essential is a policy that provides the key link between flood capacity and gravel extraction activities. This policy can be used in the consent authority's statutory analysis for directing gravel extraction to areas of aggradation. The word 'encouraging' is noted, but this does not directly imply only the use of non-regulatory methods and can be one element to justify a consent decision.

Regional Resource Management Plan

OBJECTIVE

OBJ 45 The maintenance or enhancement of the natural and physical resources, and use and values, of the beds of rivers and lakes within the region as a whole.

This objective recognises the region wide importance of the regions gravel resource, but at the same time, the necessity to sustainability manage the resource. This is reflected in the holistic objectives of this study.

POL 79 ENVIRONMENTAL GUIDELINES – BEDS OF RIVERS AND LAKES

5.8.1 To manage the effects of activities affecting river beds and lake beds in accordance with the environmental guidelines set out in Table 12 below:

Table 12. Environmental Guidelines – Beds of Rivers and Lakes

Table 12. Environmental Guidelines – Beds of Rivers and Lakes

Issue	Guideline
1. Fish passage	The activity should be undertaken in a manner that continues to provide for the existing passage of fish past the structure.
2. Fish spawning	In areas of fish spawning the activity should be undertaken in a manner that minimises adverse effects on overall fish spawning patterns.
3. Bed stability	No long term or ongoing acceleration of the rate of erosion or accretion of the bed of a river or lake as a result of any activity in a river bed or lake bed.
4. Habitat	Adverse effects on the habitat of aquatic and terrestrial flora and fauna within the bed of a river or lake should be avoided, remedied or mitigated.
5.Flow regimes	Adverse effects on natural flow regimes should be avoided where this is possible, or remedied or mitigated where avoidance is not possible.
6.Other structures & activities	There should be no significant adverse effects, including by way of destabilisation, on lawful existing structures or activities within the bed of a river or lake.
7. Flood & debris risk	There should be no reduction in the ability of the channel to convey flood flows, and no significant impedance to the passage of floating debris.
8. Damage to property	There should be no damage caused, and no increase in the risk of damage, to any property, including river control works, unless written approval is obtained from any affected parties.
9. Temporary activities	Upon completion of any temporary activity affecting the bed of a river or lake, the bed should as far as practicable be restored to no less than the state it was in prior to the activity taking place.
10. Outstanding natural features	Adverse effects on any outstanding natural features within river and lake beds should be avoided, remedied or mitigated.

Explanation and Reasons
5.8.2 Policy 79 sets out environmental guidelines for the management of activities affecting river beds and lake beds, including structures in, on, under or over river or lake beds, and bed disturbances. The environmental guidelines address the management of both natural and physical resources within river beds and lake beds.

POL 80 IMPLEMENTATION OF ENVIRONMENTAL GUIDELINES – RIVER BEDS & LAKE BEDS

5.8.3 To implement the environmental guidelines for river beds and lake beds set out in Policy 79 predominantly in the following manner:
(a) Regional rules – The environmental guidelines have been incorporated in conditions, standards and terms in the rules set out in Chapter 6 of this Plan, and to guide the level of regulation, as appropriate. In particular, the use, maintenance and removal of structures have been allowed provided adverse effects are managed in accordance with the environmental guidelines.
(b) Resource consents – The environmental guidelines will also be used in the process of making decisions on resource consents, in accordance with section 104 (1)(b) of the RMA.

Explanation and Reasons
5.8.4 Policy 80 establishes that the environmental guidelines for river and lake beds will be used to guide regulation. They have been used in rules, and will be used in resource consent processes.

ANTICIPATED ENVIRONMENTAL RESULTS

Anticipated Environmental Result	Indicator	Data Source
Fish passage and spawning are able to continue despite the erection or use of a structure or bed disturbance	Abundance of fish in selected locations	Department of Conservation Fish and Game HBRC
Avoidance, remedy or mitigation of adverse effects on natural flow regimes	Natural flow regimes	Flow monitoring programme
No significant adverse effects on existing structures or activities within the bed of a river or lake	Destabilisation of existing structures or activities	Compliance monitoring
No reduction in ability of channels to convey flood flows	River bed cross section profiles	Asset Management Plans and flow monitoring
No damage to property by works in river beds, without owners consent	Reports of damage from river control works	Occasional event reports

Anticipated Environmental Result	Indicator	Data Source
Restoration of river or lake bed following temporary activity	As far as practicable the bed is restored to at least its state prior to activity occurring	Compliance monitoring
Aquatic habitat is maintained at a sustainable level	1. Temperature not changed by more than 3°C nor raised above 25°C; 2. dissolved oxygen not exceeding guideline values; 3. ammoniacal nitrogen levels not exceeding guideline values; 4. soluble reactive phosphorous values not exceeding guideline values; 5. no loss of fish species or indigenous invertebrates	Council water quality monitoring programme

Rules

The key rules that govern gravel extraction and river control works are Rules 70, 71, 73 and 74. Each Rule is analysed below.

6.8.3 River Control & Drainage Works & Structures

Rule	Activity	Classification	Conditions/Standards/Terms	Matters for Control/Discretion	Non-notification
70 **River control & drainage works & structures** *Refer POL 79*	Any activity, as described in the Hawke's Bay Regional Council Environmental Code of Practice for River Control and Drainage Works (1999), that is carried out by a local authority exercising its powers, functions and duties under the Soil Conservation and Rivers Control Act 1941, the Land Drainage Act 1908, or the Local Government Act 1974, in relation to flood control and drainage, including: • edge protection works • planting • river protection maintenance works • irrigation intake maintenance • weed and vegetation control (excluding spraying) • drain maintenance, and drainage outlet maintenance • drain crossings • river mouth openings for the purpose of flood mitigation • river management and drainage for the maintenance of surface water quality • channel diversions within a river bed or drain, ancillary to the above activities that would otherwise contravene: • section 13 or section 14 of the RMA, or • section 15 of the RMA in relation to the discharge of sediment.	**Permitted**[153]	a. The activity or structure shall be undertaken in a manner that continues to provide for the existing passage of fish past the structure. b. The appropriate Fish and Game Council, iwi and Department of Conservation office, shall be notified at least 5 working days before any channel diversion is undertaken. c. There shall be no discharge of contaminants, other than sediment, arising from the use of machinery in the bed of any river or lake. d. The activity shall not adversely affect any wetland.[154] e. All activities shall be undertaken in accordance with the Hawke's Bay Regional Council Environmental Code of Practice for River Control and Drainage Works, 1999.		

[153] If Rule 70 cannot be complied with, then the activity is a discretionary activity under Rule 69.

[154] For the purpose of this Plan the term 'wetland' does NOT include:

- wet pasture land
- artificial wetlands used for wastewater or stormwater treatment
- farm dams and detention dams
- land drainage canals and drains
- reservoirs for firefighting, domestic or municipal water supply
- temporary ponded rainfall
- artificial wetlands.

Rule 70 effectively allows the HBRC operations team to carry out the listed and referred activities as a permitted activity. It is noteworthy that this does not include gravel extraction.

Rule	Activity	Classification	Conditions/Standards/Terms	Matters for Control/Discretion	Non-notification
71 **Activities affecting river control & drainage schemes**[155, 156] *Refer POL 79*	Any of the following activities, where they are undertaken by persons other than the local authority or persons acting on their behalf, within a land drainage or flood control scheme area that is managed by a local authority exercising its powers, functions and duties under the Soil Conservation and Rivers Control Act 1941, the Land Drainage Act 1908, or the Local Government Act 1974: • The introduction or planting of any plant including any tree in, on, or under the bed of any river, lake or artificial water course, or within 6 metres of the bed. • The erection of any building, fence or other structure in, on, or under the bed of any river, lake or artificial water course, or within 6 metres of the bed. • The deposition of any rock, shingle, earth, debris or other substance in, on, or under the bed of any river, lake or artificial water course, or within 6 metres of the bed. • The reclamation or drainage of the bed of any river, lake or artificial water course. • The undertaking of any other land disturbance activity which impedes access to the bed of any river, lake or artificial water course, or within 6 metres of the bed. • The erection of any structure and the undertaking of any land disturbance activity which interferes with the integrity of any defence against water.[157]	Discretionary[158]			

[155] It is important to note that the Hawke's Bay Regional Council owns much of the land within River Control and Drainage Schemes, and thus has landowner rights and responsibilities in relation to this land.
[156] Any activity permitted by Rules 64 and 65 is not subject to Rule 71.
[157] "Defence against water" includes stopbanks and their foundations.
[158] The ongoing maintenance or repair of any structure authorized by a resource consent pursuant to Rule 71 is permitted pursuant to Rule 64.

Policy 71 has a discretionary activity status and applies to works undertaken by other parties other than HBRC.

6.8.5 River Bed Gravel Extraction

Rule	Activity	Classification	Conditions/Standards/Terms	Matters for Control/Discretion	Non-notification
73 **Small scale river bed gravel extraction** *Refer POL 79*	The extraction of sand, gravel or other material from the bed of a river using a hand-held, non-mechanical device (e.g. a shovel), and any associated disturbance of the bed.	**Permitted**	a. The quantity of bed material extracted by any person at any one time shall not exceed 0.25 m^3. b. The total quantity of bed material extracted by any person shall not exceed 1 m^3 per year. c. The material shall be extracted from an area of river bed that is not covered by water at the time of extraction. d. The area from which material is extracted shall be recontoured so that no mounds or depressions remain. e. There shall be no discharge of any contaminant directly into water.		
74 **Large scale river bed gravel extraction** *Refer POL 53, 79*	The extraction of sand, gravel or other material from the bed of any river or lake, and: • any associated disturbance of the bed, and • any associated discharge of sediment, and • any associated diversion of water that is not provided for by Rule 73.	**Restricted discretionary**		a. Location of extraction sites and stockpile areas. b. Volume of gravel extracted. c. Rate of removal of gravel. d. Period of extraction. e. End use of the gravel. f. Dust management. g. Other matters set out in Policy 53. h. Financial contributions. i. Duration of consent. j. Review of consent conditions. k. Compliance monitoring.	

Rule 73 is a standard permitted activity rule that all councils have for very small scale gravel extraction.

Rule 74 is the key Rule that governs gravel extraction and is a restricted discretionary activity. Section 3 of the report discusses this rule in detail.

8.3 FINANCIAL CONTRIBUTIONS for Gravel Extraction

8.3.1 Where the HBRC grants a resource consent, it may impose a condition requiring that a financial contribution be made for the purposes specified in this Plan.

8.3.2 The term "financial contribution" is defined in section 108 (9) of the RMA as:
"… a contribution of: (a) money, or (b) land, including an esplanade reserve or esplanade strip (other than in relation to a subdivision consent), but excluding Maori land within the meaning of the Maori Land Act 1993 unless that Act provides otherwise, or (c) a combination of money and land."

8.3.3 Section 108 (10) of the RMA states that:
"A consent authority must not include a condition in a resource consent requiring a financial contribution unless:

(a) The condition is imposed in accordance with the purposes specified in the plan (including the purpose of ensuring positive effects on the environment to offset any adverse effect); and
(b) The level of contribution is determined in the manner described in the plan."

8.3.4 Financial contributions may, therefore, be required for a variety of purposes, including the purpose of offsetting any adverse effects. In accordance with section 111 of the RMA, any financial contribution of money collected by the HBRC must be used in reasonable accordance with the purposes for which the money was received.

8.3.5 The following provisions reflect the requirements of the Act and set out:

(a) the circumstances when a financial contribution may be imposed
(b) the purposes for which the contribution may be used, and
(c) the manner in which the level of contribution will be determined.

8.3.6 CIRCUMSTANCES

8.3.6.1 The HBRC will only use financial contributions as a resource management tool in relation to resource consents granted for river bed gravel extraction.

8.3.7 PURPOSES

8.3.7.1 The purposes for which financial contributions will be sought from river bed gravel extractors are as follows:

(a) Construction of, or maintenance of, roads, fences and gates that are used or will be used to access the gravel extraction site.
(b) Stop bank restoration or enhancement to offset the effects of gravel extraction on flooding.
(c) Strengthening or restoration of affected flood control or river stabilisation works.

(d) Replanting of vegetation removed, destroyed or damaged by gravel extractors accessing gravel extraction sites, or by the gravel extraction process.
(e) Downstream planting of riparian margins to offset erosion caused or exacerbated by gravel extraction.

8.3.8 LEVEL OF CONTRIBUTION

8.3.8.1 The level of contribution will be determined in the following manner:
(a) The total annual cost of the works and services to be funded by the contributions (as determined in each year's annual plan prepared pursuant to the Local Government Act 1974) divided by the total annual estimated volume of river bed gravel extraction, thereby giving rise to a uniform financial contribution per cubic metre of gravel extracted.
(b) The final actual financial contributions sought will fairly and reasonably reflect the degree of adverse effects arising as a result of river bed gravel extraction.

This effectively allows the consent authority to impose financial contributions to mitigate the more physical effects and damages on infrastructure in the event of planned or unplanned damage. As discussed in Section 3 of this report, these provisions are not utilised in the existing gravel management process.

Appendix B. Relevant Forms and Documents used in HBRC Existing Gravel Consent Process

REASONS FOR DECISION

1. The consent conditions promote the sustainable management of the extraction operation by avoiding, remedying or mitigating any adverse effects of the activity on the environment.

2. The activity is not contrary to the objectives, policies or Rule 7.1 of the Regional River Bed Gravel Extraction Plan.

STANDARD CONSENT CONDITIONS

1. Unless otherwise indicated by the Council the period to which the consent relates is from 1 July to 30 June thefollowing year.

2. An officer of the Council shall have the right, during business hours, of access to the site of extraction and to the books and documents relating to the extraction of gravel authorised by this consent and kept by the holder in order to check the accuracy of the returns made to the Council.

3. The consent holder shall notify the Council forty-eight (48) hours prior to any new extraction operation commencing within the area specified by the resource consent.

4. The consent does not of itself confer any right of access over private and/orpublic property. Arrangements for access must be made between the consent holder and the property owner (including land under the control of the HBRC).

5. Where the consent holder requires access across river berm areas held by Council under the Reserves Act (or any other relevant Act) and leased to a third party, the consent holder shall negotiate access across that land with the lessee.

6. The consent holder shall ensure that any person exercising the consent shall produce the consent to the Council when requested to do so by a duly authorized officer of the Council.

7. Any authorisation to extract gravel conferred by a consent does not guarantee that the quantity of quality required will be available.

8. Consent holders shall maintain an accurate and accessible daily record of the volume of gravel taken, the site of extractionand the date it was taken. All quantities are to be based on loose measure and rounded to the nearest cubic metre. Such records are to be provided monthly to the HB Regional Council on the Statutory Declaration forms provided.

9. The consentholder shallimmediately repair any damage that they have caused to any banks, access roads, fences , ga tes, protection or other works relating to the control of the river. The cost of such repair shall be met by the consent holder.

10. The consent holder shall ensure that the site is restored on completion of the gravel extraction operation as follows:

a) Gravel heaped up during the process of removal shall be spread out by the consent holder on completion of the gravel extraction operation.
b) Consent holder shall remove all, plant, machinery, equipment, signs and other structures associated with the operation from the riverbed immediately on completion of opera tions.
c) No reject, surplus or unused gravel from a gravel processing plant is to be deposited into or onto the riverbed.

11. A consent does not confer any exclusive right of occupation over the area allotted to the holder.

12. A consent holder shall erect a warning sign (generally in the form shown in Appendix A) adjacent to the site of extraction where as a result of the extraction the stretch of river has or is likely to become dangerous to the public. These signs will be required wherever holes are made in the riverbed, which could become a danger to fishers and others who may use the riverbed. The signs shall be removed on completion of the operation or when the area is no longer a danger to the public.

13. No refuelling or fuel storage shall occur on the riverbed.

14. Should any archaeological site be discovered within the area affected by the operation the consent holder shall as soon as possible notify the Historic Places Trust and the Council.

15. No machinery shall be driven across the active river channel ·without prior authorisation from the Council in consultation with the Department of Conservation and the Hawke's Bay Fish and Game Council or the Eastern Region Fish and Game Council to the north or and including the Waiau River and its tributaries. When driving a vehicle across the river flow, consent holders shall take all practicable steps to prevent an increase in the level of turbidity of the river. The consent holder shall give particular attention to avoiding turbidity within waterways during the fish-spawning period of May-October.

16. a) When extracting gravel from outside the river flow and above the water level, extraction will commence from the water's edge on an even face or as otherwise directed by an officer of the Council. Gravel may be removed only from specified areas, which must be leveled off before leaving the site.
b) When extracting gravel from outside the river flow and below standing water level, consent holders shall maintain a one metre wide barrier between the river and excavation site so that any turbidity increase in the river is kept to a minimum. The barrier is to be removed at the end of the operation.
c) When extracting gravel from the river flow, consent holders shall take all practicable steps to prevent increase in the level of turbidity of the river. Should the gravel extraction operation result in increased turbidity the consent holder shall take all practicable steps, including any actions directed by an officer of the Council, to remedy the turbidity. The consent holder shall give particular attention to avoiding turbidity within waterways during the fish-spawning period of May-October.

17. No hangi stones are to be removed from the Mohaka River, unless they are required for cultural purposes, and then the permission of affected hapu will be needed.

ADDITIONAL SPECIFIC CONSENT CONDITIONS (if required)

1. Access tracks to be watered regularly to keep dust down.

2. No heavy vehicle access to Maori Point at the Omahu public access before 7.00 am or after 6.00 pm, Monday to Friday. No work permitted on the weekends or public holiday.

3. No heavy vehicle access to Maraekakaho at the Monument before 7.00 am or after 6.00 pm, Monday to Friday. Access weekends or public holidays from 7.30 am to 3.00 pm only.

4. No heavy vehicle access at Waipawa on the south side, down stream from Waipawa river bridge before 6.00 am or after 10.00 pm, Monday to Friday. Access weekends or public holidays from 7.30 am to 5.00 pm only.

ADVICE NOTES

1. That pursuant to Section 36 of the Resource Management Act 1991, the applicant is responsible for paying costs relating to receiving and processing of this resource consent. This amount is shown on the application form.

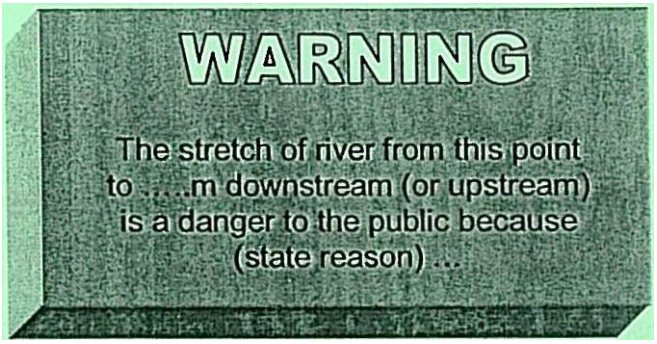
2. Notwithstanding any conditions outlined above, additional specific conditions may be imposed on gravel extraction activities in the region on any occasion, to take account of the site conditions at the time, to protect property, to protect human health, to ensure river or flood control is not prejudiced, or to avoid, remedy or mitigate any adverse effects on the environment.

3. This consent does not constitute authority to erect, reconstruct, place, alter, extend, remove or demolish any structure or to divert water or construct a causeway or discharge gravel wash into a river. These activities are controlled and you must seek a resource consent to carry them out.

4. The consent holder may apply to change the terms and conditions of the consent (except for the duration) if circumstances change (Section 127 of the Resource Management Act 1991).

5. The consent is transferable to any other person unless the consent states otherwise. The transfer has no effect until written notice of the transfer is given to the Council. The same conditions will apply to the new consent holder.

Warning signs erected in accordance with Rule 7.1.5 shall give the advise indicated below:



Appendix C. Other Councils Regulatory Plan Provisions

Greater Wellington Regional Council

Rule R129: All other activities in river and lake beds – discretionary activity
All other activities, except for damming and diverting of water, in river and lake beds that is not permitted or restricted discretionary by Rule R112 to Rule R125 is a discretionary activity except for those activities that are non-complying or prohibited under Rule R126, Rule R127 or Rule R128.

Policy 17-3: Gravel extraction

Having regard to Policies 5-22 to 5-25, activities in, on, under or over the *beds*^ of *rivers*^ and *lakes*^ that enable gravel extraction will generally be allowed provided that:

(a) The long term average annual volume of gravel available for extraction from those *rivers*^ and *river*^ reaches listed in Table 17.1 must be limited to the quantities stated in the table, unless:

- (i) there is a demonstrable *river*^ management need to increase or decrease this volume, or
- (ii) the gravel extraction is necessary to decrease the risk of flooding or damage to *structures*^, or
- (iii) future information establishes that actual sustainable rates of gravel extraction are higher or lower than those in Table 17.1 taking into account the cumulative volumes being extracted, the natural rates of replenishment and the *effects*^, including cumulative effects, of extraction.

(b) For any *river*^ or *river*^ reach not specified in Table 17.1, the *effects*^ of the cumulative volume of gravel being extracted on an annual basis in the *river*^ reaches must be considered, including matters in relation to:

- (i) the natural rates of gravel replenishment,
- (ii) the *effects*^, including cumulative *effects*^, of the gravel extraction,
- (iii) demonstrable *river*^ management needs, and
- (iv) the need to decrease the risk of flooding or damage to *structures*^.

(c) For the purposes of this policy "annual" is defined as 1 July to 30 June the following year.

Table 17.1 Long term average annual allocable volumes of gravel

River or Reach	Volume (m³)
Kawhatau River	20,000
Makino Stream	3,000
Makuriiti Stream	3,000

River or Reach	Volume (m³)
Manawatu River	
• From 1 km upstream of Ngawapurua Bridge to source	20,000
• 1 km upstream to 2.5 km downstream of Ngawapurua Bridge	No extraction
• 2.5 km downstream of Ngawapurua Bridge to Ballance Bridge	15,000
• Manawatu Gorge to Karere Rd	2,500
• Karere Rd to Hamilton's Line	15,000
• Hamilton's Line to Oroua confluence [2007 to 2009]	20,000
• Hamilton's Line to Oroua confluence [2009 onwards] the 2 km aggrading reach between 39 Miles (NZMS 260 S24:212-832) and Benchmark 643 (NZMS 260 S24:226-830)	17,500
• Hamilton's Line to Oroua confluence [2009 onwards] the 2 km aggrading reach between BM 604 (NZMS 260 S24:206-833) and BM 622 (NZMS 260 S24:207-826)	35,000
Mangahao River	15,000
Mangatainoka River	15,000
Ohau River	
• Upstream of a point 1 km above SH 1 bridge	5,000
• Downstream of a point 1 km above SH 1 bridge	10,000
Oroua River	
• Upstream of Menzies Ford	10,000
• Downstream of Menzies Ford	55,000
Pohangina River	25,000
Rangitikei River	
• Makahikatoa Stream to Man	15,000

Horizons Regional Council

17.9 Rules - Gravel Extraction, Bed Disturbances and Plants

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion Non-Notification
17-16 **Small-scale gravel extraction**	The excavation or other disturbance of the *bed*^ of a *river*^ or *lake*^ for the purpose of extracting gravel and other *bed*^ material, pursuant to s13(1) RMA and any ancillary: (a) damming or diversion of *water*^ pursuant to s14(2) RMA (b) *discharge*^ of *water*^ or sediment into *water*^ or onto or into *land*^ pursuant to ss15(1) or 15(2A) RMA (c) deposition of substances in or on the *bed*^ of the *river*^ or *lake*^ pursuant to s13(1).	**Permitted**	(a) The activity must not take place in a *river*^ or *lake*^ regulated under Rule 17-3. (b) The amount of gravel and *bed*^ material extracted must not exceed 50 m^3 in any 12 month period. (c) The gravel or other material must only be extracted from an area of *river*^ *bed*^ that is not covered by flowing *water*^ at the time of extraction. (d) The activity must comply with the general *conditions*^ listed in Section 17.3. (e) The activity must not take place in any *rare habitat**, *threatened habitat** or *at-risk habitat**.	
17-17 **Other gravel extraction**	Except as regulated by Rules 17-3 and 17-16, the excavation or other disturbance of the *bed*^ of a *river*^ or *lake*^ for the purpose of extracting gravel and other *bed*^ material, pursuant to s13(1) RMA and including any ancillary: (a) damming or diversion of *water*^ pursuant to s14(2) RMA (b) *discharge*^ of *water*^ or sediment into *water*^ or onto or into *land*^ pursuant to ss15(1) or 15(2A) RMA (c) deposition of substances in or on the *bed*^ of the *river*^ or *lake*^ pursuant to s13(1) (d) *discharges*^ to air pursuant to s15(2A) RMA.	**Discretionary**	(a) The activity must not take place in any *rare habitat**, *threatened habitat** or *at-risk habitat**.	
17-18 **Other minor *bed*^ disturbances**	Except as regulated by other *rules*^ in this chapter, the excavation, drilling, tunnelling or other disturbance of the *bed*^ of a *river*^ pursuant to s13(1) RMA and any ancillary: (a) damming or diversion of *water*^ pursuant to s14(2) RMA (b) *discharge*^ of *water*^ or sediment into *water*^ or onto or into *land*^ pursuant to ss15(1) or 15(2A) RMA (c) deposition of substances in or on the *bed*^ of the *river*^ or *lake*^ pursuant to s13(1). **Advice Note:** For the avoidance of doubt, this *rule*^ does not include gravel extraction.	**Permitted**	(a) The activity must not take place in a *river*^ regulated under Rule 17-3. (b) The activity must comply with the general *conditions*^ listed in Section 17.3. (c) The activity must not take place in any *rare habitat**, *threatened habitat** or *at-risk habitat**.	
17-19 **Plants**	Except as regulated by other *rules*^ in this chapter, the introduction, planting, removal or destruction of a plant in or on the *bed*^ of a *river*^ or *lake*^ pursuant to s13(1) or s13(2) RMA, and any ancillary: (a) excavation, drilling, tunnelling or other disturbance of the *bed*^ of a *river*^ or *lake*^ pursuant to s13(1) RMA (b) damming or diversion of *water*^ pursuant to s14(2) RMA (c) *discharge*^ of *water*^ or sediment into *water*^ or onto or into *land*^ pursuant to ss15(1) or 15(2A) RMA (d) deposition of substances in or on the *bed*^ of the *river*^ or *lake*^ pursuant to s13(1).	**Permitted**	(a) A pest plant, as listed in the Regional Pest Plant Management Strategy, must not be introduced or planted. (b) The activity must not involve the planting of a tree or shrub in a reach of a *river*^ with a Schedule B Value of Flood Control and Drainage, as regulated by Rule 17-15. (c) The activity must not involve the removal or destruction of plants in Lake Papaitonga, Pukepuke Lagoon or Lake Horowhenua except for a radius of 500 m from the Lake Horowhenua outlet weir (which is permitted by this *rule*^). (d) The activity must comply with the general *conditions*^ listed in Section 17.3. (e) The activity must not take place in any *rare habitat**, *threatened habitat** or *at-risk habitat**.	

Rule Guide:

Gravel extraction that cannot meet the conditions set out in Rule 17-17 is a discretionary activity under Rule 17-23.

The discharge of contaminants into water or into or onto land, other than contaminants specifically identified in the rules, is regulated by the rules in Chapter 14.

Activities undertaken in *rare habitats**, *threatened habitats** or *at-risk habitats** are regulated under Rules 13-8 and 13-9.

17.8 Rules - Activities Within Rivers with a Schedule B Value of Flood Control and Drainage

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion Non-Notification
Rule 17-14 **Activities undertaken by or on behalf of the Regional Council in *rivers*^ with a Schedule B Value of Flood Control and Drainage**	The following activities within a reach of a *river*^ with a Schedule B Value of Flood Control and Drainage, where they are undertaken by or on behalf of the Regional Council: (a) the erection, placement, or extension of any *structure*^ in, on, under or over the *bed*^ of a *river*^ pursuant to 13(1) RMA (b) the excavation, drilling, tunnelling or other disturbance (including gravel extraction) of the *bed*^ of a *river*^ pursuant to s13(1) RMA (c) any damming or diversion of *water*^ pursuant to s14(2) RMA (d) any *discharge*^ or deposition of plants, removed *bed*^ material, rock, shingle, earth, *cleanfill material**, *water*^ or sediment into *water*^ or onto or into *land*^ pursuant to ss13(1), 15(1) or 15(2A) RMA (e) the damage, destruction, disturbance or removal of plants or parts of plants pursuant to s13(2) RMA.	**Permitted**	(a) The activity must be undertaken in accordance with the Environmental Code of Practice for River Works (Horizons Regional Council, June 2010). (b) The activity must not involve: (i) an activity prohibited under Rule 17-1 (ii) an activity regulated under Rule 17-3, except to the extent that the activities may be carried out in specified Sites of Significance - Aquatic and Sites of Significance - Cultural in accordance with (a).	
17-15 **Activities affecting Schedule B Value of Flood Control and Drainage**	Except as regulated by Rule 17-5, the following activities pursuant to ss 9(2) and 13(1) RMA in, on or under an *artificial watercourse** or a reach of a *river*^ with a Schedule B Value of Flood Control and Drainage or adjacent *land*^ as defined in (j) to (m): (a) the planting of a tree or shrub (b) the erection, placement or extension of any building or other *structure*^ (including accessways) (c) the erection, placement or extension of a	**Discretionary**		

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion Non-Notification
	fence perpendicular to a *river*^ or *artificial watercourse** (d) the erection, placement or extension of a fence greater than 1.2 m high parallel to a *river*^ or *artificial watercourse** (e) the deposition of any rock, shingle, earth, debris or other *cleanfill material** (f) any excavation, drilling, tunnelling or other disturbance likely to undermine the functional integrity of a stopbank or *river*^ control *structure*^ (g) any *land disturbance** that impedes access required for *maintenance** of a *river*^ or drainage scheme (h) the *upgrade**, reconstruction, alteration, extension, removal or demolition of any *structure*^ that is maintained by the Regional Council for the purposes of flood control or erosion protection or drainage and any ancillary: (i) excavation, drilling, tunnelling or other disturbance of the *river*^ or *lake*^ *bed*^ pursuant to s13(1) RMA (ii) damming or diversion of *water*^ pursuant to s14(2) RMA (iii) *discharge*^ of *water*^ or sediment into *water*^ or onto or into *land*^ pursuant to ss15(1) or 15(2A) RMA (iv) deposition of substances in or on the *bed*^ of the *river*^ or *lake*^ pursuant to s13(1) (v) *land disturbance** pursuant to s9(2) RMA where the activities listed in (a) to (h) are			

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion Non-Notification
	undertaken in any of the following areas: (i) within the *bed*^ of a *river*^ or within an *artificial watercourse*^ (j) on a stopbank (k) on any strip of *land*^ between an *artificial watercourse*^ or *bed*^ of a *river*^ and 8 m inland of the landward toe of a stopbank (l) for areas without stopbanks, anywhere within 10 m of an *artificial watercourse*^ or the *bed*^ of a *river*^ (l) Only *land*^ use activities described under (f) and (g) are controlled under this *rule*^ on *land*^ described under (j) and (k) on and adjacent to the Manawatu River secondary stopbank located between Ruahine Street at Fitzroy Bend and Ruamahanga Crescent. The other listed *land*^ use activities are not controlled in that area. This *rule*^ does not apply to activities undertaken by or on behalf of the Regional Council.			

Rule Guide:

The discharge of contaminants into water or into or onto land, other than contaminants specifically identified in the rules, is regulated by the rules in Chapter 14.

17.11 Rules - Activities that do not Comply with Permitted Activity, Controlled Activity or Restricted Discretionary Activity Rules and all other s13(1) RMA Activities Not Covered by this Chapter

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion Non-Notification
17-22 **Activities that do not comply with *permitted activity*^ *rule*^ general *conditions*^**	Any activity that does not comply with Rule 17-5 condition (a), Rule 17-6 condition (a), Rule 17-7 condition (g), Rule 17-9 condition (c), Rule 17-10 condition (j), Rule 17-11 condition (e), Rule 17-12 condition (d), Rule 17-16 condition (d), Rule 17-18 condition (b), Rule 17-19 condition (d), including any ancillary: (a) excavation, drilling tunnelling or other disturbance of the *bed*^ pursuant to s13(1) RMA (b) damming or diversion of *water*^ pursuant to s14(2) RMA (c) *discharge*^ of *water*^ or sediment into *water*^ or onto or into *land*^ pursuant to ss15(1) or 15(2A) RMA (d) deposition of substances in or on the *bed*^ of the *river*^ or *lake*^ pursuant to s13(1).	**Restricted Discretionary**	The activity must comply with all other conditions, standards and terms of the applicable *permitted activity*^ *rule*^.	Discretion is restricted to: (a) measures to avoid, remedy or mitigate the *effects*^ of the activity in relation to any non-compliance with the matters listed in Section 17.3 (b) duration of consent (c) review of consent *conditions*^ (d) compliance monitoring
17-23 Activities that do not comply with *permitted activity*^, *controlled activity*^ or *restricted discretionary activity*^ *rules*^ and all other s13(1) RMA activities not covered by this chapter	Any activity that does not comply with one or more *conditions*^, standards or terms of a *permitted activity*^, *controlled activity*^ or *restricted discretionary activity*^ *rule*^ in this chapter, but which is not expressly classified as a *discretionary activity*^, *non-complying activity*^ or *prohibited activity*^ or is a s13(1) RMA activity not covered by this chapter, including any ancillary: (a) excavation, drilling, tunnelling or other disturbance of the *bed*^ pursuant to s13(1)	**Discretionary**		

Rule	Activity	Classification	Conditions/Standards/Terms	Control/Discretion Non-Notification
	RMA (b) damming or diversion of *water*^ pursuant to s14(2) RMA (c) *discharge*^ of *water*^ or sediment into *water*^ or onto or into *land*^ pursuant to ss15(1) or 15(2A) RMA (d) deposition of substances in or on the *bed*^ of the *river*^ or *lake*^ pursuant to s13(1).			

Rule Guide:

The discharge of contaminants into water or into or onto land, other than contaminants specifically identified in the rules, is regulated by the rules in Chapter 14.

Waikato Regional Council

4.3.4.4 Discretionary Activity Rule – Bed Disturbance Activities

Any river or lake bed disturbance activity, including:

1. Excavation, drilling, tunneling, or
2. The introduction of any plant or part of any plant in, on or under the bed, or
3. Deposition of any substance in, on or under the bed, or
4. Reclamation or drainage of the bed, or
5. The clearance of vegetation in, on or under the bed:

that is not otherwise provided for by, or does not comply with, a permitted or controlled activity rule within this Regional Plan is a **discretionary activity** (requiring resource consent).

Bay of Plenty Regional Land and Water Plan

Rule 71 **Discretionary – Activity in the Beds of Streams, Rivers and Lakes**

Unless provided for by another rule in this regional plan, the:

1 Use, erection, reconstruction, placement, alteration, extension, removal, or demolition of any structure or part of any structure in, on, under, or over the bed of a stream, river or lake,
2 Excavation, drilling, tunnelling or other disturbances to the bed of a stream, river or lake,
3 Introduction of planting of any plant or any part of any plant in, on, or under the bed of a stream, river or lake,
4 Disturbance, removal, damage or destruction of any plant or any part of any plant in, on, or under the bed of a stream, river or lake,
5 Deposition of any substance in, on, or under the bed of a stream, river or lake,
6 Reclamation or drainage of the bed of a stream, river or lake,

Is a discretionary activity.

ECAN

The Minister for Canterbury Earthquake Recovery has made amendments to the following using section 27(1)(a) of the Canterbury Earthquake Recovery Act 2011:

Christchurch City Plan (District Plan);
Natural Resources Regional Plan (NRRP); and the
Proposed Land and Water Regional Plan (pLWRP)

These amendments will alter the requirements for resource consent when undertaking earthquake-related land repairs. Changes to the District Plan, NRRP, and pLWRP are aimed at reducing requirements for resource consent when repairing land with increased liquefaction vulnerability while managing any negative environmental effects. These provisions apply to 'flat land' located within the greater Christchurch area. For repair works on the Port Hills or Banks Peninsula, existing provisions in the Christchurch City Plan, the Banks Peninsula District Plan and Regional Plans apply. The amendments have now been publicly notified in The Press and apply immediately.
Date it takes effect: Friday 5 September 2014

Natural Resources Regional Plan

As a result of the Canterbury Land & Water Regional Plan (LWRP) being made **partially operative on 13 August 2015 and 15 October 2015,** some parts of the NRRP are now inoperative. The parts of the NRRP that **remain operative** are:

- Chapter 1 - Overview
- Chapter 2 – Ngāi Tahu and the management of natural resources
- Chapter 3 – Air quality
- Chapter 5 - Water quantity
- Chapter 6 – Activities in the beds of lakes and rivers

Please note that while Chapters 5 and 6 of the NRRP are still operative, all rules within these chapters are to be treated as inoperative with the exception of rules that relate to the damming of water, or the taking or using of surface water.

6.6 Regional Rules

Rule BLR5 Excavation, drilling, tunnelling, depositing, reclamation, drainage or disturbance in, on, under or over the bed

Activity	Conditions
1. The excavating, drilling, tunnelling, depositing, reclamation, drainage or disturbance (but not including excavation of materials for the erection, reconstruction, placement, use, alteration, extension, demolition or removal of a structure classified by Rules BLR2, BLR3, BLR4 or BLR7) in, on, over or under the bed of a lake or river, is: (a) a **permitted activity** provided the activity complies with all the conditions of this rule; (b) a **discretionary activity** where Condition 1 is not complied with; (c) a **prohibited activity** where Condition 12 is not complied with; or (d) a **restricted discretionary activity** where any other condition is not complied with. This rule does not apply to activities in artificial lakes and detention and retention lakes classified by Rule BLR1.	1. The activity shall not be undertaken in, on, or under the beds of any high naturalness lakes listed in Table WQN19 of Schedule WQN5 in Chapter 5 or Schedule BLR6; 2. No part of the activity shall occur within surface water or at or below the water table. 3. The activity shall not involve the disturbance or removal of any rocks with a diameter greater than 500 millimetres on any axis. 4. The activity shall not include the deposition of any substance, other than bed material, on the bed. 5. The activity shall not be, or result in, the reclamation of the bed. 6. The volume excavated by any person or on behalf of any person, organisation or corporation: (a) in the bed of any river or lake shall not exceed 20 cubic metres per week and not more than 50 cubic metres in any 12 consecutive months or, (b) between 1 February and 31 August, in the beds listed in Schedule BLR2, shall not exceed 50 cubic metres per month and not more than 250 cubic metres in any 12 consecutive months period; or, (c) between 1 February and 31 August, in the beds listed in Schedule BLR3, shall not exceed 100 cubic metres per month and not more than 500 cubic metres in any 12 consecutive months period. 7. Any excavation undertaken in accordance with Condition 6 above will include the removal of excavated material (other than surplus or reject material) from the bed within ten days of that material being excavated. 8. The Customer Service Centre of Environment Canterbury shall be notified before any excavation of more than 50 cubic metres in any four weeks is undertaken in accordance with Conditions 6(b) or (c) of this rule. This notification must state, the location of the excavation site, the quantity of material to be excavated, the approximate dates when the activity is to be undertaken and a contact phone number of the person undertaking the activity. 9. To avoid destabilising any lawfully established structure in, on, under or over the bed of a lake or river the activity shall: (a) be undertaken at a distance greater than 50 metres from any lawfully established dam, weir, culvert crossing, bridge, surface water intake plant or network utility pole or pylon and 150 metres from any lawfully established water level recorder; and (b) not be undertaken within 5 metres of any existing flood control structures or to a depth exceeding 1 metre. 10. The activity, or any associated equipment, materials or debris shall not obstruct or alter the passage of water in a manner that causes: (a) any more than minor increase in the risk or potential for flooding of surrounding lands;

Where Rule Applies: This rule does not apply to all areas/situations in the Canterbury region - see Table BLR3: Index of rules.	(b) any more than minor destabilising of lawfully established flood control structures or flood control vegetation or any other lawfully established structures in, on, or under or over the bed of a lake or river; (c) any more than minor increase in erosion of the river or lake bed; or (d) drainage of water from the bed or diversion of flows within the bed. 11. No vegetation used for flood control or bank stabilisation shall be disturbed, removed, damaged or destroyed, except by or on behalf of the person or agency responsible for maintaining that vegetation for flood control purposes. 12. No plant species identified in Schedule BLR1 shall be planted or introduced. 13. The activity and any associated equipment, materials or debris shall not obstruct or alter the navigation of the bed or water body in a manner that has the potential to cause injury to any person. 14. The activity shall not include any refuelling of machinery or vehicles on the bed. 15. Upon completion of the activity: (a) all reject surplus or unused bed material stored in the bed shall be spread out; (b) any excavated areas shall be left with battered slopes not exceeding a 3:1 slope angle (3 horizontal to 1 vertical) and any flow channels disturbed during the activity shall be reinstated; and (c) all equipment and temporary structures associated with the activity shall be removed from the bed. 16. The activity shall not occur within any section of the water body that is backed up by the tide.
	Restriction of Discretion
	Where the activity is classified as a **restricted discretionary activity**, Environment Canterbury has restricted its discretion to the following matters: 1. Effects on the stability and integrity of lawfully established structures. 2. The volume of bed material to be extracted or deposited. 3. The depth of excavation. 4. Effects on the risk of flooding, including: (a) effects on upstream and downstream flood carrying capacity; and (b) the cumulative impact in conjunction with other similar activities in the catchment. 5. Effects on sediment load and transport, including cumulative effects in conjunction with other similar activities in the catchment. 6. Effects on the stability of bed or banks, including any increased risk of erosion and any cumulative impacts in conjunction with other similar activities in the catchment. 7. Effects of the activity, including management of vehicles and materials, on the integrity and effectiveness of flood control works or flood control vegetation. 8. Effects on other activities, including commercial and recreational activities, on or over the bed or on land adjacent to the bed. 9. Effects on water quality and aquatic life. 10. Effects on the habitat of trout and salmon. 11. Effects on indigenous vegetation and habitat for indigenous fauna, including: disturbance or loss of fish passage, spawning habitat or nesting and breeding habitat for indigenous birds. 12. Effects on natural character and braided river systems. 13. Any impacts on heritage sites or sites of significance to Ngāi Tahu. 14. Effects arising from the extent of excavation. 15. Financial contributions or bonds as specified in Part 6.13 of this chapter.

For information only:

1. Persons exercising this rule should be aware that permission may need to be obtained at their own expense from the legal owner or administering body of the bed and of the resource and/or the owner of land via which access to the riverbed is obtained.
2. The activity must comply with the water quality rules in NRRP Chapter 4 Water Quality.
3. Any deposition or excavation may also need to meet requirements of rules or seek resource consent under the relevant District Plan or City Plan.
4. The storage of hazardous substances, including fuel and oil, is addressed by NRRP Chapter 4 Water Quality.

6.10.5.5 Rule BLR5 Excavation, drilling, tunnelling, depositing, reclamation, drainage or disturbance in, on, under or over the bed

Excavation, drilling, tunnelling, depositing, reclamation, drainage or disturbance within the bed is restricted under section 13 of the RMA. These activities within the bed have the potential to impact on rates of erosion, river channel alignment and structure stability. However, the significance of this impact will depend on numerous activity and site-specific elements. The purpose of the rule is to remove the requirement, under section 13 of the RMA, to get resource consent for those activities which will have no more than a minor adverse effect on the environment (provided the conditions of the rule are met).

Rule BLR5 specifically provides for gravel extraction by including conditions for the excavation of bed material. The rule does not provide for excavation in relation to erection, placement, maintenance or modification of structures. These activities are addressed by Rules BLR2, BLR3, BLR4 and BLR7. The volumes of excavated material **permitted** under this rule are limited to account for the potential cumulative effects of numerous extraction activities within the river reach or catchment. For volumes in excess of the permitted limits the varying rates of gravel supply and excavation within specific river reaches need to be assessed through the resource consent application process.

Reclamation, drainage and deposition (other than the deposition of bed material) are addressed by Rule BLR5 as restricted discretionary activities. This is because the potential effects of these activities on the instream environment, other values and uses are likely to be more than minor and need to be assessed on a case-by-case basis.

In general, **restricted discretionary** activity status is appropriate for activities covered by this rule that do not comply with conditions, as the likely adverse effects can be reasonably specified.

Canterbury Land and Water Regional Plan

RULES

Note: The recommendations of the Hearing Commissioners on submissions to the Canterbury Land & Water Regional Plan have been **formally adopted** by Council.
The Plan was made **partially operative** on 1 September 2015 and 1 December 2015.

At its meetings on 13 August 2015 and 15 October 2015, the Environment Canterbury Council resolved to make the Land & Water Regional Plan operative, with the exception of the following rules:

- Rules 5.123 – 5.127 (Take and Use Surface Water)
- Rules 5.154 – 5.158 (Dams and Damming)

On 9 April 2016 the Minister for Canterbury Earthquake Recovery amended the Canterbury Land and Water Regional Plan (LWRP) and the proposed Canterbury Air Regional Plan (pCARP) under section 27(1)(a) of the Canterbury Earthquake Recovery Act 2011 (CER Act). The amendments enable the ongoing operation of Burwood Landfill for the disposal of earthquake waste through to 2021.

Changes were previously made to the Canterbury Land and Water Regional Plan under Action 46 of the Land Use Recovery Plan to enable the continued operation of the landfill within the existing landfill footprint. However, following further assessment of resource consent requirements and consultation with the community in relation to those applications, it was identified that further changes to regional planning documents were necessary. These further changes are the subject of the Minister's amendments on 9 April 2016.

5.147
Sections 124A to 124C of the Resource Management Act 1991 do not apply to resource consents to extract gravel from the bed of a lake or river in Canterbury.

5.148
The extraction of gravel from the bed of a lake or river including the deposition of substances on the bed and excavation or other disturbance of the bed of a lake or river is a **permitted activity**, provided the following conditions are met:

1. The activity is not undertaken in, on, or under the bed of any river or lake listed as a high naturalness waterbody in Sections 6 to 15; and
2. No part of the activity occurs within flowing water; and
3. The activity does not include the deposition of any substance, other than bed material, on the bed; and
4. The volume excavated by any person or on behalf of any person, organisation or corporation: (a) in the bed of any river or lake does not exceed 5 m3 in any 12 consecutive months; or (b) between 1 February and 31 August, in the beds listed in Schedule 14, does not exceed 5 m3 per month and not more than 10 m^3 in any 12 consecutive months period; or (c) between 1 February and 31 August, in the beds listed in Schedule 15, does not exceed 10 m3 per month and not more than 20 m^3 in any 12 consecutive months period; and
5. Any excavated material (other than surplus or reject material) is removed from the bed within 10 days of the material being excavated; and

6. Unless undertaken by the network utility operator responsible for the structure, the activity is undertaken more than 50 m from any lawfully established dam, weir, culvert crossing, bridge, surface water intake plant or network utility pole or pylon, more than 150 m from any lawfully established water level recorder and more than 5 m of any existing defences against water; and
7. The activity and any associated equipment, materials or debris does not obstruct or alter access to or the navigation of the lake or river; and
8. The activity does not include screening or any other processing of the gravel within the bed of the lake or river; and
9. The activity is not undertaken in an inanga or salmon spawning site listed in Schedule 17; and
10. Excavation shall not occur within 100 metres of birds which are nesting or rearing their young in the bed of the river.

5.149
The extraction of gravel, including the ancillary deposition of substances on the bed and excavation or other disturbance of the bed that complies with all the conditions in Rule 5.148, except with respect to the volume limits in condition 4 of Rule 5.148, is a **permitted activity**, provided the following condition is met:

1. The extraction of gravel is undertaken by or on behalf of the CRC in conformance with the current version of the Canterbury Regional Gravel Management Strategy prepared to give effect to Policy 10.3.4 of the Canterbury Regional Policy Statement.

5.150
Any extraction of gravel from the bed of a lake or river where one or more of the conditions for Rule 5.148 or 5.149 are not met is a **discretionary activity**.

5.151
Notwithstanding any other rule in this Plan, temporary structures and diversions associated with undertaking activities in Rules 5.147 to 5.150 or in relation to artificial watercourses are **permitted activities**, provided the following conditions are met:

1. The activity is not undertaken in an inanga or salmon spawning site listed in Schedule 17; and
2. The temporary structure and diversion is in place for not more than 4 weeks in any 12 month period.

5.152
Temporary discharges to water or to land in circumstances where a contaminant may enter water associated with undertaking activities in Rules 5.147 to 5.150 or in relation to artificial watercourses are **permitted activities**, provided the following conditions are met:

1. The discharge is only of sediment, organic material and water originating from within the bed of the lake or river; and
2. The discharge is not undertaken in an inanga or salmon spawning site listed in Schedule 17; and
3. The discharge is not for more than ten hours in any 24-hour period, and not more than 40 hours in total in any calendar month.

5.153

Where not classified by any other Rule in this Plan, the diversion or discharge of water and contaminants as a result of the extraction of gravel from the bed of a lake or river including the deposition of substances on the bed and excavation or other disturbance of the bed of a lake or river, is a **discretionary activity.**

Appendix D. Questionnaire circulated to Regional Councils and Responses

Environmental Management Services

Hawkes Bay Riverbed Gravel Management Study
Regional Council Benchmarking Questions
Otago Regional Council

1. How are gravel extraction permits administered in your region (eg do you as the river engineering department administer and issue the permits or does your resource consent department do this; do you hold the permits yourselves or are they held by individual extractors etc.)?

Decision-making on resource consents must take account of matters that are broader than "engineering" considerations. There must also be clear separation between regulatory and operational functions within an organisation. For these reasons ORC's consents section have the responsibility for deciding and issuing resource consents for gravel extraction.

Some resource consents are held by ORC but most are held by other organisations or individuals.

2. If you hold the gravel consents yourselves, did you prepare a resource consent application, and if so, can you supply a representative example?

Applications are usually prepared by planning consultants.

3. Within flood control scheme areas, do you use gravel extraction as a tool to maintain the flood conveyance capacity of the river, and if so how effective is this approach.

It is used in a limited way within some flood control scheme areas. There is an increasing expectation is some parts of Otago that ORC will take a more active role in managing river form (rather than capacity) using gravel extraction as a tool.

4. What is the basis to your royalty charges for gravel and is this written down in a document? For instance are you relying on RMA s36 charging and what activity costs (eg cross section monitoring) do you on-charge to extractors?

ORC charges a compliance monitoring fee. The fee is set through the Annual Plan process and is published in the Annual Plan.

5. Do you have a 'Gravel Management Plan' or an equivalent type of document that guides your activities in this area; and if so, can you supply a copy?

ORC is preparing River Morphology and Riparian Management Plans for some rivers in Otago. The rivers being targeted are those where river morphology is dynamic over short time scales and where there is high community interest in how the river and its margins should be managed. The plans are prepared in consultation with the community and stakeholders, through a series of workshops. Whilst the plans have no statutory basis they act as a guide for ORC's river management activity and help inform the Annual Plan process. The plans help ensure that community expectations around river control and gravel extraction are managed and that the respective roles of ORC and landholders are clear. They also ensure that decision-making takes account of wider community values and that rivers are not simply seen as gravel quarries.

6. How do you direct extractors to extract gravel from aggrading rivers/reaches that are further away or of poorer quality from more readily available or better quality sources?

The Plans referred to in 5 above assist as they ensure that there is consideration of community values and impacts other than just the quality of the material that is to be taken. Care needs to be taken with consent conditions that rely on discretion. Such conditions are not always lawful and can allow directions to be given that do not account for river values.

7. Do you finance gravel extraction from aggrading rivers from target rate scheme or general rate funding as opposed to relying on commercial gravel extractors? If so, is this a significant and costly activity for your schemes/rating?

ORC principally relies on commercial operators but it is likely that ORC will need to direct fund extraction in some areas in the future.

8. Are you facing 'gravel banking' by commercial extractors and if so, how are you dealing with this?

This is a legal issue that does not seem to have a clear answer.

9. Do you have any documentation or information on the different Acts that govern your river management responsibilities (eg RMA, Soil Conservation and Rivers Control Act, Crown Minerals Act, Land Drainage Act etc.)?

N/A.

10. Do you have any relevant legal opinions on gravel management that you are willing to share?

We have none.

11. Have you experienced any 'interface' issues between your gravel extraction permitting regime and District Councils' earthworks and other district plan consenting requirements?

Nothing of note.

12. Do you have any defined process or agreements with TAs in place for identifying the lateral extent on a floodplain that your gravel permitting process applies to?

No, as that has not been necessary.

13. How do you measure/monitor gravel extracted for consent compliance monitoring and gravel royalty recovery?

ORC relies on information provided by the consent holder. That information comprises the volumes extracted and in some cases cross-sections that have been surveyed by the consent holder pre and post extraction.

14. Is there any other information relating to gravel management that you think is relevant?

None.

Darryl Lew
14 April 2016

Environmental Management Services

Hawkes Bay Riverbed Gravel Management Study
Regional Council Benchmarking Questions
Environment Canterbury

1. **How are gravel extraction permits administered in your region (eg do you as the river engineering department administer and issue the permits or does your resource consent department do this; do you hold the permits yourselves or are they held by individual extractors etc.)?**

In Canterbury, gravel is administered in the following ways:

- Resource Consents,
- Gravel Authorities (Permits issued under a permitted rule of the Land and Water Regional Plan),
- Resource Consents held by the council (Permits under a resource consent held by Regional Engineer),
- Permitted baseline in the Land and Water Regional Plan.

The River Engineering Section issues and administers gravel extraction authorisations, these Gravel Authorisations are for extraction on behalf of the Regional Council where there is a known surplus of material and the removal of that material will benefit flood and erosion control schemes. A rule in the Canterbury Land and Water Regional Plan enables the issuing of gravel authorisations. These authorisations require operators to work in accordance with the Canterbury River Gravel Extraction Code of Practice (2015). The Code of Practice was written as part of the implementation of the Canterbury Regional River Gravel Management Strategy (2012) and has set maximum volumes of up to 60,000 m3 and durations up to 12 months. The Land and Water Regional Plan has restricted some areas from the issuing of Gravel Authorisations, and in these areas Resource Consents can still be applied for.

Resource consents are processed and administered by a separate section of Council. Consents may also be applied for if an applicant wishes to take more than 60,000m3 or have a longer duration than 12 months.

The River Engineering section holds both Resource Consents and Gravel Authorisations to take material for the benefit of our scheme areas.

2. If you hold the gravel consents yourselves, did you prepare a resource consent application, and if so, can you supply a representative example?

We have applied for gravel extraction consents and for Gravel Authorisations. Under current circumstances the project manager would apply for an authorisation or resource consent depending on the circumstances. A copy of the most recent Resource Consent application is attached.

3. Within flood control scheme areas, do you use gravel extraction as a tool to maintain the flood conveyance capacity of the river, and if so how effective is this approach?

We have river bed level monitoring programmes for our major river schemes, and target minimum bed levels to enable management of flood & bank erosion risk by gravel extraction. This approach has had marginal success in the past due to inability to target extraction - but the newly imposed authorisation process under the Land and Water Regional Plan will improve our ability to target gravel extraction to maintain flood capacity.

4. What is the basis to your royalty charges for gravel and is this written down in a document? For instance are you relying on RMA s36 charging and what activity costs (eg cross section monitoring) do you on-charge to extractors?

Gravel extractors who hold a resource consent or gravel authorisation are charged a gravel management fee of $0.13 per cubic metre of consented/authorised volume, and this is charged irrespective if the full allocated amount is taken or not. The gravel management fee funds all the survey and analysis work required to determine how much gravel is available for extraction and where it should be taken to gain the most benefit from extraction. The charging regime is set out in the Gravel Management Strategy and charges are approved through the Long Term Plan process. Other costs passed onto extractors include the costs of processing their applications and the monitoring of their activity.

5. Do you have a 'Gravel Management Plan' or an equivalent type of document that guides your activities in this area; and if so, can you supply a copy?

The Canterbury Regional River Gravel Management Strategy (2012), copy provided.

6. How do you direct extractors to extract gravel from aggrading rivers/reaches that are further away or of poorer quality from more readily available or better quality sources?

We direct extraction to the nearest sites where gravel is available, and the contractor makes a choice giving regard to cartage costs & suitability. Gaining access to the riverbed over private land is often a constraint that the contractor must work through. The Gravel Authorisation process discussed above is an incentive to extract from those areas because the costs associated with gaining that permission is significantly less than a resource consent.

7. Do you finance gravel extraction from aggrading rivers from target rate scheme or general rate funding as opposed to relying on commercial gravel extractors? If so, is this a significant and costly activity for your schemes/rating?

No – we rely solely on commercial extraction but recognise incentives may be needed in problem reaches of key rivers such as Blands Reach – Ashburton North Branch.

8. Are you facing 'gravel banking' by commercial extractors and if so, how are you dealing with this?

Yes – this was a problem in all rivers before the Regional Gravel Management Strategy – and remains a problem with larger & strategically located rivers such as the Ashley & Waimakariri which have long term large volume consents. The policies in the Land and Water Regional Plan are now giving stronger direction to consents officers to only issue short duration consents to ensure the gravel is taken over shorter durations (in alignment with our Gravel Management Strategy). Copy of policy 4.95A is below. The Gravel Authorisations are also ensuring gravel banking does not occur due to their short durations.

The Regional Plan now directs that sections 124A to 124C of the RMA do not apply to gravel extraction in Canterbury. This means that upon the expiry of a gravel consent, the un-used portion of the original allocation is now available for any party to apply to take, rather than the original consent holder having first priority to that resource. This incentivises extractors to take their full allocation within their consented timeframe, or else they may lose that allocation.

Copy of Policy from the Land and Water Regional Plan:
4.95A *Effective management of rivers for flood control purposes is enabled, and erosion of riverbeds, banks and structures from the effects of gravel extraction is minimised, by aligning the duration and volume limits in any resource consent granted for the extraction of gravel with those set out in the Canterbury River Regional Gravel Management Strategy.*[1]

9. Do you have any documentation or information on the different Acts that govern your river management responsibilities (eg RMA, Soil Conservation and Rivers Control Act, Crown Minerals Act, Land Drainage Act etc.)?

10. Do you have any relevant legal opinions on gravel management that you are willing to share?

11. Have you experienced any 'interface' issues between your gravel extraction permitting regime and District Councils' earthworks and other district plan consenting requirements?

Yes. Poorly defined "interface" depending on legal definition of riverbed. Some district plans trigger land use consents from both Regional & District Councils.

12. Do you have any defined process or agreements with TAs in place for identifying the lateral extent on a floodplain that your gravel permitting process applies to?
No – dealt with case by case if an issue.

13. How do you measure/monitor gravel extracted for consent compliance monitoring and gravel royalty recovery?

Every resource consent and gravel authorisation have conditions about measuring and reporting the volumes taken. Volumes must be recorded and then submitted to us on a quarterly basis. The Compliance Monitoring branch of the Council then checks these figures against activity seen on site. Larger resource consents also require bed level surveys to demonstrate extraction.

As noted above, the gravel management fee is charged on the total volume irrespective of what is actually extracted therefore the reporting of volumes taken is not important for the fee collection. The fee may be invoiced upon granting of the consent/authorisation or smaller amounts are invoiced through the duration of the consent/authorisation.

14. Is there any other information relating to gravel management that you think is relevant? No

Darryl Lew
14 April 2016

Environmental Management Services

Hawkes Bay Riverbed Gravel Management Study
Regional Council Benchmarking Questions
Greater Wellington regional Council

GWRC FP response 19 May 2016 GWRC File Ref FMGT-7-91

1. How are gravel extraction permits administered in your region (eg do you as the river engineering department administer and issue the permits or does your resource consent department do this; do you hold the permits yourselves or are they held by individual extractors etc.)?
   GWRC Flood Protection (FP) currently has resource consents to extract gravel from all rivers in which operative river schemes exist and are administered by GWRC. The volume, location and timing vary depending on the specific river. GWRC FP then issues licences to individual contractors to extract a certain volume for a specified period.

2. If you hold the gravel consents yourselves, did you prepare a resource consent application, and if so, can you supply a representative example?
   Current applications are generally a "consent suite" package which includes gravel extraction activities in addition to all other consented river management activities. GWRC are using consultants to help prepare these.

3. Within flood control scheme areas, do you use gravel extraction as a tool to maintain the flood conveyance capacity of the river, and if so how effective is this approach.
   Gravel is extracted either as a tool to manage the river alignment or to maintain flood capacity more generally. FP manages the gravel extraction in line with regular bed level surveys which identify areas of aggradation/degradation and compare it to an optimum bed envelope. This approach is very effective in areas where both the needs of GWRC and contractors align. Gravel extraction close to urban areas or close to the end use (a roading project say) work very well. In remote reaches, it is difficult to find extractors.

4. What is the basis to your royalty charges for gravel and is this written down in a document? For instance are you relying on RMA s36 charging and what activity costs (eg cross section monitoring) do you on-charge to extractors?

Licences are issued by Flood Protection to contractors extracting under GWRC's resource consents.

In the Western part of the region, licence fees are charged to reflect the reasonable costs associated with:

- Supervision and administration
- Obtaining resource consents
- A contribution to the regular cross-section surveys

In reality, these licence fees only cover a portion of the costs.

In the Wairarapa, a gravel royalty is charged in addition to a licence fee. The intent of the gravel royalty is to cover the reasonable costs listed above and also to generate a surplus which is invested back into the management of the river schemes. The royalty is charged under a licence issued in 1972 by the Commissioner of Crown Lands. The revenues vary from year to year, but at the time of writing around $90,000 is allocated to Wairarapa river schemes each year.

5. Do you have a 'Gravel Management Plan' or an equivalent type of document that guides your activities in this area; and if so, can you supply a copy?
   We have engaged a consultant (Laddie Kuta) on a secondment basis to assist us with our gravel analysis process and to develop a gravel strategy.

6. How do you direct extractors to extract gravel from aggrading rivers/reaches that are further away or of poorer quality from more readily available or better quality sources?
   This is difficult. Generally there has to be a commercial need to extract and it is hard to make contractors use sources that are not viable for their operation. Haulage costs are generally the most significant cost. Where we charge royalties (Wairarapa rivers) the royalty charge is waived as incentive to attract extraction, however in comparison to haulage costs from a commercially unfavourable site the waiver of royalties is basically insignificant. Some larger contractors have land-based extraction options available.

7. Do you finance gravel extraction from aggrading rivers from target rate scheme or general rate funding as opposed to relying on commercial gravel extractors? If so, is this a significant and costly activity for your schemes/rating?
   To date GWRC has not funded gravel extraction but this is a possibility. There are significant budget and river management issues to consider.

8. Are you facing 'gravel banking' by commercial extractors and if so, how are you dealing with this?
   No. This problem is not an issue as there is generally far more material available than is licenced. We sometimes have issues with smaller contractor's obtaining licences and then not winning the roading contract (for E.g). We try and minimise this by continual monitoring

of the licence holders and talking to them if there has been little or no extraction. We also issue shorter term licences.

9. Do you have any documentation or information on the different Acts that govern your river management responsibilities (eg RMA, Soil Conservation and Rivers Control Act, Crown Minerals Act, Land Drainage Act etc.)?
   RMA, SCRCA, LGA mainly. Functions of Regional Councils (catchment boards) defined in all three, we are empowered to set up schemes and carry out works under the SCRCA but everything we physically "do" must be permitted or consented under the RMA.
   We also use Floodplain Management Plans and Asset Management Plans to help define the focus of our activities.

10. Do you have any relevant legal opinions on gravel management that you are willing to share?
    This is a very broad question but if you have something particular in mind then we'd be happy to look into it.

11. Have you experienced any 'interface' issues between your gravel extraction permitting regime and District Councils' earthworks and other district plan consenting requirements?
    Generally not in regard to gravel extraction. However, there is potential competition for extractors. If we make things too difficult or unattractive then many operators might move from our river based extraction to land based DC aligned areas.

12. Do you have any defined process or agreements with TAs in place for identifying the lateral extent on a floodplain that your gravel permitting process applies to?
    River Corridors are defined in most District Plans in our Region and gravel extraction/river management activities are permitted by TA planning instruments. River corridors are defined through the FDFMP process.

13. How do you measure/monitor gravel extracted for consent compliance monitoring and gravel royalty recovery?
    Extraction volumes are self-recorded, and contractors are expected to submit extraction volumes as they extract. We regularly monitor and audit extraction operations to ensure correct volumes are being recorded.

14. Is there any other information relating to gravel management that you think is relevant?
    We are increasingly finding that we're not able to consider gravel volumes/levels in isolation and must consider them in relation to overall river management (eg. how design channels and buffers work). We are addressing this through Floodplain Management Plans currently in development and review, and through our Gravel Strategy. Check back with us in six months to see how we're getting on.

Environmental Management Services

Hawkes Bay Riverbed Gravel Management Study
Regional Council Benchmarking Questions
Horizons Regional Council Response

1. How are gravel extraction permits administered in your region (eg do you as the river engineering department administer and issue the permits or does your resource consent department do this; do you hold the permits yourselves or are they held by individual extractors etc.)?
   Gravel extraction is managed using the consent process and administered by our resource consent department. For some river schemes we internally hold 'global' consents for all gravel extraction and manage the extraction locations with contractors. In other schemes gravel extraction consents are held both by individual contractors and by ourselves for different reaches of the river.

2. If you hold the gravel consents yourselves, did you prepare a resource consent application, and if so, can you supply a representative example? Yes resource consent applications are made for river operations gravel extraction. An example is attached to this email.

3. Within flood control scheme areas, do you use gravel extraction as a tool to maintain the flood conveyance capacity of the river, and if so how effective is this approach. Yes we do. Gravel extraction is used effectively as both a tool to maintain flood conveyance and to influence channel alignment

4. What is the basis to your royalty charges for gravel and is this written down in a document? For instance are you relying on RMA s36 charging and what activity costs (eg cross section monitoring) do you on-charge to extractors?

We charge RMA Section 36 fees on all consented gravel extraction. These fees are calculated from the reported volumes of gravel extracted and the fee is specified in Horizons' Long Term Plan and Annual Plans (e.g. currently $0.41/m3 extracted). These charges allow for research into sustainable gravel allocation, e.g. tracking of gravel volumes and the movement of gravel through river systems. Section 36 charges are payable by all resource consent holders and contribute (30%) to the Council's costs for its surface water, ground water and gravel resource research and monitoring programmes. All consent holders (incl. Horizons) report on the volumes they extract monthly and are charged

from these volumes. For the Horizons consents, we usually pass the charge on to the contractor who extracts and utilises the gravel.

We have two further (rarely used) charges related to gravel extraction for consent holders in specific reaches. One type is specified in consent conditions of two consents and was set up during the consent process to offset the environmental effects of the extraction (the revenue goes into river restoration works via a trust). The other type was related to extractions from the degradation reach of the Rangitikei River. This charge is considered a financial contribution under Section 108 of the RMA to mitigate adverse effects on flood protection and erosion control works. The charge is set in Horizons' annual plan.

5. Do you have a 'Gravel Management Plan' or an equivalent type of document that guides your activities in this area; and if so, can you supply a copy? The One Plan, Horizons' consolidated regional policy statement and regional plan, provides a policy and regulatory framework for gravel management. Chapter 17, Activities in artificial watercourse, beds of rivers and lakes, and damming, is the principle chapter. Policy 17-3, Gravel extraction, includes reach-specific gravel extraction limits (in Table 17.1). Rules 17-6 and 17-7 are specifically focused on managing the effects of gravel extraction; if the extraction is proposed in a rare, threatened or at risk habitat it would be regulated by Rules 13-8 or 13-9. Extraction carried out in flood control and drainage scheme reaches identified in the One Plan[1] is permitted, if carried out by or on behalf of Horizons in accordance with the Environmental Code of Practice for River Works; any other extractor would need consent.

6. How do you direct extractors to extract gravel from aggrading rivers/reaches that are further away or of poorer quality from more readily available or better quality sources? This is an on-going problem. We are often unable to encourage contractors to extract gravel from priority areas where distance and quality are a factor.

7. Do you finance gravel extraction from aggrading rivers from target rate scheme or general rate funding as opposed to relying on commercial gravel extractors? If so, is this a significant and costly activity for your schemes/rating?
   No we generally do not fund gravel extraction as a scheme activity. However, given low demand in some areas and localised aggradation this could be reviewed in the future.

8. Are you facing 'gravel banking' by commercial extractors and if so, how are you dealing with this?
   In the past some gravel banking has occurred and this has been solely their commercial decision and not influenced by ourselves.

9. Do you have any documentation or information on the different Acts that govern your river management responsibilities (eg RMA, Soil Conservation and Rivers Control Act, Crown Minerals Act, Land Drainage Act etc.)?

[1] Which do not include the schemes that came into existence since the One Plan was notified.

10. Do you have any relevant legal opinions on gravel management that you are willing to share?

Have you experienced any 'interface' issues between your gravel extraction permitting regime and District Councils' earthworks and other district plan consenting requirements? No I am unaware of any in river issues here. We have had an instance where gravel extraction from a river berm area required a district council consent. Horizons does make submissions on proposed District Plan provisions regulating gravel extraction, in particular if they are likely to contradict or duplicate One Plan provisions.

11. Do you have any defined process or agreements with TAs in place for identifying the lateral extent on a floodplain that your gravel permitting process applies to?
    Not that I am aware of.

12. How do you measure/monitor gravel extracted for consent compliance monitoring and gravel royalty recovery?
    This is largely managed on an honesty system with contactors forwarding returns either directly to our consents monitoring department for their own consents or to the river operations department for gravel takes managed under Horizons consents.

13. Is there any other information relating to gravel management that you think is relevant? The latest gravel mining trends operated by large gravel extractors on private land is limiting the ability of river operations to effectively, and cost efficiently, utilise gravel extraction for channel management.

Darryl Lew
14 April 2016

Environmental Management Services

Hawkes Bay Riverbed Gravel Management Study
Regional Council Benchmarking Questions

1. How are gravel extraction permits administered in your region (eg do you as the river engineering department administer and issue the permits or does your resource consent department do this; do you hold the permits yourselves or are they held by individual extractors etc.)?

   There are three options for gaining permission to excavate gravel from rivers in the Bay of Plenty:

   - ***As a permitted activity under the operative Regional Gravel Management Plan (any member of the public can extract 100 m3 per site per annum).***
   - ***By obtaining a gravel allocation to undertake gravel extraction on behalf of the Regional Council (through a permitted activity, no time or quantity restrictions apply within the river schemes).***
   - ***Under resource consent.***

   For a few rivers, the Rivers & Drainage Section of the Bay of Plenty Regional Council (BOPRC) hold consents on-behalf of the Rivers Schemes to enable gravel to be removed for river control purposes. For these rivers a permit can be issued to allow extraction under the BOPRC consent.

   Gravel extraction consents are also held by external contractors and local iwi. Council's Consents Section issue the consents while the Rivers & Drainage Section determines the extraction locations and quantities permitted.

2. If you hold the gravel consents yourselves, did you prepare a resource consent application, and if so, can you supply a representative example?

   Copy of resource consent 61321 attached. Issue date was 2009. Copy of application can be supplied on request (this is an old application and more recent ones may be obtained from other Councils).

3. Within flood control scheme areas, do you use gravel extraction as a tool to maintain the flood conveyance capacity of the river, and if so how effective is this approach.

   Yes gravel extraction is used by BOPRC as an effective tool to maintain the flood conveyance capacity as well as the integrity and dynamics of the rivers. Excavation sites have proven to result in cleaner beaches that allow gravel to migrate through the river systems more effectively.

   Some rivers have a mean bed level envelope to manage bed levels within a minimum and maximum level.

4. What is the basis to your royalty charges for gravel and is this written down in a document? For instance are you relying on RMA s36 charging and what activity costs (eg cross section monitoring) do you on-charge to extractors?

   Gravel management fees are in accordance with section 36 of the RMA and are set out in under the relevant resource consents. The charges cover administration, monitoring (cross section survey) and supervising of gravel extraction. The current fee is $0.90/m3 and is charged on monthly returns supplied by the contractors etc.

5. Do you have a 'Gravel Management Plan' or an equivalent type of document that guides your activities in this area; and if so, can you supply a copy?

   BOPRC has had an operative Regional River Gravel Management Plan since 2001 which governs the extraction of gravel from rivers and stream with the Bay of Plenty excluding extraction in the coastal marine area.

   The plan can be view on Council's website: http://www.boprc.govt.nz/knowledge-centre/plans/regional-river-gravel-management-plan/.

6. How do you direct extractors to extract gravel from aggrading rivers/reaches that are further away or of poorer quality from more readily available or better quality sources?

   Gravel allocations are considered, issued and managed through the Rivers & Drainage Section at BOPRC.

   Obtaining a gravel allocation allows the extractors to operate as a permitted activity under the Gravel Plan and/or resource consent.

   The Natural Environmental Regional Monitoring Network (NERMN) Report on River and Stream Channel Monitoring provides Council with:

   - ***Data to identify the quantity of gravel available for extraction and the present extraction rates.***
   - ***Data to allow setting maximum annual extraction rates based on river control and river maintenance criteria.***
   - ***Data which Council can meet its statutory obligations and effectively manage the region's resources.***

7. Do you finance gravel extraction from aggrading rivers from target rate scheme or general rate funding as opposed to relying on commercial gravel extractors? If so, is this a significant and costly activity for your schemes/rating?

   No extraction is carried out under funding from rates (target or general).

8. Are you facing 'gravel banking' by commercial extractors and if so, how are you dealing with this?

   No, gravel banking is not an issue at present. Feedback received from contractors is that the quality of gravel excavated from waterways in the Eastern BOP is of mixed quality and only suitable for certain products. The overriding factor for contractors is the proximity to work suits i.e. transport costs.

9. Do you have any documentation or information on the different Acts that govern your river management responsibilities (eg RMA, Soil Conservation and Rivers Control Act, Crown Minerals Act, Land Drainage Act etc.)?

   The principal statue which the environmental effects of gravel excavations are managed is the RMA. Other relevant statues are the Soil Conservation and Rivers Control Act 1941 under which BOPRC undertakes flood control works, and the Crown Minerals Act 1991 which governs the excavation of gravel from Crown owed riverbeds. This is set out under the Statutory Framework of the Regional Gravel Management Plan.

10. Do you have any relevant legal opinions on gravel management that you are willing to share?

    Legal opinion was obtained around using Rule 3 from the Water and Land Plan in issuing allocations. Can be shared once approval obtained.

11. Have you experienced any 'interface' issues between your gravel extraction permitting regime and District Councils' earthworks and other district plan consenting requirements?

    This is something Council staff are mindful of when issuing allocations under permitted rules but no problems have arisen to-date.

12. Do you have any defined process or agreements with TAs in place for identifying the lateral extent on a floodplain that your gravel permitting process applies to?
    No

13. How do you measure/monitor gravel extracted for consent compliance monitoring and gravel royalty recovery?

    Cross section surveys and monthly returns received by extractors.

14. Is there any other information relating to gravel management that you think is relevant?

- ***Gravel Management Guidelines http://www.boprc.govt.nz/knowledge-centre/our-library/guideline-publications/***

- ***NERMN River and Stream Channel Monitoring Programme 1990-2010 (Engineering staff are currently preparing the next review).***

- ***Regional Water and Land Plan http://www.boprc.govt.nz/knowledge-centre/plans/regional-water-and-land-plan/***

Darryl Lew
14 April 2016

Appendix E. Proposal from NIWA to MBIE

2016 Contestable Fund

Research Programmes Template
(full proposal)

Proposal Glossary

Word/acronym/ abbreviation/te reo Māori	Full description/translation
Abrasion	Process by which gravel particles reduce in size or break into smaller particles as they are transported down a river.
Aggregate	Aggregate is the collective term for gravel, sand and stone.
Allocation	The volume of gravel that may be taken by resource consent holders/written authorisation holders as defined by the conditions of their consent.
Bar	A deposit of sediment (sand/gravel) within a river channel.
Bedload	Particles of aggregate carried by the natural flow of a waterway on or immediately above its bed.
Channel form	The shape of a river channel including its width and depth, whether it is single thread or braided and the presence and size of features such as bars, riffles and pools.
Delft3D	Open source 2D and 3D hydraulic and morphological modelling software.
Ecosystem	A system formed by all plants, animals and micro-organisms in a particular area interacting with the non-living physical environment as a functional unit.
GCD software	Geomorphic Change Detection software. Software package developed to map and analyse change occurring between repeat topographic surveys.
GIS	Geographic Information System. Software designed to manage, analyse and present/map spatial and geographic data.
Good management practice	An umbrella term to describe industry led programmes promoting practice changes to improve industry performance against particular or agreed objectives.
GRATE	Gravel Routing And Textural Evolution model: 1D morphological modelling software developed by NIWA with specific functionality for modelling of gravel bed and braided rivers.
Gravel	Includes all coarse and fine materials sourced primarily from river deposits.
Gravel/sand transition	The location on some rivers where the river substrate changes from gravel to sand, usually associated with a reduction in slope.
Hapū	Sub-tribe.
Hydraulic model	Numerical model of water depth and flow velocities in a river.
IPENZ Rivers Group	A technical group, affiliated to the Institute of Professional Engineers New Zealand, comprising river engineers and managers.
Iwi	Tribe.
Kaitiaki	Guardian.
Kaitiakitanga	The exercise of guardianship.
LiDAR	Light Detection And Ranging. Aerial laser scanning technology widely used to survey topography.
Lithology	Physical characteristic of the rock type of individual gravel grains.
MMS	Mobile Mapping System. Mobile laser scanning system using similar technology to LiDAR but at a smaller scale and lower cost.
Morphological model	Model of river flow coupled with sediment transport to simulate evolution of channel bed levels and substrate size.
NPS-FM	National Policy Statement – Freshwater Management

NSC	National Science Challenge.
Over-extraction or over-allocation	A situation where either: values associated with current gravel resource use cannot be sustained to a minimum standard if all resource consents are fully exercised; and/or the total allocation exceeds the total available volume if all consents are fully exercised.
Riffle	A small rapid within a river or stream where water is flowing over shallow rocks.
Riparian	Relating to the bank of streams, rivers and lakes – riparian vegetation is vegetation found on the banks of a river, stream or lake.
Shear-stress	Streamwise force exerted by flowing water on to the river bed which drives bedload transport.
Step-length	The average distance travelled by gravel particles while entrained during a flood.
Substrate	River bed material (i.e. gravel).
Te Kūwaha	NIWA's Centre for Māori Environmental Research.
Topo-bathy LiDAR	A green-laser airborne LiDAR system capable of surveying shallow underwater topography as well as dry-ground topography in a single pass.

Statements

Executive Summary

The goal of this research is to facilitate sustainable extraction of gravel aggregate from New Zealand (NZ) rivers, supporting decision makers by using excellent science to reduce uncertainty relating to gravel supply rates and the effects of extraction.

The key research aims are:

1) Developing methods to reliably quantify the supply of gravel from upstream at any point on a gravel-bed river.
2) Developing more reliable numerical morphological models to quantify the spatial and temporal effects of gravel extraction on river bed levels, river morphology, and downstream gravel transfer.
3) Applying these models to explore the broad scale, long term consequences of common, generic gravel extraction scenarios on bed levels and gravel delivery to the coast.
4) Quantifying effects of gravel extraction on riverine physical habitat and ecosystems.
5) Supporting Māori engagement in decision making processes relating to gravel extraction by ensuring regulators and industry are aware of Māori values relating to gravel extraction and ensuring Māori have an understanding of the potential environmental effects of gravel extraction.
6) Developing guidelines and tools for all stakeholders to enable sustainable gravel extraction.

The benefits to NZ will be to support economic growth by allowing access to gravel to meet community and industry needs, whilst protecting environmental values and providing for the cultural and spiritual values of rivers. Better understanding of the sustainable supply of gravel will ensure gravel is not 'over-extracted', potentially leading to an increase in river-channel and coastal erosion, and that gravel is not 'under-extracted', potentially leading to a reduction in flood protection. Better understanding of the ecological effects of gravel extraction, such as changes in habitat for fish, invertebrates and wading river birds, will ensure extraction is planned and managed in a more ecologically sustainable manner.

In recognition of the kaitiaki responsibilities of iwi and hapū, this research involves deliberate engagement with and input from Māori. It makes use of existing relationships with Māori and has been designed around a two-way flow of information; encouraging Māori to examine their values relating to gravel extraction and share these with other stakeholders, and providing Māori with greater understanding of broader potential effects of gravel extraction to support kaitiakitanga. This research also involves deliberate engagement with the gravel extraction industry and with regional councils to achieve a mutually beneficial management framework and ensure consistency with regional policy statements, proposed or operative regional plans that manage rivers, and the National Policy Statement for Freshwater Management.

This research will make use of leading-edge technology, including mobile topographical mapping systems and bathymetric LiDAR, and collaboration with international experts to develop a more reliable approach to quantify the supply of gravel from any point in any river. The research team comprises NZ's leaders in morphological modelling, and will expand this capability in the course of the research. The research draws on national expertise in the field of braided river ecology to quantify the effects of gravel extraction on river biota.

Public Statement

River gravel is an important source of aggregate for roading and construction. Regulatory authorities, e.g., regional councils, currently issue consents for gravel extraction under the Resource Management Act in consultation with iwi. However, it is difficult to determine the sustainable volume of gravel that can be taken from a river due to uncertainties regarding gravel delivery from up-river, the effects of extraction operations on river-channel stability, ecosystems and cultural values, and also on gravel delivery to coasts vulnerable to erosion.

Our research aims to ensure sustainable gravel extraction by:

1. Improving methods to quantify how much gravel is available at any point on a river;
2. Improving models that predict effects of gravel extraction on river bed levels and transport rates;
3. Modelling the effects of typical gravel extraction scenarios on river bed levels and rates of gravel transfer, and related effects on channel flood capacity and erosion;
4. Improving understanding of the effects of gravel extraction on river birds, invertebrates and fish;
5. Gathering information on Māori values relating to gravel extraction;
6. Sharing the results with key stakeholders, including the gravel extraction industry, regional councils and iwi.

Our research will consult with these stakeholders to foster a shared understanding of the processes and issues around gravel extraction. The findings will enable gravel extraction to be targeted to where environmental, cultural, and economic benefits are optimised. The research will, for the first time in NZ, use bathymetric LiDAR and mobile laser systems for surveying channel topography and gravel volumes.

Impact Criteria

Benefit/s to New Zealand

Aggregate resources are a critical component of NZ's economy (transport and construction sectors), contributing more than $400M in value in 2011 (~ ⅓ of the total value of NZ's commodity production [1]). River gravel is an important source of aggregate as it is often close to market, easy to extract, and offers well graded material. The Resource Management Act and existing guidelines for managing impacts [e.g., 2] provide a structure for managing river gravel extraction, but decision making is hindered by significant uncertainty around sustainable extraction rates. Key uncertainties lie with the natural re-supply rates of river gravel from up-river and the potential impacts of gravel extraction on river ecosystems [3, 4], river and coastal erosion, and cultural values. This uncertainty leads regional councils to limit extraction consents to conservative volumes and short durations, which increases commercial risk to industry and costs to end-users [5], and creates the 'flipside' risk that extraction essential to maintain flood protection may not attract an operator [6].

Our research delivers strongly on the Investment Plan [7] by providing improved understanding, methods, guidelines and tools to enable sustainable and efficient use of the natural aggregate resource, hence reducing costs and increasing sustainability of the construction and transport industries. In addition to this direct economic benefit, the reduction of river and coastal erosion and flood risks will reduce costs from hazard events. Intangible environmental benefits will arise from provision of better tools to monitor and manage regional gravel resources, and the ability to set objectives for riverine values and define confident limits on gravel use in planning instruments, in keeping with the NPS-FM [8].

Ngati Kahungunu and Ngāi Tahu representatives both identified that Māori have a feeling of "helplessness in terms of having any influence on extraction" [9, 10] as well as concern regarding the impacts of gravel extraction, specifically on mahinga kai and taonga species but also from the *Taiapo* perspective of environmental guardianship. They also highlighted that there is a need for iwi to better understand the ecological and social impacts of gravel extraction as they currently struggle to make informed responses when they are asked to input into the consenting process. The proposed research will capture tangata whenua values in guidelines, reducing the negative cultural impacts of extraction, and empower Māori to better exercise their rights and responsibilities of kaitiakitanga by better and more confidently engaging in extraction consenting decisions.

The tools and understanding created by this research will have wider benefits through their capability to assist river channel management around multiple issues (e.g., flood conveyance, river-flow and sediment load alteration associated with upstream water-use and storage schemes, effects of climate change, and downstream effects of catastrophic natural events such as earthquakes). The work will also provide international benefits through improved and transferrable knowledge and tools for river gravel management. It aligns with Programme 3 of the Biological Heritage NSC because it evaluates the ecological impacts of gravel extraction in sensitive braided river systems.

Implementation Pathway/s

Key end-users/stakeholders associated with this research are the gravel extraction industry, local government, and Māori. The research will benefit these users by providing greater certainty in three key aspects: knowing how much gravel is delivered to extraction reaches; predicting long-term downstream impacts of extraction on river bed levels and gravel transfers; and effects of extraction operations on in-river biota and cultural values. This will be delivered to our end-users by way of improved methods, modelling tools, guidelines, and knowledge sharing.

Our implementation plan centres on early and targeted engagement with end-users by creation of a steering group involving regional council river managers, iwi representatives and representatives of the extraction industry. Input from the steering group will ensure the research is appropriately designed and targeted and the results are disseminated in the most useful way. This dissemination will include articles in industry newsletters, presentations to industry and local government workshops, presentations at hui, journal publications, and technical training seminars on models and GIS tools. A key mechanism for focussed knowledge transfer will be a good management practice guidance manual for industry, councils and iwi that will be published on NIWA, Aggregate & Quarry Association, and regional council websites. We will also transfer knowledge by engaging directly with regional councils and hapū during case-studies.

The research team has very strong existing relationships with regional council river managers through previous projects to address specific gravel management questions (Canterbury, Hawke's Bay, Waikato, Horizons-Manawatu) as well as through interaction via forums such as the River Managers Special Interest Group and IPENZ Rivers Group. The need for this research and its initial scope were developed in close collaboration with these contacts, so it is closely aligned to their needs. Their inputs will be essential to realise the benefits of this research and we have commitments of their "total support" for this research, including in-kind contributions through staff time and sharing data [11, 12]. We have also discussed the proposal with contacts in the gravel extraction industry (Aggregate and Quarry Association, Fulton Hogan) who are supportive of this research, particularly with respect to providing longer term certainty regarding gravel availability [5].

Our relationships with iwi are at an early stage but during discussions regarding this proposal they have confirmed that research into river gravel extraction would be valuable for Māori [9, 10], highlighted their areas of concern, and signalled their interest in "moving forward together with NIWA" on this research [13].

Vision Mātauranga outcomes will be achieved by engaging with iwi throughout the project: early, to identify values, during, via use of iwi teams to collect field data, and at the end, by communicating findings and including Māori values in guidance documents. To implement this, we will draw on NIWA's Centre for Māori Environmental Research, Te Kūwaha, who have very strong linkages throughout NZ and well established processes to engage with iwi. Also, an annual multi-stakeholder session will strengthen a collaborative management approach for the aggregate extraction research.

Impact Plan

The steps to deliver impacts benefits include: (1) Engaging with key stakeholders, including with the aggregate industry, regional councils, and iwi; (2) Developing new knowledge, methods and tools; (3) Applying these to case-study situations in collaboration with end-users; (4) Making data analysis tools (e.g., Geomorphic Change Detection (GCD) software to analyse river-channel surveys) and modelling tools (to predict long-term/downstream effects) available in the public domain, and running training in their use; and (5) Communicating results via guidelines, presentations, scientific papers, and workshops.

Early engagement with stakeholders will ensure focus on priority issues and values. In Year 1 workshops with extractors and councils, and hui with iwi, will share the research aims and get input on potential extraction scenarios, study reaches, issues of concern, and most effective delivery and presentation of results to promote uptake. In Years 2 and 3 we will provide regular progress updates to keep stakeholders engaged and informed and arrange active iwi participation in field data collection. Year 4 will focus on communicating the findings, improving tools for stakeholder use, and training. We will put significant effort into enhancing a toolkit (on GCD) to process remotely sensed data of river channels to monitor gravel stocks and transfers. This will be timely as several regional councils are in the process of switching from the traditional ground-surveyed, cross-section based approach of monitoring river bed-levels to use of remote-sensing (e.g., LiDAR) and are commissioning repeat surveys. Moreover, they will benefit from application of topo-bathy LiDAR, which we will use for the first time in NZ in this project.

The training workshops on methods application and modelling are a key implementation step, as full realisation of the impacts will occur beyond the research contract and will depend substantially on uptake by technical staff at regional councils and in the consulting domain.

Two years after contract completion we anticipate that:

- Modelling tools are being applied on a site-by-site basis to predict environmental effects of aggregate mining, and guidelines are being used to manage environmental effects.
- Cultural impacts are considered in all consenting decisions, and Iwi are engaged in the consenting process on an informed basis.

Five years after:

- Regional authorities are applying the methods and tools developed to process monitoring data, confidently set limits on sustainable extraction rates, and improve/update regional plans.
- Consents for river gravel extraction will be being issued for longer terms, enabling the industry to benefit economically from surety of supply of riverine aggregate.

Ten years after:

- Developments requiring aggregate are completed at less cost owing to surety of riverine supply.
- The physical and biological environments of river channels, and the stability of coastlines sensitive to supplies of river gravel, have not been significantly affected by aggregate mining.

Realisation of the benefits relies on uptake of the research by councils, iwi, extractors and consultants. By creating a formal project steering group and involving stakeholders throughout the project we mitigate the risk that they could become dis-engaged or that the developed tools will not meet their needs. Technical risk is addressed under Research Plan.

Excellence

Science

Reliable measurement of gravel load is essential for determining sustainable limits on river gravel extraction, yet a general method to do this has so far eluded the international science/engineering community. Gravel transport occurs during floods so the challenges for direct measurement are daunting, while estimation by bedload formula is notoriously uncertain. Finding a solution is a key priority flagged at recent international workshops.

Our primary research aim faces this challenge by developing a new field-based approach to measure gravel transport rates at the flood-event scale that is based on surveying morphological change. By using the latest remote-sensing technologies, we aim to resolve the size of trans-flood erosion and deposition patches and from these extract transport rate. Once proven, the method will be available for broad application internationally.

A key hypothesis is that we will find a relationship between patch size and how far gravel moves during floods (the 'step-length'). This could fail during very large floods when the change we survey only captures the net change from several accretion/erosion cycles. We will check this by using a 2D morphological model to undertake numerical experiments with large floods. Risk of incorrect model behaviour will be mitigated by calibrating the model to our field measurements during smaller floods. A further check on method reliability will be by working in study reaches with a zero-transport downstream boundary, so by measuring net reach volume change we can independently measure reach gravel inflow.

Having reliable measures of gravel transport rate at one location will enable calibration of morphological models (which use bedload transport formulae and so must be calibrated). This will "open the door" to using such models to predict downstream effects of extraction operations on river bed-level, form, and gravel delivery downstream, enabling assessment of effects on flooding, erosion, riverine physical habitat and ecosystems, and cultural values.

Thus our secondary research aims are to enable such predictions of effects based upon the use of numerical models by improving model capability and collecting field data about how extraction-induced effects on river morphology impact on other values.

For model capability enhancement, we will address sand-gravel mixtures, abrasion, and cross-channel shear stress and grainsize variation. We will then use the improved models to simulate a series of typical extraction scenarios.

For habitat and ecological effects we will compile evidence of effects and identify resilience by collecting new field data on geomorphic, ecological, and cultural effects at example extraction sites. The geomorphic data will be used to assess how extraction influences changes in physical habitat. The ecological campaign will capture spatial and temporal biotic responses to these physical changes. We will take a Māori-led approach to assess cultural values relating to gravel extraction. This will be the first time that physical, ecological, and cultural impacts of riverine extraction will have been studied together. The risks of inconclusive results will be mitigated by selecting study reaches with strong extraction 'signals' and monitoring for 1-2 years to capture natural restoration by floods and freshes.

Team

FIRST NAME	LAST NAME	ORGANISATION	ROLE/S	Yr 1 FTE	Yr2 FTE	Yr3 FTE	Yr 4 FTE
Alan	Grey	NIWA	Contact person	0.02	0.01	0.01	0.01
Jo	Hoyle	NIWA	Science leader	0.45	0.50	0.64	0.63
Murray	Hicks	NIWA	Key researcher	0.25	0.08	0.11	0.16
Richard	Measures	NIWA	Key researcher	0.30	0.25	0.46	0.52
Jeremy	Walsh	NIWA	Key researcher	0.27	0.15	0.16	0.21
Michelle	Greenwood	NIWA	Key researcher	0.18	0.19	0.18	0.24
New	Scientist	NIWA	Early career researcher	0.16	0.24	0.26	0.16
Jochen	Bind	NIWA	Key individual	0.25	0.33	0.38	0.15
Mandy	Home	NIWA	Other	0.09	0.06	0.05	0.04
Jon	Tunnicliffe	University of Auckland	Other	0.05	0.05		
Masters	Student	University of Auckland	Student	0.5	0.5		
Damia	Vericat	University of Lleida, Spain	Other	0.25	0.25	0.05	0.05
Joe	Wheaton	Utah State University,	Other			0.2	0.1
Dimitri	Lague	University of Rennes,	Other		0.25	0.25	0.1
Mark	Sanders	Ryder Consulting	Other	0.15	0.15		

Our team will use NZ's leading experts in sediment transport and modelling in gravel-bed rivers, draw in experts on riverbed ecology and riverine cultural values, and call in top international experts on gravel-bed river surveying.

Science Leader Dr Jo Hoyle is an emerging leader in the new field of eco-geomorphology. She has experience with river channel surveys, hydraulic modelling, and the connections between channel form and processes and in-stream biota, as well as practical experience as a river asset manager and strong links to the IPENZ Rivers Group. Key researcher Dr Murray Hicks, who will support the Science Leader, led a team that pioneered use of aerial digital photogrammetry and LiDAR to survey change in large braided rivers [14, 15]. Murray leads NIWA's Core-funded Sustainable Water Allocation Programme, which collaborated with an international consortium to survey and model the Rees River, Otago [16, 17]. He has published widely on gravel-bed rivers and has advised regional councils on gravel budgets and aggregate extraction. In 2013 he received the IPENZ Arch Campbell Award for services to river engineering in New Zealand.

Key researcher Richard Measures is a 1D-3D river hydraulic and morphological modeller, an active contributor to the international open-source model Delft3D ("2012 Delft3D Developer of the Year" award), and applied NIWA's GRATE (Gravel Routing And Textural Evolution) 1D morphological model to assist ECan and HBRC [18, 19] with gravel extraction planning including training HBRC staff in model use. Key researcher Jeremy Walsh

develops the code for the GRATE model. Key researcher Dr Michelle Greenwood, a river ecologist specialising in disturbance events, is another emerging leader who has expertise in braided, gravel-bed river ecosystems, and will investigate the effects of extraction on river biota.

Key individual Mandy Home will lead the Māori engagement aspects. Mandy is from Ngāi Tahu and is a member of NIWA's Te Kūwaha team, which has extensive experience with iwi engagement. Key individual Jo Bind, an expert in geospatial analysis, also manages NIWA's new Mobile Mapping System (MMS), which will be a key instrument for collecting the high resolution topographic data required for this project. Dr Mark Sanders (sub-contractor) brings a background in wading river birds of NZ gravel-bed rivers. The University of Auckland (sub-contractor) contributes a Master's student and co-supervisor Dr Jon Tunnicliffe, who has experience in gravel extraction issues in Hawke's Bay.

We have commitments from three exciting international collaborators, each world-leaders in their fields. Dr Dimitri Lague is the scientific director of the green-laser, topo-bathy airborne LiDAR instrument that we will be sourcing from France for this research [20]. Dr Damia Vericat, a previous collaborator [21], currently leads a project aimed at coupling channel morphodynamics and ecological diversity in Spanish rivers suffering major alterations due to gravel extraction [22] and has begun developing the concept of gravel transport step-length estimation off maps of morphological change [T8]. Dr Joe Wheaton brings experience in river restoration, monitoring and modelling riverine habitats, and is co-developer of the GCD software [24, 25] that we plan to further develop in relation to gravel extraction during this project.

Resources

Our research requires rapid, accurate (±10 cm) and high resolution (> 1 pt/m^2) repeat surveys of channel topography to map erosion and deposition from flood events and to capture changes in in-stream physical habitat. For this we intend using two leading-edge technologies: a mobile mapping system (MMS) and topo-bathy LiDAR. Use of these underpins the proposed morphological approach to quantifying gravel transport, which would be impossible or prohibitively expensive otherwise.

NIWA is currently purchasing a 'LiDAR USA Scanlook 2.0' MMS, a miniaturised LiDAR scanner integrated with GPS and an inertial reference unit (IRU). It is ideally suited to rapid surveying of the dry parts of river banks and beds between floods; its small size and weight allowing deployment on a range of platforms (e.g., 4WD vehicle, backpack or jetboat mounted for surveying smaller areas or drone/helicopter). The scanner's array of 32 lasers are spread across a 40 degree field of view, which minimises shadowing effects caused by vegetation and other physical obstacles. It achieves resolution and accuracy higher than aerial LiDAR, which sets the accuracy benchmark for our study requirements but is also more expensive to deploy. The novel use of MMS technology for river bed surveying in this project will develop robust operating and data processing procedures enabling greater uptake of this powerful tool for river bed monitoring in New Zealand and internationally.

The Universities of Rennes and Nantes (France) purchased an 'Optech Titan' topo-bathy LiDAR in 2015. Deployed from a plane or helicopter, the instrument uses a green laser to survey submerged (down to 5-10 m depth) and dry-land topography at very high resolution and precision (20 pts/m^2, ±10 cm vertical accuracy) and competitive cost compared to existing techniques (e.g., sonar). With such an instrument, it is now possible to rapidly obtain a complete description of fluvial environments (topography, bathymetry, vegetation cover) over wide areas (> 100 km^2) in a single pass. Only a few topo-bathy LiDAR instruments are available in the world, and none in NZ. Our collaborator Dr Dimitri Lague is the scientific director of this instrument and has expressed his willingness to work with the research team to operate it in NZ for this project (as well as for other deployments currently under

discussion) [20]. The Rennes/Nantes instrument, with Dr Lague's involvement, offers the huge advantage that it can be used at relatively low cost, since the main operational costs are restricted to flight hours (a light aircraft can be used) and post-processing costs. Its use in our project will be the first deployment of a topo-bathy LiDAR in NZ rivers. Over the next decade, we see this becoming the technology of choice for river channel and gravel management surveys, and so this project will play a key role in introducing it and developing its use to NZ river management. Since this will not be available until early 2018, we utilise our MMS until then.

Other special NIWA resources to be used include a remote-control mini-jetboat and a quadcopter drone (for securing aerial imagery, MMS deployment). In the unlikely event of MMS or topo-bathy LiDAR breakdown, we will use structure-from-motion based photogrammetry-derived dry river-bed topography using imagery collected with NIWA's camera-equipped drone.

Methods

Research Aim 1

Research Aim 1 is to develop a new 'morphological' approach to measure gravel transport rates based around high-resolution surveys of erosion and deposition caused by high-flow events. We will work at study reaches in a large braided river (Waimakariri, Canterbury) and a semi-braided river (Ngaruroro, Hawke's Bay). These rivers have been selected because they have gravel/sand transitions at their downstream ends plus extensive historical channel-survey datasets and extraction records - so their transport rates are already known with certainty [26, 27]. In each study reach we will:

1. Use either topo-bathy LiDAR or a combination of a MMS with boat- and image-based bathymetry mapping to survey changes in topography following a series of flood events [15, 28, 29].
2. Map and compute volumes of erosion and deposition following each flood event using GCD software, which separates real erosion/deposition from 'noise' created by survey error. Until the topo-bathy LiDAR arrives in 2018, higher survey error in wetted channels will be mitigated by focussing on erosion patches, which tend to be thicker and hence are easier to detect above survey error.
3. Measure average gravel 'step-length' (distance travelled) during different sized flood events using radio-tagged tracer particles.
4. Correlate observed step-length with size characteristics of erosion and deposition patches to create a step-length predictor (so that in future applications of the method patch size characteristics from mapped geomorphic change can proxy for step-length).
5. Combine step-lengths with erosion/deposition patch volumes to compute event gravel transport rate.
6. Set up a 2D morphological model (DELFT3D) of the study reach and, once calibrated off the field measurements of erosion and deposition, use this to numerically investigate the relationship between step-length and erosion/deposition patch dimensions. This step has been included as the model can simulate floods of any size, mitigating the risk that following large floods the effect of multiple erosion/deposition cycles may increase uncertainty associated with field measurements of erosion/deposition volumes.
7. Disaggregating the event-averaged gravel transport results into an instantaneous gravel bedload vs water discharge rating, and using this to calculate the long-term gravel transport rate through the study reach.
8. Validating the latter off the long-term average gravel transport rate determined independently from historical river surveys, extraction records, and observed zero gravel flux past the gravel-sand transition.

We will implement the new gravel transport rate approach as an extension to collaborator Joe Wheaton's GCD Arc-GIS module. This will include automated extraction of erosion patch volumes and length statistics, as well as a calculation of net change in reach gravel volume and its uncertainty. Including the new techniques in the GCD software provides fit-for-purpose tools directly relevant to gravel-extraction management which can be easily applied by consultants, regional council river engineers, or industry.

Research Aim 2

We will develop more reliable modelling tools by making significant improvements to existing numerical morphological modelling tools for predicting the effect of extraction on river bed-levels, substrate size grading, and downstream delivery of sand and gravel. This will involve:

1. Using the open source Delft3D morphological model in 2D mode (high resolution, computationally intense, suited to reach-scale modelling over individual flood time-

scales) to parameterise 1D models (low resolution but able to simulate decadal to century scale channel evolution over 100+ km of river), particularly for incorporating spatially-distributed shear stress and bed-material grainsize, which are key controlling factors for gravel transport (to be undertaken in the Waimakariri River, using the DELFT3D model built for Research Aim 1).

2. Validating cobble abrasion algorithms in NIWA's 1D GRATE model with field data on cobble size and lithology collected from a mixed lithology river (middle Tukituki River, which has a mixture of gravel lithologies of varying robustness, provides a long reach without new gravel sources, and already has an early-version GRATE model set up).
3. Co-supervising field- and modelling-based student studies to assess the effect of substrate manipulation on gravel mobility and channel form, such as 'bar-skimming' (selective extraction of coarser cobbles) and 'bar ripping' (mechanically breaking-up the bed-surface armour layer).
4. Capturing these improvements and effects of extraction operations into the GRATE model.
5. Writing updated technical and user manuals for the GRATE model and providing training courses on its use.

Research Aim 3

The improved GRATE and Delft3D models will be applied to several typical situations to characterise and quantify the effects of gravel extraction on riverbed levels, substrate size, and gravel exports downstream (e.g., to erosion-sensitive coasts), and river channel physical habitat (i.e., inundation, depth, substrate size, velocity, frequency of bed disturbance by floods). The typical situations will include: i) over- and under-extraction (short- and long-term, localised and widespread); ii) climate change effects on gravel supply and continuity of transfer; iii) episodic increases in supply from large storms and earthquakes; and iv) cumulative effects of extraction operations such as bar ripping and skimming. With i), an example question is the extent to which a temporary (say 10 year) phase of extraction 50 km upstream from the coast would diffuse downstream over time, thus smoothing-out the impact on the coastal sediment budget over a longer period. Typical situations and case-example rivers will be selected with input from the regional councils' River Managers Group.

Research Aim 4

Investigating the effects of extraction operations on river channel biota will involve:

1. Collating information from past studies and from stakeholder observations and records (e.g., extraction industry, DOC, regional councils, Fish & Game, iwi).
2. Identifying key process-links (e.g., altered riverbed topography promotes weed growth, changes in the frequency of invertebrate disturbance by floods, inhibited fish passage).
3. Undertaking controlled experiments (with un-extracted/extracted, upstream/downstream paired reaches) to measure the scale of effects of extraction works on physical habitat and biota responses and to determine the rate-of-recovery of physical habitat in extraction reaches through the natural work of floods and freshes – which will identify the physical resilience of channels to extraction operations.

The experiments will require: repeat morphological surveys using the same survey techniques detailed in Research Aim 1; Delft3D model setups for each survey, with physical habitat in relation to discharge being mapped in regard to habitat suitability (depth-velocity-substrate combinations), distribution of habitat units (riffles, runs, pools), and island characteristics (number, distance to bank – as a measure of river-bird vulnerability to predators). Biota responses will include repeat surveys of periphyton, invertebrates, birds, fish, and vegetation. Specific focus will be placed on key Mahinga Kai, linking with Research

Aim 5. The monitoring will span at least one full year to capture both extraction operations and floods/freshes.

Research Aim 5

Assessing the effects of extraction operations on Māori values will involve: i) gathering information kanohi-ki-te-kanohi (face-to-face) at hui; ii) employing a variation on the COMAR methodology to assess relationships between extraction-related channel changes and Māori values [30]. This work will be integrated into the field studies in Research Aim 4 to maximise use of resources and to deliver holistic understanding of effects. Specifically, iwi assessment teams will survey the control and extraction-impacted reaches at the same time as the surveys of physical habitat change and river channel biota, with the iwi surveys also repeated through a year to assess how rapidly cultural values may be restored naturally by floods and freshes.

Involving iwi in this way at both our key study sites in Canterbury and Hawke's Bay will build upon recent work by Hawke's Bay and Canterbury regional councils to promote engagement on decision making regarding gravel extraction. During discussions with iwi representatives they have highlighted particular hapū and marae which are most impacted by gravel extraction and who would be most valuable to involve in this data collection.

The broader results of the study will be shared face-to-face at hui towards the end of the research programme and included in publically available guidance documentation where appropriate.

Research Aim 6

Stakeholder engagement and effective communication of research outputs is essential in order to achieve maximum benefit. Key users of the research will be industry, iwi, regional council river engineers and consents staff, and consultants. We will ensure stakeholders are engaged and that the research meets their needs and is communicated in an effective way by:

1. Creating a steering group at the start of the program which will meet at least annually to help ensure the research stays focussed on stakeholders needs.
2. Holding workshops early in the research programme to increase understanding and co-develop issues of concern and specific scenarios to assess in Research Aim 3.
3. Producing a guidance manual for all stakeholders to explain the potential issues and risks associated with gravel extraction and how to avoid or mitigate them.
4. Holding workshops to present initial research results, share and seek feedback on draft guidelines, and provide training on the tools, including the use of numerical models and use of the enhanced GCD tool (particularly focussed for councils).

Research Plan (Methodology)

For Research Aim 1 (to develop a reliable method of measuring gravel transport rate), we have chosen to pursue our 'morphological' approach because: (i) rapid, sufficiently-accurate field surveys to provide the required data are now achievable with modern remote-sensing technology, (ii) analysis tools for rapidly processing such large datasets (e.g., GCD Arc-GIS plugin) have matured, (iii) there are promising indications of a relationship between erosion/deposition patch-size characteristics and transport rate in existing datasets our team has helped collect [23], (iv) locating the study reaches above gravel/sand transition points enables an independent measure of gravel transport rate, and (v) the method should be able to be taken-up by others, providing they can access the survey technology. To that end our vision is that regional councils in New Zealand (and international equivalents) will, over the next decade, embrace technology such as topo-bathy LiDAR and the opportunities that it enables in the course of regular river surveys.

Risk of failure of preferred survey equipment during our project is mitigated by having fall-back options (e.g., MMS for topo-bathy LiDAR, structure-from-motion photogrammetry for MMS). Team members are experienced in all of these techniques.

We will use 2D modelling to replicate the RA1 field observations (e.g., with a model we can easily measure gravel transport distance using 'digital tracers', map erosion/deposition patch distributions, and tally gravel transport rates). This will enable us to test hypotheses further, particularly to assess how well the approach applies during large floods when gravel slugs may move multiple steps.

For RA2, our strategy is to use field-calibrated high-resolution 2D numerical models to create expedient parameterisation routines that overcome the shortcomings of 1D models which, nonetheless, still remain the only practical tool for predicting the effects of extraction over large river distances and decade-century time-scales.

With RA3, we will use modelling tools to answer frequently-asked questions around gravel-extraction sustainability particularly in regard to effects on riverbed levels and continuity of gravel transfer, using case-example situations from collaborating regional councils.

With RA4 and RA5, we will use a paired-reach approach (adjacent treated/untreated reaches) to show the effect of extraction operations on riverbed physical habitat, biota, and cultural values. We will monitor over at least a year to ensure that effects of extraction can be placed in perspective to natural riverbed disturbance by high flows, which will demonstrate the level of extraction activity that may be sustainable on a year-by-year basis. With RA5, our strategy is to engage with iwi so that the research is focussed on their values and concerns, and then work together to collect data that informs them on how gravel extraction could affect their values.

RA6 will involve a steering group of council, industry and iwi representatives throughout the programme to ensure that the research priorities align with their priorities. Workshops early in the research programme will co-develop issues of concern and specific scenarios to assess, and closing workshops will convey results, discuss guidance advice, and provide training on tools.

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Appendix F. NZTA and Hawkes Bay Territory Authorities' Aggregate Specifications

SPECIFICATION FOR BASECOURSE AGGREGATE

1. SCOPE

This specification sets out requirements for basecourse aggregate for use on state highways and other heavily trafficked roadways.

2. GENERAL

All sampling and testing shall be performed by an IANZ Accredited laboratory for the performance of the relevant test as shown in Figure 1.

All basecourse aggregate which does not comply with the requirements of this specification shall be either: tested as agreed by the Transit New Zealand's Engineering Policy Manager for consideration as a regional basecourse aggregate for inclusion in Table 4 or rejected.

The basecourse aggregate shall be classified as either M/4 or one of the regional basecourse aggregates detailed in Table 4. Additional guidance on the use of regional basecourse aggregates is provided in the appendices to the Notes for this specification.

3. SOURCE PROPERTIES

The basecourse aggregate shall be broken or crushed from either: waterworn gravel; quarried rock or from other sources accepted as a regional basecourse aggregate detailed in Table 4. Source material shall consist of hard, sound material of uniform quality, free from soft or disintegrated stone or other deleterious material.

3.1 Testing Source Properties General

Source properties of the aggregate shall be assessed by the testing specified in Clause 3.3 on samples of aggregate from current production, which are representative of the processing method.

If the aggregate source or processing method is changed then the source properties shall be tested immediately and the Engineer informed. Acceptance of basecourse aggregate from the varied process shall be at the discretion of the engineer until the source properties are shown by test to comply with this specification.

The source property tests shall be performed at periods not exceeding two years unless a comparative petrographic examination of the current aggregate and a

sample from the material successfully tested two years earlier shows that there has been no significant change in the material.

If a petrographic examination is used as described above the source properties shall be tested at least once every four years.

The petrographic examination must be performed by persons who are qualified by education and experience to employ techniques for the recognition of the characteristic properties of aggregates and minerals. The examination shall follow the guidelines given in ASTM C 295 *Standard Practice For Petrographic Examination of Aggregate For Concrete*.

When testing source properties a sample of the aggregate suitable for petrographic examination shall be stored for a minimum of two years by the IANZ Accredited laboratory performing the test.

The Engineer may require some or all of the source property tests to be performed in addition to the testing frequencies stated above. Should the test results show that the material complies with this specification, testing will be at the Principal's cost, otherwise testing will be at the cost of the Contractor.

3.2 Source Property Tests and Sampling

Source properties shall be sampled and tested at a rate of at least one sample for every 10,000m^3 of source material.

3.3 Source Property Tests

3.3.1 Crushing Resistance

When tested in accordance with NZS 4407 : 1991, Test 3.10, *The Crushing Resistance Test*, under a load of 130 kN less than 10% fines passing 2.36 mm sieve size shall be produced.

3.3.2 Weathering Quality Index

The aggregate shall have a quality index of AA, AB, AC, BA, BB or CA when tested according to NZS 4407 : 1991, Test 3.11 *Weathering Quality Index Test*.

3.3.3 California Bearing Ratio

The sample shall be:

(a) compacted in accordance with NZS 4402 : 1986, Test 4.1.3 *New Zealand Vibrating Hammer Compaction Test at Optimum Water Content* and;

(b) tested in accordance with NZS 4407 : 1991, Test 3.15 *The California Bearing Ratio Test* (without a surcharge for at least 4 days). The soaked CBR of the basecourse aggregate shall not be less than 80%.

4. PRODUCTION PROPERTIES

Production properties of the aggregate shall be assessed by the testing specified in Clause 4.2 on representative samples of the crushed aggregate.

Representative samples of aggregate may be taken from conveyor belt, bin, stockpile or truck. Representative samples of the aggregate shall be obtained in accordance with NZS 4407 : 1991.

4.1 Production Property Test Sampling

Stored aggregate shall be subdivided into lots so that aggregates of visible difference are sampled and tested separately. The rate of obtaining samples from lots shall be as in the Table 1.

Table 1: Minimum sampling rate for production property tests

Lot Size		Number of Samples
From	**To**	
1 m^3	400m^3	2
400m^3	1500m^3	3
1500m^3	4000m^3	4

Where the lot size exceeds 4000m^3 additional testing shall be at the rate of one sample for every 1000m^3.

The Engineer may require some or all of the production property tests to be performed in addition to the testing frequencies stated above. Should the test results show that the aggregate complies with this specification, testing will be at the Principal's cost, otherwise testing will be at the cost of the Contractor.

4.2 Production Property Tests

4.2.1 Quality of Fines

The basecourse aggregate shall comply with either Sand Equivalent or Clay Index or Plasticity Index requirement stated below.

4.2.1.1 Sand Equivalent

The sand equivalent shall not be less than 40 when the aggregate is tested according to NZS 4407 : 1991, Test 3.6 *Sand Equivalent Test*.

4.2.1.2 Clay Index

The clay index of the fraction of basecourse passing the 75µm sieve shall not be greater than 3 when the aggregate is tested according to NZS 4407 : 1991, Test 3.5 *Clay Index Test*.

4.2.1.3 Plasticity Index

The plasticity index of the fraction of basecourse passing the 425µm sieve shall not be greater than 5 when the aggregate is tested according to NZS 4407 : 1991, Test 3.4 *Plasticity Index Test*.

4.2.2 Broken Face Content

The aggregate broken face content in each of the three aggregate fractions between the 37.5mm and 4.75mm sieves shall not be less than 70% by weight and shall have two or more broken faces, when tested according to NZS 4407 : 1991, Test 3.14 *Broken Face Test*.

4.2.3 Particle Size Distribution

The particle-size distribution of the aggregate shall conform with the envelope limits defined in both Tables 2 and 3 below, when the aggregate is tested according to NZS 4407 : 1991, Test 3.8.1 *Wet Sieving Test*.

If testing has been performed to show that the dry sieving method is not significantly different to the wet sieving method at 95% confidence limit for the same aggregate then dry sieving method may be used.

Table 2: Particle Size Distribution Envelope Limits for an Individual Sample

Test Sieve Aperture	Maximum and Minimum Allowable Percentage Weight Passing	
	AP40 (Max size 40mm)	AP20 (Max size 20mm)
37.5mm	100	-
19mm	66 - 81	100
9.5mm	43 - 57	55 - 75
4.75mm	28 - 43	33 - 55
2.36mm	19 - 33	22 - 42
1.18mm	12 - 25	14 - 31
600µm	7 - 19	8 - 23
300µm	3 - 14	5 - 16
150µm	0 - 10	0 - 12
75µm	0 - 7	0 - 8

Table 3: Particle Size Distribution Shape Control

Fractions	Maximum and Minimum Allowable Percentage Weight Of Material Within the Given Fraction	
	AP40 (Max size 40mm)	AP20 (Max size 20mm)
19mm - 4.75mm	28 - 48	-
9.5mm - 2.36mm	14 - 34	20 - 46
4.75mm - 1.18mm	7 - 27	9 - 34
2.36mm - 600µm	6 - 22	6 - 26
1.18mm - 300µm	5 - 19	3 - 21
600µm - 150µm	2 - 14	2 - 17

5. REGIONAL BASECOURSES AGGREGATES

For the regional basecourse aggregates the M/4 criteria shall apply except for deviations as stated in Table 4.

The regional basecourse aggregates may only be used in the region detailed if specified in Table 4 or as approved by the Engineer. The use and source of regional materials must be clearly identified in the Contractor's tender. A methodology for dealing with any special considerations must also be included in the tender.

6. COMPLIANCE

The Contractor shall supply proof of compliance before basecourse aggregate is supplied.

7. BASIS OF MEASUREMENT AND PAYMENT

The basis of payment shall be on the final compacted volume of the basecourse aggregate in place with the method of measurement as defined in the contract documents.

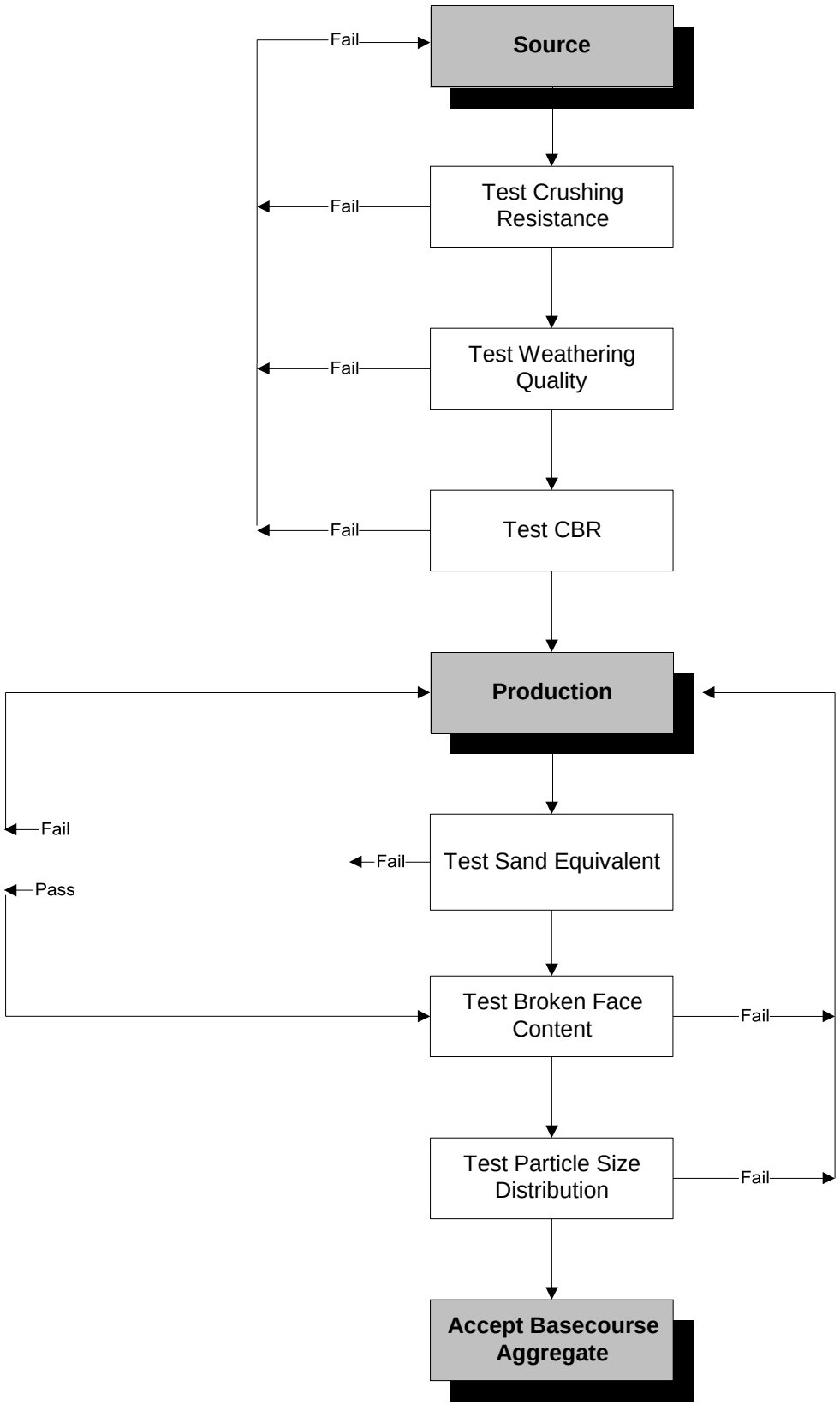

Figure 1 : Flow Chart for Basecourse Aggregate Tests

Table 4: Regional Basecourses

NZS 4407:1991 TEST NAME	TEST NO	TNZ M/4		NAPIER RIVER GRAVEL	
WEATHERING QUALITY INDEX	3.11	AA,AB,BA,BB,CA			
CRUSHING RESISTANCE	3.1	NOT LESS THAN 130kN			
CALIFORNIA BEARING RATIO	3.15	NOT LESS THAN 80%			
BROKEN FACE CONTENT GREATER THAN TWO	3.14				
SIEVE SIZE					
19mm - 37.5mm		NOT LESS THAN 70%		NOT LESS THAN 50%	
9.5mm - 19.0mm		NOT LESS THAN 70%		NOT LESS THAN 50%	
4.75mm - 9.5mm		NOT LESS THAN 70%		NOT LESS THAN 50%	
QUALITY OF FINES					
SAND EQUIVALENT OR	3.6	NOT LESS THAN 40		NOT LESS THAN 35	
CLAY INDEX OR	3.5	NOT GREATER THAN 3		IF SAND EQUIVALENT IS LESS THAN 35	
PLASTICITY INDEX	3.4	NOT GREATER THAN 5		IF SAND EQUIVALENT IS LESS THAN 35	
WET SIEVING TEST	3.8.1				
TEST SIEVE APERTURE		AP40	AP20	AP40	AP20
37.5mm		100	—		
26.5mm		—	—	78 - 100	
19mm		66 - 81	100		
9.5mm		43 - 57	55 - 75		
4.75mm		28 - 43	33 - 55		
2.36mm		19 - 33	22 - 42		
1.18mm		12 - 25	14 - 31	13 - 25	
600μm		7 - 19	8 - 23	10 - 19	
300μm		3 - 14	5 - 16	7 - 14	
150μm		0 - 10	0 - 12	5 - 11	
75μm		0 - 7	0 - 8	3 - 8	
PARTICLE SIZE DISTRIBUTION SHAPE					
FRACTIONS		AP40	AP20	AP40	AP20
19.0mm - 4.75mm		28 - 48	—		
9.5mm - 2.36mm		14 - 34	20 - 46		
4.75mm - 1.18mm		7 - 27	9 - 34		
2.36mm - 600μm		6 - 22	6 - 26	6 - 20	
1.18mm - 300μm		3 - 19	3 - 21	5 - 15	
600μm - 150μm		2 - 14	2 - 17	2 - 12	
TRAFFIC LOADING LIMIT					

NZS 4407:1991 TEST NAME	TEST NO	ROTORUA 1 RHYOLITE	ROTORUA 2 PART CRUSHED RIVER GRAVEL
WEATHERING QUALITY INDEX	3.11		
CRUSHING RESISTANCE	3.1	NOT LESS THAN 60 kN	
CALIFORNIA BEARING RATIO	3.15		
BROKEN FACE CONTENT GREATER THAN TWO	3.14		
SIEVE SIZE			
19mm - 37.5mm 9.5mm - 19.0mm 4.75mm - 9.5mm		N/A N/A N/A	NOT LESS THAN 40% NOT LESS THAN 40% NOT LESS THAN 40%
QUALITY OF FINES			
SAND EQUIVALENT OR	3.6		NOT LESS THAN 45
CLAY INDEX OR	3.5		IF SAND EQUIVALENT IS LESS THAN 45
PLASTICITY INDEX	3.4		IF SAND EQUIVALENT IS LESS THAN 45
WET SIEVING TEST	3.8.1		
TEST SIEVE APERTURE		AP40 AP20	AP40 AP20
37.5mm 26.5mm 19mm 9.5mm 4.75mm 2.36mm 1.18mm 600μm 300μm 150μm 75μm			
PARTICLE SIZE DISTRIBUTION SHAPE CONTROL			
FRACTIONS		AP40 AP20	AP40 AP20
19.0mm - 4.75mm 9.5mm - 2.36mm 4.75mm - 1.18mm 2.36mm - 600μm 1.18mm - 300μm 600μm - 150μm			
TRAFFIC LOADING LIMIT		LESS THAN 1 x 10^6 ESA	

NZS 4407:1991 TEST NAME	TEST NO	WANGANUI SHELL ROCK	TARANAKI ANDESITE – 65kN
WEATHERING QUALITY INDEX	3.11		
CRUSHING RESISTANCE	3.1	NOT LESS THAN 50 kN	NOT LESS THAN 65 kN
CALIFORNIA BEARING RATIO	3.15	NOT LESS THAN 120%	
BROKEN FACE CONTENT GREATER THAN TWO	3.14		
SIEVE SIZE			
19mm - 37.5mm 9.5mm - 19.0mm 4.75mm - 9.5mm		N/A N/A N/A	
QUALITY OF FINES			
SAND EQUIVALENT OR	3.6		
CLAY INDEX OR	3.5		
PLASTICITY INDEX	3.4		
WET SIEVING TEST	3.8.1		
TEST SIEVE APERTURE		AP40 AP20	AP40 AP20
37.5mm 26.5mm 19mm 9.5mm 4.75mm 2.36mm 1.18mm 600µm 300µm 150µm 75µm		N/A N/A N/A N/A 70 MAX N/A 50 MAX N/A N/A N/A 10 MAX	
PARTICLE SIZE DISTRIBUTION SHAPE			
FRACTIONS		AP40 AP20	AP40 AP20
19.0mm - 4.75mm 9.5mm - 2.36mm 4.75mm - 1.18mm 2.36mm - 600µm 1.18mm - 300µm 600µm - 150µm		N/A N/A N/A N/A N/A N/A	
TRAFFIC LOADING LIMIT			LESS THAN 2 x 10^5 ESA

NZS 4407:1991 TEST NAME	TEST NO	TARANAKI ANDESITE –85kN	TARANAKI ANDESITE–100kN
WEATHERING QUALITY INDEX	3.11		
CRUSHING RESISTANCE	3.1	NOT LESS THAN 85 kN	NOT LESS THAN 100 kN
CALIFORNIA BEARING RATIO	3.15		
BROKEN FACE CONTENT GREATER THAN TWO	3.14		
SIEVE SIZE			
19mm - 37.5mm 9.5mm - 19.0mm 4.75mm - 9.5mm			
QUALITY OF FINES			
SAND EQUIVALENT OR	3.6		
CLAY INDEX OR	3.5		
PLASTICITY INDEX	3.4		
WET SIEVING TEST	3.8.1		
TEST SIEVE APERTURE		AP40 AP20	AP40 AP20
37.5mm 26.5mm 19mm 9.5mm 4.75mm 2.36mm 1.18mm 600μm 300μm 150μm 75μm			
PARTICLE SIZE DISTRIBUTION SHAPE			
FRACTIONS		AP40 AP20	AP40 AP20
19.0mm - 4.75mm 9.5mm - 2.36mm 4.75mm - 1.18mm 2.36mm - 600μm 1.18mm - 300μm 600μm - 150μm			
TRAFFIC LOADING LIMIT		LESS THAN 1 x 10^6 ESA	

NZS 4407:1991 TEST NAME	TEST NO	WELLINGTON 1 GREYWACKE	
WEATHERING QUALITY INDEX	3.11		
CRUSHING RESISTANCE	3.1		
CALIFORNIA BEARING RATIO	3.15		
BROKEN FACE CONTENT GREATER THAN TWO	3.14		
SIEVE SIZE			
19mm - 37.5mm 9.5mm - 19.0mm 4.75mm - 9.5mm		NOT LESS THAN 60% NOT LESS THAN 60% NOT LESS THAN 60%	
QUALITY OF FINES			
SAND EQUIVALENT OR	3.6	NOT LESS THAN 30	
CLAY INDEX OR	3.5	IF SAND EQUIVALENT IS LESS THAN 30	
PLASTICITY INDEX	3.4	IF SAND EQUIVALENT IS LESS THAN 30	
WET SIEVING TEST	3.8.1		
TEST SIEVE APERTURE		AP40 AP20	
37.5mm 26.5mm 19mm 9.5mm 4.75mm 2.36mm 1.18mm 600μm 300μm 150μm 75μm		100 - 95 58 - 85 30 - 65 15 - 45 10 - 35 8 - 25 5 - 20 3 - 15 0 - 10 0 - 8	
PARTICLE SIZE DISTRIBUTION SHAPE CONTROL			
FRACTIONS		AP40 AP20	
19.0mm - 4.75mm 9.5mm - 2.36mm 4.75mm - 1.18mm 2.36mm - 600μm 1.18mm - 300μm 600μm - 150μm			
TRAFFIC LOADING LIMIT			

RCC – Recycled Crushed Concrete

NZS 4407: 1991 TEST NAME	TEST NO	RCC BASECOURSE	
[2,3]**DEFINITION**	**RCC** is **Recycled Crushed Concrete** composed of rock fragments coated with cement with or without sands and/or filler, produced in a controlled manner to close tolerances of grading and minimum foreign material content. RCC fragments shall consist of clean, hard, durable, angular fragments of concrete. A basecourse is the upper 150 mm layer in the pavement, while the sub-base is below the basecourse layer. Subbases shall conform to the requirements of TNZ M/3 notes, the Foreign Material Contents listed below and the project specific specification. Variation to the following limits are possible should the material meet the requirements of TNZ M22, accepted by Transit New Zealand. **It must be approved for use by the appropriate Regional Council.**		
[2]**FOREIGN MATERIAL**	The percentages of foreign materials shall be determined by RTA Test Method T276. The percentages of foreign materials shall not exceed the following percentages by mass: Type 1 Materials: Glass, brick, stone, ceramics and asphalt < 3%; Type II Materials: Plaster, clay lumps and other friable material: < 1%; Type III Materials: Rubber, Plastic, Bitumen, Paper, Wood and other vegetable or decomposable matter: < 0.5% No Type II or III materials may be retained on the 37.5mm or above sieves for RCC Basecourse materials. In no circumstances shall the RCC product contain any asbestos or asbestos fibre. Testing for foreign materials shall be at the minimum sampling rate for production property tests		
WEATHERING QUALITY INDEX	3.11	(N/A)	
CRUSHING RESISTANCE	3.1	NOT LESS THAN 130kN	
CALIFORNIA BEARING RATIO	3.15	NOT LESS THAN 80%	
BROKEN FACE CONTENT GREATER THAN 2	3.14		
SIEVE SIZE			
19mm - 37.5mm 9.5mm - 19.0mm 4.75mm - 9.5mm		NOT LESS THAN 70% NOT LESS THAN 70% NOT LESS THAN 70%	
QUALITY OF FINES			
SAND EQUIVALENT OR	3.6	(N/A)	
CLAY INDEX[2] OR	3.5	(N/A)	
PLASTICITY INDEX[2]	3.4	NOT GREATER THAN 5	
WET SIEVING TEST	3.8.1		
TEST SIEVE APERTURE		AP40	
75mm 63mm 37.5mm 19mm 9.5mm 4.75mm 2.36mm 1.18mm		100 100 98 - 100 76 - 94 57 - 75 38 - 58 27 - 47 19 - 39	

NZS 4407: 1991 TEST NAME	TEST NO	RCC BASECOURSE	
600µm 300µm 150µm 75µm		12 - 32 6 - 26 0 - 22 0 - 14	
RCC – Recycled Crushed Concrete – continued: **PARTICLE SIZE DISTRIBUTION SHAPE**			
FRACTIONS		AP40	
37.5mm - 9.5mm 19.0mm - 4.75mm 9.5mm - 2.36mm 4.75mm - 1.18mm 2.36mm - 600µm 1.18mm - 300µm 600µm - 150µm		27 - 47 17 - 41 8 - 30 6 - 24 5 - 21 3 - 19	
TRAFFIC LOADING LIMIT			

Please note: N/A = Not Applicable and test is not required
1. RCC is generally non plastic as cement dust reacts with any plastic fines present.
2. These requirements for RCC were based on the Transport South Australia's Pavement Material Specification Part 215.
3. RCC shows comparable performance to high quality M4 aggregate as proven at Transit New Zealand accelerated pavement testing facility CAPTIF.

Special Considerations

Stockpiles of RCC should be separated (a minimum distance) from water courses because of the alkaline nature of RCC leachate.

Where RCC aggregates are used in granular basecourse applications in conjunction with subdrains, the following procedures are recommended to reduce the likelihood of leachate precipitates clogging the drainage system:

- Wash the processed RCC aggregates to remove dust from the coarse particles.
- Ensure that any geotextile fabric surrounding the drainage trenches (containing the subdrains) does not intersect the drainage path from the base course, ie do not fully wrap drains (to avoid potential plugging with fines).

The pH value of the RCC aggregate can exceed a pH value of 11. This can be corrosive to galvanized or aluminum pipes placed in direct contact with the RCC. Galvanized or aluminum pipes shall not be used in RCC pavements.

NZS 4407: 1991 TEST NAME	TEST NO	GLENBROOK MELTER SLAG
DEFINITION	Glenbrook Melter Slag is a co-product of the iron making operation at NZ Steel, Glenbrook. The material is processed by "SteelServ" to produce an AP40 aggregate complying to the standard TNZ M4 requirements. **It must be approved for use by the appropriate Regional Council.**	
CHEMICAL ANALYSIS	To ensure a consistent product, the acceptable ranges of the individual relative proportions of slag are: Min % / Max % Cao 10 20 Fe 0 10 SiO2 9 15 Al2O3 15 21 MnO 0.5 1.7 MgO 11 15 TiO2 27 42 Cr2O3 0.2 0.6 V2O5 0.1 0.5 Note: The Fe content is removed from the slag during the crushing process The non-ferrous component of every production batch of sub-base and base course Slag shall be analysed in a IANZ accredited laboratory for its chemical properties and at an interval of six months or 10,000m3 of production (whichever occurs first), for the source properties, so as to assure Transit New Zealand that the Slag remains within the parameters specified.	
POTENTIAL EXPANSION OF AGGREGATES FROM HYDRATION REACTIONS (preformed as a Source Test)	EN 1744-1:1998	Not Greater than 0.5% at seven days
WEATHERING QUALITY INDEX	3.11	>BB
CRUSHING RESISTANCE	3.1	NOT LESS THAN 130kN
OTHER	As per TNZ M4	
TRAFFIC LOADING LIMIT		

Special Considerations

Stockpiles should be separated (a minimum distance) from water courses because of the alkaline nature of leachate.

Steel Slag aggreate are known to potentially clog geotextile fabric wraped drains, the reduced amount of free lime in Melter Slag should reduce this risk. Where Melter Slag aggregates are used in granular basecourse applications in conjunction with subdrains, the following procedures required :

- Ensure that any geotextile fabric surrounding the drainage trenches (containing the subdrains) does not intersect the drainage path from the base course ie do not fully wrap drains (to avoid potential plugging with fines).

The pH value of the melter slag aggregate generally ranges from approximately 8 to 10 in laboratory testing and 7.5-8 in the field; however leachate from blast furnance and steel slags are often in these ranges and can exceed a pH value of 11. This can be corrosive to galvanized or aluminum pipes placed in direct contact with the slag. With this in mind galvanized or aluminum pipes shall not be used in melter slag aggregate pavements.

While melter slags have reportedly good test results in terms of potential to swell. The use of Slag aggregate next to structures (such as bridge abutments) is not permitted.

AGGREGATE / RECLAIMED GLASS BLENDED BASECOURSE

DEFINITION

Overseas experience suggests that appropriately processed reclaimed glass is well suited for use as a basecourse aggregate. Adding glass to aggregate, in suitable proportions, provides a number of environmental benefits without compromising the mechanical properties of the aggregate.

This extension of the M/4 specification allows up to 5% reclaimed glass (by mass) to be blended with natural or recycled aggregate for road base construction. The aggregate / reclaimed glass (cullet) blend must comply with the requirements of the M/4 specification except for the variations and additions provided in this table.

Up to 5% reclaimed glass can also be added to subbase aggregate in accordance with the relevant requirements of the M/4 specification.

Proportions of cullet in excess of 5% may be used at the discretion of the Transit New Zealand Engineering Policy Manager, provided that the requirements of the M/22 specification have been satisfied. Such applications are likely to be restricted to relatively low traffic volume projects and the material may be subject to higher standards with respect to contamination limits.

CULLET PROPERTIES

Reclaimed Glass Source	The cullet can originate from a number of glass products, viz: waste food and beverage containers, drinking glasses, window glass, or plain ceramic or china dinnerware. Reclaimed glass from hazardous waste containers, light bulbs, vehicle windscreens, fluorescent tubes or cathode ray tubes shall not be used.
Grading	The cullet shall be crushed to achieve the following gradation: (NZS 4407:1991 Test 3.8.1)

Sieve	Percent Passing
9.5 mm	100
4.75 mm	70 – 100
2.36 mm	35 – 88
1.18 mm	15 – 45
0.30 mm	4 – 12
0.075 mm	0 - 5

The plus 4.75 mm component of the cullet must not contain more than 1% of flat or elongated particles, i.e. particles with a maximum to minimum dimension ratio greater than 5:1. The ASTM D 4791 test is appropriate (except that the test sample shall be taken as the material retained on the 4.75 mm sieve).

Contamination Limit	Debris, such as paper, foil, plastic, metal, cork, food residue, organic matter, etc can have a significant influence on the performance of the aggregate / glass material. The cullet shall not contain more than 5% debris, as determined using the procedure described in RTA Test Method T267 (where "reclaimed glass" is substituted for "recycled concrete").
Cleanliness	The cullet shall be washed to ensure that undesirable odours are eliminated.

PRODUCTION

Concentrations of reclaimed glass within the aggregate could have a detrimental influence on the performance of the material in a basecourse layer. Therefore, the aggregate and reclaimed glass shall be mixed thoroughly to ensure that there is an even distribution of glass throughout the basecourse stockpile.

CULLET QUALITY ASSURANCE TEST FREQUENCY

Tests for compliance with grading, particle shape and contamination shall be carried out at a frequency of two tests (each) per cullet stockpile.

ADDITIONAL PRODUCTION TESTING	As per TNZ M4	
TRAFFIC LOADING LIMIT		

CHANGES TO TNZ M/4
SPECIFICATION FOR BASECOURSE AGGREGATE

The major changes in this April 2006 edition of the TNZ M/4 specification are:

- Inclusion of Aggregate / Reclaimed Glass Blended Basecourse as a regional variant. Reclaimed Glass is also allowed in subbase with this specification.

The major changes in the May 2005 edition of the TNZ M/4 specification were:

- The ability to obtain approval of alternative basecourse materials as agreed by Transit's Engineering Policy Manager.
- Inclusion of Recycled Crushed Concrete as a regional variant.
- Inclusion of Glenbrook Melter Slag as a regional variant.

The major changes in the 2003 edition of the TNZ M/4 specification were:

- The creation of 3 new regional variants on TNZ M/4 for Taranaki Andesite.
- The removal of unused regional variants, Christchurch Uncrushed River Gravel, Nelson Basalt Rock and Wellington 2 Uncrushed River Gravel
- Regional variants are only to be used where they are specifically allowed for in the contract documents.
- The addition of 2 appendices to the TNZ M/4 Notes. The two appendices are technical notes covering the use of Wanganui Shell Rock and Taranaki Andesite.
- Updating terminology from Equivalent Design Axles (EDA) to Equivalent Standard Axles (ESA) in Traffic Loading Limit.

(iv) Test certificate for Mechanical Impact Protection rating (IK)

(v) Test certificate of thermal endurance and thermal testing requirements.

If the developer chooses to install roadway lighting that varies from the *above* standards, they shall pay Council a capitalised maintenance charge, based on the *additional* inst allation , operational and maintenance costs, as compared to standard street lighting .

Additional costings shall be calculated over a 30 year life period, and in present value terms using a discount rate of 8%. (Refer to NZTA Economic Evaluation Manual) .

Any road lighting that varies from the complying standard, must still be designed in accordance with AS/NZS 11 58 "Lighting for roads and public spaces".

Rural Roadway Lighting Design

Fl .10.3. Lighting on rural roads is provided for vehicle safety in hazardous areas such as intersecti ons. Any new road intersecting with a Rural Arterial or Rural Collector road will require a minimum one light on the opposite side of the main road and an additional light installed on the intersecting road.

MATERIALS

F1.11. Testing

Fl.11.1. All appropriate material testing shall be carried out by testing laboratories with recognised registration or quality assurance qualifi catio ns.

Concrete

Fl.11.2. All concrete shall be ready mix concrete supplied from an approved ready mix plant , and conform with NZS 3109 Extruded and in-situ kerb and channel and dish channels, sumps, footpaths, residential cro ss ings and commercial / industrial crossings , shall have a minimum 28 day compressive strength of 20 M .

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Fl.11.3. Subbase Aggregate

A variety of materials may provide satisfactory performance in the subbase layer providing the pavement layer depths are designed accordingly . The pavement design shall specify the subbase material to be used and provide soaked CBR test results confirming that the material is compatible with the design. The aggregate shall have a minimum crushing resistance of 1 00 KN when tested in accordance with NZS 4407: 1991 Test 3.10, and shall produce a minimum CBR of 40 when tested in accordance with NZS 4407:1991 Test 3 . 1 5 after compaction .

The minimum subbase aggregate requirements are that the material shall be able to be constructed in accordance with TNZ B/2 including compaction standards and surface shape tolerances. The maximum particle size shall be the lesser of 80 mm or 40% of the layer depth in accordance with B/ 2.

The TNZ M/3 "Notes on Subbase Aggregate " is useful in specifying subbase aggregates .

Fl.1 l.4. Basecourse Aggregate

Basecourse aggregate shall comp ly with TNZ M/4.

Refer to Table 5 in the M/4 specification for details of the "Napier River Gravel " regional variant.

Fl.1l.5. Transition Layer

Any transition layer shall be included in the approved pavement design. The transition layer material may be a filter aggregate complying with TNZ F/2 or an approved geotextile filter fabric.

Fl.1l.6. Road Surfacing Materials

The road surfacing material shall comply with the following:

(a) Asphaltic Bitumens shall comply with TNZ M/1.

(b) Sealing Chip shall comply with TNZ M/ 6.

(c) Asphaltic Concrete shall comply with TNZ M/1 0.

(d) AS/NZS 4455 : Masonry Units, Pavers, flags and segmental retaining wall units.

Fl.1l.7. Traffic Signs and Road Name Plates

All materials for signs shall comply with the "St andard for the Manufacture and Maintenance of Traffic Sig ns, Posts and Fitt ings " published by NZTA and the Road Safety Manufacturers Association. Further to this specification, no timber post s, plates or blades shall be used.

Fl.1 l.8. Road Marking Paint

Road marking paint shall comply with TNZ M/ 7: Road Marking Paint s.

Fl.12. NON-PUBLIC ACCESSWAYS FOR OTHER THAN FRONT LOTS (Urban & Rural)

Non-public accessways include all roads and accessways that remain in private ownership after completion of any development other than a front allotment.

The standards described in this section apply to the length of accessway on private land. The length between the road carriageway to the road boundary is controlled by Sections Fl .6.14. and **Fl** .6.1 5. of this Code . These two sections include controls on the location of vehicle crossings which , in turn, affect the location of accessways.

In all cases where the access is to be used or shared by more than a single allotment or dwelling unit it shall be formed at the time of subdivision or land developme nt. Where urban accessways could be damaged by the subsequent development of the allotments, Council may defer the requirement to complete the pavement construction for a specified period.

Minimum formed and legal widths and other relevant standards shall be as detailed on Table F-4. Further to Table F-4 the following geometric and drainage

requirements shall apply:

(a) All changes in horizontal alignment shall be formed by use of circular curves.

WDC Maintenance Specification

M30: Materials

CONTENTS

WDC Maintenance Specification M30
Materials

1 GENERAL

This specification sets out the requirements for materials that apply to the WDC Standard Maintenance Specifications.

Unless otherwise stated, the latest version of all standards and specifications shall apply.

2 SAMPLING AND TESTING OF MATERIALS

The Contractor shall be responsible for all sampling and testing of materials, including costs.

All sampling and testing shall be undertaken in accordance with the relevant standards and specifications. All materials used in the Contract Works shall comply with their respective standard specifications.

All material test results shall be International Accreditation NZ (IANZ) certified for both sampling and testing. The Contractor shall submit samples, when required by the Engineer, for pre-acceptance testing. The Engineer reserves the right to obtain additional samples himself.

The Contractor shall retain the certified test results covering all materials incorporated in the works. A copy and summary of these shall be submitted to the Engineer. Batch certification of materials factory manufactured shall be retained for all materials included in the works

3 GRANULAR AGGREGATES

3.1 General

The Contractor shall be familiar with the properties of the aggregate he intends to use to ensure that it can be used and constructed to the required specification.

The Contractor shall not add materials to the aggregate subsequent to satisfactory acceptance testing without prior approval of the Engineer.

The Contractor shall nominate the intended source of aggregate material at least 7 days before construction commences and shall be responsible to ensure where applicable that resource consents exist and are complied with.

3.2 Testing

All conformance testing required will be undertaken by the Contractor, at his cost, and results made available to the Engineer on request.

The Contractor shall retain the certified test results covering all materials incorporated in the works. A copy and summary of these shall be submitted to the Engineer.

3.3 AP65 Subbase

AP65 shall consist of:

- Well graded, deleterious free, granular material.
- Maximum stone size – 65.0mm.
- 30% minimum broken faces (NZS4407:1991 'Methods of Sampling and Testing Road Aggregates' Test 3.14).
- Soaked CBR greater than 30% (NZS4407:1991 Test 3.15).
- Plasticity Index of material finer than 0.425mm sieve – less than 12 (NZS4407:1991 Test 3. 4).

3.4 1234

AP40 crushed river basecourse shall conform to the following Specification:

NZS 4407:1991 Test Name	***Test No.***	***Aggregate***
Weathering Quality Index	3.11	AA, AB, BA, BB, CA
Crushing Resistance	3.1.0	Not less than 130kN
California Bearing Ratio (CBR)	3.15	Not less than 80%
Broken Face Content > 2	3.14	
Sieve Size 19.0mm – 37.5mm 9.5mm – 19 mm 4.75mm – 9.5mm		 Not less than 50% Not less than 30% Not less than 30%
Quality of Fines Sand Equivalent or Clay Index Plasticity Index	 3.6 3.5 3.4	 Not less than 35 Not greater than 3 if Sand Equivalent less than 35 Not greater than 5 if Sand Equivalent less than 35
Wet Sieving Test Test Size Aperture 37.5mm 26.5mm 19mm 9.5mm 4.75mm 2.36mm 1.18mm 600µm 300µm 150µm 75µm	3.8.1	 AP40 78-100 13 – 25 10 – 19 7 – 14 5 -11 3 – 8
Particle Size Distribution Shape Fractions 19.0mm - 4.75mm 9.5mm – 2.36mm 4.75mm – 1.18mm 2.36mm - 600µm 1.18mm - 300µm 600µm - 150µm		 AP40 6 - 20 5 – 15 2 - 12

4 UNSEALED SURFACE AGGREGATES

4.1 General

This section covers the end product placed by the Contractor and in place at the completion of the works within the upper 100mm of the road pavement.

4.2 Proportion Of Broken Rock

In each of the three aggregate fractions between the 37.5 mm and 4.75 mm sieves, not less than 50% by weight shall have two or more broken faces.

4.3 Aggregate Strength and Quality

Strength and Quality attributes shall meet the following specification when the aggregate is tested in accordance with Test 3.10 of NZS 4407:1991.

Table 1 : Aggregate Strength And Quality

Material Description	***Crushing Resistance***	***Weathering Index***	***Sand Equivalent***
NRB M/4 (AP40)			40
PAP 40	130 kN	AA, AB, AC,	36
PAP 20		BA, BB, CA	36
AP 65			
AP 40	110 kN	AA, AB, AC,	15
AP 20		BA, BB, CA, CB	

4.4 Grading and Stone Shape

Grading attributes shall meet the following specification when the aggregate is tested in accordance with Test 3.10 of NZS 4407: 'Methods Of Sampling And Testing Road Aggregates'.

The weight of material in each fraction shall lie within the limits shown.

Table 2 : Aggregate Grading Envelope

Test Sieve Aperture	**Percentage Passing**			
	NRB M/4 (AP40)	*AP 65*	*PAP 40 AP 40*	*PAP 20 AP 20*
63.0 mm		100		
37.5 mm	100	70-85	100	
19.0 mm	66-81	46-68	63-81	100
9.5 mm	43-57	31-54	41-57	52-75
4.75 mm	28-43	20-41	26-43	31-55
2.36 mm	19-33	13-32	18-33	21-42
1.18 mm	12-25	9-23	11-25	13-31
600 micron	7-19	6-16	6-19	7-23
300 micron	3-14	3-12	3-14	5-16
150 micron	10 max	10 max	10 max	12 max
75 micron	7 max	6 max	7 max	8 max

Table 3 : Aggregate Grading Shape Control

Fractions	Percentage Of Material In Fraction			
	NRB M/4 (AP40)	*AP 65*	*PAP 40 AP 40*	*PAP 20 AP 20*
37.5 - 9.5		24-46		
19 - 4.75	28-48	15-37	27-49	
9.5 - 2.36	14-34	10-31	13-34	19-47
4.75 - 1.18	7-27	7-25	7-28	8-35
2.36 - 600	6-22	6-19	6-22	6-27
1.18 - 300	5-19	5-16	5-19	3-21
600 - 150	2-14	2-12	2-14	2-17

Material which contains stones which because of the fractured shape cause damage to vehicle tyres shall not be used in the upper 50mm of any pavement.

4.5 Clay Content

The supplied material shall have a plasticity index of between 5 and 10 with a liquid limit of between 25 and 35.

Permeability shall be in the classification of low to moderate.

The clay index of any material shall not exceed 4.5

4.6 Alternative Materials

The Contractor may propose to use alternative material which does not comply with Clauses 3.3 to 3.6 inclusive.

The Contractor shall not use an alternative material without the prior written approval of the Engineer.

The Contractor shall provide test results for the proposed material in accordance with Clause 3.2 for consideration by the Engineer.

The Engineer may require the Contractor to install a test section of the alternative material for evaluation. The test section shall not exceed 200m long by the full width of the road. The evaluation shall last for a minimum period of two (2) months from the date of completion.

The Contractor's cost of complying with this clause shall be borne by the Contractor with the exception of the cost of the test section where the material is subsequently approved by the Engineer.

The Engineer may require the removal of the test section and reinstatement by the Contractor where the material is not accepted.

5 SEALING CHIP

Sealing chip shall be in accordance with TNZ Specification M/6 2006 Sealing Chip (including Napier variant dated Sept 1995)and amendments.

6 SAND

Sand shall consist of crushed or uncrushed gravel, stone or rock or a combination of any of these. It shall be hard, durable and clean and shall not contain any harmful materials such as iron, salt, shale or coal.

The grading of the sand shall fall within the envelope defined in the following table when tested in accordance with Test 3.8.2 of 'NZS 4407:1991.

Sieve Size	***Percentage Passing By Weight***
4.75 mm	100
2.36 mm	90-100
1.18 mm	70-100
600 micron	40-100
300 micron	5-70
150 micron	0.15

The sand equivalent shall not be less than 70 when the material is tested in accordance with Test 3.6 of 'NZS 4407:1991.

7 BALLAST

The least dimension of any stone classed as ballast shall be 125mm.

Ballast shall have a weathering quality index of AA, AB, AC, BA, BB, or CA when tested in accordance with 'NZS 4407 : Methods of Testing Road Aggregates' Test 3.11

Ballast shall have a crushing resistance greater than 130kN when tested in accordance with NZS 4407: 'Methods of Testing Road Aggregates' Test 3.10

8 PREMIXED MATERIALS

8.1 General

Premix includes all bitumen-bound materials, whether hot or cold laid, which have been mixed prior to being placed in the repair area. Bitumen stabilised aggregates are not covered by this specification.To be classified as premix as opposed to bitumen stabilised aggregate, the mix shall have a binder content greater than 2.5%.

8.2 Hotmix Materials

Asphaltic concrete shall be in accordance with TNZ Specification M/10: 2005 and P11/P 2003 together with subsequent amendments.

The following amendment is to be made to TNZ M/10
DELETE Clause 6 and replace with : 'No separate payment will be made for the supply of Asphaltic Concrete'

8.3 Other Premixed Materials

Other premix materials shall be designed to meet the service requirements detailed below:

- Upon completion of the work the material shall be sufficiently dense and bonded to ensure that it is not displaced, shoved, removed or picked up by traffic.
- Upon completion of the work and for a period not less than 12 months following, the material shall not bleed or flush.
- Any repair shall be uniformly dense and free of segregation.
- If the surface of any repair is porous then subsequent sealing of the repair may be necessary to constitute completion. The requirements of Clause 3.8c(ii) above shall then apply to the sealed surface.

At the start of the Contract the Contractor shall submit to the Engineer details of the premix materials he intends to use.

9 ASPHALTIC BITUMEN

Asphaltic bitumen shall comply with 'TNZ M/1:1995 Specification for Roading Bitumens'

The following amendment is to be made to TNZ M/1
DELETE Clause 6 and replace with: 'No separate payment will be made for the supply of Asphaltic Bitumen'.

10 CONCRETE

Concrete shall be ordinary grade concrete with the minimum specified crushing strength at 28 days when tested in accordance with 'NZS 3109: Concrete Construction'

Concrete shall be produced in accordance with 'NZS 3104: Specification For Concrete Production'.

11 MORTAR

Mortar for providing a water-tight joints in manholes or other stroemater structures shall be an approved polymer modified cementitious mortar such as Fosroc Renderoc HB, or an approved epoxy mortar such as Humebond.

Mortar shall be applied in accordance with the manufacturer's specifications to fill all voids

12 CEMENT FOR STABILISATION

Cement shall comply with the requirements of NZS 3122 'Specification for Portland and Blended Cements'

Cement shall be protected from moisture until used and shall be free from significant lumps and flow freely during application.

13 STORMWATER PIPES AND ACCESSORIES

13.1 Concrete Pipes

Precast reinforced concrete pipes shall comply with NZS 3107 'Specification For Precast Concrete Drainage And Pressure Pipes'

Pipe strength shall be Class X or as specified in the Contract Documents

Pipe joints shall be in accordance with the manufacturer's recommendations

13.2 Corrugated Steel Pipes and Flumes

Corrugated steel pipes and flumes shall comply with the requirements of NZS 4405 'Helical Lock-seam Corrugated Steel Pipes' for materials, galvanising and fabrication

13.3 HDPE Pipes

HDPE pipe shall comply with the requirements for drain pipes in 'NZS 7604: High Density Polyethylene Drain and Sewer Pipe and Fittings'.

Pipes shall be Class SN6, SN8 or SN16 as specified in the Contract documents.

13.4 Subsoil Drains

Sub-soil drainage pipe shall comply with the requirements of TNZ Specification F/2:2002 and shall be either:

<u>High density polyethylene (HDPE) pipe</u>

HDPE pipe shall comply with the requirements for drain pipes in 'NZS 7604: High Density Polyethylene Drain and Sewer Pipe and Fittings'.

Sub-soil drainage pipe shall be perforated with holes that shall not exceed 35mm² in area with a maximum dimension of 6.5mm in any direction. The perforations shall be evenly spaced along the pipe length and shall exceed a total perforation area of 2000mm² per one metre length of pipe

<u>Plain wall PVC pipes</u>

PVC pipes shall comply with AS/NZS 1260: PVC Pipes and Fittings for Drain, Waste and Vent Applications', Class SN4 or SN6

13.5 Manholes

Manholes shall be standard circular precast reinforced concrete 1050mm dia manholes with all manhole components able to withstand HN-HO-72 loading.

Cast iron covers and frames shall be Humes 1105, or approved equivalent.

Light duty lids and covers may be used in footpaths and berms.

14 TIMBER

14.1 General

All sawn timber shall be No 1 Framing Grade Radiata Pine in accordance with NZS 3631 'New Zealand National Timber Grading Rules'.

All natural round timber shall be Radiata Pine or Douglas Fir and shall comply with the requirements of NZS 3605: ' Timber Piles And Poles For Use In Buildings'.

14.2 Preservation Treatment

All permanent timber shall be treated to current requirements of the NZ Timber Preservation Council (NZTPC) for the particular end use as shown in the following table.

Specification	***NZTPA Hazard Class***	***Typical End Use***
Low Decay Hazard Protected from weather, insect resistant	H1.1	Interior lining
Low Decay Hazard Protected from weather but with a risk of moisture exposure	H1.2	Wall framing
Moderate Decay Hazard Above ground, exposed to the weather	H3.1	Weatherboards, exterior trim
Moderate Decay Hazard Above ground, exposed to or protracted from the weather but some risk to moisture exposure	H3.2	Structural decking, fencing
High Decay Hazard Ground Contact	H4	Fenceposts, agricultural posts, landscaping timber
Severe Decay Hazard Ground contact and high risk end use	H5	Piles, retaining walls, transmission poles
Marine Use	H6	Marine piles and timber

15 TOPSOIL AND SEED

Under normal circumstances, existing topsoil can be re-used for reinstatement of berms, verges etc.

Where required, imported topsoil shall be a dark brown friable loose loam containing a high percentage of humus and shall be free of any stones, weeds or other debris.

All topsoiled surfaces shall be re-seeded by spreading the seed mix on the finished surface at a rate of 12.0g/m^2, seed mix as follows:

- One third Brown Top (Agrostis Capillaris);
- One third White Clover (Trifolium Repens);
- One third Sheep's Burnet (Sanguisorba minoe spp Muricata).

Other seed mixes may be used with the Engineer's prior approval

Aggregate Standards used in the Hawkes Bay Region

Authority	Aggregate Specification	Other Specification	Details	Aggregate Strength and Quality				Sources	Alternative Materials/Comments
				Crushing Resistance (*a*)	Weathering Index (*b*)	Sand Equivalent (*c*)	CBR (*d*)		
NZTA	**TNZ M/4: 2006**	-	-	**Not less than 130kN**	**AA, AB, BA, BB, CA**	**Not less than 40 (Napier Gravel = not less than 35)**	**Not less than 80%**	-	-
NCC	TNZ M/4	-	"Napier River Gravel"	Not less than 130kN	AA, AB, BA, BB, CA	Not less than 35	Not less than 80%	HB river aggregates	N/A
	TNZ M/3 Notes on Subbase	-	Subbase Aggregate: usually river aggregate in HB	Not less than 100kN	-	-	Not less than 40		
HDC	TNZ M/4	-	-	Not less than 130kN	AA, AB, BA, BB, CA	Not less than 35	Not less than 80%	contractors individual quarries and river gravel sources	HDC engage contractor. Contracts stipulate aggregate must comply with NZT M/4 aggregate specifications. Contractors to provide evidence of aggregate compliance testing
WDC	WDC specifications	"40mm Red"	AP40 Crushed River Basecourse for some **sealed** pavements (AP65 Subbase)	Not less than 130kN	AA, AB, BA, BB, CA	not less than 35	Not less than 80%	contractors individual quarries and river gravel sources	Not all sealed pavement aggregates have to comply with NZT M/4, as alternative materials can be used. Contractor may propose to use alternative materials which do not comply with WDC specifications. Needs prior approval from WDC Engineer; provide test results; and may need to install a test section of road.
			AP40 Crushed River Basecourse for **unsealed** and some **sealed** pavements (AP65 Subbase)	110kN	AA, AB, AC	15	-		
CHBDC	TNZ M/4 (sealed roads)	-	AP40 Crushed River Basecourse for **sealed** pavements (AP65 Subbase)	Not less than 130kN	AA, AB, BA, BB, CA	not less than 35	Not less than 80%	contractors individual quarries and river gravel sources	For re-sealing, CHBDC engage contractor and stipulate aggregate must comply with NZT M/4 aggregate specifications
	no specifications for unsealed roads	red metal and rotten rock	AP40 and AP65 red metal and rotten rock mix for **unsealed** pavements and subbase	-	-	-	-	-	-

a. NZS 4407: 1991, Test 3.10 The Crushing Resistance Test
b. NZS 4407: 1991, Test 3.11 Weathering Quality Index Test
c. NZS 4407: 1991, Test 3.6 Sand Equivalent Test

d. tested in accordance with NZS 4407: 1991, Test 3.15 (California Bearing Ratio Test) and NZS 4402: 1986, Test 4.1.3 (New Zealand Vibrating Hammer Compaction Test at Optimum Water Content