Gravel Management Plan

Gravel Demand Forecast (Issue 5)

for

Hawke's Bay Regional Council

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1 EXECUTIVE SUMMARY

This report has been produced for Hawke's Bay Regional Council (HBRC) in line with the 'consultant proposal' of 6 October 2014. The methodology has followed that outlined in the original proposal with some variation based on findings and information uncovered in this phase.

The prime purpose of this report is to produce a river gravel demand forecast and a methodology for continuing with this in the future. It also identifies growth opportunities for gravel and related opportunities to encourage the best outcomes for extraction sites and river gravel demand.

The writers utilise a strong understanding of the construction industry supply chain in order to evaluate the aggregate industry and provide guidance on drivers of aggregate demand. Input from expert economic and construction forecasters (Infometrics Ltd) is included to provide a basis for translating construction forecasts into river gravel aggregate demand.

While it is understood that Hawke's Bay aggregates are derived from various sources - river gravel sources, land based gravel pits, and several lime quarries, and this report covers each of these - the HBRC is primarily focussed on the gravel from river sources and the associated flood protection and other related issues.

A 5 year gravel demand forecast is included in the report. Also discussed, is a basis for river gravel forecasting and it is recommended that 5 year rolling forecasts be employed initially to provide a basis for extraction allocations and river gravel management. Working collaboratively with the industry on this will be beneficial for all stakeholders to encourage longer term planning and risk management by all key participants. Investigation into methods for extending that into longer forecast time frames should be considered as a next step.

Among the recommendations is an investigation of options or methods to incentivise river gravel extraction in locations required by HBRC for flood protection, which are not necessarily preferred locations by extractors.

Overall there will be benefits in HBRC working collaboratively with players in the gravel extraction industry to achieve best outcomes on a range of opportunities and issues. HBRC has indicated it supports this approach. The establishment of an industry working group would be recommended to review the report outcomes and establish plans or strategies for key issues.

Some aspects of this report will have impacts on other Gravel Management Plan projects, including the Gravel Resource Inventory project which is currently underway.

2 METHODOLOGY

The project has included two regional visits by Barry Larsen (Consultant) and Murray Stevens (Consulting Geologist) during October and November 2014, which included site visits to extraction sites in the northern, central and southern sectors of the Hawke's Bay. Meetings with key industry participants and stakeholders were held and numerous interviews carried out along with industry and inter regional research.

Extraction Companies - Holcim Aggregates, Higgins Aggregates, Winstone Aggregates, Ray Berkett, Infracon, etc.

Road Maintenance and Civil Contractors - Downer, Fulton Hogan, Higgins, and a number of smaller contractors

Local and Regional Authorities – Central Hawke's Bay District Council (CHBDC), Hastings District Council (HDC), Napier City Council (NCC), Wairoa District Council (WDC)

Ruataniwha Project - OHL-Hawkins consortium for Ruataniwha, Hawkes Bay Regional Investment Company (HBRIC)

Civil Contractors NZ (Hawke's Bay Branch) - newly merged industry organisation of NZ Contractors Federation and Roading New Zealand (RNZ)

Aggregate & Quarry Association (AQA) – Andrea Cave, Bill Bourke

Allan Tuck - Engineering Consultant, MIPENZ (Institute of Professional Engineers), REAAA national Committee, former Higgins Regional Manager (Hawke's Bay)

NZ Petroleum and Minerals, MBIE – (for Quarry Aggregate Statistics)

Statistics NZ - Ready mixed concrete production statistics

Firth Concrete – Hawke's Bay

Business Hawkes Bay – Susan White, CEO

Ports of Napier – Chris Bain, COO

We thank each of these organisations for their valuable input to this project. For commercial reasons some individual details or data remain confidential, but have been aggregated with other data to achieve an overall picture.

3 NATURE OF AGGREGATE INDUSTRY IN HAWKE'S BAY

Figure 1: The Hawke's Bay region has a number of local authorities, and 7 major rivers (Wairoa, Mohaka, Esk, Tutaekuri, Ngaruroro, Tukituki and Waipawa.

3.1 River Gravel Extraction – Northern, Central, Southern

River gravel extraction is the prime source of aggregate production in the Hawke's Bay.

HBRC allocates gravel extraction volumes to companies at nominated locations, usually defined by a specific cross section in the rivers, on an annual basis. For administrative purposes the region is broken into northern, central and southern river extraction areas.

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. This figure is based on HBRC statistics for gravel declaration returns extracted annually. The recent acquisition of Infracon's assets by Higgins may see their share increase.

Figure 2: River gravel extraction on the Ngaruroro River

Figure 3: Ngaruroro River gravel being processed

3.2 Coastal Extraction

Historic coastal extraction of gravel off the beach has been carried out by Winstone at their Awatoto Shingle site on the foreshore over many years. Recent years have seen around 30,000 m^3 annually taken off the beach for blending with gravel from river sources.

Napier City Council has, for over 20 years, extracted gravel from the Napier foreshore, along Marine Parade, which is transported to Westshore to replenish the beach. These volumes in recent years have been around 12,000 -15,000 m^3 annually and includes pea metal size product.

3.3 Land Based Pits

Land based gravel pits are an important part of the local construction industry. These are sometimes referred to colloquially as red rock pits, and are typically slight to moderately weathered river terrace gravels uplifted above the main active river channels. They typically contain a portion of silt, red-brown fines and clay.

Hastings District Council (HDC) has six (6) of its own land based gravel pits, and also sources gravel from around 30 other private land based pits, where a royalty is paid to landowners. Extraction contracts are let by HDC and they supply the roading contractors. Much of the local volume is used in road maintenance activities by its contractors, understood to be in the order of 30,000 m^3 p.a. according to information provided by HDC. Downer currently has the urban road network maintenance contact and Fulton Hogan the rural road network contract. The Whaketu Arterial link road project is one of the only larger contracts due to be constructed in the near future in the HDC area, with an estimated cost of $20 million. Construction is due to start in mid-2015.

Central Hawkes Bay District Council (CHBDC) extracts gravel from land based pits in addition to river gravel sources. The land based pits currently provide around 15,000-20,000 m^3 p.a according to CHBDC. Fulton Hogan has the current road maintenance contract for CHBDC. According to CHBDC, no major roading projects are planned in the medium term in CHB.

Napier City Council (NCC) road maintenance contractor is Higgins who source aggregate largely from their own extraction sites for this work, primarily river gravel sources. Napier City roads are typically sealed roads.

Wairoa District Council (WDC) - The current road maintenance contractor is QRS and the sealing contract is by Downer. Sealing chips are brought in from the central part of the Hawke's Bay region. The WDC Infrastructure business unit advises that a small percentage of their road maintenance metal is from river gravel sources, with most coming from red rock metal pits and limestone quarries. Annual aggregate volumes were not available at time of writing.

According to CHBDC, HDC and WDC, the NZTA road maintenance funding allocations are projected to be flat at best for the next 5 years. This will impact on the total spend on roading and hence gravel demand.

Pan Pac Forests and other forestry companies are regular users of aggregates; primarily from land based red metal pits and limestone quarries. These were not investigated in detail in this report, given the focus on river gravel extraction.

Civil Contractors and **Agricultural Contractors** make up a good portion of the 50 or more river gravel extractors across the region.

3.4 Hard Rock Quarries and Limestone

It is understood that there no traditional 'hard rock' quarries in the region, apart from several limestone quarries which typically service the agricultural industry. However, minor volumes of limestone rock are occasionally used in road maintenance activities in the southern part of the Hawke's Bay region, where they are in close transport distance to the work. They are more frequently used in the Wairoa District Council area on road maintenance work.

4 OTHER KEY CONSUMERS OF GRAVEL

This section discusses some of the key consumers of gravel. It is not intended to be fully comprehensive. Forestry consumers are covered briefly in Section 3.

4.1 Road Maintenance, Civil & Agricultural Contractors

This is covered briefly in Section 3 of the report.

4.2 Ready Mixed Concrete

Ready mixed concrete plants are significant users of aggregates and sand. NZ Statistics releases quarterly and annual concrete production returns. For the December 2013 year the combined Hawkes Bay & Gisborne regions produced 103,932 m^3 of concrete. However by extrapolation an approximate figure for Hawke's Bay region is assumed for the purposes of this report.

On a population basis Hawke's Bay has 82% of the combined population. We also understand that 7 of the 8 concrete plant or company returns are in Hawke's Bay (87%). In order to approximate volumes, if we take an average figure of say 85% then the Hawke's Bay region concrete production would be in the order of 88,000 m^3. This could imply approximately 105,000 loose cubic metres of gravel and sand was consumed in 2013 for concrete production in Hawke's Bay, representing around 24% of the regional river gravel and sand extraction. Note this regional figure excludes other gravel from land based pits and limestone, for which there is currently no estimate available. These other sources of aggregate volumes could account for a 'guesstimated' 20% or more in addition to river gravel.

Either way, this makes concrete a significant user of regional aggregates. Concrete forecast demand will be an important driver of gravel and sand demand.

By way of explanation: When loose sand is mixed with loose volumes of gravel, water and cement during concrete production, the sand and fines occupy much of the air void space in the loose gravel, thus reducing the combined loose volumes to a cubic metre of concrete.

4.3 Asphalt production

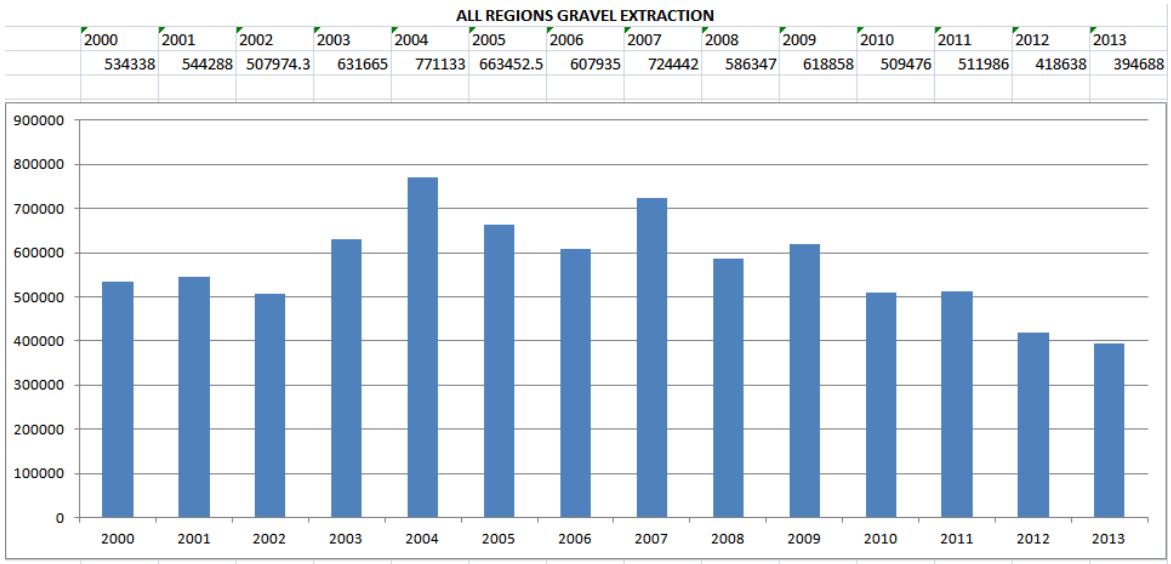
Higgins operates the main **asphalt plant** in the region. For commercial reasons the production figures are not included in this report, but the gravel volumes consumed in producing their products are small in relation to the total regional gravel volumes.

4.4 Landscape Yards / Building Depots / DIY Outlets/ Other

Various outlets for gravel and aggregate sales are located throughout the region and are used by a multitude of contractors, builders, and DIY consumers. The gravel or aggregate volumes consumed through these distribution points are not easily calculated, and are not separately identified in this report.

5 HISTORIC CONSUMPTION OF AGGREGATES

The following graphs, provided by HBRC, show the annual gravel extraction volumes (in cubic metres) declared since 2000. These cover the total region, plus the 3 sub-regions (north, central and southern rivers). Included is the percentage reduction in volume since the previous peak years in this timeline. These sub-regional figures show that the largest extraction by far is in the 'central' region. Note the graphs exclude coastal extraction at Awatoto (Winstone Aggregates) which has typically been around 30,000 m^3 annually.



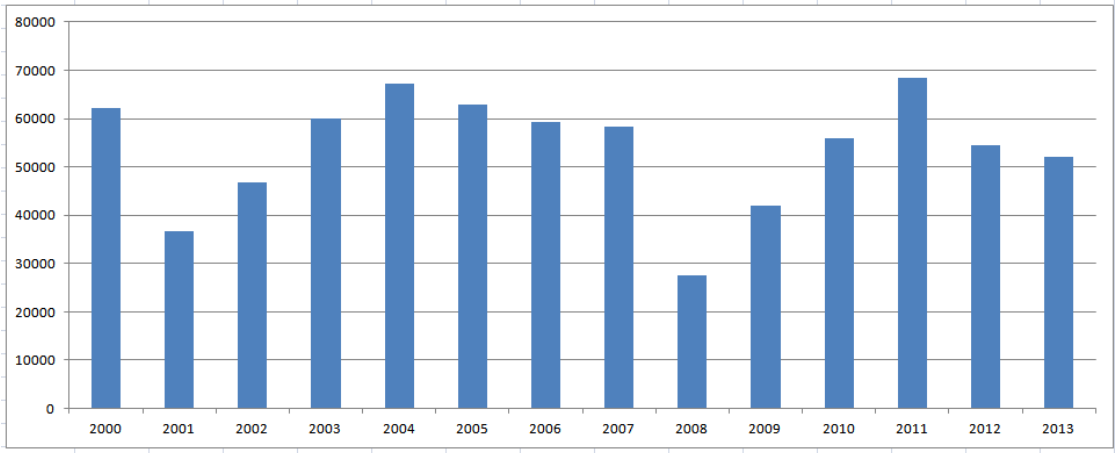
Total for last 14 years	**8025221**
	14
Average	**573230**
2013 reduction on peak	**49%**
2013 reduction on average	**31%**

Figure 4: Annual River Gravel returns (cubic metres) – Total for Hawke's Bay: Source HBRC

The peak years coincide with the major expressway roading projects.

NORTHERN GRAVEL EXTRACTION

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
62085	36623	46898	59938	67310	62770	59253	58279	27531	41965	55973	68466	54591	52171

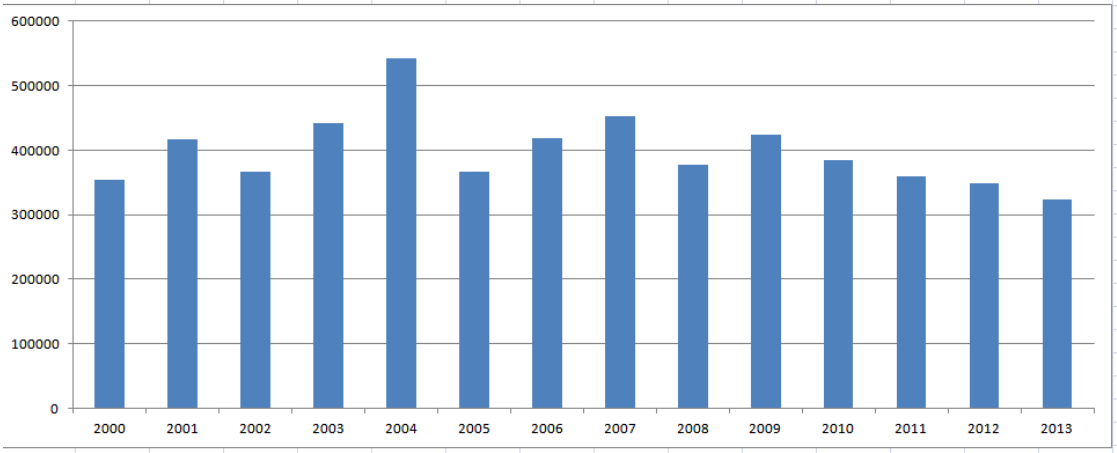


Total for last 14 years	**753853**
	14
Average	**53847**
2013 reduction on peak	**24%**
2013 reduction on average	**3%**

Figure 5: Annual River Gravel returns (cubic metres) – Total for Northern sub region: Source HBRC

CENTRAL GRAVEL EXTRACTION

District	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
C	354588	416257	366325.3	442502	541886	366639	419430	452259	377053	423193	384885	359667	347863	323102



Total for last 14 years	**5575649**
	14
Average	**398261**
2013 reduction on peak	**40%**
2013 reduction on average	**19%**

Figure 6: Annual River Gravel returns (cubic metres) – Total for Central sub region: Source HBRC

The central region is where the 3 largest extractors operate from: Winstone, Holcim and Higgins. These are favoured locations due to the proximity to key markets within the most densely populated urban areas of Hawke's Bay.

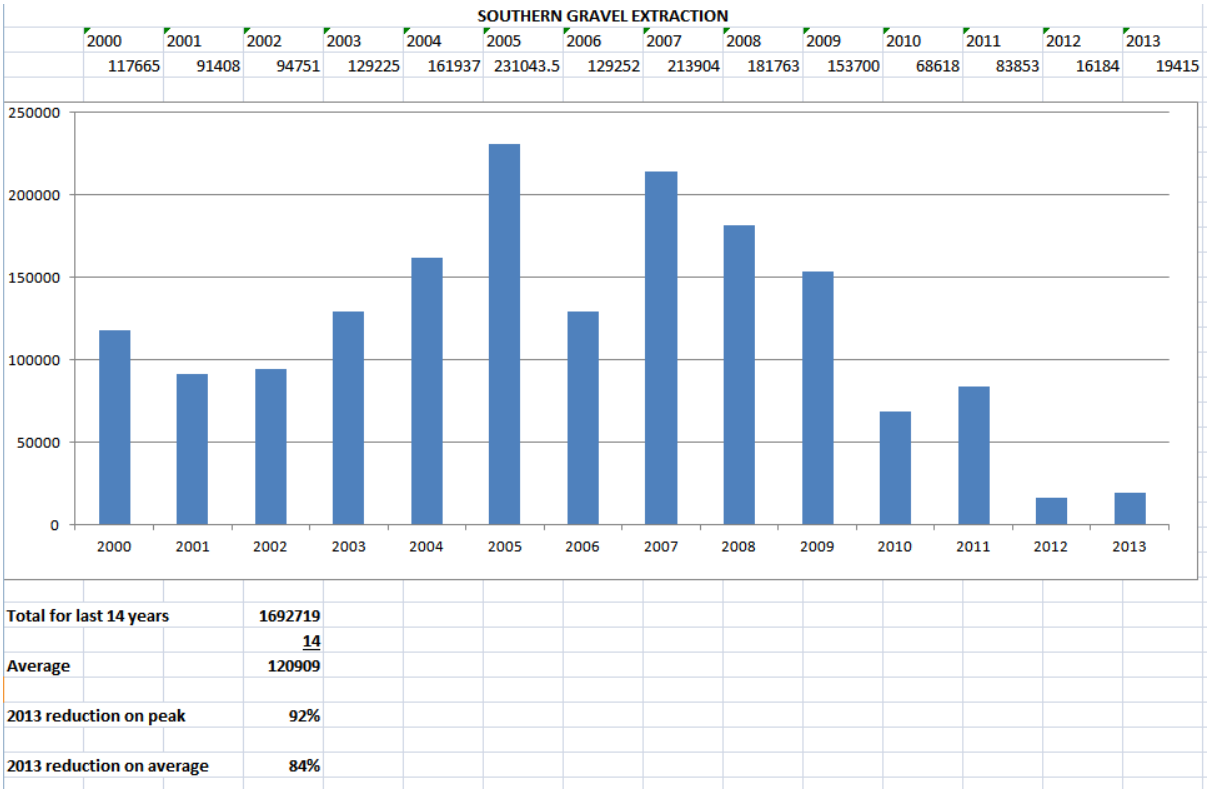


Figure 7: Annual River Gravel returns – Total for southern sub region: Source HBRC

The southern extraction has fallen off significantly since the demise of two extractors. However it is understood these operations were probably not economically viable due to the longer haul distance to the main markets and the location of the central players in close proximity to those markets. This reduction in extraction has created some issues for HBRC, and these are discussed elsewhere in the report.

6 DEMAND FORECAST FOR GRAVEL

6.1 Construction Industry Growth Forecasts

There are numerous high level factors which affect gravel (aggregate) demand. These can include the following:

- Population Growth
- Infrastructure Investment by
    - Central government, including NZ Transport Agency
    - Local government

    - Commercial Sector
    - Private sector
- Regional Specific (HBRC)
    - Growth of forestry and its fluctuations with harvest peaks
    - Growth of dairy and viticulture industries
    - Growth in other regions (export of gravel to other regions, e.g. Auckland)
    - Tourism
    - Other factors
- Change in Technology
    - Change in roading design and road maintenance techniques, (in-situ stabilisation of existing pavement layers), policy on strategic renewal of the road network
- Natural Disasters (not specifically accounted for in this report, but contingency planning is important)
    - Flooding
    - Tsunami
    - Earthquake
    - Volcanic eruption

While there are a number of economic, demographic and industry drivers which contribute to quarry aggregate demand (including gravel), typically construction activity provides a good direct indicator of such demand.

The following graph, sourced from Infometrics Ltd, of building and construction forecasts provides an indication of potential construction growth rates for the next 5 years. This is Infometrics' primary or 'central' forecast for the region. Later in the report 'high and low' growth scenario forecasts are also considered relative to this forecast. From the forecast data, an estimated river gravel demand has been forecast.

Hawke's Bay construction
Year-ended work put in place, expressed in 1995/96 $M

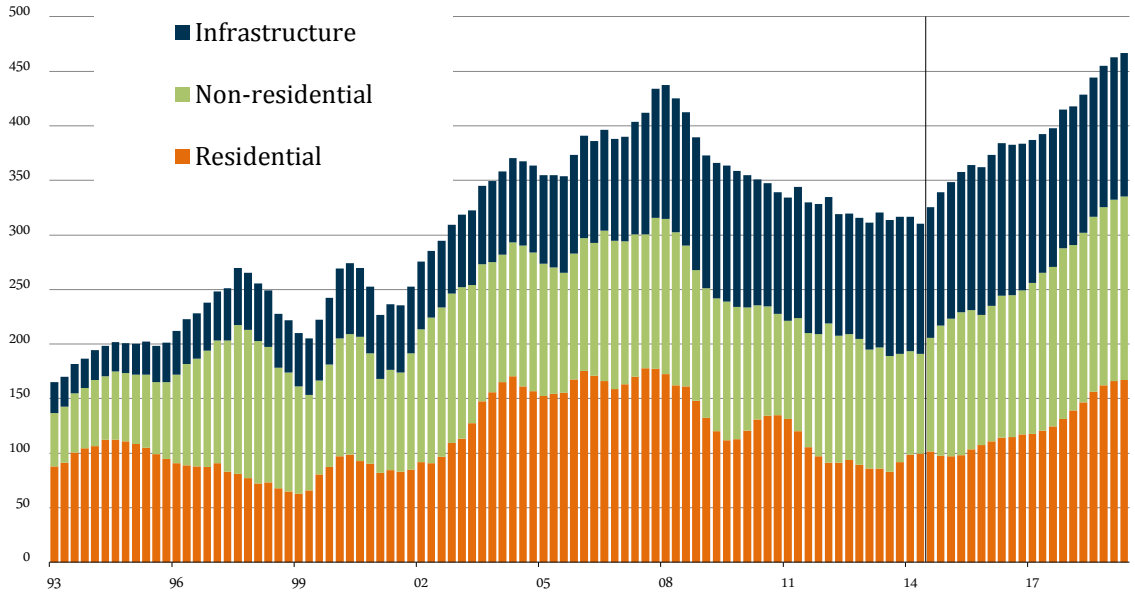


Figure 8: Graph-of Five year construction forecast 2014-2019 (excluding Ruataniwha Project)

Source: Infometrics, June 2014

Explanation of forecasting graph: Three categories of construction are shown in forecast graph.

Residential construction includes new housing and additions and alterations.

Non Residential includes, commercial, industrial, farm buildings and the like.

Infrastructure would include road construction, ports, airports, rail, water (storm water, sewerage and waste, water supply), irrigation, electricity and telecommunication, and power generation.

Forecast model: For residential and non-residential work, the **forecasting process** uses building consents as a key input to 'model' work put in place by local authority area. For infrastructure work, the model splits nationwide activity using historical ratios of activity by region based on Infometrics Infrastructure Survey data. The dollar value is shown in 1995/96 dollars which effectively takes out the inflation factor, and thus endeavours to indicate real growth rates.

Forecast Growth rates (excluding Ruataniwha): The graph above indicates that the 'total construction' growth is forecast by Infometrics to increase at 6%- 8% per annum on average for the 5 years in the forecast period 2014-2019. The Infrastructure sector shows lower growth than the other two sectors, of 10% total growth over the total forecast period. This lower growth rate is consistent with market and industry feedback mentioned elsewhere in the report.

Ruataniwha Excluded: The forecast in the above graph excludes the Ruataniwha water storage dam project, which has not yet been confirmed as proceeding. For purposes of this river gravel usage forecast, it is important to note that the aggregate to be used in construction of the dam project is proposed to be sourced from within the dam and lake site. This includes aggregate required for the rock core of the dam, (understood to be in the order of 2 million cubic metres) and also aggregate

used in the production of ready-mix concrete at a proposed concrete batching plant on the site and for other uses. In other words the construction phase will not require supplies of aggregate or gravel from other existing extraction sites in the region.

This avoids confusion with forecast data for the other gravel extraction sites in the region. Having said that there will clearly be some significant impact in terms of flow on economic growth and construction activity in the region, and it is important to extrapolate that into future forecasts, should the Ruataniwha Scheme go ahead.

Incorporating the Impact of Ruataniwha Project Going Ahead

The following graph includes the possible impact on construction activity of the Ruataniwha project going ahead.

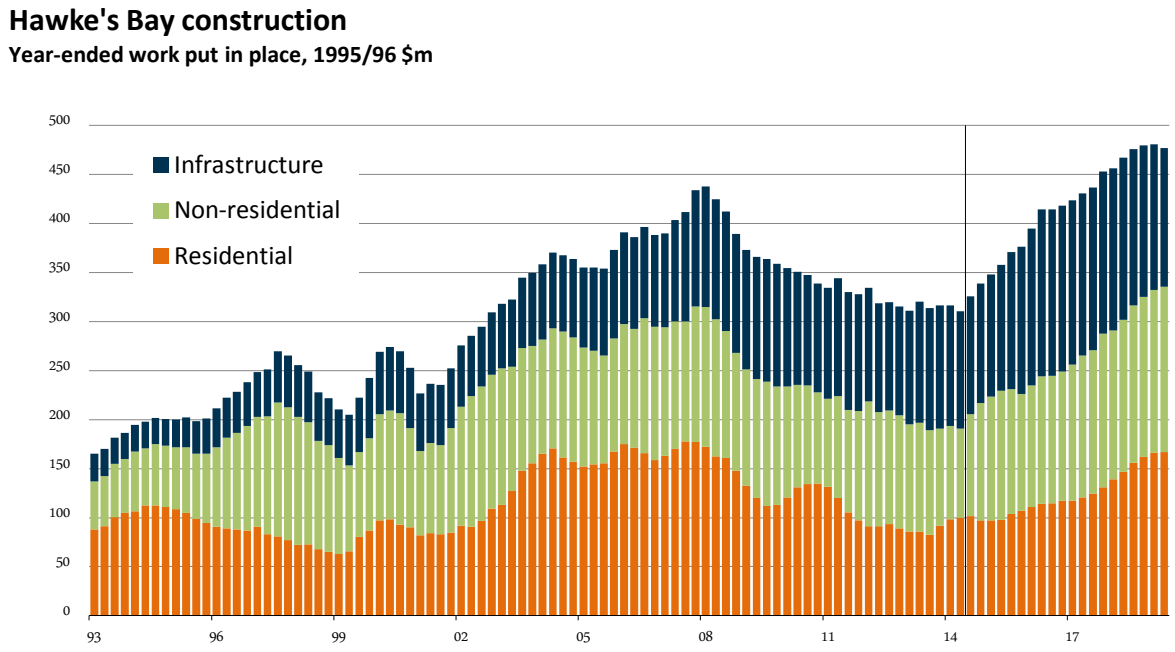


Figure 9: Graph of 5 year construction forecast 2014-2019 (Ruataniwha Project included)

Graph Source: Infometrics, June 2014

Forecast Growth Rates (Ruataniwha impact included):

The construction growth rates and impact of Ruataniwha will increase the demand for gravel and these are discussed in the next section of this report, entitled Forecast River Gravel Demand – Hawke's Bay.

6.2 Forecast River Gravel Demand – Hawke's Bay

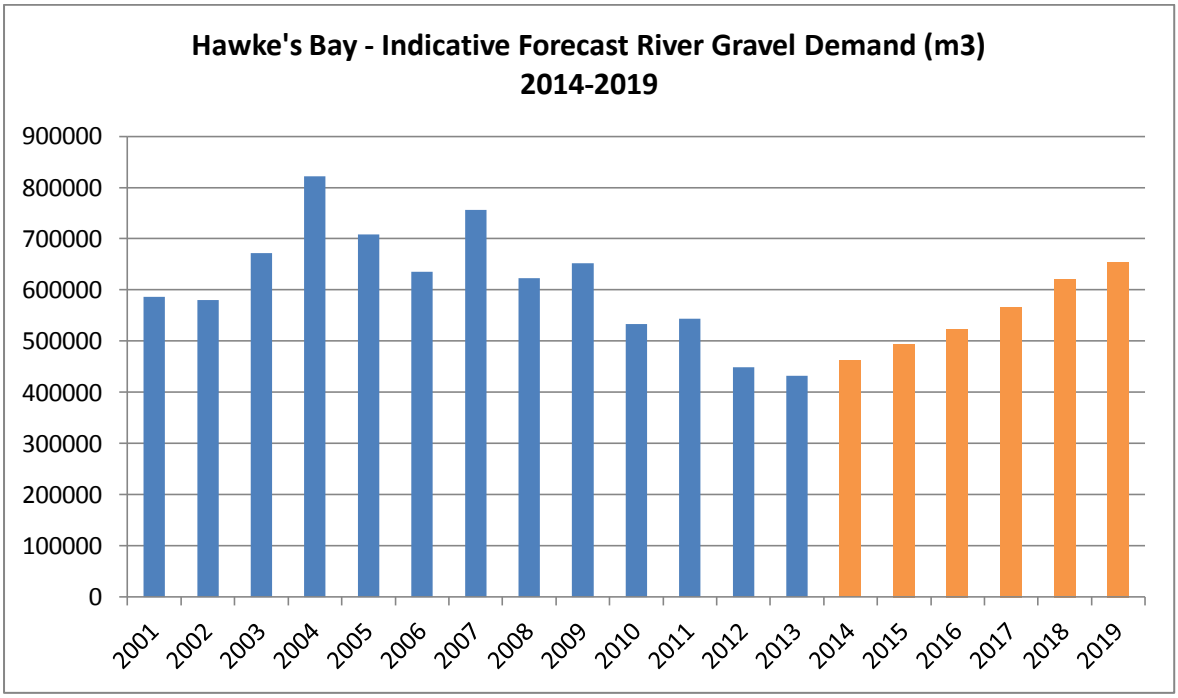


Figure 10: Hawke's Bay Indicative Forecast River Gravel Demand 2014-2019 (orange) and HBRC historic gravel returns 2001-2013 (blue) – Excludes Ruataniwha Project

Forecast gravel demand volumes, in cubic metres, and annual percentage increases (rounded) are shown in the tables below. These are calendar years to align with the HBRC annual returns. The volumes represent the total Hawke's Bay region, and include coastal extraction. If coastal extraction is stopped in future, then it is assumed those volumes would come from river sources.

Year	Dec 2013	2014	2015	2016	2017	2018	2019
M^3	**432,193**	**462,879**	**494,354**	**524,016**	**566,461**	**621,408**	**654,964**
% incr.	**actual**	**7.1 %**	**6.8%**	**6.0%**	**8.1%**	**9.7%**	**5.4%**

*Table 1: Indicative (**mid-level**) Forecast River Gravel Demand with annual increase – Hawke's Bay – (**EXCLUDES** Ruataniwha project)*

Year	Dec 2013	2014	2015	2016	2017	2018	2019
M^3	**432,193**	**462,879**	**525,830**	**600,498**	**652,141**	**676,922**	**659,999**
% incr.	**actual**	**7.1%**	**13.6%**	**14.2%**	**8.6%**	**3.8%**	**-2.5%**

*Table 2: Indicative (**mid-level**) Forecast River Gravel Demand with annual increase – Hawke's Bay (**INCLUDES** Ruataniwha project)*

Important note: *As with all forecasts these are indicative and based on data available, assumptions and modelling tools. The figures should therefore be treated as indicative of the potential demand, but not be totally relied on 100% for planning purposes. We recommend updating the forecasts annually with 5 year rolling forecasts.*

The impact of including Ruataniwha in the above forecast indicates additional gravel in the order of 250,000 m^3 may be required over the forecast period. Note this excludes the actual dam site construction gravel which would be sourced from within its dam and lake area, as referred to in other parts of this report. This means the Ruataniwha project will not require gravel from other existing regional river sources and hence that impact has been removed from these forecasts. Infometrics have attempted to exclude the dam and lake project site from the 'other impacts' outside of the dam in their forecasts for construction activity.

In addition to the local market, the demand for Hawke's Bay gravel in other regions, particularly the Auckland market, is likely to see increased extraction volumes in Hawke's Bay as discussed in this report. This increase will probably be restricted to Hawke's Bay 'pebble' for the landscape and decorative concrete market.

Forecast methodology: The forecast uses the actual HBRC 2013 calendar year volume 'extracted' as the baseline number from which future demand is estimated, as the 2014 year end figure was not available at the time of writing. The 2013 figure includes coastal extraction which is currently still occurring, but may not be in the near future. That gravel will have to be taken from rivers in future.

The future demand is based on utilising Infometrics construction growth forecasts provided above in the previous section of this report. The historic extraction figures shown in the above forecast graph (2001-2013) are the annual gravel returns information provided by HBRC. The 2019 calendar year forecast figure is based on an annualising the 6 months growth figure (to June 2019) provided by Infometrics data.

6.3 High and Low Growth Forecast Scenarios

As requested by HBRC we have also considered high and low growth scenarios in addition to the central (or mid-level growth) forecast of Infometrics. The following forecast graphs, also supplied by Infometrics Ltd, show the high, mid and low growth forecasts for each of the 3 individual construction categories: residential, non-residential, and Infrastructure.

These graphs highlight that the 'high growth' scenarios for both residential and non-residential are not significantly above the 'central or mid-level growth' forecasts provided in the previous section, reflecting the relatively strong growth that appears to be built into those numbers. In contrast, the

upside to the infrastructure numbers are much more considerable, and reflect the possibilities of Ruataniwha and the Maungaharuru wind farm both going ahead within the forecast period (the latter looks particularly unlikely but is included in a high growth scenario).

Given the above scenarios, **our recommendation for HBRC gravel demand forecasting is to utilise the mid-level and low level growth forecasts (for the combined 3 categories)**. The forecasting can be updated on an annual basis to reflect any new information that arises during that time.

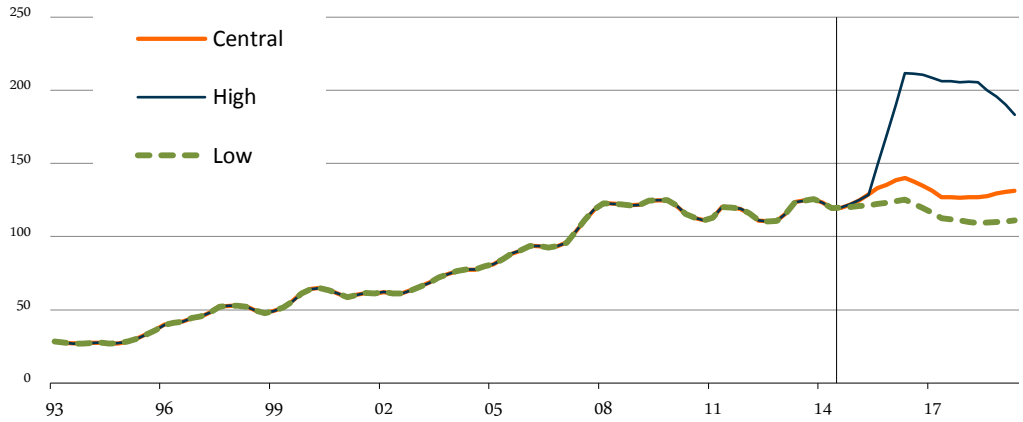


Figure 11: Hawkes Bay Infrastructure Construction Forecast – 2014-2019: High, central, and low scenarios (Year ended, work put in place, 1995/95 $M) – Source Infometrics

Figure 12: Hawkes Bay Residential Construction Forecast – 2014-2019: High, central, and low scenarios (Year ended, work put in place, 1995/95 $M) – Source Infometrics Ltd

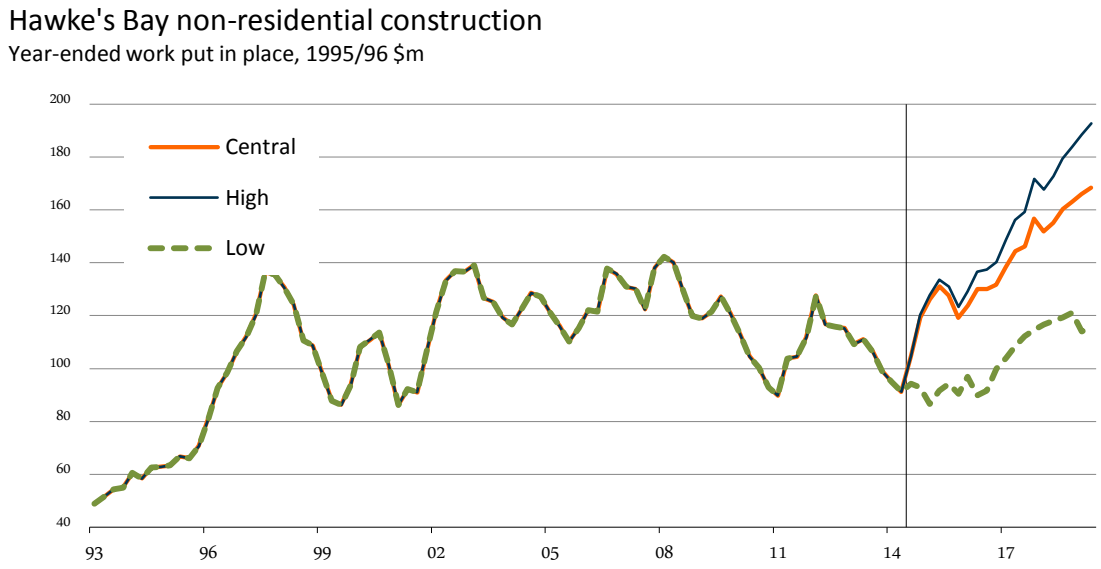


Figure 13: Hawkes Bay Non-Residential Construction Forecast – 2014-2019: High, central, and low scenarios (Year ended, work put in place, 1995/95 $M) – Source Infometrics Ltd

The 'central' or 'mid-level growth' forecast is shown previously in table 1. Below is the 'low growth' scenario for gravel demand in Hawke's Bay.

Year	Dec 2013	2014	2015	2016	2017	2018	2019
M^3	**432,193**	**420,092**	**449,498**	**474,220**	**487,972**	**497,731**	**494,247**
% incr.	**actual**	**-2.8%**	**0.7%**	**5.5%**	**2.9%**	**2.0%**	**-0.7%**

*Table 3: Indicative (**low growth**) Forecast River Gravel Demand with annual increase – Hawke's Bay – (EXCLUDES Ruataniwha project)*

The following graph (Figure14) shows the 3 growth forecast scenarios for the region for river gravel extraction.

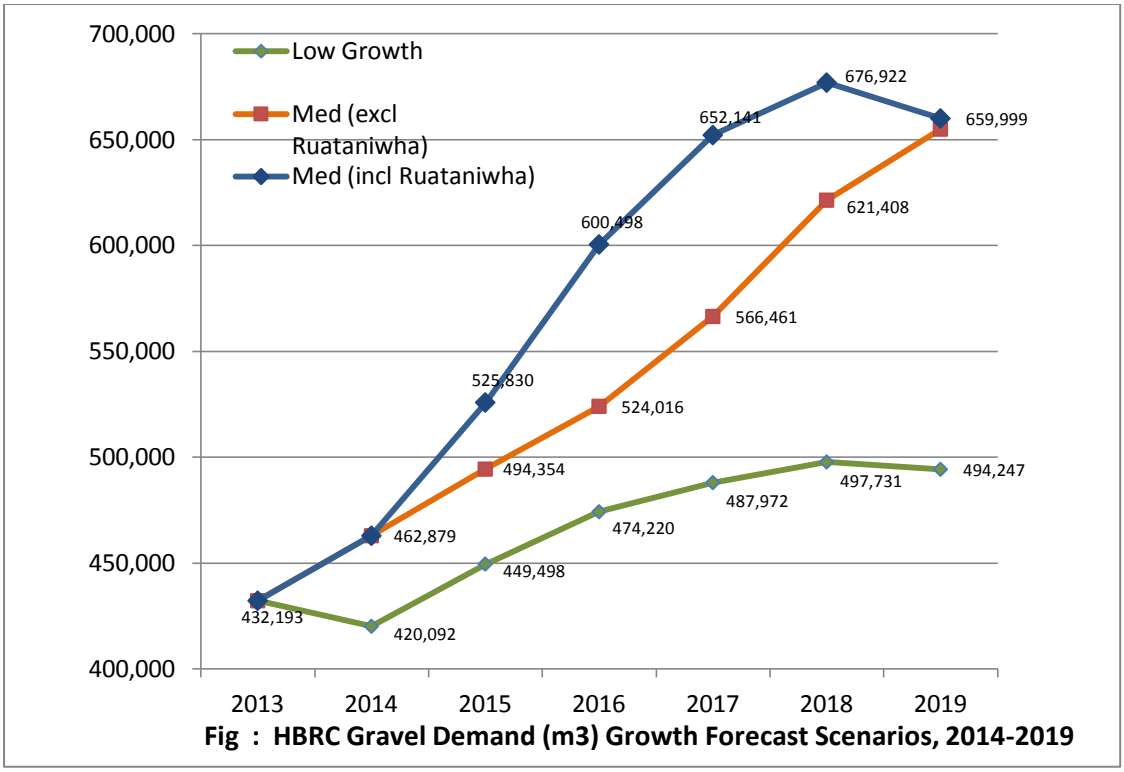


Figure 14: HBRC River Gravel Demand – Growth Forecast Scenarios

6.4 Applying Demand Forecasts to River Gravel

The annual growth percentages show indicative 'regional' growth rates for river gravel demand based on Infometrics construction forecasts.

High, mid, and low growth forecast scenarios have been reviewed. For reasons described in the previous section, **our recommendation for HBRC gravel demand forecasting is to utilise the mid-level and low level growth forecasts**

Putting in place management strategies for gravel allocation scenarios can then be commenced.

There is no accurate information, within the current scope of this report work, which can predict whether the same growth rates should be applied to each sub-region or individual river. For example, will the northern and southern sub-regions experience lower growth than these regional average percentages, and conversely will the central region experience higher than regional average regional growth? Based on recent trends, shown in HBRC gravel returns over the last 8-10 years, this might well be the case. The central region is where the 3 largest extractor's business operations are based. As mentioned elsewhere the 3 largest have extracted around 60% -70% of the regional total according to HBRC returns.

If required, further sub-regional assessment of relative growth expectations could be done in collaboration with the industry players, and it is likely to be anecdotal feedback or 'guestimates'. It may well end up being within 'margin of error' differences**. It is recommended that for the purposes of this report, that the same percentage growth rates be applied to each sub region- that is, northern, central and southern rivers.**

6.5 Balancing Supply and Demand of River Gravel

The future available gravel volumes in the rivers are the subject of another project underway with the HBRC, the Gravel Resource Inventory. Balancing supply and demand volumes has therefore not been covered in detail in the scope of this report.

In a **higher demand growth scenario**, where gravel demand exceeds current supply locations, the use of other river locations (southern) could be brought into play with potential incentivising to move to those areas. We understand from HBRC that currently insufficient gravel is being removed from some of the southern rivers, Upper Tukituki and Waipawa. This is covered in *Section 7.10: Incentivising Extraction from River Locations Remote from Market*.

In **low demand growth scenarios** various options will need to be considered by HBRC. As with a recent case in the Tukituki River, HBRC may consider tendering out the gravel removal to nominated stockpiles for future processing and distribution. The sale of some or all of that material over time will be needed.

It is recommended that key aspects of this report are circulated to the industry for comment and engage them in a meeting to establish practical solutions. The establishment of a small representative industry working group may be a good option.

7 RECOMMENDATIONS – RISKS & OPPORTUNITIES

7.1 Regional Export Opportunities – current and potential

Premium river gravel products have been 'exported' from Hawke's Bay for many years to other regions. Rounded river **pebbles** are highly sought after in other regions where pebble is not available. These include various sizes of graded pebbles for use in ready-mix concrete production. They are used in decorative and architectural concrete finishes and for the landscaping market and building supply outlets in other regions. Aggregates are carted long distances to Taupo, Auckland and Northland, and Gisborne.

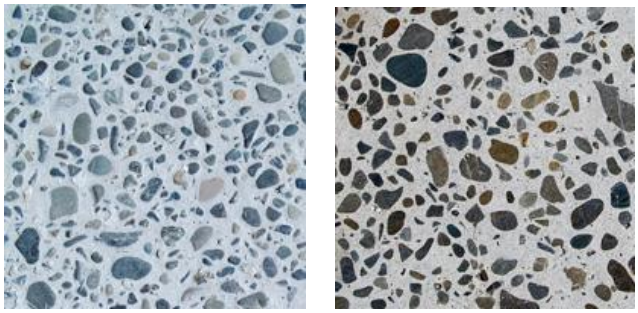


Figure 15: Decorative concrete produced in Auckland by Stevenson Concrete using Hawke's Bay gravel; LHS, exposed finish; RHS honed, polished and sealed finish.

Crushed river gravel aggregate is also exported to Taupo for **asphalt production** by Higgins Aggregates. Transport considerably adds to the landed price of the aggregates.

Future demand growth - The Auckland construction market growth predicted over the next 15 years with housing shortages could see demand for Hawke's Bay pebble increase substantially on its current volumes in the areas described above.

Note: Extract from recent Workforce Skills Roadmap Report:

The Auckland construction activity will peak in 2018/19 and increase 44 per cent on the work completed in 2013. New house building will more than double over the next decade, with an increase in apartments and townhouses - and 70 per cent of all residential growth will take place by 2018.

Gisborne region has hard rock quarries supplying its needs, although small volumes of pebbles are exported for decorative concrete production. Industry feedback would suggest Gisborne is not currently seen as a major growth opportunity for Hawke's Bay pebble.

Waikato region has surfeit of hard rock quarry aggregates supplying the industry including concrete production and exports to many adjacent regions, including Auckland.

Heading **south of Hawke's Bay** other regions have their own river gravel sources, and hence there is less opportunity to export pebble from Hawke's Bay.

Export Growth Potential - Based on industry figures, it is estimated that Hawke's Bay river gravel exports account for approximately 100,000 tonnes annually (say 60,000 cubic metres), or around 14% of the total river gravel extracted (based on HBRC 2013 figures).

With export markets growth as forecast above, particularly in Auckland, the Hawke's Bay pebble volumes have potential to increase substantially with similar high growth rates.

7.2 Barging of Aggregates to other regions

The option of barging aggregates from Hawke's Bay to other regions has been investigated in the past by the major gravel extractors, but we understand that it was not financially viable due to the logistics and distribution and multiple handling costs. Consequently no further investigation into its viability has been made as part of this report.

7.3 Rail Transport of Aggregates

Similar to barging above, rail transport has not been seen to be financially viable when compared with road transport. Transport companies typically arrange gravel transport as part of back loading round trips with other products in order to mitigate the cartage costs. Demand locations for pebble outside Hawke's Bay have been discussed elsewhere, and are primarily seen as the Auckland and Taupo market.

There is no direct rail line from Hawke's Bay to the Auckland market. The only rail route is south to Palmerston North, and then turning north to Taumarunui, Hamilton and Auckland. Of course towards Manawatu region and south there are also river gravel sources which could come into consideration if rail costs were commercially viable.

The Napier to Gisborne rail line was mothballed in 2012, after a large storm caused major damage to the line, and has not been reopened. HBRC has recently investigated leasing the line from Kiwi Rail and the feasibility of re-opening it. No decision has been made on this at time of writing this report.

Figure 16: NZ North Island Rail Network – Source, Wikipedia

Note, Napier-Gisborne line is currently mothballed

In other regions, Environment Waikato commissioned a study in 2010 to investigate whether rail could be a viable alternative to road transport and mitigate the pressure on roads from hauling far higher tonnages of aggregate north into Auckland.

However, the comparison showed rail would still be more costly than road transport, and that the advent of heavier truck payloads on roads could offset some of rail's environmental advantages.

The study concluded that for rail to be a viable alternative to road for hauling aggregates to Auckland, direct connection between quarry and the rail network was essential to cut out intermediate handling costs. Where direct access was not feasible, as was the case with existing Huntly quarries, rail was more costly than road.

Environment Waikato stated in their report (17 November 2010) to the Regional Transport Committee, that the representatives from the quarry industry, rail and local government, concluded that it was not worthwhile to carry out Phase 2 work on the project due to the marginal economics of the proposal.

Where rail has been successful is in situations where it is transports large volumes of bulk product directly between production unit and production unit or end use point, with no multiple handling involved. One such example is coal transport from Solid Energy's Rotowaro coal mine in Waikato to

NZ Steel at Glenbrook in south Auckland. The infrastructure at both ends is well set up with daily coal trains loaded by overhead silos at the coal mine site. These overhead silos are fed by conveyor from the coal mine site. The dedicated coal train has specialised bottom dump wagons. At the receiving end (NZ Steel) the train dumps coal into bins below the wagons, and the coal is then transported by conveyors to large stockpiles. Clearly this requires significant investment in infrastructure and typically involves large volumes to justify the economics.

Figure 17: Photograph of coal load out area at Solid Energy's Rotowaro mine in Waikato.

Coal is fed by conveyors into overhead silos (on left), which feed the coal train wagons

In another example at Otaki, Winstone Aggregates have a rail siding directly into their quarry which is adjacent to the North Island main trunk (NIMT) rail line. The quarry aggregate is fed by conveyor into overhead hopper bins to load the train. Railway ballast (aggregate) has been transported directly into Wellington rail yards. This scenario minimises handling costs at both ends.

While we have not investigated rail transport within the region in more specific detail, it is unlikely to be viable compared with road transport, due to the reasons discussed above plus the fact that gravel (from rivers or land based pits) is available in many scattered locations across the region, rather than in one direct loading location.

Rail transport is often not typically viable within the same region over short distances, except as described in the NZ Steel scenario. It requires large tonnages to justify, dedicated trains with specialist bottom dump wagons, and at the delivery end or distribution point it typically creates an 'urban quarry' situation with the attendant consent issues of dust, noise traffic, etc. Delivery to 'customer sites' then still has to be done with road trucks.

Export of pebbles to multiple locations in Taupo, Auckland and north (where there is no local supply) is by road transport as discussed.

7.4 Importing of Aggregates to Hawke's Bay

The volumes of imported aggregates from other regions are understood to have been small over the years.

Specialist products such as smelter **slag** (a by-product of iron and steel making) from NZ Steel in Glenbrook (south of Auckland) are used for making **sealing chip**. These are used in high risk roading areas needing high 'skid resistance' characteristics on selected parts of highways. These aggregates are tested in a laboratory test known as PSV (polished stone value). High PSV is the currently used predictive measure of high skid resistance. This high PSV chip (PSV value of 60) has been imported and used in the Hawkes Bay state highway network, but only in very small volumes, understood in relative terms to be only 1%-2% of the regional production of Hawke's Bay aggregates.

Sealing chip is manufactured in Hawke's Bay for local roads and state highway network maintenance and construction, but does not exhibit the extra high PSV property such as the slag which has a PSV value of 60. Low-medium level PSV 53-55 chip is made in several locations in Hawkes Bay and used on the local road networks and some state highway contracts.

However there is ongoing research by the NZ Transport Agency and industry technical groups to determine if the PSV test is the best predictor of 'skid resistance' in sealing chip. There are various industry expert reports which indicate that PSV may not always correlate to adequate long term in-situ skid resistance on the roads. However, until such time as a better test method is proved, PSV remains as the industry standard test.

Decorative aggregate pebbles are imported in different colours (red, white, golden-brown) from other regions for the landscaping market in Hawke's Bay. These provide end users with a contrast to the more common grey coloured local pebble.

Limestone chips are also imported for the landscaping market in small volumes, despite there being limestone quarries in the region.

7.5 Forecasting Gravel Demand Method

There is currently no useful regional gravel demand forecasting system in place, other than estimated annual gravel allocation requests by extractors. There is also the issue of duplication in these allocation requests, where multiple extractors/contractors might be planning to tender for aggregate supply to the same contracts.

A key objective of HBRC's Gravel Management Plan and this report is to propose a basis for forecasting gravel demand.

It is proposed that the construction forecast graphs sourced from Infometrics in this report, be used as key input for 5 year forecasting, and that these can be updated into rolling 5 year forecasts annually. Infometrics produces 5 year forecasts in June each year. It is **recommended that this forecasting information could be shared with the industry to encourage collaborative approach to forecasting**. A process of comparing or testing these forecasts against actual volumes produced in future years is strongly recommended. Critiquing and commentary by the industry is to be

encouraged in order to produce more robust outcomes. Aggregate demand forecasting is both an art and a science, and also requires good industry knowledge.

7.6 Annual River Gravel Allocation Process

The HBRC allocates gravel extraction volumes on an annual basis, commencing 1 July each year. While it seems that this process rolls over quite quickly, some of the larger extractors have said that a one year time frame is too short for business planning and investment purposes. These extractors believe longer time frames are required. This is a common problem in other regions with alluvial river gravel resources.

There is a risk with this annual approach. With no long term security of supply guaranteed, it is understood at least one significant extractor has secured a land based gravel pit and another is looking at it, to protect their long term future in gravel extraction, should the river gravel allocations be terminated, significantly reduced or if extraction is redirected by to a less economically favourable location. It has been suggested anecdotally that if an extraction operation was relocated to such sizeable land based sites, the economic viability of relocating back to a river based site is less than attractive, particularly if fixed crushing and screening plant is employed as opposed to mobile plant.

Given the purpose of this report is to forecast future demand, it is **recommended that HBRC work with the industry to consider extending the allocation out beyond one year with those specific extractors where requested.** Bear in mind this may only be a small number of larger extractors. This of course is totally dependent on the actual gravel availability at extraction sites. Over extraction of rivers also needs to be monitored, and can cause other negative issues such as washout around bridge piles and the like. It may be worth considering for example a 5 year rolling allocation – that is reviewed annually. This might be tied in with the 5 year rolling demand forecasts, discussed elsewhere in this report.

The key issue for HBRC is, if extractors were to request allocations longer than one year, then those extractors need to be able to commit to the extraction of those volumes, not just simply 'banking' the volumes.

It is important to note that our industry feedback from some smaller extractors suggest they are comfortable with the current annual allocation process, as they have not had any issues to date.

7.7 Coastal Extraction of Gravel

Winstone Aggregates in Awatoto has been extracting gravel off the beach for many years. However in 2017 it is possible that no further coastal or beach extraction may be permitted, due to concerns with coastal erosion. A number of expert reports have been produced on this issue. Winstone currently takes around 30,000 m^3 annually off the beach.

Recommendation: HBRC has indicated a collaborative industry approach would need to be taken to identify alternative gravel allocation sites to replace this coastal allocation. We recommend this option be progressed.

Further north, Napier City Council lets an annual contract to extract gravel on the Napier foreshore to replenish Westshore beachfront. This has seen 12,000-15,000 m^3 annually taken in recent years. This product includes pea sized gravel. If future consenting of coastal extraction is not guaranteed, and assuming Westshore beach replenishment is to continue, then we recommend that a future option would be to let tenders to the market, to source, supply and deliver the gravel for the Westshore beach replenishment from river sources. The length of contract period would need to be considered to determine the best economic option. Industry input would be recommended on this matter.

7.8 Annual Aggregate Returns – NZ Petroleum and Minerals (NZPM) Statistics

In assessing the regional aggregate production for this report, we referred to the annual statistics provided by NZPM, formerly Crown Minerals. NZPM captures and reports annual aggregate production statistics (or returns) for New Zealand by regional breakdown. These were originally required where a crown mineral license was in place, but were later extended to include other quarry sites to get a more comprehensive picture of the industry. The individual company results are not published for commercial reasons. In many regions of New Zealand this NZPM data is incomplete or out of date, which we will refer to later in this section. The NZPM returns for the 2013 calendar year are as follows:

Rock, sand and gravel for building	341,939
Rock, sand and gravel for roading	252,591
Rock, sand, gravel & clay for fill	16,847
Sand for industry	51,370
Total for above categories	**662,747 Tonnes**

Table 4: Hawke's Bay Production 2013 calendar year (tonnes): Source NZ Petroleum & Minerals

Reference to aggregate producer's product lists indicates the loose density of their products varies from 1.4 to 1.9 tonnes/cubic metre. For this purpose we will assume an average density of approximately 1.6 tonnes per cubic metre. The NZPM annual statistic from above would then equate to around **415,000 cubic metres of (all) aggregate for 2013.** The HBRC river gravel (only) returns for 2013 were **432,000 cubic metres**. However this HBRC figure does not represent the full regional production, as it excludes all the land based gravel extraction. Clearly the NZPM statistics significantly under estimate the total regional returns by a wide margin.

In the Hawkes Bay region there are understood to be about 10 companies that have furnished returns to NZPM for the calendar year 2013, albeit for multiple extraction or production locations.

We understand that of those 10, the 3 major river gravel extractors in the central region (Winstone, Holcim, and Higgins) have furnished river gravel returns, and the other 7 include some land based gravel sites. Compare this with the more than 50 companies and organisations which have annual river gravel allocations in the HBRC area according to HBRC records. Therefore many of those will

not be in the NZPM returns. While many of those 50 companies have only small volume allocations, this demonstrates how incomplete the NZPM annual statistics are. Bearing in mind that the big 3 central extractors take nearly 60%-70% of the river gravel allocations in Hawke's Bay, then the NZPM total returns for Hawke's Bay are significantly underestimated.

In addition to river gravel extraction, it is also likely that many of the small operations using land based pits are not included in the NZPM aggregate return statistics.

This aggregate returns issue is not unique to Hawkes Bay. On a similar aggregates project by the authors of this report, for the Far North District Council, it transpired that the two largest quarries in the FNDC area had not been requested to furnish returns for the Northland statistics, as they were simply not on the NZPM list. Given the reliance on aggregate production statistics used by a multitude of forecasters and planners, in economic and strategic aggregate planning and forecasting, it is obvious that this is an inadequate situation, which needs an industry solution.

In regard to the incomplete returns, the issue is primarily that there is not a complete database of extractors/producers held by NZPM to send the annual return requests to

Having said all that, it appears that, in regard to river gravel extraction, that HBRC has a very high level of regional returns because these are linked in with the gravel allocation process. For the purposes of this report, which is addressing river gravel, that is a positive outcome for HBRC.

Recommendation: That a collective industry approach needs to be taken in order to first ensure there is a complete database of aggregate 'producers/extractors', and that local input will be needed regionally to keep it up to date. The Aggregate and Quarry Association and HBRC could play a key role in this. Although it could be argued that HBRC is primarily interested in gravel returns for which they have reasonably good records already, and hence do not require the 'total' regional demand from all sources.

7.9 By-product of Gravel Extraction Processing

One of the more complex points associated with calculating total aggregate production volumes, is that while river gravel extraction volumes (cubic metres) are received by HBRC in the annual returns, the actual yield in terms of usable or saleable product varies between extractors. Some of the larger extractors, in the process of crushing and screening to produce saleable product, often produce significant volumes of by-product which mounts up in stockpiles over many years. One of these by products, often referred to as pea gravel for obvious reasons, is generally not a widely used or saleable product. Hence the sales/production volumes do not strictly correlate with the extraction figures.

The extraction industry is keen to get assistance in how to utilise this by-product. The Westshore beach replenishment is a potential opportunity, as the current coastal extraction consents for that project may be discontinued in the not too distant future.

7.10 Incentivising Extraction in River Locations Remote from Market

One of the key issues for the Gravel Management Plan is how does HBRC incentivise extractors to extract from other than their favoured locations, which are generally in close proximity to their processing plants and/or their end market. The transport costs are key commercial issues.

Recommendation: Investigate options to incentivise alternate extraction locations and consider a review of the HBRC regional extraction charges per cubic metre. Consider increasing this rate in totality across the region to all extractors to make it equitable and reduce it in other more remote locations where HBRC wishes to extract, or propose a **transport subsidy**. There will be a number of scenarios to consider with this, and we suggest industry input will be valuable.

If HBRC can advise some scenarios of which southern river locations require gravel removal and the indicative volumes involved, it will be possible to estimate the potential cost differential to cart it by road to processing sites, over and above the cost of carting from current sites.

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9 DISCLAIMER

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