

Before Independent Hearings Commissioners Appointed by Canterbury Regional Council and Selwyn District Council

In the matter of The Resource Management Act 1991

And

In the matter of Applications by **Fulton Hogan Limited** for all resource consents necessary to establish, operate, maintain and close an aggregate quarry (**Roydon Quarry**) between Curraghs, Dawsons, Maddisons and Jones Roads, Templeton

**EVIDENCE OF MICHAEL OLIVER CHILTON
ON BEHALF OF FULTON HOGAN LIMITED**

AGGREGATE DEMAND AND SUPPLY

DATED: 23 SEPTEMBER 2019

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Introduction

- 1 My name is Michael Oliver Chilton. I am a director and consulting engineer of Aggretech Limited.
- 2 I have been asked by Fulton Hogan Limited (**Fulton Hogan**) to provide evidence in respect of its application for resource consents to establish, operate, maintain and close the proposed Roydon Quarry (**Proposal**).
- 3 My area of expertise is aggregate demand and supply.

Qualifications and Experience

- 4 I hold a Bachelor of Engineering degree in Mining Engineering and a certificate of competence as an A-grade quarry manager. I am a member of the Australasian Institute of Mining and Metallurgy (MAusIMM) and a technical member of the Institute of Quarrying New Zealand (Inc) (TMIQ).
- 5 I have worked as a quarry engineer in New Zealand since 2005, designing and overseeing operations from small borrow pits and alluvial extraction sites of <20,000 tonnes per annum (**tpa**) up to larger hard rock quarries providing 500,000 tpa. Since forming Aggretech Limited in 2015 I have worked as an independent consultant to the quarry industry on technical and engineering matters.
- 6 I contract to the Aggregate and Quarry Association of New Zealand (**AQA**) as their technical adviser and also serve private quarry owners. My AQA work involves informing members on technical matters, participation in various technical committees, providing advice to the Board and members on specific technical matters and proactively identifying technical issues and promoting solutions. The majority of my private work is related to quarry site design and improvement / optimisation and resource consenting issues.
- 7 Since 2015, I have sought and collated quarry industry production statistics on behalf of the AQA with the aim of informing discussions and decision-making around the country. These figures are used by the AQA and its members in their publications and submissions.
- 8 I acknowledge that I have read and am familiar with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014, and agree to comply with it. I confirm that this evidence is within my area of expertise, except where I state that this evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions I express in this evidence.

Scope of Evidence

- 9 In my evidence I will:
- 9.1 Discuss the importance of aggregates to society;
 - 9.2 Outline my involvement in the Roydon Quarry Proposal to date;
 - 9.3 Identify the key features of the Proposal as they relate to my area of expertise;
 - 9.4 Discuss the contribution of Pound Road to aggregate supply;
 - 9.5 Describe the forecasted local demands for aggregate through to 2048;
 - 9.6 Discuss how those demands might be met, with and without the proposed Roydon Quarry;
 - 9.7 Evaluate the benefits of the Proposal in meeting aggregate demand forecasts;
 - 9.8 Identify demand and supply issues raised by submitters;
 - 9.9 Address any residual demand and supply issues arising from the s42A reports;

The importance of aggregate to society

- 10 Aggregates are fundamental to the lives of New Zealanders. Roading, building and agriculture rely on the continuing supply of suitable quality aggregates from a quarry source close to the area of demand.
- 11 New Zealand has one of the highest rates of aggregate consumption per capita in the world, averaging between 8-10 tonnes per person per year. The only countries who use more aggregate per person are Canada (10t) and China (14t)¹. The high rate per capita in New Zealand is generally attributed to a low population over a large area.
- 12 In 2017, New Zealand produced an estimated 45 million tonnes (Mt) of aggregates, with a revenue of \$670 million². As part of the review into the Road Controlling Authorities Forum's Low Volume Roads Funding Guideline, aggregate production was compared to other well-known New Zealand commodities, with forestry producing 25Mt and dairy 21Mt³.

¹ Jim O'Brien, Global Aggregates Information Network Convenor

² Source New Zealand Petroleum & Minerals, Annual Minerals Industry Statistics

³ Personal communications within Road Controlling Authorities Forum's Low Volume Roads working group

- 13 Approximately 10,000 New Zealand jobs rely on aggregate⁴.
- 14 The dominant uses of quarried material in New Zealand are roading (50%), building (20%), then limestone for agriculture and industry (10%)⁵, shown in Figure 1.
- 15 Ensuring sources of aggregate supply are located close to the end user ensures they are cheaper and cleaner to deliver to the customer. Ideally, a quarry is located in an area of high-quality rock, close to transportation infrastructure and the end users that it serves.
- 16 The realisation of the importance of aggregates, combined with the negative effects of reverse sensitivity, has caused many states and countries to develop a state or national aggregates strategy, for example the Victorian Extractive Resources Strategy⁶, published in 2018 or the UK Government's National Planning Policy Framework, Chapter 17, published in 2019⁷. These documents highlight the importance of planning for future aggregate supplies well ahead of time, showing where strategic aggregate resources are located and preventing the sterilisation of future resources by conflicting land uses, e.g. not allowing houses to be built within a set distance of a potential future quarry.
- 17 Although New Zealand does not have a national aggregates strategy, many district authorities are looking ahead to plan for future aggregate supplies. GNS Science have been working on a national study of aggregate resources, to identify future aggregate "hot spots" where ideal conditions of geology, proximity, transport infrastructure, land use and approximately 40 other criteria are used to give a ranking of most likely future quarry sites. This project is awaiting the outcome of a Provincial Growth Fund application to be completed and published.

⁴ AQA website <https://www.aqa.org.nz/industry/fact-files/>

⁵ Source New Zealand Petroleum & Minerals, Annual Minerals Industry Statistics

⁶ <https://earthresources.vic.gov.au/geology-exploration/industry-investment/extractive-resources-strategy>

⁷ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf

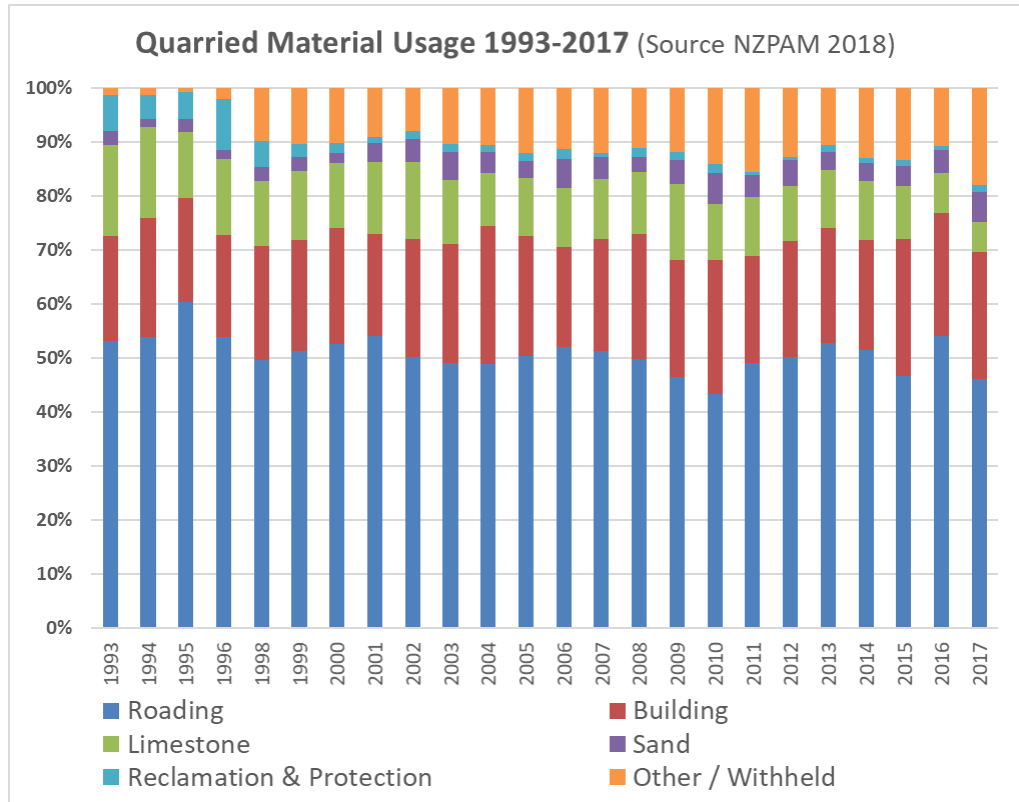


Figure 1 - Summary of uses for New Zealand aggregate 1993-2017 (Source: NZPAM)

My involvement in the Roydon Quarry Proposal

- 18 Although I was aware that AQA had made a submission on the Proposal prior to this, my first involvement with the Proposal was a workshop with Fulton Hogan staff, its consultants and legal advisers on 5 August 2019.
- 19 In preparation for giving evidence on the Proposal, I have:
- 19.1 Spoken to Fulton Hogan staff about the site and the proposed methodology of quarrying;
 - 19.2 Spoken to other industry people to get feedback on Christchurch's infrastructure position and some information on the geology of the proposed quarry site;
 - 19.3 Reviewed New Zealand Petroleum and Minerals's (**NZP&M**) annual minerals industry statistics⁸ and contacted NZP&M staff about them;
 - 19.4 Reviewed previous evidence given towards quarrying consent applications in the Christchurch region, particularly the previous evidence from Mr Richard English of his work collating aggregate supply and demand figures for Christchurch⁹;
 - 19.5 Reviewed the application documents, including appendices and section 92 responses and the evidence prepared by Mr Mike Copeland and Mr Craig Stewart;
 - 19.6 Spoken to Fulton Hogan representatives about the Pound Road site and its range of aggregate products;
 - 19.7 Used information from Christchurch City Council¹⁰ (taken from Statistics New Zealand) to model the past and future population against aggregate consumption; and
 - 19.8 Made use of my personal register of quarries in Google Earth.
- 20 I have been reviewing the national statistics from NZP&M with a specific focus on Canterbury for the scope of this evidence. NZP&M compile annual statistics for aggregate production around New Zealand. This is a compulsory survey for mining

⁸ Available here: <https://www.nzpam.govt.nz/our-industry/nz-minerals/minerals-data/industry-statistics/>

⁹ Before the Christchurch Replacement District Plan Independent Hearings Panel: 2123 CCC Evidence of R English 16/10/15, 2331 CAPG Statement of Evidence of R English 29/10/15, 2455 Fulton Hogan Statement of Evidence of R English 29/10/15. "Aggregates Demands and Resources" CCC District Plan Review, Twelfth Knight Consulting October 2014

¹⁰ <https://www.ccc.govt.nz/culture-and-community/christchurch/statistics-and-facts/facts-stats-and-figures/population-and-demographics/population/current-pop/>

permit holders (my estimate 5-10% of quarries) but voluntary for all others. Response rates have averaged 77% over the last six years.

The essential features of the Proposal in terms of resource

- 21 The proposed Roydon Quarry is intended to benefit the people of Christchurch City, Selwyn District and (to a comparatively lesser extent) Waimakariri District (**Greater Christchurch**) by enabling Fulton Hogan to provide high-quality topcourse, basecourse and sub-base aggregate close to their points of need.
- 22 It will extend the life of the total consented aggregate supply within Greater Christchurch by about 5-6 years. This figure is derived from Fulton Hogan's estimation that the site has 30 million tonnes of extractable resource and my forecasted future demand for the potential market the Proposal would service.
- 23 The Proposal will ensure Fulton Hogan retains a suitable long-term topcourse, basecourse and sub-base resource in the Greater Christchurch aggregate market.
- 24 The site is located partly on fluvial deposits (river gravels) and partly on a dune of wind-blown river sand. The area is an extensive fluvial plain or terrace, commonly with relict braided channels, refer to Figure 2. Source GNS Science QMAP (2018, 1:250K) and Christchurch Urban Map (2018, 1:50K). I understand from the evidence of Mr Kelvyn Jolly the aggregate is entirely suitable to make good topcourse, basecourse and sub-base products.
- 25 The site is ideally located to provide supply to urban growth areas particularly in Selwyn District and Southwest Christchurch. The site has good direct access to the State Highway and Main South Road. The parcel of land is large which is ideal for providing long-term longevity as well as providing efficiencies of extracting and processing aggregates onsite instead of carting raw aggregates in from external extraction sites. See also evidence from Mr Andrew Metherell and Mr Craig Stewart.



Figure 2 – Terrain analysis of LiDAR showing the old river channels through the site

The contribution of Pound Road quarry to date

26 The Proposal is designed to be a replacement for the existing Pound Road quarry. The top course / basecourse / sub-bases that are produced from Pound Road will be able to be produced at Roydon Quarry if consented. The manufactured quantities proposed for Roydon are expected to match those from Pound Road.

27 I understand from the evidence of Craig Stewart that there are limited quantities of resource remaining at Pound Road although it has around 3 years of additional consented supply available to be imported from Fulton Hogan’s Roberts Road extraction-only site. While there could be some overlap between the two sites, it is anticipated it would be limited in terms of the basecourse processing component.

28 Concrete aggregates and sealing chip products are provided from the McLeans and Miners Road sites. These sites have a different focus to Pound Road / Roydon.

Forecast local demand for aggregate

29 To forecast local aggregate demand, I looked at the Canterbury aggregate production figures from NZP&M going back to 2000. I needed to designate the

proportion going into Greater Christchurch as opposed to the rest of the Canterbury region so I used Mr English's demand figures from his October 2015¹¹ work. I have superimposed Mr English's figures over the NZP&M figures in Figure 3 below.

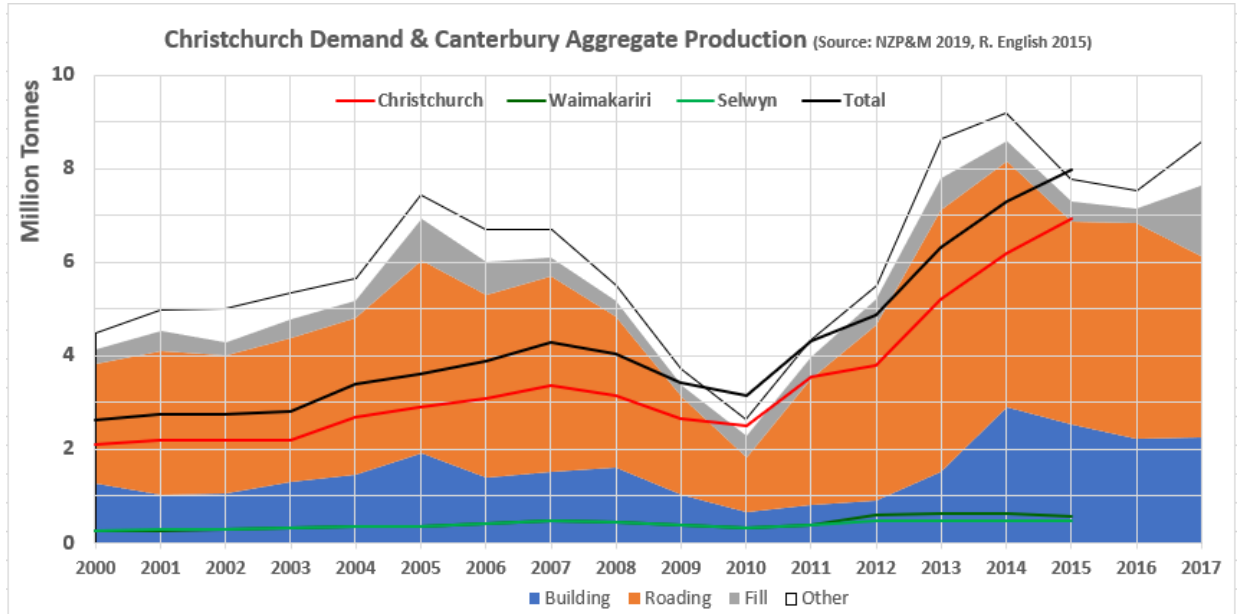


Figure 3 - Canterbury aggregate production figures (2000-2017) compared to Christchurch, Waimakariri and Selwyn totals up to 2015

- 30 Mr English's work shows some correlation with the total Canterbury production figures as expected. If you remove the outliers of 2010, 2011 and 2015 where Mr English's survey of quarries exceeded the total reported production of Canterbury, you see that pre-earthquakes, an average of **62%** of Canterbury's production was consumed in Christchurch City and Waimakariri and Selwyn Districts (the study region), and post-earthquakes, an average of **81%** was consumed in the study region.
- 31 For comparison to the national product split in Figure 1, the Canterbury Regional aggregate usage split is shown in Figure 4.
- 32 The total production figures for Canterbury are shown in Figure 5. The rapid growth after 2010 reflects the demand associated with the rebuild.

¹¹ <http://www.chchplan.ihp.govt.nz/wp-content/uploads/2015/07/2123-CCC-Evidence-of-Richard-English-16-10-2015.pdf>

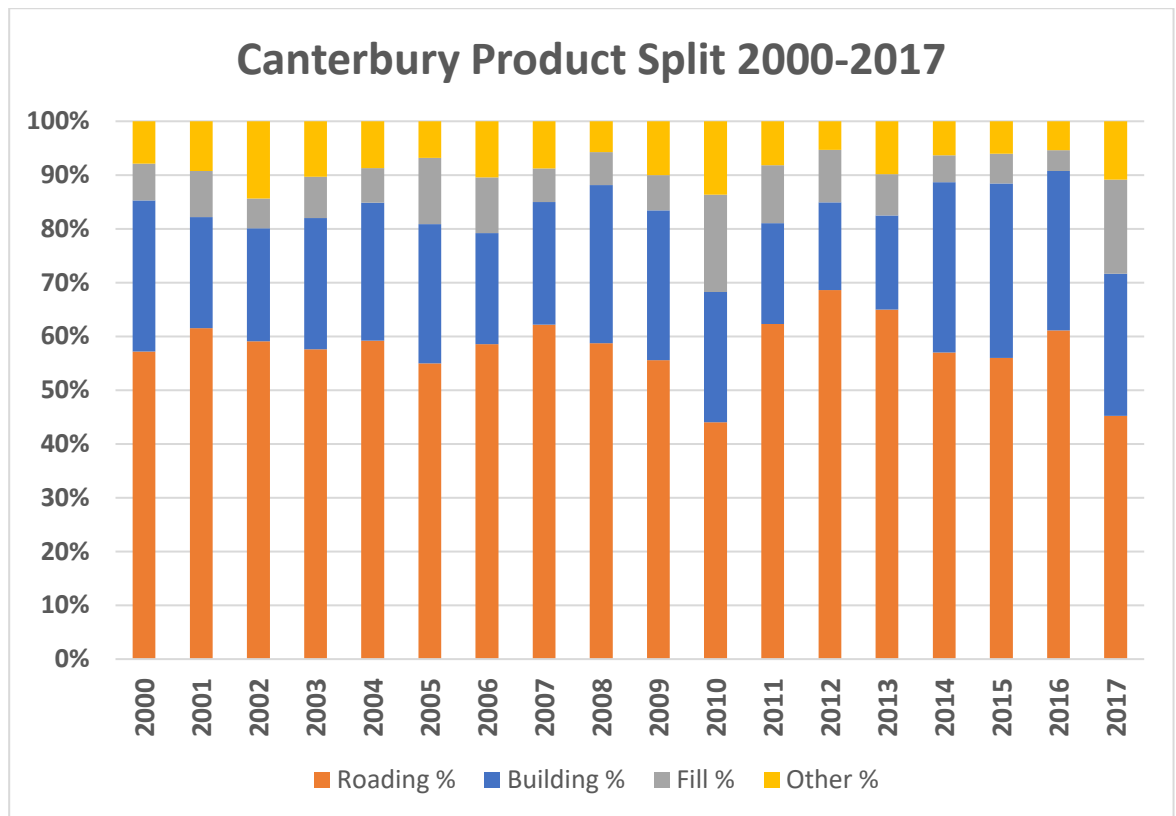


Figure 4 - Summary of uses for Canterbury aggregate 2000-2017 (Source: NZP&M)

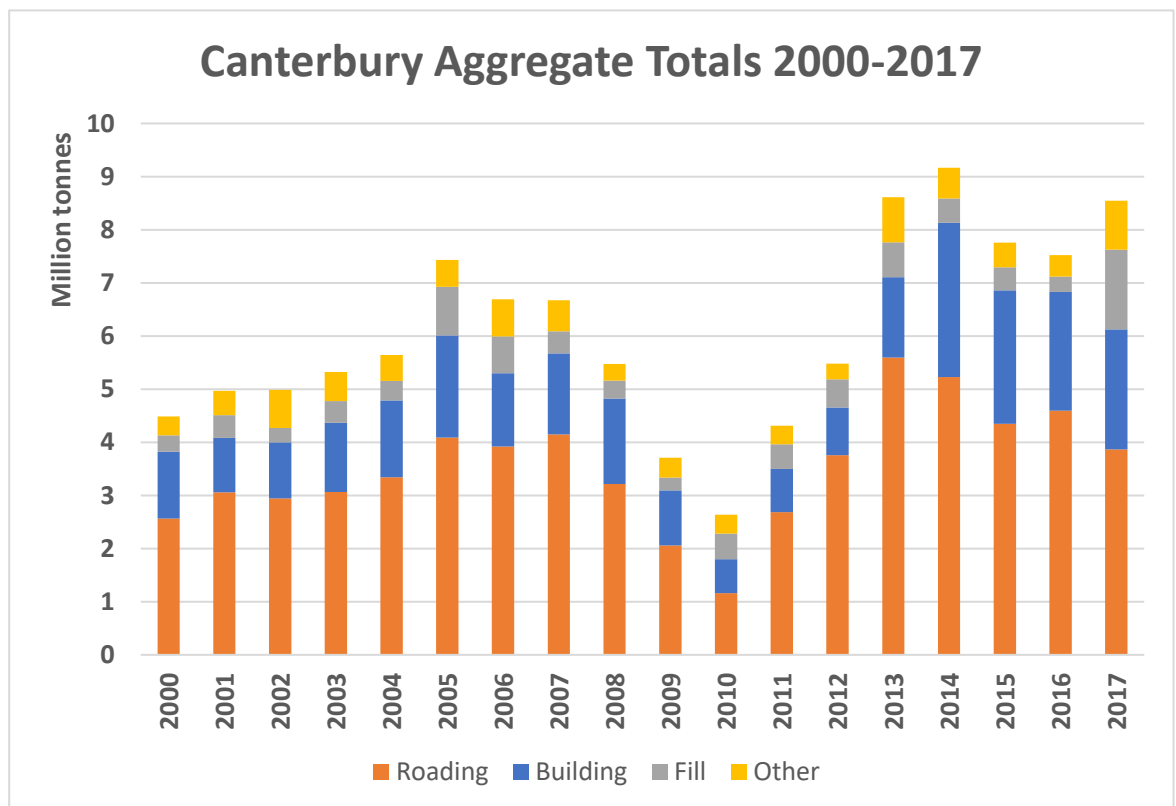


Figure 5 - Total Production for Canterbury 2000-2017 (Source: NZP&M)

33 I used CCC's population data (Figure 6) for Greater Christchurch¹² combined with the proportional quarry data to calculate an actual tonnes-per-person figure for Greater Christchurch (Figure 7). I then used the growth predictions (150,000 person increase from 2018-2048) from the "Our Space 2018-2048" document to forecast future aggregate need.

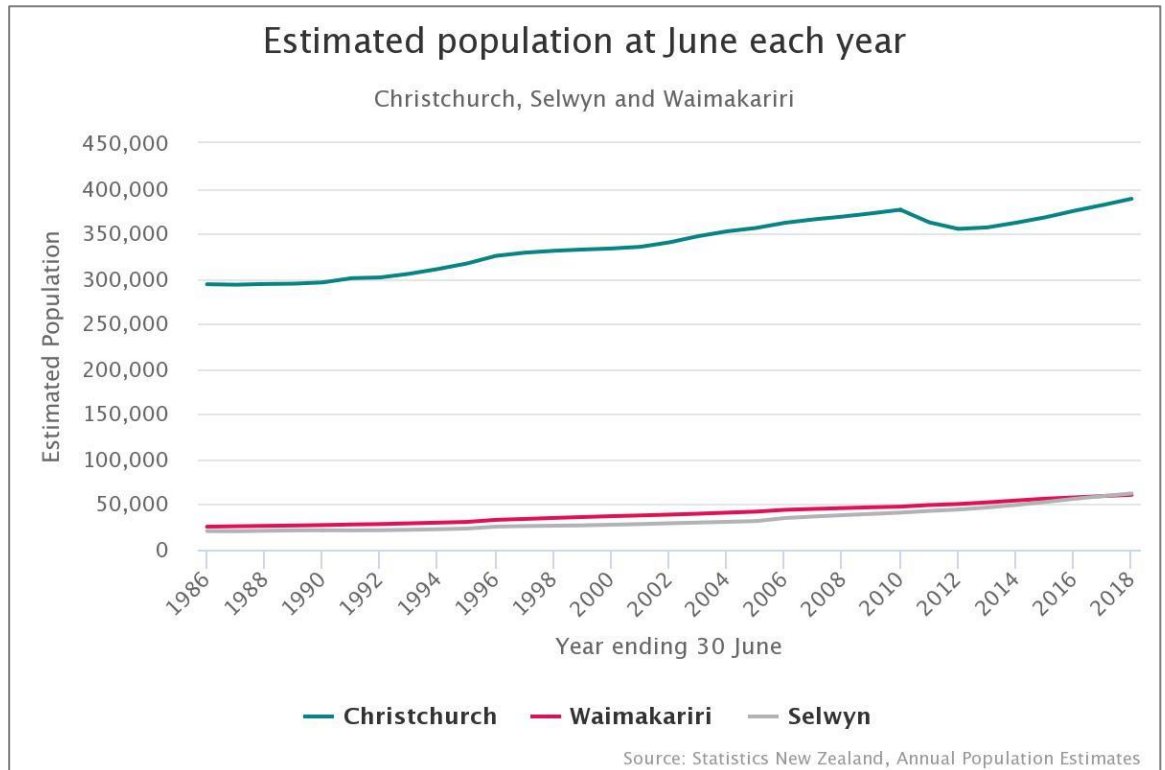


Figure 6 - Population Statistics from CCC to 2018 (Source: Statistics NZ)

34 New Zealand, like other countries around the world, uses a tonnes-per-person figure for aggregate consumption (demand) as a benchmark.

¹² <https://www.ccc.govt.nz/culture-and-community/christchurch/statistics-and-facts/facts-stats-and-figures/population-and-demographics/population/current-pop/>

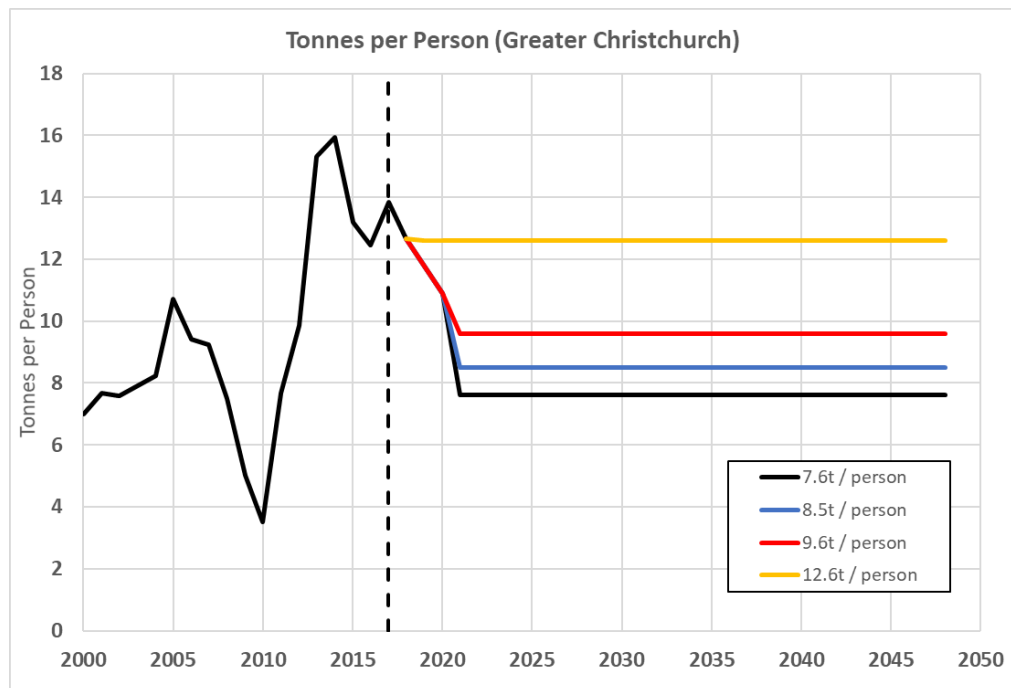


Figure 7 - Actual and forecasted t/person to 2048

- 35 Figure 7 above shows that there are four different forecasts for tonnes per person. The different estimates are outlined in Table 1. The tonnes-per-person figure was derived by averaging production in the production year periods shown.
- 36 I consider the “pre-quake” (black) and “pre-GFC” (blue) figures are too pessimistic given the growth expected in the region in the next 30 years and historical trends in New Zealand. I also consider the post-quake rate (yellow) is overly optimistic as large roading projects and the bulk of the rebuild have finished and no further significant roading projects are in the NZTA project forward work plan.
- 37 In my opinion, the long-term (18-year) average is the best measure to use for future forecasts. It is also aligned with New Zealand’s historical average production rate of 8-10t per person per annum. This represents a return to business as usual (**BAU**) for Greater Christchurch following periods of high demand.

Table 1 - How forecast t/person were derived

Name	Production Years	t / person	2018-2048 Total (Mt)
Pre-Quake	2000-2010	7.6	145
Pre-GFC	2000-2007	8.5	160
18-year average	2000-2017	9.6	178
Post-quake	2011-2017	12.6	229

38 Following the forecast above, the projected aggregate demand per annum is shown in Figure 8.

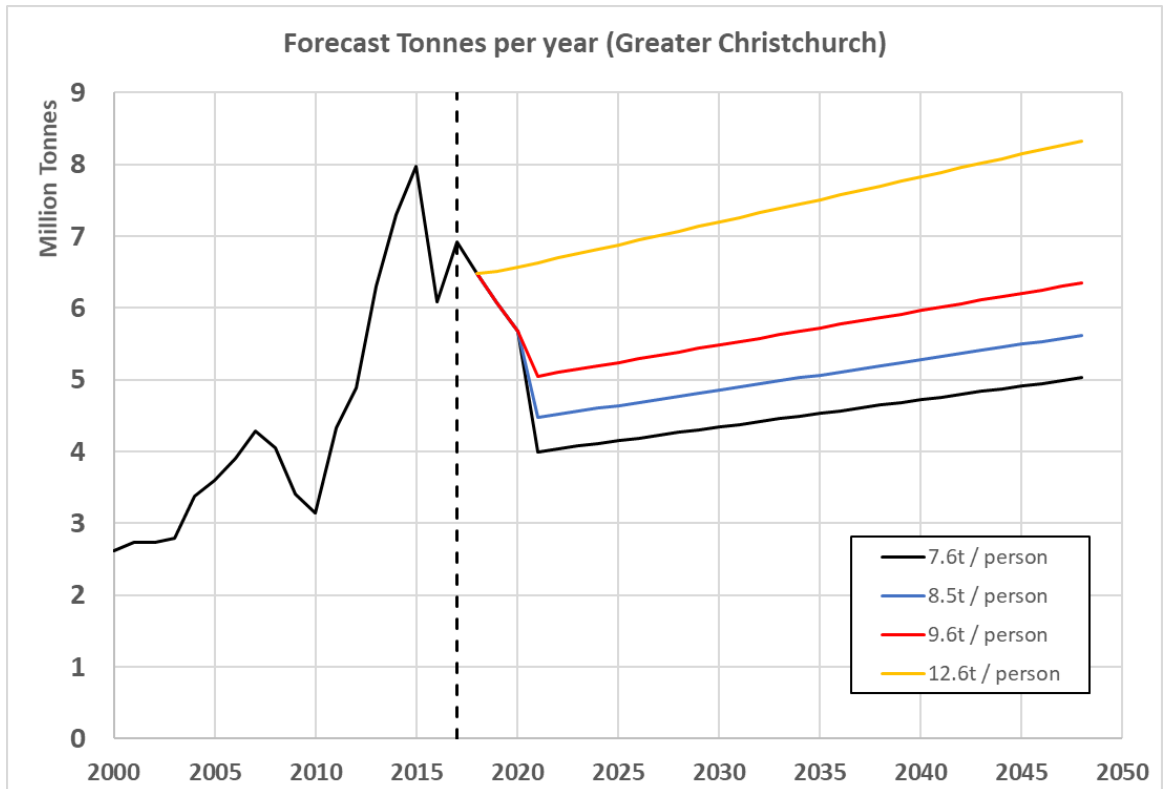


Figure 8 - Projected tonnes per annum consumed in the Christchurch, Waimakariri and Selwyn districts

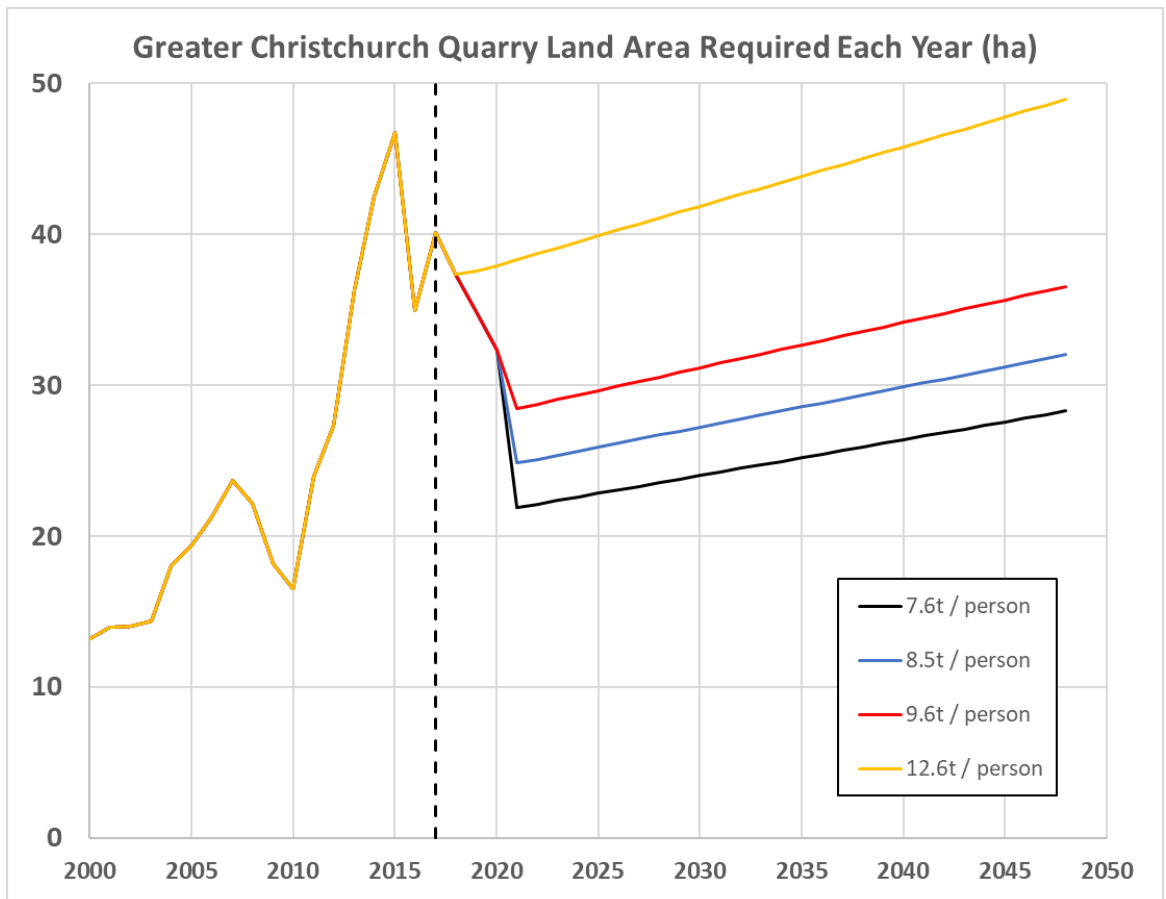


Figure 9 - Associated land area required for aggregate production each year in Christchurch, Waimakariri and Selwyn districts

- 39 I have also shown in Figure 9 the amount of land that the tonnes above equates to, assuming that future river extraction will occur at a rate of 500,000tpa. Greater Christchurch sits on alluvial gravel but extraction depths are restricted by Council requirements to not extract any deeper than a metre above the highest recorded ground water levels. Consequently, pits are typically 5 to 10 metres deep, including non-saleable material components such as overburden and clays. This results in a large quarry surface area but limited resource volumes relative to the area. As a comparison, a typical hard rock quarry bench height would be 8-15m, so the Canterbury alluvial sites are usually not even the height of one hard rock quarry bench.
- 40 The shallow extraction also requires that to provide for Greater Christchurch's ongoing aggregate need, large amounts of land need to be protected from conflicting land uses such as housing. To 2048, almost 1000ha is required at the predicted rate of 9.6t per person (roughly twice the size of the Christchurch CBD).
- 41 Roydon's quarry's proposed 150-170ha if consented would only add 5-6 years to the aggregate supply for Greater Christchurch. While this may seem like a short duration on its own, it increases the current supply duration by 22% and provides additional time for new resources to be found, consented and developed.
- 42 I consider one of the reasons my forecast is more conservative than Mr English's, may be that he had local in-depth knowledge, gained over many years with local producers. However, for the purpose of forecasting, this cannot be quantified and I would recommend the use of the 9.6t per person per annum figure I have calculated, although noting this may be towards the lower end of the range based on Mr English's higher figure.
- 43 I note however that the prediction of supply and demand 30 years from now is a forecast only, and it should be recognised that substantial variation is possible even from one year to the next, as shown from the data of the last 18 years.
- 44 NZP&M are due to release their 2018 figures in late-September 2019. I do not anticipate the newer figures will materially influence the future predictors although I will review these prior to the hearing if they are provided by NZP&M.

How that demand could be met

- 45 There have been three quarries consented since Mr English's work in 2015 when he calculated 130Mt of aggregate resource remaining. These three new consents have added a total of 7.9Mt to the consented gravel volume in the Greater Christchurch area.

- 46 If no further quarries are consented in Greater Christchurch and aggregate demand continues as forecast, Figure 10 shows when the total supply of aggregate is likely to run out, around 2043.
- 47 If Roydon were consented in say 2020, the consequential effect to Greater Christchurch's aggregate reserves and longevity would be as shown in Figure 11, extending the availability of resources to almost get through 2048.
- 48 River extraction is likely to continue to provide only a small portion of Greater Christchurch's aggregate needs, at least in the short term. The river sources are further away from the south and west areas of Christchurch that are currently serviced by Pound Road than the proposed Roydon site.
- 49 I note river extraction is facing challenges around the country with sections of rivers close to end users being degraded by over-extraction and sections of rivers further away aggrading. This has significantly altered volumes of river gravel extraction and priorities for river management in regions such as Manawatu, Hawke's Bay, Bay of Plenty and Rangitikei.
- 50 For the purposes of forecasting reserves to depletion, I assumed a total of 500,000tpa would be extracted from Greater Christchurch's rivers until 2048.

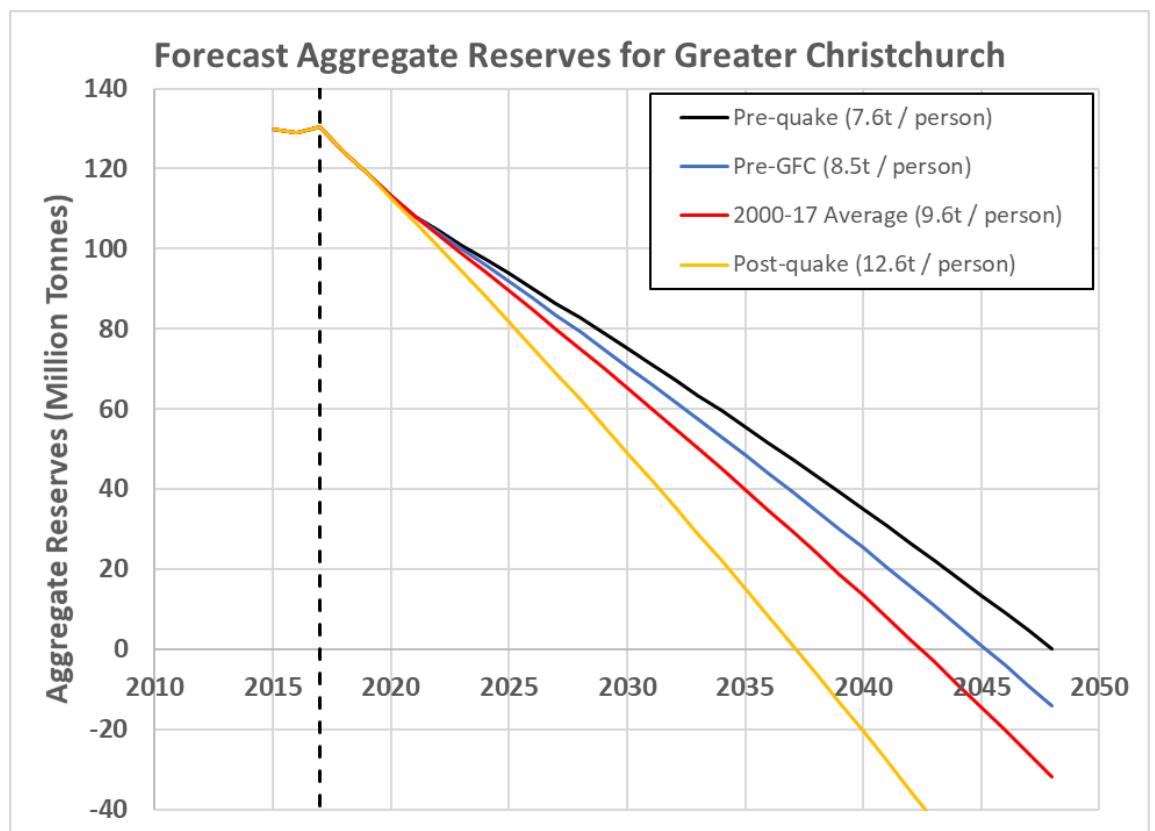


Figure 10 - Forecast aggregate reserve depletion

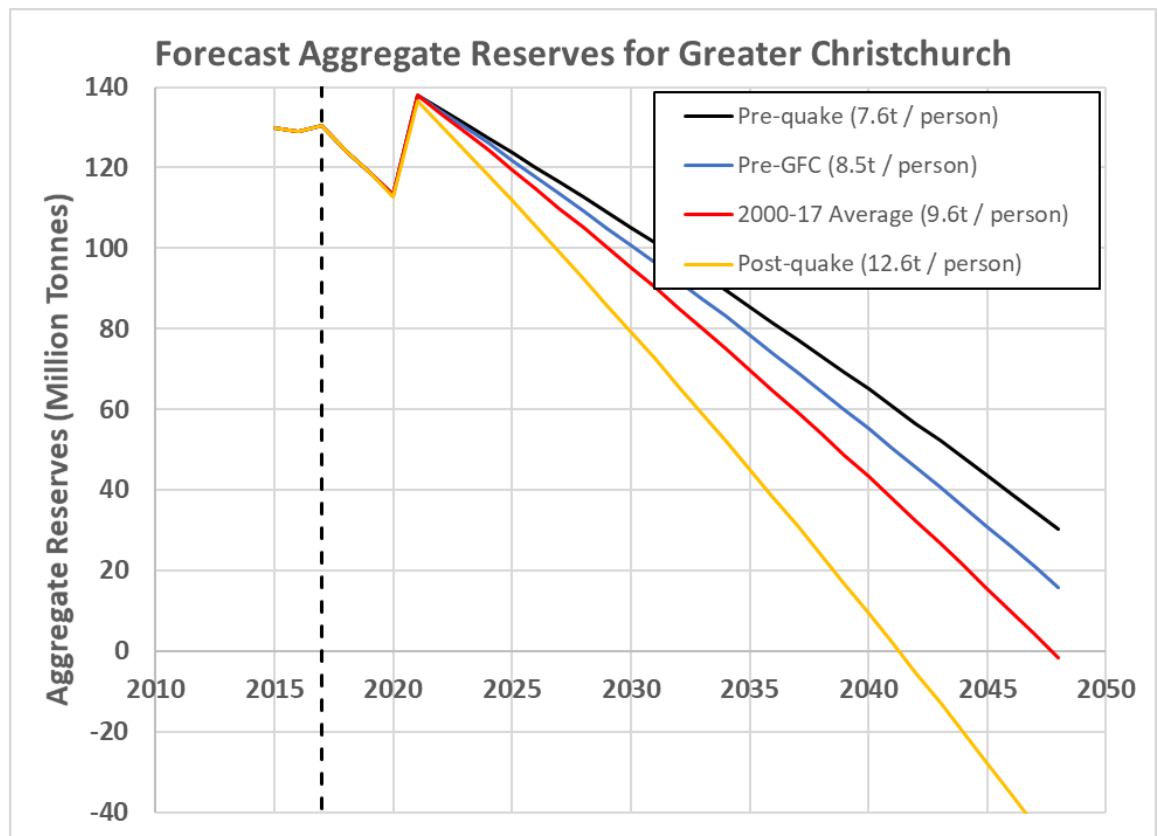


Figure 11 - Effect of consenting a 30Mt resource in 2020

- 51 Another potential supply source is recycled aggregate. From my experience in New Zealand, there is not enough material to recycle to meet the need for aggregates that would otherwise be provided by virgin aggregate. This is highlighted by the fact that all cleanfill, not just material that can be reprocessed for sale, is coming in to quarries at a slower rate than virgin material leaving the quarry.
- 52 In established markets such as Europe, where waste is much more closely controlled and there are conditions for recycling demolition waste, there is still only an estimated 14-20% of demand that can be provided by recycling 100% of waste streams. At present, the UEPG estimates only 8%¹³ of aggregates are from recycled materials.
- 53 Other options to provide for Greater Christchurch's future aggregate needs is to consent another site further away from the end users or even bring in aggregates from outside the area. This is much less desirable as it means more trucks on the road to keep up with the volume demand (consumers are unlikely to accept a lower delivery volume each day). This also has negative effects of more air pollution and higher costs to consumers.

Assessment of the benefits of the Proposal in meeting that demand

- 54 Mr Stewart has discussed how looking for the proposed Roydon Quarry commenced in 2012, meaning that if consented, the entire planning and development process will

¹³ <http://www.uepg.eu/what-are-aggregates> The UEPG is the European Aggregates Association and is a member alongside AQA of the Global Aggregates Information Network (GAIN).

have taken in the order of 8 to 10 years. This demonstrates the length of time it takes to develop greenfield quarry resources required to extend the supply of aggregate into Greater Christchurch.

- 55 Planning, consenting and investing in site infrastructure and plant is typically only suitable for long-term quarry options. This site was considered to have a sufficient quantity of aggregate to warrant investment as discussed by Mr Stewart.
- 56 This proposal not only extends Greater Christchurch's aggregate reserves, it meets several other criteria making it highly desirable as the location for a quarry:
- 56.1 It is close to the concentrations of end users, i.e. Templeton, Prebbleton, Christchurch City
 - 56.2 Roydon is close to highway transport and power infrastructure
 - 56.3 The resource is of suitable quality
 - 56.4 The parcels of land are large enough to warrant the large investments involved
 - 56.5 There are limited neighbours within close proximity to the site.
 - 56.6 There is no significant heritage, cultural or ecological overlays or values pertaining to the site.

Submitter issues regarding demand and supply

- 57 I have read submissions questioning whether a new quarry is needed, either at all or specifically in the proposed location, e.g. Carole & L Greenfield, John & Anne Cunningham and Bill Woods. Both Mr and Mrs Cunningham and Mr & Ms Greenfield cite the aggregate demand forecast being a few years old and major projects coming to an end. Mr Woods argues the future aggregate demand can be met by river extraction and currently designated quarries.
- 58 I agree that major roading projects like Christchurch Southern Motorway and Christchurch Northern Corridor and in general, the rebuilding of Christchurch following the earthquakes is coming to an end. My forecasting recognises this and shows lower aggregate demand than Mr English predicted through his work in 2015. I expect that demand for the foreseeable future will come less from major projects or extensive rebuilding but more from maintenance work, lighter rebuilding and residential development. With New Zealand favouring flexible pavement designs with chip seal surfaces (primarily because of low cost and low traffic volumes compared with some overseas roads), the maintenance costs and aggregate volumes required to refresh roads will be higher than say a structural asphalt pavement or a concrete

road. Aggregate quantities required for house foundations has also increased since the earthquakes.

59 In addressing Mr Woods' submission, I understand, the 'sustainable' volume of aggregate able to be extracted from rivers in proximity to Christchurch is declining and has reached or exceeds what Canterbury Regional Council considers to be the sustainable maximum. I note that river extraction is also not as reliable as land-based extraction in terms of continuity of supply, as consent terms are typically limited and extraction must cease in certain conditions e.g. in flooding and when bird nesting is occurring.

60 I have also read submissions in support of the proposed quarry in its location, e.g. AQA, Aklow Contracting Ltd, Ashburton Contracting Ltd, Allied Concrete Ltd, RJ Civil Construction Ltd, Institute of Quarrying and Lyttelton Port Company. The common theme in the submissions of support were continuity of supply for dependent businesses e.g. contracting and readymix concrete, therefore providing for Greater Christchurch's infrastructure needs into the future. Also maintaining levels of aggregate reserves proximate to areas of demand is key to keeping aggregate products affordable.

Demand and supply issues arising from the s42A reports

61 I have read the s42A reports.

62 In Mr Andrew Henderson's evidence for Selwyn DC, the market assessment section in Mr Yeoman's memorandum comments that it would have been good for Fulton Hogan to update the demand forecasts and allow for the reserves of the additional quarries. This has been taken into account in this evidence.

63 I did not find any other comments pertaining to my evidence in the other s42A reports.

Conclusion

64 Roding, building and agriculture rely on the continuing supply of suitable quality aggregates from a quarry source close to the area of demand.

65 Ensuring sources of aggregate supply are located close to the end user ensures they are cheaper and cleaner to deliver to the customer. Ideally, a quarry is located in an area of high-quality rock, close to transportation infrastructure and the end users that it serves.

66 If no further quarries are consented in Greater Christchurch and aggregate demand continues as forecast, the total supply of aggregate is likely to run out around 2043 (approximately 24 years).

- 67 The Proposal will extend the life of the total consented aggregate supply within Greater Christchurch by about 5-6 years, increasing the current supply duration by 22% and providing additional time for new resources to be found, consented and developed.
- 68 The Proposal will benefit the people and communities of Greater Christchurch by enabling Fulton Hogan to provide high-quality topcourse, basecourse and sub-base aggregate close to their points of need.

Dated 23 September 2019

Michael Chilton
Director and Consulting Engineer – Aggretech Ltd