Kings Quarry – Stage 2 Assessment of Economic Effects

27 March 2025

m.e consulting

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Prepared for

Kings Quarry Limited

Document reference: SSG 003.24 FT Approvals Bill Application\Stage Two - FT Assessment - Final Report

Date of this version: 27 March 2025

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Director approval:

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Executive Summary

Kings Quarry Limited have applied for consent under the Fast-track Approvals Act 2024 to accelerate the extension of the existing quarry. The Act is aimed at facilitating the delivery of infrastructure and development projects that are expected to deliver significant regional or national benefits. The legislation recognises the importance of timeliness and certainty for projects poised to deliver major benefits, given that prioritising such project can unlock potential throughout the economy. The Stage 2 extension of Kings Quarry has the ability to provide economic benefits of regional significance. Market Economics (M.E) were commissioned to assess the economic effects of the proposed extension. This is assessed through analysing the aggregate market of the Auckland region, in terms of supply and demand, the potential cost savings achieved by the extension, and the economic impact of its operation.

Natural resources like aggregate play a fundamental role in enabling and supporting growth. Aggregate serves as a primary construction material and is utilized in concrete and road construction projects, whether for the base or chip. The demand for aggregate and its sourcing location are determined by the quantity required and the location of construction projects. However, aggregate is a low-value, high-volume commodity, and its delivered price is particularly sensitive to transportation distance. Auckland stands as New Zealand's predominant commercial and population centre, and it is expected to be a focal point for the country's economic and population growth in the foreseeable future. As Auckland continues to evolve towards a compact city model with more intensive land use, there will be a heightened demand for aggregate to facilitate this transition. This demand is driven by the need to address historical infrastructure deficiencies and accommodate the region's growth, making aggregate an essential component of Auckland's development and its response to increasing economic and population needs.

The economic assessment of Kings Quarry Stage 2 estimates the future demand for aggregate and compares this outlook with the existing production levels. Auckland already has a deficit in terms of locally produced aggregate and meets the excess demand through importing aggregate from other regions. The results of the modelling project the Auckland region’s aggregate demand to exceed supply by around 6.9 million tonnes in 2048 under the medium scenario, while the high scenario projects a larger gap of around 20 million tonnes Enabling the extension to Kings Quarry will assist Auckland to reduce its reliance on imported aggregate and reduce the total transport requirement to access aggregate.

The associated benefits from this change relate to direct transport savings and lower emissions levels. This is assessed by comparing the outcomes associated with sourcing the aggregate from Kings Quarry compared with alternative sites. The analysis of transport and emissions costs are informed by the Kings Quarry Stage 2 Extension Greenhouse Gas Emissions Assessment conducted by Air Matters. This report provides the transport distances and level of CO2 emissions used in the analysis. The analysis suggests that over a forty-five-year period (total assessment period), enabling the expansion will avoid considerable costs. These avoided costs (benefits) are associated with the reduced transport effects, particularly the additional transport costs. The breakdown of the average annual costs of enabling Kings Quarry Stage 2 relative to the Alternatives are:

- Transport Costs:
    - Low Scenario: $19.8m
    - High Scenario: $23.2m

- Carbon Emissions costs:
    - Low Scenario: $0.8m
    - High Scenario: $1.7m

This suggests that the over forty-five years, the present value (at a 2% discount rate) of the savings when using the mid-points is around $747m for transport costs and $29.5m for carbon emissions using the alternatives.

The operation of King Quarry Stage 2 will create an impact to the economy in terms of the value added and employment which is sustained by the economic activity it will generate. The total annual economic impact through its operation is projected to be around $4.8m in value added and sustaining around 27 jobs across the economy per year. Across the projected forty-five year life span, the present value (2% discount rate) of the total value added impact is projected to be around $140.4m with 1,218 job years (MECs) sustained over this period.

The modelling outputs demonstrate a pressing need for more aggregate supply in the Auckland region. Granting Kings Quarry consent to supply around 500,000 tonnes of aggregate per year would be a beneficial step towards ensuring sufficiency, though it must be noted that this will not be able to make up the entire shortfall going forward. As a fast track consent is expected to bring forward operation, this means that more aggregate supply can be made available sooner. It would be advisable to grant this consent as one part of a wider strategy to align access to key resources with the needs of Auckland as a growing city and economy, which can be achieved in a shorter timeframe.

1 Introduction

Kings Quarry Limited (KQL) have applied for consent under the Fast-track Approvals Act 2024 to accelerate the extension of the existing quarry. The Act is aimed at facilitating the delivery of infrastructure and development projects that are expected to deliver significant regional or national benefits. The legislation recognises the importance of timeliness and certainty for projects poised to deliver major benefits, given that prioritising such project can unlock potential throughout the economy. The Stage 2 extension of Kings Quarry has the ability to provide economic benefits of regional significance. Market Economics (M.E) were commissioned to assess the economic effects of the proposed extension

Construction and development activities are vital components of a growing economy. Enabling these sectors to function effectively facilitates the improvement of places over time by ensuring they can respond to local population needs and the associated pressures. A crucial component of this system is the raw materials used for construction, of which aggregates comprise the largest share. These inputs must be sourced from a suitable location. Aggregate's bulk means that quarries tend to be located near to, but outside large population centres. This minimises the transportation costs and other negative effects associated with delivering the materials – such as accidents, congestion, and pollution – while maintaining separation from residential and other land uses, thereby minimising conflicts and social costs. Having access to sufficient aggregate supply is important because it avoids the adverse effects associated with material shortages, transport costs and the related effects.

1.1 Project aim

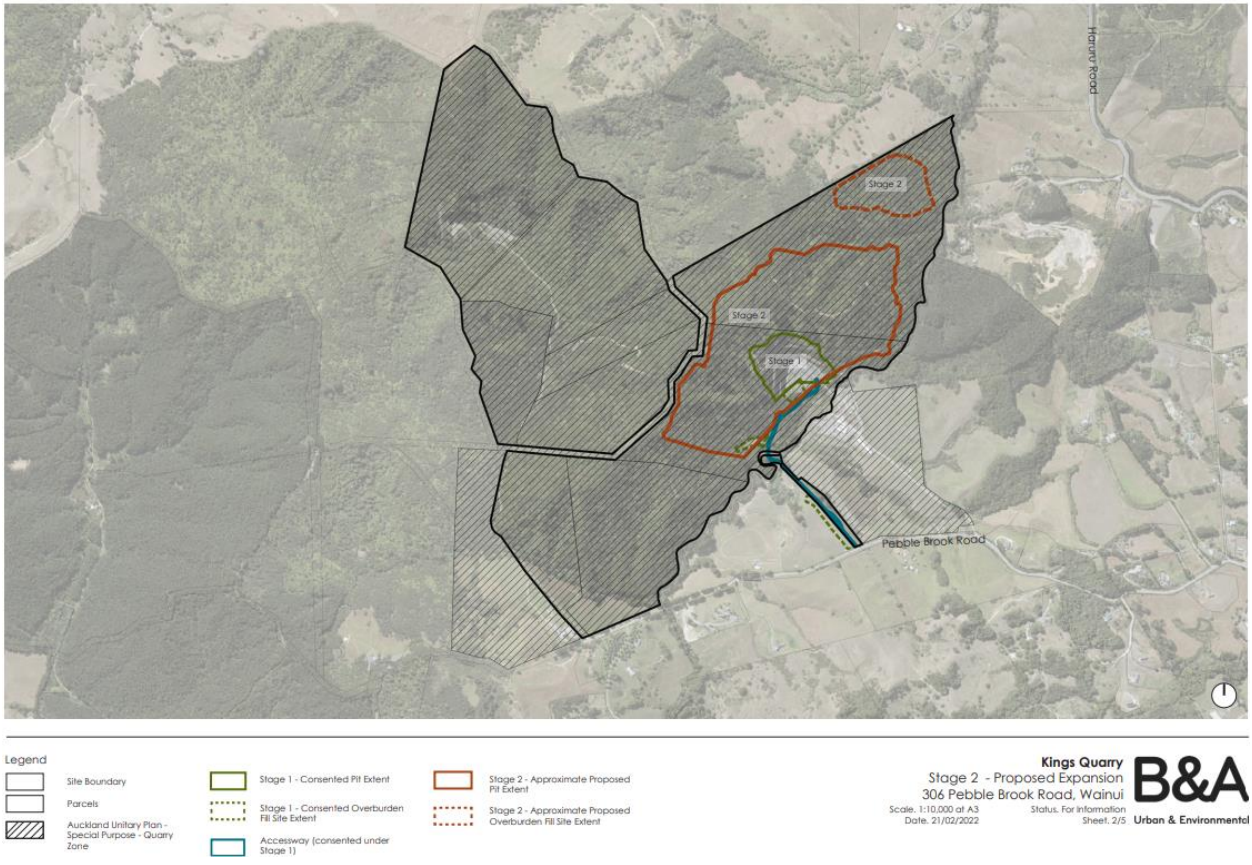
KQL are applying for consent under the Fast-track Approvals Act 2024 which will bring forward production of aggregate materials for the Auckland market. Granting this consent would generate significant regional benefits for the Auckland region. These regional benefits are mostly in the form of reduced costs for Auckland's construction sector, and occur in the context of market uncertainty, growth pressures and the inflationary environment in the local economy. Figure 1-1 shows the Kings Quarry site within the Special Purpose – Quarry Zone under the Auckland Unitary Plan (Operative in Part) (the Stage 2 pit extent is outlined in red). Figure 1-2 shows the location of the quarry in relation to outlined future urban zoned growth areas in the Auckland region.

The purpose of this report is to highlight not only the role that the Kings Quarry expansion has in maintaining an accessible supply of rock aggregate in Auckland, but also the potential costs savings available to the market from the quarry. The report also considers the economic impact that the operation of the quarry sustains in terms of its contribution to value added (GDP) and employment. Bringing this to market early can potentially be achieved under the Fast-track Approvals Act.

Initially this report outlines the role aggregate plays in the regional and national economy, then assesses recent trends in aggregate production and consumption in Auckland, highlighting the significant shortfall in supply compared to current and future anticipated demand. Based on this, this report aims to highlight the significance of the expansion of Kings Quarry under the Fast-Track Approval process compared to the standard RMA consenting pathway. This is shown in the form of reduced transportation costs arising

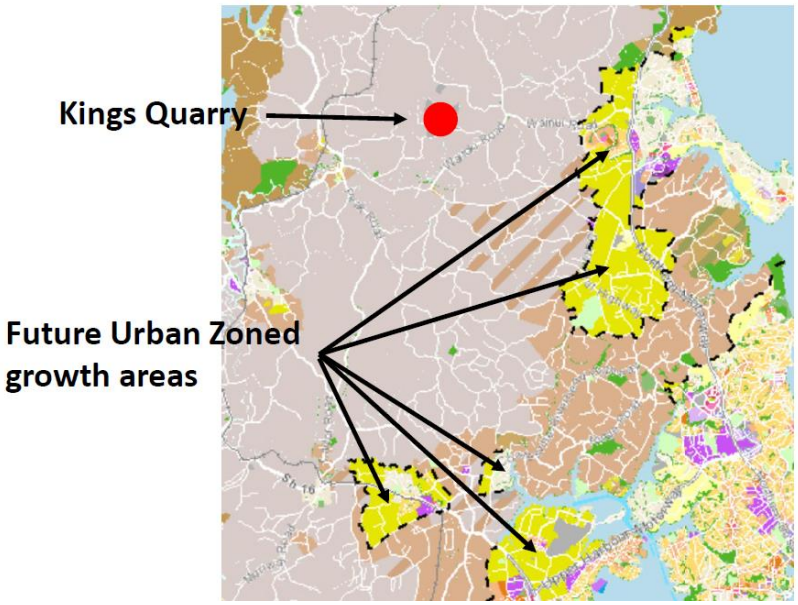
through bringing the supply on earlier and the associated emissions cost savings and highlighting the economic benefits to the Auckland region.

Figure 1-1 Kings Quarry Site Stage 2 Expansion



Source: Barker & Associates, February 2023

Figure 1-2: Location of Kings Quarry



1.2 Approach

As stated above, the Fast Track Approvals Act 2024 is aimed at facilitating the delivery of infrastructure and development projects that are expected to deliver significant regional or national benefits. In order to estimate the benefits that the Stage 2 Expansion will have on the Auckland economy, it is necessary to identify the overall role aggregate plays in the regional economy.

First, the demand and supply of aggregate across New Zealand is examined, and likely future consumption is explored under the growth scenarios. To provide a range for comparison, we have estimated the level of aggregate demand from high growth within Auckland from 2024-2048. Under the economic growth scenario, we have projected the additional GDP productivity growth, which is the difference between expected economic growth and population growth. While the economic growth scenario assumes that much of the growth is tied to population and household growth, it includes additional activity in the Auckland economy that is tied to export performance (both nationally and internationally).

Second, having established the scope and scale for aggregate and its potential future growth and change (in the context of national growth), the benefits are then examined in terms of avoided costs achieved by sourcing aggregate from Kings Quarry instead of sourcing aggregate from neighbouring regions. More specifically, Kings Quarry is an available resource within Auckland, proximate to growth areas. Because aggregate is a high-mass, low-value product, it is expensive to transport long distances via the road network. This places the quarry extension at a crucial point to decrease Auckland's significant under-supply, in turn reducing the quantity of aggregate imported into the region and the associated transport cost of this.

Finally, the economic impacts of the project are estimated using a bespoke Multi-regional Input-Output (MRIO) model. The results are presented in terms of Value Added (VA), and the level of employment it will support.

2 Context

Auckland is New Zealand's largest and fastest growing region; it is also where much of the future economic growth will be centred. Building and construction are key parts of the Auckland's growth story. The city's economy is diverse and expanding, leading NZ's economic performance. The city is also a key population centre that needs investment in response to existing and emerging growth pressures.

This section provides a context showing Auckland's growth performance in terms of population and the economy. Aggregate is a key input into many everyday uses. As the city grows and expands, so too does the demand for aggregate. Examples of current and anticipated growth projects are included to illustrate the link between growth and demand for aggregate. Literature highlights the key relationships between aggregate demand, population growth and economic growth[1]. These are the key dimensions used in this section. The section starts by putting Auckland in a NZ-wide context. It describes the population and economic growth performance.

2.1 Auckland's Population

As mentioned, Auckland is NZ's largest population centre. The City hosts approximately 1.8m people – a third of NZ's total population. Historically, the city has seen an uptick in the share of NZ's population that lives in Auckland, but Covid has seen a brief reverse in the increase. Regardless, more than 33% of NZ population is in Auckland. Table 1.1 provides demographic data, highlighting the changes in Auckland and NZ. The table provides backward and forward-looking data and is based on StatsNZ estimates (of historic data) and projections (forward-looking).

Over the past decade or so (2014 to 2024), Auckland's population grew by 18%, while the national population also increased by 18%. During this time frame, Auckland accounted for 34% of the national population change. Looking ahead, the projected five-year change (2025-2030) under a medium scenario shows a 6% increase in the population of Auckland and a 3% increase for New Zealand as a whole. The projected change for the years beyond that (2030-2048) shows an expected 19% change for Auckland but only 12% for New Zealand under a medium growth scenario. Under each of the growth scenarios, Auckland's future growth is forecast to exceed that of New Zealand as a whole, further enhancing its role as a hub of people and activity. **Auckland's role as a key destination for population growth and economic activity means that it will continue to act as NZ's premier population and investment destination.**

[1] Wilson, D., Sharp, B., Sheng, M. S., Sreenivasan, A., Kieu, M., & Ivory, V. (2022). Aggregate supply and demand in New Zealand (Waka Kotahi NZ Transport Agency research report 693).

Table 1.1: Estimated and Projected Population Change

	Estimated Change 2014-2024	Projected Change 2025-2030	Projected Change 2030-2048	Estimated Change 2014-2024 (%)	Projected Change 2025-2030 (%)	Projected Change 2030-2048 (%)
Auckland						
Low	277,900	17,300	185,400	18%	1%	9%
Medium	277,900	109,300	477,100	18%	6%	19%
High	277,900	204,100	781,100	18%	11%	28%
New Zealand						
Low	822,000	- 143,600	22,700	18%	-3%	3%
Medium	822,000	165,200	834,100	18%	3%	12%
High	822,000	481,500	1,692,800	18%	9%	20%
Share of National Population change (%)						
Low	34%	-12%	817%			
Medium	34%	66%	57%			
High	34%	42%	46%			

Spatially, the growth is expected to be distributed around Auckland. Using Stats NZ's population projections[2] and aggregating the Local Boards to five broad areas shows that spatially, the growth will be concentrated around the northern/western parts as well as the on the isthmus-southwards. The specific share of growth in the main locations are:

a. North 28%
b. West 13%
c. Central 16%
d. East 17%
e. South 25%

These spatial patterns are relevant because it influences where aggregate will be (indirectly) required. This relates to where concrete plants are located around Auckland (the link between Kings Quarry aggregate and concrete plants is discussed later in the report). Given Kings Quarry's location in Auckland's North, it is ideally located to provide aggregate to North, Central and Western Auckland – areas that will see large shares of the population growth looking forward (58% of the total).

2.2 Economic Performance

Like NZ's population, Auckland generates a disproportionate share of NZ's GDP. Over the past ten years, Auckland has experienced strong growth[3], and GDP is estimated at $159.7bn (in 2024). Compared to the NZ economy with a GDP of $418.8bn, Auckland contributes 38% of the national economic value.

Between 2001 and 2011, Auckland grew marginally faster than the national economy (2.8% p.a. compared to 2.5% p.a.). However, over the last decade, Auckland's growth rate has surpassed that of New Zealand as a whole, with a 3.5% real terms annual increase, compared to the 2.9% national rate – These figures are

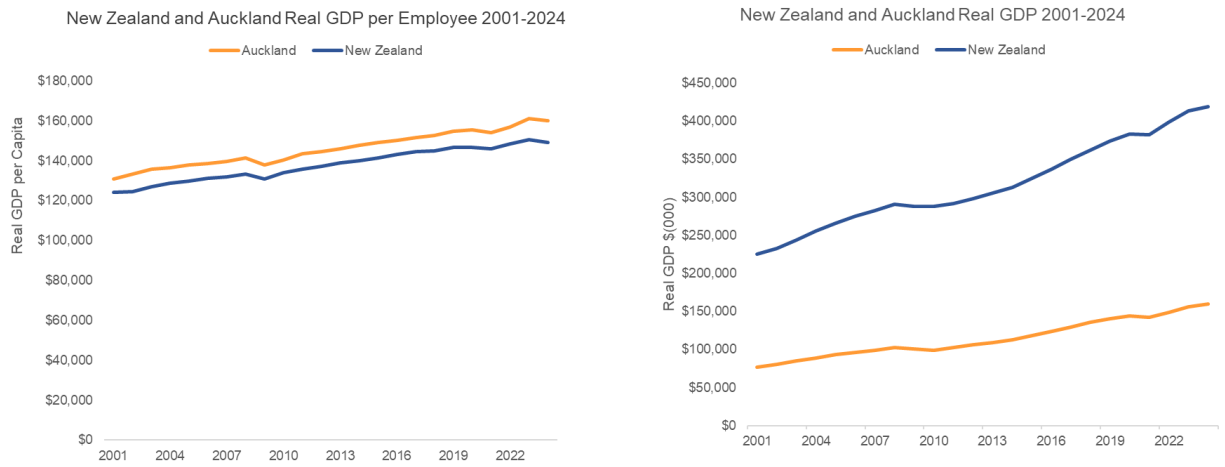
[2] StatsNZ. Subnational population projections, consistent with medium scenario of National population projections. Released 5 February 2024.

[3] Sourced from Infometrics.

high and are influenced by the exceptionally strong post-Covid period. Figure 1-3 displays the growth of national and regional GDP since 2001.

From 2001 to 2024, Auckland contributed to 43% of New Zealand's overall GDP growth. In the first decade of this period (2001-2011), this percentage was 40%. However, more recently (2011-2021), Auckland's contribution increased to 41%. Despite the pandemic's impact, Auckland remained responsible for 27% of the country's growth between 2019 and 2021, which then increased to 48% in the years since 2021. The comparatively faster growth underlines Auckland's role as economic hub in NZ.

Figure 1-3: GDP – Trends (Total GDP and per capita GDP)



In terms of GDP per employee, Auckland is outperforming the rest of NZ. This reflects the city's economic structure and composition. The share of knowledge economy, and manufacturing activities lift the per employee productivity compared to the rest of NZ (which is influenced by rural NZ's economic structure that includes lower productivity sectors, like forestry, and some agricultural activities). Auckland's GDP per employee is around 7% higher than the national average. Over the past decade (2012 and 2022), Auckland's GDP per capita grew broadly in line with the rest of the economy. **This underlines Auckland's role in the national economy, as well as a direct requirement to ensure that the infrastructure and investment activities support the city growth. Infrastructure spending is critical, including investment in new assets together with ensuring that existing assets are maintained.**

2.3 Infrastructure investment

New Zealand has a significant infrastructure challenge that is going to require an unprecedented period of investment. Auckland is in a similar position and the January 2023 flooding events only highlighted infrastructure deficiencies. The population and economic growth will require ongoing investment. This investment is needed to accommodate growth. Additional investment will be needed to address historic backlogs and infrastructure shortfalls. A Waka Kotahi NZTA report noted, there has been a deficit in infrastructure re-investment for the medium term which, when coupled with strong population growth,

means that much public infrastructure is coming to the end of its useful and/or economic life[4]. Combining the historic shortfalls with growth means that demands on infrastructure investment are likely to become even more acute over the short- to medium terms. Acknowledgement of these pressures can be seen in central government policy statements, for example the Government Policy Statement on Land Transport (GPS-LT) that proposes to increase a 30% funding (revenue) increase for the National Land Transport Fund. While the GPS-LT mostly relates to NZ-wide new build projects, the scale of need is clear it also highlights a lift in demand for aggregate arising from road maintenance[5]. While changes in central government present some uncertainty around the investment pathway, Government has signalled a move from a 3-year programme to a 10-year National Land Transport Programme (NLTP) to provide more certainty to local authorities and to outline investment to cater for short term, medium- and long-term pressures.

In Auckland specifically, several large-scale infrastructure projects will generate considerable demand for concrete. The National Construction Pipeline report (MBIE, 2023) shows, infrastructure construction activity in Auckland is forecast to be relatively consistent through to 2028, even as residential and non-resident building construction are projected to decline. Much infrastructure spending is dependent on aggregate. While roading takes up a large share of total aggregate (65%), its uses span an array of sectors, such as improving and maintaining water systems or park infrastructure. According to the Infrastructure Commission, there are several large projects planned across Auckland. Examples of funded (or funding sources confirmed) include:

- Kāinga Ora projects:
    - Mt Roskill Precinct Project Bundles 1- 3, stormwater and utilities,
    - Mangere Precinct Projects and rail station upgrades.
    - Tamaki Precinct Projects Bundles 1 and 2, and stormwater and water supply projects.
- Watercare
    - Central Interceptor.
    - Queen Street wastewater diversion and piping.
- Ministry of Education
    - 24 projects ranging from new schools and expansion work in response to roll growth.
- Auckland Transport
    - Several projects, including the Carrington Road projects.
- Eke Panuku projects
    - Including Osterley and Amersham Way Streetscape works.

These projects' budgets sum to $1.8bn and is over the next 4-5 years. Projects beyond this time horizon are not funded (so not included in this list). Other high-profile projects that are in the pipeline include:

- Auckland Airport: The airport is a crucial component of New Zealand's domestic and international economy. Pre-covid, 62% of domestic passengers and 75% of international arrivals passed through it. Numerous projects are planned to improve the facilities, amounting to a $3.9bn construction programme over the next 6 years. Some of the announced projects were put on hold due to the

[4] https://www.nzta.govt.nz/assets/resources/research/reports/693/693-aggregate-supply-and-demand-in-new-zealand.pdf

[5] The newly established State Highway Pothole Prevention and Local Road Pothole Prevention activity classes.

uncertainty introduced by Covid-19, but these are now starting up again (including Domestic Terminal construction works and Airfield expansion).

- Penlink corridor: this project is underway and is a 7km transport connection between the Whangaparāoa Peninsula and SH1 at Redvale, which will include new local road connections and a bridge crossing the Wēiti River. These works are estimated to be completed in late 2026 and will cost around $830 million.
- Central Rail Link: construction is still underway on this project. When completed it will consist of 2 3.45km tunnels under ground (up to 42m deep), 2 underground stations, a redeveloped Britomart station, Maungawhau Station redeveloped and wider network upgrades.
- Eastern Busway: work continues through to 2027 including; construction of busway from Pakuranga to Botany, new intersections and lanes on Ti Rakau Drive, new road connections and bridges and overpasses.

2.4 Auckland's aggregate market

Aggregate supply struggles to increase in response to spikes in demand. Auckland has a well published local shortfall (local supply cannot match demand) so aggregate is imported from other regions. This increases the costs of imported material. According to the New Zealand Infrastructure Commission, Te Waihanga (2021), since 2014 there have been no new quarries established within Auckland; meanwhile only three expansions have been undertaken[6]. This further exacerbates the shortages in the region. The report estimated Auckland's aggregate shortfall to be around 4.5m tonnes[7], which must be imported at a higher cost. The estimates of aggregate supply match the adjusted supply levels derived from our modelling, placing the level at around 10m tonnes.

An online survey of aggregate supply and demand by NZTA[8] – conducted in 2020 and featuring 89 participants nationally, of whom 13 were from Auckland[9] – sought to understand the views of key and representative groups within the industry. Nearly all Auckland respondents agreed that there were issues with aggregate supply, with more than half describing these as major issues. Although not disaggregated at a regional level, the main reported issues across the country aligned with the regularly cited anecdotal evidence. These included issues obtaining the correct sort of aggregate from close to the areas of demand; the consenting process being difficult; a lack of forward planning; and competition for produced aggregate. These responses reinforce the need for additional supply, especially of the sort which can be located close to areas of demand.

Expanding aggregate supply faces numerous additional challenges in the existing policy landscape. Some key issues are listed below.

- There is a large lead in time to procure the necessary equipment, either to replace machines or obtain new ones. For some equipment, this time can be between 12 and 24 months.

[6] https://tewaihanga.govt.nz/our-work/research-insights/infrastructure-resources-study

[7] This is higher than the M.E estimates that are described later in the report.

[8] https://www.nzta.govt.nz/assets/resources/research/reports/693/693-aggregate-supply-and-demand-in-new-zealand.pdf

[9] There was also one respondent from Northland, whose answers were grouped with the Auckland region.

- The tight labour market and lack of workers with the requisite skills make finding new or replacement staff difficult.
- Energy grids are under strain and raising energy can be unfeasible in some scenarios.

These issues all add complexity to production. Moreover, they make it harder to respond to changes in demand, entrenching the supply shortfall in Auckland.

The changing policy landscape, with a significant shift towards environmental protection, is seen as a significant barrier to growth and long-term security of supply. For example, the National Policy Statement for Indigenous Biodiversity adds considerable uncertainty around the ability to expand some existing quarries (where significant natural areas are impacted).

2.5 Conclusion

Aggregate supply has a central role in infrastructure delivery. Infrastructure investment in response to housing growth, high impact weather events, and economic growth requirements need secure access to quality and appropriately located aggregate. The price effects of supply can influence project viability.

Auckland's future growth trajectory is expected to reflect the established geography and functioning of its centers and business areas. With housing intensification around the established centers, most of Auckland's population growth, and the increase in economic activity, will require appropriate infrastructure to support the efficient functioning of Auckland. Therefore, stage 2 of Kings Quarry will contribute towards facilitating Auckland's growth while reducing its dependence on imported aggregate.

3 Aggregate Use

Aggregate is an important material used in construction. Aggregates have a wide variety of uses such as base material under foundations, roads, and railroads. They are a component of composite materials such as concrete and asphalt. Without a ready supply of appropriately-located aggregate, the production of concrete and the development of buildings, roading and infrastructure would halt – or cost considerably more.

This section provides an overview of historic aggregate production and relevant performance ratios before discussing the approach to estimating future patterns. The results of the demand projections are then presented and compared against the known production levels.

3.1 Historical Aggregate Production

New Zealand Petroleum and Minerals (NZP&M) is a part of MBIE and administers the Crown Minerals Act 1991. The division collects and publishes data on a combination of aggregate production classifications.[10] The NZP&M data cover the period from 1993 to 2023. The materials are grouped by use and region, enabling a spatial summary of relevant mineral commodities. For this report, we focus on aggregate as encompassing:

a. rock for reclamation and protection;
b. rock, sand and gravel for building, and
c. rock, sand and gravel for roading.

The categories are based on a 'purpose' level and are not reported in a more disaggregated manner i.e., at a commodity level. Nevertheless, the data provides a broadly consistent alignment with the Kings Quarry products. We have excluded[11] some of the categories because they show poor alignment with Kings Quarry's aggregate use.

The production figures come from a voluntary survey meaning that the results rely on the responses received by NZP&M. This also means that the results are subject to the degree to which the responses are representative of the total industry. In 2023 the whole-survey response rate was 63%, down from an average of around 76% between 2012 and 2020. While this necessitates a cautious approach to the data, inspection of granular data across our groupings of interest reveals relatively little variation across recent years by region[12], indicating that the 2023 data does not omit critical data points. This suggests that the dataset is sufficiently robust to inform this assessment, especially from a distributional perspective.

[10] This includes production figures for rock, sand and gravel across uses of reclamation and protection, building, roading, fill and industry.

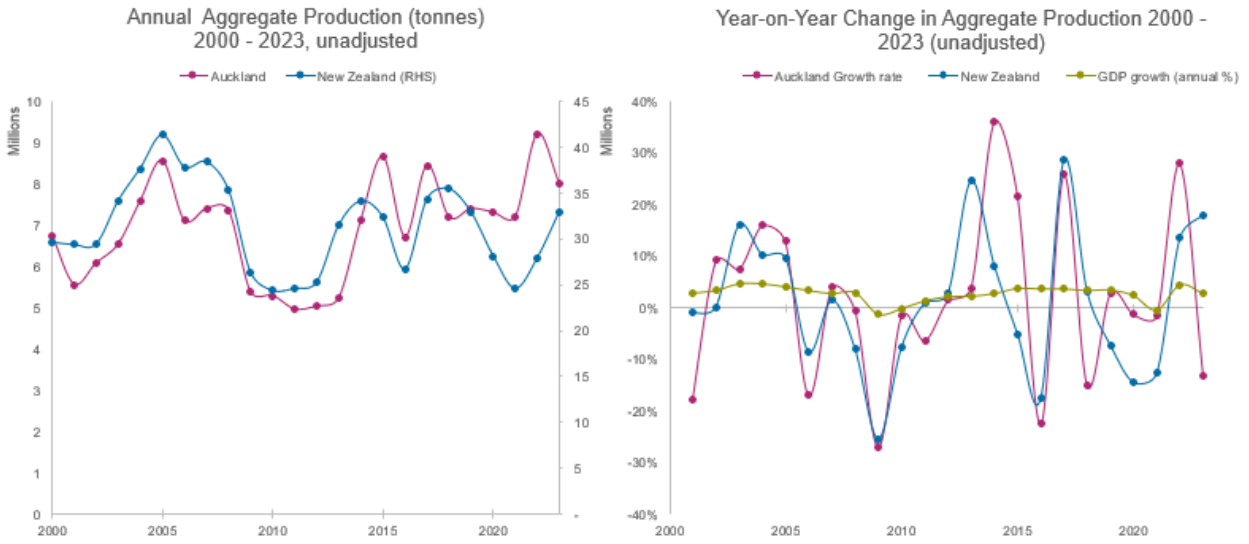
[11] The excluded groupings are "Rock, sand, gravel and clay for fill" and "Sand for Industry".

[12] Bay of Plenty was an exception in 2021. It appears that some large quarries were either closed or failed to report, a nearly 90% reduction from 2020 to 2021.

However, other industry sources suggests that the NZP&M survey could be understating total production. For example, the complete data collected by Fulton Hogan on Auckland's aggregate market (2019), imply that aggregate production could be understated by 28%. A review of the NZP&M data revealed that non-responders, appear to be evenly distributed between regions. We can therefore apply the adjustment index for Auckland to the other regions to scale the data accordingly. Despite 2023 seeing a lower-than-average response rate, nearly all regions experienced volume fluctuations within the bounds of historic year-on-year trends.

Figure 3-1 shows aggregate production across NZ and Auckland over the past two decades. Note, the Auckland data shows the production volumes and not the locally used volumes (i.e., any interregional imports are not shown in the figure).

Figure 3-1: Aggregate Production Since 2000



In the early 2000s aggregate production in New Zealand went through a period of growth, increasing in volume by 37%, from 26m tonnes produced in 2000 to a peak of 36m tonnes produced in 2005 (based on the unadjusted NZP&M data). The levels subsequently began to fall to a low of 21m tonnes in 2010, aligning with the economic recession associated with the Global Financial Crisis. There was a strong recovery of aggregate production in the few years immediately afterwards, during which time the economy was performing well, growing at around 4% annually. Major projects, including the Christchurch rebuild following the earthquakes, and large infrastructure projects like Transmission Gully, will have contributed to this growth. 2020 and 2021 both saw falls in aggregate production but are largely explained by COVID-19 restrictions and the virtual shutdown of some industries. At the highest alert level, quarrying and mining could not be performed, reducing production. Moreover, even at lower alert levels, projects involving aggregate might have been delayed, which could likewise have reduced production.

Overall, Auckland aggregate production follows a broadly similar production profile as that observed across NZ. However, Auckland accounts for an average of 22% of NZ-wide aggregate production (2000 – 2023), so the national figures are influenced by Auckland patterns. It is expected that the regional and national trends will converge over the short term.

Despite being NZ's largest population hub, with most of the growth occurring in Auckland, the city only produces around one quarter of New Zealand's aggregate. Auckland produced 8.0 m tonnes of aggregate in 2023 according to the survey. The Waikato region, by comparison, has at times produced more aggregate than Auckland (2013 and 2018). Industry sources highlight that Auckland has a deficit of aggregate, and the city imports a portion of total requirements. The table shows the total aggregate production across the upper North Island regions, and the total New Zealand aggregate production.

As shown in **Error! Not a valid bookmark self-reference.**, reported national aggregate production in 2023 rose to 33.0m tonnes[13]. In terms of regional production, Auckland has remained in the top three producers in the country over the last ten years. With 8.0m tonnes produced in 2023 according to the NZP&M survey, Auckland is the largest regional producer of aggregate rock. Auckland's position is consistent with it being the most populated region, with the most employment and highest GDP in the country, leading to elevated demand for aggregate.

Table 3.1: New Zealand Aggregate Production (million tonnes) 2013-2023

Region	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Northland	2.0	1.8	1.7	0.7	1.4	0.9	0.8	1.1	1.0	0.8	1.4
Auckland	5.2	7.1	8.7	6.7	8.4	7.2	7.4	7.3	7.2	9.2	8.0
Waikato	6.3	5.4	6.3	4.3	7.0	9.2	5.6	6.5	6.3	6.0	7.2
Bay of Plenty	1.9	1.8	0.7	0.6	1.4	1.1	1.3	1.2	0.1	0.6	1.2
Total New Zealand	**31.5**	**34.1**	**32.4**	**26.7**	**34.4**	**35.5**	**32.9**	**28.2**	**24.6**	**28.0**	**33.0**

The production volumes of the NZP&M survey shown in **Error! Reference source not found.** likely understate the true level of aggregate production given that the figures come from a voluntary survey meaning that the results rely on the responses received by NZP&M. To account for this, these figures have been adjusted to better reflect actual production and inform future projections. The adjustments are based on a full and comprehensive survey carried out by Fulton Hogan on Auckland's aggregate production volumes in 2019. The Fulton Hogan numbers have subsequently been cross checked by other significant

[13] Note that supplying production information to MBIE (NZ Petroleum and Minerals) by quarries is voluntary. This means there is an amount of under reporting and fluctuations in the production numbers. The aggregate production numbers in Despite being NZ's largest population hub, with most of the growth occurring in Auckland, the city only produces around one quarter of New Zealand's aggregate. Auckland produced 8.0 m tonnes of aggregate in 2023 according to the survey. The Waikato region, by comparison, has at times produced more aggregate than Auckland (2013 and 2018). Industry sources highlight that Auckland has a deficit of aggregate, and the city imports a portion of total requirements. The table shows the total aggregate production across the upper North Island regions, and the total New Zealand aggregate production.
As shown in **Error! Not a valid bookmark self-reference.**, reported national aggregate production in 2023 rose to 33.0m tonnes. In terms of regional production, Auckland has remained in the top three producers in the country over the last ten years. With 8.0m tonnes produced in 2023 according to the NZP&M survey, Auckland is the largest regional producer of aggregate rock. Auckland's position is consistent with it being the most populated region, with the most employment and highest GDP in the country, leading to elevated demand for aggregate.

Table 3.1 have been adjusted to account for it.

industry operators and their accuracy confirmed. The adjusted production estimates are shown in **Error! Not a valid bookmark self-reference.**.

Table 3.2: Adjusted New Zealand Aggregate Production (million tonnes) 2013-2023

Region	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Northland	2.7	2.5	2.4	1.0	2.0	1.2	1.1	1.5	1.3	1.1	2.0
Auckland	7.3	9.9	12.1	9.4	11.8	10.0	10.3	10.2	10.1	12.9	11.2
Waikato	8.9	7.5	8.7	6.1	9.8	12.9	7.8	9.1	8.7	8.4	10.1
Bay of Plenty	2.7	2.5	1.0	0.9	2.0	1.6	1.8	1.7	0.2	0.8	1.7
Total New Zealand	**44.0**	**46.1**	**45.0**	**36.8**	**47.6**	**48.7**	**44.7**	**38.1**	**31.4**	**37.3**	**44.9**

The adjusted production volumes show Auckland output go from 8.0m tonnes to a more accurate 11.2m tonnes in 2023. The degree of inaccuracy in the Auckland market has been applied to the reported estimates from the other regions to produce figures closer to the real volumes.

The future supply of aggregate in Auckland is assumed to remain constant at current levels observed during the past five years (2019-2023). This is because production in Auckland is relatively constant. New consents tend to balance out existing sources drying up. The average production over the past 5 years and over the past 10 years is 10.9m tonnes annually.

Crucially, aggregate production is dependent on the consents and consent conditions, and these can expire. The gap between the consented volumes, current production levels and expiry dates are unknown. Therefore, the existing production levels are used illustrate the quantum of the shift, relative to current volumes.

3.2 Historical Per Capita Aggregate Production and Demand

StatsNZ produce population estimates at a Territorial Authority level. Drawing on the population data and combining it with the production estimates enable a derivation of a per-capita use ratio. Such a ratio provides an ability to design a scenario that reflects future demand levels. The per-capita ratios can also be used (together with other sources) to estimate the degree to which a region is self-sufficient in aggregate production, as it is assumed that per capita demand should be broadly similar between regions and high or low per capita supply is an indicator of a regions role in sourcing or providing aggregate from neighbouring regions.

Table 3.3 summarises the population estimates for the upper North Island regions, as well as NZ over the past ten years.

Table 3.3: Annual Population Estimates (millions), 2014-2023

Region	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Northland	164,700	168,200	172,100	176,400	181,200	185,800	189,100	194,600	198,900	201,500	202,200
Auckland	1,493,200	1,520,400	1,552,800	1,589,800	1,625,100	1,654,800	1,681,300	1,714,200	1,704,100	1,695,200	1,753,700
Waikato	424,600	432,400	442,100	452,800	465,000	475,600	485,700	500,100	508,400	513,800	524,800
Bay of Plenty	279,700	286,100	293,200	301,500	311,500	320,800	328,200	339,200	344,000	347,700	349,700
Total New Zealand	**4,442,100**	**4,516,500**	**4,609,400**	**4,714,100**	**4,813,600**	**4,900,600**	**4,979,200**	**5,090,200**	**5,111,400**	**5,124,100**	**5,245,000**

The data reveals that in 2023 Auckland reversed the COVID-19 slump of 2021 and 2022 that saw its population decline, and its population grew by 3.5% - far higher than other regions and the rest of New Zealand as a whole (1.8%). However, whether this elevated growth will persist in the medium term remains uncertain.

The population data is combined with the adjusted aggregate production (using the Fulton Hogan study) to estimate aggregate per-capita ratio. **Error! Not a valid bookmark self-reference.** shows the average aggregate production levels per capita for regions near Auckland between 2013 and 2023. The production per capita in Auckland has exhibited fluctuations, ranging from a low period in 2013 with 4.9 tonnes per capita to 7.8 tonnes per capital in 2015 and a peak of 7.6 tonnes per capita in 2022. It's important to note that these figures may not necessarily align with the national average because regional infrastructure projects and significant events (the Christchurch rebuild following the earthquake, for example), can exert a substantial influence on how production adjusts to meet demand. Therefore, when applying the per-capita ratio for forward-looking assessments, it's advisable not to rely solely on data from a single year but rather consider a longer timeframe. In recent years, the average tonnes per capita are likely to be unrepresentative of uninterrupted production due to the impact of COVID-19 lockdowns, coupled with the robust recovery in the post-COVID environment. While Auckland's production per capita increased in 2022, a smaller decrease was seen in 2023. This volatility has been seen historically, as significant increases in the last ten years, such as in 2015 and 2017, were followed by equivalent decreases. This underscores the importance of considering the broader context and historical trends when evaluating production per capita and its implications.

Table 3.4: Average Aggregate Production per capita, 2014-2023

Region	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Northland	16.6	14.7	13.8	5.7	11.0	6.6	6.0	7.9	6.7	5.7	9.7
Auckland	4.9	6.5	7.8	5.9	7.3	6.1	6.1	6.0	5.9	7.6	6.4
Waikato	20.9	17.3	19.8	13.4	21.1	27.1	16.0	18.2	17.2	16.3	19.2
Bay of Plenty	9.6	8.8	3.5	2.9	6.3	4.9	5.5	4.9	0.5	2.3	5.0
Total New Zealand	**9.9**	**10.2**	**9.8**	**7.8**	**9.9**	**9.9**	**9.0**	**7.5**	**6.1**	**7.3**	**8.6**

Over the past 10 years Auckland has consistently produced a lower amount of aggregate on a per-capita basis relative to the other regions. The Waikato, meanwhile, has constantly produced more aggregate than it requires on a per-capita basis, meaning it has ability to export material to proximate regions which are under-supplied internally – especially Auckland and Bay of Plenty.

For Auckland, the annual per capita ratio has varied between 4.9 tonne/capita and 7.6 tonnes/capita between 2013 and 2023. During this period, the median and average ratios were:

- Auckland:
    - Median 6.1 tonnes/capita
    - Average 6.4 tonnes/capita
- Waikato:
    - Median 18.2 tonnes/capita
    - Average 18.8 tonnes/capita
- NZ:
    - Median 9.0 tonnes/capita

- Average 8.7 tonnes/capita

These ratios suggest that Auckland imports a portion of its aggregates to supplement locally produced aggregates. Given that aggregate is a high volume, low value[14] product which is expensive to transport, it should be accessed as close as possible to where it is used.

3.3 Forward-looking Demand Outlook for Aggregate

To understand the potential future role that the Kings Quarry will play, it is important to understand the range within which future aggregate demand will sit. M.E. have developed two scenarios for future aggregate demand. These include a standard population driven scenario and a high growth scenario reflecting high population growth with economic growth.

Several other scenarios were modelled and appraised to understand the wider spread. The core drivers of the scenarios are:

- The medium growth scenario
  - Medium population growth without an additional allowance for higher growth.
- A high growth scenario
  - High population growth plus an additional factor to reflect shifts like higher (additional) demand associated with climate change and related responses (e.g., building in resilience and rebuilding activities). Also, accounts for higher investment in roading projects than previously.

Population projections are sourced from the StatsNZ medium and high growth scenarios. The link between population and economic growth is acknowledged. For the high scenario an additional growth factor is included and is informed by NZ Treasury medium-term economic forecasts, the population shifts and the potential responses. The high scenario runs off the median aggregate demand ratio, whereas the medium scenario uses the average per capita ratio.

3.3.1 Aggregate Demand Estimates

Table 3.5 shows the total aggregate demand estimates for the regions presented. Scenario 1 reflects the medium population growth and the lower per-capita demand rate. Scenario 2 uses the higher population projections and an additional factor representing a higher economic growth pathway (1.75%).

[14] Aggregate is low value relative to its weight.

Table 3.5: Aggregate Demand Forecasts by Scenario (million tonnes)

Scenario	2025	2028	2033	2038	2043	2048	% Change 2025-2048
Medium Growth	15.4	15.1	15.9	16.7	17.4	18.1	17.4%
High Growth	15.8	17.0	20.0	23.4	27.2	31.5	99.8%

The overall change in aggregate demand is projected to grow to 18.1m tonnes by 2048 under Scenario 1, equal to a 17.4% increase, or a 0.7% compound growth rate. For scenario 2, the higher growth assumptions mean that the future demand is estimated to almost double over 23 years. The percentage change is 99.8% and the compound growth rate is estimated at 3.1%. These two scenarios present the anticipated demand bounds over the long term. While there could be short periods where growth is below these estimates it would be inappropriate to base medium- or long-term decision making on such short-term movements. Therefore, the above range is seen as realistic and appropriate for the purpose of this assessment.

The demand projections are sensitive to the input assumptions, including the per-capita ratio employed. Increasing the ratio by 10%, leads to a 10% increase in total demand – that is a linear relationship between this ratio and the estimated demand.

3.4 Differences between Aggregate Supply and Demand

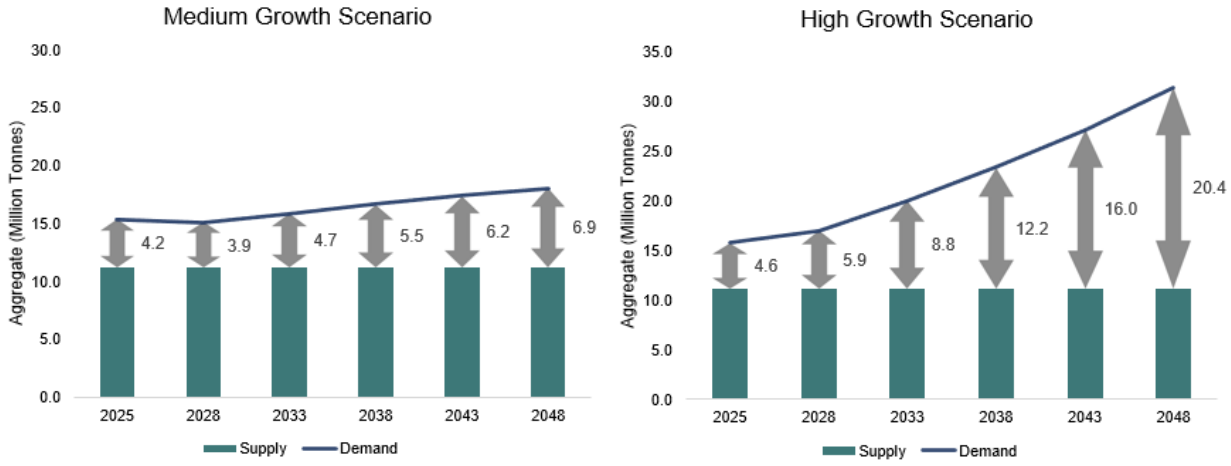
The output gaps show the wedge between demand and supply. The two scenarios incorporate different inputs to show how future demand could vary based on the medium and high growth assumptions outlined above. Table 3.6 displays growth projections relative to the local (Auckland) supply of aggregate. Figure 3-2 shows the same information, but visually to illustrate the shifts relative to the existing supply (including the imported values). The supply level is set at the most recent aggregate level in 2023 of 11.2m tonne per year. However, the comparison to the projection's assumes that this as a baseline level when it is uncertain if this level could potentially be an outlier.

The total supply in Auckland is subtracted from the total demand to identify the output gap. A negative number therefore represents more demand than supply in the region. This gap shows the net position (surplus or deficit) over time. Auckland already imports a portion of its aggregate, and these sources are located at some distance from their destination, meaning that an increase in aggregate sourced from other regions will increase other costs.

Table 3.6: Aggregate Output Gaps (million tonnes)

Scenario	2025	2028	2033	2038	2043	2048
Projected Demand (million tonnes)						
Medium Growth	15.4	15.1	15.9	16.7	17.4	18.1
High Growth	15.8	17.0	20.0	23.4	27.2	31.5
Difference between 2023 supply of 11.2million tonnes and demand.						
Medium Growth	- 4.2	- 3.9	- 4.7	- 5.5	- 6.2	- 6.9
High Growth	- 4.6	- 5.9	- 8.8	- 12.2	- 16.0	- 20.4

Figure 3-2: Aggregate Output Gap in Auckland



As the market grows and demand lifts, additional product will need to be imported to satisfy business and infrastructure needs, assuming that no additional local capacity is added.

The scenarios show demand exceeding (Auckland-based) supply, with the current situation ranging from 4.26m to 4.6m tonnes in 2025. Over time, this shortfall grows to between 6.9m tonnes and 20.4 tonnes by 2048. The difference highlights the sensitivity to high growth rates, and the need to ensure that there are sufficient, readily accessible raw materials that can be used to satisfy the growth requirements. This will assist in minimising the wider economic costs associated with the aggregate market.

However, it must be noted that these demand projections are compared with the most recent level of aggregate production in 2022 which has been almost the highest level seen in the last 10 years. While it may be a temporary surge, any newly consented capacity for other Auckland-based quarries (for example, Brookby and potentially Hunua and Flattop which are listed projects under the Fast Track Approvals Act) may see production rise in Auckland. However, by estimation, this may only add between 3.5 and 5m tonnes per year. This could be sufficient for the short term (under the medium growth scenario) but would be insufficient for the medium to long term.

The average level of aggregate production for the last five years has been 10.4 million tonnes, 2.5 million tonnes lower than the 12.9 million tonnes produced in 2022, and 0.8 m tonnes lower than the 11.2m tonnes produced in 2023. This peak production level could regress toward the historical average in the short term, depending on the Fast-track Approvals process.

Because of the nature of aggregate as a low-value, high-weight product, it does not travel well, with the cost to the consumer heavily influenced by the distance each truck load travels. This means that for aggregate extraction to be economical, it should be located proximate to the areas it is required. Therefore, regardless of additions to production in the southern part of Auckland, population growth and infrastructure development in northern Auckland require aggregate sources within closer proximity. This means that providing for additional aggregate capacity at the Kings Quarry is vitally important to ensure efficient growth path and a sustainable economy.

Over the long term, the analysis suggests that without a combination of maintaining the existing level of demand and further development of Waikato resources, there is likely to be a shortfall in Auckland under high growth assumptions. The Waikato is a net exporter of aggregate and is used in regions like Auckland to satisfy total demand (because local supply is insufficient).

3.5 Alternative Sources for Aggregate

Quarry activities are enabled within Significant Natural Areas under the National Policy Statement for Indigenous Biodiversity 2023 where they meet the following criteria;

a. *that the aggregate extraction "could not otherwise be achieved using resources in New Zealand"*

As stated above, aggregate is a low value, high volume and high weight commodity. This means that it is not a commodity that can be economically transported long distances between source and final use. In general terms, a truck of aggregate doubles in cost approximately every 30km it travels. This means that it is not possible to move rock from distant locations to meet the needs of the Auckland market in any meaningful volumes. It is not the case that rock sourced in Northland or from the lower parts of Waikato Region or beyond are substitutes for Auckland sourced aggregates.

In reality, this means that even though the criteria in the National Policy Statement reads, "...*could not be otherwise achieved using resources in New Zealand"* [emphasis added], in reality the resources must be substitutable within the region (at most) for this to be a meaningful criteria.

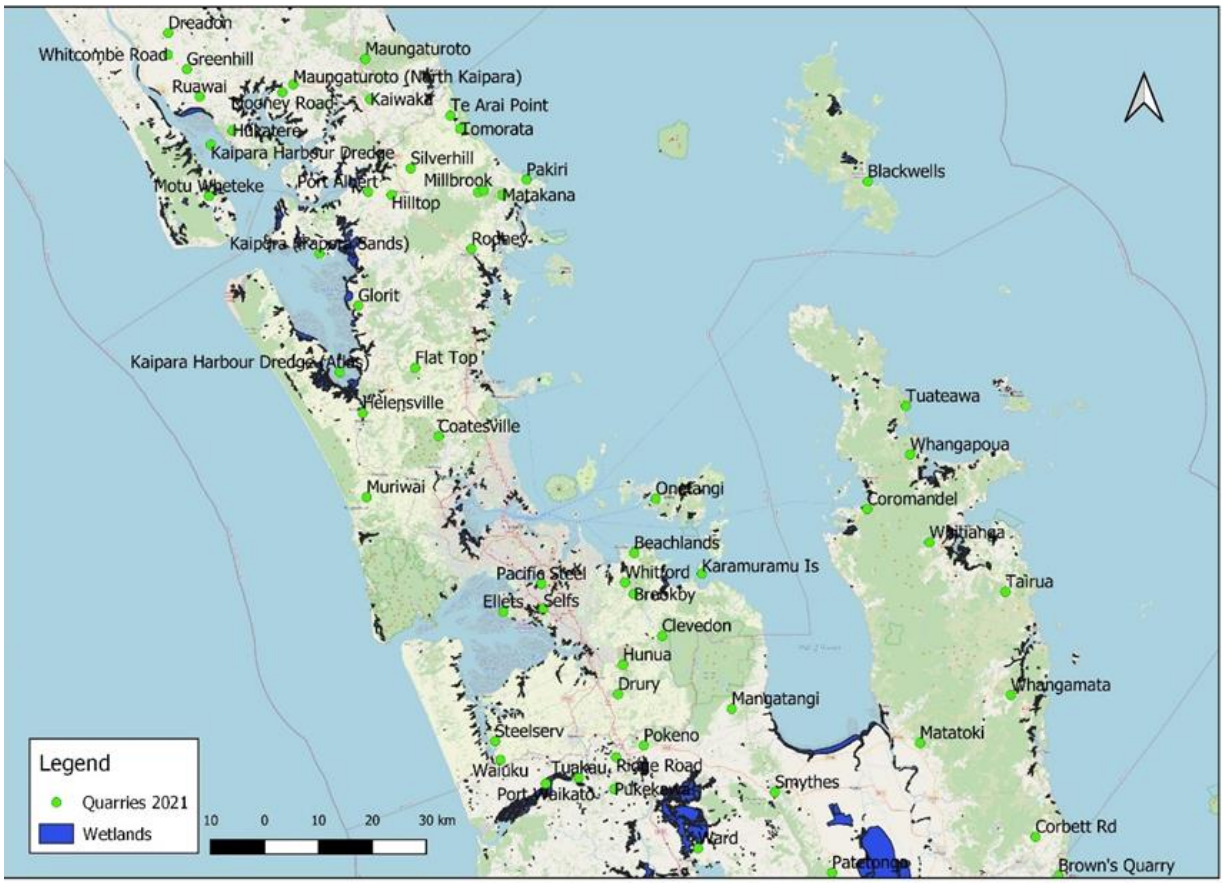
In the case of Kings Quarry, the aggregate is extremely well situated with respect to significant future growth areas in Northern (Dairy Flat to Silverdale in particular) and Western Auckland (out towards Kumeu and Whenuapai).

There are no "practicable alternative locations" for this volume of quarrying to occur, to meet these growth needs within Auckland – that is not already dedicated to meeting development needs elsewhere. This is Auckland's aggregate reality. Auckland is a net importer of aggregate and under a high growth future, the shortfall will reach as high as 20m tonnes annually (6m tonnes under the medium future).

Figure 3-3, below, shows the location of Auckland's quarries and appended to this report is a listing of the production of Auckland's aggregate quarries, which makes it clear that there are no alternatives in this location well suited to meeting the growth needs of northern Auckland. Coatesville and Helensville are the closest 2 sites – neither of which are suitable. Helensville is a sand source and Coatesville hasn't been quarried for some time and the pit is full of water.

A full list of Auckland's aggregate quarries, both active and inactive along with production volumes and other notes are appended to this report. That data confirms that there are no suitable alternatives to Kings Quarry in any practical sense in terms of meeting the growth needs of this part of northern Auckland.

Figure 3-3: Quarry Locations, Auckland (north), 2021



3.6 Market Summary

From a financial, when evaluating aggregate production from financial, environmental, and social standpoints, it becomes evident that it is both more suitable and efficient for aggregate production to be situated in close proximity to its intended destination of use. Furthermore, for a market to operate efficiently, the supply side must possess the agility to adapt to shifts in demand. Without the ability to accommodate capacity increases, an ever-expanding portfolio of projects requiring aggregate is likely to exert upward pressure on prices.

The significance of maintaining a stable aggregate price cannot be overstated. It not only ensures the economic viability of ongoing projects by keeping costs in alignment with initial forecasts but also acts as a catalyst for initiating new projects by exerting control over expenditures. These advantages, coupled with the curbing of expenses related to transferring input costs to end users or consumers, underscore the critical importance of achieving aggregate sufficiency.

The next section explains the potential cost savings associated with the Kings Quarry Stage 2 extension.

4 Kings Quarry Expansion Stage 2 Benefits

Having established the scope and scale of the Auckland market for aggregate and its potential future growth and change (in the context of national growth), it is necessary to establish the benefits associated with the Stage 2 Fast Track application.

This section focuses on the avoided costs achieved by sourcing aggregate from Kings Quarry instead of sourcing aggregate from neighbouring regions for construction aggregate and more distant regions for landscaping. In so doing, it assumes that the costs of production are primarily similar for other quarries in the Auckland Region.

Kings Quarry is an available resource as per Stage 1 of the process, and because aggregate is a high-mass, low-value product, it is expensive to transport long distances via the road network. This places the quarry extension at a crucial point to decrease Auckland's significant under-supply, in turn reducing the quantity of aggregate imported into the region and the associated transport cost of this.

The analysis of transport and emissions costs are informed by the Kings Quarry Stage 2 Extension Greenhouse Gas Emissions Assessment conducted by Air Matters. This report provides the transport distances and level of CO_2 emissions used in the analysis. The transport distances are based on the following assumptions:

- All material sourced from Kings Quarry equivalent to 500,000 tonnes/year will be used within the Auckland Region with target local markets being North Shore and West Auckland.
- Of the 500,000 tonnes/year of aggregate supplied to the Auckland Region from Kings Quarry, it will displace other aggregate supplies at the following ratios:
- South Auckland Region: 40% (200,000 tonnes/year)
- Out-of-Region (Waikato and Northland): 40% (200,000 tonnes/year)
- Kings Quarry will supply 100,000 tonnes/year of decorative pebble to the Auckland market (40% of current market) directly displacing supply from Manawatu Region and the South Island.

Furthermore, the transport and emissions costs estimates are based on high level assumptions and exclude other considerations, like the implications of adding additional truck movements on the roading network and other social costs (accident costs, time delays and so forth). In addition, aggregate is a low value, high volume commodity and is highly sensitive to costs. Increasing transport distances increases transport costs, and the cost per tonne of aggregate, will increase.

4.1 Construction Aggregate Transport Costs

As mentioned, the proposed Stage 2 expansion will deliver its associated benefits sooner if the fast-tracked pathway is followed. Current estimates of transportation costs for construction aggregate are approximately $0.34-$0.40/km tonne. To assess the benefits of a fast-track consent in terms of the cost savings, two scenarios are compared. The high scenario reflects cost per km/tonne at $0.40 and the low scenario at $0.34, as per King Quarry Limited's anticipated production volume of 500,000 tonnes per year under Stage 2.

Table 4.1 estimates the high and low cost scenarios in terms of the potential annual transport cost savings generated by Kings Quarry Stage 2 instead of if the aggregate is imported from alternate quarries. Based on these estimates, the annual savings in transport costs is between $19.8m and $23.3m per year.

Table 4.1: Annual Transport Cost Savings

Aggregate supply displacement	Tonnes of Aggregate (per year)	Vehicle Movements (27 tonne per vehicle)	Net change in distance* (km per round trip)	km saved per year	Tonne kms	Low Scenario $0.34 per km/tonne	High Scenario $0.40 per km/tonne
Inter-region (South Auckland)	200,000	7,407	25	185,185	2,500,000	$ 850,000	$ 1,000,000
Out-of-region (Waikato/Northland)	200,000	7,407	91	674,074	9,100,000	$ 3,094,000	$ 3,640,000
Out-of-region (Manawatu)	100,000	3,703	930	3,444,444	46,500,000	$ 15,810,000	$ 18,600,000
Total	**500,000**	**18,517**	**-**	**4,303,703**	**58,100,000**	**$ 19,754,000**	**$ 23,240,000**

**Calculated as: the 'Average distance to North Shore/ West Auckland' from the current aggregate supply locations minus the Average distance to North Shore / West Auckland from Kings Quarry (77km).*

To assess this, a midpoint of the annual transport cost savings (**Table 4.1**) is applied across the Kings Quarry extension's expected lifecycle of 45 years. The lifecycle cost savings are discounted at a rate of 2% p.a.

Table 4.2: Lifecycle Transport Cost Savings

Aggregate Supply Displacement	$ millions
Inter-region (South Auckland)	32.2
Out-of-region (Waikato/Northland)	117.0
Out-of-region (Manawatu)	598.1
Total	**747.3**

The present value of transport cost savings for the Kings Quarry extension is projected to be $747.3 million across all locations. While the most of this is a due to replacing supply from the Manawatu region, significant benefits (in this case in the form of avoided costs) are created by the reduction of aggregate distribution distances within the Auckland region and from the neighbouring Waikato and Northland regions.

4.2 Emissions Costs

The project will deliver wider environmental benefits through avoided emissions from lower transportation requirements. This contributes to New Zealand's resilience to climate change by reducing the emission of greenhouse gases from lowering the transportation requirements of aggregate.

The estimation of emissions cost reductions is also informed by the Greenhouse Gas Emission Assessment produced by Air Matters. From the report, values can be derived for the amount which quantifies the annual reduction in carbon emissions (tonnes of CO_2) generated by the Kings Quarry Stage 2 extension. Based on this, it is estimated that the project will deliver an annual reduction of 12,551 tonnes. From here, the quantity of carbon emissions is multiplied by the shadow price of carbon[15] for 2024. The prices a low value of $70 per tonne and a high value of $140 per tonne. While a portion of the transport cost savings reflects lower emissions costs through diesels inclusion in the Emissions Trading Scheme, the analysis is

[15] Source: Treasury CBAx tool, Recommended Emission Values, NZD$ (2024) per tonne of CO2-equivalent

meant to reflect the impact of potential emissions reductions, separately, in their own right, with monetary values assigned to contextualise the reduction level.

Table 4.3 shows the value of the annual carbon emissions reductions under the high and low shadow price with emissions from freighting aggregate and return trips, separately. The annual cost of carbon emissions, at 12,551 tonnes per year, is estimated to be between $0.85m and $1.69m, under the low and high price, respectively, with a mid-point of $1.2m. Furthermore, a moderate level of uncertainty should be considered given the number of high-level assumptions that have been made.

Table 4.3: Potential Annual Net Changes in Transport Related GHG Emissions Cost

Aggregate supply displacement	Tonnes of aggregate (per year)	No. of heavy vehicle movements (29 tonne per vehicle)	km saved per year (km per trip)	Emission factor+ (kg CO2-e per km)	CO2-e emissions (tonne)	2024 Shadow Price of Carbon ($ per tonne of CO2 equivalent)		Annual Cost of Carbon Emissions	
						Low	High	Low	High
Emissions from heavy vehicles (kg CO2-e per km)									
Inter-region (South Auckland)	200,000	6,897	172,425	1.499	258	$ 70	$ 140	$ 18,060	$ 36,120
Out-of-region (Waikato/Northland)	200,000	6,897	627,627	1.499	941	$ 70	$ 140	$ 65,870	$ 131,740
Out-of-region (Manawatu)	100,000	3448	3,206,640	1.499	4807	$ 70	$ 140	$ 336,490	$ 672,980
Emissions from freighting goods (kg CO2-e per tonne.km)									
Inter-region (South Auckland)	200,000	12.5*	2,500,000	0.105	262	$ 70	$ 140	$ 18,340	$ 36,680
Out-of-region (Waikato/Northland)	200,000	45.5*	9,100,000	0.105	955	$ 70	$ 140	$ 66,850	$ 133,700
Out-of-region (Manawatu)	100,000	465*	46,500,000	0.105	4882	$ 70	$ 140	$ 341,740	$ 683,480
Total (Stage 2 provides a net CO2-e benefit)					**12,105**			**$ 847,350**	**$ 1,694,700**

** Based on transporting one way and assuming no backhauling of bulk material occurring.*

+ MfE Measuring Emissions: A guide for organisations – 2022. Emission Factor Workbook. ROAD freight emission factors for heavy goods vehicles. HGV diesel >30,000kg (2010-2015 fleet).

^ MfE Measuring Emissions: A guide for organisations – 2022. Emission Factor Workbook. ROAD freighting goods in New Zealand. Long-haul heavy truck

Using the estimates from above, the potential net emissions cost reduction is considered across the 45 year lifecycle of Stage 2 in Table 4.3. While the Air Matters' report does not assess the carbon emissions impact from the whole lifecycle of the quarry, only a 'base year'. Table 4.4 shows the annual emissions cost estimates expanded across the projected timeline with a discount rate of 2% p.a. used as well as undiscounted. This places the present value of the cost savings across the lifecycle at between $50.8 to $101.7 million, with a mid-point of $76.3 million. However, it must be noted that this relies heavily on the assumptions that the factors which dictate the level of carbon emissions would remain constant over the course of the entire lifecycle and that the shadow price of carbon would remain within the high and low range.

Table 4.4: Potential Net Changes in Transport Related GHG Emissions Cost (millions)

	Low ($64 per tonne of CO2)	High ($128 per tonne of CO2)	Mid-Point
Undiscounted	$ 50.8	$ 101.7	$ 76.3
Discounted @ 5% p.a.	$ 29.5	$ 58.9	$ 44.2

5 Economic Impacts

5.1 Approach

This analysis relies on an estimated cashflow analysis based on projected annual operating costs, in respect to the forecasted spending on operational activities of the quarry extension. This was based on a cost of $8.50/tonne with an annual extraction of 500,000 tonnes. M.E. have matched this planned spending to 109 economic sectors in a Multi-Regional Input-Output (MRIO) model which has been customised for the Auckland economy (using a 2020 base year). The spending is assumed to be mostly directed to the metal ore and non-metallic mineral mining and quarrying industry in the Auckland region.

The MRIO model provides projections of the value added and employment generated and sustained in the economy as a result of this additional activity. Value added (synonymous with GDP) arises through the spending, directly through the construction process and indirectly as construction suppliers increase their purchases of raw materials and services, as the new activity flows on to other sectors of the economy and businesses pay wages and make profits. The links between the study area and the surrounding regions are also captured, showing the extent of the spread of the additional economic activity. This means that if the Auckland construction sector purchases aggregates or construction supplies from the rest of the North Island, then increased demand in Auckland, as a result of this development, has flow on effects in the rest of the North Island which are captured in the MRIO.

The IO model contains data on gross output for each sector and employment in Auckland. We are then able to then generate an annual average ratio of gross output per person employed in each sector in order to translate additional economic activity into additional employment – by sector. By applying these ratios to the annual spending on quarrying activity, M.E have been able to estimate the additional count of jobs (by sector and approximate location) sustained in each year as a result of the proposed development ("job years"). The employment projections are measured in Modified Employee Counts (MECs). This measure is based on Statistics New Zealand's Employment Count (EC) statistic but also includes an estimate of the number of working proprietors. As the IO model uses 2020 as a base year, the projected spending inputs to the model are deflated to 2020 terms. From here, the IO model value added outputs are reinflated to present terms, while the employment outputs reflect the 2020 proportions of gross output per MEC without reinflation. Further detail of the use of MECs as a measure of employment and translation of MECs to Full Time Equivalents (FTEs) is included in the Appendix.

5.2 Economic Impacts

M.E's analysis of value added, and employment sustained, considers only the direct, indirect and induced economic impacts. That is, firstly, the effects that are directly associated with the amount of expenditure required to develop the site. From a comprehensive economic impact perspective, 'indirect' and 'induced' impacts – also known as flow-on impacts – are also relevant. These reflect the additional activity, stimulated by the development, across the whole economy.

Many of the inputs required in production are manufactured by industries based across Auckland, with others made around New Zealand. As quarrying activity inputs used in production, the manufacturing

sector increases output. In addition, when more labour is required in quarrying and in the suppling sectors, the workers are paid wages which they then spend at retail outlets and so on, generating more demand for goods and services. Thus, the indirect and induced impacts measure how much additional activity the direct spend will stimulate. The MRIO allows the calculation of these indirect and induced effects as they relate to this development – for the Auckland economy taking into account inter-regional goods flows. Value added is effectively the contribution to GDP (less GST) that a project generates, as such it is the value of construction minus the intermediate costs to generate the construction (such things as the cost of building materials, consents, electricity, business services and imported goods). It captures wages and salaries paid, operating surpluses generated for owners, depreciation, and tax. In the construction sector it is equivalent to approximately 30% of total output. The annual economic impact of the Kings Quarry Stage 2 extension is shown in Table 5.1.

Table 5.1: Annual Value Added and Employment Impacts

	Auckland Region	Rest of North Island	Rest of South Island	Total
Value Added Impact ($m)				
Direct Value Added	2.3	0.0	0.0	**2.3**
Indirect Value Added	0.8	0.2	0.1	**1.0**
Induced Value Added	1.2	0.2	0.1	**1.4**
Total	**4.2**	**0.4**	**0.2**	**4.8**
Employment Impact (MECs)				
Direct Employment	5.1	0.0	0.0	**5.1**
Indirect Employment	7.4	0.5	0.5	**8.4**
Induced Employment	12.4	0.6	0.6	**13.6**
Total	**25**	**1**	**1**	**27**

For the quarry extension, it is projected to sustain $4.8m in value added annually. Within this, it will have a direct value added impact of $2.3m per year, with further flow on impacts adding $1.0m and $1.4m through the indirect and induced impacts, respectively. Regionally, the majority of this is directed towards the Auckland regional economy.

In terms of employment, it is projected to sustain a total of 27 MECs (21.5 FTEs) across the wider New Zealand economy, although, mainly within the Auckland region. The direct employment sustained is focused on the mining and quarrying industry, while the indirect and induced impacts expand to sustain employment across industries such as professional services, transport, manufacturing and others to a lesser degree. It is important to note that while the development may generate a number of 'new jobs', the majority of the work will be carried out by existing skilled workers in the engaged sectors. The development does not 'generate' new jobs as much as it sustains jobs across industries. Therefore, this should not be interpreted as 27 new jobs, but rather the economic activity being generated is the equivalent of sustaining 27 jobs for one year.

Based on the information provided, the quarry will have a lifecycle of 45 years at 500,000 tonnes per year. To assess the full benefits of the consent, in terms of the quarry's economic impact, the full lifecycle of the extension is assessed. This considers the quarry extension under a fast track consent, with operation

starting in 2026, with a 2% discount rate is applied to the value added impacts. The results are shown in Table 5.2.

Table 5.2: Economic Impacts across 45 year Lifecycle

	Value Added ($m, Undiscounted)	Value Added ($m, Discounted @ 2% p.a.)	Employment (MECs)
Direct Impacts	103.3	67.7	229
Total Impacts	214.2	140.4	1,218

The scenario has a direct value added contribution with a present value of **$67.7m** with a total value added contribution of **$140.4m**. While discounting is used to illustrate the benefits of timing, the long time period (45 years) in which the quarry is assessed means that the value added of the later years is discounted significantly more than the initial years. When no discounting is applied, the total value added sustained by the quarry is projected to be around $214.2m with $103.3m of this from the direct impacts.

The quarry extension is also projected to have a significant impact on employment across the 45 year lifecycle. A total of 1,218 MECs (968 FTEs) are projected to be sustained, to be interpreted as the 1,218 jobs for one year. Within the total impact, 229 (182 FTEs) of these associated with the direct impacts., with the balance sustained through the indirect and induced impacts. As mentioned with the annual impacts, the direct employment sustained is focused on the mining and quarrying industry. As the indirect and induced impacts spread over the wider economy, employment is projected to be sustained across industries such as professional services, transport, manufacturing and others to a lesser degree.

6 Conclusions

Efficient and sustainable access to aggregate will be an important factor in both facilitating Auckland's economic growth and providing infrastructure such as roads, buildings, pipes, dams, factories and houses and other economic componentry to support the rapidly growing population and economy. The extension of Kings Quarry will have a positive impact on Auckland's economy by reducing construction costs and helping secure supply locally.

As Auckland's economy grows, demand for aggregate material will increase into the future. With demand growth in Auckland, sources of aggregate close to growth areas will increasingly be relied upon to supply, due to the relatively high costs of transporting the product from regions further afar. Under the projections presented above, Auckland's own demand for aggregate will increase further beyond the level which local supply can meet. As the demand for aggregate increases into the future, Auckland's supply deficit will continue to worsen, assuming the region's total production remains at its current level.

Therefore, granting of the fast-track consent for the extension of Kings Quarry would reduce Auckland's substantial supply deficit by increasing the amount of local aggregate available. As such, Auckland would become less reliant on sourcing aggregate from the Waikato and other parts of New Zealand, at a lower cost. Furthermore, this helps to reduce pressure on Waikato's quarries as they will also face future increases in demand locally.

In pure cost terms, the extension of Kings Quarry is expected to generate annual transport cost savings of between $19.8m and $23.2m. When the operation of the quarry is assessed over a 45 year lifecycle, the value of cost savings for the quarry extension is projected to be around $747.3m using the mid-point.

The quarry extension would deliver an annual net carbon emissions reduction of around 12,551 tonnes. The value of this reduction is estimated to be between $0.85m and $1.69m, annually. The present value of these reductions across the 45 lifecycle is estimated to be between $29.5m and $58.9m.

The operational activity is projected to generate positive impacts which flow across the Auckland economy. The quarry is projected to sustain total impacts of around $4.8m in value added and support 27 MECs (21.5FTE's[16]), annually. When the full lifecycle is considered, it is projected to sustain a total value added contribution to the economy of around $140.4m ($214.2m undiscounted), with 1,218 MECs (968 FTE's) sustained.

Once fully developed, the quarry will provide a new source of aggregate to increase supply within the Auckland region. The development will help ensure that Auckland has a sufficient aggregate supply for potential development in order to help meet projected growth.

[16] See definition of conversion between MECs and FTE's in the Appendix

Appendix

Employment Impacts in FTEs

MEC is a headcount of all employees and includes an allowance for working proprietors. This is based on data from the Business Demography Survey (BDS) and the Linked Employee-Employer Dataset (LEED). The result is a headcount of employees (wage or salary earners) and working proprietors (the self-employed), i.e., modified employee count. Both LEED and BDS includes all workers with wages or salaries reported to Inland Revenue (PAYE data), and LEED data is augmented with self-employment data from annual tax returns to include working proprietors. LEED is a comprehensive database which contains data belonging to all individuals with taxable income, suggesting that there is a lower risk of sampling errors being introduced. Both these data sets have a fine-grained sector resolution that provides insight into how different parts of the economy are impacted.

StatsNZ's provide high level information about FTEs in the Quarterly Employment Survey (QES). The QES collects data from a sample of employers (approximately 3,900 enterprises) about filled jobs, earnings, and paid hours and covers all employees on the employer's payroll, but working proprietors are not included. The QES does not cover all industries of NZ's economy (agriculture is excluded), and the sector aggregation is very high level. The employment levels are translated into full-time employment equivalents using a basic calculation - total number of full-time employees plus half of part-time employees.

This suggests MEC is a more robust measure of employment providing finer resolution, covering all sectors and capturing the self-employed (working proprietors). Despite these limitations, the employment impacts presented in section 5 have been translated from Modified Employee Counts (MECs) to Full Time Equivalents (FTEs) below.

Employment Impacts in FTEs

	Auckland Region	Rest of North Island	Rest of South Island	Total
Annual Employment Impact (FTEs)				
Direct Employment	4.0	0.0	0.0	**4.0**
Indirect Employment	5.9	0.4	0.4	**6.7**
Induced Employment	9.9	0.4	0.5	**10.8**
Total	**19.8**	**0.9**	**0.8**	**21.5**
Lifecycle Employment Impact (FTEs)				
Direct Employment	181.7	-	-	**182**
Indirect Employment	264.8	18.4	17.2	**300**
Induced Employment	444.2	20.2	21.0	**486**
Total	**891**	**39**	**38**	**968**

Auckland Quarries

Quarry Name	Company	Material	Volume	Address	Other Info
Beachlands	Adams Group	Greywacke	200,000		
Blackwell's	Fulton Hogan	Aggregates	16,000	Medland Road, Great Barrier Island	Blackwell's quarry is owned by Fulton Hogan. It is located on Medlands Road (about 500 metres up intersection with Walter Blackwell Road) near Medlands, on Great Barrier Island. It is leased from the landowner through Auckland Council. It is understood the rock is a type of andesite with high crushing resistance. The quarry produces all grades of metal for use in roading and construction on the island – including AP and GAP 20,30,40,65,100,150, gabion rock and drainage metals. Blasting and crushing is done once a year during October to March, to build up stockpiles for sale. Sealing chip is not made here and has to imported on barges from Auckland quarries (Stevenson or HG Leach). Local tradesmen use the AP20 to make concrete, and there is no readymix plant on the island. The maximum consented volume is 16,000 cubic metres per year, and production is typically close to that volume.
Brookby	Kaipara	Greywacke	2,800,000	149 Kimptons Road, Whitford, Kaipara	The Brookby greywacke quarry is owned by Brookby Quarries, a subsidiary of Kaipara. Brookby is located in Whitford, Auckland and is one of the largest quarries in the region. It has been operating since 1940 and supplies its products, including premium basecourses, concrete aggregate and sealing chip, to customers throughout Auckland. The quarry is capable of producing and supplying 3.5 million tonnes per annum that largely contributes to Auckland's growing urbanisation and resulting infrastructure needs. In July 2016, the company forecast that if demand conditions develop in Auckland as expected, Brookby's market share is expected to reach between 22 and 28 per cent by 2025.
Clevedon	Stevenson Aggregates; Fulton Hogan; Warren Fowler Earthmovers	Greywacke	200,000	546 McNicol Road, Clevedon	The Clevedon quarry (formerly known as McNicol Road) is a greywacke quarry located in Clevedon and owned by Fulton Hogan subsidiary Stevenson Aggregates. Fulton Hogan had acquired the quarry in January 2016 from the Warren Fowler Group, which had owned the quarry since the 1990s. It is outfitted with mobile quarrying, crushing and screening capabilities and supplies a full range of roading and drainage aggregates. It is understood to produce up to 200,000 tonnes per year. The quarry comprises about 4.3 million cubic-metres of solid blue greywacke rock and a further 1 million cubic-metres of brown rock. Fulton Hogan acquired the quarry to both replace declining production at its nearby Whitford quarry and resource-up for ongoing Auckland construction growth.
Coatesville	Coatesville Quarry	Aggregates		132 Robinson Road, Coatesville	Coatesville Quarry on Robinson Road in Coatesville, Auckland, is owned by Zambuca family interests. The rock is conglomerate and has not been quarried for well over a decade. The pit is full of water. In May 2022 the whole property was put on the market for sale, as a quarry and/or for potential development, but as at early July 2022, remains unsold.
Ellets	Ihumatao Quarries	Basalt, scoria			
Hunua	Winstone Aggregates	Greywacke	2,800,000	Hunua Gorge Road, Hunua, Papakura	Hunua quarry is owned by Winstone Aggregates, an operating division of Fletcher Building. It is located near Papakura, south of Auckland. The quarry spans across 240 hectares and is situated within a high-quality greywacke rock resource. Hunua is one of the largest suppliers of aggregates to Auckland. Hunua rock products are used primarily in the infrastructure sector for concrete production and roading projects. The processing plant has an annual output of around two million tonnes. The quarry sees around 250-300 truck movements per day. The quarry has been operating since the 1920s, and its current extraction area is at the end of its life. The old pit is now used as a managed fill site. A second extraction area - Symonds Hill - was consented and operates from Symonds Hill. The new Symonds Hill pit sits on land adjacent to the Hunua quarry, with the centre of the new pit about 1 kilometre south-east of the existing processing plant. Hunua's existing processing plant, stockyard, site infrastructure (including weighbridge) and Hunua Gorge Road access will all be used for Symonds Hill.

Matakana	Wharehine	Greywacke	300,000	309 Omaha Valley Road, Matakana	The Matakana (or Rauners) quarry is owned by Wharehine. It is located near Matakana, north of Auckland. The quarry covers 24 hectares of land and has been operating since 1979. It has provided aggregates for a number of significant roading projects including more than 300,000 tonnes of metal for the Northern Gateway Toll Road and more than 8000 cubic metres of special grade coarse aggregate for asphalt production.
Millbrook	Wharehine	Greywacke	400,000	1673 Pakiri Road, Wellsford	Millbrook quarry (or Whangaripo quarry) is wholly owned by Wharehine. It has been serving the Rodney district for more than 50 years. Wharehine purchased former shareholder Holcim NZ's 50 per cent shareholding in Millbrook Quarry in 2017. Millbrook has provided large volumes to big infrastructure projects, such as the Puhoi to Warkworth motorway and more recently to the Matakana Link Road. The quarry covers over 240 hectares. It is a significant provider of aggregates to the Rodney district and produces concrete chip aggregates for use in tunnels and bridges, roading projects and diverse concrete structures. Annual production can vary with the impact of large infrastructure projects but otherwise is typically around 400,000 tonnes.
Selfs	Portage Quarries				
Stevenson - Drury	Fulton Hogan	Greywacke	3,000,000		
Stoney Ridge	Origin Quarries	Greywacke	80,000	88 Onetangi Road, Ostend, Waiheke Island	Stoney Ridge (or Hoporata) quarry is owned by Origin Quarries. It is located on Waiheke Island in Auckland. Stoney Ridge (or Hoporata) quarry is owned by Origin Quarries. It is located on Waiheke Island in Auckland. The greywacke quarry typically produces between 50-80,000 tonnes annually.
Te Arai Point	Lake Road Quarries	?	60,000		
Whangaripo	Rodney Aggregate Supplies	Greywacke	80,000	1039 Matakana Valley Road, RD2 Wellsford	The Whangaripo quarry is owned by Rodney Aggregates Supplies, a joint venture between Fulton Hogan and Winstone Aggregates. It was first established to provide aggregate for the Petrie family farm in 1937. Since then it has grown into a full-scale commercial operation and been leased to a number of operators, including Sharps, Wharehine, Bitumex and Winstone Aggregates. Once Rodney - owned by Fulton Hogan and Winstone Aggregates - had taken over the lease it sought consent for a quarry that can produce some 280,000 cubic metres annually (as per current consent limits). The quarry provides a range of products including sealing chip, concrete aggregates, GAP products, and asphalts. A full list of the products available from Whangaripo can be found here.
Whitford	Fulton Hogan	Greywacke		Maraetai Road, Whitford	Whitford Quarry was closed down in October 2022, when it reached the end of its operational life as a quarry. Rehabilitation and planting were underway as of late 2022, and it will be returned to Auckland Council for use as an extension to the current Whitford landfill for extra capacity. The Whitford quarry was established at its current site in the 1940s. It was been operated by Fulton Hogan since 2004, and transferred to its subsidiary, Stevenson Agregates, on 1 July 2019. The land and mineral rights are owned by Auckland Council and Fulton Hogan, now Stevenson Aggregates, had a contract with the council to extract rock. The quarry site produced about 25,000 tonnes of aggregate products monthly; mostly used for roading or drainage.

Flat Top	Winstones	Basaltic Andesite	800,000	560 Haruru Road, Kaukapakapa	Seeking Fast-Track approval for a Pit extension