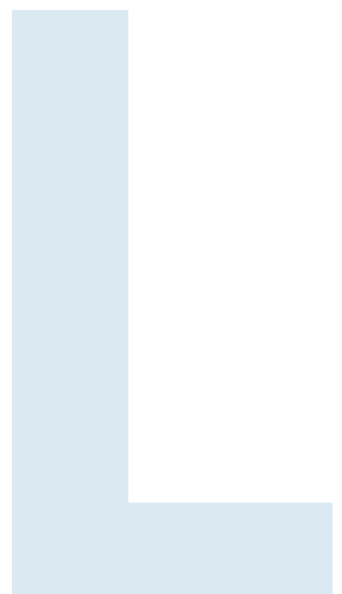


Technical Report L

Economics Assessment (NZIER)





Assessing the wider economic impact of a possible closure of Redvale landfill in Auckland

NZIER report to Waste Management New Zealand

August 2026

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The New Zealand Institute of Economic Research (NZIER) is an independent, not-for-profit economic consultancy that has been informing and encouraging debate on issues affecting Aotearoa New Zealand for more than 65 years.

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Key points

WM New Zealand (WMNZ) is one of three landfill operators that receive Auckland waste. It operates two landfill sites in Auckland: Redvale Landfill and Energy Park (Redvale Landfill), operated by WMNZ, and the Whitford Landfill and Energy Park (Whitford Landfill), operated in a joint venture with the Auckland Council.

The current resource consent for Redvale Landfill requires it to cease accepting waste at the end of December 2028. Although WMNZ is looking to develop a new landfill site at Wayby Valley, Wellsford, namely the Auckland Regional Landfill (ARL), it is not expected to come on stream until the mid-2030s, subject to resource consents being granted. This leaves a potential gap of up to eight years in Auckland's landfill capacity when Redvale Landfill ceases accepting waste.

Redvale Landfill currently takes about 50 percent (or 600,000 tonnes per annum) of waste disposed of in Auckland. WMNZ considered potential landfill alternatives between 2028 and the mid-2030s. These included maintaining the status quo (i.e. granting a new consent for Redvale Landfill) and balancing waste volumes between Redvale Landfill and Whitford Landfill. These options require new resource consents for either Redvale or Whitford, or both. The only other viable alternative is to send the residual waste which would have otherwise been accepted by Redvale Landfill to Hampton Downs Landfill, the closest landfill site in the Waikato region, operated by EnviroNZ. While this may have the capacity to take the majority of Redvale's waste, it is understood that the resource consent for the site has the effect of limiting the tonnage that can be accepted to in the order of 800 kilo-tonnes per annum (ktpa), meaning it cannot currently accept the majority of Redvale's waste in addition to the waste it already accepts from Auckland and elsewhere.

NZIER has previously undertaken high-level economic modelling for WMNZ on the economic costs of those alternative landfill use options. The findings suggest that maintaining the status quo will be the least costly option, and sending the residual waste to Hampton Downs (notwithstanding the tonnage limit referred to above) will be the most costly option. This previous assessment captured only the immediate, direct transport costs based on the vehicle kilometres travelled by waste trucks under each option. It did not capture the impact of diverting waste truck trips to different parts of the Auckland roading network, or the flow-on impact on different industries and the wider economy.

NZIER has been commissioned by WMNZ to assess the wider economic impact of transporting waste to alternative landfill sites assuming (per its current consent) Redvale Landfill is required to cease accepting waste at the end of 2028. To understand the full extent of the economic impact, we also compared an alternative scenario, in which Redvale's waste volume is transported to Whitford (up to its current consented limit) and the residual to Hampton Downs (ie ignoring the potential tonnage limit on Hampton Downs receiving this waste) , with a business-as-usual (BAU) scenario in which Redvale continues to operate under a new consent.¹

¹ NERA has completed an assessment of the effect on landfill gate prices. Our BAU scenario aligns with NERA's *factual* and our no-Redvale aligns with NERA's *alternative counterfactual* (Mellsop and Logchies 2026).



Our approach

We drew on the broad approach used in NZIER's previous relevant work on Auckland road decongestion. We first examined, using our transport modelling, the direct congestion impacts on Auckland road users and how these translate into direct productivity and efficiency impacts on the relevant industries. We then assessed how those direct impacts ripple across the wider Auckland and New Zealand economies using computable general equilibrium (CGE) modelling. We separated the total economic impacts into:

- **Impact of changes in the efficiency of supply chains** due to longer trips by road freight, trades (i.e. construction services), and postal and courier services for moving goods and supplies, and how this flows through to New Zealand's supply chains.
- **Impact of changes in productivity and operational costs in the waste services sector** due to longer travel times and distances for landfill disposal, and how these flow through to the wider economy.
- **Impact of changes in the agglomeration of activity and productivity** as workers and businesses spend more time in traffic during work-related trips (including commuting), and the resulting flow-on effects on the wider economy.

Auckland road users will, in aggregate, spend an additional 1.9 million hours in traffic each year if Redvale is closed and waste is diverted to Hampton Downs

Our transport modelling indicates substantial increases in travel times and distances for waste truck trips originating from WMNZ's transfer stations on the North Shore and in Selwood if they are diverted to Hampton Downs. Route changes would increase the number of waste truck trips crossing the Auckland Harbour Bridge from 37 per day in the BAU scenario to about 150 per day in the Redvale closure scenario, an increase of approximately 113 trips per day, with approximately 177 waste truck trips per day using SH16.

For road users other than waste trucks, our transport modelling estimates a net increase in travel time of **over 1.9 million hours per annum across Auckland**. Although our transport modelling accounts for travel-time offsets on routes currently used by waste trucks sending waste to Redvale Landfill, these offsets will be significantly exceeded by increases in travel times elsewhere. In particular, congestion impacts will be felt by road users in central, east and south Auckland. This is because, under our assumption that operators choose the lowest-cost practical route, all diverted waste trucks from the North Shore will use the Harbour Bridge to travel to and from Hampton Downs. We therefore apply this route-choice assumption consistently across all diverted trips. The Harbour Bridge connects the North Shore with the rest of Auckland and is a major chokepoint in the Auckland roading system. Increased volumes of waste trucks using the Harbour Bridge or any other alternative routes, will affect all other southbound and northbound traffic on those routes. While use of alternative routes may reduce congestion impacts on particular parts of the network, they would generally involve additional travel time and/or distance, i.e. increased costs to the economy. By contrast, waste trucks travelling from south of the Harbour Bridge would not have to cross the Harbour Bridge or use alternative routes, if Redvale Landfill closes.



We estimate that Redvale Landfill's closure will reduce Auckland's annual gross domestic product (GDP) by \$623 million and New Zealand's by \$447 million

Table 1 summarises the wider economic impacts estimated by our CGE model, using our transport modelling results as inputs into our CGE modelling.

If Redvale ceases to accept waste, diverting its waste volume to Whitford Landfill and Hampton Downs will increase congestion on Auckland roads. This will result in a total **annual loss of \$623 million (0.4 percent) in Auckland's GDP, and a \$447 million (0.1 percent) annual loss in New Zealand's GDP**, compared with the BAU scenario in which Redvale Landfill continues to accept waste beyond 2028. At an 8 percent discount rate,² these impacts amount to a **\$3.6 billion loss to the Auckland economy and a \$2.6 billion loss to the New Zealand economy over an 8-year period.**

The impact of reduced agglomeration and the associated loss in labour productivity is the dominant economic impact, accounting for about 69 percent of the total economic impact. This is because changes to the waste trucks' travel routes affect all workers in Auckland who travel on the roads to get to their jobs.

The impact of a less efficient supply chain is the second most significant, accounting for 22 percent of the total economic impact. This affects the logistics of all industries that use road freight to move their traded goods between Auckland and the rest of the country.

Table 1 Estimated wider economic impact on Auckland and New Zealand

Changes relative to the BAU scenario, \$ million

Impact	Auckland		New Zealand	
	Annual GDP	8-year NPV	Annual GDP	8-year NPV
Supply chain efficiency	-137.5	-789.9	-102.8	-590.5
Productivity and operational costs of waste services	-55.2	-317.2	-33.7	-180.7
Agglomeration	-430.9	-2,476.3	-310.8	-1,785.9
Total	-623.4	-3,582.4	-447.2	-2,569.7

Note: Totals may not sum exactly due to rounding.

Source: NZIER

The economic impact is less negative for New Zealand as a whole than for Auckland. This is because some regions outside Auckland will experience economic gains as resources and economic activity are reallocated to other regions with more productive opportunities, given the increased congestion in Auckland. However, overall, the economic impact is negative for the Auckland Region and the New Zealand economy.

This assessment includes and extends our previous high-level economic modelling

It is important to note that the results of this assessment and those of our previous high-level assessment of the economic costs of transporting waste to alternative landfill sites are not additive.

² As per the Treasury's guideline, an 8 percent discount rate should be applied to calculate the net present value of commercial proposals: <https://www.treasury.govt.nz/information-and-services/public-sector-leadership/guidance/reporting-financial/discount-rates>

This wider economic impact assessment, using CGE modelling, examines changes to waste truck routes, their effects on congestion across the broader Auckland roading network, and, from that, the flow-on impact across different industries in the Auckland and New Zealand economies. Our previous economic modelling captures the immediate impact if WMNZ were to divert Redvale Landfill's residual waste to alternative landfills when its consent requires landfilling activities to cease. We also modelled direct transport costs based solely on vehicle kilometres travelled, which are ultimately borne by Aucklanders as a cost of landfill disposal.

Contents

1	Introduction	1
1.1	A substantial amount of residual waste in Auckland will need to be disposed of elsewhere if Redvale Landfill closes	1
1.2	Diverting Redvale’s waste tonnage to alternative landfills will have an economic impact	3
1.3	Scope of our analysis	6
2	Methodology.....	7
2.1	Framework.....	7
2.2	Modelling approach.....	8
3	Our transport modelling	15
3.1	Purpose and approach.....	15
3.2	Developing our transport modelling.....	15
3.3	Transport modelling outputs	17
4	CGE modelling results	20
4.1	Impact on supply chain efficiency.....	20
4.2	Impact on productivity and operational costs of waste services	21
4.3	Impact on agglomeration.....	23
4.4	Total economic impact	25
5	Concluding comments.....	26
6	References.....	28

Appendices

Appendix A NZIER’s regional CGE model.....	30
Appendix B Industry description	33
Appendix C Detailed CGE modelling results.....	36

Figures

Figure 1 Haulage routes for waste across Auckland	4
Figure 2 Stylised speed-flow curve and network level of service	8
Figure 3 Our framework for the ripple effects of productivity impacts.....	9
Figure 4 Our CGE model represents the circular flows among all the agents and activities in the economy	10
Figure 5 NZIER’s process of modelling the wider economic impact	11
Figure 6 Spillover effects from traffic congestion points	17
Figure 7 Our CGE model represents the circular flows between all the agents and activities in the economy	31

Tables

Table 1 Estimated wider economic impact on Auckland and New Zealand	iii
Table 2 Class 1 landfills in Auckland and adjacent regions	2



Table 3 Potential options for landfill use across Auckland beyond 2028	3
Table 4 Summary of NZIER's previous economic modelling for options to manage residual waste from Redvale	5
Table 5 Key parameter values used in developing inputs for CGE modelling.....	14
Table 6 Distance and duration of haulage routes	15
Table 7 Distance and duration change	18
Table 8 Increases in waste truck trips per day across the Harbour Bridge under the 'Redvale closes' scenario	18
Table 9 Annualised changes in travel times for all other road users in Auckland	19
Table 10 Estimated net increases in travel time costs for supply chain industries	20
Table 11 Estimated impact of reduced supply chain efficiency on real GDP	21
Table 12 Estimated net increase in travel time for waste services.....	21
Table 13 Estimated impact of productivity loss in waste services on real GDP.....	22
Table 14 Estimated net increase in travel distance and operating costs for waste services.....	22
Table 15 Estimated impact of increased operation costs of waste services on real GDP.....	23
Table 16 Estimated annualised travel time of non-freight work-related and commuting trips by vehicle type	23
Table 17 Estimated average generalised cost of travel for work-related travel.....	24
Table 18 Estimated change in productivity by sector in Auckland from reduced agglomeration	24
Table 19 Estimated impact of reduced agglomeration on real GDP	25
Table 20 Estimated wider economic impact on Auckland and New Zealand	26
Table 21 Industry description.....	33
Table 22 Estimated annual impact on industry output.....	36

1 Introduction

WMNZ is one of three landfill operators handling Auckland waste. It operates two Class 1 landfill³ sites in Auckland, with Redvale Landfill fully operated by WMNZ and Whitford Landfill operated as a joint venture with the Auckland Council.

The current resource consent for Redvale Landfill requires it to cease accepting waste in December 2028. WMNZ is looking to develop a new landfill site at Wayby Valley, Wellsford, known as the ARL. The consenting process for ARL has progressed since its initial lodgement with the Auckland Council in 2019 and remains subject to appeals. Even if the resource consent is granted, ARL is not expected to become operational until 2036. This could create a potential gap of up to eight years in Auckland's landfill capacity if Redvale is required to cease accepting waste.

NZIER has previously undertaken economic modelling for WMNZ to assess options for disposing of waste currently sent to the Redvale landfill site (NZIER 2024, 2025). That high-level assessment informed the evidence base for understanding the direct economic costs of diverting waste from Redvale to alternative landfill sites.

1.1 A substantial amount of residual waste in Auckland will need to be disposed of elsewhere if Redvale Landfill closes

Redvale Landfill currently takes about 50 percent (or 600,000 tonnes per annum) of the waste disposed of in Auckland. Based on the Auckland Council's most recent waste assessment estimates, this is over 40 percent of the 1.45 million tonnes of waste that went to Class 1 landfills in 2022 from across the Auckland region (Auckland Council 2023).

About 240,000 tonnes of waste are sent to Whitford Landfill in East Auckland each year. Although there are no Class 2⁴ waste-only landfills in Auckland, WMNZ operates Class 2 waste management facilities at both the Redvale and Whitford Landfill sites.

There are two other Class 1 landfills in adjacent regions that receive Auckland waste. One is at Hampton Downs in North Waikato, operated by Enviro NZ, and the other is at Puwera in Northland, operated by Whangārei District Council and Northland Waste.

³ A Class 1 Landfill is a site that accepts Municipal Solid Waste (MSW). It generally also accepts construction and demolition (C&D) waste, some industrial wastes and contaminated soils (Waste Management Institute New Zealand (WasteMINZ) 2023, 10).

⁴ A Class 2 construction and demolition (C&D) landfill is a site that accepts non-putrescible wastes including C&D waste, managed fill material, controlled fill and clean fill material (ibid, 11).

Table 2 Class 1 landfills in Auckland and adjacent regions

As of September 2024

Landfill	Region	Operated by	Consent until	Tonnes of waste sent from Auckland per year
Redvale	Auckland (north)	WMNZ	2028	600,000
Whitford	Auckland (east)	WMNZ & Auckland Council	2041	240,000
Hampton Downs	Waikato	Enviro NZ	2036	600,000
Puwera	Northland	Whangārei District Council & Northland Waste	2038	50,000

Source: Tonkin + Taylor; WMNZ, NZIER

Estimates in the 2023 Waste Assessment indicate that although the annual total of Class 1 waste tonnage sent to landfill increased rapidly between 2010 and 2016, it has since declined from the 2016 peak and stabilised. This occurred despite population and economic growth during this period (Auckland Council 2023, 39). Some of this could be attributable to waste minimisation efforts in recent years. However, the Auckland Council in its Waste Minimisation Plan 2024, forecasts that by 2040 there could be a total of 1.7 million tonnes of Class 1 waste sent to landfill in Auckland per annum, if the current waste growth trajectory continues (Auckland Council 2024, 51). This confirms the need for landfill disposal of waste for the foreseeable future, even with waste minimisation initiatives in place and declining per capita waste tonnage in Auckland.

Under its current resource consents, WMNZ will cease accepting waste at Redvale Landfill in December 2028, leaving a substantial gap in Auckland's landfill capacity. WMNZ's alternative site at Whitford could only accept 100,000 tonnes of additional waste from Redvale as of right, ie without the need for any additional resource consents and / or amendments to its designation.

Last year, WMNZ undertook a public consultation on potential options to rebalance landfill use across Auckland beyond 2028. The options considered included maintaining the status quo, redirecting all waste to Whitford, and balancing waste between Redvale and Whitford in various combinations (WMNZ 2025).⁵ All these options will require new resource consents, as summarised in Table 3 below.

⁵ Trucking residual waste to Hampton Downs Landfill was ruled out as an option because: economic modelling indicated the incremental transport cost could be substantial and forecast a productivity decline; Hampton Downs is operating close to its consented capacity and customer feedback indicated that this was operationally impractical (WMNZ 2025, 7)

Table 3 Potential options for landfill use across Auckland beyond 2028

Consent required (Yes/ No)	Maintaining the status quo	Redirecting all waste to Whitford	Class 1 landfill to Redvale and Class 2 landfill to Whitford	Class 1 landfill to Whitford and Class 2 landfill to Redvale	Split waste between Redvale and Whitford based on source	Use Whitford's consented tonnage and send the rest to Redvale
Consent for Redvale	Yes – consent extension	No	Yes – 400,000 tonnes annual capacity	Yes – 200,000 tonnes annual capacity	Yes – 300,000 tonnes annual capacity	Yes – 500,000 tonnes annual capacity
Consent for Whitford	No	Yes – 850,000 tonnes annual capacity	Yes – 450,000 tonnes annual capacity	Yes – 650,000 tonnes annual capacity	Yes- 550,000 tonnes annual capacity	No

Source: WMNZ, NZIER

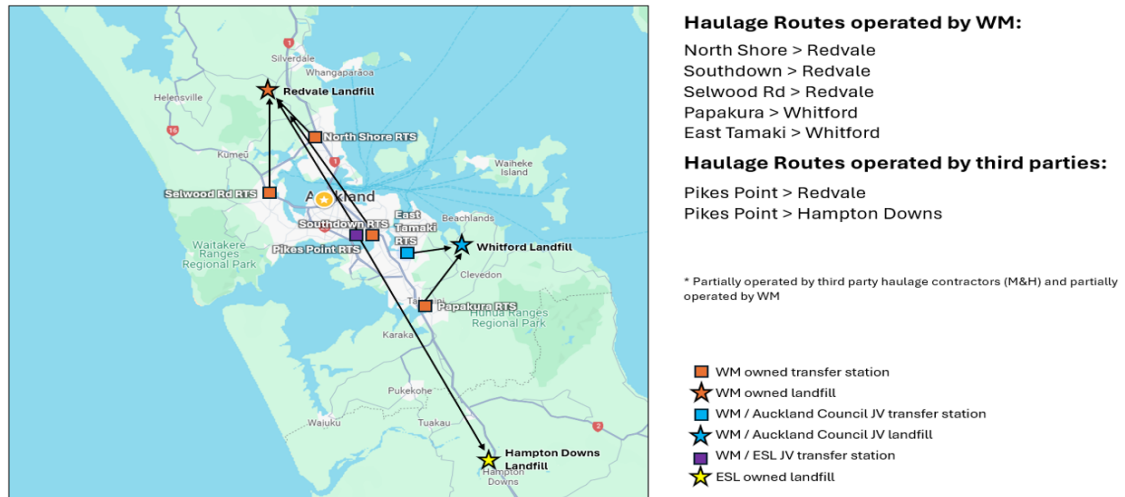
If none of those options is consented, the only alternative will be to use all of Whitford Landfill's current consented tonnage and to transport the remaining residual waste to another landfill. This assessment assumes that Hampton Downs Landfill is the next best alternative landfill for the residual waste to be transported to once Redvale Landfill is required to stop accepting waste (however, as set out above, there are consenting challenges with Hampton Downs which may mean this option is not, in fact, available under its existing resource consents).⁶

1.2 Diverting Redvale's waste tonnage to alternative landfills will have an economic impact

Figure 1 depicts how the WMNZ transfer stations are connected to the Redvale, Whitford and Hampton Downs Landfills. Transferring Redvale Landfill's waste volume to either Whitford or Hampton Downs via the transfer stations will mean longer routes for waste transport from the North Shore and West Auckland, resulting in increased transport costs. This change in the use of landfill sites will also affect the day-to-day operations of the sites. If either Whitford or Hampton Downs Landfills receives waste volumes beyond their currently consented volumes, there will be direct costs associated with obtaining resource consents and developing infrastructure. Ultimately, these cost impacts will be absorbed by Auckland households and businesses, who are the end users of landfill disposal.

⁶ Noting it is WMNZ's position that Hampton Downs Landfill's current resource consents cannot accept this waste, ie in reality the effects could be more significant than contemplated by this assessment if Auckland's residual waste must be transported further.

Figure 1 Haulage routes for waste across Auckland



Source: WMNZ

NZIER's previous assessment for WMNZ modelled the economic costs of waste disposal based on the options described in section 1.1. The modelling specifically examined the costs and emissions associated with the truck kilometres travelled to landfill sites and is summarised in Table 4.⁷ The findings suggest that granting WMNZ consents to continue landfilling operations at Redvale Landfill until ARL becomes operational will be the lowest cost option. In the absence of obtaining a new consent for Redvale Landfill, transferring 100,000 tonnes to Whitford Landfill under its current consented tonnage and sending the rest of Redvale's waste volume to Hampton Downs will be the costliest option. This high-level assessment captures only the direct transport costs associated with waste truck kilometres travelled under the various options. It does not include other costs, such as operating the landfills, obtaining new resource consents, and constructing new infrastructure.

⁷ WMNZ provided information on the average truck capacities and cost per kilometre travelled for the trucks. The model assumed each landfill has the same composition of trucks transporting waste. In the absence of detailed information on the travel routes for the waste being trucked to Redvale or Whitford, the model also assumed all waste in Auckland is trucked from the Auckland CBD.



Table 4 Summary of NZIER's previous economic modelling for options to manage residual waste from Redvale

Per annum

Options	Total cost (\$) – lower bound	Total cost (\$) – upper bound	Cost ranking*
Maintaining the status quo	\$20,212,883	\$25,724,864	1
Redirect all waste to Whitford	\$21,886,933	\$27,855,422	4
Class 1 to Redvale and Class 2 to Whitford	\$22,344,800	\$26,626,506	5
Class 1 landfill to Redvale and Class 2 landfill to Whitford	\$22,694,150	\$27,240,964	6
Split waste between Redvale and Whitford landfills based on source	\$21,162,733	\$26,933,735	3
Use Whitford's consented tonnage and send the rest to Redvale	\$20,679,933	\$26,319,277	2
Use Whitford's consented tonnage and send the rest of the waste to Hampton Downs	\$37,175,600	\$47,313,253	7

Note: the lower-bound transport cost estimates are based on assumptions of a greater average load weight per truck. The upper-bound transport cost estimates are based on a lower average load weight per truck.

*ranking is based on lower bound cost rankings.

Source: NZIER estimates using WMNZ information, provided in February and March 2025.

Transporting waste from the transfer stations that currently serve Redvale to either Whitford or Hampton Downs will increase the volume of heavy vehicle traffic on the roading network:

- in the Whitford area
- travelling south
- travelling from North Shore and West Auckland across Auckland.

The increasing number of truck trips to Whitford or Hampton Downs will increase congestion on parts of Auckland's roading network, particularly the Auckland Harbour Bridge, which connects the North Shore to the rest of Auckland. The Harbour Bridge is already a major traffic choke point in Auckland's roading network, given its high traffic volumes, limited number of lanes, and that there are few alternative routes, particularly in the event of disruptions. This remains true whether the alternative landfills have the capacity to take Redvale Landfill's waste volume.

Increased congestion will slow the movement of people, goods, and services across Auckland and New Zealand, reducing the efficiency of supply chains, the productivity of industries, and employment across the economy. A 2017 NZIER study estimated that reducing Auckland's road congestion so that traffic travels at or below the capacity of the roading network could lift New Zealand's gross domestic product (GDP) by \$927 million to \$1,281 million per annum (NZIER 2017). Therefore, increased congestion on the Auckland road network due to increased waste truck movements to Hampton Downs will result in a substantial economic loss.

1.3 Scope of our analysis

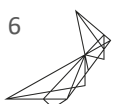
The previous high-level assessment by NZIER captured only the direct transport costs associated with the truck kilometres travelled to landfills. It did not capture the impact of additional truck trips required to divert Redvale Landfill's waste volume to alternative landfill sites on Auckland's roading network, nor the flow-on economic impact on Auckland and New Zealand.

The scope of this work is to assess:

- the impact of diverting waste trucks on Auckland's road users
- the impacts on the wider Auckland and New Zealand economies, under the scenario in which waste is transported to Whitford and Hampton Downs Landfills rather than to Redvale.

To understand the full extent of the economic impact of Redvale Landfill ceasing to accept waste before ARL is operational, we assess the impacts of an alternative scenario – sending a portion of Redvale's waste volume to Whitford Landfill (up to its current consented limit) and the remainder to Hampton Downs (ignoring the consenting issues identified above) – relative to a BAU scenario in which Redvale Landfill continues to operate under a new consent.

Our methodology is outlined in the next section.



2 Methodology

2.1 Framework

Congestion underpins our assessment. We use the engineering measure of congestion, namely the level of service (LOS). The LOS is determined by traffic volume and speed. This relationship is illustrated in Figure 2. We also applied this framework in NZIER's previous work on the impact of Auckland road decongestion (NZIER 2017).

Under the LOS framework, congestion is defined as the state in which demand for the road, i.e. traffic volume, exceeds its capacity (Wallis and Lupton 2013; ARUP and EY 2025). We consider LOS D in Figure 2 to be the point at which congestion begins. At this point, the transport network is operating at its maximum sustainable flow; that is, speed and traffic volume are optimised to achieve maximum throughput.

At any point before LOS D, the transport network is not utilising its capacity, and adding more traffic to the road increases the total flow of vehicles over a given period. Beyond LOS D, additional vehicles on the network reduce speeds sufficiently that the total flow over a given period is lower than at LOS D, despite more vehicles on the road. Therefore, shifting to any point beyond LOS D would entail a cost (an increase in travel time) due to congestion.

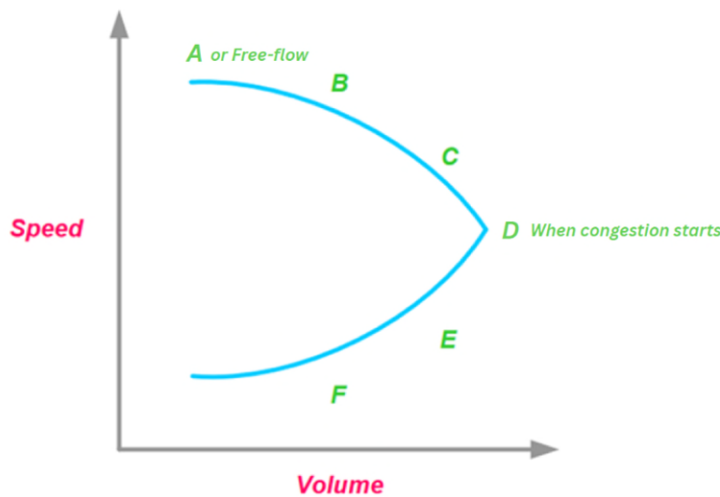
This framework applies to the roading network as a whole. If the roading network is operating beyond LOS D, a route that appears less congested will quickly become congested as drivers seek alternative routes. This would still result in a deterioration in the overall performance of the roading network, reflected in a further shift away from LOS D.

Auckland's roading network is already severely congested. TomTom's traffic index⁸ estimates that, in 2025, Auckland drivers lost an average of 76 hours per year stuck in traffic, and that almost a third of average annual rush-hour travel time was spent in congestion. Cars are the dominant means of travel in Auckland, with the 2023 Census indicating that nearly 85 percent of Aucklanders get to work by car, truck or van (ARUP and EY 2025, 16).

⁸ Auckland traffic report. TomTom Traffic Index. <https://www.tomtom.com/traffic-index/city/auckland> (TomTom, n.d.).

Figure 2 Stylised speed-flow curve and network level of service

LOS levels are in green



Source: NZIER

Obtaining a resource consent for Redvale Landfill’s ongoing operations will ensure that WMNZ’s BAU transport operations will not alter the pattern of waste truck traffic across Auckland, and therefore will not affect current levels of road congestion.

If Redvale Landfill ceases to accept waste, transferring its waste volume to Whitford and Hampton Downs Landfill sites will increase the number of trucks travelling across Auckland from the North Shore and West Auckland. This will add further pressure to the already congested Auckland roading network, particularly on the Auckland Harbour Bridge, which is considered a major choke point. This change is seen as a shift along the LOS curve to a point farther beyond LOS D, indicating increased congestion. Diverting waste truck traffic from the North Shore via SH16 could reduce congestion on the Harbour Bridge but that would shift congestion to SH16. Overall, the Auckland transport network would deteriorate with the transfer of waste volume to Whitford and Hampton Downs Landfill instead of Redvale Landfill.

Our economic impact assessment captures the flow-on economic impacts on the Auckland and New Zealand economies from this increase in congestion if Redvale Landfill waste is diverted to Whitford Landfill and Hampton Downs Landfill, relative to the BAU scenario in which Redvale Landfill continues to accept waste.

2.2 Modelling approach

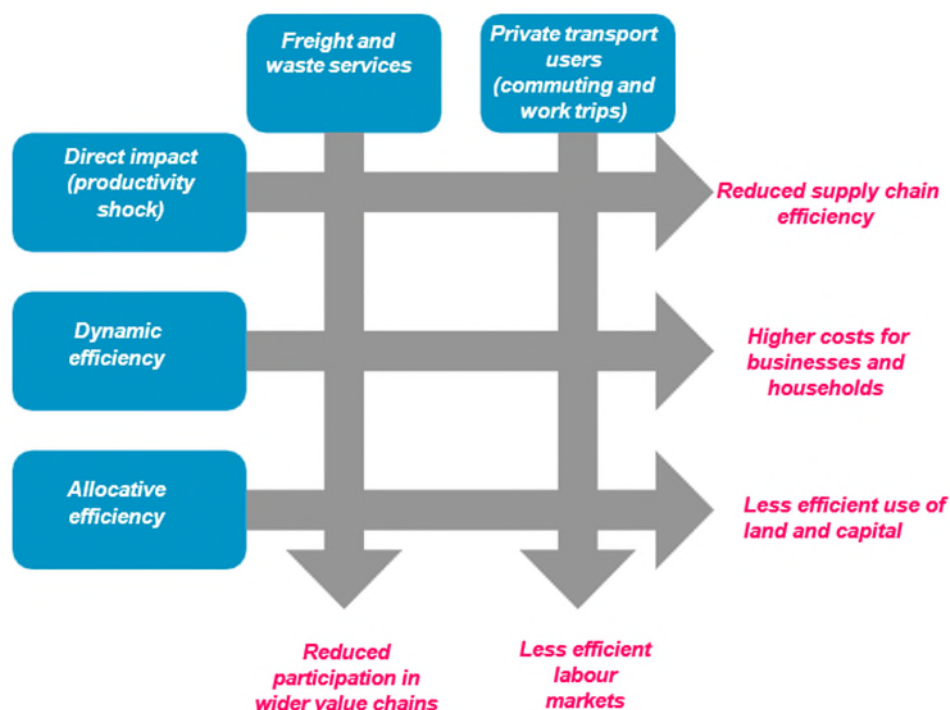
We build on the approach used in NZIER’s previous work on Auckland road decongestion (NZIER 2017). Our assessment examined the direct impacts on Auckland road users and the implications for the productivity of the relevant industries if Redvale Landfill’s waste is sent to Whitford Landfill and Hampton Downs Landfill.

We then assess how those productivity impacts ripple across the wider economy. The ‘three-legged stool’ analogy for productivity explains how the wider economic impacts manifest beyond the direct impacts:



- Leg one is the **direct productivity impact** itself, resulting from changes in travel time for industries in the supply chain and for private transport users who travel by car for commuting and work trips. Changes in travel time also affect the productivity and operational costs of the waste services industry.
- Leg two is the **dynamic efficiency loss** arising from higher costs in other industries due to direct productivity losses.
- Leg three is the **loss in allocative efficiency** caused by resources being reallocated to less efficient uses.

Figure 3 Our framework for the ripple effects of productivity impacts



Source: NZIER

We use computable general equilibrium (CGE) modelling to estimate the wider economic impacts of increased congestion resulting from sending Redvale's residual waste to Whitford Landfill and Hampton Downs Landfill. We separate the total impacts into the following channels:

- **Impact of changes in productivity and operational costs in the waste services sector** due to longer travel times and distances for landfill disposal, and how these flow through to the wider economy.
- **Impact of changes in the efficiency of supply chains** due to longer trips by road freight, trades (i.e. construction services) and postal and courier services, and how this flows through to New Zealand's supply chains.
- **Impact of changes in the agglomeration of activity and productivity** as workers and businesses spend longer in traffic on work-related trips (including commuting), and the resulting flow-on effects on the wider economy.

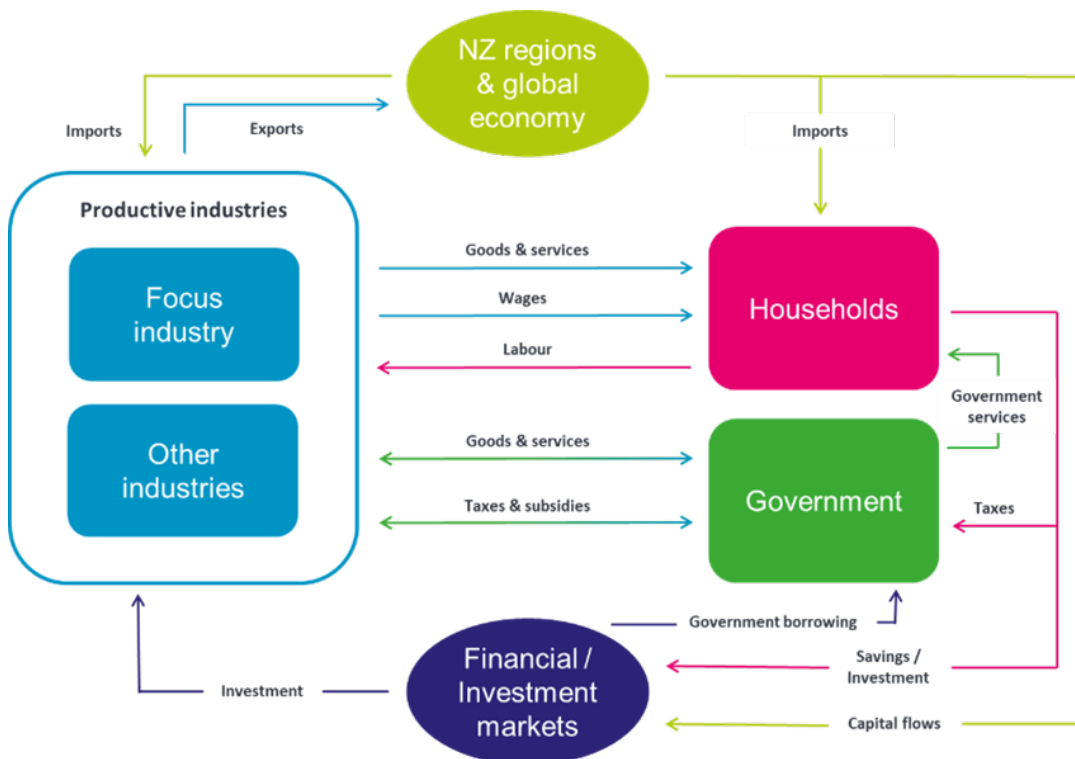
2.2.1 CGE modelling

We use our NZIER comparative static regional CGE model, TERM-NZ, to estimate the wider economic impact of diverting Redvale's waste to Whitford Landfill and Hampton Downs Landfill if Redvale's landfilling operations are required to cease.

TERM-NZ is a bottom-up regional CGE model. It is based on Stats NZ's Input-Output tables that identify the structure of the industries involved. The model is highly detailed, incorporating 206 industries, 206 commodities, and 15 New Zealand regions, which can be further divided into 67 Territorial Authorities and 21 Auckland local boards.

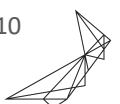
All regions in the model are linked via inter-regional trade in commodities and the movement of labour and capital. The model captures the inter-linkages between sectors, as well as their links to households (via the labour market), the government sector, capital markets and the global economy (via imports and exports). The relationships are illustrated in Figure 4.

Figure 4 Our CGE model represents the circular flows among all the agents and activities in the economy



Source: NZIER

CGE modelling is regarded as a robust and credible methodology for measuring economic impacts because it accounts for resource constraints and the flow-on effects across industries from initial changes in the economy. We estimate the wider economic impact of Redvale no longer operating by applying 'shocks' as inputs to our CGE model and then estimating changes in GDP and industry output for the Auckland and New Zealand economies.



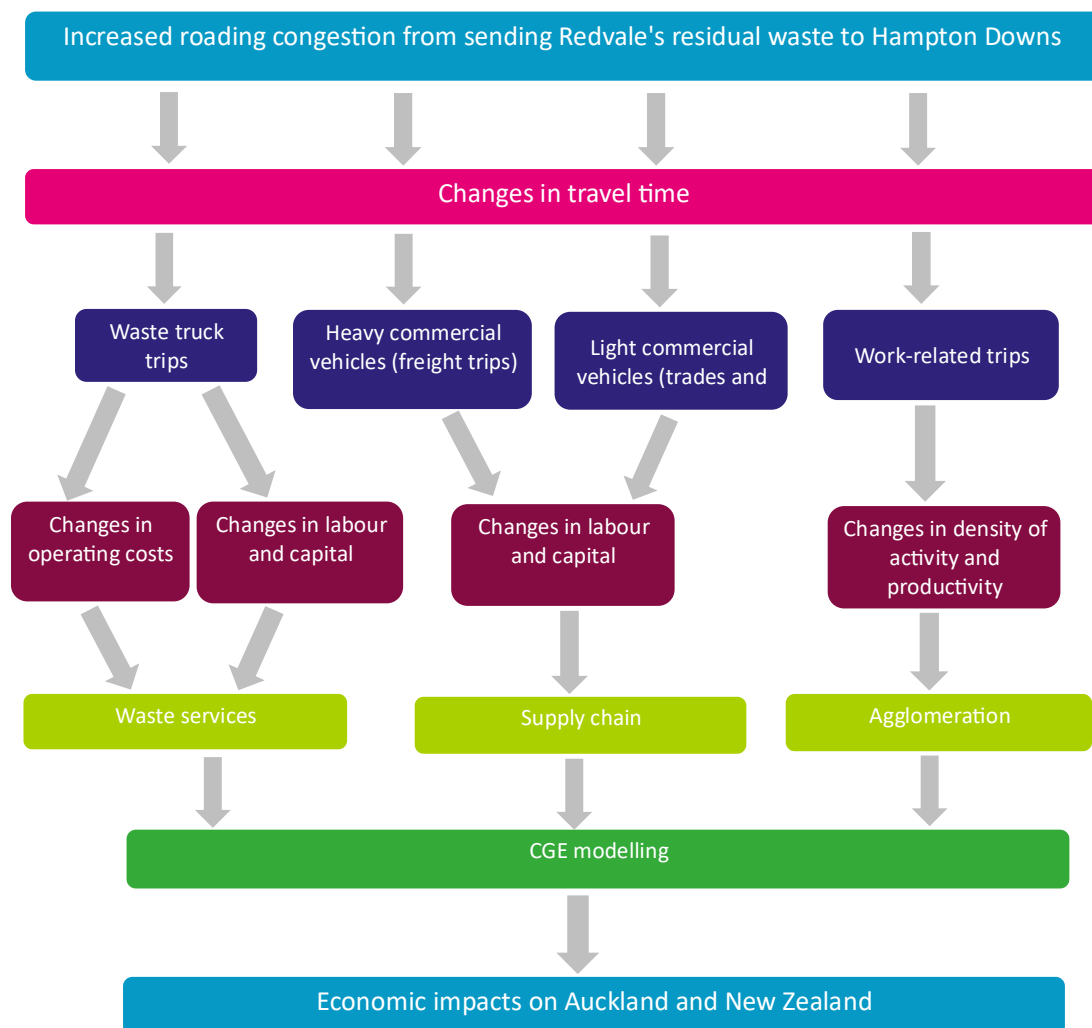
In our CGE model, we simulate the Auckland and New Zealand economies to a base year of 2028, when Redvale Landfill ceases to accept waste. The overall economic impact is estimated by comparing GDP and industry output in the scenario where the economy operates without Redvale Landfill to the BAU scenario in which Redvale Landfill continues to accept waste.

Appendix A provides a more in-depth overview of our CGE model. Appendix B lists the industry groupings included in our CGE model.

2.2.2 Developing inputs for CGE modelling

The inputs to our CGE model are direct impacts estimated using the process outlined in Figure 5 below. We decompose changes in travel time by road user type and, from this, derive the direct impacts on relevant industries, which are used as inputs, or ‘shocks,’ in our CGE modelling.

Figure 5 NZIER’s process of modelling the wider economic impact



Source: NZIER



Based on the origins and haulage routes of waste currently sent to Redvale for landfill disposal (refer to Figure 1), increasing waste truck trips from north and west Auckland to Whitford Landfill and Hampton Downs Landfill will affect different segments of Auckland's roading network to varying degrees. Therefore, in our analysis, we have divided the Auckland region in our CGE model database into north, west, central, east, and south Auckland. The impacts on those Auckland sub-regions are then aggregated to produce estimates for the Auckland region as a whole.

We used detailed transport modelling to calculate changes in travel time for different road users across road segments. Our transport modelling was based on NZTA's volume-capacity model for forecasting motor vehicle travel time and travel time delay (NZ Transport Agency 2024a) within NZTA's Land Transport Benefits Framework (NZ Transport Agency 2024b).⁹ This tool aligns with our LOS framework for congestion.

The two key data inputs for our transport modelling are WMNZ's truck movements from transfer stations across Auckland and Auckland Transport's (AT) traffic counts by time, route and vehicle type. In our transport modelling, we incorporated both increased congestion on routes to Hampton Downs relative to the BAU scenario and congestion relief on existing routes from north and west Auckland to Redvale Landfill (i.e. offsets). For each route, we modelled transport impacts in both directions of travel, including those passing major choke points such as the Auckland Harbour Bridge.

The changes in travel times for each route, estimated in our transport modelling, are aggregated and used as inputs to the CGE model, corresponding to the Auckland sub-regions used in our CGE model simulation. We discuss our transport modelling and its outputs in more detail in section 3.

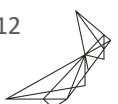
We followed the broad guidelines of the NZTA's Monetised Benefits and Costs Manual (MBCM) (NZ Transport Agency 2025) and our CGE model database to translate changes in mean travel time into direct impacts on the waste services sector, the supply chain, and agglomeration.

To estimate the direct impact on productivity of waste disposal services in Auckland, we first calculated the increase in total travel time costs for waste trucks, using WMNZ's waste truck fleet data and the value of travel time for heavy commercial vehicles I (HCV I)¹⁰ in the MBCM. This was then translated into a change in the combined productivity of labour and capital in the waste disposal services industry based on the industry's labour and capital composition.

Changes in operational costs for waste services were measured using changes in total vehicle operating costs (VOCs) for waste trucks, driven by changes in distance travelled and VOC per kilometre for those trucks. Based on the MBCM, VOC for HCV I is split into components such as fuel and oil, tyres, maintenance and repairs, and depreciation. We used estimates of intermediate use of diesel, maintenance services, and rubber tyre manufacturing from our CGE model database to calculate changes in intermediate use of these components, which we then used to calculate the direct impact on total operational costs for the waste services industry.

⁹ Details of how NZTA's volume-capacity model works are presented in the underlying paper 'Modelling travel time and travel time delay' by Infometrics (2021).

¹⁰ Based on waste truck data provided by WMNZ for the March 2025 year, which contains unique identifiers of each waste truck by licence plate.



To estimate impacts on supply chain efficiency, we calculated changes in travel time costs for freight, trades and postal trips. We drew on transport modelling output for trips by medium- and heavy-duty commercial vehicles (MCVs and HCVs) and light commercial vehicles (LCVs), and on the relevant travel time values in the MBCM. These changes in travel time costs were then translated into direct impacts on the combined productivity of labour and capital in road freight, construction services and postal and courier services, based on the relative size of these three industries in the Auckland economy. To capture impacts on supply chains within and outside Auckland, our CGE model assumes that road freight is affected when used to move goods both within Auckland and between Auckland and the rest of New Zealand.

We followed the broad approach in the MBCM to quantify the direct impact on agglomeration. The approach recognises that clustering of activity in dense urban areas, such as Auckland, has a positive impact on productivity and depends on effective transport systems (NZ Transport Agency 2025, 98). The extent to which economic density affects sharing, matching, and knowledge spillovers, thereby influencing a firm's production technology, was estimated in previous studies in the major industrial and urban centres of New Zealand.¹¹

Under the MBCM guidelines, agglomeration impact is measured by the relationship between changes in effective employment density and changes in productivity across industries. When the transport network becomes more congested and/or the level of employment in the urban area falls, this effectively reduces the number of jobs people can access on the same trip. To estimate the change in effective job density when Redvale Landfill is no longer operating, we calculated changes in average generalised cost across non-freight work and commute trips by cars and LCVs, and across commute trips by MCVs and HCVs. We then used changes in labour demand estimated by our CGE modelling for the supply chain efficiency and waste disposal services impact channels. We then adopted the industry-specific agglomeration elasticities in the MBCM to estimate changes in productivity across industries, and applied these to our CGE model to estimate the associated flow-on impact.

Table 5 lists the key parameters and their values that we have assumed in our calculations of the direct impacts. Note that we have adjusted our calculations of travel time costs and VOCs to 2028 values to reflect the direct impacts in 2028, the year when Redvale Landfill's current consent requires it to cease accepting waste.

¹¹ For example, 'Agglomeration elasticities in New Zealand' by Maré and Graham (2009).



Table 5 Key parameter values used in developing inputs for CGE modelling

Input		Assumed values	Source
Factor for annualising changes in travel time	Number of workdays in a year ¹	250	NZIER
	Number of work hours in a year	2,000	
Value of travel time (\$/hour)	Passenger cars	\$58.24	MBCM (NZ Transport Agency 2025)
	LCVs	\$61.69	
	MCVs - HCVs	\$79.91	
Factor for adjusting travel time costs to the 2028 base year		1.44	NZIER
Breakdown of VOC by component for waste trucks (HCV I) (%)	Fuel and oil	51.3%	MBCM (NZ Transport Agency 2025)
	Tyres	7.7%	
	Maintenance and repairs	35.3%	
	Depreciation	5.7%	
Split of LCVs used for work trips	Non-freight or trades trips	44.1%	NZIER based on Auckland Transport's traffic count data
	Freight or trades trips	55.9%	
Agglomeration elasticities by industry		Table 37 of the MBCM	MBCM (NZ Transport Agency 2025)

1 A standard working year of 250 working days has been adopted for the analysis. Redvale Landfill operates for 310 days per year; therefore, using 250 days results in a conservative estimate of the annual travel-time and associated economic impacts.

Source: As per table



3 Our transport modelling

The inputs to our CGE modelling are based on our transport modelling, which shows how diverting waste truck trips to Hampton Downs will affect different road users across Auckland's road network.

3.1 Purpose and approach

We model the impact on travel times if Redvale Landfill no longer accepts waste from 2028. Under our modelling scenario, waste trucks currently going to Redvale Landfill will be diverted to Whitford Landfill and Hampton Downs Landfill. This route change is expected to have the following effects on the Auckland roading network:

- Traffic volume in the northern corridors (towards Redvale) will decrease, meaning that there should be travel time savings (which we deem travel time offsets) for vehicles travelling on this part of the roading network.
- Traffic volume on the southern corridors (towards Hampton Downs) will increase, particularly heavy vehicle traffic, due to the increased number of waste truck trips. This will increase traffic on this part of the roading network.

Our transport modelling looks at the following two aspects:

- Route change for waste trucks, and, as a result, increased travel time due to the farther destination.
- Net changes in travel times for all other road users (HCVs, MCVs, LCVs, and cars) due to changes in traffic volume across different parts of the roading network.

3.2 Developing our transport modelling

WMNZ provided us with data on the waste truck count and haulage routes between transfer stations (RTSs) and landfills for the March 2025 Financial Year. Table 6 summarises the average travel distance and time for each haulage route.

Table 6 Distance and duration of haulage routes

Operator	Origin	Destination	Distance (km)	Duration (minutes)
WMNZ	North Shore RTS	Redvale Landfill	16.412	20.7
WMNZ	Southdown RTS	Redvale Landfill	45.082	40.0
WMNZ	Selwood Road RTS	Redvale Landfill	38.036	33.6
WMNZ	Papakura RTS	Whitford Landfill	20.805	23.3
WMNZ	East Tamaki RTS	Whitford Landfill	13.081	16.8
3rd party	Pikes Point RTS	Redvale Landfill	46.648	42.6
3rd party	Pikes Point RTS	Hampton Downs Landfill	64.132	57.7

Source: WMNZ, NZIER



To model the impact of a waste truck route change on all other road users across the Auckland roading network, our transport modelling used built-in traffic count data from Auckland Transport and NZTA¹² for the same time period as WMNZ's waste truck and haulage route data. These data sources show traffic volumes by vehicle type, route, and time of day.

We used NZ Road Centrelines data from Land Information New Zealand (LINZ)¹³ to break routes into detailed road segments, enabling our transport modelling to reflect changes in road segment attributes, such as whether a road is on a motorway or an arterial, or whether there are any changes in lane count.

We utilised NZTA's Volume-Capacity tool, which calculates changes in travel times by vehicle type and peak period (AM peak/Mid-peak/PM peak)¹⁴ – based on changes in traffic volume. The tool allows us to set the base year for traffic data and the forecast year, which we set as 2024 and 2028, respectively. We use 2024 as the base year because that is the year for which waste-truck data is available, and 2028 as the forecast year because that is when Redvale is assumed to cease accepting waste.

The steps we took in our transport modelling are detailed below.

3.2.1 Defining the waste truck routes and affected road segments

We constructed the routes between the RTSs and the landfill locations by:

- Identifying the coordinates of each RTS and landfill, based on the map of haulage routes (refer to Figure 1), and manually checking their locations in Google Maps.
- Generating origin-destination travel times and distances between each RTS and each existing landfill. We obtained the spatial data for those routes from the OpenStreetMap database and then overlaid it with the NZ Road Centrelines spatial data.
- Filtering out anomalies¹⁵ and selecting only the RTS-landfill pairs operated by WMNZ and/or third parties.
- Breaking each route into road segments using NZ Road Centrelines 2025.

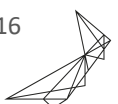
We separate 'arrival' and 'return' routes in some cases because trucks may use different roads depending on the direction of travel. We also explicitly identified routes that cross the Auckland Harbour Bridge, as it is a major choke point in the Auckland roading network. To maximise travel efficiency, we assume that diverted waste truck trips from the North Shore use the Harbour Bridge to get to and return from Hampton Downs. While alternative routes are available and may be used by some operators depending on prevailing traffic conditions, these would result in additional travel time and/or distance i.e. additional costs to the economy. The additional waste truck movements will materially affect travel times across Auckland, particularly between the north and south Auckland sub-regions.

¹² <https://at.govt.nz/about-us/reports-publications/traffic-counts>

¹³ <https://data.linz.govt.nz/layer/50329-nz-road-centrelines-topo-150k/>

¹⁴ AM peak = 07:00-09:00 / Mid-peak = 10:00-14:00 / PM peak = 14:00-17:30

¹⁵ For example, haulage routes which will be unlikely to take place, for example, sending waste from a RTS in west Auckland to the Whitford landfill.

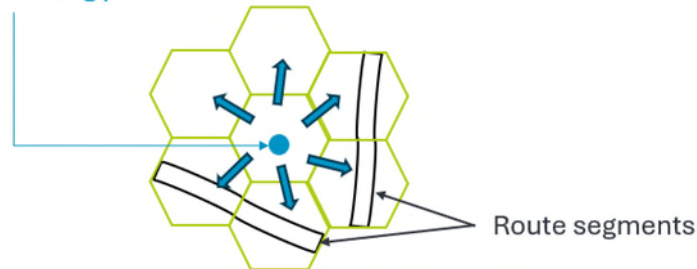


3.2.2 Incorporating the spillover effects to other users of the roading network

To capture spillover effects on other road users across the Auckland roading network, we allowed congestion 'hot spots' to spill over into nearby route segments, using the traffic monitor point locations from Auckland Transport's traffic count data. This enables us to capture how congestion spreads spatially along a corridor.

Figure 6 Spillover effects from traffic congestion points

AT traffic monitoring points



Source: NZIER

To estimate changes in travel time for road users on each affected road segment during each peak period, we adjusted traffic volumes derived from traffic count data to reflect expected changes in waste truck trips for each road segment. We then input these adjusted volumes into the NZTA volume capacity tool. We aggregated the outputs for road segments on the affected routes and summarised the travel time impacts by vehicle type and peak period.

To align with the Auckland sub-region groupings in our CGE modelling, we used local boards as a practical spatial layer to aggregate impacts on each road segment at the sub-region level.

3.3 Transport modelling outputs

From our transport modelling, we generated the following outputs:

- Changes in destination, distance and travel times for waste truck trips
- Waste truck movements across the Auckland Harbour Bridge
- Annualised increases in travel times for all other types of vehicles travelling on the affected routes, travel time offsets for those travelling on less congested routes, and from those, the net changes in travel times.

3.3.1 Impact on waste truck trips

Table 7 summarises the average travel distances and times per waste truck trip on the affected routes, along with changes relative to haulage routes to Redvale (refer to Table 6). The impact on travel times and distances is greater for waste truck trips originating from the North Shore and Selwood RTSs.



Table 7 Distance and duration change

Per affected waste truck trip

Origin	Destination	Distance (km)	Travel time (minutes)	Change in distance (km)	Change in travel time (minutes)
North Shore RTS	Hampton Downs	86.2	75.8	69.8	55.1
Southdown RTS	Hampton Downs	60.1	54.2	15.0	14.2
Selwood Road RTS	Hampton Downs	80.0	68.7	42.0	35.2
Pikes Point RTS	Hampton Downs	64.1	57.7	17.5	15.1

Source: NZIER

3.3.2 Waste truck movements across the Auckland Harbour Bridge

Waste truck crossings of the Auckland Harbour Bridge will increase substantially if Redvale Landfill closes, and waste is sent to Hampton Downs instead. Our transport modelling suggests 37 waste truck trips across the Harbour Bridge per day under the BAU scenario. In contrast, this number will rise to about 150 truck trips per day if Redvale's North Shore waste volume is diverted to Whitford Landfill and Hampton Downs Landfill.

Table 8 Increases in waste truck trips per day across the Harbour Bridge under the 'Redvale closes' scenario

Number of waste truck trips, per day

Scenario	AM trips	Mid trips	PM trips	Total
BAU scenario	7.4	20.0	9.6	37.0
Redvale closes	26.0	73.3	50.9	150.2
Difference	18.6	53.4	41.3	113.2

Note: These are the daily averages over 250 normal days of the financial year 2024/25.

Source: WMNZ and NZIER

3.3.3 Annualised changes in travel times for other road users

Table 9 summarises the annualised changes in travel times for other road users across Auckland.

Some routes currently used by trucks transporting waste to Redvale landfill will become less congested when those waste trucks are diverted to Whitford Landfill and Hampton Downs Landfill. This will result in travel time offsets for other road users on those routes, given the reduction in travel times. However, these offsets are much smaller than the increases in travel times elsewhere, resulting in a net increase in aggregate travel times on the Auckland transport network.

Our transport modelling suggests a significant net increase in travel times for other road users across Auckland, with those in central, east and south Auckland particularly affected.



The increased number of waste truck trips over the Harbour Bridge to and from Whitford Landfill and Hampton Downs Landfill will affect both southbound and northbound traffic.

Compared with the BAU scenario, we estimate that diverting waste truck routes to Whitford Landfill and Hampton Downs Landfill if Redvale Landfill is required to cease accepting waste, will result in a net increase in travel time of over 1.9 million hours per annum for other road users across Auckland.

Table 9 Annualised changes in travel times for all other road users in Auckland

Changes relative to the BAU scenario, annualised hours

Change	Cars	LCVs	MCVs + HCVs	Total
Increases in travel times	2,905,999	37,854	6,694,824	3,638,667
Travel time offsets	-1,353,715	-31,184	-316,298	-1,701,197
Net increase	1,552,285	6,661	378,524	1,937,470

Note: We applied an annualisation factor of 250.

Source: NZIER



4 CGE modelling results

To translate the estimated net congestion impact into the Auckland economy, we applied our transport modelling outputs to the economy's industry structure within our CGE model database and followed the steps described in section 2.2.2. The direct impacts on relevant industries were then applied as productivity shocks in our CGE model to estimate the resulting economic impacts.

4.1 Impact on supply chain efficiency

Table 10 shows the changes in travel-time costs for road freight using MCVs and HCVs, and for construction services and postal and courier services using LCVs.

Our transport modelling suggests that travel times will be longer for supply chain industries travelling in central, east and south Auckland. Aggregating the net changes in travel times across Auckland, our calculation indicates that the direct impact is much larger for road freight than for construction services and postal and courier services. Relative to the BAU scenario, travel time for road freight trips in Auckland is estimated to increase by over 368,000 hours in total, on an annual basis. This will result in an additional annualised travel time cost for road freight of over \$42 million. The estimated changes in travel time costs presented in this report have been adjusted to 2028 values, the year when Redvale Landfill's current consent to accept waste ceases to exist.

Table 10 Estimated net increases in travel time costs for supply chain industries

Annualised changes, relative to the BAU scenario

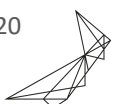
	Increase in travel time (hours)	Increase in cost of travel time (\$million)
Road freight	368,090	\$42.5
Construction services	2,877	\$0.3
Postal and courier services	322	\$0.03

Source: NZIER

Longer travel times for the supply chain industries will make moving goods and supplies less efficient. This is captured in our CGE model as negative shocks to the productivity of labour and the capital stock of those industries. The negative productivity impact is larger for road freight than for construction services and postal and courier services, because road freight is used by both export-oriented and other industries to deliver goods to purchasers. Higher road freight costs will lead to higher prices and lower demand for goods produced in more congested areas of Auckland, which, in turn, will reduce industry output and labour demand in those areas.

Our CGE model estimates a \$137 million reduction in Auckland's annual GDP due to a less efficient supply chain compared with the BAU scenario.

Inter-regional trade from the rest of New Zealand to Auckland's more congested areas will also be negatively affected. However, some of this is offset by gains in export-oriented industries in the rest of New Zealand. As Auckland becomes more congested, supply chain activity in Auckland decreases, and resources are reallocated to other regions, thereby



increasing supply chain activity there. This explains why the impact on New Zealand GDP is less negative than that on Auckland. Overall, the net impact on the New Zealand economy from diverting waste to Whitford Landfill and Hampton Downs Landfill is still negative.

Applying an 8 percent discount rate in line with Treasury's guidance,¹⁶ the economic impact of reduced supply chain efficiency amounts to a \$790 million reduction in Auckland's GDP and a \$590 million reduction in New Zealand's GDP over an 8-year period.

Table 11 Estimated impact of reduced supply chain efficiency on real GDP

Changes relative to the BAU scenario

Region	Annual impact (\$ million)	Annual impact (%)	8-year NPV @ 8% discount rate (\$ million)
Auckland	-137.5	-0.08%	-789.9
New Zealand	-102.8	-0.02%	-590.5

Source: NZIER

4.2 Impact on productivity and operational costs of waste services

Our transport modelling suggests that diverting waste truck routes to Whitford and Hampton Downs adds 63,178 hours of travel time for waste trucks across north, west, central and east Auckland, compared with the BAU scenario. This is associated with a \$7 million increase in the annual cost of travel time for Auckland's waste services industry for landfill disposal.

Table 12 Estimated net increase in travel time for waste services

Annualised changes, relative to the BAU scenario

Increase in travel time (hours)	Increase in cost of travel time (\$ million)
63,178	7.2

Source: NZIER

Longer travel times to landfills make Auckland's waste services industry less efficient, requiring more labour and capital to transport the same volume of waste. In our CGE model, this represents a decrease in the productivity of labour and capital in the waste services industry. This increases the costs of labour and capital for waste services and for other Auckland industries that rely on waste services.

It is estimated that the productivity loss resulting from diverting waste to Whitford Landfill and Hampton Downs Landfill reduces Auckland's annual GDP by \$37 million relative to the BAU scenario. The impact on the New Zealand economy is less severe, with a \$24 million reduction in national annual GDP. This reflects increased activity in other regions, driven by

¹⁶ As per Treasury's (2025) guidance on discount rate for commercial proposals [https://www.treasury.govt.nz/information-and-services/public-sector-leadership/guidance/reporting-financial/discount-rates#:~:text=Non%2Dcommercial%20proposals%20\(SRTP\),review%20to%20be%20in%202027.](https://www.treasury.govt.nz/information-and-services/public-sector-leadership/guidance/reporting-financial/discount-rates#:~:text=Non%2Dcommercial%20proposals%20(SRTP),review%20to%20be%20in%202027.)



reduced demand and output in Auckland, which partially offsets the negative impact on Auckland's economy.

Table 13 Estimated impact of productivity loss in waste services on real GDP

Changes relative to the BAU scenario

Region	Annual impact (\$ million)	Annual impact (%)	8-year NPV @ 8% discount rate (\$ million)
Auckland	-36.8	0.02%	-211.7
New Zealand	-24.0	<0.01%	-137.9

Source: NZIER

Based on our transport modelling, the annualised distance travelled by waste trucks across Auckland will also increase by 4,660,660 km as a result of diverting waste truck routes to Whitford Landfill and Hampton Downs Landfill. This will increase demand for Auckland's waste services industry for inputs such as diesel, rubber tyres, and repair and maintenance services to operate the waste trucks. Depreciation of waste trucks will also increase.

Based on the MBCM's breakdown of VOC and the intermediate input use of waste services in our CGE database, we estimate an increase of more than \$5 million in annualised VOC for Auckland's waste services industry.

Table 14 Estimated net increase in travel distance and operating costs for waste services

Annualised changes, relative to the BAU scenario

Increase in distance travelled (km)	Increase in VOC (\$ million)
4,660,660	5.4

Source: NZIER

The rise in operational costs for waste services leads to higher prices in our CGE model. This has a negative impact on downstream industries that rely on waste services to operate. Consequently, resources, including labour, will be relocated to regions outside Auckland, which in turn increases economic activity in those regions.

Our CGE model estimates that higher operational costs for Auckland's waste services driven by increased waste truck trips to Whitford Landfill and Hampton Downs Landfill will reduce Auckland's GDP by \$18 million per year compared with the BAU scenario. Meanwhile, New Zealand's annual GDP is estimated to fall by \$10 million, with gains in the rest of New Zealand partly offsetting the negative impact in Auckland.



Table 15 Estimated impact of increased operation costs of waste services on real GDP

Changes relative to the BAU scenario

Region	Annual impact (\$ million)	Annual impact (%)	8-year NPV @ 8% discount rate (\$ million)
Auckland	-18.3	0.01%	-105.4
New Zealand	-9.7	<0.01%	-55.7

Source: NZIER

4.3 Impact on agglomeration

Using our transport modelling, we decomposed the annualised travel time for non-freight work and commute trips by vehicle type for both the BAU and the no-Redvale scenarios. We calculate that if Redvale Landfill ceases receiving waste and its waste volume is diverted to Whitford Landfill and Hampton Downs Landfill, this will result in an additional 1,566,181 hours spent in traffic each year on work and commuting trips across Auckland's roading network.

Table 16 Estimated annualised travel time of non-freight work-related and commuting trips by vehicle type

Annualised hours

Type of travel	BAU scenario	Redvale closes	Change in travel time
Work and commute trips by cars	23,429,712	24,981,997	1,552,285
Non-freight-related work and commute trips by LCVs	239,808	243,270	3,462
Commute trips by MCVs and HCVs (excluding waste trucks)	188,394	198,828	10,434
Total	23,857,914	25,424,095	1,566,181

Source: NZIER

We followed the MBCM's guidance to translate this into what it means for the agglomeration of activity across industries in the Auckland economy. As a first step, we calculated the average generalised cost per trip for all non-freight work-related and commuting trips across Auckland. This captures the overall cost of non-freight work-related travel in Auckland and provides an indicator of accessibility between workers and workplaces. Higher travel costs reduce accessibility between workers and workplaces, thereby reducing economic interactions and, consequently, agglomeration in an urban economy.

We calculated an average generalised cost of \$21.56 per trip for the BAU scenario and \$22.98 for the no Redvale scenario. This represents a 6.6 percent increase in the average cost per trip for all non-freight work trips across Auckland.

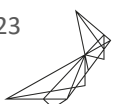


Table 17 Estimated average generalised cost of travel for work-related travel

Average cost per trip, \$

BAU scenario	Redvale closes	Change in average generalised cost per trip
21.56	22.98	6.56%

Source: NZIER

Drawing on the MBCM, agglomeration in an urban area declines as the effective density of employment activity decreases. This is driven by a decline in labour demand and/or an increase in the average generalised cost of work-related travel. Our CGE modelling suggests that in Auckland, labour demand will decrease due to a less efficient supply chain and a less productive waste services industry. Based on this and the estimated change in the average generalised cost per work-related trip, we calculated the effective employment density relative to the BAU scenario. We then estimated the change in productivity for each broad industry category, using the agglomeration elasticities provided in the MBCM.

Table 18 Estimated change in productivity by sector in Auckland from reduced agglomeration

Relative to the BAU scenario, %

Sector	Change in effective employment density	Change in productivity
Agriculture, Forestry and Fishing	-5.57%	-0.18%
Mining	-5.69%	-0.20%
Manufacturing	-5.59%	-0.35%
Electricity, Gas, Water and Waste Services	-3.32%	-0.12%
Construction	-5.33%	-0.31%
Wholesale Trade	-5.42%	-0.48%
Retail Trade	-5.42%	-0.48%
Accommodation and Food Services	-5.42%	-0.31%
Transport, Postal and Warehousing	-4.78%	-0.28%
Information Media, Telecommunications and Other Services	-5.34%	-0.37%
Financial and Insurance Services	-5.36%	-0.48%
Rental, Hiring and Real Estate Services	-5.40%	-0.44%
Professional, Scientific and Technical Services	-5.37%	-0.48%
Administrative and Support Services	-5.41%	-0.48%
Public Administration and Safety	-5.41%	-0.48%
Education and Training	-5.41%	-0.42%
Health Care and Social Assistance	-5.41%	-0.46%
Arts and Recreational Services	-5.39%	-0.29%
Other Services	-5.39%	-0.36%

Source: NZIER



These declines in agglomeration and productivity mean that economic activity will decrease, with output falling across industries in Auckland. Our CGE model estimates a \$431 million reduction in Auckland's annual GDP under the no-Redvale scenario compared with the BAU scenario. With industries in Auckland being relatively less productive and competitive than those in the rest of New Zealand, economic activity will increase in regions outside Auckland. This results in a smaller negative impact, with a \$311 million per annum decrease in national GDP relative to the BAU scenario.

At an 8 percent discount rate, we calculate that the wider economic impact of reduced agglomeration amounts to a total GDP loss of \$2.5 billion for the Auckland economy and \$1.8 billion for the New Zealand economy over an 8-year period. We also estimate the cumulative cost over a seven-year period, as shown in the table below.

Table 19 Estimated impact of reduced agglomeration on real GDP

Changes relative to the BAU scenario

Region	Annual impact (\$ million)	Annual impact (%)	8-year NPV @ 8% discount rate (\$ million)
Auckland	-430.9	0.26%	-2,476.3
New Zealand	-310.8	0.07%	-1,785.9

Source: NZIER

4.4 Total economic impact

Table 20 summarises the wider economic impact on Auckland and New Zealand, as estimated by our CGE model.

If Redvale ceases accepting waste in 2028, diverting its waste volume to Whitford Landfill and Hampton Downs Landfill and increasing congestion on the Auckland roading network will result in a total annual loss of \$623 million (0.4 percent) in Auckland's GDP, and a \$447 million (0.1 percent) annual loss in New Zealand's GDP, compared with Redvale continuing to operate beyond 2028. At an 8 percent discount rate, these impacts amount to a \$3.6 billion loss to the Auckland economy and a \$2.6 billion loss to the New Zealand economy over an 8-year period.

The impact of reduced agglomeration and the associated loss in labour productivity is the greatest, accounting for about 69 percent of the total economic impact. This is because changes to waste trucks' travel routes affect all workers in Auckland who use the roading network to get to their place of work.

The impact of a less efficient supply chain is the second largest, accounting for over 22 percent of the total economic impact. This affects the logistics of all industries that use road freight to move their traded goods between Auckland and the rest of the country. The productivity and operational cost impacts of waste services affect fewer industries and therefore have a much smaller flow-on economic impact.



Table 20 Estimated wider economic impact on Auckland and New Zealand

Changes relative to the BAU scenario, \$ million

Impact	Auckland		New Zealand	
	Annual GDP	8-year NPV	Annual GDP	8-year NPV
Supply chain efficiency	-137.5	-789.9	-102.8	-590.5
Productivity and operational costs of waste services	-55.2	-317.2	-33.7	-180.7
Agglomeration	-430.9	-2,476.3	-310.8	-1,785.9
Total	-623.4	-3,582.4	-447.2	-2,569.7

Note: Totals may not sum exactly due to rounding.

Source: NZIER

Appendix C sets out the estimated impact on the output of each industry included in our CGE modelling.

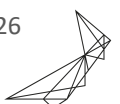
5 Concluding comments

If Redvale Landfill ceases to accept waste, its waste volume will need to be diverted to alternative landfill sites. If the waste is diverted to Whitford Landfill and Hampton Downs Landfill (notwithstanding the consenting impediments), there will be substantial congestion and delays across Auckland. We estimate that this change in waste truck routes will result in a net increase of about 1.9 million hours of travel time for traffic across the Auckland roading network per year. Road users in central, east and south Auckland are expected to be particularly affected, as there will be a large increase in waste truck trips across the Auckland Harbour Bridge and alternative routes. The Harbour Bridge connects the North Shore and the rest of Auckland and is a significant choke point in the Auckland roading system.

Our CGE modelling results indicate that changes to waste truck routes and increased congestion arising from Redvale Landfill ceasing to accept waste and the diversion of that waste to Whitford Landfill and Hampton Downs Landfill will have significant economic impacts on Auckland and New Zealand. We estimate the following:

- a \$624 million decrease in Auckland's annual GDP, which cumulates to an economic loss of \$3.6 billion over an 8-year period.
- a \$447 million decrease in New Zealand's annual GDP, cumulating to a \$2.6 billion loss to the national economy over an 8-year period.

The wider economic impact occurs mostly through reduced agglomeration, the associated loss in labour productivity, and reduced supply chain efficiency. Changes in the travel routes of waste trucks and trip diversions mean the net increase in congestion across Auckland's roading network will affect all workers who travel on the roads. Increased



congestion on Auckland's roading network will also affect the logistics of all industries that use road freight to move goods and supplies across Auckland and the rest of New Zealand.

The wider economic impact is less negative for New Zealand as a whole than for Auckland. This is because some regions outside Auckland will experience economic gains, as resources and economic activity will be reallocated to other regions with more productive opportunities, given the increased congestion in Auckland. Overall, the impact is negative for both Auckland and the New Zealand economy. It is also important to note that the results of this assessment and those from NZIER's high-level economic modelling of the economic costs of transporting waste from Auckland to alternative landfill sites are not additive.

This wider economic impact assessment, using CGE modelling, examines changes to waste truck routes and their impact on congestion across the broader Auckland roading network, and, from that, the flow-on impact across different industries in the Auckland and New Zealand economies. Our previous economic modelling captured the impact of increased transport costs if WMNZ were to divert Redvale's waste to alternative landfills when its consent required landfilling operations to cease. We modelled these direct transport costs based purely on changes in vehicle kilometres travelled by the waste trucks, which are ultimately borne by Aucklanders as a cost of landfill disposal.

Our findings indicate that the closure of the Redvale Landfill site will impose significant costs on the wider economy, given the increased congestion on the Auckland transport network. These costs reflect the deterioration in productivity across many industries, driven by travel-time delays for different types of road users.



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Appendix A NZIER's regional CGE model

General equilibrium analysis using a purpose-built CGE model is our preferred method for assessing economic impacts and is widely used in New Zealand and internationally. CGE models have in common constraints on the supply side, consumer budgets, the availability of inputs to production and a price adjustment mechanism as a rationing response, given that factors of production are not limitless. This complex quantitative methodological approach overcomes shortcomings of alternative methodologies that make them inappropriate for economic impact analysis.¹⁷

A CGE model consists of equations which describe model variables and is calibrated using detailed data on the structure of the economy based on Stats NZ's Input-Output tables that are consistent with these model equations. This data provides a snapshot of the economy in a particular year, which serves as a baseline (or BAU) against which to compare policy simulations or economic changes.

The model data are linked through a set of equations which capture how the economy responds to external changes. These equations are based on neoclassical assumptions that govern the behaviour of the model's economic agents and ensure that supply and demand for goods, services, and factors of production in the economy are balanced. They also determine how firms and households respond to changes in the relative prices of factors of production and intermediate inputs.

Using actual economic data, CGE models estimate how the regional or national economy reacts to major projects or changes in policy, technology or other external factors. CGE models are useful whenever we wish to estimate the effect of changes in one part of the economy on the rest of the economy.

CGE models are not only driven by prices that respond to changes in supply and demand, but they also account for resource constraints and flow-on effects. That is, in a CGE model, there are no "free lunches".

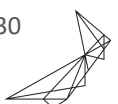
CGE models have in common constraints on the supply side, consumer budget, the availability of inputs to production and a price adjustment mechanism as a rationing response, considering that factors of production are not limitless.

Our CGE model: TERM-NZ

We used our NZ-TERM ('The Enormous Regional Model') CGE model of the New Zealand economy and its regions for this economic impact analysis. NZIER's NZ-TERM has been built in consultation with CGE modelling experts at the Centre of Policy Studies (CoPS), which is based at Victoria University, Melbourne.

TERM-NZ is a bottom-up CGE model. It is based on Stats NZ's Input-Output table that identifies the structure of the industries involved. TERM-NZ contains information on 206 industries, 206 commodities, and 15 New Zealand regions, which can be further split into 67 Territorial Authorities and 21 Auckland local boards. To estimate the effect of some change (referred to as a 'shock'), the modeller:

¹⁷ More details about the shortcomings and limitations of alternative approaches for economic impact assessment such as Input-Output multipliers can be found on the Australian Bureau of Statistics website under the following link: <https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-input-output-tables/2019-20>.



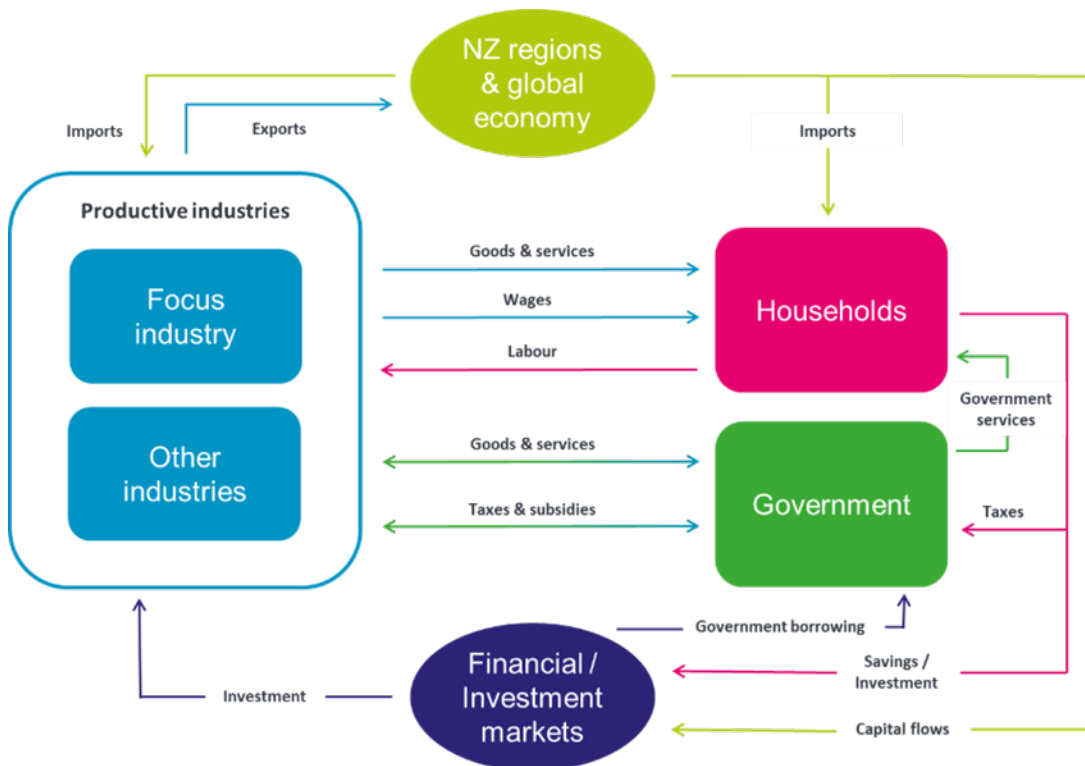
- specifies a starting position for the economy based on data in which supply is equal to demand in all markets (known as being 'in equilibrium'),
- changes parts of the data to reflect the shock and then,
- using a highly detailed model of the economy and specialised software, determines what needs to happen to return the economy to a new equilibrium.

The difference between the old and the new equilibrium can then be analysed to determine the effect of the shock on a range of economic indicators, like GDP, employment, wages and living standards, i.e. private consumption.

In the TERM-NZ model, each of the fifteen regions is modelled as its own economy, but all the regions are linked via inter-regional trade and flows of capital and labour. National results can be shown by the summation of the regional results.

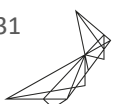
A visual representation of TERM-NZ is shown in Figure 7. It highlights how the model can capture the complex, multidirectional relationships among the various parts of each regional economy and how they interact with the rest of New Zealand and the rest of the world.

Figure 7 Our CGE model represents the circular flows between all the agents and activities in the economy



Source: NZIER

A CGE model estimates opportunity costs (between action and inaction), winners and losers. Resources are limited. It also considers the price impacts of shocks and can capture regional linkages between industries as well as spillover effects.



NZIER's CGE models are highly regarded amongst government agencies with whom we have worked to conduct policy analysis or sectoral impact studies. This includes MBIE, The Treasury, the Ministry of Foreign Affairs and Trade, the Ministry for Primary Industries and the Ministry for the Environment.

For this analysis, and to improve computational efficiency, the sectors and regions in the CGE model database have been grouped into 41 broader industries and six regions. The six regions include the north, west, central and east, and south Auckland sub-regions, which are grouped based on the locations of the Auckland local boards and the haulage routes for disposal of Auckland's waste. This allows us to look at what increased waste truck trips to Whitford and Hampton Downs mean for different parts of the Auckland roading network, and, from that, the flow-on economic impacts.



Appendix B Industry description

Table 21 Industry description

Industry	Description
Retail & wholesale margin	Margin on sales of goods for resale for the retail, accommodation and food services industries; margin on sales of goods for resale for the wholesale trade industry
Agriculture, forestry, fishing	Agricultural forestry fish service, crustaceans, fish, forestry, other animal products, wool, dairy cattle, pigs, deer, other livestock, cattle, sheep, cereals, forage products, fibres, sugar crops, unmanufactured tobacco, other fruit and nuts, citrus fruit, stone fruit, berry fruit, grape, pome fruit (apples, pears), kiwifruit, vegetables, living plants, buds, seeds, spice, and aromatic crops
Mining	Services incidental to mining and manufacturing, precious metals and stones, chemical, fertiliser minerals, salt, gypsum, limestone, cement, building stone, iron ores, non-ferrous metal ores, and concentrates, natural gas, crude petroleum, coal
Food manufacturing	Wines, spirits and tobacco products, beer, soft drinks, and fruit juices, macaroni and noodles, bakery products, animal feed, starches, grain products, animal and vegetable oils and fats, prepared fruit and nuts, prepared vegetables, other dairy products, milk and cream in solid or processed liquid form, prepared fish, bacon and ham products, smallgoods, meat and offal
Textile	Clothing, knitted fabrics and footwear, carpets, tanned skins and leather; handbags and articles of leather, other textiles, woven fabrics, yarn and thread, natural and man-made textile fibres
Wood products	Wood containers and other wood products, building joinery, panels, boards, veneer sheets, and plywood, wood
Pulp, paper etc	Pulp, paper, and paperboard
Printing	Newspapers and journals, books and other printed material
Petroleum	Other petroleum products, petrol
Diesel	Diesel
Chemical products	Soap and perfumes, pharmaceutical products, plastics in primary forms, fertilisers and pesticides, basic chemicals; other paper and paperboard products; other chemical products and man-made fibres
Polymers & Rubber	Other plastics products, packaging products of plastics, semi-manufactures of plastics, rubber, paints
Rubber tyres	Rubber tyres and tubes
Non-metallic mineral products	Concrete, and other non-metallic mineral products, non-structural ceramic ware and clay products, glass and glass products
Wastes and scraps	Wastes and scraps, including non-metal wastes and scraps produced in manufacturing processes
Primary metal	Basic iron, steel, and other metals
Metal product	Weapons and ammunition; accumulators, primary cells, and batteries, metal containers and steam generators, prefabricated buildings, structural metal products, steel products, semi-finished metal products
Transport equipment	Aircraft and spacecraft, other transport equipment and parts, ships, pleasure, and sporting boats, motor vehicles, trailers, and semi-trailers; bodies (coachwork)



Industry	Description
Machinery	Machinery for food production, machinery for mining, other special-purpose machinery, agricultural and forestry equipment, general industrial machinery, engines, photographic and scientific equipment, medical equipment, television, cameras, and other electronic goods, other electrical equipment and parts thereof, electric motors, generators, and transformers, computers, parts, and office machinery, domestic appliances
Furniture and other	Games and toys, sports goods, jewellery, furniture
Electricity, Gas, Water	Sewerage services, water, gas, electricity transmission and distribution, electricity generated by wind, electricity generated by hydro, electricity generated by geothermal, electricity generated by gas, electricity generated by coal
Waste collection, treatment and disposal services	Waste disposal, recycling and environmental protection services
Construction	Civil engineering services, non-residential building construction, residential building construction
Construction services	Land and land improvements, building completion work, plumbing and other installation services, electrical installation work, other installation work, pre-erection work
Accommodation & food services	Beverage services, takeaways, meal services, accommodation
Road freight	Road transport freight services
Road transport	Road passenger transport
Other transport	International flight, air passenger transport, air transport freight services, passenger transportation by waterborne vessels, sea transport freight services, railway passenger transport, railway transport freight services
Tourism	International tourism, export tourism, domestic tourism, travel arrangement and sightseeing transportation services
Postal and courier services	Postal and courier services
Storage and warehousing	Storage and warehousing services, supporting transport services
Information & Telecommunications	News agency, library, and archive services, internet telecommunications services and online content, telecommunications services, broadcasting, programming, and programme distribution services, motion picture, radio, tv services, packaged software, tapes, audio, and video records, publishing, printing, and reproduction services
Financial & Insurance	Services auxiliary to financial services, superannuation and individual pension services, other insurance services, life insurance, financial intermediation services
Rental & real estate services	Owner - occupied dwellings, other real estate services, leased commercial property services, leased residential property services, equipment hire services
PSTAS services	Other support services, cleaning, placement and supply of personnel, it technical consulting and support services, it infrastructure provisioning and network management, it design and development related services, advertising and marketing services, accounting and taxation services; management consultancy, legal services, other business services, architectural and engineering services, research and development, capitalised



Industry	Description
	exploration, intellectual property licensing services, computer software and services
Health	Other social services, childcare services, aged accommodation, other health care, ambulance, other allied, optician physio chiropractor, dental, pathology, specialist md, general practitioners, hospital and nursing care, veterinary services
Public administration	Investigation and security services, central government administration services, local government administration services
Education	Other education services, higher education, secondary education, primary education, preschool education
Arts & Recreation	Gambling services, sport and recreation services, libraries, museums, and art
Maintenance	Maintenance of domestic and office equipment; maintenance of transport machinery and equipment; maintenance of other equipment
Other services	Education export, other personal and community services

Source: NZIER



Appendix C Detailed CGE modelling results

Table 22 Estimated annual impact on industry output

Changes relative to the BAU scenario, %

Industry	Auckland	Rest of North Island	Rest of New Zealand	New Zealand
Retail & wholesale margin	-0.38	0.05	0.10	-0.12
Agriculture, forestry, fishing	-0.84	0.08	0.10	0.06
Mining	-1.31	0.12	0.18	0.03
Food manufacturing	-0.90	0.19	0.16	-0.05
Textile	-1.06	0.08	0.02	-0.42
Wood products	-0.82	0.18	0.16	-0.00
Pulp, paper etc	-1.31	0.31	0.60	-0.27
Printing	-1.06	0.42	0.38	-0.53
Petroleum	-0.60	-0.01	0.10	-0.08
Diesel	-0.01	0.14	0.14	0.14
Chemical products	-1.13	0.34	0.34	-0.35
Polymers & Rubber	-1.41	0.64	0.71	-0.50
Rubber tyres	-0.69	0.32	0.37	-0.08
Non-metallic mineral products	-0.71	0.25	0.21	-0.15
Wastes and scraps	-1.41	0.19	0.21	-0.43
Primary metal	-0.86	0.21	0.24	-0.71
Metal product	-0.86	0.23	0.24	-0.14
Transport equipment	-0.80	0.13	0.17	-0.19
Machinery	-0.92	0.30	0.31	-0.27
Furniture and other	-0.83	0.20	0.20	-0.26
Electricity, Gas, Water	-0.56	0.01	0.05	-0.06
Waste collection, treatment and disposal services	-0.81	0.02	0.08	-0.26
Construction	-0.16	0.05	0.13	-0.01
Construction services	-0.20	0.05	0.12	-0.01
Accommodation & food services	-0.53	0.02	0.10	-0.15
Road freight	0.20	0.23	0.23	0.22
Road transport	-0.41	-0.03	0.06	-0.13
Other transport	-0.37	-0.03	0.03	-0.20
Tourism	-0.51	-0.07	0.04	-0.26
Postal and courier services	-0.45	0.03	0.10	-0.16
Storage and warehousing	-0.34	0.10	0.13	-0.11



Industry	Auckland	Rest of North Island	Rest of New Zealand	New Zealand
Information & Telecommunications	-0.25	-0.00	0.05	-0.14
Financial & Insurance	-0.27	0.01	0.08	-0.11
Rental & real estate services	-0.24	-0.00	0.11	-0.06
PSTAS services	-0.33	0.05	0.10	-0.13
Health	-0.21	-0.08	0.03	-0.09
Public administration	-0.21	-0.06	0.02	-0.08
Education	-0.30	-0.07	0.03	-0.13
Arts & Recreation	-0.23	-0.08	0.02	-0.12
Maintenance	-0.36	0.03	0.09	-0.08
Other services	-0.86	-0.01	0.07	-0.29

Source: NZIER

