Appendix F NERA Economics Assessment

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Effect on landfill gate prices of Redvale closing before Auckland Regional Landfill opens

Report for Russell McVeagh

14 November 2025

Project Team

James Mellsop
Thomas Logchies

NERA
Level 11
15 Customs Street West
Auckland 1010, New Zealand
www.nera.com

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1. Introduction

1.1. Instructions

1. Waste Management (**"WMNZ"**) owns and operates the Redvale Landfill at Dairy Flat, in north Auckland. Redvale Landfill is required to stop accepting waste after December 2028. WMNZ is seeking new consents under the Fast-track Approvals Act 2024 (if successfully referred) to enable the ongoing operation of the Redvale Landfill until the new Auckland Regional Landfill (**"ARL"**) that WMNZ is developing in Wayby Valley (north of Auckland) is operational and accepting waste in the mid-2030s.
2. We have been asked to estimate the effect on landfill gate prices if Redvale closes before the ARL opens. More specifically, we estimate the difference in landfill gate prices between two scenarios:
   A. The scenario in which WMNZ is successful in obtaining new resource consents for Redvale and Redvale continues operation at its current site until the ARL is estimated to open in mid-2030s (we refer to this as **"the Factual",** because it is the scenario WMNZ is seeking approval for); and
   B. The scenario in which Redvale will stop accepting waste after December 2028, when Redvale is currently required to cease accepting waste under its existing consent, up until the ARL opens in the mid-2030s (we refer to this as **"the Counterfactual"**, because it is the scenario that would occur if WMNZ is not successful in obtaining new resource consents for Redvale).[1]

1.2. Conclusions

3. We would expect landfill gate prices at the nearby landfills (i.e. Whitford, Hampton Downs and Puwera landfills) to be materially higher under the Counterfactual than under the Factual, because:
   A. The annual demand for landfill waste disposal from the Auckland area is likely to materially exceed the available annual capacity of the three remaining nearby landfills under the Counterfactual, only one of which is in the Auckland region itself;[2] and
   B. There are very high barriers to building a new landfill within the relevant timeframe and even expansion of existing landfills is likely to be difficult.

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1 Given that in the absence of the application for fast track approval Redvale will stop accepting waste in December 2028, it might be more natural to define the closure scenario as the factual. However, given we are analysing the effective continuation of the status quo against closure, we treat the effective continuation of the status quo as the factual. In treating what is being applied for as the factual, our approach is analogous to how the Commerce Commission refers to a merger proposal as the factual, which the Commission then compares to the market structure if the merger did not occur (the counterfactual). Analytically our results would be the same if we switched nomenclature.

2 It is worth noting that in this report, we refer to capacity in relation to what each landfill is consented for, rather than the physical airspace that each landfill has.

4. With the information available, accurate estimates of the likely price increases are difficult to make. Using simplistic methodologies, we estimate a range of 10% to 83.3%. These results are summarised in Table 1 below.

Table 1: Estimated range of price increases

Methodology	Estimated Counterfactual price ($ per tonne)	Estimated Counterfactual price increase compared to Factual price of $144.51 per tonne
Building on previous Commerce Commission analysis (see section 4.2.3 below)	$158.96 to $166.18	10-15%
Cournot modelling (see section 4.2.1 below)	$187.11	29.5%
Using calibrated demand curve where quantity is set at capacity (see section 4.2.2 below)	$264.84	83.3%

5. Even the bottom end of this estimated range of price increases (10-15%) should be regarded as a material price increase. Competition regulators (including the Commerce Commission) would generally consider a price increase of this magnitude arising from a transaction (such as a merger) as constituting a substantial lessening of competition.
6. Furthermore, we think the economic features of the Auckland landfill market outlined at [3] above imply that we should expect a materially higher price increase than the bottom of our range.
7. While there are important caveats to our Cournot modelling and use of the calibrated demand curve, these methodologies are corroborative of a materially higher price increase than is suggested by our Commerce Commission precedent methodology.
8. Indeed, we think it is plausible to expect price increases of around 30%, which is the level implied by our Cournot modelling and is well below that implied by our use of the resulting demand curve.
9. It might be that we would observe more demand response by the time prices get to this level, and perhaps expansion by one or more of the landfills. However, both demand response and expansion would take time. Due to the barriers already discussed, it is difficult to see expansion occurring until well into the Factual period.
10. The price increases we are estimating are those at the gates of the Whitford, Hampton Downs and Puwera landfills. These gate price increases (particularly those at Hampton Downs and Puwera) would likely affect Northland, Waikato and Bay of Plenty users of landfills to some extent, as well as Aucklanders.
11. The price increases we are estimating are those at the gates of the Whitford, Hampton Downs and Puwera landfills. These gate price increases (particularly those at Hampton Downs and Puwera landfills) would also likely affect Northland, Waikato and Bay of Plenty users of landfills to some extent, as well as Aucklanders.

12. These price increases would apply to the waste that can be accepted by the three remaining landfills under the Counterfactual, which on our assumptions would be just over 1,000,000 tonnes.[3] So, for these tonnes at say a price increase of approximately 30% (or $42.60 per tonne), $42,600,000 extra would be paid per year to dispose of this waste, at least until some sort of response occurred.[4]

13. Something else would need to be done with the other approximately 400,000 tonnes.[5] Whatever that is (be it reduction in waste-producing economic activity, more sorting, fly tipping, etc), that would also have a cost. Given the magnitude of the tonnes (almost 30% of Auckland's tonnes), that cost would be material.

14. While the focus of our assessment is on the landfill gate price and quantity effects, from that perspective it is reasonable to conclude that keeping the Redvale landfill open until the ARL is operational and accepting waste would have significant regional benefits for Auckland and likely Northland, Waikato and Bay of Plenty as well.

2. The Factual

2.1. Overview of market structure

15. The Factual can also be seen as a continuation of the status quo, with Auckland landfill waste being received by Redvale, Whitford, Hampton Downs and Puwera. It is estimated that Auckland currently produces 1.45 million tonnes of landfill waste each year.[6] This estimate is based on 2023 projections by Auckland Council. As shown in Figure 1, these projections estimate a gradual increase in waste over time, with approximately 1.7 million tonnes per year by 2040.[7] To be conservative, we assume the annual waste to landfill would remain constant at 1.45m per annum.

3 Using capacities as stated in Table 2, the combined capacity of the Hampton Downs, Whitford and Puwera landfills are estimated to be approximately 1,037,469 tonnes per annum.

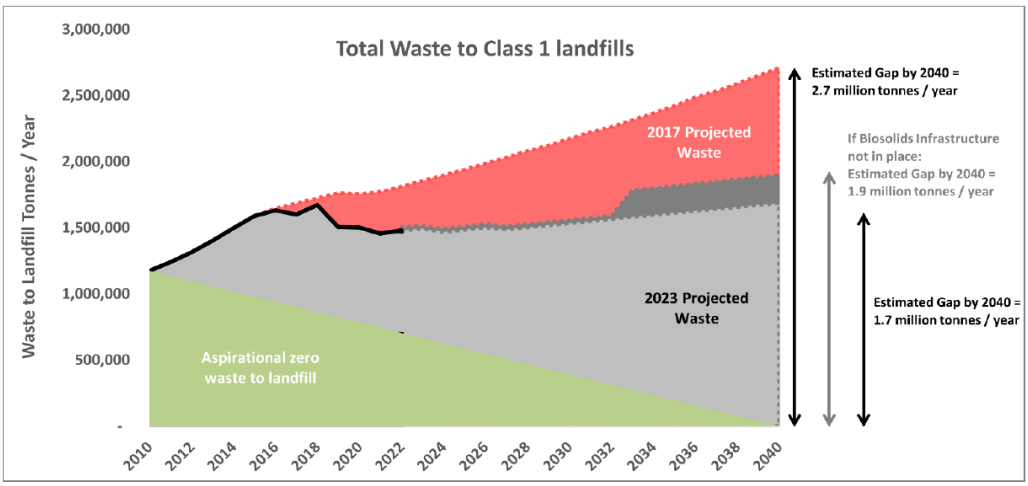
4 We assume all landfills are run on a profit maximising basis.

5 The approximately 400,000 tonnes of excess waste is estimated by subtracting the estimated counterfactual annual capacity from annual demand. See Table 4 for specific values.

6 See Auckland Council, Waste Minimisation and Management Plan 2024: Towards Zero Waste, 2024, ("Auckland Council 2024 Waste Management Plan"), p. 8. This Auckland Council report notes that more than 28,000 tonnes of waste is produced per week. Note that other possible values include a 2022 estimate of approximately 1.48m tonnes from the Auckland Council's 2023 waste assessment (Auckland Council, Auckland's Waste Assessment 2023, November 2023, p.39).

7 Auckland Council 2024 Waste Management Plan, p. 51.

Figure 1: Estimated and projected annual waste from Auckland going to landfills



Source: Auckland Council, Waste Minimisation and Management Plan 2024: Towards Zero Waste.

16. Current volume and capacity estimates for each of the four landfills receiving Auckland waste are shown in Table 2, followed by a brief overview of each landfill, and the locations of the landfills surrounding Auckland are shown in Figure 2.

Table 2: Factual volumes and capacities in tonnes (present day estimates, assumed to continue under the Factual)

Landfill	Annual Capacity available to accept Auckland waste	Capacity Market shares (%)	Annual Volume (from Auckland)	Volume Market shares (%)
Redvale	639,671	38%	577,906	40%
Whitford	350,000	21%	217,643	15%
Hampton Downs	600,000	36%	600,000	42%
Puwera	87,469	5%	50,000	3%
Total	**1,677,140**		**1,445,549**	

Source: See the below paragraphs for the sources of these values

A. **Redvale**: owned by WMNZ, Redvale is currently one of the landfills receiving a significant amount of waste from Auckland, which we estimate as having approximately 40% of the market share. Located in Dairy Flat, approximately 30km north of Auckland's CBD, it also has a locational advantage being among the closest landfills to Auckland's CBD.[8] In FY25, Redvale is budgeted to receive 577,906 tonnes.[9] Information provided by WMNZ indicates it may have an annual capacity of approximately 640,000 for 2025.[10] However, as we

8 Straight line distance is about 25km, and 30km via roads (https://maps.app.goo.gl/9PCHMnaVZfwHzn3E8)

9 Waste Management, Redvale Tonnage disposal locations post RV.xlsx, received 18 June 2025, cell B42

10 Waste Management, RDV 22-25 Tonnes and Rev summary.xlsx, received 18 June 2025, cell F16. We also understand that annual tonnage at Redvale has been above 800,000 tonnes in the past.

understand it, Redvale's resource consents do not have restrictions on the annual intake, but Redvale is instead constrained by its total remaining capacity and the scope of its existing consents - we understand there are approximately 2.06 million cubic metres of airspace remaining.[11] Based on the current market volumes and the expected demand for landfill capacity in Auckland, it is necessary for Redvale Landfill to receive at least 600,000 tonnes per annum to ensure expected demand is adequately met.

Because Redvale exits the market under the Counterfactual, whether Redvale has an annual capacity does not impact the results of our analysis.

B. **Whitford:** This landfill is a 50:50 joint venture between Auckland Council and WMNZ.[12] We understand that Whitford's pricing decisions are made by the joint venture manager, acting independently from WMNZ and the Council. Therefore, our analysis assumes Whitford's pricing is set independently of that at Redvale. Whitford is located approximately 30km southeast of Auckland's CBD,[13] and received approximately 217,000 tonnes of waste from Auckland in 2024 (15% market share by volume).[14] Current designation conditions limit waste intake for Whitford to 350,000 tonnes a year and 155 trucks per day.[15]

C. **Hampton Downs**: owned by Enviro NZ, this landfill is located in North Waikato, approximately 70km south of Auckland's CBD.[16] Hampton Downs is estimated to take approximately 800,000 tonnes of waste a year.[17] While a portion of this capacity is used to service the Waikato and Bay of Plenty regions, Hampton Downs also receives waste from Auckland. The information on what proportion of Hampton Down's waste originates from Auckland is limited, but estimates show that it is likely in the range of 600,000, with 200,000 tonnes assumed to originate from the Waikato and Bay of Plenty regions.[18] Capacities outlined in Hampton Down's 2023 application to renew its regional consents were assessed on an acceptance rate of 800,000 tonnes per year.[19] Given Hampton Downs is estimated to currently take 800,000 tonnes annually, we assume that it would not be able to take any additional waste from Auckland following Redvale's closure without obtaining new resource consents. (We analyse an alternative assumption in the addendum to this report.)

D. **Puwera:** Also known as the Northland Regional Landfill, this landfill is a 50:50 joint venture between Northland Waste and the Whangarei District Council.[20] Puwera is estimated to

11 We understand that the fast track consent application would include an increase to this airspace.

12 Auckland Council 2024 Waste Management Plan, p.45

13 Straight line distance is about 23km, and 30km via roads (https://maps.app.goo.gl/HRzUAEFYpm1GwANp9)

14 Waste Management, WDS 22-25 Tonnes and Rev summary.xlsx, received 18 June 2025, "WDS 22-25 Tonnes Summary", cell D15.

15 T+T Assessment of Alternatives, p.13.

16 Straight line distance is about 64km, and 70km via roads (https://maps.app.goo.gl/Nbau1n3uNwCdkMjW8)

17 T+T Assessment of Alternatives, p.14.

18 This is obtained from Tonkin+Taylor's report which references the Auckland Council's 2017 waste assessment report allocating approximately 600,000 tonnes a year to Hampton Downs from Auckland (T+T Assessment of Alternatives, p.14, footnote 9).

19 Hampton Downs Landfill – Resource Consent Application, 28 June 2023, sections 2 & 15

20 Whangarei District Council, Northland Regional Landfill Limited Partnership Statement of Intent and Business Plan 2022/23, 2022, A.5.1.

receive approximately 100,000 tonnes of waste per annum,[21] and while it is not clear what proportion originates from the Greater Auckland region, estimates by Tonkin & Taylor Ltd list the volume to be approximately 50,000 tonnes, representing 3% of the total Auckland market volume.[22] A potential reason why it is not a common alternative could be is its distance to Auckland relative to other landfills, being approximately 175km from Auckland's CBD.[23] This would likely lead to significantly higher transportation costs, making it a less desirable destination. Puwera is estimated to have approximately 2,500,000 cubic metres of air space remaining as of June 2024, but it is unclear whether Puwera's consents outline any annual capacity constraints.[24] However, due to its current waste intake being much smaller compared to other landfills, we assume that any excess annual capacity would be relatively small. As an estimate, we use analysis from WMNZ, which assumes that following Redvale's closure, Puwera would take over some of Redvale's volumes, mostly comprising of waste from Puwera's operator Northland Waste. WMNZ estimates this to be approximately 37,500 tonnes which, when added to Puwera's estimated current intake from Auckland, would lead to a total capacity available to Auckland of approximately 87,500.[25]

17. It is important to note that in our subsequent analysis we assume that neither Hampton Downs nor Puwera would allocate more capacity under the Counterfactual than the Factual to Auckland waste (at the expense of capacity allocated to Waikato/Bay of Plenty and Northland respectively). We think a more likely outcome is that as demand for their services rises in light of the closure of Redvale, Hampton Downs and Puwera would raise their prices to all customers, regardless of waste origin. In other words, the closure of Redvale would increase prices to Northland, Waikato and Bay of Plenty users of landfills, as well as Aucklanders. Accordingly, the price increases we explain below would likely apply (at least to some degree) to Waikato, Bay of Plenty and Northland waste as well as to Auckland waste.
18. However, we include analysis that does not account for capacity constraints, which assumes landfills will take the profit maximising waste from Auckland regardless of their volume from other regions. This analysis leads to similar conclusions compared to when we consider capacity constraints (i.e. a significant increase in prices), and therefore our assumptions of exogenous volumes is not determinative of the conclusions we reach in this report.

21 T+T Assessment of Alternatives, p.14.

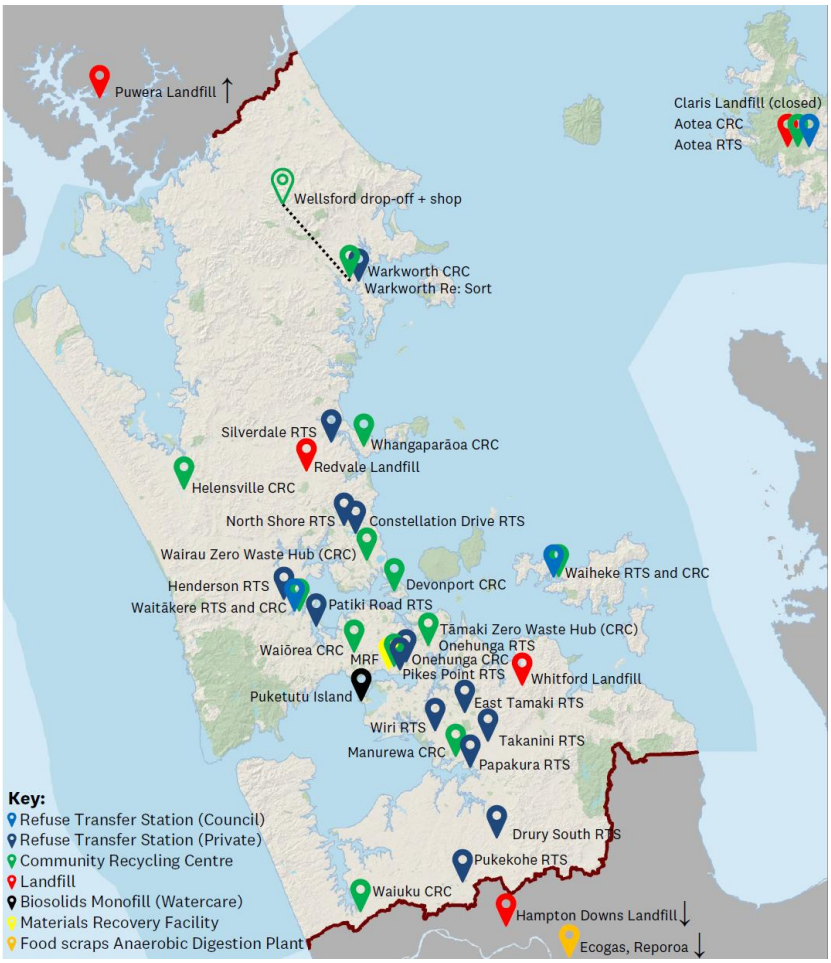
22 T+T Assessment of Alternatives, p.1.

23 We are advised the distance to be approximately 175km.

24 T+T Assessment of Alternatives, p.11.

25 Waste Management, Redvale Tonnage disposal locations post RV.xlsx, received 18 June 2025, cell S42

Figure 2: Map of Auckland Waste Facilities



Source: Auckland Council, Waste Minimisation and Management Plan 2024: Towards Zero Waste.

2.2. Barriers to entry, expansion and concentration measures

19. We demonstrate in this subsection that:

    A. The Auckland landfill waste market is already highly concentrated;

    B. There are high barriers to entry and expansion; and

    C. Accordingly, the Auckland landfill waste market is likely to remain highly concentrated for the duration of the Factual.

20. The high barriers to entry into landfill markets were noted by the Commerce Commission ("the **NZCC**") in its 1999 merger decision between WMNZ and Waste Care Limited.[26] The relevant market was defined within Auckland, with waste processed at a regional level. Competitors to the merged entity were within Auckland, alongside historic Waikato landfills which have since ceased operations (we understand that Hampton Downs came into operation after the NZCC's decision). Puwera, which was in development stage, was not considered to be a competitive

[26] NZCC, Decision 355 - Application for Acquisition Clearance - Waste Management and Waste Care, May 1999, para. 169-190.

constraint due to its intention of accepting only regional volumes, as well as transport constraints.

21. In its decision, the NZCC noted the following conditions of entry for the landfill market at the time:

    A. **Suitable Site Location:** Landfills require investment land that is not only in a suitable location but is large enough to be able to compete with other landfills. In its decision, the NZCC noted a generally held view in the industry that environmentally robust and suitably located sites were very scarce.

    B. **Regulatory Requirements:** The decision noted a number of consents must be obtained prior to the operation of the landfill, with a high likelihood of delays and appeals adding to the length of the consent process. Given the high capital investment required to enter into the landfill market, the regulatory requirements would increase the risk of investment, and may make potential entry into the market less appealing.

    C. **High Capital Cost:** It was recognised that the development of a landfill requires substantial capital investment. With the majority of the large establishment costs being sunk costs, the downside risk from investment in a landfill is very high and therefore serves to discourage entry into the market.

    D. **Economic Volumes:** Sufficient volumes of waste are needed to economically justify the establishment of a new landfill, with the volumes in most regional markets being insufficient to justify more than one landfill, meaning entry against an incumbent would be unlikely, and if attempted, extremely difficult and therefore risky.

    E. **Vertical Integration:** Given some landfills were vertically integrated by also being present in the collections process, the NZCC noted that this could increase the difficulty of a potential entrant securing enough volumes to make entry viable.

    F. **Incumbent Response:** The NZCC noted another major factor as being the threat of strategic behaviour by the incumbents. Responses may include appealing consents, the ability to formulate a counter-strategy due to the lengthy entry process, and the ability to selectively price at marginal cost to retain business. This may further discourage entry into the market

22. These conditions of entry likely remain in place for Auckland today. This is evident from the various appeals over the construction of the planned ARL, indicating that factors such as regulatory requirements are still substantial hurdles to overcome.[27] Also, we understand there has not been any further entry since the NZCC's 1999 decision, other than Hampton Downs.

23. While in this decision the NZCC did not explicitly reference barriers to expansion, it is likely that some of these entry conditions would also present themselves as expansion conditions. For

[27] See for example the Environment Court decision of *Te Rūnanga o Ngāti Whātua v Auckland Council* [2023] NZEnvC 277 was appealed to the High Court: *Te Rūnanga o Ngāti Whātua and Royal Forest and Bird Protection Society of New Zealand Incorporated v Auckland Council* [2024] NZHC 3794. Leave was subsequently sought to appeal the High Court decision to the Court of Appeal in February 2025.

example, regulatory requirements, such as consent applications, are likely to be a material barrier for landfills to expand their operations.[28]

24. Therefore, in our analysis we assume that Whitford, Hampton Downs and Puwera will not be able to expand their capacities sufficiently or in a timely enough way to undermine the price increases we estimate below.[29]In terms of concentration, we measure this using the Herfindahl-Hirschman Index (**"HHI"**). This is a calculation often used by competition agencies as a screening device in merger analysis. It is calculated by squaring the market share of each firm in the market, and then summing the results.[30] As the HHI value increases the market is considered more concentrated, with the maximum value of 10,000 representing a monopoly (i.e. a single firm with a market share of 100% as 100^2 = 10,000).

25. The US Department of Justice (**"DOJ"**) and Federal Trade Commission (**"FTC"**) commonly use the HHI of a market when assessing mergers. In their merger guidelines, the DOJ and FTC note:

    A. Markets with an HHI greater than 1,800 are highly concentrated.[31]

    B. Mergers that create, or further consolidate markets that are highly concentrated, through an increase in the HHI of more than 100 points, are presumed to substantially lessen competition or tend to create a monopoly.[32]

26. Similarly, in Australia, the Australian Competition and Consumer Commission (**"the ACCC"**):[33]

    A. Classes a highly concentrated market as a market with an HHI greater than 2,000.

    B. Considers a change in HHI of more than 100 points as a significant increase in concentration.

27. Additionally, while the NZCC does not employ HHI thresholds as its primary screening tool, it uses a three-firm concentration ratio as a tool to assess the likelihood of a merger requiring a clearance application.[34] In its merger guidelines, the NZCC notes that mergers are less likely to raise competition concerns if the post-merger three-firm concentration ratio is less than 70% and the merged firm's combined market share is less than 40%, or the post-merger three-firm concentration ratio is 70% or more and the merged firm's combined market share is less than 20%.[35]

28. Table 3 shows the measures of market (volume) concentration under the Factual.

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28 See for example the earlier consenting process for Redvale - *Waste Management NZ Limited v Auckland Council* [2015] NZEnvC 178; [2016] NZEnvC 043; T+T Assessment of Alternatives, p.3.

29 The joint ownership of Whitford with the Council might also increase the complexity of expanding Whitford's capacity.

30 For example, if the market consisted of four firms with shares of 40%, 30%, 20% and 10% then the HHI would be 3,000 ($40^2 + 30^2 + 20^2 + 10^2$).

31 U.S. Department of Justice and the Federal Trade Commission, Merger Guidelines, December 2023, p.5.

32 Department of Justice and the Federal Trade Commission, Merger Guidelines, December 2023, pp.5-6.

33 ACCC, Merger assessment guidelines, June 2025, para. 1.24.

34 The three-firm concentration ratio is the sum of the market shares for the three largest firms in the market. For example, in a market comprised of five firms with market shares of 30%, 10%, 20%, 5%, and 35%, the three-firm concentration ratio would be 85%.

35 NZCC, Merger and acquisitions guidelines, May 2022, para. 3.51

Table 3: HHI and concentration ratios under the Factual

Concentration measure	Factual
HHI index	3,560
Three-firm concentration ratio	97%

29. These results clearly indicate that that even under the Factual, there is a high degree of market concentration in the Auckland landfill market. Therefore, we think it would be very likely that a competition regulator like the NZCC would oppose any further aggregation in this market.

3. The Counterfactual

30. Under the Counterfactual, Redvale must cease accepting waste after December 2028, prior to the expected opening of the ARL in 2036. This would leave a period between 2028 and 2036 where Redvale cannot be used, meaning Auckland's more than 1.45 million tonnes of landfill waste must go to some combination of Whitford, Hampton Downs, and Puwera (or else some other solution must be found, e.g., fly tipping, recycling, reducing waste, etc).
31. We will assume the Counterfactual allocation between the remaining landfills will reflect the relative Factual competitiveness of each landfill, subject to capacity constraints. Relative competitiveness will be a function of landfill location and price, which we will assume will be reflected in current (Factual) market shares.[36]
32. This is performed using the volume market shares outlined in Table 2. Redvale's volume makes up approximately 40% of Auckland's annual volume, with the remaining 60% made up of Hampton Downs (42% total market share), Whitford (15% total market share), and Puwera (3% of total market share). Accordingly, Hampton Downs makes up 69%[37] of the remaining market, with Whitford accounting for 25%[38], and Puwera 5%.[39]
33. Therefore, using Hampton Downs as an example, we assume that Hampton Downs would take 69% of Redvale's volume once the latter exits the market, increasing the total volume Hampton Downs receives from Auckland from 600,000 to 999,639 tonnes (before taking into account capacity constraints, including consenting constraints given we understand as noted above, further resource consents would be required for Hampton Downs to be able to accept this volume of waste).
34. The resulting volumes and market shares when adjusting the volume for all landfills are shown in Table 4 below. The right-hand side of the table adjusts for the estimated constraints that Whitford, Hampton Downs, and Puwera face as listed in Table 2.[40]

36 Of course, relative prices might change, but for present purposes we abstract away from this complication.

37 42% / 60%

38 15% / 60%

39 3% / 60%

40 Puwera takes more with constraints in place because we assume that when capacity is reached in other landfills, Puwera will receive excess waste until it reaches capacity.

Table 4: Estimated Counterfactual volumes (from Auckland)

	Unconstrained		With constraints	
Landfill	**Volume**	**Market share (%)**	**Volume**	**Market share (%)**
Redvale	-	0%	-	0%
Whitford	362,607	25%	350,000	24%
Hampton Downs	999,639	69%	600,000	55%
Puwera	83,303	6%	87,469	6%
Excess waste	-	0%	408,080	14%
Total	1,445,549		1,445,549	

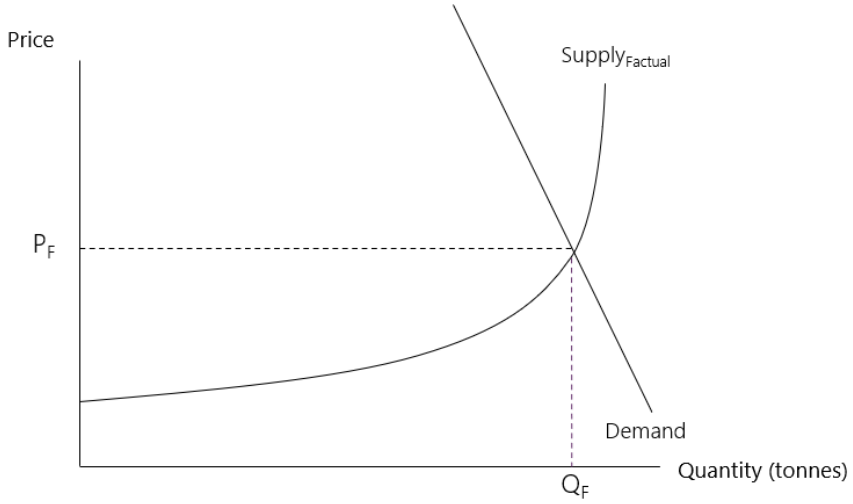
35. We understand that WMNZ has conducted its own analysis of how waste would be redirected from Redvale if it were to cease accepting waste at the end of 2028 (as currently required under its resource consent). Given that Hampton Downs and Puwera are not owned or controlled by WMNZ, WMNZ would likely direct residual waste to Whitford. However, since Whitford is a joint venture with WMNZ and Auckland Council, increasing landfill capacity at Whitford to take the required residual waste has additional consenting complexities. WMNZ's analysis also assumes that Puwera would take over some volumes, mostly comprised of waste from the operator, Northland Waste. Then it assumes that, if possible, any leftover waste would be received by Hampton Downs (and if not, there would be excess waste).
36. While this process may be slightly different to our analysis, with the constraints in place, the end results would be the same. In both cases, all three remaining landfills in the Counterfactual would reach capacity before all of Redvale's volume would be taken over.
37. In fact, the precise allocation under the Counterfactual does not really matter. The bottom line is that unless capacity is expanded, there will not be enough capacity to address Auckland's demand after December 2028, when Redvale closes.

4. Comparing the Factual and Counterfactual

4.1. Conceptual analysis

38. We have already mentioned our view that the Commission would be unlikely to clear any sort of (further) aggregation within the Auckland landfill waste market. Indeed, the Counterfactual is actually worse for competition outcomes than simple aggregation (e.g., through a merger), because it would involve Redvale's capacity leaving the market.
39. To compare the price effects under the Counterfactual compared to the Factual, we first present some conceptual analysis. Figure 3 stylistically depicts the Factual.

Figure 3: Auckland landfill market under Factual (stylistic)



40. The supply curve represents the cumulative supply of landfill services provided to Auckland at various prices, where the price is equal to the marginal cost of supplying the last unit at equilibrium. This curve has an increasing slope as quantity nears capacity, reflecting rising short run marginal costs (SRMC). Absent expansion or entry, once capacity is reached, the supply curve will in effect be vertical – regardless of price, no more output can be produced.
41. The relevant demand curve is that of collectors of waste – it is derived from the demand of waste creators.
42. There is a lack of quantitative evidence regarding the elasticities of demand for this derived demand curve. However, there are studies (and summaries of studies) of the demand elasticity of waste creators, particularly households. We outline the results in Table 5, including our brief comments on each of these sources (and noting that none of these are recent).

Table 5: Demand elasticities

Source	Elasticity Estimate	Comments
Economic Factors of Waste Minimization in New Zealand, Prepared for the Ministry for the Environment (2012).[41]	**-0.06**	Only considers household waste
ACIL Allen Consulting for the Department of Environmental Regulation and Waste Authority of Westen Australia (2014).[42]	**-0.11**	Only considers municipal waste, includes other systems such as Pay As You Throw, which may have different elasticities.
Effects of unit-based pricing on household waste collection demand: A meta-regression analysis.[43]	**-0.339**	Only considers unit-based pricing of municipal and household waste, includes all methods of waste collection.

43. We are conscious that these elasticities are focused on households, whereas approximately 80% of Auckland waste to landfill in 2022 was from commercial, industrial, and construction and demolition sources.[44] However, we do not have elasticity estimates for these demands.

44. Given the lack of elasticity estimates for demand at the landfill level and for waste creators more generally, we conservatively use the most elastic estimate of -0.339 for our analysis. This is conservative in the sense that it results in lower estimates of Counterfactual price increases.

45. Figure 4 shows (stylistically) that under the Counterfactual, the supply curve shifts inward, by the size of Redvale's capacity. The new equilibrium is characterised by the demand curve intersecting the supply curve at a steeper point, as capacity is exhausted.

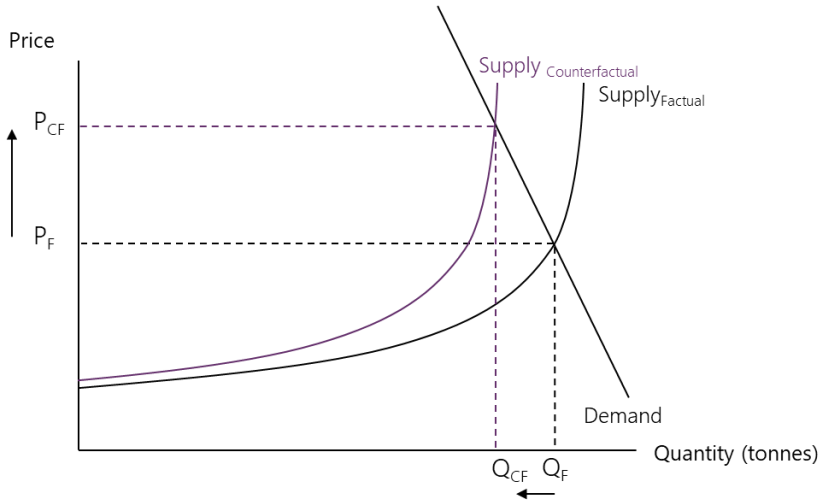
41 Covec, Economic Factors of Waste Minimisation in New Zealand – Final Report, November 2012.

42 ACIL Allen Consulting, Economic Drivers of Waste, March 2014.

43 Bel, G. & R. Gradus, "Effects of unit-based pricing on household waste collection demand: A meta-regression analysis", *Resource and Energy Economics* 44 (2016)

44 Auckland Council, "Auckland's Waste Assessment 2023", November 2023

Figure 4: Auckland landfill market under Counterfactual (stylistic)



4.2. How much would price rise?

46. Figure 4 illustrates that the price increase under the Counterfactual versus the Factual depends on:

    A. The shape and steepness of the demand curve.

        i. The demand curve is depicted as linear in Figure 4, but in reality, this is unlikely to be the case. For example, there might come a price point where alternatives to landfill become more economic, such as more recycling or more sorting of Class 2 waste from Class 1. However, we do not have any information from which to estimate the price point at which these alternatives might become economic.[45]

        ii. Regarding steepness, we have already discussed the demand elasticity evidence that is available, in section 4.1 above.

    B. The shape of the supply curve. As already noted, once capacity is reached, the supply curve will become vertical, until prices rise by enough to make expansion or new entry economic.

47. Accordingly, there are many unknowns, making estimation of the likely price increase difficult. However, we outline below three methodologies that result in a plausible range of price increases.

48. When estimating potential price increases, we assume the current market price is Redvale's average revenue for Class 1 waste in 2025 – we return to the simplifying nature of this assumption below. Using data we received from WMNZ, this is approximately $144.51 per tonne.[46] The price increases we model are independent of any levy increases imposed.

[45] And regarding Class 2 waste specifically, we understand that the only extra landfill capable of accepting Auckland Class 2 waste is near Huntly (operated by Green Gorilla). If more Class 2 waste was sent to this landfill, it would likely raise its price.

[46] Because this is an estimate of the average gate price at Redvale, this price would also factor in Waste Management's recovery of variable costs such as the waste levy.

4.2.1. Cournot model

49. One approach to estimate the extent of the price increase from Redvale's exit in the Counterfactual relative to the Factual is to use a simple model of competition such as a Cournot or Bertrand model. Such models are used in merger analysis, where an economic model is calibrated to a pre-merger situation, and then the model simulates how prices would respond to having one less player in the post-merger scenario.[47]

50. We use a simple Cournot model as an example. While the results of this model might give further insight into why the price would change, as well as what the price change might be, we also note the limitations of using such a model in the current context, which reduces the weight we place on its results.

51. In a Cournot model, each firm independently (and simultaneously with the other firms) chooses the quantity that it will supply to the market. This quantity is chosen so as to maximise the firm's profits from the sale of that quantity, and taking the quantity supplied by every other firm as given. The single market price (that all firms receive) is then determined by equating the total market supply to market demand, so that the market clears.

52. Cournot models are typically applied in industries where:

    A. The product is relatively homogeneous. In the present case, regarding Class 1 waste, the services offered at each landfill would likely have limited differentiation. However, there is differentiation in location, with sites such as Redvale and Whitford being closer to Auckland than Hampton Downs and especially Puwera. This is an important caveat to keep in mind; and

    B. Production capacity is relatively fixed in the short term, and prices adapt so as to sell capacity. In this regard, as stated in Section 2, landfills have a capacity at which they can take in waste, especially in the short- to medium-term where new consents are unable to be acquired.

53. Another caution to keep in mind is that the Cournot model assumes a single market price. In practice, due to the differentiation between landfill locations, there is unlikely to be a single market price. This is because Auckland consumers may be willing to pay a higher price to send their waste to landfills closer to Central Auckland, due to the high transport costs they would otherwise have to pay to dispose of their waste at further away landfills. However, to apply the Cournot model, we have to assume there is a single market price, for which we use Redvale's average price.

54. Another potential limitation is the elasticities used in our model. When calibrating the demand curve used in the Cournot model, an estimate of the demand elasticity is used. In the present case, the relevant elasticity would measure the changes in demand by the firms collecting the waste and delivering it to the landfills. However, in our research we were only able to find elasticities focusing on household demand, as discussed above. Therefore, these elasticities may not be reflective of the true demand elasticities that landfills face, given households only make up a part of the total demand and that households do not transact directly with landfills.

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47 New Zealand Commerce Commission, How to use quantitative analysis in your merger analysis, December 2018, paras. 75-88.

55. Keeping in mind these limitations, the results of our Cournot model estimate an approximate price increase from the Factual to the Counterfactual of 29.5%. A detailed description of our Cournot model can be found in Appendix A.

56. Additionally, due to our uncertainty surrounding the elasticities used in our analysis, we also perform sensitivity tests for the Cournot model by changing the elasticities used to calibrate the demand curve. These sensitivity tests provide a range of price increases for our Cournot model from 20% to 50%, but also illustrate that our results are quite sensitive to changes in the elasticity used. The full results of the sensitivity tests can be found in Appendix A.

57. It is important to note that this model does not consider capacity constraints. This is shown by the fact that the calculated Counterfactual quantities exceed our estimated capacity.[48] Accordingly, the analysis above likely underestimates the price increase from the Factual to the Counterfactual, as producing at capacity would lead to a lower overall quantity and therefore higher market price.

4.2.2. Using the calibrated demand curve

58. Our second approach is to use the demand curve calibrated as an input to the Cournot modelling. In particular, we identify where this demand curve would intersect with available capacity under the Counterfactual.

59. For the reasons already described, we assume that the Factual:

    A. Market price is $144.51 per tonne; and

    B. Market quantity is 1.45m tonnes.

60. Accordingly, in Figure 5 we depict this coordinate as the Factual intersection of the demand and supply curves.

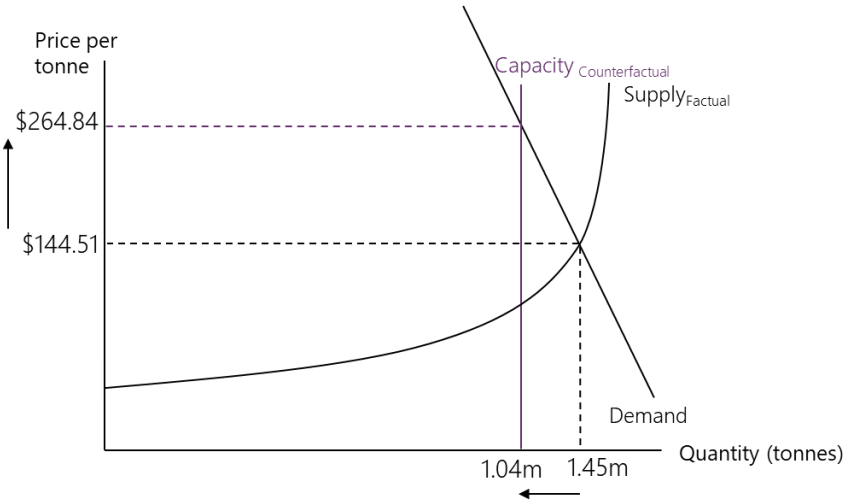
61. We then:

    A. Draw a vertical line at the total capacity under the Counterfactual, being 1.04m (calculated from Table 2); and

    B. Calculate where the demand curve would intersect this capacity line using the assumed elasticity of -0.339. This is at a Counterfactual market price of $264.84 per tonne, which is an increase of 83.3% compared to the Factual price.

[48] Calculated quantities can be found in Table 9 in Appendix A.

Figure 5: Auckland landfill market producing at capacity under Counterfactual (stylistic and not to scale)



62. As with our other approaches, it is worth noting that this method also has caveats. While this approach does consider the capacity constraints faced by the landfills, it still faces the same limitations as the Cournot model regarding the elasticities used in the model, and the assumption of a single market price. It also assumes a linear demand curve over a very large price range, which might not be reflective of reality.

63. Therefore, like the Cournot model, we also conduct a sensitivity test to obtain a range of potential price increases. Shown in Table 11 in Appendix A, the results of our sensitivity test estimate a price increase of between 56.5% and 141.2%.

4.2.3. Building on previous NZCC analyses

64. Our final approach is to compare the structural change between the Factual and the Counterfactual against the sorts of structural changes that concern competition regulators such as the NZCC.

65. Competition regulators generally consider that an increase in price in the order of 5% is sufficient to constitute a significant loss of competition arising from a merger.[49] Accordingly, the thresholds referred to in Section 2.2 above (i.e., an increase in the HHI of more than 100 points) might indicate the merger could result in a 5% (or higher) price increase.[50]

66. Accordingly, if we think the structural change between the Factual and the Counterfactual would be greater than the sort of merger structural change that might result in the NZCC declining the clearance, we might conclude we could expect at least a 5% price increase. This

[49] For example, *Woolworths & Ors v Commerce Commission* (HC). This case is also mentioned in the NZCC merger guidelines (NZCC, Mergers and acquisitions guidelines, May 2022, footnote 37). For examples from international competition agencies see: US DOJ and Federal Trade Commission (2023), Merger Guidelines, August 19, section 4.3.B. While the ACCC has since gone away from outlining a specific price increase in its 2025 guidelines, it referenced a 5% price increase in its 2017 guidelines. ACCC (2017), Merger Guidelines, November, at paragraph 4.21.

[50] However, we note that the thresholds are just screening devices, and in some cases further analysis might suggest no competition problems.

is particularly relevant to the Auckland landfill market given we have already established that the market is currently highly concentrated. Therefore, it would be expected that any transaction in the Auckland landfill market would be under significant scrutiny by the NZCC.

67. Table 6 below shows the HHI and concentration ratios under the Factual and Counterfactual scenarios.[51] Although it may seem counterintuitive, the HHI when firms produce at capacity is lower than the HHI when capacity constraints are not considered. This is because Whitford and Puwera experience a smaller decrease in volume than Hampton Downs when we account for capacity constraints, with Puwera even increasing its volume. Therefore, Puwera and Whitford have higher market shares compared to when we ignore capacity constraints. As a result, Hampton Downs, which has the highest market share in the unconstrained scenario, shows a lower market share under constraints, leading to an overall decrease in market concentration.

Table 6: Factual and Counterfactual HHI and Concentration ratios

	Factual	**Counterfactual without capacity constraints**	**Counterfactual when firms produce at capacity**
HHI index	3,560	5,445	4,554
Concentration ratio	97%	100%	100%

68. The jump in the HHI between the Factual and Counterfactual would be between 994 and 1,885 points.

69. To put this into perspective, as outlined previously, the DOJ and FTC note in their merger guidelines that mergers that create, or further consolidate markets that are highly concentrated, through an increase in the HHI of more than 100 points, are presumed to substantially lessen competition or tend to create a monopoly.[52] Similarly, the ACCC considers a change in HHI of more than 100 points as a significant increase in concentration.[53]

70. Under the Factual, the three-firm concentration ratio is already very high at 97%, and under the Counterfactual, this increases to 100%, significantly above the post-merger concentration indicators of around 70% outlined by the Commission.

71. Therefore, because market concentration indicators such as HHIs and concentration ratios indicate that the exit of Redvale would result in a substantial lessening of competition, we would expect the change in the market structure to have a material effect on prices, potentially 5% or more.

72. This negative effect is likely to be amplified if capacity constraints are incorporated into the analysis. As Redvale exits the market, landfills would be likely to reach capacity as they take on the volume previously going to Redvale. Once a landfill reaches capacity, it can no longer compete for any additional quantity, and therefore, any landfills with remaining capacity will

[51] The HHI for the Counterfactual is calculated using the following equation using the market shares found in Table 4: $25^2 + 69^2 + 6^2 = 5{,}445$ (note this example of market shares is rounded to the nearest whole number). When assuming that the firms produce at capacity, the HHI equation is: $34^2 + 58^2 + 8^2 = 4{,}554$. These market share values are different to the market shares in Table 4, as we do not count the excess capacity when calculating shares.

[52] Department of Justice and the Federal Trade Commission, Merger Guidelines, December 2023, pp.5-6.

[53] ACCC, Merger assessment guidelines, June 2025, para. 1.24.

face less constraints from existing competitors. This constraint will continue to fall until the last landfill with remaining capacity will essentially become a monopoly, as no other landfill would be able to accept any additional waste.

73. This illustrates the idea that it is highly likely that the NZCC would consider the Counterfactual to lead to a substantial lessening of competition compared to the Factual.

74. Therefore, it may be more appropriate to use the NZCC's assumed price increases when assessing merger authorisations. An authorisation framework is applied for mergers where it has already been established that the transaction would lead to a substantially lessening of competition but may lead to sufficient public benefits that outweigh any competitive harms.[54]

75. As part of its assessment, the NZCC estimates the detriments associated with a decrease in allocative inefficiency, which requires an assumed price increase. Given that this analysis requires the NZCC to estimate what a plausible price increase may be following a substantial lessening of competition, this may give insight to a more appropriate range of price increases.[55] The price increases in previous authorisations are summarised in Table 7 below.

Table 7: Price increases in previous NZCC authorisations

Authorisation	Assumed price increase
Ruapehu Alpine Lifts Limited and Turoa Ski Resorts Limited (2000)	1% to 20%
Southern Cross Hospitals and Aorangi Hospital (2011)	10% to 50%
Cavalier Wool Holdings and New Zealand Wool Services International (2011 and 2015)	5% to 15%
Cavalier Wool Holdings and New Zealand Wool Services International (2015)	5% to 15%
NZME and Fairfax (2017)	5% to 10%
Tennex Capital and San-i-pak (2018)	Redacted from the NZCC's public decision

Source: NZCC

76. Given the large increase in market concentration resulting from Redvale's exit, and the previously discussed likelihood that there would be a substantial lessening of competition in the Counterfactual, it is likely that if Redvale's exit was instead a merger, an authorisation would be required rather than a clearance. If this were the case, then rather than the 5% price increase to gate prices as noted above, an estimate of a 10-15% price increase may be more appropriate.

54 NZCC, Authorisation Guidelines, June 2023, paras. 4-5.

55 One caveat is that previous authorisations mostly involved a merger resulting in a monopoly in the relevant markets. Therefore, while the assumed price increases are for the entire market, this was essentially the price increase for the merged entity. In our context, while the market will be very concentrated, in the Counterfactual three firms will remain in the market.

4.2.4. Conclusion

77. Overall, using the various approaches outlined above, we have a range of price increase estimates from 10% to 83.3%.[56] These results are summarised in Table 8 below.

Table 8: Estimated range of price increases

Methodology	Estimated Counterfactual price ($ per tonne)	Estimated Counterfactual price increase compared to Factual price of $144.51 per tonne
Building on previous NZCC analysis	$158.96 to $166.18	10-15%
Cournot modelling	$187.11	29.5%
Using calibrated demand curve where quantity is set at capacity	$264.84	83.3%

78. Even the bottom end of this estimated range of price increases (10-15%) should be regarded as a material price increase - as we have explained, competition regulators (including the NZCC) would generally consider a price increase of this magnitude arising from a transaction (such as a merger) as constituting a substantial lessening of competition.

79. Furthermore, we think the economic features of the Auckland landfill market imply that we should expect a materially higher price increase than the bottom of our range. Those features are:

    A. The Auckland demand for landfill waste disposal is likely to materially exceed the available capacity of the three remaining landfills under the Counterfactual, only one of which is in Auckland; and

    B. There are high barriers to building a new landfill within the relevant timeframe and even expansion of existing landfills is likely to be difficult.

80. While there are important caveats to our Cournot modelling and use of the calibrated demand curve, these methodologies are corroborative of a materially higher price increase than is suggested by our NZCC precedent methodology.

81. Indeed, we think it is plausible to expect price increases of around 30%, which is the level implied by our Cournot modelling and is well below that implied by our use of the resulting demand curve.

82. It might be that we would observe more demand response by the time prices get to this level, and perhaps expansion by one or more of the landfills. However, both demand response and

[56] An argument might be made that WMNZ's vertical integration at Whitford means a reduced level of competition at the landfill level would not affect WMNZ's internal transfer price at Whitford, and accordingly WMNZ's downstream prices would be unaffected. However, this argument would not be correct. The capacity of a landfill is finite, and so if WMNZ dumps a tonne of its own waste at Whitford, that is a tonne of space WMNZ cannot sell to a third-party customer – hence WMNZ's marginal (opportunity) cost at Whitford is the third-party gate price.

expansion would take time – indeed, because of the barriers already discussed, it is difficult to see expansion occurring until well into the Factual period.

83. The price increases we are estimating are those at the gates of the Whitford, Hampton Downs and Puwera landfills. These gate price increases (particularly those at Hampton Downs and Puwera) would likely affect Northland and Waikato users of landfills to some extent, as well as Aucklanders.

84. These price increases would apply to the waste that can be accepted by the three remaining landfills under the Counterfactual, which on our assumptions would be just over 1,000,000 tonnes. So, for these tonnes at say a price increase of approximately 30% (or $42.60 per tonne), $42,600,000 extra would be paid per year to dispose of this waste, at least until some sort of response occurred.

85. Something else would need to be done with the other approximately 400,000 tonnes. Whatever that is (be it reduction in waste-producing economic activity, more sorting, fly tipping, etc), that will also have a cost. Given the magnitude of the tonnes (almost 30% of Auckland's tonnes), that cost would be material.

86. We understand other experts are analysing other effects of an extension to the Redvale consent. Our focus is just on the landfill gate price and quantity effects. Certainly, from that perspective, it is reasonable to conclude that keeping Redvale open until the ARL opens would have regional benefits for Auckland and likely Northland and Waikato as well.

Appendix A. Cournot modelling of the price effect

A.1. Cournot model with no capacity constraints

87. As we set out in Section 37, under the Counterfactual where Redvale exits the market, we would expect a substantial lessening of competition in the landfill market which would then lead to a material increase in the market price.

88. To estimate the extent of the price increase from Redvale's exit in the Counterfactual relative to the Factual, we use a simple model of competition. Such models are sometimes used in merger analysis, where an economic model is calibrated to a pre-merger situation, and then the model simulates how prices would respond to having one less player in the post-merger scenario.[57]

89. We use a model known as a "Cournot" model. Cournot models are typically applied in industries where:

    A. The product is relatively homogeneous. In the present case, regarding Class 1 waste, the services offered at each landfill would likely have limited differentiation. However, there is differentiation in location, with sites such as Redvale and Whitford being closer to Auckland than Hampton Downs and especially Puwera. This is an important caveat to keep in mind; and

    B. Production capacity is relatively fixed in the short term, and prices adapt so as to sell capacity. In this regard, as stated in Section 2, landfills have a capacity at which they can take in waste, especially in the short term where new consents are unable to be acquired.

90. In a Cournot model, each producer independently (and simultaneously with the other producers) chooses the quantity that it will supply to the market. This quantity is chosen so as to maximise the producer's profits from the sale of that quantity, and taking the quantity supplied by every other producer as given.

91. The single market price (that all producers receive) is then determined by equating the total market supply to market demand, so that the market clears. However, the fact that the Cournot model assumes a single market price may limit its suitability for the landfill market. In practice, due to the differentiation between landfill locations, there is unlikely to be a single market price. This is because Auckland consumers may be willing to pay a higher price to send their waste to landfills closer to Central Auckland, due to the high transport costs they would otherwise have to pay to dispose of their waste at further away landfills. However, to apply the Cournot model, we assume there is a single market price, for which we use Redvale's average prices.

92. To calibrate the Cournot model in the Factual, we use the following data:

    A. Quantities as specified in Table 2 This equates to a total market size of approximately 1.45m tonnes per year from Greater Auckland.[58]

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57 New Zealand Commerce Commission, How to use quantitative analysis in your merger analysis, December 2018, paras. 75-88.

58 For sources, see paras 16.A - 16.D.

B. A market price of $144.51 per tonne. This is based on Redvale's average Class 1 revenue per tonne for 2025, which was calculated by taking Redvale's total revenue, and dividing it by the total quantity in tonnes.

C. An assumed market elasticity of demand of -0.339. This estimate is based on a meta-analysis which took the average elasticity of 25 studies.[59] However, it should be noted that this estimate is based on household demand, and may not be reflective of the true demand elasticities that landfill face given households only make up a part of the total demand and that households do not transact directly with landfills.[60]

93. Using these data, we can calibrate an "equilibrium" in the pre-Redvale exit Cournot model (see Appendix A.4 for a detailed description of how this is done).

94. In a Cournot model, this calibration essentially involves calculating each firm's marginal cost as being inversely proportional to market share (i.e., firms with a larger market share will have a lower marginal cost). That is, based on the known output that each firm sells and the known market price (pre-Redvale exit), we can determine what marginal cost each firm would have in order to maximise profits.

95. Note that when calibrating the model using this elasticity, we have negative marginal costs for Redvale and Hampton Downs.[61] This is another reason for us to be cautious about the weight we place on the results. If we constrain marginal costs to prevent them being negative, the price increase calculated by the model would be even higher than in our base case.

96. Having calibrated the pre-exit (Factual) Cournot equilibrium, we then remove Redvale as a player in the market, and solve the model for a new, post-Redvale exit (Counterfactual), equilibrium. This involves the following:

A. Taking each firm's marginal cost as calibrated in the Factual equilibrium;

B. Assuming that each firm maximises profits, determining the quantity that each firm would sell under the Counterfactual based on these marginal costs, and taking the quantities of all other firms as given; and

C. Aggregating each firm's quantity to determine the overall Counterfactual equilibrium market quantity and using the elasticity to determine the resulting Counterfactual equilibrium market price. This then allows us to determine the impact that Redvale's exit has on the price, by comparing the Factual and Counterfactual market prices.

97. In Table 9 we set out the results of our model. When Redvale exits, the remaining landfills each take 144,476.5 tonnes of Redvale's volumes, with the total market volume also decreasing by

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59 Bel, G. & R. Gradus, "Effects of unit-based pricing on household waste collection demand: A meta-regression analysis", *Resource and Energy Economics* 44 (2016): 169-182.

60 We were unable to find total market elasticities for landfills Other estimates for household demand elasticities include -0.06 to -0.47 (Dijkgraff E. & Gradus R, "Cost Savings of Unit-based Pricing of Household waste, the case of the Netherlands", Resource and Energy Economics 26, no. 4 (2004): 353-371.), and -0.076 to -0.226 (Fullerton D. & T.C. Kinnaman "Household Demand for Garbage and Recycling Collection with the Start of a Price per Bag." *National Bureau of Economic Research Working Paper* No. 4670(1994)).

61 Based on the algebra set out in Appendix A.4, it can be shown that marginal costs are positive for firm i provided $e < -q_i/Q$, which using the inputs to our model yields a value of $e < -0.415$ to ensure this is the case for all firms. If we do not allow negative marginal costs, and instead make them equal to zero, we get an estimated price increase of 34.2% instead of 29.5% as shown below.

144,476.5 tonnes. While potentially unintuitive, this is a feature of the Cournot modelling framework, in that each firm adjusts its quantity equally in response to a firm leaving the market.

98. As a result of Redvale leaving the market, the overall market price increases as the total supply of the market reduces. This results in an increase in the market price, from $144.51/tonne to $187.11/tonne. That is, the Counterfactual price is 29.5% higher than the Factual price.

Table 9: Quantity and Price changes under Cournot model with no capacity constraints

Landfill	Factual	Counterfactual	Change
Redvale	577,906	-	
Whitford	217,643	362,119.16	144,476.50
Hampton Downs	600,000	744,476.50	144,476.50
Puwera	50,000	194,476.50	144,476.50
Total	**1,445,549**	**1,301,072**	**-144,476.50**
Price	$144.51	$187.11	$42.60 (29.5%)

99. As can be seen, the calculated Counterfactual quantities exceed the likely capacity. Accordingly, the analysis above likely underestimates the price increase from the Factual to the Counterfactual.

A.2. Price when firms produce at capacity

100. In our second approach, we assume that under the Counterfactual, firms would produce at capacity. To estimate what the price would be at this volume, we use the demand function calibrated as an input to the Cournot model in section A.1 above.

101. Table 10 below shows the results of this analysis, estimating that operating at a capacity of 1,037,469 tonnes would lead to a price of $264.84 in the Counterfactual, an increase of 83.3% from the Factual price of $144.51.

Table 10: Quantity and Price changes when firms produce at capacity

Landfill	Factual	Counterfactual	Change
Redvale	577,906	-	
Whitford	217,643	350,000	132,357
Hampton Downs	600,000	600,000	-
Puwera	50,000	87,469	37,469
Total	**1,445,549**	**1,037,469**	**(408,080)**
Price	$144.51	$264.84	$120.34 (**83.3%**)

A.3. Sensitivity testing

102. Lastly, we also undertake sensitivity testing for the elasticities we use in our analysis. As mentioned in sections 4.2.1 and 4.2.2, while we are unable to find more appropriate elasticity estimates, we note there are issues with the elasticity estimates we use in our approaches.

103. Therefore, we conduct sensitivity analysis using different elasticity values to provide a range of estimates for our models. In our approaches, we use a demand elasticity of -0.339. We expand this to a range of -0.2 to -0.5 to attempt to capture what the true elasticity may be.

104. Table 11 below shows the results of these sensitivity tests, with the Cournot model results resulting in a price increase between 19.99% and 49.97%, and a price increase of between 56.5% and 141.2% when we assume firms produce at capacity.

Table 11: Sensitivity tests for modelling approaches

	Elasticity	
	-0.2	**-0.5**
Cournot model		
Factual price	$144.51	$144.51
Counterfactual price	$216.72	$173.39
Change (%)	$72.21 (**49.97%**)	$28.89 (**19.99%**)
Firms producing at capacity		
Factual price	$144.51	$144.51
Counterfactual price	$348.48	$226.10
Change (%)	$203.97 (**141.2%**)	$81.59 (**56.5%**)

A.4. Developing Cournot model

105. In this Appendix we set out the steps taken to developing the Cournot model.

Step 1: calibrate pre-exit market demand

106. We start by calibrating the market demand curve. Using data provided by Waste Management, Auckland Council, and Academic literature, we have the market price, *P*, market quantity, *Q*, and we have market demand elasticity, *e*. We assume a linear demand curve given by:

$$P = a + bQ, b < 0$$

107. The market elasticity is given by:

$$e = \frac{\partial Q}{\partial P}\frac{P}{Q}, e < 0$$

108. The market elasticity equation can be re-arranged to:

$$\frac{\partial P}{\partial Q} = \frac{P}{eQ}$$

109. Since we know also that the slope of the demand curve is given by $b = \frac{\partial P}{\partial Q}$, we can use the values of *P*, *Q*, and *e* to calculate the value for *b*:

$$b = \frac{P}{eQ}$$

110. We can then also use values for *P*, *Q*, and now *b* to get the value of *a* by solving:

$$a = P - bQ$$

Step 2: calibrate pre-entry marginal costs

111. In a Cournot model, each firm i chooses quantities to maximise profits, as given by:

$$\pi_i = q_i(P(Q) - mc_i)$$

112. Assuming constant marginal costs, the first-order condition for profit maximization is found by:

$$\frac{\partial \pi_i}{\partial q_i} = P(Q) + q_i \frac{\partial P}{\partial q_i} - mc_i = 0$$

113. We re-arrange this equation to calculate each firm's marginal cost as:

$$mc_i = P(Q) + q_i \frac{\partial P}{\partial q_i}$$

114. Since the total market demand (*Q)* is the sum of each firm's individual market demand (q_i), we can write the linear demand curve as:

$$P = a + bQ = a + b\sum_{i=1}^{n} q_i$$

115. From this demand curve we can determine that $\frac{\partial P}{\partial q_i} = b$. Substituting this into the above equation for each firm's marginal cost, we calculate each firm's marginal cost using:

$$mc_i = P + q_i b$$

Step 3: calculate post-exit quantities and prices

116. Post-exit we have one less player in the market. We would therefore have first-order conditions for each market player given by:

$$P + q_i b - mc_i = 0$$

117. Using the equation for *P*, we can re-write this as:

$$a + b\left(\sum_{i=1}^{n} q_i\right) + q_i b - mc_i = 0$$

118. To illustrate how this equation is solved, consider the case where we have three firms in the market post-Redvale's exit i.e., for each firm i=1, 2, and 3. Expanding out the above equation (and re-arranging) would give the following three equations:

$$-2bq_1 - bq_2 - bq_3 = a - mc_1$$
$$-bq_1 - 2bq_2 - bq_3 = a - mc_2$$

$$-bq_1 - bq_2 - 2bq_3 = a - mc_3$$

119. We know the values of *a* and *b* (the pre-entry values calibrated above). We also know mc_i for the 3 remaining firms, as calibrated above. We therefore require a solution to the above three equations in three unknowns (the q_i's).

120. We solve these equations in *Excel*, based on the matrix algebra specification of the equations as follows:

$$\begin{pmatrix} -2b & -b & -b \\ -b & -2b & -b \\ -b & -b & -2b \end{pmatrix} \begin{pmatrix} q_1 \\ q_2 \\ q_3 \end{pmatrix} = \begin{pmatrix} a - mc_1 \\ a - mc_2 \\ a - mc_3 \end{pmatrix}$$

121. Once we have determined the values for q_1, q_2, and q_3, we calculate the post-exit market quantity as $Q = \sum q_i$ and then the post-entry market price as $P = a + bQ$. We then compare the pre-exit and post-exit market prices to determine the change in price due to Redvale's exit.

Appendix B. Addendum

122. The analysis contained in the main body of our report is based on the assumptions contained in the main report, including the assumptions set out in paragraph [16] regarding the capacities and volumes of the various relevant landfills.

123. As an addendum to our main report, we have been instructed to assess the potential effect of closing the Redvale Landfill assuming that Hampton Downs has the ability to take on an additional 500,000 tonnes of waste per annum. We are instructed that Hampton Downs likely requires new resource consents as it is currently not consented to accept an additional 500,000 tonnes of waste annually. However, we assume for the purposes of this analysis that Hampton Downs' existing consents permit this additional volume and the landfill has the requisite physical and operational capacity to accept 500,000 tonnes.

124. Under this scenario, we assume an alternative counterfactual (**"the Alternative Counterfactual"**) under which Whitford and Puwera would take on any additional demand until they reach capacity, and Hampton Downs would take on any remaining capacity (up to 500,000 tonnes per annum).

125. This means the market would no longer have significant excess demand (as in the Counterfactual scenario in our main report). However, as we explain below, keeping Redvale open would still result in benefits, as we believe it is still likely that Redvale's closure would result in a material price increase even under the Alternative Counterfactual.

126. On the assumption that Hampton Downs does have the ability to take an extra 500,000 tonnes, it is reasonable to assume that this additional capacity of approximately 500,000 tonnes (or more) would also be present under the scenario where Redvale remains open – we will call this the **"Alternative Factual"**. This means that the market under the Alternative Factual can be characterised as having significant excess capacity.

127. Table 12 below shows the estimated capacity, volumes and market shares under the Alternative Factual and the Alternative Counterfactual scenarios.

Table 12: Estimated Alternative Factual and Alternative Counterfactual volumes and capacities in tonnes

Landfill	Capacity	Capacity market share (%)	Volume	Volume market share (%)
Factual:				
Redvale	639,671	29%	577,906	40%
Whitford	350,000	16%	217,643	15%
Hampton Downs[62]	1,100,000	51%	600,000	42%
Puwera	87,469	4%	50,000	3%
Total	2,177,140		1,445,549	
Excess capacity			731,591	
Counterfactual:				
Redvale	-	-	-	-
Whitford	350,000	23%	350,000	24%
Hampton Downs	1,100,000	72%	1,008,080	70%
Puwera	87,469	6%	87,469	6%
Total	1,537,469		1,445,549	
Excess capacity			91,920	

Source: See paragraph 16 in the main NERA report for the sources of these values

128. When a market exhibits significant excess capacity, we would expect this to be reflected in a relatively low market price. Then, when this capacity is reduced under the Alternative Counterfactual (with some sites in fact reaching their capacity), the incentive to lower prices to limit excess capacity is removed. It then follows that because excess capacity is reduced under the Alternative Counterfactual scenario, we would expect prices to be higher.

129. Additionally, the closure of Redvale would result in a material increase in concentration. Table 13 below shows our estimates of concentration measures under the Alternative Factual and the Alternative Counterfactual:

62 Hampton Downs' new capacity is estimated by adding 500,000 tonnes to Hampton Downs' capacity of 600,000 from our main report.

Table 13: Factual and Counterfactual HHI and Concentration ratios

	Factual	Counterfactual
Capacity:		
HHI index	3,691	5,669
Concentration ratio	96%	100%
Volume:		
HHI index	3,560	5,486
Concentration ratio	97%	100%

130. Under the Alternative Counterfactual, once Redvale exits the market, Hampton Downs' market shares would increase significantly, both in terms of capacity and volume. This would result in a large increase in the HHI, even surpassing the increase associated with the Counterfactual scenario in our main report.[63] Therefore, we would expect competition regulators such as the NZCC to be concerned about a substantial lessening of competition following Redvale's exit from the market.

131. Another way to conceptualise the issues is to consider that with the closure of Redvale, the residual demand curve[64] facing each of the remaining three landfills would shift out. Two of those landfills (Whitford and Puwera) would quickly reach capacity, meaning that for a material portion of the Auckland demand, Hampton Downs would in effect be a monopolist.

132. It follows that, given there is likely to be a substantial lessening of competition, competition regulators would expect prices to rise. As mentioned in our main report, the NZCC has used price increases in the range of 10-15% when assessing merger authorisations, where a substantial lessening of competition has already been established.[65] Therefore, we would expect prices increases as a result of Redvale closing, even with Hampton Downs taking on the excess demand, to be at least in the range of 10-15%.

133. The ultimate capacity of a landfill is finite and so accepting a tonne of waste now means one less tonne of waste that could be accepted in the future, when prices might be higher. If Hampton Downs does have spare capacity of 500,000 tonnes per annum, it might not be profit maximising for Hampton Downs to accept any further volumes under the Alternative Factual with its status quo prices, but it might be profit maximising to accept further volumes under the Alternative Counterfactual with its higher prices.

63 Table 6 of our main report lists a maximum counterfactual HHI of 5,445 (based on volume).

64 The residual demand curve is the market demand that is not met by other firms at any given price. The residual demand is derived by subtracting the supply of all other firms from the market demand. (Jeffery M. Perloff, *Microeconomics* (Pearson 2015), 224).

65 See Table 7 of our main result for a list of price increases used by the NZCC for their merger authorisations.

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NERA
Level 11
15 Customs Street West
Auckland 1010, New Zealand
www.nera.com