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Brownfield land redevelopment strategies in urban areas: Criteria contributing to the decision-making process

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Abstract

Urban intensification seems to be a growing trend, especially in the context of severe land scarcity. Brownfields offer great potential in meeting the increasing demand for housing in major cities worldwide. Redevelopment projects appear to provide immediate solutions to housing shortages that are being experienced due to population pressures in large metropolitan areas. The paper explores the range of factors that property developers need to consider in their decision-making process when assessing the viability of brownfield redevelopments. This research, which employed a comparative case study approach, and examined two brownfield redevelopments in Auckland, focused on the economic, social, and environmental criteria that were utilised in the decision-making process. Document analysis of the two case studies, site observations, and semi-structured interviews with the property developers were the main data collection methods. The results suggested that the economic aspects of a brownfield redevelopment are the most important criteria that developers consider during the feasibility assessment of proposed projects. Projects that offer the potential for quick investment returns for all stakeholders are the preferred choice for developers. Brownfield redevelopments offer significant potential for invigorating local areas through urban intensification which boosts local businesses and encourages community revitalisation. The environmental concerns appear to be the lowest priority and little consideration is given to reducing the environmental impacts or incorporating green building practices in the new developments. A major shift from a purely economic focus toward a comprehensive environmental approach to new developments is needed to ensure the sustainable development of cities.

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Keywords

Brownfield redevelopment; High density housing; Property developers; Economic returns; Environmental impacts

1.0 Introduction

Brownfield redevelopment is gaining momentum in urban planning and is now extensively used to fulfil social and economic demands on land availability in major cities. Abandoned brownfield sites are now considered a resource, and current global trends promote re-urbanization, urban regeneration, and densification (Boudjadja & Boudemagh, 2021). Urban regeneration enables the utilisation of underused/unused or abandoned urban land, referred to as brownfields, and promotes the redevelopments of core urban property, thus enhancing a region's economic development (Pahlen & Glöckner, 2004) and adding to urban intensification. There is no universally agreed

definition of brownfields, with several authors attempting to define the concept. For example, Otsuka et al. (2013) define brownfields as previously economically viable city or countryside properties that have been unoccupied for some time and may potentially be contaminated. An alternative definition by the US Environmental Protection Agency characterises brownfields as properties or sites that have the potential for expansion or redevelopment. However, complications exist in their redevelopment due to the possible presence of hazardous substances, contaminants, or pollutants (EPA, 2021). Conversely, not all brownfields are contaminated, and therefore a more encompassing definition is needed. In that regard, Martinát et al. (2016) offer a helpful definition describing brownfields as "underused, neglected, and potentially contaminated properties (land and buildings), usually as relicts of former industrial, agricultural, residential, military, or other such activities" (p. 79).

The increasing demand for housing in urban areas and the lack of prime greenfields has opened avenues for the greater use of brownfields in urban centres (Perovic & Kurtović-Folić, 2012). Brownfield redevelopment is trending globally, driven by the increasing urban drift and population increase in major cities, resulting in housing shortages for city dwellers (Dulić & Krklješ, 2014). For example, the British government aims to build six million more homes in the next 20 years to deal with the UK housing crisis (Freeman et al., 2020), resulting from the steady decline in the building of new and affordable homes since the 1970s (Marquesini, 2018). The availability of more than 18,200 brownfield sites covering an excess of 26,000 hectares of land could provide an opportunity to build more than one million new homes (Tema, 2020).

Big European cities experience similar housing shortages exacerbated by the current COVID-19 pandemic, which caused a surge in the working from home culture. Innovative ways are being explored to boost the supply of additional apartments to meet the growing demand for living spaces in Stockholm, Berlin, Prague, and other European capitals. Brownfield redevelopment seems to play a crucial role in utilising the land occupied by older airports: 30,000 new homes are planned at the site of Bromma Airport in Stockholm (Nienaber & Johnson, 2021), and more than 5,000 apartments at Berlin's former Tegel airport (Euronews, 2021). Developing an action plan for Prague's brownfields is expected to alleviate the need for 8,000 new apartments by 2030 (Zábranský, 2019).

Auckland, the biggest city in New Zealand, had a shortage of 75,000 homes in 2020, and in 2021 this number dropped to a deficit of 25,000 houses (Hewett, 2021). The reduction in housing shortages can be attributed to the Auckland Unitary Plan (AUP), introduced in 2016, which rezoned large bands of land in Auckland for more intensive development leading to increased developers' interest and subsequent redevelopment of brownfields. Consequently, the AUP has allowed for the construction of one million additional dwellings since 2016. In particular, the period between 2017 – 2020 saw the sharpest growth in consented dwellings in Auckland since 1991. Additionally, there is a growing trend toward multi-unit dwellings (apartments, townhouses, units), whose share represents 60.77% of all consented dwellings (Maharaj & Martin, 2021) (Figure 1).

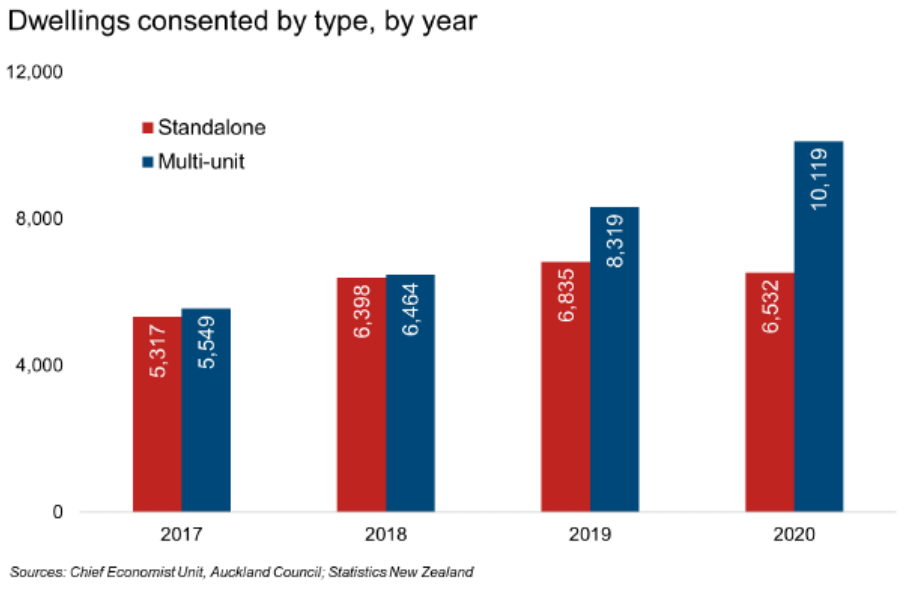

Figure 1. Dwellings consented by type in Auckland (Maharaj & Martin, 2021).

Assertions in local government studies that Aucklanders are showing greater acceptance towards high-density housing and increasing willingness to trade off larger dwellings for smaller ones in return for greater accessibility to jobs and amenities (Maharaj & Martin, 2021) are debatable. Economic factors, such as the overpriced housing market that makes it difficult for younger generations to purchase properties, the rise in living costs, and the reduction in retirement income, could also contribute to the perceived acceptance of density.

Furthermore, recent data shows that 68% of the consented dwellings in Auckland in the period 2017 – 2020 have been in brownfields (Maharaj & Martin, 2021). However, density patterns are uneven across the city, suggesting that a range of other factors, such as proximity to desirable amenities, employment, and supporting infrastructure, could influence the viability of any development.

Despite the apparent benefits that brownfield redevelopments in Auckland could offer, such as using existing infrastructure and making public transport and other amenities more feasible, thus reducing congestion, the uptake of brownfield redevelopment has not been as rapid as expected (Martin & Norman, 2018). On the contrary, since 2013, the proportion of brownfield residential building consents had fallen, with the most pronounced fall being in 2016 and the first half of 2017, followed by a swift recovery in the second half of 2017 (Figure 2).

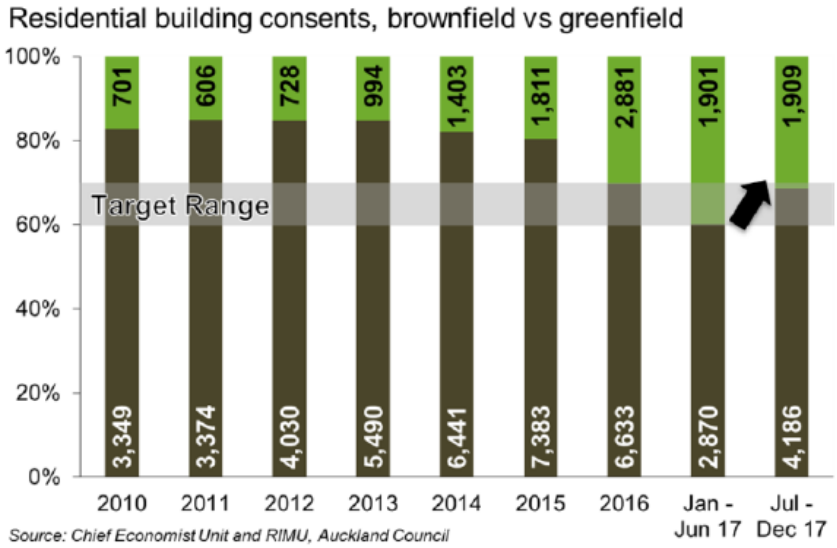

Figure 2. Brownfield vs greenfield trends in residential building consents in the period 2010-2017 (Martin & Norman, 2018).

Even though there is an increasing body of literature on decision-making processes for brownfield redevelopments, there is scarce data available in a New Zealand context. Brownfield redevelopment is relatively new territory for a country that still aspires to quarter-acre ownership. Insights into the decision-making process for potential brownfield redevelopment projects could prove helpful for developers, councils, and other stakeholders who play a vital role in the feasibility or risk assessment processes. Therefore, this research aims to understand developers' main criteria as part of their decision-making process before undertaking brownfield redevelopments. The main research question of this study is "What are the main criteria contributing to the decision-making process in brownfield redevelopment?" The three sub-questions explore the economic, social, and environmental criteria contributing to the decision-making process.

2. Background

Brownfield redevelopment is a vital component of urban development, helping revitalise degenerated areas and adding new ambience to a location. Redeveloped suburbs attract residents, potentially improve environmental quality, and contribute to economic growth and physical regeneration (Dulić & Krklješ, 2014). Brownfields represent environmentally compromised urban assets that need to be restored to constructive uses to allow for reconnection and integration with the surrounding communities (Loures, 2015). The rejuvenated interest in brownfields has been driven by urban sprawl with several European countries, Russia, the United States, and China, reconsidering the reuse of derelict urban properties (Longo & Campbell, 2016). Regeneration of brownfield sites has several benefits, such as the possible use of pre-existing city infrastructure and greater access to public transport and other amenities (Martin & Norman, 2018). Furthermore, the creation of jobs,

availability of affordable housing, and increased economic growth for neighbouring communities (Thornton et al., 2007) can arise through brownfield developments. However, for brownfield redevelopment, several risk factors need to be evaluated in the decision-making process that determines the feasibility of projects.

2.1. Economic criteria

The economic risks associated with brownfield developments are widely discussed in the literature. The identified risks arise at three stages - remediation/infrastructure, development, and investment (Adair et al., 2003). Greenfield development is considered far less challenging than developing derelict brownfield sites that present various adversities (Barlindhaug & Nordahl, 2017). Several literature sources indicate that brownfield projects cost twice as much as greenfield developments due to additional fees such as increased costs involving partnerships and consultations between planning authorities and developers (Guironnet et al., 2016). The expected cash flow, which is essential for investors, is affected by the high equity and long holding periods characteristic of redevelopment areas (Barlindhaug & Nordahl, 2017). Redevelopment projects would often have a higher risk rate and increased development costs, leading to higher contingency fees (De Sousa, 2000).

Land revitalization in brownfield developments is a costly process, especially when there are contaminants and harmful substances that require expensive procedures to treat (Haninger et al., 2017). Often various remedial actions need to be undertaken to convert brownfield sites into useable land. In such cases, there are costs associated with insurance cover for future liabilities and financial assistance to recover from clean-up costs associated with contaminated land (Beiback, 2002). However, there are also economic gains associated with brownfield developments attributed to reduced costs of urban sprawl.

Brownfields' prime advantages are their central locations and pre-existing connections to infrastructure, including stormwater utilities and roadways, which save on infrastructure expenses (EPA, 2020). The location provides increased opportunity for mixed-use developments with possibilities to accommodate housing and retail outlets, offices, workshop spaces and shared public facilities such as parks (Rey et al., 2021). Generally, infrastructure costs are funded by taxpayers and thus incur no major expenses for private developers (De Sousa, 2000), with previously contaminated or derelict land considered more economically viable for developers than the development of greenfields (Kotval-K, 2016). Decreased construction costs due to reduced infrastructure and public services cost also mean there is a lesser risk of vacancy but a substantial increase in property value (Umweltbundesamt, 2005).

2.2. Social criteria

The social aspects of brownfield redevelopment are associated with potential health risks, and any community concerns need to be addressed before development on site can begin. Any contamination risks need to be thoroughly assessed, a full investigation conducted, and remedial measures put in place before the development commences (Haninger et al., 2017; Hellawell & Hughes, 2021). Various assessment tools to measure the level of harm concerning toxicity and contamination are mentioned in the literature, such as the quantitative risk assessment (O'Reilly & Brink, 2006).

Exposure to asbestos on contaminated sites is of particular concern. This risk factor could affect several site users, such as residents, construction workers, commercial and industrial employees, and site visitors. Therefore, risk assessments are conducted to assess the potential risks of contaminants, such as asbestos and further environmental hazards (Hallawell & Hughes, 2021; Squires & Hutchison, 2021). O'Reilly and Brink (2006) highlight the importance of having a brownfield health risk screening matrix to safeguard public health. The chosen screening approach should present a scientific method to assess the health risks of the proposed brownfield redevelopment site. Hazardous substances, contaminants, and pollutants on-site can create significant risks for potential developments, requiring the use of valid risk mitigation processes.

2.3. Environmental criteria

Several environmental aspects associated with brownfield redevelopments are identified in the literature. A significant benefit of brownfield redevelopment is the decrease in automobile commute to the city and the subsequent reduction in pollution due to greater and more efficient urban densities (EPA, 2020; Kotval-K, 2016). According to EPA (2020), when brownfields are redeveloped, individuals limit driving times when living or working in urban centres because of a multitude of available transportation options (such as walking, train, bus, ride-sharing, biking), which have apparent environmental and health benefits. Hence, brownfield redevelopment in urban areas lessens greenhouse gas emissions and promotes public wellness and health. However, brownfield developments are often situated on contaminated sites and may require remedial works. Various chemicals and pollutants, such as lead and other heavy metals like arsenic, acids, asbestos, solvents, pesticides, and hydrocarbons that impend the health and wellbeing of residents have to be removed (Adelaja et al., 2010). The availability of communal assets in brownfield developments can create noticeable improvements in the environment, augment communities, and improve residents' quality of living (Bacot & O'Dell, 2006).

3. Methodology

The study employed a comparative case study research methodology. A case study is a comprehensive empirical inquiry investigating an event within its real-world setting (Yin, 2014) and analyses events, processes, or occurrences in that particular instance (Denscombe, 2010). Multiple case study research utilising multiple data collection methods is instrumental as it enables a comparison between the cases and a more comprehensive understanding of the issue at hand (Campbell, 2010; Yin, 2014). Hence, this research utilised a comparative case study approach to study brownfield redevelopment in urban areas.

The two chosen case studies are in different suburban areas in Auckland (Auckland City and South Auckland) and are of different housing types (stand-alone houses and apartments/walk-ups). Furthermore, both developments are at different stages of construction (one that had recently been completed and the other which is currently under construction).

The primary data collection methods were document analysis, semi-structured interviews with the property developers, and site observations. The document analysis studied the project documentation and local government documents pertaining to the two case studies. Face-to-face interviews with the property developers provided valuable insights into the decision-making process factors. Site observations complemented the other two data collection methods and enriched the gathered qualitative data.

4. Findings

4.1 Case studies description

Case Study A is a completed development for five stand-alone houses in Manurewa, South Auckland (Figures 3 & 4). Stand-alone houses are highly valued in the market, with 25,289 new stand-alone houses consented in New Zealand in the year ending August 2021 as opposed to 21,164 consented multi-unit homes. However, the statistics are different in Auckland, where there were 6957 stand-alone houses consented in the year ending August 2021 as opposed to 12,972 multi-unit homes (Edmunds, 2021). The latter set of statistics illustrates recent urban intensification trends and a general orientation to multi-unit homes in Auckland. Furthermore, the decreasing number of consented stand-alone houses in Auckland, where land is premium and scarce, makes them more sought after and desirable.

The development commenced in mid-2019 and reached completion in 2020. Asbestos contamination was discovered on site, and professional remedial work was undertaken for its removal. The location of the redevelopment site in a well-established urban area with easily accessible public amenities and a strategic transport network made it quite desirable, resulting in the immediate sale of all houses in 2020 shortly after completion.

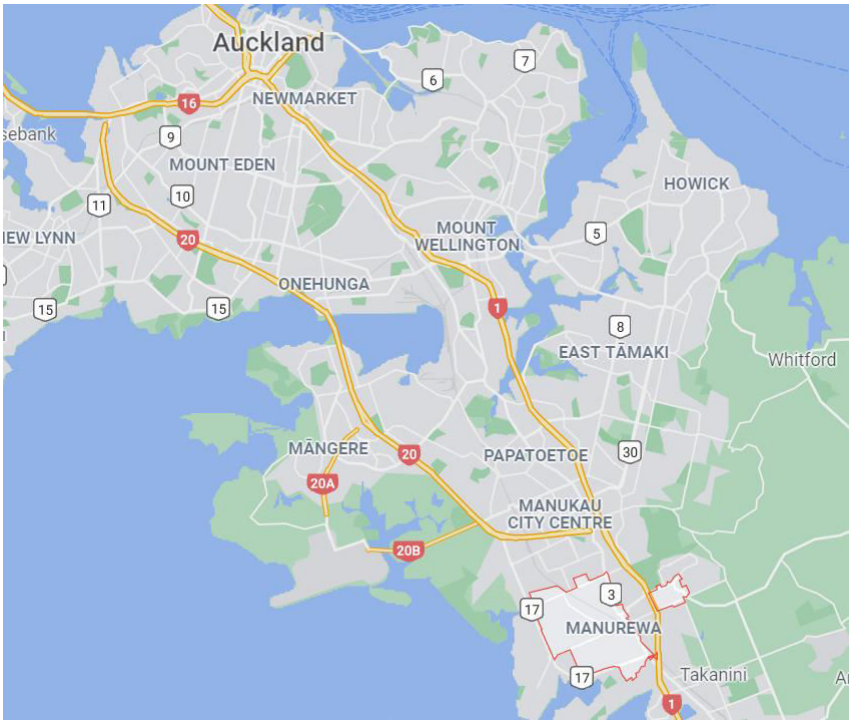

Figure 3. Location of Case Study A in Manurewa, South Auckland (Google Maps, 2022)

Figure 4. Case Study A: 5 stand-alone houses in Manurewa, South Auckland (completed) (Google Street View, 2022)

Case Study B, Neodomo Ellerslie, is located in Ellerslie, Auckland City (Figure 5), comprising of two blocks. Block A contains 23 three-bedroom walk-up apartments and 23 car parks. Block B is made up of a mixture of one, two, and three-bedroom options (DDL Homes, 2022).

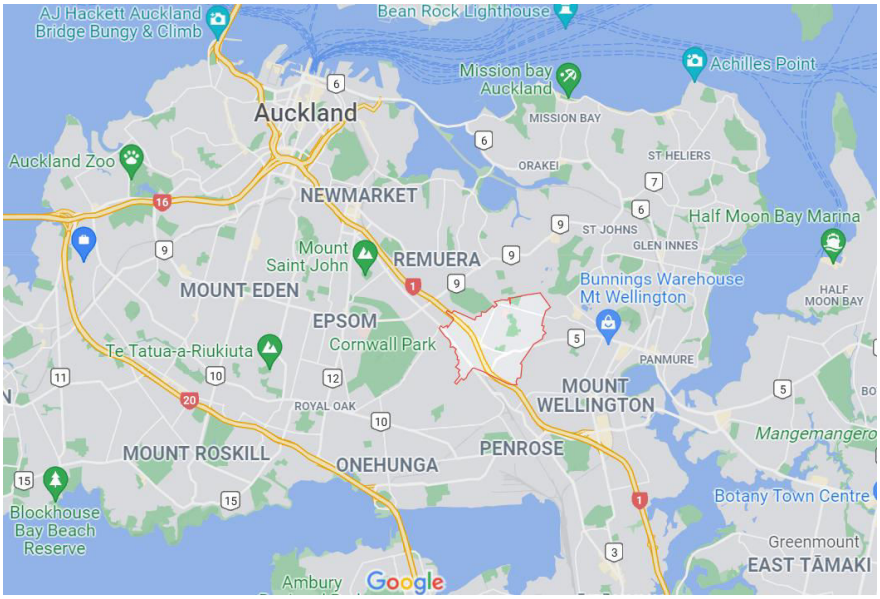

Figure 5. Location of Case Study B in Ellerslie, Auckland Central (Google Maps, 2022)

The development began in January 2020 and is currently in progress (Figure 6). All 23 walk-up apartments have been sold off the plans (DDL Homes, 2022). This site also had asbestos contamination, which took a week to remove and costed approximately NZ$10,000.

Figure 6. Case Study B: 23 walk-ups in Ellerslie, Auckland Central (under construction) (Authors' photo, 2021)

Walk-ups have been used across Auckland in the past few years as multi-units to meet the housing demand. There were 3,124 building consents processed in Auckland in the year-ending June 2021. The last ten years mark a steady upward trend in the number of consented apartments from 170 in 2011 to over 3,000 in 2021 (Statista, 2022).

4.2 Document analysis and site observations' results

Location and proximity to convenient transport options and local amenities appeared to be significant factors for both developments. The two developments are within a few minutes' drive to State Highway 1. Case Study A is within close proximity to Manurewa Town Centre, and Case Study B is exceptionally close to Ellerslie Town Centre. Primary, Intermediate, and Secondary schools are within walking distance from both developments. Local parks, sports facilities, and other recreation options are in the vicinity of the two developments. All these factors seem to be highly valued by potential buyers, which increases the likelihood of selling properties faster and making a quick return for developers.

The original site for Case Study A was quite large, 1012m2, and had a single stand-alone house. Such generous-sized sections are hard to find, especially in Auckland (Figure 7).

Figure 7. Aerial view of Case Study A in Manurewa, pre-development. Original section with a single stand-alone house, garage and carports. Scale 1:1000 (GeoMaps, 2021)

The original 3-bedroom, 1-bathroom stand-alone house, an ex-rental, was quite modest and at the time of the sale was advertised by the real estate agent as an opportunity to “renovate/develop” (Bayleys, 2018) (Figure 8). The property was sold for NZ$780,000 in 2018.

Figure 8. The 3-bedroom stand-alone house on the original site (Bayleys, 2018).

The property is zoned as ‘Residential - Mixed Housing Urban Zone’ under the AUP (Figure 9), allowing for urban intensification and building coverage of 45%. This type of zoning encourages brownfield redevelopment, especially in areas with easy access to local amenities and convenient public transportation. Large sections with development potential located in Mixed Housing Urban Zones are especially attractive to property developers and investors as they can maximise their profits.

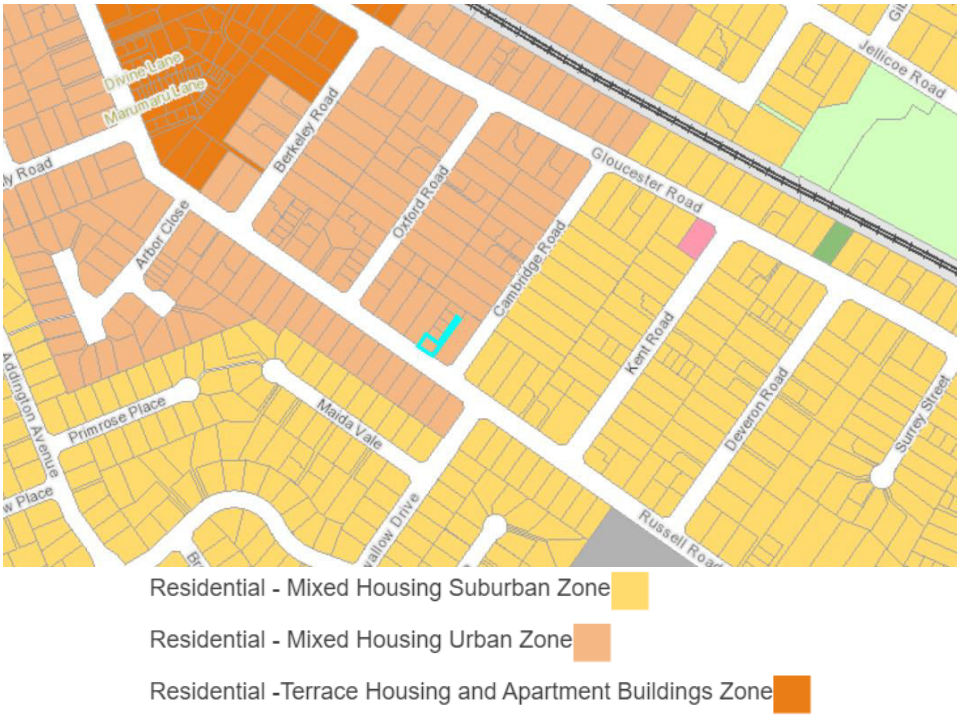

Figure 9. Zoning for Case Study A – Residential Mixed Housing Urban Zone. Scale 1:5000 (GeoMaps, 2021)

The redevelopment has created five new housing lots of varying sizes: two lots of 148m2 and three slightly bigger ones of 166m2, 176m2 and 190m2. The growing trend of much smaller property sections is clearly evident in the way the original large section has been maximised. All five new stand-alone houses were sold shortly after completion in 2020 for a range of sale prices: NZ$743,000; 2 X NZ$760,000; NZ$835,000 and NZ$865,000 (Property Value, 2022).

Existing infrastructure at brownfields is an important factor for developers. The easy access to existing underground services such as power, water, stormwater and wastewater (Figure 10) near the property boundaries presents a greater advantage for brownfield development because of the reduced costs associated with extending the required services into the properties.

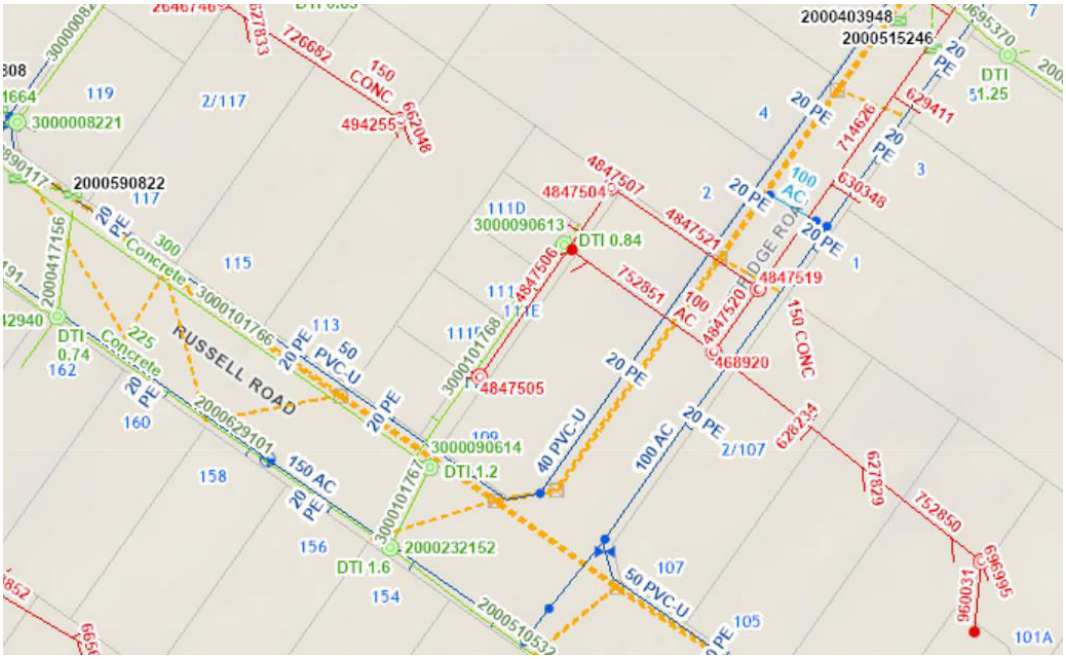

Figure 10. Underground services: power (yellow), water (blue), stormwater (green) and wastewater (red) for Case Study A. Scale 1:1000 (GeoMaps, 2021)

The original section size for Case Study B was quite generous, 1917m2, in comparison to the floor area of the single 2-bedroom, 1-bathroom stand-alone house of 179m2 (Figure 11). The property with the original house, built in 1920, was sold in mid-2019 for $3,800,000 (Property Value, 2022). The property is zoned as 'Residential - Mixed Housing Urban Zone' under the AUP and as such offers great development potential (Figure 12).

As a result of the redevelopment now there are 23 walk-up apartments with an estimated size of 60m^2 each. The size of the apartments is significantly smaller in comparison to the stand-alone houses in Case Study A. In addition, they are accessible only by stairs so they might seem less desirable. As such they would only suit a particular type of households. However, the more central location and the proximity to the CBD as well as their affordability could compensate for the smaller dwelling size and the complete lack of land ownership. The availability of existing infrastructure in the area, such as power, water, stormwater and wastewater, was a definite advantage (Figure 13).

Figure 11. Aerial view of Case Study B in Ellerslie, pre-development. Original section with a single stand-alone house. Scale 1:1000 (GeoMaps, 2021)

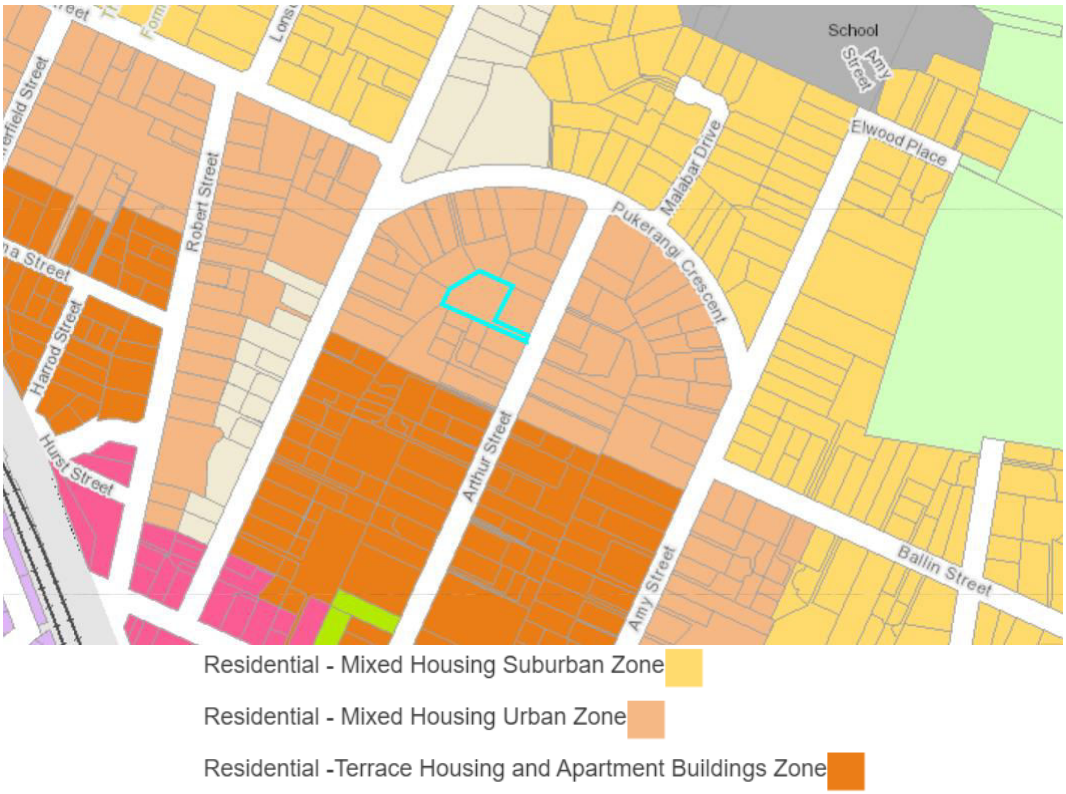

Figure 12. Zoning for Case Study B – Residential Mixed Housing Urban Zone. Scale 1:5000 (GeoMaps, 2021)

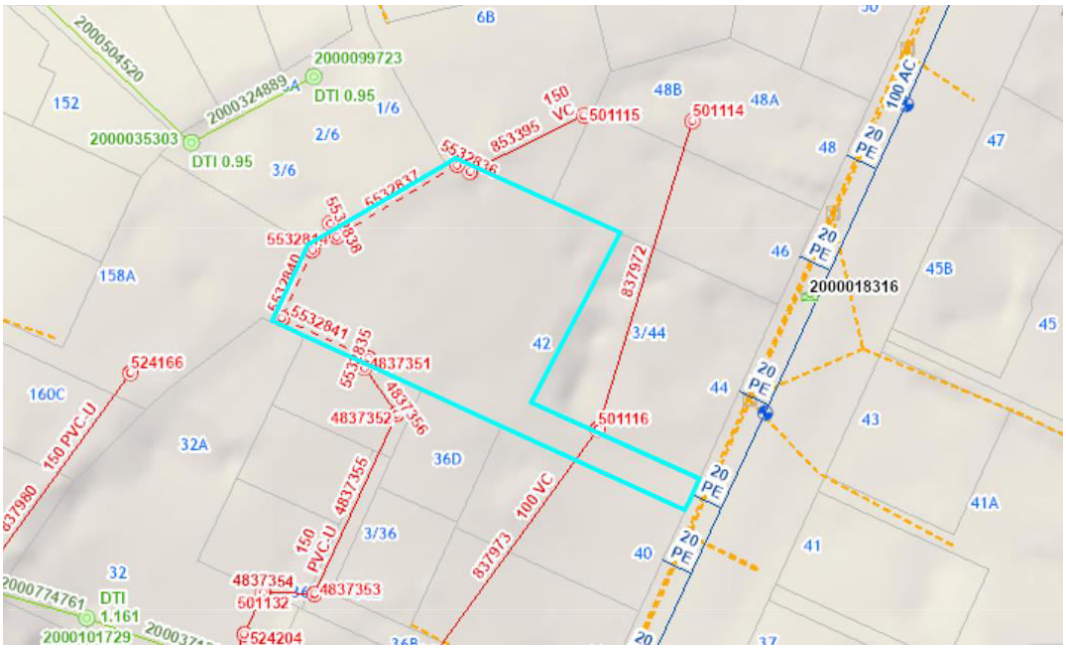

Figure 13. Underground services: power (yellow), water (blue), stormwater (green) and wastewater (red) for Case Study B. Scale 1:1000 (GeoMaps, 2021)

The residual effects of urban intensification are evident in the two case studies. For high-density housing, which is a significant feature of brownfield redevelopments, resource availability is challenging, with one example being the availability of car parking spaces. The problem is the same for the two case studies, with a single garage allocation for each house in Case Study A and a single car parking space for each apartment in Case Study B. A single garage is not sufficient to cater for families that usually have 2+ vehicles. It is evident from

the photo in Figure 14 that each house requires a minimum of two car spaces. Due to the unavailability of enough parking spaces, vehicles are illegally parked along the 'right of way' driveway, which possibly causes congestion and hinders traffic flow. Additionally, there is no on-street parking available nearby for tenants or homeowners due to no parking indicated by the yellow roadside markings shown in Figure 15.

Figure 14. Cars blocking shared driveway at Case Study A (Authors' photo, 2021)

Figure 15. No roadside parking allowed at Case Study A (Authors' photo, 2021)

4.3 Interview results

The developers of the two case studies participated in semi-structured qualitative interviews. Although the participants had a varying number of projects or developments and had unique business goals, their response was proportionately positioned with similar challenges, principles, and decision-making criteria for their developments.

4.3.1 Expected return on investment determines feasibility

Expected development profit is highly influential in meeting the stakeholders' objectives. According to Developer B, stakeholders are mainly interested in the profit margins of new developments, with potential risks weighted against the expected returns. For Case Study A, the expected development return was set at 31%. Developer A mentioned that staying abreast with costs on the feasibility report is vital for the expected 31% return. He mentioned that the accuracy of the feasibility assessment and close match with the Quantity Surveyor's valuation of costs and materials was paramount. He further elaborated that utility costs associated with energy supply, water supply, council rates, processing costs, financial costs all needed to be accounted for development success. For Case Study B, the expected development return was estimated to be 23%. The construction cost per square meter for Case Study A is NZ$1,600, much lower than Case Study B at NZ$2,500. The lower cost per square meter for Case Study A is attributed to the company developer being a professional builder. Hence, his ability to undertake most of the building works by himself. On the other hand, Case Study B subcontracts all construction works, which adds significantly to the extra cost.

Consequently, the expected profit of 23% is lower than the expected threshold, mainly due to the threshold being established prior to the company's involvement in the development. The director of Case Study B stated that the feasibility report recommended a listed sale price of NZ$685,000, before the unexpected increase in value of the properties, which are now selling for approximately NZ$850,000 each. The decision to develop or

not depends on the development return percentage. The expectation is to make as high a profit as possible. The developer of Case Study A is flexible on the development return percentage, which is dependent on various social factors and location. However, the developer of Case Study B had a threshold of 30% for development return percentage as he had to meet the expectations of potential stakeholders in order to obtain funding for the development.

4.3.2 Risk and feasibility assessments are critical

Developer A stated that risk assessment is an important aspect before any investment decision-making process, whether the site is a greenfield or a brownfield. He minimised any risks associated with the development by involving building professionals (architects and engineers) in the project as early as possible in the planning stage. Similarly, Developer B carried out a risk assessment and a feasibility study with professionals' assistance to minimise any unexpected or hidden risks from emerging later. Developer A stated that they did not rely on the advice of town planners and local authorities during the decision-making process and trusted the advice given by other building professionals and his own background checks before making the final call. Developer B shared a similar opinion on making one's own judgment calls on a development potential but did consult professionals in the process: "*there is always a full feasibility study done, along with pre-application meeting with Council to make sure we understand the guidelines. We discuss with planners, architects, traffic engineers, all to ensure that our numbers will stack up in the feasibility and there are no hidden risks or asbestos/contamination that we come across after*".

4.3.3 Choosing the right location makes all the difference

The decision-making process is highly influenced by the location for Developer A, who generally targets potential first home buyers and is willing to pay a competitive price for land in a prime location. He stated that buying a development property not close to train stations or a highway intersection was risky as it was not an attractive option for first home buyers. Developer B also stated that location influences 90% of his decision-making on developments. Both developers consider 'location' as one of the driving factors for brownfields. Auckland appears to be a trendy city for buying property, which has driven the brownfield development trend. Developer B added that "*brownfields are exploding because of unrealistic values of property evaluated by real estate companies that represent a flawed valuation of land*."

4.3.4 Existing infrastructure increases profitability

Developer A believed that brownfield development capitalizes on land use by providing opportunities to build upwards rather than sideways. The availability of necessary services on-site or within the vicinity of a brownfield site was a positive outcome in terms of time savings and money savings. Brownfields are more profitable ventures than greenfields, where substantial money and time are invested in organising basic services. Developer B stated that if the profit margin is higher than the 30% threshold, he will develop whether it is greenfield or brownfield, and currently, greenfields are a more expensive investment. Developer A also stated that "*there are economic benefits for the government from brownfield development as there is already existing infrastructure and capital investment is not required to build new suburbs*."

Developer B believes that "brownfields allow for medium to high-density housing, which creates economic benefits for all of New Zealand and increases the availability of more affordable housing." Both developers shared similar views that brownfield sites are more lucrative than greenfield sites. Developer B mentioned that with an increase in first home buyers, brownfield sites had the scope to create a large number of homes. The advantage included the availability of all services, stormwater, and sewer, being already present on the property or close by, so fewer development costs are incurred. Moreover, the AUP seems to be working for both developers. However, Developer A felt that more work was needed in getting the zoning correct in suburbs before effective development could occur. Developer B thinks highly of the AUP and feels that much consideration has been placed into the new zonings, such as accessibility to public transport, public roads, traffic networks, and existing infrastructures.

4.3.5 Environmental impact is not a concern

The environmental impact was not a factor of great concern for the developments. The majority of the trees on the Case Study A site were consented for removal as per Council guidelines. However, the developer disregarded the landscaping plan submitted as part of the Resource Consent application. On the other hand, Case Study B had a professionally created landscaping plan with a plant schedule as part of the Resource Consent application. However, both developers only followed minimum Council requirements as the Environmental Impact Assessment (EIA) was not required for the two sites and, therefore, not completed. Creating green spaces was not a major concern for the developers. Developer A mentioned that EIAs were not conducted for his developments, but he does abide by council rules and guidelines to minimise the environmental impact.

Developer B stated: "*we usually have a geotechnical report done; if there is any contamination or uncertified fill, then we will get a contamination report done, which may lead us to get a Discharge Consent because the contamination could discharge into the local facility".* Both developers have also not considered sustainable designs in any of their developments and fulfil Council guidelines by complying with minimum requirements for glazing, insulation, and provisions for heating homes. The presence of nearby green recreational spaces is appreciated by Developer A, who bases 50% of the decision-making on the proximity of the development to green spaces and school zones. Developer A considers green recreational spaces as an essential requirement for the well-being of children. This view is shared by Developer B, whose firm contracts professionals for landscape design in his developments. However, green recreational spaces are not a critical requirement and influence only 20% of his decision-making.

Developer A believes that urban design qualities enhance the city by assisting businesses and contributing to economic growth. However, he feels that lifestyle is impacted due to high-density living, with the most significant impact being on the younger generation. He felt that with smaller sections, children do not have space to grow, impacting their lifestyle and social development. Both developers consider the value of green spaces and recreational parks as a way of adding value to high-density living and as a physical characteristic to consider for future developments.

5. Discussion

5.1 Economic considerations contributing to the decision-making

Feasibility studies are an essential part of any proposed development. Its success is primarily determined by a robust risk analysis of the project, which could help flag any hidden risks in the earlier project stages. These risks include site-specific analysis, socio-economic and political planning, and financial and market evaluations (Wu et al., 2017). Furthermore, satisfactory high returns on investment are gained depending on the level of risk taken (Adair et al., 2003). The interviewees were unanimous that feasibility is a vital criterion fundamental to them; if a project does not demonstrate good feasibility, then the development is considered unviable. The feasibility analysis for the two case studies took into consideration the total cost of the project from start to completion: the land cost, the cost of construction (including landscaping costs and site works), design and management (including professional fees), consent, utilities and contributions, real estate costs. The economic aspects played a crucial part in the decision-making process of both developments. This correlates to assertions in the literature that economic factors are the leading motivator for investors of brownfield developments (De Sousa, 2000).

The feasibility analysis should show an average expected development return of around the 30% threshold for brownfield projects to be initiated. As the document analysis revealed, that threshold was met by Case Study A but not by Case Study B, whose development return was estimated at 23%. The reason was that the property investor had planned the development before setting the threshold. Although he initially accepted the lower return, he later realised that meeting the threshold was the best option for maximising returns for the time and money he had invested in the project. Investment benefits and returns are of primary concern to developers (Wang et al., 2022). As a result of the COVID-19 pandemic lockdowns, the delays led to increased materials costs, labour shortages, and higher interest rates from funders and negatively impacted the financial aspects, as well as creating greater risk for the developer.

Specific risk assessment for projects is completed by consultants or other stakeholders who endeavour to produce superior service (Wu et al., 2017). Both developers in this research used professional services to investigate the feasibility and risk assessment of the projects. The involvement of professionals was significant for both developers, despite the high professional fees charged, and was crucial at the early planning stage. For both case studies, the valuation cost was included as a separate item and a lump sum. The other professional fees for architects, engineers, land surveyors, etc., were calculated at 4% of the construction costs. Brownfield investment projects require full cost planning, including the expenses of valuation professionals, which is often very costly (Wu et al., 2017). If a project is deemed unfeasible, then it becomes a financial expense for the developers to forfeit.

Prime location and proximity to various amenities are crucial factors for property developers when evaluating the economic viability of a brownfield site. Promoting a well-balanced structure of compatibility of various urban elements is key (Pahlen & Glöckner, 2004). The developers in this research favoured their sites' location and closeness to local amenities over any other factor. They determined the success and sale price of the development, the level of intensification allowed, and the amount of building coverage permitted. Short traveling distances between home, work, and leisure were achieved on both sites. Location is a critical factor for developers as the location of a property influences purchase decisions, which then reflects property prices with buyers willing to pay premium prices for desirable locations (Zihannudin et al., 2021). Developments in prime locations represent a lower risk for developers to secure funding and realize sales (Syms, 1999).

Higher land value means increased viability for higher-density housing construction and increased profit potential for developers (Maharaj & Martin, 2021). The proximity to train services and amenities, such as retail and shopping, health centres, schools, and housing, all add value to the development and increase investors' possibilities of higher returns (EPA, 2020).

As determined by the local Territorial Authority (TA), the urban zoning of a potential brownfield site is another critical factor that developers consider when determining the economic viability of a project. Since its launch in 2016, the AUP (Auckland Council, 2016) has been fundamental in helping ease the housing shortages experienced in Auckland by increasing housing supply through the relaxation of various land use regulations, including constraints on residential density (Greenaway-McGrevy & Sorensen, 2017). The two case studies are located in a Mixed Housing Urban (MHU) zone and, as such, were allowed to have a maximum building coverage of 45% compared to only 40% in a Mixed Housing Suburban (MHS) zone (Auckland Council, 2016; Auckland Council, 2018). Developers prefer the MHU zone as it allows for the construction of buildings up to three storeys in various residential categories such as detached dwellings, low-rise apartments, and terraced housing. In comparison, the MHS zone encompasses established residential areas and greenfield sites with standalone dwellings typically limited to one to two storeys in height (Tang, 2021). From a developer's point of view, a brownfield site located in an MHU zone in Auckland has greater possibilities of higher returns and thus is much more preferable.

Pre-existing infrastructure is an indispensable feature of brownfield sites that increases their lucrativeness for developers. The developers favoured the brownfield sites of the two case studies in this study as the availability of existing infrastructure, such as power, water, stormwater, and wastewater, was a cost-effective advantage for their projects. The central location of brownfield sites and the reuse of existing public infrastructure enable developers to forego considerable infrastructure costs and result in considerable savings (Brown et al., 2016; EPA, 2020).

5.2 Social considerations contributing to the decision-making

Brownfield developments have social impacts on residents, communities, and businesses and are essential for the viability of any project. Human activities dominate the process of brownfield creation and development (Wang et al., 2022). The property developers highly favoured the two brownfield sites in this study, located in close proximity to local town centres, good schools, rail networks, and other public transport facilities. The proximity to transport networks is a significant social benefit to improving liveability and reducing the reliance on private transportation (Beames et al., 2018; Stubbs, 2002). The single garage provision for each stand-alone house in Case Study A and the single car parking space for each of the 23 walk-up apartments in Case Study B encourage the use of public transport, walking, or cycling. The resultant unintentional social benefit is more significant physical activity for residents, such as walking to public transport and improving population health (Zapata-Diomedi et al., 2019).

Other social benefits of brownfield developments include creating job opportunities, promoting a revitalised and positive environment, and improving urban quality of life (Wang et al., 2011). Community revitalisation is often associated with brownfield redevelopments and results in urban regeneration by attracting new business investments which can contribute to community improvement. A redeveloped former brownfield can strikingly improve the area’s quality of life, particularly in economically disadvantaged areas (Brown et al., 2016). Both developers in this research believed the local community benefitted economically due to brownfield developments as population growth boosted local businesses. As a result, planning authorities often prioritize urban zones that have significant potential to invigorate the local area. Furthermore, stakeholders such as financiers and Auckland Council played a vital role in approving the two brownfield developments in this research. The participation of stakeholders such as regulators and investors is becoming increasingly important to ensure acceptance of proposed redevelopment projects (Thomas, 2003).

5.3 Environmental considerations contributing to the decision-making

The expectation that environmental considerations will be at the forefront of urban development is unrealistic. Environmental concerns continue to be overlooked by property developers, with the primary purpose being to maximize the capitalization of developments (De Sousa, 2000). A similar focus on economic benefits applies to urban brownfield redevelopments in Auckland. To ensure the sustainable development of cities, there is a need to shift away from the economic focus of developments towards the rejuvenation of the natural environment, including prioritising the landscape and biodiversity on brownfield redevelopment projects (Cappai et al., 2019). The developers in this research have not taken any extra initiatives to minimise the environmental impacts of their projects. Instead, they only made minimal efforts to comply with Council guidelines and regulations, with landscaping being the main focus of their projects. However, even those proposed landscaping plans were not implemented as per the requirements, even though both developers believed this was an essential aspect of urban redevelopment.

Landscaping creates urban green spaces that impact city residents' health and well-being and contribute to sustainable urban planning and development (Kim, 2018; Włodarczyk-Marciniak et al., 2020). Even though spatial and financial restrictions are often the main barriers to establishing new green spaces (Kronenberg, 2015), the associated environmental benefits including improvements in air quality, mitigating flood risks, and regulating temperature (Brun et al., 2018), far outweigh the obstacles. Green spaces become invaluable assets in brownfield developments by reducing meteorological and hydro-related hazards and improving the overall urban ecosystem health (Kim et al., 2018).

Good neighbourhood design is paramount if the inclusion of urban green spaces is required. Maharaj & Martin (2021) emphasise that the design of neighbourhoods in new developments can significantly impact the quality of life of residents and the sustainability of their communities. However, good design is irrelevant if it is merely reflected in plans but does not eventuate in reality, which is the case with the two developments in this research. Therefore, there must be strict guidelines around green space requirements in all future brownfield developments. Additionally, adherence to these expectations should be closely monitored.

6. Conclusions

This research suggests that the economic returns of brownfield redevelopments are the most crucial criterion for property developers in the decision-making process. Feasibility studies, which provide a robust risk analysis of the project, are critical to the success of any development. The involvement of professionals, despite the high professional fees charged, to investigate the feasibility and risk assessment of proposed projects is vital to developers. Cost-cutting at this early stage of evaluating market viability is not an option as developers realise that such mistakes could be very costly and could compromise the projects' success. An average expected development return of around the 30% threshold is a rough guide for investors to consider a development as viable. Prime location and proximity to various amenities, such as public transportation, local town centres, and good schools, determine the lucrativeness of a project and the rapid economic return on investment for the stakeholders. On the one hand, such brownfields are low-risk investments for developers to secure funding and sales. On the other hand, they generate strong interest and attract potential buyers willing to pay premium prices for desirable locations.

Other factors that increase the investment returns and impact developers' decisions are the urban zoning of a potential brownfield site and the availability of pre-existing infrastructure. The former allows for increasing residential densities, and the latter offers cost-effective advantages for the proposed projects. The increase in population growth through urban intensification boosts local businesses. It encourages community revitalisation, which is much favoured by planning authorities as they appreciate the significant potential of brownfield redevelopments to invigorate the local area. Therefore, the economic and social considerations in the decision-making process appear intertwined and have cumulative effects on the urban quality of life.

The environmental considerations, however, are neither prioritised nor given any importance. The prevailing attitude of conformity to planning rules remains restricted to the project's design stage without being realised at the construction stage. Thus, proposed landscaping plans, which simply become unavoidable and necessary design exercises, never see the light of day as they do not get implemented. Despite the agreement among developers that they are an important aspect of urban redevelopment, cost-saving considerations and the desire to maximise profits take precedence over any environmental concerns. Reducing the environmental impacts of new developments is not a concern for developers, which is evidenced by the complete lack of green building practices. A shift away from the sole economic focus of developments towards the regeneration of the natural environment, including prioritising the landscape of new projects, could ensure the overall sustainable development of cities. Future research could focus on local residents as community inclusion could provide valuable insights into the quality of urban life in these new urban environments.

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