A new greenfield residential subdivision, flanked by lifestyle blocks pushing into the productive hinterland. Lincoln, Waikiriri Selwyn District, Aotearoa New Zealand (with permission from Don Royds, 2023)

LANDSCAPE
REVIEW

Exploring the design thinking methodology to stimulate alternative approaches in peri-urban landscape planning

SHANNON DAVIS, STUART CHARTERS, GUANYU CHEN AND PABLO GREGORINI

Peri-urban areas are vital to the function and value of our communities, environment and economy. Many epitomise the relationship between a community and the landscape, providing essential ecosystem services to a settlement. With the expansion of cities and the resulting urban sprawl, the ability of peri-urban zones to sustain food provision is threatened in Aotearoa New Zealand. This paper reports and reflects on a workshop facilitated by the Centre of Excellence: Designing Future Productive Landscapes, Te Whare Wānaka o Aoraki | Lincoln University, with the Canterbury Mayoral Forum, to explore alternative land use topologies for peri-urban areas in Waitaha | Canterbury. Its focus is on applying a 'design thinking methodology' to explore this issue and the opportunities for engagement and solution ideation that it promotes. Workshop participants engaged in activities designed to provoke alternative and innovative thinking about the spatial relationship between urban growth (housing) and agricultural land (production). Key findings illustrate the strengths of the methodology to elicit alternative responses to land use planning within the peri-urban zone, and indicate a desire to rethink how we plan and design city edges to better protect and enhance their ability to produce food and support other essential ecosystem services alongside urban expansion.

Introduction

Governments, local authorities, planners and landscape architects have long recognised the need to limit city expansion, predominately from an 'urban' perspective that sees successful cities as having high levels of accessibility, connectivity, density and diversity, achieved primarily through a compact urban form (Bibri, Krogstie and Kärrholm, 2020; Haarstad et al, 2023). Looking at the issues associated with urban sprawl from a 'rural' perspective, we see a different range of priorities, including the need to protect versatile and highly productive soils, retain land for agricultural uses, defence of rural culture and to maintain access to local food production (Morgan, 2014; Morgan and Sonnino, 2010; Opitz et al, 2016; Pothukuchi and Kaufman, 1999; Steel, 2008, 2020; Viljoen, 2005; Viljoen and Bohn, 2005; Viljoen et al, 2015), alongside other important ecosystem services such as stormwater management and climate regulation, flood mitigation, water purification, and pollination. A broad consensus among designers and policy makers is that peri-urban agricultural land is an essential component of urban planning (Sarker, Bornman and Marinova, 2019). It follows that future thinking around peri-urban land use planning is critical to the long-term success of settlements and cities. With the global urban population growing exponentially, highly productive arable landscapes, as finite and scarce resources, are being irreversibly lost to make way for urban expansion to accommodate the growing population.

Although our understanding of land use conflicts in the peri-urban zone is articulated in a range of literature, research into spatial land use possibilities is an identified research gap in Aotearoa New Zealand. Notably too, the recently gazetted National Policy Statement on Highly Productive Land indicates a contest between national policy settings and practical application.

The conventional 'empirically driven' mindset of problem-solving has practical limitations due to interlocking political and practical constraints, as well as the strategic

Shannon Davis is a Senior Lecturer in Landscape Planning at Lincoln University, PO Box 85084, Lincoln 7647, Canterbury, Aotearoa New Zealand.
Telephone: +64 21-121-1298
Email:
Shannon.davis@lincoln.ac.nz

Stuart Charters is an Associate Professor in Applied Computing at Lincoln University
Telephone: +64 3-423-0415
Email:
Stuart.charters@lincoln.ac.nz

Guanyu Chen is a PhD candidate at Lincoln University.
Email:
Hanley.chen@lincolnuni.ac.nz

Pablo Gregorini is Professor in Department of Agricultural Sciences at Lincoln University.
Email:
Pablo.gregorini@lincoln.ac.nz

KEY WORDS

design thinking; structured provocations; land use planning; peri-urban; urban expansion; highly productive land

Citation: Davis, S.; Charters, S.; Chen, G.; Gregorini, P. (**2024**) Exploring the design thinking methodology to stimulate alternative approaches in peri-urban landscape planning. *Landscape Review*, 20(1), pp 7-30.
Received: 3 November 2023
Published: 17 April 2024

uncertainty and unpredictability resulting from the systematic complexity of land use conflict. Within conventional ways of problem-solving, problems are expected to be addressed by following a rigorous and empirically driven approach, in which decisions are informed by knowledge generated through the rational process of data gathering, modelling and forecasting (Considine, 2012; Howlett, 2014; Parsons, 2002; Wagle, 2000). This perspective on problem-solving and decision-making is rooted in the belief that system challenges can be simplified to technical problems that are amenable to scientific solutions (Head, 2008).

However, this conventional approach may lead to stagnation in the endless analytical process when confronting a complex issue with many interlocking constraints and a high level of uncertainty and unpredictability (Davis and Stroink, 2016; Lewis, McGann and Blomkamp, 2020). One such issue is the conundrum over whether to use land for food or housing, a decision that Aotearoa New Zealand peri-urban areas are now facing as a consequence of pressure from urban population growth and the need for more housing. Further, as the irreversible loss of highly productive soil[1] is happening rapidly nationwide due to urban expansion, it has become an urgent task to find an alternative solution that allows the co-existence of food production landscapes and housing, and to preserve highly productive land. Exploring alternative approaches to inform decision-making is considered fundamental to enabling adaptive change. In this context, we adopted the design thinking methodology as an alternative approach aimed at facilitating the generation of innovative ideas with its focus on using 'design' as a method of creative problem-solving.

This case study research, documenting a local government exemplar, illustrates a way of using the design thinking methodology to identify land use issues within the peri-urban zone. By employing structured provocations in accordance with the design thinking methodology, we aimed to catalyse innovative thinking about the wicked problem: how can landscapes for both people and production prosper within peri-urban Aotearoa New Zealand, reconnecting people with land and food? This paper also showcases the processes we took to facilitate a design thinking workshop and discusses how design thinking can be applied to help with complex planning and decision-making issues where a conventional mindset or approach may fall short.

Design thinking as a tool for facilitating innovation

The concept of 'design thinking' was developed by David Kelly as an approach to provoke innovative ways of thinking in support of meeting customers' needs (Brown, 2008; Camacho, 2016). The design thinking approach was later found to be effective in facilitating innovation and addressing difficult or unusual challenges (Buchanan, 2019). As the process has undergone adaption, iteration, improvement and expansion, design thinking has been developed into new disciplines, and the process of 'design' refers ever more often to understanding real-world issues, identifying issues and needs, integrating knowledge, gaining insights from different disciplines and eventually contributing to the development of innovative solutions (Arifin and Mahmud, 2021; Léger, Laroche and Pruneau, 2020).

In contrast, the conventional mindset of problem-solving is considered to fall short in its capacity to help comprehend intricate challenges involving multi-spheres, which normally include environmental, social and economic considerations (Davis and Stroink, 2016). The field of facilitating innovation has seen a growing emphasis on design thinking as a fundamental tool crucial for fostering innovation and alternative solutions when dealing with complex, multidimensional problems (Dodgson, Gann and Salter, 2005; Groeger et al, 2019). A growing number of organisations are striving to incorporate a design thinking approach in tackling complex problems, and many of them have achieved favourable outcomes as a result (Bevan et al, 2007; Body, 2008; Leavy, 2012; Liedtka, 2011; Meyer, 2011).

The design thinking methodology has been widely adopted in a range of fields, including education (Balakrishnan, 2022; Panke, 2019; Rao, Puranam and Singh, 2022), product and service design (Parizi et al, 2022; Wang, 2022) and management (Knight,

Daymond and Paroutis, 2020; You, 2022). Yet it has seldomly been employed in engaging with politicians and decision-makers in order to catalyse insights into planning issues of public concern. Lewis, McGann and Blomkamp (2020) and McGann and colleagues (2018) investigated the experimental adoption of design thinking in the public sector for policy-making purposes. Based on their findings, they suggested that while design thinking is seen as a potential contributor to the problem-solving process, more research is needed to evaluate its actual impact on practices.

Participatory planning strategies have long been promoted in spatial design disciplines such as landscape architecture and urban design. Benefits of adopting such approaches have been explored in the areas of forming vision and goals, including community issues and concerns, and generating a feeling of public ownership and a consensus on priorities (Kumar et al, 2016). However, while there has been general agreement on the importance of participatory planning within the spatial design disciplines, design-focused outputs using participatory methods have been less studied. For landscape planning, as a profession involved in managing future landscape change, the systematised approach of design thinking, with its focus on rapid design ideation, offers an important tool. The design thinking workshop presented in this paper, held with local authority representatives, provided an opportunity to understand how design thinking can be used as a 'design tool' in supporting planning issues that are of public concern.[2]

Mayoral forum workshop using design thinking methodology

A representative group of mayors of Waitaha | Canterbury (all of them members of the Canterbury Mayoral Forum), elected councillors and employed professional planners attended a half-day workshop hosted by Te Whare Wānaka o Aoraki | Lincoln University, Centre of Excellence: Designing Future Productive Landscapes. The aim of the workshop was to rethink the conventional approach to land use planning and explore spatial land use alternatives for the peri-urban zones of Aotearoa New Zealand.

The design thinking methodology framed the workshop approach. Participants were introduced to the methodology and the individual steps were described. The workshop focused on the first three steps: 1. Empathise, 2. Define and 3. Ideate (figure 1). Each step was facilitated by one activity, as explained in the following three sections.

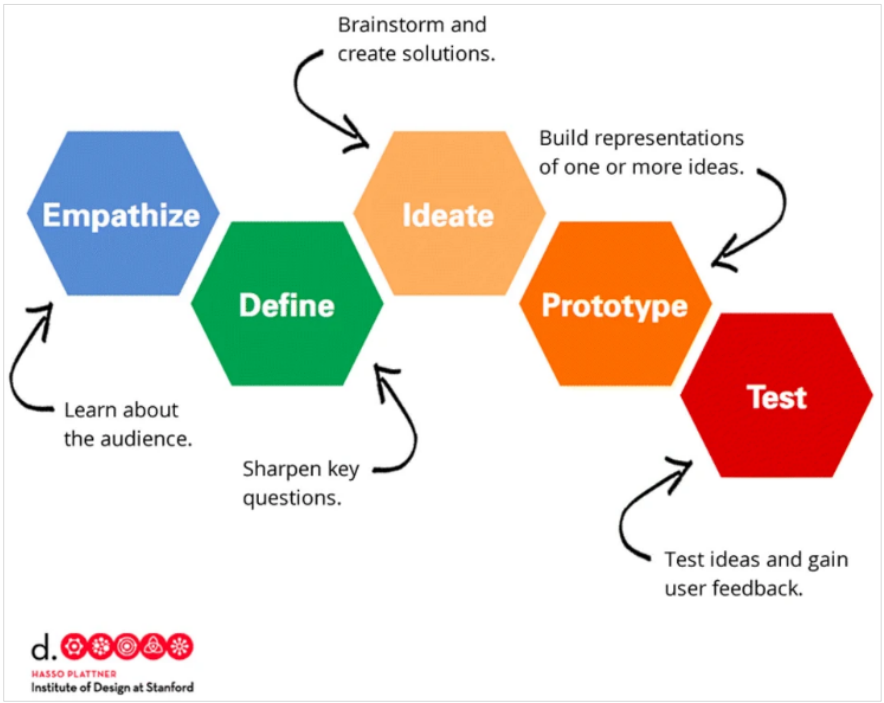


Figure 1. Design thinking process (Institute of Design at Stanford, used under Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Licence).

Activity one: Empathise – identifying current land use issues, conflicts and threats in peri-urban areas (group activity)

The first activity consisted of four tasks. The participants were grouped into teams of three or four to complete them, as follows.

1. On Post-it notes, write down the range of issues you are aware of in the Waitaha | Canterbury peri-urban zones, relating to:
    - residents
    - growers and farmers
    - land use planning
    - economic activity
    - community and recreation.
2. On poster paper, identify the one most important issue identified, and discuss it with your group.
3. Unpack your 'top issue': what is behind it?
    - Expectations vs reality?
    - Does it relate to pre-existing or new activity?
    - What initial ideas do you have that could help address the issue?
4. Report back.
    - What was your top issue?
    - Why is it your top issue?
    - What ideas do you have that could address the issue?

Activity one generated the identification of a range of issues and discussion around them, as shown in the word cloud (figure 2). The most commonly mentioned issues related to reverse sensitivity,[3] loss of land, housing, demands on the land/development, productive land and people.

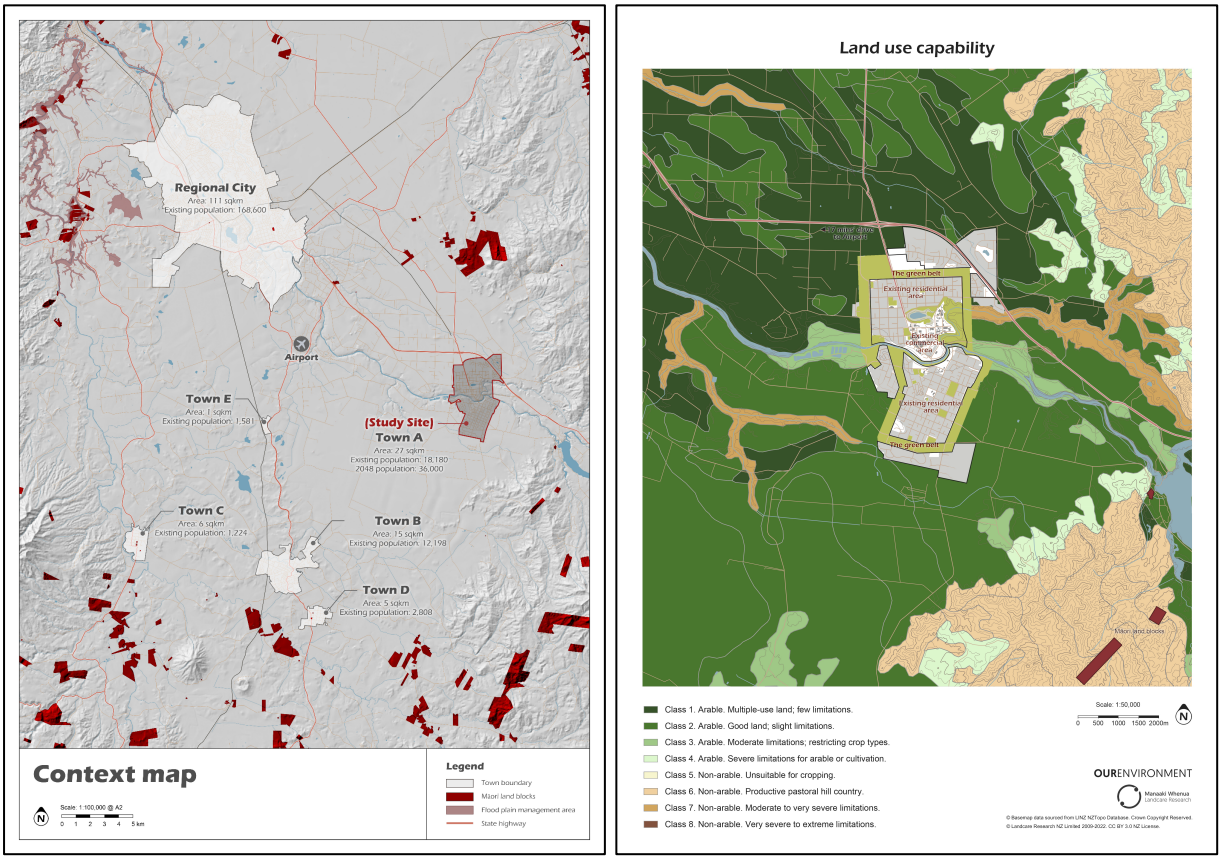
Figure 2. Word cloud generated from the issues identified in activity one (image by Guanyu Chen, 2022).

Activity two: Define – examining prepared land use scenarios (group activity)

Next, participants were introduced to five hypothetical urban planning scenarios developed to respond to the rapid population growth of an anonymous town in Aotearoa New Zealand. They were asked to move around the room and conduct a SWOT (strengths, weaknesses, opportunities, threats) analysis of the five scenarios, where differing spatial models were used to plan land for food production and land for housing. Participants were not introduced to the scenarios prior to arriving at each one to prevent them from developing preconceptions and to limit premature comparison. They were given the following instructions.

1. Examine the proposed scenario. Think about and record the strengths, weaknesses, opportunities and threats of this scenario in relation to land and land use relationships for housing and food production.
2. Move to the next tables and repeat for the other four scenarios.
3. Report back.
    - What scenario do you think will work best when planning for the future of the peri-urban areas within your constituency?
    - What are the top opportunities this scenario provides your district?

A case study, presented through maps and text (figure 3), was provided for activity two to allow participants to consider an overall hypothetical scenario for a town facing similar issues to that of the towns within Waitaha | Canterbury. A town outside the region was chosen to allow 'free' thinking for all workshop participants, without the burden of demands from a 'real-life' district and constituents.



(a) **(b)**

Figure 3. Hypothetical case study materials: **(a)** context map and **(b)** land use capability site map (images by Guanyu Chen, 2022; maps adapted from Manaaki Whenua Landcare Research, used under Creative Commons Attribution-ShareAlike 3.0 New Zealand Licence).

The hypothetical case study selected was a township that had a size, scale, and distance to a regional city similar to those within Waitaha | Canterbury. It had a predicted population growth of approximately 100 per cent over the next 25 years (figure 3(a)). The case study site was also surrounded by highly productive soil[1] (Land Use Capability classes 1–3) (figure 3(b)), consistent with the context of many towns in Waitaha | Canterbury. How to find the information associated with each scenario was explained to participants, which included the scenario 'approach' (for example, soil-oriented), residential area (in hectares) and urban density levels (including average density, and households per hectare (hh/ha) relating to each density present) (figure 4).

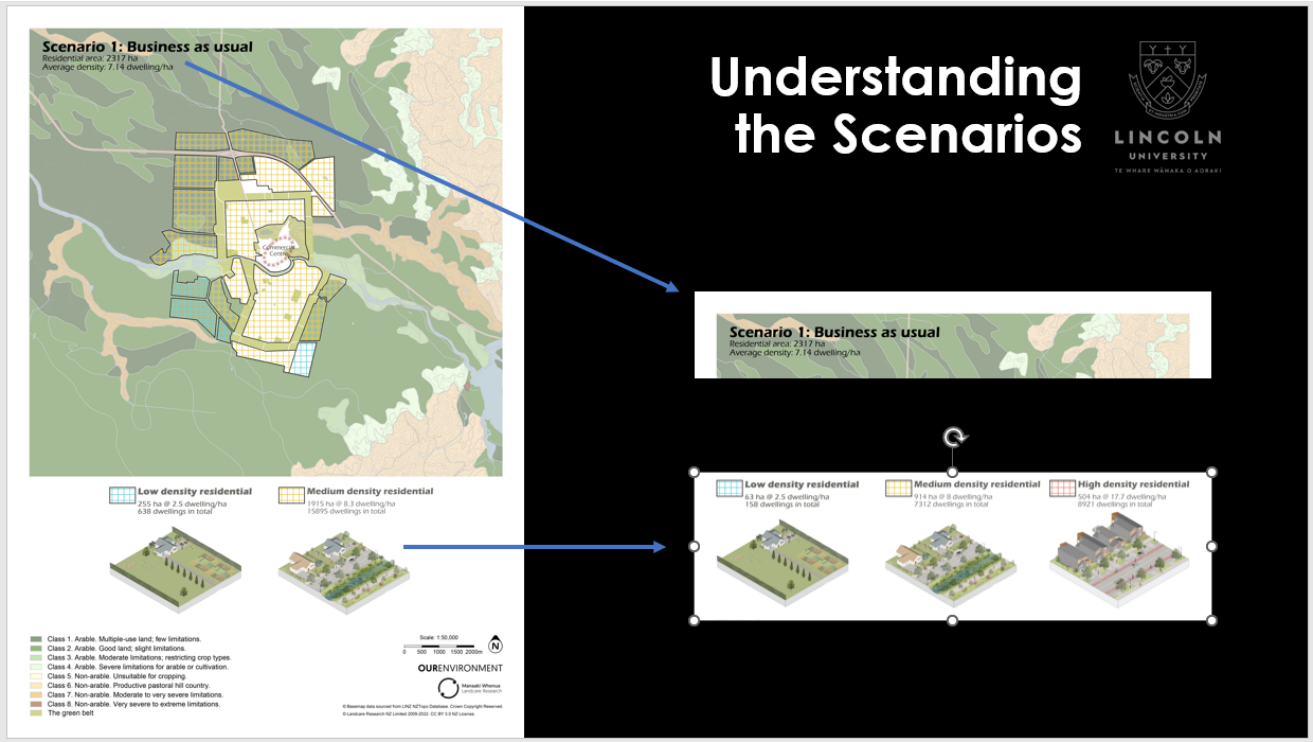


Figure 4. Information provided to help participants understand the scenarios (images by Guanyu Chen, 2022; map adapted from Manaaki Whenua Landcare Research, used under Creative Commons Attribution-ShareAlike 3.0 New Zealand Licence).

The five scenarios were:

- scenario 1: Business as usual (figure 5)
- scenario 2: Soil-oriented planning (figure 6)
- scenario 3: Transport-oriented planning (figure 7)
- scenario 4: Dense island/urban farm (figure 8)
- scenario 5: Hard boundary (figure 9).

The teams were left to circulate around the scenarios and conduct a SWOT analysis for each one.

Scenario 1 (figure 5) depicts residential housing of low (2.5 hh/ha) and medium (8.3 hh/ha) density. All existing housing densities are retained, and all urban extension areas are at a similar density. Urban expansion follows a 'sprawling' pattern (indicated on the map by additional hatched areas) predominately to the west, towards the regional city.

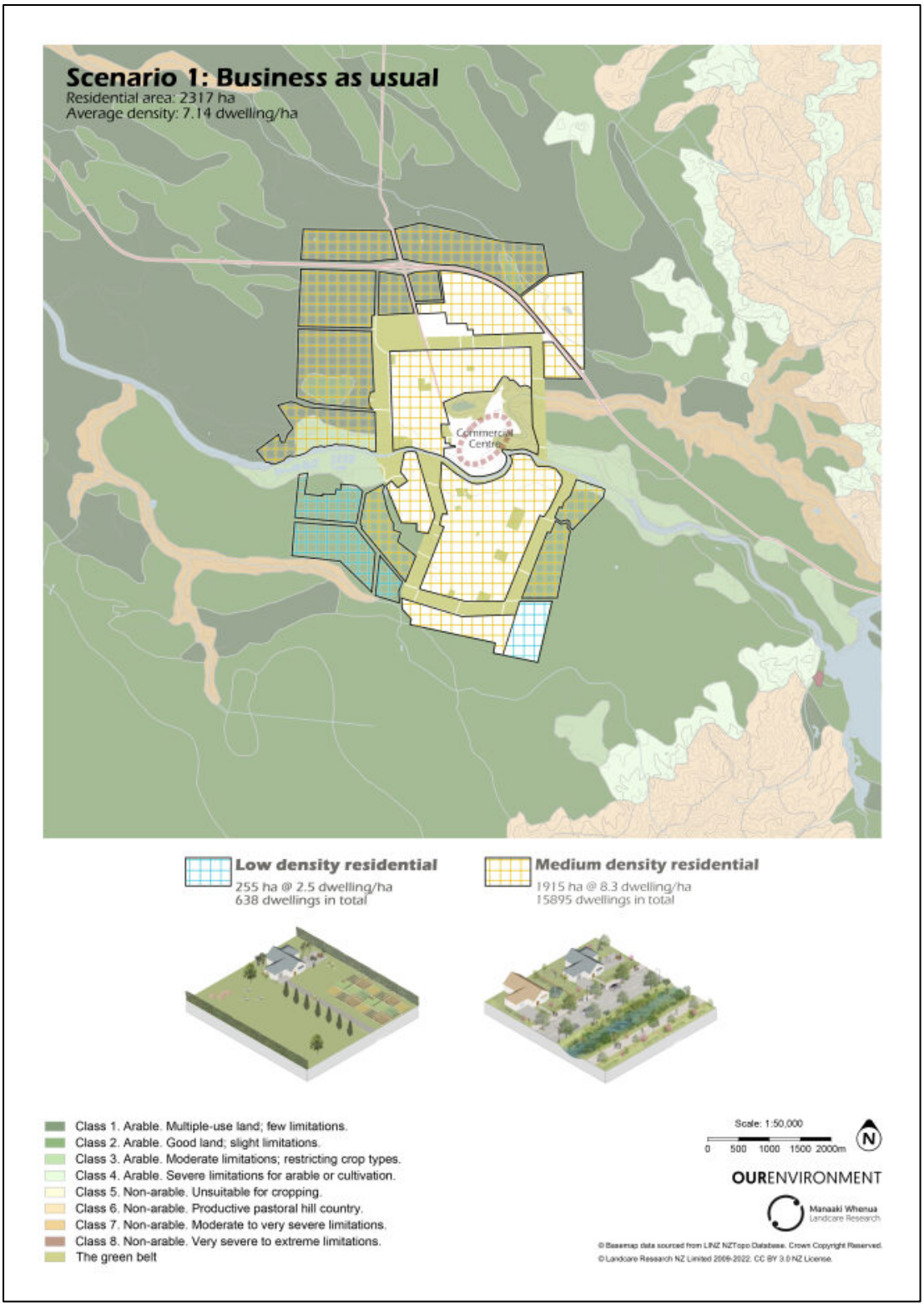


Figure 5. Scenario 1: Business as usual (image by Guanyu Chen, 2022; map adapted from Manaaki Whenua Landcare Research, used under Creative Commons Attribution-ShareAlike 3.0 New Zealand Licence).

Scenario 2 (figure 6) depicts residential housing of medium (8 hh/ha) and high (17.1 hh/ha) density. No urban expansion occurs on soil classes 1–3 (categorised in Aotearoa New Zealand as highly productive[1]). Instead, it occurs only on the two areas of class 4 soil (high-density housing), while the existing urban areas receive the remaining population by way of urban in-fill.

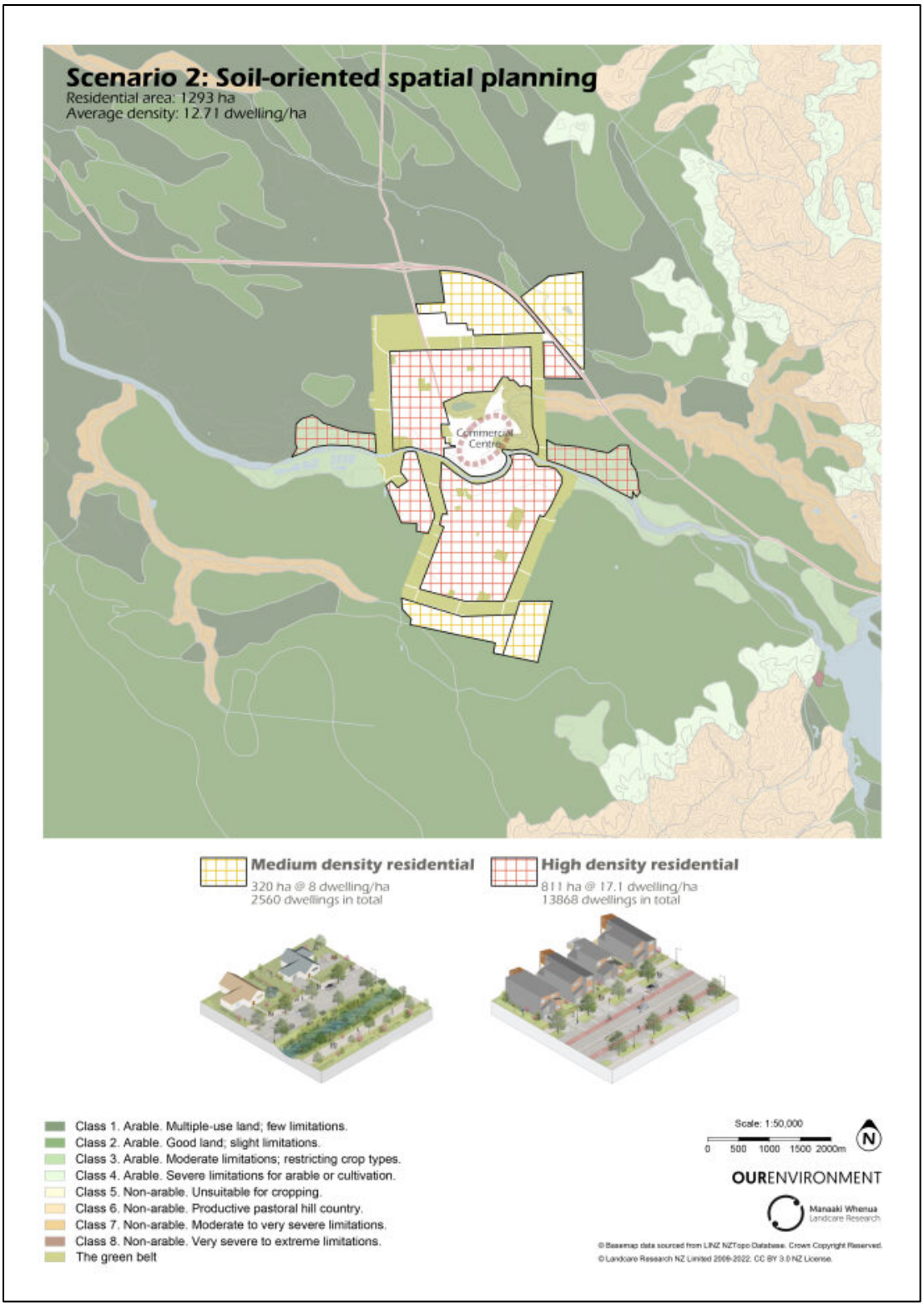


Figure 6. Scenario 2: Soil-oriented planning (image by Guanyu Chen, 2022; map adapted from Manaaki Whenua Landcare Research, used under Creative Commons Attribution-ShareAlike 3.0 New Zealand Licence).

Scenario 3 (figure 7) depicts residential development of low (2.5 hh/ha) and medium (8 hh/ha) density. Population increase is fulfilled by expanding the urban areas at a medium density along the existing highway linking the town to the regional city. All new development is at medium density.

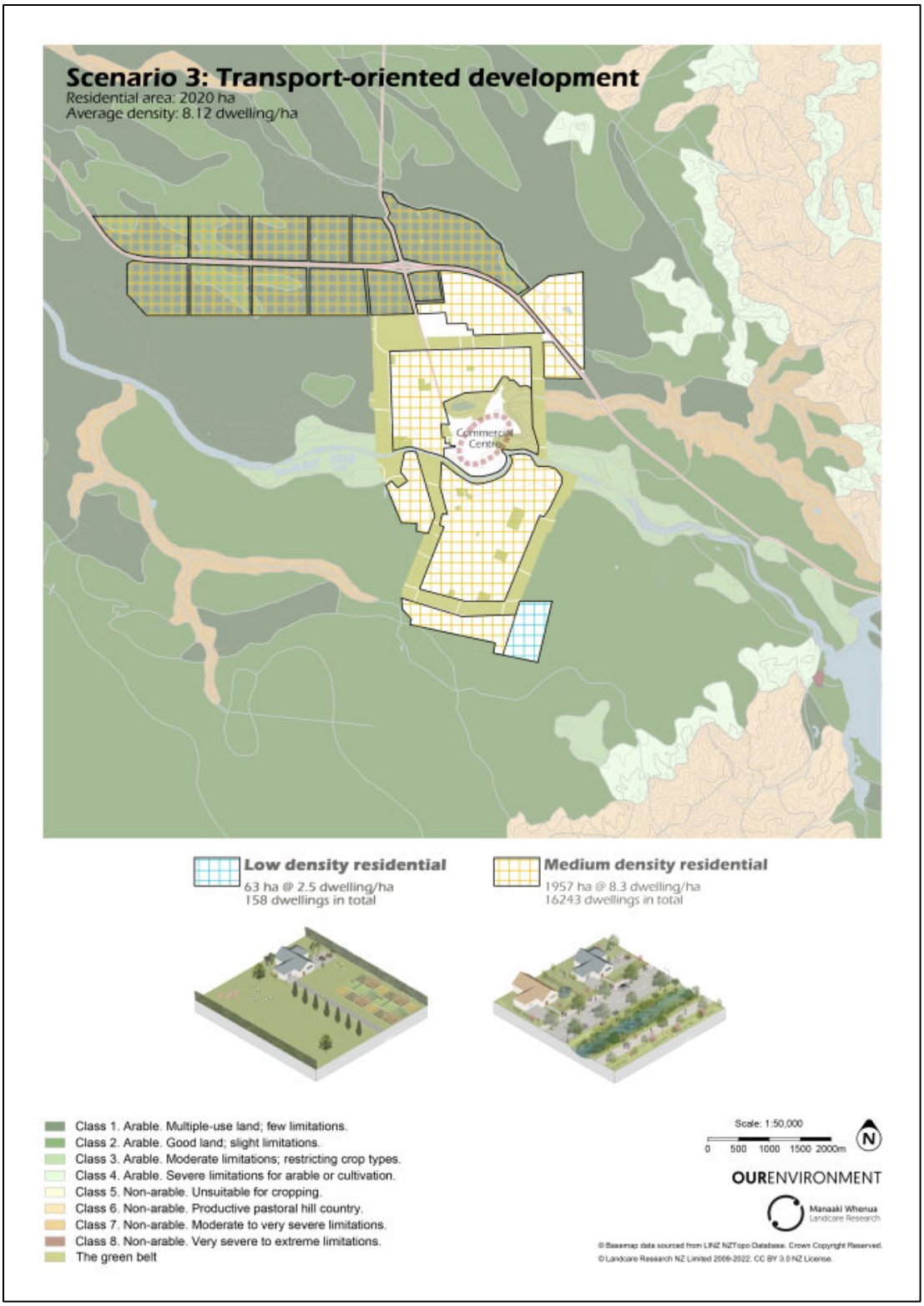


Figure 7. Scenario 3: Transport-oriented development (image by Guanyu Chen, 2022; map adapted from Manaaki Whenua Landcare Research, used under Creative Commons Attribution-ShareAlike 3.0 New Zealand Licence).

Scenario 4 (figure 8) depicts residential development at low (2.5 hh/ha), medium (8 hh/ha) and high (17.1 hh/ha) density. All existing densities remain the same, while the proposed additional population is received within the urban edge and accommodated in high-density housing located around 'urban farms'. The 'urban farm' zone is created around the immediate edge of the existing urban area. These 'urban farms' are approximately 100 ha, and spatially link to the existing greenbelt and open spaces.

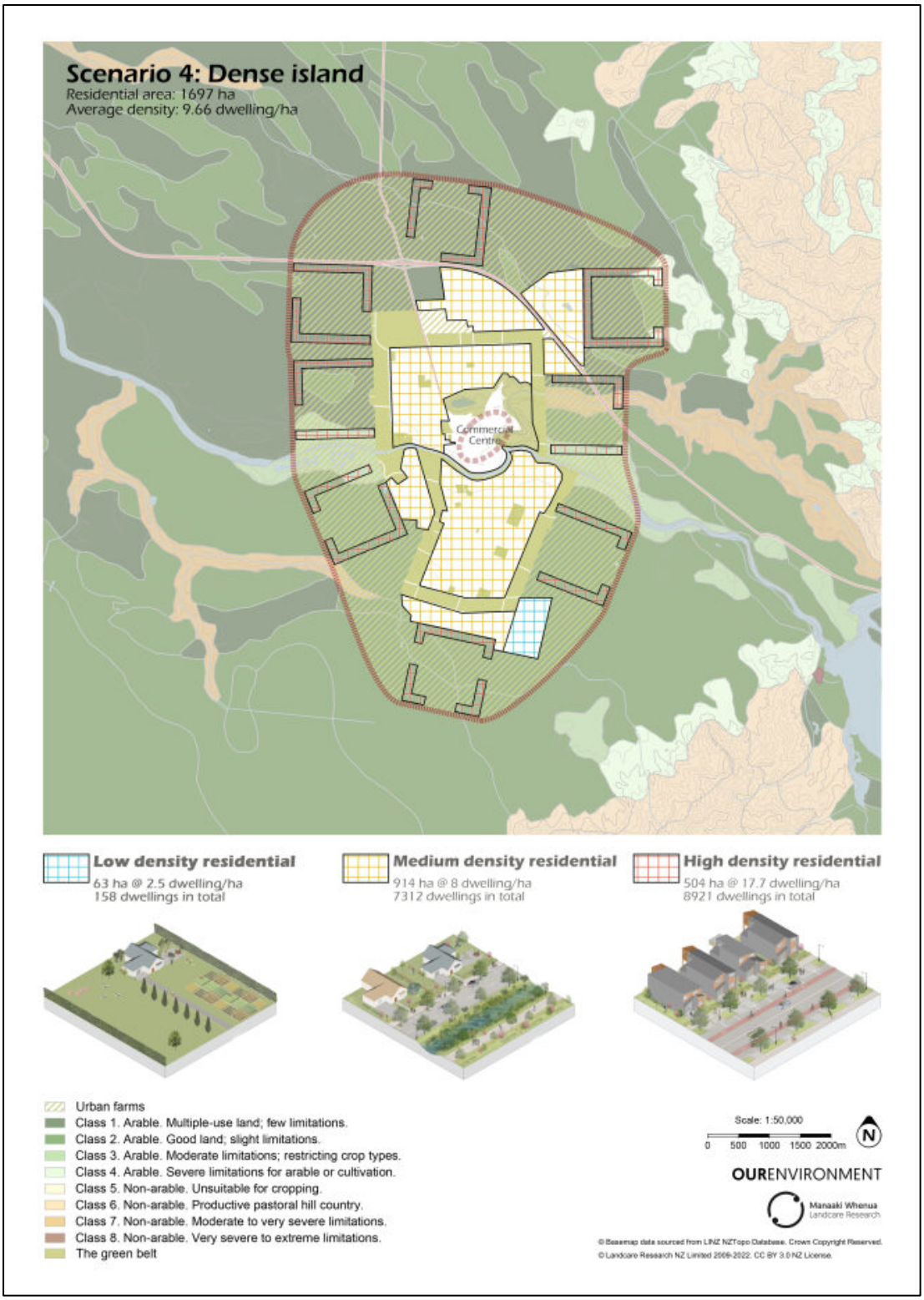


Figure 8. Scenario 4: Dense island/urban farm (image by Guanyu Chen, 2022; map adapted from Manaaki Whenua Landcare Research, used under Creative Commons Attribution-ShareAlike 3.0 New Zealand Licence).

Scenario 5 (figure 9) depicts residential development of high (16.8 hh/ha) density. All additional houses in this scenario are accommodated within the existing boundary of the settlement.

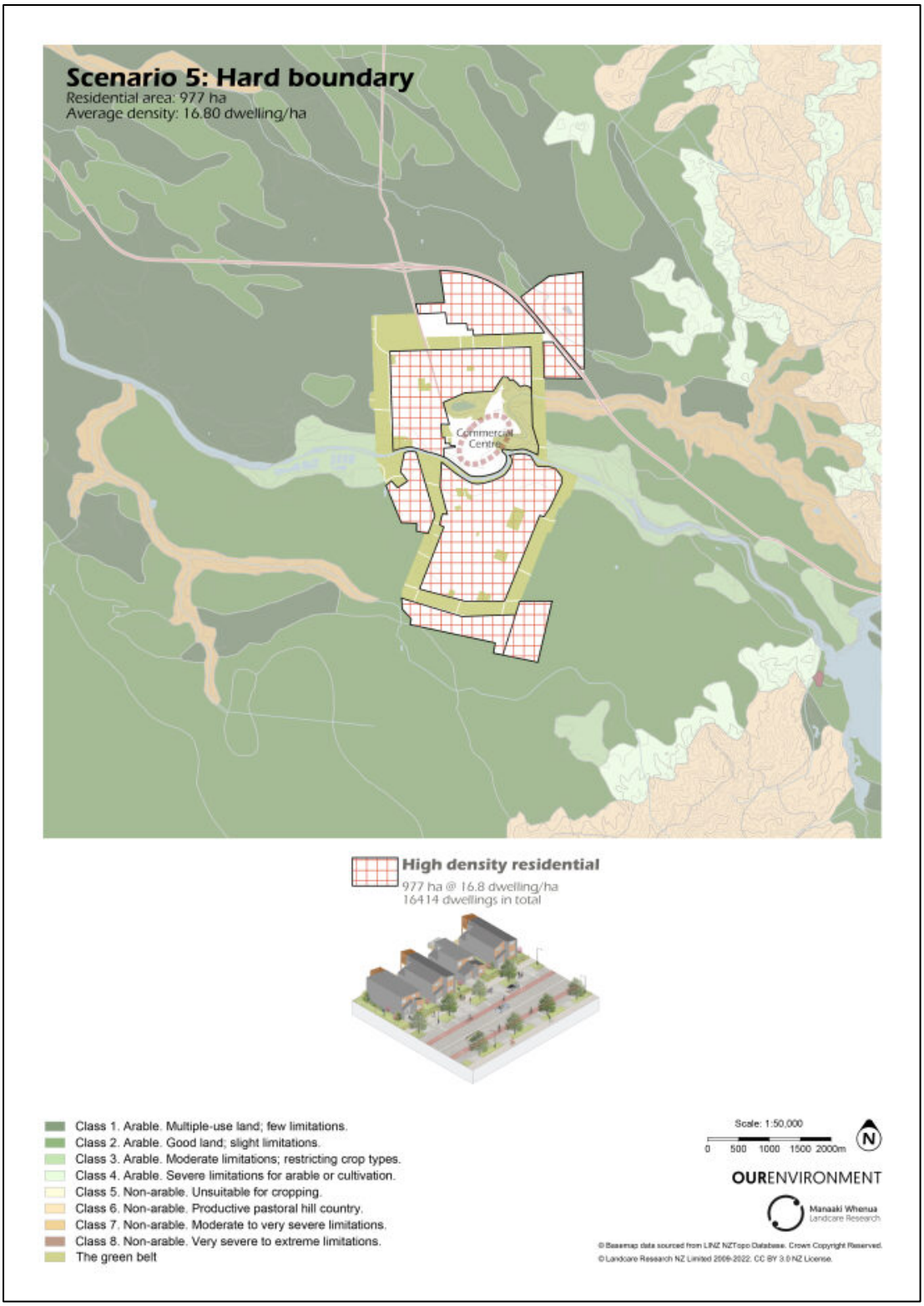


Figure 9. Scenario 5: Hard boundary (image by Guanyu Chen, 2022; map adapted from Manaaki Whenua Landcare Research, used under Creative Commons Attribution-ShareAlike 3.0 New Zealand Licence).

The outputs from the SWOT analyses were coded thematically and are presented in figure 10. The identified weaknesses and threats, and strengths and opportunities were colour-coded, showing similar or relevant topics in the same colour.

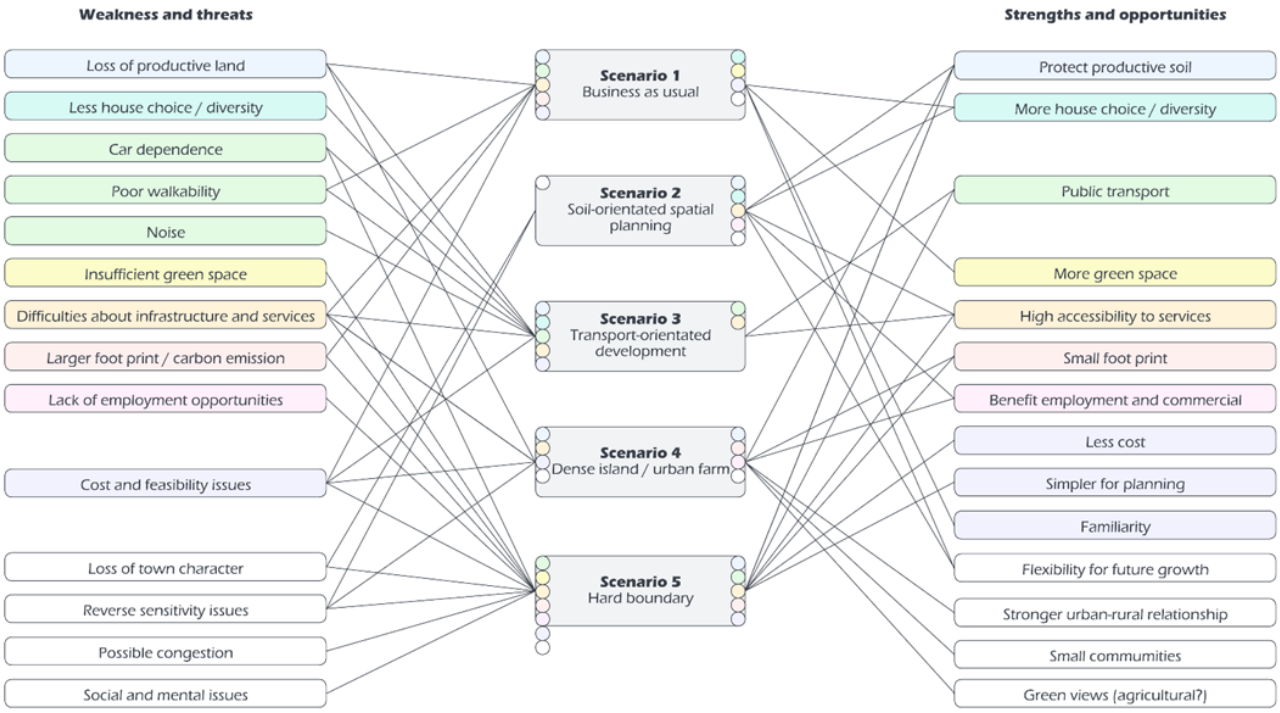


Figure 10. Thematic analysis of the SWOT analysis carried out by participants (image by Guanyu Chen, 2022).

Scenario 2: Soil-oriented development attracted the fewest weaknesses and threats (one) and the top equal number of strengths and opportunities (five), making it the most desirable scenario for participants according to this activity. This result highlights the perceived importance of protecting the highly productive land surrounding the town from urban development. Participants' evaluation of scenario 5: Hard boundary revealed the greatest number of weaknesses and threats (seven), as well as the most (equal to scenario 2) strengths and opportunities (five). Participants attributed to scenario 4: Dense island/urban farm an equal number of strengths and weaknesses (four of each), while scenario 3: Transport-oriented development accrued five weaknesses and threats, and two strengths and opportunities. Scenario 1: Business as usual elicited five weaknesses and threats, and four strengths and opportunities.

Of the strengths and opportunities participants identified, protecting productive land and high accessibility of services were the top occurring issues. For weaknesses and threats, the highest number of participants identified difficulties relating to infrastructure and services, alongside the issue of cost and feasibility. Loss of productive land and reverse sensitivity were both also identified in this activity as issues of concern.

Activity three: Ideate – design imagination (individual activity)

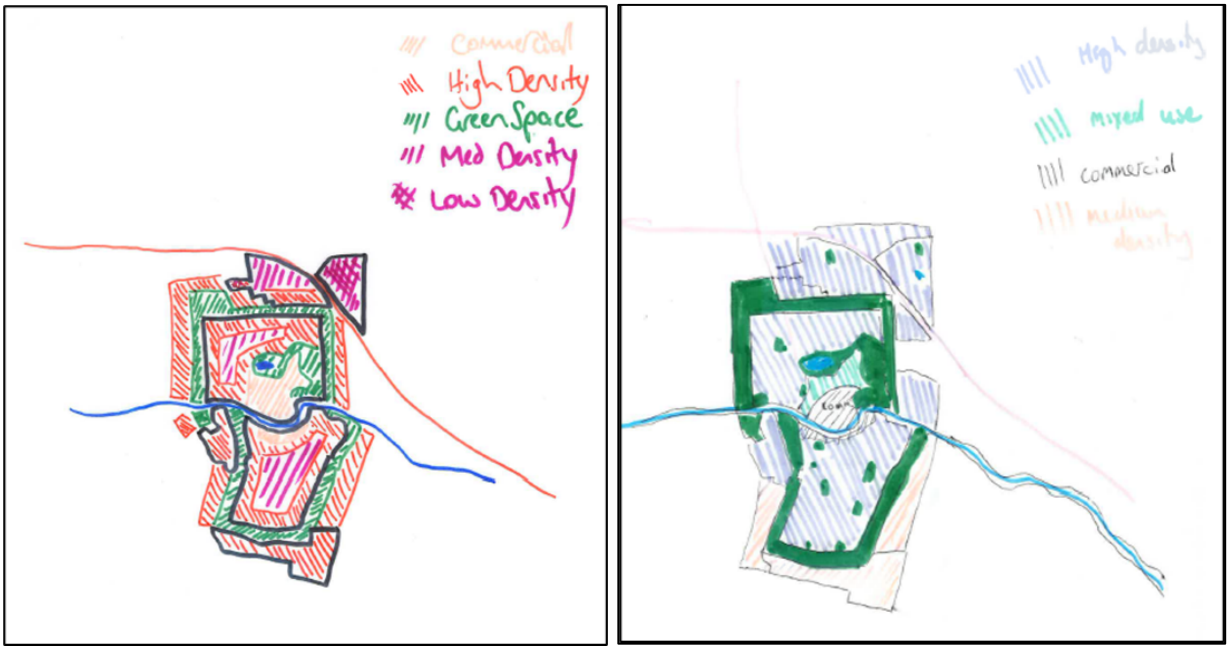
Building on the prior two steps, activity three asked the participants to review their SWOT analysis and then translate their thoughts into spatial design. The instructions provided for the participants were as follows.

1. Review the SWOT analysis from activity two.
2. Using the anonymous town base map as a landscape guide, draw your preferred peri-urban scenario.
3. Discuss with your table your spatial planning approach, highlighting why you have chosen to design the land use zones how you have.

Key themes identified through the analysis of participants' individual designs were: 'higher density housing', 'protection of productive soils and existing agricultural land', 'rural–urban transitions', 'accessibility' and 'integrated spatial design'. This section discusses each of these themes as well as presenting samples of participants' drawings related to them.

Higher-density housing

Figure 11(a) proposes increased density for both existing residential areas (by way of in-fill) and new housing areas located around the periphery of the existing town. Figure 11(b) also indicates an in-fill strategy for all existing developed areas, except for the existing urban extension sitting outside the existing greenbelt to the south. This area, along with two additional proposed medium-density extensions, is located around the edge of the existing green belt, benefitting from its amenity value.



(a) **(b)**

Figure 11. Self-drawn plans emphasising an increase in higher-density housing (with permission of participants, 2022). Both plans also illustrate the retention of existing 'commercial' and 'greenspace'. Example (a) shows both urban intensification of some existing urban areas, and new higher-density housing areas; however, it retains some existing urban areas as medium and low density. Example (b) illustrates a desired transition to all higher-density urban areas, apart from the southern 'edge', which is either retained or proposed as medium density.

Protection of productive soils and existing agricultural land

Figure 12 portrays a hard-boundary approach, with an in-fill housing strategy for all existing developed areas, as well as on the two lower-class soil (LUC 4) ']wings'.

Rural–urban transition

Figure 13(a) proposes 'high-density' urban growth within the lower-class soil 'wings', and the retention of medium- and low-density housing within the existing urban extensions. Figure 13(b) proposes two new extensions to the existing spatial form for medium- and low-density housing. Figure 13(c) proposes an in-fill strategy for all existing built-up areas, and then new growth zones for medium-density, very low-density (lifestyle) and industrial areas encompassed by a new green belt.

Accessibility (transport corridors, neighbourhood centres, public parks)

Figure 14 indicates urban expansion on the 'wings' that have lower-class soil, with an eventual extension on high-class soil along the main transportation highway to the east. Undeveloped areas to the north are also 'in-filled' to make the best use of space to the north, close to the existing highway.

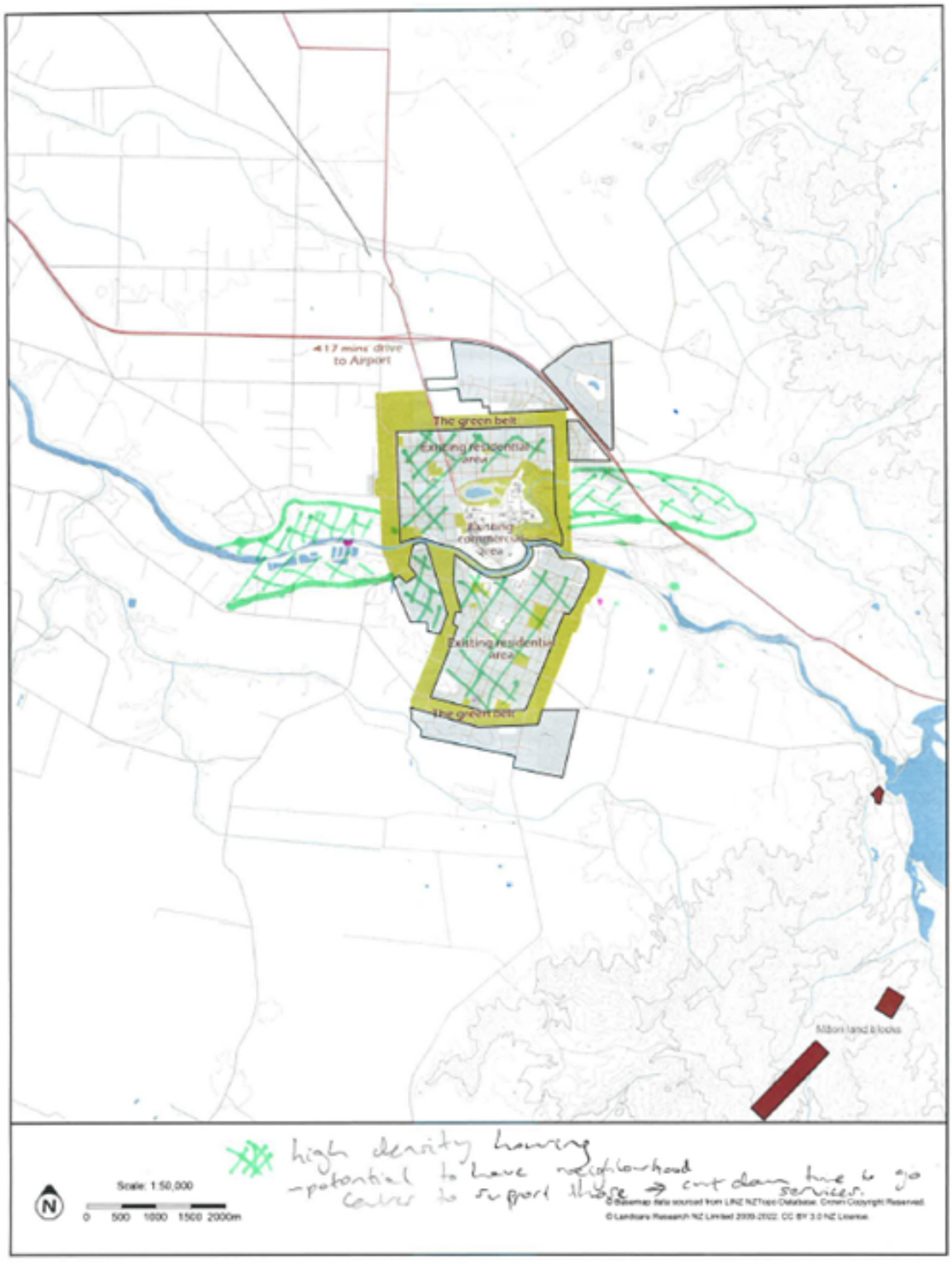
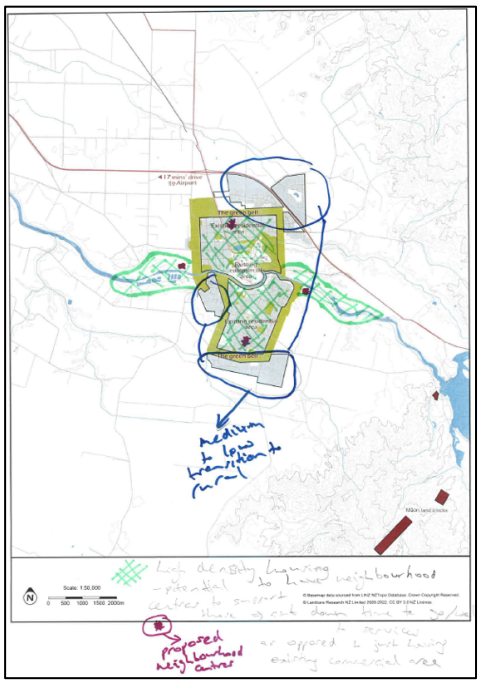
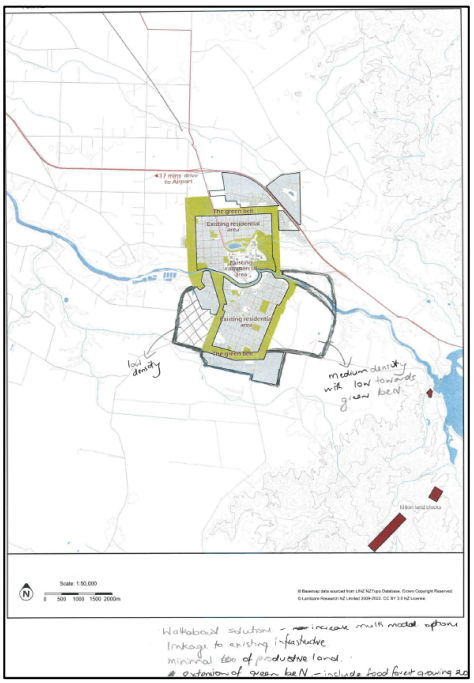


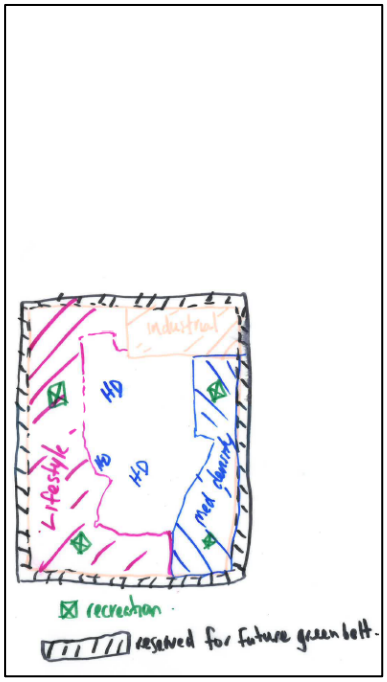
Figure 12. Self-drawn plan prioritising the protection of 'high-class' soil from residential sprawl (with permission of participant, 2022).



(a)



(b)



(c)

Figure 13. Self-drawn plans responding to the issue of 'density transition' from urban to rural areas (with permission of participants, 2022). Example (a) illustrates transition along the continuum from urban to rural through housing density moving from high density within the greenbelt, to medium and lower density closer to the urban edges. Similarly, example (b) illustrates urban–rural transition through the spatial transition of housing density. Example (c) illustrates a proposal of urban densification within the existing urban area, with a new medium and low (lifestyle blocks) density extending beyond the existing urban footprint, with a new greenbelt proposed at the periphery.

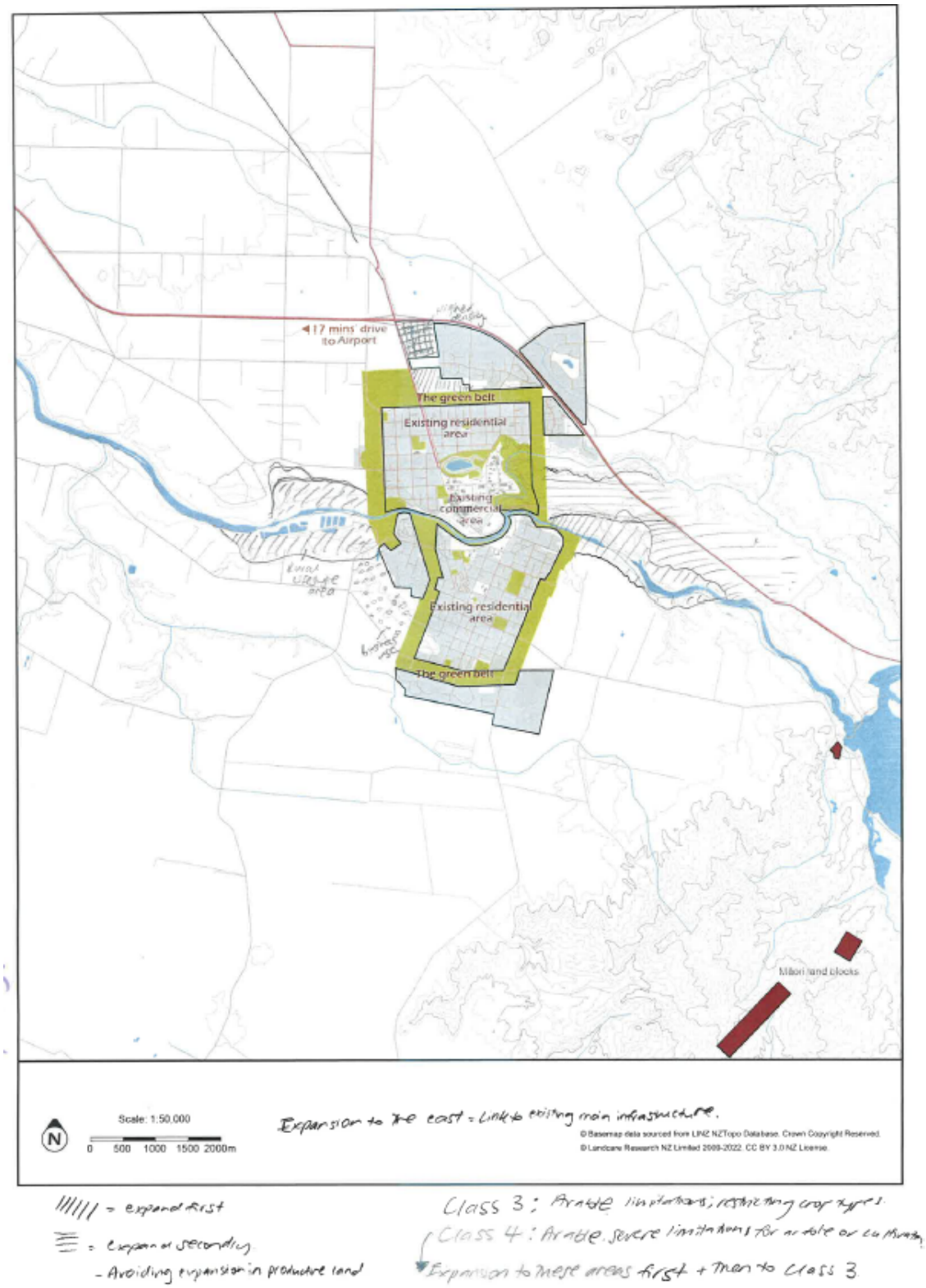


Figure 14. Self-drawn plan prioritising soil-oriented development with 'accessibility' (with permission of participant, 2022).

Integrated spatial design

The plan presented in figure 15 includes increasing housing density, providing active transport links and taking urban growth and accessibility into consideration to support the existing town centre. Further, in-fill of existing fragmented urban extensions improves accessibility to the existing highway, and a diversification of land use activities provides additional services south of the river.

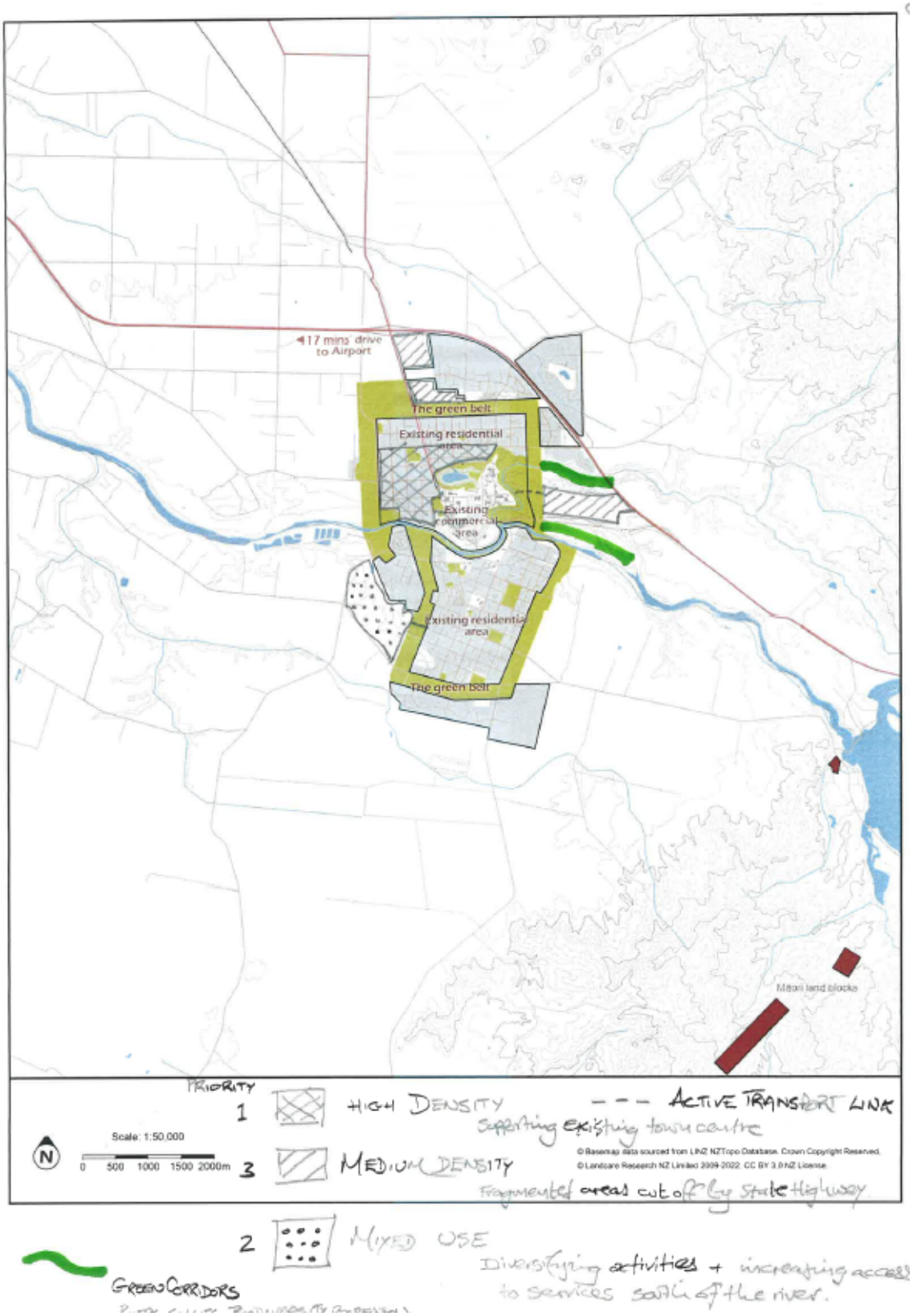


Figure 15. This self-drawn plan is an example of the most integrated spatial design proposed by participants (with permission of participant, 2022).

Discussion

By designing the workshop using an approach driven by design thinking, we were able to observe the strengths and weaknesses of the methodology within this setting. A range of themes emerged from the process that highlighted the opportunity a design thinking

process provides for spatial exploration and innovation when thinking about land use change. Clear themes were identified across the three activities, indicating the consistency of concern around issues such as loss of productive land, housing density and difficulties in accessing infrastructure and services, and reverse sensitivity.

The predominant theme to emerge from the workshop was that of protecting highly productive soils and existing agricultural land use. After being identified as an issue during activity one and then explored through a SWOT analysis during activity two, the protection of these soils and landscapes was an evident goal across most of the drawn plans produced in activity three. Related to protecting productive soils in this setting of population growth was the increase in housing density, which all participants also explored during the workshop.

Among the other key themes was the spatial transition between urban and rural land use, which saw participants exploring different spatial forms and approaches. Some participants in activity three, for example, adopted a hard boundary approach, while others preferred a continuum. Such differences underline the complexity of the issue and indicate the range of approaches under consideration to address it. Accessibility of people to transport, services and infrastructure was another theme highlighted across activities. Workshop participants, as representatives of their constituents and local landscapes, were cognisant of issues and concerns about adequate and efficient services and infrastructure. Many identified creating an accessible environment for people as an issue and explored it further. Aligned to this was the final key theme of land use and infrastructural integration, which was highlighted in activity three when participants considered multifunctional land use as part of their exploration of future planning.

As well as empowering participants to develop their thinking around the issues and future opportunities for peri-urban land use planning, the workshop drew out a number of challenges. One of these was the externality and impact on the participants' thinking due to their awareness of constituents' NIMBY (not in my back yard) attitudes. In practice, decision-makers often grapple with conundrums, such as residents desiring more roads but fewer vehicles on them, or the general desire to protect highly productive soil while individual landowners want to reap the economic benefits associated with urban development if land use change is permitted. Similarly, residents tend to understand the social benefits of higher-density living, but often contest initiatives promoting it when district plans change. This highlights the need for greater public awareness of the overall 'real' cost associated with each type of benefit and for early consultation with constituents where complex systems, such as peri-urban land use, are under consideration.

Our utilisation of the design thinking approach yielded many useful insights and useable points to consider, including the challenges noted above, in future peri-urban land use planning and policy. This underscores the methodological advantages of the 'quick and dirty' design thinking approach in a context that has a high level of complexity and uncertainty and that requires swift alternative solutions (McGann et al, 2018). This rapid ideation style may be able to deliver novel approaches and highlight previously unconsidered opportunities for implementable solutions to intricately structured problems that require interconnected responses. This aligns with Liedtka's (2011) argument that the most valuable insights in an uncertain environment often arise from rapid prototyping and real-world trials, as opposed to relying solely on extrapolation of history.

At the initial stage of the design thinking process, the facilitator plays a pivotal role in nurturing fragile 'new' ideas. Many of these ideas may initially appear 'radical or unworkable', but may turn out to be valuable later on (Body, 2008). Several strategies can be employed to foster this incubation process and minimise bias. For instance, we deliberately structured workshop tasks to minimise contextual familiarity. The scenarios presented in activities two and three were situated in spatial contexts distinct from the participants' real-life work environments, although they were issue-aligned when considering pressure for land use change. This deliberate choice freed participants from the constraints of their everyday 'place' and community-based concerns and encouraged creative thinking by compelling them to embrace the issues rather than the place. Another

action we took to facilitate the process was to keep the participant groups small (in this case, groups of four). Echoing Body (2008), small groups are good for controlling conversations about why something won't work under the existing system and making the participants feel more comfortable about challenging the existing systems and assumptions, which in turn fosters a safer space for innovative thinking.

Recognising and overcoming bias throughout the design thinking approach – from planning to facilitation, to participation and the analysis and interpretation of outcomes – is critical to the integrity of the design thinking approach. The best way to support creativity and innovation is to identify possible bias and actively challenge it. To this end, as well as adopting a hypothetical landscape setting so that participants were removed from their specific constituent responsibilities and local landscape nuances, the workshop gave participants the scope to openly explore and identify issues free of limitations in activity one, explore and analyse five land use scenarios in activity two, and design 'freely', within the scope of the workshop topic, in activity three.

Related to this issue of scope is the consideration of methodological and procedural limitations. For example, the workshop focused on peri-urban landscape planning, specifically on the topics of highly productive land and housing, and did not explicitly consider other essential urban design considerations, such as flooding potential, erosion and topography, landscape identity or housing affordability. Another limitation was that participants were constrained in the time they had to engage in the workshop as busy, professional people with multiple commitments and responsibilities. Like bias, limitations are an inherent part of the design thinking approach; however, by actively questioning and engaging with the process, we can enrich outcomes from the design thinking approach.

What next?

The full potential of the design thinking approach is not harnessed through adopting it for one-off events such as this mayoral forum workshop. Rather, its true strength becomes apparent when it is employed iteratively. The mayoral forum workshop has formed the first step in a multi-step study looking at solution-based, peri-urban land use design. In subsequent research, we have surveyed and engaged with peri-urban residents and food producers, which allowed us to substantiate the views of the mayoral forum members and their understanding of the core issues facing peri-urban Aotearoa New Zealand (Davis, Chen and Darvill, 2023). This continuation of the design thinking methodology, in which we engage with different stakeholder groups, will deepen our understanding of the issues. We expect to further harvest these insights through ongoing engagement with iwi, diverse communities, and stakeholders.

In the context of the ongoing discourse surrounding peri-urban land use and food security, the design thinking approach serves as a useful design-focused toolkit to stimulate innovative and novel solutions, foster effective communication among stakeholders, and promote mutual understanding of issues such as highly productive and versatile soil. At the same time, it incorporates essential community knowledge and values, and ultimately drives a shift towards alternative approaches to peri-urban land planning. Design thinkers are well positioned to lead the way in facilitating interactions and building empathy among decision-makers, creating safe and supportive environments to incubate innovation and contributing to the iteration of the design thinking processes for diverse and novel outcomes.

Conclusion

The design thinking steps of 'empathise', 'define' and 'ideate' allowed the research team to better understand the existing landscape values and land use aspirations in a critical point in Aotearoa New Zealand's history.

This research has provided a case study and methodology for facilitating conversations between government authorities and environmental design professionals such as landscape architects. Activities based on design thinking, such as those in our study, demonstrate the possibility the design thinking methodology holds as a catalyst for

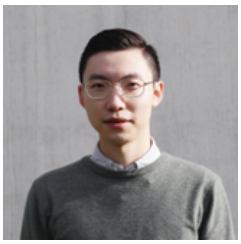
active engagement and solution ideation when considering complex land use issues. As presented in this paper, the design thinking methodology has potential to support design professionals in better understanding the range of pressures, expectations and aspirations of stakeholder groups, as well as finding diverse, community-led and novel solutions to complex issues.

The methodology supported both participants and researchers to deepen their understanding of how issues and policies could be translated to spatial land use design. Critical to the receiving environment and community, the peri-urban zone provides vital ecosystem services, and sophisticated and thoughtful future planning for these areas is essential to the protection of the landscape and the success of the communities it supports. Novel ideation is critical to tackling wicked problems facing twenty-first century cities globally. The design thinking methodology is a powerful enabler for unlocking solution-based futures both here in Aotearoa New Zealand and internationally as the world population grows and urbanises at an unprecedented rate.

About the authors

Shannon Davis is a Senior Lecturer in Landscape Planning in the School of Landscape Architecture, Lincoln University. She is also a research leader within the Centre of Excellence: Designing Future Productive Landscapes, leading the research theme 'Future Foodscapes for Health'. Her research specialises in the areas of urban agriculture and peri-urban land use.

Stuart Charters is an Associate Professor within the School of Landscape Architecture at Lincoln University and leads the research theme 'Digital Agroecology' within the Centre of Excellence: Designing Future Productive Landscapes. His research focus is on human aspects of computing, including software engineering, visualisation and eResearch.



Guanyu Chen is a PhD candidate at Lincoln University. His current research focuses on landscape performance evaluation, its relevant evaluation methods, strategies, frameworks, supporting mechanisms, and theories, as well as environmental valuation, agricultural landscape, and peri-urban planning.

Pablo Gregorini is a Professor of Livestock Production and Agricultural Systems at Lincoln University. He is the director of the Lincoln University Pastoral Livestock Production Lab and head of the Lincoln University Centre of Excellence for Designing Future Productive Landscapes. Further afield, he chairs the International Scientific Committee for the Nutrition of Herbivores and serves on the International Scientific Committee for farm systems design.

Acknowledgements: The authors would like to thank the Canterbury Mayoral Forum members for their participation in this workshop. Also thank you to Marcus Robinson and Richard Morris for assisting during the workshop.

Funding: This research was funded by the Lincoln University Centre of Excellence: Designing Future Productive Landscapes.

NOTES

[1] The Land Use Capability (LUC) classification system categorises land into eight classes according to the physical qualities of the land, soil and environment (Manaaki Whenua Landcare Research, 2021). LUC Classes 1–3 are considered 'highly productive'.

LUC Class 1 is categorised as arable and is the most versatile multiple-use land, with minimal limitations, highly suitable for cropping, viticulture, berry fruit, pastoralism, tree crops and forestry. LUC Class 2 is categorised as arable with very good multiple-use land, slight limitations, suitable for cropping, viticulture, berry fruit, pastoralism, tree crops and forestry. LUC Class 3 is considered arable with moderate limitations, restricting crop types and intensity of cultivation, suitable for cropping, viticulture, berry fruit, pastoralism, tree crops and forestry. LUC Class 4 is considered arable but with significant limitations for arable use or cultivation, very limited crop types, suitable for occasional cropping, pastoralism, tree crops and forestry. Some Class 4 land is also suitable for viticulture and berry fruit. LUC Class 5 is considered non-arable but is highly productive pastoral land, not suitable for crops but only slight limitations to pastoral, viticulture, tree crops and forestry. LUC Class 6 is considered non-arable, with slight to moderate limitations to pastoral use, suitable for pasture, tree crops, forestry and, in some cases, vineyards. LUC Class 7 is described as non-arable with moderate to very severe limitations to pastoral use, and a high risk of land requiring active management to achieve sustainable production. This classification can be suited to grazing with intensive soil conservation measures but is more suited to forestry. Finally, LUC Class 8 is non-arable land with very severe to extreme limitations to all productive land uses (Manaaki Whenua Landcare Research, 2024).

[2] Human ethics approval for this study was granted by the Lincoln University Human Ethics Committee: HEC2002-13.

[3] Reverse sensitivity is the legal vulnerability of an established activity to complaints from a new land use. It arises when an established use is adversely impacting on nearby land and a new activity is proposed for the land.

REFERENCES

Arifin, N.R.; Mahmud, S.N.D. (**2021**) A systematic literature review of design thinking application in STEM integration. *Creative Education,* 12(7), pp 1558–1571.

Balakrishnan, B. (**2022**) Exploring the impact of design thinking tool among design undergraduates: a study on creative skills and motivation to think creatively. *International Journal of Technology and Design Education,* 32(3), pp 1799–1812.

Bevan, H.; Robert, G.; Bate, P.; Maher, L.; Wells, J. (**2007**) Using a design approach to assist large-scale organizational change: '10 high impact changes' to improve the National Health Service in England. *Journal of Applied Behavioral Science,* 43(1), pp 135–152. DOI: 10.1177/0021886306297062.

Bibri, S.E.; Krogstie, J.; Kärrholm, M. (**2020**) Compact city planning and development: emerging practices and strategies for achieving the goals of sustainability. *Developments in the Built Environment,* 4, art 100021. DOI: 10.1016/j.dibe.2020.100021.

Body, J. (**2008**) Design in the Australian Taxation Office. *Design Issues,* 24(1), pp 55–67. Accessed 6 March 2024, www.jstor.org/stable/25224150.

Brown, T. (**2008**) Design thinking. *Harvard Business Review,* 86(6), p 84.

Buchanan, R. (**2019**) Systems thinking and design thinking: the search for principles in the world we are making. *She Ji: The Journal of Design, Economics, and Innovation,* 5(2), pp 85–104.

Camacho, M. (**2016**) David Kelley: from design to design thinking at Stanford and IDEO. *She Ji: The Journal of Design, Economics, and Innovation,* 2(1), pp 88–101.

Considine, M. (**2012**) Thinking outside the box? Applying design theory to public policy. *Politics & Policy,* 40(4), pp 704–724.

Davis, A.C.; Stroink, M.L. (**2016**) The relationship between systems thinking and the new ecological paradigm. *Systems Research and Behavioral Science,* 33(4), pp 575–586. DOI: 10.1002/sres.2371.

Davis, S.; Chen, G.; Darvill, N. (**2023**) Housing and food production: Resident and grower perceptions of peri-urban food-production landscapes. *Land*, 12(12), p 2091. DOI: 10.3390/land12122091

Dodgson, M.; Gann, D.; Salter, A. (**2005**) *Think, Play, Do: Technology, Innovation, and Organization*. Oxford: Oxford University Press.

Groeger, L.; Schweitzer, J.; Sobel, L.; Malcom, B. (**2019**) Design thinking mindset: developing creative confidence. *Academy of Design Innovation Management Conference 2019*. DOI: 10.33114/adim.2019.09_288.

Haarstad, H.; Kjærås, K.; Røe, P.G.; Tveiten, K. (**2023**) Diversifying the compact city: a renewed agenda for geographical research. *Dialogues in Human Geography,* 13(1), pp 5–24. DOI: 10.1177/20438206221102949.

Head, B.W. (**2008**) Three lenses of evidence-based policy. *Australian Journal of Public Administration,* 67(1), pp 1–11.

Howlett, M. (**2014**) From the 'old' to the 'new' policy design: design thinking beyond markets and collaborative governance. *Policy Sciences,* 47(3), pp 187–207.

Knight, E.; Daymond, J.; Paroutis, S. (**2020**) Design-led strategy: how to bring design thinking into the art of strategic management. *California Management Review,* 62(2), pp 30–52.

Kumar, A.; Lodha, D.; Mahalingam, A.; Prasad, V.; Sahasranaman, A. (**2016**) Using 'design thinking' to enhance urban re-development: a case study from India. *Engineering Project Organization Journal,* 6(2–4), pp 155–165. DOI: 10.1080/21573727.2016.1155445.

Leavy, B. (**2012**) Collaborative innovation as the new imperative: design thinking, value co-creation and the power of 'pull'. *Strategy & Leadership*, 40(2), pp 25–34. DOI: 10.1108/10878571211209323.

Léger, M.T.; Laroche, A.-M.; Pruneau, D. (**2020**) Using design thinking to solve a local environmental problem in the context of a university civil engineering course: an intrinsic case study. *Global Journal of Engineering Education*, 22(1), pp 6–12.

Lewis, J.M.; McGann, M.; Blomkamp, E. (**2020**) When design meets power: design thinking, public sector innovation and the politics of policymaking. *Policy & Politics*, 48(1), pp 111–130. DOI: 10.1332/030557319x15579230420081.

Liedtka, J. (**2011**) Learning to use design thinking tools for successful innovation. *Strategy & Leadership,* 39(5), pp 13–19. DOI: 10.1108/10878571111161480.

Manaaki Whenua Landcare Research (Cartographer) (**2021**) Land Use Capability (LUC). Accessed 7 March 2024, https://ourenvironment.scinfo.org.nz/data-provenance#luc.

Manaaki Whenua Landcare Research (**2024**) Explore NZ Landcover Change. *Our Environment*. LCDB Version 5.0. Accessed 7 March 2024, https://ourenvironment.scinfo.org.nz/maps-and-tools/explore-nz-landcover-change.

McGann, M.; Blomkamp, E.; Lewis, J.M. (**2018**) The rise of public sector innovation labs: experiments in design thinking for policy. *Policy Sciences,* 51(3), pp 249–267. DOI: 10.1007/s11077-018-9315-7.

Meyer, A. (**2011**) Embedding design practice within organizations. In *The Handbook of Design Management*, 1st ed., R. Cooper; S. Junginger; T. Lockwood, Eds.; London: Berg/Bloomsbury, pp 187–201.

Morgan, K. (**2014**) Nourishing the city: the rise of the urban food question in the Global North. *Urban Studies,* 52(8), pp 1379–1394.

Morgan, K.S.; Sonnino, R. (**2010**) The urban foodscape: world cities and the new food equation. *Cambridge Journal of Regions, Economy and Society,* 3(2), pp 209–224.

Opitz, I.; Berges, R.; Piorr, A.; Krikser, T. (**2016**) Contributing to food security in urban areas: differences between urban agriculture and peri-urban agriculture in the Global North. *Agriculture and Human Values,* 33, pp 341–358.

Panke, S. (**2019**) Design thinking in education: perspectives, opportunities and challenges. *Open Education Studies,* 1(1), pp 281–306.

Parizi, R.; Prestes, M.; Marczak, S.; Conte, T. (**2022**) How has design thinking being used and integrated into software development activities? A systematic mapping. *Journal of Systems and Software,* 187, art 111217.

Parsons, W. (**2002**) From muddling through to muddling up: evidence based policy making and the modernisation of British government. *Public Policy and Administration,* 17(3), pp 43–60.

Pothukuchi, K.; Kaufman, J. (**1999**) Placing the food system on the urban agenda: the role of municipal institutions in food systems planning. *Agriculture and Human Values,* 16(2), pp 213–224.

Rao, H.; Puranam, P.; Singh, J. (**2022**) Does design thinking training increase creativity? Results from a field experiment with middle-school students. *Innovation,* 24(2), pp 315–332.

Sarker, A.H.; Bornman, J.F.; Marinova, D. (**2019**) A framework for integrating agriculture in urban sustainability in Australia. *Urban Science,* 3(2), p 50. DOI: 10.3390/urbansci3020050.

Steel, C. (**2008**) *Hungry City: How Food Shapes Our Lives*. London: Vintage Books.

Steel, C. (**2020**) *Sitopia: How Food Can Save the World.* London: Chatto & Windus.

Viljoen, A. (**2005**) *CPULs: Continuous Productive Urban Landscapes: Designing Urban Agriculture for Sustainable Cities*. Oxford: Architectural Press.

Viljoen, A.; Bohn, K. (**2005**) Continuous productive urban landscapes: urban agriculture as an essential infrastructure. *Urban Agriculture Magazine,* 15, pp 34–36.

Viljoen, A.; Schlesinger, J.; Bohn, K.; Drescher, A.W. (**2015**) Agriculture in urban design and spatial planning. In H. de Zeeuw; P. Drechsel, Eds., *Cities and Agriculture: Developing Resilient Urban Food Systems*. Abingdon: Routledge, pp 88–120.

Wagle, U. (**2000**) The policy science of democracy: the issues of methodology and citizen participation. *Policy Sciences,* 33(2): 207–223.

Wang, G. (**2022**) Digital reframing: the design thinking of redesigning traditional products into innovative digital products. *Journal of Product Innovation Management,* 39(1), pp 95–118.

You, X. (**2022**) Applying design thinking for business model innovation. *Journal of Innovation and Entrepreneurship,* 11(1), p 59.