

# **A Very Deep Salad Bowl**

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# Abstract

The underground parking garage is architectural garbage of our culture.

How many tons of earth have been removed to create parking spaces?

How will radical shifts in transportation technologies affect this existing built condition?

In a future of autonomous mobility, ridesharing and rapid transit, there will be an unprecedented amount of underused underground parking space in major metropolitan areas like Vancouver. This project adopts four levels of underground parking in a ubiquitous podium tower in downtown Vancouver as a testing ground for a new spatial typology. Through a series of architectural interventions, occupants are confronted with our cultural garbage and challenged to shift their perception of the underground as non-space in the city.

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# **A Very Deep Salad Bowl**



Fig. 1. Conceptual collage.

**The underground parking garage is architectural garbage of our culture.**

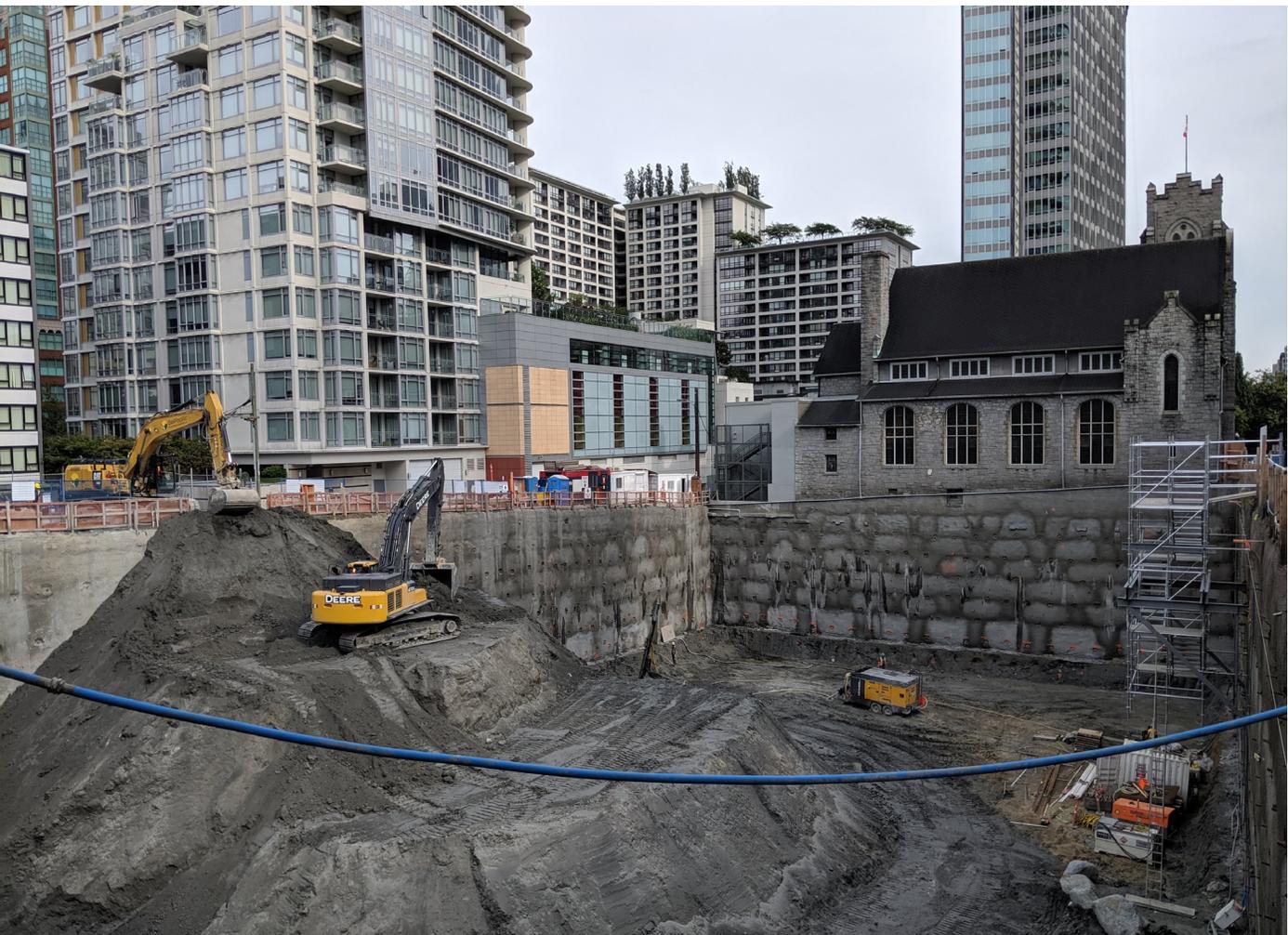


Fig. 2. The Butterfly, Revery Architecture.

**How many tons of earth have been removed to create parking spaces?**



Fig. 3. Former Vancouver Empire Landmark Hotel.

**How will radical shifts in transportation technologies affect this existing built condition?**



Fig. 4. 1335 Howe St, Onni Group.

**There is no consolidated, public record of how much underground parking exists in Vancouver. This lack of awareness is leading us to a massive oversupply.**

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Fig. 5. Concord Pacific before and after. Source: <https://www.concordpacific.com/communities/>.

Parking in cities is the product of static bylaws and market demand. Selling a unit with a parking space can add up to \$80,000 to the price of a unit.<sup>1</sup> A study conducted by the region of Metro Vancouver found that for both rental and strata apartment buildings, parking supply exceeds use across the region.<sup>2</sup>

Historically, Vancouver has been praised for its mixed-use slender towers that preserve view corridors. This urban design strategy is known as "Vancouverism" which was imported to Vancouver by Hong Kong developers in the 1980s. An excellent example of how popular this strategy has become in Vancouver is the Concord Pacific development along the north side of False Creek, which is the largest private urban development project underway in North America (fig. 5).<sup>3</sup>

This project proposes that if we can understand the way that underground parking occupies space in cities, then we can imagine new futures for it as off-street parking needs decrease across North American cities. Even though the City of Vancouver has removed minimum parking requirements for new major developments in downtown, it is still economically beneficial for developers to provide off-street parking as an amenity to future buyers. As a result, it may take some time before the effects of this change in off-street parking bylaws are reflected in new developments.

The unique design challenges of underground parking areas make this a rich condition to explore. Parking areas often lack adequate pedestrian areas, leaving pedestrians confused about where it is safe to walk. These spaces are scaled to the vehicle rather than the body which creates awkward human occupation. This effect is summarized by Christopher Alexander in *A Pattern Language*, "The problems [of vast parking lots] stem essentially from the fact that a car is so much bigger than a person. Large parking lots, suited for the cars, have all the wrong properties for people. They are too wide; they contain too much pavement; they have no place to linger."<sup>4</sup>

Looking at underground parking is more compelling than other parking typologies since it is built into another building and is not easily demolished. The land that has been excavated to create this space will never return to where it was. We will be left with underground voids and their existing structure for a long time. It is worth considering these spaces because of their embodied energy and permanence in the built environment.

Since the invention of the assembly line for the mass production of vehicles in 1913 by Henry Ford, North American city design has focused on accommodating the vehicle. Codes and bylaws have come to reflect our car-dependent culture. This history has set a precedent that bylaws and best practices can be changed to reflect a new culture that is more conscious of the existing built environment.



Fig. 6. Roy Arden, Condominium Advertisement, Vancouver BC 1992. Source: Roy Arden archive, <http://www.royarden.com/pages/photo1.html> (accessed December 18, 2019).

**By creating this much density in Vancouver, an absurd amount of underground parking has emerged to support it.**

The site for this project is 888 Beach Avenue (fig. 6), which was the first townhouse podium tower in downtown Vancouver. This building is one of James Cheng's first towers in Vancouver, it was built in 1993. Cheng has gone on to design many other podium tower buildings in Vancouver.



Fig. 7. Neighbourhood map of Vancouver highlighting neighbourhood vicinity of 888 Beach Ave. Imagery from Google Earth V 7.3.2.5776. (June 12, 2019). Vancouver BC. 49° 16'32.55"N 123° 07'28.76"W. Eye alt. 3.20 km. Sanborn 2008. <https://earth.google.com/> (accessed December 17, 2019).

The first developer interest in this site came from Jim Pattison who wanted to develop a hotel for Expo 86. The site was then sold three times before the developers of 888 Beach obtained the land and proposed apartment towers. The project received generous height variances due to the City of Vancouver's desire to promote family living in downtown Vancouver. The towers were approved to be 87 and 77 metres high while current bylaws allowed for a maximum of 45 metres.<sup>5</sup> The developers were also able to have an FSR of 6 which was 30% denser than the bylaws allowed at the time.<sup>6</sup>



Fig. 8. 888 Beach Ave in context. Imagery from Google Earth V 7.3.2.5776. (June 12, 2019). Vancouver BC.  $49^{\circ} 16'24''N$   $123^{\circ} 07'53''W$ . Eye alt. 35 metres. Sanborn 2008. <https://earth.google.com/> (accessed December 17, 2019).

This building is located in the Granville Slopes between the Granville and Burrard Street bridges (fig. 7). The site is well situated in downtown Vancouver with lots of access to public space such as the False Creek seawall, Sunset Beach Park, May and Lorne Brown Park, George Wainborn Park, community centres, restaurants, entertainment and shopping along Davie and Granville Streets (fig.8). It is worth noting that 888 Beach is kitty-corner to the BIG Architecture and DIALOG Vancouver House site which is the contemporary manifestation of "Vancouverism". 888 Beach is arguably the first instance of Vancouverism in Vancouver (fig. 9).

Three towers on the site are connected with townhouses and commercial space on the ground level (fig. 10,13,14). The townhouses create human-scale elements on the street which help to integrate the tall and dense towers into the neighbourhood at a time when this kind of construction was non-existent (fig. 10). Cheng was influenced by the Brownstone housing in Brooklyn and Boston and abstracted it for 888 Beach. The site is unique because it does not have a mid-block public lane. As a result, there is a large private garden in the centre of the site (fig. 12). There are two existing vehicular entrances to the underground parking on Beach Ave and Howe Street (fig. 15).

This site was chosen because of its significance in the history of development in Vancouver and the large four levels of underground parking it has.



Fig. 9. 888 Beach Ave in today's Vancouver context.



Fig. 10. Main entrance to Beach Tower from Hornby Street.

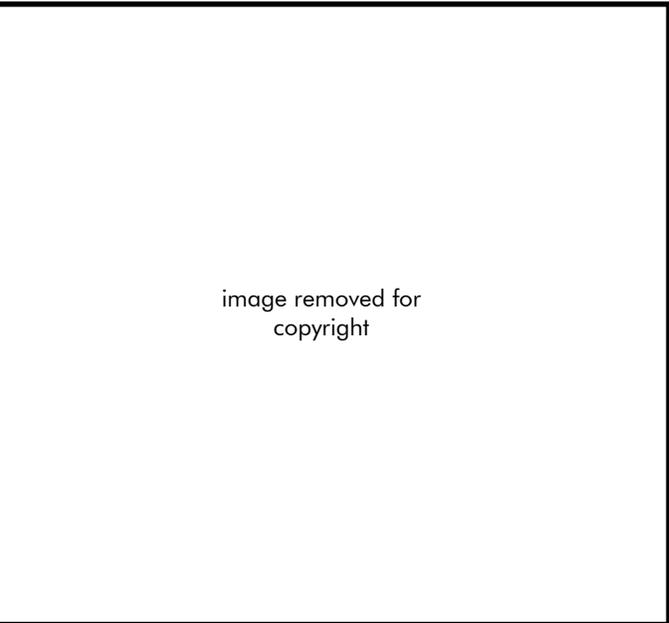


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Fig. 11. Beach Ave ramp.

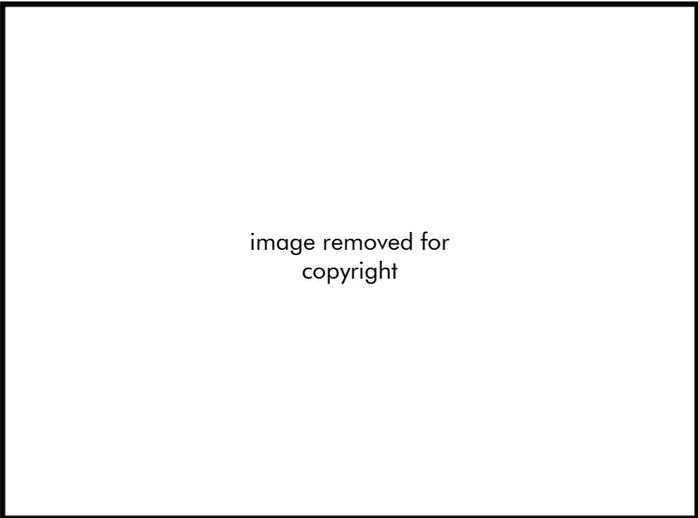


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Fig. 12. Reflecting pool.

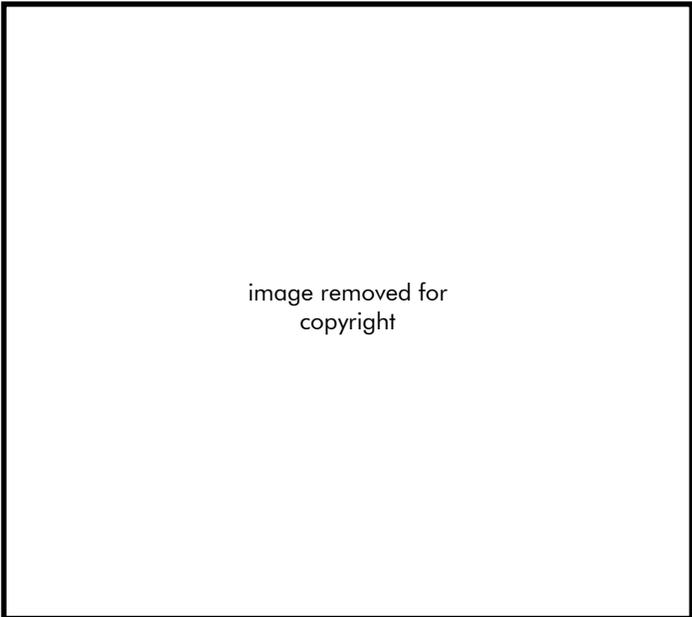


Fig. 13. Ocean tower.

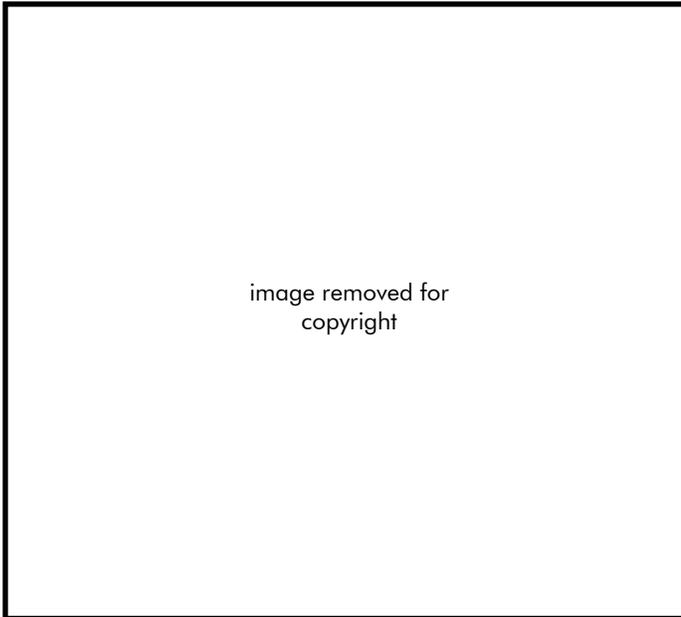


Fig. 14. Garden tower.



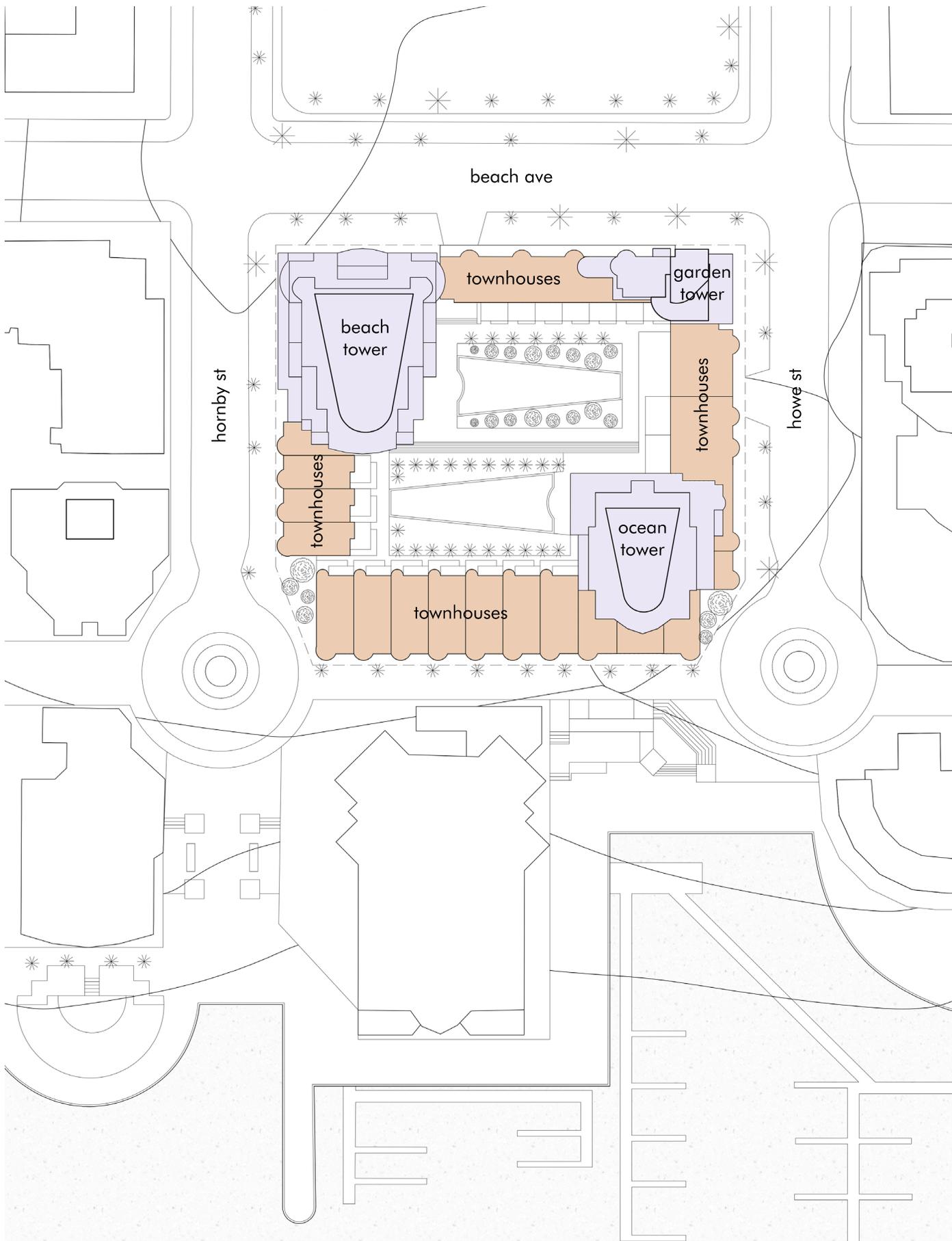


Fig. 15. Site Plan, existing condition.

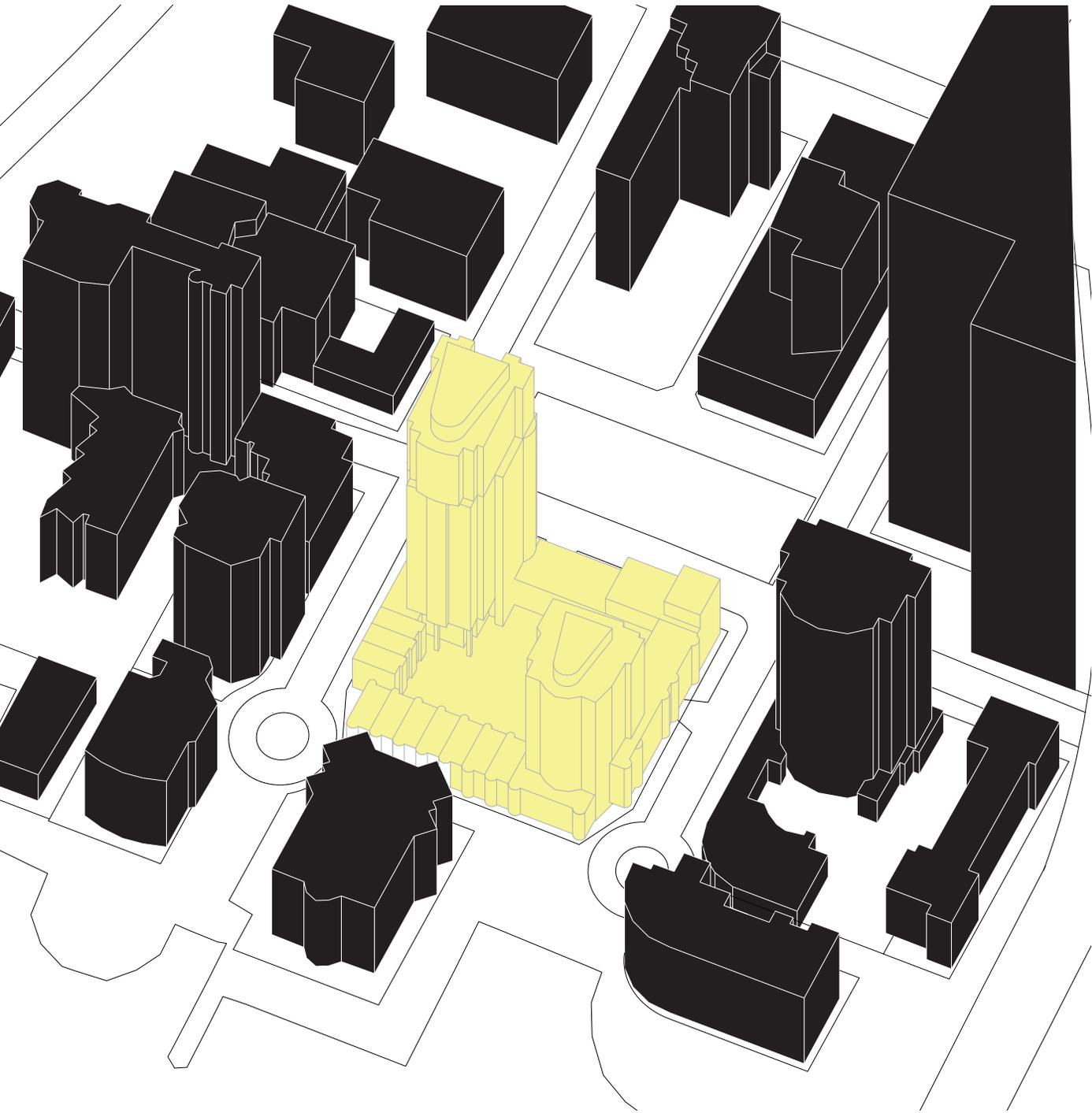


Fig. 16. Isometric, existing above ground condition.

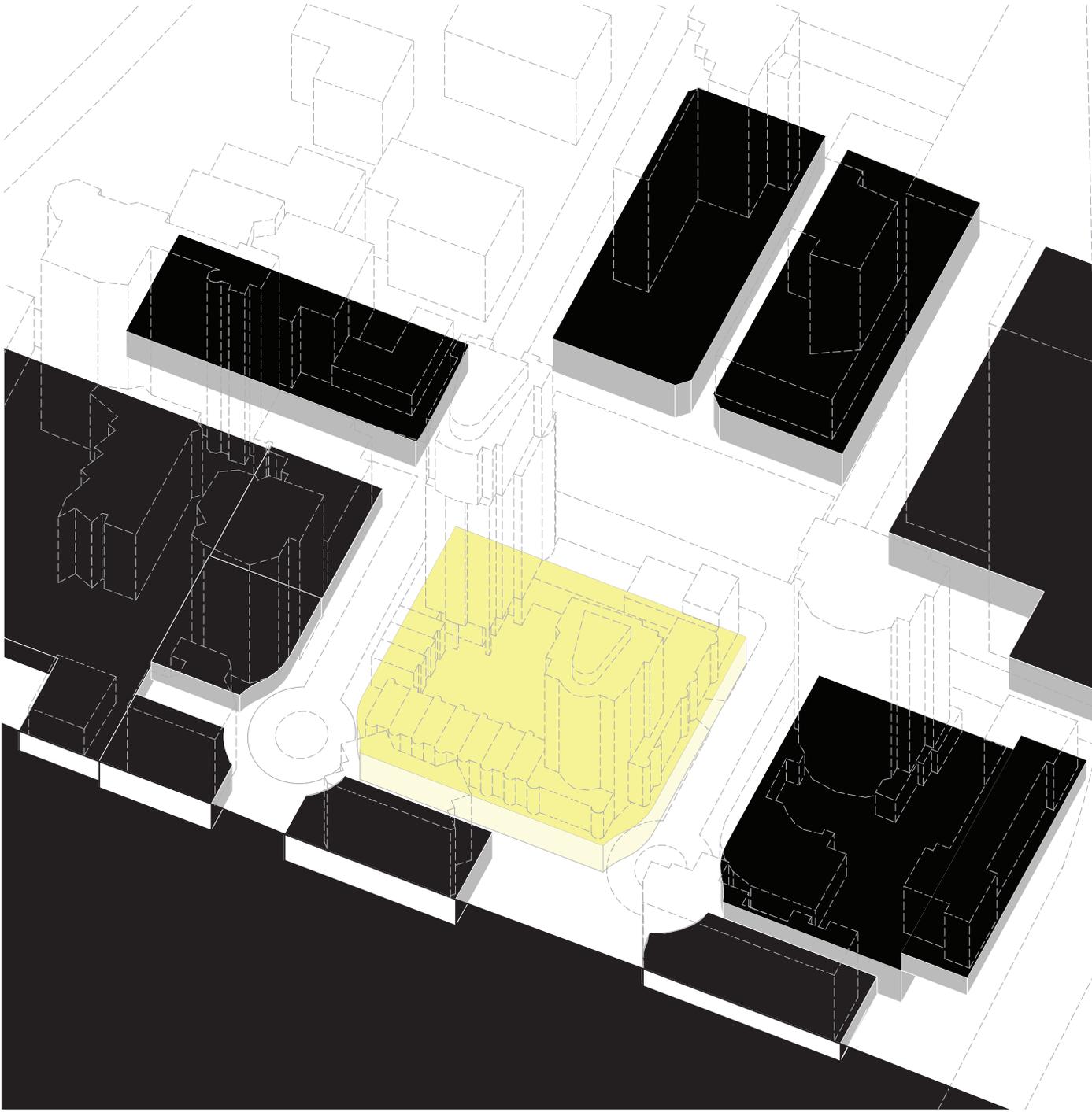


Fig. 17. Isometric, existing below ground condition.

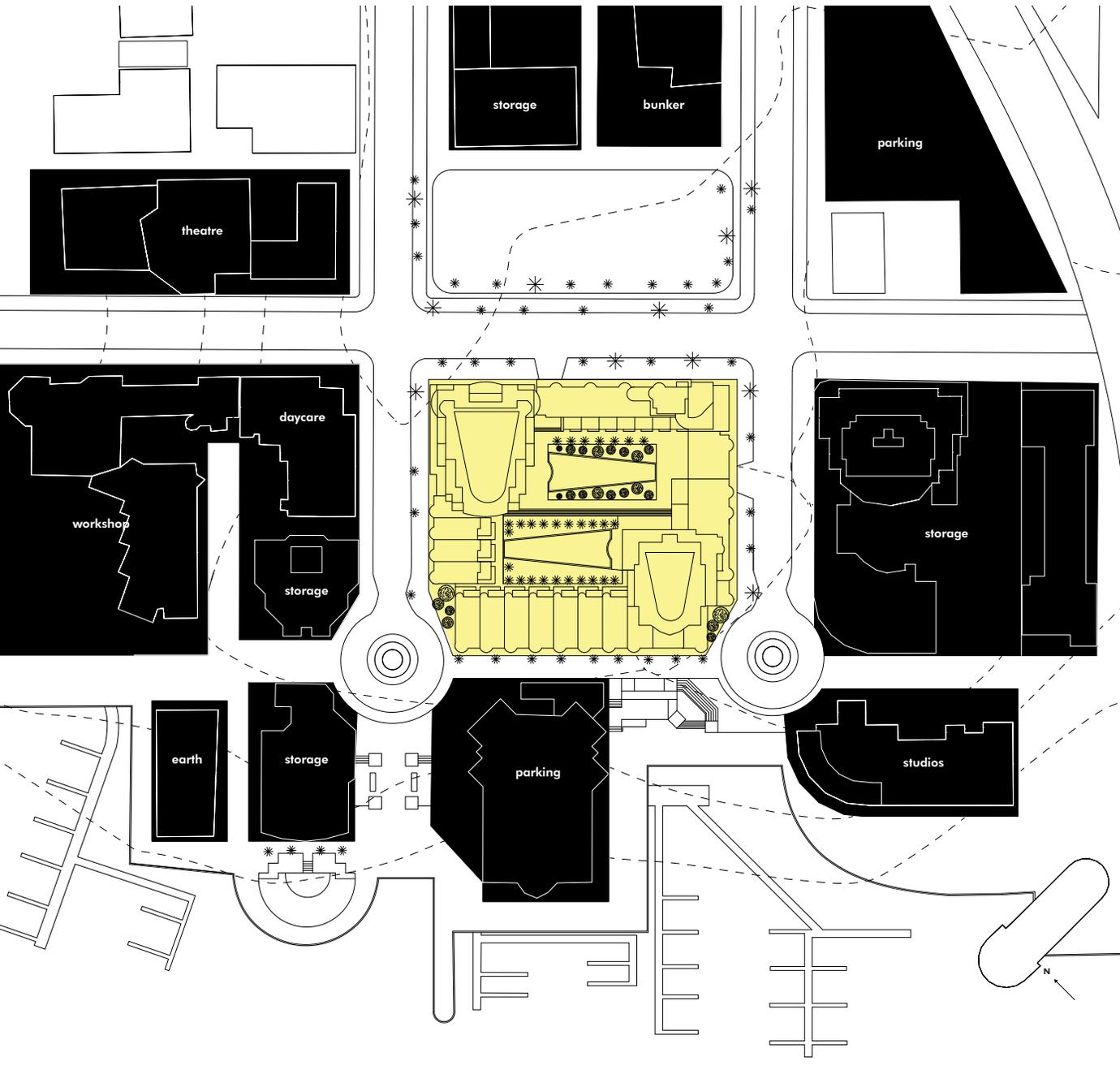


Fig. 18. Site plan, neighbourhood strategy.

There are roughly 13 buildings within the neighbourhood vicinity of 888 Beach that have multiple levels of underground parking (fig. 16, 17). As a way to make better use of these redundant parking spaces, I am proposing that parking gets consolidated in the neighbourhood and moved to one or two other sites so that residents that may wish to have a parking space can still have one but elsewhere.

This project uses 888 Beach as one example of how these spaces could be used to benefit residents and the community. Things like storage, workshops, studios, daycares, schools, etc. are just some ideas about what the other underground parking areas could be used for in this neighbourhood or others like it (fig. 18).

I am proposing an urban agriculture centre that consists of a commercial mushroom, lettuce and bell pepper farm. The site will also provide community gardens, a vegetable market and a farm to table restaurant (fig. 19, 20, 21, 22).

By 2050 the world's population will grow by another 2 billion and 67% of people will live in cities.<sup>7</sup> Earth has lost a third of its arable lands over the last 40 years.<sup>8</sup> Producing food in urban areas has the potential to ease the demand on agricultural lands and reduce the distance food travels to get to our homes.



Fig. 19. Conceptual collage. Restaurant entrance from bike path.



Fig. 20. Conceptual collage. Market entrance from Beach Ave.



Fig. 21. Conceptual collage. Vehicle entrance from Howe St.

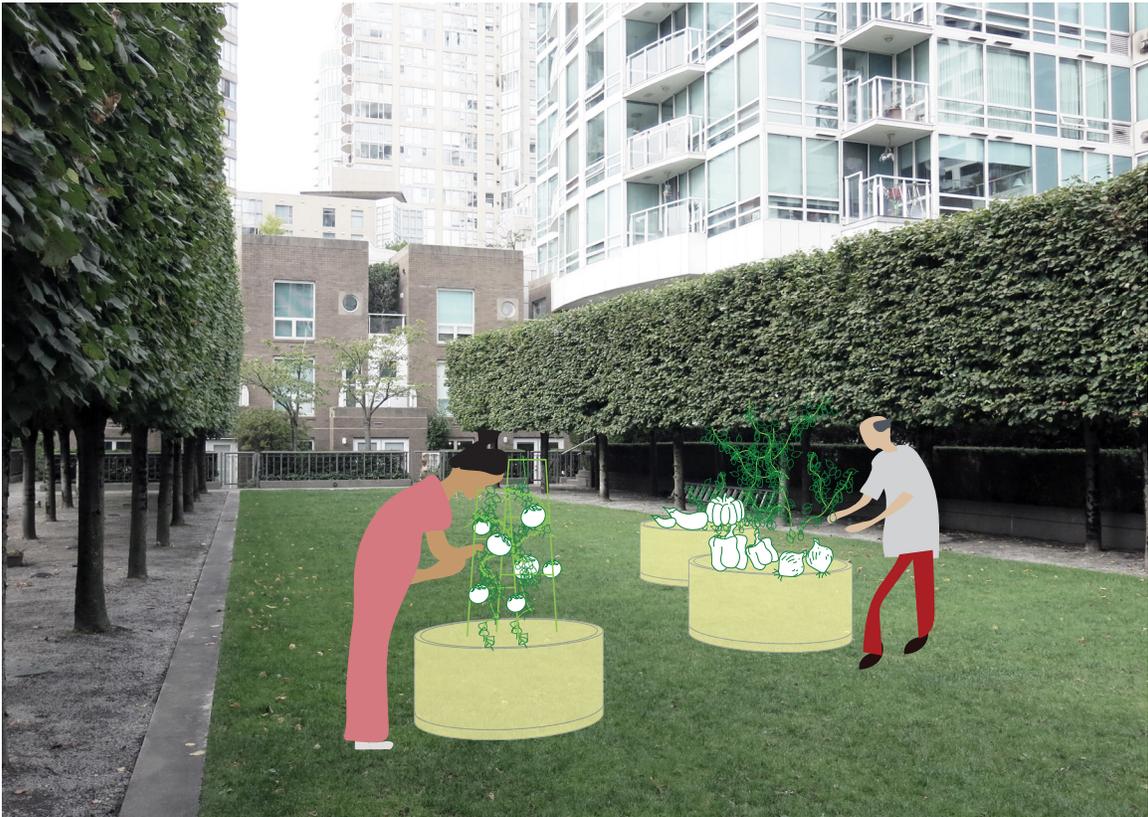


Fig. 22. Conceptual collage. Central courtyard.

financial overview

	oyster mushroom	lettuce	bell pepper	
				
				<b>totals</b>
weekly crop yield (kg/wk/sq. ft.)	0.155*	0.143**	0.333***	
crop area (sq. ft.)	58,800	202,209	202,209	463,218
weekly crop yield (kg/wk)	9,114	28,916	67,336	105,366
annual crop yield (kg/yr)	364,560	1,156,640	2,693,424	4,214,624
price per kg (\$)	9.20**	8.50	8.77	26.47
annual gross sales (\$)	3,353,952	9,831,440	23,621,468	36,806,860
annual net sales (\$)	1,341,580	3,932,576	9,448,587	14,722,743
people fed per week	1,042	3,304	7,695	12,041

weekly yields



 = 1 metric ton

weekly net yield and sales

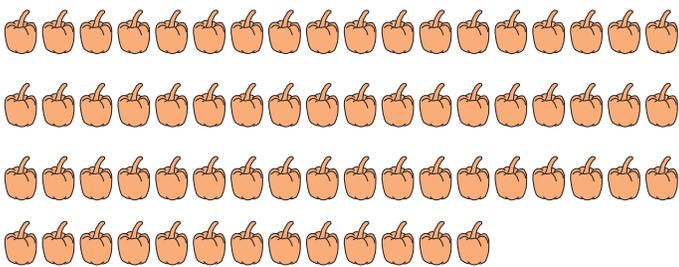
**9,114 kg**  
= \$83,850



 = 1 metric ton

weekly net yield and sales

**28,916 kg**  
= \$245,786



 = 1 metric ton

weekly net yield and sales

**67,336 kg**  
= \$590,537

annual profit

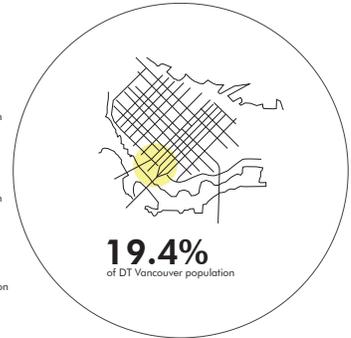
annual gross sales

**\$36,806,860**

annual net sales (40% of gross)

**\$14,722,743**

-  **1,042**  
1.7% of DT Vancouver population
-  **3,304**  
5.3% of DT Vancouver population
-  **7,695**  
12.4% of DT Vancouver population



Canada's food guide: 1.25kg of fruits and vegetables per day

Need 788,750 kg of fruit and vegetables everyday for all of Vancouver to eat to this standard

Based on DT Vancouver pop. of 62,030

\*<https://grocycle.com/how-to-set-up-a-low-tech-mushroom-farm/>

\*\* Statistics Canada

\*\*\*Bayley, J.E., Yu, M., & Frediani, K. (2010). Sustainable food production using high density vertical growing (Verticrop). In XXVIII International Horticultural Congress on Science and Horticulture for People (IHC2010): International Symposium on 921 (pp. 95-104).

\*\*\*\*<https://portablefarms.com/2012/bell-peppers/>

Fig. 23. Financial overview.

Based on a calculation of crop yields per square foot and assuming a 40% profit with the remainder being operating costs, I estimate that this site has the potential to generate 14.7 million dollars in profit annually (fig. 23). The ownership of the underground parking is maintained by the strata and leased to the farm operators.

105,366 kg of vegetables can be grown on the site each week which is enough to feed almost 20% of downtown Vancouver its recommended vegetable intake by Canada's food guide (fig. 23).

There is limited access to natural light on the site which makes it an ideal space for hydroponic and mushroom farming.

Hydroponic farming does not require soil to grow plants but rather uses water and nutrients to grow without dirt. The plants will be grown under LED grow lights to replace the need for natural day-light (fig. 24, 26).

Oyster mushrooms grow in bags when mixed with a substrate (e.g. coffee grounds) and hang in rooms to fruit (fig. 25).



Fig. 24. Conceptual collage. Germination carts for hydroponic farming.

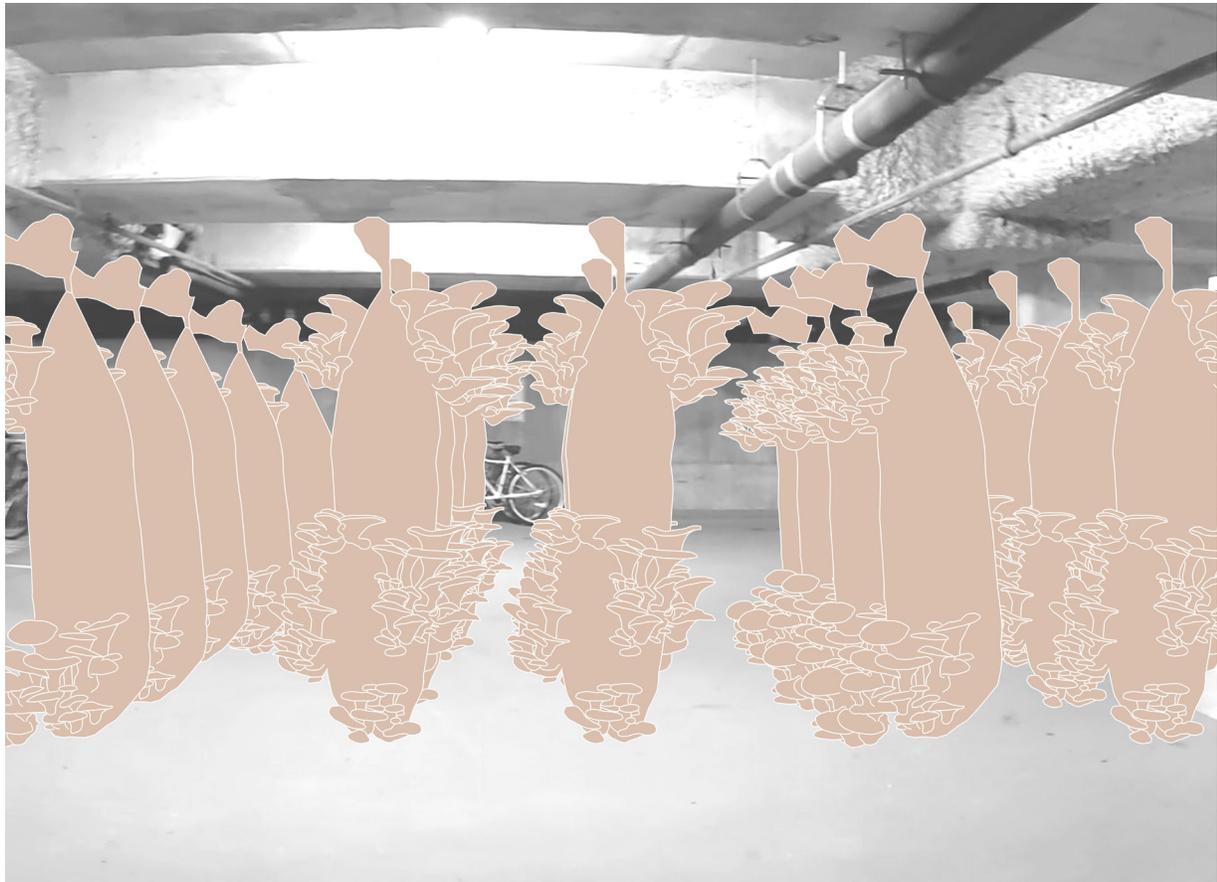


Fig. 25. Mushroom bags hanging for fruiting.

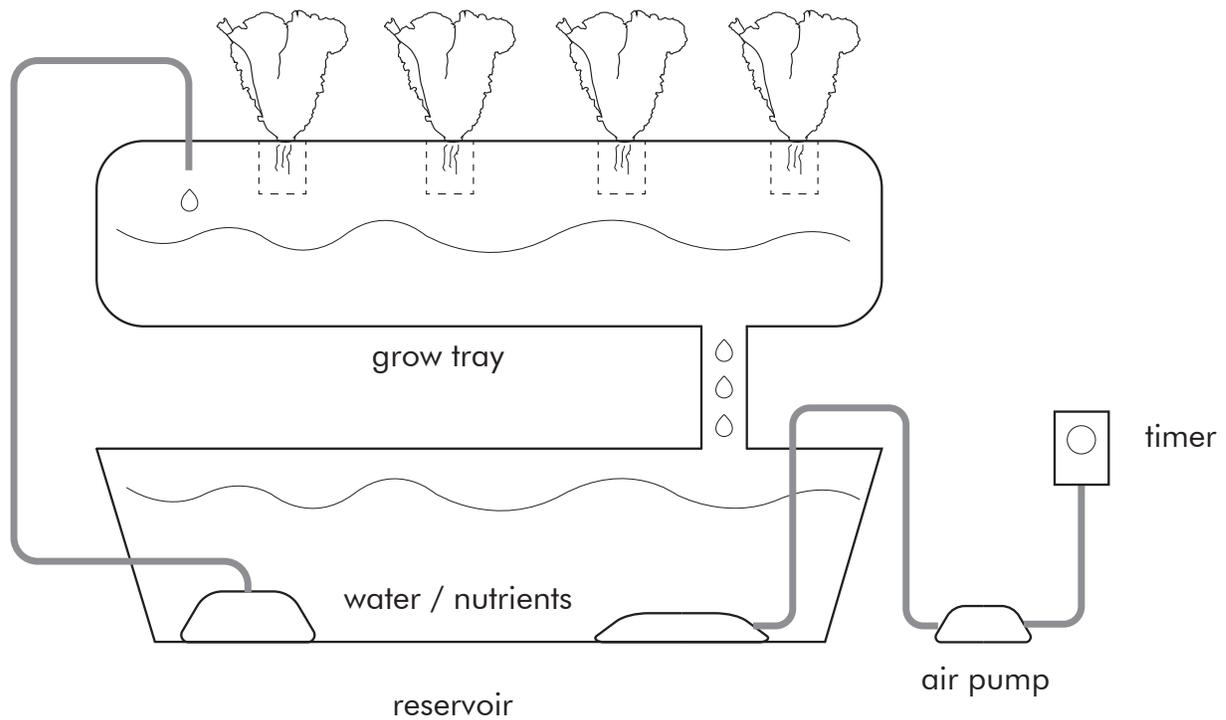


Fig. 26. Hydroponic farming overview.

## Notes

1. Author unknown. The Metro Vancouver Apartment Parking Study, Technical Report. Vancouver BC: Translink and Metro Vancouver, 2012. Accessed December, 2019. [http://www.metrovancouver.org/services/regional-planning/PlanningPublications/Apartment\\_Parking\\_Study\\_TechnicalReport.pdf](http://www.metrovancouver.org/services/regional-planning/PlanningPublications/Apartment_Parking_Study_TechnicalReport.pdf).
2. Author unknown. The 2018 Regional Parking Study, Technical Report. Vancouver BC: Translink and Metro Vancouver, 2018. Accessed December, 2019. <http://www.metrovancouver.org/services/regional-planning/PlanningPublications/RegionalParkingStudy-TechnicalReport.pdf>.
3. "Communities." Concord Pacific. <https://www.concordpacific.com/communities/> (retrieved Dec. 16, 2019).
4. Alexander, A Pattern Language, 505.
5. Punter, John Vincent. 2004. The Vancouver Achievement: Urban Planning and Design. Vancouver: UBC Press, 92.
6. Ibid, 92.
7. Population Division of the UN Department of Economic and Social Affairs (UN DESA). The 2018 Revision of World Urbanization Prospects. United Nations, 2012. Accessed December, 2019. <https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf>.
8. Duncan Cameron, Colin Osborne, Peter Horton, Mark Sinclair. A sustainable model for intensive agriculture. Sheffield UK, 2015. Accessed December, 2019. <http://grantham.sheffield.ac.uk/wp-content/uploads/A4-sustainable-model-intensive-agriculture-spread.pdf>.



Fig. 27. Process model.

## **On Process**

One of the most time consuming and challenging parts of this project was understanding the existing built condition of 888 Beach Ave. Many rolls of tracing paper were used to draw over top of the as-built drawings (see appendix b) to block out areas that could be used in the design proposal and find connections between levels. Model making also contributed significantly to my understanding of the site. This process took longer than expected but resulted in a deep knowledge and intuition of the site. It allowed me to more easily make design decisions once the program was decided. The following pages show a small sampling of the analysis.

-  street level
-  P1
-  P2-P4
-  parking structure
-  parking & tower structure



Fig. 28. Trace paper sketch overlaid on existing plans. All four levels overlaid on one plan to understand how the spaces could vertically connect.

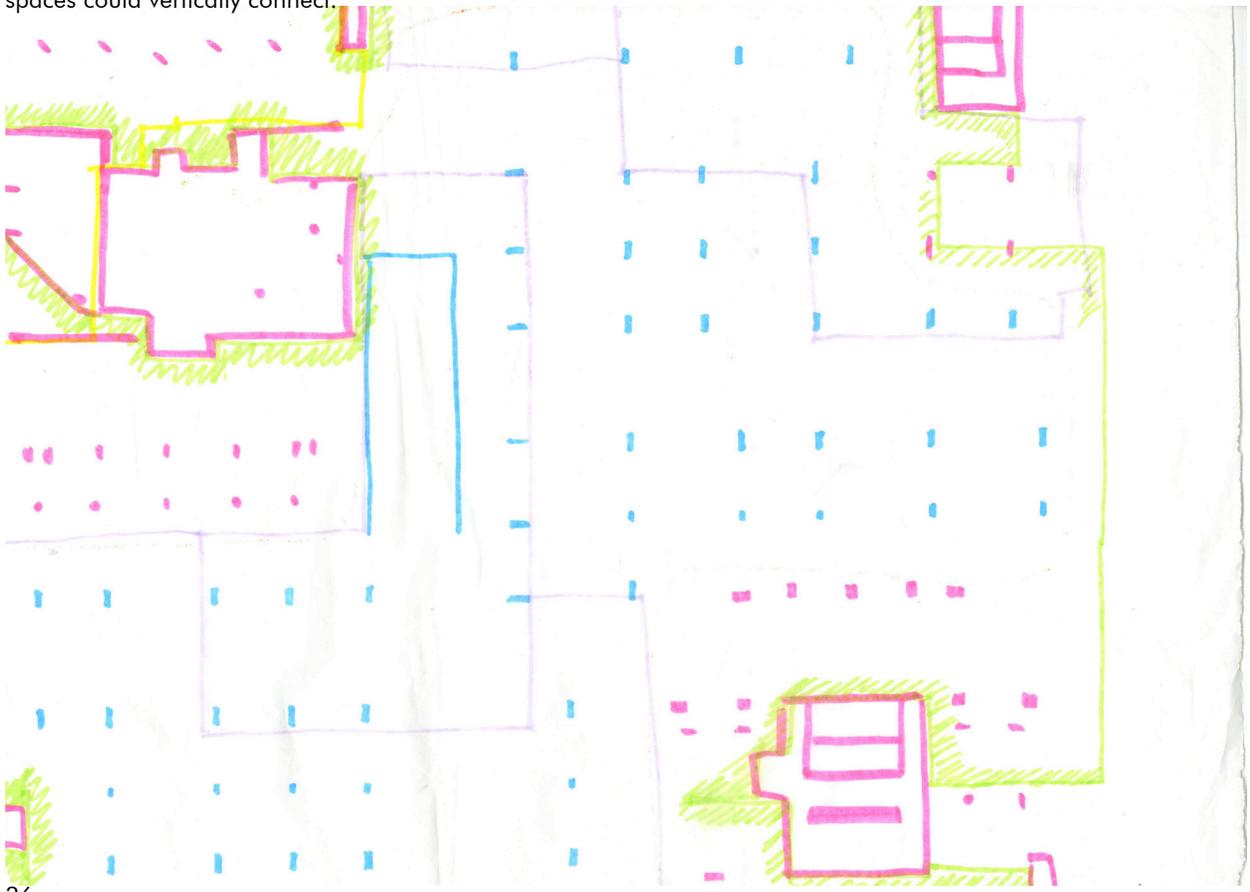


Fig. 29. Trace paper sketch overlaid on existing plans.



Fig. 30. Trace paper sketch overlaid on P1 and P2 plans. Yellow indicates existing drive aisles. Red shows townhouses and tower cores.

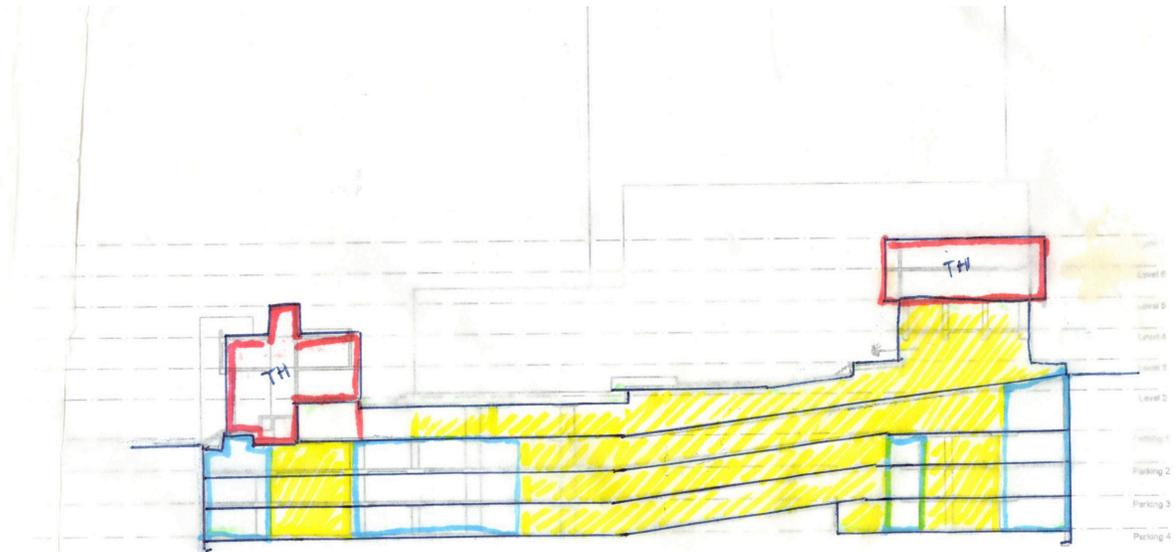


Fig. 31. Trace paper sketch overlaid on North-South section through Beach Ave ramp. Yellow indicates existing drive aisles. Blue is parking stalls. Red shows townhouses.

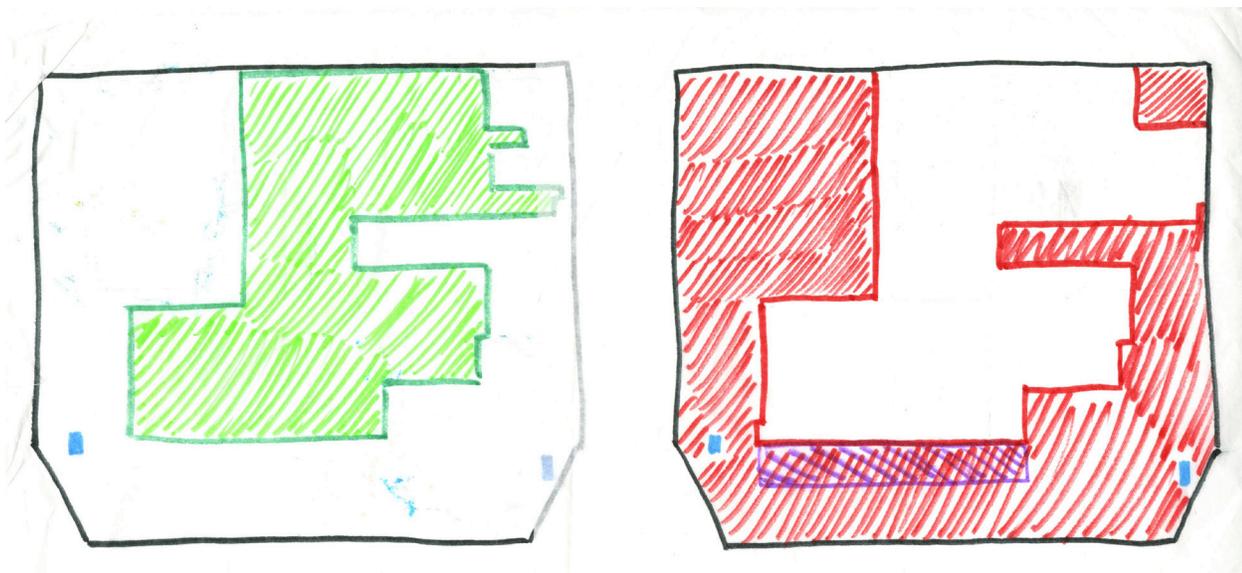


Fig. 32. Trace paper sketch overlaid on P1 plan. Green is available space for intervention. Red is off-limits.

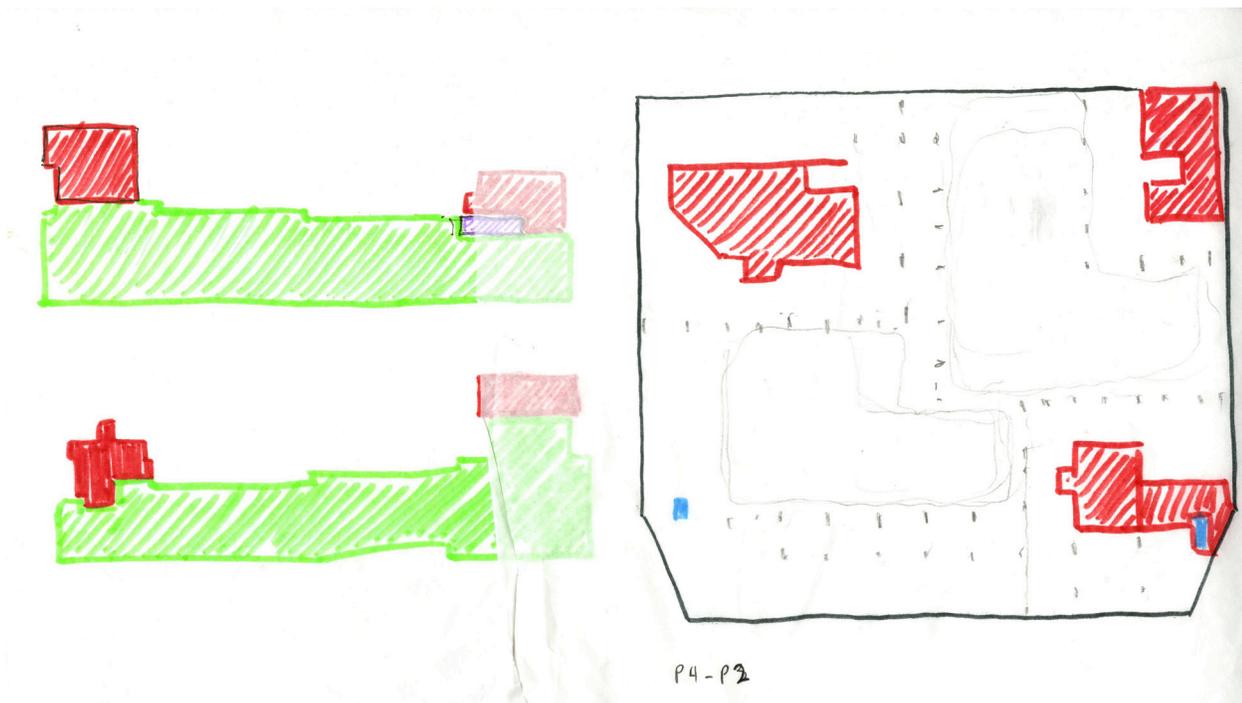


Fig. 33. Trace paper sketch overlaid on sections and P2 plan. Green is available space for intervention. Red is off-limits.

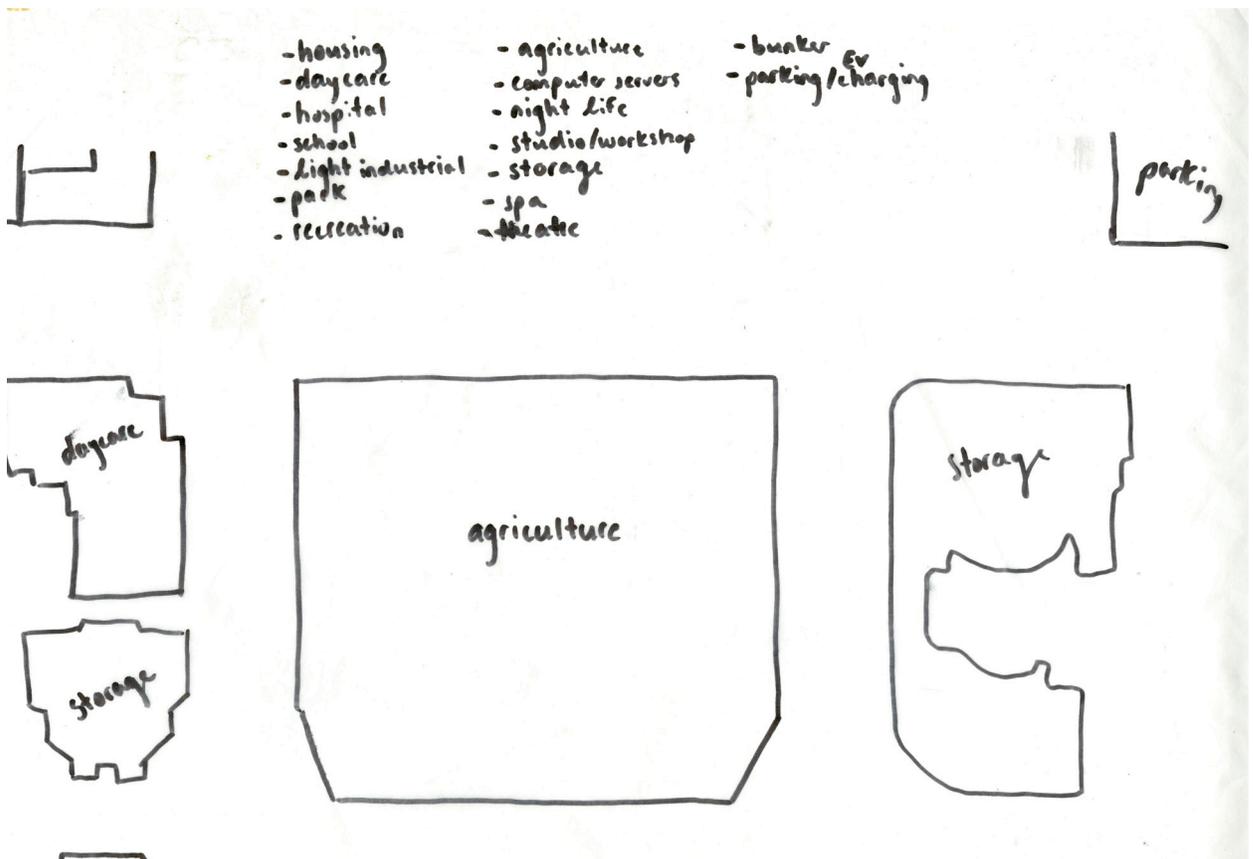


Fig. 34. Trace paper sketch overlaid on site plan. An early iteration of a neighbourhood strategy of how parking and other amenities will be consolidated.

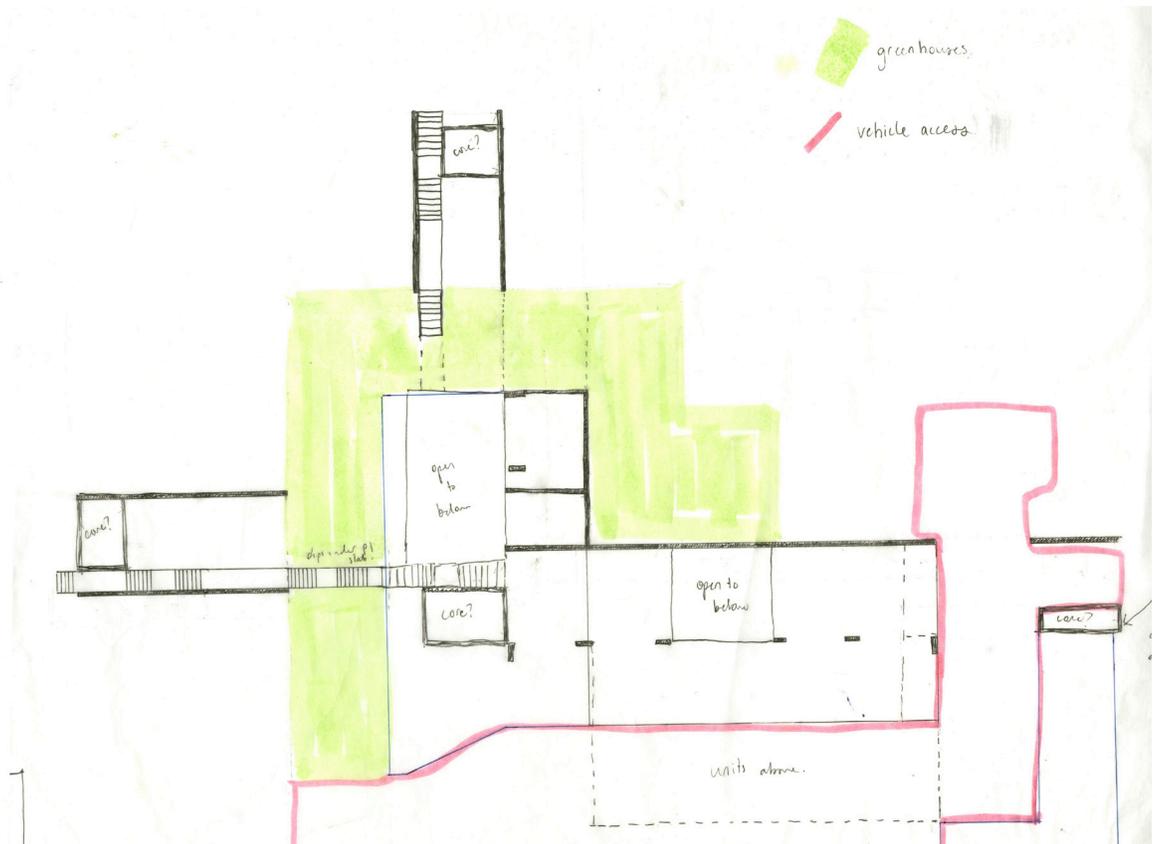


Fig. 35. Trace paper sketch overlaid on P1 plan. Here I began to start thinking about circulation through the site.

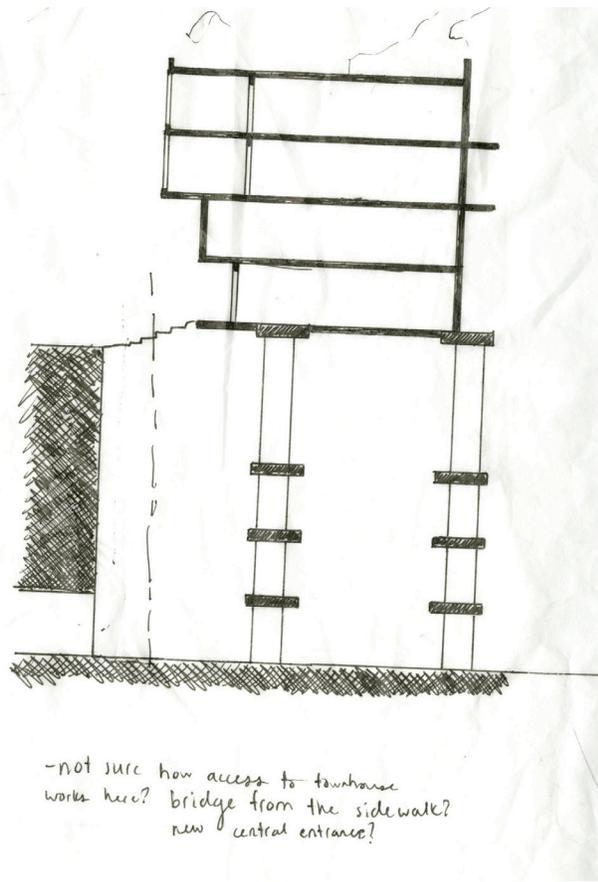


Fig. 36. Trace paper sketch overlaid on a section. Exploring how to make cuts into the existing structure.

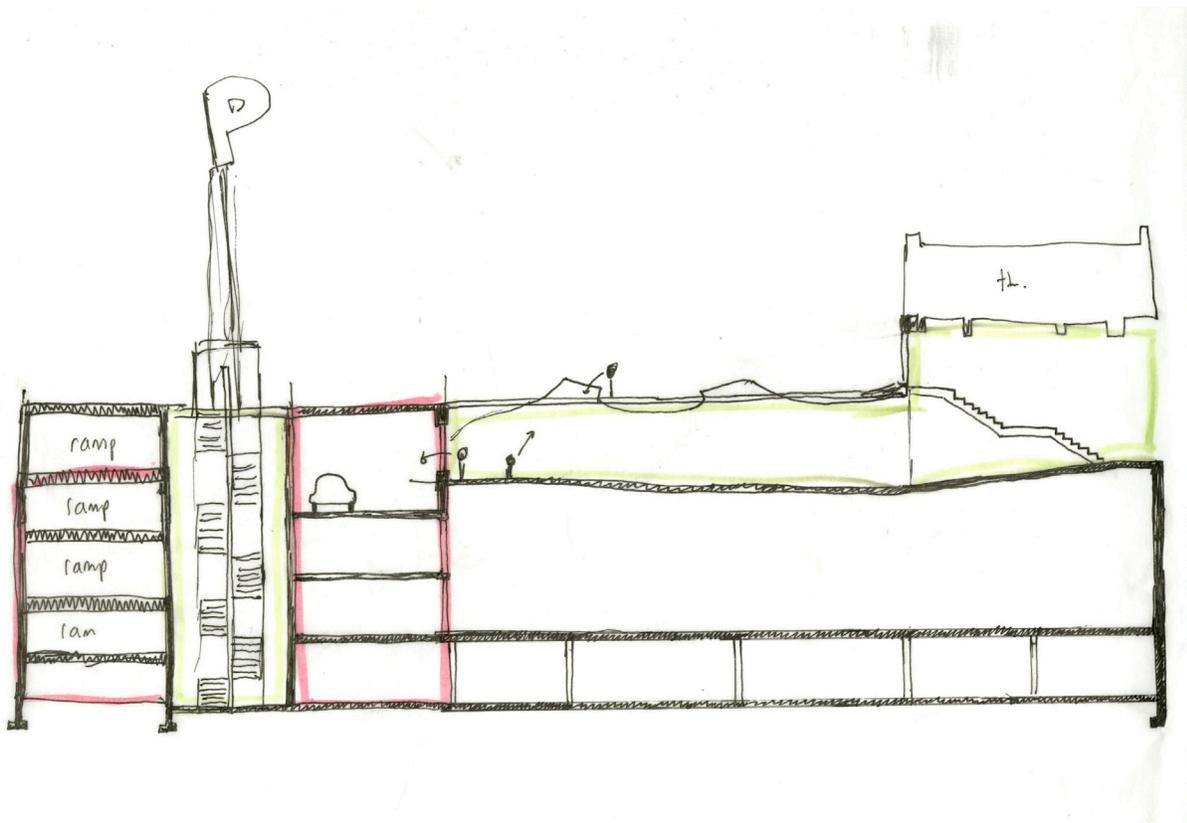


Fig. 37. Trace paper sketch overlaid on a section. Exploring how to make cuts into the existing structure for circulation.

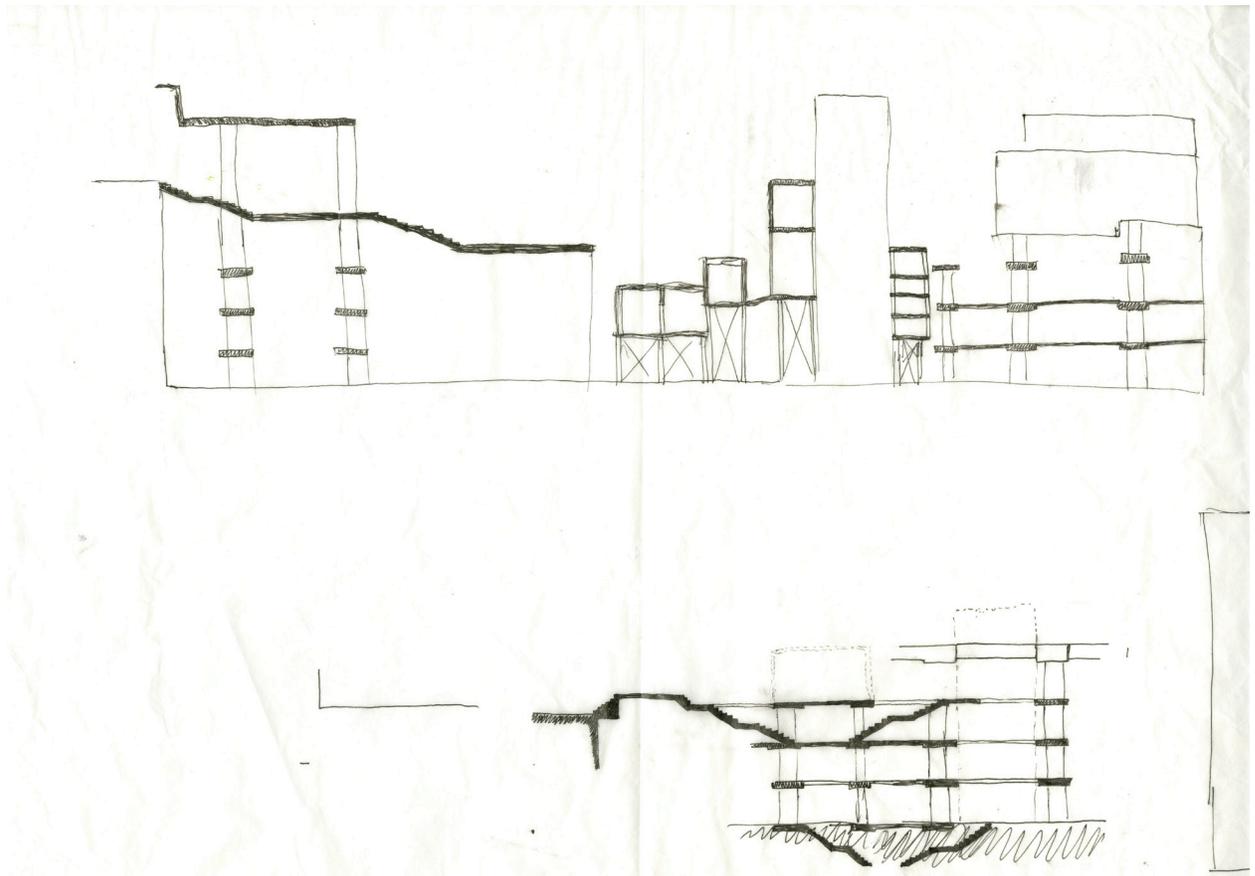


Fig. 38. Trace paper sketch overlaid on a section. Exploring how to make cuts into the existing structure.

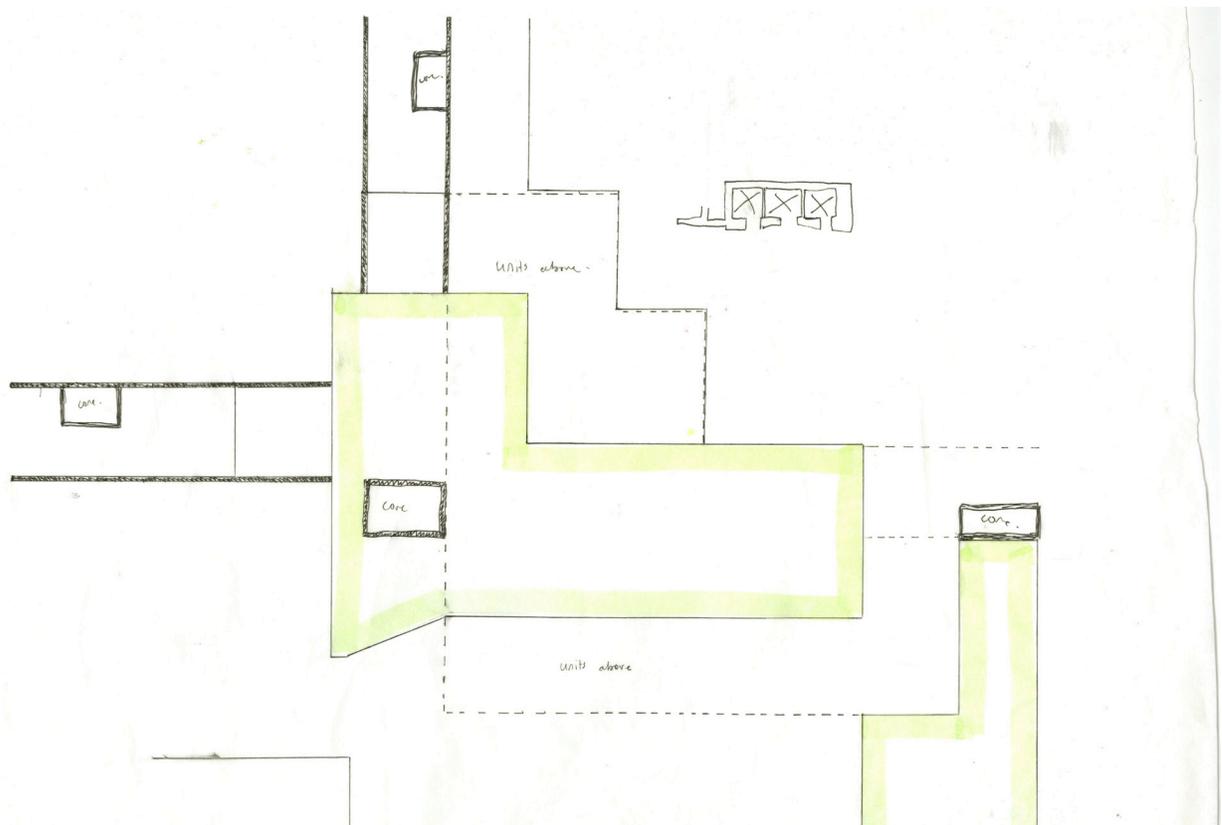


Fig. 39. Trace paper sketch overlaid on P1 plan.

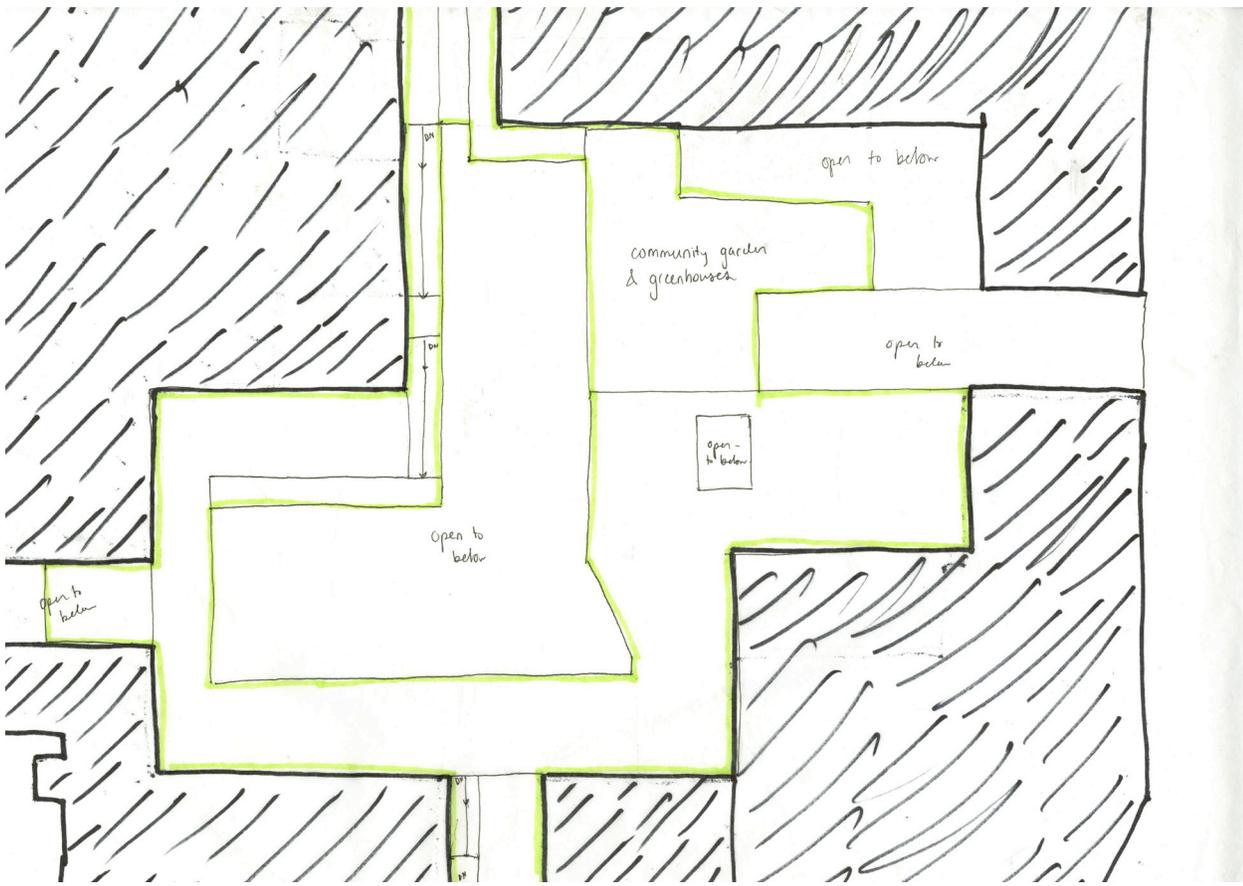


Fig. 40. Trace paper sketch overlaid on Courtyard plan. Starting to think about programming the space for a farm.



42 Fig. 41. Trace paper sketch overlaid on P1 plan. Starting to think about programming the space for a farm.

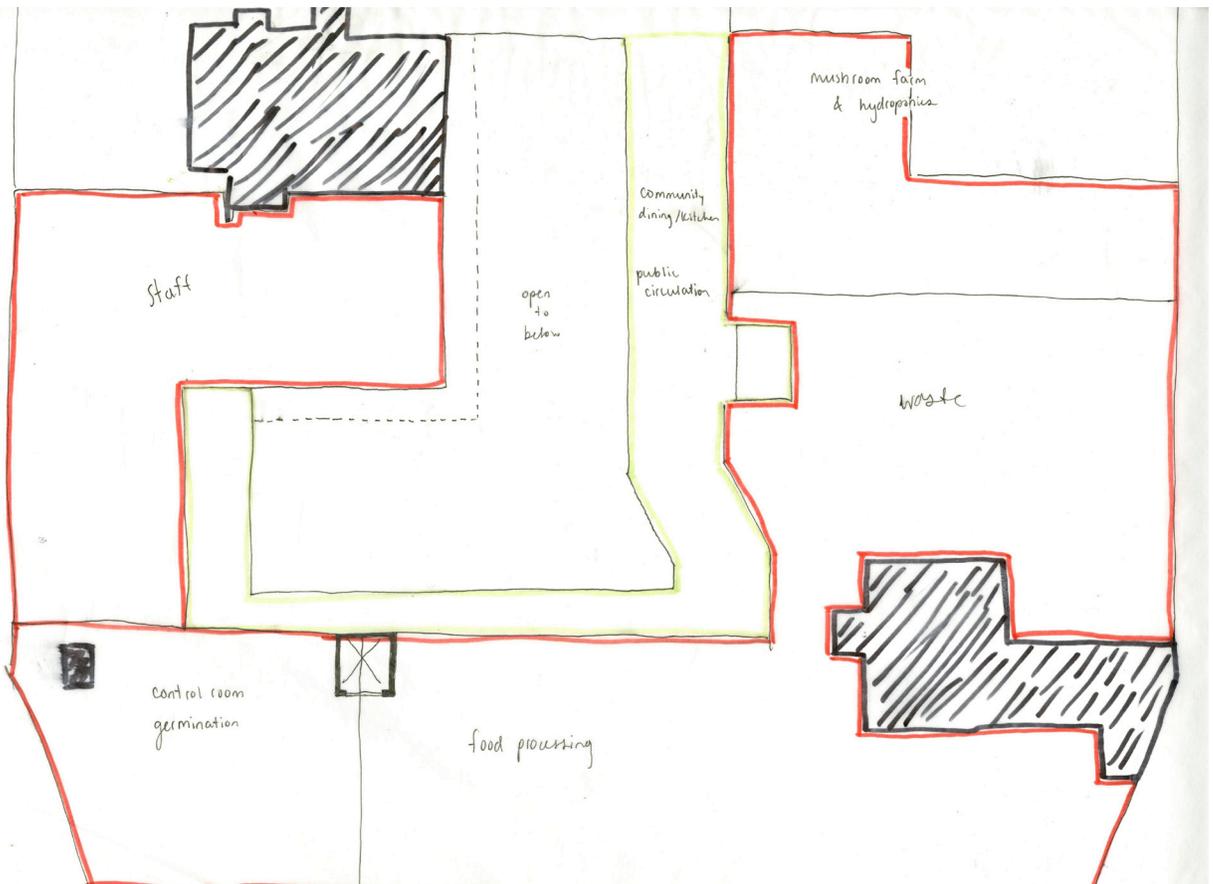


Fig. 42. Trace paper sketch overlaid on P2 plan. Starting to think about programming the space for a farm.

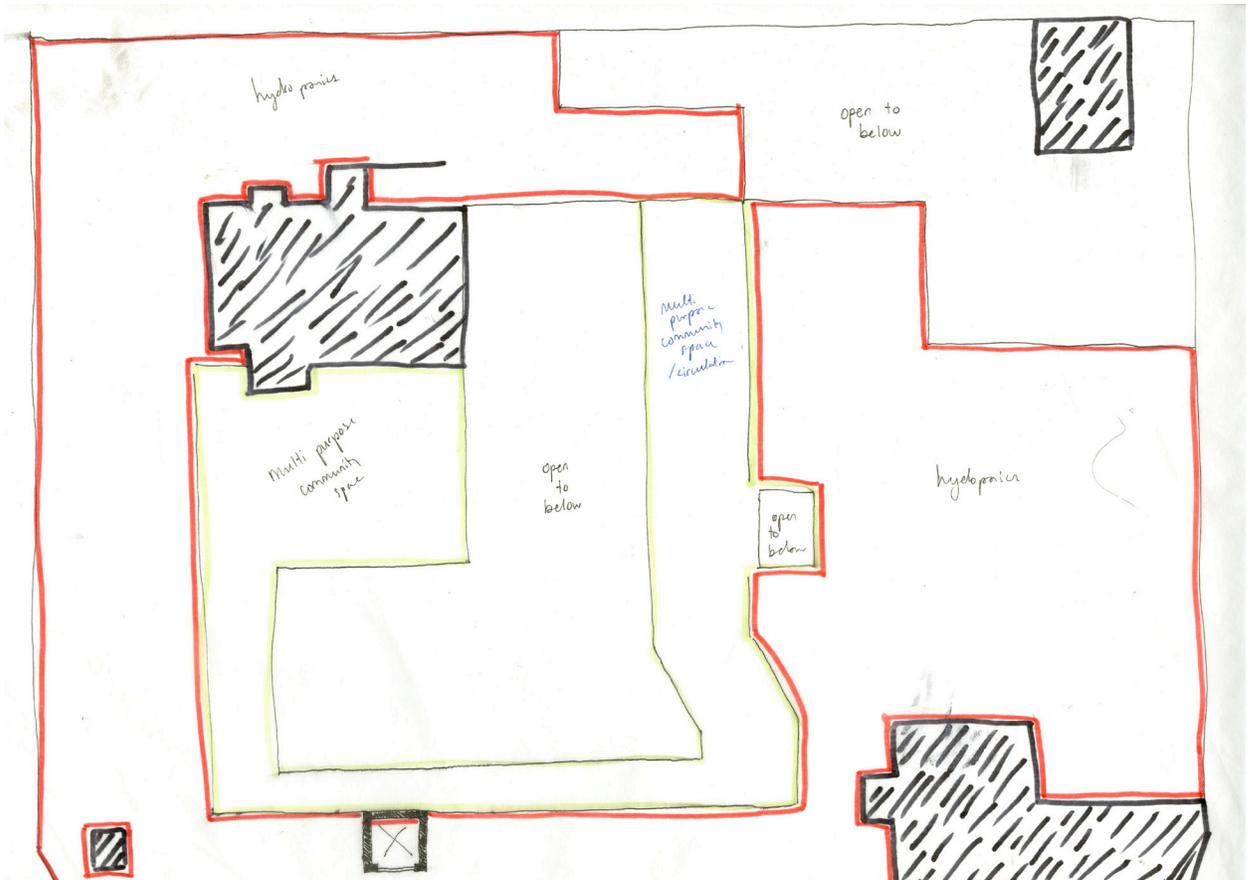


Fig. 43. Trace paper sketch overlaid on P3 plan. Starting to think about programming the space for a farm.



Fig. 44. Process model, 1:200. Top view of Courtyard.



Fig. 45. Process model, 1:200. Top view of P1.



Fig. 46. Process model, 1:200. Top view of P2.

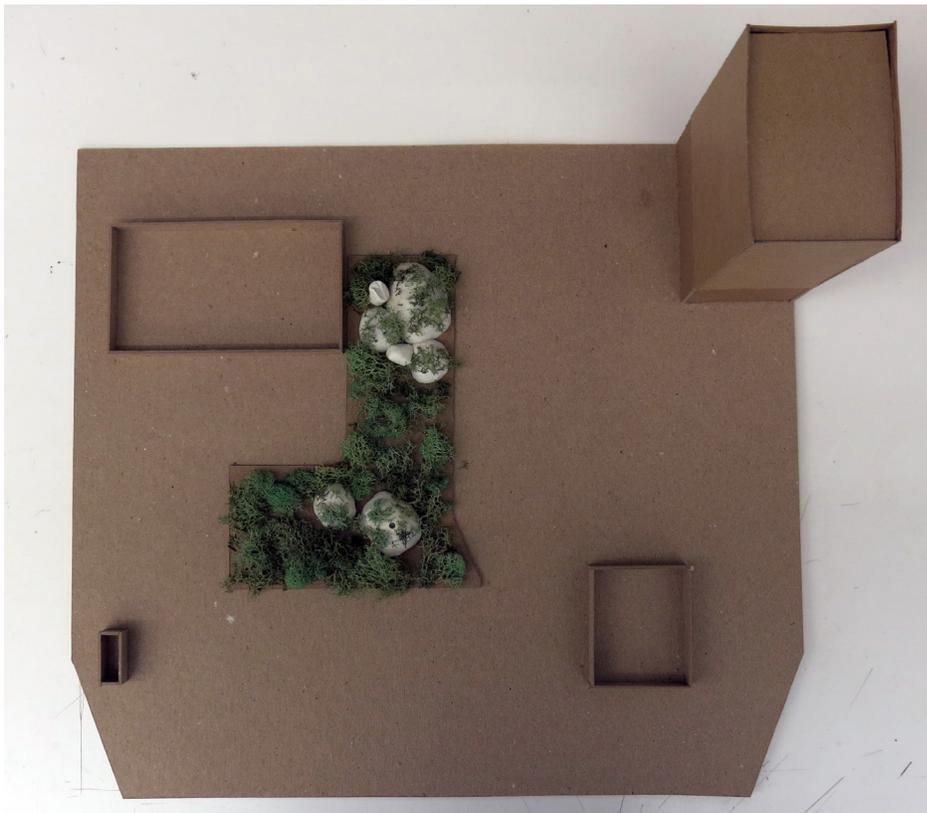


Fig. 47. Process model, 1:200. Top view of P3/P4.



Fig. 48. Cropped courtyard plan showing farm to table restaurant and community garden. Yellow indicates new interventions, white is left the same.

## Design Proposal

The drawings for the final review are colour coded to help orient viewers. Anything in yellow is accessible to the public. The light grey indicates the commercial farm. Light brown, green and orange represent the mushroom, lettuce and pepper crops respectively. Skylights are shown in light blue circles in the plan. Anything in white is left out of this design intervention (fig. 48).

The major design challenges of this site and many other underground parking lots are getting natural light below ground, circulation for non-vehicular traffic and negotiating the relationship between the existing use of the towers and townhouses and the agriculture centre.

The overall organizational strategy for the site was to place public activity on the levels closer to the surface and use the deepest levels underground for the commercial farm (fig. 49). The courtyard and P1 levels contain community gardens and indoor workshop space to hold educational events about urban farming. These activities require more access to natural light and are thus placed closer to the surface level. Levels P2-P4 are where most of the commercial farm activity takes place since it requires less natural light. A general strategy for this site is to create a pedestrian observation ramp from the existing Beach Ave vehicle ramp that allows the public to circulate below ground and see the space being used as a farm (fig. 51).

The three cores of the towers remain untouched on the underground levels (fig. 54). One townhouse is overtaken to host the farm to table restaurant which serves dishes made from vegetables grown on the site and from other local food producers (fig. 48, 50). The townhouses have private garages that connect to the underground parking (fig. 50, 79). The existing four units of commercial space are consolidated and used as a market to sell food grown on the site.

As you enter the site you may either enter onto the community garden level or begin descending into the underground (fig. 57). The underused reflecting pool and garden are replaced with a more "fruitful" community garden (fig. 58). The garden has circular planters arranged in a non-hierarchical way to allow for users to cluster them together as they may need. The circle is used as a formal juxtaposition to the rigid rectilinear form of parking structures. It is also used formally to make cuts into the existing building, for example, the skylights.

On P1 there is a sunken courtyard with a large opening to the community garden above to visually connect the two levels (fig. 59). P1 hosts public events for people to learn about urban farming and food production (fig. 53). This level also maintains the existing vehicle ramp to allow for goods to flow in and out of the site. It serves both the farm and the towers.



Fig. 49. Cropped section perspective North-South.

Continuing the descent brings you to the mushroom farm on P2 (fig. 54). There are places along the ramp to stop and observe the farm in various stages of production (fig. 60). Mushroom farming consists of three stages: mixing and inoculation, incubation and fruiting. Mixing and inoculation must occur in a sterile room.<sup>1</sup> In this room, the substrate and mushroom spawn is mixed together and bagged.<sup>2</sup> Various substances can be used as a substrate, a simple and readily available one is coffee grounds.<sup>3</sup> Once coffee grounds have been used to make coffee they make for an excellent substrate for the mushroom spawn. Here lies a great opportunity to further engage with the community by collecting used coffee grounds from nearby coffee shops. Sawdust pellets and straw can also be used as a substrate in this process. The incubation phase requires a warm and dark space.<sup>4</sup> The room should be around 20-24 degrees Celcius.<sup>5</sup> In this phase, the mushroom spawn begins to grow throughout the bag. During fruiting, the bags are hung and exposed to fresh air, humidity and 10-12 hours of sunlight per day (fig. 61).<sup>6</sup> This allows the mushrooms to fruit and become ready for harvest. Mushroom farms produce very toxic fumes so there must be an adequate ventilation system in place.<sup>7</sup> Fortunately, the underground parking garage has a mechanical ventilation system in place to deal with car exhaust. Further analysis is required to determine if any further mechanical ventilation is required. Many people have died on commercial mushroom farms because of inadequate ventilation.

The lower two levels have hydroponic lettuce and bell pepper farms with similar opportunities to view the stages of farming (fig. 55, 56). The lettuce and bell pepper hydroponic farms require two large rooms. One for germination and one for growing. Because the plants will grow without soil, the seedlings need to be germinated so that roots can sprout before they are placed into the hydroponic growing system.<sup>8</sup> This process requires a lot of moisture and light so the germination carts have LED lights placed on each shelf (fig. 62). Lettuce germination takes approximately eleven days.<sup>9</sup> The growing room is where the main hydroponic system is set up. Many different systems allow for hydroponic farming.<sup>10</sup> The lettuce and bell pepper crops allow for much greater yields than the mushrooms because the hydroponic technology allows for the crops to be stacked on six levels on a cart. Both the growing room and germination room require a high degree of environmental control and plenty of LED grow lights. The space also requires a significant cleaning area where trays can be cleaned and sanitized for the next round of crops.<sup>11</sup>

I hope that this site can operate outside of the prevailing global food market and create a new local food market for Vancouver that could pop up in other neighbourhoods as well. This site has the potential to provide fresh, healthy food that is grown in the neighbourhood (fig. 65).



Fig. 50. Cropped section perspective North-South highlighting restaurant.



Fig. 51. Cropped section perspective East-West highlighting pedestrian ramp.



Fig. 52. Cropped section perspective East-West.

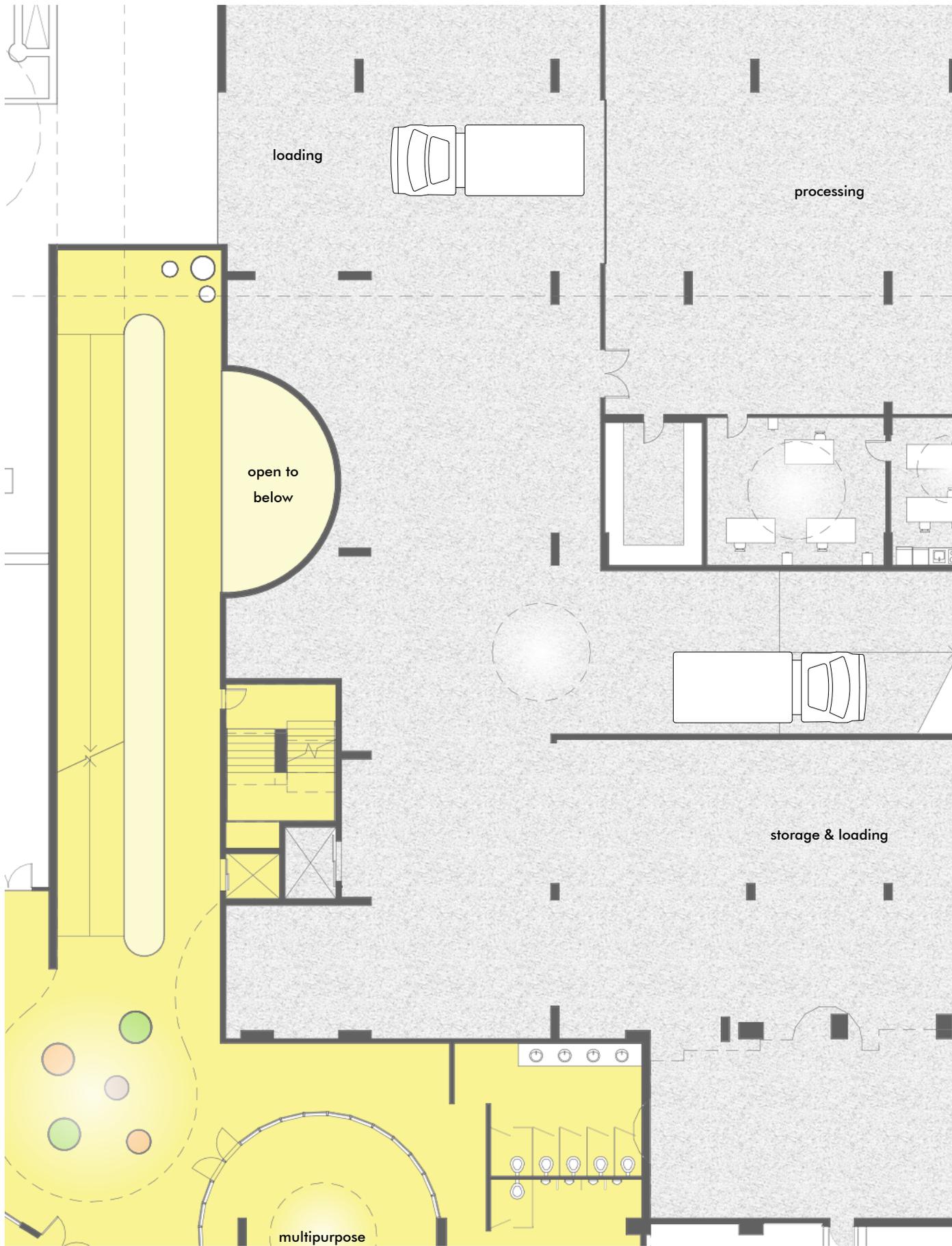


Fig. 53. Cropped P1 plan.

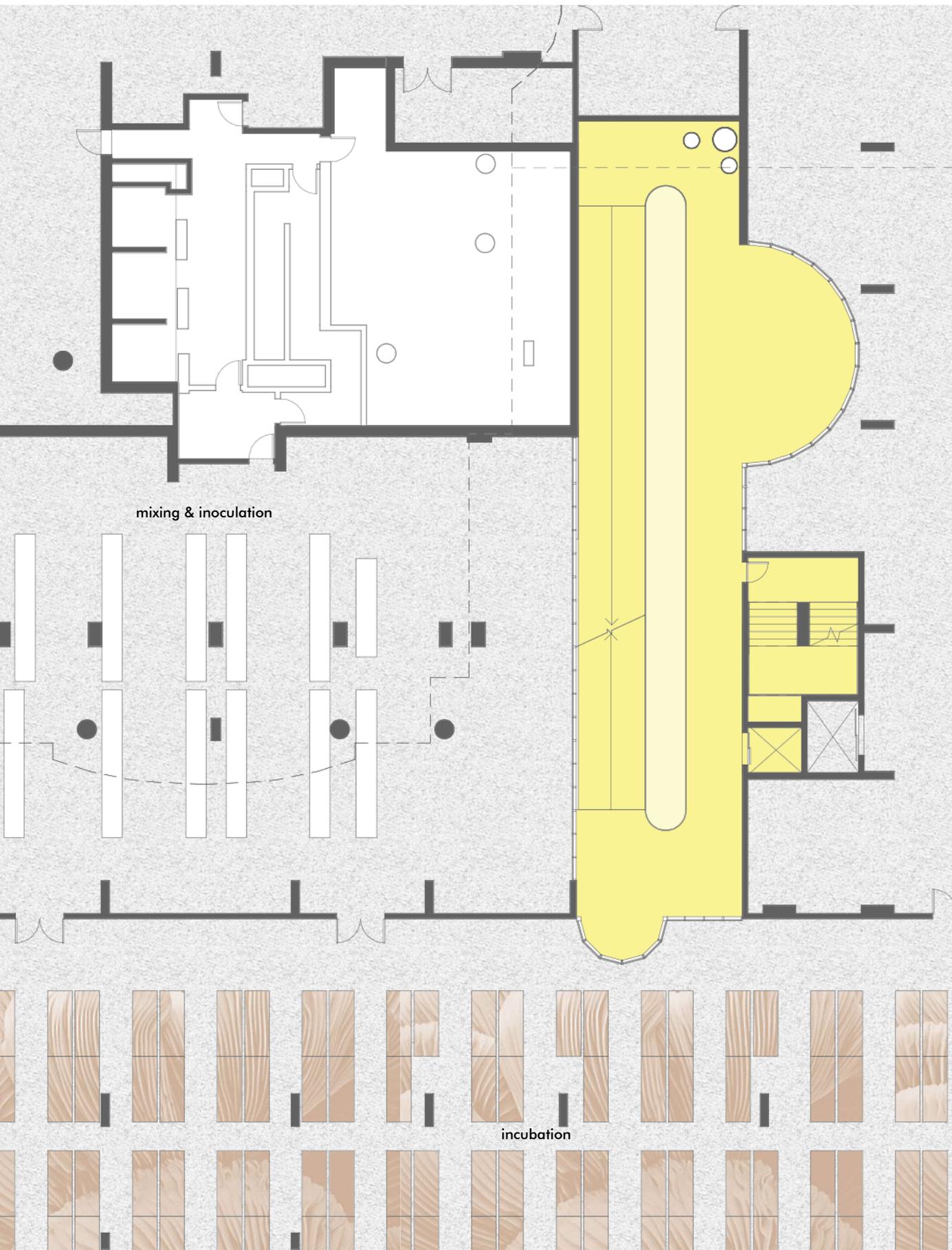


Fig. 54. Cropped P2 plan.

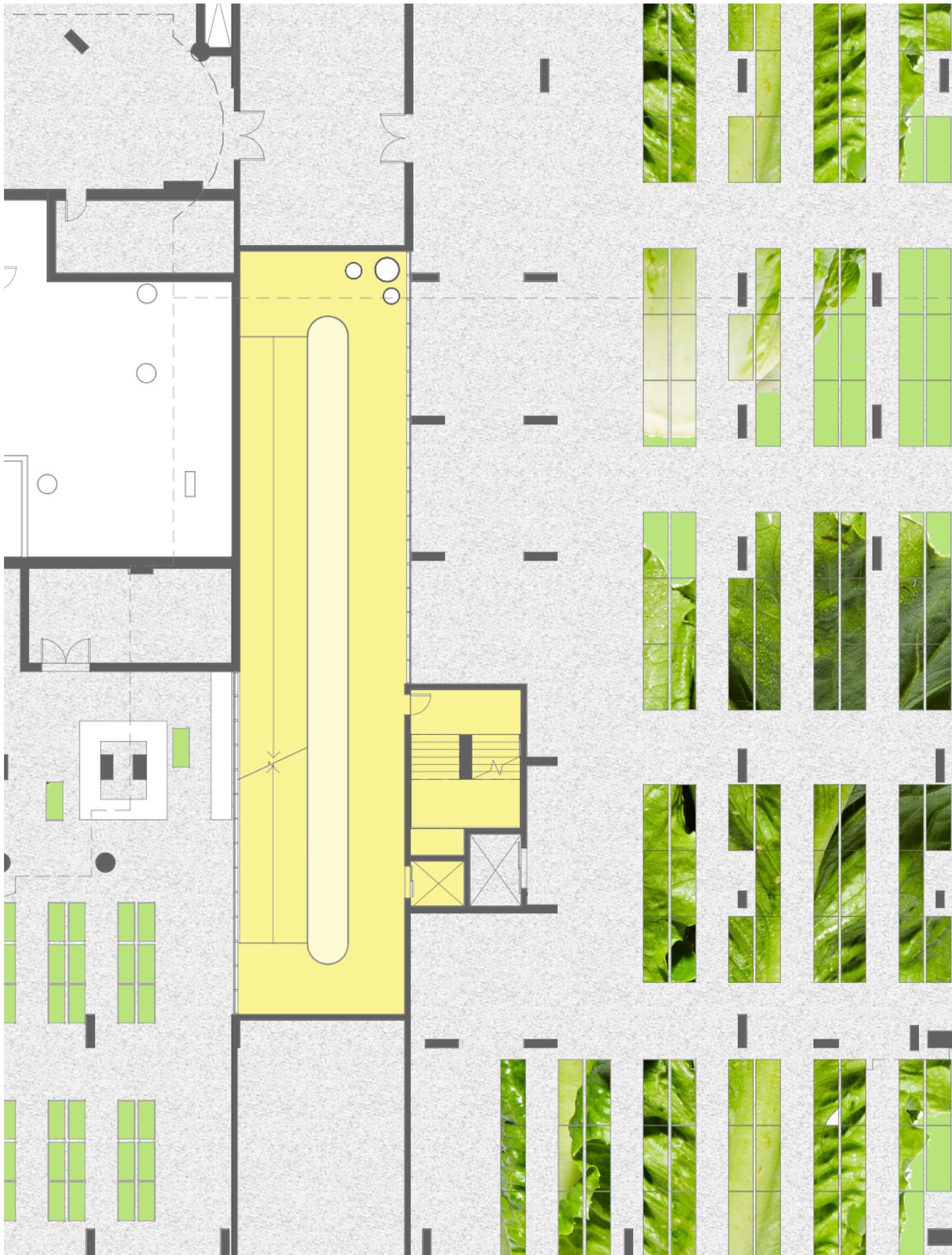


Fig. 55. Cropped P3 plan.



Fig. 56. Cropped P4 plan.



Fig. 57. Entrance perspective.

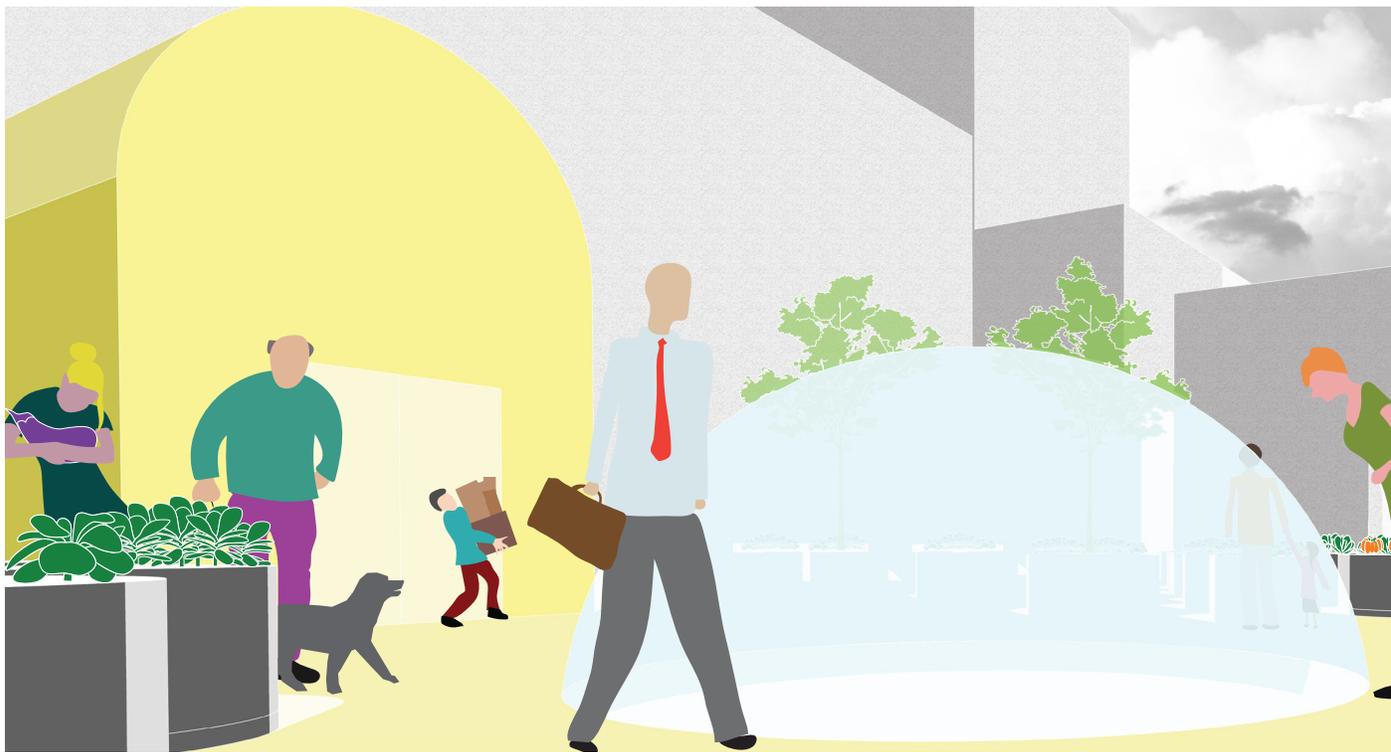


Fig. 58. Courtyard perspective.



Fig. 59. Sunken courtyard view.



Fig. 60. View from ramp, P2.



Fig. 61. Isometric view of mushroom floor connection to surface level.

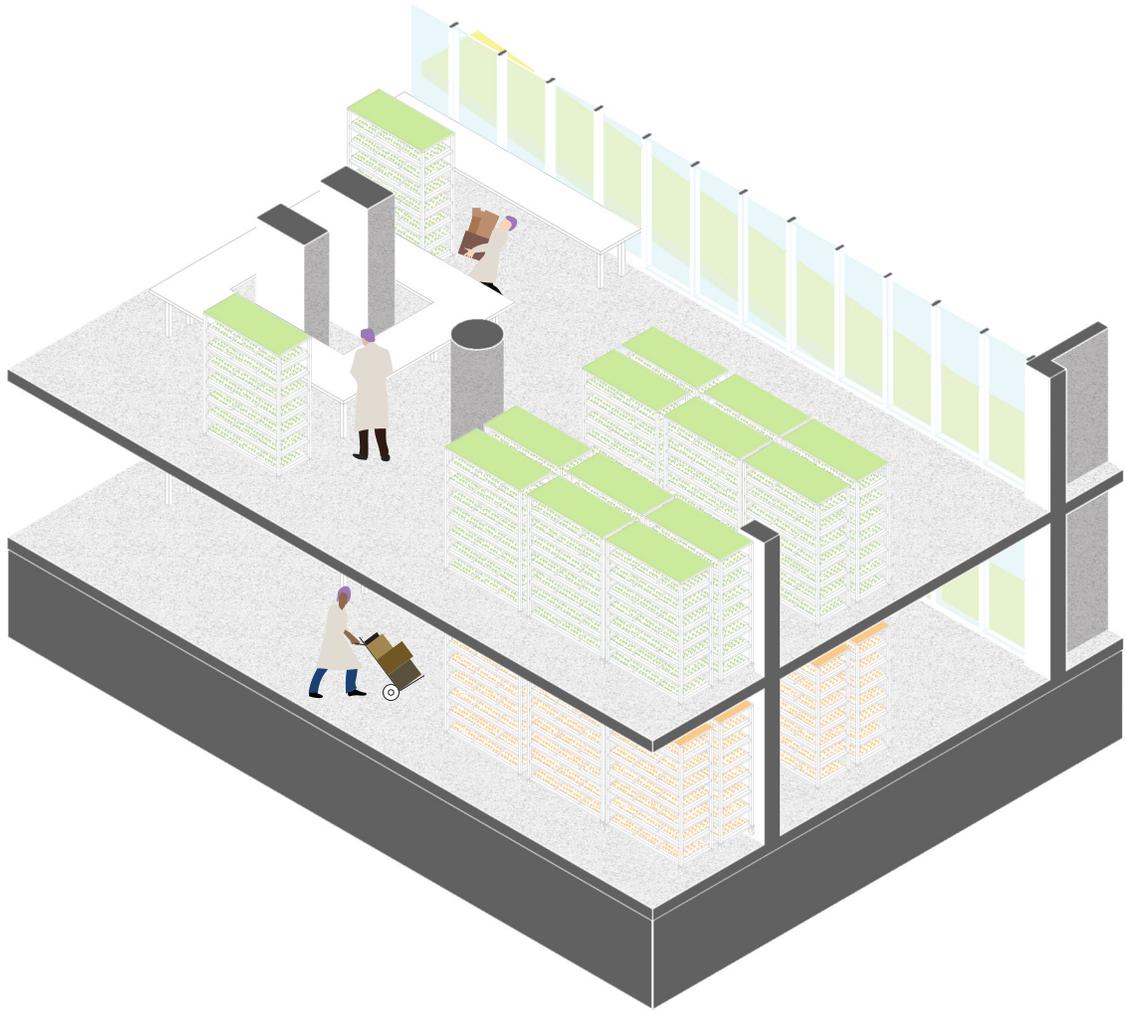
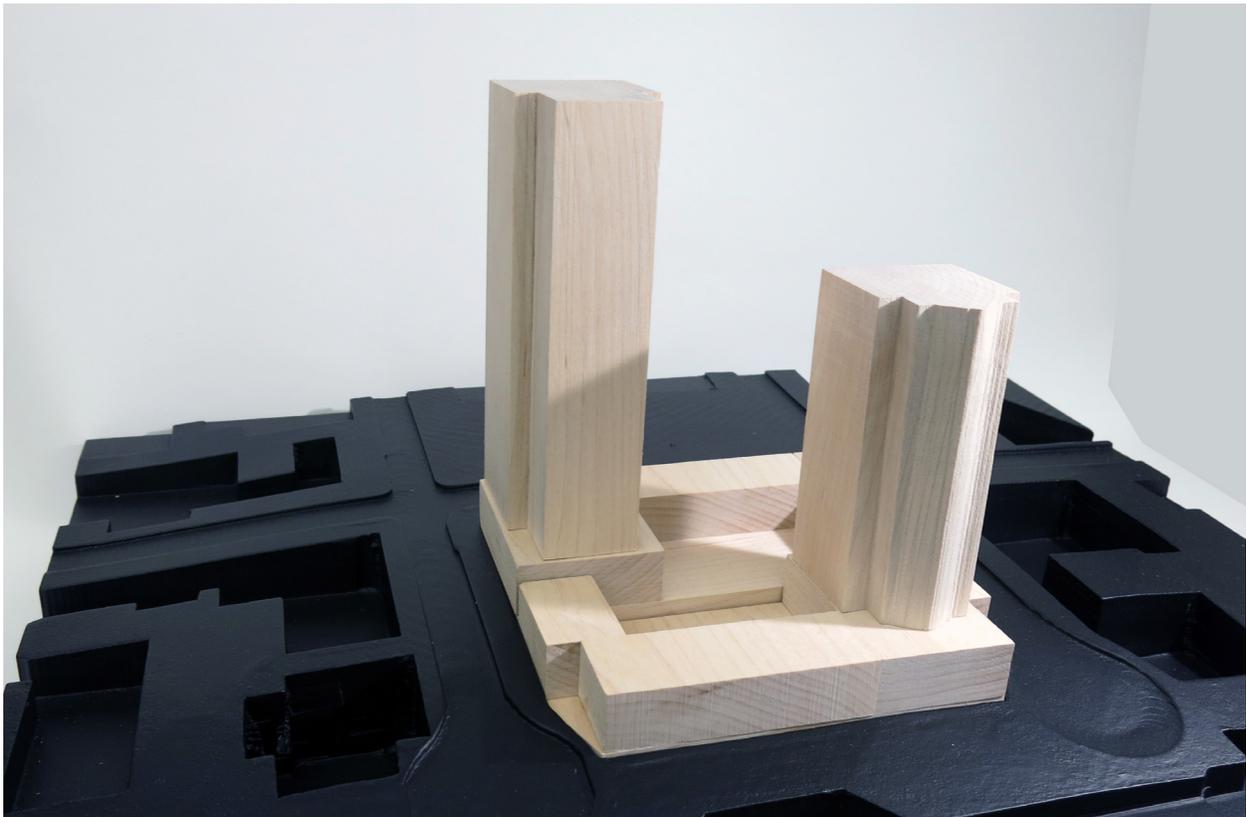


Fig. 62. Isometric view of lettuce farm germination room.



Fig. 63. 1:500 site model. 888 Beach Ave massing shown in maple. The black voids represent other underground parking areas in the neighbourhood.



62 Fig. 64. 1:500 site model. 888 Beach Ave massing shown in maple. The black voids represent other underground parking areas in the neighbourhood.

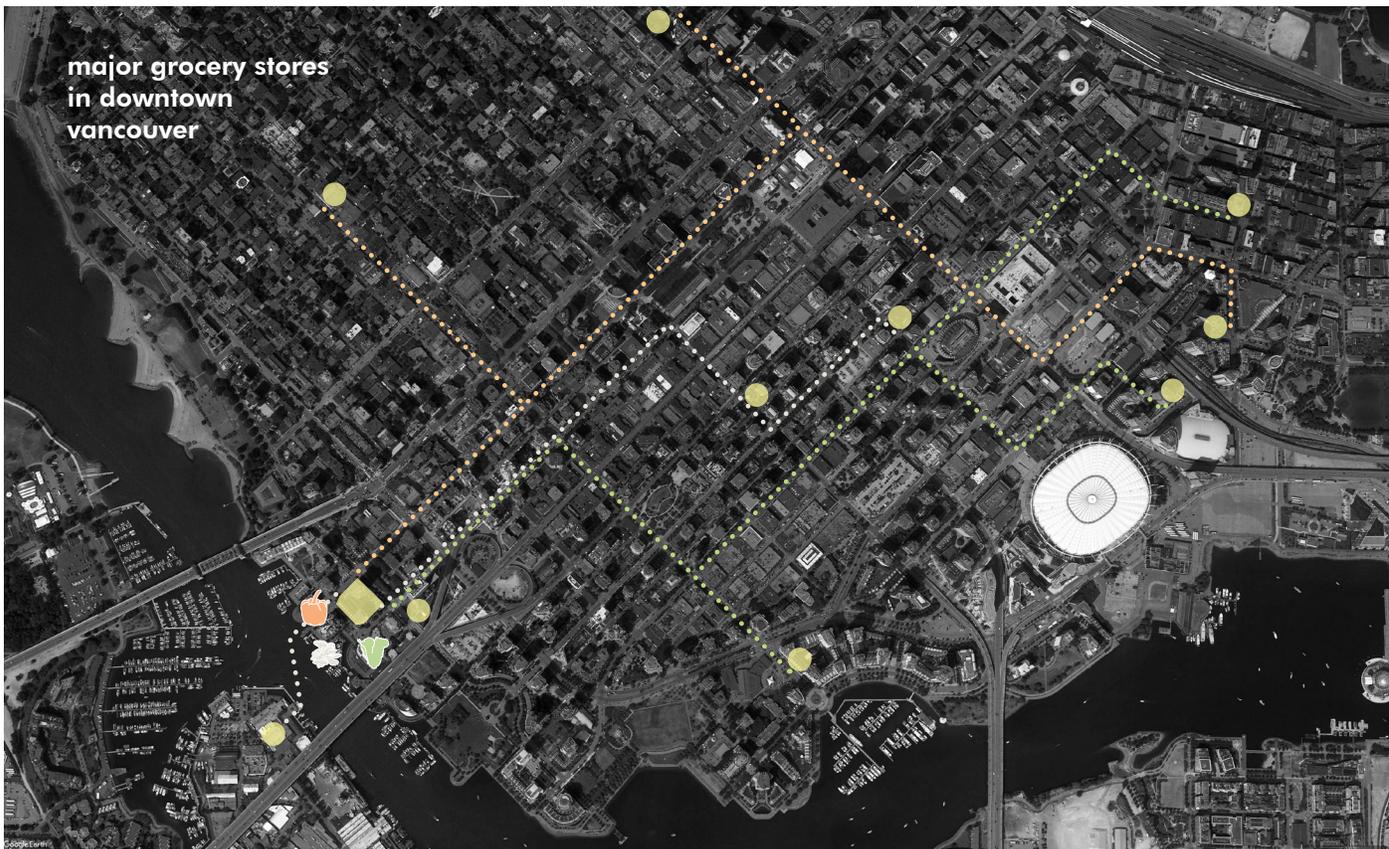


Fig. 65. Map of major grocery stores in Downtown Vancouver. Imagery from Google Earth V 7.3.2.5776. (June 12, 2019). Vancouver BC. 49° 16'32.55"N 123° 07'28.76"W. Eye alt. 3.20 km. Sanborn 2008. <https://earth.google.com/> (accessed December 17, 2019).

## Notes

1. Sayner, Adam. "How to Set Up a Low Tech Mushroom Farm."Grocycle. <https://grocycle.com/how-to-set-up-a-low-tech-mushroom-farm/> (accessed December 16, 2019).
2. Ibid.
3. Ibid.
4. Ibid.
5. Ibid.
6. Ibid.
7. Ibid.
8. Melissa Brechner and A.J. Both. Hydroponic Lettuce Handbook. Ithaca NY: Cornell Controlled Environment Agriculture, 2013. <http://cea.cals.cornell.edu/attachments/Cornell%20CEA%20Lettuce%20Handbook%20.pdf> (accessed December 16, 2019), 9.
9. Ibid, 20.
10. Ibid, 6.
11. Ibid, 26.



Fig. 66. Final presentation boards and models, December 12, 2019, 11:30 am.





Fig. 67. Post review smiles.

## Conclusion and Next Steps

The feedback received at the final presentation suggested that I do a more specific analysis of the spatial requirements of the hydroponic and mushroom farming technologies. Specifically regarding lighting, ventilation and plumbing. This would be an important next step in making this project even more feasible for real-world applications. Although the project is more about the idea that the site could be anything, by doing a more specific analysis to see what the limitations and challenges will be is something I would like to investigate further.

I would like to continue working on this project by more rigourously documenting underground parking spaces in Vancouver. I plan to do this through photographic and mapping exercises. I would like to start a database of this information that is public and open source. Maybe others can add to it as well. I think the City of Vancouver would be interested in this study and there may be an opportunity for them to support it as well.



## **Appendix A: Background**

History of the Vehicle and Parking  
Vehicles as a Service  
Automotive Infrastructure  
Parking Typologies  
Underground Architecture  
Mind Map and Precedents

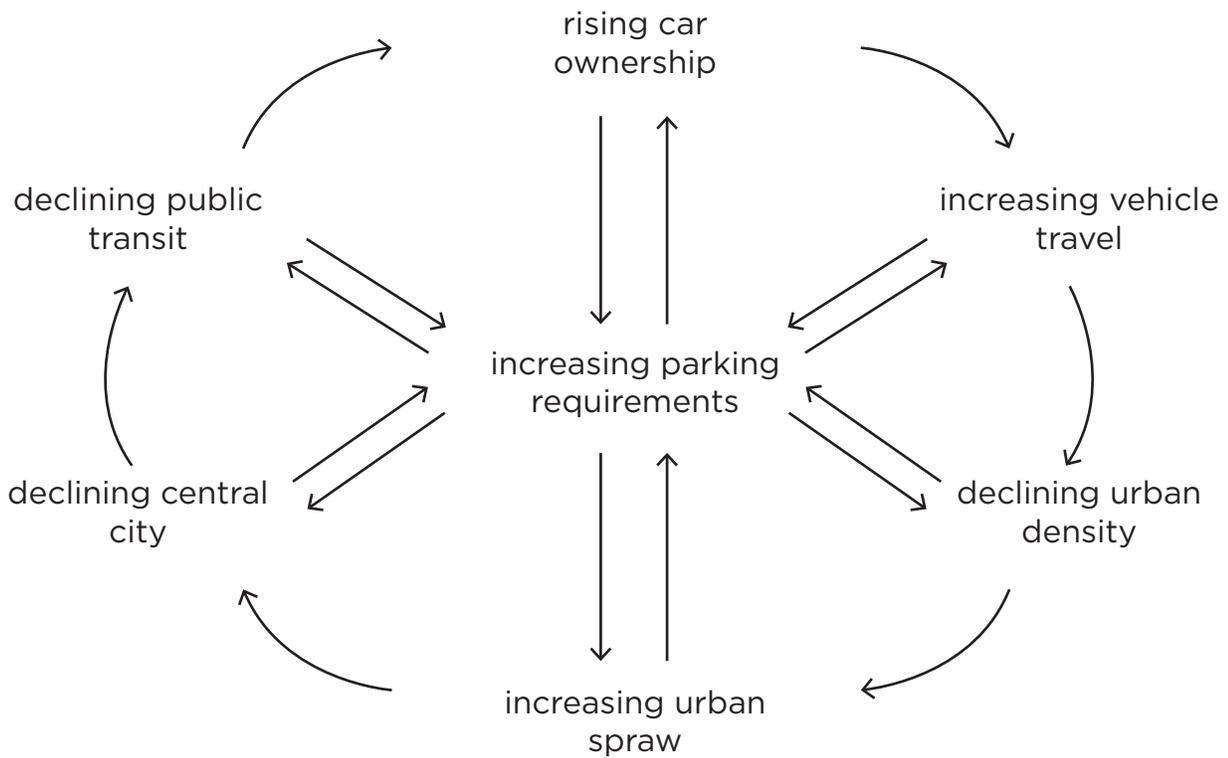


Fig. 68. Off-street Parking Requirements Accelerate Urban Sprawl. Adapted from Donald Shoup, *The High Cost of Free Parking* (2005).

# The Vehicle and Parking

In the twentieth century, the demand for parking greatly increased with private vehicle ownership. By 1923 cities were beginning to think about how to allocate sites for off-street parking facilities.<sup>1</sup> Since then, parking requirements have been embedded in zoning requirements leaving us with a horrifying amount of parking in cities. Off-street parking requirements reduce density because each building has its own, unshared parking that is often unavailable to the general public.<sup>2</sup> This reduction in density results in decreased attractiveness of the dense and accessible area that people initially were drawn to.<sup>3</sup> Cities get to a point where there is so much parking that there is nothing worth driving to these areas for anymore. This effect is shown in fig. 1.

Off street parking requirements result from political and market forces that planners have also contributed to. By ensuring that parking remains free, we have exacerbated urban sprawl, however, the off street parking requirements themselves have not been the sole cause of this.<sup>4</sup> The city has forced people to subsidize cars. By requiring off street parking for residential zoning, the price of housing has become more expensive.<sup>5</sup> This is an example of how the cost of parking has been disguised in other forms as Donald Shoup highlights in his book, *The High Cost of Free Parking*. In 1935 Los Angeles began requiring one off-street parking space per dwelling unit for multifamily housing.<sup>6</sup> Many other cities including Vancouver adopted similar requirements.

The cost for a developer to add one parking stall in a housing development in Vancouver can vary between \$20,000 and \$45,000.<sup>7</sup> This has contributed to high construction and housing costs in Vancouver and North America. By identifying the changing demand for off street parking in new buildings, there is potential to reduce these costs.

Data from 1999 shows that in Vancouver there were 46,053 parking spaces which is 42% parking coverage in the city.<sup>8</sup> Cities like Vancouver obtain a lot of revenue from paid parking. From 2009-2015 parking revenue in Vancouver rose 58%.<sup>9</sup> In 2015 parking revenue in Vancouver was \$49.5 million.<sup>10</sup> There is fear that this reduced income for the city will reduce social services. However, there is potential for the city to find new ways of recouping this revenue from the parking spaces they have. There are no doubt other great needs in the city, such as affordable housing, affordable business tenant space and effective public space. These are all potential new futures for parking spaces in cities.

In 2018, the City of Vancouver updated the off-street parking bylaw to eliminate the minimum parking requirements for residential uses in downtown. This is an indication that the need for residential parking is decreasing. The previous bylaw was enacted in 2014 and required the lesser of one parking space for each 140m<sup>2</sup> of gross floor area or one parking space per dwelling unit.

The timeline in fig. 2 is an attempt to temporally map the history of the vehicle since 1908 when the Ford Model T was first mass produced on the assembly line. It shows how individual car sales have increased over the twentieth century with corresponding impacts on the building of cities. For example, in 1974 in Detroit, land devoted to vehicles covered 74% percent of downtown.<sup>11</sup> The aim of the timeline is to show how with the increased mass production of the vehicle, starting with the Ford Model T, we have increased our reliance and usage of privately owned vehicles. As the timeline begins to look into the future, you can see that private car ownership is expected to decrease and new forms of transportation will emerge.

## Vehicles as a Service (VaaS)

Within the discourse of autonomous vehicles and the future of transportation, terms such as mobility as a service and transport as a service (TaaS) are often

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used. I am choosing to use the term Vehicles as a Service (VaaS) since the focus of this project will be the vehicle, with the understanding that the vehicle fits into a larger network of mobility and transportation. By narrowing the scope of the project in this way, I will be able to study the vehicle and automotive infrastructure more deeply. The terms vehicle and automobile will be used interchangeably both referring to a land-based machine that is used for the transportation of people and goods. With the introduction of the autonomous vehicle, the vehicle becomes a service rather than a consumer product. People will cease to purchase their own vehicle and instead will purchase the service of mobility from autonomous vehicle fleets. This has the potential to end private ownership of vehicles.<sup>12</sup> The conversation around the introduction of autonomous vehicles into mainstream society is still very speculative. There are many potential future scenarios that are likely.<sup>13</sup> I will take it as given that within the next fifty years autonomous technology in passenger vehicles will be widespread. This stance is supported by a recent report published by ReThinkX, “an independent think tank that analyzes and forecasts the speed and scale of technology-driven disruption and its implications across society.”<sup>14</sup> Their report, *Rethinking Transportation 2020-2030* finds that “within 10 years of regulatory approval of autonomous vehicles (AVs), 95% of U.S. passenger miles traveled will be served by on-demand autonomous electric vehicles owned by fleets, not individuals, in a new business model we call “transport-as-a-service (TaaS).”<sup>15</sup> The findings of this report have helped me to clearly locate the project in time and contemporary issues.

What interests me is what will be left behind as we become a VaaS society. There is no doubt that we have dedicated a lot of space the automobile in our cities. These spaces are what I will call automotive infrastructure.

## Automotive Infrastructure

I will define the term automotive infrastructure as services and facilities necessary for independently owned vehicles to function. This includes roads (of all scales and types), gas stations, parking areas, service garages, car dealerships, tire shops and car graveyards. This is different from transportation infrastructure since I am only looking at vehicular transportation where transportation infrastructure would include other modes of transportation such as public transportation and air travel. Transportation infrastructure is a more general, all-encompassing term than automotive infrastructure.

With the shift to VaaS, this definition of automotive infrastructure will change and thus, affect many industries such as automobile insurance, auto repair shops and car dealerships. These businesses operate in a way that is suited to private ownership of vehicles. These types of businesses face challenges in the world of VaaS. The ReThinkX report presents some evidence of this, “traditional roles of car dealers will be taken over by TaaS providers/fleet owners. We, therefore, see the car dealership industry in terminal decline from the advent of the TaaS disruption.”<sup>16</sup> I am identifying this future terminal decline as an opportunity for design to imagine the future of automotive infrastructure.

I will anticipate the future infrastructural needs in a society where autonomous vehicles are widespread. What is the fate of automotive infrastructure? Will it continue to serve the transportation industry or change its use completely? Defining automotive infrastructure has helped me to locate the project in space.

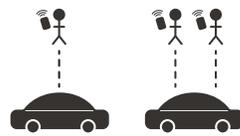
## Parking Typologies

Fig. 4 diagram of parking typologies.



Individual vehicle ownership

2019



Vehicles as a service

2030

- X car dealerships
- X gas stations
- X parking
- X auto repair shops
- X auto department of Canadian Tire
- X internal combustion vehicles
- X wide roads

Automotive infrastructure  
becomes waste and space

2031

Fig. 70. Changing vehicle ownership model.

# Underground Architecture

Historical and contemporary use of underground space appears limited to urban services. The shallow subsurface up to depths of 1 m below grade has already become an urban service layer.<sup>17</sup> These urban service layers consist of primarily horizontal orientations which make it difficult to insert vertical interventions (geothermal, aquifers, human circulation) into this context. The development of these underground services is often executed without a resolved plan but with randomness generated from necessity for example, underground parking.

Underground urbanism can be defined as a way to think about city planning in underground space that contributes to cities and their livability beyond infrastructural uses. It appears there are two main issues with underground urbanism: physical and psychological. The issues of access to natural light and ventilation make these spaces challenging for human occupation. The associations people have with being underground are highly negative. This is problematic. Underground urbanism should aim to integrate underground developments with above ground urban fabric.<sup>18</sup> Underground urbanism is the ideal car free environment. Currently, many underground areas are privately owned, such as the Toronto PATH which is mostly retail space. It is critical that access to underground spaces are not controlled by the opening hours of the businesses that occupy them to ensure their success as public space.<sup>19</sup> The Beurstraverse sunken shopping street in Rotterdam is a good example of this. It has a central axis of public space that is lined with privately owned businesses. As a result, the public space remains open to the public at all times of the day regardless of the opening hours of the businesses surrounding it. In underground spaces, the progression between street and interior is critical. It should be instinctive to enter.

Many projects underground tend to have some “natural” element to them, exposed rock or existing caves converted into a museum (see Snohetta precedent). For example, the TempPELLIAUKIO Church in Helsinki has exposed bedrock in the main hall. The condition I plan to work with has completely separated the “natural” elements of the underground with concrete. This creates a unique existing condition to work within. It will be challenging to find ways to bring natural light and ventilation into these spaces since they have large buildings constructed above them.

Table 1 is an outline of some basic design strategies for underground from *Underground Space Design: A Guide to Subsurface Utilization and Design for People in Underground Spaces*.

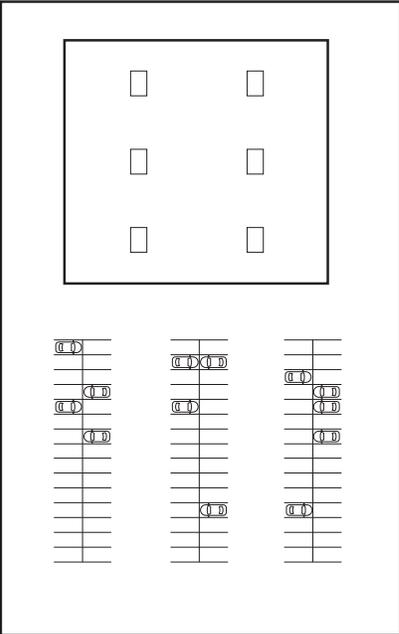
## Mind Map and Precedents

The following mind maps, fig. 5 and fig. 6 are an attempt to unify the ideas previously discussed in order to identify the urgency of this graduation project. Fig. 5 was a first attempt at the mind map where the organization of the page was not considered but rather, as words and ideas came to mind, they were recorded and connections between the nodes were drawn as necessary. There was not an overriding organizational strategy. The second iteration, fig. 6 was a refinement of fig. 5. The key nodes were organized vertically on the page and solid lines were only used to connect major topics to each other. The other nodes of text that float around major topics within the dashed lines indicate related topics that are not central to the project but are still relevant.

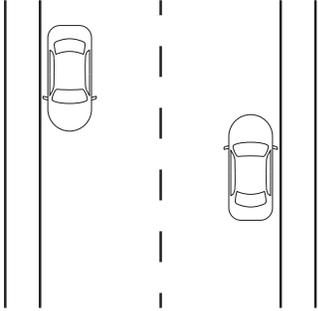
Key precedents and corresponding analysis can be found on pages following.

# Parking Typologies

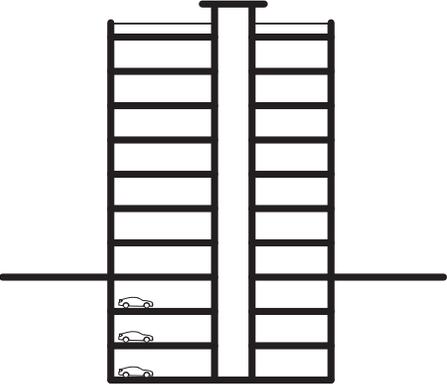
surface lot



street parking



underground garage



residential garage



parking garage



Fig. 71. Parking Typologies.  
78

Exterior and entrance	Layout and spatial configuration	Interior elements and systems	Lighting	Life Safety
<ul style="list-style-type: none"> <li>• entrance through a sunken courtyard</li> <li>• above grade entrance pavilion</li> <li>• entrance through large above-grade building mass</li> <li>• open stairways, ramps and escalators</li> <li>• glass enclosed vertical and included elevators</li> </ul>	<ul style="list-style-type: none"> <li>• system of paths, activity nodes and landmarks</li> <li>• sunken exterior courtyard</li> <li>• interior atrium space</li> <li>• building thoroughfare</li> <li>• short, lively passageways</li> <li>• zones of distinct character</li> <li>• interior windows overlooking activity</li> <li>• hierarchy of privacy</li> <li>• complex room shapes and interconnected spaces</li> </ul>	<ul style="list-style-type: none"> <li>• colourful, warm and spacious environment</li> <li>• pattern, line and texture</li> <li>• natural elements and materials</li> <li>• sculptures and man-made artifacts</li> <li>• uncluttered furnishings</li> <li>• mirrors</li> <li>• alcoves and window-like recesses</li> <li>• paintings and photographs</li> <li>• transmitted and reflected exterior views</li> <li>• clear system of signs and maps</li> <li>• well-ventilated, comfortable environment</li> </ul>	<ul style="list-style-type: none"> <li>• natural light through windows and skylights</li> <li>• transmitted and reflected natural light</li> <li>• artificial light with natural characteristics</li> <li>• skylights and wall panels with artificial back-lighting</li> <li>• indirect lighting of ceilings and walls</li> <li>• dark, ambiguous boundaries</li> <li>• patterns of light and shadow</li> </ul>	<ul style="list-style-type: none"> <li>• clear internal organization and egress system</li> <li>• safe vertical egress - stairwells, elevators and escalators</li> <li>• compartmentalization and places for safe refuge</li> <li>• clear signs and emergency lighting</li> <li>• effective detection, alarm and communication systems</li> <li>• effective smoke removal and air handling</li> <li>• effective fire suppression</li> <li>• fire-resistant construction and restriction of hazardous materials</li> </ul>

Table 1. Underground design strategies.

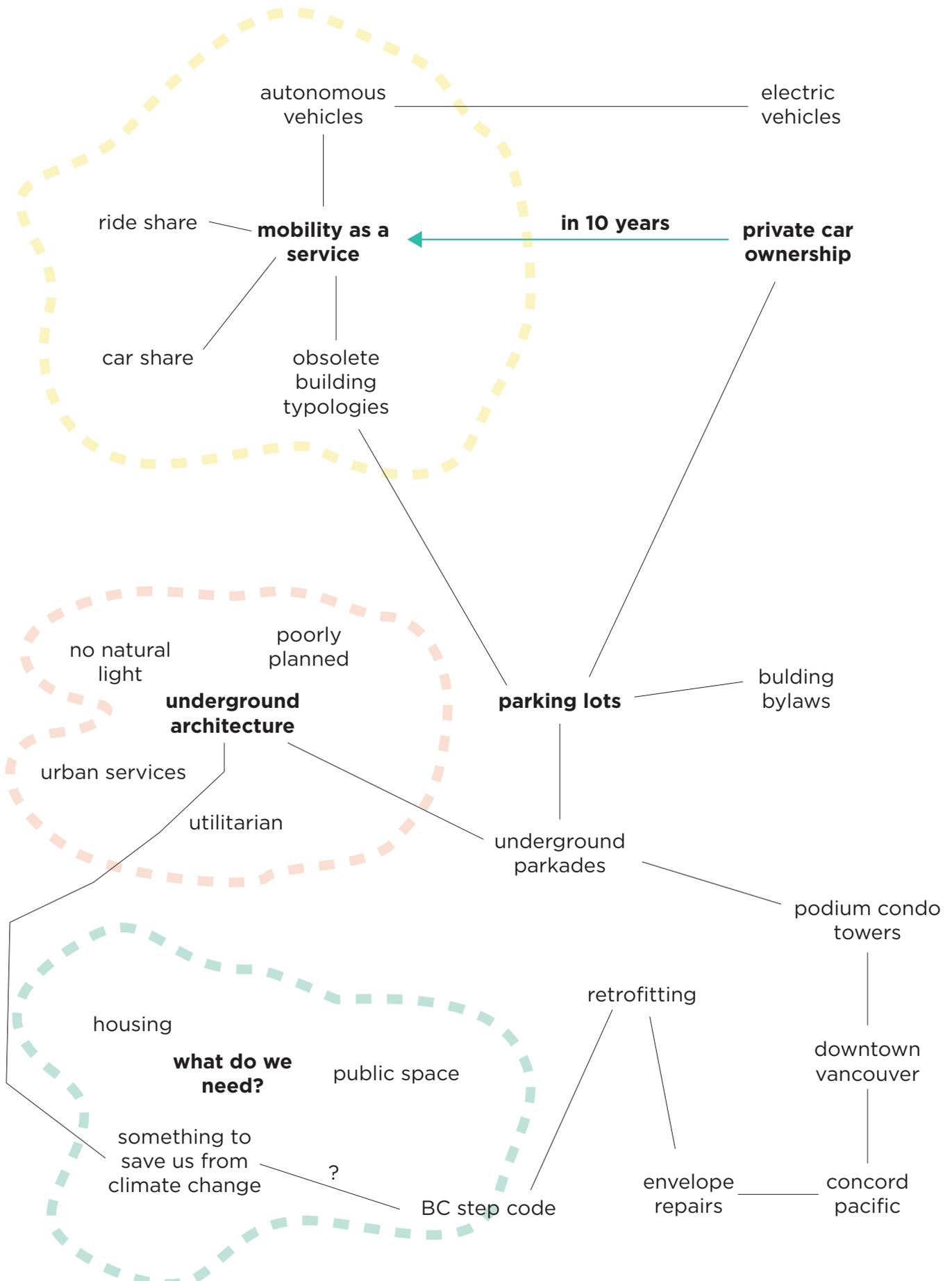


Fig. 72. Mind Map I.

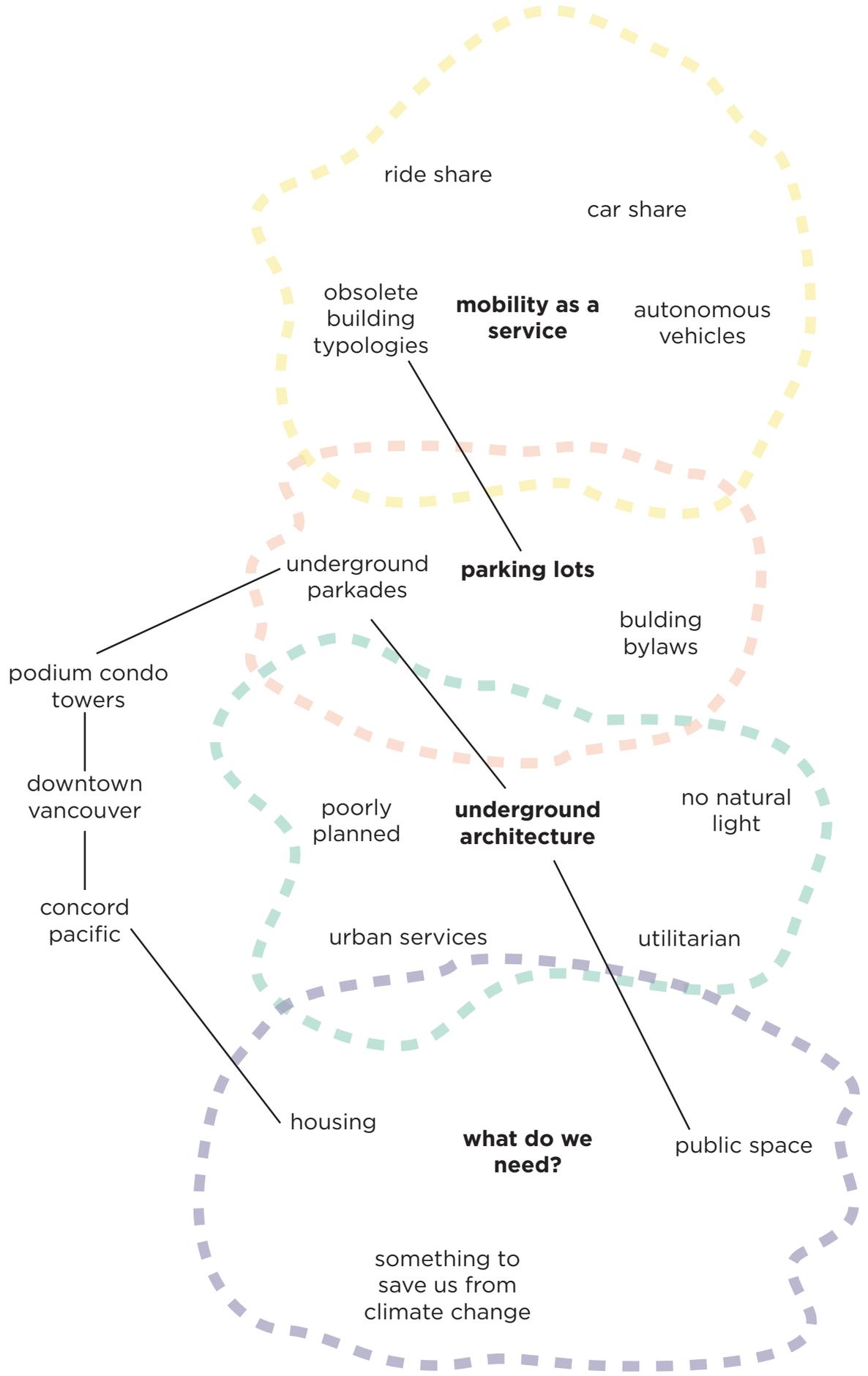


Fig. 73. Mind Map II.

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# Peckham Levels

Keywords: parking, retrofit, temporary

Location: London, England

Year constructed: 2017

Architect: Carl Turner Architects

Client: Make Shift Community

Project description from the Make Shift Community website:

“Peckham Levels is our second project, created to showcase the cultural talent at work in Peckham and offer much needed affordable workspace for artists and entrepreneurs.

**It has transformed seven levels of an underused multi-storey carpark in Peckham into a cultural destination and workspace for local creative workers.**

The space includes 50 studios for artists, makers and small businesses; as well as space for food businesses, retailers, markets, events and more.

The project building a new creative workshop and cultural destination that showcases its members and connects them with the world outside.

“The idea for Peckham Levels was born when Southwark Council announced an open call, asking the community to propose a positive alternate use for the empty levels within the multistorey car park in the centre of Peckham.

The council issued a brief highlighting the potential this space had to support employment and the arts and asked for suggestions for temporary projects that could take up residence in the car park for 5 years. Dozens of ideas were submitted by architects, entrepreneurs and community groups; and in November 2015 Peckham Levels was selected as the winning bid.

Over the last two years Make Shift continued to develop the concept, working closely with the local community to identify members, developing designs and bringing the space to life.

Peckham Levels its doors for the first time in December 2017.”<sup>20</sup>

This project is an excellent example of a retrofit of a parking garage that successfully contributed to the community. The ideas about programme in this project are what I could see myself adopting from this project in GP2. The need for affordable business space in Vancouver and many other dense urban cities is high. This project has become one of the “hottest work/life hubs” in London, perfect for artists and designers.<sup>21</sup> I also like that it seems to offer a variety of scales of spaces for people which is also what makes it so successful. It beautifully combines work, retail and social space. I also think that the scale of this project is comparable to what I will propose for GP2.

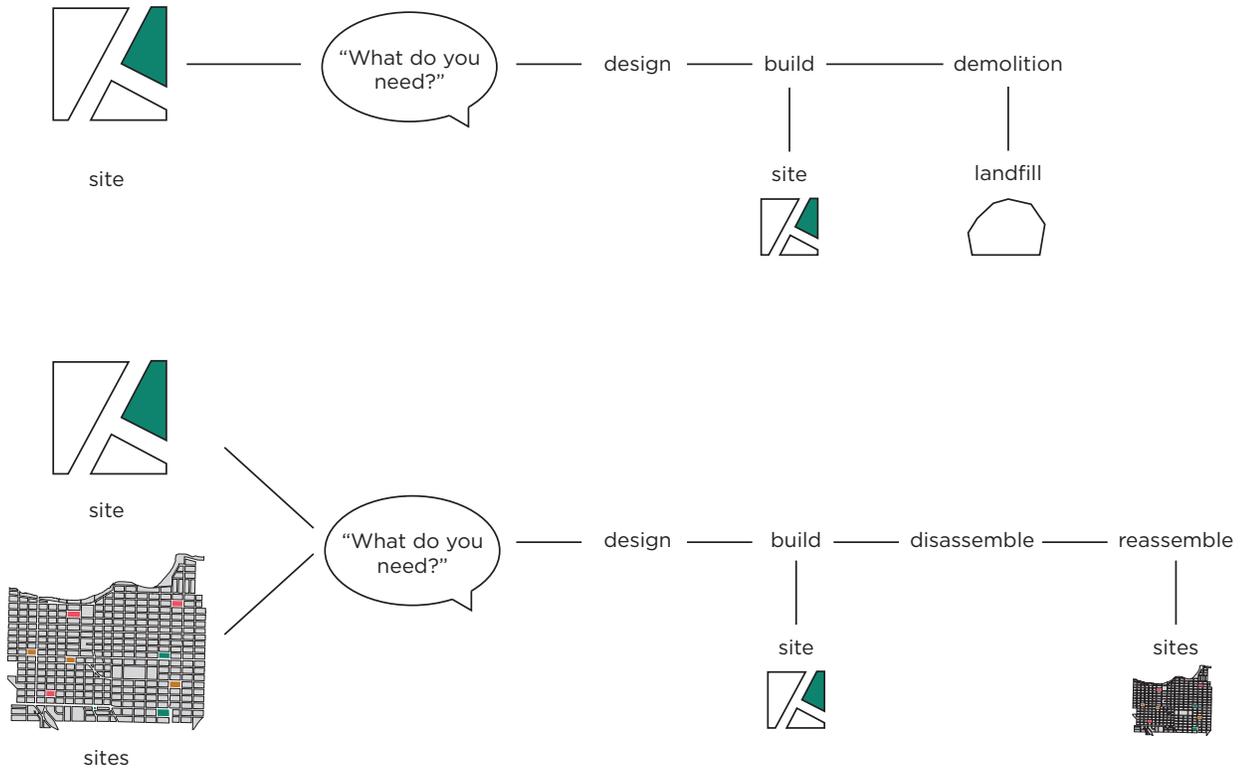
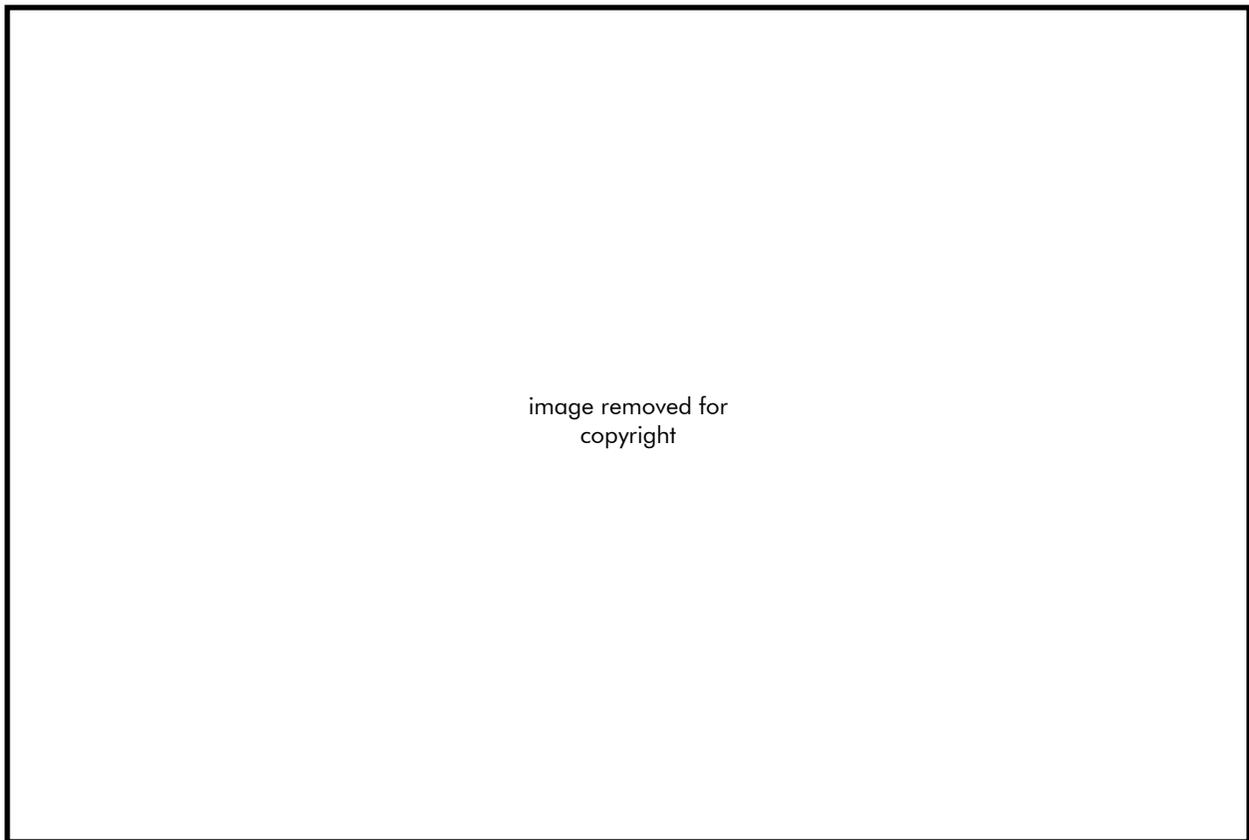


Fig. 75. Diagram of Holding Pattern Design Process.



# Holding Pattern

Keywords: temporary, material flows, urban

Location: Long Island City, NY

Year constructed: 2011

Architect: Interboro Partners

Client: MoMA PS1 and neighbours

Interboro Partners designed a temporary environment for a MoMa event. Instead of disposing of the materials used after the event was over, they went out to institutions in the neighbourhood to see what they needed and then paired those needs with the choice in materials and objects for the design project in the MoMa courtyard.

Project description from the Interboro website:

"Because we expanded our client base from one client (MoMA PS1) to over 50, Holding Pattern operated like an urban design project. The environment we created **responded to different desires in ways that a fixed piece of architecture couldn't, and giving the neighborhood a stake in the design made locals more likely to patronize the museum.**

During the summer, these objects sat in the MoMA PS1 courtyard under a canopy constructed by stringing ropes from holes in MoMA PS1's 16-foot tall concrete wall to the parapet across the courtyard. Just as Hugh Ferriss revealed the potential of New York City's 1916 zoning code by drawing the theoretical building envelope, we revealed the very odd, idiosyncratic space of the courtyard and created an inexpensive and column-free space for the activity below. From the ground, the experience was of a soaring, hyperboloid surface."<sup>22</sup>

What I like about this project is the way that Interboro has so simply redefined the conventional design process that many architects would take for this kind of project. I attempted to diagram this rethinking in a diagram (fig. 8).

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# The Water

Keywords: underground, dankness, nature, phenomenological

Location: Copenhagen, Denmark

Year constructed: 2018

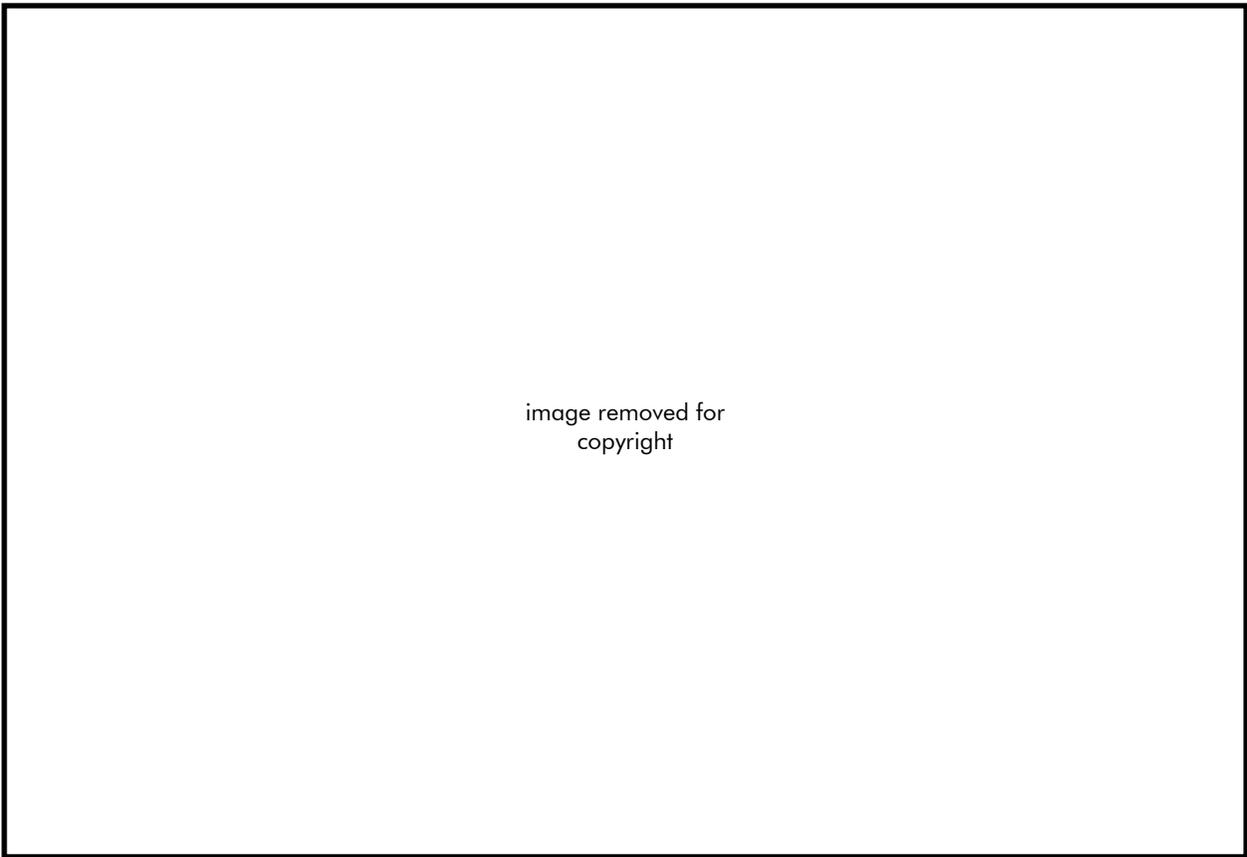
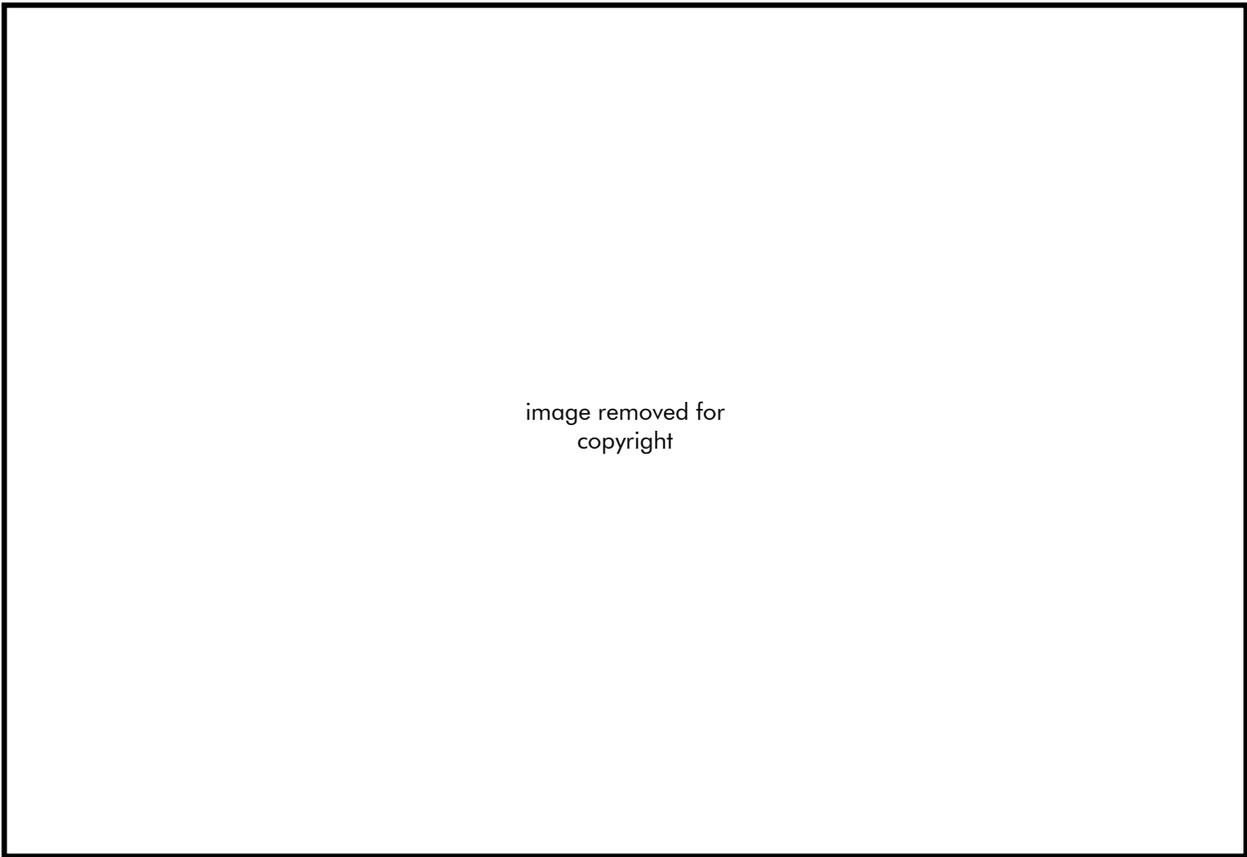
Architect: Hiroshi Sambuichi

Client: Cisterns Museum

Project description from ArchDaily:

"In designing the "shrine-like" installation, Sambuichi reopened the ground above the cistern for the first time in 150 years, allowing the sun and water to meet in a tranquil embrace. Accessed via a 120-meter-long corridor, the experience is that of a journey through light and atmosphere that connects visitors to the specific qualities of the place. Several mirrors reflect light through the space, while a camera obscura projects an image of the Frederiksberg Palace onto the cistern walls as a reminder of the site's wider context."<sup>23</sup>

This project is an installation within a former underground water reservoir in Copenhagen. The intent of the project is to return the natural elements that once occupied the site to it. The opening times of this installation depend on the length of day. Only during daylight can this project be visited because of minimal artificial light. The project also doesn't attempt to provide an ideally conditioned space. It is often cold, humid and dark. This kind of temporal and environmental variation is an idea I would like to explore in my project.



# Lascaux IV: The International Centre for Cave Art by Snøhetta

Keywords: underground, museum

Location: Montignac, France

Year constructed: 2012-2016

Architect: Snøhetta

Client: Conseil Général de la Dordogne

Project description excerpt from Snøhetta website:

"Throughout the museum, the visitor experience sequences a balance of stark differences in atmospheres, light and intensities – from the enclosed exhibition spaces ensconced in the hill, to the light-filled lobby and transition spaces. The juxtaposition between descent and ascent, inside and outside, earth and sky, or nature and art, evoke the analogous experience of the caves."<sup>24</sup>

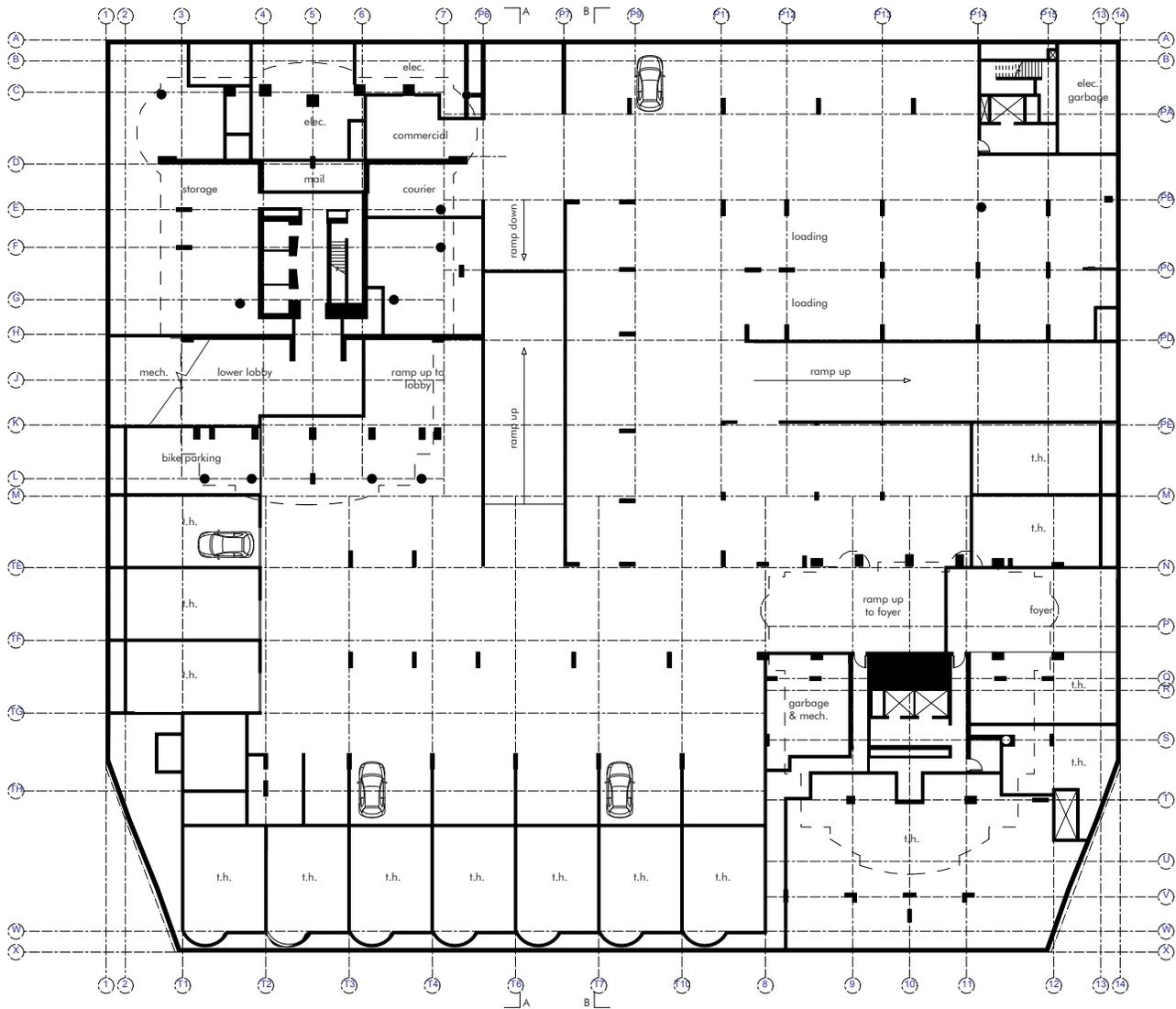
This project carefully considers the circulation sequence into the replica of the prehistoric caves that the museum showcases. The circulation considers how the body transitions from above ground to below ground and back by creating a gradient of these conditions. This also informs the organization strategy for program.

## Notes

1. Ben-Joseph, *Rethinking A Lot*, 69.
2. Shoup, *The High Cost of Free Parking*, 159.
3. Ibid, 159.
4. Shoup, *The High Cost of Free Parking*, 129.
5. Ibid, 141.
6. Ibid, 143.
7. *The Metro Vancouver Apartment Parking Study, Technical Report*, 5.
8. Shoup, *The High Cost of Free Parking*, 163.
9. Robinson, *Vancouver addicted to Parking Revenue* <http://www.vancouver.sun.com/news/vancouver+addicted+parking+revenue/11736950/story.html>
10. Ibid.
11. Ben-Joseph, *Rethinking A Lot*, 76.
12. Sperling, *Three Revolutions*, 152.
13. Meyboom, *Driverless Urban Futures*.
14. Arbib, *Rethinking Transportation 2020*, 3.
15. Ibid, 6.
16. Ibid, 72.
17. Admiraal, *Underground Spaces Unveiled*, 59.
18. Ibid, 70.
19. Ibid, 71.
20. <https://www.makeshift.org/new-index>.
21. <https://www.standard.co.uk/go/london/attractions/peckham-levels-where-to-eat-drink-and-get-creative-at-this-onestop-shop-a3744331.html>.
22. <http://www.interboropartners.com/projects/holding-pattern>.
23. <https://www.archdaily.com/873169/hiroshi-sambuichi-architecture-begins-with-water-air-and-sun>.
24. <https://snohetta.com/project/322-lascaux-iv-the-international-centre-for-cave-art>.

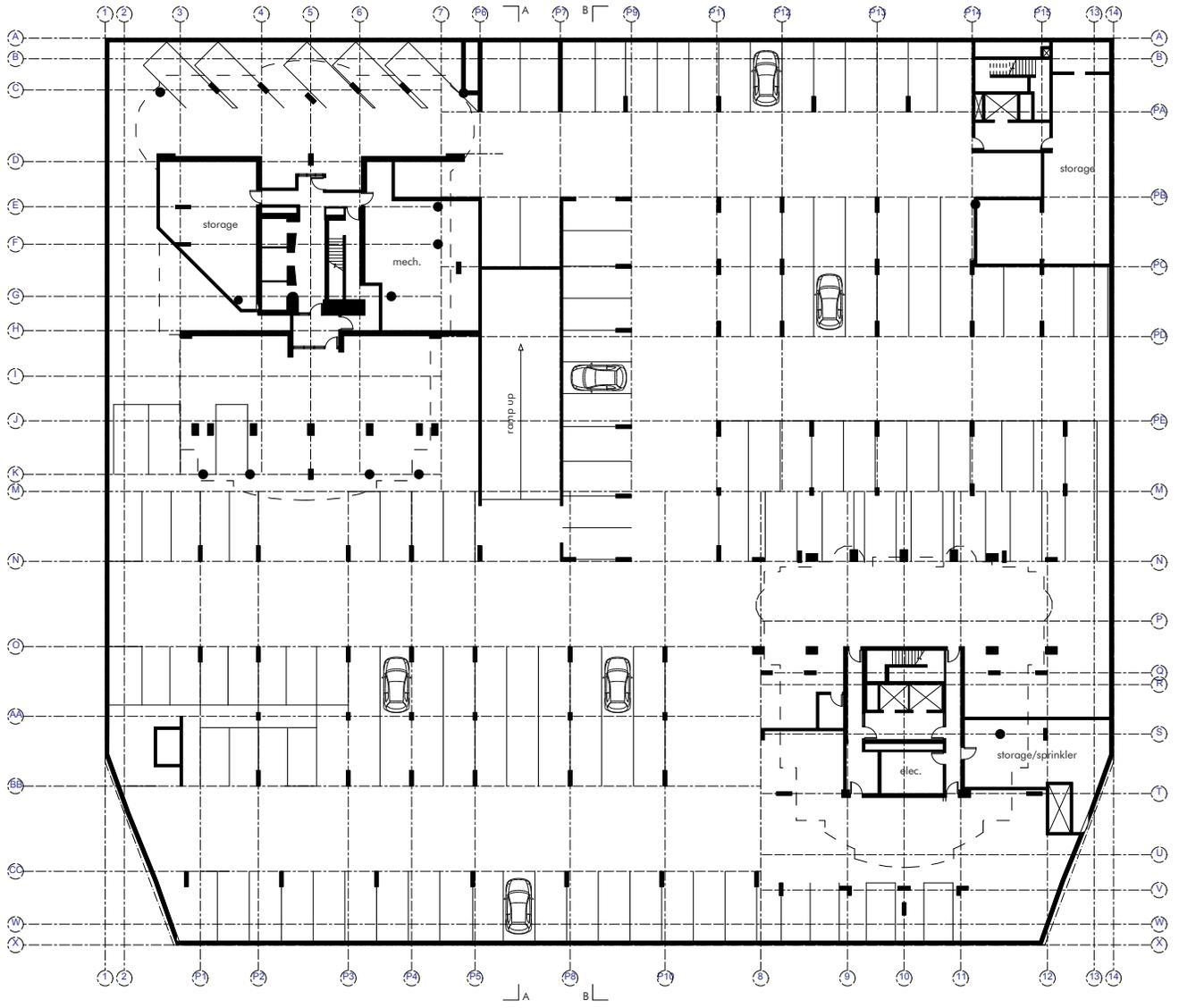


## **Appendix B: 888 Beach As-built Drawings**



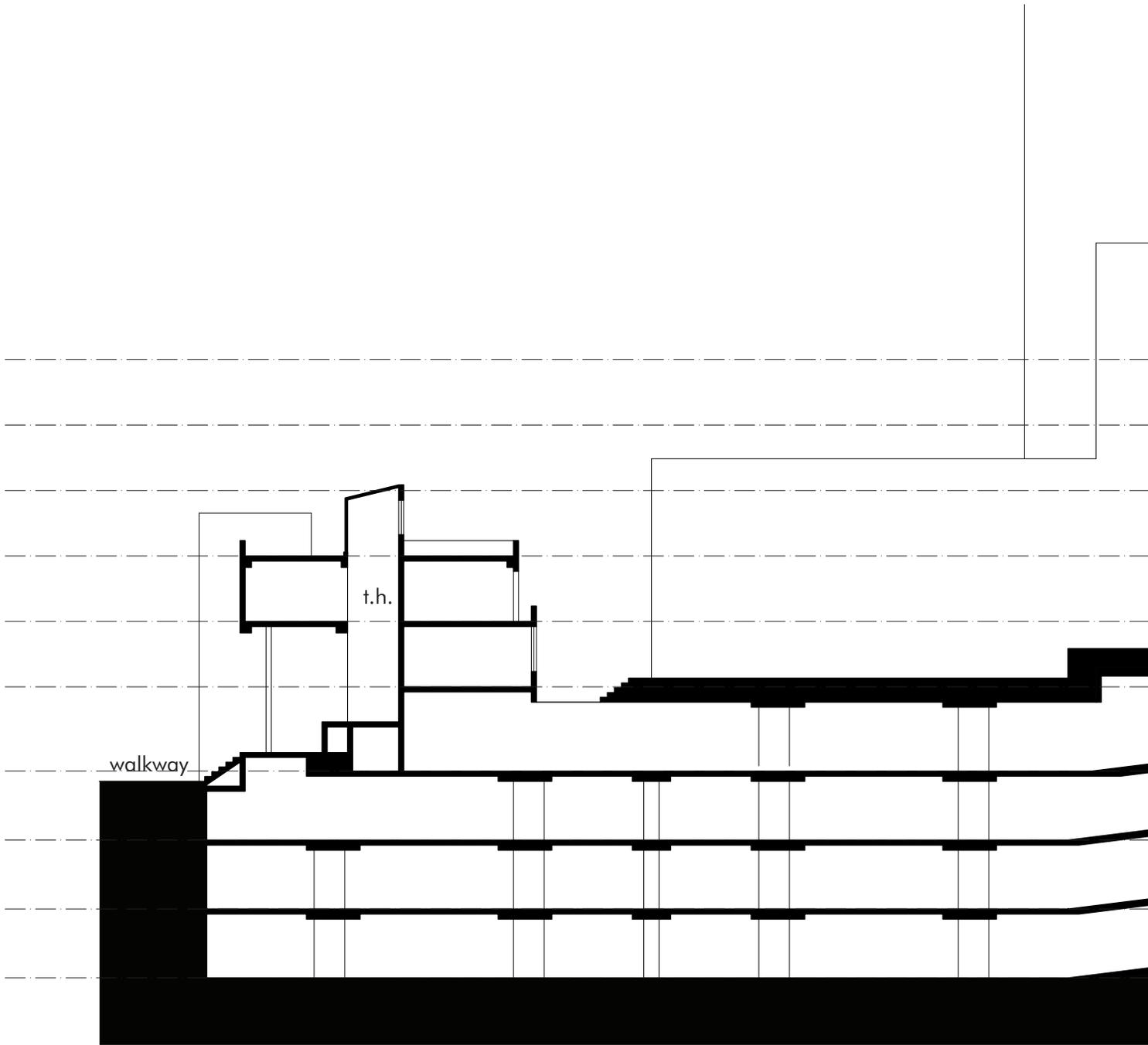
Parking level 1  
1:200

Fig. 79. 888 Beach Ave P1 as-built.

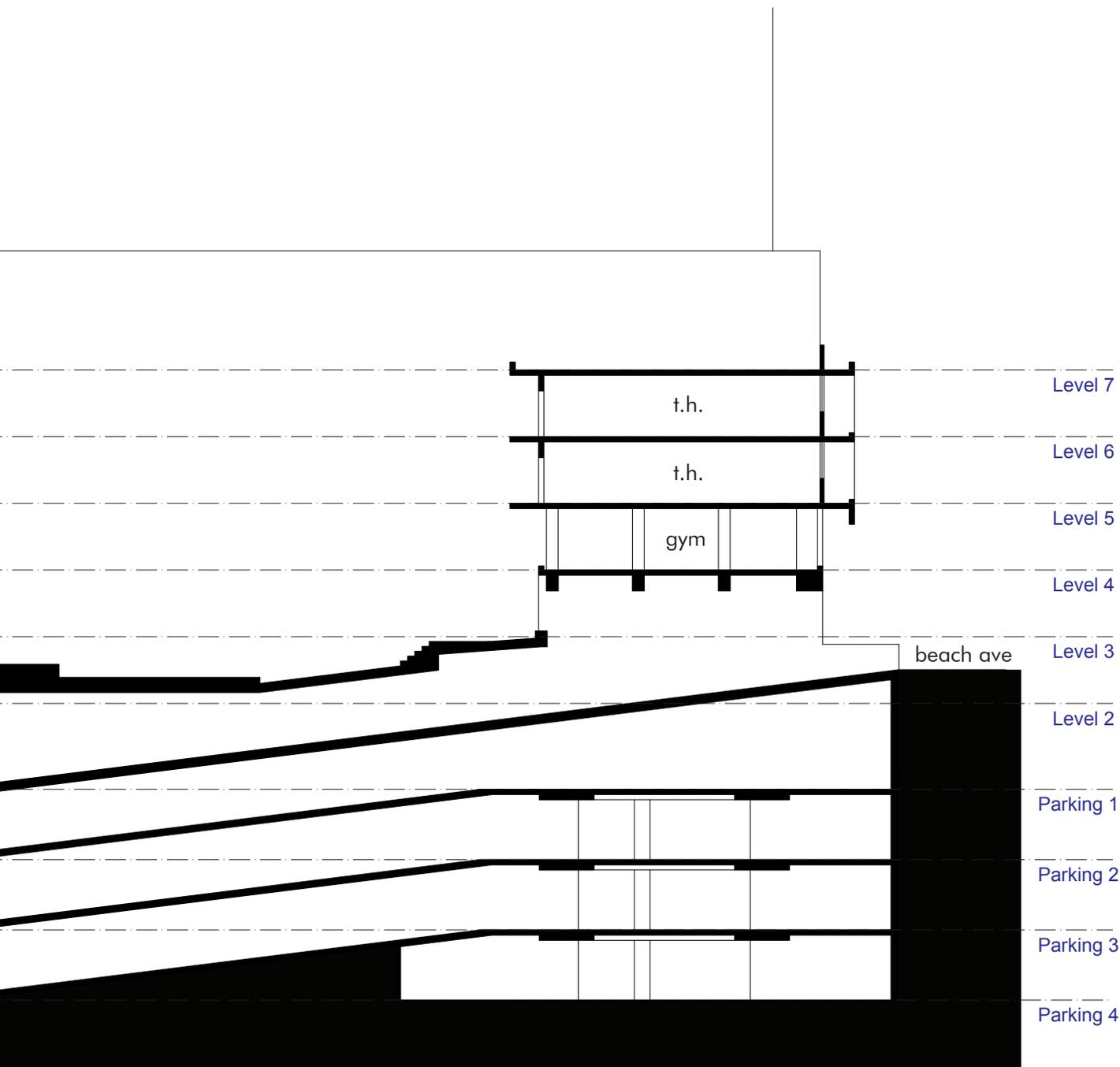


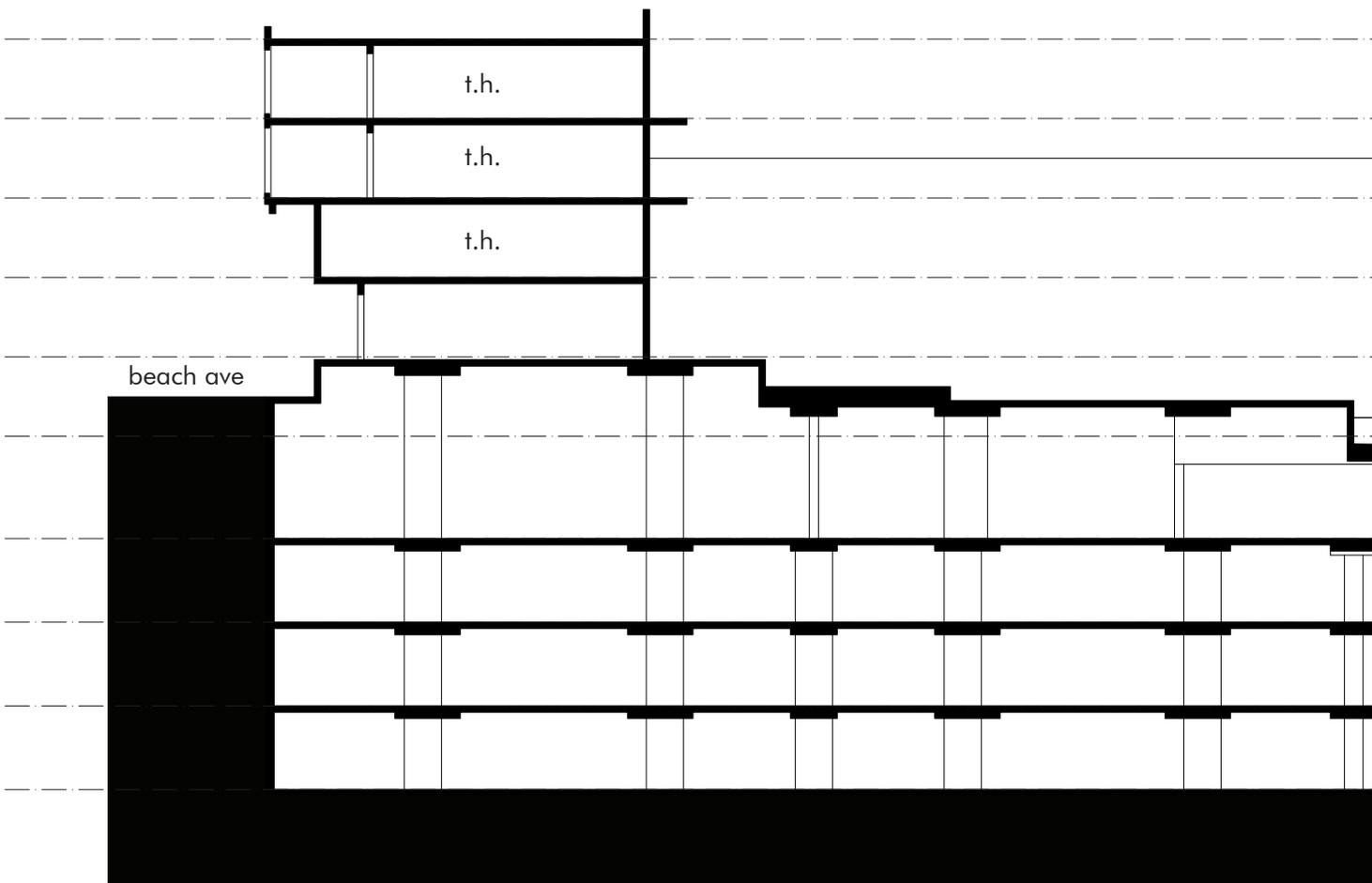
Parking level 2, 3, 4  
1:200

Fig. 80. 888 Beach Ave P2, P3, P4 as-built.

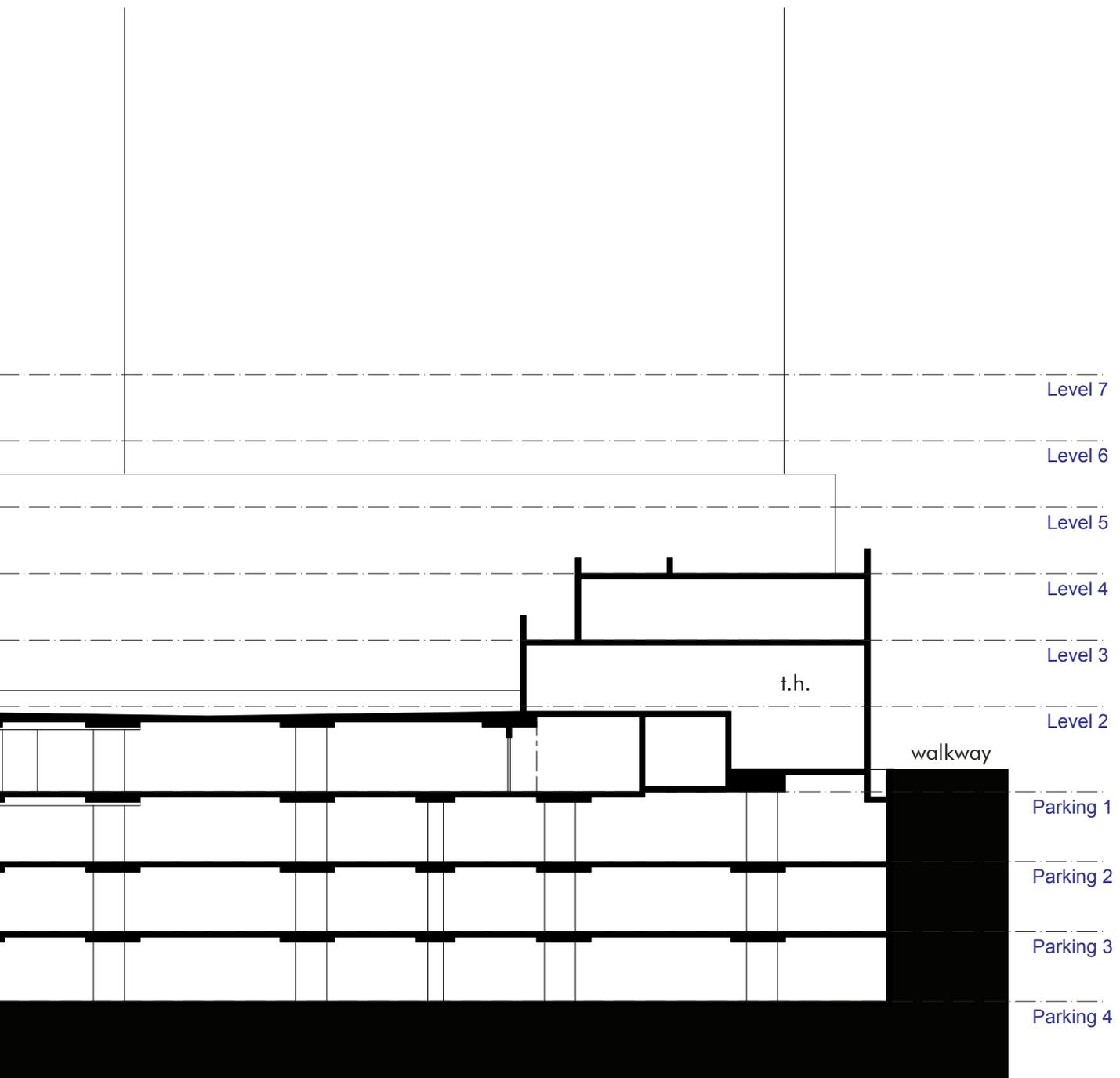


Section A-A  
1:200





Section B-B  
1:200



# Bibliography

## Transportation

- Appleyard, Donald, Kevin Lynch, and John Randolph Myer. 1964. *The View from the Road*. Cambridge: Published for the Joint Center for Urban Studies of the Massachusetts Institute of Technology and Harvard University by the M.I.T. Press, Massachusetts Institute of Technology.
- Arbib, James and Tony Seba. 2017. *Rethinking Transportation 2020: The Disruption of Transportation and the Collapse of the Internal-Combustion Vehicle and Oil Industries*. rethinkx.com. Accessed February 10, 2019. <https://www.rethinkx.com/transportation/>.
- Blake, Peter. 1964. *God's Own Junkyard: The Planned Deterioration of America's Landscape*. [1st]. ed. New York: Holt, Rinehart and Winston.
- Clements, Lewis M. and Kara M. Kockelman. 2017. "Economic Effects of Automated Vehicles." *Transportation Research Record* 2606 (1): 106-114.
- Dimendberg, Edward. 1995. "The Will to Motorization: Cinema, Highways, and Modernity." *October* 73: 90.
- Easterling, Keller. 1999. *Organization Space: Landscapes, Highways, and Houses in America*. Cambridge, Mass: MIT Press.
- Hart, Chenoe. "Perpetual Motion Machines: Driverless cars won't be a new form of transportation but the end of it." *Reallife* (August 2016). <https://reallifemag.com/perpetual-motion-machines/>.
- Kanter, Zach. "Autonomous Cars Will Destroy Millions of Jobs and Reshape the US Economy by 2025." *qz.com*, accessed February 3, 2019, <https://qz.com/403628/autonomous-cars-will-destroy-millions-of-jobs-and-reshape-the-economy-by-2025/>.
- Maia, Sara Costa, Hannah Teicher, and Annalisa Meyboom. 2015. "Infrastructure as Social Catalyst: Electric Vehicle Station Planning and Deployment." *Technological Forecasting & Social Change* 100: 53-65.
- Meyboom, Annalisa. 2018. *Driverless Urban Futures: A Speculative Atlas*. Milton: Taylor and Francis. doi:10.4324/9781351134033. [http://ubc.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwIz1La4QwEICHsr20177Z7Qv\\_gCUPY-K125X-gF0ovUgSEyGUC-72\\_zcT11btaY9BUWbUeZiZbWA4eyLpxCbg2KkiuAqL\\_t4Tq3IRHKtVnmpGrJGTU3at8ZgleUupq6-mzMRjTfGn1tkw-J4OcpDCoTM7UzQSMhdv\\_3-ZEFWecFk5D6GTzfEJ0r9LSjpETz9wXy0pqToqJlRveDqfsjsCm\\_wx59E7IGbz3gvRIKZOuwTH68SCJz-HYYT\\_EBRy55hJOB\\_zCK5i\\_tFjW8RmsZbJpjW6SMiJKttewKVfr5Wu6H7WQfuC88RSjCudoeBw8xGTcFMoLx60W2mhlWY3bfbUWQudFYWVNMq-5llxbKonJQjJ7A7Pmq3FzSlzUKjO1zW04LfPCMG-toNwQbWqWswWkQ9VVI2GjnNVI1Qtlet1WcQN5X7VarZ6XIVxjKs9uD7zkHZyEuEd1LYX3MNU13-4hYhce4\\_vzA6nznNg](http://ubc.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwIz1La4QwEICHsr20177Z7Qv_gCUPY-K125X-gF0ovUgSEyGUC-72_zcT11btaY9BUWbUeZiZbWA4eyLpxCbg2KkiuAqL_t4Tq3IRHKtVnmpGrJGTU3at8ZgleUupq6-mzMRjTfGn1tkw-J4OcpDCoTM7UzQSMhdv_3-ZEFWecFk5D6GTzfEJ0r9LSjpETz9wXy0pqToqJlRveDqfsjsCm_wx59E7IGbz3gvRIKZOuwTH68SCJz-HYYT_EBRy55hJOB_zCK5i_tFjW8RmsZbJpjW6SMiJKttewKVfr5Wu6H7WQfuC88RSjCudoeBw8xGTcFMoLx60W2mhlWY3bfbUWQudFYWVNMq-5llxbKonJQjJ7A7Pmq3FzSlzUKjO1zW04LfPCMG-toNwQbWqWswWkQ9VVI2GjnNVI1Qtlet1WcQN5X7VarZ6XIVxjKs9uD7zkHZyEuEd1LYX3MNU13-4hYhce4_vzA6nznNg).
- Meyboom, Annalisa. 2009. "Infrastructure as Practice." *Journal of Architectural Education* 62 (4): 72-81.
- Sperling, Daniel, Anne Brown, and ProQuest (Firm). 2018. *Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future*. Washington, DC: Island Press. doi:10.5822/978-1-61091-906-7. [http://ubc.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwV1NT8MwDLVgPQCnUUB0bFVOiB1ade3aNc0tP24IIE0cY36kR4L2mC\\_H6dJpnbasZEqOU5iv9h-DkAU-oF3YhOatEloULGwqKK6ok1SIRCl6zJohGQ6RielOrmhxnQQZQ12m6BtbOcilqkpLX7EAXuvOMqNLkvmIS7DQIUW4763sl\\_](http://ubc.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwV1NT8MwDLVgPQCnUUB0bFVOiB1ade3aNc0tP24IIE0cY36kR4L2mC_H6dJpnbasZEqOU5iv9h-DkAU-oF3YhOatEloULGwqKK6ok1SIRCl6zJohGQ6RielOrmhxnQQZQ12m6BtbOcilqkpLX7EAXuvOMqNLkvmIS7DQIUW4763sl_)

## Material Processes

- Addis, William and Taylor & Francis eBooks A-Z. 2012. *Building with Reclaimed Components and Materials: A Design Handbook for Reuse and Recycling*. London; Sterling, VA: Earthscan. [http://ubc.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwV1LT4QwEJ6oe9F40FUj62p60duaAi2Ps7rZmHjbgzdSSmtMXDSEjfhF01NA0BAPkNLQzqRQZpj5ZgYgDG754s83QUtcmCT3TSFIKgwYxlanovAjK3lbuOo-Q6hOV-y17\\_vvwY8UmG7s5ajtJFLct17Rtsz0dcA\\_nc2Co2L2pl43ZFTktPveywa7wB2kkD-puiGG7wpeOnHvUBXYWOEtPA\\_Vj09JvNc61pUKI7VCc-YsiG192YlYUfKmtAJBGStdpok1K84fxJmyyOYGIpwOIdU07hYJCR8AR4xz8j7l](http://ubc.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwV1LT4QwEJ6oe9F40FUj62p60duaAi2Ps7rZmHjbgzdSSmtMXDSEjfhF01NA0BAPkNLQzqRQZpj5ZgYgDG754s83QUtcmCT3TSFIKgwYxlanovAjK3lbuOo-Q6hOV-y17_vvwY8UmG7s5ajtJFLct17Rtsz0dcA_nc2Co2L2pl43ZFTktPveywa7wB2kkD-puiGG7wpeOnHvUBXYWOEtPA_Vj09JvNc61pUKI7VCc-YsiG192YlYUfKmtAJBGStdpok1K84fxJmyyOYGIpwOIdU07hYJCR8AR4xz8j7l)

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Ballesteros, Mario. 2008. *Verb Crisis*. Vol. 6th issue.; 6. New York; Barcelona: Actar.

Goodbun, Jon and Karin Jaschke. 2012. "Architecture and Relational Resources: Towards a New Materialist Practice." *Architectural Design* 82 (4): 28-33.

Hinte, Ed van, Césaire Peeren, and Jan Jongert. 2007. *Superuse: Constructing New Architecture by Shortcutting Material Flows*. Rotterdam: 010 Publishers.

Hodge, Brooke and Patricia Mears. 2006. *Skin + Bones: Parallel Practices in Fashion and Architecture*. New York: Thames & Hudson.

Hopkins, Rob. 2012. "Peak Oil and Transition Towns." *Architectural Design* 82 (4): 72-77.

Klumpner, Hubert (Urban Think Tank), interviewed by Becky Quintal at Bi-City Biennale of Urbanism/Architecture Shenzhen China, 2015.

McDonough, William and Michael Braungart. 2002. *Cradle to Cradle: Remaking the Way we make Things*. 1st ed. New York: North Point Press.

Prigogine, I. and Isabelle Stengers. 1984. *Order Out of Chaos: Man's New Dialogue with Nature*. New York, N.Y: Bantam Books.

Schumacher, E. F. 1989. *Small is Beautiful: Economics as if People Mattered*. New York: Perennial Library.

Till, Jeremy and Tatjana Schneider. 2012. "Invisible Agency." *Architectural Design* 82 (4): 38-43.

## Postindustrial

Arnold, John D. M. and Donald Lafreniere. 2017. "The Persistence of Time: Vernacular Preservation of the Postindustrial Landscape." *Change Over Time* 7 (1): 114-133.

Dandaneau, Steven P. 1996. *A Town Abandoned: Flint, Michigan, Confronts Deindustrialization*. Albany: State University of New York Press.

Grigor, Talinn and Romina Katchi.db. 2015. "Debris of what-would-have-been: A Photo-Essay Concerning Deindustrialization in Hyper-Capitalist and Post-Socialist Cities." *Journal of Urban History* 41 (2): 294-306.

Kapp, Paul Hardin. 2012. *SynergiCity : Reinventing the Postindustrial City*. University of Illinois Press.

## Infrastructure

Banham, Reyner. 1976. *Megastructure : Urban Futures of the Recent Past*. New York: Harper & Row.

Easterling, Keller. 2014. *Extrastatecraft: The Power of Infrastructure Space*. London; New York: Verso.

Hayden, Dolores. 2003. *Building Suburbia: Green Fields and Urban Growth, 1820-2000*. 1st ed. New York: Pantheon Books.

Jacobs, Jane. 2011. *The Death and Life of Great American Cities*. 50th anniversary ed. New York: Modern Library.

## Urban Design

Alexander, Christopher, Sara Ishikawa, and Murray Silverstein. 1977. *A Pattern Language: Towns, Buildings, Construction*. Vol. 2.; 2. New York: Oxford University Press.

Banham, Reyner. 1969. "Non-plan: An Experiment in Freedom" *New Society*. 435-443.

Lynch, Kevin. 1960. *The Image of the City*. Cambridge [Mass.]: Technology Press.

Montgomery, Charles. 2013. *Happy City: Transforming our Lives through Urban Design*. First ed. New York: Farrar, Straus and Giroux.

Picon, Antoine. 2015. *Smart Cities : A Spatialised Intelligence*. Wiley.

Reeds, Jon. 2011. *Smart Growth: From Sprawl to Sustainability*. Totnes, Devon: Green Books.

Venturi, Robert, Denise Scott Brown, and Steven Izenour. 1972. *Learning from Las Vegas*. Cambridge, Mass: MIT Press.

## Building Technology

Deplazes, Andrea. 2005. *Constructing Architecture: Materials, Processes, Structures : A Handbook*. Basel; Boston: Birkhäuser-Publishers for Architecture.

## Parking

Ben-Joseph, Eran. 2012. *ReThinking a Lot: The Design and Culture of Parking*. Cambridge, Mass: MIT Press.

Cairns, Stephen and Jane M. Jacobs. 2014. *Buildings must Die: A Perverse View of Architecture*. Cambridge, Massachusetts: The MIT Press.

Henley, Simon. 2007. *The Architecture of Parking*. New York: Thames & Hudson.

Kan, Raymond. The Metro Vancouver Apartment Parking Study: Revised Technical Report. Vancouver: City of Vancouver, 2012.

Robinson, Matthew. "Vancouver addicted to parking revenue." Vancouver Sun. February 23, 2016.

Shoup, Donald C. and American Planning Association. 2005. *The High Cost of Free Parking*. Chicago: Planners Press, American Planning Association.

Author unknown. The Metro Vancouver Apartment Parking Study, Technical Report. Vancouver BC: Translink and Metro Vancouver, 2012. Accessed December, 2019. [http://www.metrovancouver.org/services/regional-planning/PlanningPublications/Apartment\\_Parking\\_Study\\_TechnicalReport.pdf](http://www.metrovancouver.org/services/regional-planning/PlanningPublications/Apartment_Parking_Study_TechnicalReport.pdf).

Author unknown. The 2018 Regional Parking Study, Technical Report. Vancouver BC: Translink and Metro Vancouver, 2018. Accessed December, 2019. <http://www.metrovancouver.org/services/regional-planning/PlanningPublications/RegionalParkingStudy-TechnicalReport.pdf>.

## Underground Architecture

Admiraal, Han and Antonia Cornaro. 2018. *Underground Spaces Unveiled: Planning and Creating the Cities of the Future*. London: ICE Publishing.

Labbé, Monique. 2016. "Architecture of Underground Spaces: From Isolated Innovations to Connected Urbanism." *Tunnelling and Underground Space Technology Incorporating Trenchless Technology Research* 55: 153-175.

Lawrence, David. 1994. *Underground Architecture*. Harrow, Middlesex: Capital Transport.

Moldovan, Ioana Madalina, Silivan Valentin Moldovan, and Nicoleta Maria Ilies. 2016. "Invisible Architecture - Sustainable Underground Architecture." *Surveying Geology & Mining Ecology Management (SGEM)*, . <http://ubc.summon.serialssolutions.com/2.0.0/link/0/eLvHCXmwv1LT8MwDI5AXBAcelq3eoFLVbQOS7YeOlwxYBKbkDrgiNI8pEkwEAX-P7a7rd0GQhy4tJUTpU3t2I6Tz2FMxKeVaEYnKPDsVYbG1HjuDDj1tmqV8R4PvxWUzbi0VWdhfNRgQfXxgMNWI9A2j8wf9IoEOAZRACuIARwnReDb63RdMyPALdTUFwa3bRjCAPkBQKQggXpVauTP3y8>

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## Site

Arden, Roy. Condominium Advertisement, Vancouver BC 1992. Digital. Publisher unknown. <http://www.royarden.com/pages/photo1.html> (accessed December 18, 2019).

Punter, John Vincent. 2004. *The Vancouver Achievement: Urban Planning and Design*. Vancouver: UBC Press.

Concord Pacific. "Concord Communities." <https://www.concordpacific.com/communities/> (accessed April 14, 2019).

## Agriculture

Population Division of the UN Department of Economic and Social Affairs (UN DESA). *The 2018 Revision of World Urbanization Prospects*. United Nations, 2012. Accessed December, 2019. <https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf>.

Melissa Brechner and A.J. Both. *Hydroponic Lettuce Handbook*. Ithaca NY: Cornell Controlled Environment Agriculture, 2013. <http://cea.cals.cornell.edu/attachments/Cornell%20CEA%20Lettuce%20Handbook%20.pdf> (accessed December 16, 2019).

Duncan Cameron, Colin Osborne, Peter Horton, Mark Sinclair. *A sustainable model for intensive agriculture*. Sheffield UK, 2015. Accessed December, 2019. <http://grantham.sheffield.ac.uk/wp-content/uploads/A4-sustainable-model-intensive-agriculture-spread.pdf>.

Sayner, Adam. "How to Set Up a Low Tech Mushroom Farm." *Grocycle*. <https://grocycle.com/how-to-set-up-a-low-tech-mushroom-farm/> (accessed December 16, 2019).