The Garden In The Machine:

From the Age of the Machine to the Age of Life

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CONTENTS

Preface

Introduction

Over the course of creating this thesis, I was interested in exploring the relationship between the natural and man-made environment and investigating the relationship between these two, often conflicting concepts from an ecological and environmental perspective. This exploration will commence by observing such a relationship taking place in the development of Tolka Valley, where in the last two centuries the natural environment existing on the site has been moulded and shaped as a result of human intervention. Historical and contemporary views and ideas concerning this relationship over time will then be discussed and their application illustrated using precedents. This research of ideas will then be taken and applied to my observations for the site, to allow the findings to be synthesised and form an initial architectural proposal positioned within Tolka Valley that can manifest these ideas in built form. The initial proposal will be critically examined and used to form a basis to establish the site, space and systems to be incorporated into the final architectural design.

The four ecologies of Tolka Valley

Following my reading of Los Angeles: The Architecture of Four Ecologies, a book in which the author, Reyner Banham, describes the city of Los Angeles through four man-made ecologies, I choose to view the site of Tolka Valley through a similar lens. From the myriad of different ecologies that exist within the site, I have chosen to present four that I have observed as being predominant.

One of the earliest forms of transport to reach the site of the Tolka Valley was the Royal Canal, built parallel to the meandering Tolka River and stretching to the centre of Dublin city, in effect dividing it off as an area separate from Cabra and Finglas. The canal acted as a man-made artery circulating people and goods along the site, which in the 1820s contained little more than divided plots of farmland and houses scattered around the area in a dispersed pattern linked by roads. In 1850 a railway line was built running along the canal, further connecting the site to the surrounding Dublin region and would continue to be used for transport long after 1950s when trade via the Royal canal would cease. (Pile, 2022)

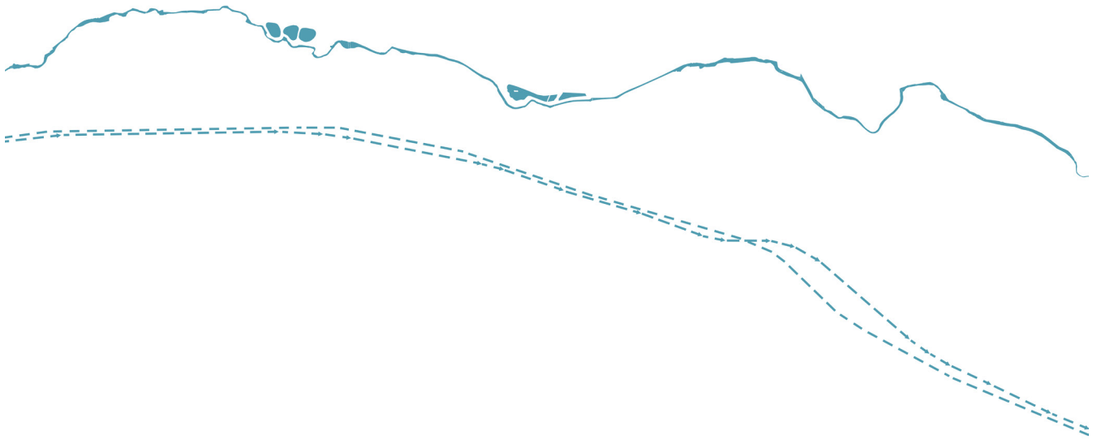


Figure 1 – Diagram of Canal & Railway ecology

Following the end to a phase of economic protectionism, industrial buildings quickly began to spring up in the 1970s. Unlike the paper mills that were confined to using the weirs constructed at points throughout the Tolka river's course, these new industrial buildings could operate in an enclave, pierced only by roads to accommodate the movement of goods through wheeled vehicles. Amalgamated into a cluster of industrial buildings on a wide stretch of land between the river and the canal, effectively divided off from either, was what would grow and become the Dublin Industrial estate. (Pile, 2022)

Figure 2 – Diagram of Industrial Estate and Canal & Railway ecology

With the expansion of industry came an expansion of population. The city of Dublin had already begun to spread out, taking up more empty plots of land as it continued to push its boundaries. By the emergence of the industrial estate and following the end to policies of protectionism, the large stretch of housing that had been growing in Cabra, south of the Tolka Valley, had now reached the boundary created by the canal and rail line. Similarly, Drumcondra which had grown eastwards, easily pushed past the asphalt boundary and had occupied the lower east portion of the site with housing estates, stopping once it reached the territory of the industrial estate. Even to the North of the site, rows of housing had appeared across both the road and the river in Glasnevin. In the late 1990s, as the site soon became surrounded by housing, the farmland that had resided west of the site, in Pelletstown, was rezoned by Dublin City Council to accommodate for more housing. With the former farm now ousted, rows and clusters of new houses and apartments were built in its place, in a construction process that continues to this day. (Pile, 2022)

With extensive growth came extensive waste and as the Tolka Valley became filled with buildings and infrastructure, it also became filled with waste. The open area in the north of the site above the river began to be used as a landfill, where junk and rubbish, including toxic elements, were dumped onto the ground. After the site, which was once composed of open fields, had half of its soil sealed off by various forms of pavement and hard infrastructure, a desire for nature emerged. With it came the decision to do away with the landfill and attempt to restore it to a former image of nature. Burying the guilt of pollution, soil and earth was placed on top of the landfill, creating a thin layer of grass that would form Tolka Valley Park and serve as a superficial image of nature laying just above the natural river, with cracks appearing in its constructed façade each time the toxic substances below leak out from behind the green veil. (Cowley, 2022)

The canal and railway line, as well as the industrial estate, the housing estates old and new, along with the park all reside as four neighbouring ecologies in the archipelago that is Tolka valley.

Figure 3 – Diagram of Housing, Industrial Estate and Canal & Railway ecology

Figure 4 – Diagram of four ecologies of Tolka Valley

Timeline of Thinking

“Like the elevator, each technological invention is pregnant with a double image: contained in its success is the spectre of its possible failure.”
- Rem Koolhaas (1978, p. 27)

Metabolism

Originating in Japan, Metabolism is a modern architecture movement that came about after the Second World War, when several young Japanese architects used this term to describe their ideas about how cities and structures should be planned to mimic living things. They were of the view that cities and structures are dynamic, biological organisms with a metabolism, rather than static objects. The name comes from the biological process of preserving living cells, referred to as metabolism. (Craven, 2019)

One of the proponents of this movement was Kisho Kurokawa. (Craven, 2019) In his book, Each One a Hero: The Philosophy of Symbiosis, he outlines his perspectives in chapter one, which is titled; From the Age of the Machine to the Age of Life. Kurokawa (1997) refers to the 20th century as the age of the machine, considering Industrial society to be “the ideal of modern architecture” with reference made to Le Corbusier calling the home “a machine for living” and the founder of futurism, Filippo Tommasso Marinetti, declaring that “a poem is a machine”. He describes how humanity became freed from labour by various technological inventions, like the car and the train, which allowed mankind to expand into uncharted territories. He then dubs the 21st century as the age of life, explaining that he deliberately selected terms and concepts relating to words of life principals, like Metabolism, Metamorphosis and symbiosis to fit this name. He also states that machines do not alternate, expand or metabolise of their own volition. (Kurokawa, 1997)

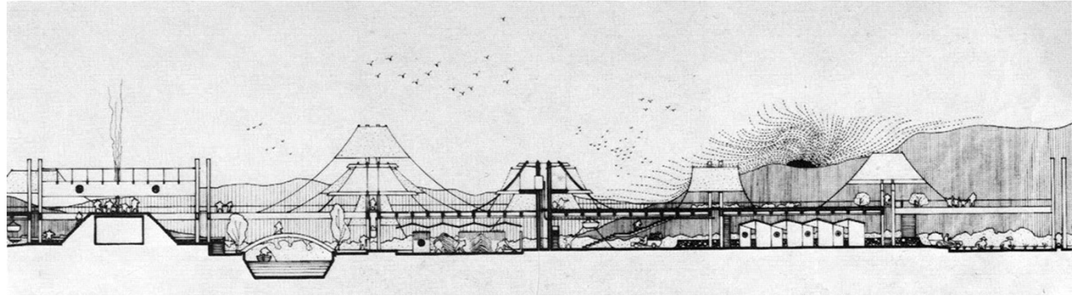


Figure 5 – Section of the Agricultural City (ArchEyes, 2021)

In 1960 Kisho Kurokawa designed the Agricultural City in order to replace the agricultural towns in Aichi that were destroyed by the 1959 Ise Bay Typhoon. (ArchEyes, 2021) The city grows on two planes: the bottom plane, positioned at ground level, where most of the production and vehicle movement takes place to allow for the routine handling and management of agricultural tasks, and the top plane, elevated four metres above ground where roads, water services, electricity and monorails are installed and connected throughout the structure. (ArchEyes, 2021) This upper plane consists of a horizontal 300- and 500-meter grid. (Scaroni & Lippa, 2018) This grid was informed by what Kurokawa believed to be the fundamental unit of a Japanese rural community, composed of a shrine, a temple and a grammar school. (ArchEyes, 2021)

The elevation allows the city to deal with potential flooding. (ArchEyes, 2021) Kurokawa questioned the idea that the city and the country must be at odds, presented by ArchEyes (2021), he states that “rural communities are cities whose means of production are in agriculture.”

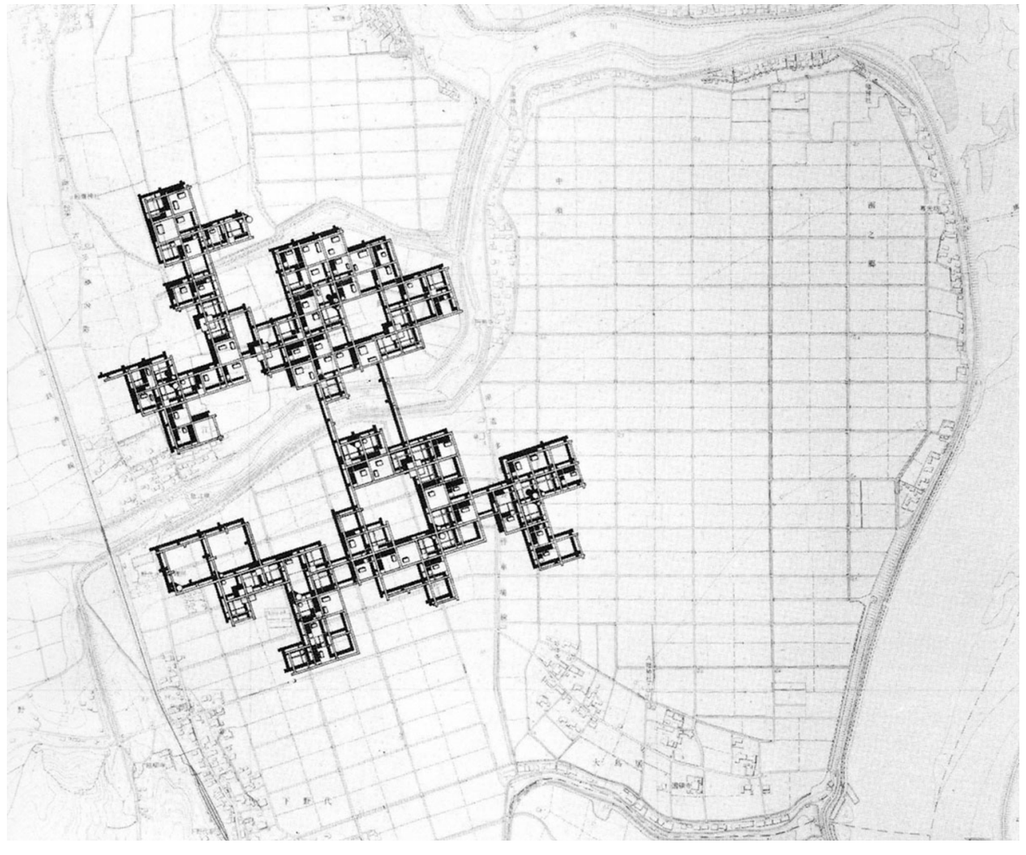


Figure 6 – Site plan of the Agricultural City (ArchEyes, 2021)

A Manifesto for the 21st Century

The Harrison Studio begin their manifesto with a description of humanities history from an ecological perspective with the intention of providing a warning of the man-made climate and ecological disaster. Within their description of history, The Harrison Studio (2010) provide critical reflection on human technological progress, making mention of “Human creativity generating technologies that appear not to like that which are not themselves”. From this description they lead into their five understandings. The first four understandings primarily focus on nature and natural systems, in the fourth understanding stating that “All natural systems have learnt to nest with each other, and, within a context of symbiosis contribute to collective systems survival, sometimes with abundance”. In their fifth understanding, they shift their focus to man-made systems and the inherent challenge that they face. Following this, they go on to describe a future that is needed, one understanding of their concern for a tomorrow that will be “creating flood and drought at continental scale”, as mentioned before their five understandings, and prevent the destruction of the world as we know it. This future is presented with the aim that it will provide longevity, involving entire life cycles of “living, reproducing then dying”, emphasising a need for focus to be taken away from immediate technological growth with its “violation of the laws of conservation of energy pointing toward systems entropy”. (The Harrison Studio, 2010)

The Spark, a proposal for a data centre designed by Snøhetta, can be seen as an example of a building which takes on a sustainable approach to human systems expressed by A Manifesto for the 21st Century. The Spark was created in response to the expected increase in the consumption of digital data worldwide. Although this data, according to Walsh (2018), is thought to be floating in “the cloud,” it is actually held in a vast network of energy-intensive data centres that are connected to cities by a system of fibre optic cables. These data centres are frequently constructed in complete isolation from the urban environment. (Walsh, 2018) The Spark is instead located in the middle of Lyseparken, Norway, where it will be able to provide heat for the surrounding neighbourhood from its excess. The building will support facilities next to it where the public will be able to experience the portion housing the data centre, which is designed vertically to reduce its impact on the surrounding ecology. (Kingsland, 2018)

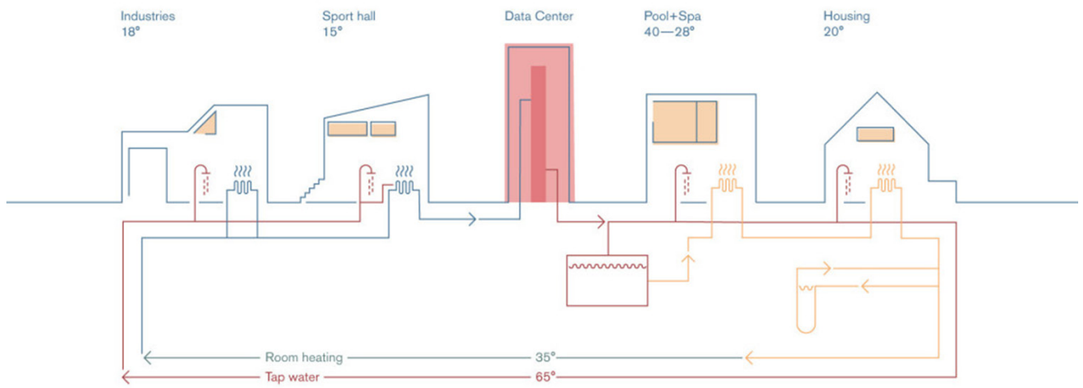


Figure 7 – Diagram of heated water flow from The Spark (Kingsland, 2018)

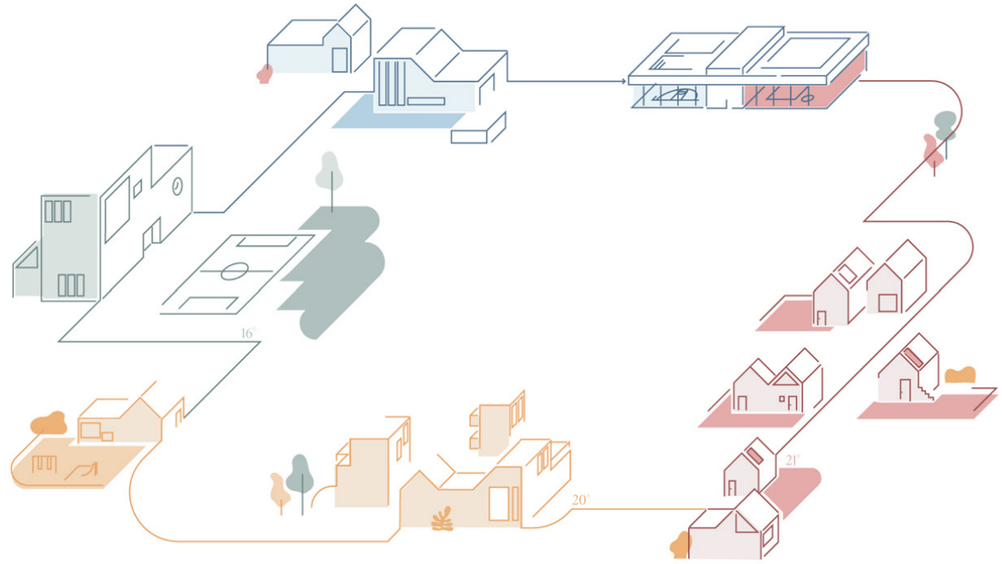


Figure 8 – Diagram of buildings serviced by heated water (Kingsland, 2018)

Initial Approach

Application of Thinking to Tolka Valley

The ecology of the industrial estate is composed of large, shed-like buildings, their design driven with a desire for speed and efficiency. Cheap concrete block walls alongside a structure supported by steel frames, clad with corrugated metal panelling, provide large open space ideal for manufacturing. The land surrounding each industrial building exists as a monotonous grey, concrete surface, bustling with cars, various transport vehicles and miniature coffee shops to provide sustenance. With the prior landscape no longer visible, any greenery in the estate exists as either decoration or something subdued by a different technology.

Meanwhile, the canal and the railway remain a neighbouring ecology to the industrial estate, but one it chooses to turn its back on. As the railway has remained functional, the canal has given up its industrial use in a way that may be compared to the systems entropy described by The Harrison Studio (The Harrison Studio, 2010).

Tolka park resides as an ecology bordering the natural landscape of the river valley and its ecological prosperity, along with the mundane landscape of the pitch and putt golf course. The park's toxic history as a landfill remains the result of a short-sighted and immediate approach, unlike the considerate ecological thought provided by Harrison Studio.

As the ecology of the canal and railway can be seen to border with the ecology of the industrial estate in a location containing a large, contaminated green space, not unlike the ecology of the park, the fourth ecology of the housing estates remains distant, uncaptured by the microcosm found on the site along Broombridge Road. Here, open land continues to be converted into new houses provided with private gardens that remain collectively as a new iteration of the former pastoral landscape on the site but without the materially productive activity of a farm.

Synthesis

Overlaps between The Spark and the Agricultural City can be seen in several aspects. Firstly, both structures choose to bring to the forefront that which is often relegated to the outskirts of human activity. The Spark takes the technology of the data centre that is often situated in large, isolated sites, such as the desert or the artic circle (Kingsland, 2018), and bring it into the city, where it will interact directly with the nearby community. Similarly, the Agricultural City takes the landscape of the countryside, often viewed in opposition to the city and places a new city in the centre of it, where the agriculture will become the city. The emphasis Kurokawa places on natural processes, like symbiosis, and their predicted relevance to the 21st century described in his book, alongside the importance of food production in his Agricultural City, can be clearly seen in A Manifesto for the 21st Century when The Harrison Studio (2010) discuss contemporary issues, warning “the food supply will shrink” and how humanity must “enable nature’s ways of invention and human ways of invention presently so oppositional to co-join”. This translates to The Spark, which links into its man-made context through a cyclical system of water and heat flow described by Snøhetta in Kingsland (2018) as comparing “the process to blood travelling through the body”.

Informed significantly by its context, Kurokawa elevates the Agricultural city four meters above the ground to allow an exchange with the river and the farmland below while avoiding floods in the flat landscape it appears to be situated on. In Tolka Valley the steep incline approaching the river at either side has been relegated to the park ecology, with construction having taken place on most of the even land surrounding it. However, unlike the Agricultural City, there is a lack of interaction with the river or the canal, as seen in Figure 9. Additionally, the scale of the Agricultural city is comparable to Tolka Valley, with its structure as large as the site, shown in Figure 10.

Figure 10 – Agricultural City to scale overlayed onto Tolka Valley

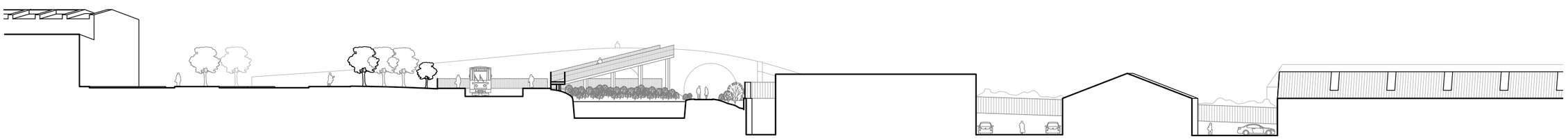


Figure 9 – Section through Tolka Valley railway, canal and industrial estate

After applying the timeline of thinking to the four ecologies of Tolka Valley, it seems apparent how such little interaction between the neighbouring ecologies produces a system unlike that of the Agricultural City, with its interconnected portions shown in Figure 11, or The Spark and as a result is experiencing, in some parts, an entropy like that described by The Harrison Studio.

Figure 11 – Circulation within the Agricultural City

Initial Design Proposal

To explore the thesis through the design of architecture, an initial proposal was made to tests the concept of metabolism and symbiosis within Tolka Valley. The proposal was positioned in an entropic site within the industrial estate along the Royal Canal and Broombridge Road, containing an intersection between Tolka Park-like greenery, the Royal Canal and the Dublin Industrial Estate. Following my research, the objective for this proposal was to transform the site into a productive system that could benefit both the human and the non-human. This takes a similar approach to The Agricultural city by bringing food production from the outskirts to the city. This would benefit people by providing large amounts of fruit and vegetables for the area. To achieve this, vertical indoor farming with aquaponics growing units was used. Aquaponics is a form of soil-less agriculture that involves the natural process of water exchange between plants and fish, where one filters the water and the other fertilizes it, achieving symbiosis between the two. This method of farming significantly increases the amount of food produced, while requiring a smaller amount of the site in comparison to traditional soil-based farming, as shown in Figure 12. Machinery as well as people would circulate the building through the process of farming. Additionally, the building extends outwards as it reaches higher into the sky for the purpose of accommodating more growing units and to avoid the power lines running over the site. With a small portion dedicated to the building, the rest of the site can be rewilded and serve as a natural habitat for the local ecosystem.

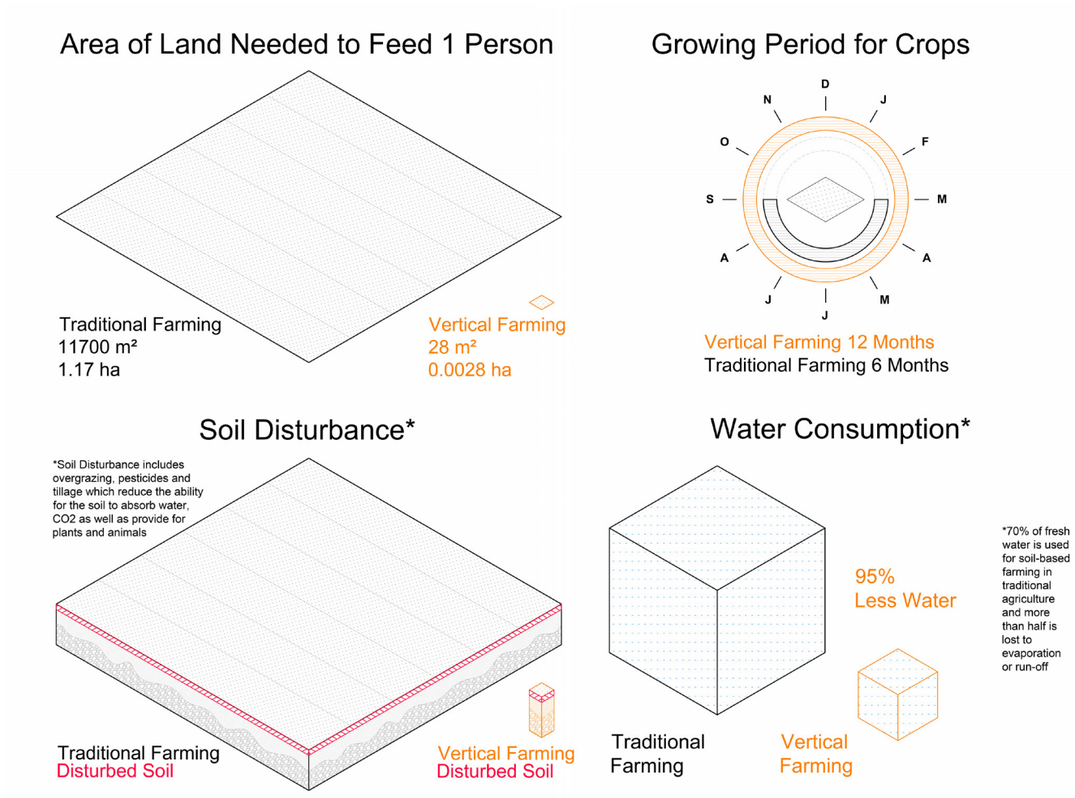
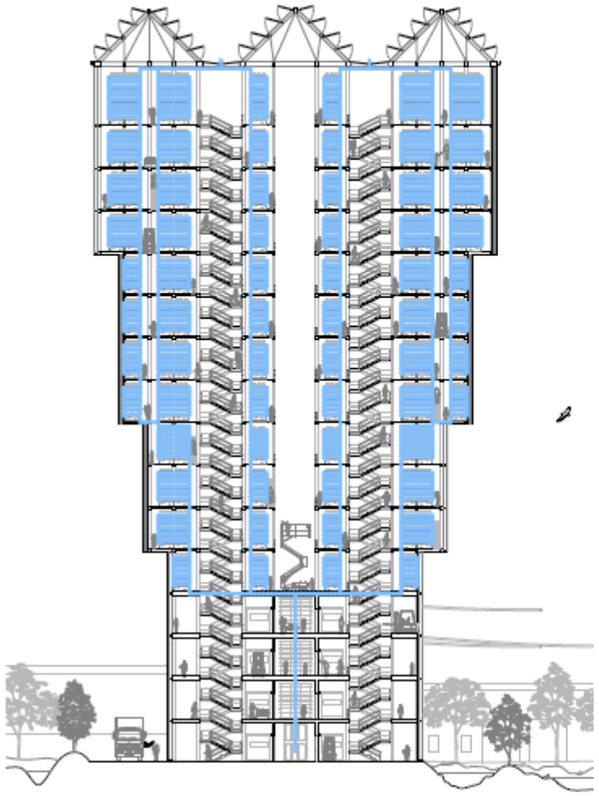
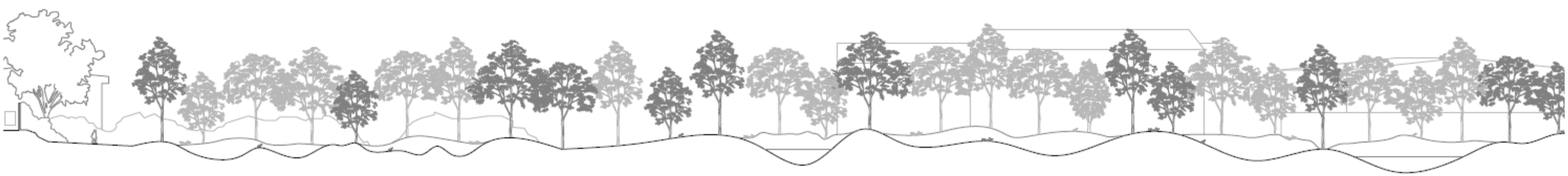


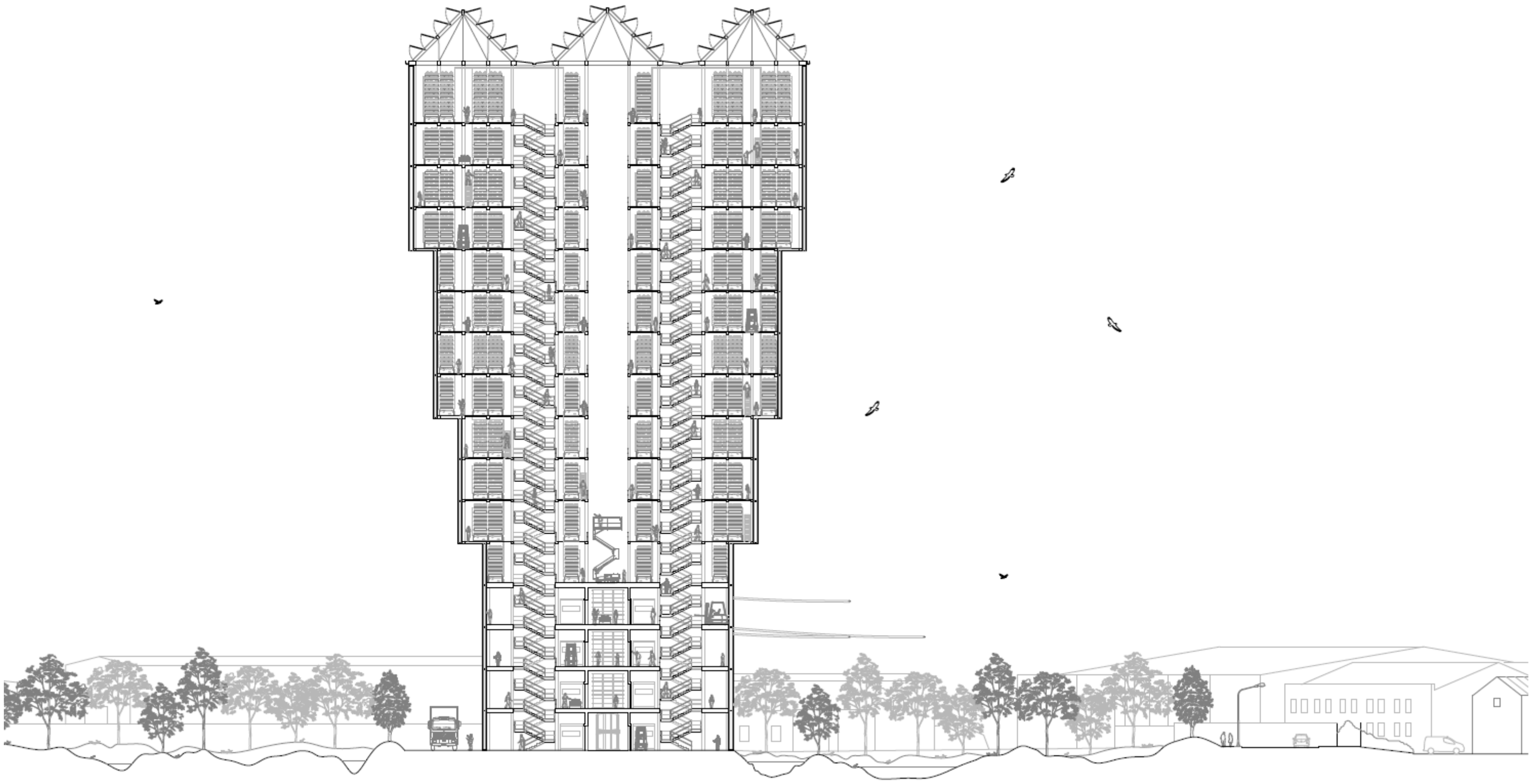
Figure 12 – Advantages of Vertical Farming

Site Location Map



Vertical Water Flow





Site Section Through Aquaponic Farm

Design

Reflection

Upon reflecting on the initial proposal, several shortcomings were observed in addressing the topics established by the research I had produced. The primary issue regarding it was the lack of spaces dedicated to people using the building. Many of the precedents researched, such as The Spark, integrate public amenities into its productive system, while the vertical farm building proposed consists entirely of growing spaces and areas that directly related to these spaces. The provision of spaces for people going forward would also serve to mitigate some of the shortcomings identified within the housing estate ecology, by providing amenities to aid the dwellings that have been expanding rapidly in the area. However, the initial proposal does not address the issues identified with the four ecologies of Tolka Valley. No interaction occurs between the building and ecology of the park or housing estates. While the proposal is positioned to address the entropy of the canal ecology and the isolation of the industrial estate ecology, it does neither, offering no benefit to the canal or the walkway running along it and not integrating the industrial estate with the other ecologies. Additionally, an overreliance on the symbiosis contained within the growing units to create a metabolic architecture presents another issue with the building. An adequately metabolic architecture should incorporate multiple systems that work in symbiosis, like The Agricultural City, which assimilates housing, public transport and agriculture, among others. These remain as issues that I set out to address going forward into the design.

The Brief

To avoid repeating the problems associated with the initial proposal, focus was placed on creating a proposal that would investigating how to better incorporate machinery and plants as well as people in a way that mimics a natural system, with consideration taken for the four ecologies identified on the site. Several precedents were examined to provide a foundation for how productive growing areas can be mixed with community facilities.

The competition entry, Harlem Harvest, incorporates several systems shown in figure 13 which serve to aid in hydroponic growing. This system can be observed by people in the education spaces positioned alongside it, who also benefit from and engage with this system through the food and water produced, as well the processing of toilet waste.

The Vertical Urban Farm located in Romainville, Paris combines community spaces on the ground floor with growing spaces on the upper floors, as sketched in Figure 14. The ground floor contains a café to attract visitors that allows food to be consumed where it is produced, as well as a shop where plants grown above can be sold. Additionally, the education space serves to inform people about the growing processes that take place throughout the building. These spaces together provide a system where the productive process is directly linked with community engagement. Fig

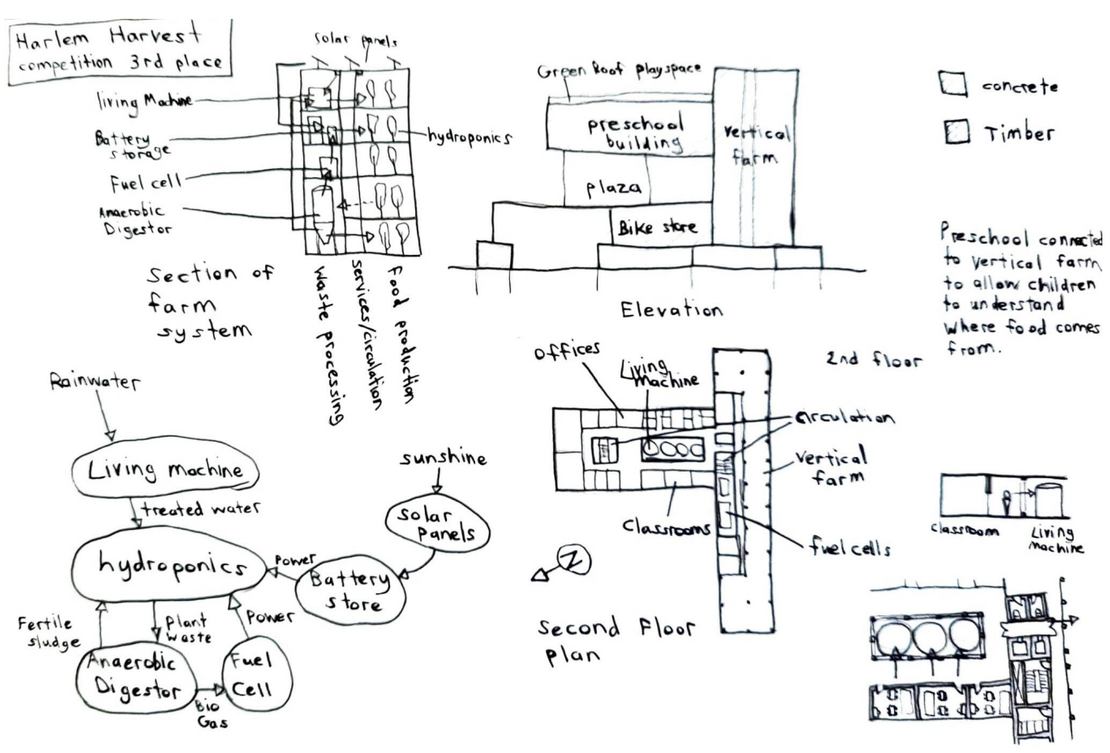


Figure 13 – Exploratory Sketch of Harlem Harvest

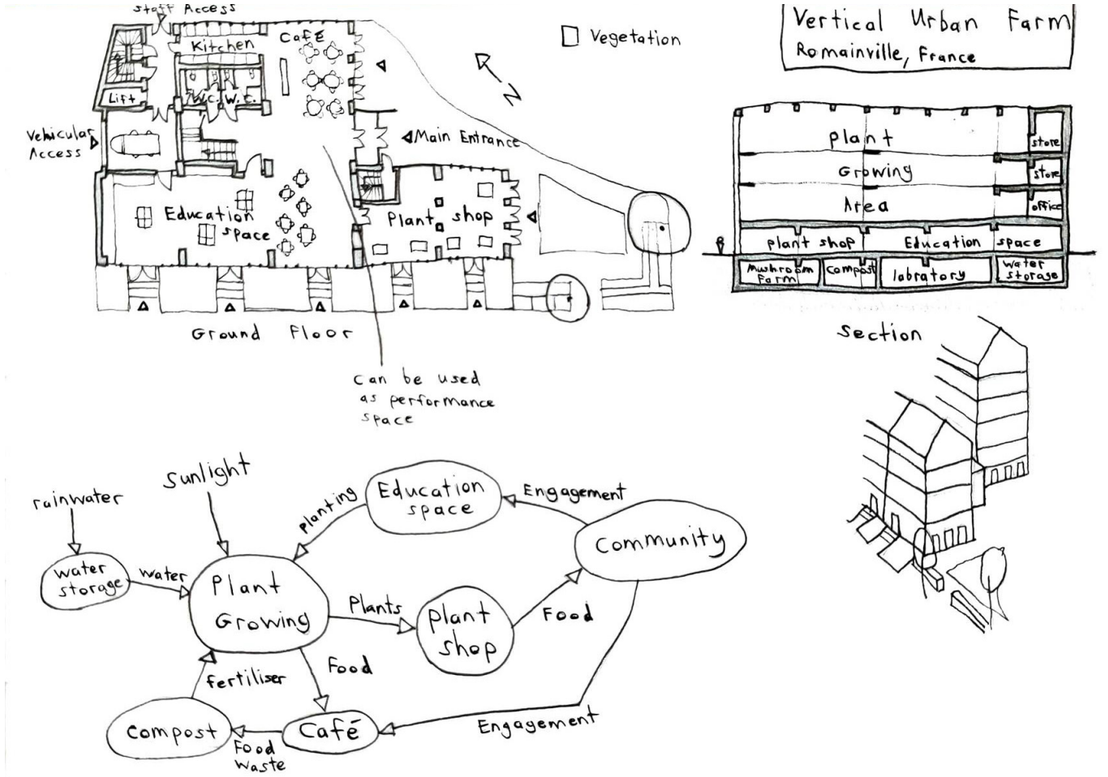


Figure 14 – Exploratory Sketch of The Vertical Urban Farm

The programme was created with the intention of providing several different spaces to a variety of different people in the building. Spaces involving food consumption, distribution or preparation were suited to the food production taking place within the building. Growing spaces would be accessed to allow visitors to learn about the process of growing food. Meanwhile, large open spaces, such as sports halls, take advantage of the height and generous dimensions required to take full advantage of large-scale vertical farming.

Spaces for the Public include:

- Café with Outdoor Space
- Outdoor Food Market
- Educational Kitchen
- Education Space
- Indoor Garden
- Outdoor Community Garden
- Religious Gathering Space
- Art Studio
- Recording Room
- Yoga Studio
- Basketball Court
- Outdoor Sports Pitch
- Fencing Arena
- Volleyball court
- Reception Lobby
- Changing Rooms & Toilets

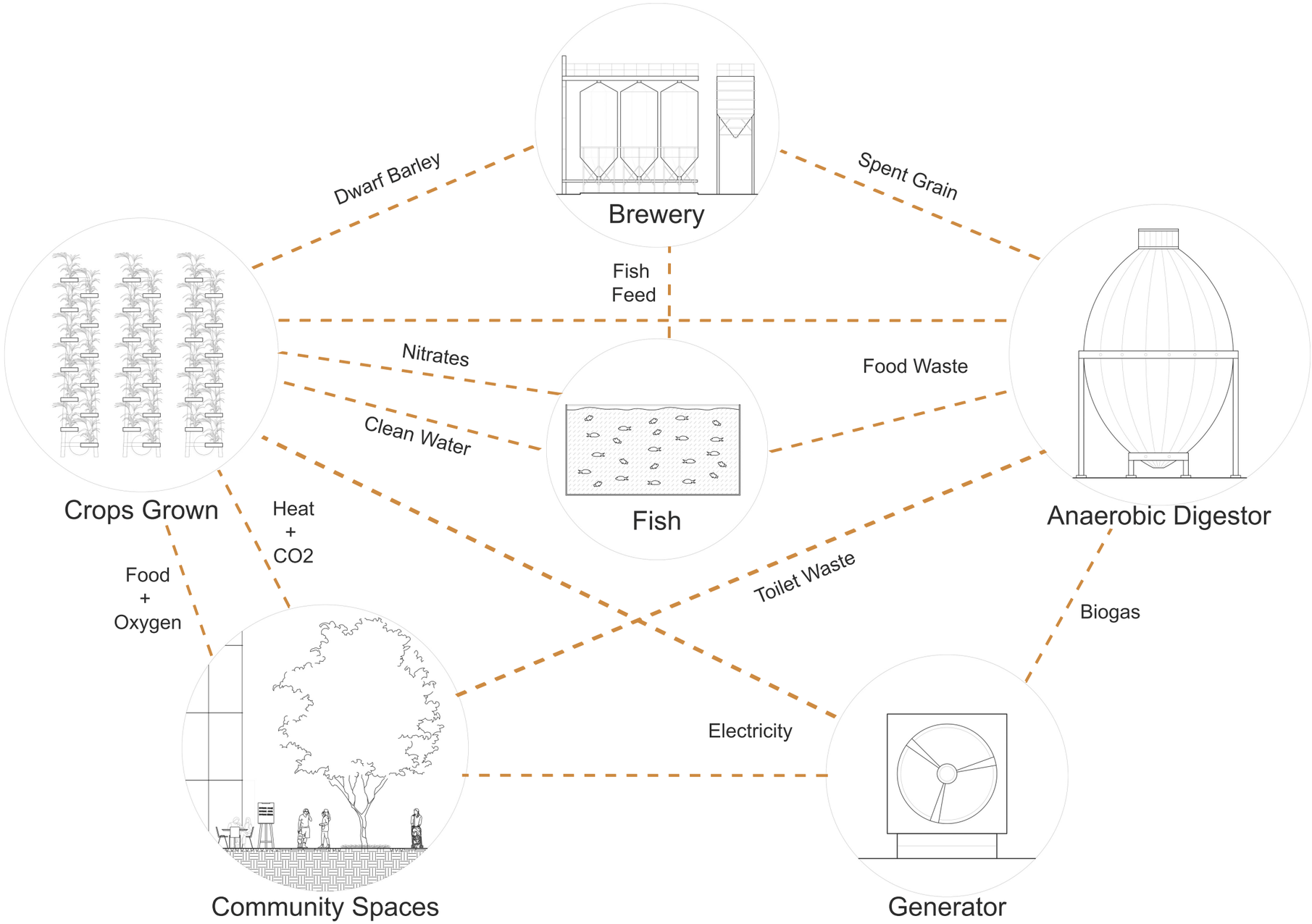
Spaces for the Staff include:

- Growing Area
- Planting & Packaging Area
- Plant Storage
- Fish Preparation & Storage
- Quality Control Room
- Research Laboratory
- Offices
- Staff Canteen

Services within the building were also considered as part of the programme given their importance in establishing the building as a metabolic system. The main services include:

- Aquaponic Growing Units, including Planting Trays and Fish Tanks
- Living Machine for Water Filtration
- Anaerobic Digestor for Organic Waste
- Generator to Provide Energy using Biogas

When combined with the community spaces within the building, these services can work together in a process where the waste from one system provides sustenance for another. To ensure a sufficient supply of feed could be produced for the fish housed in the Aquaponic units, the process of fish feed creation was added to the metabolic system. Through the incorporation of a brewery into the system, dwarf barley could be grown to supply the brewery, from which the spent grains generated in the process would serve as feed for the fish. This addition influenced the decision to locate the building within the industrial estate, on a site where it could neighbour an existing Brewery and function as a metabolic system within an ecology that currently fails to emulate natural processes.



Climate Action - Submission to Dublin City Council

The observations included have been written in response to Chapter 3 Climate Action of the Dublin City Development Plan 2022-2028. A particular focus will be placed on the issue of sustainable transport and waste following research carried out in the final year of the Bachelor of Architecture programme at Technological University Dublin. The purpose will be to provide a case study addressing these issues.

According to National Statistics, Ireland's population is expected to experience significant growth over the next two decades. (Central Statistics Office, 2019) While there are many challenges associated with providing for the needs of a growing population, one of particular interest relates to food.

The majority of the food supply in Dublin City is brought in from areas outside of the region, such as its periphery, other areas of the country or, in the case of many fruits and vegetables, shipped in from abroad. (Central Statistics Office, 2018) This factor combined with the growing population and densification of the region, results in an increasing difficulty in sourcing food locally. Section 3.5.5 of the Development Plan serves to outline the unsustainability of our agricultural and transport sector when it states that "data collected by the EPA indicates that the transport sector was responsible for 20.4% of total greenhouse gas emissions in 2019, second only to the agriculture sector." This reinforces the need for provision of locally sourced and sustainably produced food in the region. For this reason, I would argue that a much greater emphasis be placed on agriculture and its associated issues, which is lacking consideration significantly in the Development Plan when considering its carbon footprint.

I propose for the provision of vertical farms, that utilize hydroponics as a growing system, to offer a viable solution to this problem. Unlike a traditional farm, this system is designed to produce a variety of food in the controlled indoor environment of a building, that can be erected in an urban center, where the food will be consumed.

Placing such a facility on the site of an existing run-down warehouse structure within the Dublin Industrial Estate, along the Royal Canal Way and laying to the south of The Porterhouse Brewing building offers a potential case study for how this system may be implemented. This location would allow it to provide food for people and tie into businesses in the surrounding local area. Capable of integrating with the brewery on its neighbouring site, it can offer a sustainable solution to many of the Porterhouse's waste products as well as providing it with barley that it currently imports from abroad. Spent barley waste from the brewery can be used as fish feed for the vertical farm, which is able to use the waste produced in fish tanks within the facility as a natural fertilizer for the crops that are grown there, cutting out the need for any artificial fertilizers.

For this reason, I believe the proposal would greatly contribute to policy CA23 outlined in section 3.5.4, which supports the shift towards circular economy as set out in the Whole of Government Circular Economy Strategy 2022-2023 – a publication that makes specific reference to "Increased circularity within the Agricultural sector… through reduced use of external inputs, closing nutrient loops and minimizing harmful environmental discharges."

Figure 15 – Ireland's Vegetable Imports

Food Processing - *The Porterhouse Brewing, 3fe Roastery, Batchelors*

Food Distribution - *Lidl, Aldi, Honest2Goodness*

Food Consumption - *Cafe 53, Romayo's Diner, Geisha Asian Restaurant*

Internal Arrangement

To provide flexibility and minimize internal barriers, a large, consistent grid was established, composed of columns spaced at a 10-meter distance from one another. Maximising the depth of light penetration into the building and taking advantage of the vertical propensity of the aquaponic growing units, the vertical dimension from floor to ceiling was also spaced at 10 meters. From their size, these dimensions would support the creation of large open spaces.

Beginning to arrange the programme, the spatial qualities associated with a natural environment such as a clearing in a forest were taken as inspiration. This was recreated within the building by organizing spaces so that they are surrounded by growing units. These ‘clearings’ would be suited to supporting sports facilities such as a basketball court due to the large floor to ceiling height needed and encourage interaction with the growing units.

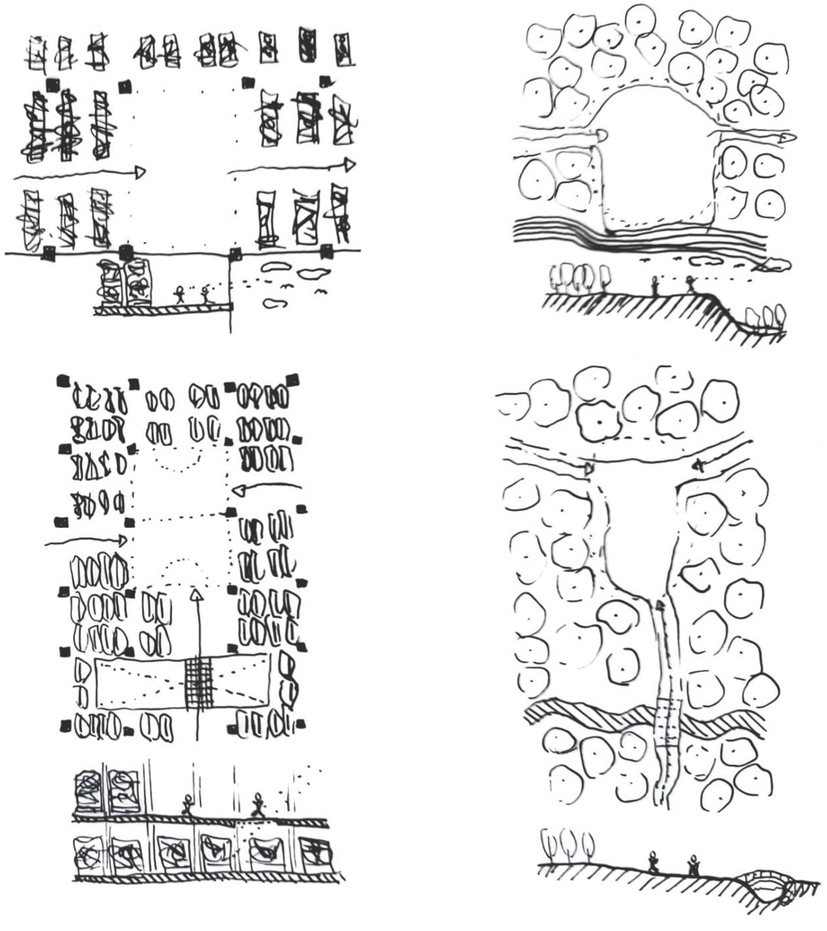


Figure 16 – Sketch Exploring the Recreation of a Natural Environment

Looking at the building in its entirety, a scheme was developed that could support the creation of ‘clearings’. This was approached by establishing the building as a solid, cube-like mass filled with hydroponic units. From there, spaces for people are carved out of this solid mass, sprawling out from the centre, where a circulation core is punctured through the building to allow movement between spaces and floors.

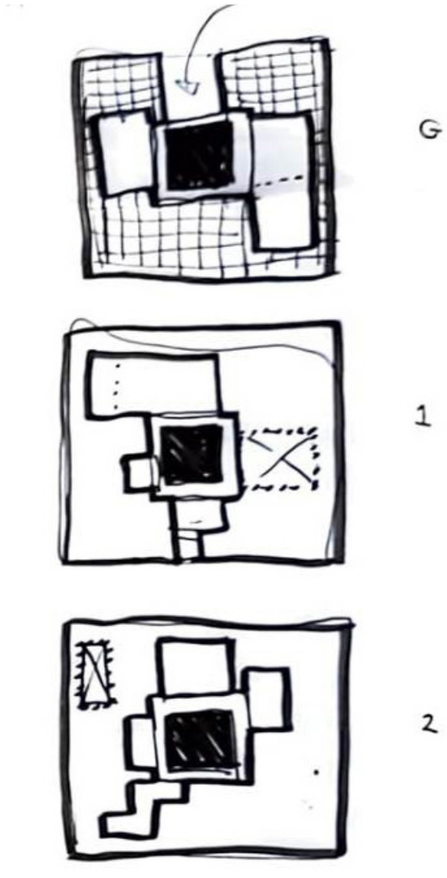
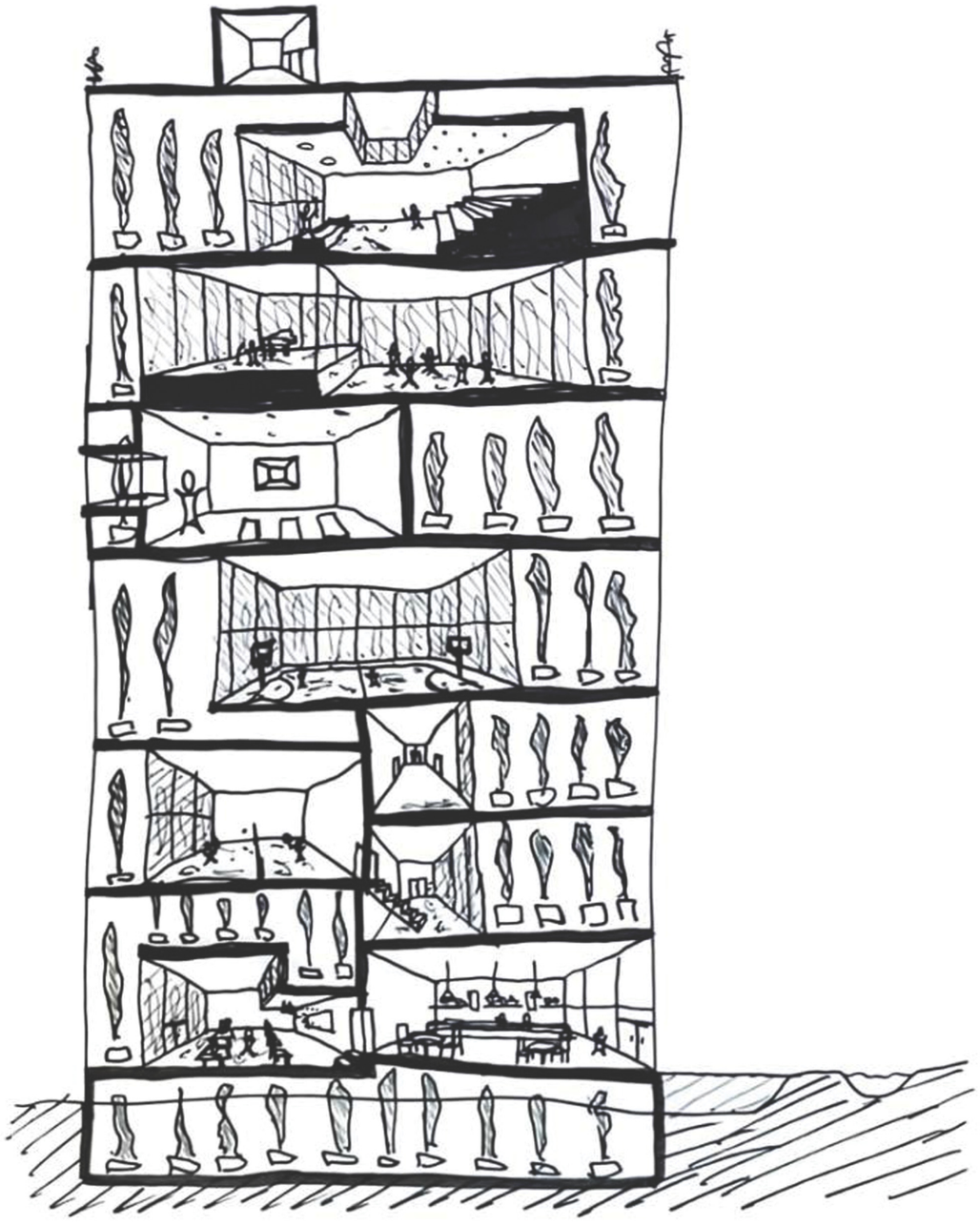


Figure 17 – Sketch of Massing and Voids

A system of arranging spaces that allows them to shift both in their formation in plan as well as their positing vertically, allows the variety of difference spaces required to be accommodated in a singular building, with their different functions serviced and each connected to greenery.



The different spaces and services were arranged mostly around the perimeter to allow features such as staff facilities, water services and sports halls to be spaced apart from one another. This decision made it possible to surround each of them with growing units and the opportunity to bring visitors along a route through the growing areas, similar to a path running through a forest, in order to access these spaces or ‘clearings’. Additionally, these growing areas bleed into community spaces at various points, such as in the education spaces and the Café.

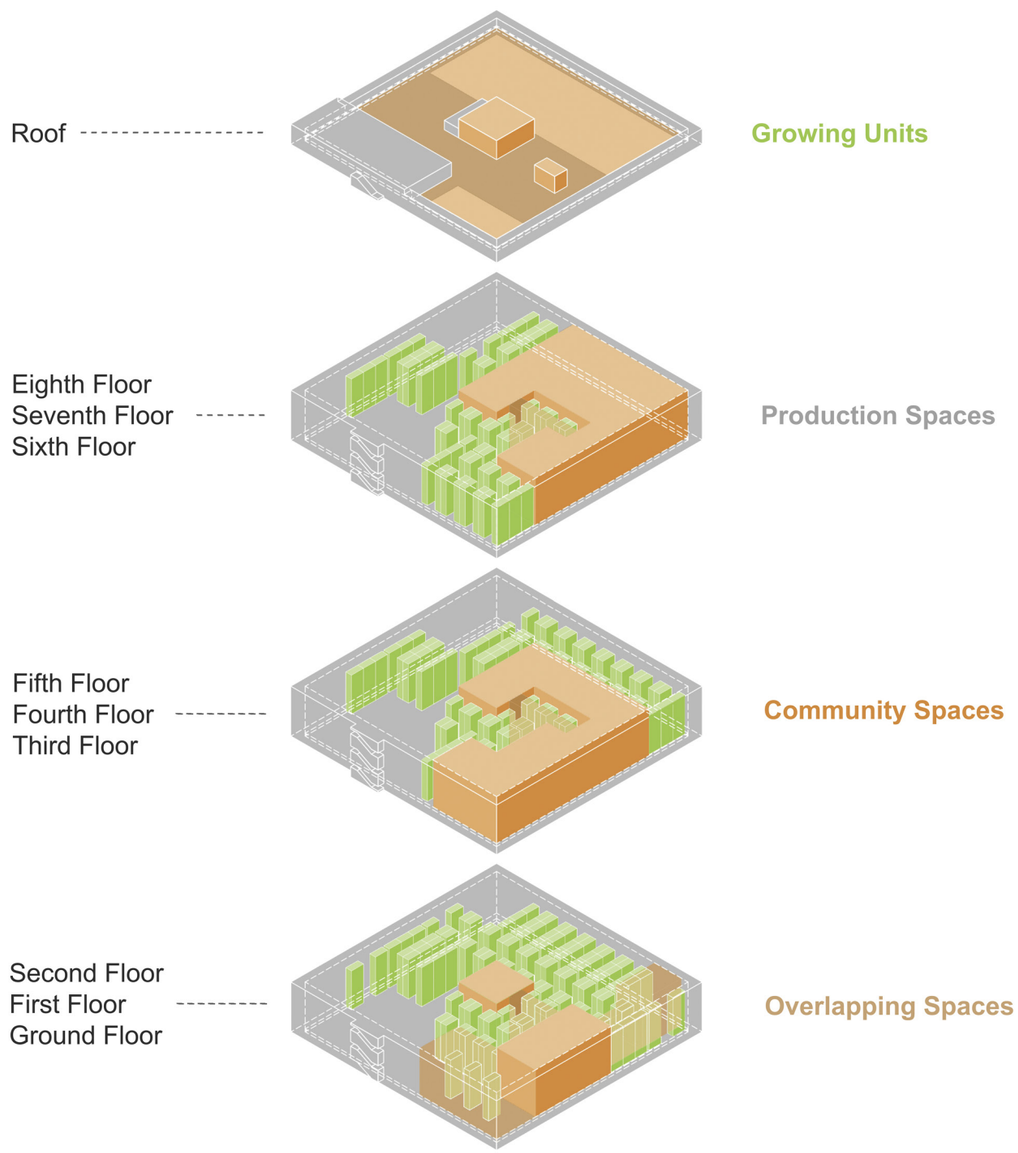
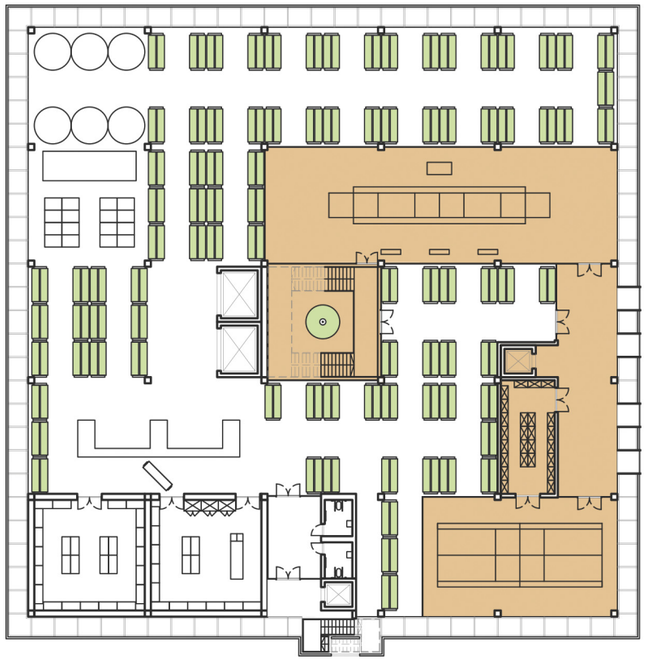
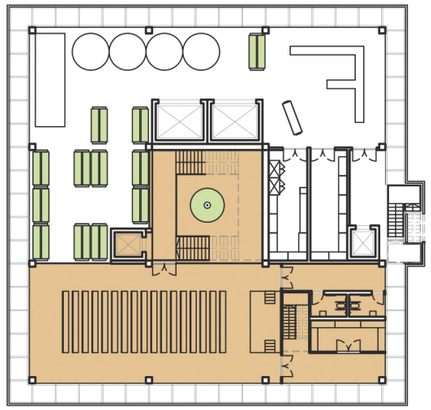


Figure 18 – Axonometric Showing Overlap of Spaces

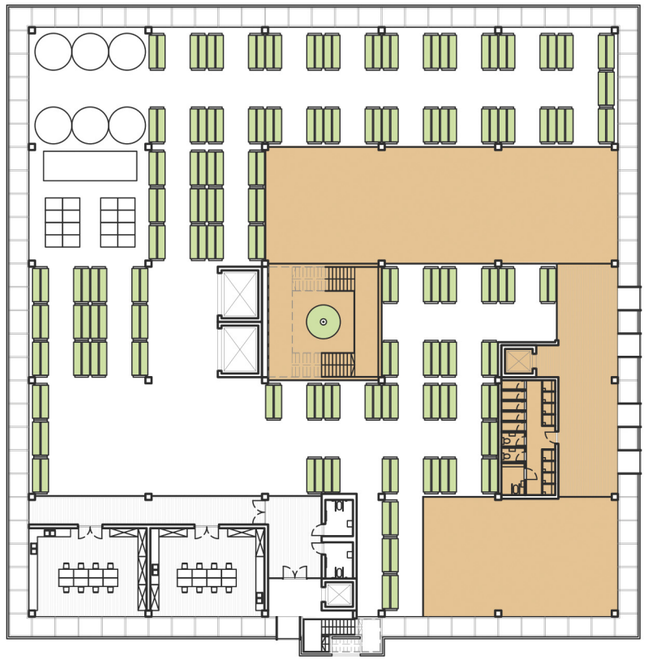


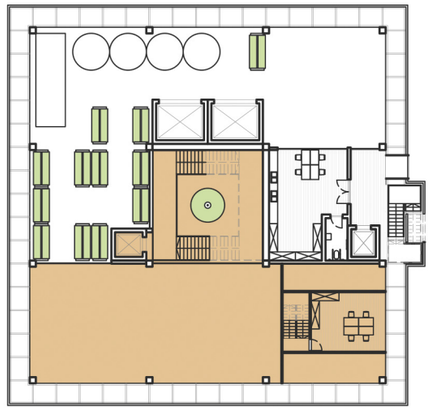


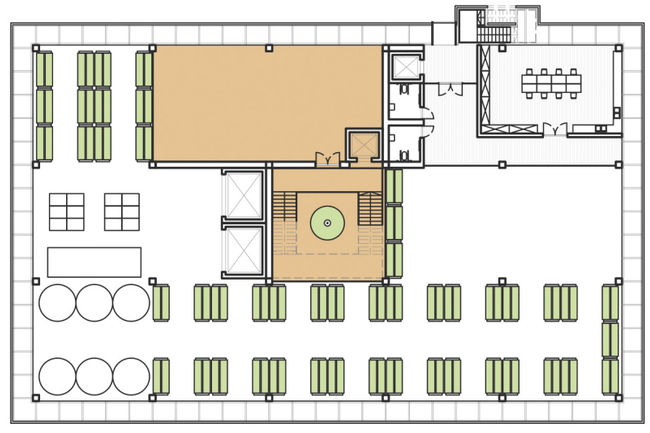
Third Floor Plan

Community Spaces

Growing Units



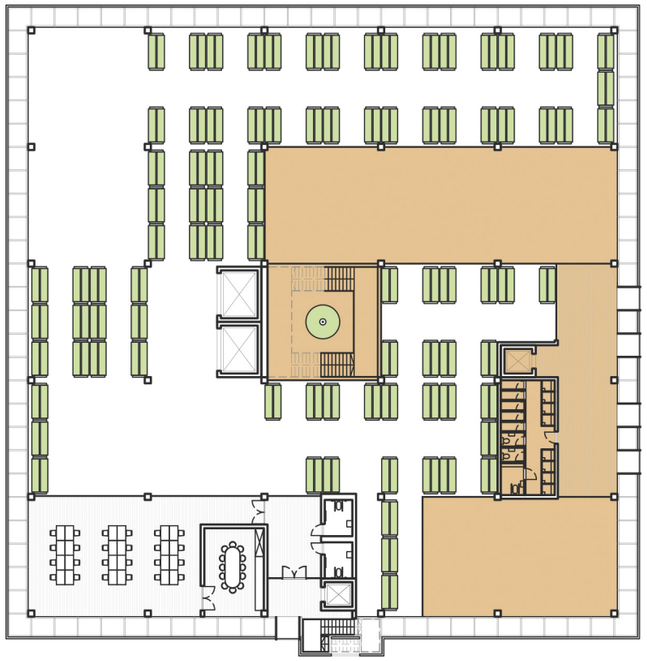


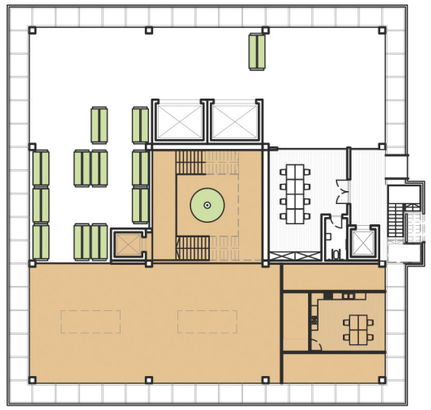


Fourth Floor Plan

Community Spaces

Growing Units

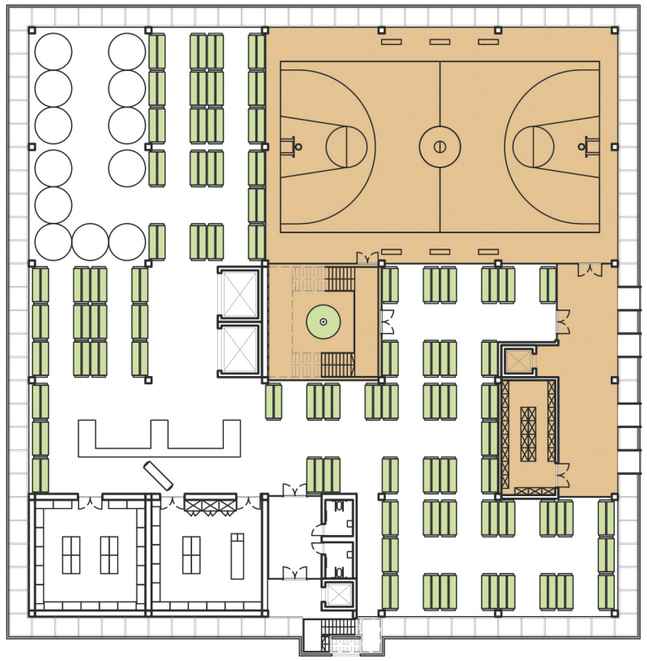


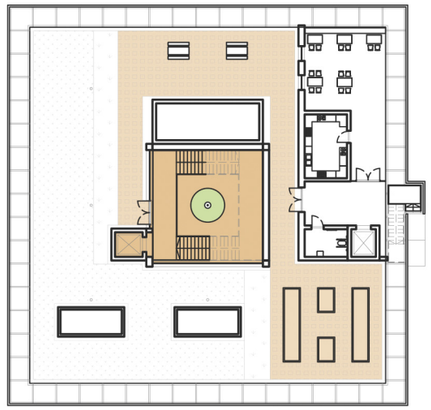


Fifth Floor Plan

Community Spaces

Growing Units





Sixth Floor Plan

Community Spaces

Growing Units

An education space sits on the ground floor within each building surrounded by growing units, similar to the café. This position encourages visitors to be drawn in from the surrounding walkway and immerse themselves with the growing units, while allowing them to learn about vertical aquaponic farming through engaging with the process directly.

The circulation core at the centre of each building directly interacts with the vertical planting that continues up through the space as one ascends higher up the stairs. While passing through this space, its glazed perimeter offers views of the spaces around it, such as the growing areas present at all floors, as well as the variety of different activities taking place in different positions throughout the building.

The difference in temperature and humidity required for the growing areas and sports facilities such as the basketball court means the two cannot interact directly. However, through a layer of glazing, the basketball court establishes a visual connection with the growing units surrounding it in order to achieve the feeling of being immersed in nature.

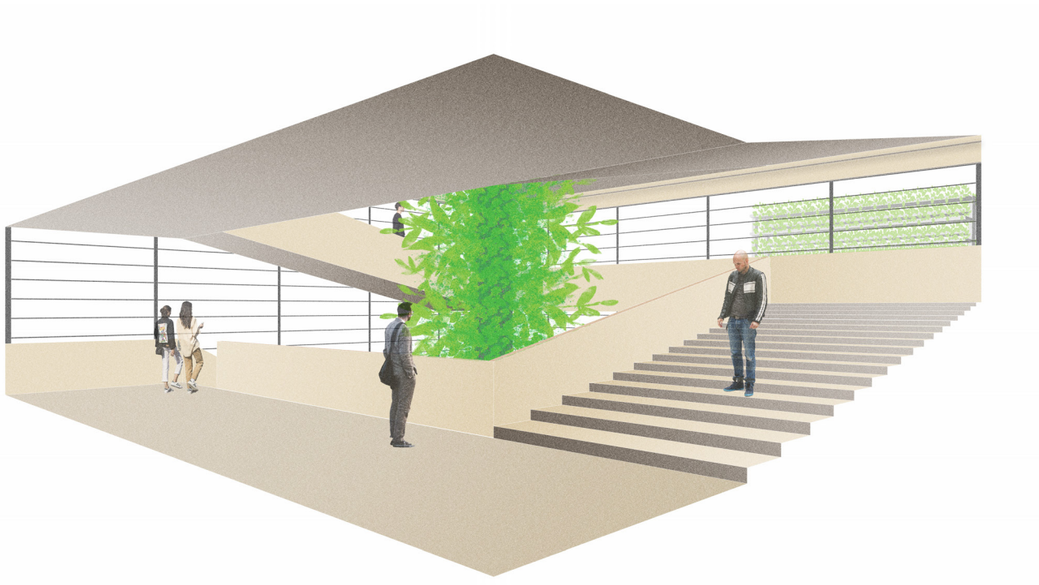


Figure 19 – Central Circulation Space Perspective

Figure 20 – Education Space Perspective

Figure 21 – Basketball Court Perspective

Site Strategy

Taking the surrounding context into consideration, the height of the proposal was kept within line of a recent residential development in the west of the industrial estate. This was done to ensure a sufficient height could be achieved without it becoming an overbearing presence on the site.

Contextual Section AA

In considering the orientation of the building, sketches were made looking at the views that could be captured from the building at points along the façade by puncturing through the growing areas and allowing a framed view of various locations in Tolka Valley. From the building positioned within the industrial estate, a southern view of the nearby canal can be captured on the lower floors, with a display of the Technical University Dublin's outdoor sports facilities visible on floors higher up, with the top floors granting a northern view of the distant Tolka Park. This would provide a strong visual connection between the industrial estate ecology to the canal and railway ecology, in addition to the park ecology, when little to none existed prior.

With the orientation and rough massing established, I looked at the approach to the building on the immediate site. A further connection to the industrial estate ecology and the canal and railway ecology was formed through the decision to link part of the canal walkway to the area of the proposal. Given the difference in height between the canal walkway and the ground level on the site, this would be achieved through raising the ground level on the area of the proposal to become level with the walkway, allowing level access to the site and potential to host outdoor facilities. Given the frequent use of the canal walkway, this could encourage those passing by to visit the site. Additionally, the height difference established would allow for transport vehicles to be easily loaded from the rear, while vertically separated from outdoor spaces occurring at the level of the canal walkway.

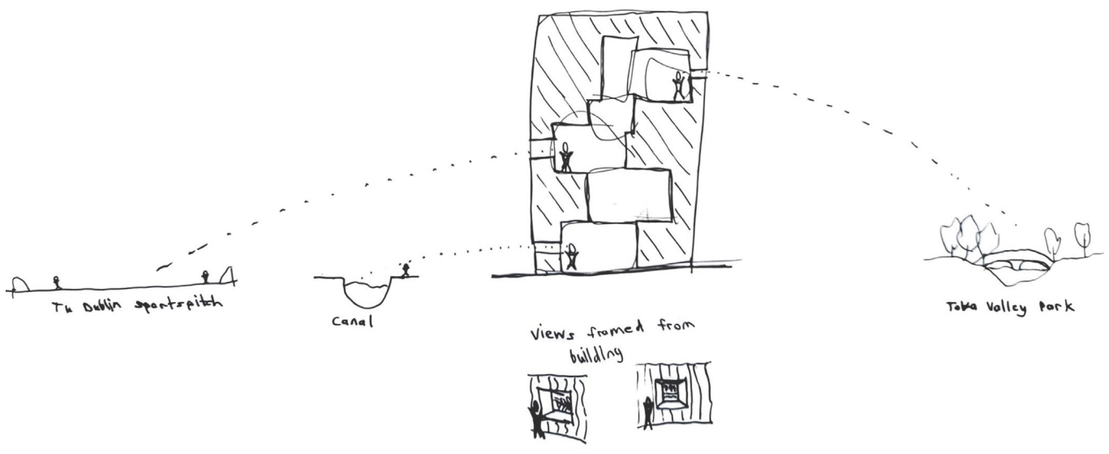


Figure 22 – Sketch Exploring Potential Views

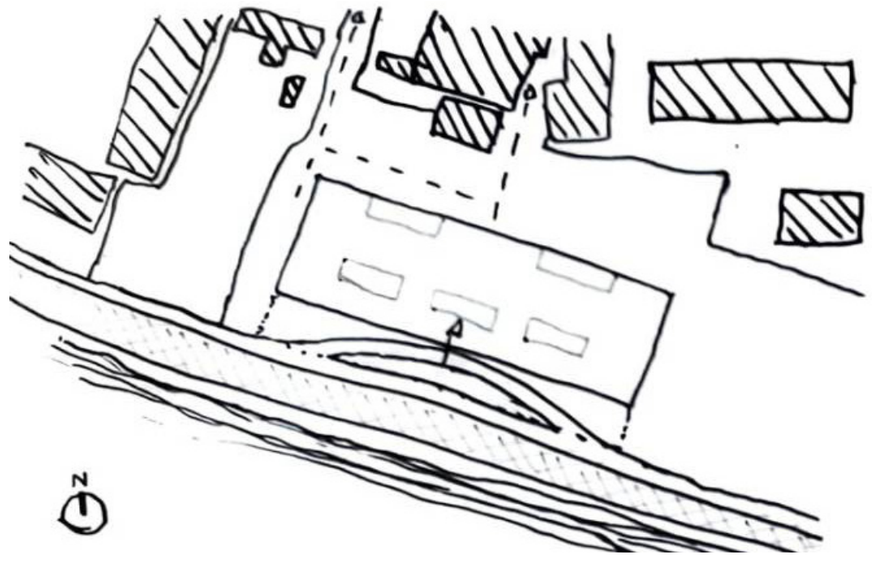


Figure 23 – Sketch of Site Plan

Splitting the massing into three buildings, I began working out the positioning of the buildings within the raised area, as seen in Figure 24. Beginning with a checkerboard pattern in sketch A allowed for transition between open and closed spaces and the creation of a central open space for outdoor eating but failed to address the issue of transporting goods from the central building into trucks in a satisfactory way. Additionally, the central open space remained partially hidden to users of the canal walkway. An inversion of this layout was explored in sketch B, which provided access to loading vehicles for all buildings by placing them around the perimeter of the area and opened the central eating area to visitors from the canal walkway. However, the proposed community garden was positioned where it would be overshadowed by the buildings and remain partially hidden. Sketch C addresses these issues while retaining the advantages by bringing the community garden and eating area to the main entrance of the site at the front, keeping the sports pitch in the corner and positioning each building around the site's perimeter, along with the trees that serve to filter out noise from moving vehicles below.

Upon further development, the outdoor food market took the position of the community garden as the central space on the site to attract visitors from along the canal to experience the market space, where the fruit, vegetables and fish produced by the aquaponic growing units could be sold and that opens out to the café, indoor garden and educational kitchen, in a route guided by a permeable pavement. The community garden is instead allocated to the rooftop where it would receive maximal light and rainwater. Large trees run along the site's perimeter to establish a soft boundary and a sloping surface is established to connect the canal walkway to a new route created around the elevated portion of the site. It is interrupted at moments to provide access to the elevated portion of the site and is to be used by pedestrians and cyclists, with vehicle use occurring at selected hours. Here grasscrete covers the surfaces intended for people and vehicles, while grass planting covers the remaining areas, reestablishing a small portion of the green fields that were lost when the industrial estate was formed.

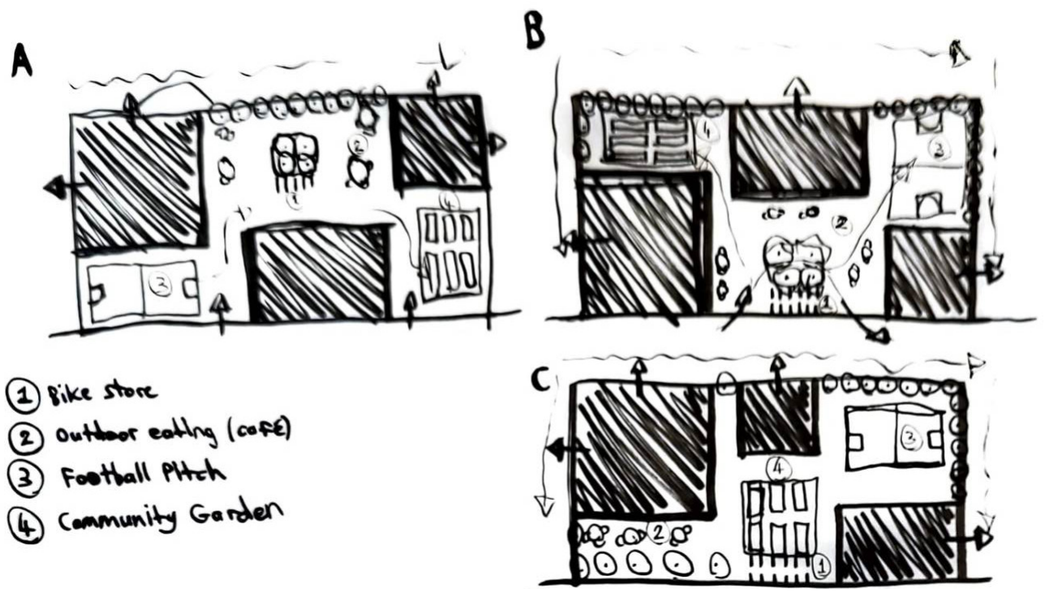
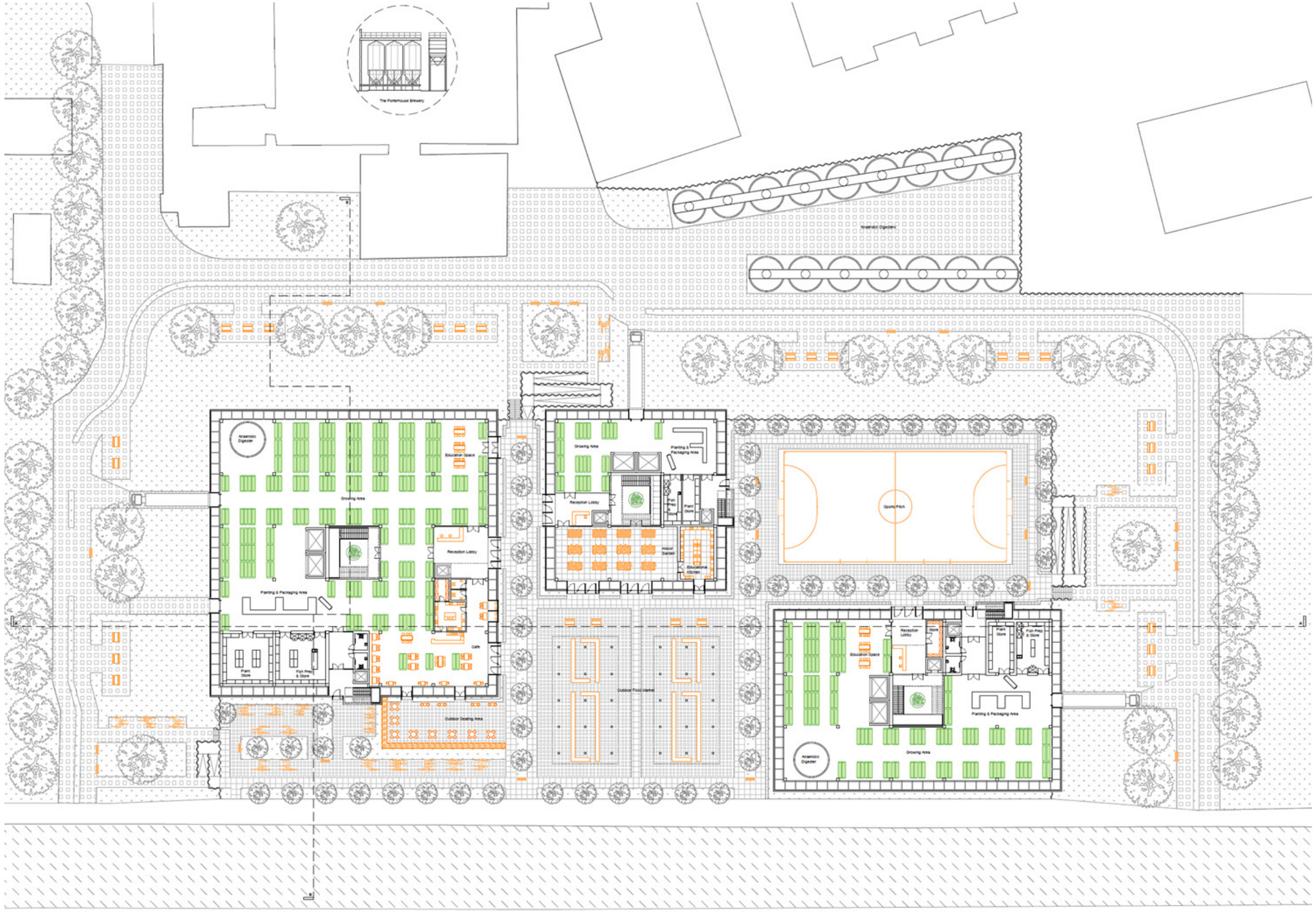


Figure 24 – Sketches of Arrangement Options on Site



N

Ground Floor Plan

Systems

The façade for each building is wrapped entirely in glazing to maximise the amount of sunlight entering into the building and reaching the growing units which are dispersed throughout. A curtain walling system with two layers of frosted glazing running around the entirety of the building's perimeter would serve the function of an insulating buffer to prevent extreme heat loss or gain. Additionally, it provides an effective method of ventilation, along with the central stair core. Internally, heat, oxygen and carbon dioxide can be exchanged between the spaces for plants and the spaces for people through ventilation. The thickness of the façade also provides the opportunity to include features such as window seats or framed views, to highlight the surrounding context when considered in conjunction with its orientation.

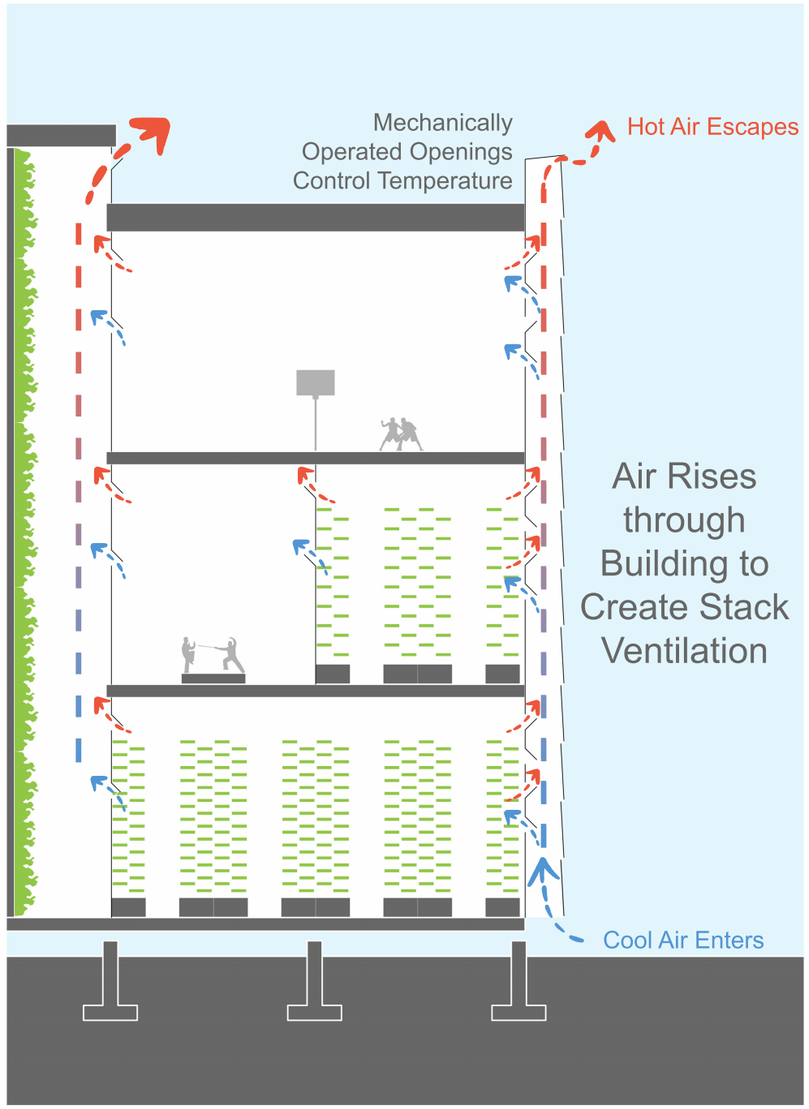
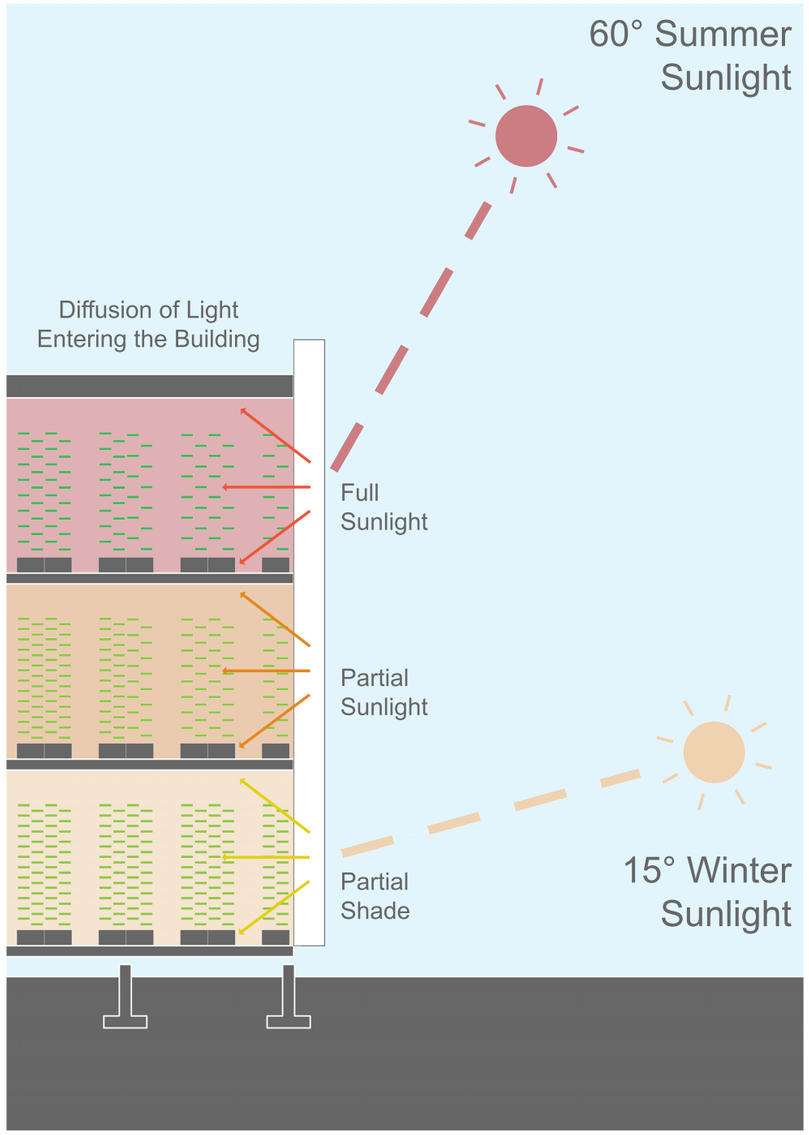
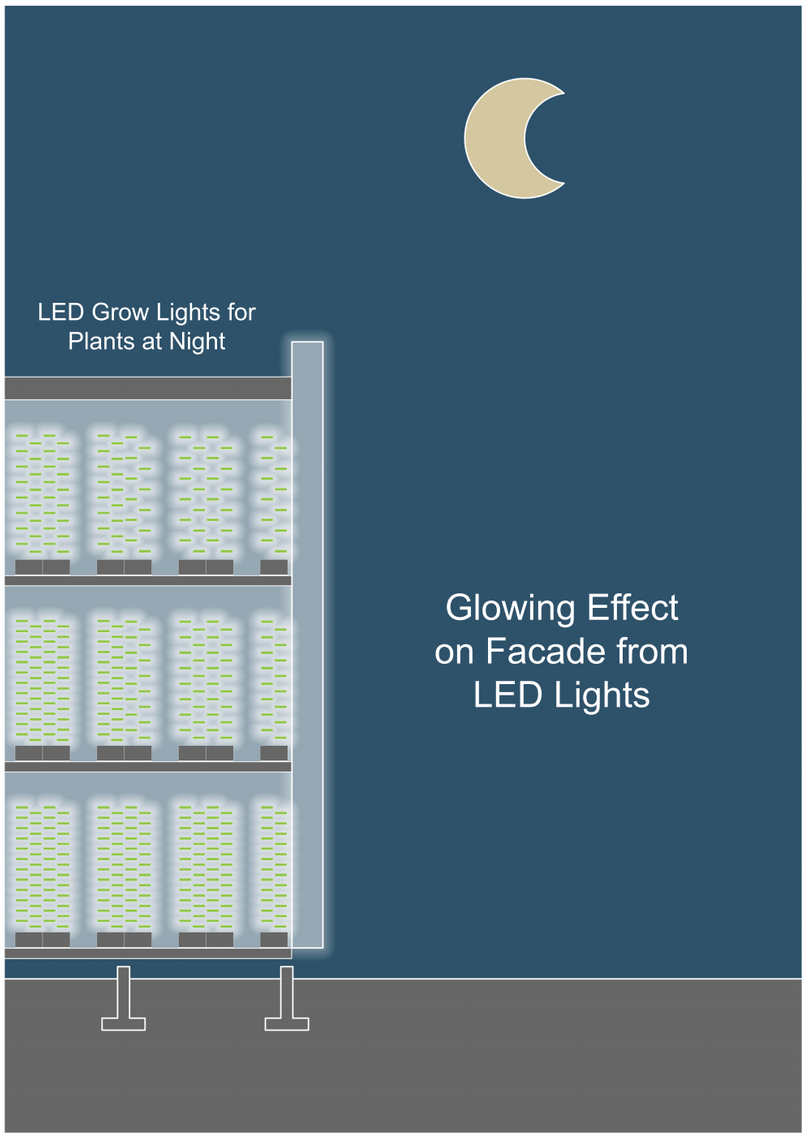


Figure 25 – Sketch of View Looking Out from Building

The semi-transparency of the translucent facade absorbs intense light from the sun and disperses it into the building during daytime to provide even lighting, ideal for the growing areas and the public spaces inside. Throughout the floors, the variety of plants being grown are positioned according to their different daylight requirements.



During the night, LED lights from the growing units allow the translucent façade to glow. As a result, light is provided for outdoor facilities between the buildings in addition to spaces in the surrounding area. This includes supplying light to the canal route, which may encourage more regular engagement throughout different times of the day.



The glow from the LED lights at night reduces the monotony of the glazed facade by revealing to the outside the positioning of several rooms within the building and the stair cores positioned against the glass. This effect was tested using sketch models.

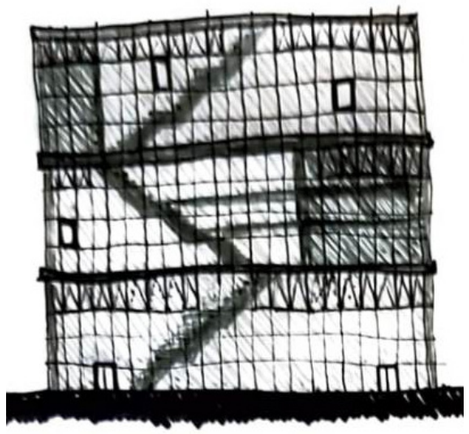
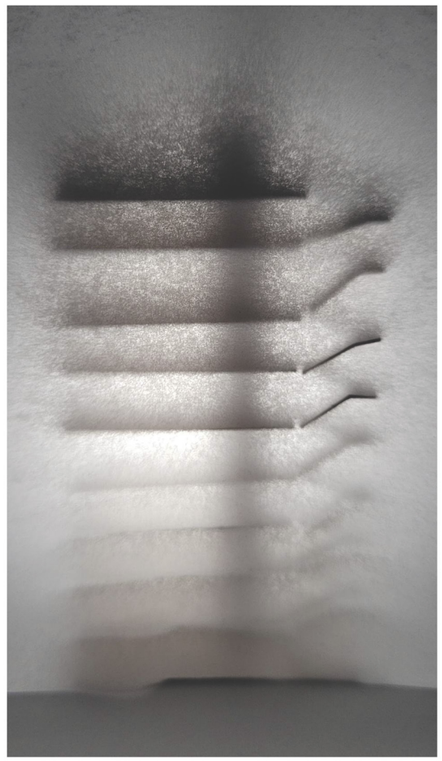
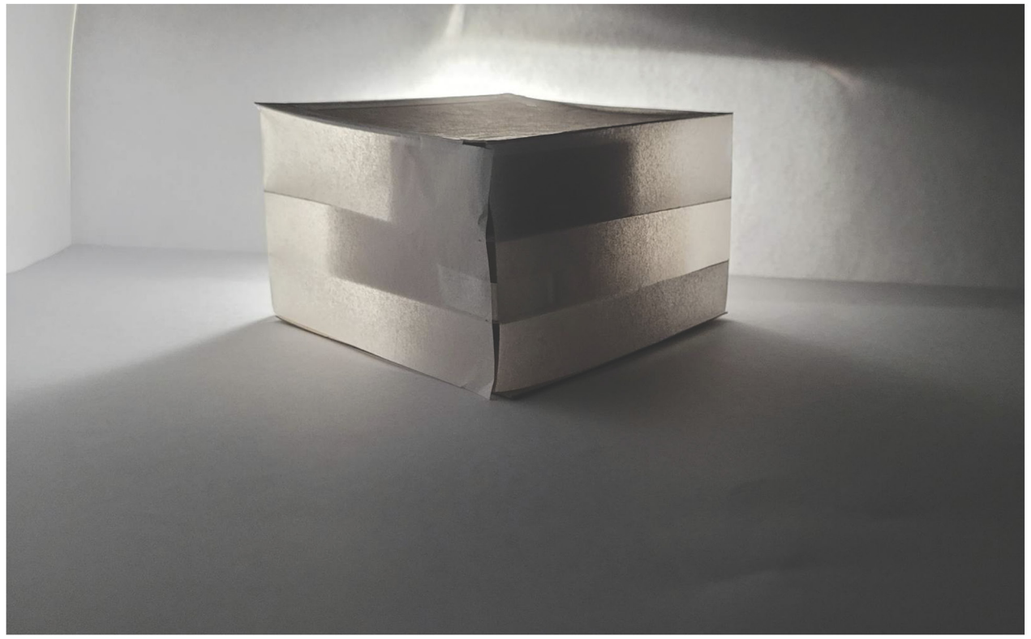
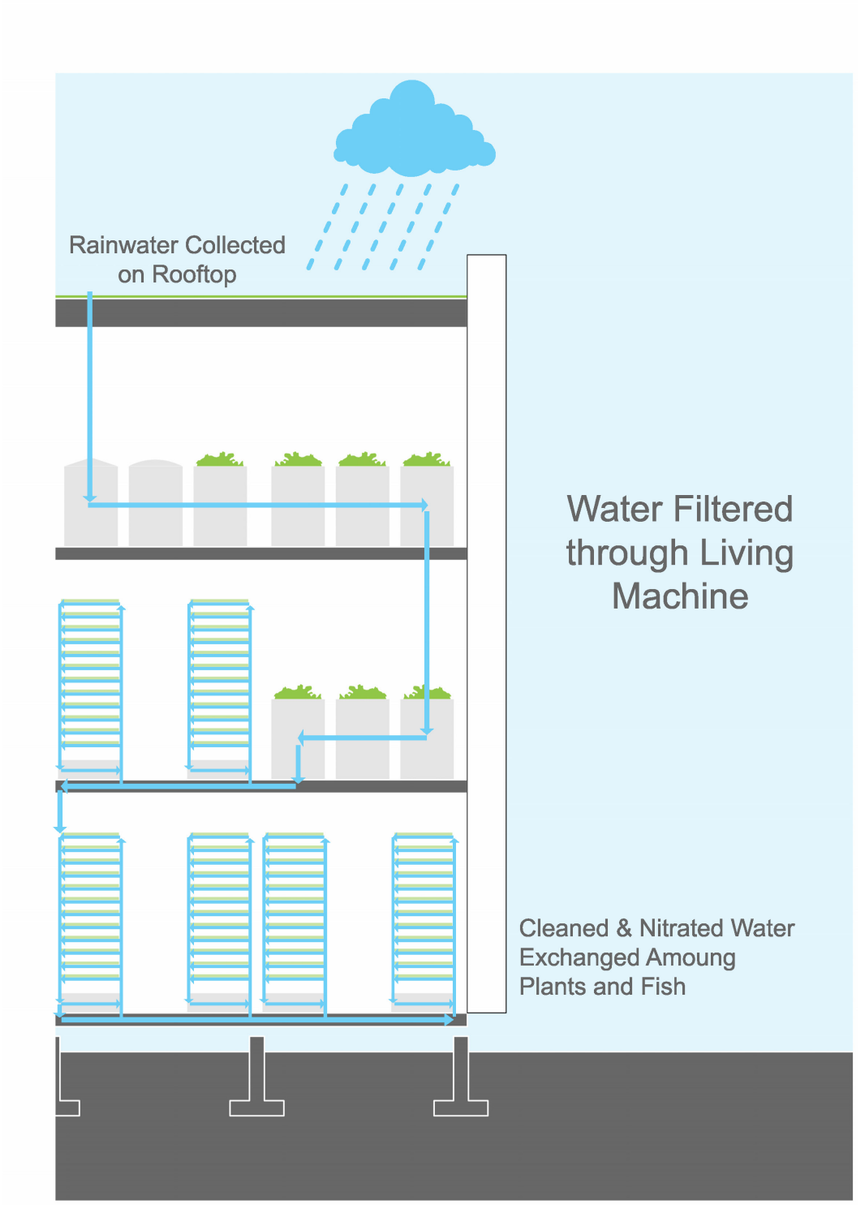


Figure 26 – Sketch of Glowing Facade





Rainwater is collected and used to provide water for aquaponic units. These units rotate regularly to allow all plants to capture sufficient sunlight. Their shelves can be rotated manually to allow trays to be removed and transported to the packaging area so they can be harvested and then replanted.



Detailed Section BB

Conclusion

To address the ecological and environmental issues of today, it is crucial that architecture is challenged to think of itself not in isolation, but instead as something composed of and nested within a collection of systems. These systems can vary to include, spatial arrangements sequenced to support the function of different spaces within the building, a process of waste management where the output from one service provides the input for another, or a wider connection through transport where it may feed into and benefit systems taking place within a scope larger than its physical dimensions. From the examples and research shown as well as the drawings, sketches and models included to articulate the built realisation of these concepts, this thesis offers the opportunity to create such a piece of architecture that can, in the words of The Harrison Studio (2010), “Within a context of symbiosis contribute to collective systems survival, sometimes with abundance”.

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