



# **Zinitown-the urban farm of Guangzhou**

Architectural adaptation strategies for urban agricultural production.

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To all the uncertainties , the fears, and all the efforts, in covid-19.

## Introduction

The abnormal urbanization in Guangzhou promotes the contradiction between agricultural land and real estate land, production land and commercial land. The encroachment of cultivated land causes farmers to flock to cities continuously, which leads to the increase of agricultural production cost because of the lack of labours. Yet demand for agricultural products in cities is growing. In order to ensure the production, merchants abuse pesticides to improve the quantities of agricultural products, resulting in a decline in the quality of food for urban residents. At the same time, high-rise buildings and dense buildings reduce the contact between urban residents and nature. In cities, there are fewer leisure facilities and green environment, and people are easy to feel anxiety.

This thesis is going to provide a strategy to improve the urban food production in Guangzhou, as a vertical farm in Zinitown.

The first chapter is going to explain the current developing problems in food production in Guangzhou, then to provide strategies to solve the agricultural production problems. Then it will give a hypothesis in the deserted building in Zinitown area, by rearranging the abandoned building. The cultivation room and the roof greenhouse with transparent lighting were planned. Through hydroponic and aquaponic system to achieve urban agricultural production.

By providing a solution as vertical farm in zinitown, because it's convenient geographic location and "no-pesticide" technique, it can reduce the circulation cost in the agricultural production process and improve the quality of agricultural products. At the same time, green plants can also turn the city's "reinforced concrete forest" into a real green and vibrant green forest. Meanwhile, the semi-public place in this project can provide a lot of leisure spaces to meet the leisure needs and daily activities places for urban residents. Furthermore, it can also provide a large number of job opportunities for the city, allowing migrant workers in the city to have the opportunity to engage in the industry they are familiar with.

## **CONTENT**

### **1. Guangzhou: the problems in urban development and agricultural production**

1.1. urban expansion	6
1.2.city heat island	7-8
1.3.decreasing of agricultural production	9
1.4.increasing food demands	10
1.5.decreasing in agricultural productions' human recourses	11

### **2. Guangzhou agriculture production: the advantages to having agriculture in the city**

2.1.social aspects	
2.2.economic outputs	14-15
2.3.environment benifits	16-17
	18-19

### **3. Guangzhou agriculture production: urban and architectural possible strategies**

3.1.construct with urban park and old communities	22-24
3.2.combine agriculture with urban village regeneration	25-28
3.3.integrate in abandoned industrial building	29-32
3.4.collaborate with real estate developer	33-34
3.5.reuse urban rooftop	36-37

### **4. Analysis of Zinitown**

4.1.Geography&Climate	40-43
4.2.Building history	44-46
4.3.Mobility	47-48
4.4.Functions	49-50
4.5.Greenery	51
4.6.Stakeholders	52
4.7.SWOT	53-54

4.8.Building B5	55-87
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### **5. Case study**

5.1.Sky Green	90-92
5.2.MEOD	93-95
5.3.Hydro-Urban	96-97
5.4.Sunqiao urban argriculture district	98-101

### **6. Hypothesis**

104-145

### **7. Conclusion**

149

### **8. Bibliography**

153-157

### **9. Acknowledgements**

161

*“Before 1900, With Beijing Road as the center, Guangzhou expanded in a concentric circle outward in a cluster shape. The land was highly concentrated, and the built-up area was generally limited to the area between Yuexiu Mountain and Zhujiang River Road, which is now the scope of Yuexiu District.”*

## **01|Guangzhou: the problems in urban development and agricultural production**

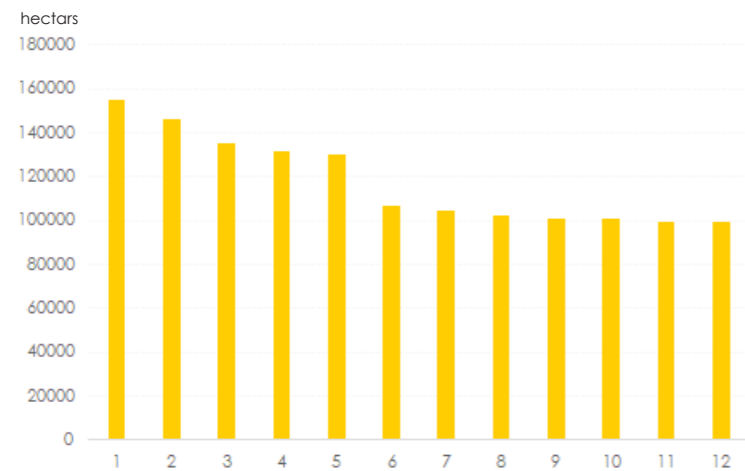
# 1. Guangzhou: the problems in urban development and agricultural production

## Introduction

In Guangzhou, the society with the majority of agricultural population has been transformed into an urban society with the majority of urban population. However, in the process of urbanization development, in order to promote the development of urbanization more quickly, the measures taken are often to increase the proportion of secondary and tertiary industries and reduce the proportion of agriculture in urban development. With the continuous development and expansion of the city, the malady of the abnormal urbanization, which emphasizes industry and commerce while neglects agriculture, is constantly emerging, bringing more and more problems to the city.

### 1.1 Urban Expansion

The overall trend of population density and building density is



**Figure 1**  
Annual change in cultivated area in Guangzhou(2001-2012)



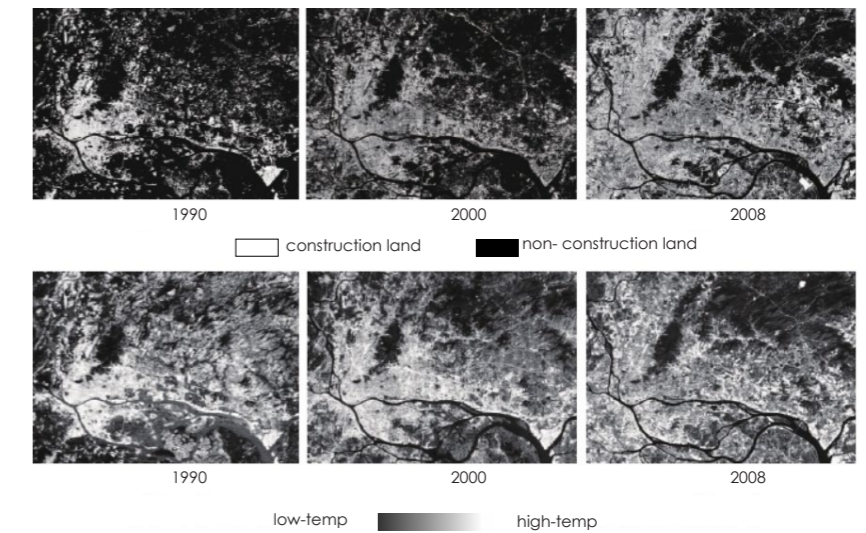
**Figure 2**  
Annual change in cultivated area /capita in Guangzhou(2001-2012)

from high density in the central area to middle and low density in the periphery (Zhou Suhong, 2005), Dense buildings lead to the decrease of urban green space and the per capita cultivated land area [figure 1][figure 2], The per capita cultivated land area of the city is 0.4 mu, which is far lower than the national average and less than half of 0.8 mu as stipulated by FAO. At the same time, cultivated land not only plays the role of providing agricultural and sideline product production, but also plays the role of providing industrial land for urban building expansion. Therefore, the contradiction of land use is very prominent.

### 1.2 City heat island

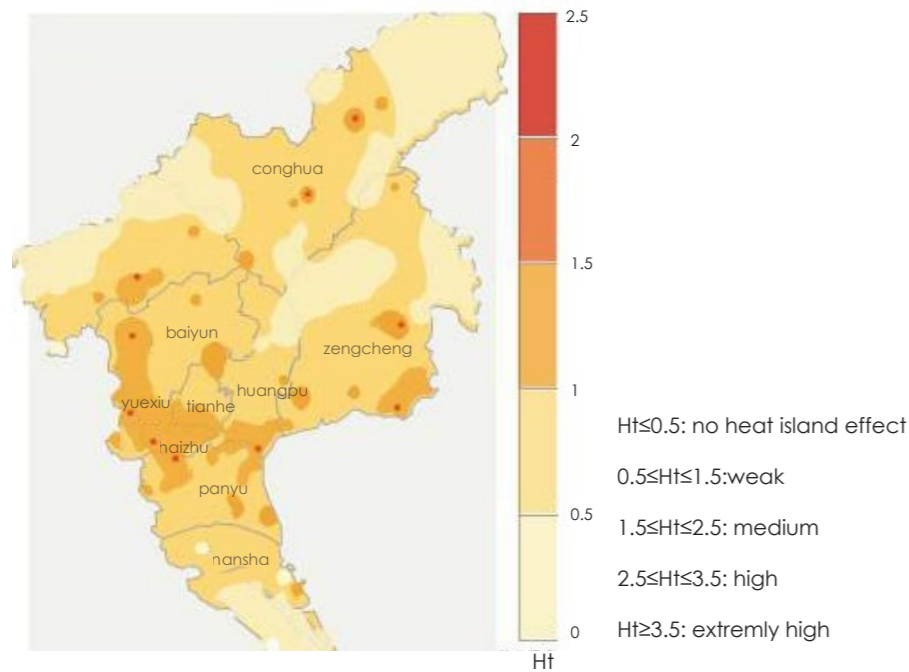
More than half of the world's population lives in urban areas and it is expected that the percentage will continue to rise (World Health Organization, 2014). Heightened temperatures within urban areas compared to the surrounding rural areas, known as the urban heat island (UHI) effect, have been well-documented (Alcoforado & Matzarakis, 2010) and are experienced in cities around the world. The reasons that urban areas are warmer than rural areas are well understood. Due to tall buildings increasing surface area; more of the solar radiation is stored as sensible heat due to higher thermal admittance of hard surfaces; less terrestrial, or long-wave, radiation is lost due to restricted sky view factor; there is less evapotranspiration from soil, plants, and open water as these are replaced by hard

**Figure 3**  
Distribution map of building land and surface temperature in 1990/2000/2008.



surfaces; there is less wind at ground level meaning the heated air does not dissipate as quickly, and; there is anthropogenic heat exhausted from buildings, automobiles, and other sources (Oke, 1987). Hence with the passing of time and the expansion of the city, as well as the expansion of the built-up area of Guangzhou, the scope of the heat island is gradually enlarged, and the spatial change of the heat island region is basically consistent with the spatial expansion of the built-up area. While the areas with severe urban heat island phenomenon are mainly concentrated in urban high-density

residential areas, commercial centers and industrial areas. From 1990 to 2000, the construction of urban green space system in Guangzhou was imperfect, especially most of those new parks were mainly just covered by grassland(Chen Chaohui,2002). Meanwhile,the area of high temperature and extra-high in the built area in 2000 accounted for 42.6%. Therefore, during this period, the urban heat island effect in Guangzhou was mainly show an increase trend(Fan Yapeng,2014)[figure 3].In addition, it has a high dense built area in old district with highly centralizes business area in Guangzhou, extremely it has narrow street and poor ventilation situation in the city(Zhou Suhong,2005).



**Figure 4**  
Distribution of average heat island intensity in Guangzhou in 2019.

Till now, according to the 2019 urban heat island monitoring data, 8.1% of the regional heat island intensity in Guangzhou reaches the moderate level, 51.4% of the regional intensity is weak, and 40.5% of the regional intensity is none[Figure 4].During recent years, many studies have been conducted in order to explore the role of green areas in moderating the urban climate. the most fundamental one is evapotranspiration which means losing water from a plant in the form of vapor into atmosphere. This process consumes solar energy and increases latent heat more than sensible one. Leaves cool through evapotranspiration and therefore the temperature of the air surrounding leaves reduces.In an ideal situation, evapotranspiration could affect the cooling process significantly and cool the air temperature around green spaces by 2-8 degree in comparison to surrounding areas (Taha,H.1998).

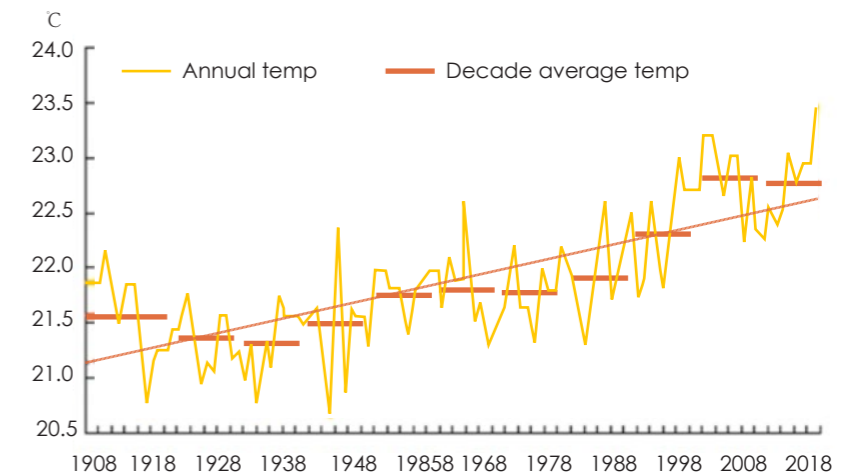
So urban agriculture can play an important role in city in not only can bring more greens to the city to beautify the city environment, but also the vegetation can adjust the micro climate and help to reduce urban heat island in some degree.

### 1.3 Decreasing of agricultural production

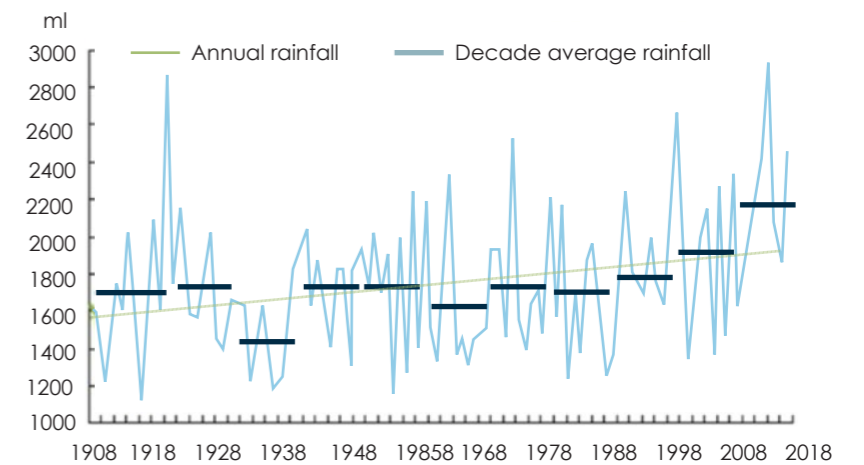
According to a new report by the World Meteorological Organization (WMO), 2019 was the second warmest year on record for global temperatures, is the second only to 2016. China had seven consecutive warm winters from 2013. Under such a big climate background, the climate of Guangzhou in recent years also presents the characteristics of "high temperature, much rainfall and heavy meteorological disasters".

From the graphic[Figure 5],it shows the trend characteristics of "the number of high temperature days surges, the highest temperature repeatedly sets new highs, the duration of high temperature increases, the first day of high temperature is advanced, and the

**Figure 5**  
Yearly temperature chart from 1908-2018



**Figure 6**  
Yearly rainfall chart from 1908-2018

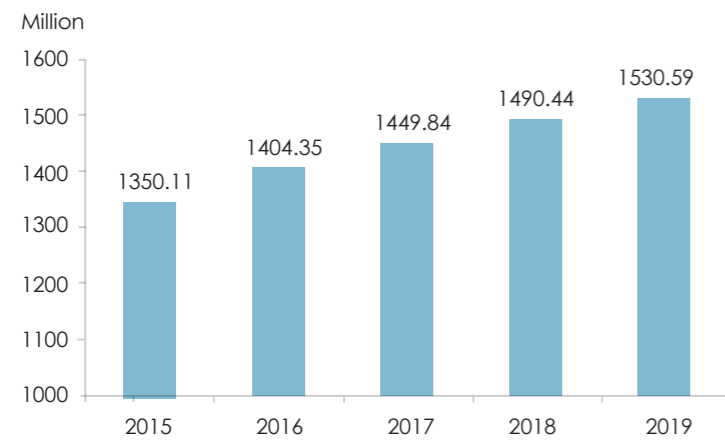


whole day is delayed" in Guangzhou in 2 decades .In the past century, the rainfall in Guangzhou [Figure 6] has increased at a rate of 32.2 mm / 10 years, which means that the annual rainfall now is more than 300 mm higher than that at the beginning of the 20th century. The average annual rainfall in Guangzhou in the recent ten years has reached 2193.8 mm, which is the period with the highest rainfall. The frequency, intensity and influence of urban waterlogging disaster in Guangzhou are increasingly aggravated due to the increase of

short-time heavy rainfall events and the change of urban underlying surface. Typhoon, rainstorm and flood, strong convection, lightning strike, high temperature and other meteorological disasters occur frequently in recent ten years, which cause social influence and huge economic loss to Guangzhou. However, as population growth and the negative impacts of climate change on vegetation continue to increase, the capacity of land to cope with climate change is limited.

#### 1.4 Increasing the demand of food

Guangzhou is China's third largest city and the largest city in southern China. It is also the third most populous city in China. By the end of 2019, Guangzhou had a permanent population of 15.3059 million [Figure 7]. with an urbanization rate of 86.46%. At the end of the year, 9.5372 million people had registered permanent residence, accounting for 79.90% of China's urbanization rate.



**Figure 7**  
Permanent residence in  
Guangzhou (2015-2019)

At the same time, Guangzhou is also one of the cities with high population density in China, with a growing number of people moving into the city so as to a growing demand for grain. Today, the agricultural bases of Guangzhou are mainly distributed in the suburbs of Baiyun District, Panyu District, Huadu District, Zengcheng District and Conghua District. The densely populated areas are commercial areas with tall buildings in Tianhe District and Haizhu District. Vertical farming is a potential solution to food shortages in those low-dense areas, to ease transportation pressures and improve energy efficiency.

#### 1.5 Decreasing in agricultural productions' human resources

As a big city, Guangzhou has a large number of non-local people pouring into Guangzhou to work. In 2008, migrant workers accounted for 40 percent of Guangzhou's population. Agricultural labor costs are relatively high, and secondary and tertiary industries are relatively developed. Many farmers are no longer willing to engage in agricultural work. The main reason that many migrant workers move to cities is that they don't want to do the tiring and uneconomic work of agriculture any more. At present, few young adults in the suburbs of Guangzhou are willing to carry on the agricultural business of their parents. Therefore, the lack of human resources is also a major problem facing the development of urban agriculture in Guangzhou.

**Figure 8**  
The images of Migrant  
workers and farmer.





*"Urban farming can also raise awareness of environmental issues and urban sustainability in the general population".*

*(Lanarc & Golder, 2013)*

**02|Guangzhou agriculture production: the advantages to having agriculture in the city**

## 2. Guangzhou agriculture production: the advantages to having agriculture in the city

### 2.1 Social aspects

Urban agriculture can foster community engagement across socio-economic sub-groups. A study from the University of California showed that the presence of green space promotes interpersonal interaction and breaks down barriers between individuals within neighborhoods (Golden, 2013). A resort-like community built on Landfill- battery park(NYC) ,It has grown during its 50-year history into a vibrant community. "We are investing in diverse programming to make the community welcoming to everyone."said by an investor."it seems like everyone knows here".

Urban farming can facilitate community engagement in environmental projects, which increases awareness of green spaces with-



**Figure 9**

Kids in community garden

in a city. Green space awareness can create "networked movements increasing activism and engagement of citizens" (Golden, 2013). Therefore, urban agriculture can build interpersonal connections based on shared goals and promote advocacy for the preservation of important urban green spaces. Urban farming can also serve as a tool for the education of urban youth (USDA, 2017).

Urban farming can prioritize serving local food in cafeterias and provides educational programs in agriculture, food systems, health, and nutrition. These efforts are often successful as in the United States "63 percent of school districts with farm to school programs completed at least three farm-to-school related activities" (USDA, 2017).

The educational benefits of urban agriculture are not limited to



**Figure 10**

community garden visiting

youth. Urban farming can also raise awareness of environmental issues and urban sustainability in the general population. Some urban farms will host programs and events for the general public that incorporate local chefs, foods, and other farming organizations (Lanarc & Golder, 2013).

Another advantage of urban farms is the job opportunities they provide in cities (Cicekli & Barlas, 2014; Despommier, 2010, 2011, 2013; Miller, 2011) as limited job vacancies is a serious issue in many big cities. Not only are direct jobs involved in the vertical farm provided, but indirect job opportunities are provided as well. The main jobs involve working on these farms making, protecting and managing the entire farm structure (Besthorn, 2013).

In this profitable project, the migrants can get benefits from the vertical farm to get more job opportunities.

## 2.2 Economic outputs

For local food, it is very efficient since food materials produced locally need not be transported to their destination (Despommier, 2009; Ellingsen & Despommier, 2008). Foods usually have to be transported long distances before they are consumed. In urban agriculture, large amounts of food are produced at a low cost of fuel or transportation. The cost is so low that it overshadows the real environmental and social benefits of it. This is accompanied by continuous production which breaks the price shock in the international crop market (Germer et al., 2011).

Urban farming can promote economic development and tourism. It will attract businesses and residents and are catalysts for business development and promotion of city life. Food markets and price paid for such products can affect the size and nature of food products. People can have easy access to get more nutritious, healthy with a relatively high price comparing with the



**Figure 11**

Image of Zinitown.

vegetables from other province, hence those characteristics can influence customer to buy it.

As argued by Despommier (2009), in every city there are numerous appropriate sites for such projects and if used effectively, they can return and circulate a lot of money back into the city (Despommier, 2009). We believe that though it seems very trivial, evaluating all the conditions on every level is required, so as to thoroughly assess all the possibilities when deciding upon establishing a vertical farm (Voss, 2013).

Guangzhou is a city who has a perfect geographic location where it is in a confluence area with an extremely convenient water transportation, leading to a rapid development of the industrial started from 1840s. therefore, a large amount of industrial buildings started from then were built with various architectural styles and different functions, and it is most located in the

city and has a very high accessibility, till now, most of them were abandoned and left empty. Urban agriculture can be a business opportunity to promote the regeneration of the industrial buildings to form a close economic loop in the city between the production



### 2.3 Environment benefits

Outside of simply lowering CO<sub>2</sub> levels, urban agriculture projects provide many benefits. Urban farming helps to improve air quality, mitigate runoff, and regulate temperature in urban areas (Grard *et al.*, 2018). Additionally, Urban Farming provides stormwater mitigation through absorption into the agricultural plot itself as well as capture for irrigation. For example, in Philadelphia, it is estimated that a 1,000 square foot rooftop garden will mitigate approximately 22,500 gallons of water per year (Heather, 2012). Producing food is not the only application of vertical farms, but it can also help in recycling the city's water supplies (Ellingsen & Despommier, 2008; Lam, 2007). As part of an initiative plan suggested by Despommier (2010), instead of releasing wastewater into rivers, it can be used for VF irrigation, where the wastewater is purified and recycled and water drainage will not be necessary. So, the gray or black water can be purified in vertical farms and converted to drinkable water through evapotranspiration (Banerjee & Adenaer, 2014; Besthorn, 2013; Cicekli & Barlas, 2014; Despommier, 2009, 2010; Sauerborn, 2011; Thomaier *et al.*, 2015; Voss, 2013). Moreover, the advantage of vertical farming is that it has the ability to reduce the threat of these infectious diseases since it does not



use fecal matter as a fertilizer like in conventional agricultural techniques (Despommier, 2010; Ellingsen & Despommier, 2008). Therefore, it helps to stop the transmission of such harmful infectious diseases. In environments polluted with fecal matter, many viral or bacterial diseases can potentially endanger the lives of 2 billion people. However, this is mostly avoided by implementing VF (Despommier, 2011, 2013; Graff, 2009). Undoubtedly, urban agriculture can bring the city green and help mitigate the micro climate by their evaporations and water reuse.

**Figure 12**

Image of roof planting.



*"Weeding a garden is particularly effective in stress relief and provides mental health benefits to participants. Learning about the way plants grow and the best conditions to help them thrive can provide the mental and intellectual stimulation of cultivating a new skill."*

### **03 | Guangzhou agriculture production: urban and architectural possible strategies**

### 3. Guangzhou agriculture production: urban and architectural possible strategies

#### 3.1 Construct with urban parks and old communities

Nowadays, most of the existing urban parks in Guangzhou are plane which require a large area of urban land resources, at the same time, the parks and green spaces are mainly for leisure. The final result is that, driven by economic interests, urban park land is constantly encroached upon by urban construction. (Chen Xuming, 2014) Hence, some small parts of the public city parks can be converted into communal place as a community garden. The people working in the garden benefit from exercise and sunshine, as well as the therapeutic benefits of working in a garden. Weeding a garden is particularly effective in stress relief and



**Figure 13**

Image of old communities in Guangzhou

provides mental health benefits to participants. Learning about the way plants grow and the best conditions to help them thrive can provide the mental and intellectual stimulation of cultivating a new skill. Also, a community garden can change the culture of a neighborhood by providing a shared interest and activity that brings people together. Meanwhile, some residential buildings in the old center district of the city Guangzhou are facing the difficulties of lacking communal spaces for neighborhood, people occupied the communal places as private garden or covers the spaces as private usages then starting commercial activities. Fortunately, the government is transforming those old communities now and that can be an opportunity to bring in the idea of “community garden” to give people awareness of communal spaces and how should they take advantages of them properly. A newly built community garden case is in Shanghai in 2017, China. As a community garden, is long and narrow which covers about 100m<sup>2</sup> interior space (transformed from a container) and 290m<sup>2</sup>

public space. In the whole garden, it has different zones for services, public activities, vegetations and interactive gardening area. The garden targeted to different groups of people and it covers rain water collection, composting, small greenhouse and a sustainable energy circulation system. The community garden will hold different activities whether online or offline, for kids, parents, and elderly, which build a emotional tie among the neighborhood for enjoying the happiness of being in a huge family. Social ties are important to the

**Figure 14**

Community garden in Shanghai



wellbeing of people in a community since they can bring positive health effects and community involvement. Community gardens allow for the creation of social ties and build a greater feeling of community. These connections help reduce crime, empower residents and allow residents to feel safe in their neighborhoods.

#### • Dilemmas

Until now, Guangzhou has experienced three periods of transformation of old communities, namely 2007-2015 (slow advancement stage), 2016-2018 (pilot stage), and 2019 to present (acceleration stage).

#### i. Residents have low willingness to invest

In the transformation of old communities, all funds are allocated

according to a certain proportion, which are shared by the government, residents, and other channels. However, judging from the current progress, the willingness of residents to contribute is very low, because many communities were built in the period of welfare housing allocation. Residents generally believe that enterprises should make capital contributions, and it is difficult to change their perceptions in the short term.

### ii. The enthusiasm of social capital is also insufficient

At the same time, the enthusiasm of social capital is also insufficient, because the transformed community is not allowed to have commercial activities outside, and residents have not formed the habit of paying property management fees for a long time, resulting in very low management profits. moreover, the floor area ratio of the entire site cannot be changed, so companies cannot cover the cost of investment by building commercial housing.

### iii. The government is under great financial pressure

Under the situation of the 2020 epidemic, the government needs to stabilize economic development and promote employment. However, the epidemic has led to an economic downturn, tax cuts and fee reductions, resulting in a reduction in overall fiscal revenue. [Figure 15]The government cannot meet the huge amount of funds for transformation demand just by themselves.

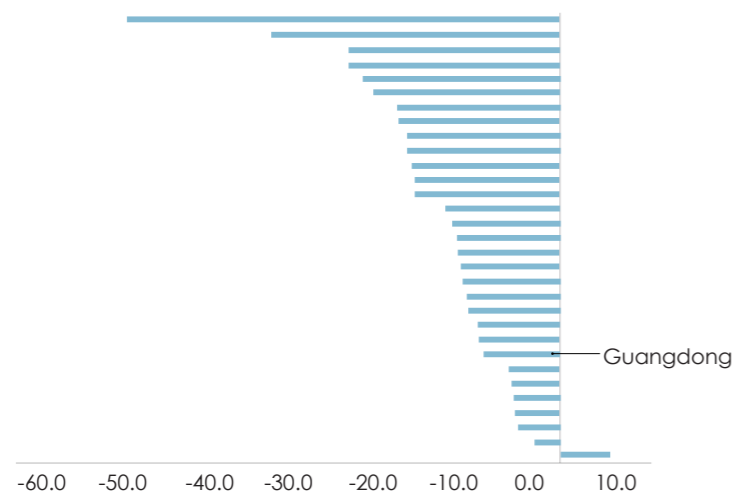


Figure 15

Public revenue growth(2020)

Therefore, the renovation of the old community faces a huge funding gap, so that the progress of the renovation is slow and the effect is not as good as expected.

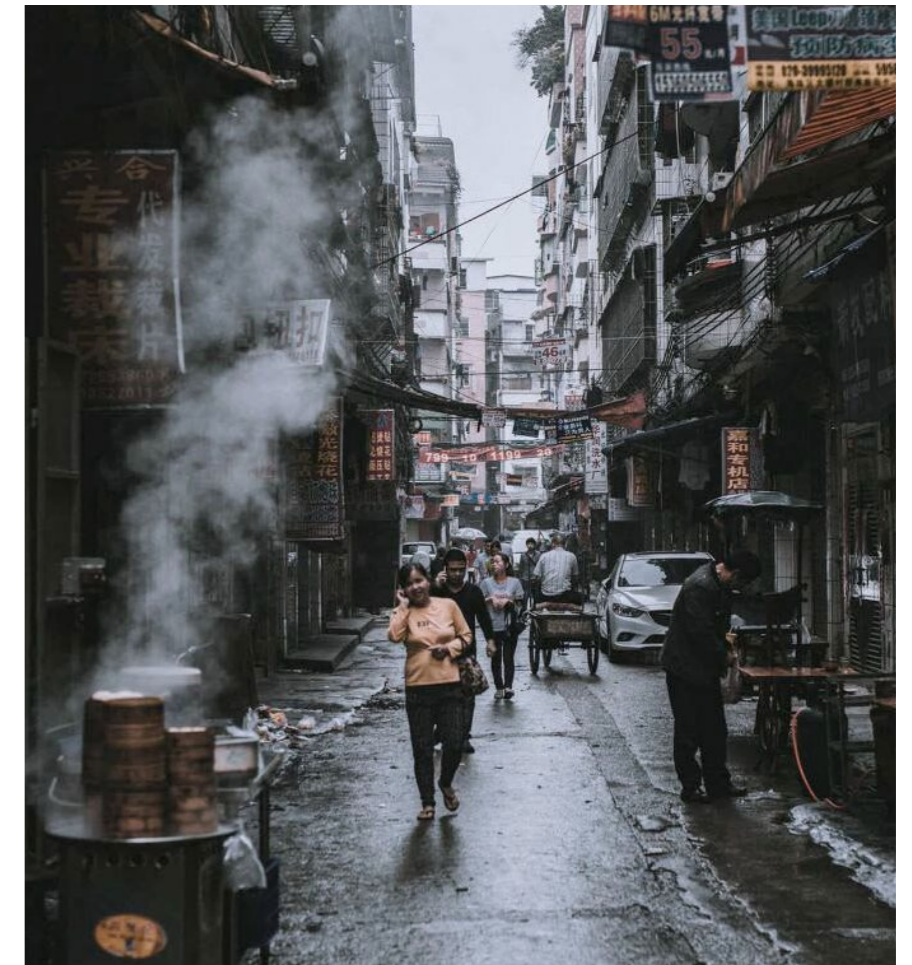
## 3.2 Combine agriculture with urban village regeneration

Urban village refers to "due to the rapid expansion demand of the city, the original village is surrounded by the modern city, resulting in a low-rise and high-density rural community with relatively chaotic space(Liu Shineng,2014).At present, there is no universally recognized data of villages within the city, but generally speaking, villages within the city refers to special urban communities that still retain the form, history, culture, lifestyle, interpersonal network, organizational system and management mode of rural communities within the built urban areas (Li Tie,2017). Urban village is a special regional spatial phenomenon derived from the transformation of China's social and economic development and the process of urbanization. It is a "gray society outside the system" outside the city-type subject society(Huang Lijun,2011). There are many definitions of village in the city, but they are basically inseparable from "city" and "country". The situation is even more pronounced in some develop-

-d regions(Sun Li,2013) .There are 139 "urban villages" in the urban area of Guangzhou, which are distributed in 5 old urban areas, namely Tianhe District (28), Haizhu District (20), Dao Baiyun District (58), Fangcun District (17), and Huangpu District (16).

Figure 16

city village in Guangzhou



By the end of 2003, there were more than 300,000 permanent residents in "urban villages", and the total population exceeded 1 million with the addition of temporary residents. Due to the dual urban and rural systems of land, household registration, population, and administrative management, the existing urban villages are not really included in the unified planning, construction and management of the city. Its development facing a great spontaneity, especially in the mode of production, lifestyle, landscape construction and community organization. at the same time, it retains some characteristics from rural which are



**Figure 17**  
city village in Guangzhou

obviously different from the city. (Liu Shexin, 2002) On September 28, 2020. The Information Office of Guangzhou Municipal Government held a press conference on deepening urban renewal and promoting high-quality development in Guangzhou. The conference made it clear that in the next three years, 83 urban villages in Guangzhou will be renovated, 183 urban villages will be renovated within five years, and 400 urban villages will be renovated within 10 years. Hence, the urban agriculture can be integrated into the practice of regeneration of city urban village, on the one hand, it can help the community have a better living conditions in terms of the beautification by the green, on the other hand, it also can provide a concept of being in a better environment, where the productions can be sold out in the neighborhood with a reasonable price and fresh taste.

• Dilemmas

**i. The capital requirements for the transformation are high**

"According to data from the Guangzhou Municipal Bureau of Land Resources and Housing Management, there are 138 'urban villages' in Guangzhou, while the urban planning development zone covers 385 square kilometers, and the area of urban villages is 20.9% of the urban planning development zone. These "villages in cities" will need to be invested at least 200 billion yuan according to the estimates of professionals."

The risks in the reconstruction of urban villages lie in the two links of cooperation between funds and developers. The demolition and compensation costs of urban villages are huge expenses, including the cost of demolishing old houses, temporary resettlement costs, and so on. The high cost of demolition and resettlement, huge investment, large resettlement area for relocation, and small saleable area lead to small returns, resulting in developers reluctant to get involved in the transformation of urban villages. (Zeng Xuelong, 2011)

**Figure 18**  
city village in Guangzhou



**ii. Different types of villages in cities have large differences in the willingness of villagers to transform**

Some mature urban villages that are in the prosperous urban areas and have been completely surrounded by cities, and whose residents have moved to residential quarters to live in, the villagers have a strong desire to renovate, hoping to rebuild the old villages to increase the value of their original houses. In some growing urban villages, the village committee and villagers are more resistant to the interviews.



Through the interviews, it is understood that these villagers have a large amount of rental houses and can obtain substantial rental income. They are worried that the renovation will harm their interests and the willingness to rebuild is very low. In some rapidly urbanizing urban villages, the villagers are worried about the uncertainty of the future. They are afraid that the renovation will make them lose their last source of livelihood. They are very resistant to the renovation and have low trust in the village committee and the government. (Huang Lijun, 2017)

### iii. Unstable income of villagers involves re-employment issues

Due to various reasons, especially the urban villages in the center of the city, there is basically no agricultural production, and they are mainly engaged in the secondary and tertiary industries. House rental and dividends have become the main source of income for the villagers, and the suburban urban villages also have a large number of factories and houses for rent. , Rent and dividend income are relatively stable. If the reformed villagers lose the economic foundation they depend on for survival, they will be at a loss. The commerce and trade industry and rental houses bring income to the villagers. The villagers are as good as the status quo. It is more difficult to change and upgrade the village collective industry in the transformation of urban villages. The huge industrial chain not only provides jobs for a large number of migrants, but also brings income to the villagers and reduces the burden on the government. (Zeng Xuelong, 2011)



**Figure 19**  
the transformed "red-brick" factory

### 3.3 Integrate in abandoned industrial building

Guangzhou, located in the south part of mainland China, has a unique geographical condition. It is at the confluence area of three rivers where the water network extends in every direction, and leading to a very superior conditions of water transport. The superior water system provided necessary conditions of Guangzhou as a river port and seaport city, so to provided conditions for industrial transportation. There still remain industrial architectural heritages of different USES in Guangzhou, such as factory buildings, warehouses, office buildings, supporting service buildings, industrial and commercial service buildings, supporting ancillary buildings, former residences of celebrities, municipal buildings and industrial structures. They have various architectural styles, the architectural heritage is not only the epitome of China's industry, but also an important witness of the entire history of China's industry. (Cao Xing, 2017)



**Figure 20**  
the transformed "red-brick" factory

At present, the old industrial buildings in Guangzhou are mainly distributed in Xicun, Baiyitan, Yuancun and Huangpu district/[Figure 22]. For the industrial buildings, the materials' life span of itself is always longer than its function life, besides, the structure is solid, also the internal space is as high as spacious so has the flexibility of use, as result, the possibilities of transformation and utilization is quite large(Lin Yi,2010).while under the guidance of the policy in Guangzhou, most of the industrial buildings in those four areas have been transformed into commercial oriented spaces, business complex, creative industries or incubator centers.

They changed the functions and spaces or added extra buildings to make those abandoned area livable again. Therefore, urban agriculture also can be considered into the transformation of industrial buildings, on the one hand, it has a very high accessibility in terms of the location of the city itself, then the general public are being aware of the new things after transforming, since there's always a group of people continue exploring fresh and newly experience in the city.in this way, they buildings is not only provide a spaces to grow, but also an area for experiencing.



**Figure 21**  
Abandoned industrial buildings distribution



• **Advantages**

**i. Short development period**

One of the main advantages of refurbishing a building ahead of a total new build is that in most cases, new accommodation is available in a much shorter period of time. It is believed that in most cases the time which is spent on a refurbishment job (including pre contract planning and planning permission) is only a half to three quarters of the time which is needed to complete a demolish and new build construction. Because of the time saved on the refurbishment of the structure there are financial rewards such as; the shorter development period reduces the cost of financing the scheme and also the client receives the building sooner which he in turn receives revenue sooner from renting etc (Highfield,2000).

**ii.environmental impacts**

Whenever a building is recycled, by opting for refurbishment rather than demolishing and rebuilding the structure then a large amount of energy is being saved by avoiding the need to extract raw materials and convert them into a replacement building. Smaller scale refurbishment, for example; when the existing structure and the external building envelope are retained, will clearly yield the greatest energy savings, but even the more drastic renovations, where larger scale refurbishment takes place involving the structural aspects and the refurbishing of the outer leaf will mostly use up considerably less energy resources than the choice to demolish and rebuild(Highfield,2000). Even though this may only seem like a very small saving of energy compared to the overall consumption of energy, if a lot of projects are refurbished instead of being demolished and rebuilt then a lot of energy could be saved.

**iii. Aesthetic/ Architectural advantages**

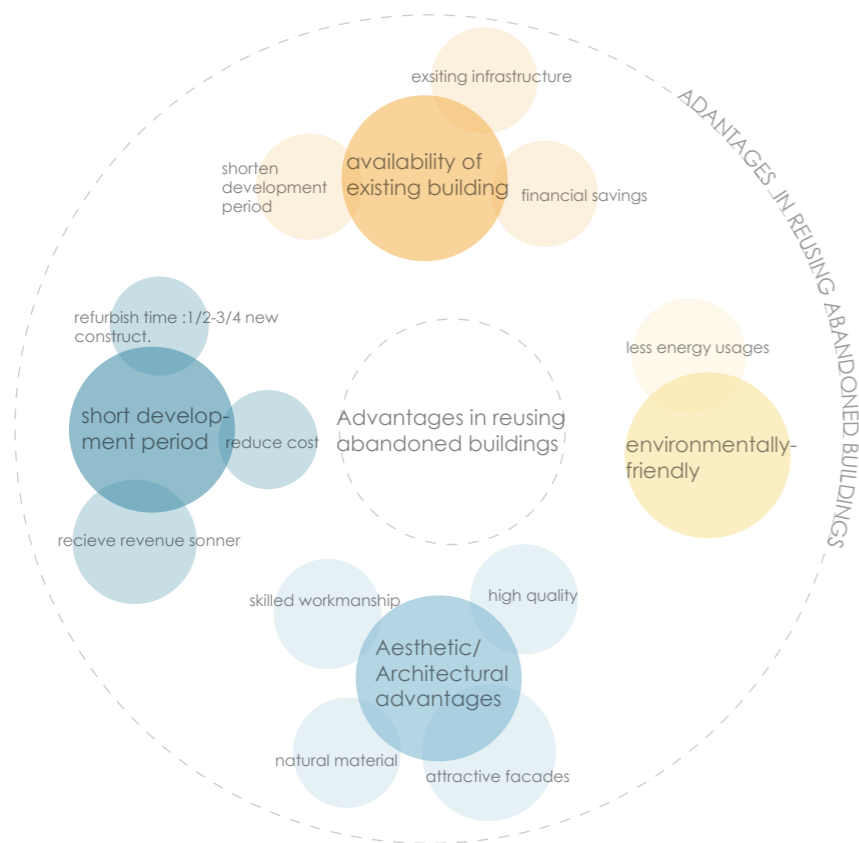
Another advantage of choosing a renovation project is the aesthetic and architectural advantages that can be obtained if attractive older buildings are chosen to refurbish. The reason for this is because a lot of older houses and buildings were constructed with highly expensive materials, natural materials, high quality and skilled workmanship. All of these factors contribute to a very attractive façade to the exterior and interior of the building. An example of the architectural quality that an older building has is when you see an old house, with the outer leaf of the house being constructed using cut limestone (Highfield,2000).

**iv. availability of existing building**

When a refurbishment project is being carried out, the contractors can, in a lot of cases, use the existing infrastructures, which are in place, such as:

1. Water services.
2. Electricity.
3. Gas mains.
4. Waste water connection.
5. Cables and telecommunication.

These infrastructures would not be available if for example a new build was chosen on a green field site. The availability of these infrastructures can prove to be very beneficial financially to the client as there is no need for the services, which are aforementioned above to be installed. Other than the direct financial savings that are being achieved, there are indirect savings to be achieved such as, the development period being further shortened because of the infrastructure already being in place whereas this time saving would not be available if no infrastructure was in place.

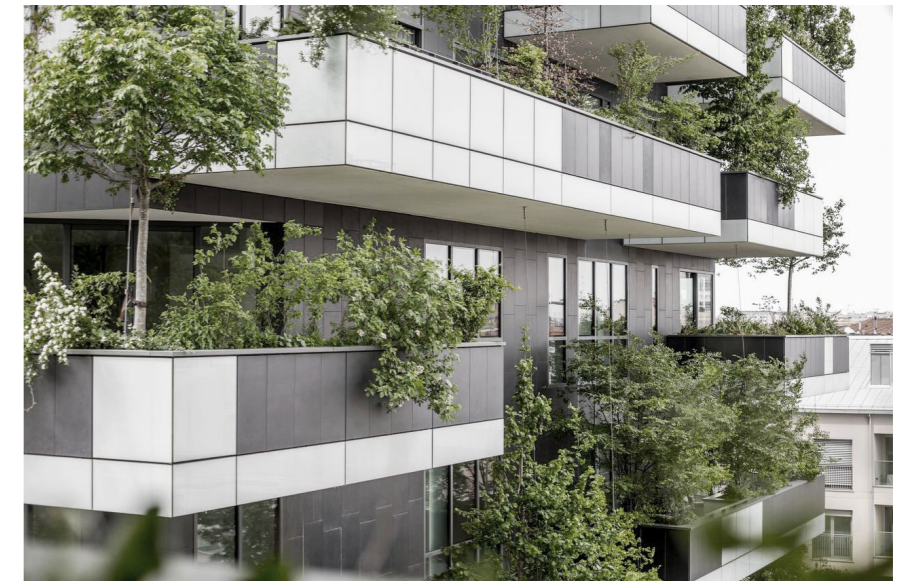


**Figure 22**  
advantages in reusing  
abandoned buildings

### 3.4 Collaborate with real estate developer

Song Weiping, founder of Greentown Group and co-chairman of the Greentown China Board of Directors: My opinion is that 80% of small towns in China must be agricultural towns. It is very necessary to scientifically transform rural areas through small towns. In the process of building a small town, the content carried in the urban civilization is used to penetrate and transform the countryside. The industrial model should be 20% real estate + 40% agriculture + 40% others. Taking the agricultural base in Shengzhou as an example, Shijia'ao Village has a population of more than 1,200. Today, Blue City Agriculture Company has employed more than 260 "agricultural workers" locally. The future economic ecology is like this: the people in the city buy farms and sign long-term leases of cultivated land. It can be planted by itself, or partly or completely entrusted to Lancheng for planting, or even sold to Lancheng Agriculture. In the process of real estate development, small plots of planting land can be reserved in the public areas of the floors or in the condominiums, and sub-leased to residents to grow vegetables and fruits that

**Figure 23**  
Bosco Verticale



are easy to manage and conducive to survival. It can be managed by citizens independently or by entrusting specialized personnel. The harvested agricultural products can be provided for their own consumption, or they can be exchanged or sold. Allow citizens to experience the agricultural lifestyle at their doorsteps, achieve relaxation, leisure and entertainment, and obtain fresh, pollution-free green products. (Chen Xuming, 2002)

- Dilemmas

- i. Extreme weather conditions

In tropical and subtropical regions, especially provinces such as Guangdong and Hainan, experiencing climate change, extreme weather increases every year, such as typhoons, floods, and heavy rains. The survival rate of plants in parasites is extremely low in these mutations.



**Figure 24**

images of after typhoon in Guangzhou



- ii. High construction and maintain cost

Vertical farming puts forward higher requirements for the load-bearing and wind load capacity of the building structure. Once it becomes an outdoor garden, the load of the ordinary building floor will be added to the soil layer and the moisture content, and additional concrete needs to be added to improve the floor's performance. For load-bearing capacity, the cost must be increased by at least 50% or even doubled. And when the thickness of the soil layer for planting green plants is thick enough to meet the structural requirements, its root system is also likely to have a significant impact on the building, such as wall cracks and floor damage. When choosing green varieties with a high survival rate, a series of stringent requirements and economic inputs will be involved in the planting process, such as the maintenance and management of greening.

### 3.5 Reuse urban rooftop

Guangzhou has a subtropical maritime monsoon climate, with long summers and short winters, warm and rainy all year round, and is known as the "flower city" with evergreen flowers throughout the year. The climate is suitable for plant growth and fruit tree resources are very rich. With the economic development, the heat island effect in Guangzhou is very obvious. Especially in summer, citizens living in high-rise buildings will find it difficult to leave the air conditioning. Green roofs are ideal storm-water management tools. They utilize an unused spatial resource and keep the water at its source. The same is true for urban roof farms (with surface growing beds). They offer the same water management benefits and additionally the opportunity to cultivate produce in places where no open space or vacant lots for ground base growing are available. Green roofs and rooftop farms retain water during rainfall events, delay its runoff, and increase the volume of water returned to the atmosphere

**Figure 25**

rooftop bar in Guangzhou



directly through evapotranspiration. Meanwhile, the solar energy gain on a green roof can be reduced by up to 87% compared with non-shaded buildings surface (Wong, N.H.2003). The reduced heat transfer into the building results in improved building performance and energy savings. This is especially evident during warm summer month and lowers the energy demands for the building cooling system (Oberndorfer, E.2007). On an urban scale, the summer cooling of green roofs and rooftop farms contributes also to the mitigation of the urban heat island effect. Metropolitan areas, through their lack vegetation and agglomeration of dark impervious surfaces, are significantly warmer than their surrounding rural areas, especially at night. The air temperature above vegetated roofs can be up to 30°C lower compared to conventional roofs, resulting in up to 15% of annual energy consumption savings (Getter, K.L. and Rowe, B. 2006).

## • Dilemmas

### i. Lack of special laws and regulations

Due to the lack of clear laws and regulations in Guangzhou, many rooftop greening projects appear pale and weak when implemented, and it is difficult to move at the touch of a little interest of the developer or the owner, which makes it difficult for the rooftop greening industry to be timely and effective in Guangzhou and even Guangdong. Widely implemented. But I believe that with the implementation of the national environmental protection undertakings and the demonstration effect of the roof greening industry in other central cities, I believe that in the future, Guangzhou will also be equipped with relevant laws and regulations to encourage the development of the roof greening market.



**Figure 26**

urban rooftop in Guangzhou

### ii. Blurred property rights of roof greening

The top-level owners do roof greening, and the ownership of property rights has always been a topic of controversy. The unclear roof property rights will directly lead to the difficulties of the roof greening business. As the policies and laws on the right to use roofs have not been implemented in practice, neither real estate developers nor floor users can show their enthusiasm for construction, and it is difficult to further promote the development of the roof greening market. For this reason, we must comprehensively consider the interests of the government, residents, real estate developers, etc., so as

to increase the overall benefits brought by the real roof greening.

### iii. Rooftop funding is difficult to solve

At present, all major cities in my country have not been able

**Figure 27**

urban rooftop in Guangzhou



to fundamentally solve the funding problem of roof gardens. The funding problems mainly include construction costs and management and maintenance funds. As the Guangzhou Municipal Government has no targeted special funds for the construction of roof gardens, the funding problem cannot be solved reasonably, which makes it impossible to implement the design, construction and subsequent maintenance costs of roof gardens, and the promotion of roof gardens can only be on paper. (Lin Qing, 2017)

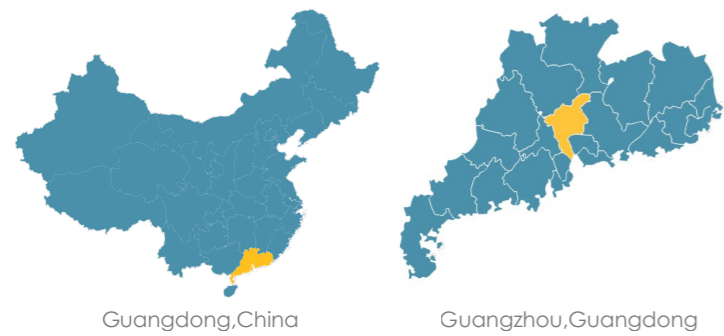
*“There were 11 buildings in 1953, including 1 Soviet-style office building and 3 dormitory buildings. The entire factory area retains four workshops from the 50s to the 90s from different eras.”*

#### 04 | **Analysis of Zinitown**

## 4. Analysis

### 4.1 Location&Climate

#### • Location

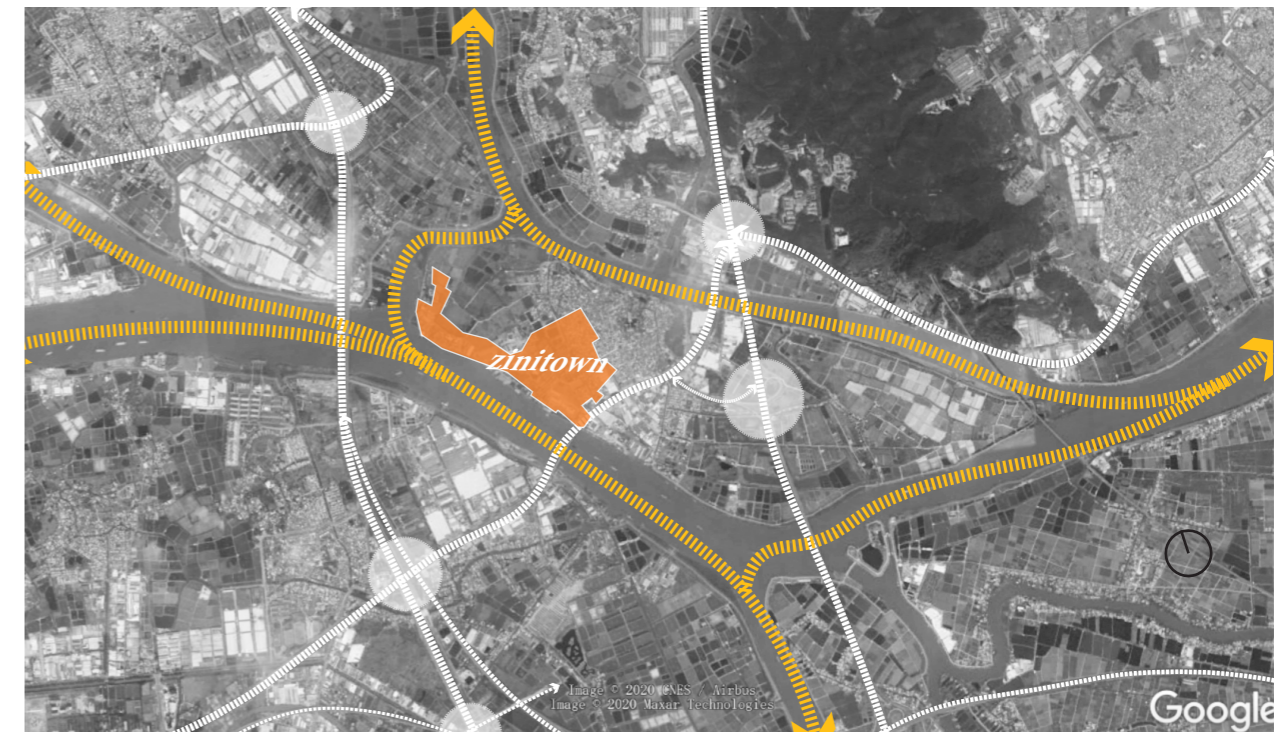


Panyu, alternately romanized as Punyu, is one of 11 urban districts of the prefecture-level city of Guangzhou, the capital of Guangdong Province, China. It was a separate county-level city before its incorporation into modern Guangzhou in 2000. The present district covers an area of about 530 km<sup>2</sup> (200 sq mi).

Panyu District has a subtropical maritime monsoon climate. The high temperature is affected by the southerly monsoon. It is warm, humid and rainy, with sufficient sunlight and a long frost-free period.



Panyu District, Guangzhou



Legend

- river
- main road
- secondary road

Zinitang Located at the center of the Pearl River Delta, within a half-hour traffic and living circle of Guangzhou Central, Foshan, Panyu, and Shunde District, less than 20 minutes away from Guangzhou South Railway Station, it was formerly known as Zini Sugar Factory.



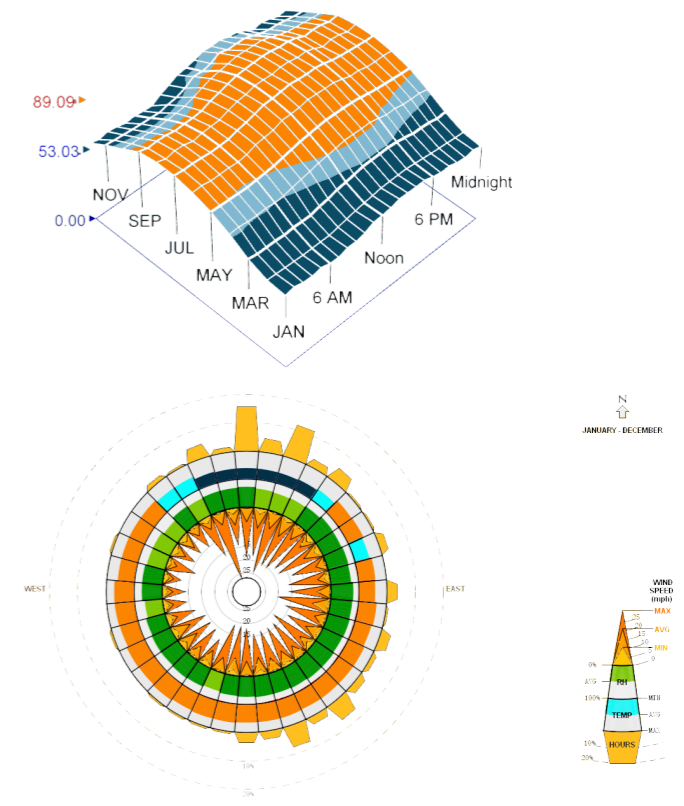
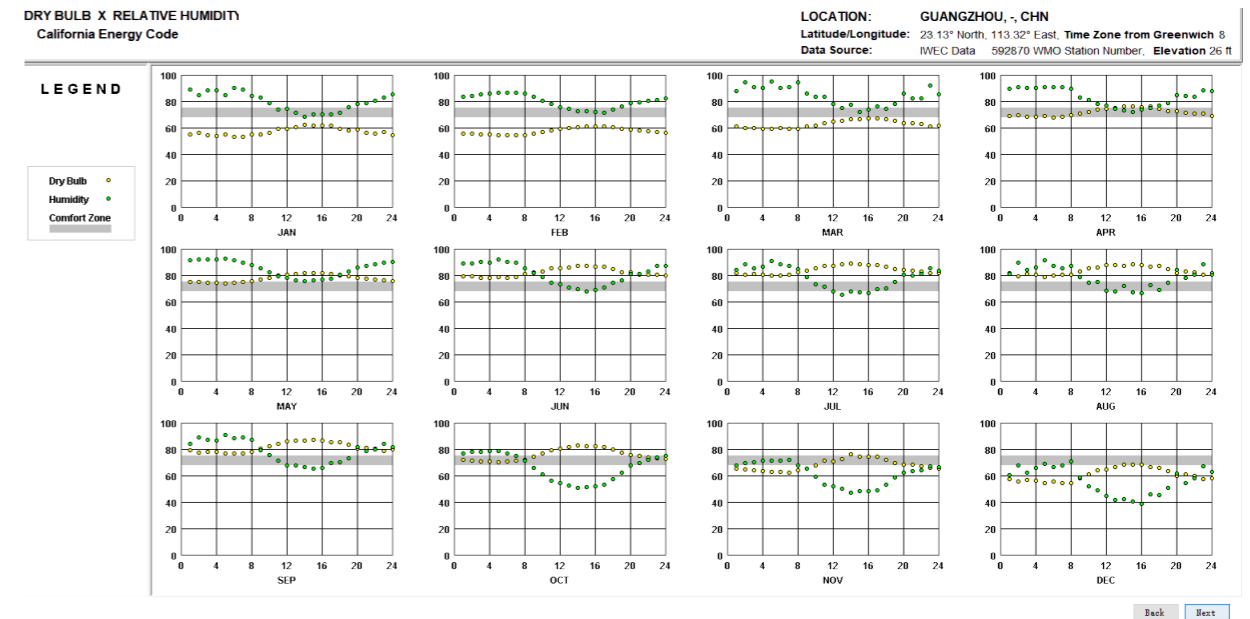
Zinitang is located in Zini Village, Shawan, Panyu (formerly Zini Sugar Factory). The Shawan waterway surrounds the island and covers an area of approximately 260,000 square meters. It has innovative technology, traditional handicrafts, cultural creativity, art education, life and leisure, etc. Format.

The old factory building of Zini Sugar Factory covers an area of more than 360,000 square meters. The buildings and equipment with cultural relic value are concentrated in the core area of nearly 80,000 square meters of production and office. There were 11 buildings in 1953, including 1 Soviet-style office building and 3 dormitory buildings. The entire factory area retains four workshops from the 50s to the 90s from different eras. Such well-preserved Soviet-style buildings are extremely rare in Guangdong.

Zinitang Creative Park is complementary to Baomo Garden and Changlu Farm. It is an important tourist attraction for the renovation of an old factory in Panyu. Zinitang has traditional handicrafts, innovative technology, art education, life and leisure, etc. The transformed industrial art and humanistic environment attracts people who are keen on cultural exchanges to visit, achieving differentiation from Baomo Garden and Changlu Farm, creating diversification Cultural tourist attractions.

## 4.1 Location&Climate

### • Climate



From the data shows in chart, start from December to march, in winter, the temperature is a bit below temperature from the comfort zone. Then April-May, October to November, most of the days are in the comfort zone. while start from June to September, the temperature get higher and the necessary cooling equipment should be equipped. The annual main wind direction is from north, north-east and south-east.

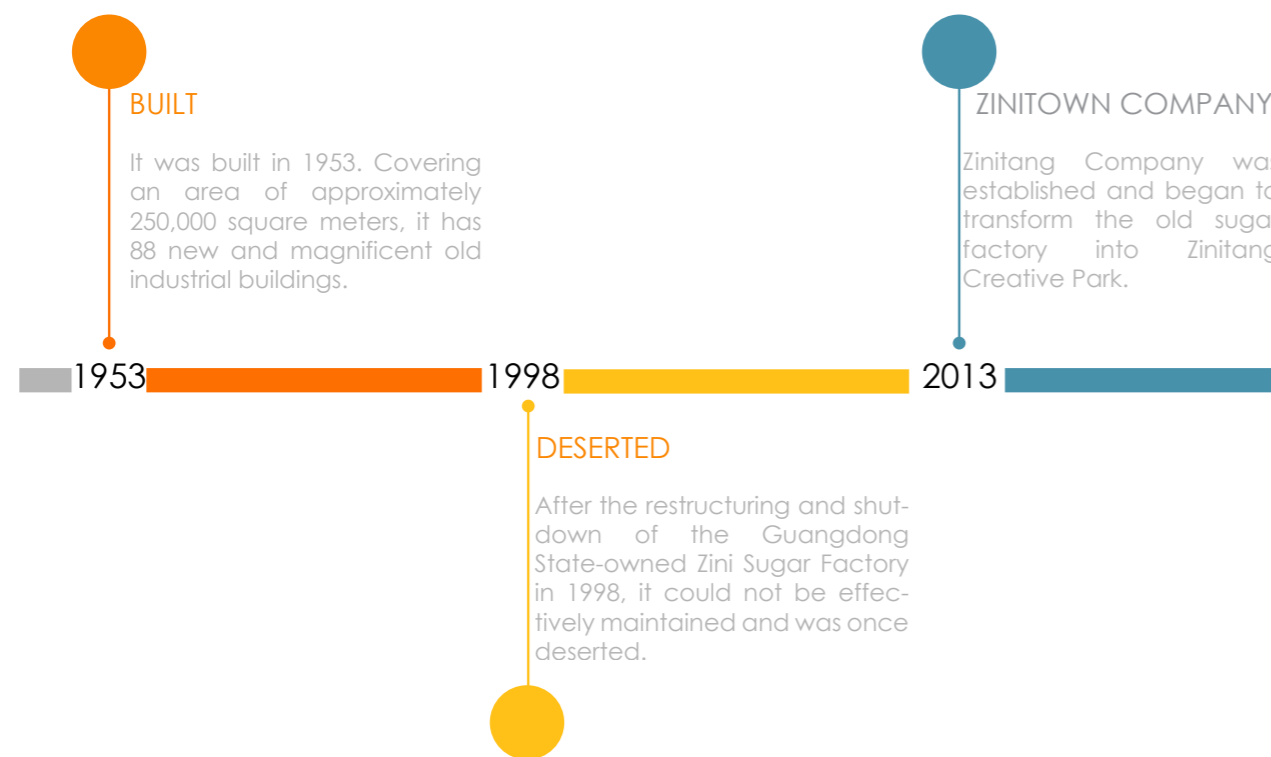


## 4.2 Building history



## 4.2 Building history

The predecessor of Zinitang was the largest cane sugar factory in Guangdong Province. It was built in 1953. The "Hanxiao" brand white sugar, which is familiar to the old, is produced here. Covering an area of approximately 250,000 square meters, it has 88 new and magnificent old industrial buildings, reflecting the simple and atmospheric style of the early days of the founding of New China, and was included in the list of important new discoveries in the third national cultural relics census in 2009. After the restructuring and shutdown of the Guangdong State-owned Zini Sugar Factory in 1998, it could not be effectively maintained and was once deserted. In 2013, Zinitang Company was established and began to transform the old sugar factory into Zinitang Creative Park.



## 4.3 Mobility- Food transport&people

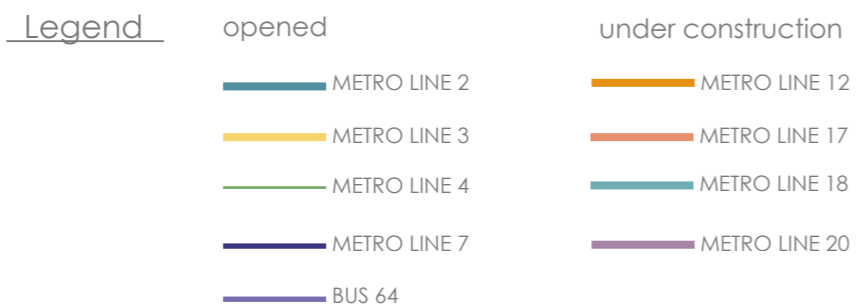
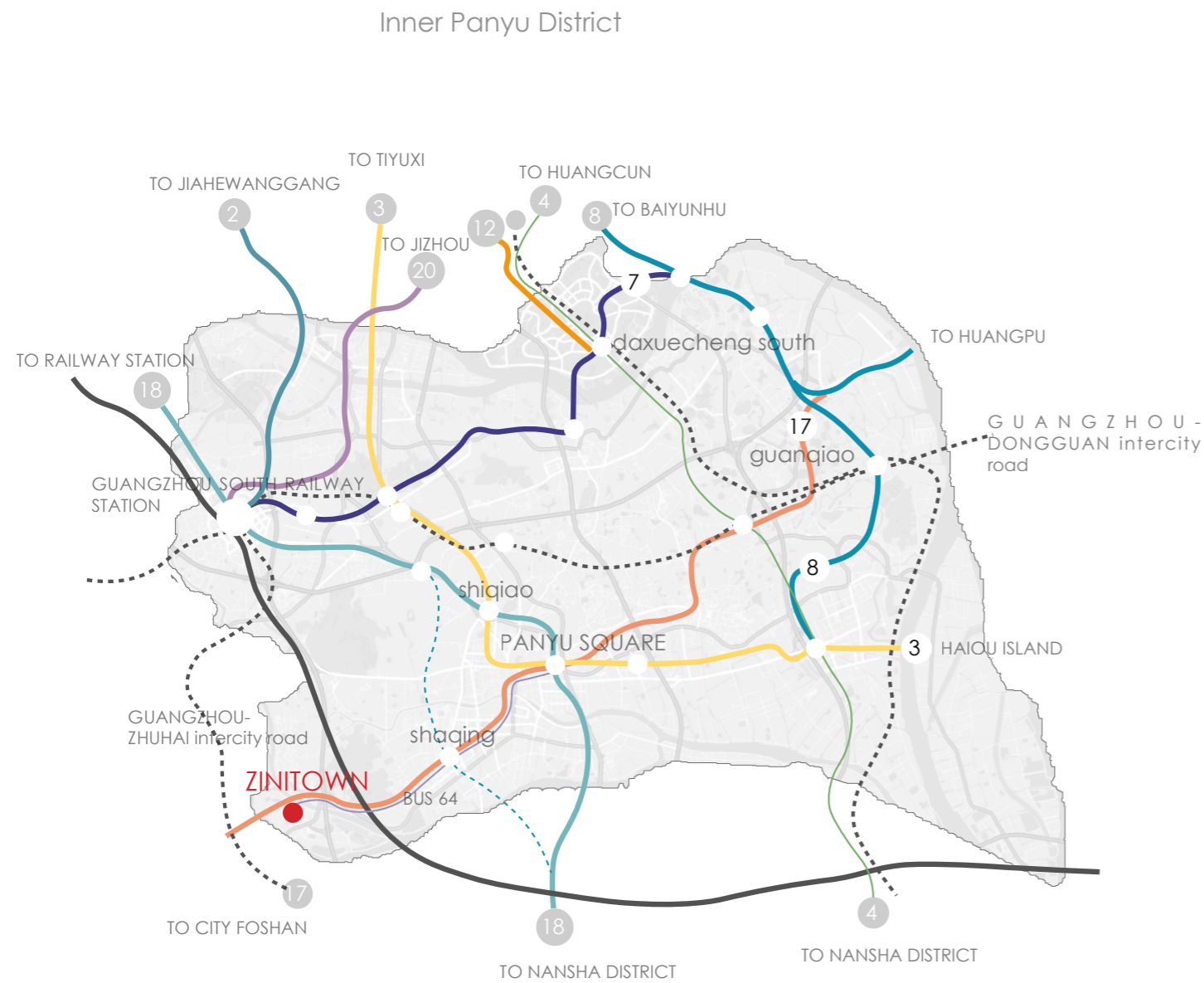
Inner City:Dsitrict-district



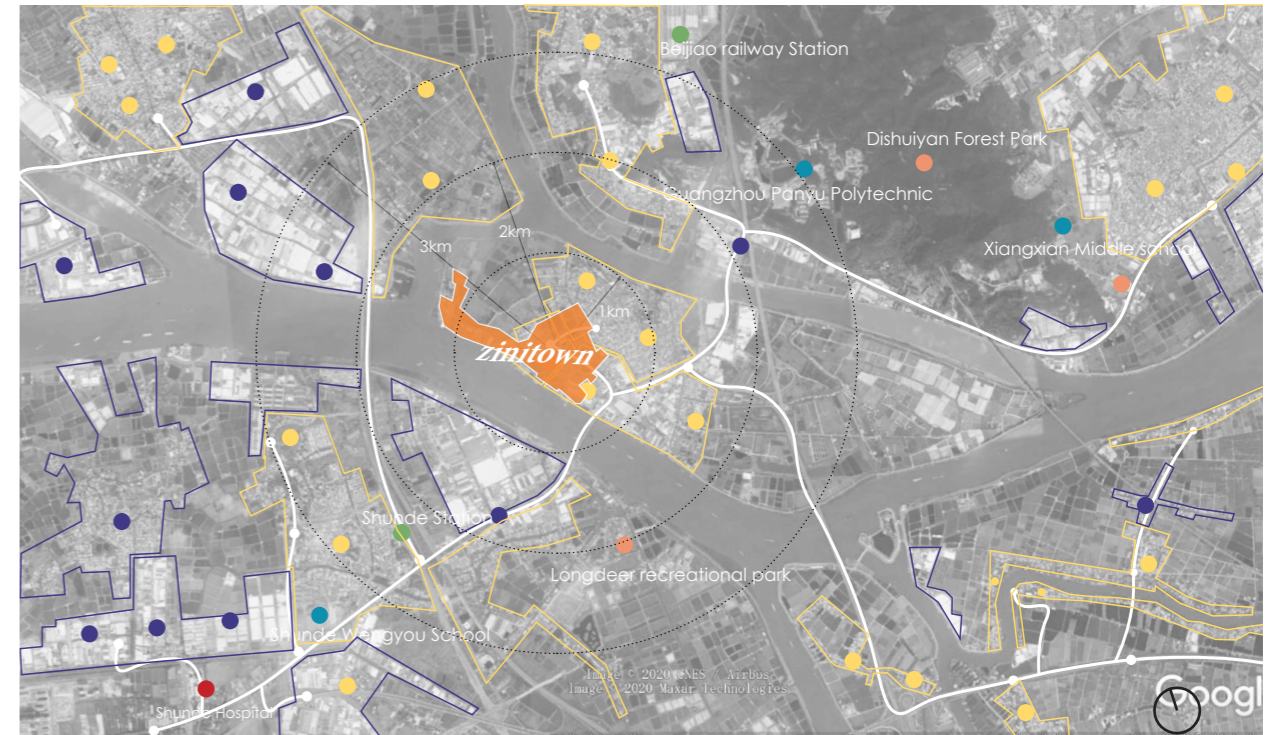
For transporting those packed vegetables, the farm will organize their own trucks to transport to the distribution sites among the city and the nearby cities, so as to keep the vegetables fresh enough and to minimize the possible commute distance to reduce to emission of carbon dioxide.

The visitors can drive to the site or choose public bus to zinitown. In this project, the visitors were divided into three different groups, first is the local people from the local community where they can reach there very conveniently-- by walk. The second is the people who lives in the same district or in the same city Guangzhou, or the close districts, they can even choose to drive or public metro then transfer to the bus 64. While for the other people who from the outside Guangdong province can first fly to Guangzhou then take the bus or drive by car.

### 4.3 Mobility-people



### 4.4 Functions



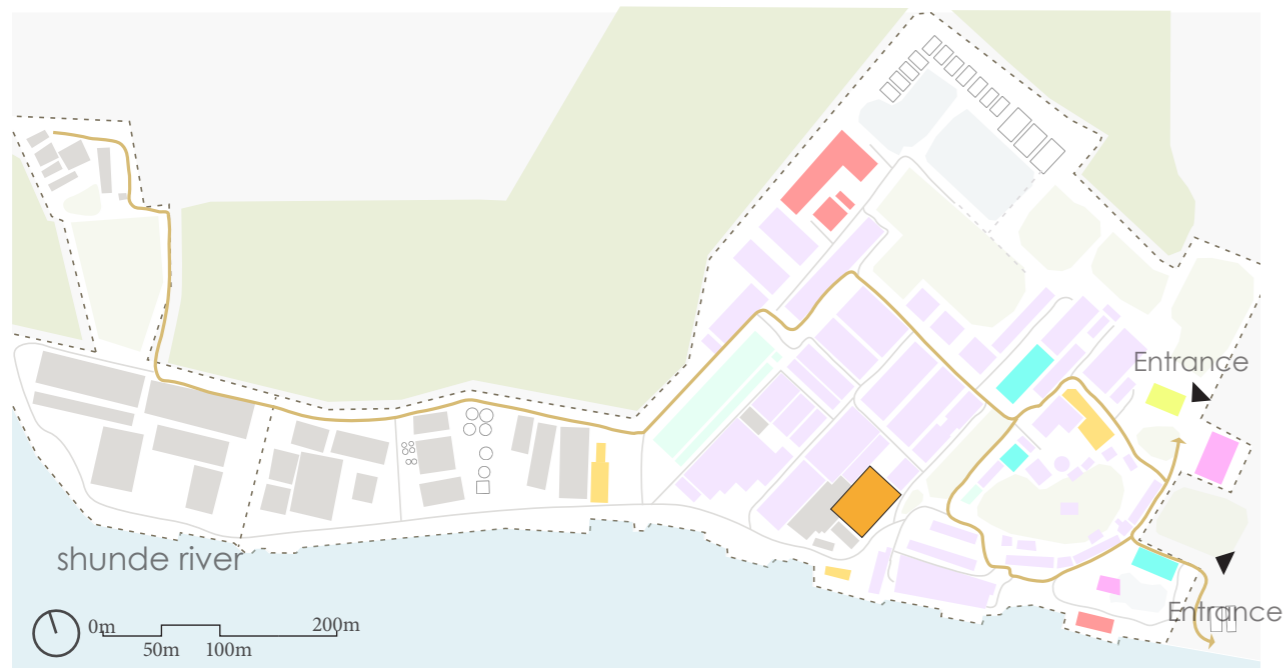
The nearby area has plenty of residential areas in this project, so we can consider the quantity of the local communities, it is not only consisted by the close community but also by nearby district.

So when we plan "participation process" phase, the local stakeholders are diverse and it might have multiple phases in different zones and areas.

Meanwhile, Zinitown can also offer some activities/free visits/free participation activities to introduce the project to locals on weekdays.

It is also very obvious to see that there is a huge place into different industries, so they can be a potential customer in the sales phases for Zinitown. Moreover, the school, supermarket or open market near residential areas can also be a distribution site for promotion.

#### 4.4 Zinitown-Functions



- |            |                     |            |
|------------|---------------------|------------|
| developing | kindergarten        | Building 5 |
| service    | culture&art related |            |
| restaurant | office              |            |
| hotel      | recreational        |            |

Nearly 60% in the whole area has been developed, the buildings have been transformed into business, recreational, service and kindergarten, etc.

There's a sports center under construction when I came there in September, 2020 during COVID. Also some private studios for sculpture and art-related projects were developing.

Zinitown is famous for art-related festivals, photography base and film base and music festival. After the field study, since it was under COVID-19, even it is on weekends, there's not a lot of visitors there, so the services, the restaurant were not completely open. While after interviewing the employee there, they are expecting a special restaurant, and maintaining a very satisfied attitude into "vertical farm" proposal.

#### 4.5 Greenry



- Legend
- |                   |                   |
|-------------------|-------------------|
| public green      | semi-public green |
| river/inside lake | Building 5        |

The site has an inside lake and a huge lawn which was a campsite there.

The north-east part has a bit higher greenery rate because that part has been developed already, while in the west part, it lacks green and public places for the public.

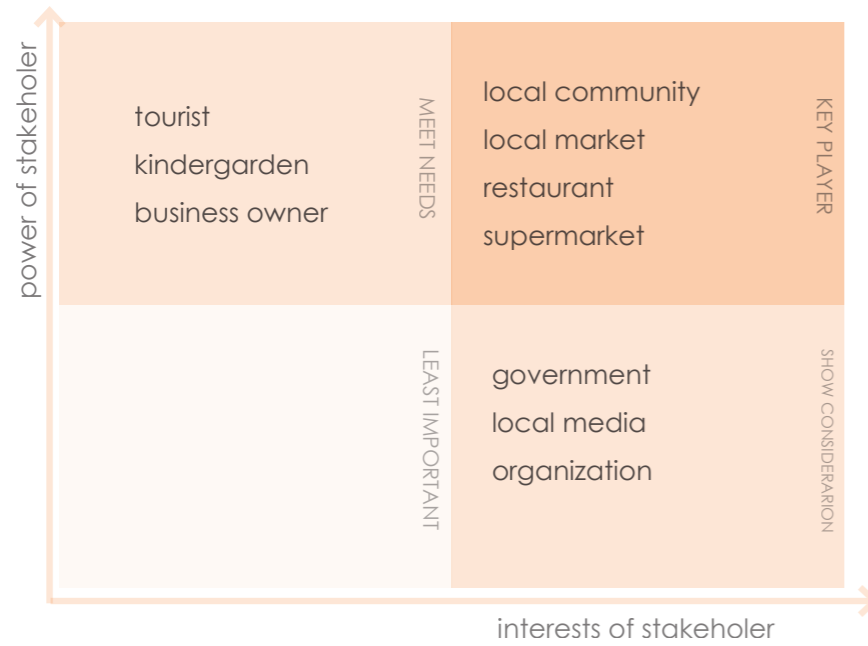
Hence we can consider that maybe it can have an open square there for street performance, providing people a public and open space to relax and interact with the environment.

Moreover, the riverside has a spectacular view; if we will develop the west side, a city park can be rebuilt there to connect the nature with people, the nature with architecture.

At the same time, we have a very good view at the top of the target building towards the river, so when we are proposing a business, a good location can be a key factor where on the terrace in that building.

## 4.6 Stakeholder

### Identification of stakeholders



Q:How do you like a vertical farm company in zinitown?



Employee in zinitown

A:It will be perfect,we pursue the diversities and dynamics here,it will also made us more well-known!



Local people

A:If it can provide activities like community garden or workshop,i think ill bring my kids here.



Tourist

A:That's a good idea, but if you sale vegetables with an competitive price comparing with XX,ill buy it!

## 4.7 SWOT

### STRENGTH

- Abandoned indutrisal buidling provides a space to reuse rather than new built.(expensive)
- The building itself is reusable with an interesting inner spcaes.
- More than half of the buildings has been developed in zinitown,and it has already brought tourist&costomer there.
- High accesibility with no more than 2 hours to the surrounding important cities .
- Geographic location provides a suitable plants grwoing condition.



### WEAKNESS

- The structure of the building might be reinforced.
- The size of the building is large so the initial investement will be high,under consiration of all the cultivation and ventilation ,lighting systems in vertical farm.

#### 4.7 SWOT



#### OPPORTUNITIES

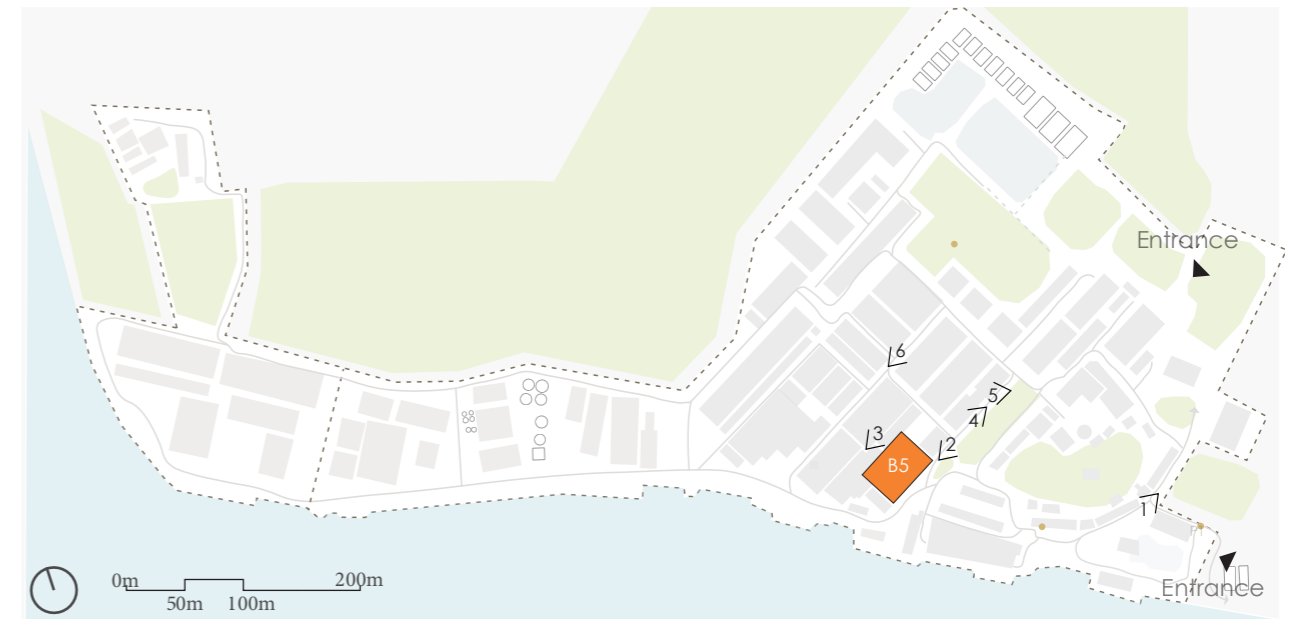
- Local community and kindergarden can be considered as an important target to bring opportunities. .(community garden,class vegetable fields etc. )
- Perfect landscape view from rooftop.
- Young generation are tending to pay more to get much healthier food nowadays in China,especially in big cities.
- Close to industrial area,the potential customer can be a huge group from every canteen and workers in the factory.

#### THREATEN

- Serve typhoon normally come for twice a year,rooftop vegetations will be ruined if the terrace is completely opening and planting.

#### 4.8 Surrounding&Building B5

#### • Surrounding







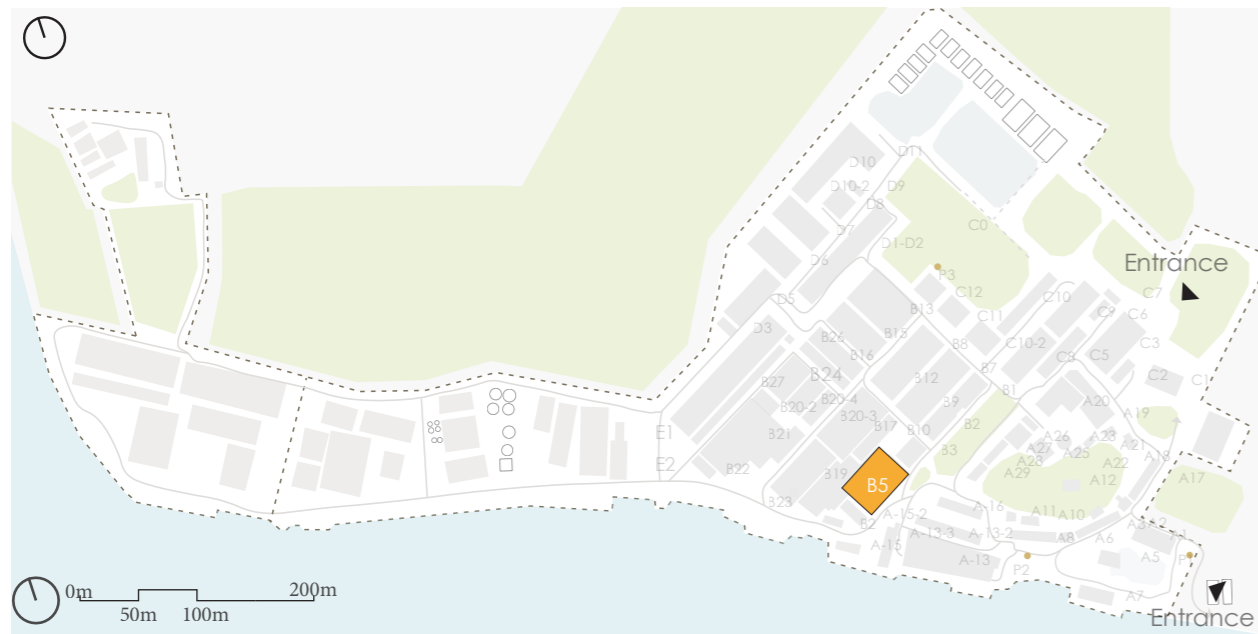
The right side building is developing for an mix-use office here,while because of covid,it has not been completed.





## 4.8 Surrounding&Building B5

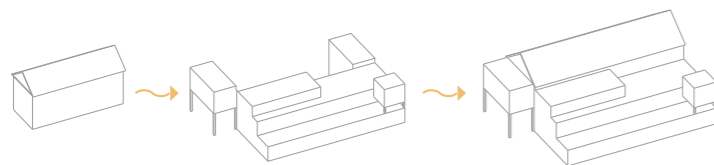
### • Building B5



**Building 5** was a processing workshop of sugar when it was built, from the archive, the building was built in four floors with 120' (width=30.48m)\*46' (length≈11.68m). After on field study and measuring the current building B5, found that:

- the size has enlarged;
- another structure was added into the original structure;
- all the original structural elements haven't been moved while the non-construction wall and inner wall have been dismantled ;

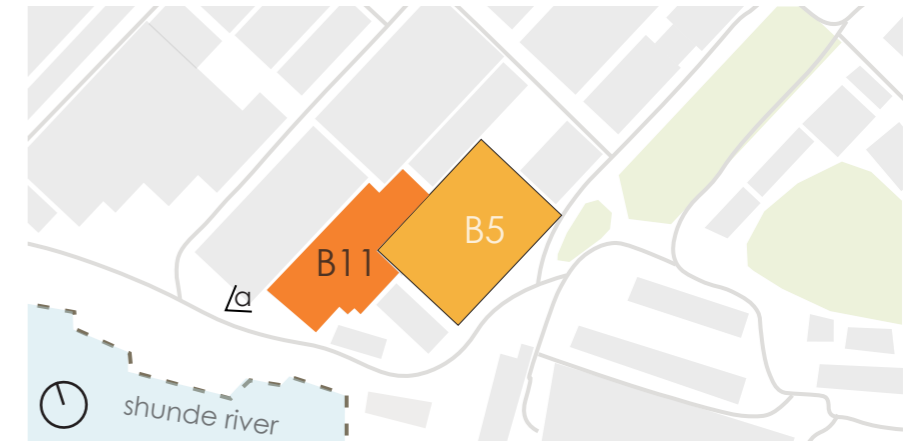
### Building-B5 transformation process



1953 → unknown year between 1953-2017 → 2017~

## 4.8 Surrounding&Building B5

### • Building B11



**Building 11** is connected with building 5, here we consider building 11 as the second phase of transformation process in the project, because:

- The area of building 5 is already enough to develop a vertical farming under the economical point of view;
- The building 5 has already been reinforced in structural elements while the building 11 has left a deserted structural frame with nearly-broken floors/walls/terrace, under consideration of structural and economical point of view.
- The level of destruction in building 11 is very high, so the company closed the part of the building, it is impossible to get in to the building.

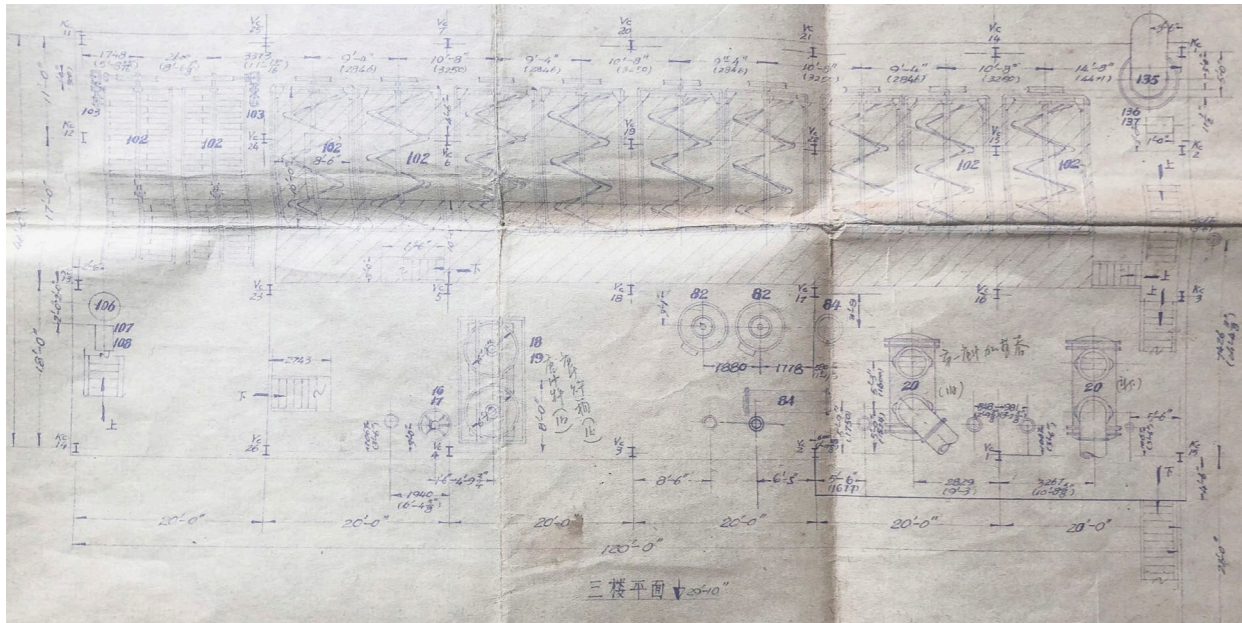
Hence if the vertical farming company developed very fast in an idea time, the farm company can consider to transform B11s' platform as semi-public place to connect B5, and the other usable places as functional palces in B11.

a

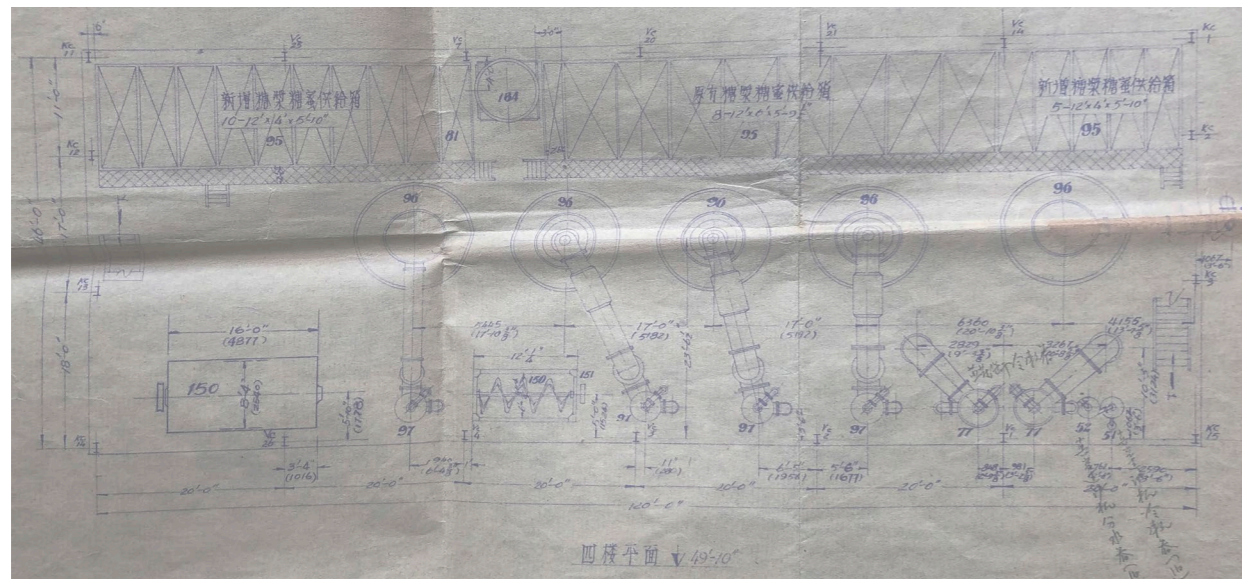


#### 4.8 Surrounding&Building B5

- Building-B5 in 1953



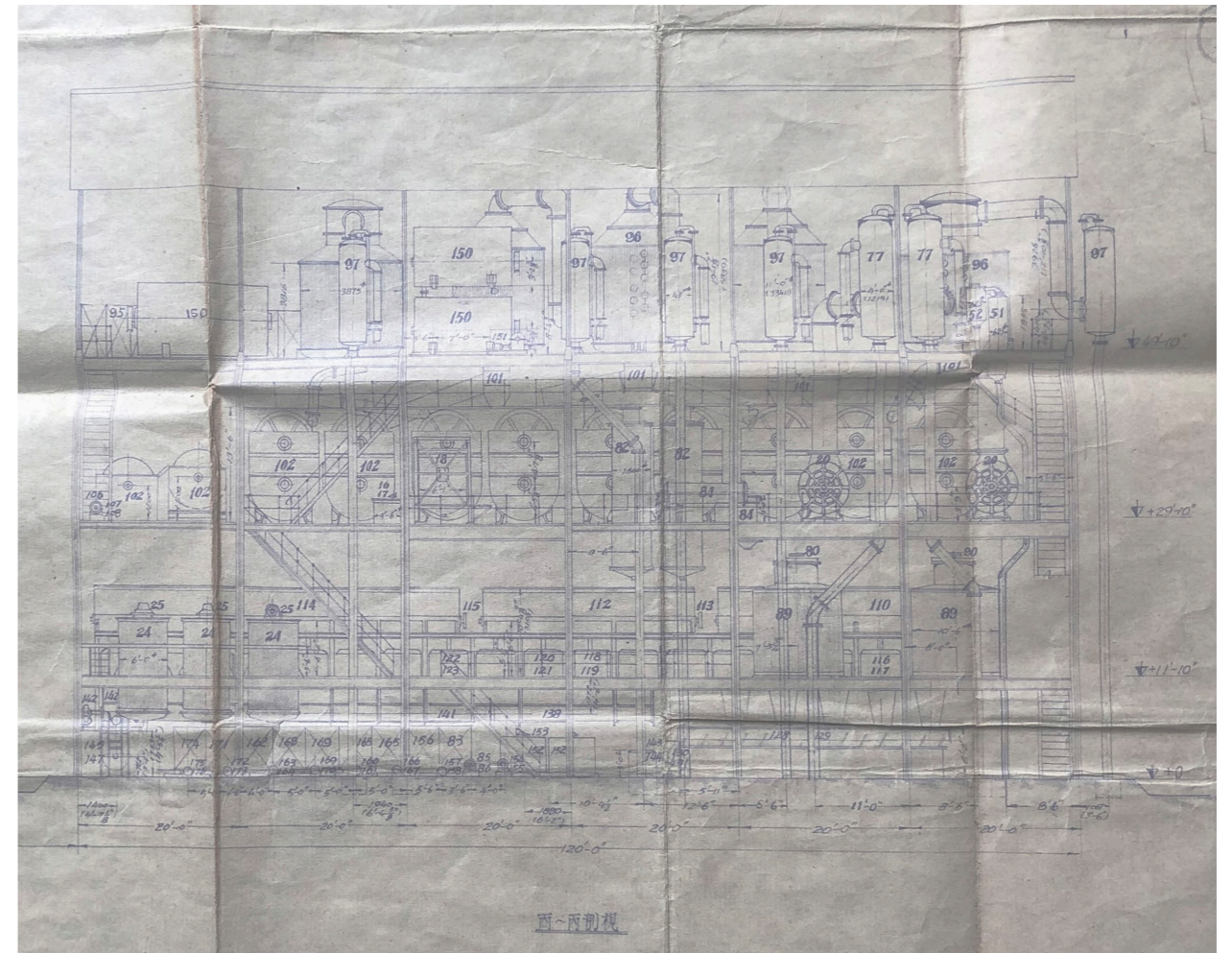
The third floor plan



The fourth floor

#### 4.8 Surrounding&Building B5

- Building-B5 in 1953



Section

These are preserved drawings which comes from Zinitown company,we can recongnize that the building had 4 floors when it was built in 1953, while the building 5 still maintain the original structure in the north side,in an unknown year, another part has been structued in the south side ,as it is shown now.

## 4.8 Surrounding&Building B5

- Building-B5 in 2020



There's a bridge to connect building 5 and building A-15, but in new planning, the developer will disconnect those two buildings, but still maintain the second floor platform which starts from B5 then continues to the end of this street.



Now, this is the building 5, because of the huge volume and current condition, no company invested to develop it right now.



Because of the mass and dangerous condition of B5 and the connected part with B11, few people coming in and explore in case of being dangerous.



I am a photograprer,we produce lots of commercial products from zinitown factory,it is famous for film and phtography production business!

I pick up my own vegetables every Saturdy morning here in vertical farm,our family took an area for our garden, with using their technologies and our efforts,we are having healthier food!

We go here for picnic with our family on weekends,sometimes we use the campsite place to spend another night here,sometimes we do it near river side!

I like to be here in the grassland to having fun with my family!!!But i dont like the food near here,i want try something interesting and fresh!

We are the sculpture in zinitown,we see people walking and going around,but we barely see anyone in hot summer day,we need to plant more trees for shading!

Photographing Zone

Developing art&cultural related area

Indoor swimming pool

Deserted severe damaged factory



Hotel

Hotel

Restaurant

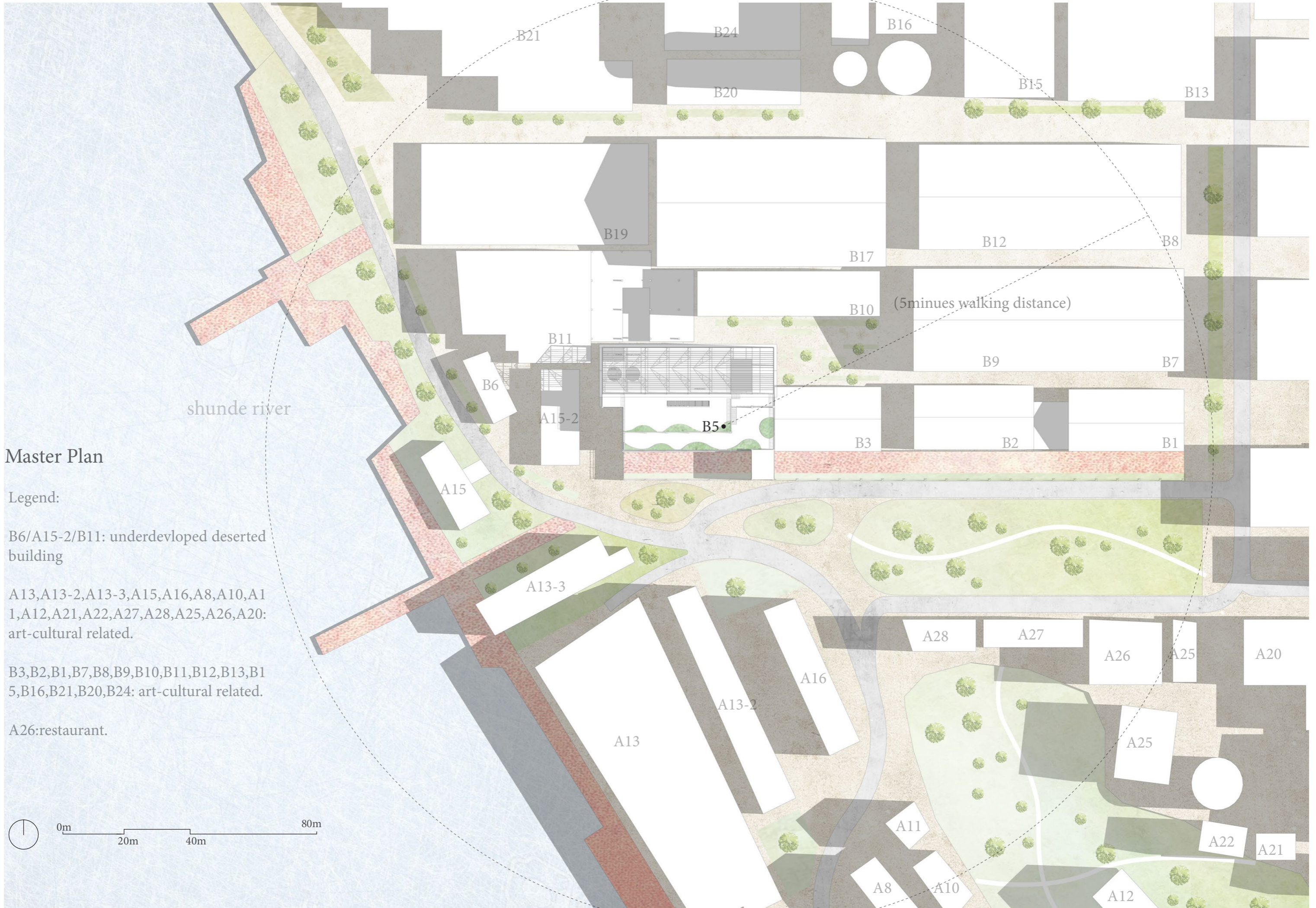
Sports Center



Lets go to the sports center!!!  
I want to go climbing there!!!

紫糖  
130栋

会酒



**Master Plan**

**Legend:**

B6/A15-2/B11: underdeveloped deserted building

A13,A13-2,A13-3,A15,A16,A8,A10,A11,A12,A21,A22,A27,A28,A25,A26,A20: art-cultural related.

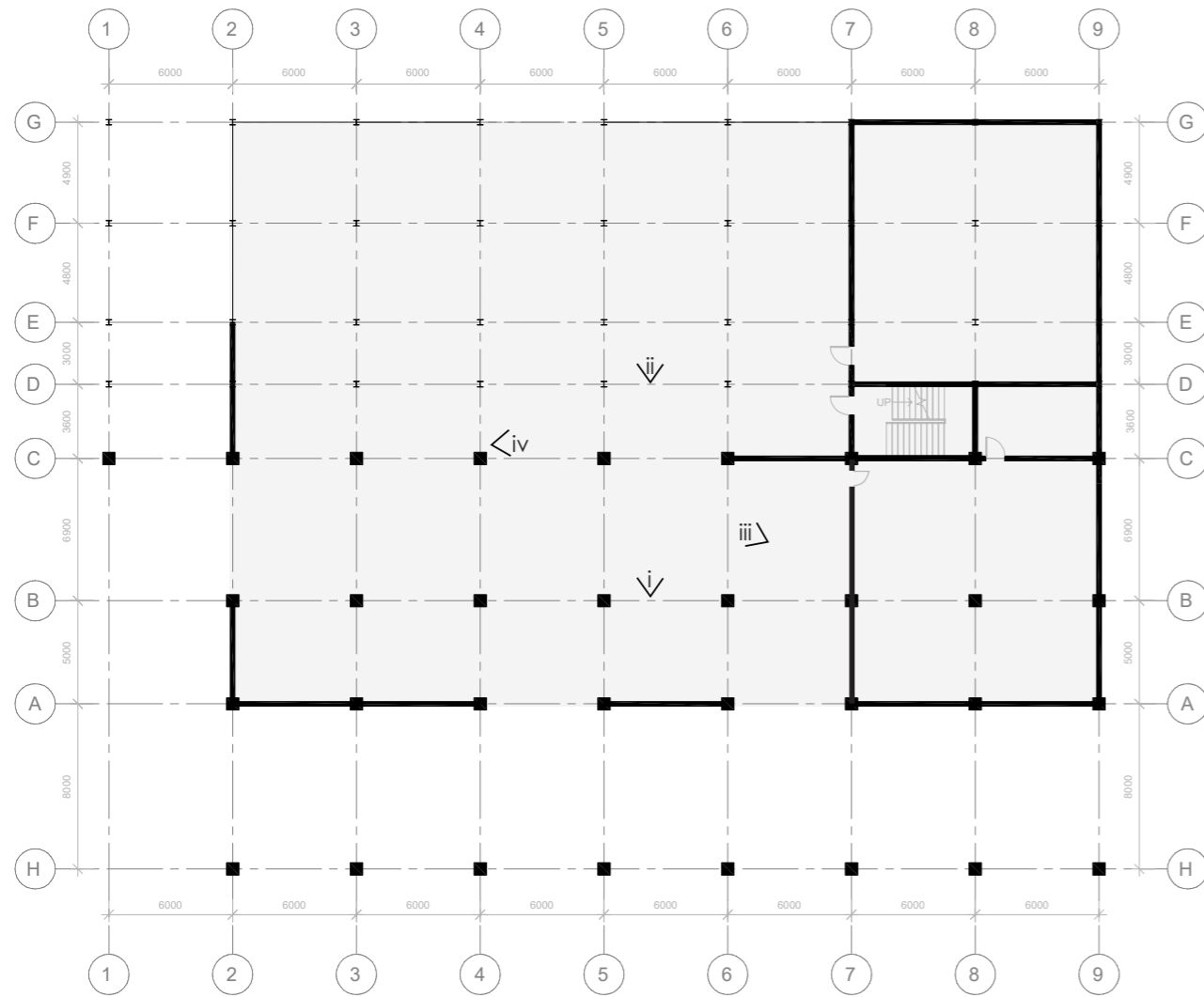
B3,B2,B1,B7,B8,B9,B10,B11,B12,B13,B15,B16,B21,B20,B24: art-cultural related.

A26:restaurant.

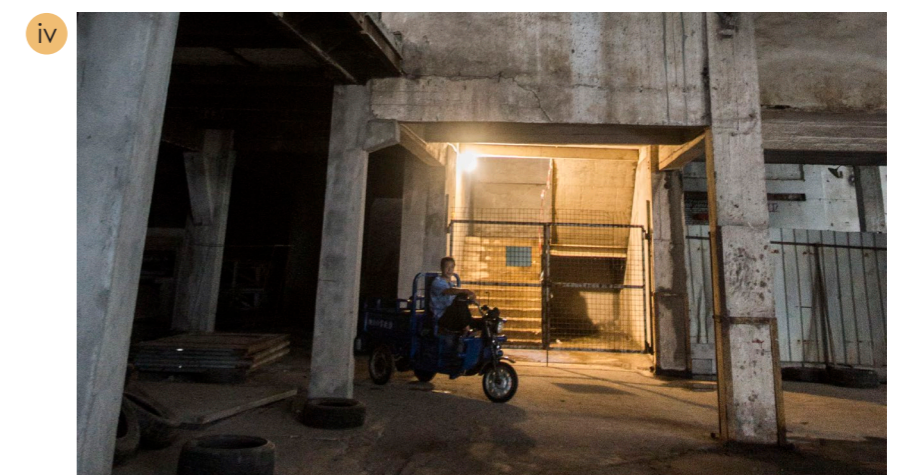
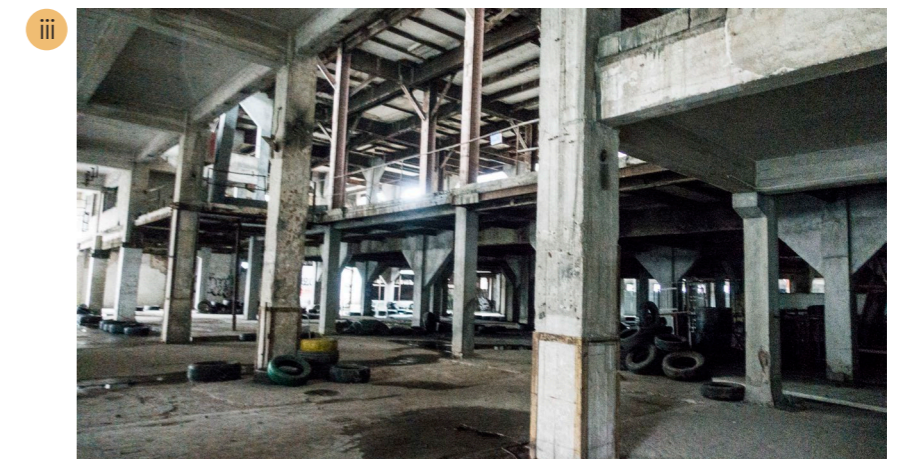
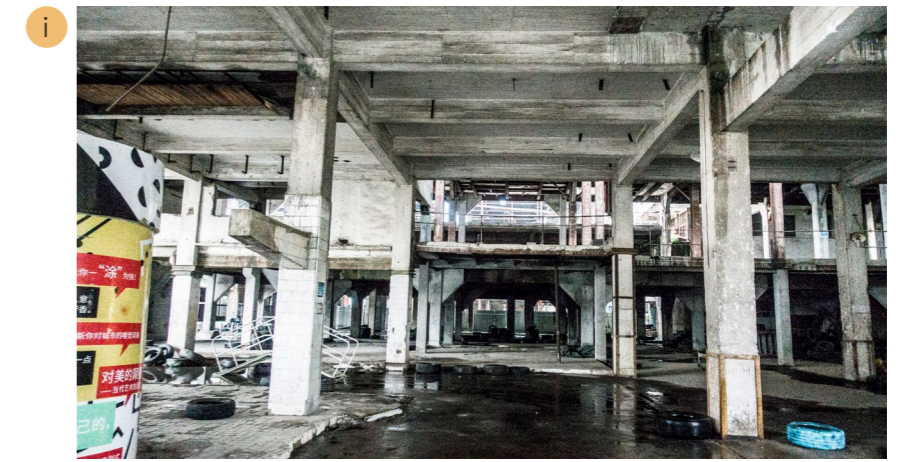
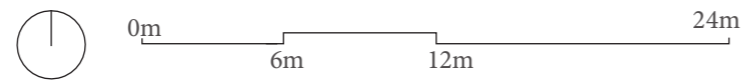


## 4.8 Surrounding&Building B5

• Building-B5 in 2020



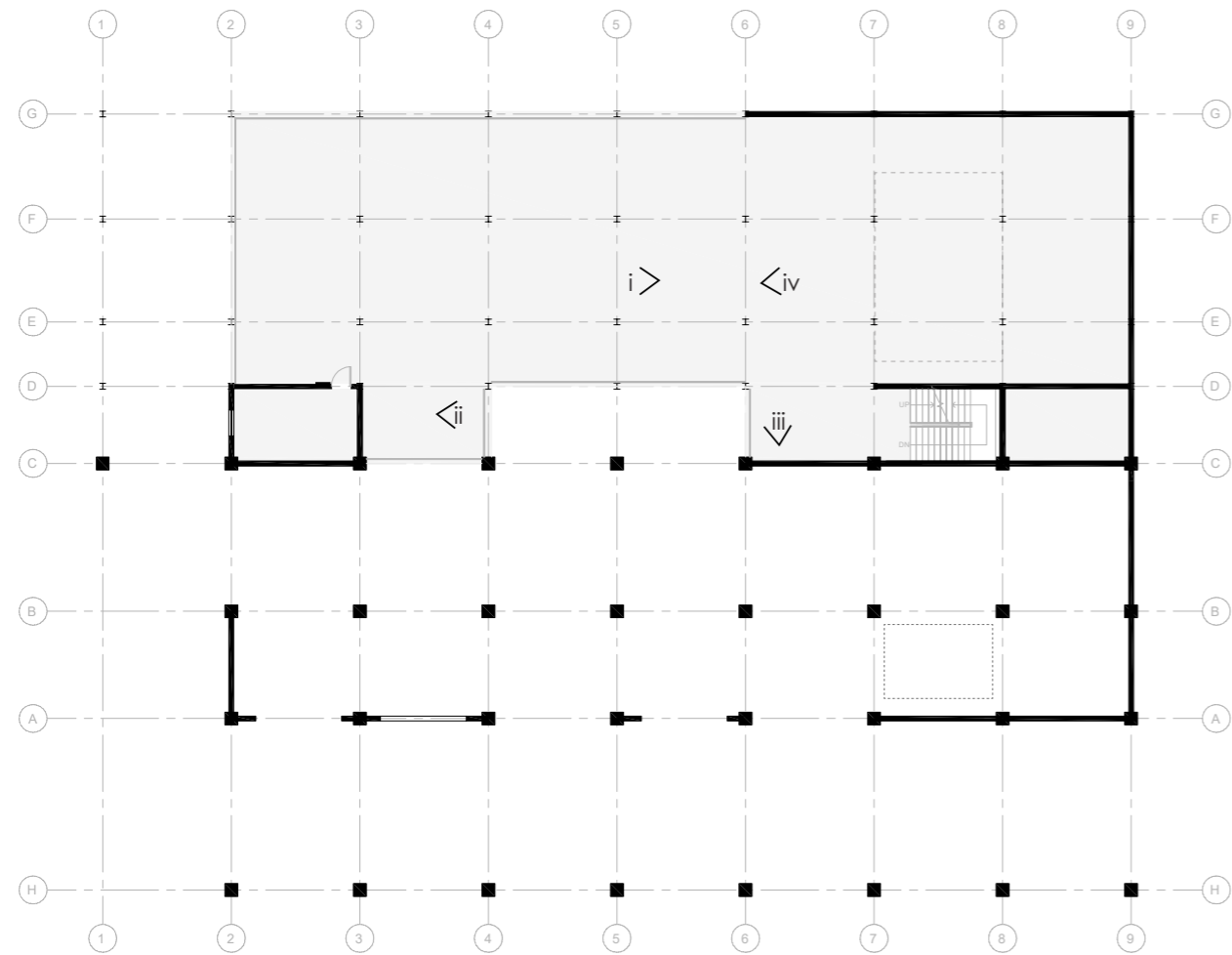
1 floor plan



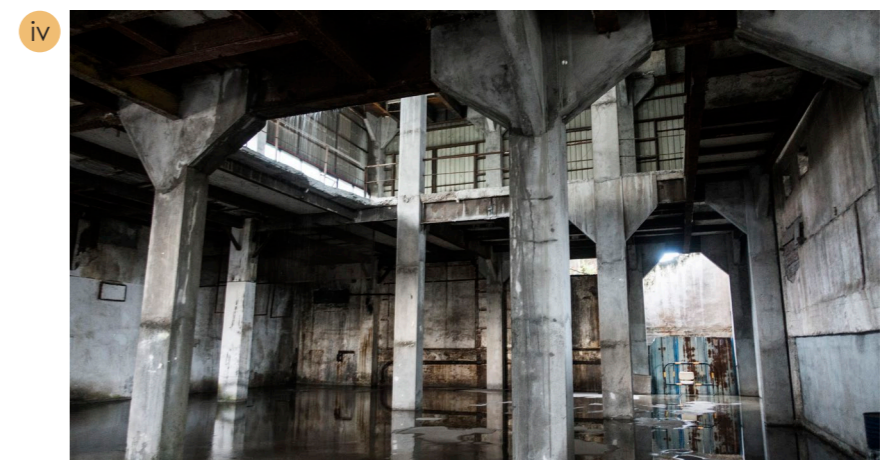
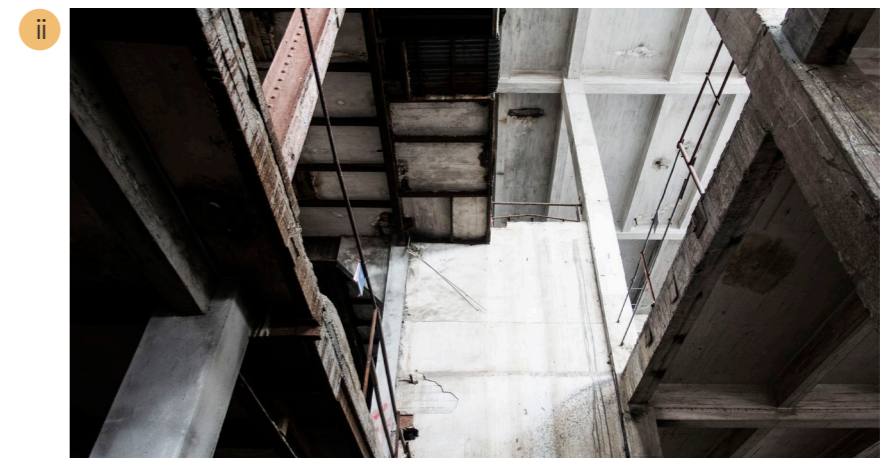
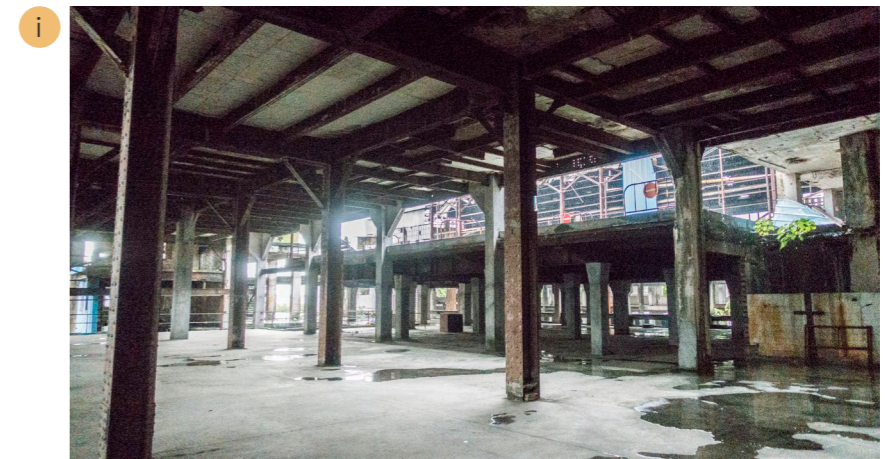
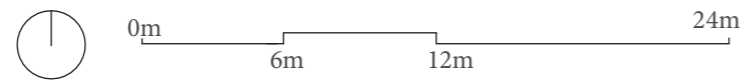


## 4.8 Surrounding&Building B5

- Building-B5 in 2020

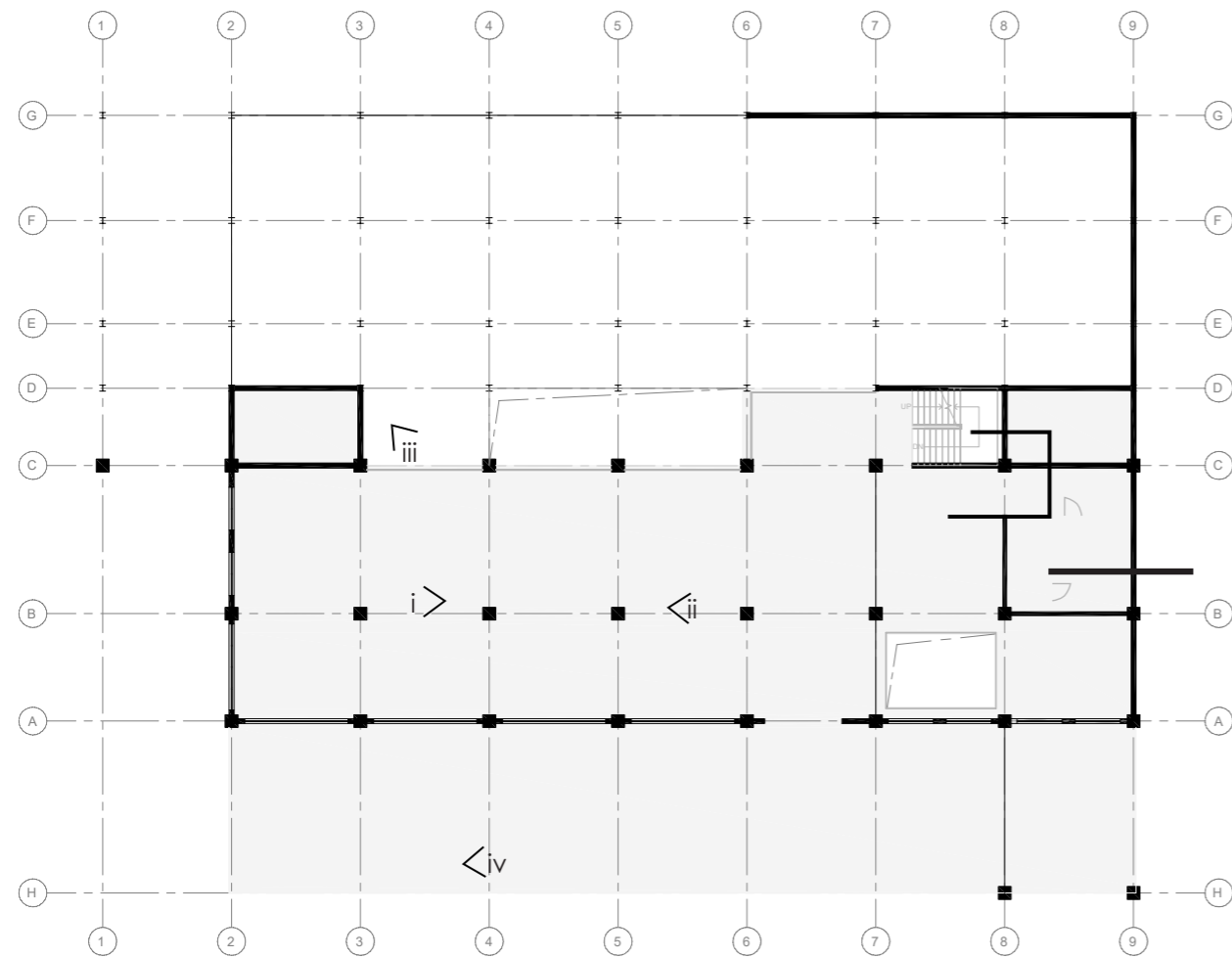


2 floor plan

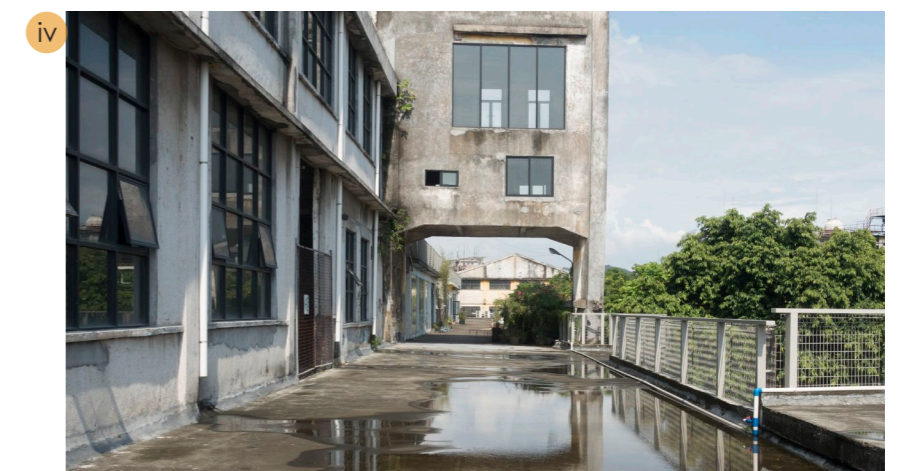
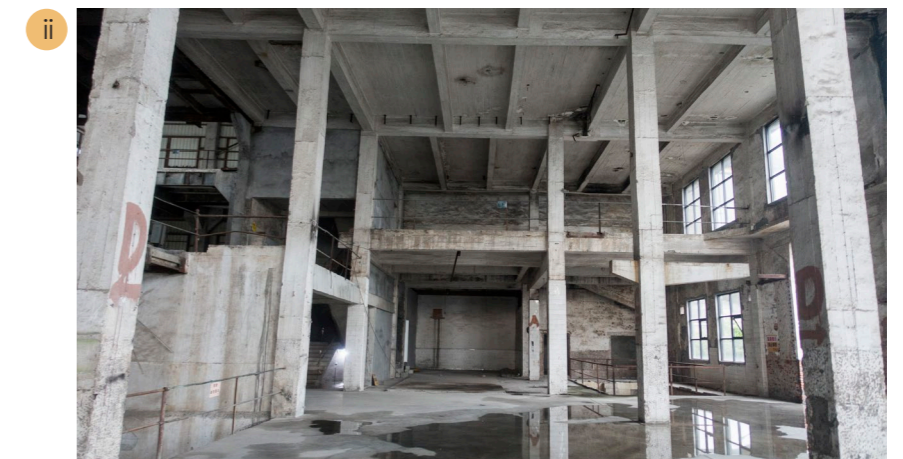
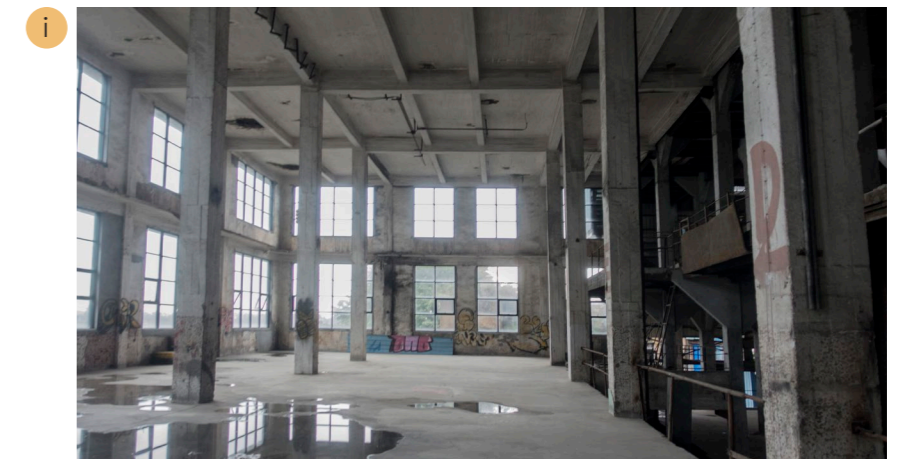


## 4.8 Surrounding&Building B5

- Building-B5 in 2020

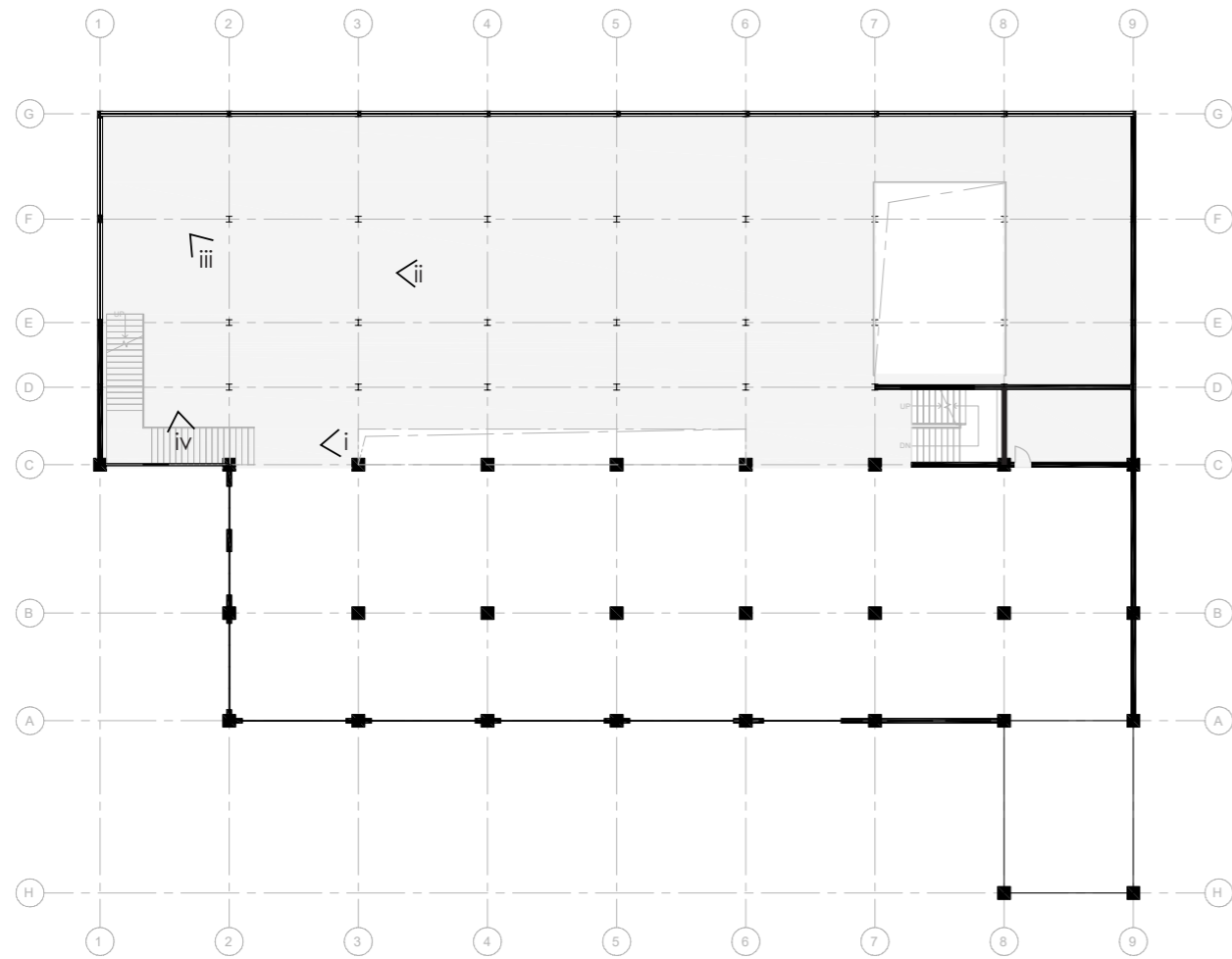


2.5 floor plan



## 4.8 Surrounding&Building B5

- Building-B5 in 2020



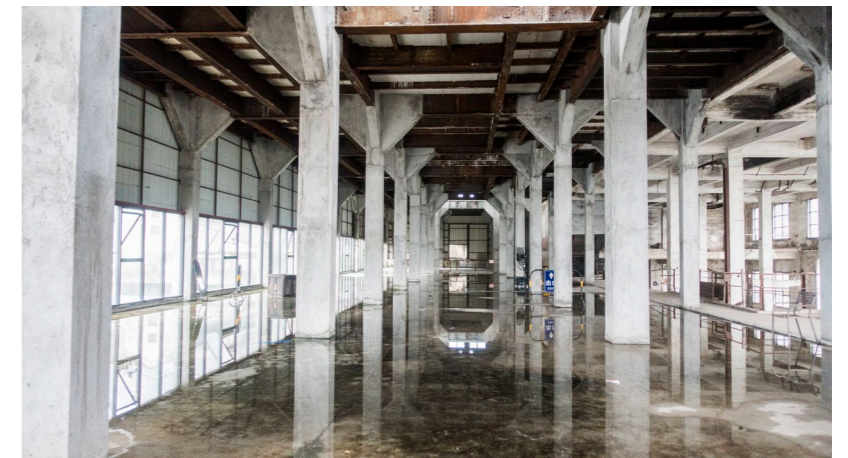
3 floor plan



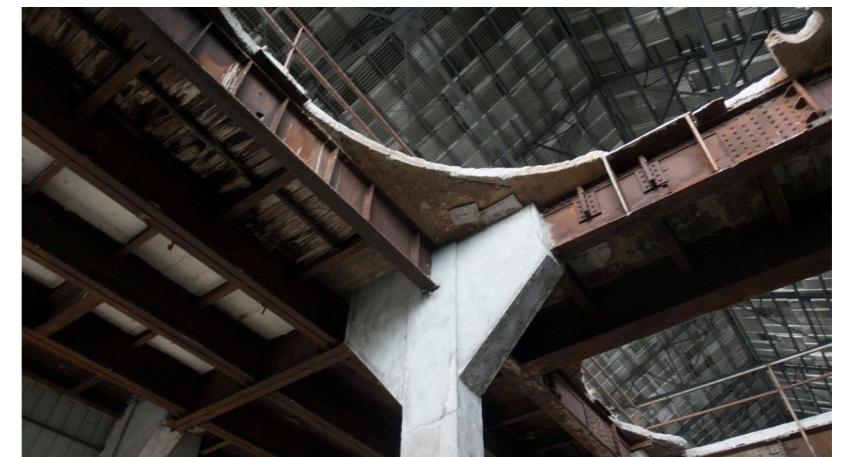
i



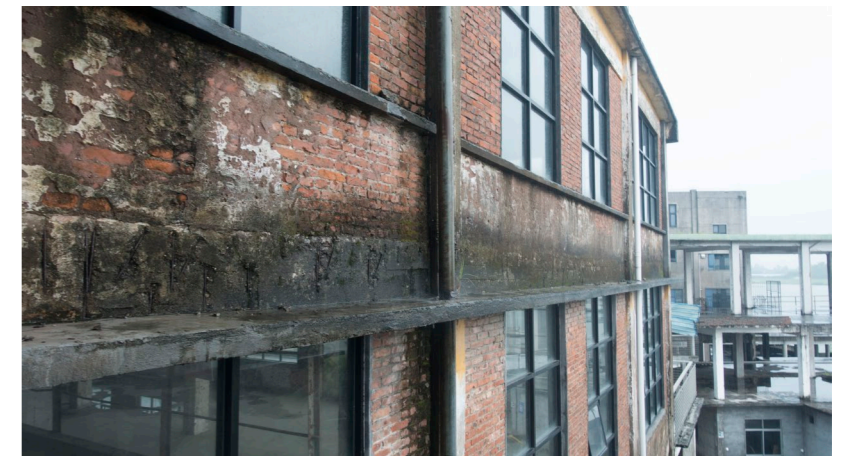
ii



iii

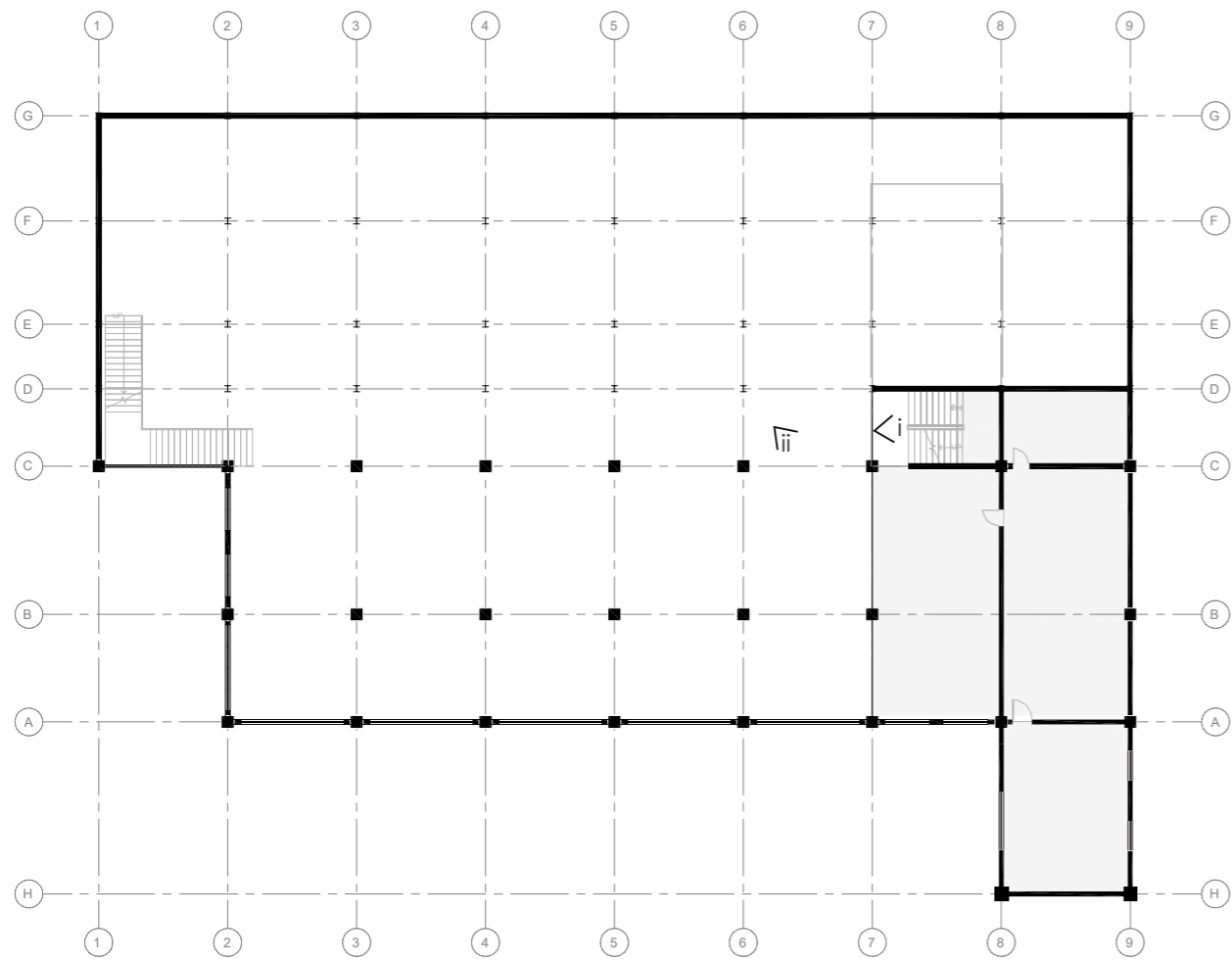


iv



## 4.8 Surrounding&Building B5

- Building-B5 in 2020



3.5 floor plan



i

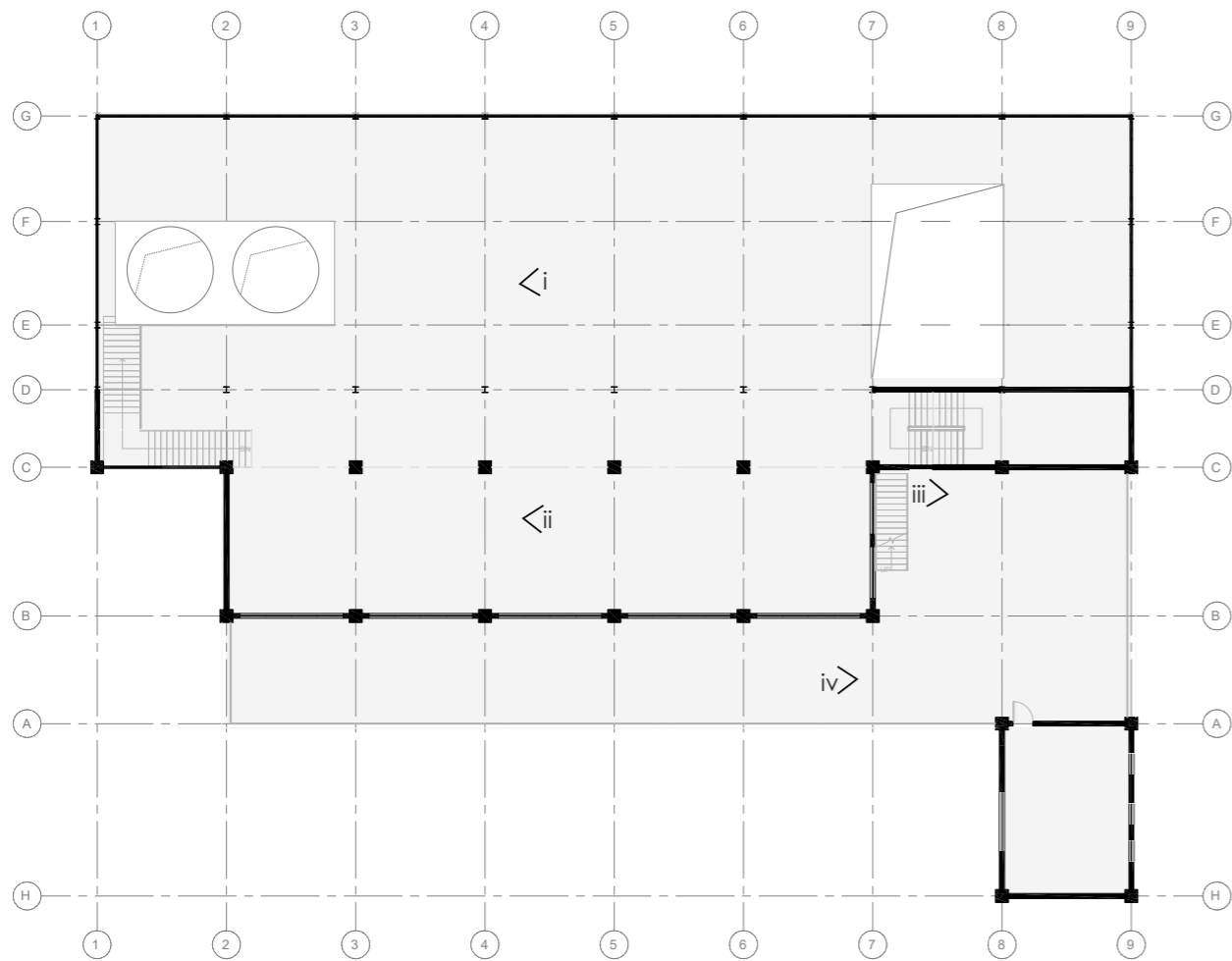


ii

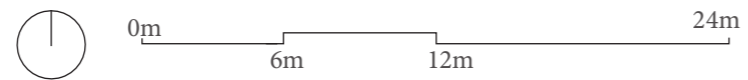


## 4.8 Surrounding&Building B5

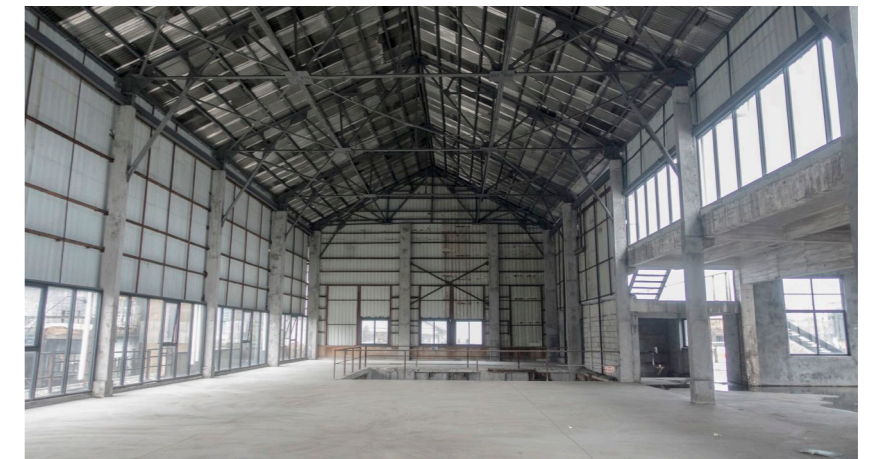
- Building-B5 in 2020



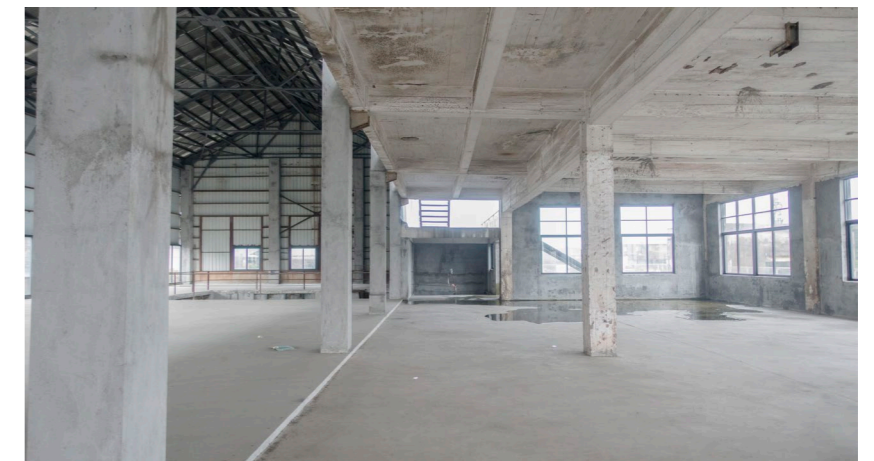
4 floor plan



i



ii



iii

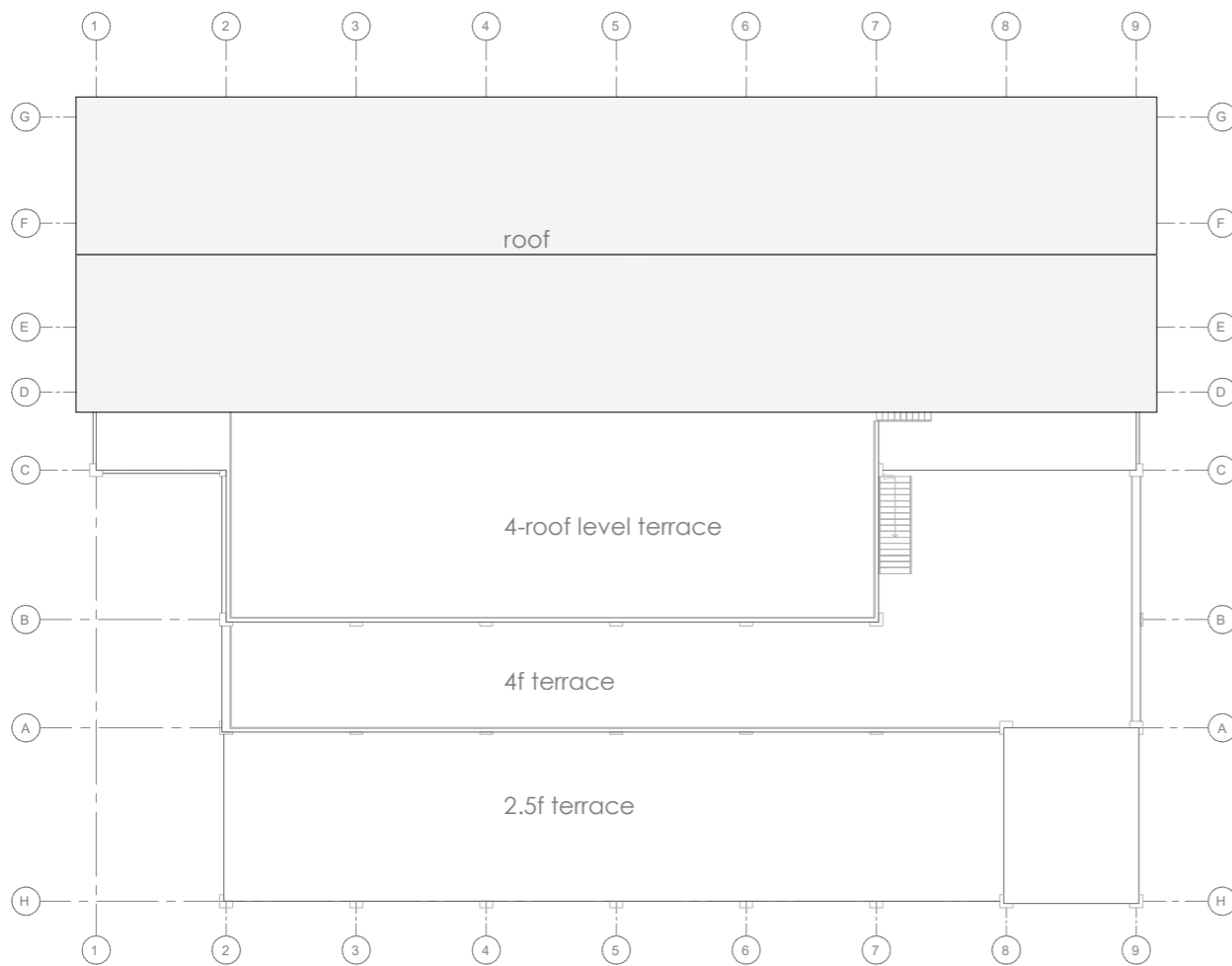


iv

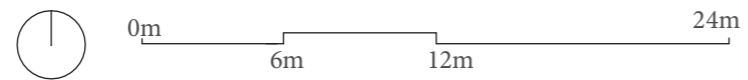


## 4.8 Surrounding&Building B5

- Building-B5 in 2020



Roof floor plan



*"Throughout our history, we've constructed soaring buildings over land once submerged beneath the waves and transformed our sleepy fishing village into a shining metropolis for the future."*

*-SG food*

05 | **Case study**

## 5. Case study

# 01 | Sky Green



**Figure 28**  
Veggie transport

### i. Location

Singapore.

### ii. Area

Unknown, but when compared with traditional monolayer farms, the Sky Greens patented vertical farming system intensifies land use and can result in at least 10 times more yield per unit land area.

### iii. Farming

- Cultivation system

#### Hydroponic

The frame can be as high as 9 meters tall with 38 tiers of growing troughs, which can accommodate the different growing media of soil or hydroponics. (world's first low carbon vertical farm with 9m shelves.)

Unlike conventional land-based farming which constrains harvesting and packing methods, vegetables at Sky Greens can be harvested and packed right where they grow, thus reducing double handling and lowering cost and wastage.



**Figure 29**  
Sky green interior





- **Crops**

Naibai, Caixin, Xiao Baicai, Chinese cabbage, Mao Bai, Lettuce, Bay-am, Kai Lan, Kang Kong, Spinach

- iv. **Retail**

Sky Greens Farm will offer a reliable supply of safe and fresh vegetables. Consistent and reliable harvest – contract farming for steady supply.

- v. **Energy conservation**

With the harnessing of natural sunlight, there is no need for artificial lighting. Water rotation is powered by a unique patented hydraulic water-driven system which utilises the momentum of flowing water and gravity to rotate the troughs. Only 40W electricity (equivalent to one light bulb) is needed to power one 9m tall tower..

- vi. **Water conservation**

With the plants irrigated and fertilised using a flooding method, there is no need for a sprinkler system thereby eliminating electricity wastage, as well as water wastage due to run-offs. Only 0.5 litres of water is required to rotate the 1.7 ton vertical structure. The water is contained in an enclosed underground reservoir system and is recycled and reused.

- vii. **Resilience**

Being housed in a protected environment ensures that the system can be relatively maintenance-free and have low manpower dependency. The rotating troughs and intensified plant to plot ratio also mean high manpower efficiency.



*Figure 30*

image of vegetations

## 02 | MEOD



**i. Location**

Singapore

**ii. Area**

60000 m<sup>2</sup> in 2023

**iii. Farming**

- **Cultivation system**

**Aeroponics system**

- **Distribution**

Available in all major supermarkets, Vegetable Farms ,Egg Farms and Fish/Seafood Farms.

- **Crops**

unknown on the website, but the products can be found in the supermarkets and Farms. Including vegetables and fishes.

**iv. Water conservation**

MEOD employs water recycling and rainwater harvesting for its crops, allowing it to use less than 1% of the water used in conventional farming.

**v. Resilience**

Instead of using chemical pesticides, the team at MEOD employs

an expert in organic and bio control methods who uses pests and natural predators to keep their vegetables at the highest quality. Insects like ladybugs and praying mantis are used to consume pests like aphids and moths.

**Figure 32**  
Package for Xiao Bai Cai



**Figure 31**  
Package for Xiao Bai Cai



## 03 | Hydro Urban



### i. Location

Singapore.

### ii. Area

3500 m<sup>2</sup>

### iii. Farming

- Cultivation system

#### Hydroponic

We are able to efficiently grow 30 to 50 times more than a traditional farm! They keep vegetables in a controlled vertical-farm to provide our plants with the best environment possible. This protects our produce from pollution or the unpredictable weather outdoors.

To ensure you get the freshest produce possible, we harvest and hand pack our vegetables to every order.

- Crops

Lettuce, Kale, Crystalline Iceplant, Japanese Komatsuna, Coral Green, Wasabi Leaves.

### iv. Retail

On-line order or off-line on site buying.

*Figure 33*

Interior Hydroponics



# 04 | Sunqiao urban agriculture district



## i. Location

Sunqiao, Shanghai, China

## ii. Area

100 hectares

## iii. Farming

- Cultivation system

Aquaponics and Hydroponics

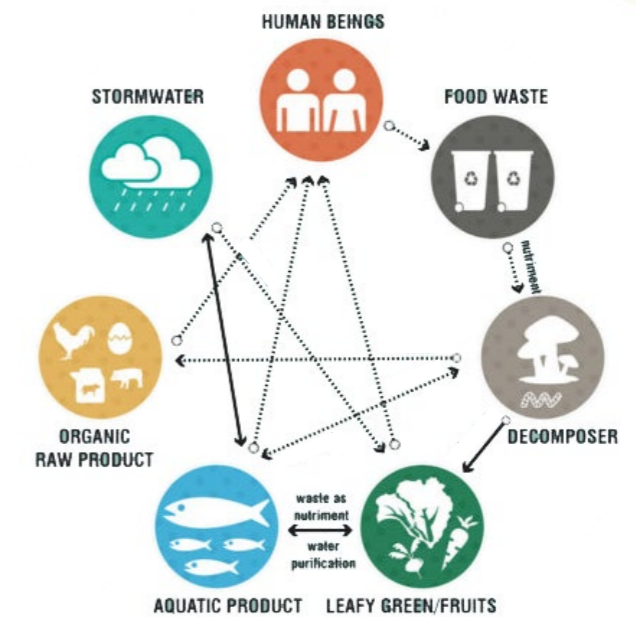
- Crops

spinach, kale, bokchoi, watercress etc.

**Figure 34**

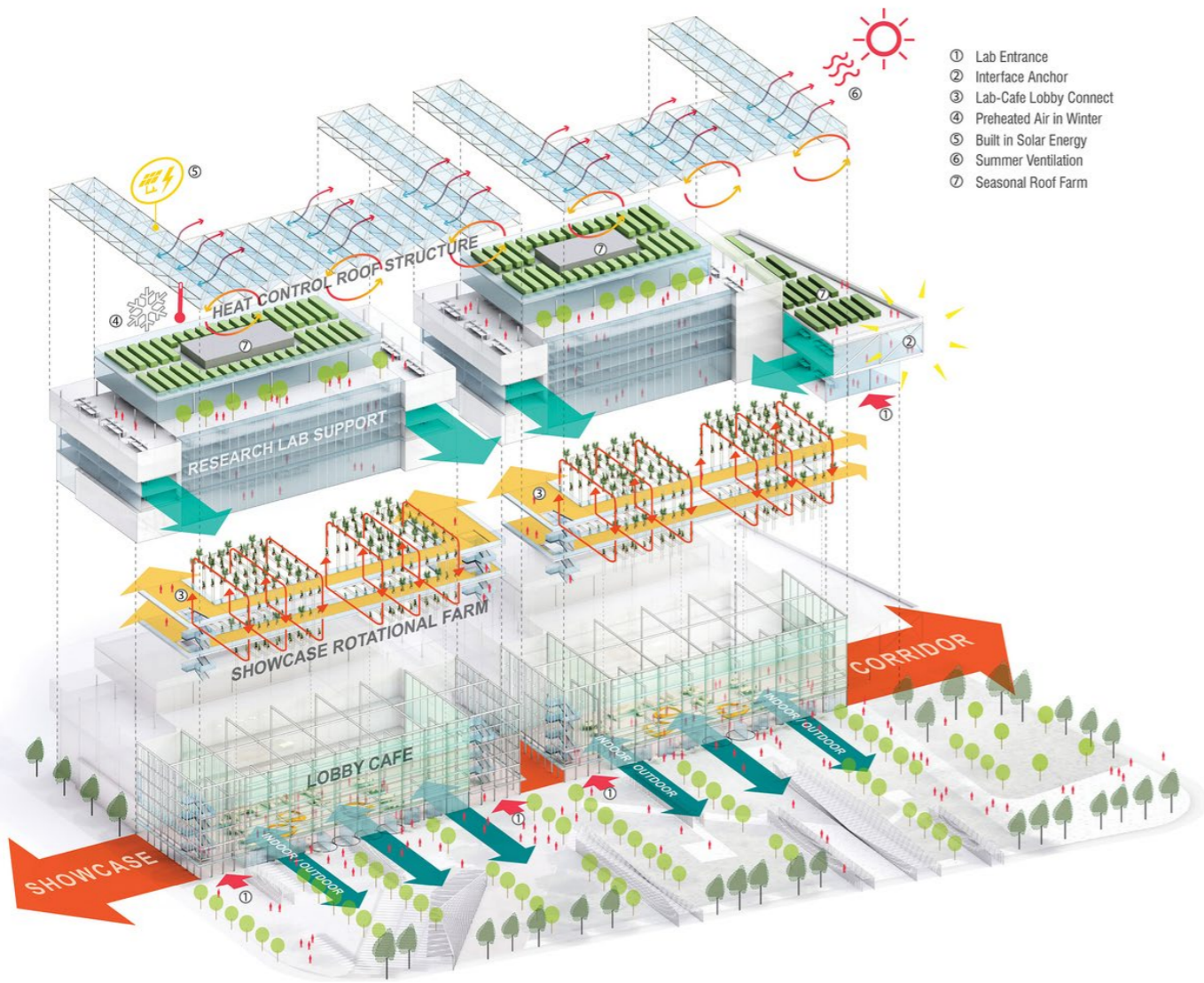
graphic of recirculating diagram.

reference: <https://www.sasaki.com/>

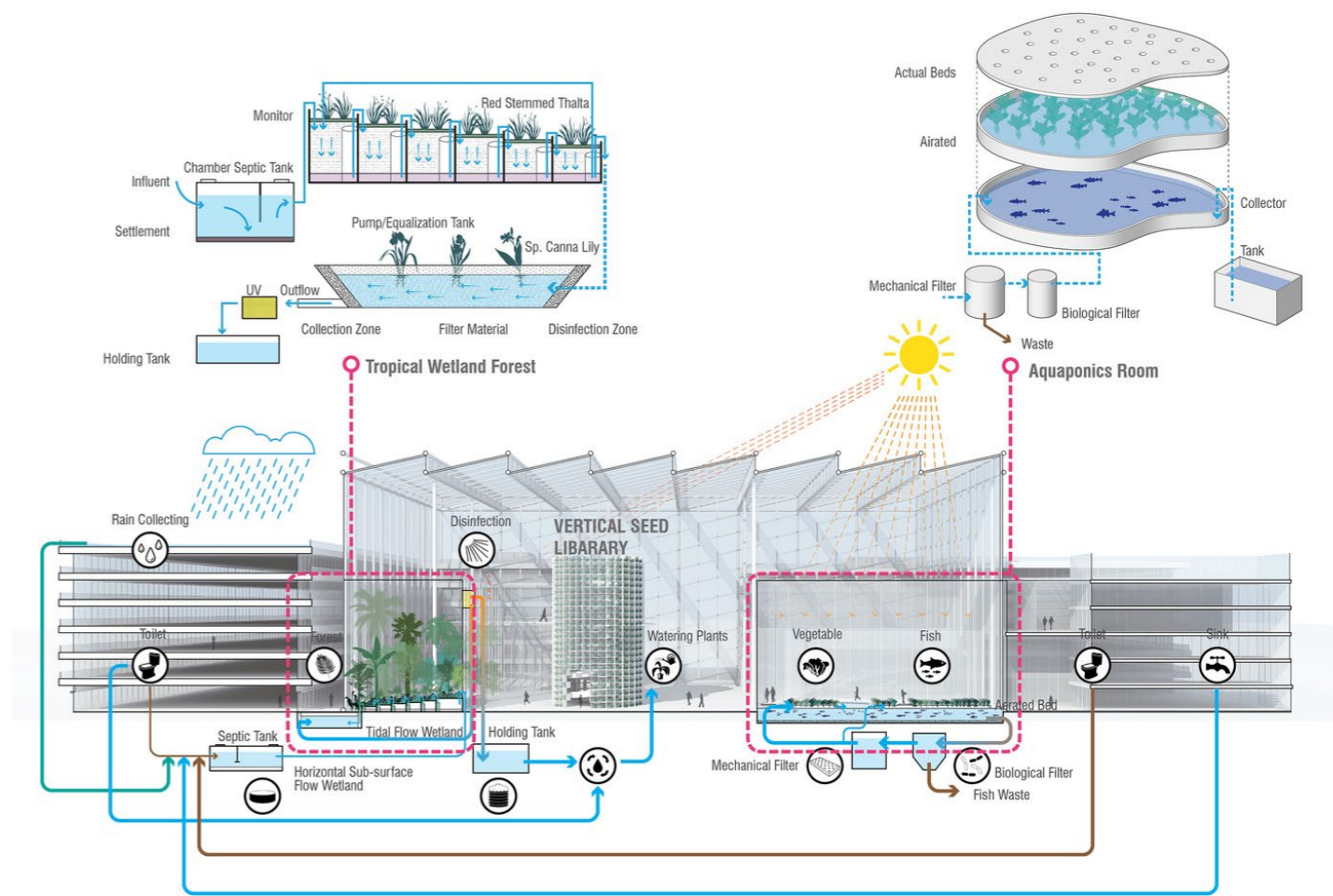


## iv. The concept of the building

After 20 years of conventional agricultural production on the site, Shanghai is expanding the role of Sunqiao in its foodshed. The new plan for the district, slated to begin construction in 2017, focuses on the integration of vertical farming systems in conjunction with research and public outreach. The result is an interactive, playful, and socially-engaging experience that presents urban agriculture as a dynamic living laboratory for innovation and education.



**Figure 35**  
 graphic of modern green house.  
 reference: <https://www.sasaki.com/>



**Figure 36**  
 graphic of integrated living system.  
 reference: <https://www.sasaki.com/>

*“To grow your own food gives you a sort of power and it gives people dignity. You know exactly what you’re eating because you grew it. It’s good, it’s nourishing and you did this for yourself, your family and your community.”*

*–Karen Washington, Garden of Happiness, Bronx, NY*

06 | **Hypothesis**

## 6. Hypothesis

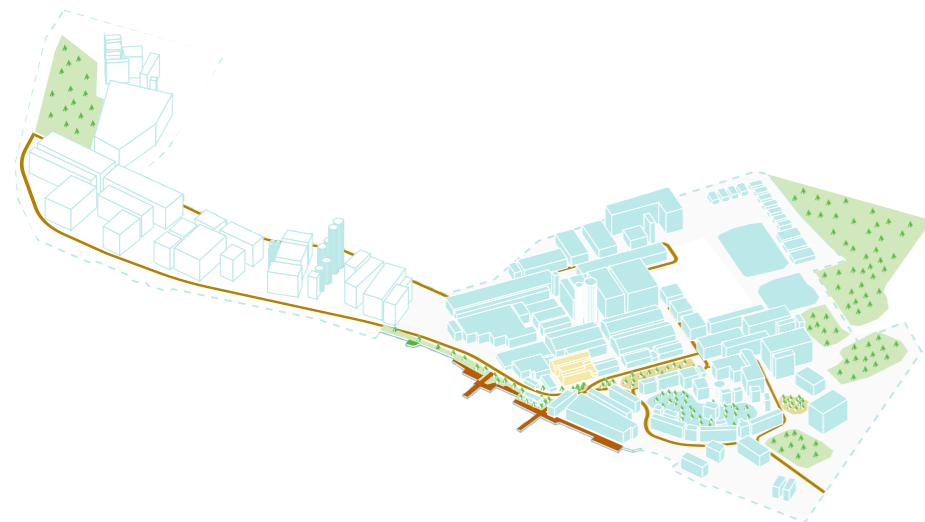
- Building



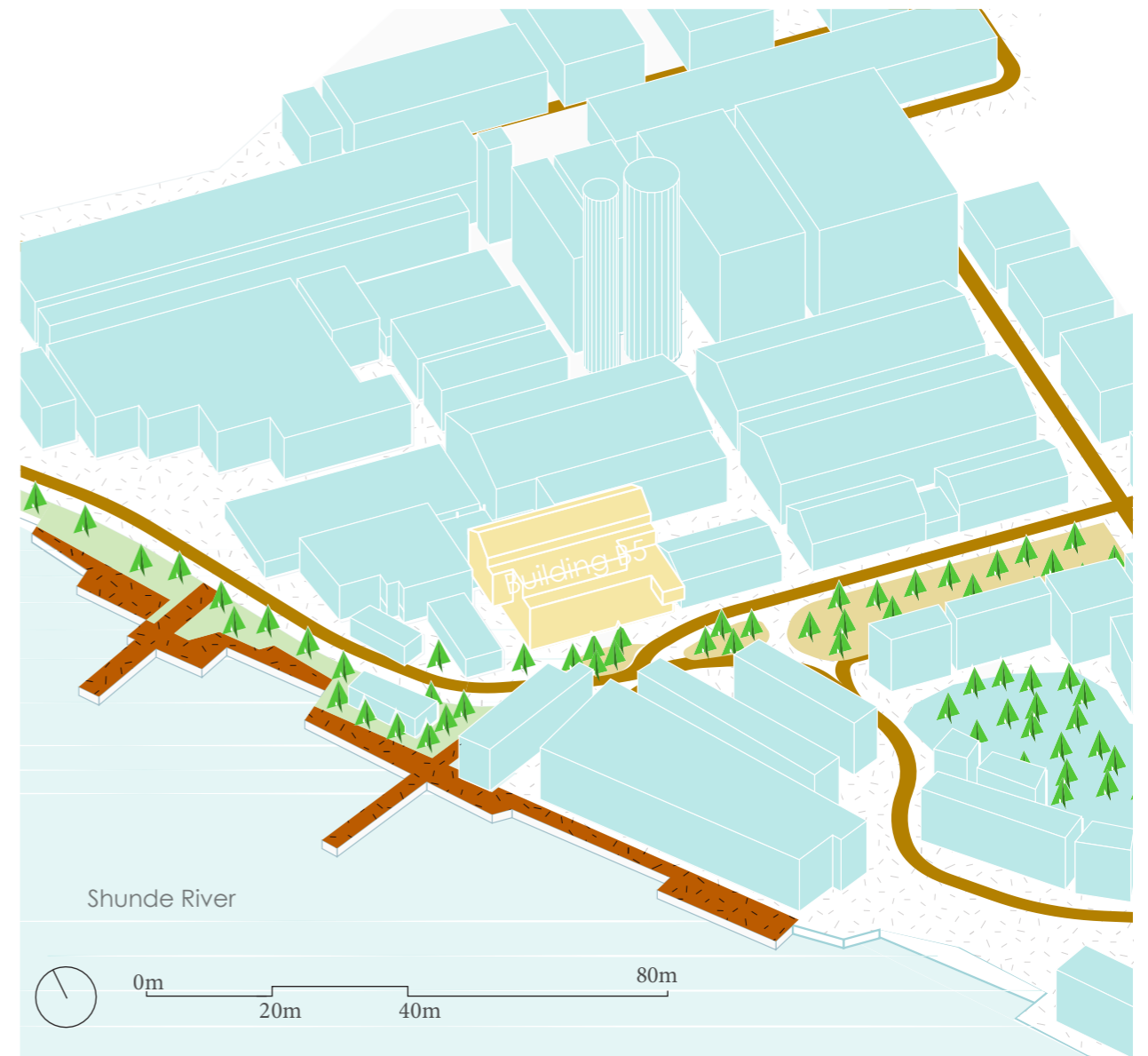
- Greenery & main road



- Zinitown



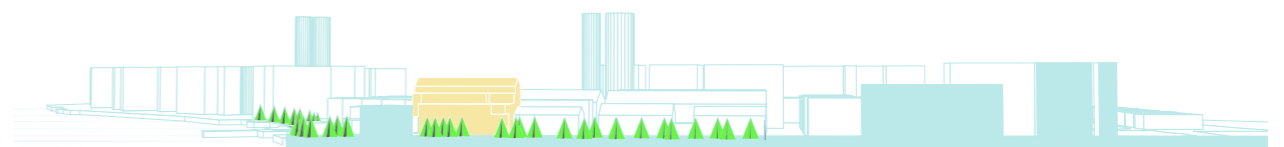
- Greenery
- Building B5
- Developed Building
- Developing



- A-A section



- B-B section



• Shadow Analysis

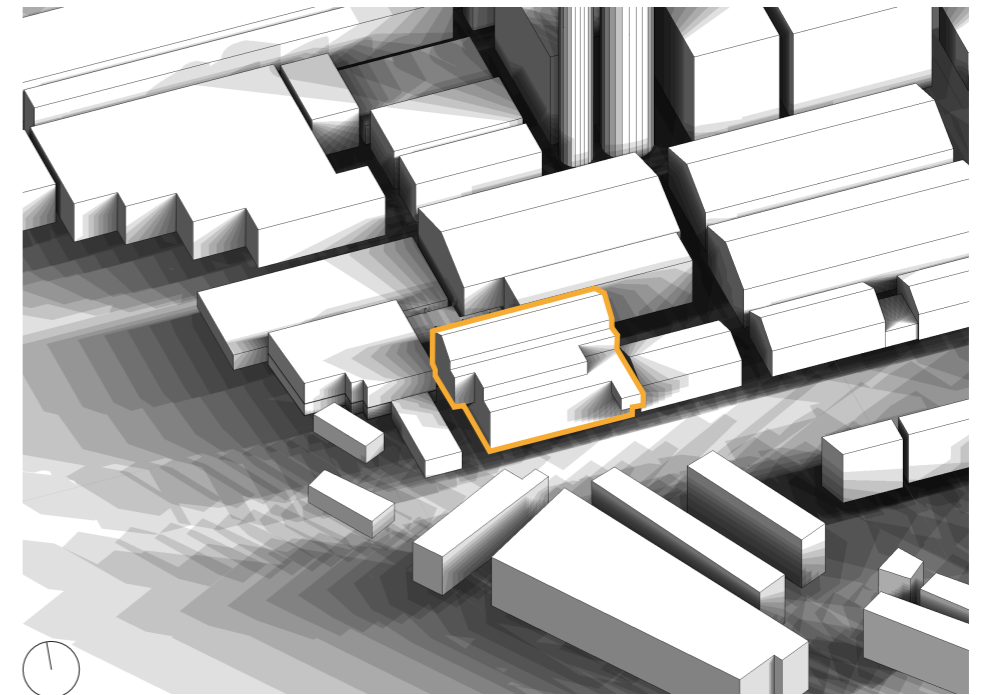
• 06/01 (the coldest day-average)



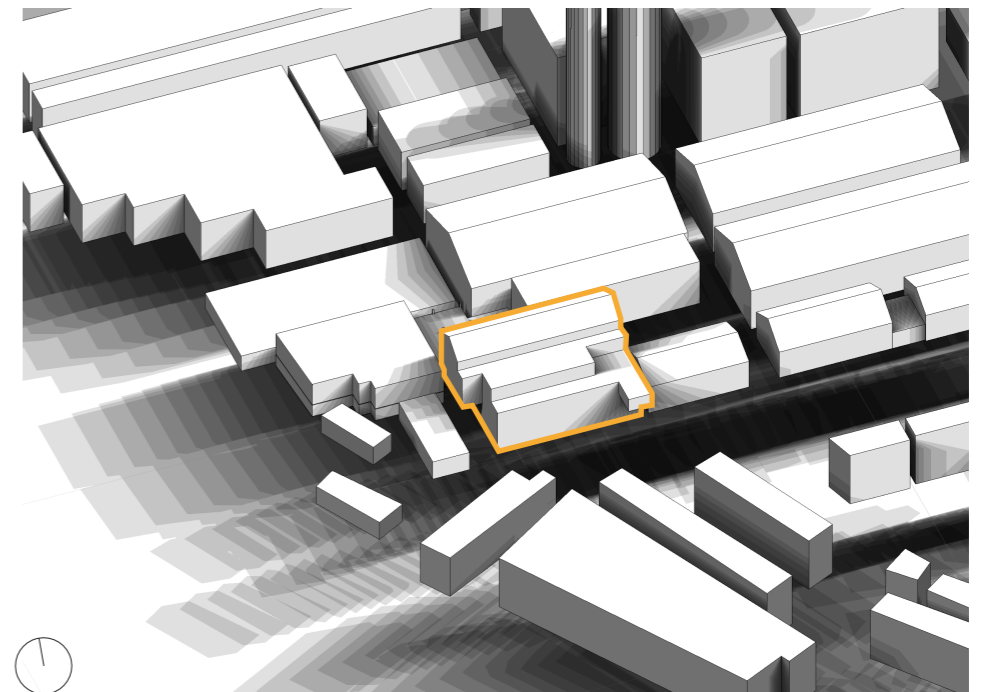
• 30/08 (the hottest day-average)



• 06/01 (the coldest day-average)



• 30/08 (the hottest day-average)



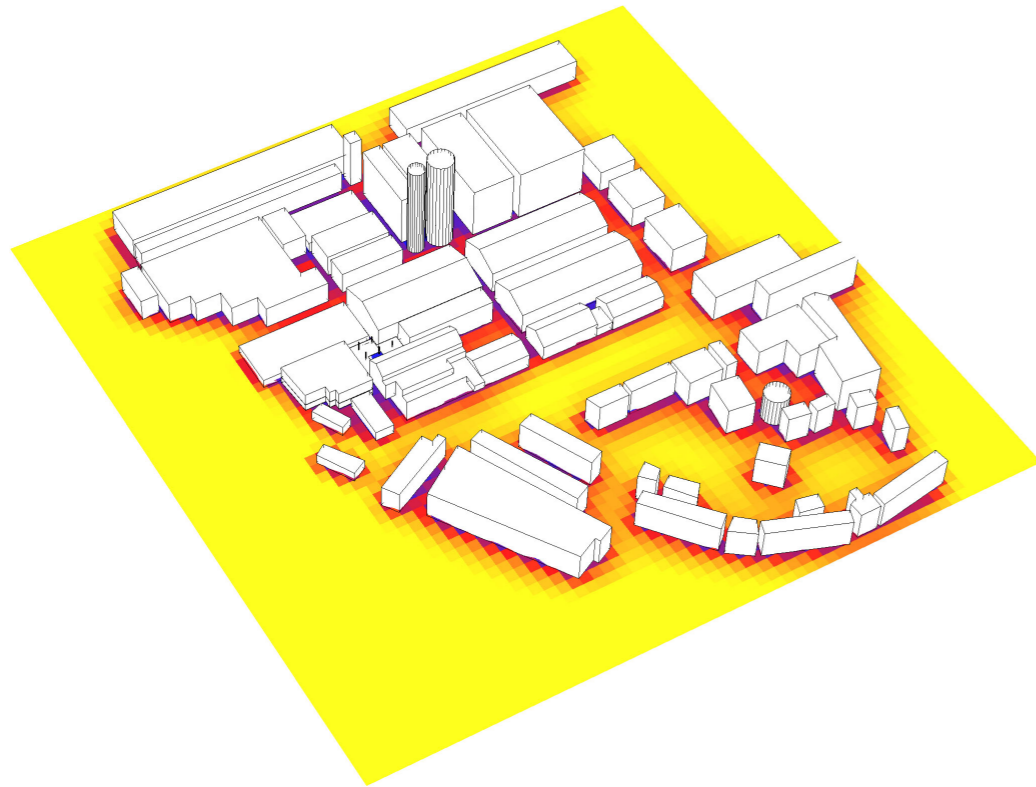
It is shown from the shadow analysis that the south side are mainly receive most of the solar radiation in the building in the choosed typical days. Hence the plantations' ideal location is in the south side with largely window opening spaces.

 Building 5

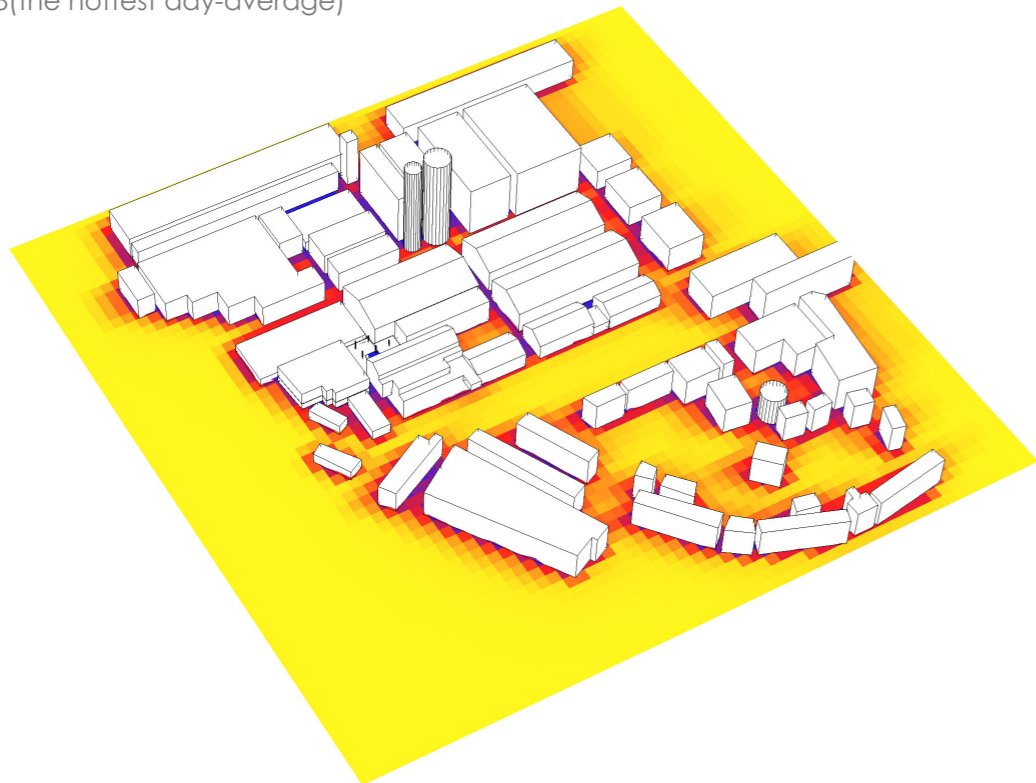


• Solar Radiation

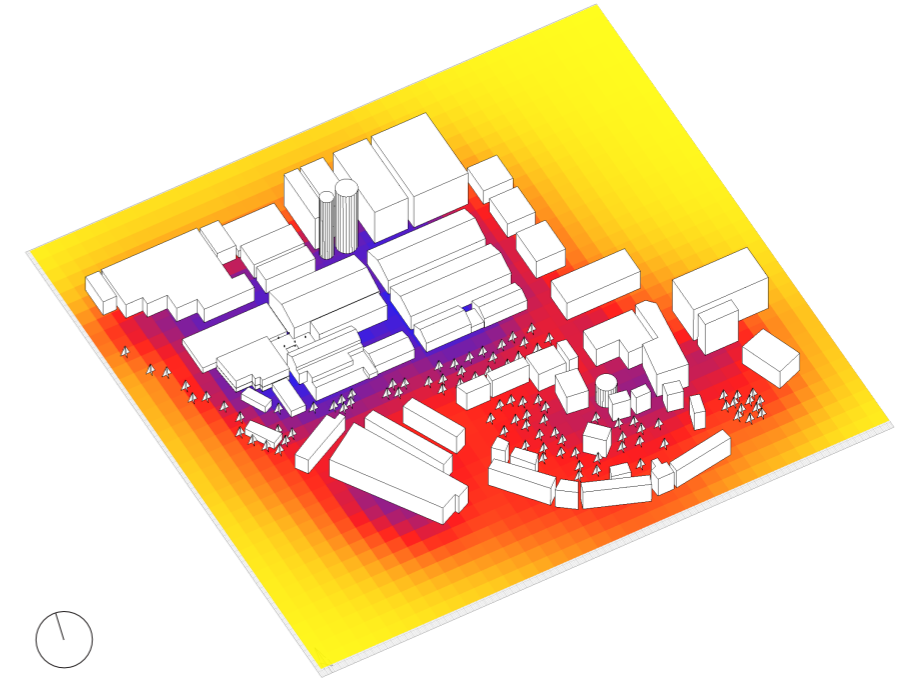
• 06/01 (the coldest day-average)



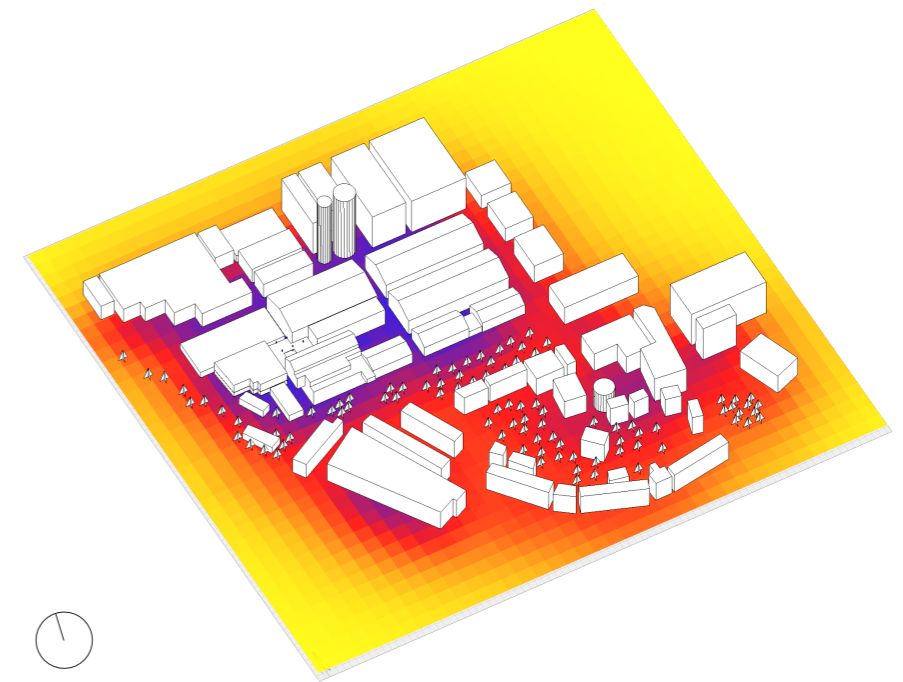
• 30/08 (the hottest day-average)



• 06/01 (the coldest day-average)

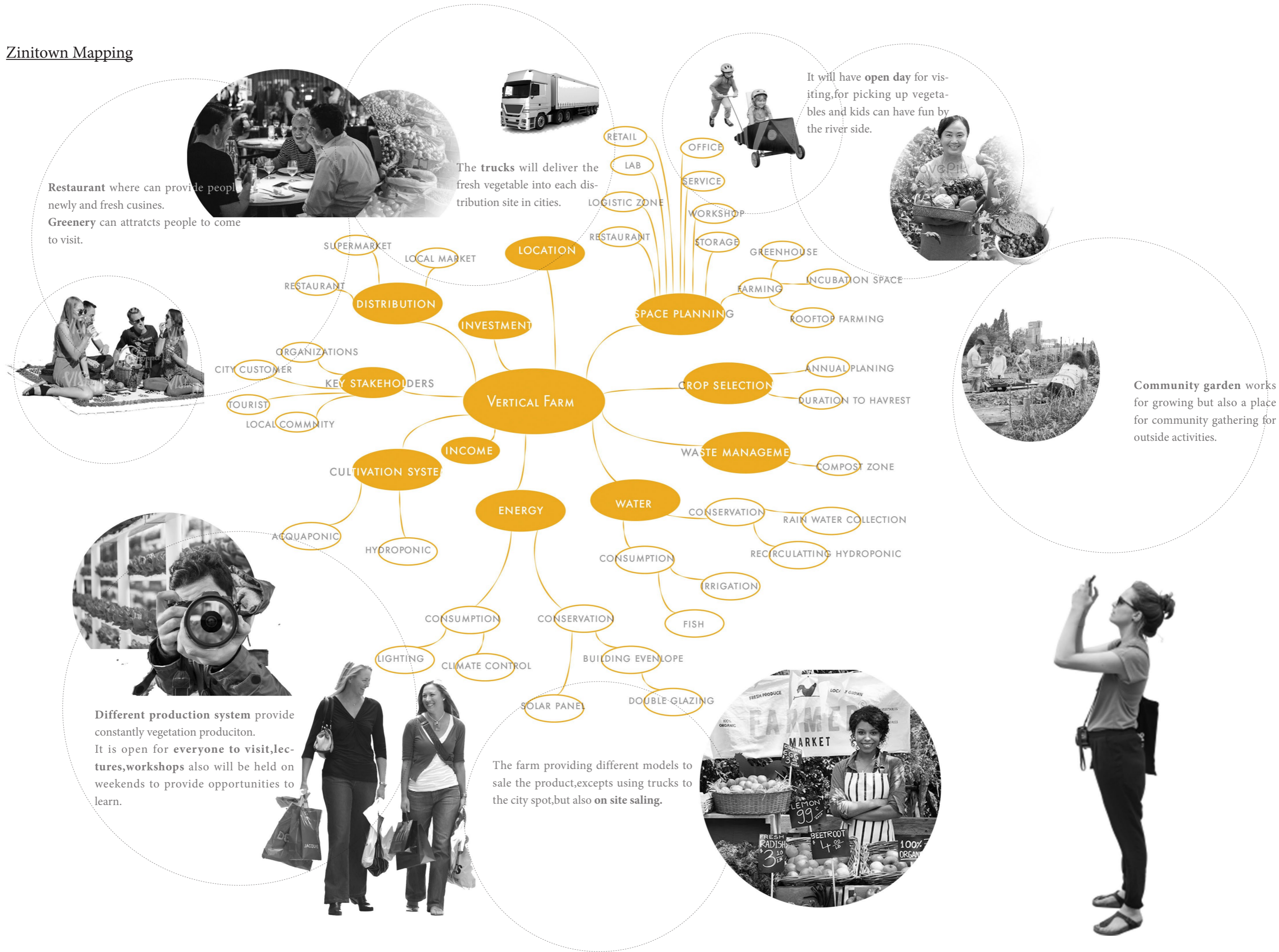


• 30/08 (the hottest day-average)



What is obvious is that the daily solar radiation is extremely high in the vacant area without any buildings or shelters, when putting some greenery in the project, the simulation shows that the yellow area has minimized and the red/purple area has increased. so in this project, we can consider to bring more green in the surroundings to cool the environment and make it more comfortable for people to walk on the street. Moreover, the higher incidence parts could put the photovoltaic panel to make use of the energy.

• Zinitown Mapping



Restaurant where can provide people newly and fresh cusines. Greenery can attracts people to come to visit.

The trucks will deliver the fresh vegetable into each distribution site in cities.

It will have open day for visiting,for picking up vegetables and kids can have fun by the river side.

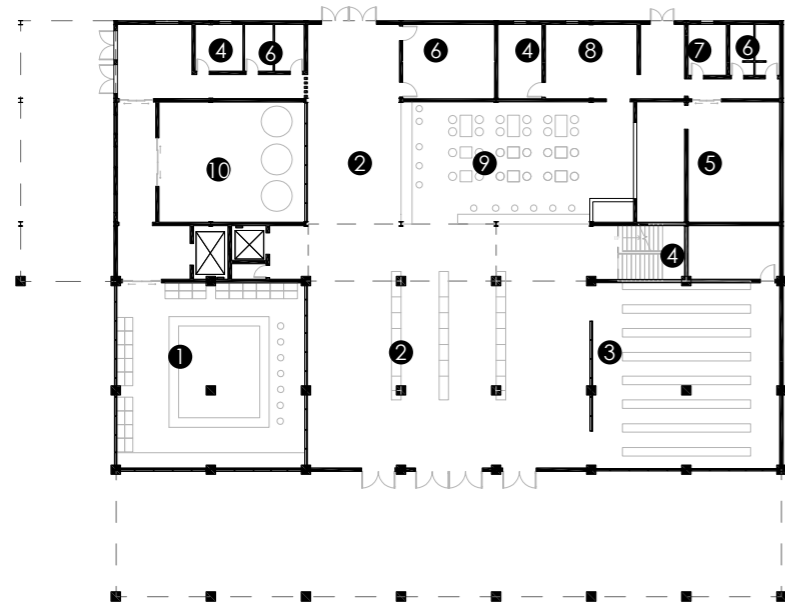
Community garden works for growing but also a place for community gathering for outside activities.

Different production system provide constantly vegetation produciton. It is open for everyone to visit,lectures,workshops also will be held on weekends to provide opportunities to learn.

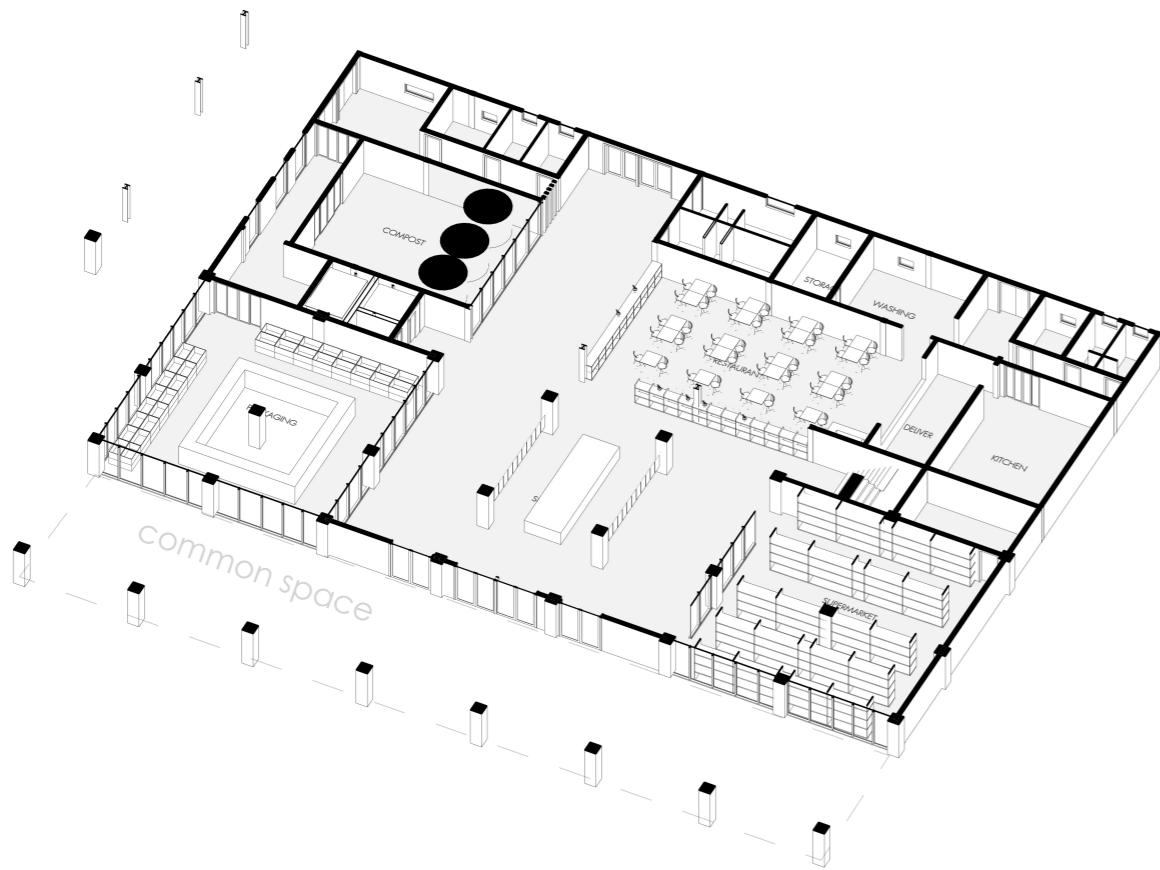
The farm providing different models to sale the product,excepts using trucks to the city spot,but also on site saling.

• Space Planning

• 1 Floor

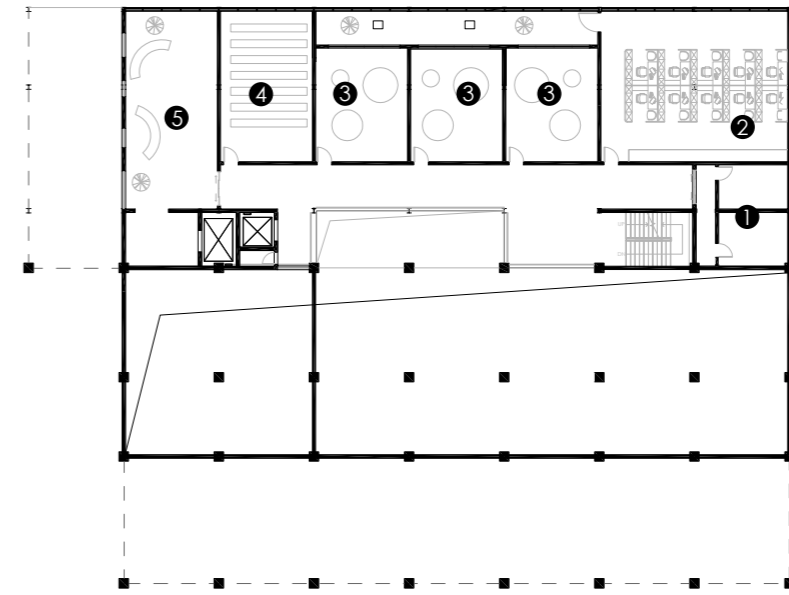


- ① packaging
- ② lobby
- ③ supermarket
- ④ storage
- ⑤ kitchen
- ⑥ Toilet
- ⑦ freeze
- ⑧ washing
- ⑨ restaurant
- ⑩ compost

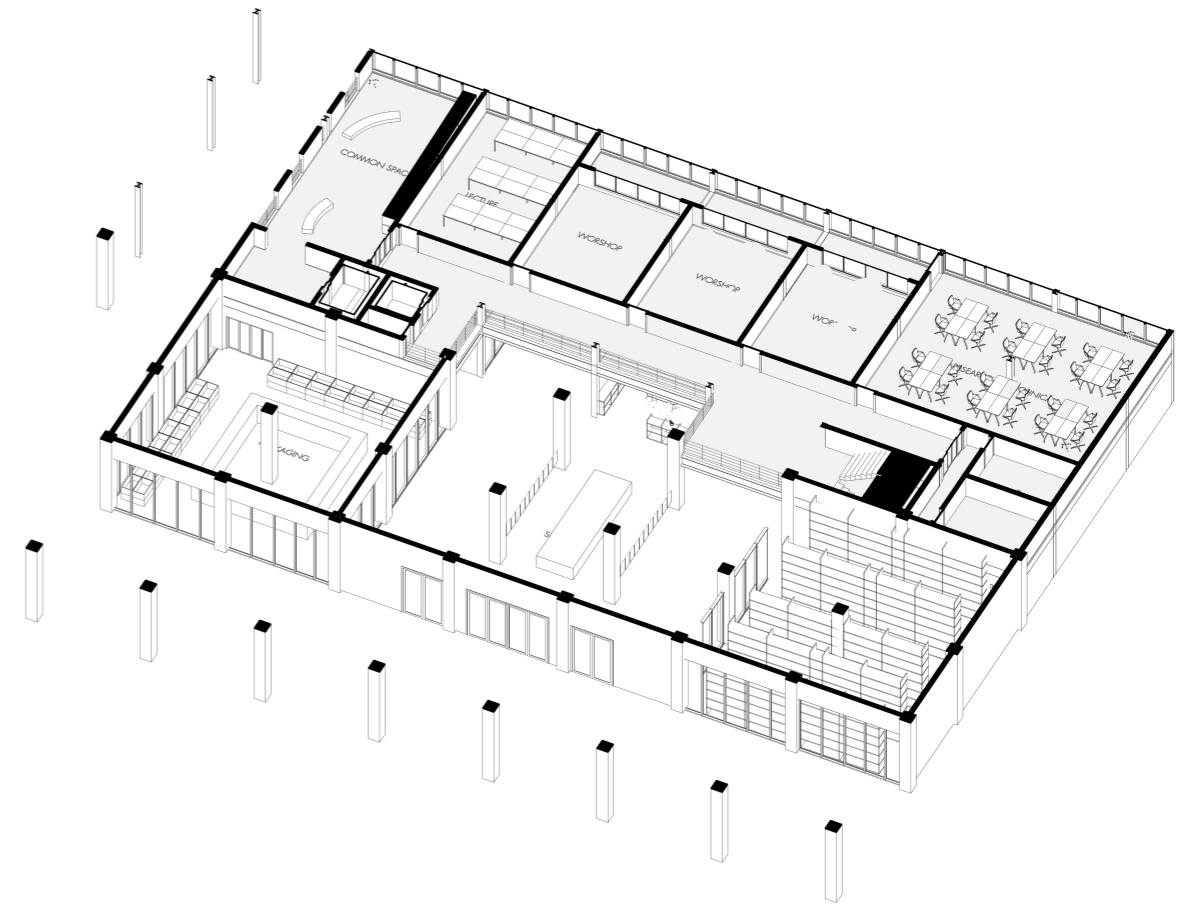


• Space Planning

• 2 Floor

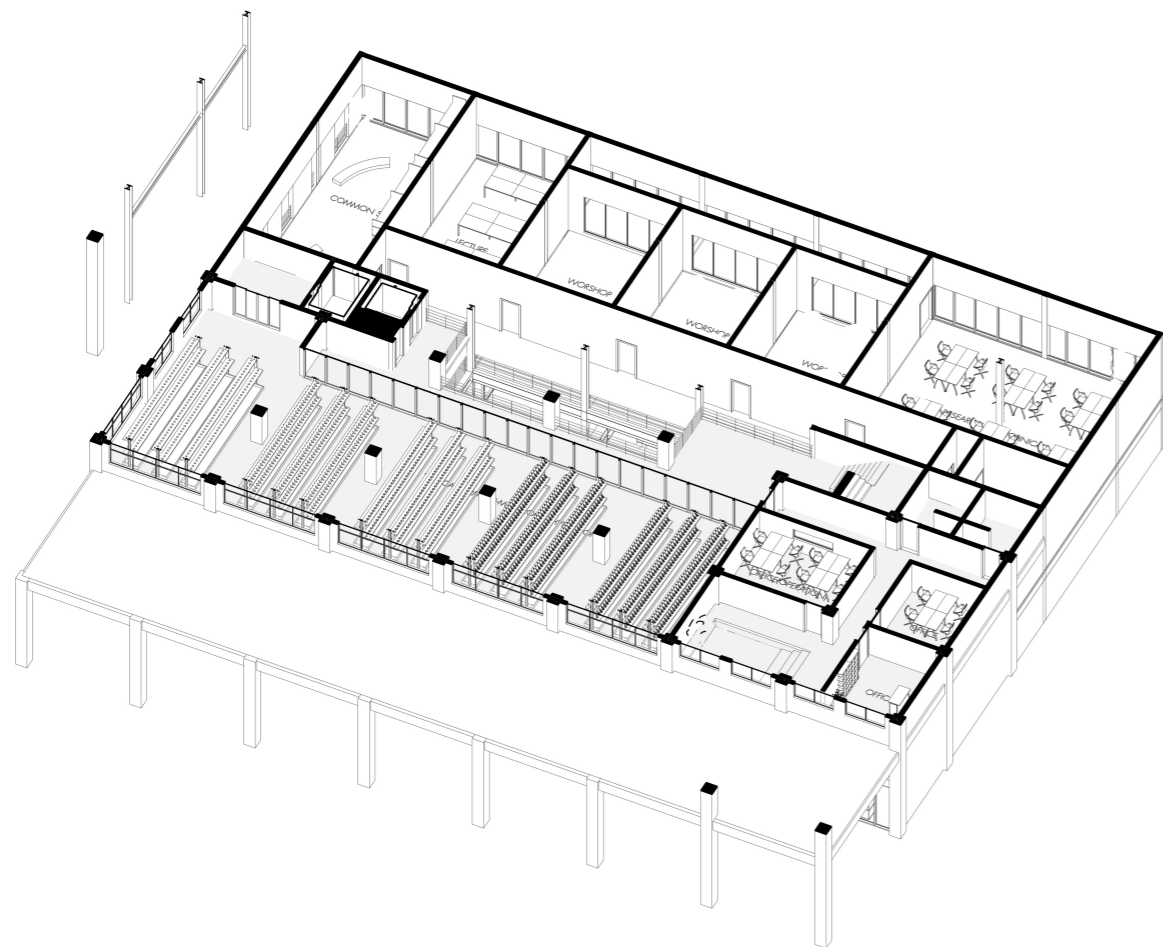
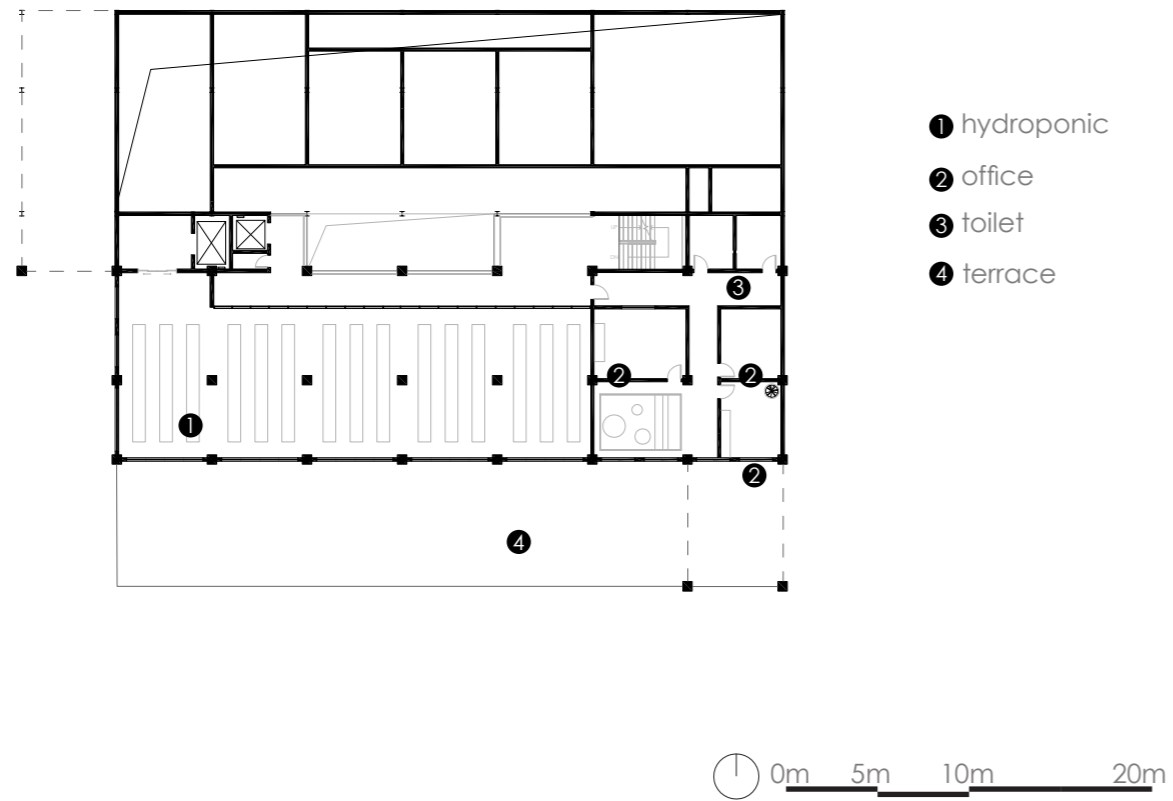


- ① Toilet
- ② reearch center
- ③ workshop
- ④ leccture
- ⑤ common space



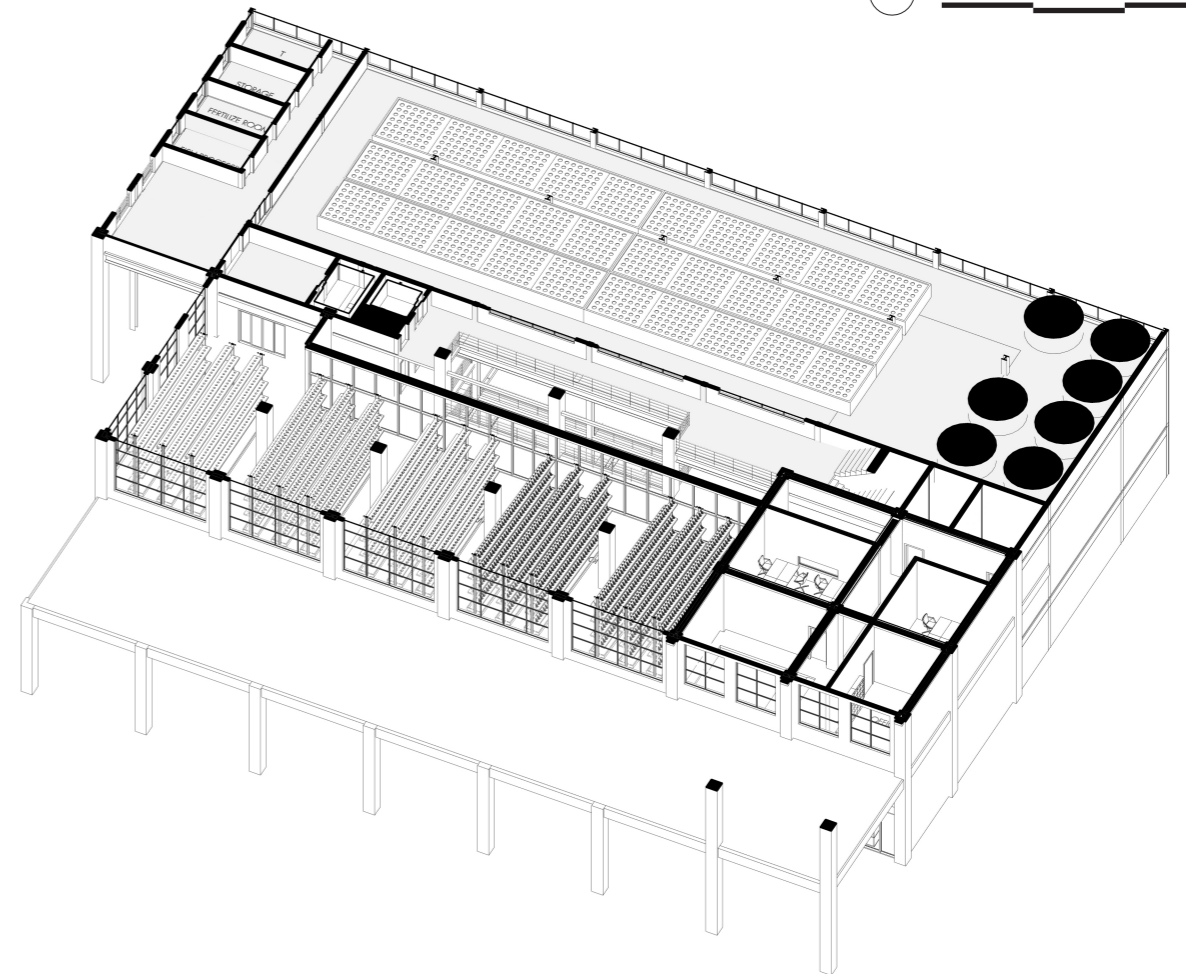
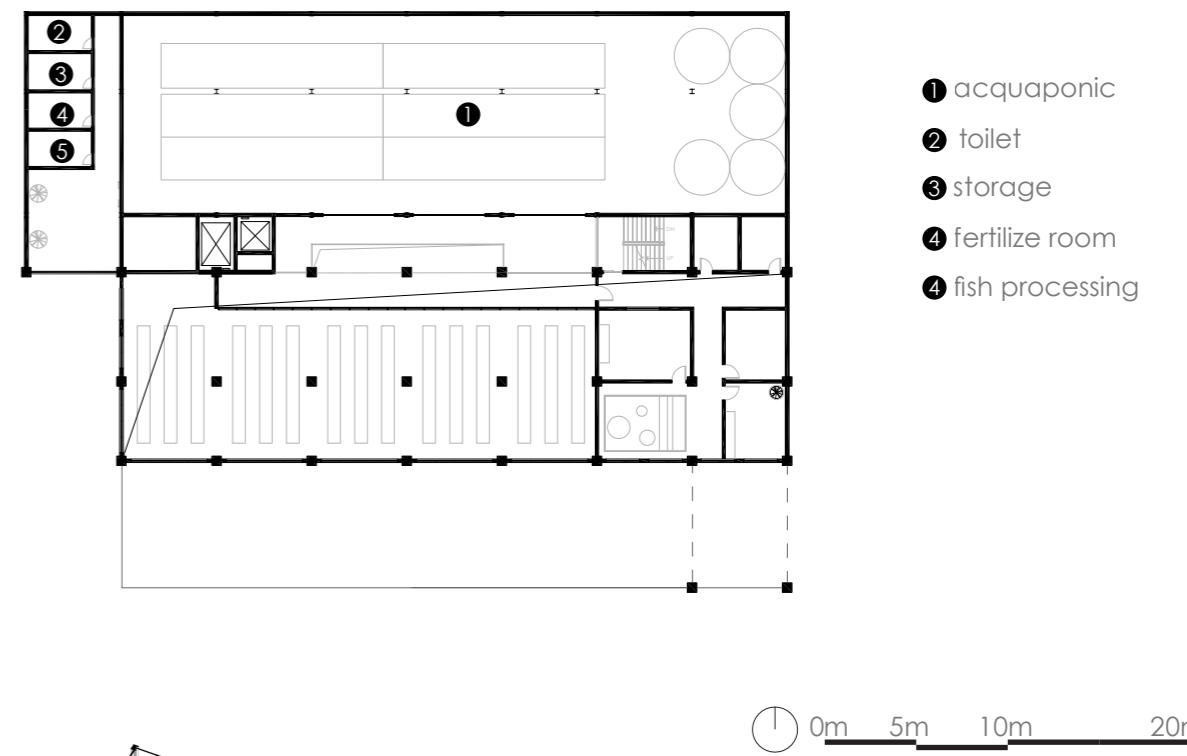
• Space Planning

• 2.5 Floor



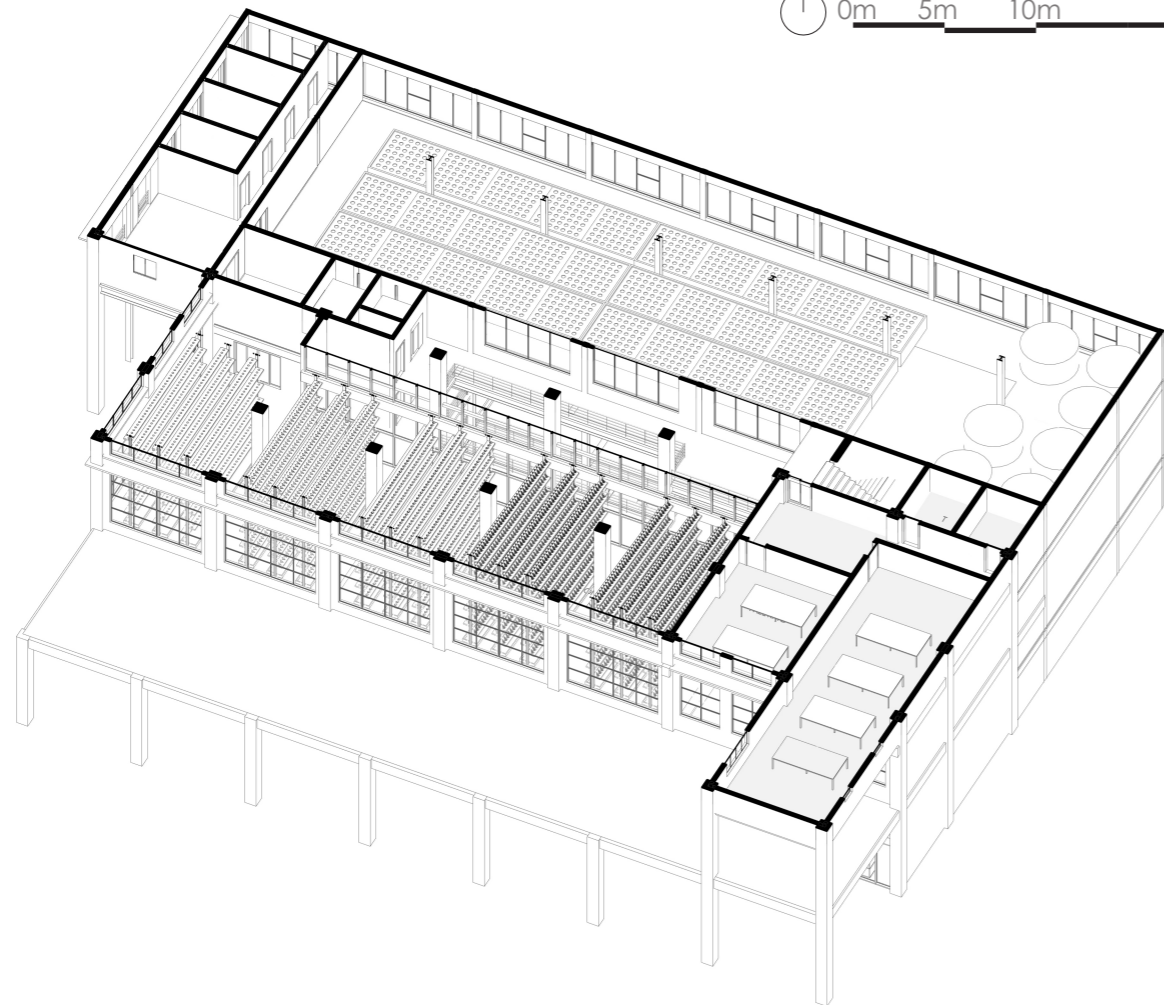
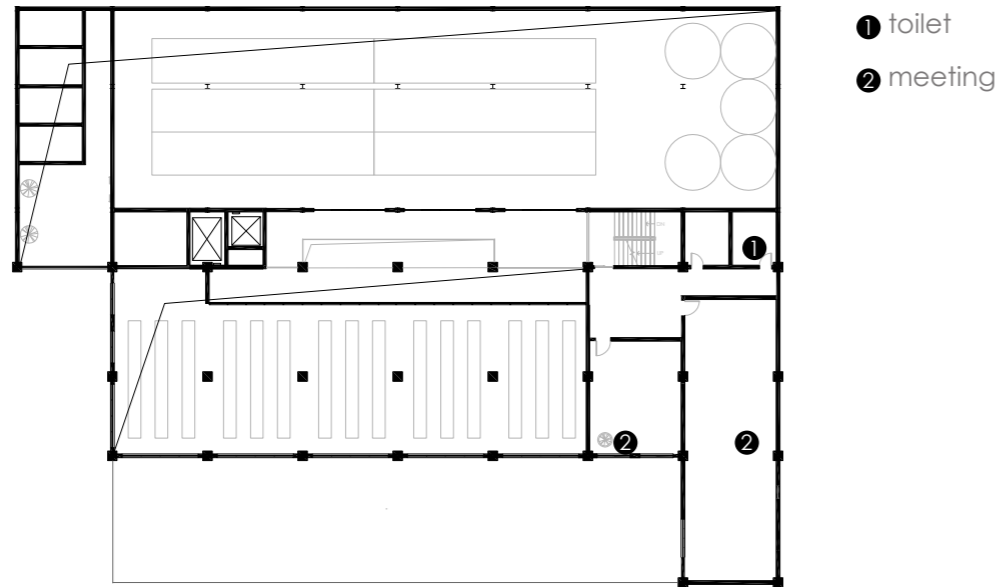
• Space Planning

• 3 Floor



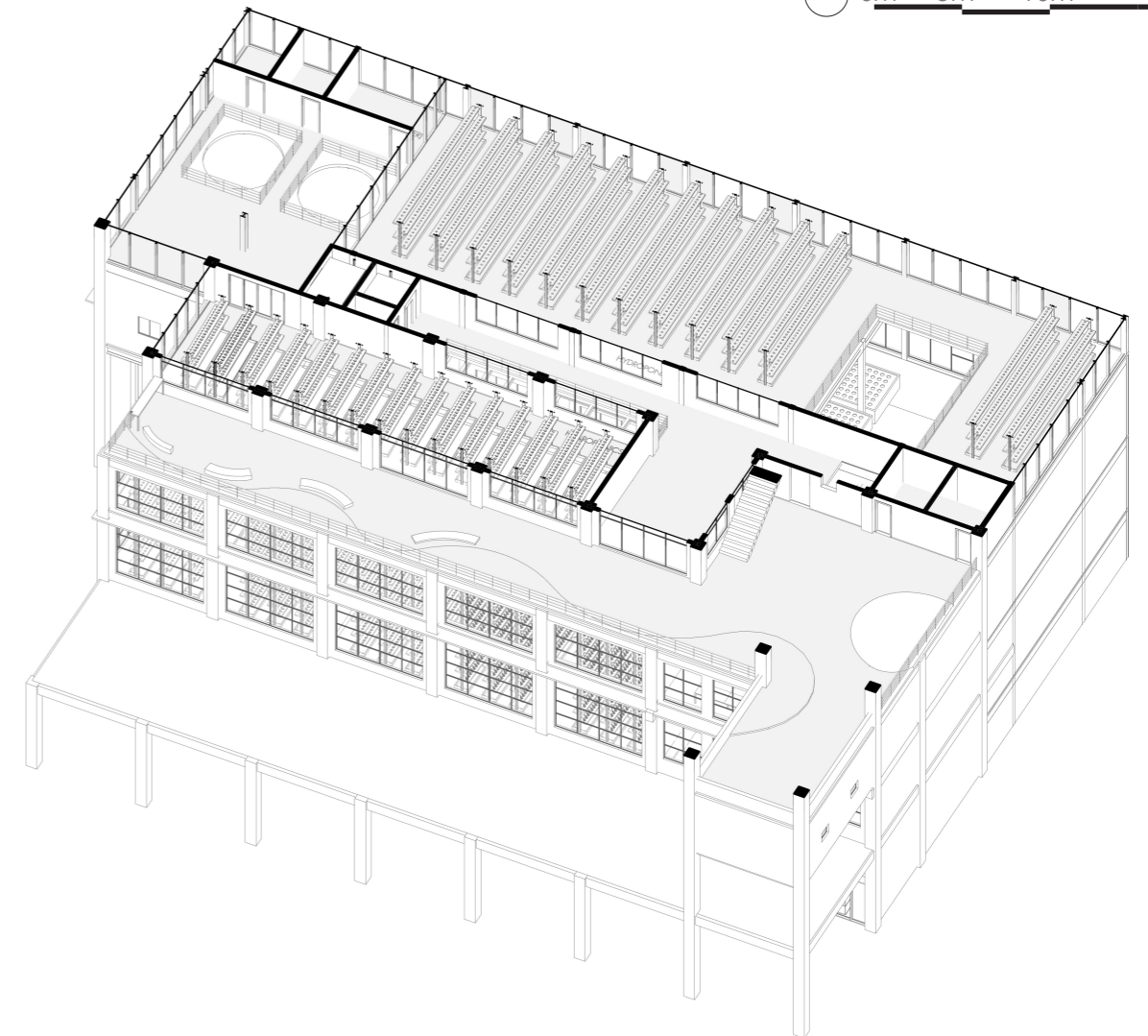
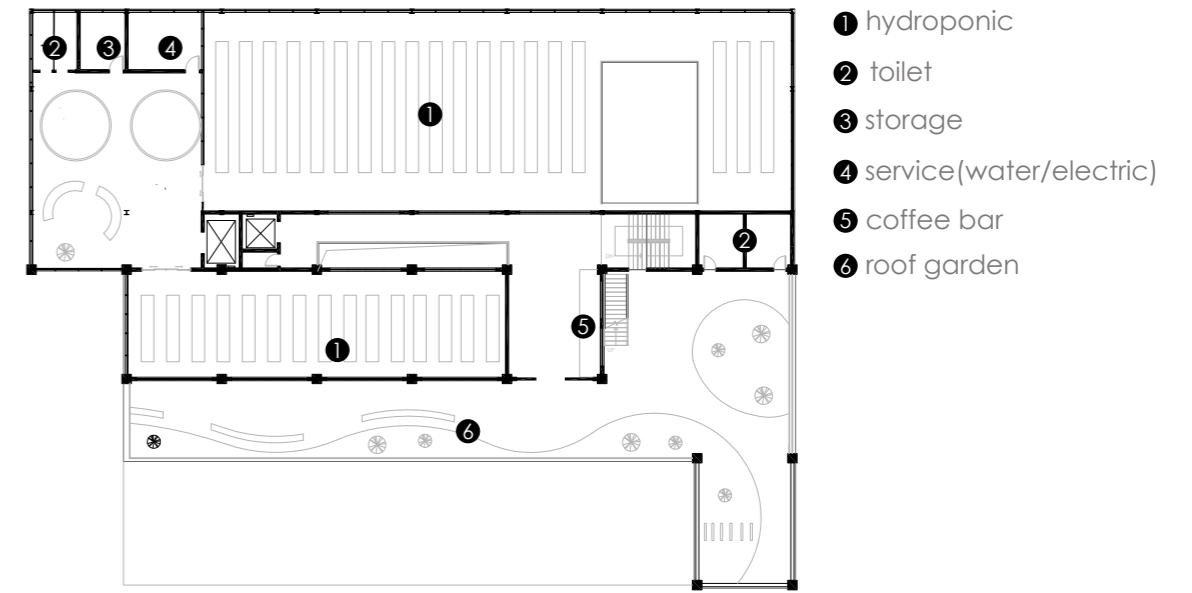
• Space Planning

• 3.5 Floor



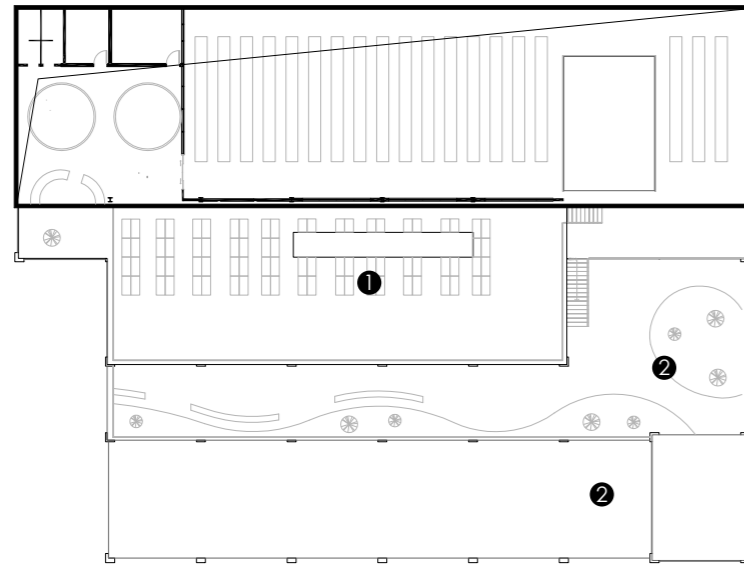
• Space Planning

• 4 Floor

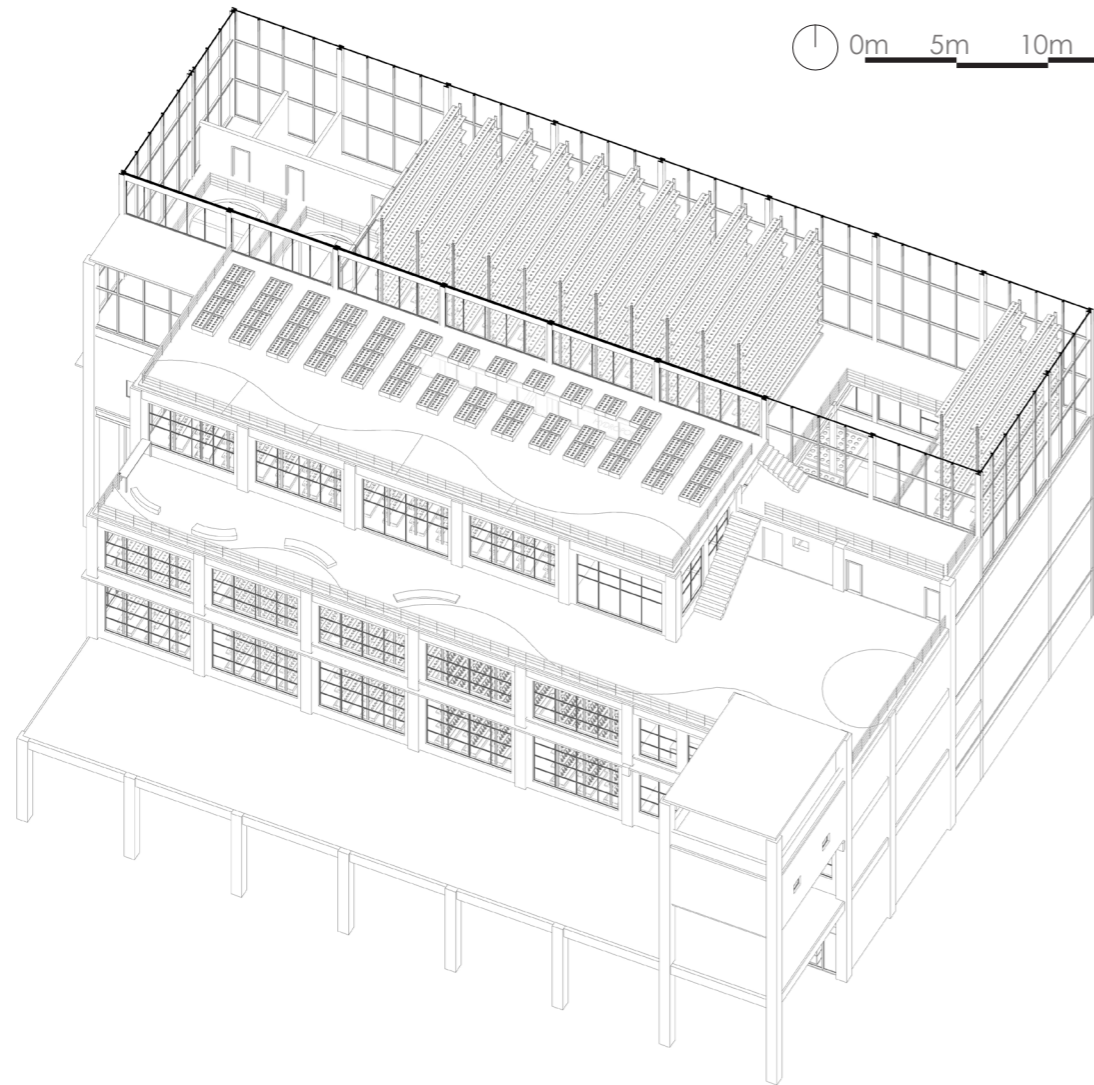


• Space Planning

• 4.5 Floor

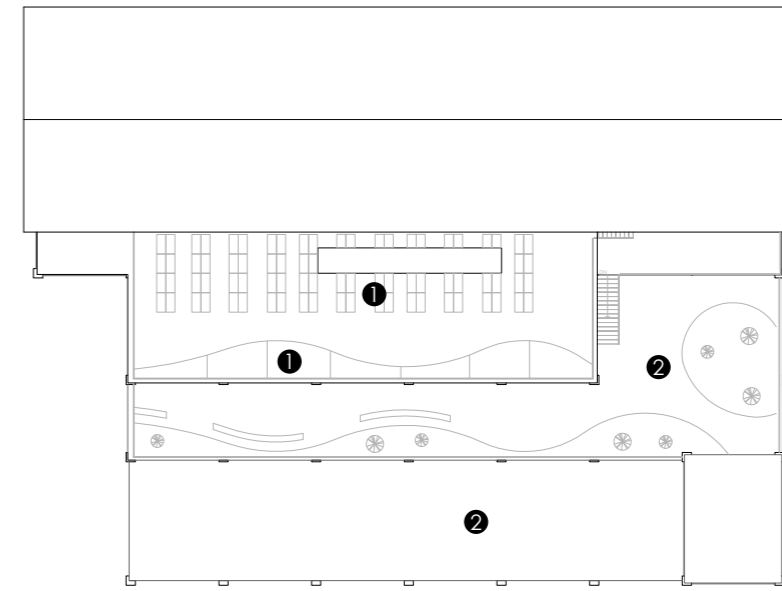


- 1 community garden
- 2 roof garden

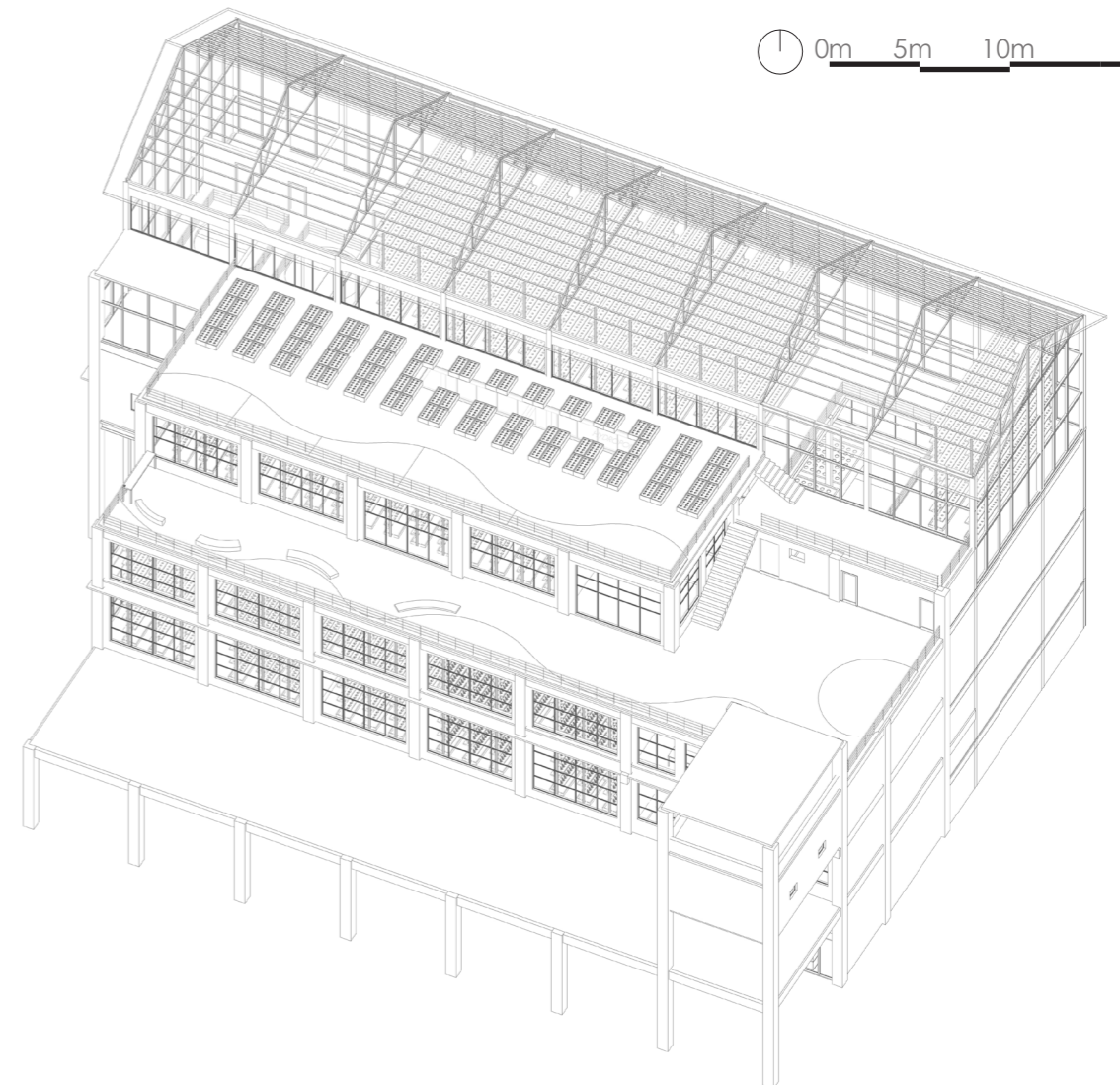


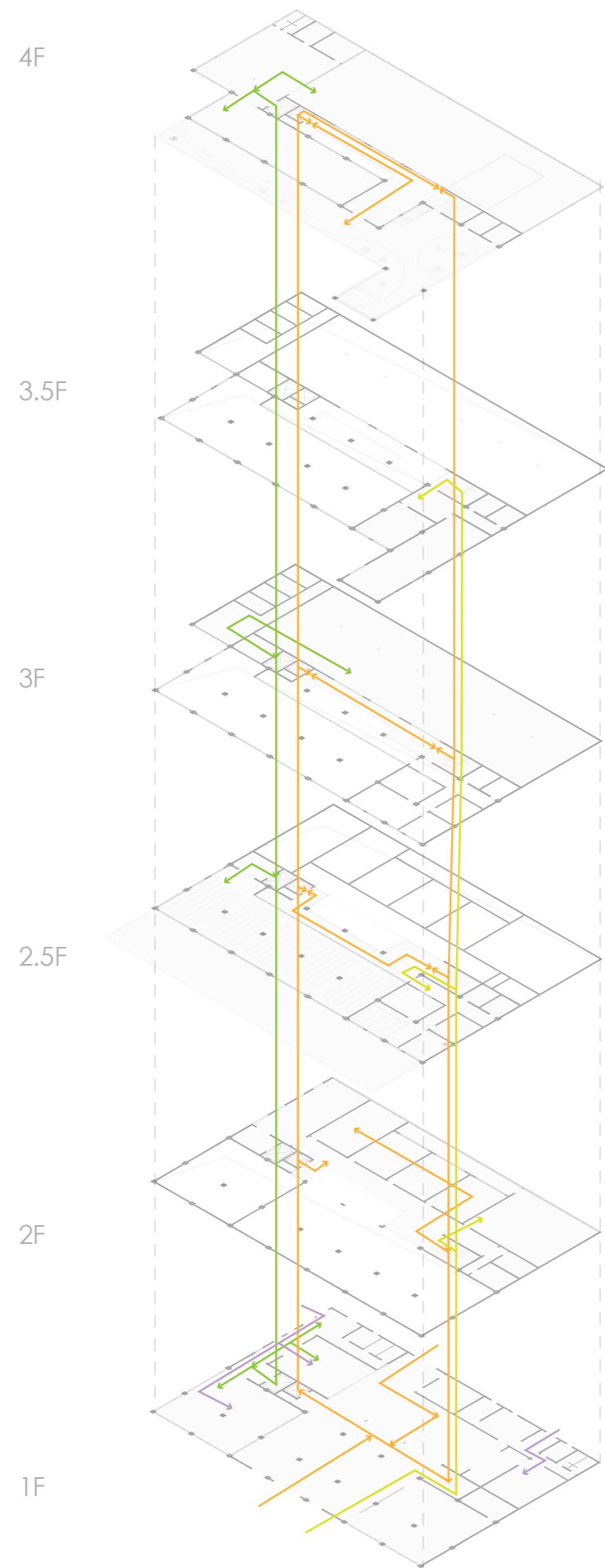
• Space Planning

• Roof Floor



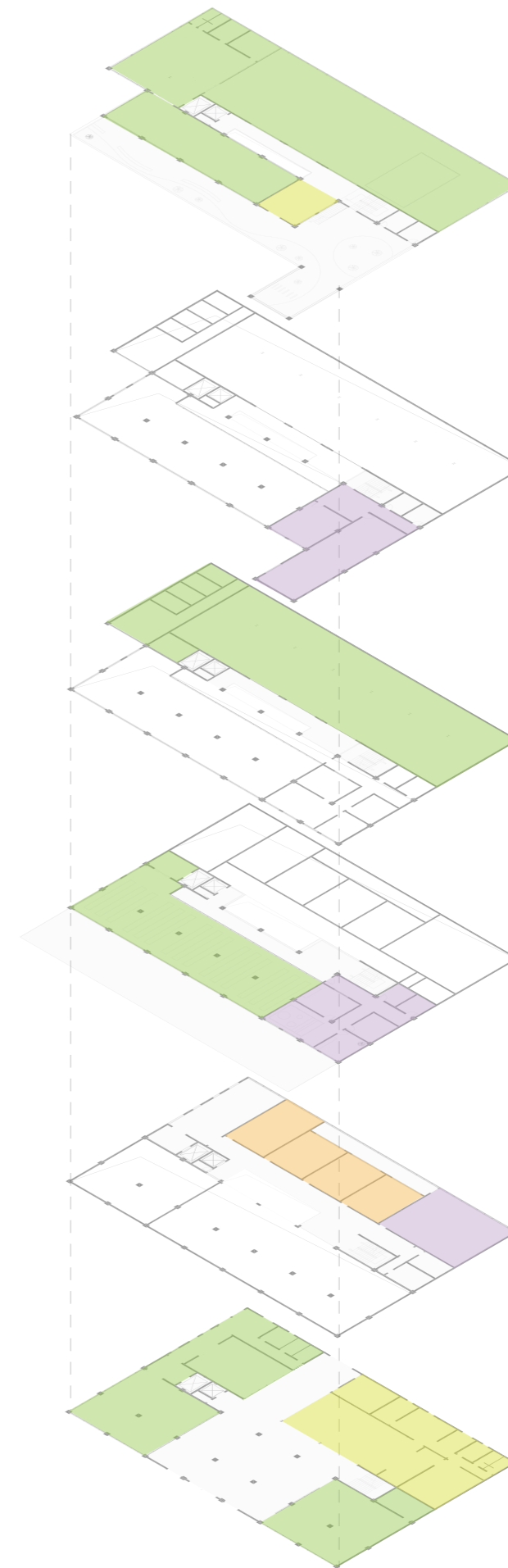
- 1 community garden
- 2 roof garden





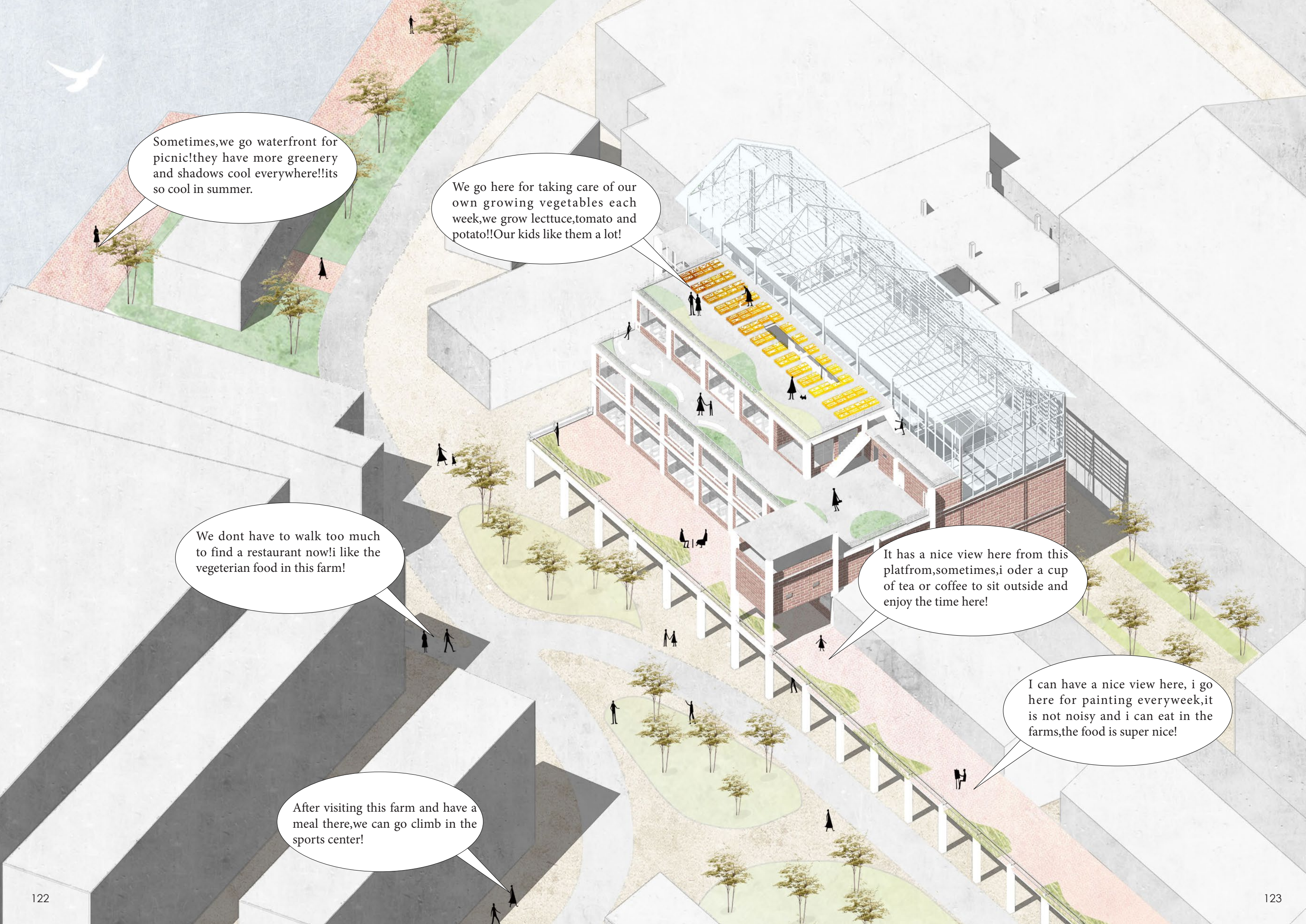
Flow analysis

- tourists
- employees
- vegetation
- workers



Functional analysis

- production & sales
- workshop
- research lab & office
- restaurant & bar



Sometimes, we go waterfront for picnic! they have more greenery and shadows cool everywhere!! its so cool in summer.

We go here for taking care of our own growing vegetables each week, we grow lettuce, tomato and potato!! Our kids like them a lot!

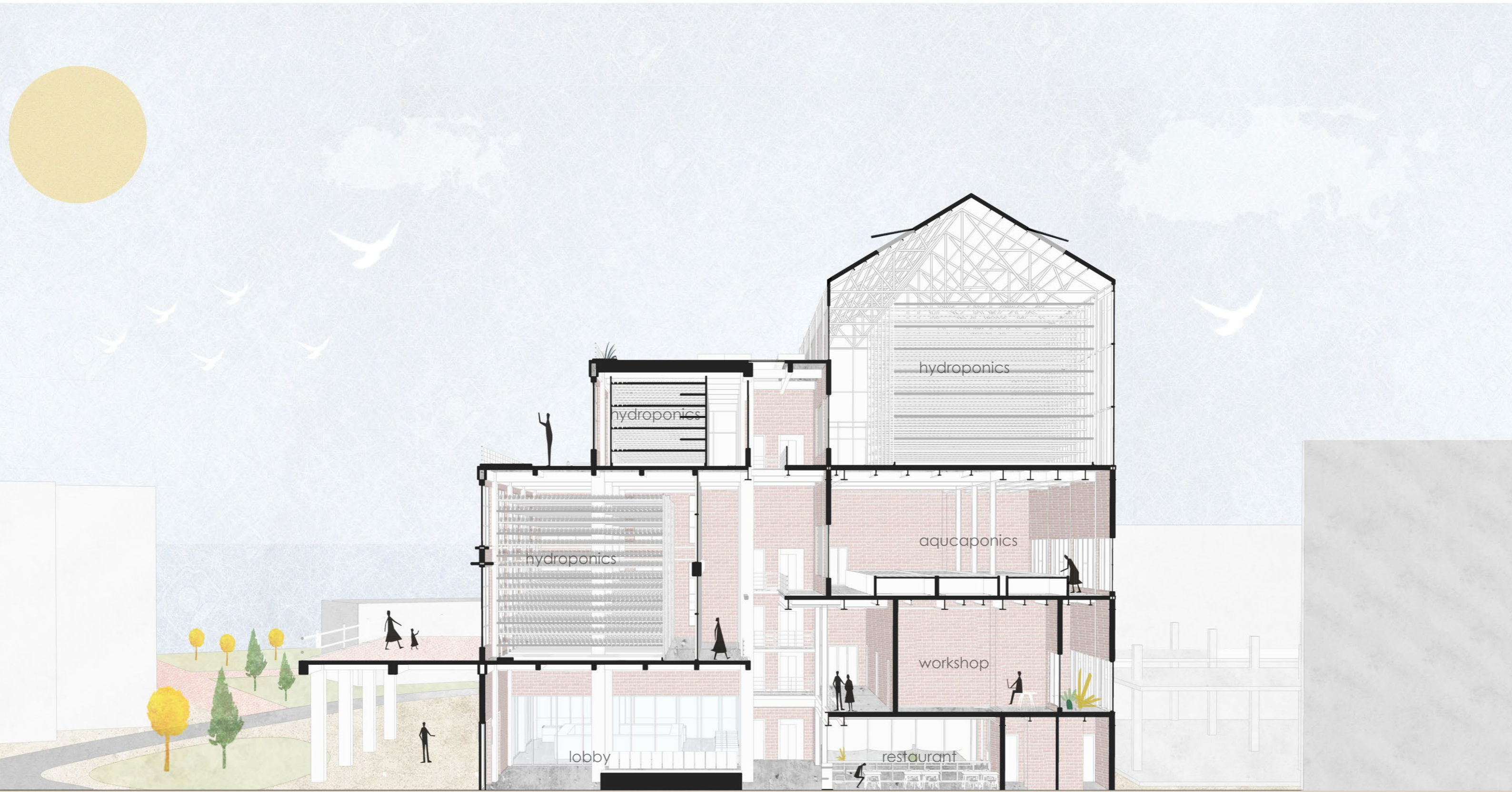
We don't have to walk too much to find a restaurant now! I like the vegetarian food in this farm!

It has a nice view here from this platform, sometimes, I order a cup of tea or coffee to sit outside and enjoy the time here!

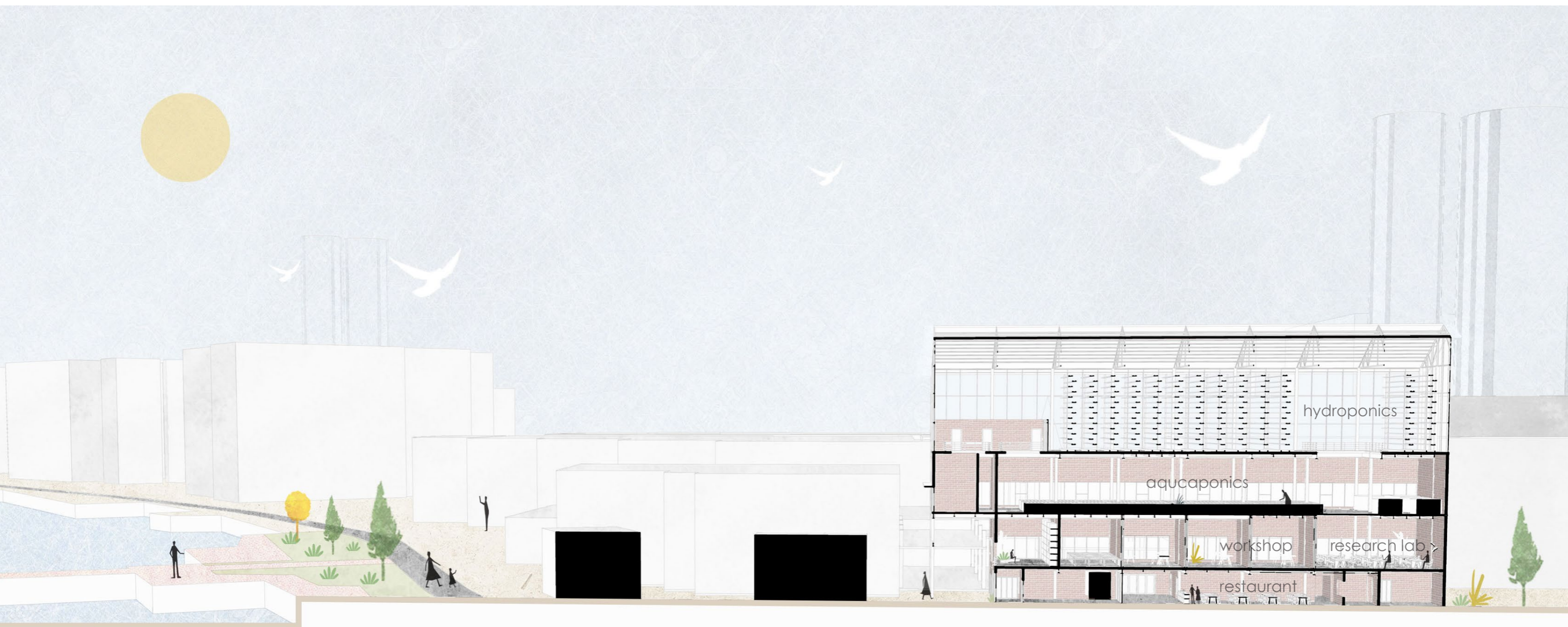
I can have a nice view here, I go here for painting every week, it is not noisy and I can eat in the farms, the food is super nice!

After visiting this farm and have a meal there, we can go climb in the sports center!





0m 5m 10m 15m



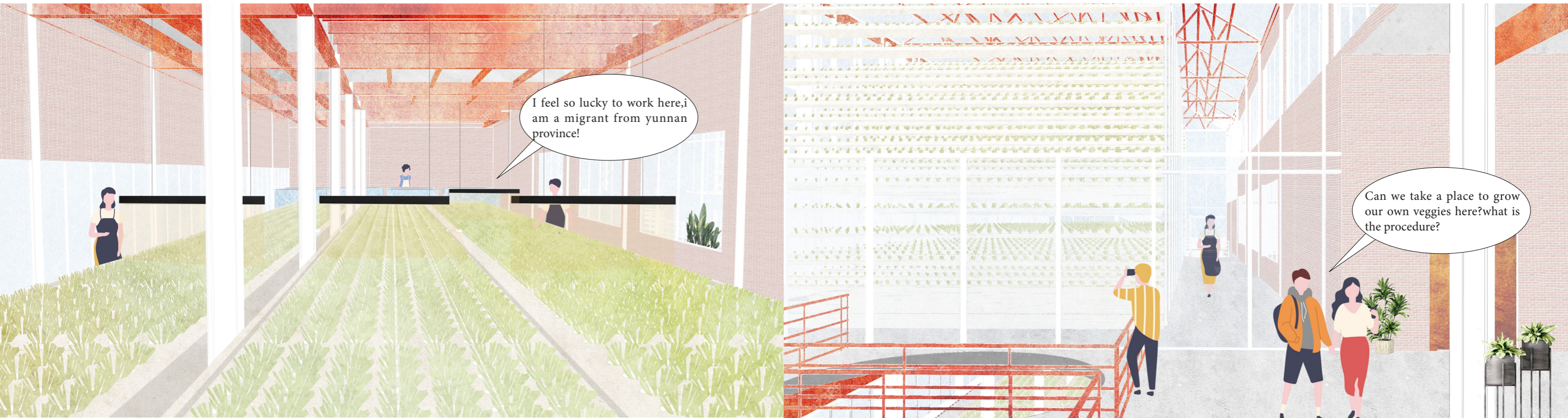
0m 5m 10m 15m



This restaurant is awesome with their cantonese cuisine with fresh veggies and fishes!



We can book for visiting inside in the cultivation room next time!



I feel so lucky to work here, i am a migrant from yunnan province!

Can we take a place to grow our own veggies here? what is the procedure?





## LOCAL MARKET

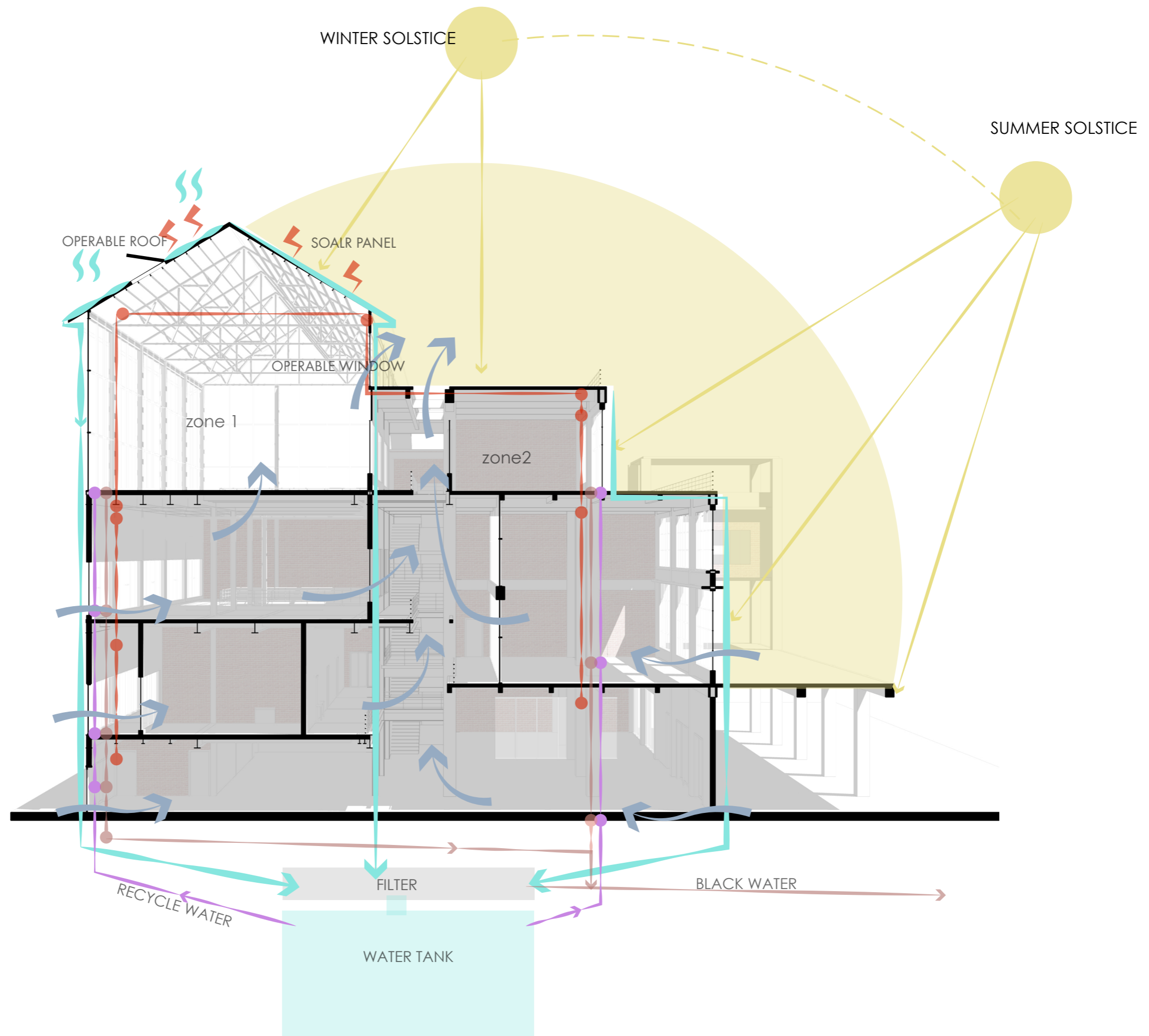
opens:

Mon-Sun:9:00-11:00am  
周一 - 周日: 9:00-11:00

If you are interested in our  
workshops and lectures,dont  
hesitate to join us!

有意愿参与工作坊者, 请进店咨  
询!





  
 rain water capture(area): 2462 m<sup>2</sup>  
 rain water capture(annual): 4185.400 m<sup>3</sup>

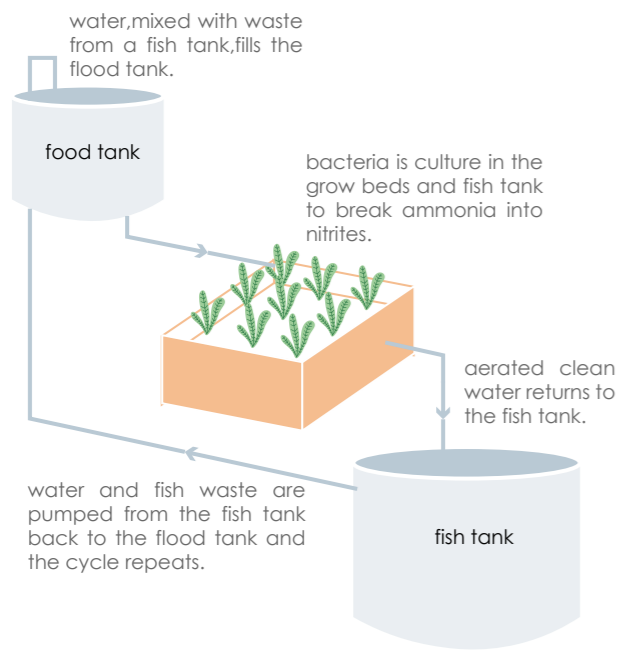
  
 PV production(annual): 137219.28Kwh

• ZONE 1 is the room for latter energy simulation.

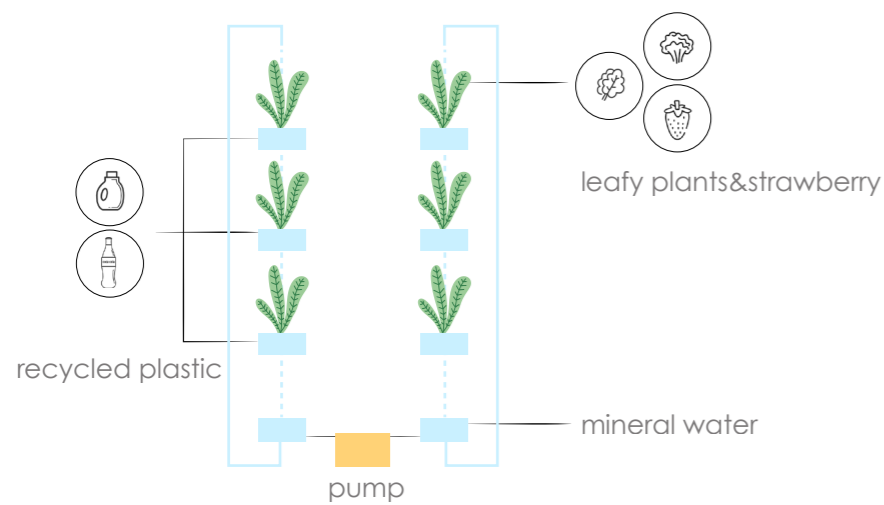
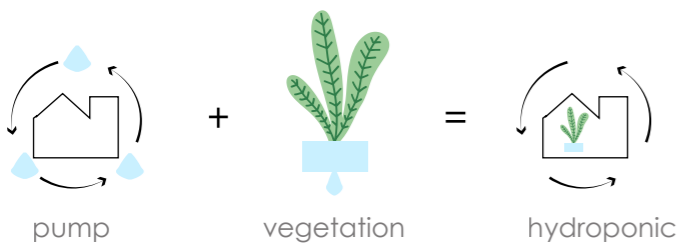


• Cultivation system

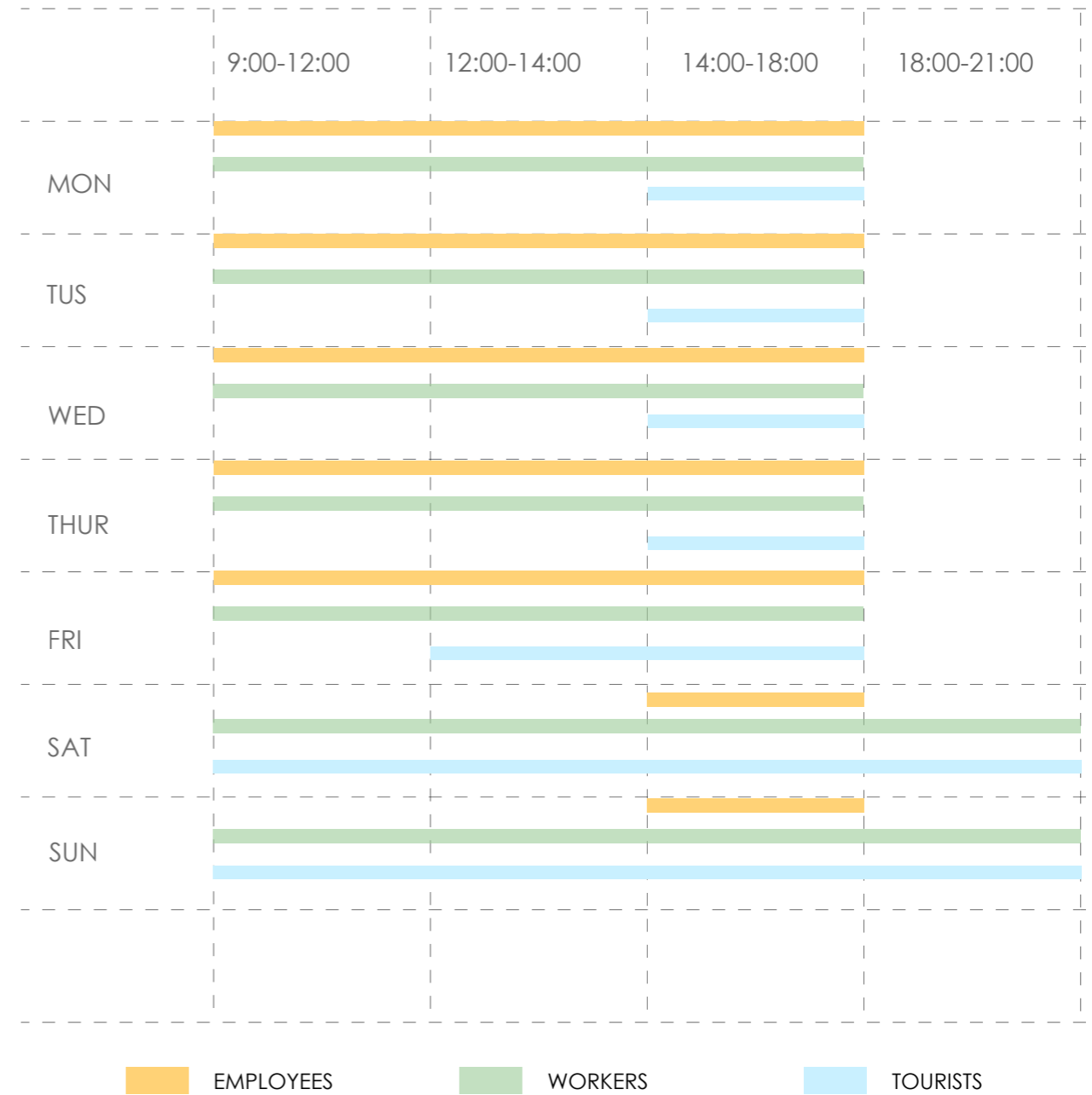
• acquaponics



• hydroponic



• Timeline

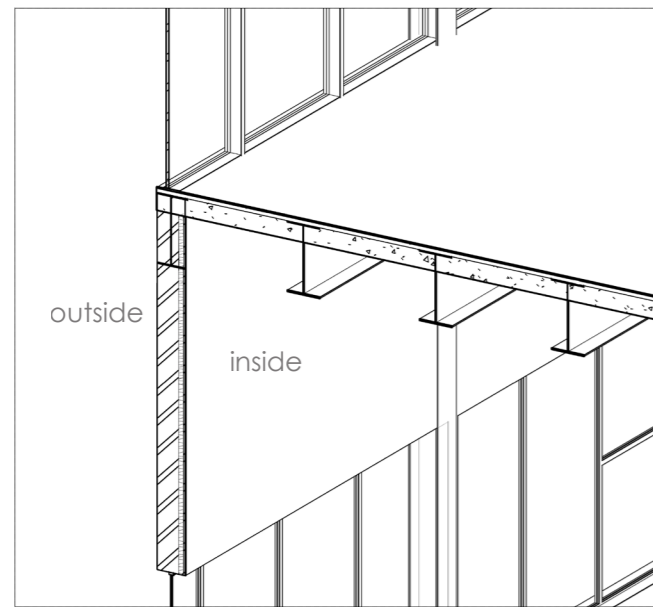


The workshops and lectures will be hold on mostly on weekends, but sometimes on weekdays, the weekdays' workshop can provide close neighbourhood with coming to participate with a short and efficient period, while they could apply those knowledges into their commnuity garden on the 4.5 floor.

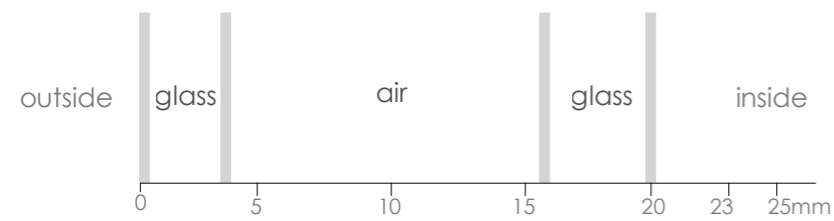
Every day the workers come to work for picking up, planting and packaging process for the leafy and strawberry products, then the truck will drive them to distribute to the market/school/industry.

The people who work in the office for business/management department and research center go to work by shifting on weekends, making sure that the company is running under well control.

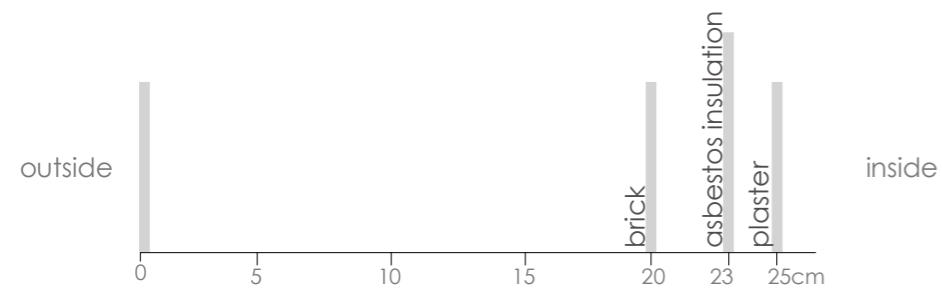
• Building envelope



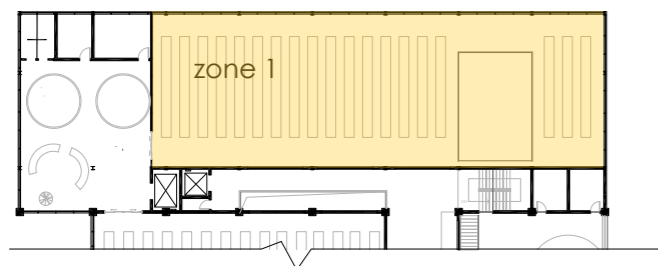
• Transparent envelope ( $U$  value =  $1.9 \text{ W/m}^2\text{K}$ )



• Opaque envelope ( $U$  value =  $0.534 \text{ W/m}^2\text{K}$ )

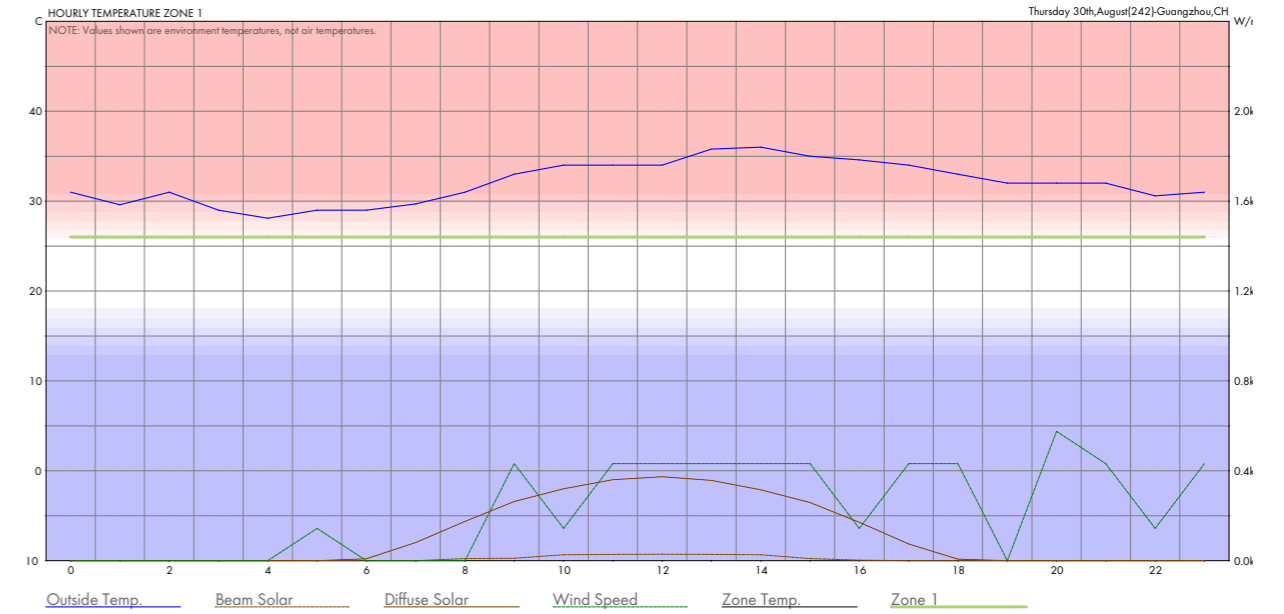


• Energy simulation

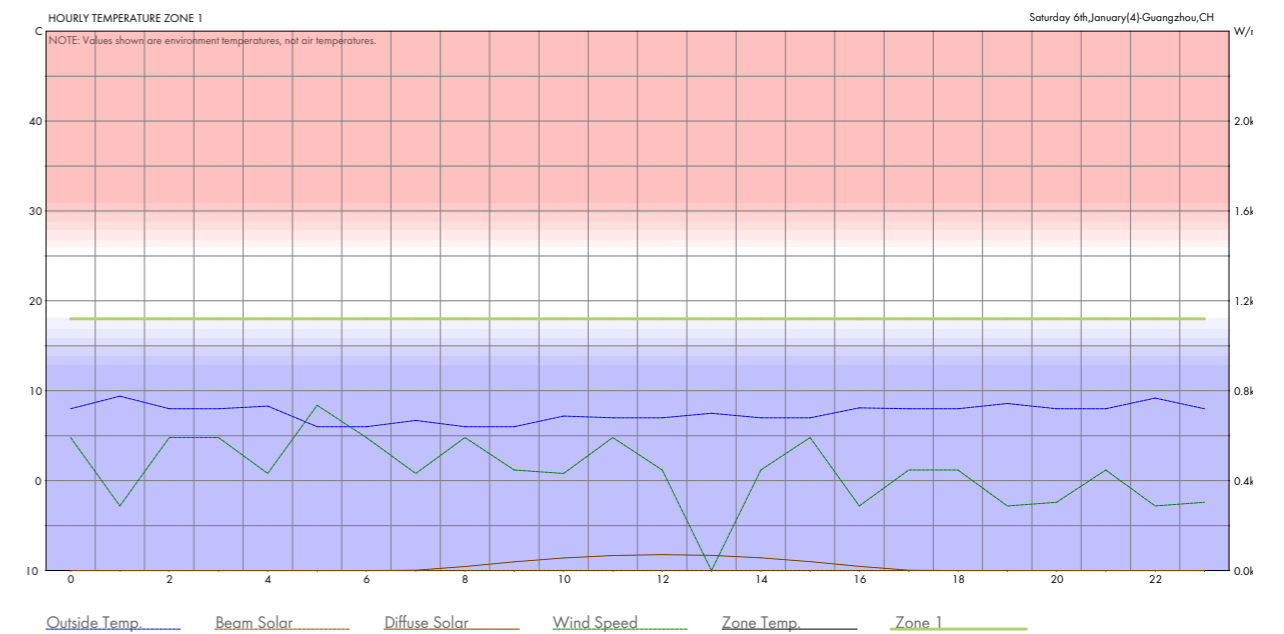


• Indoor temperature in zone 1

• Thursday, 30th August

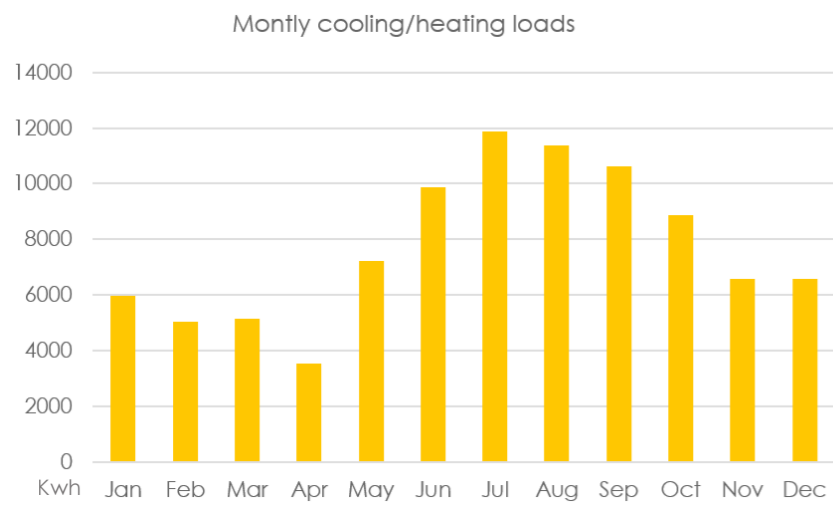


• Saturday, 6th January



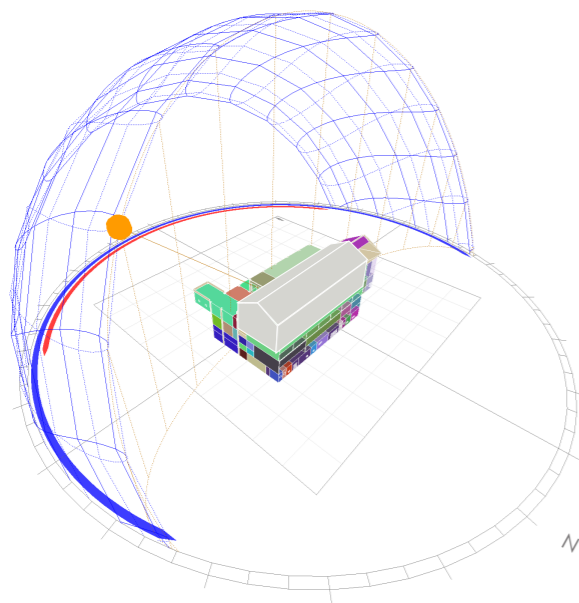
• 06.01 and 30.08 is the coldest and hottest day in database from the weather data.

• Energy consumption in zone1



• Yearly energy consumption: 92624.63Kwh

• Photovotalic Production



• ZONE 1

SOLAR PANEL

PV technology:Crystakkin silicon

PV installed: 120kWp

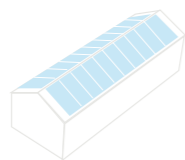
System loss:14%

Slope Angel: 30°

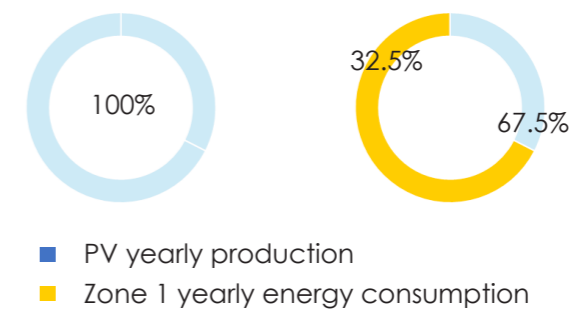
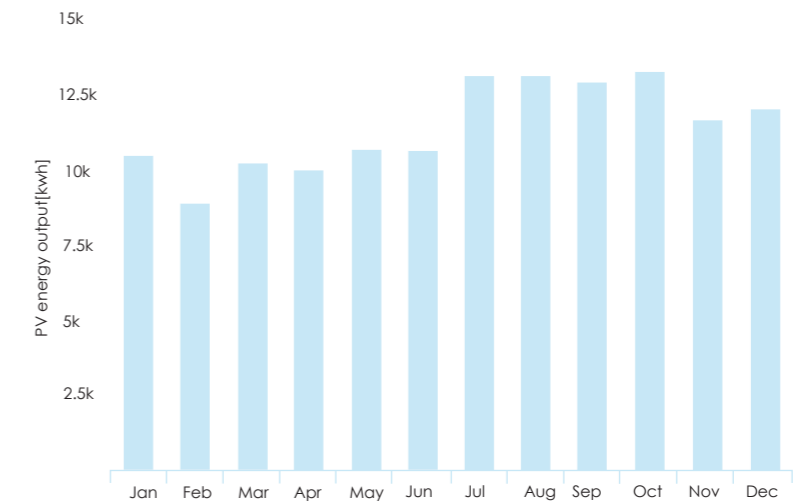
Azimuth angel: 0°

Area: 723.4 m²

Yearly PV energy prodcution: 137219.28Kwh



Monthly energy output from fix-angle PV system



• Production distribution



07| *Conclusion*

## *Conclusion*

We can conclude that the research part was analyzing the urban growing problems which lead to food shortage in Guangzhou. Based on the proposal of the strategies and analyze the industrial area of Zinitown, it gave a hypothesis of transforming the deserted industrial building into a vertical farm.

The hypothesis strength the importance in planning a vertical farm ,by reusing the interior space and outside space, implementing hydroponic and aquaponic system,by using energy conservation techniques and waste management to realize a sustainable urban production.

Meanwhile, it makes a connection among building, surroundings and human-beings, so that people can have more public, semi-public places for leisure, relaxing, and marketing. In the riverside, the activated space brings more possibilities for general public. On the platforms, the semi-private space provides people with an opportunity to appreciate the overwhelmed landscape view into the shunde river. In the aisles, daily market is running, people can have the access to the fresh and local food there. Moreover, the project also makes a link between people and agricultural productions that they eat, it is possible for them to see, to learn, to raise and to know how the vegetables to germinate, to blossom, and to grow. By participating the workshop and lectures there, people will be more confident with what they eat.

Although the high-tech orientation of vertical farming has made it less labor-intensive than traditional farming, but to a certain extent, the problem of labor force has been alleviated. Migrant workers can have a platform to get trained, develop skills, and engage in the work that they are familiar with, which also provides more employment opportunities for migrant workers.

The necessity of the development of vertical farm in Guangzhou is reflected in alleviating the contradiction between urban expansion and reduction of cultivated land. It is not just can relieve the pressure of urban population expansion and food security, but to improve the relationship between people and greenery, the people and environment and to bring more job opportunities.

Shanghai has the Chinese first urban farming district designed by Sasaki which is under construction now, i hope this hypothesis can be a proposal to be the first vertical farm in the city of Guangzhou in China.

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