1

2

3

4

3

SYNTHESIS

POETIC TO SCIENTIFIC

Figure.87: FIRST FLOOR EAST ENTRANCE (AUTHOR 2021)

3.1 INTRODUCTION

This third chapter will convey the design decision made to take the project from poetic abstraction to a physical manifestation. The technological intention will be addressed, followed by the specific brief for the structure, the data centre, which will become the main point of focus for the project.

The Data centre is the main civic structure on the site, which houses and shares various forms of data and knowledge to the public, through knowledge sharing activities. Whilst allowing for a ecological system to be introduced in and around it.

From there the benefits of merging a human system and an ecosystem will be touched on briefly, followed by explanation of the structural system and other systems within the building. Finally, the design will be unpacked and explained.

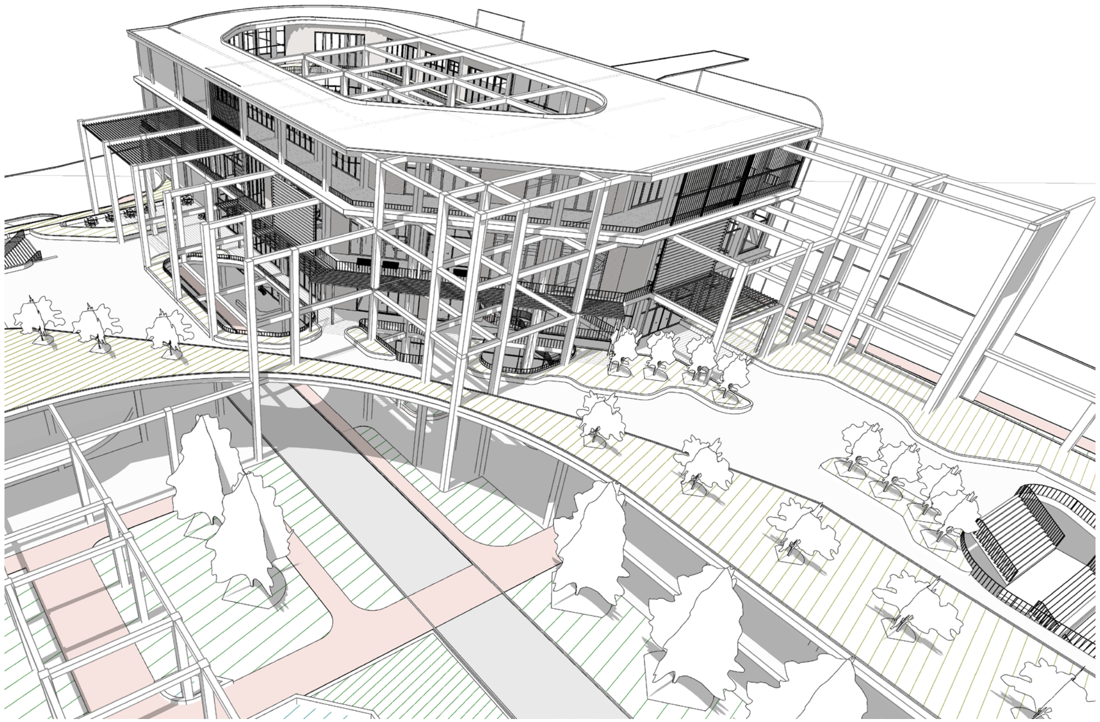


Figure.88: NORTH FACADE- DATA CENTRE (AUTHOR 2021)

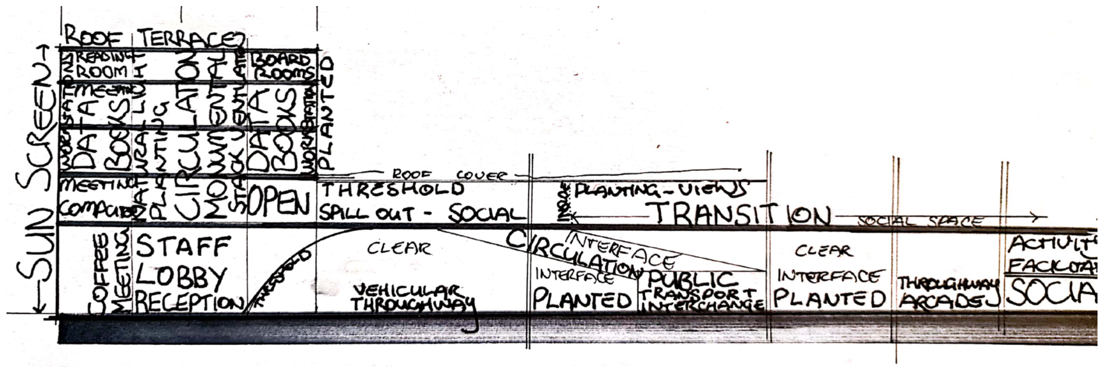


Figure.89: ORGANISING PROGRAMME (AUTHOR 2021)

3.2 TECHNOLOGICAL INTENTIONS

The technological approach and intentions attempt to reconnect the natural world and mankind. Designing these two systems, an ecosystem and human system (building)to work in symbiosis and further, as the co-evolution of man and nature.

The approach is rooted within the theory discussed within the previous chapter of the project.

Through the implementation of these theories one can create an interface where these two systems work in symbiosis. It becomes important to explicitly expose these different systems to the inhabitants of the structure. The benefit of this symbiotic relationship will be clear in how it affects spaces. For instance the structure (human) providing habitat for the introduction of planting (nature) which in turn improves the micro-climate of the space.

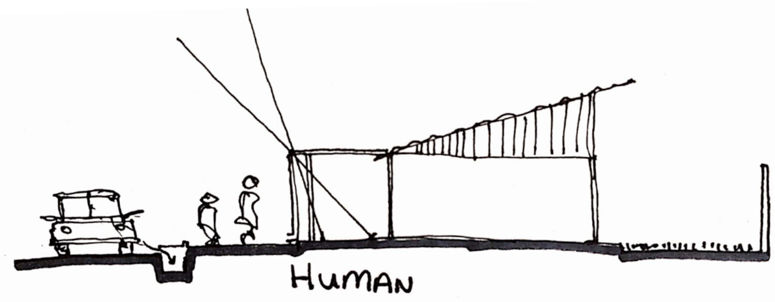


Figure.90: HUMAN SYSTEM (AUTHOR 2021)

Figure.91: NATURAL SYSTEM (AUTHOR 2021)

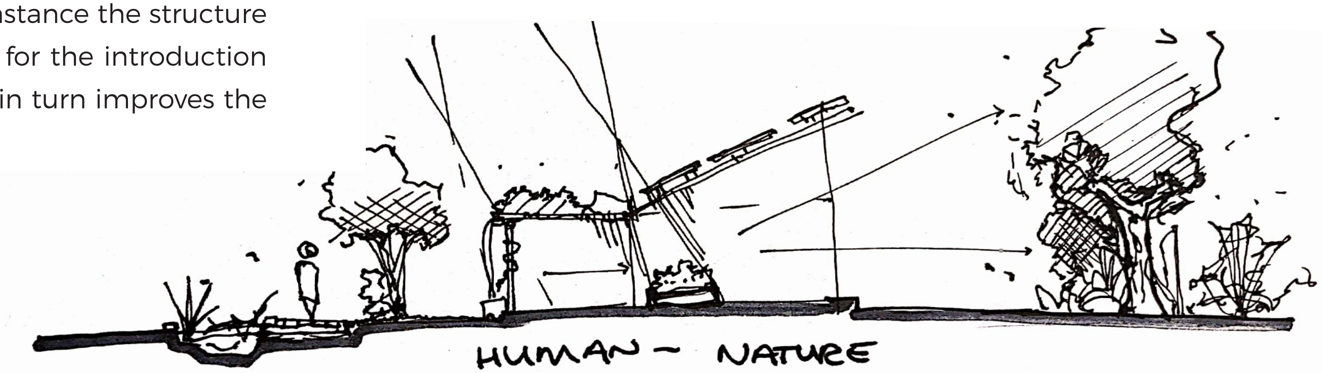


Figure.92: HUMAN NATURE SYMBIOSIS (AUTHOR 2021)

3.3 BRIEF FOR DATA CENTRE

The data centre will become the main area of focus for the study and the main area of design. The programme of this structure will attempt to incorporate the ecological principles set out by the dissertation theory of deep ecology, the normative position of the nested approach, the Biophilia hypothesis (Wilson 1993 & Kellert 2005), regenerative sustainability (Gibbons 2020) and exposing natural systems as explained by Sym van der Ryn and Stuart Cowan (2010)

The brief for this area is as follows: The centre should become an area of knowledge and data transfer, and provide various spaces for this function, like the Seatlle central library, such as lecture rooms, seminar space and online learning workspace, together with the introduction of an ecological system. It should also allow for the incorporation of some economic functions into the structure. Finally, a system of conservation that provides a capacity to safeguard species for future generations. The programme will include:

SOCIAL - Learning and seminar like space for the transfer of knowledge between individuals and/or various size groups. These spaces will include amphitheatre seminar space for presenting to larger groups, lecture rooms which can accommodate various fields of information with various sizes of "classes", group workshop areas and individual work unit for online learning.

ECONOMIC - Commercial/rentable for economic stimulant for the structure, whilst providing space for occupants to meet. This will include a restaurant like space, event space, hot seats for office use and other rentable space.

ECOLOGICAL - An active-collection-genetic-seed-bank. This programme will deal with the processing, sorting and storage of red data list species for storage in the short term (1-20 years). This will cause the structure to have an active role in conservation of indigenous species. Species will be harvested by professionals in areas where it is appropriate to harvest them and subsequently transferred to the site. From here the seeds must be registered, cleaned and dried, packaged, documented and stored on site. The storage of seeds becomes an important point as the duration at which seeds are stored is directly dependant on the temperature that can be achieved and maintained. For instance, the Svalbard Global Seed Bank is meant to be for apocalyptic scenarios, where mass extinction takes place (Qvenild 2008). The temperature must remain at -18° as seeds can be stored for

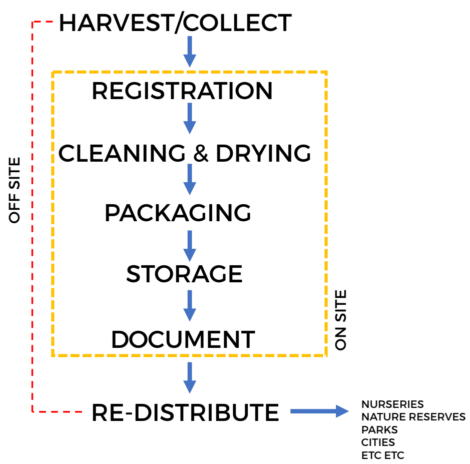


Figure.93: GENETIC BANK PROGRAMME PROCESS (AUTHOR 2021)

an extremely long time at this temperature (Kameswara Rao 2006). As this genetic bank is an active collection and seeds will be stored at the longest for 20 years, the temperature can be a lot higher. "The temperature of 0–10˚C and relative humidity (RH) of 25–30% and seed moisture 68% are adequate for medium-term storage module" (Kameswara Rao 2006). As genetic materials become needed (opening of a new nature reserve, preservation, conservation etc.) seeds can be withdrawn and distributed to the intended site.

All of these programmes will have direct or indirect contact with an ecological system that will be introduced into the structure, either through interior and exterior planting or the living wall that acts as the building skin that provides habitat for various species. The benefit of being exposed to such living/green elements is documented and will be explained.

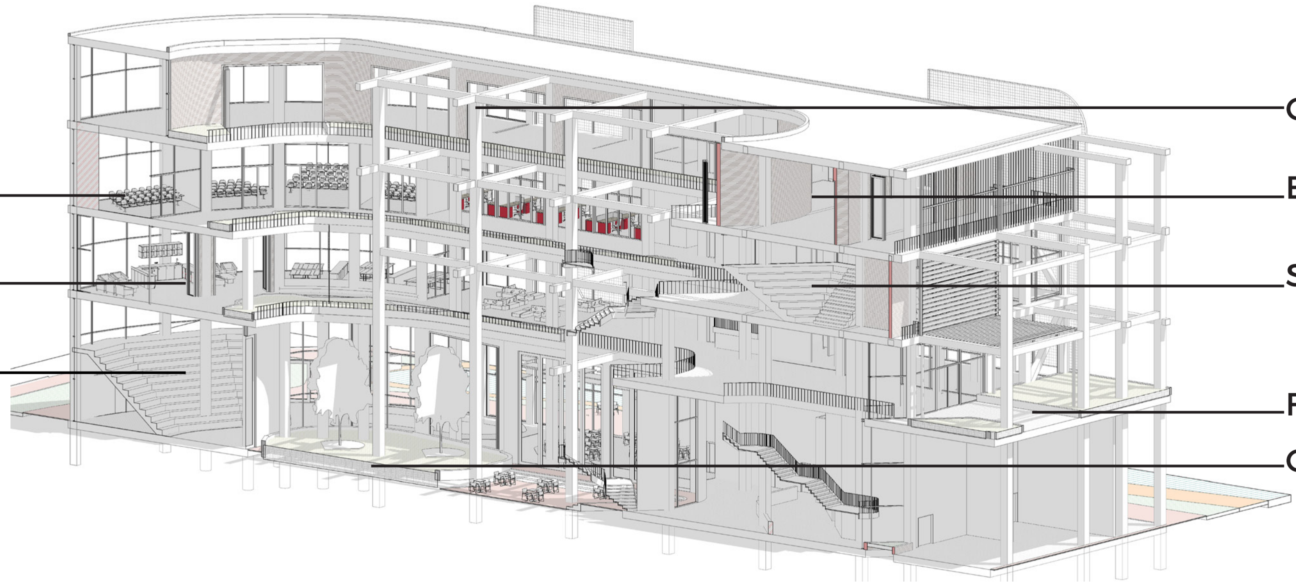


Figure.94: STRIP SECTION DATA CENTRE (AUTHOR 2021)

3.4 BENEFITS OF AN INTERFACE WITH ECOLOGY

In designing an interface between man and nature, various factors exist that can be benefit the inhabitants of a structure.

3.4.1 THE EXPOSURE TO NATURE

Various benefits exist for humans to be exposed to natural elements. All of which are connected to our complex set of senses; with sight being the most prevalent of them all but again, not the only one.

The viewing of natural elements is shown to provide a wide range of benefits for human health (Velarde, Fry and Tveit 2007).

These include reduced anxiety and stress (Ulric 1979), lower heart rate (Laumann, Gärling & Stormark 2001) and increased attention (Tennessen & Cimprich 1995), all of which can be beneficial to any environment but more so to spaces where learning and sharing is important.

Other types of exposure to nature include the other senses such as sound, taste, smell and touch but also non-sensory pathways such as the effects of microbiota on the production of serotonin, melatonin and various other neuroactive molecules (Rook, Raison & Lowry 2012).

By designing spaces with our exposure to the natural world in mind, numerous health benefits can be achieved, that specifically aids in the knowledge and data sharing function of the structure.

3.4.2 ECOSYSTEM SERVICES

The benefit that humans gain from nature is known as ecosystem services (Wohlitz et al 2016).

This becomes an extremely important aspect of the introduction of an ecological system and the benefits are substantial.

It should be noted that in accordance to the Deep Ecological platform rule #1 - a species worth is not attributed to the benefit it has for humans (Naess & Sessions 1985). This value is not mutually-exclusive (meaning the benefit for both human and non-human occur simultaneously), the specific species has intrinsic value but the added benefit of value to humans in some shape or form. This still means that species shouldn't merely be introduced because they provide a service to humans, but rather because they in themselves have value.

Various forms of services can be provided by a natural system through ecosystem services:

1. Regulating air quality and improving micro-climate can be achieved by the introduction of vegetation into space.
2. Ecosystems become carbon sequestrators and have the ability to store greenhouse gasses
3. Waste water treatment through the use of wetlands, which also prevents floods.
4. Erosion prevention through the use of vegetation on troublesome slopes further contributing to soil fertility
5. Pollination
6. Biological control of pests
7. Habitat and Supporting services
8. Creating habitat for various species
9. Maintaining genetic diversity
10. Provisioning services
11. Food for consumption by humans and non-humans
12. Raw materials that can be used in construction or as organic material

(Wohlitz et al 2016)

All of these services speak of the benefit in having an ecosystem in symbiosis with a human system (or the structure).

The benefit that these services provide to various other species, including humans can not be understated. By exposing these services and benefits to the inhabitants of the structure, people can experience the value that these species have within themselves and the benefit they provided to individuals and the larger development.

Figure.95: ECOSYSTEM SERVICES https://www.earthwiseaware.org/what-are-ecosystem-services/

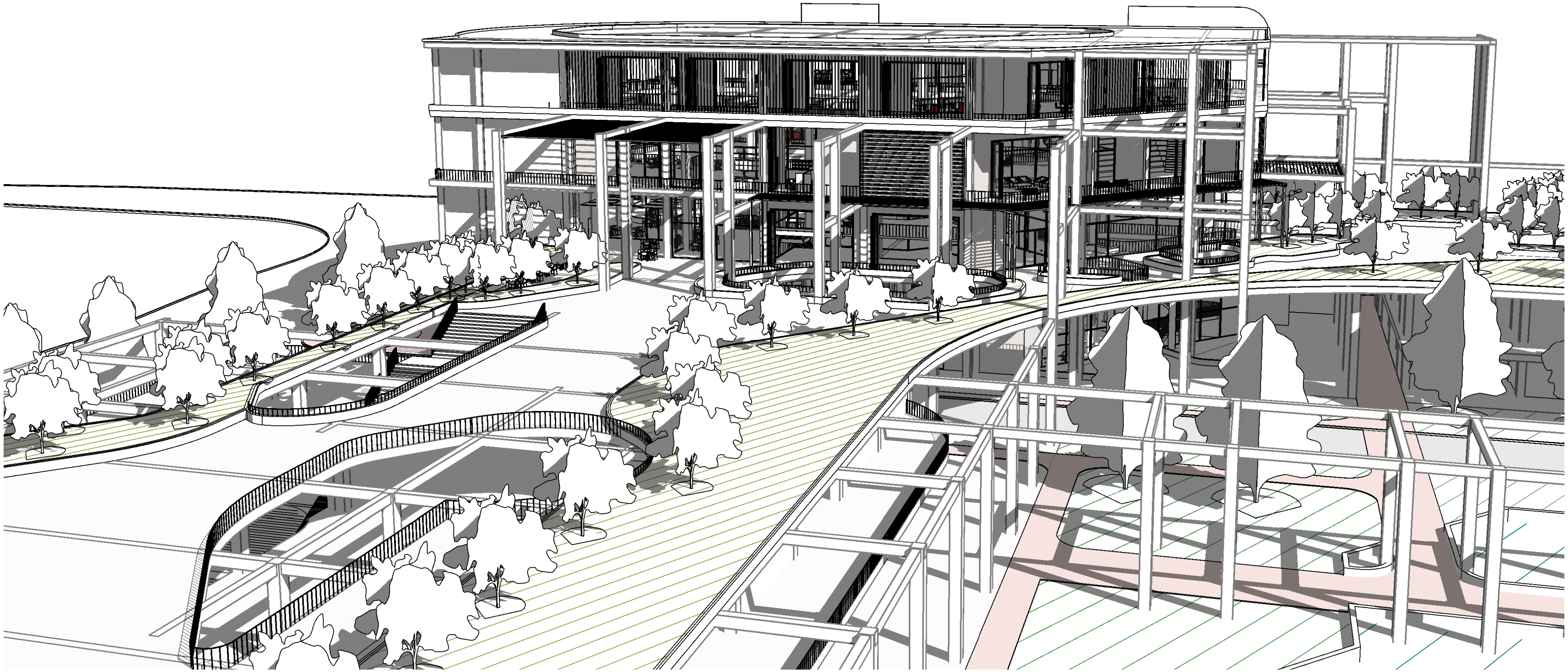


Figure.96:FLYOVER AND DATA CENTRE EAST FACADE (AUTHOR 2021)

3.5 UNPACKING THE DESIGN

For the Data Centre a void is cut through a series of coffer slabs in the centre of the structure. (Refer to Fig).

The function of this cut is twofold: it allows for the exposure to natural cycles as van der Ryn (2007) proposes. The building will experience weather events, wind drafts and importantly light ingress into the structure reaching to the ground floor, illuminating the building, making nature visible (van der Ryn 2007).

This also allows for the introduction of planting habitat on all floors facing the Northern aspect, For the Southern aspect of the interior some shade loving species can be introduced. This informs and implements the Biophilia hypothesis (Kellert 2005 & Wilson 1993).

This central void allows for the main circulation route to be housed within it, a large stairway will move up the floors within it. The central stairway is supported by columns and beams that remain within the central void.

As the building has 4 floors, standards require that the structure have elevators. This also allows for universal access throughout the structure, two elevators are placed at opposite ends of the structure for ease of access.

Two fire escapes are also required and they are placed in existing fire escape shafts adjacent to the elevators at appropriate distances.

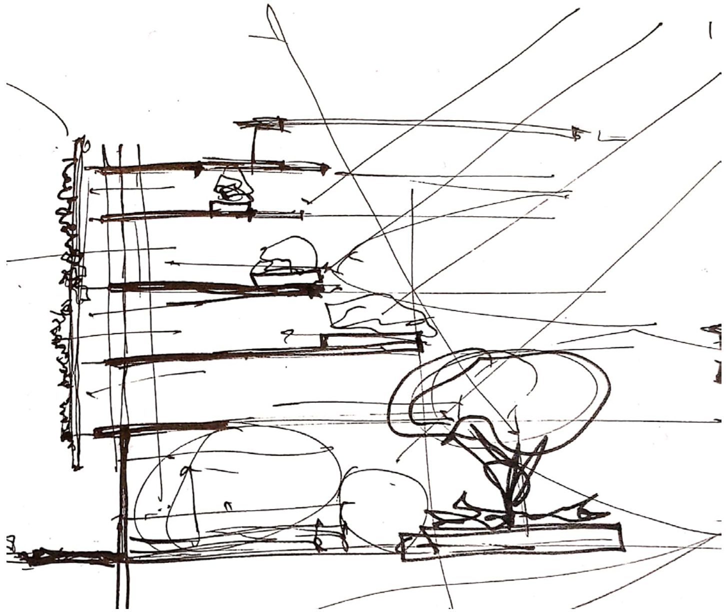


Figure.97: EARLY VOID CONCEPT (AUTHOR 2021)

3.6 GROUND FLOOR

The ground floor becomes the main meeting space and is also considered more public in nature. A public speaking platform, café (and kitchen), a children's play area, seating inside and outside and parts of the genetic seed bank are housed on this floor. Large central pivot industrial doors span the floor to soffit and when opened the space feels as if it is bleeding into the central courtyard space.

Within the central courtyard, seating is provided around a planter that houses a variety of vegetation, two of which will be flowering feature trees. *Dombeya rotundifolia* - Wild pear and *Bolusanthus speciousus* - Tree wisteria (vanwykshout). These species will bloom together (D. rotundifolia White July-Oct and B. speciousus Purple Sept-Nov) in a spectacular show of colours. Sufficient space is provide for these specimens. These trees symbolise the coexistences of man and nature. Together with this various birds and insects, species will be attracted to the vegetation in the planter.

Large spillout spaces exist outside the building with masses of vegetation that are evident around walkways and an artificial wetland that supports various other species and decreases visibility to the street.

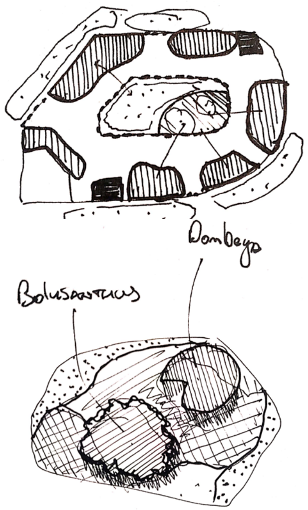


Figure.99: GROUND FLOOR COURYARD AND SPACIAL ORGANISATION (AUTHOR 2021)

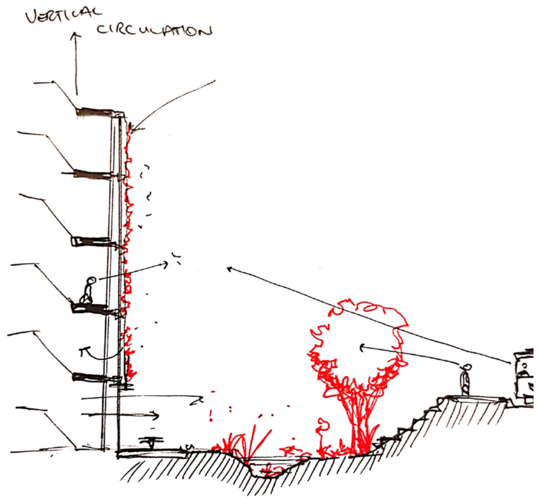


Figure.100: VIEW FROM STREET (AUTHOR 2021)

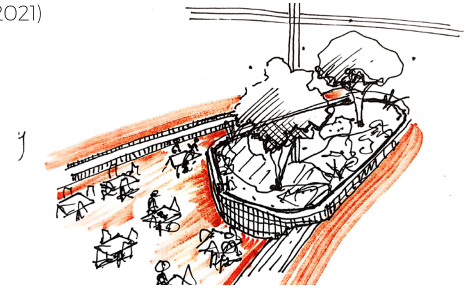


Figure.101:CENTRAL COURTYARD (AUTHOR 2021

Figure.102: CENTRAL COURTYARD AND PLANTER (AUTHOR 2021)

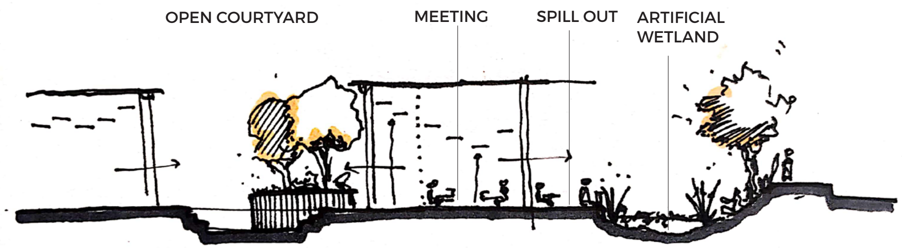


Figure.98: GROUND FLOOR CONCEPTUAL SECTION (AUTHOR 2021)

Figure.103: GROUND FLOOR NORTH ENTRANCE (AUTHOR 2021)

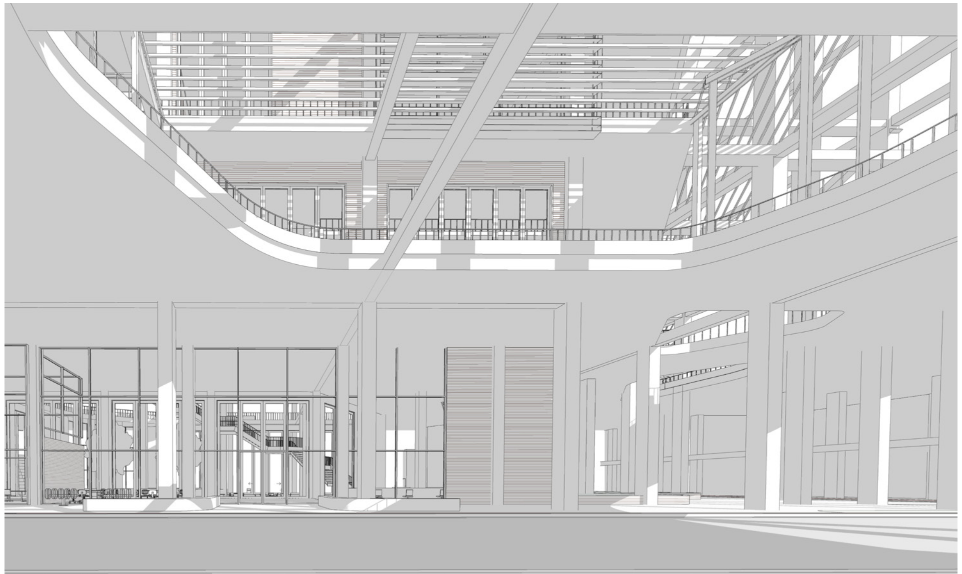


Figure.104: GROUND FLOOR APPROACH EAST ENTRANCE (AUTHOR 2021)

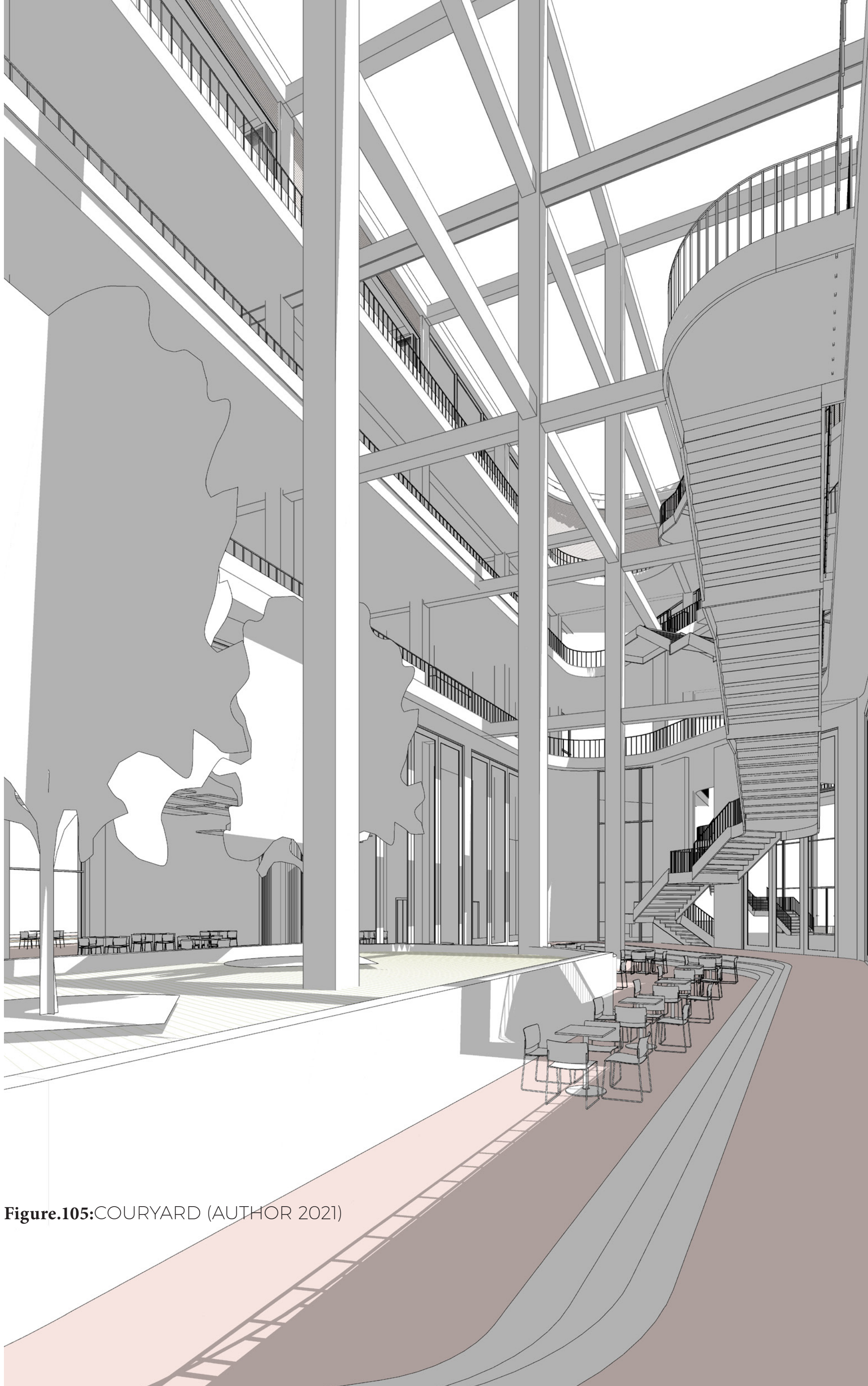


Figure.105:COURYARD (AUTHOR 2021)

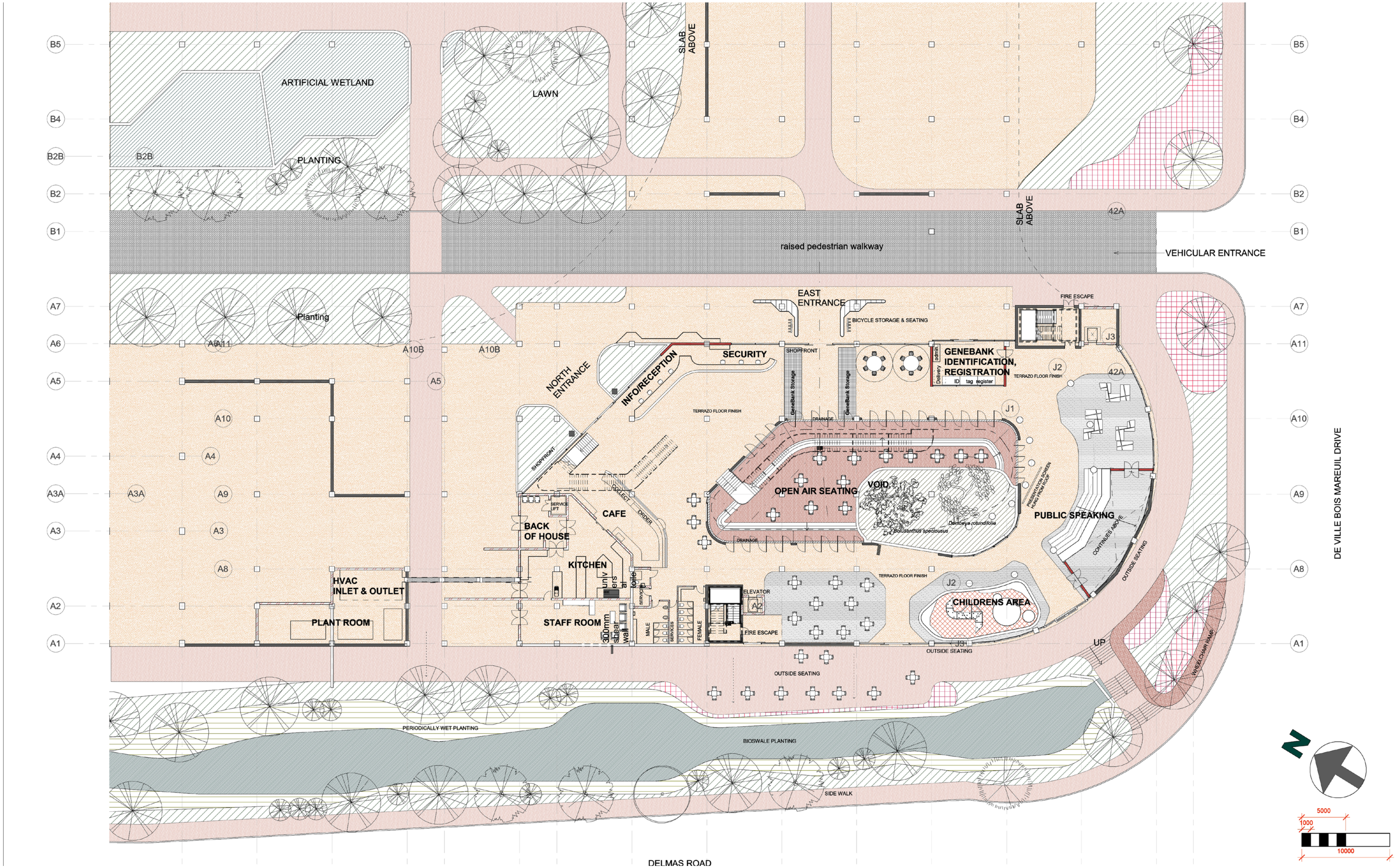


Figure.106:GROUND FLOOR PLAN

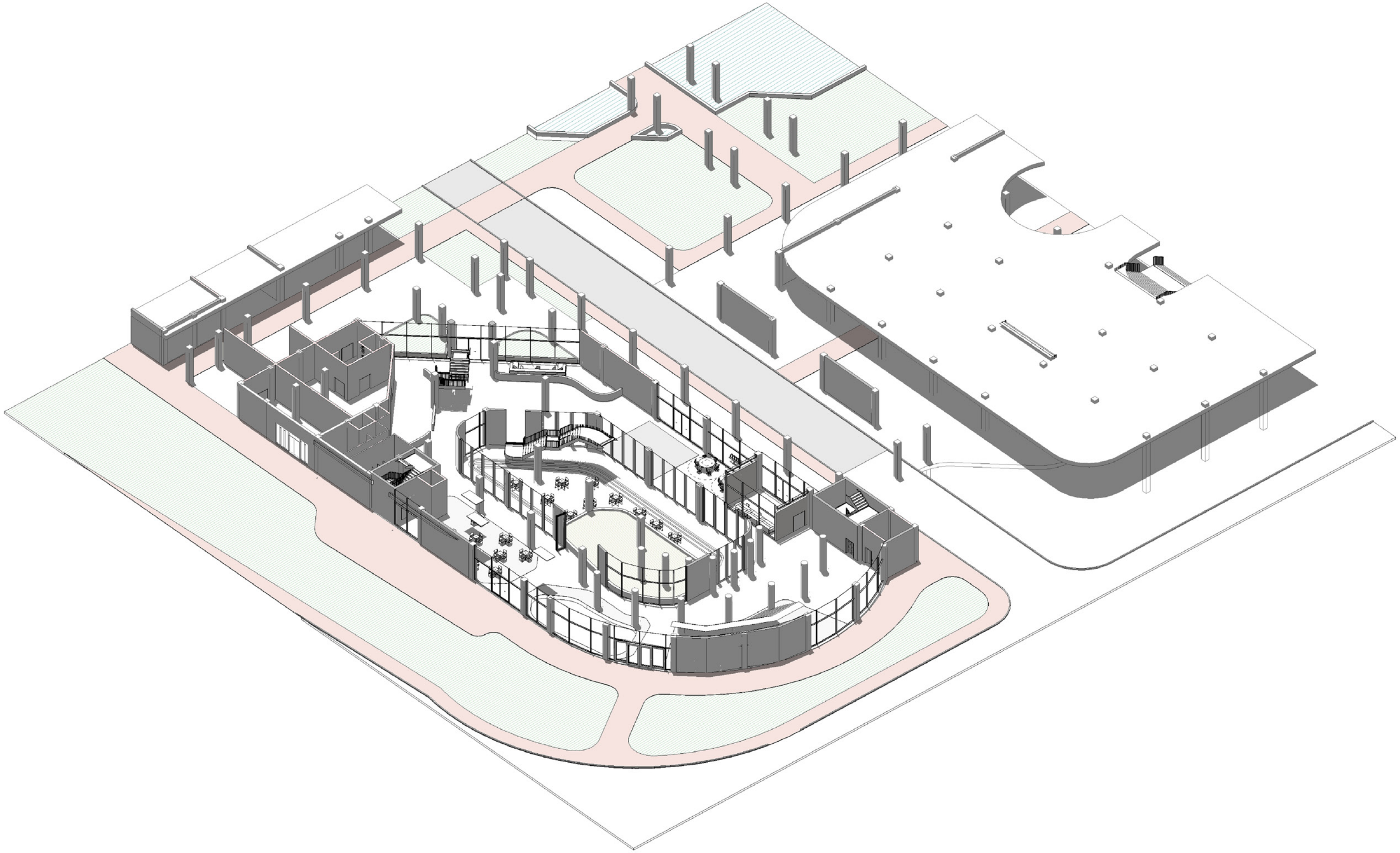


Figure.107: GROUND FLOOR AXONOMETRIC `

3.7 FIRST FLOOR

The first floor becomes the "main entrance" way, and connects to the outside transition space the flyover. This part of the structure carries people from node to node and into the data centre.

The flyover becomes a main connection point to habitat, housing various plant species and pergola structures. This creates comfortable spaces that attract masses of birds and various insects, making it "alive".

This space spills into the data centre, where the bulk of the commercial space of the structure exist, providing space economic stimulus, and a space for social interaction whilst exposing the inhabitants to the ecological system, inside and outside.

The threshold leading into this space has an enormously scaled shade structure extending out of the third floor, covering this entrance. Next to the shade structure the living wall wraps around the building covering it in louvres and plants.

Once inside the structure, past the commercial space, group working spaces sit at the southern side of the building, together with kitchenette areas for occupants to prepare meals or take breaks.

The design development of the void was completely enclosed with shop-fronts, these were moved back to create "outside" space between the various programme areas and the central void within the structure. This makes ventilation within the structure more effective and more efficient as spaces that are being ventilated are more compact.

Moving the shop-fronts back allows for the introduction of large planting at the areas that have a north aspect. Another wing of the Genetic seed bank is found on this floor.

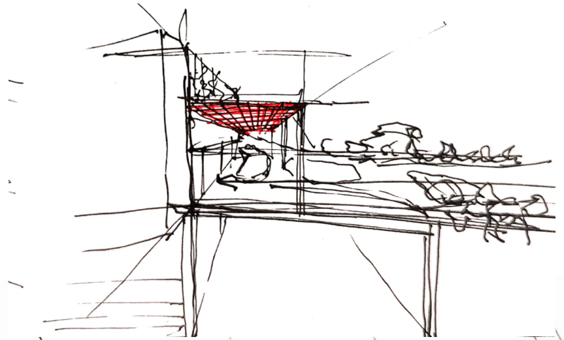


Figure.108: CONCEPT FIRST FLOOR ENTRANCE (AUTHOR 2021)

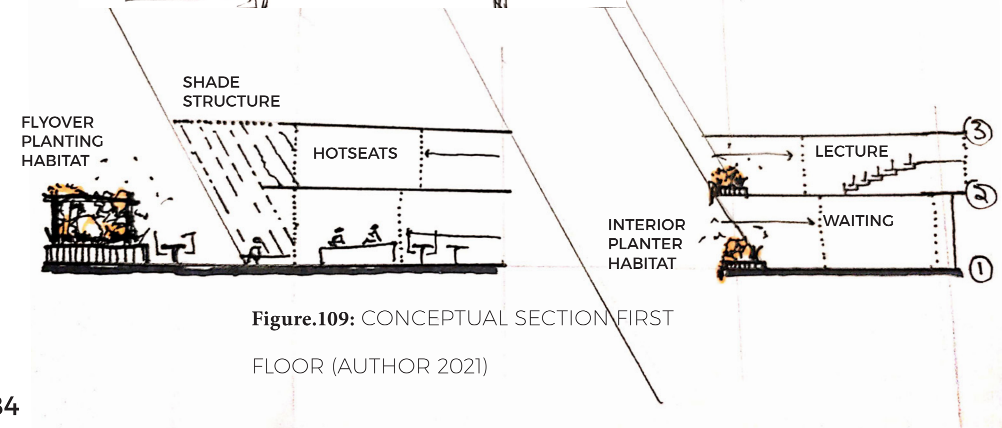


Figure.109: CONCEPTUAL SECTION FIRST FLOOR (AUTHOR 2021)

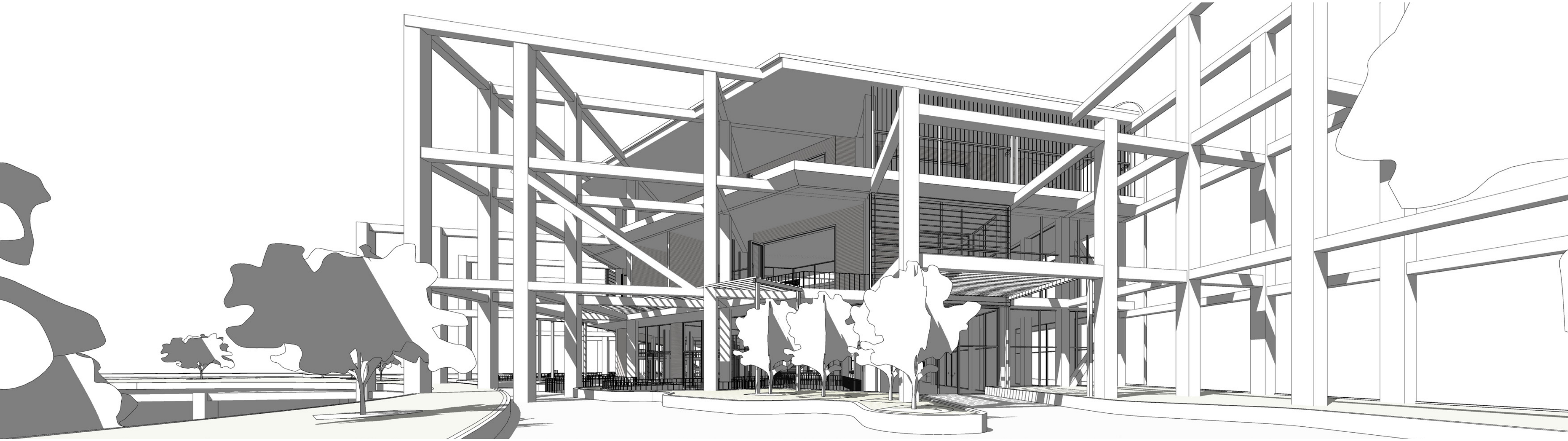


Figure.110: FLYOVER NORTH FACADE (AUTHOR 2021)

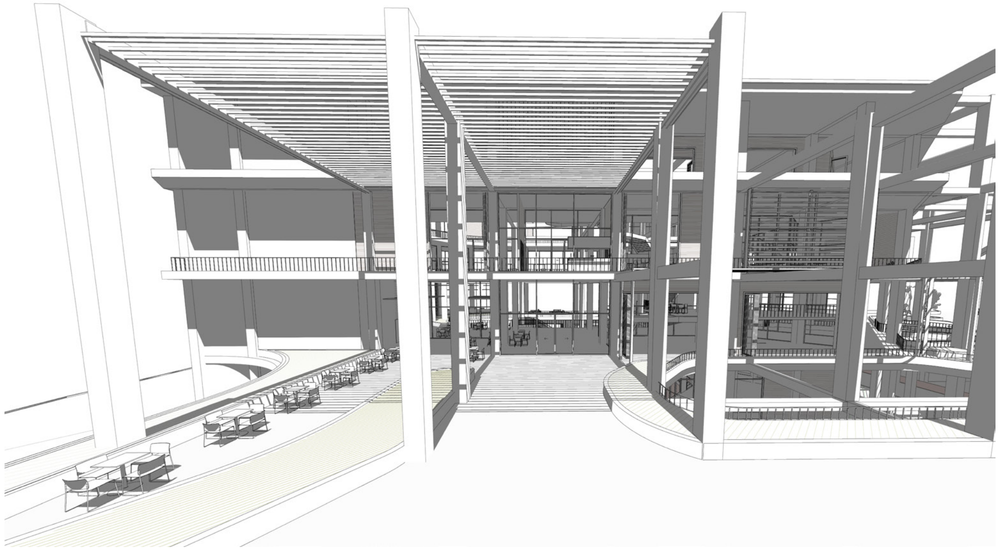


Figure.111: EAST ENTRANCE FIRST FLOOR (AUTHOR 2021)

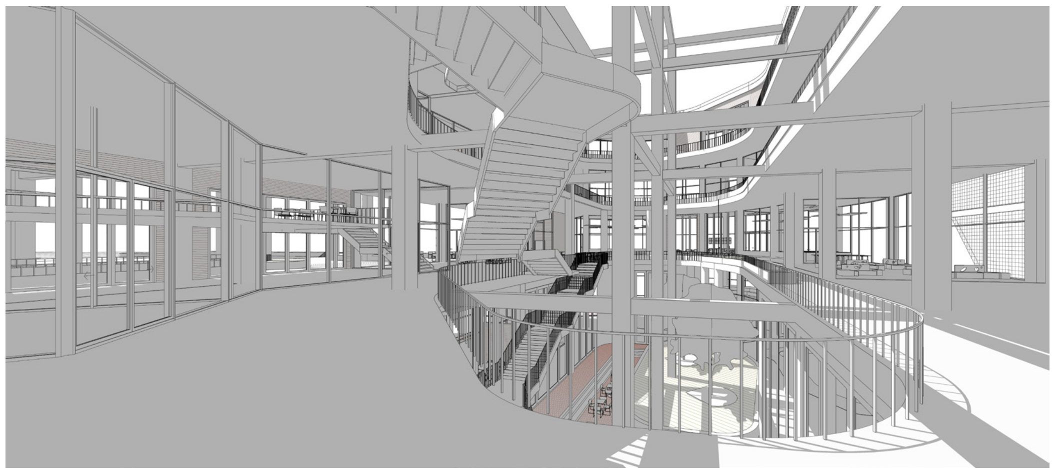


Figure.112: CIRCULATION IN VOID FIRST FLOOR (AUTHOR 2021)

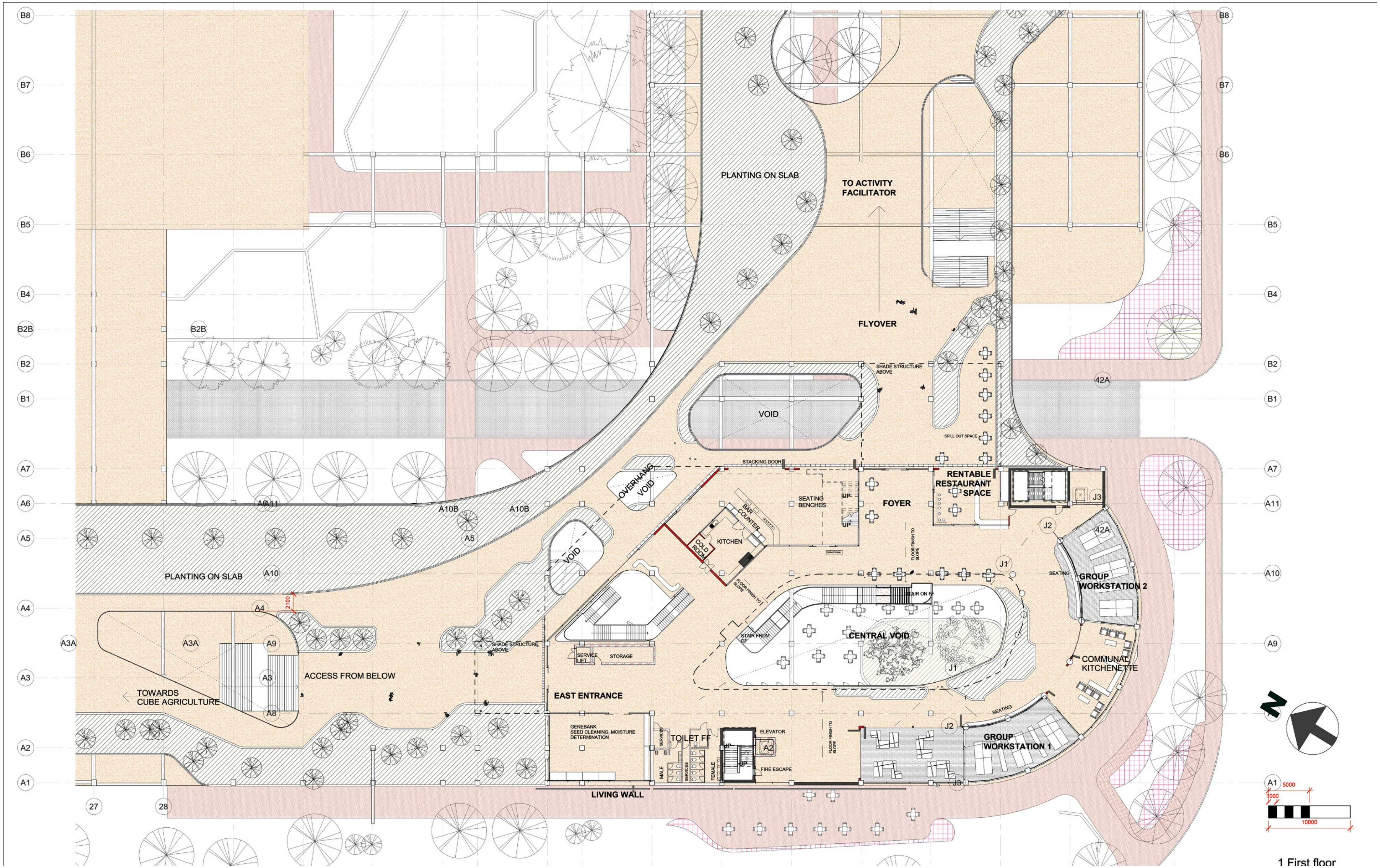


Figure.113: FIRST FLOOR PLAN (AUTHOR 2021)

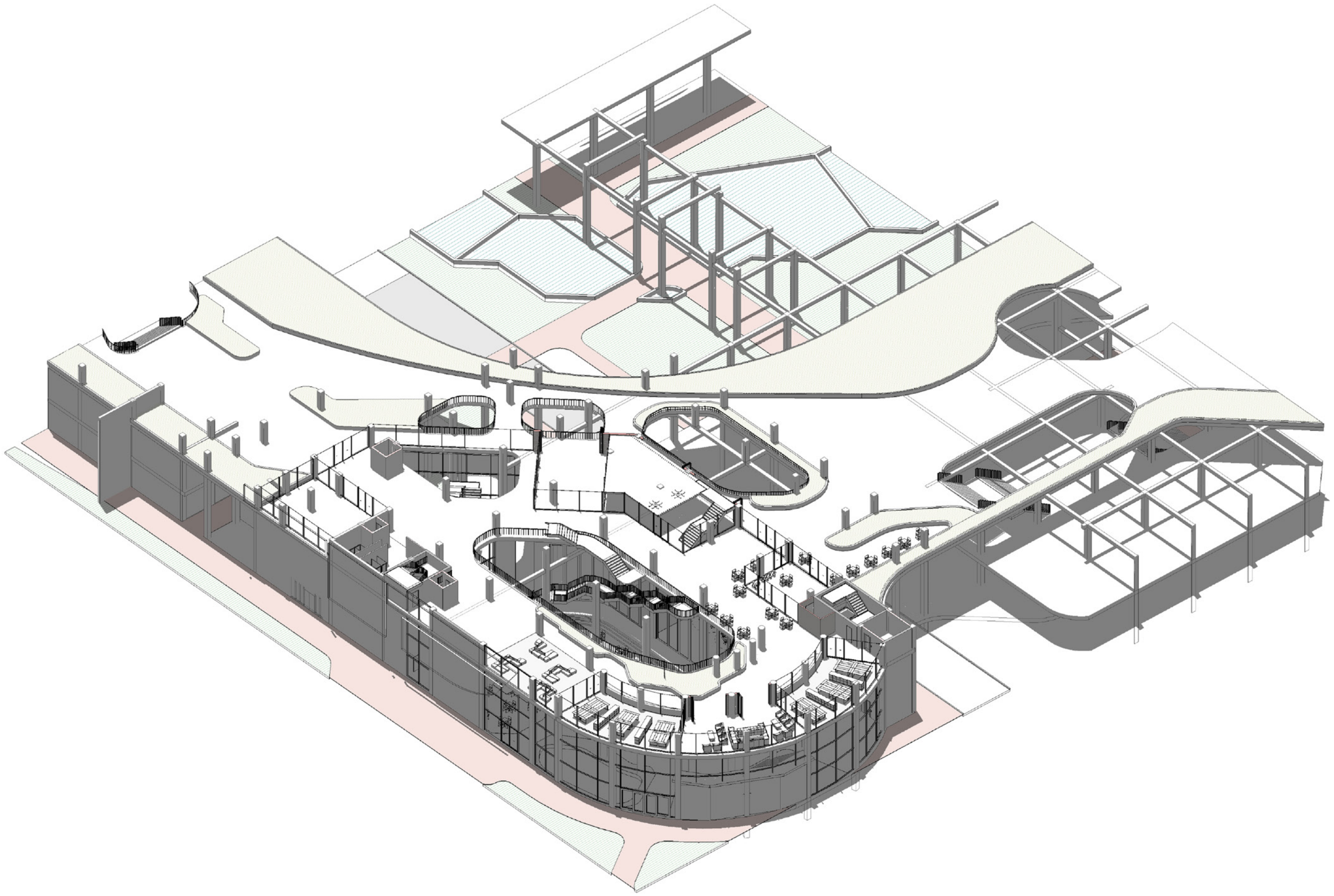


Figure.114: FIRST FLOOR AXONOMETRIC (AUTHOR 2021)

3.8 THE SECOND FLOOR

The second floor is only accessible by the stairs and elevators within the building. On this floor it becomes a more subdued atmosphere, with individual speakers addressing larger groups in the seminar room or lecture rooms.

This floor also houses hotseats for office use and boardrooms that can be rented and used. A series of work units also exist on the floor and this will become spaces for individuals to participate in online learning within closed private spaces.

Finally, the final genetic bank wing is found on this floor, where seeds are packaged and made ready for storage, the final steps . The genetic bank and the hotseats share a kitchenette between them for the staff of both facilities.

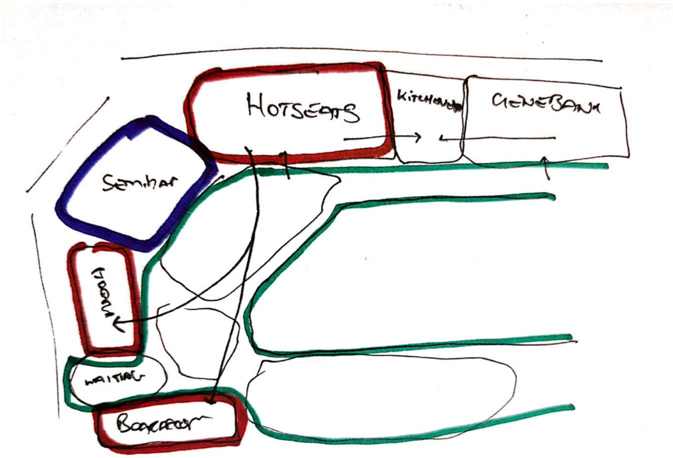


Figure.115:SECOND FLOOR ORGANIZATION (AUTHOR 2021)

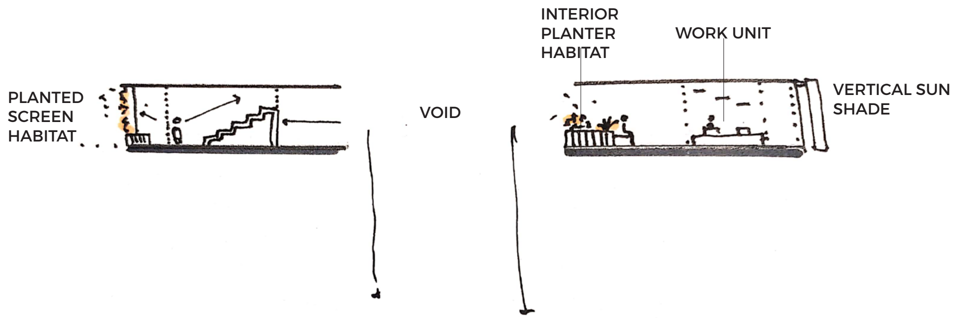


Figure.116: CONCEPTUAL SECTION SECOND FLOOR (AUTHOR 2021)

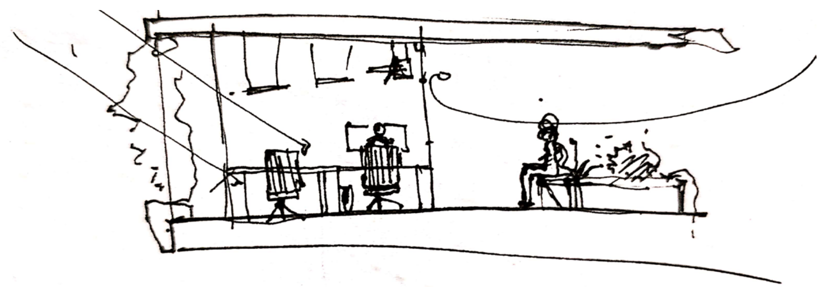


Figure.117: INTERFACE AND CLIMATE (AUTHOR 2021)

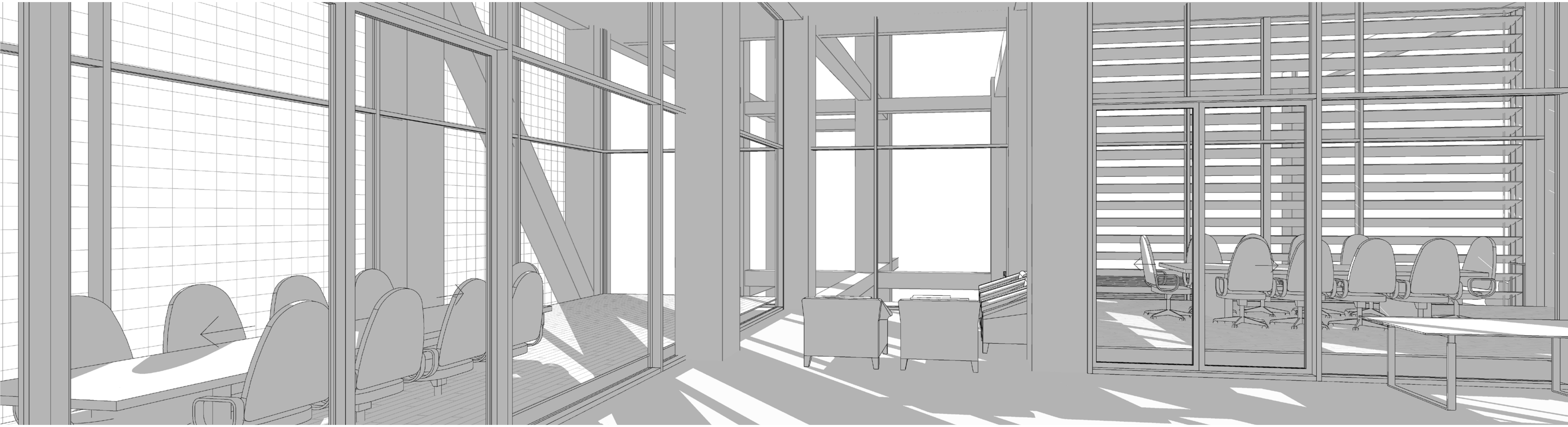


Figure.118: BOARD ROOMS AND SHADING DEVICE (AUTHOR 2021)

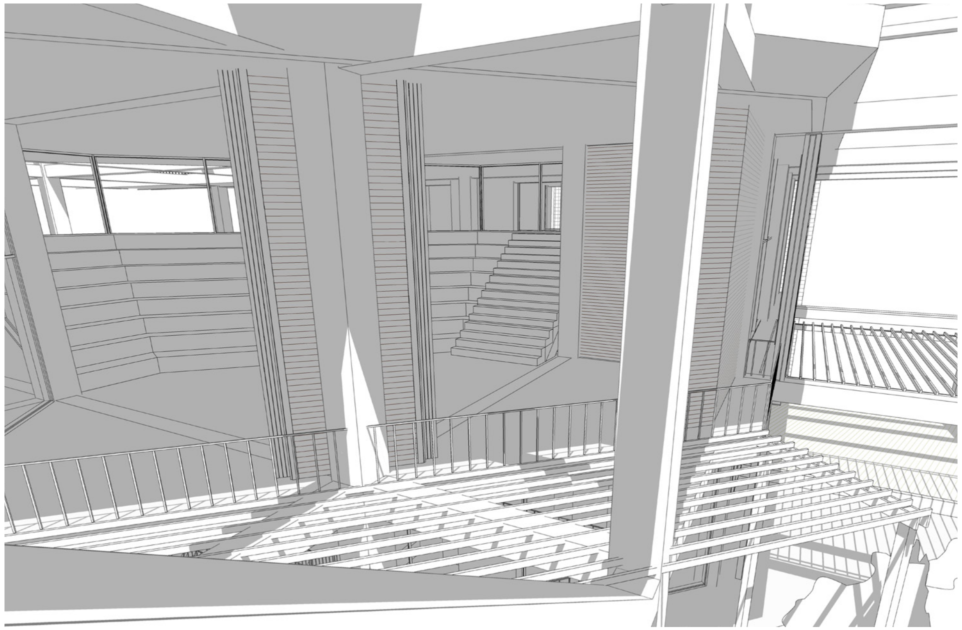


Figure.120: SEMINAR ROOM SECOND FLOOR (AUTHOR 2021)

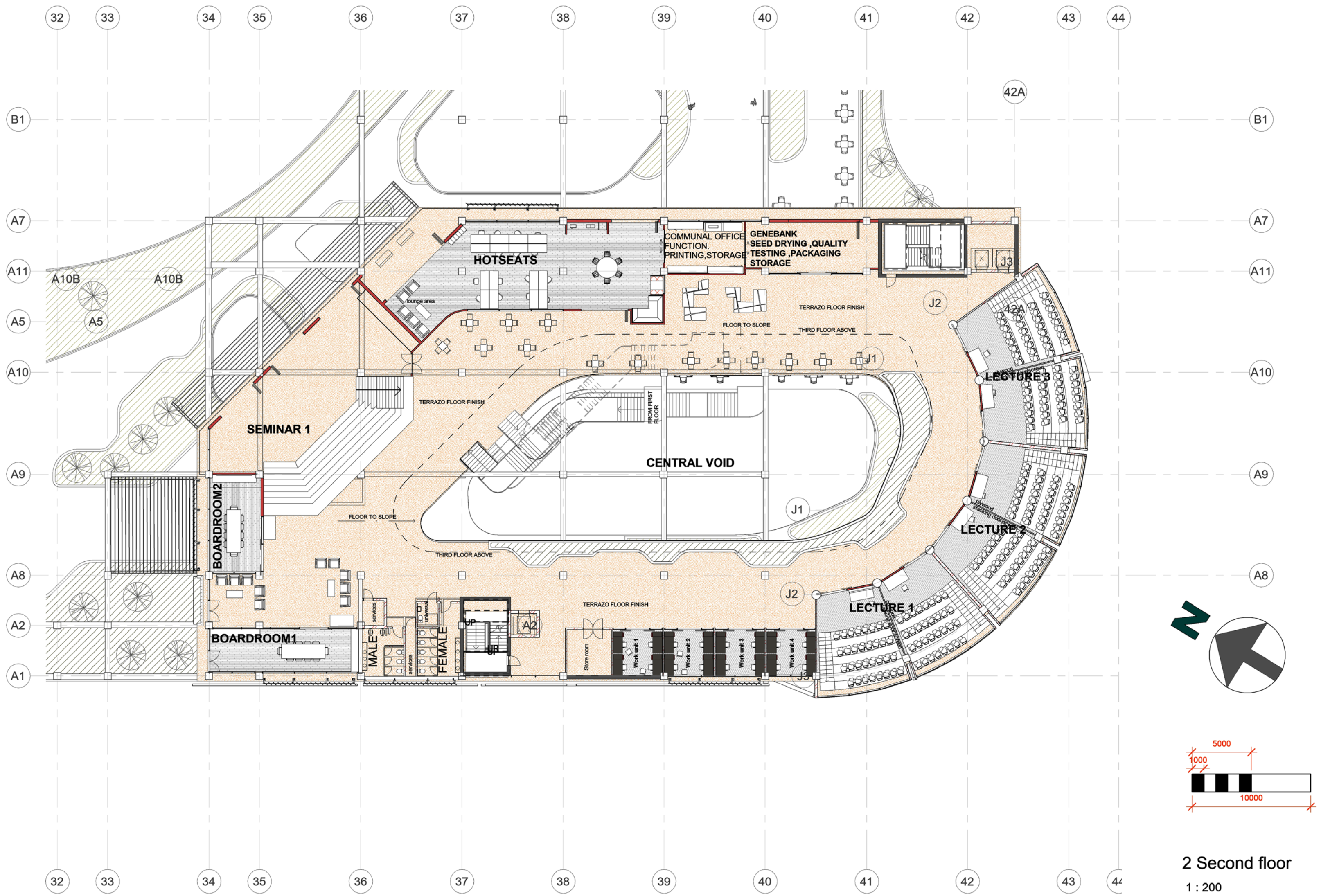


Figure.121:SECOND FLOOR PLAN (AUTHOR 2021)

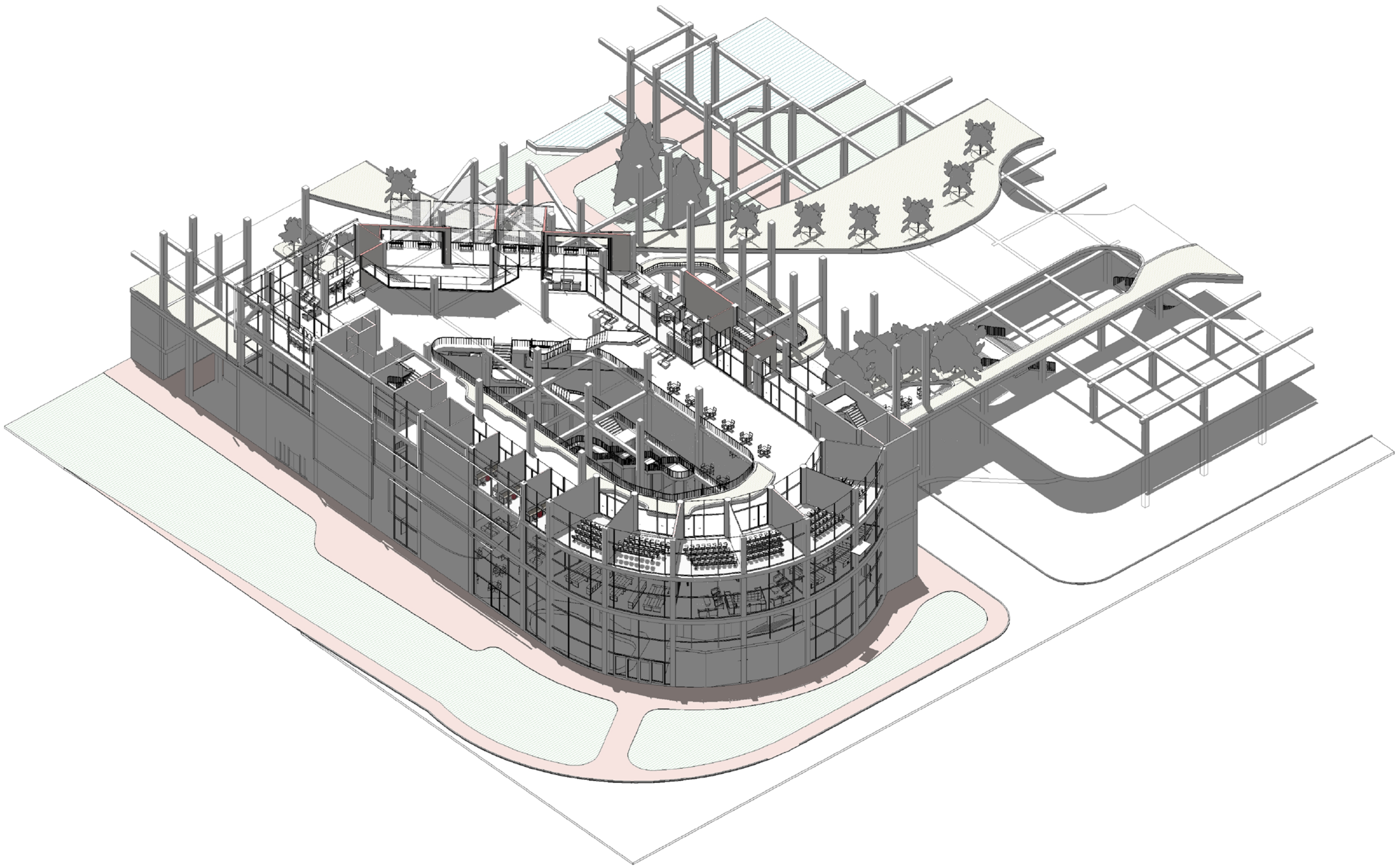


Figure.122: AXONOMETRIC SECOND FLOOR (AUTHOR 2021)

3.9 THE THIRD FLOOR

The third floor is a somewhat open space designed to act as a breakaway from the rest of the Centre. It also acts as an event space in case such a space is required within the precinct. This space becomes the highest area in the development. With views of the street, development and rehabilitated landfill area.

This floor will have substantial exposure to the living wall, within its facade accommodating various species of plants that will attract various species of insects and birds.

As the functions on this floor is minimal in normal working days there is an opportunity to linger in this space and be exposed to biophilia.

Informal seating and meeting space is provided for people who wish to move out of the busy floors below.

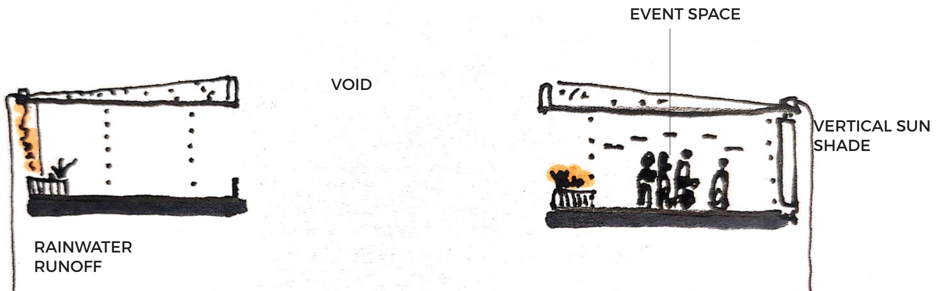


Figure.123: THIRD FLOOR CONCEPT SECTION (AUTHOR 2021)

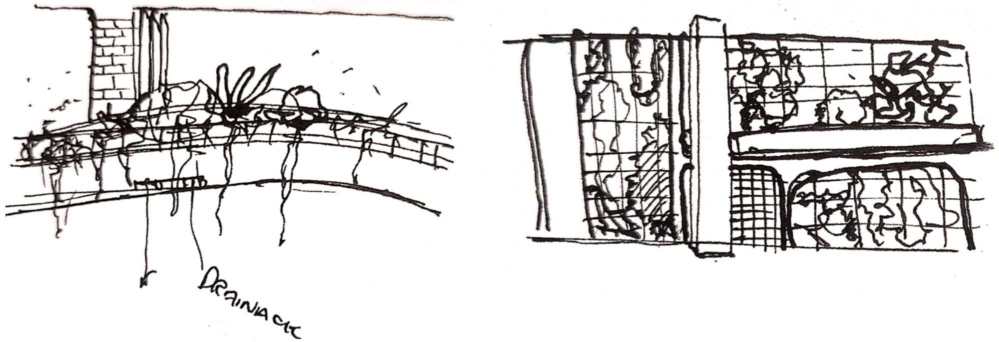


Figure.124: SPECIES INTRODCUTION (AUTHOR 2021)

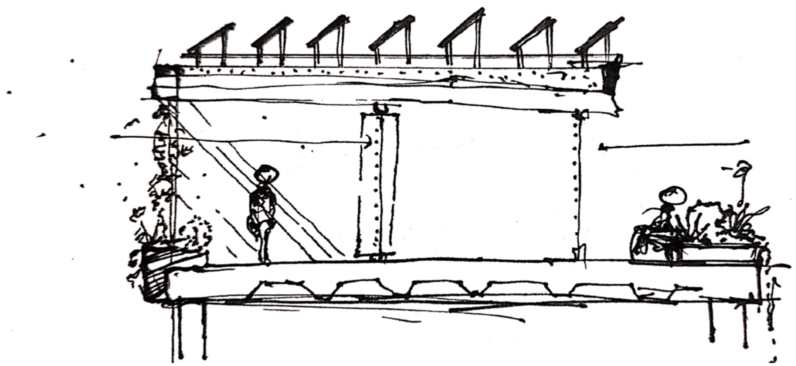


Figure.125:THIRD FLOOR INTERFACE (AUTHOR 2021)

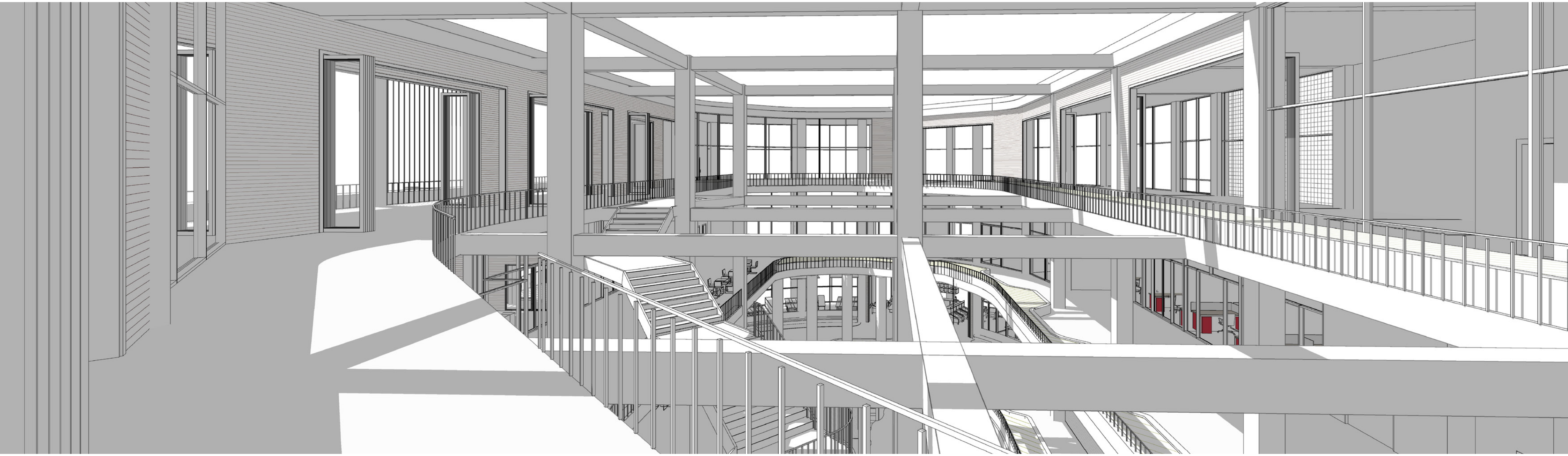


Figure.126:THIRD FLOOR CENTRAL VOID VIEW (AUTHOR 2021)

Figure.127: EXPOSED COLUMN AND BEAM STUCTURE (AUTHOR 2021)

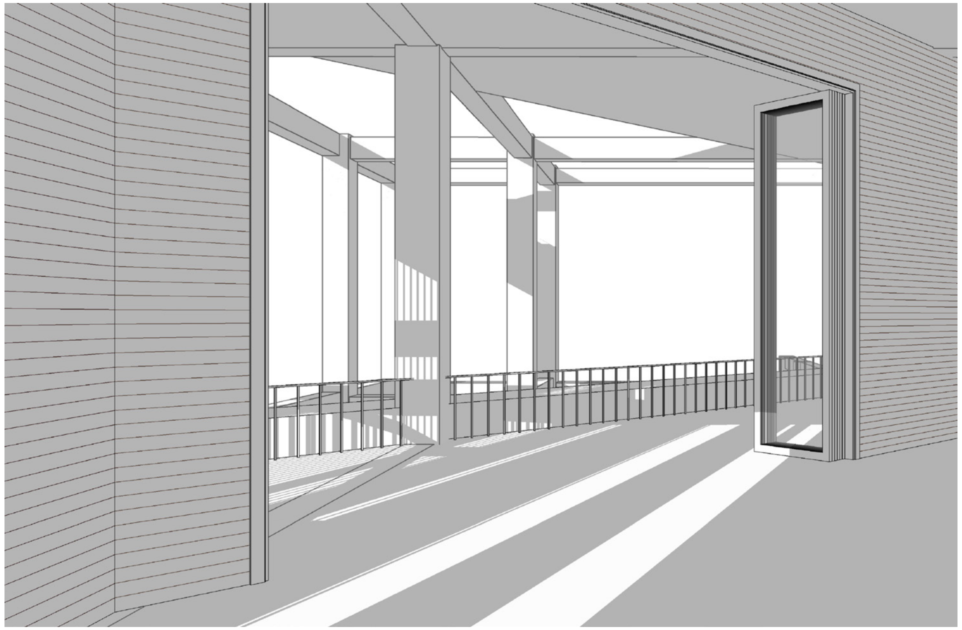


Figure.128:THIRD FLOOR STRUCTURE AND OPENING (AUTHOR 2021)

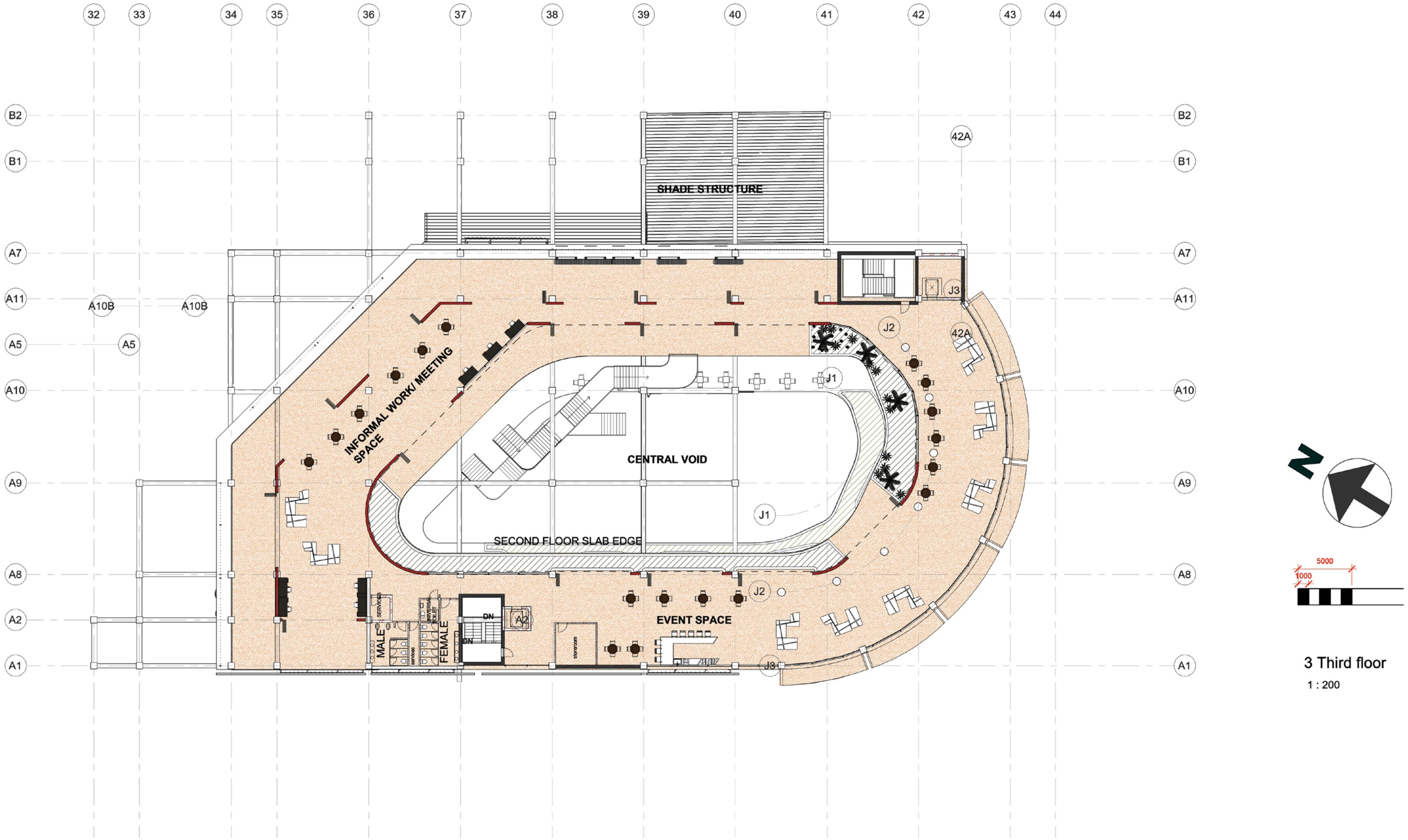


Figure.129:THIRD FLOOR PLAN (AUTHOR 2021)

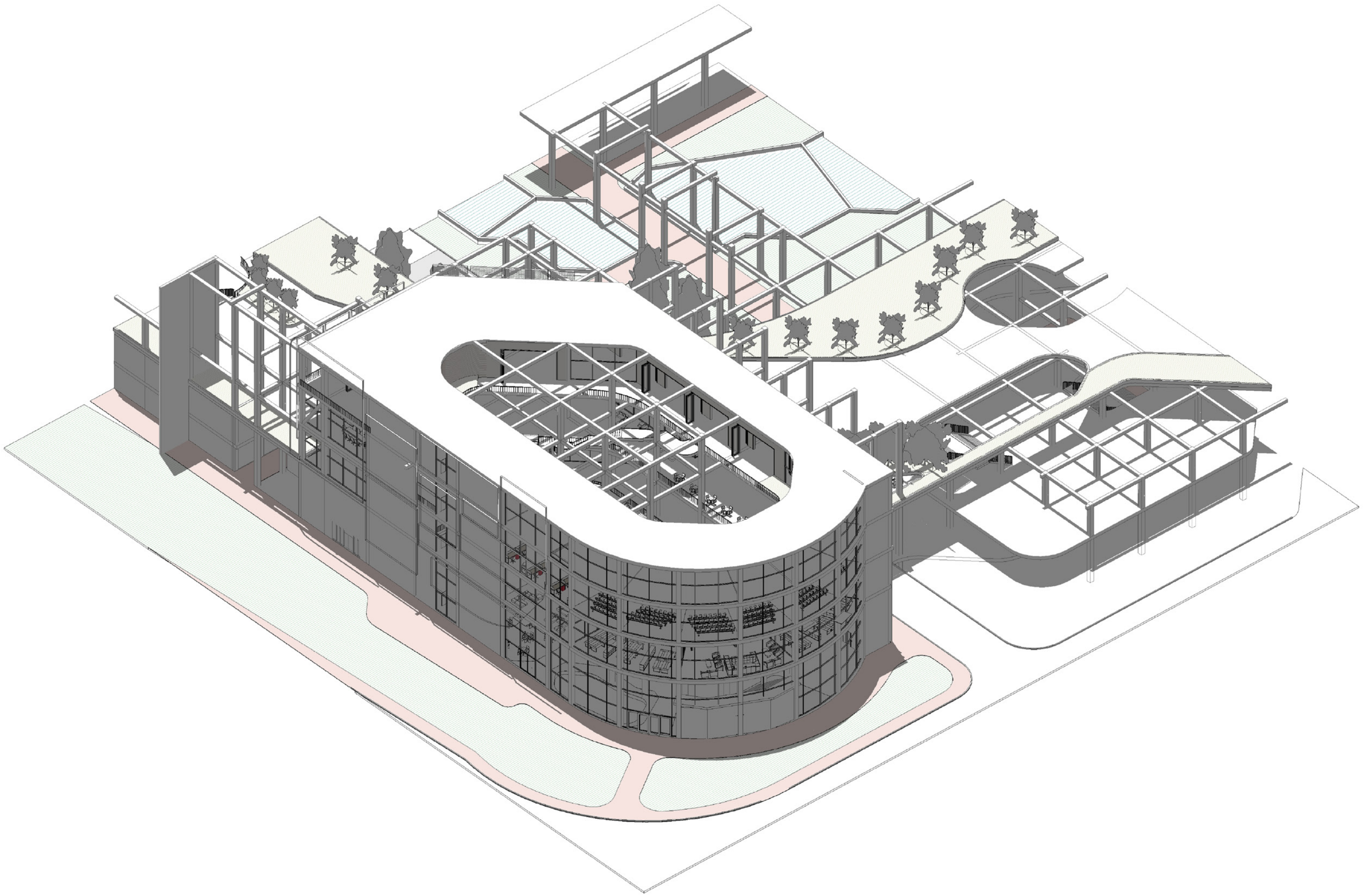


Figure.130: AXONOMETRIC THIRD FLOOR (AUTHOR 2021)

The structure in its entirety become a space of sharing, from an individual level of Online learning to larger groups working together with seminar speakers spreading knowledge. Within this, the structure showcases a system where a human system (the building) and an ecosystem works together in co-evolution or symbiosis for the benefit of both. The GeneticBank allows the structure to have a direct impact on ecological system within its immediate area and beyond, contributing to the genetic conservation of areas within Gauteng.

By introducing an ecological system in such a way, the idea of deep ecological thinking becomes a more tangible idea, where people are exposed to this system by means of an interface with it. This system will cause the introduced species to have intrinsic value (Naess & Sessions 1985) and cause the inhabitants to experience this.

Seeing how these systems change with the seasons becomes an exposure to phenology (the study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life). The structure becomes almost a living educator, where the different systems are exposed (van der Ryn 2007) and informs people of the workings of the combined systems of man and nature.

These systems will be explained shortly.

The structures design is attributed to the theory discussed: Deep Ecology (Naess & Sessions 1985), the Biophilia hypothesis (Kellert 2005 & Wilson 1993), Regenerative sustainability (Gibbons 2020), Island Biogeography and making nature visible (van der Ryn 2007).

By following these approaches it introduces a ecosystem into the building; one which humans are a part of. As explained, various benefits exist for both humans and non-humans by following this approach such as: ecosystem services, habitat creation, improved mental wellbeing of humans, biodiversity, improved micro climates and so on.

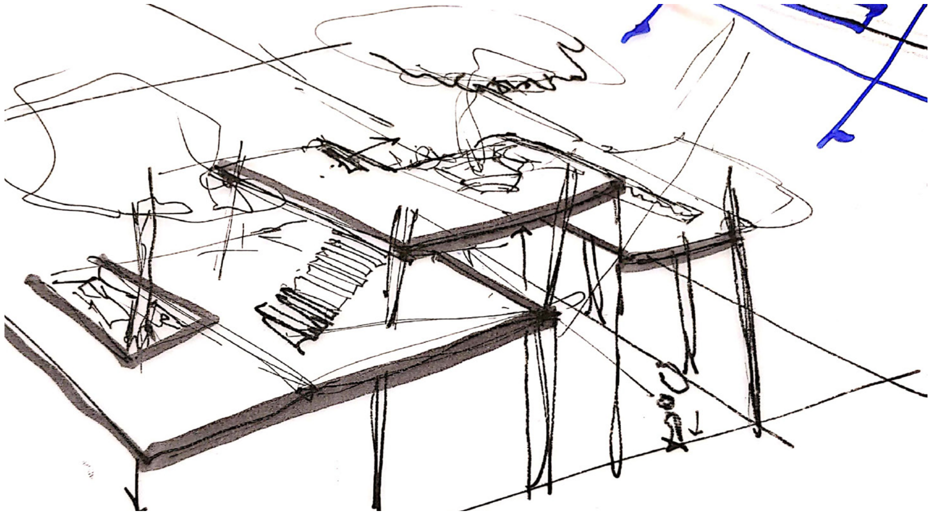


Figure.131: INITIALL CONCEPT SKETCH FOR DATA CENTRE (AUTHOR 2021)

Figure.132: NORTHERN ENTRANCE APPROACH ON FLYOVER (AUTHOR 2021)

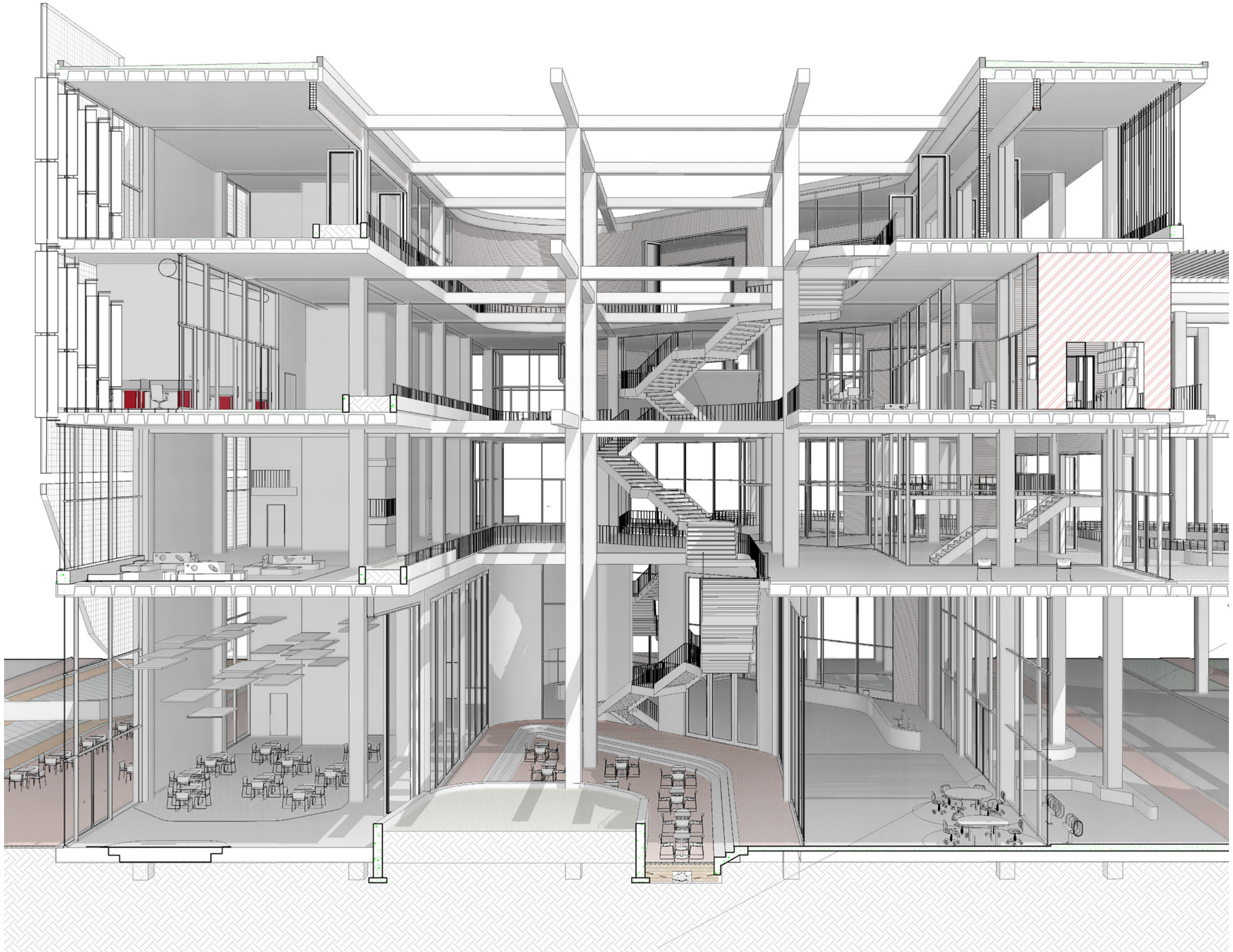


Figure.133: SECTION PERSPECTIVE WEST-EAST (AUTHOR 2021)

Figure.134: SECTION PERSPECTIVE NORTH-SOUTH (AUTHOR 2021)

3.10 STRUCTURAL SYSTEM

The primary structural system consists of the existing column, beam and slab frame of the structure, which will be cut into whilst ensuring that the building remains structurally sound.

Consultation with an engineer set the parameter to which the project kept to ensure the structure remain structurally strong. This process gave insight into overhang lengths (35% of Slab span) and strategies to withstand deflection forces (Keeping columns in ordered groups) .

The secondary structural system will add in space creating elements such as walls, shop-fronts. These elements if shop front will be new materials. Elements such as brick or concrete walls, can be recycled from the site.

The tertiary system becomes the building skin and ceiling and wall panels. The building skin will be expanded upon shortly. The ceiling panels aid in reducing the scale of the structure, whilst providing room for some services

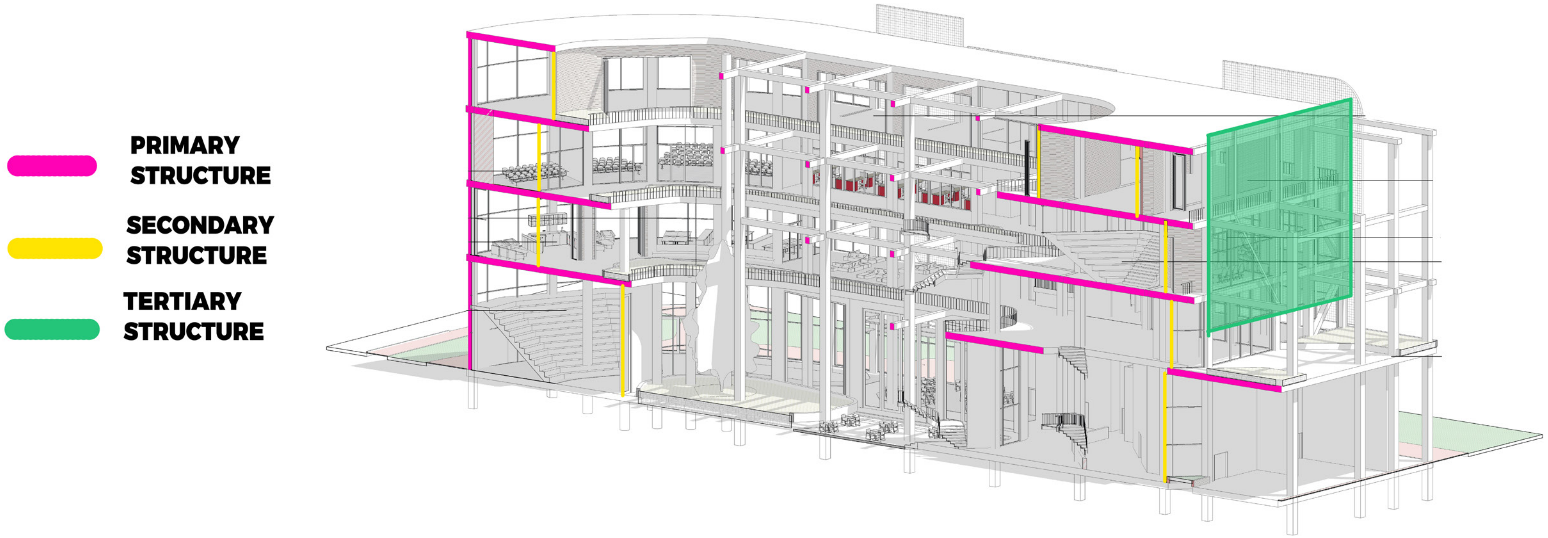


Figure.135: STRUCTURAL SYSTEM (AUTHOR 2021)

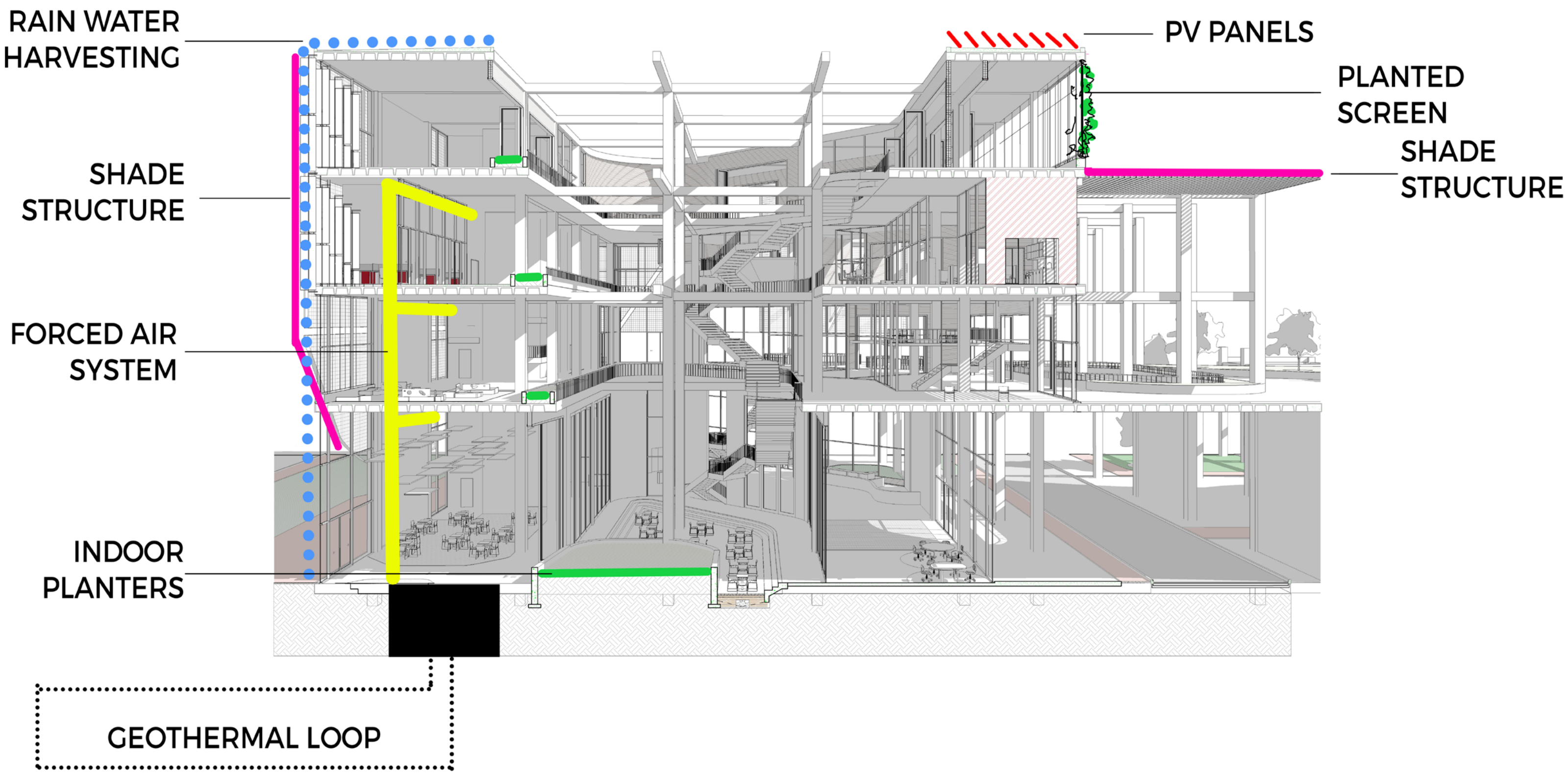


Figure.136: SYSTEM APPROACH (AUTHOR 2021)

3.11 SYSTEM STRATEGY

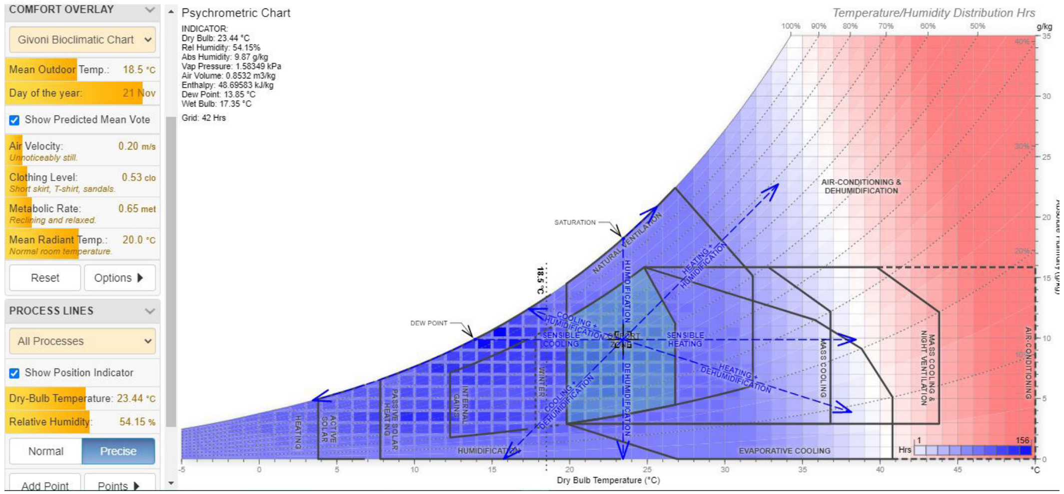
The systems within the structure stem from the theories of sustainability, the reuse of space , deep ecological thinking and the theory discussed. Most of the systems work in conjunction with each other, for instance; rainwater harvested from the roof will water the planters on the façade after it has passed through an artificial wetland.

The photovoltaic panels supplements power throughout the structure. Through this method fewer resources are used creating a more efficient and sustainable system, which in turn has a positive impact on the economic and ecological stance of the site.

Various systems will be working within the structure, most of which will deal with heating and cooling. These systems include:

3.11.1 PHOTOVOLTAIC (PV)

A PV array for the production of electricity, which will power the other systems in the building and various other part of the structure such as lights, computers etc. The PV panels will also have the added benefit of shading the roof, restricting heat ingress.



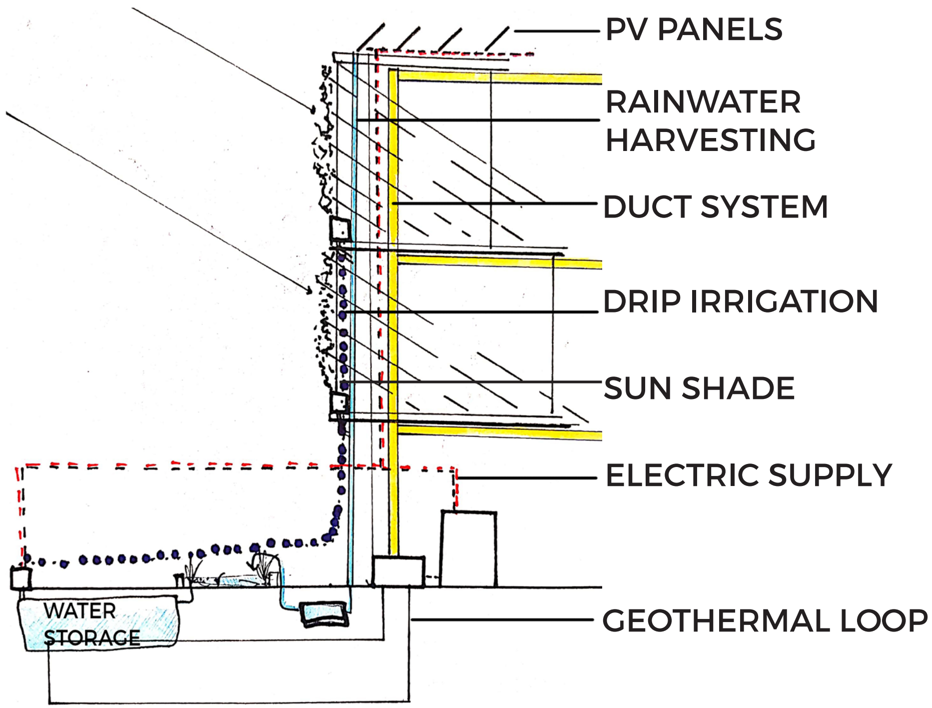


Figure.137: PSYCHOMETRIC CHART (ANDREWMARSH.COM) TOP

Figure.138: INTEGRATED SYSTEMS (AUTHOR 2021) BOTTOM

3.11.2 RAINWATER HARVESTING AND GREY WATER HARVESTING

A substantial harvesting system will also be relied upon. Rainwater from the roof will be directed into the artificial wetland where it will be filtered and stored for other uses (depending on the amount it can be used for irrigation and used to for flushing and cleaning of the site). Grey water will be harvested from wash hand basins within the structure and also directed towards the artificial wetland system and stored for later use.

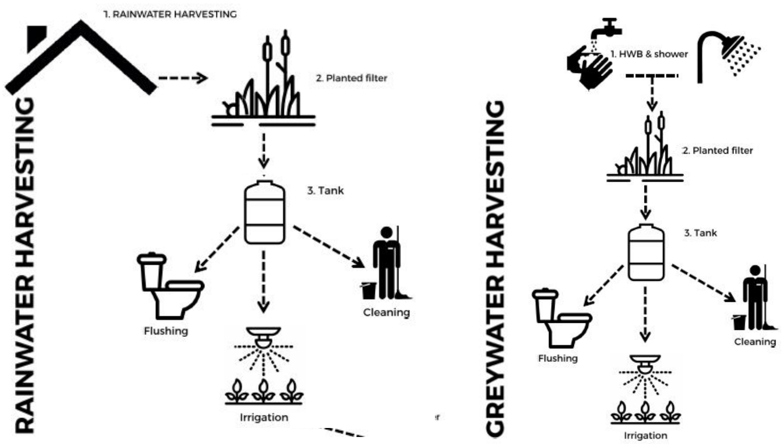


Figure.139:WATER HARVESTING STRATEGIES (AUTHOR 2021)

3.11.3 GEOTHERMAL HEATING & COOLING.

This method of heating and cooling uses the constant temperature found in the soil which fluctuates between 16.5˚C and 21˚C at a depth of 2 meters. This in turn heats or cools a liquid that gets transferred to a heat exchanger and which subsequently heats or cools air that is moved to conventional forced air system to heat or cool the building.

Depending on the time of the year this method can be efficient but in extreme heat or cold it will need to be supplemented by an air conditionings system to aid with heating or cooling of the structure. The site has sufficient space to have a horizontal geothermal loop (the pipe system which houses the liquid within the soil) next to the structure. Fresh air for the air-conditioning system will be acquired in and around heavily planted area, where the air is cooler, instead of heated air from hardscaped surfaces. This becomes important for this air is used within the HVAC and receiving dirty or heated air from outside is counter-intuitive to the systems approach.

At night the structure will be night cooled, all hot air will be purged from the structure, allowing the building to be cooler during the day.

3.11.4 LIVING WALL SHADING SYSTEM

This system will also be incorporated into the structure. The system will exist out of two parts: one part (human-made) will be horizontal and vertical fins on the Northern and eastern/ western façades respectively. These fins are able to move mechanically as light and temperature requirements change, allowing for more or less sunlight into the structure. The other part (natural) will be a system of planted façade modules, existing out of either mesh screens or iron rod bars for plants to grow on (depending on species requirement). Plants species will be chosen for their sun/shade requirement and placed on the corresponding aspect of the building. Evergreen and deciduous plants will be mixed, this will allow the structure to receive more sunlight in winter months when the deciduous plants have lost their leaves. Various factors can inform plant selection: sun and water requirements, flowering time and colour, does it attract a certain butterfly or bird etc.

The geothermal heating & cooling and the sun shade will work in symbiosis to cool and heat the structure and will be exposed showing the interface of the human-nature relationship working together (van Der Ryn 2007). This system will be supplemented by a standard air conditioning system that will only be used in the most extreme cases.

Together these systems in combination will work to make the building efficient and more sustainable while using less energy.

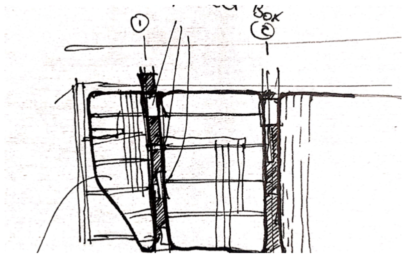


Figure.140: INITIAL IDEA LIVING WALL (AUTHOR 2021)

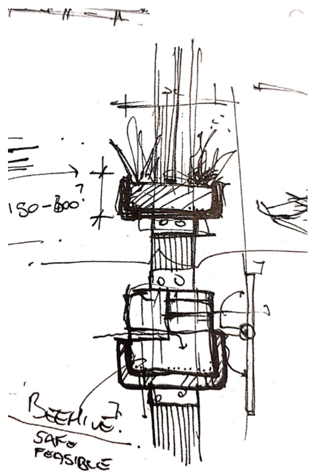


Figure.142: INITIAL DETAIL PLANTERS (AUHTOR 2021)

SYMBIOSIS OF HUMAN AND NATURAL SYSTEM

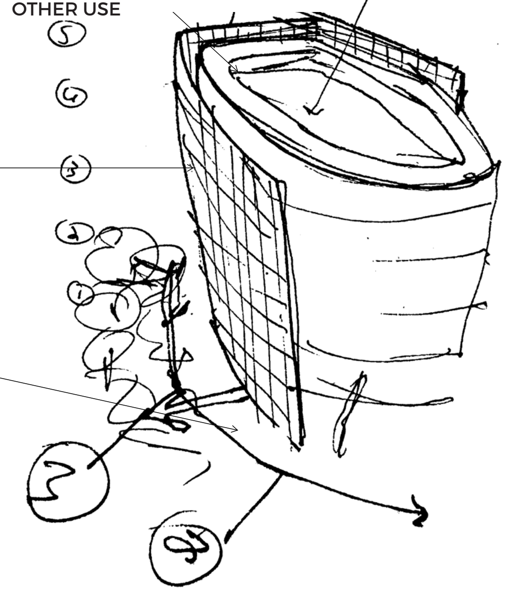


Figure.141: SYMBIOSIS (AUTHOR 2021)

3.15.1 PLANTING PALETTE - TREES


Figure.143: *Faidherbia albida*


Figure.144: *Heteropyxsis natalensis*


Figure.145: *Kigelia africana*


Figure.146: *Kiggelaria africana*


Figure.147: *Bolusanthus speciousus*


Figure.148: *Acacia tortilis*


Figure.149: *Ficus ingens*


Figure.150: *Crotum gratissimusa*


Figure.151: *Olea europea subsp africana*


Figure.152: *Combretum krausii*


Figure.153: *Acacia burkei*


Figure.154: *Diospyros whyteana*


Figure.155: *Dais continifolia*


Figure.156: *Harpephyllum caffrum*


Figure.157: *Galpinia transvaalica*


Figure.158: *Combretum erythrophyllum*


Figure.159: *Dombreya rotundifolia*


Figure.160: *Erythruna lysistemon*


Figure.161: *Acacia karoo*


Figure.162: *Burkea africana*


Figure.163: *Cussonia paniculatem*


Figure.164: *Peltoforum africanum*


Figure.165: *Schotia bracypetala*


Figure.166: *Acacia xanthaphloea*


Figure.167: *Acacia sieberiana*


Figure.168: *Englerophytum magalismontanum*

3.15.2 PLANTING PALETTE

Figure.169: *Aloe ferox*

Figure.170: *Aloe arborescens*

Figure.171: *Melins repens*

Figure.172: *Aloe marlothii*

Figure.173: *Xerophyta retinervis*

Figure.174: *Melins nerviglumis*

Figure.175: *Aloe pretoriensis*

Figure.176: *Aristida congesta*

Figure.177: *Themda triandra*


Figure.178: *Grewia occidentalis*


Figure.179: *Ancylobrotrys capensis*


Figure.180: *Chlorophytum bowkeri*


Figure.181: *Crocosmia aurea*


Figure.182: *Dieters grandiflora*


Figure.183: *Ertheria rigida*


Figure.184: *Felicia sp*


Figure.185: *Jasminum sp*


Figure.186: *Budleja saligna*

3.15.3 SPECIES SELECTION

Part 3.15.1 & 3.15.2 give an indication of the type of species that can be introduced into the development (there are various other species not shown). Most of these plants fall within the relevant vegetation units: Gauteng shale mountain bush veld & Rand Highveld grassland. Other species that do not fall within these units are chosen mostly for aesthetic reason and they are easily sourced.

The mixture of these two vegetation units provides a large mix of species available for selection, ranging from smaller ground cover from the grassland unit to large Acacia trees from bush veld unit.

Choosing species from these units has various benefits: Most of the species will have the same requirements regarding; Water and geological condition. Further, these species will attract indigenous fauna to the area, species from all spheres, insects, birds, reptiles and hopefully mammals.

Some feature trees: Erythrina lysistemon & Dombeya rotundifolia. These species bloom in the same time and create an impressive sight with their white and red flowers.


Figure.187: *Bauhinia galpinii*


Figure.188: *Hypoestes aristata*


Figure.189: *Combretum microphyllum*

3.15.4 FEATURE TREES

Figure.190: *Erythrina lysistemon*

Figure.191: *Dombeya rotundifolia*

3.16 GREEN STAR AND RATING

The De Villa Bois structure received a 4-star Green star rating prior to completion. It scored well in parts such as; management, transport, water, material use, emissions and energy. Most of these aspects can be improved upon.

Some of the points scored are irrelevant now, as the structure was never completed and some aspects were never built, however, there are still parts that are of relevance.

MANAGEMENT

The management of the structure becomes important. There is a need to be more environmentally adept and understanding. This is required from construction management phase to the full occupation of the building by staff and the public to ensure the systems in place work efficiently. The energy and water use within the structure (and the larger development) will be monitored by staff. Together with this the health of the ecosystem must be monitored and managed by relevant parties, to ensure it function as it should and supports biodiversity. Any fault or system that is not functioning as it should will be addressed immediately.

INDOOR ENVIRONMENTAL QUALITY

Indoor environmental quality is approached largely by the creation of the central void in the structure. This void allows for natural ventilation and the ingress of natural light within the structure. Overhangs on façades that receive direct sunlight are designed adequately (allowing for sun ingress in wintertime but shading spaces in the summer)

Within this the Geothermal heating and cooling system keeps the enclosed spaces of the structure heated or cooled in the respective over-heated and under-heated period of the year

ENERGY

All energy demands will be supplemented by PV panels. Other strategies include the use of Automatic lights that switch off if people are not using a certain space, the same goes for the ventilation system.

Through the reducing of scale of the building ,it allows for a smaller and more efficient HVAC systems which uses less energy, combined with the the Geothermal heating and cooling system it creates an efficient system for ventilation.

TRANSPORT

The development reuses existing parking bays within the structure. Priority parking is given to electrical vehicles and disabled persons.

Bicycle storage is also provided in the data centre as well as other parts of the development.

A new public transport interchange is also proposed which will connect to a larger system of public transport, encouraging people to use public transport.

WATER

Rain water and grey water will be harvested from the various parts of the development and used for irrigation and flushing throughout the development. This water will be filtered through an artificial wetland system and stored in underground tanks for later use.

MATERIALS

Some of the existing material used within the structure was created in a specific way: in terms of the concrete 30% of the cement used in the project will be replaced by industrial waste products, reducing the embodied energy of the concrete. In terms of the steel 60% of the steel reinforcing will have a recycled content of greater than 90%. As the structures scale is reduced and by reusing concrete as recycled concrete aggregate this will once again be more recycled material within the concrete reducing its embodied energy.

Space that use timber floor will make use of rubber cradle acoustic systems. The rubber crumb cradles are created from recycled tyre rubber and can be installed quickly and avoid the need for levelling screed with extensive drying times. InstaCradles facilitate easy levelling of uneven sub-floors. These floor are also acoustically appropriate for these spaces .

LAND USE & ECOLOGY

The land use of the development is drastically altered with the deconstruction of the structure and the conversion from what would have been a mall to an ecological focused civic centre with various functions. The deconstruction allows for the introduction of vast amounts of flora (and hopefully attract various fauna in the process) that will improve the ecology of not only the De Villa Bois structure but the entire Garstkloof site and beyond. The improved of the Garstkloof nature area and landfill will further improve ecology and biodiversity for the site.

INNOVATION

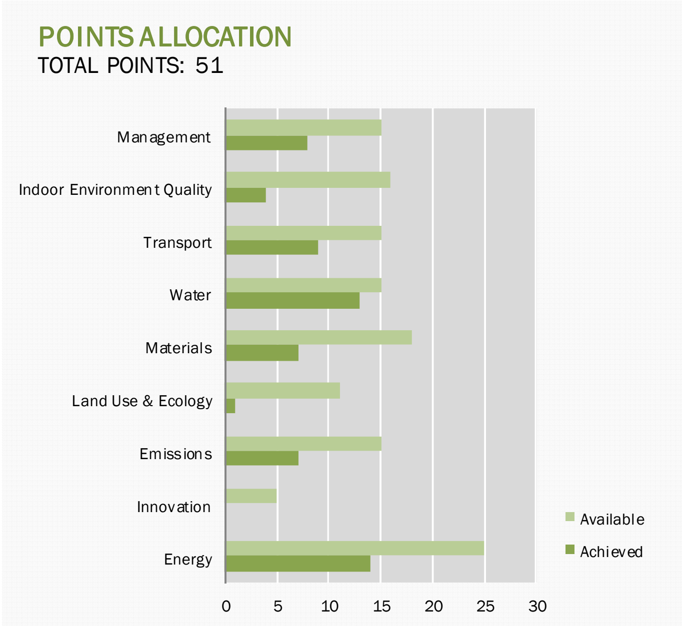
The living wall becomes an innovation worth including in the report. This system will aid in the heating/cooling of the structure but also benefit ecology by the introduction of species. The introduction of an ecosystem into a human system will also fall under innovation.

ADDITIONAL CATEGORY: SOCIO-ECONOMIC

As the structure was never complete and left abandoned for over 10years, no social or economic function existed on site. By developing the site and allow for commercial and further changing the perspective of the site from an eyesore to something positive impacts on the socio-economic stance. The site also provides much needed civic space for an area in Pretoria that lacks it.

In conclusion, the previous rating was a 4-star rating with a score of 51 points. The "new" structure had a rough estimated point value of 70.5, which is sufficient for a 5-star rating (points between 60-74). With most of the points coming from innovation, improvement of land use and ecology and indoor environmental quality.

The management of the structure will remain important long after construction is completed.



GREEN BUILDING COUNCIL OF SOUTH AFRICA

Figure.192: GREENSTAR RATING (GBCSA)

3.17 SBAT RATING

The sustainable building assessment tool gave a indication for environmental, economic and social performance. To my surprise, the project scored the least for environmental performance, which I believe to be a lack of rating tools from the SBAT in terms of the ecology.

The project also scored poor in energy as a in depth energy usage was not completed , as this was not within the project scope.

Generally however the building/development performed well.

SB4 Environmental, Social and Economic Performance	Score
Environmental	4,2
Economic	4,5
Social	4,5
SBAT Rating	4,4

SB5 EF and HDI Factors	Score
EF Factor	4,3
HDI Factor	4,2

SB6 Targets	Percentage
Environmental	83
Economic	91
Social	90

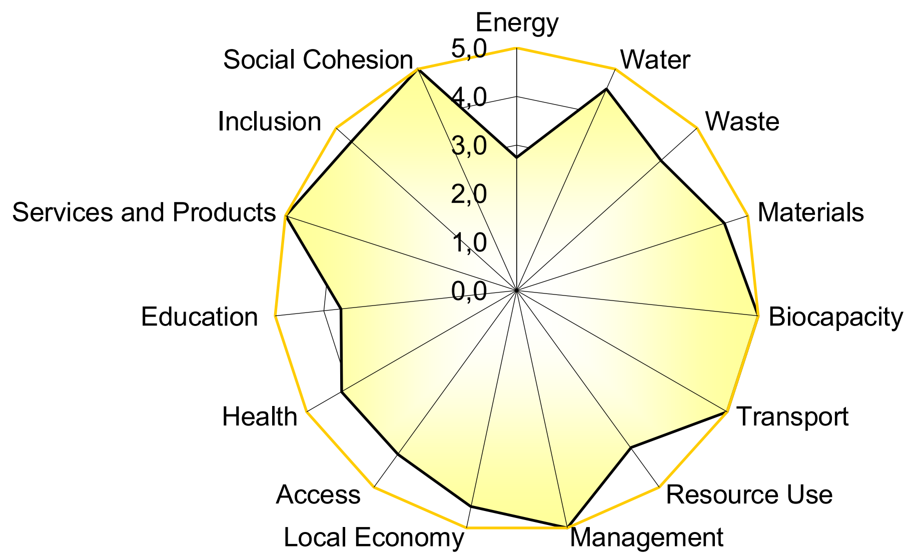


Figure.193: SBAT RATING CREATED FROM SBAT EXCEL SHEET

3.18 CONCLUSION

By designing the structure in such a way to accommodate for the ecological system, habitat is increased for species, whilst providing the human occupants of the structure with various benefits, ranging from increase attention spans (Tennessen & Cimprich 1995) to improved micro climate (Wohlitz et al 2016).

The social, ecological and economic potential of the development is improved upon through the introduction of an ecosystem and the introduction of commercial areas and meeting space.

Introducing an ecological system in such a way can become a prototype for new development being planned or older existing structure being reused.

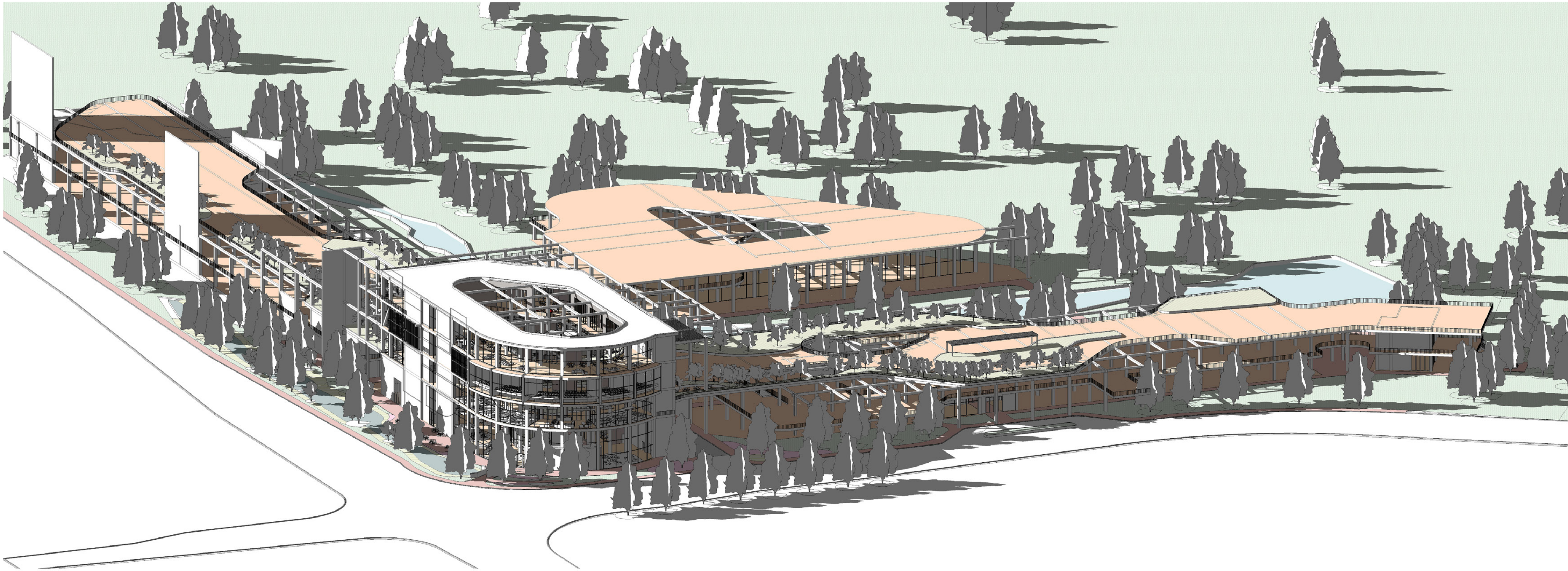
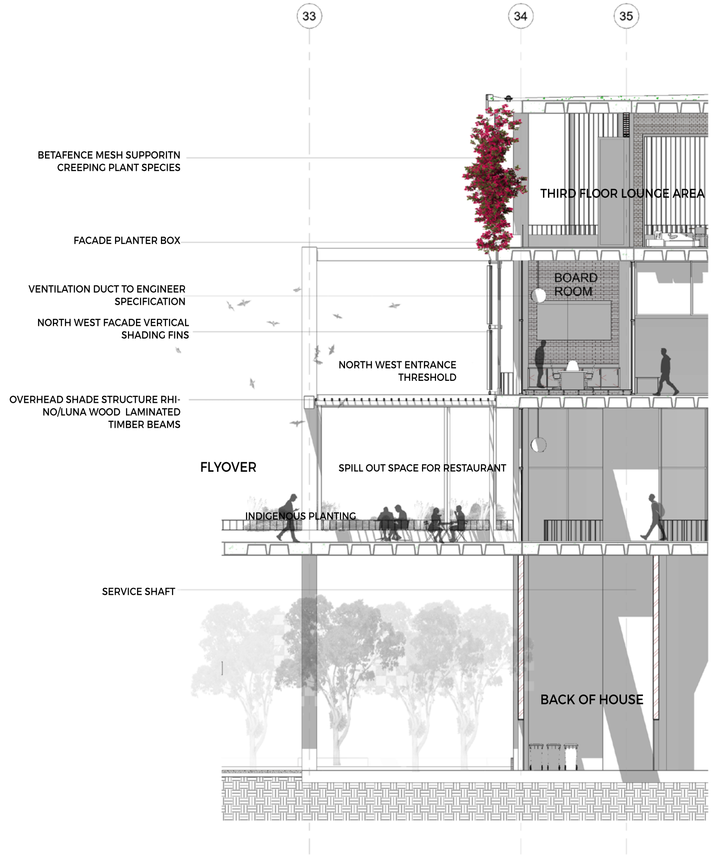


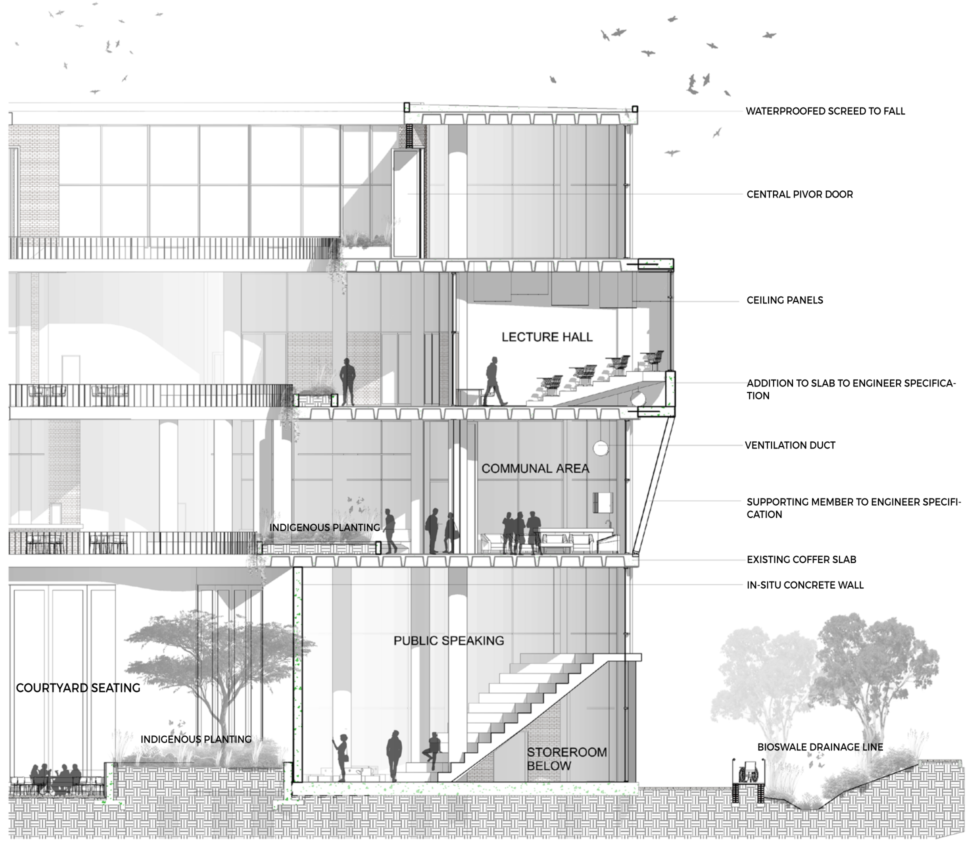
Figure.194: AXONOMETRIC (AUTHOR 2021)

Figure.195: SECTION EAST-WEST 1:50 on A0 (AUTHOR 2021)



North strip section

1 : 100



South strip section

1 : 100

Figure.196: STRIP SECTION 1:100 on A1 (AUTHOR 2021)

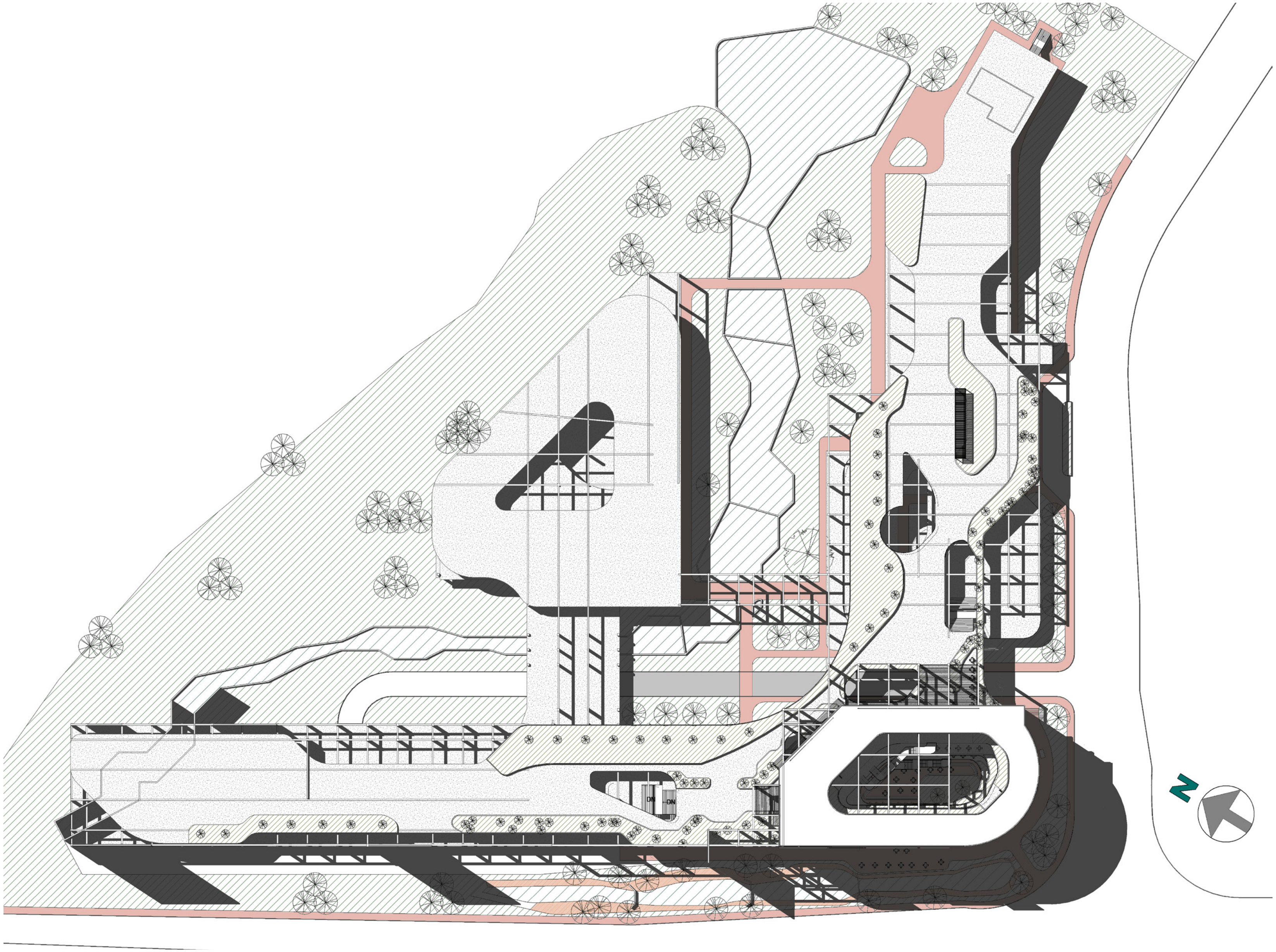


Figure.197: SITE PLAN (AUTHOR 2021)

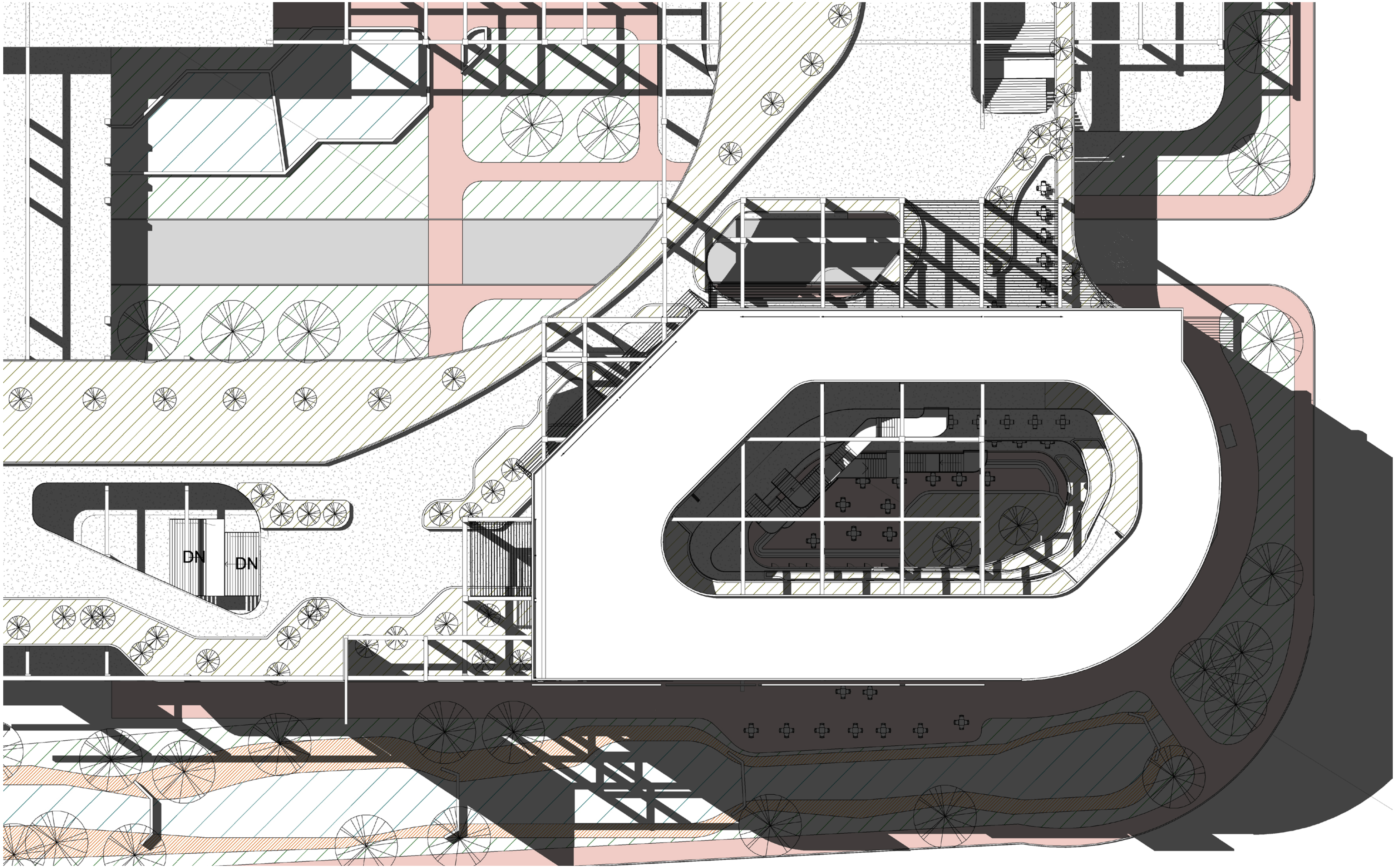


Figure.198: SITE PLAN DATA CENTRE (AUTHOR 2021)

Figure.199: RENDERS (AUTHOR 2021)

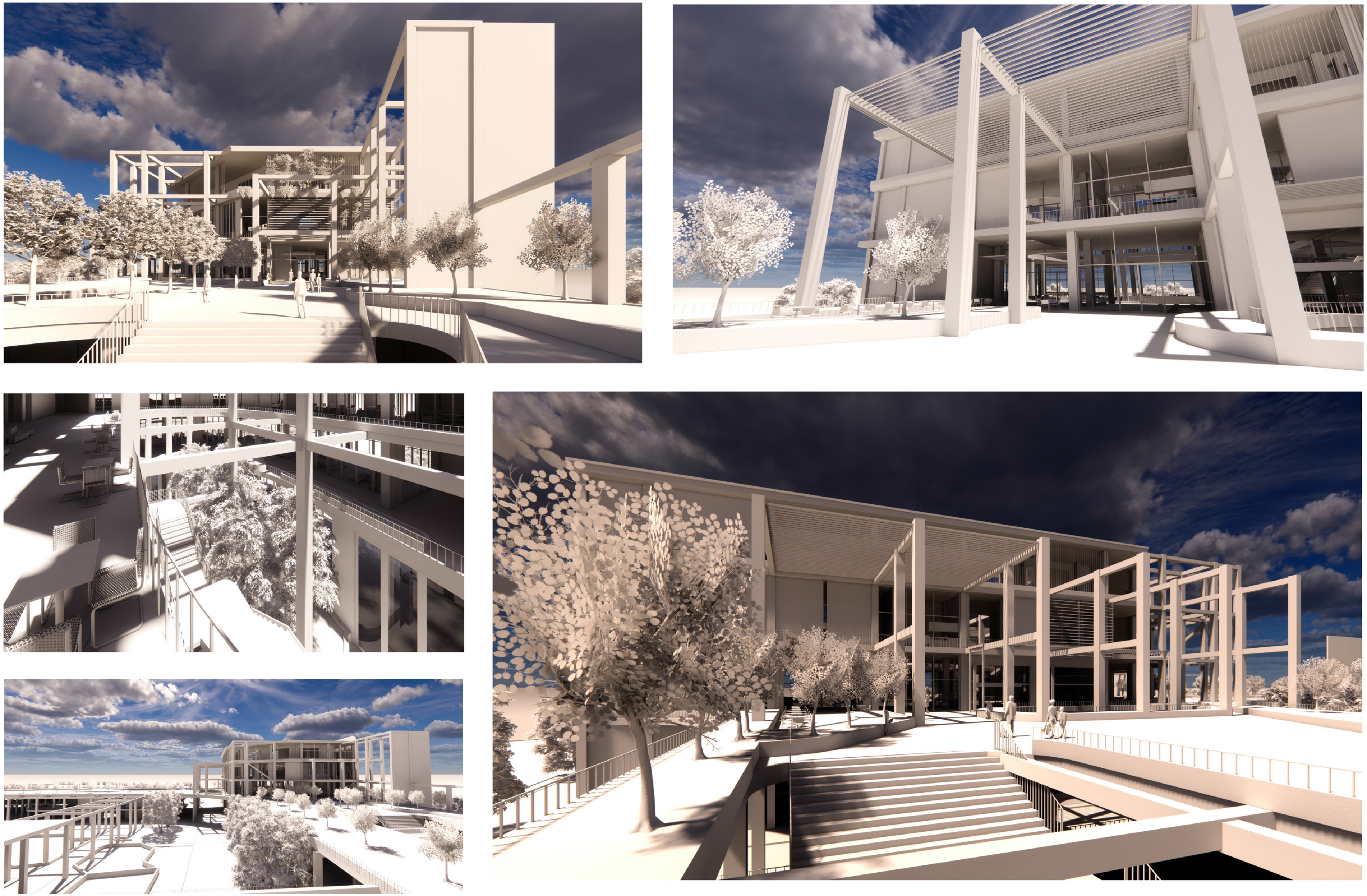


Figure.200: RENDERS CONTINUED (AUTHOR 2021)

Figure.201: RENDERS CONTINUED (AUTHOR 2021)

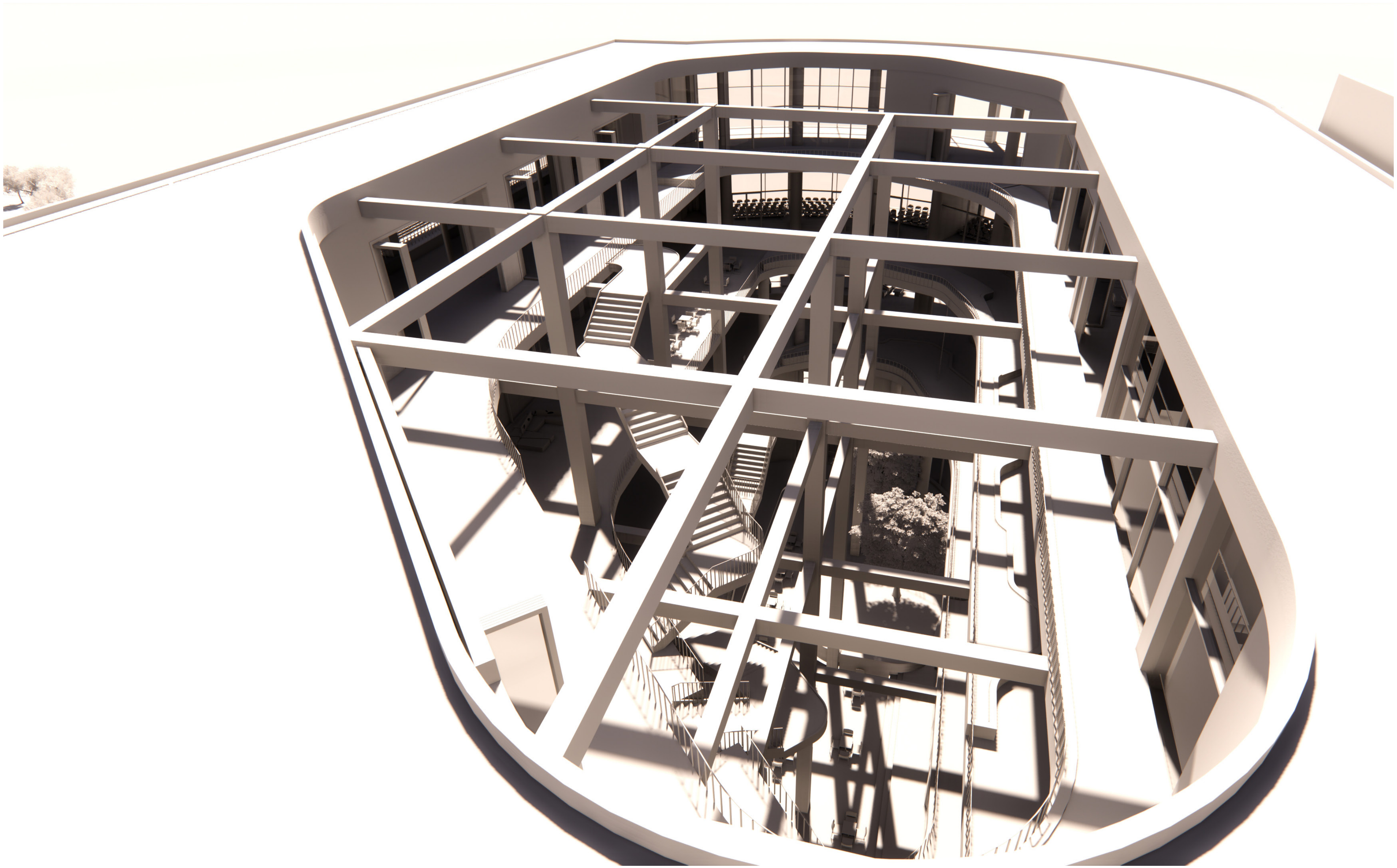


Figure.202: RENDERS CONTINUED (AUTHOR 2021)

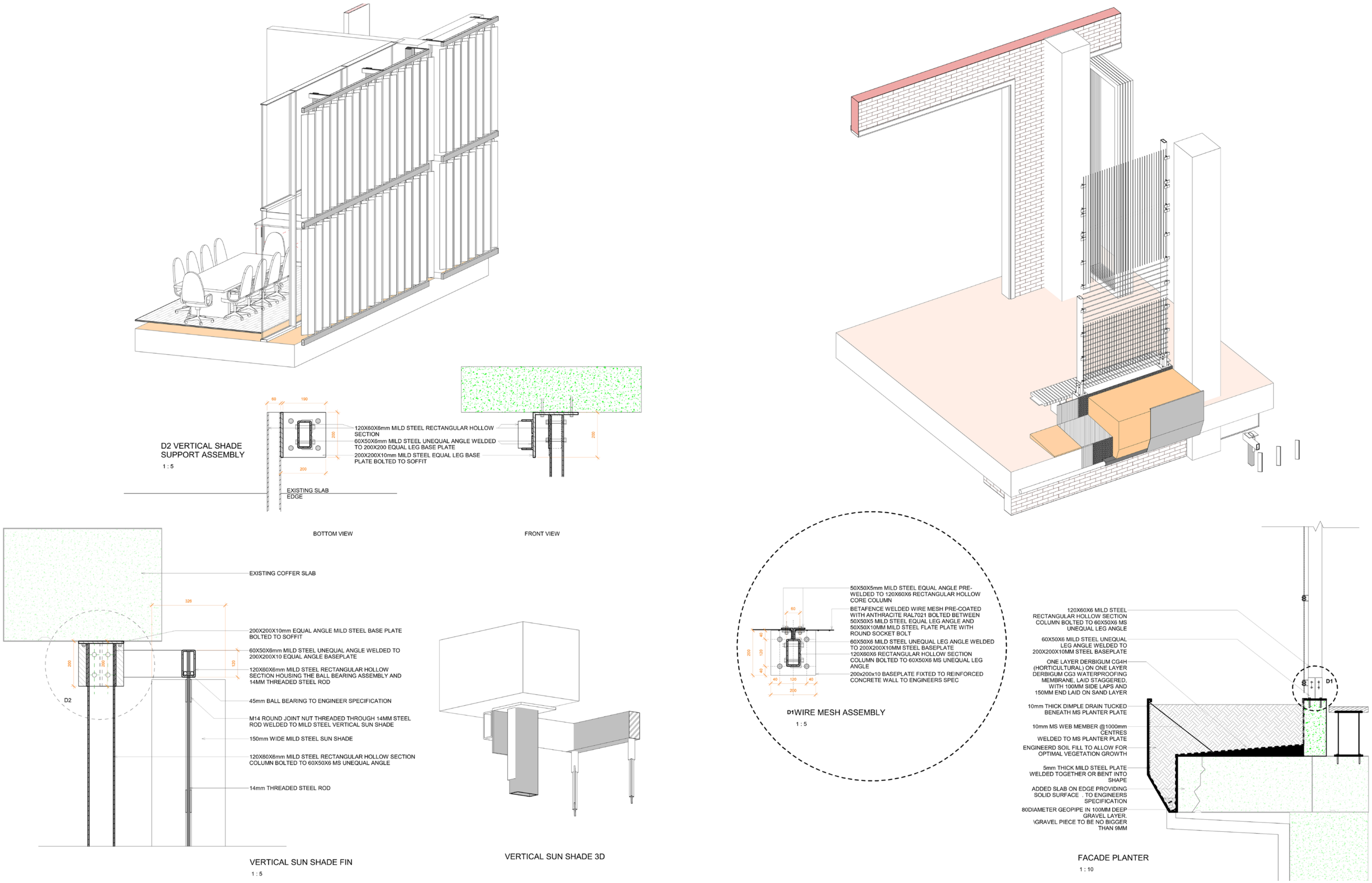


Figure.203: DETAILS (AUTHOR 2021)

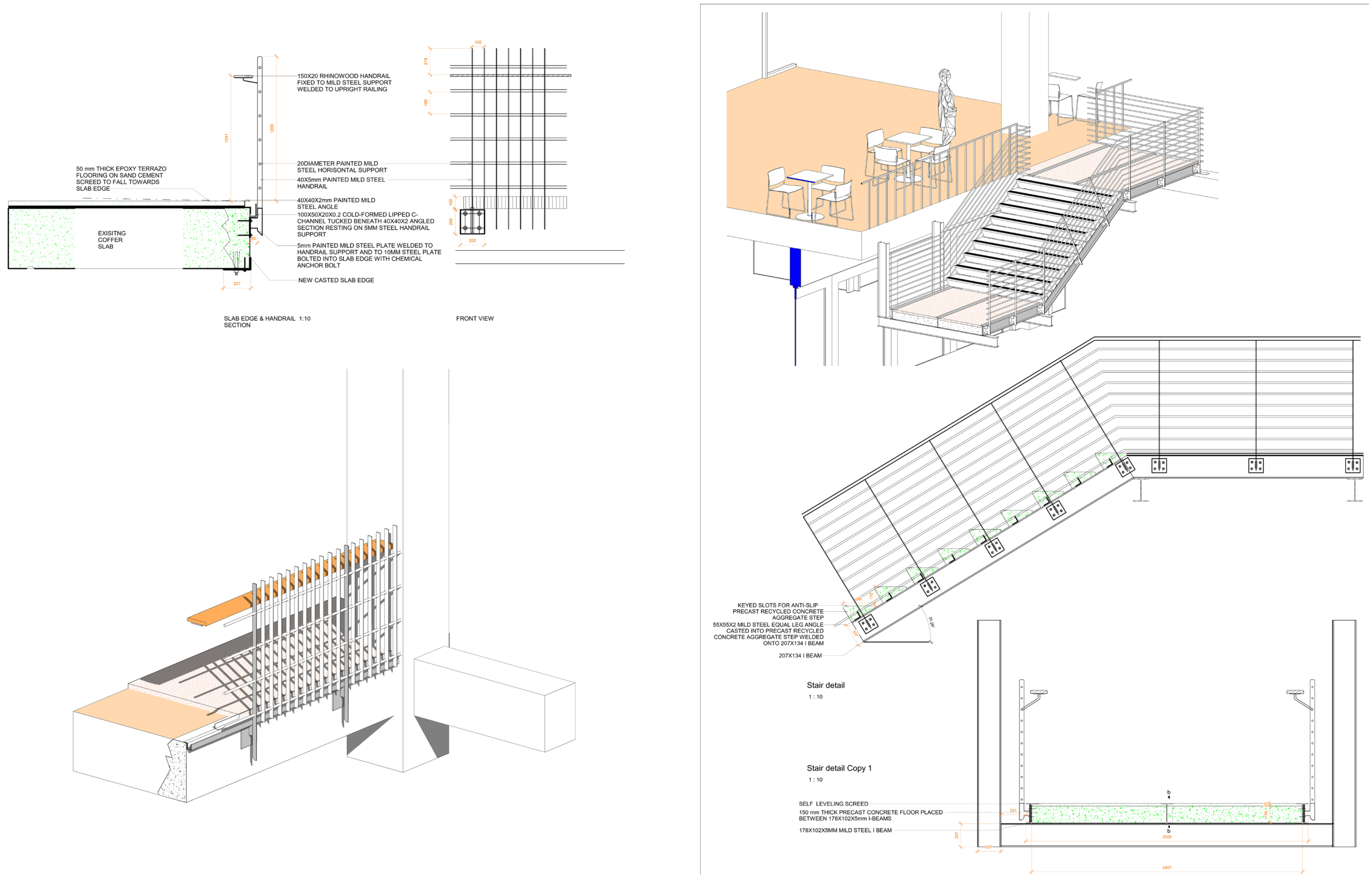


Figure.204: DETAILS (AUTHOR 2021)