P5 Presentation
aE Studio

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Architectural Engineering Studio
Start **Spring 2023/24**
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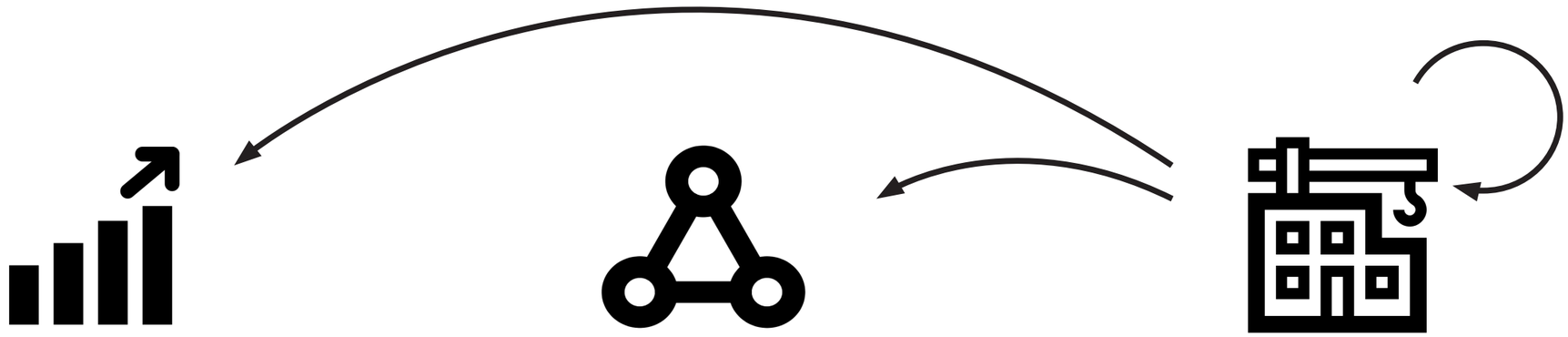
Adaptive reuse of campus buildings towards a living campus

WHAT | Adaptive reuse



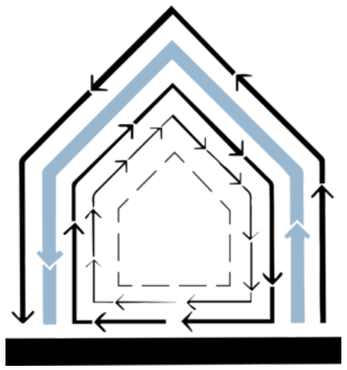
(Inter)National scale

Urban scale

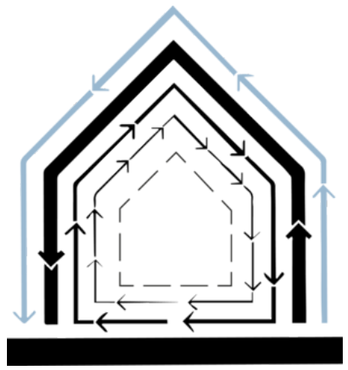
Building scale

The focus of the project is based upon the technique of **adaptive reuse**.
Meaning the building is able to **adapt itselve towards the current needs**, based upon the contemporary problems in the (inter)national and urban scale

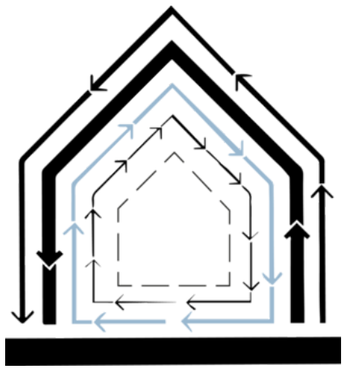
WHAT | Shearing Layers of Change



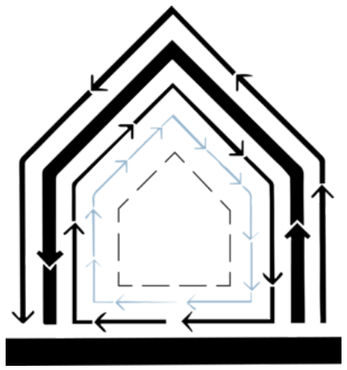
Structure ≈ 200 years



Skin ≈ 50 years



Systems ≈ 25 years

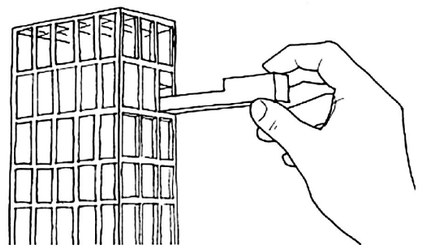


Space plan ≈ 15 years

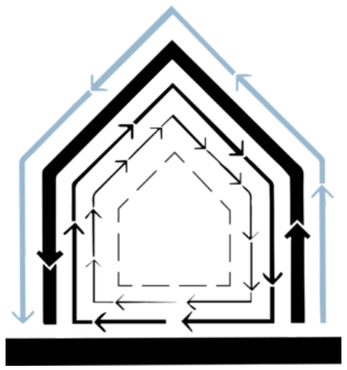
Source: Manifesto — Open building. (n.d.). Open Building. https://www.openbuilding.co/manifesto

The **adaptability of a building** has to do with the concept of the shearing layers of change by Steward Brand (1994). Adaptability is how much the **layers are separated**, the change of the ‘faster’ layers should not be hindered by the ‘slower’ layers

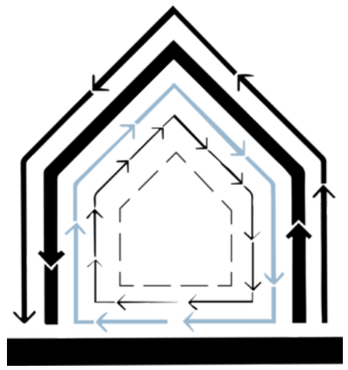
WHAT | Shearing Layers of Change



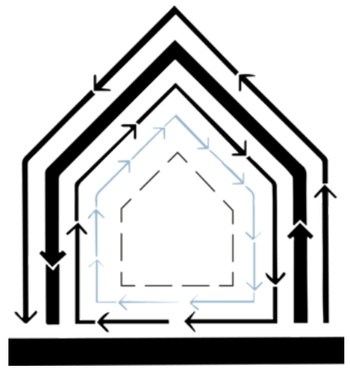
Structure as an existing building*



Skin ≈ 50 years



Systems ≈ 25 years

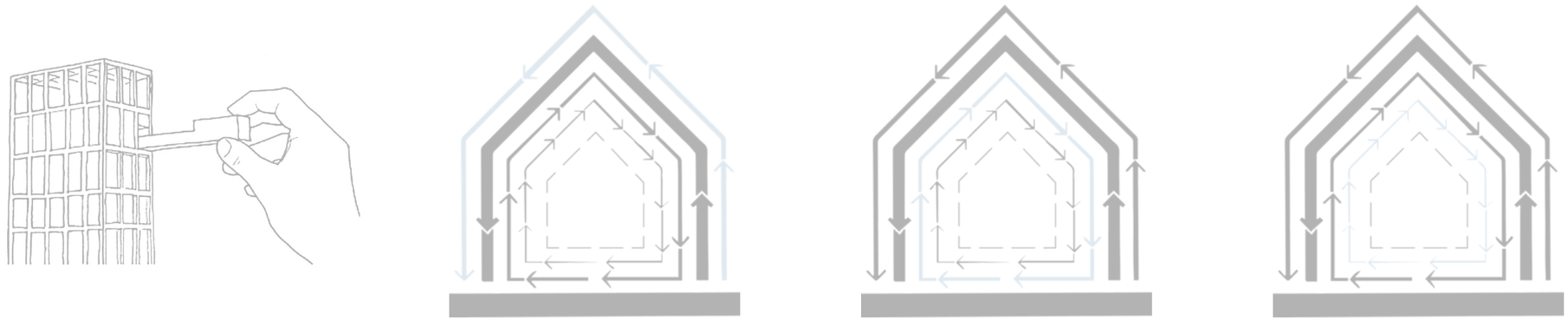


Space plan ≈ 15 years

Adaptive reuse of an already exsiting building, thereby using the structure that is already there and **building further upon the layers** who are overdue and need the change, in order to stay up-to-date

*Source: Redirect notice. (n.d.). https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.linkedin.com%2Fpulse%2Fcelebrating-50-years-applied-architectural-industrial-baloghy-1e%3Ftrk%3Dpulse-article_more-articles_related-content-card&psig=AOvVaw1r-qCGYvBvIfdQHuCJ0tp7&ust=1702386643868000&source=images&cd=vfe&opi=89978449&ved=0CBEQjRxqFwoTCKD8t826h4MDFQAAAAAdAAAAABAH

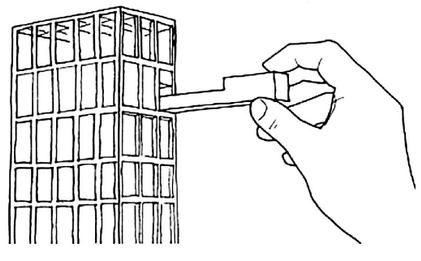
WHAT | Shearing Layers of Change



Open Building: Bookcase as the structure of the building, and the infill as the books.
Able to change over time and to meet differentiating requirements in the future

*Source: Redirect notice. (n.d.). https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.linkedin.com%2Fpulse%2Fcelebrating-50-years-applied-architectural-industrial-baloghy-1e%3Ftrk%3Dpulse-article_more-articles_related-content-card&psig=AOvVaw1r-qCGYvBvIfdQHuCJ0tp7&ust=1702386643868000&source=images&cd=vfe&opi=89978449&ved=0CBEQjRxqFwoTCKD8t826h4MDFQAAAAAdAAAAABAH

WHAT | Faculteit Elektrotechniek, Wiskunde en Informatica (EWI)

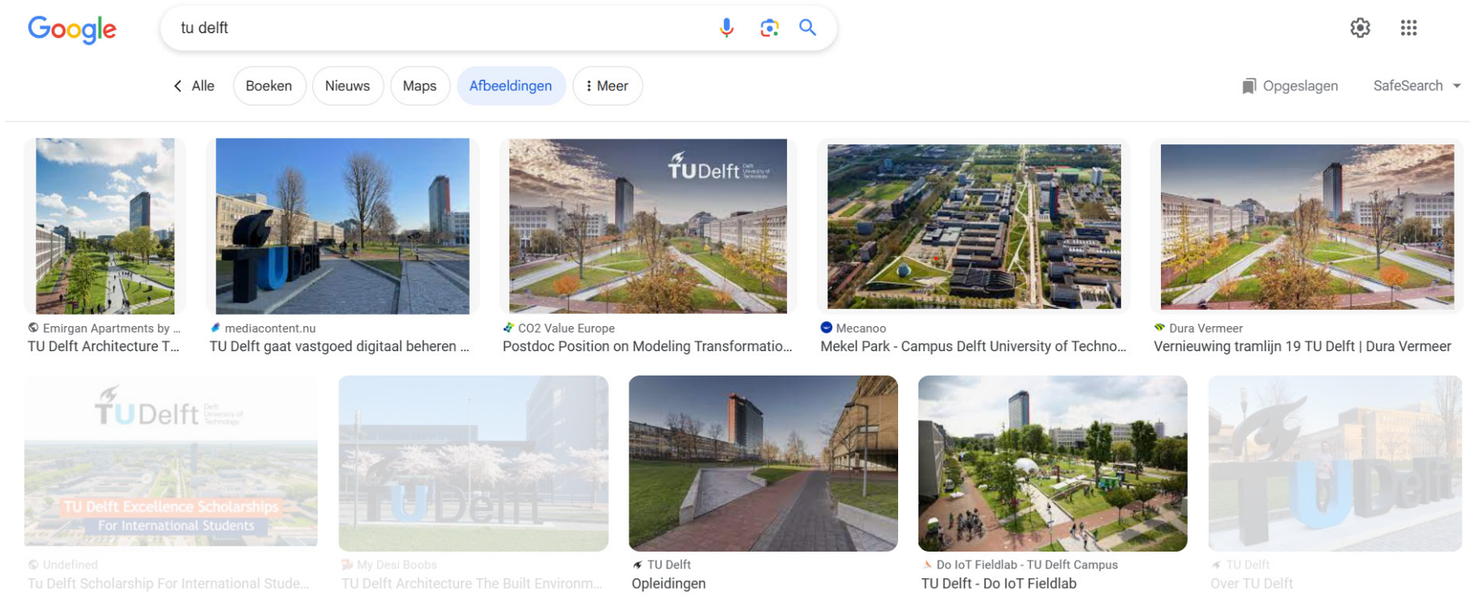


Structure as an existing building*

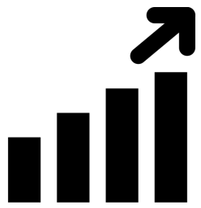
Building 36; **EWI (1972)**

EWI Building 36 on the heart of the **TU Delft campus** is to be taken as an case for the majority of the post WW2 university buildings in the Netherlands. This buildings is therefore used within this project

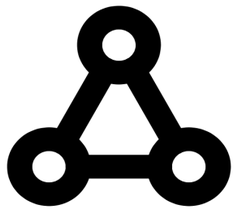
WHAT | Faculteit Elektrotechniek, Wiskunde en Informatica (EWI)



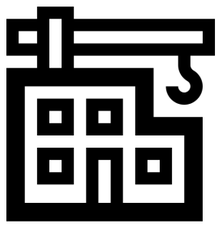
EWI as a landmark for the TU Delft. Value of heritage for students, inhabitants and Delft as a whole, therefore the **building is here to stay**. But how do you make it future proof



(Inter)National scale



Urban scale



Building scale

What is it that the building **has to be adapted towards** in order to for it to stay and be made future proof. That is based upon the current problems that are build up from the different scales.

WHY | Problemstatement

(Inter)National scale

Growing number of students and shortage in student housing

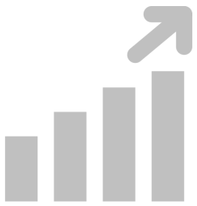
Urban scale

Building scale

WHY | Problemstatement

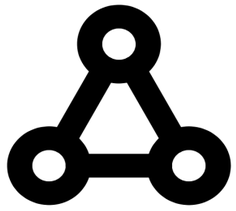
*"A student housing shortage of 27.000 in 2022 and **expecting to grow** to 44.800 in 2030."* (Kences, Kenniscentrum Studentenhuisvesting, 2022)

*"353.500 students in the year 2022-'23 to **396.300** students in 2028-'29"* (Ministerie van Onderwijs, Cultuur en Wetenschap, 2022)



(Inter)National scale

Growing number of students and shortage in student housing



Urban scale

The search for a’living campus’

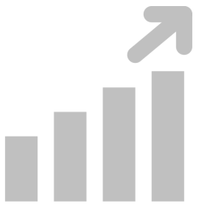
Building scale

WHY | Problemstatement

*‘‘… the campus area itself, these often lack a **‘beating heart’** and are deserted in the evening hours and at night.’’*
(TU Delft Strategic Framework 2018-2024 [TU Delft], 2018)

*‘‘This search for a vibrant heart: a central hub that **connects** the primary process of **education** with a range of **social activities**, calls for a ‘**living campus**’, benefiting not only the university community but also the residents of local neighborhoods.’’*
(TU Delft Strategic Framework 2018-2024 [TU Delft], 2018)

*‘‘The fourteen universities in the Netherlands confirm that student satisfaction and study success rates both benefit from more **physical encounters** and **collaboration on campus**.’’*
(Heijer et al., 2016)

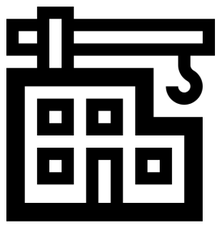


(Inter)National scale

Growing number of students and shortage in student housing

Urban scale

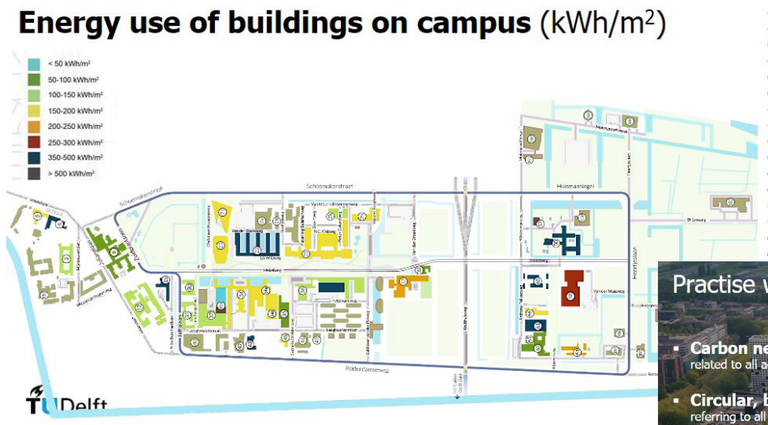
The search for a'living campus'

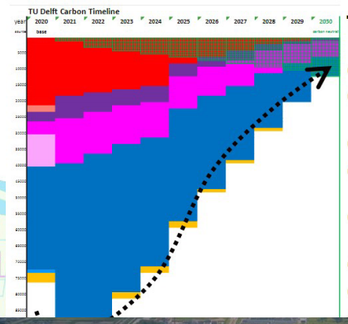


Building scale

(older) campus buildings need to stay up-to-date and become sustainable

WHY | Problemstatement



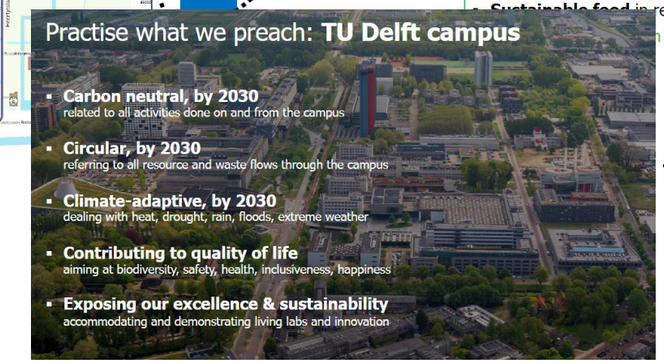


Towards net zero carbon

- **Carbon price** included in decisions
- Energy system based on **geothermal** energy and **renewable** production
- Energy **retrofit** of existing buildings
- **Supersustainable**, climate-adaptive, circular, nature-inclusive new buildings
- **Circular contracting**, circular procurement & waste management
- **Fossil-free**, emission-free campus
- **Sustainable travel**, or carbon taxed
- **Sustainable food** in restaurants

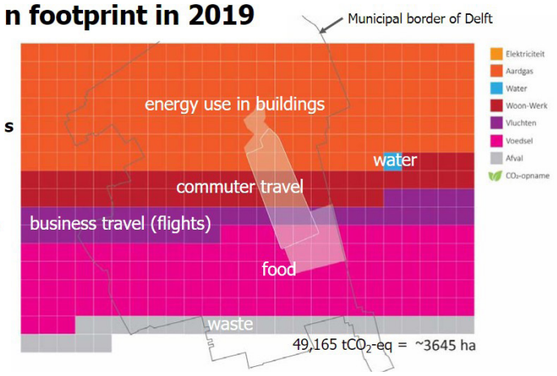
n by **forestation**

TU Delft



n footprint in 2019

s

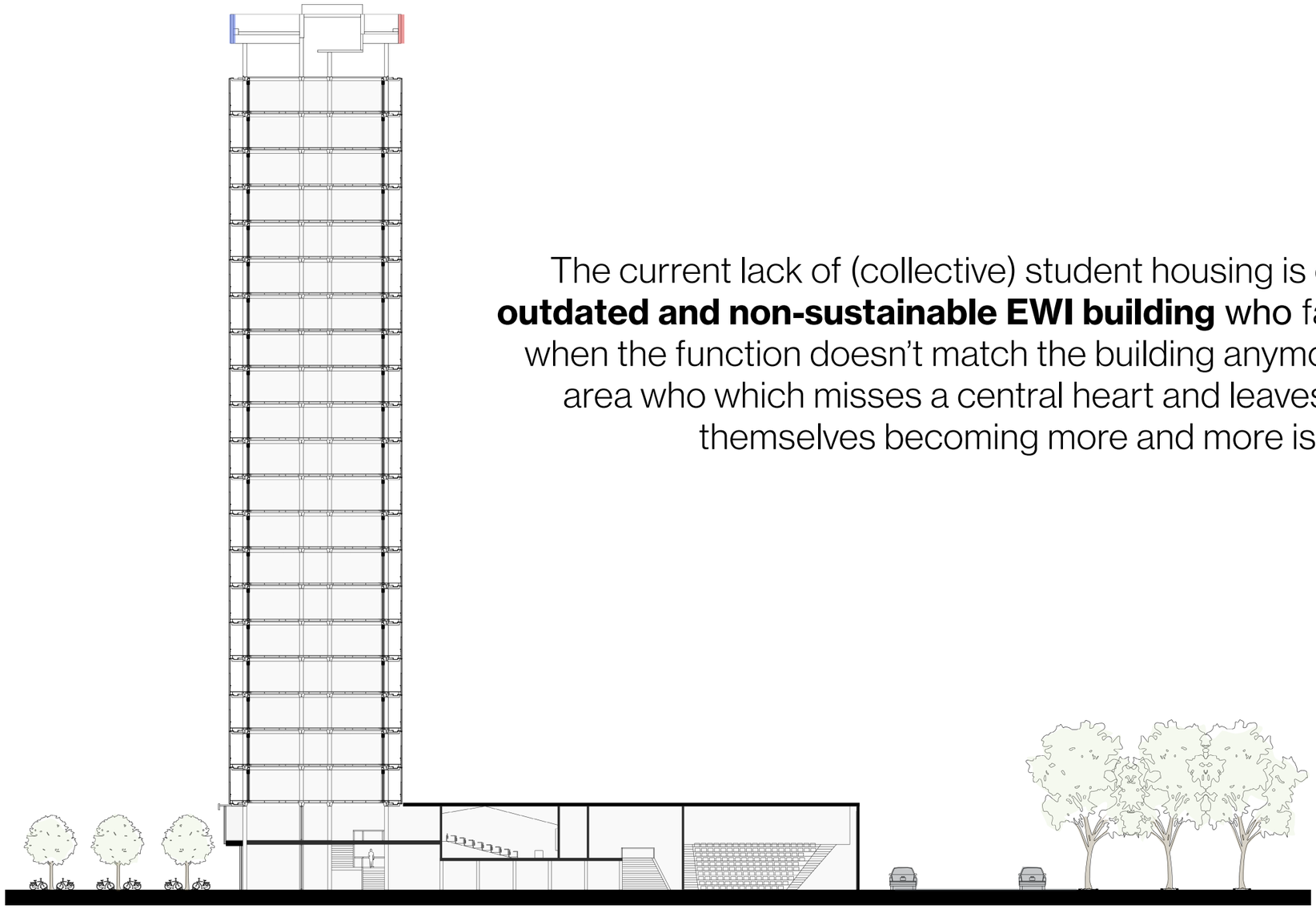


*'' Older campus buildings within the portfolio of the universities are in dire need of an investment to **stay up-to-date**, or they will become obsolete and face abandonment.''*
(TU Delft Strategic Framework 2018-2024 [TU Delft], 2018)

*''It is the stricter regulations, higher requirements for energy performance because of **sustainability** reasons, that example trends that strongly influence the functional requirements of the buildings within the university's portfolio's.''*
(Heijer et al., 2016)

*'' But the current strategy is partly **to get rid** of these expensive and **energy inefficient older building** within the university's portfolio.''*
(Van der Veldt, 2020)

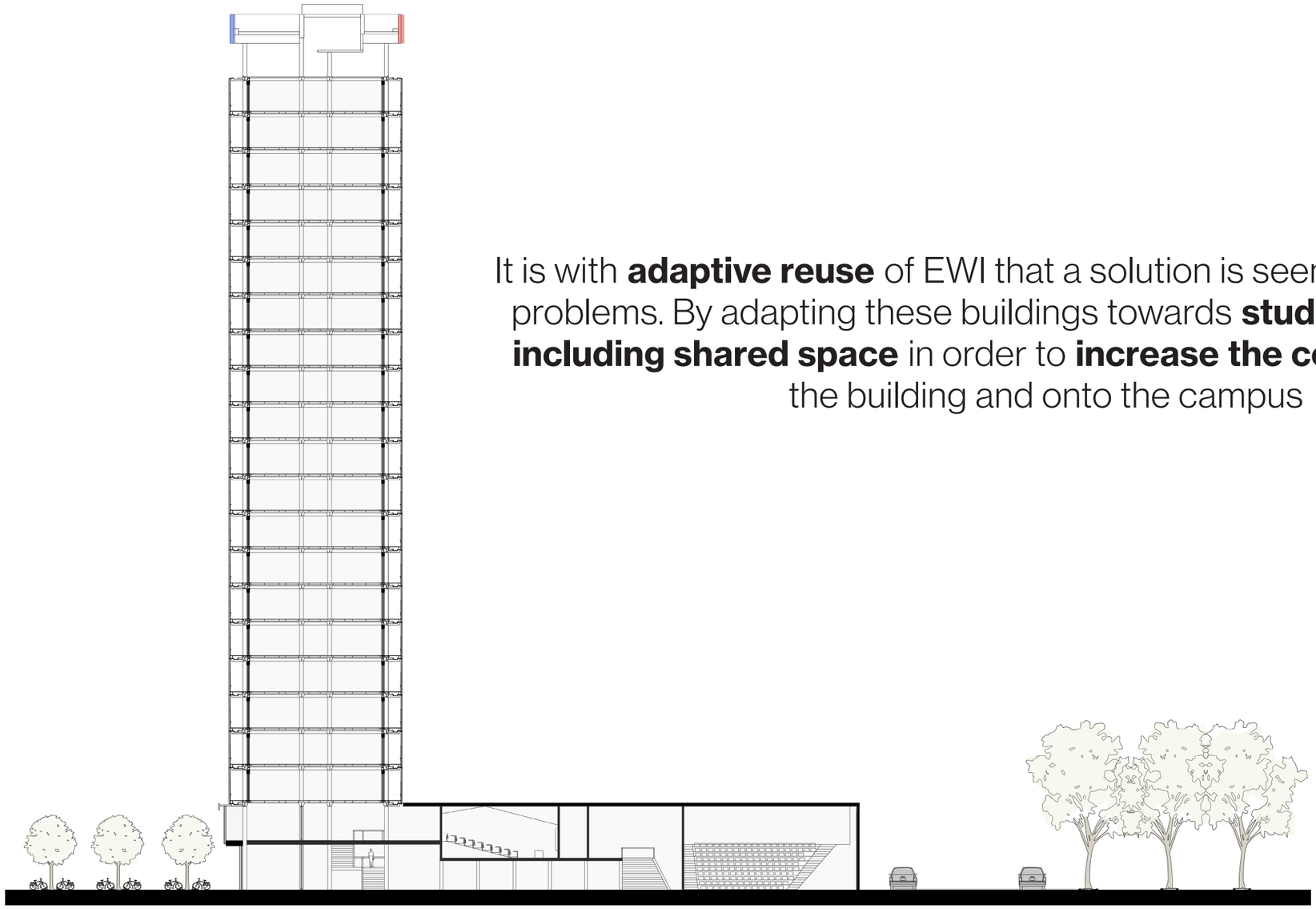
EWI | Section



The current lack of (collective) student housing is combined with **outdated and non-sustainable EWI building** who face abandonment when the function doesn't match the building anymore. The campus area who which misses a central heart and leaves the students themselves becoming more and more isolate

Section | Current situation

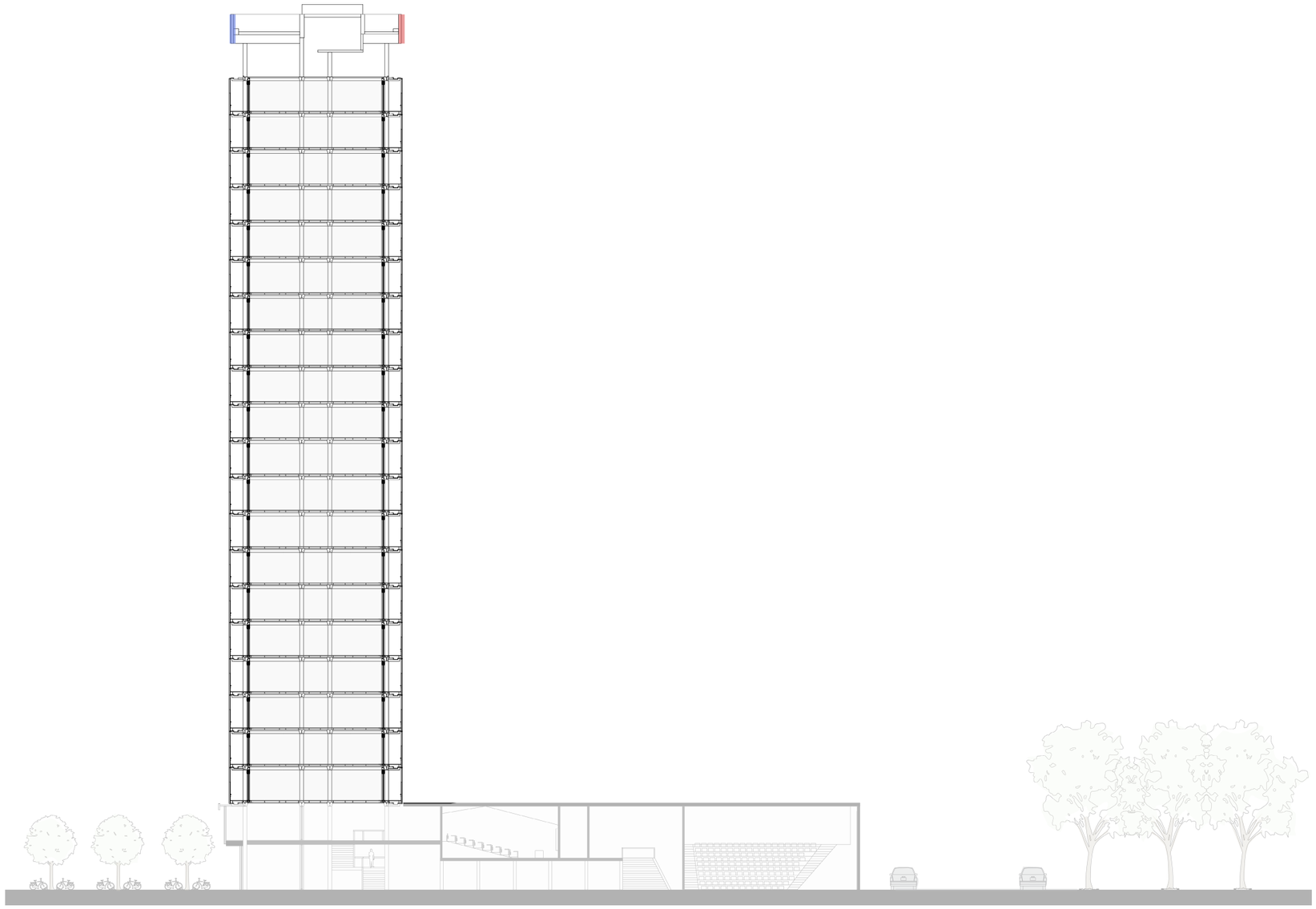
EWI | Section



It is with **adaptive reuse** of EWI that a solution is seen for the proposed problems. By adapting these buildings towards **student housing** and **including shared space** in order to **increase the community** within the building and onto the campus

Section | Current situation

EWI | Section

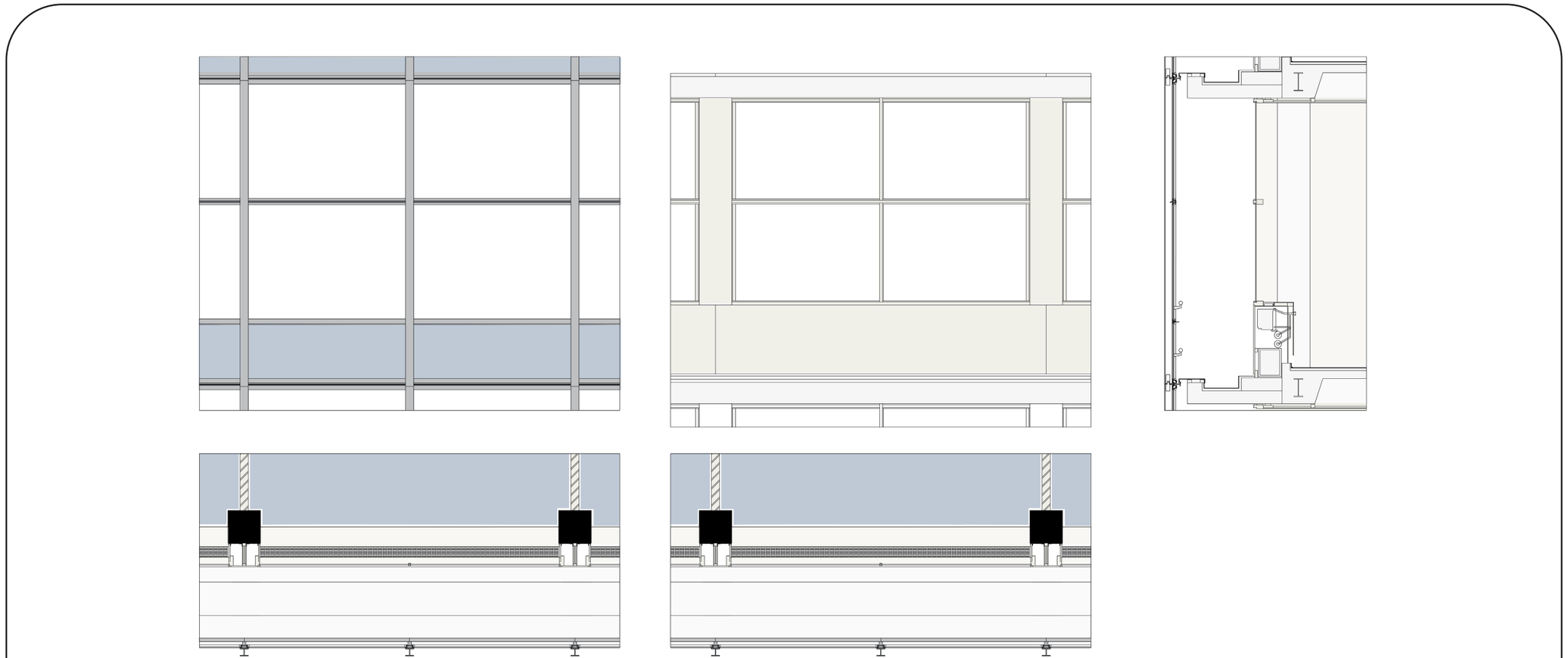


Section | Current situation high-rise

EWI High-rise | Infill build up

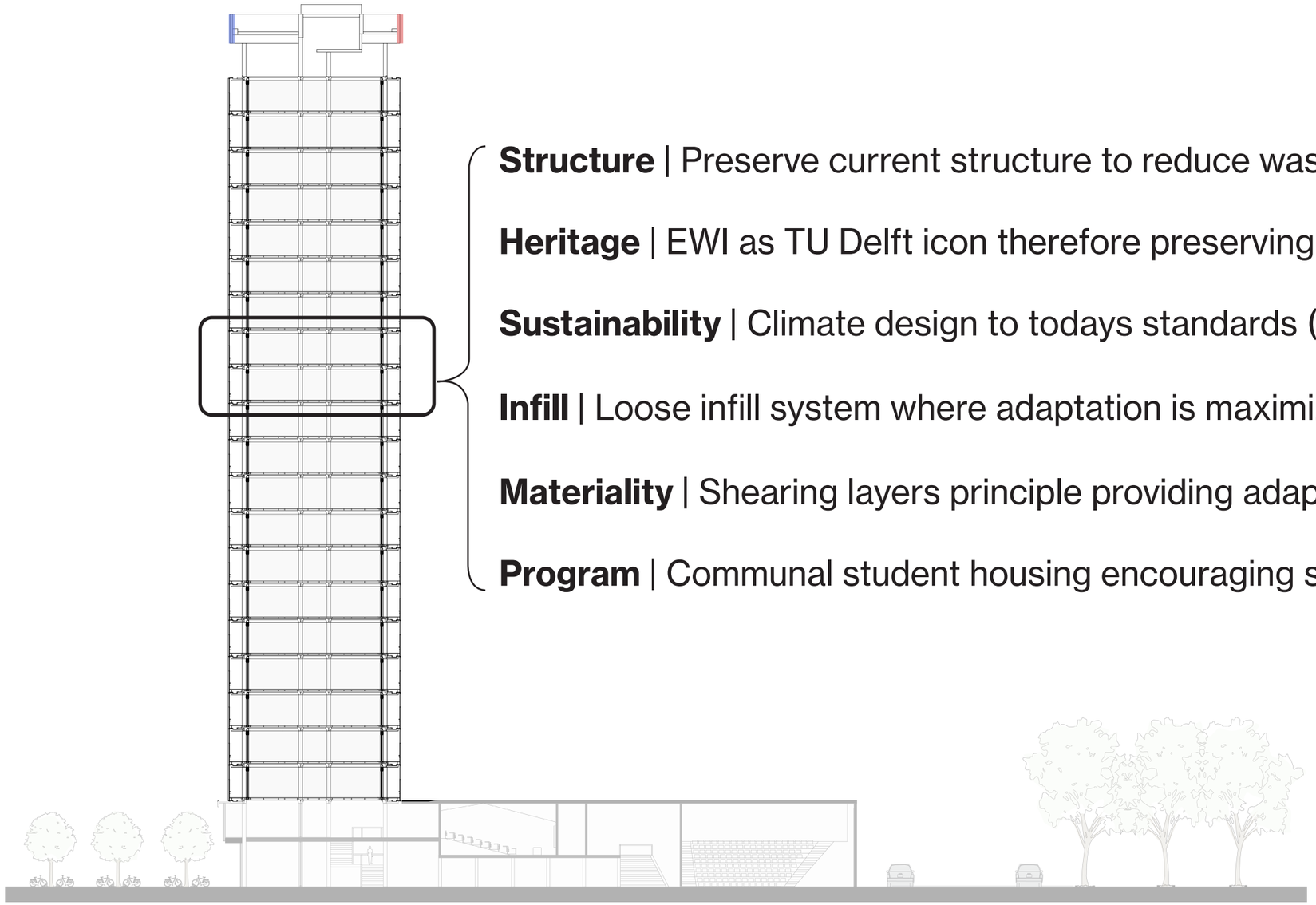
Interior facade requires higher thermal isolation and venilation possibilities. Interior walls are made of gypsum and glass, as standard offices. These materials cannot be reused directly, framing (i.e. doors) and celing can be reused in other TU Delft buildings

EWI High-rise | Infill build up



Step 0 | Current situation of second skin facade made of curtain glass wall and outdated climate facade

EWI | Section



Structure | Preserve current structure to reduce waste/costs

Heritage | EWI as TU Delft icon therefore preserving outside look

Sustainability | Climate design to todays standards (energy neutral)

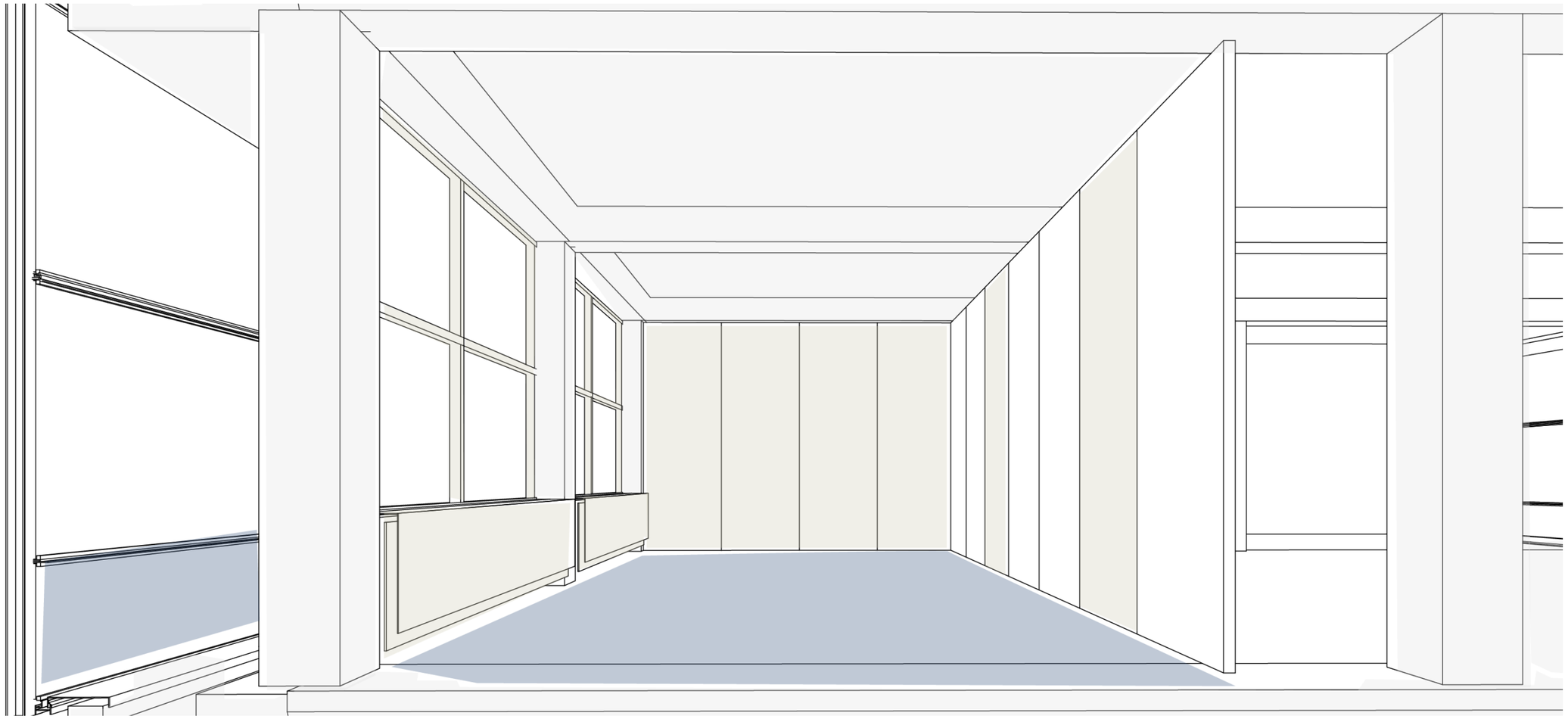
Infill | Loose infill system where adaptation is maximized

Materiality | Shearing layers principle providing adaption over time

Program | Communal student housing encouraging social interaction

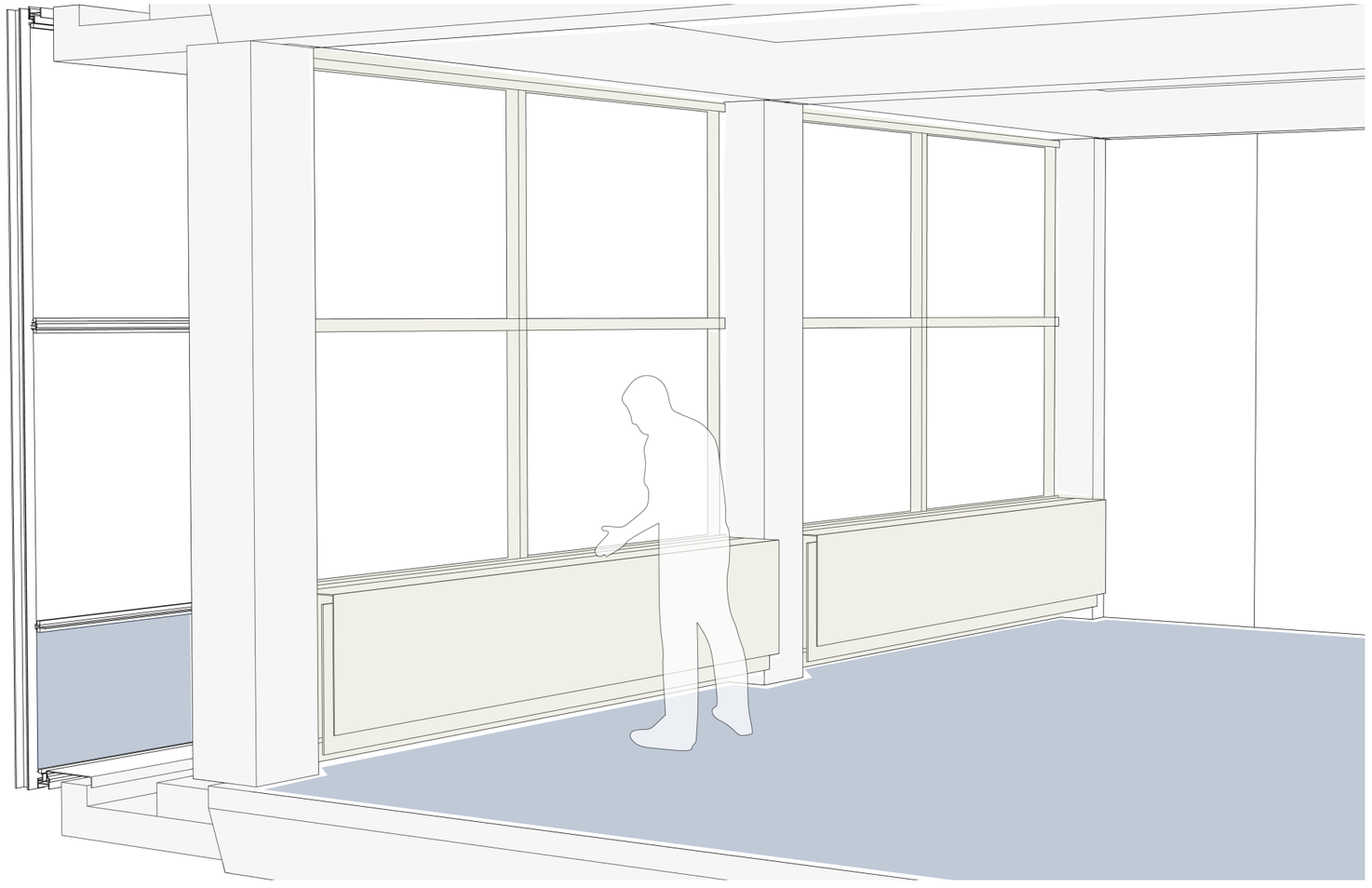
Section | Goals for EWI High-rise

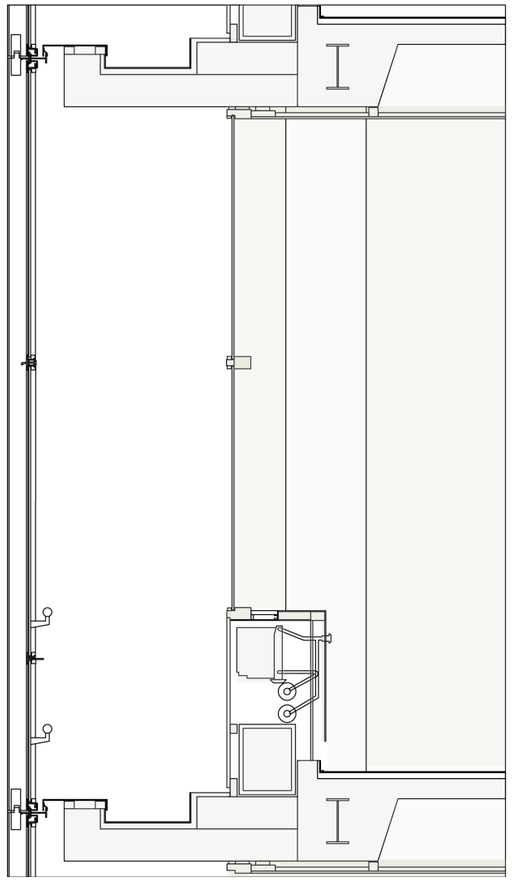
EWI High-rise | Infill build up



Step 0 | Current situation

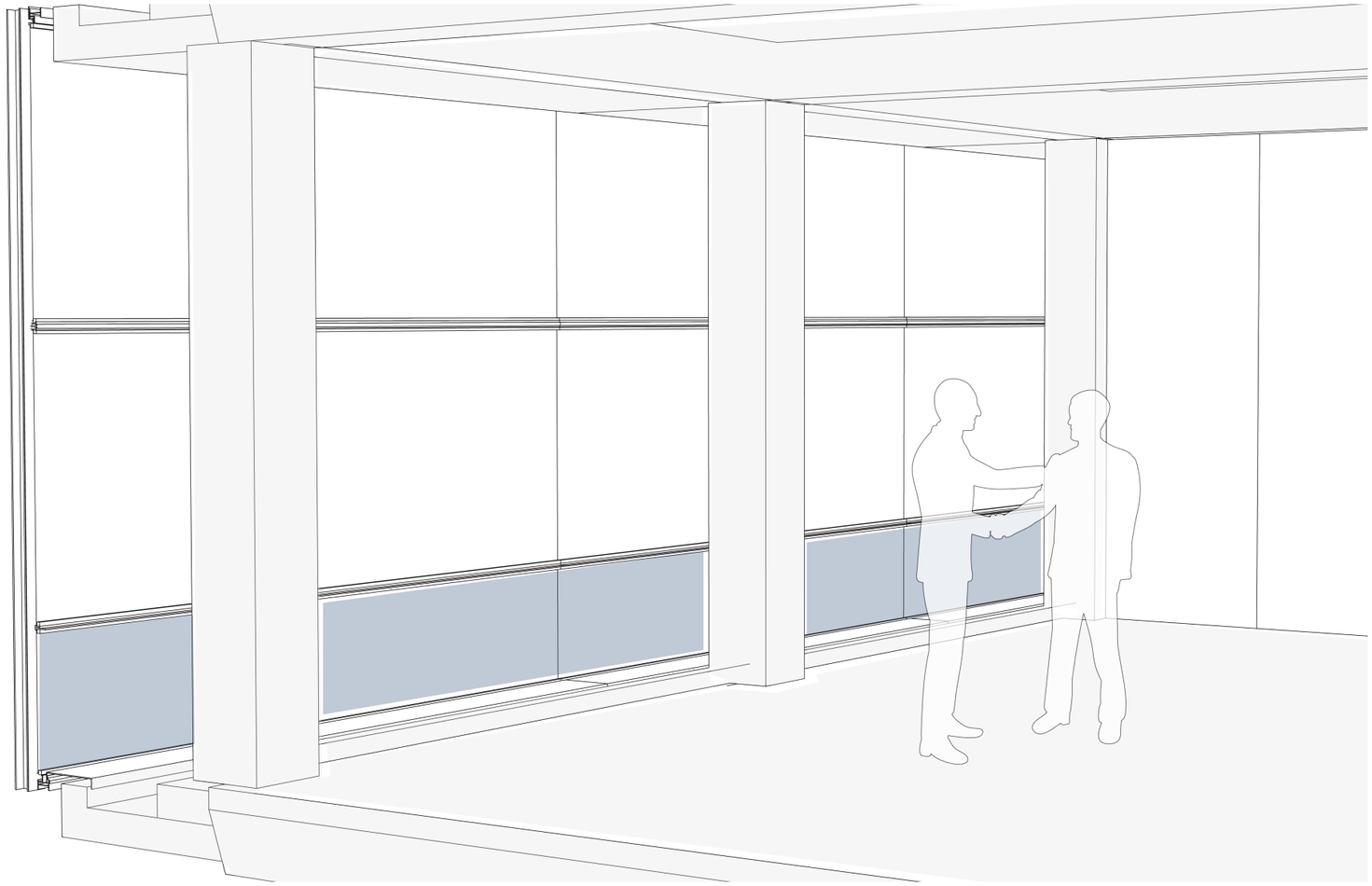
EWI High-rise | Infill build up

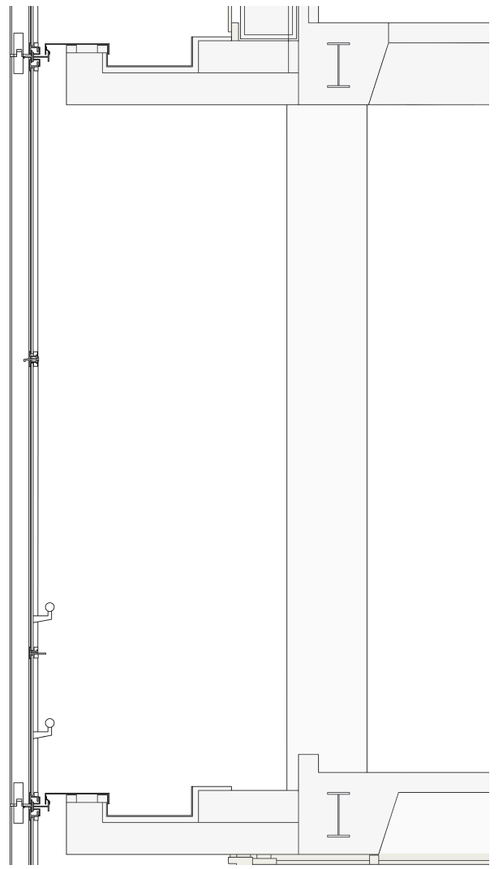




Step 0 | Current situation interior climate facade

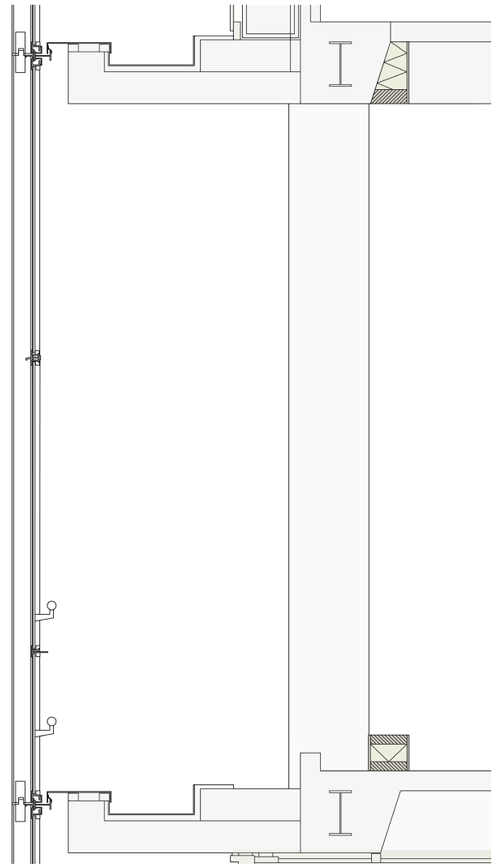
EWI High-rise | Infill build up





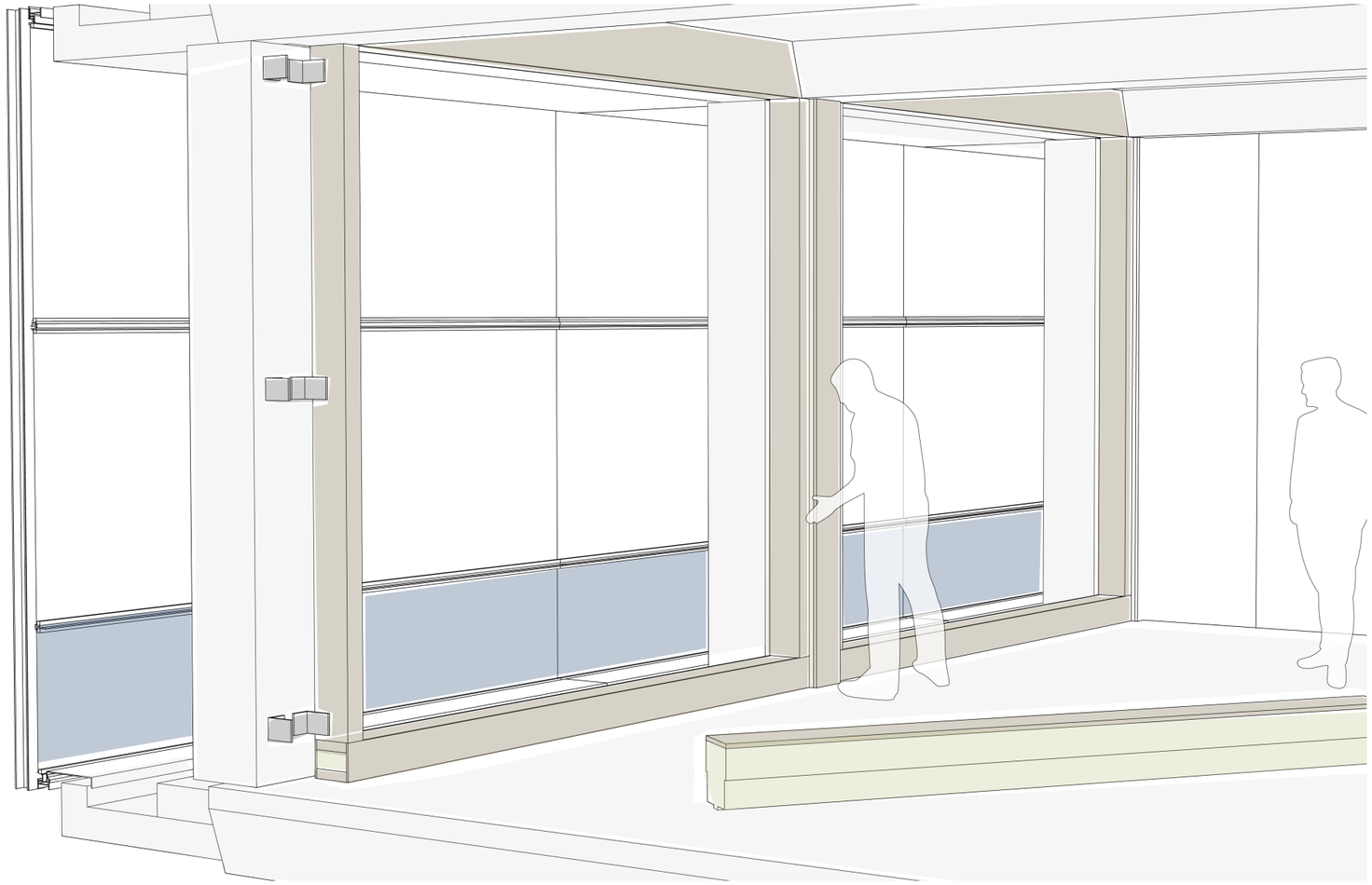
Step 1 | Remove overdue climate facade

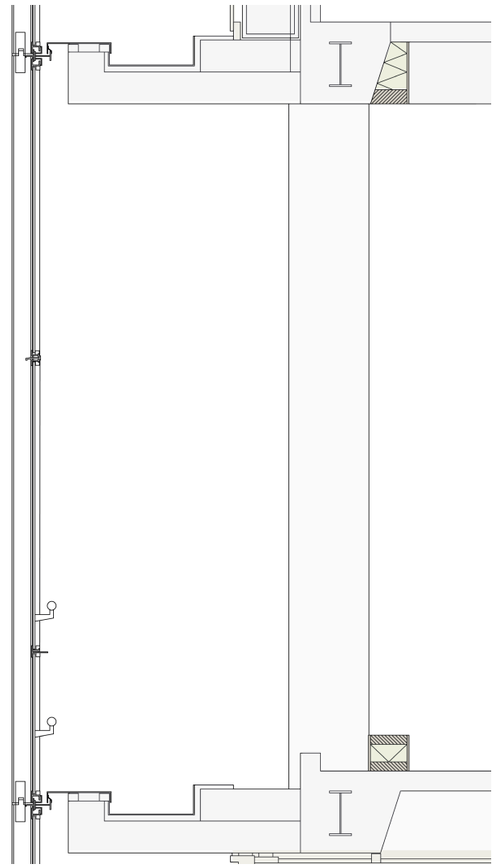
EWI High-rise | Infill build up



Step 2.1 | Place surrounding frame to existing construction

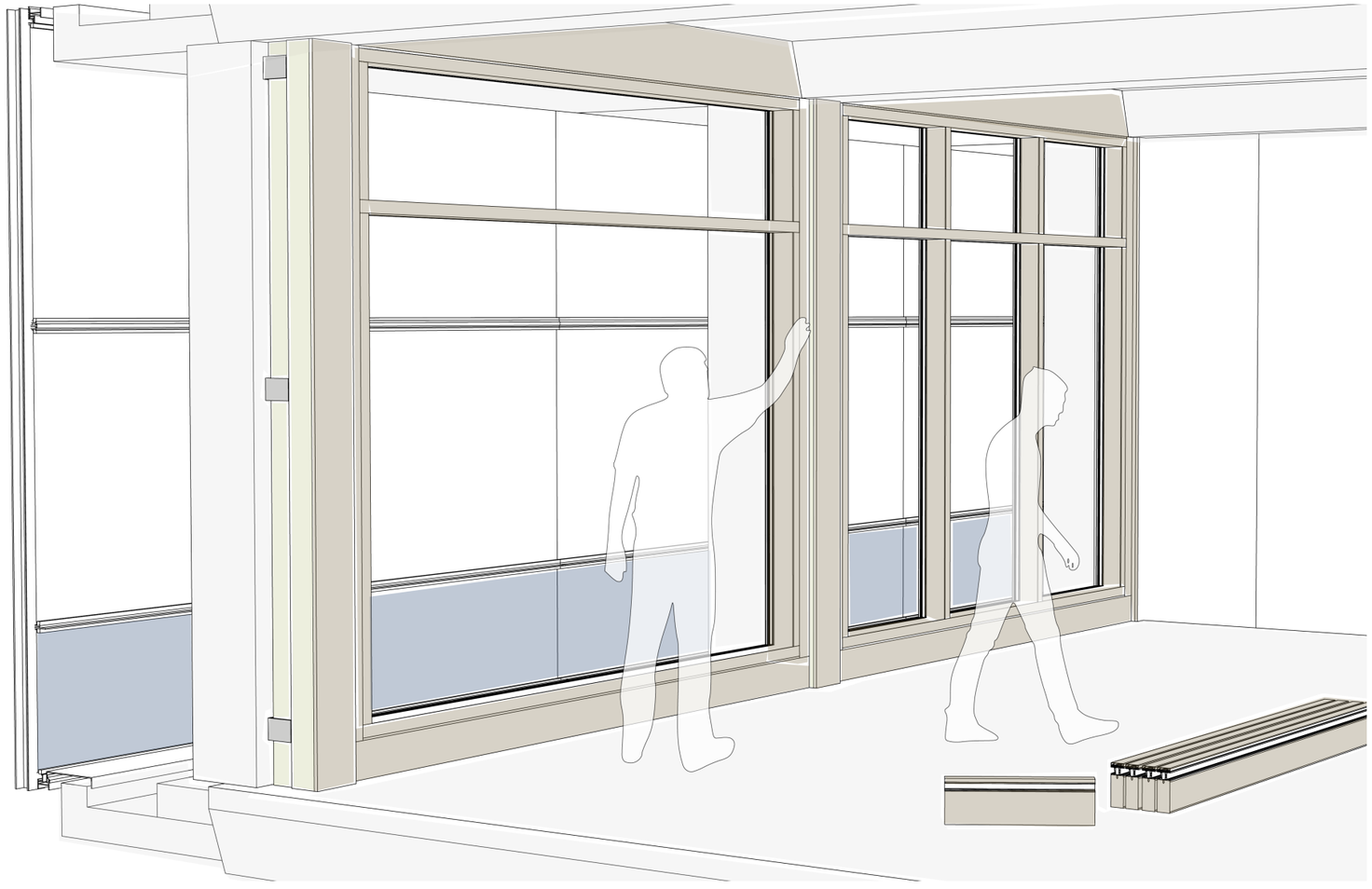
EWI High-rise | Infill build up

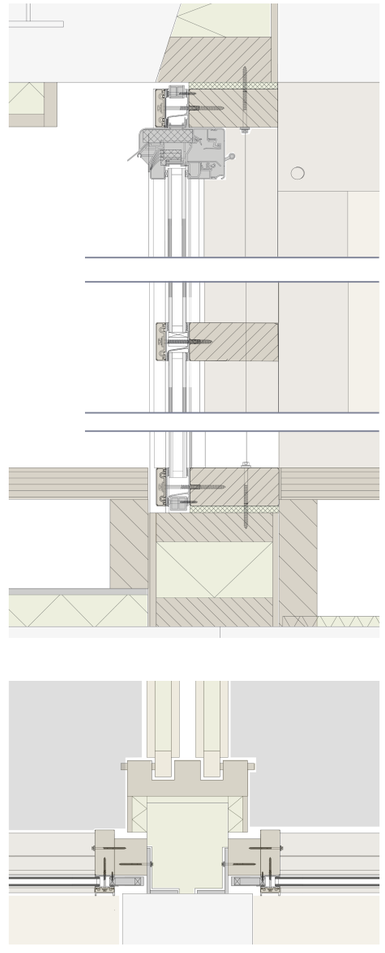




Step 2.2 | Fill the open spaces between the frames to secure the new thermal facade

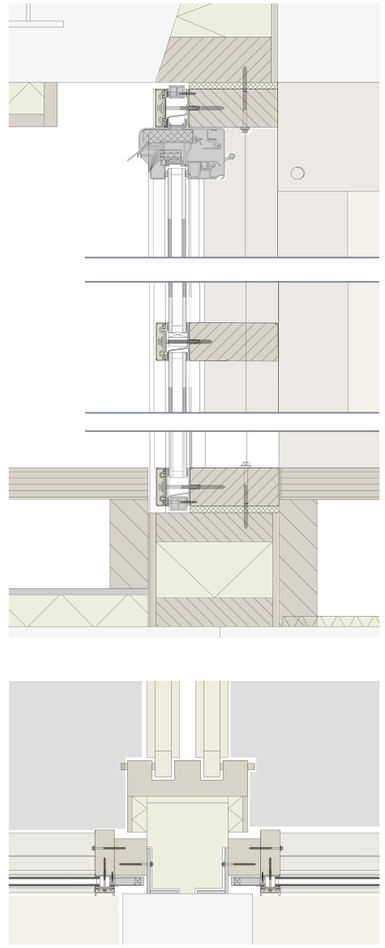
EWI High-rise | Infill build up





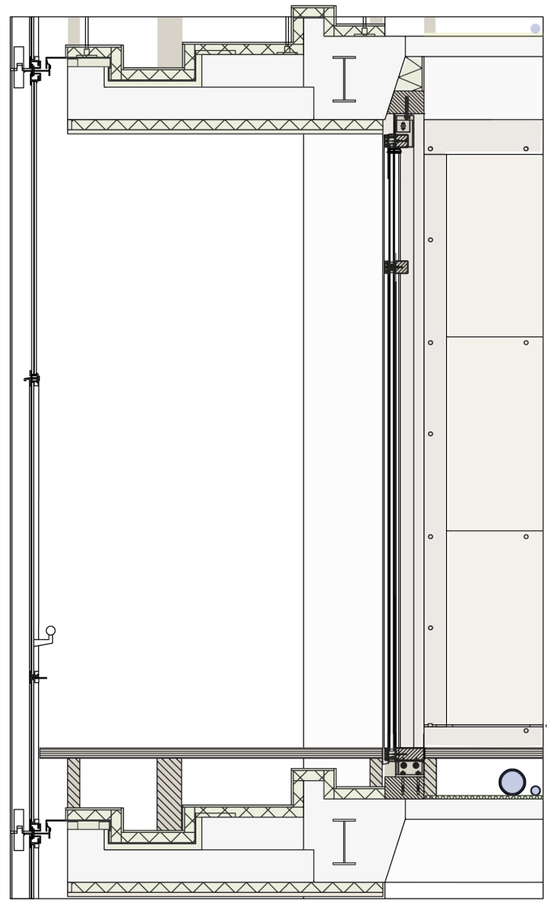
Step 2.3 | Place curtain wall frame divisions

EWI High-rise | Infill build up



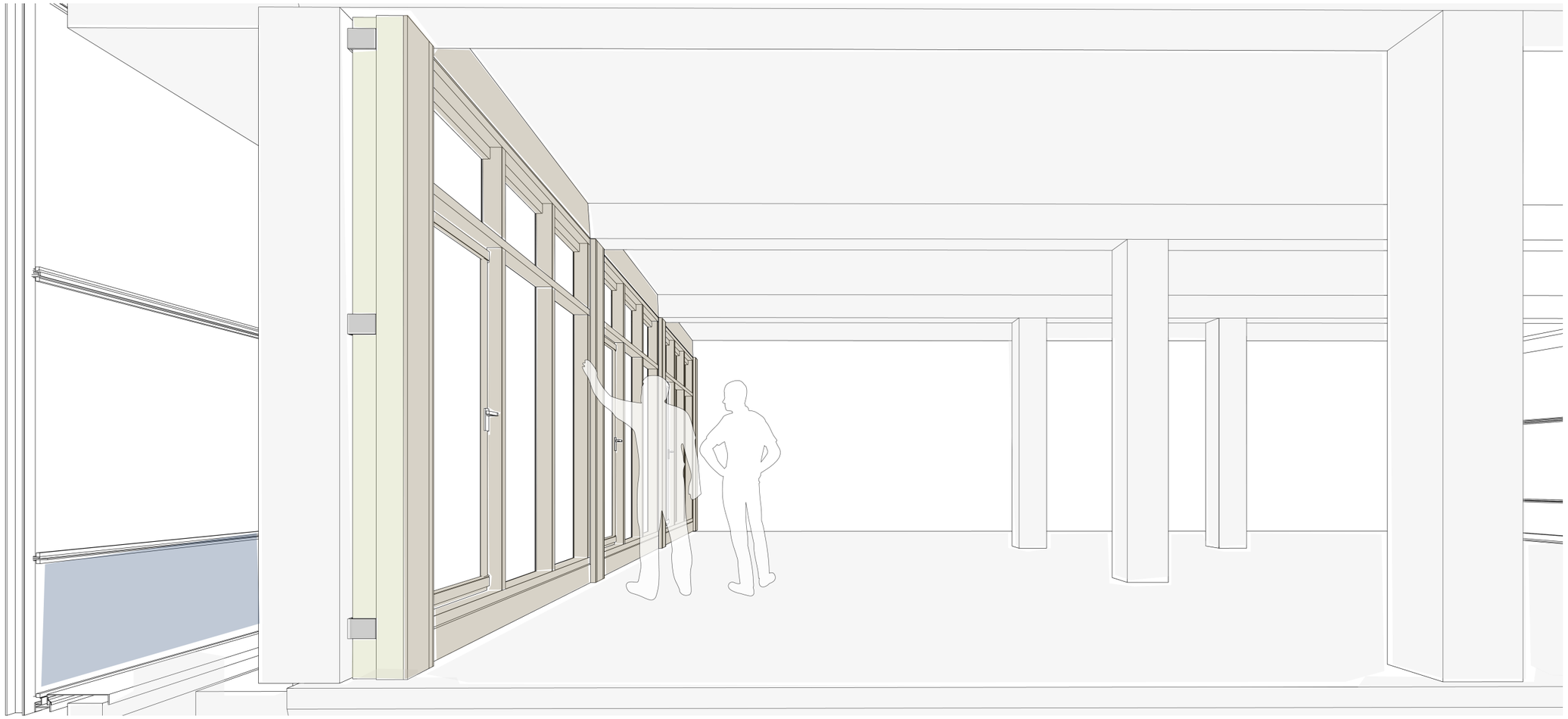
Step 2.4 | Install curtain wall glass and door elements

EWI High-rise | Infill build up



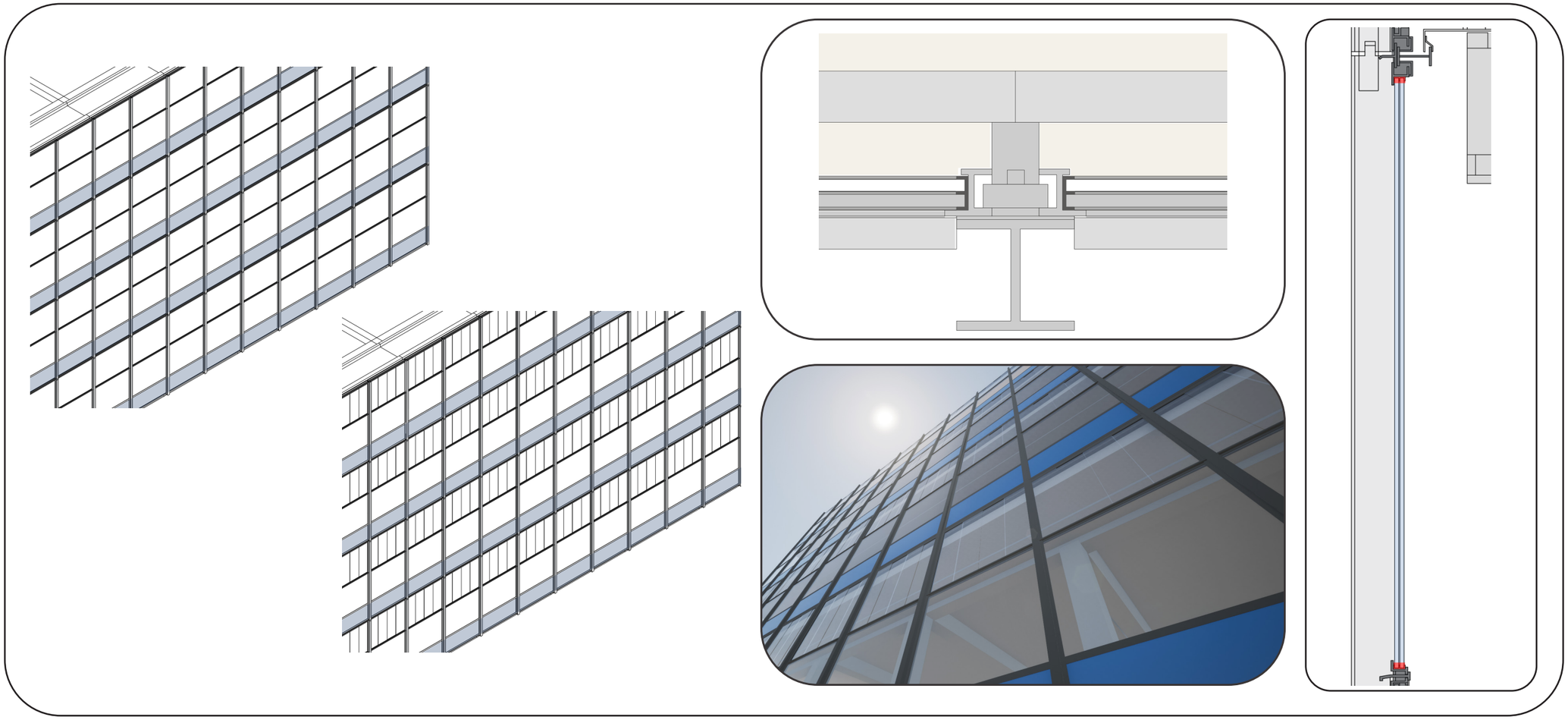
Step 2.5 | Complete the new internal climate facade

EWI High-rise | Infill build up



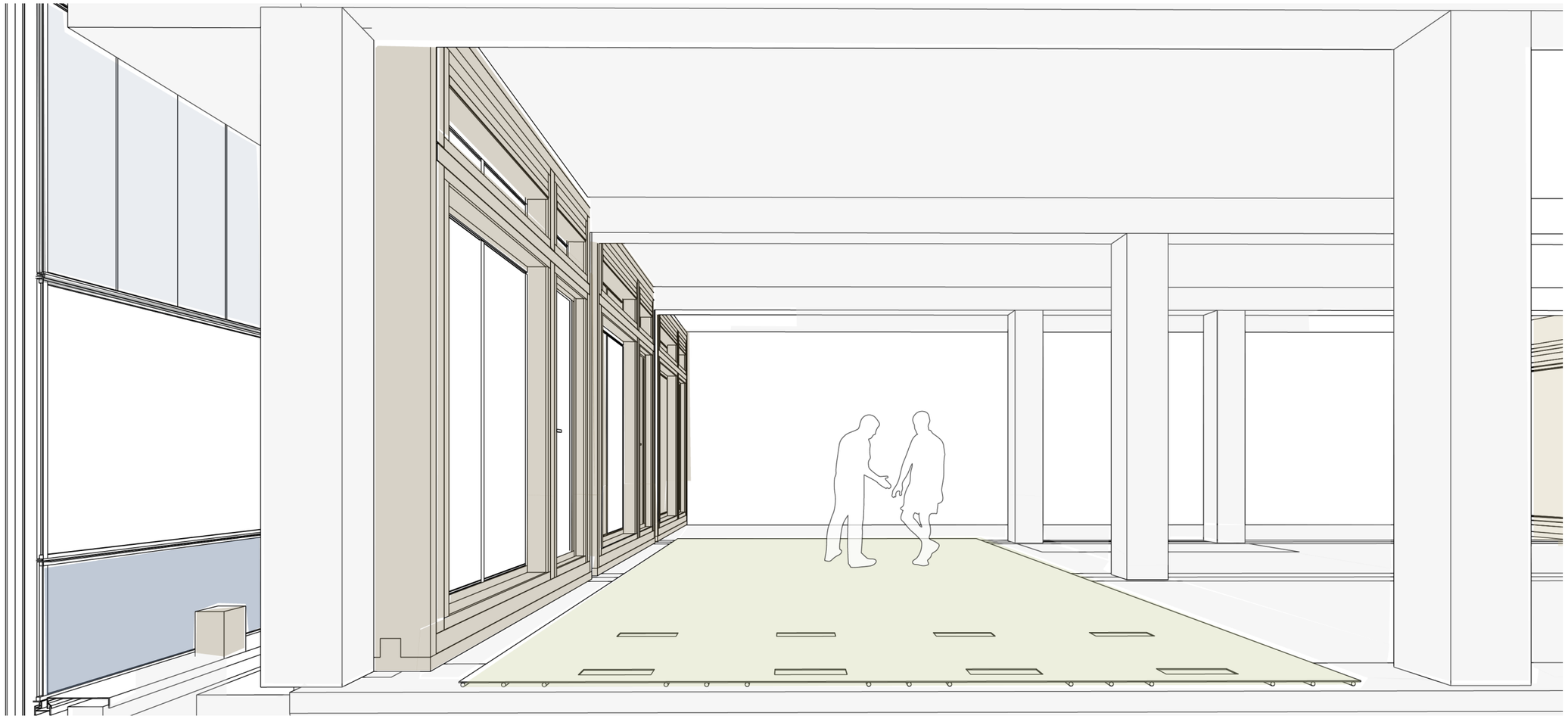
Step 2 | Add new second skin

EWI High-rise | Infill build up



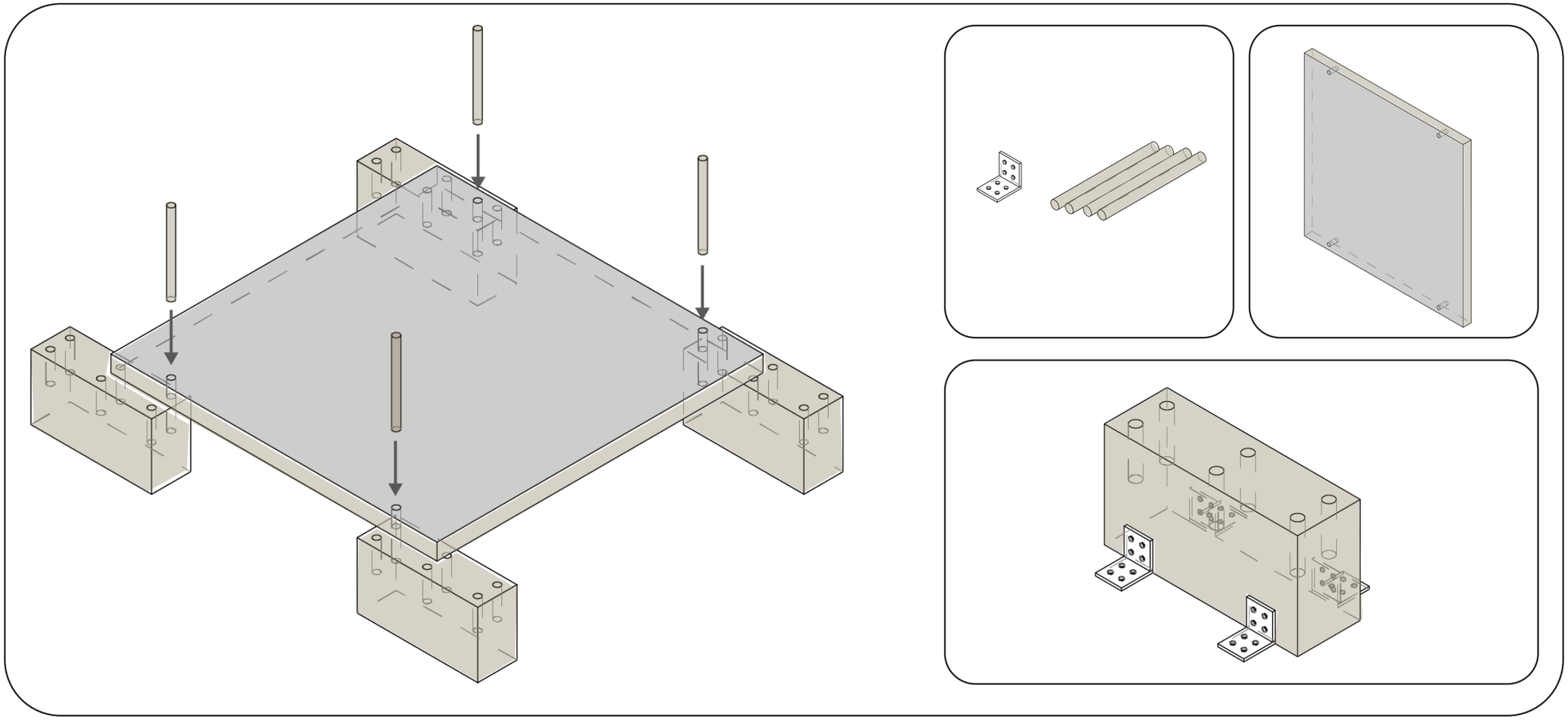
Step 3 Elements | Preserving heritage while creating openable (sliding) windows within the existing frames

EWI High-rise | Infill build up



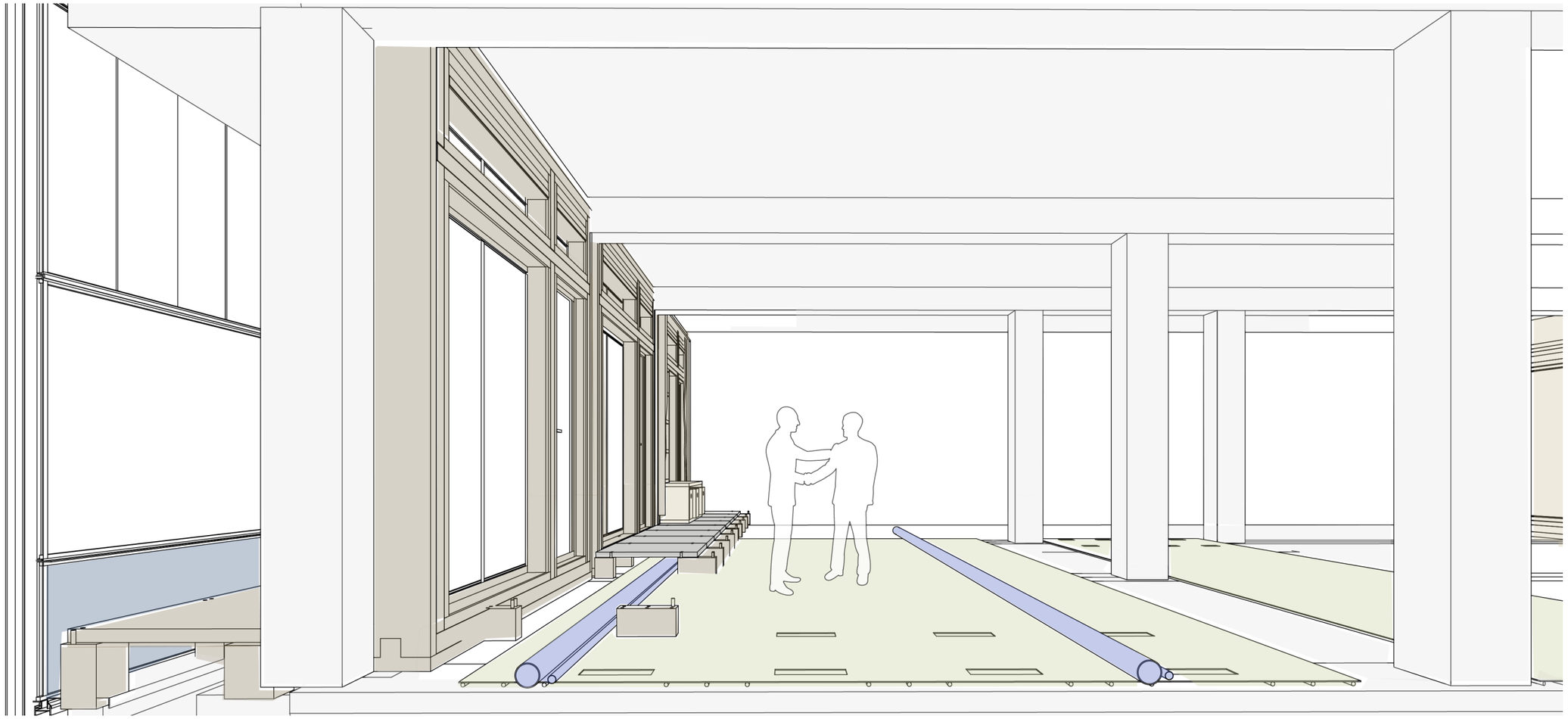
Step 3 | Lay down underfloor heating system & Place new openable windows

EWI High-rise | Infill build up



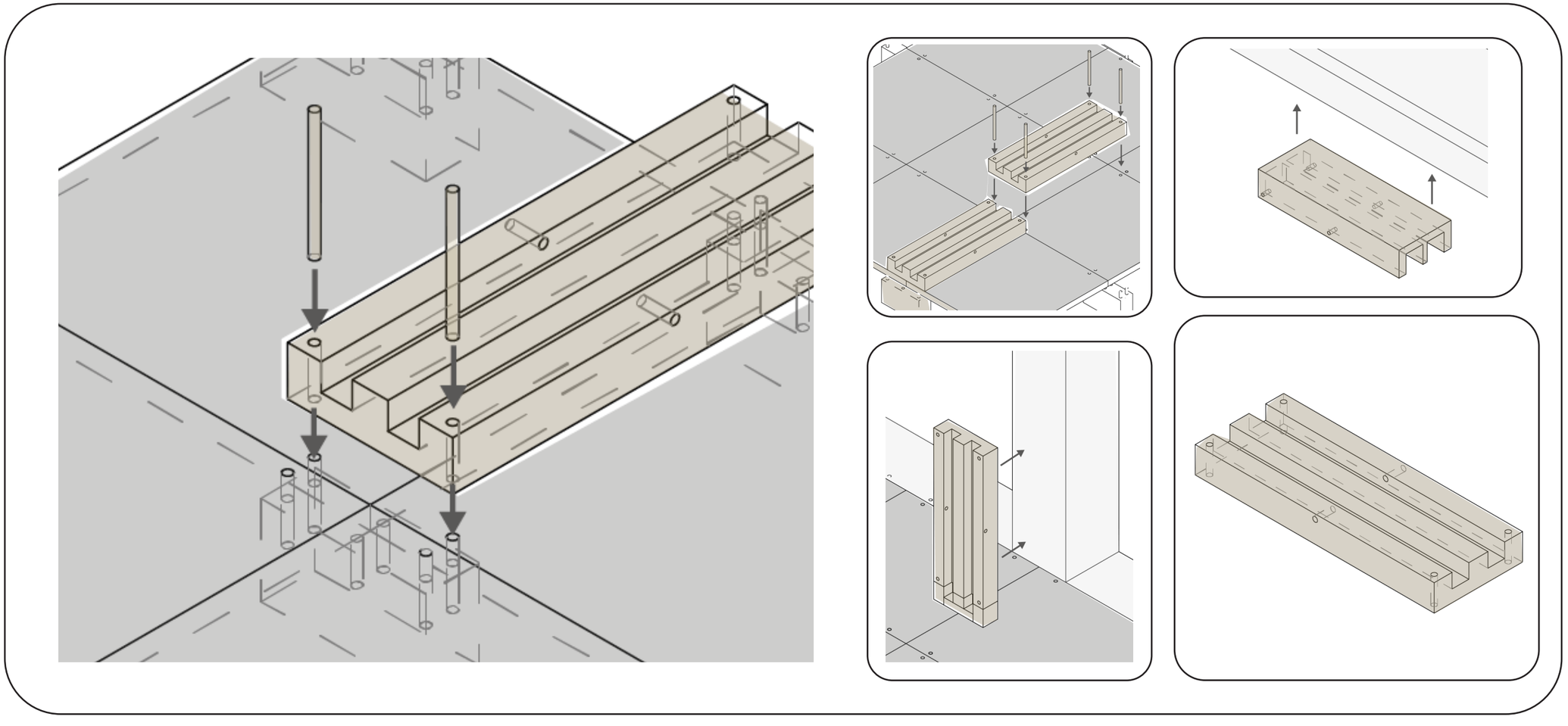
Step 4 Elements | Raised floor elements connected to structure and combined by dowels

EWI High-rise | Infill build up



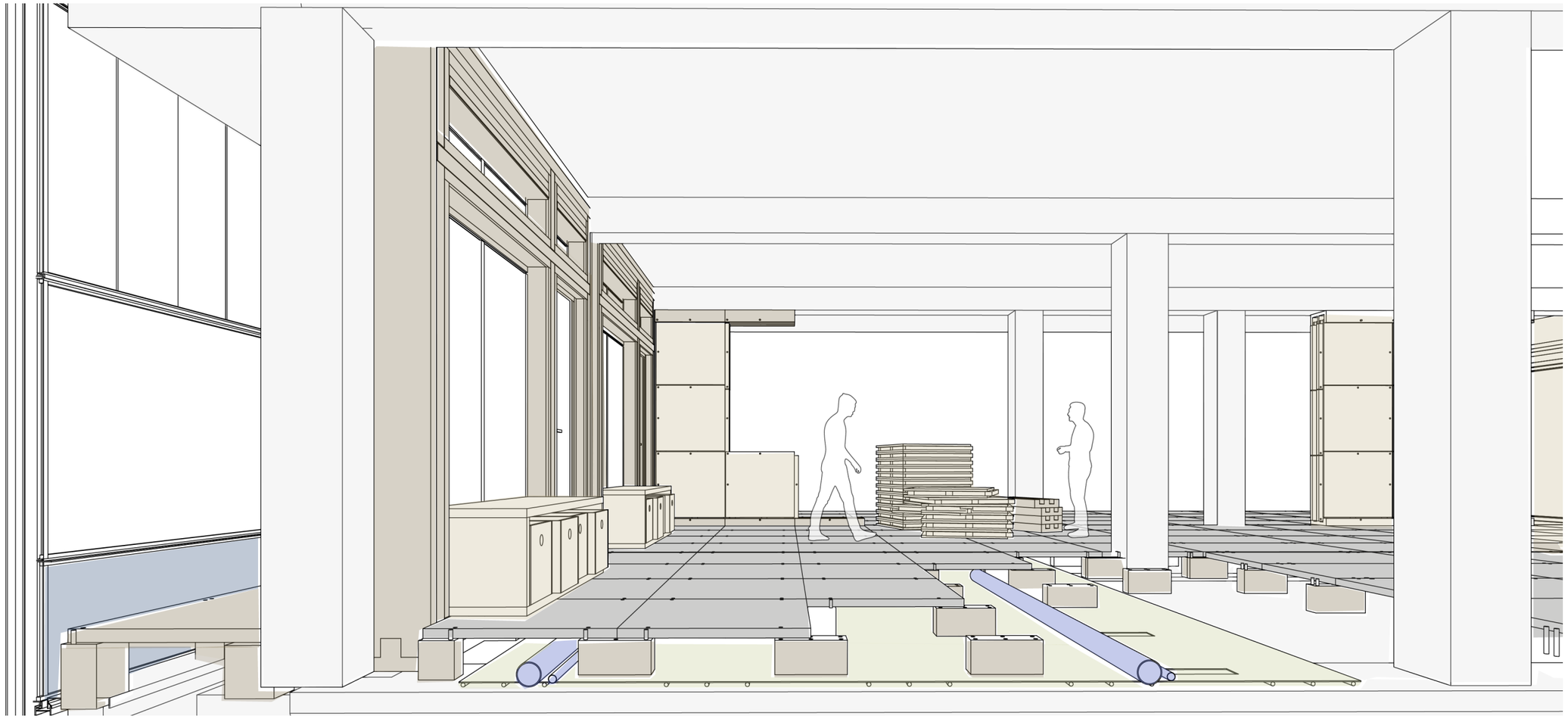
Step 4 | Install water and plumbing & Place floor element system

EWI High-rise | Infill build up



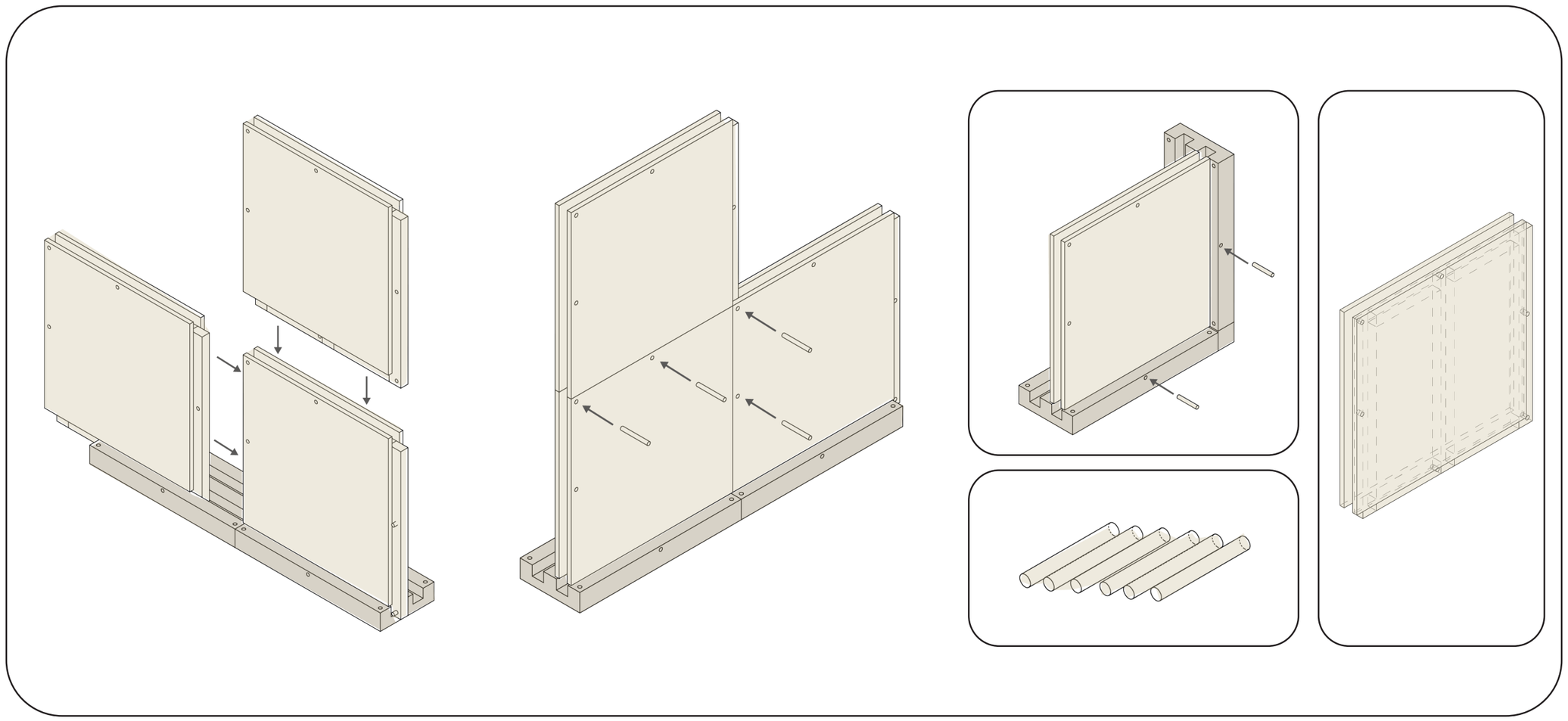
Step 5 Elements | Wall system framing placed onto floor system with dowels and direct to wall and ceiling

EWI High-rise | Infill build up



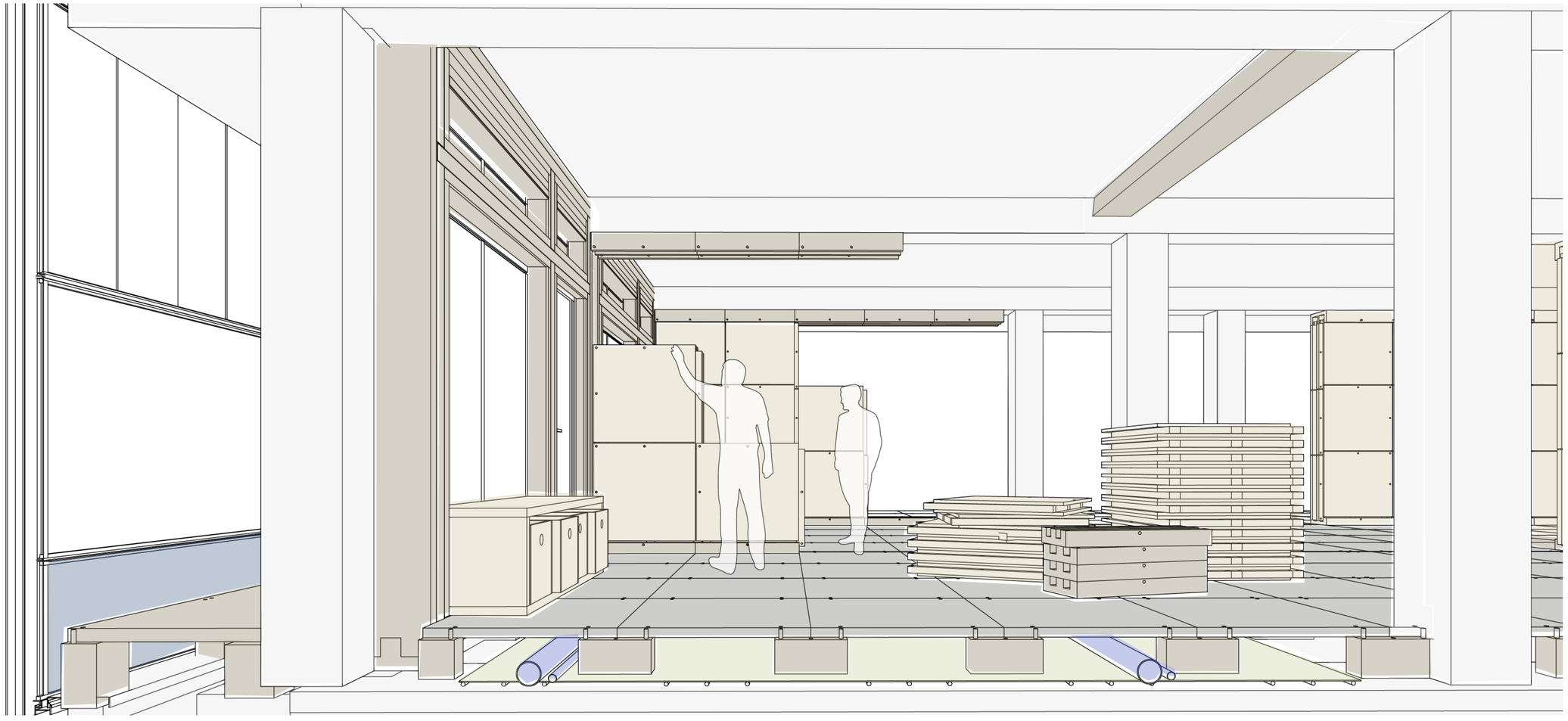
Step 5 | Place the interior wall system frames on floor, celing and walls

EWI High-rise | Infill build up



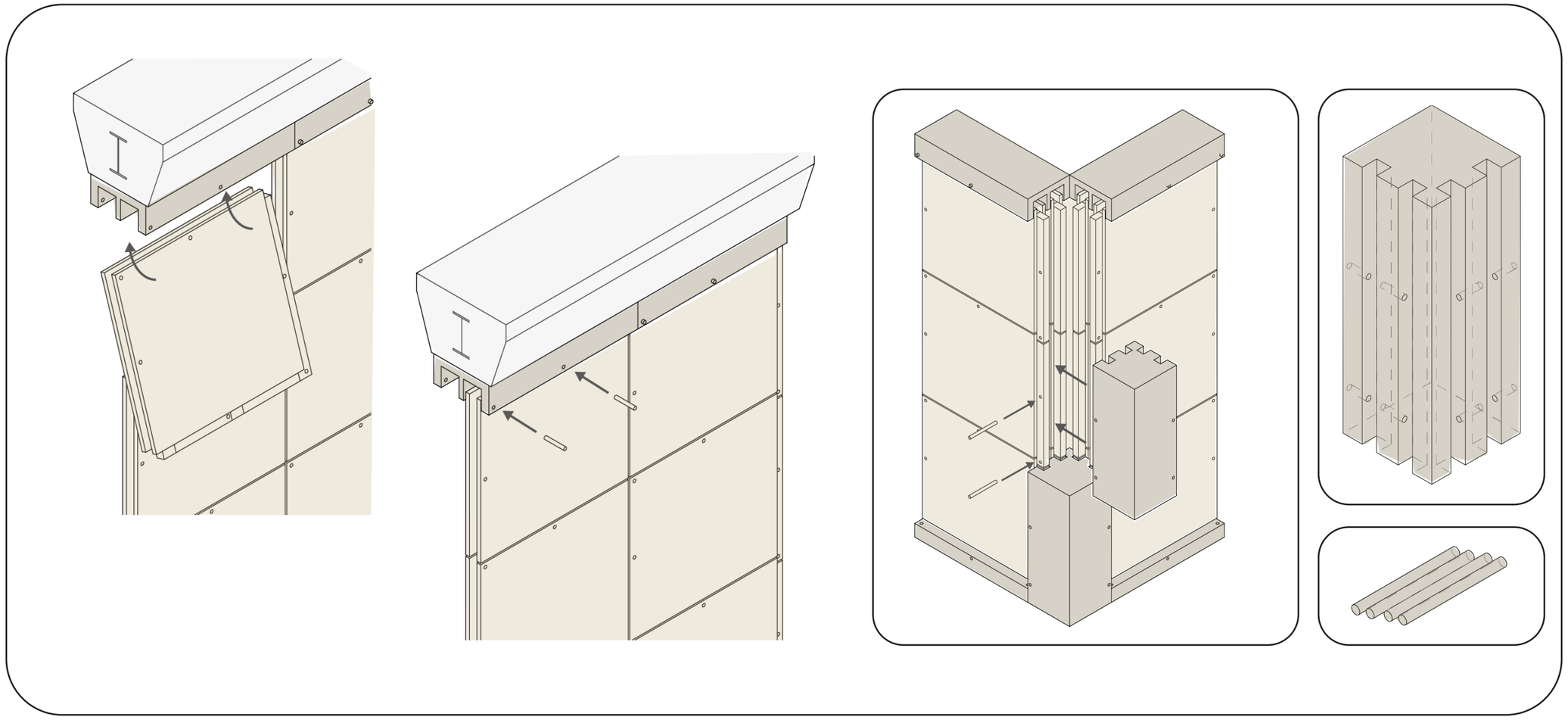
Step 6 Elements | Wall elements connected by grooves to each other or framing and secured by dowels

EWI High-rise | Infill build up



Step 6 | Build the interior walls using the modular self-build system

EWI High-rise | Infill build up

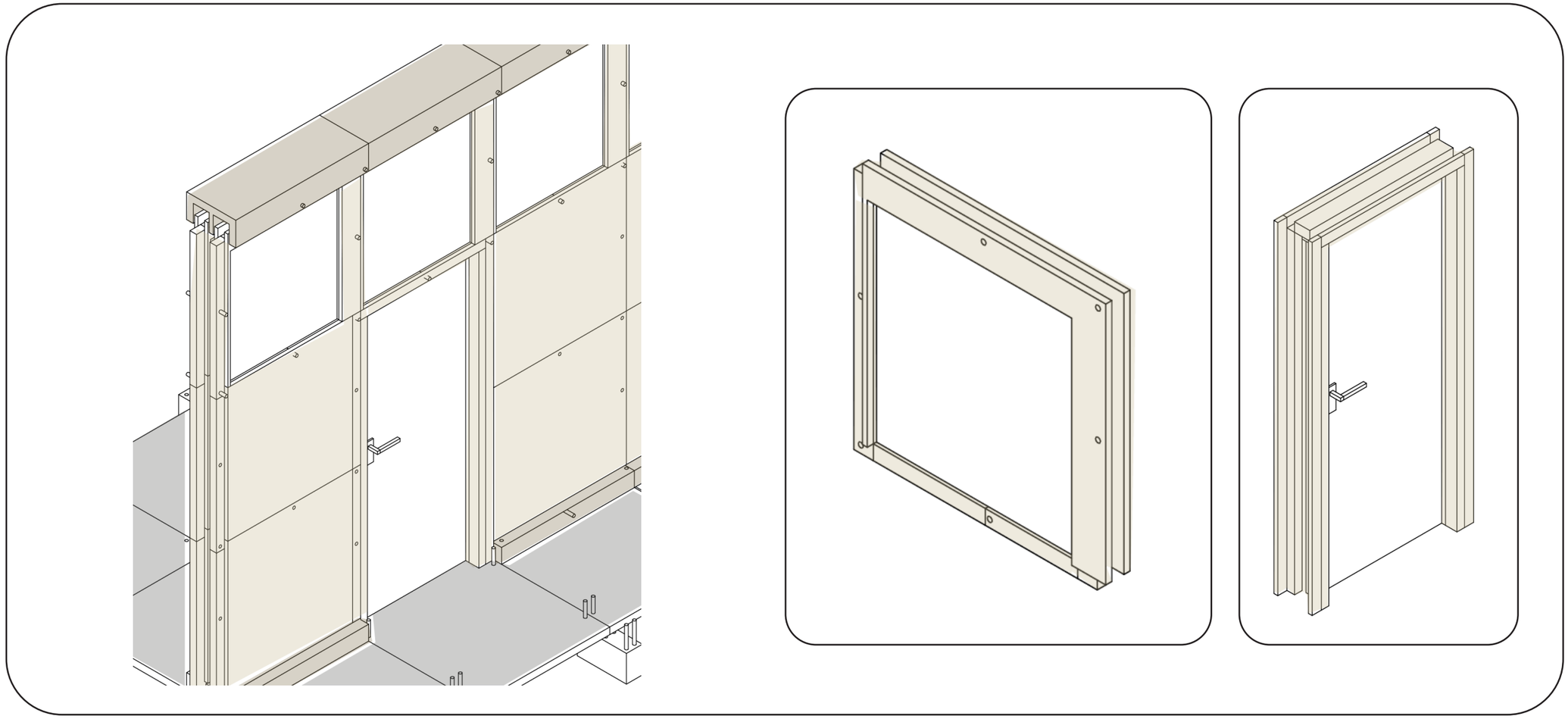


Step 7 Elements | Corner pieces in order to secure ends and from top to bottom

EWI High-rise | Infill build up

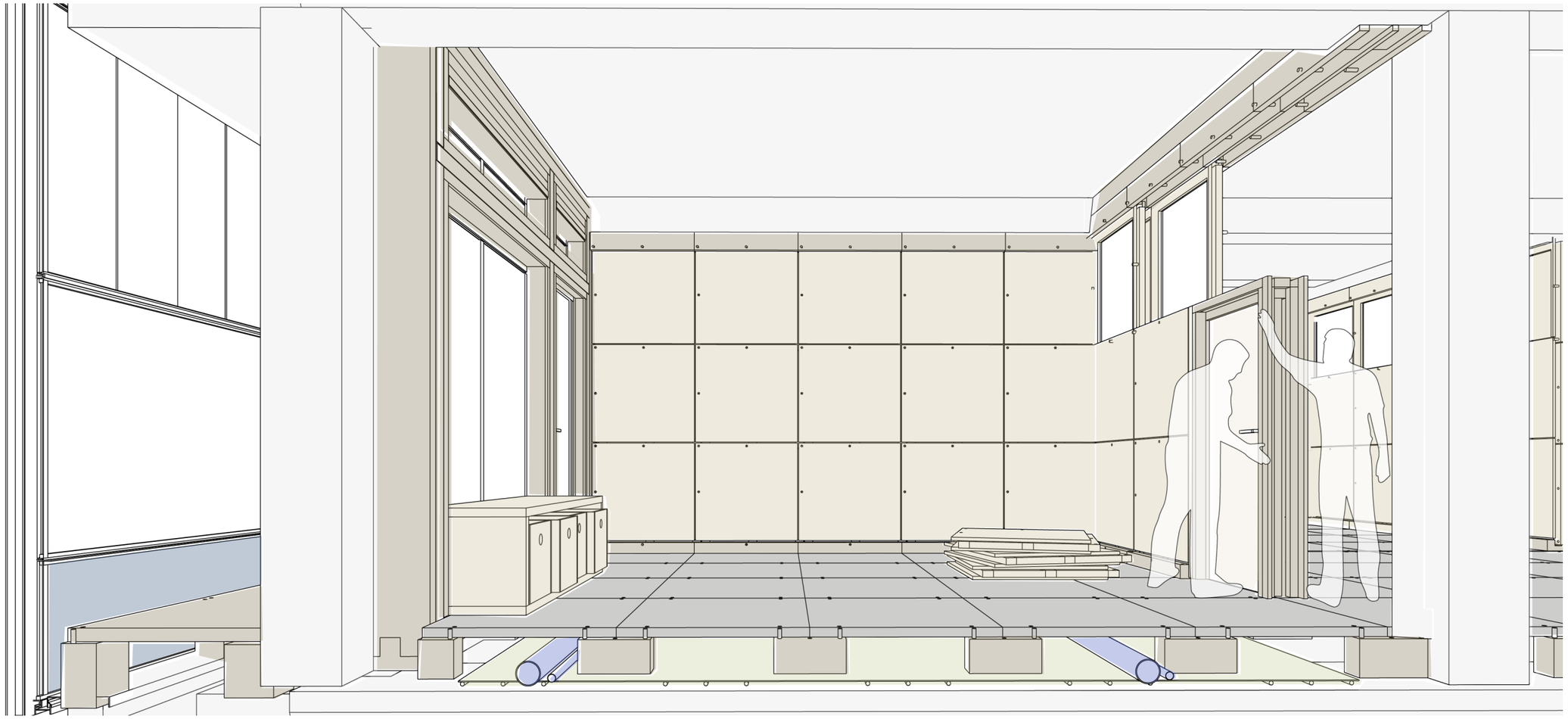
Step 7 | Close and thereby secure the interior wall from top to bottom

EWI High-rise | Infill build up



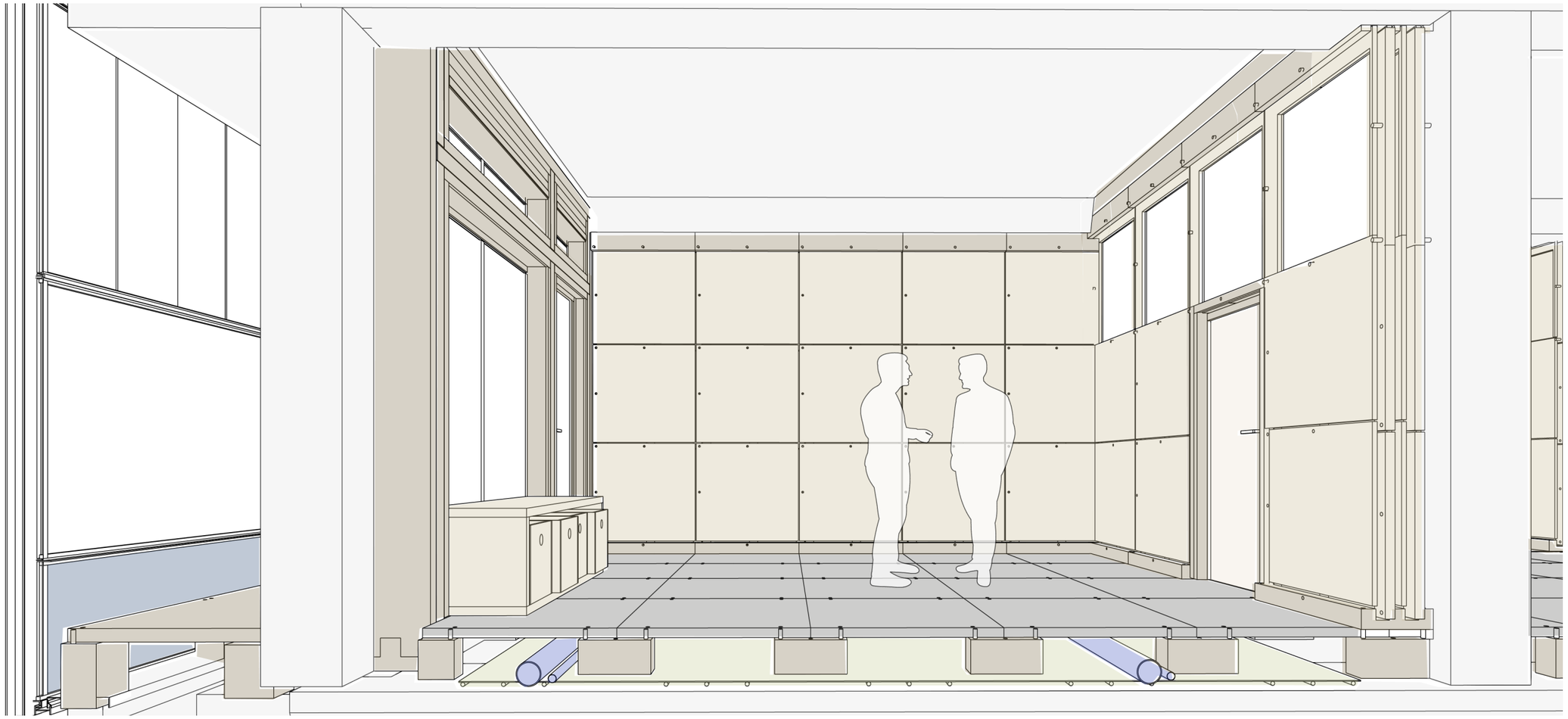
Step 8 Elements | Door and window elements to provide access and light into adjacent spaces

EWI High-rise | Infill build up



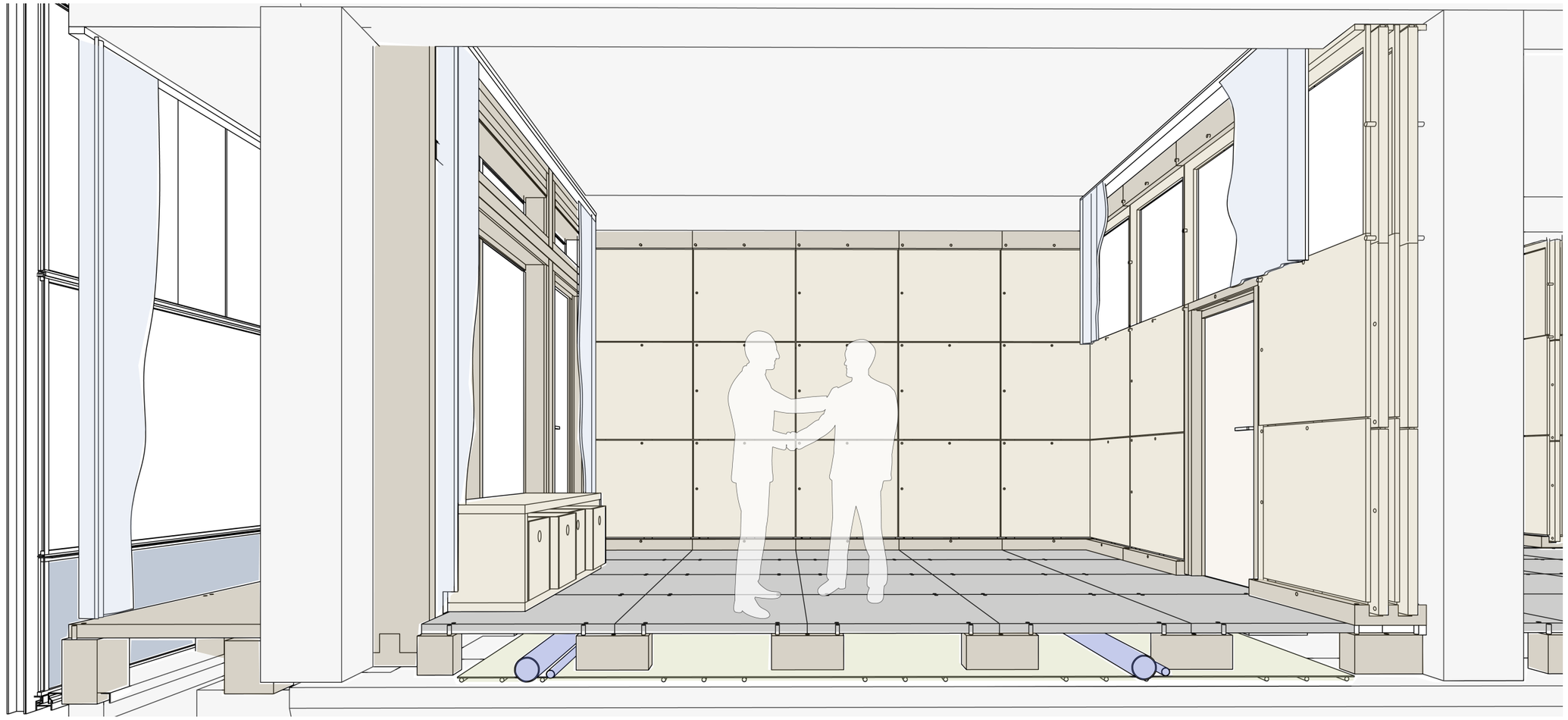
Step 8 | Place corner pieces and (optional) door/window elements

EWI High-rise | Infill build up



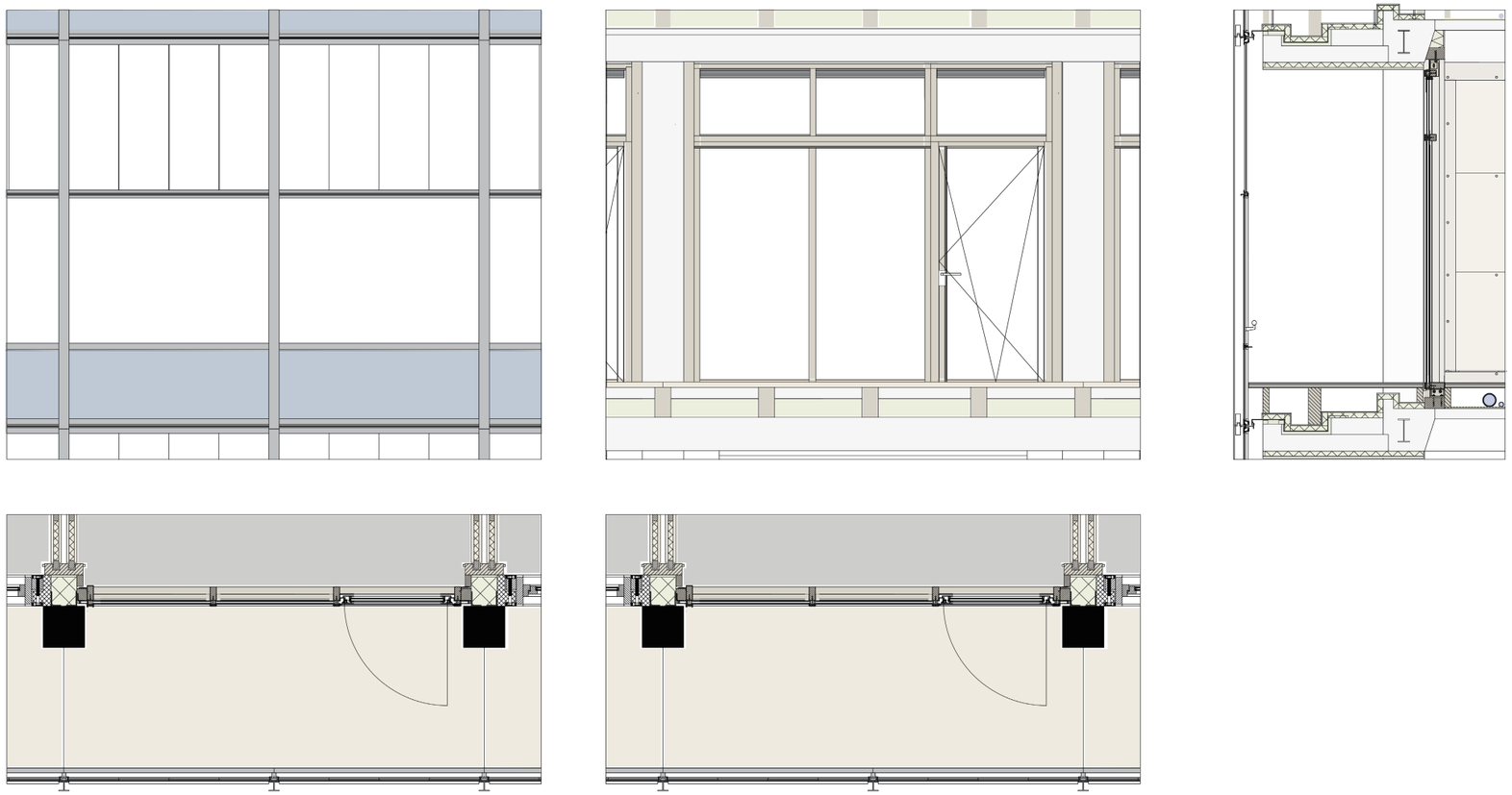
Step 9 | Complete the space

EWI High-rise | Infill build up

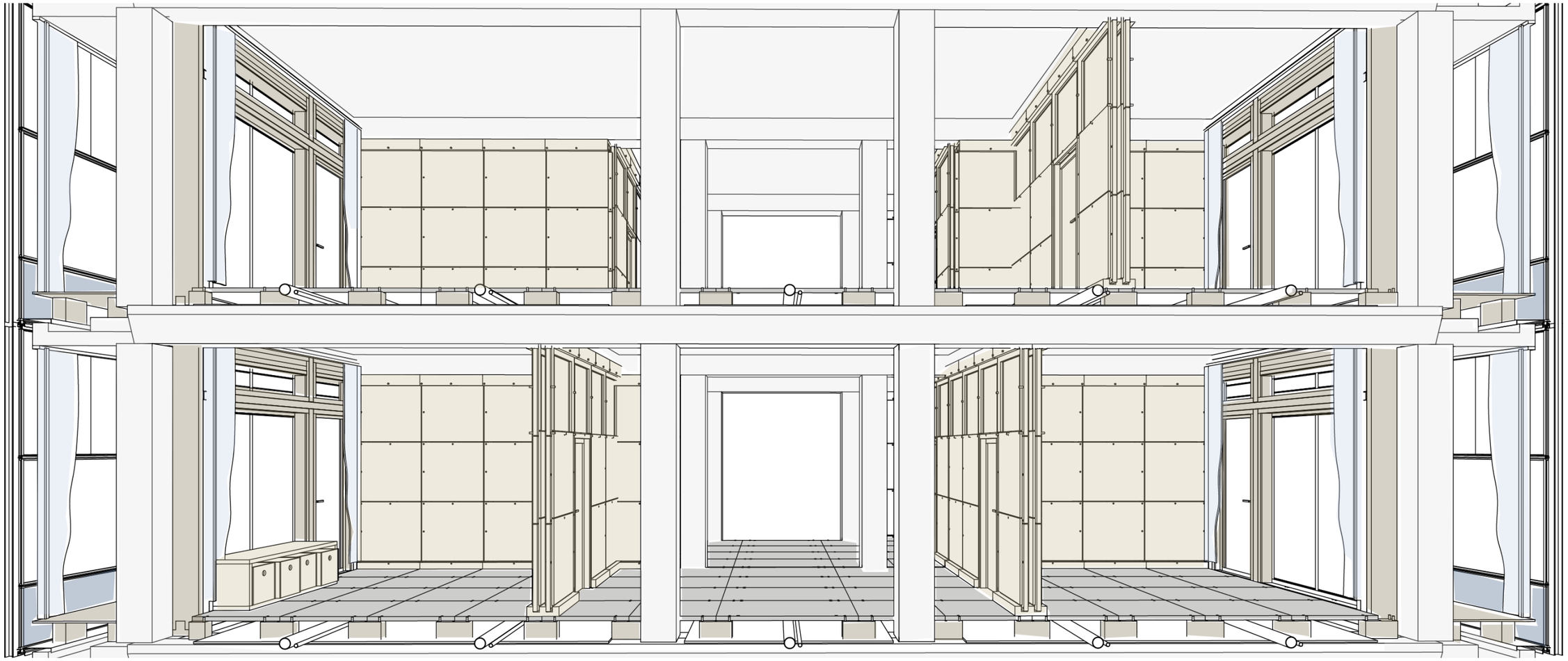


Step 8 | Install curtain systems

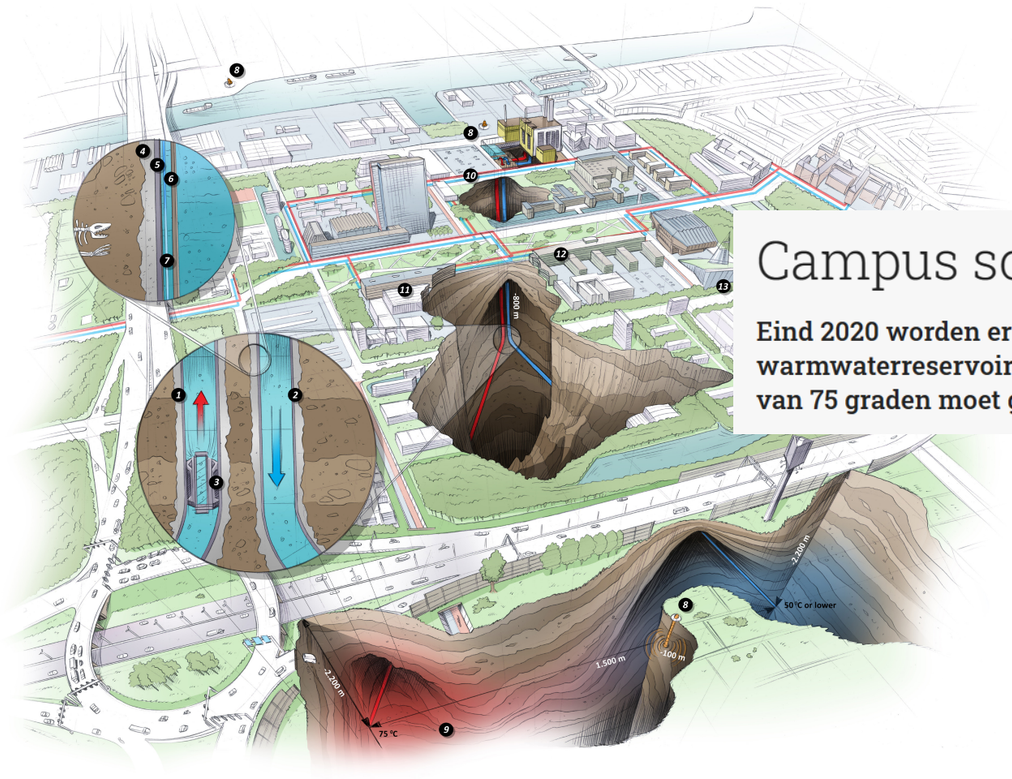
EWI High-rise | Infill build up



Overview | Outside and interior wall view and section of infill self-built system



Climate measurement | Long term sustainability measurements

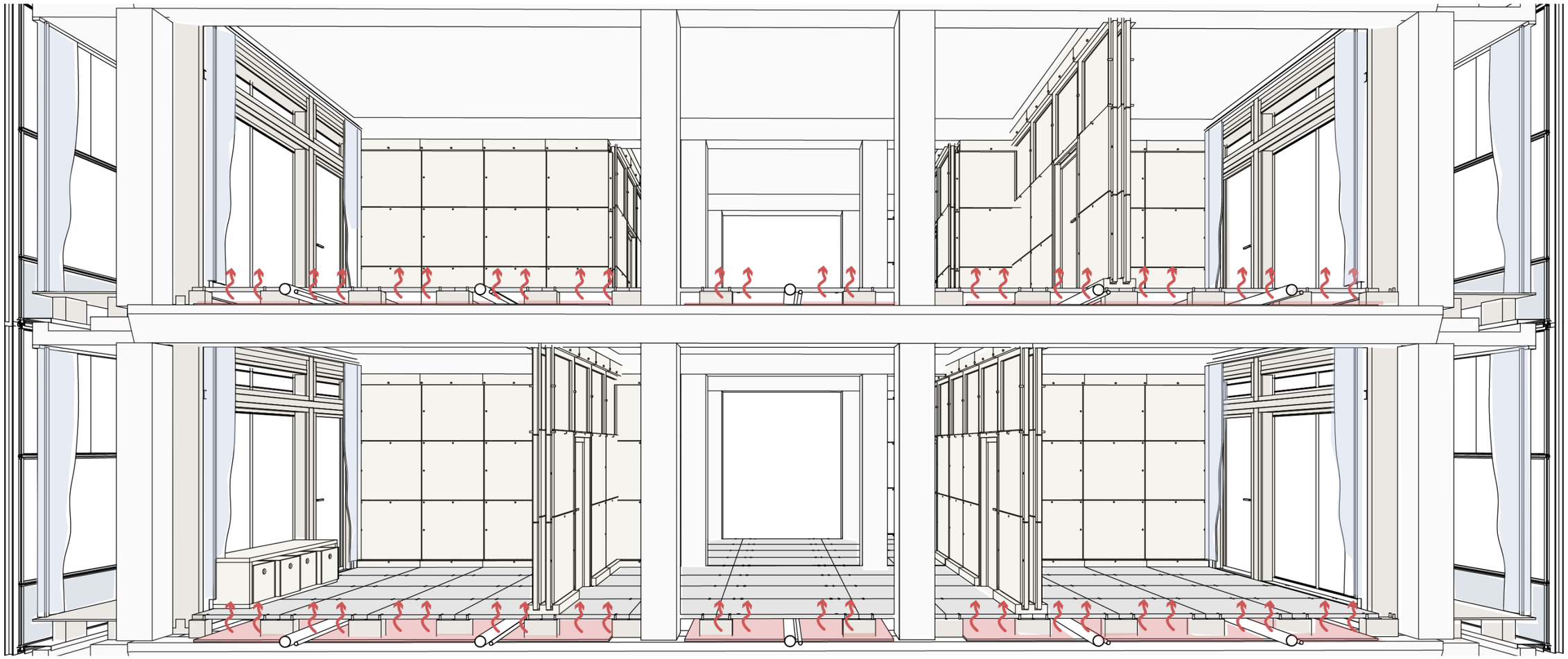


Campus schakelt over op aardwarmte

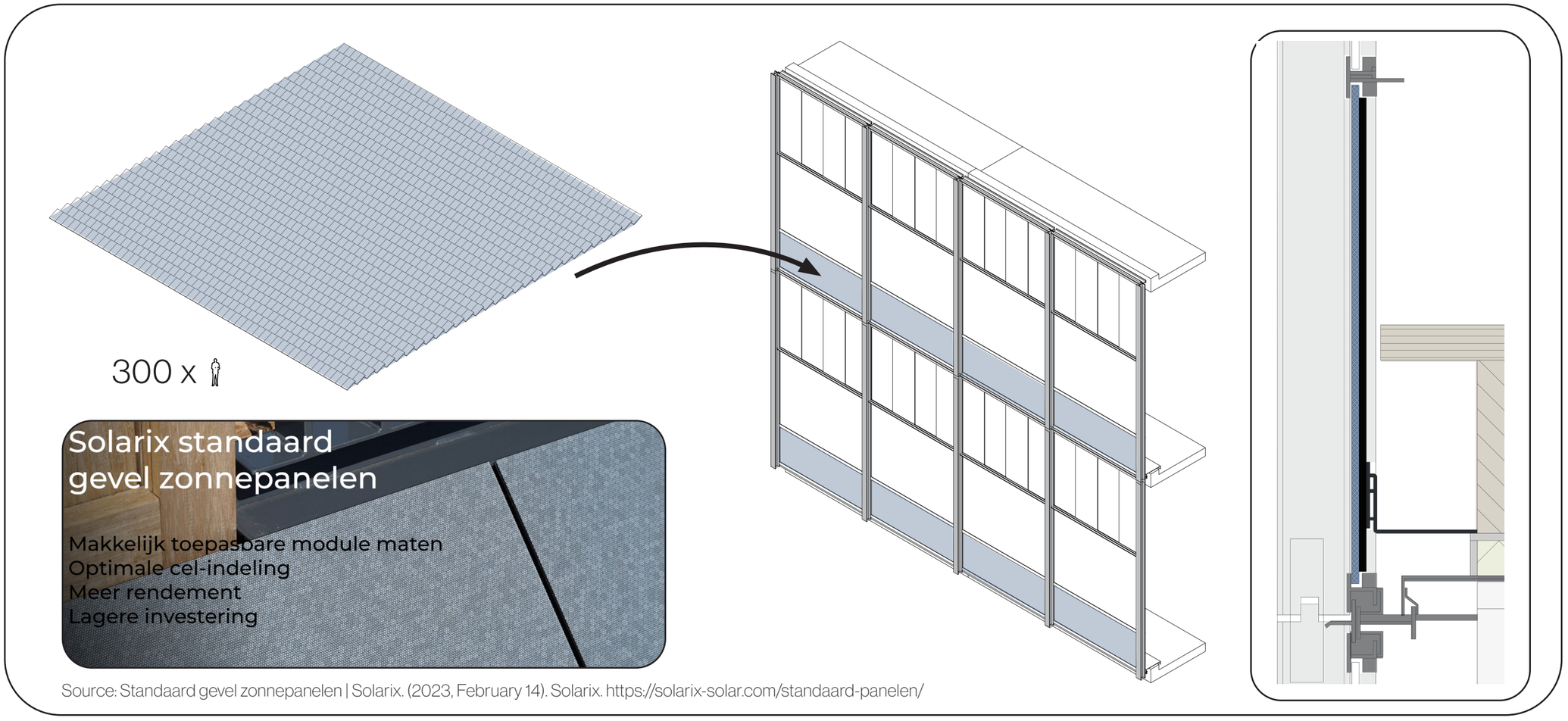
Eind 2020 worden er twee leidingen geboord vanaf de campus naar een warmwaterreservoir op ruim twee kilometer diepte onder de A13. Die geothermische bron van 75 graden moet gebouwen op de campus en omgeving van warmte voorzien.

Source: Campus schakelt over op aardwarmte. (2019). TU Delft. https://www.tudelft.nl/delft-integraal/articles/campus-schakelt-over-op-aardwarmte

Heating measurement | Heating from high temperature radiators to low temperature district heating

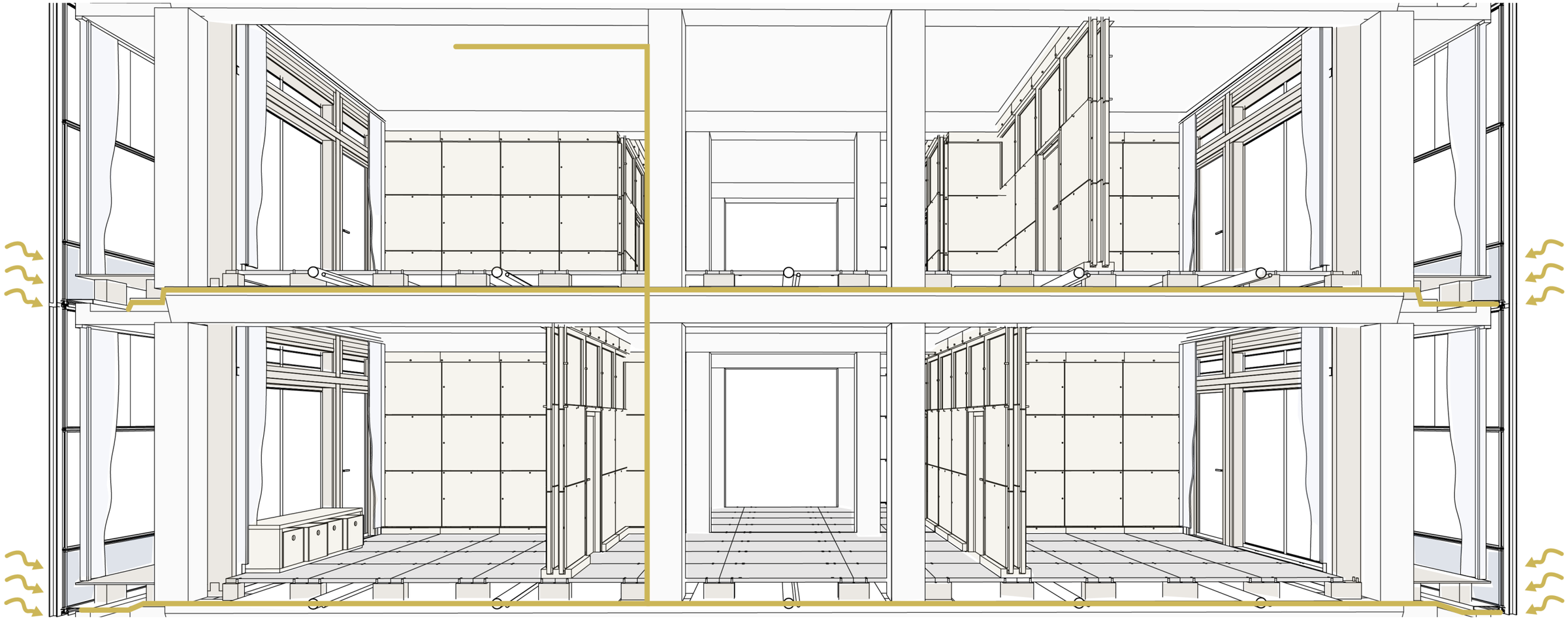


Heating measurement | Underfloor heating on TU district heating

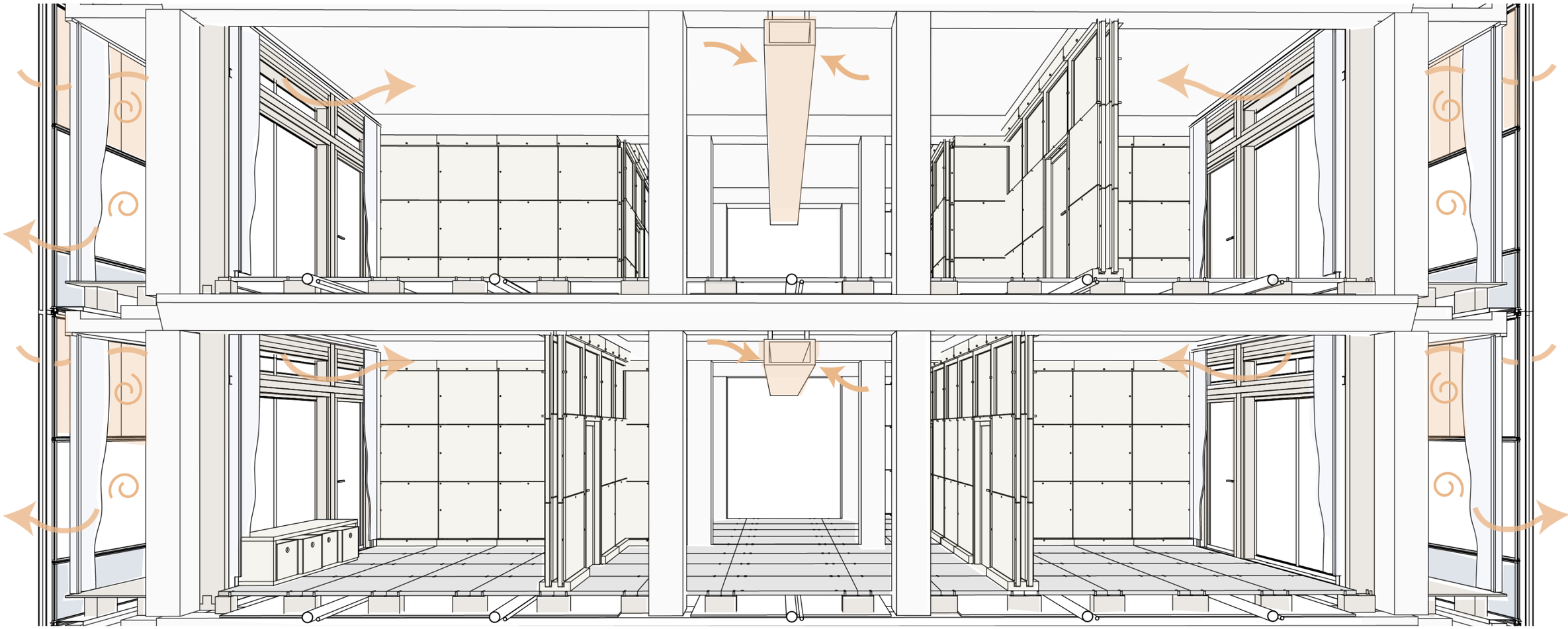


Source: Standaard gevel zonnepanelen | Solarix. (2023, February 14). Solarix. https://solarix-solar.com/standaard-panelen/

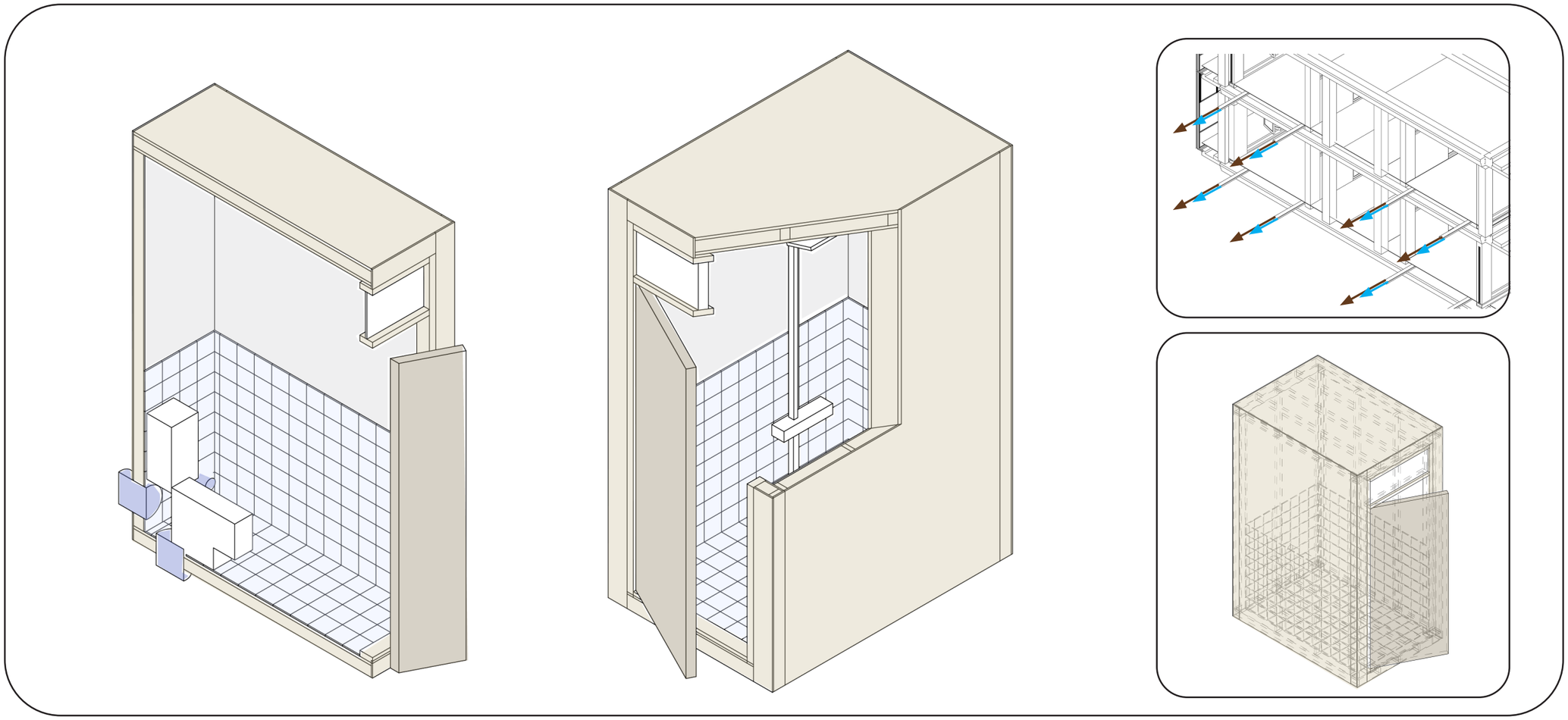
Energy | Total EWI facade generates enough energy for the inhabitants by facade solar panels



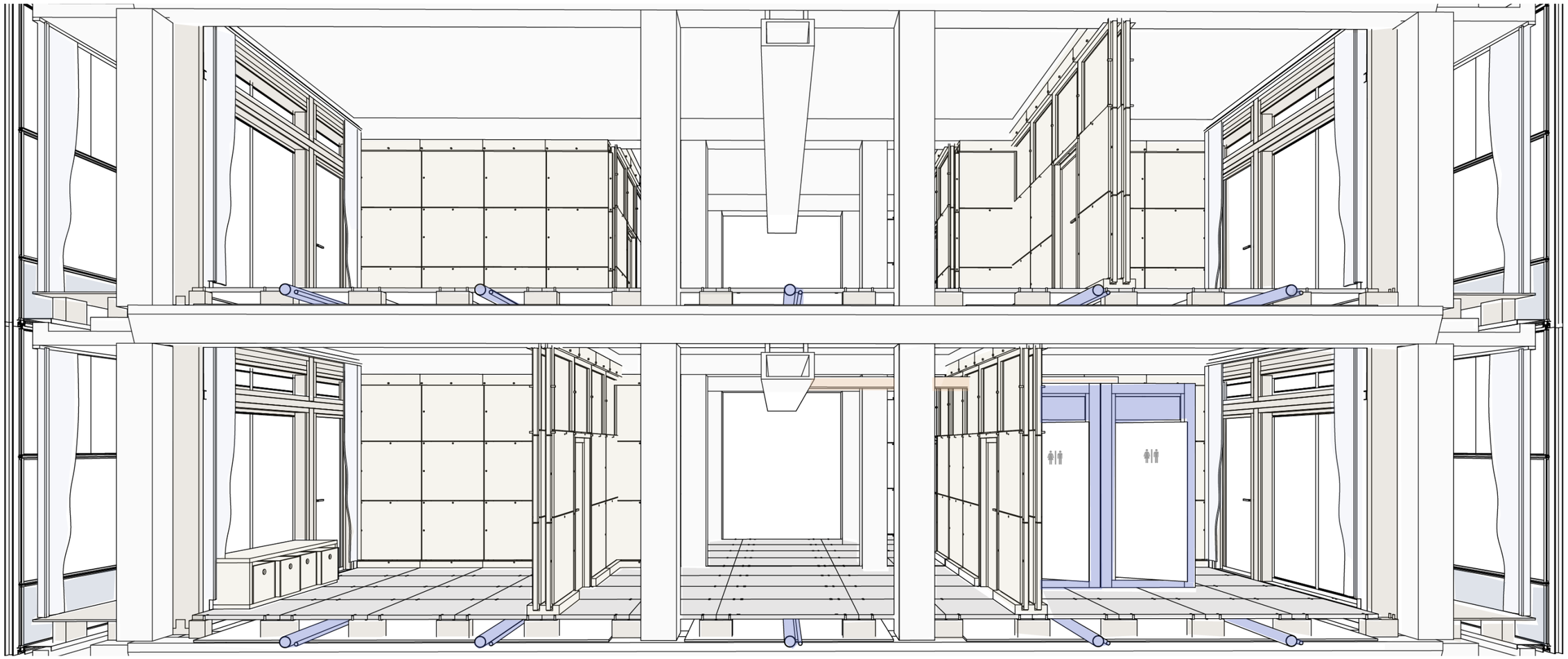
Energy measurement | Facade solar panels generating renewable electricity and serviced by floorsystem



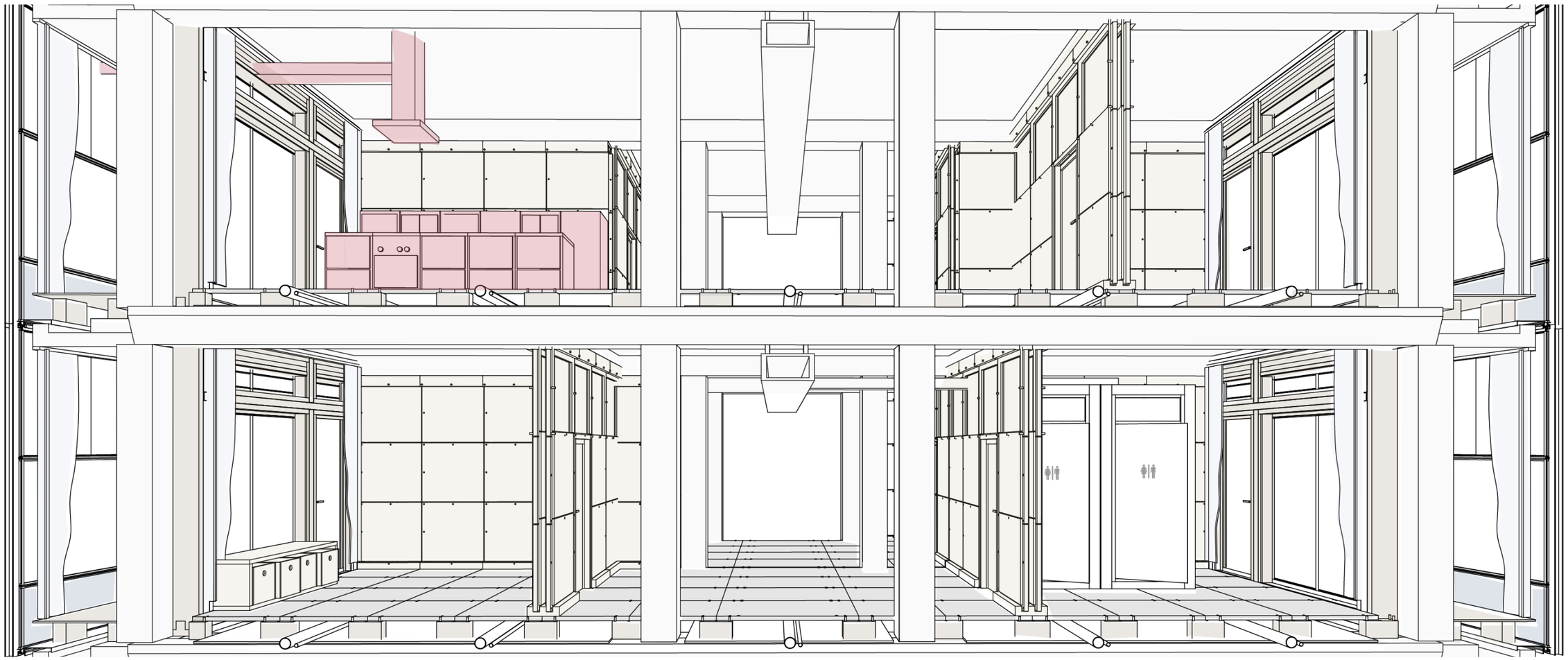
Vent. measurement | From all mechanical (in&out) to natural in and mechanical out



Water measurement | Plug and Play prefabricated toilet and shower units

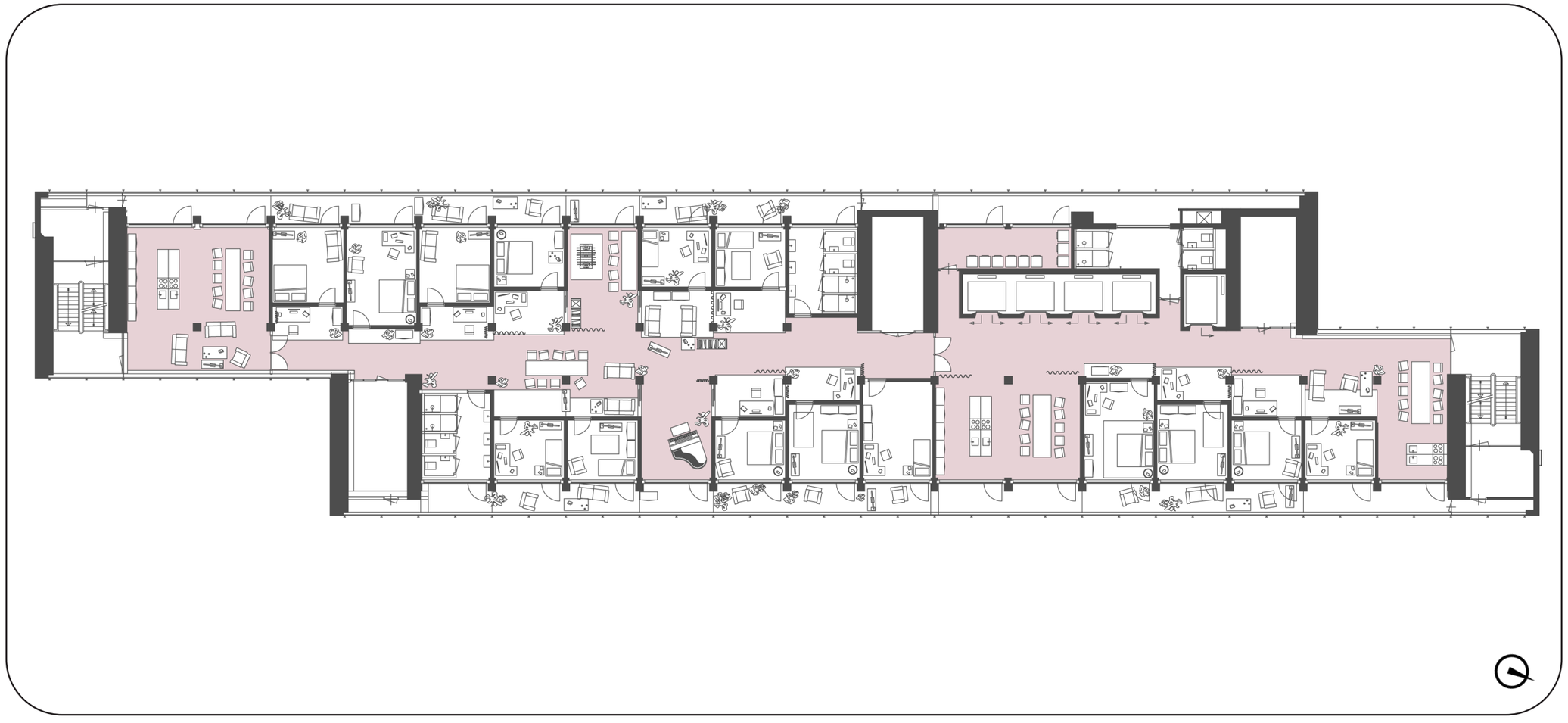


Water measurement | Plug and play water and plumbing system underneath flooring



Social measurement | Kitchen units within shared spaces (ventilate directly to the outside)

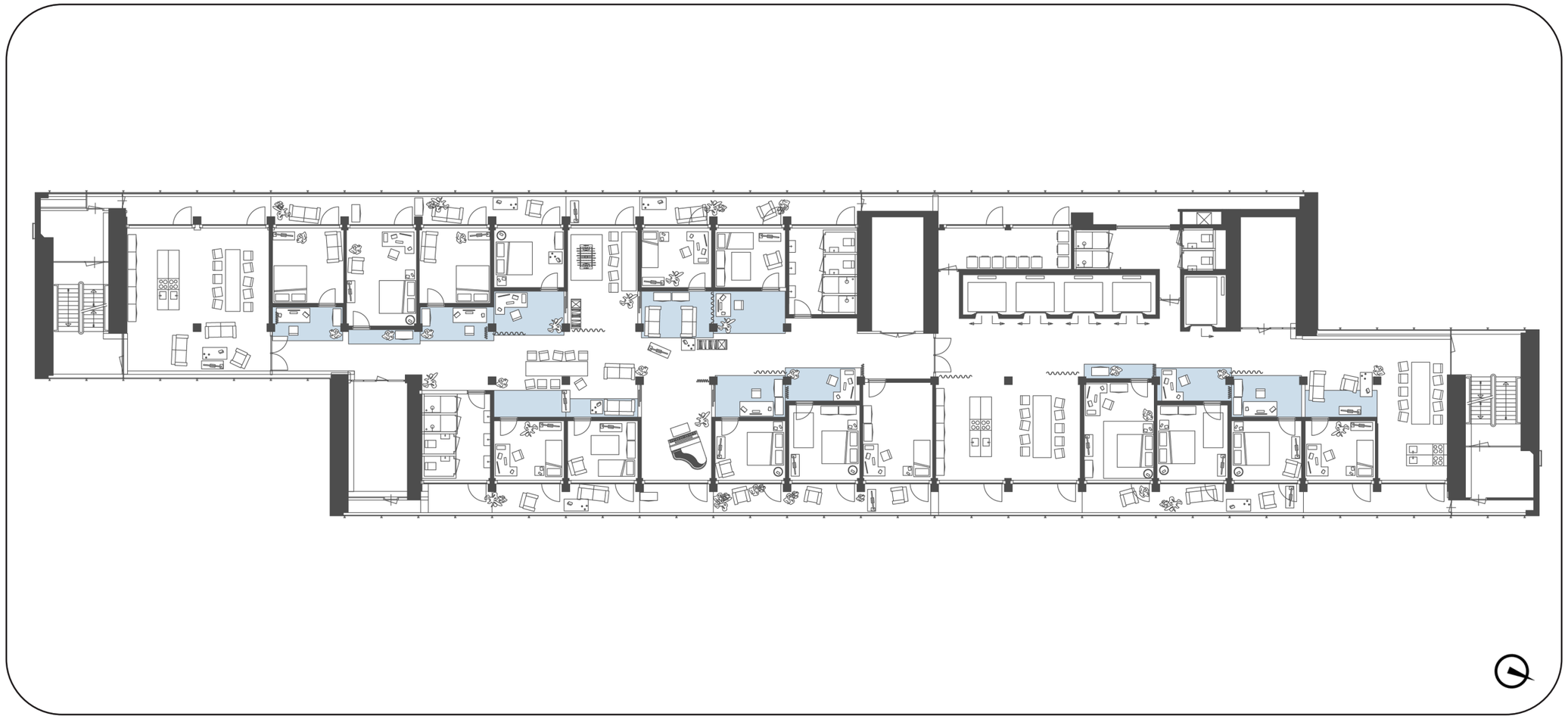
EWI High-rise | Spaces in plan



Communal space | Open social space for people to meet during shared activities

Render inside | Kitchens with diner space and livingrooms in order to encourage social activities

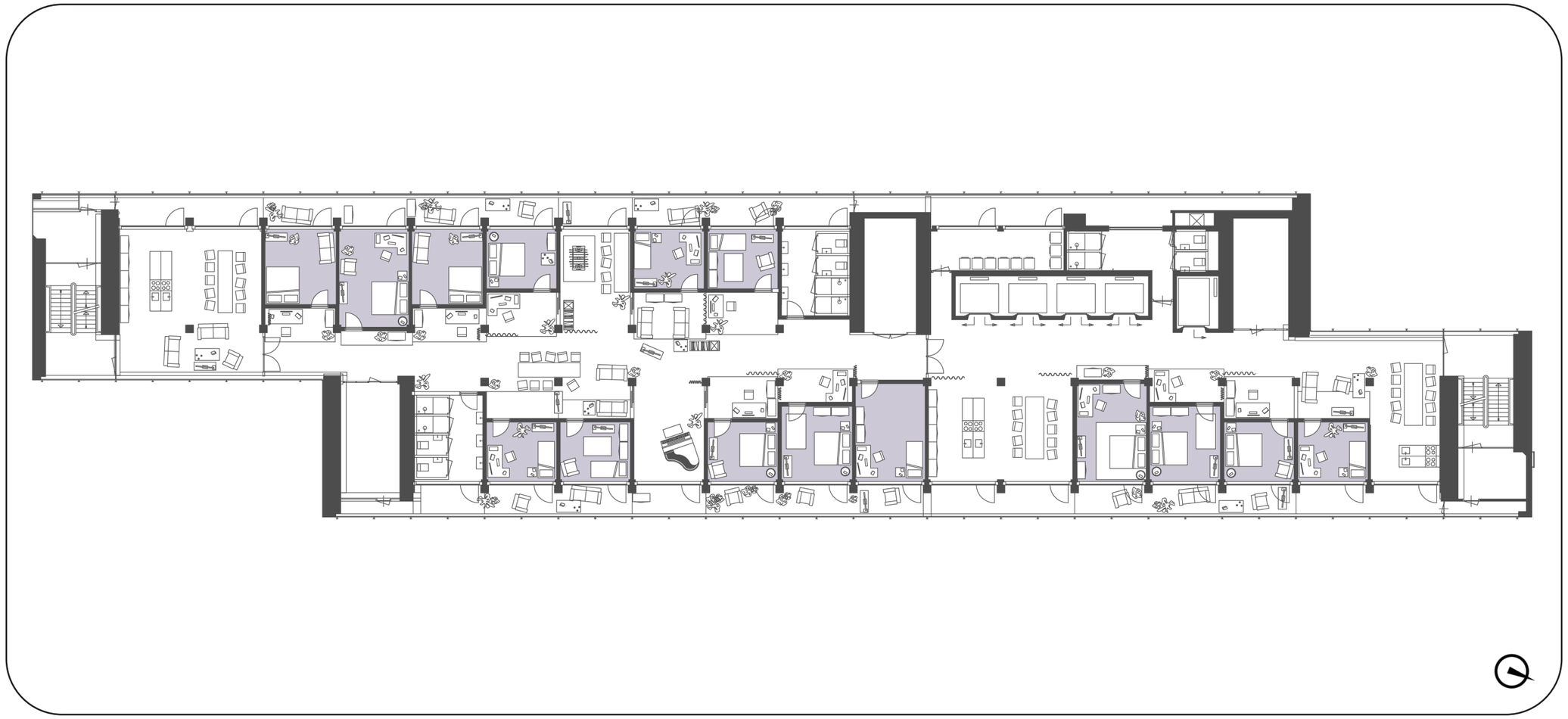
EWI High-rise | Spaces in plan



Inbetween | Buffer space between social and private and a place to appropriate and increase living space

Render inside | A space where (semi) social activities can be placed outside of the private room

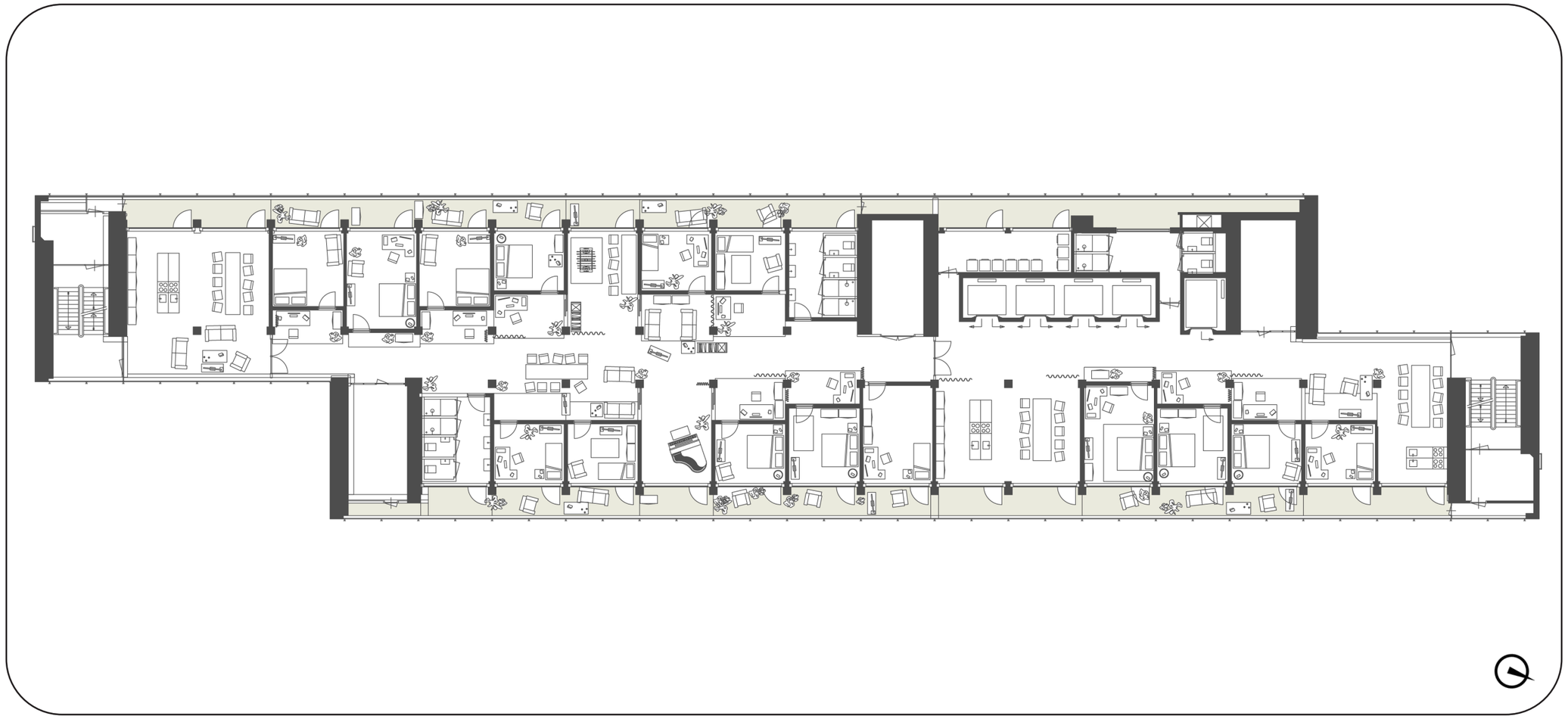
EWI High-rise | Spaces in plan



Private | Individual student housing units for privacy

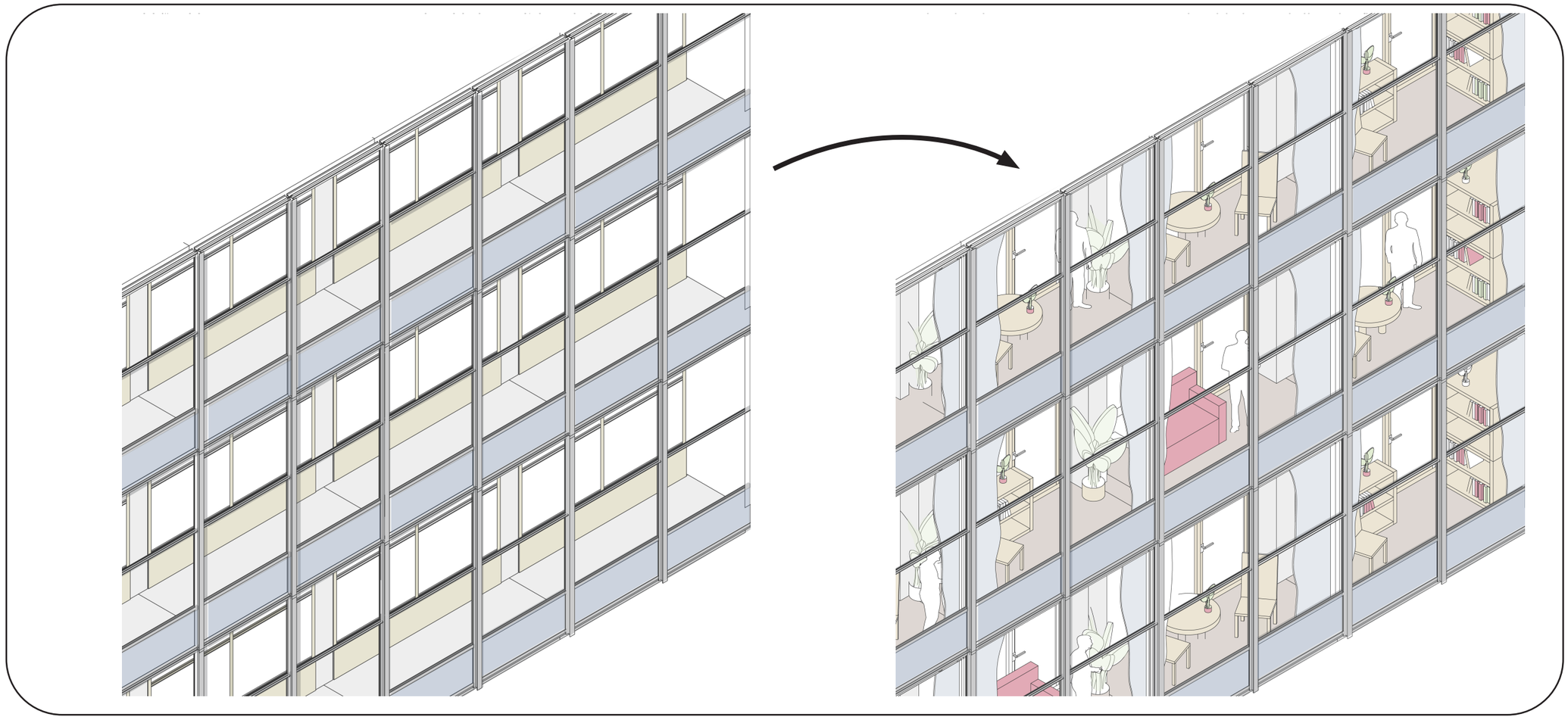
Render inside | Within the architecture there is room for personalization and appropriation

EWI High-rise | Spaces in plan

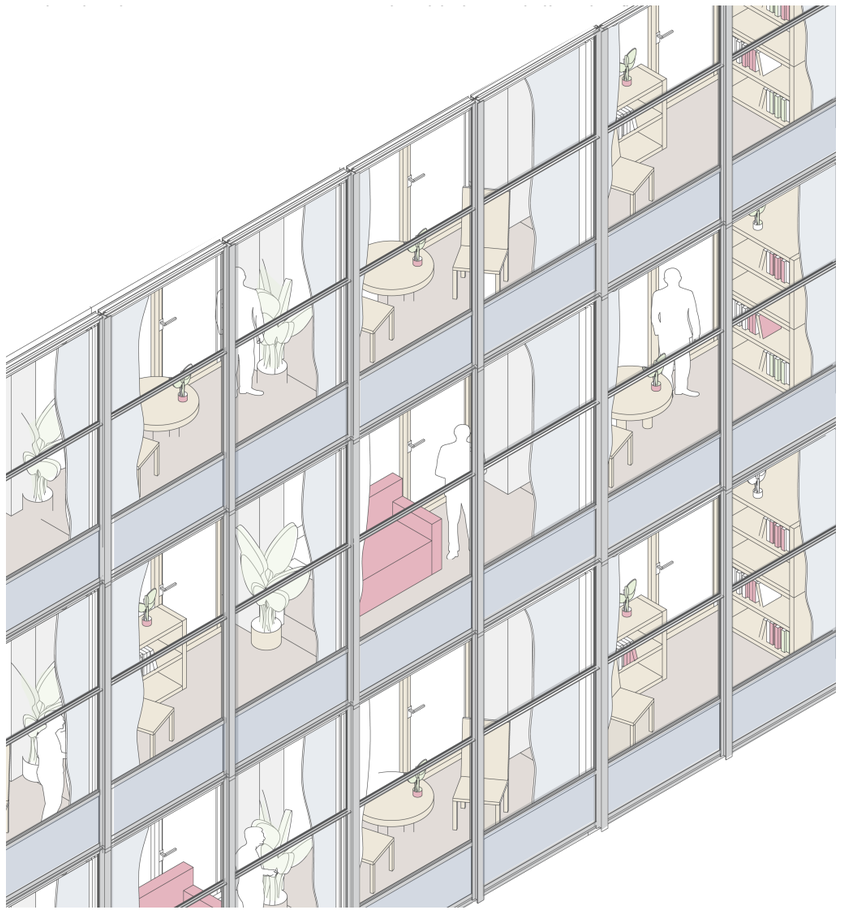


Winter garden | Not inside nor outside and can be used best in spring and fall as extension of private room

Render inside | Winter garden as extension outside space in summer but as inside space in spring and fall



Facade | From empty and unused space towards a living facade

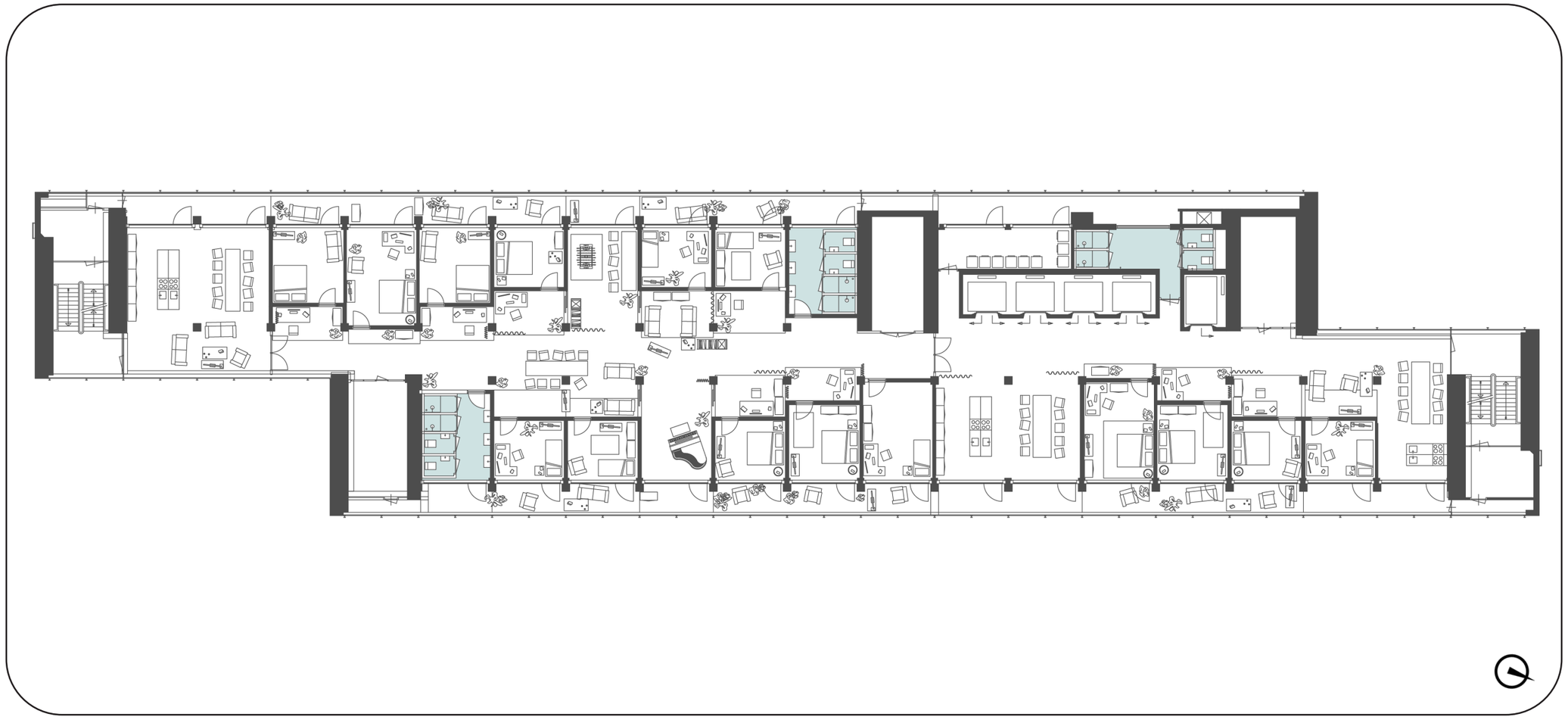


Facade | While remaining the heritage look there is the addition of life behind the curtain wall

Render outside | Life in the facade by appropriation of space within double facade during daytime

Render outside | Bringing out light to the campus and surrouding area at evening and nighttime

EWI High-rise | Spaces in plan



Water and sewage | Shower and toilet units placed in shared and mixed bathrooms

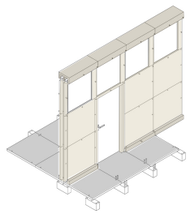
Render inside | Shower and toilet units placed in shared and mixed bathrooms

Scenario model | Adaptable management over time

Building scale

TU Delft

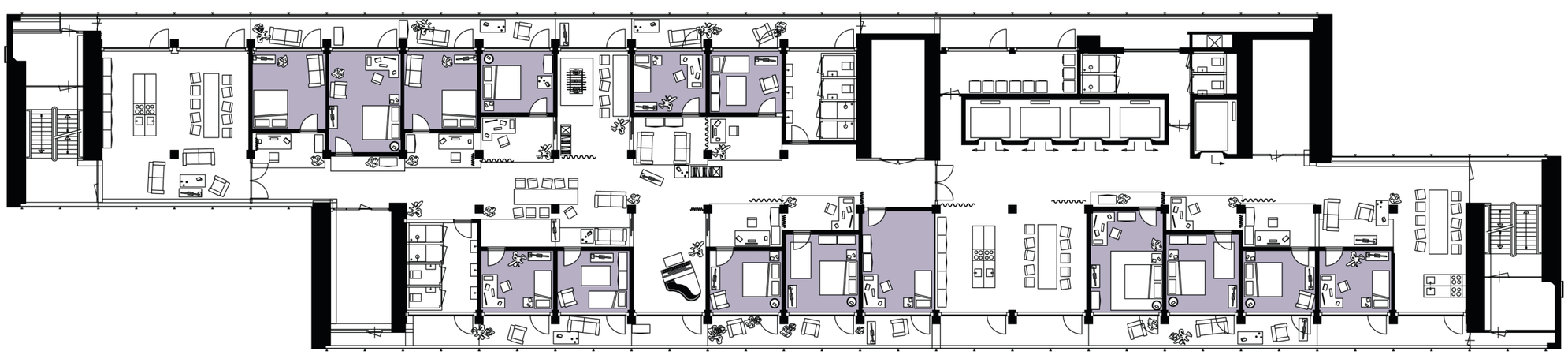
Infill scale



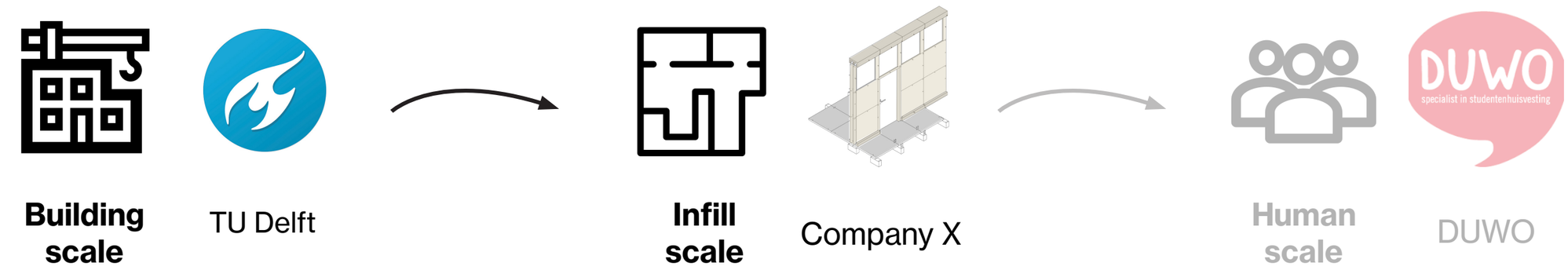
Company X

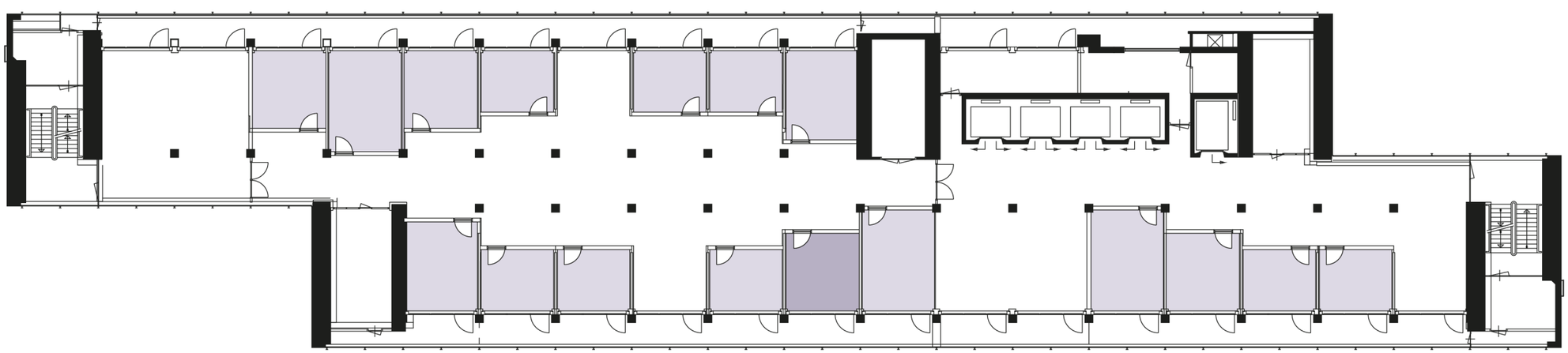
Human scale

DUWO

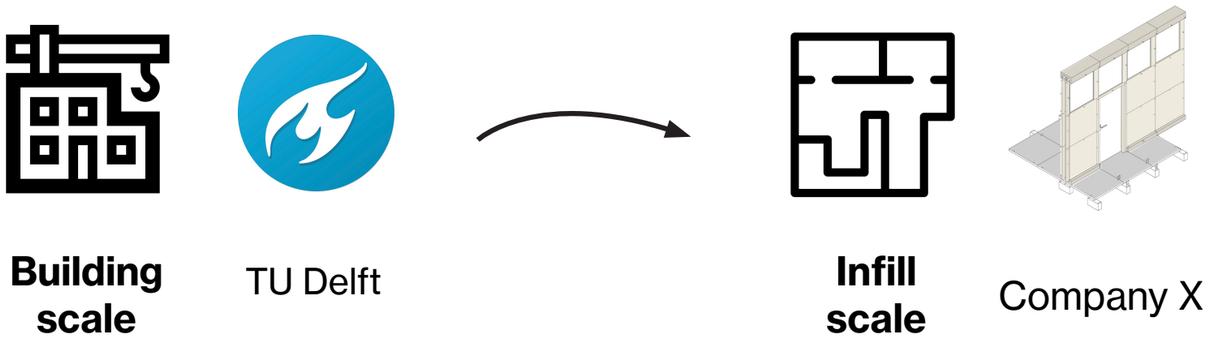


Model | Scenario management over time





Model | Scenario management over time

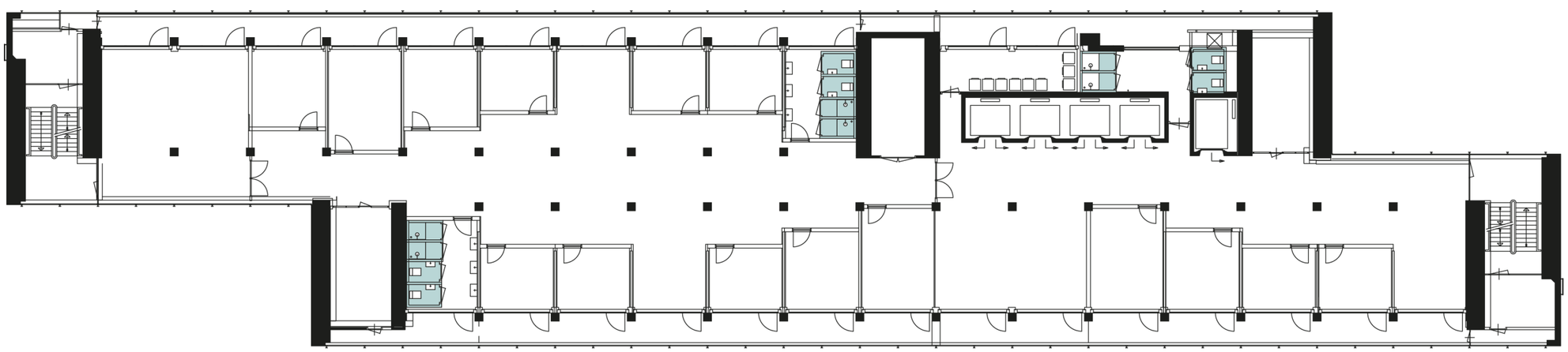


Building scale

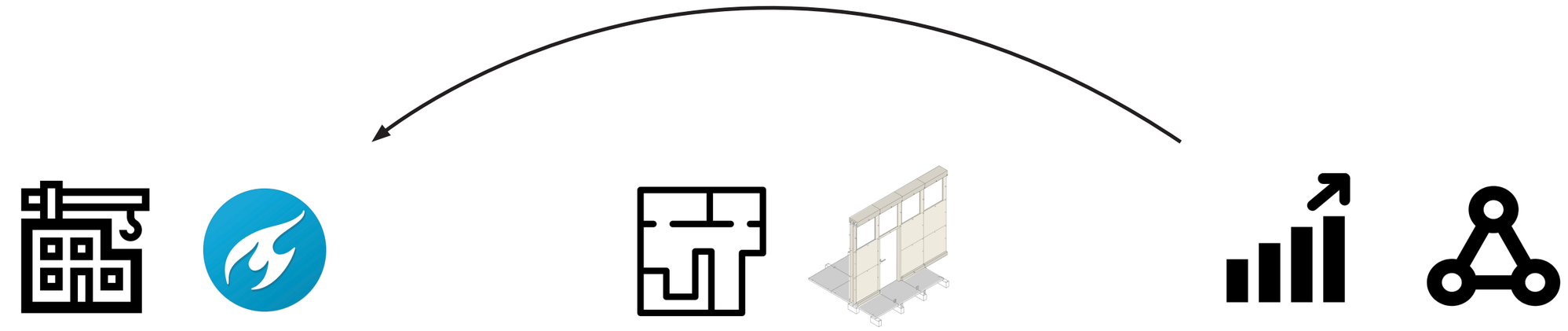
TU Delft

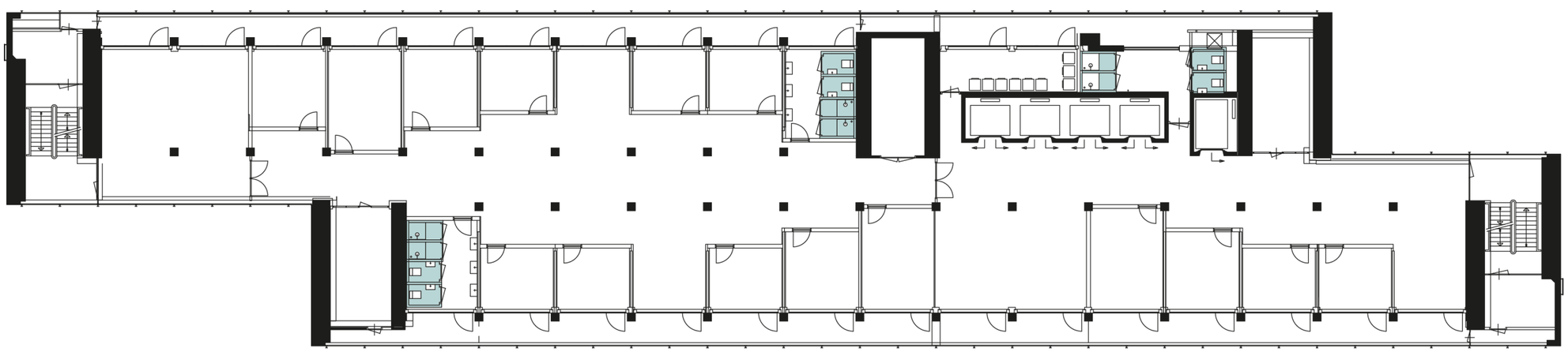
Infill scale

Company X

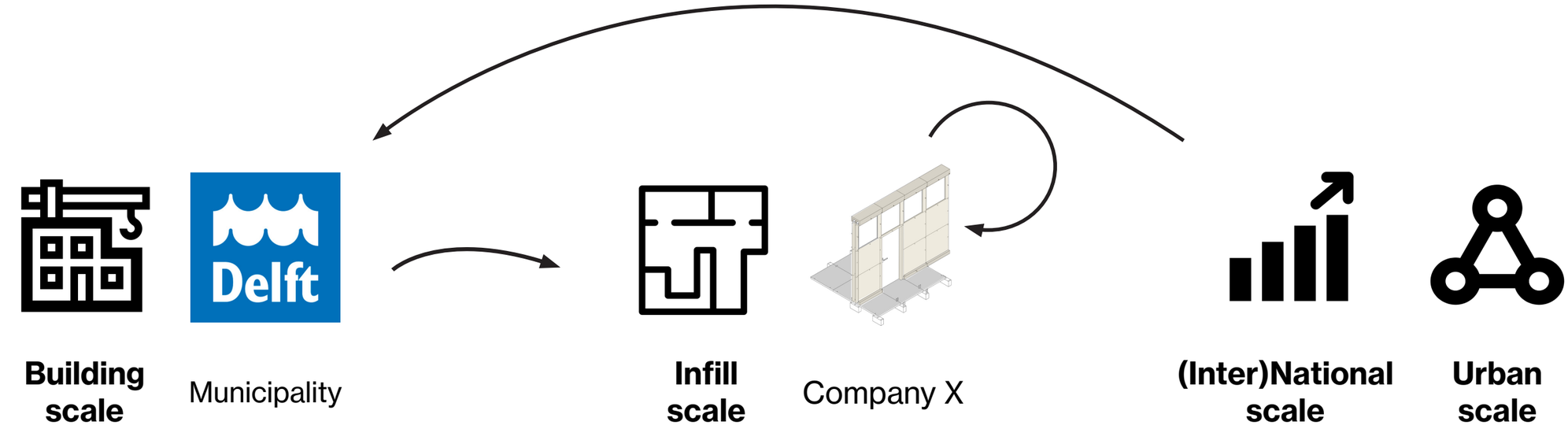


Model | Scenario management over time





Model | Scenario management over time



Building scale

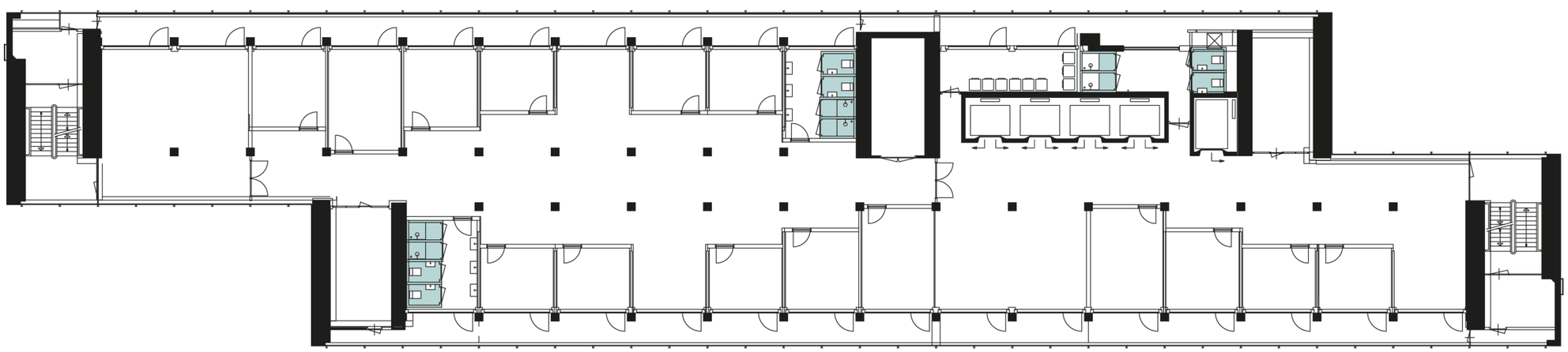
Municipality

Infill scale

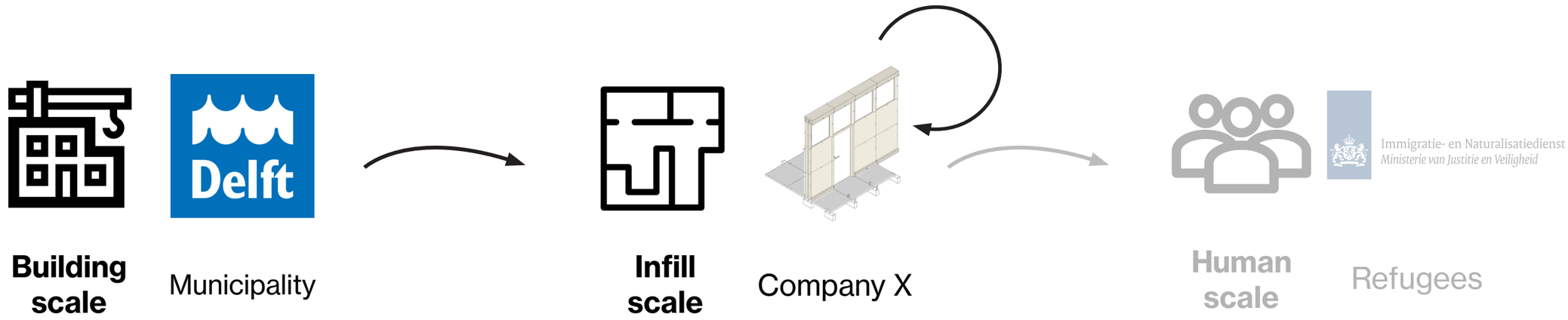
Company X

(Inter)National scale

Urban scale



Model | Scenario management over time



Building scale

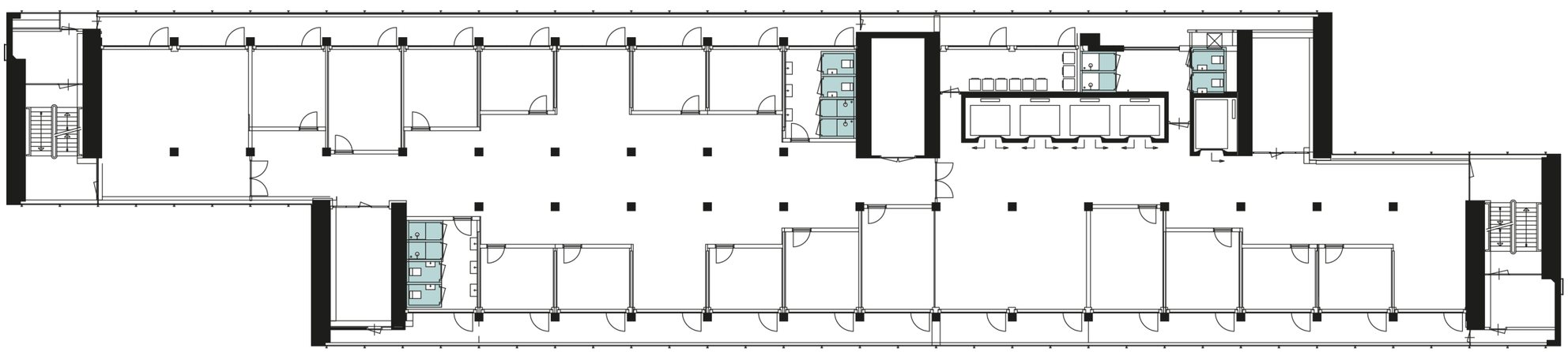
Municipality

Infill scale

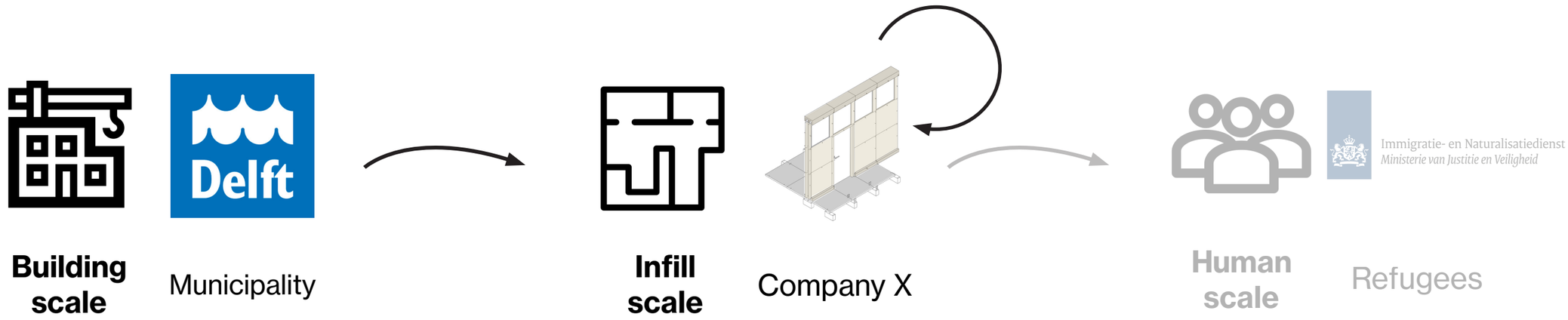
Company X

Human scale

Refugees



Model | Scenario management over time



Building scale

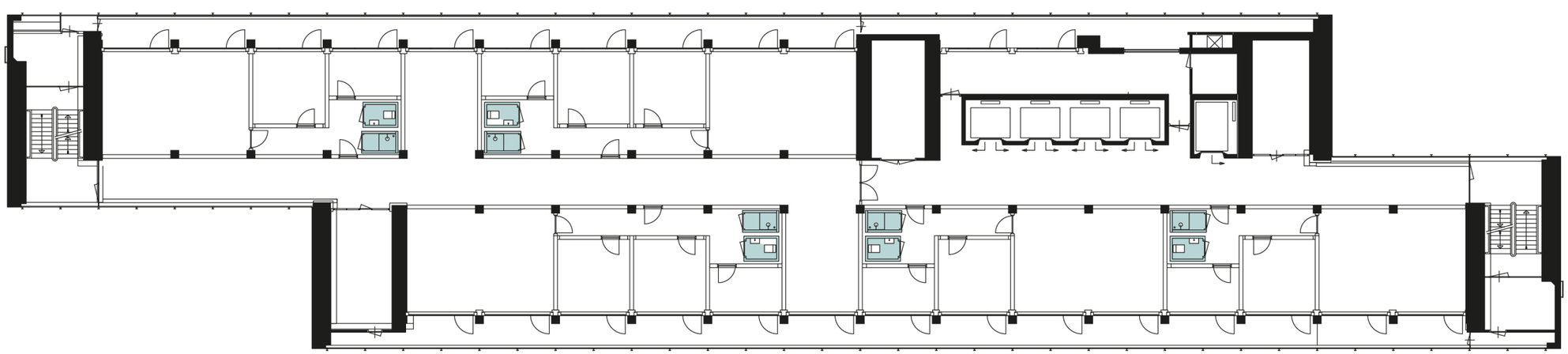
Municipality

Infill scale

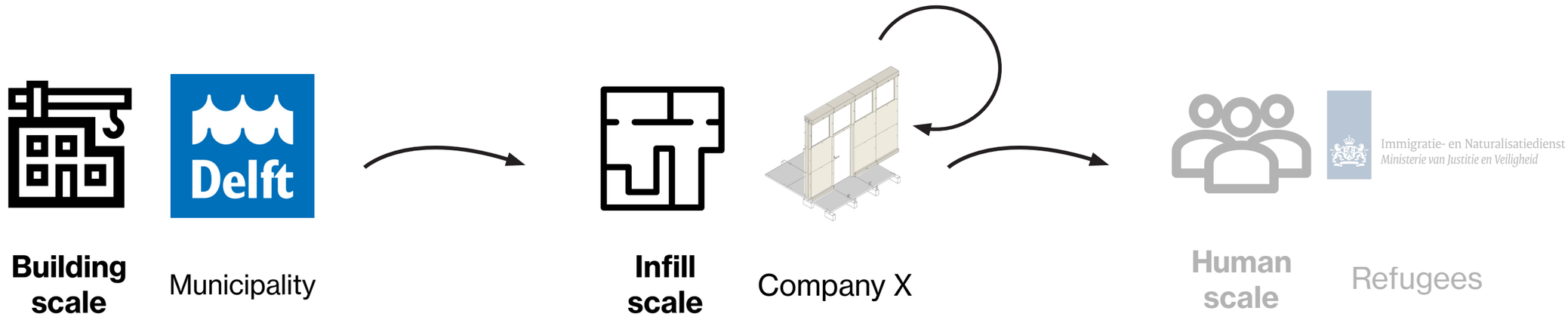
Company X

Human scale

Refugees



Model | Scenario management over time



Building scale

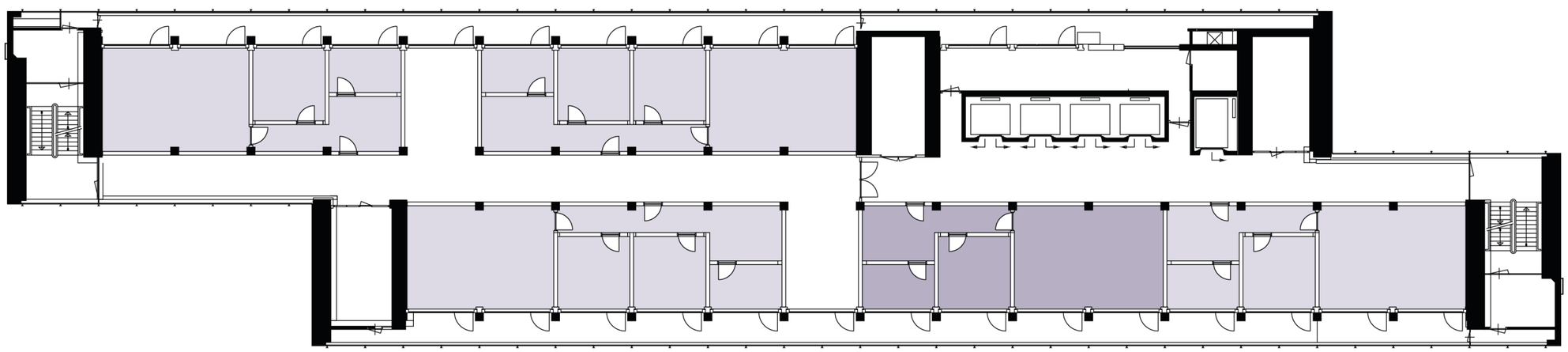
Municipality

Infill scale

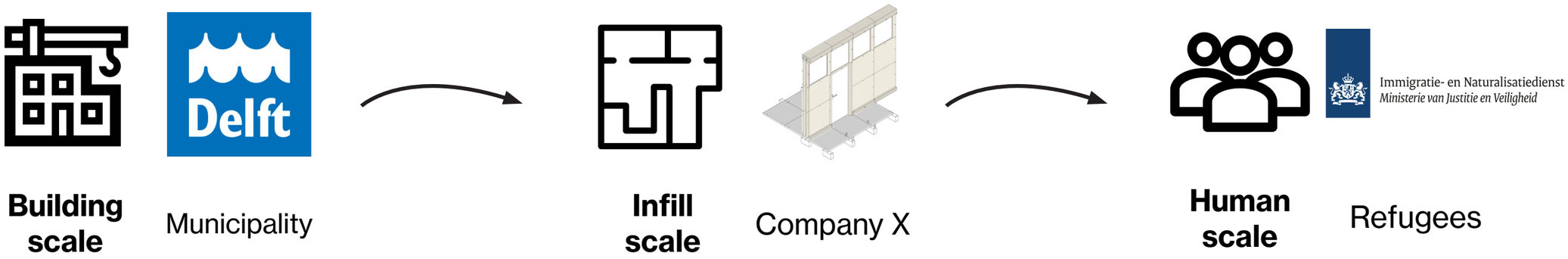
Company X

Human scale

Refugees



Model | Scenario management over time



Building scale

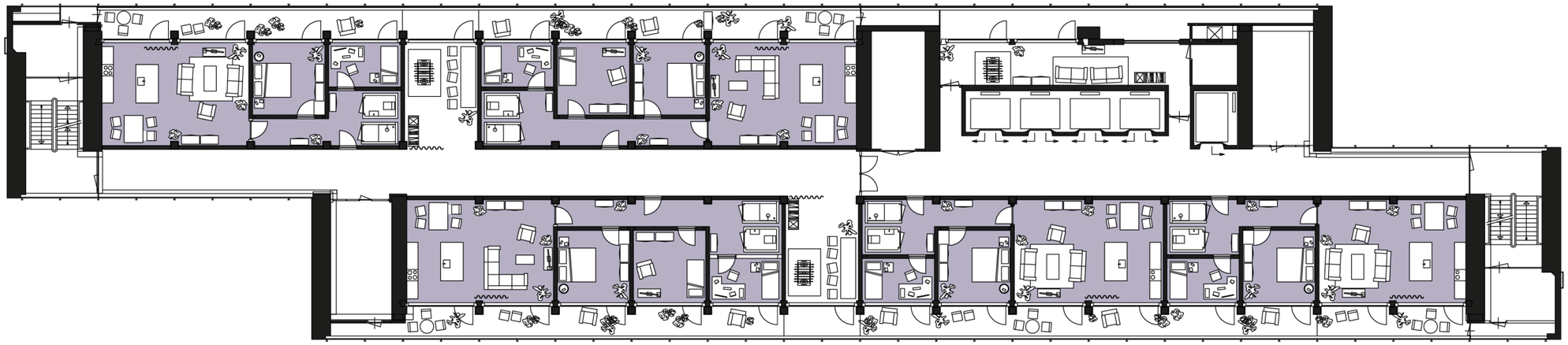
Municipality

Infill scale

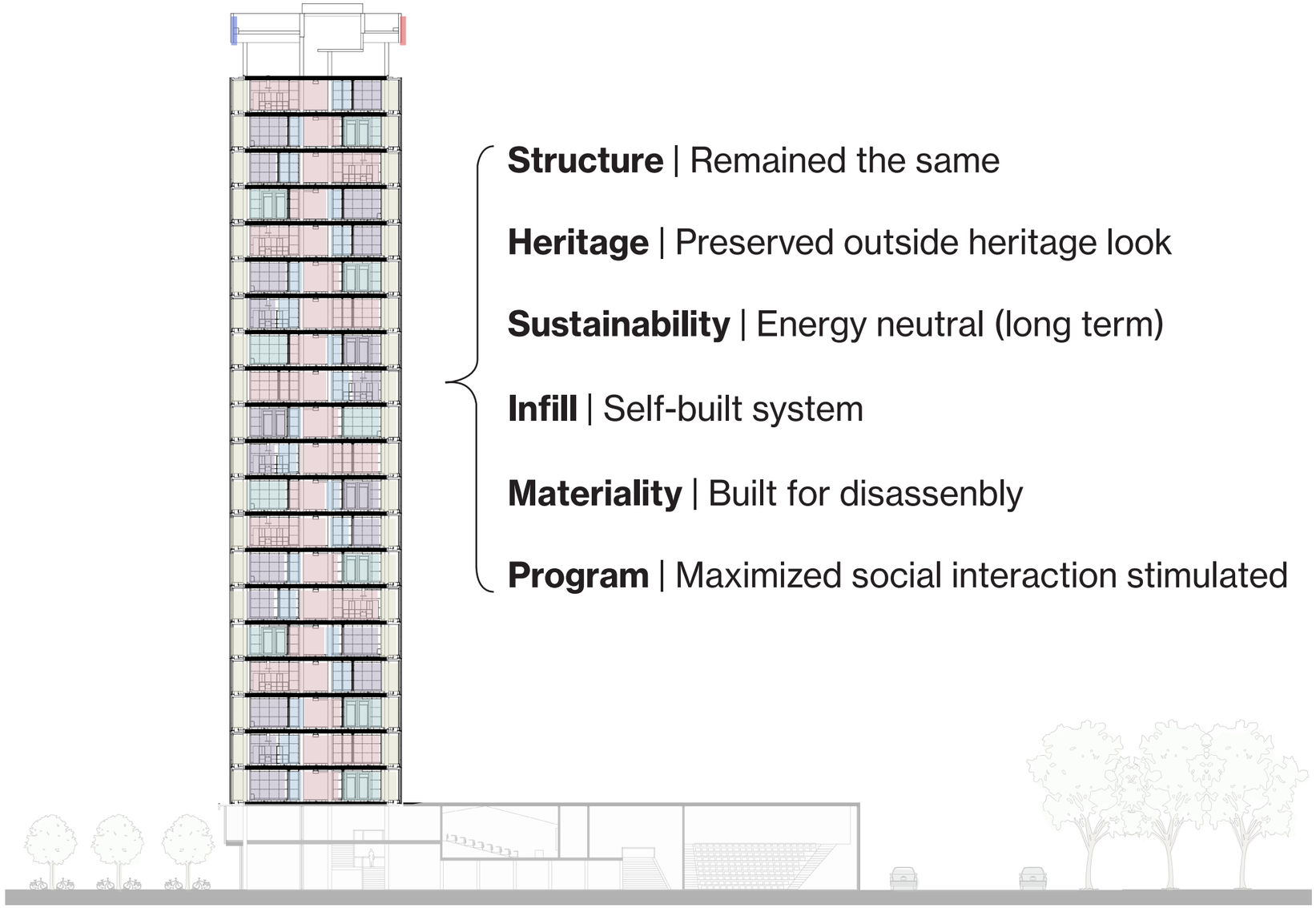
Company X

Human scale

Refugees



EWI | Section



Structure | Remained the same

Heritage | Preserved outside heritage look

Sustainability | Energy neutral (long term)

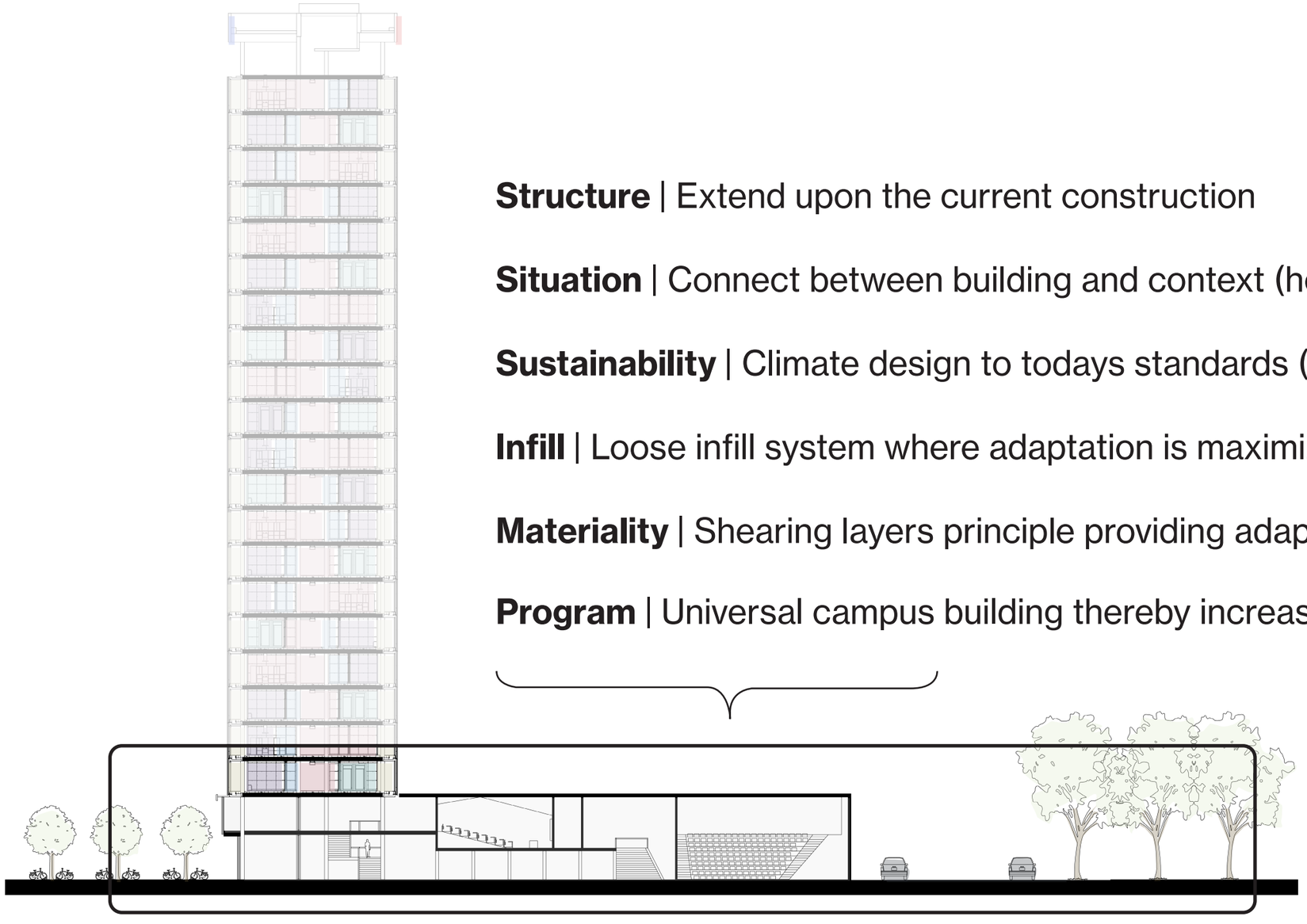
Infill | Self-built system

Materiality | Built for disassenbly

Program | Maximized social interaction stimulated

Situation | EWI high-rise achievements

EWI | Section



Structure | Extend upon the current construction

Situation | Connect between building and context (heart of campus)

Sustainability | Climate design to todays standards (energy neutral)

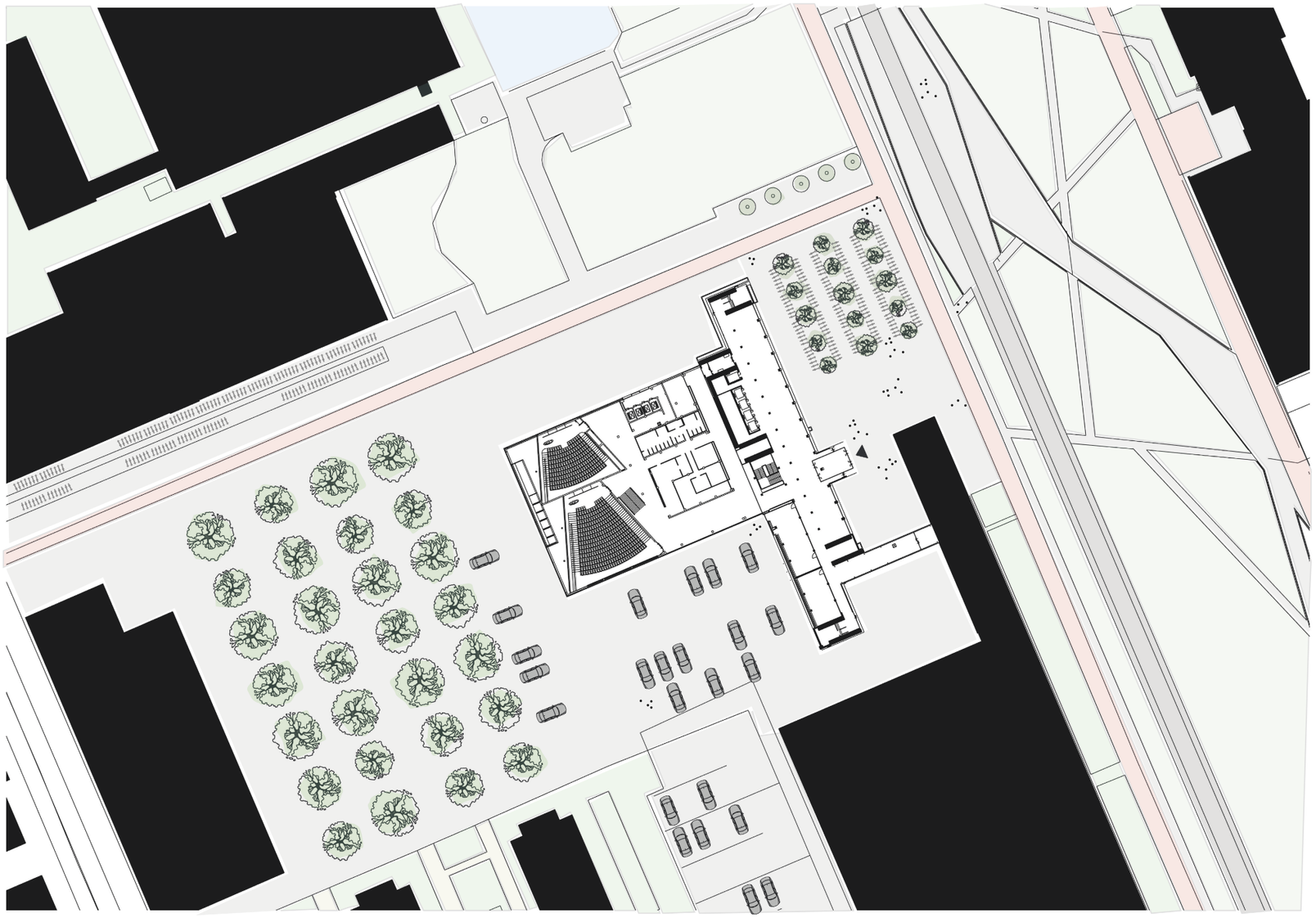
Infill | Loose infill system where adaptation is maximized

Materiality | Shearing layers principle providing adaption over time

Program | Universal campus building thereby increasing (self) study places

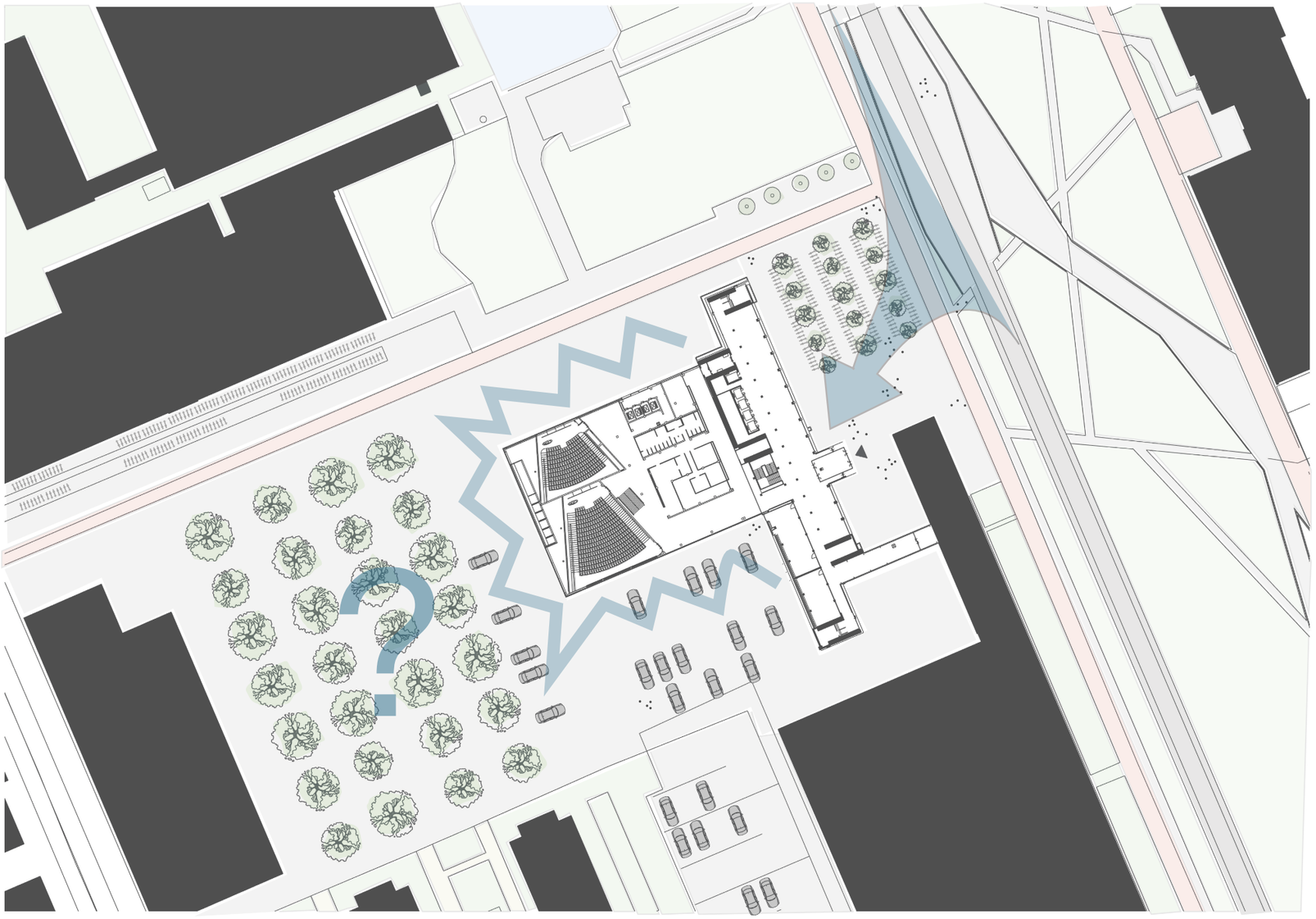
Situation | Goals for EWI low-rise

EWI Low-rise | Ground floor in context



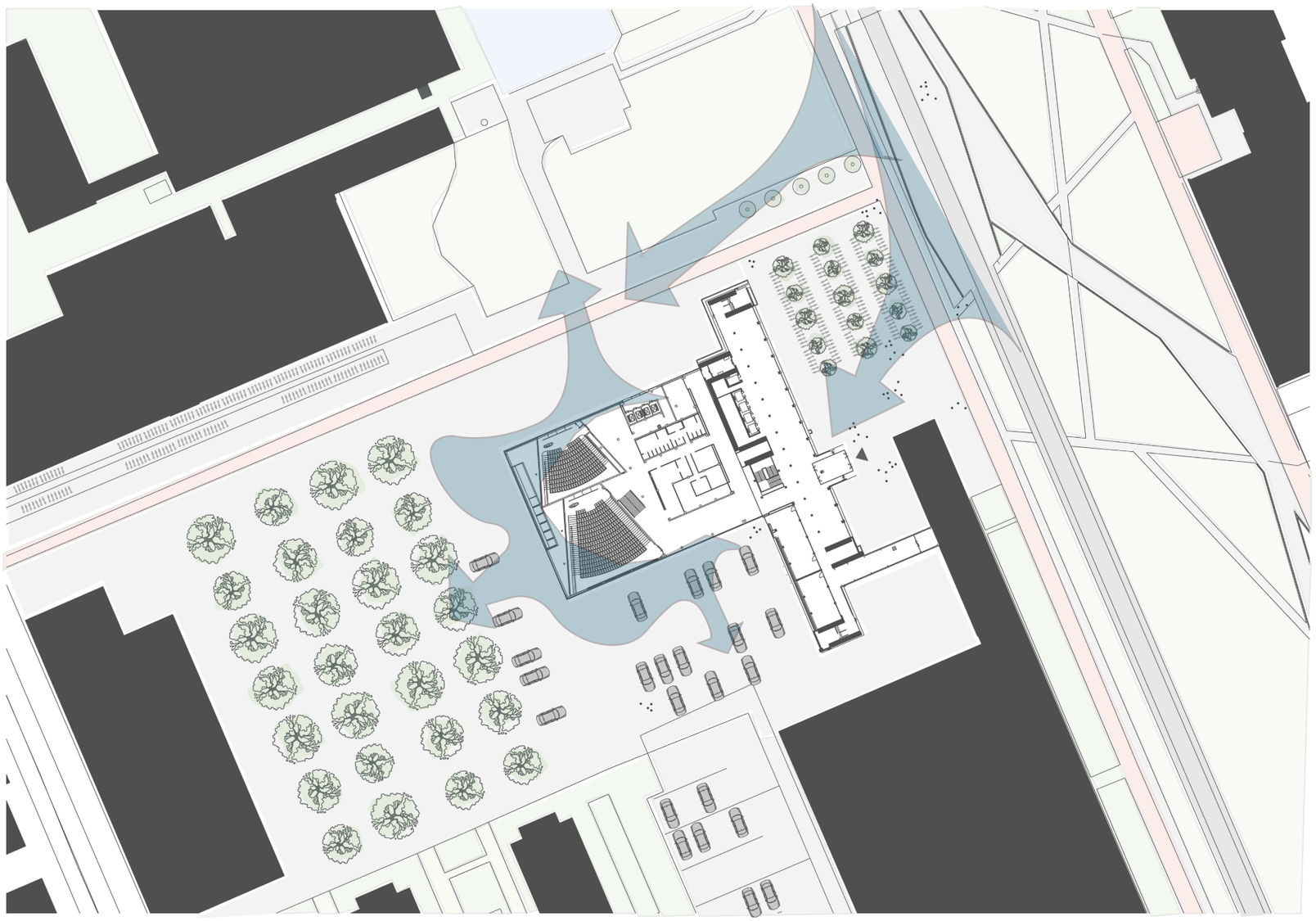
Situation | EWI low-rise context in current ground floor plan

EWI Low-rise | Ground floor in context



Situation | One predominant attractor while the rest of the building repels the car infested context

EWI Low-rise | Ground floor in context

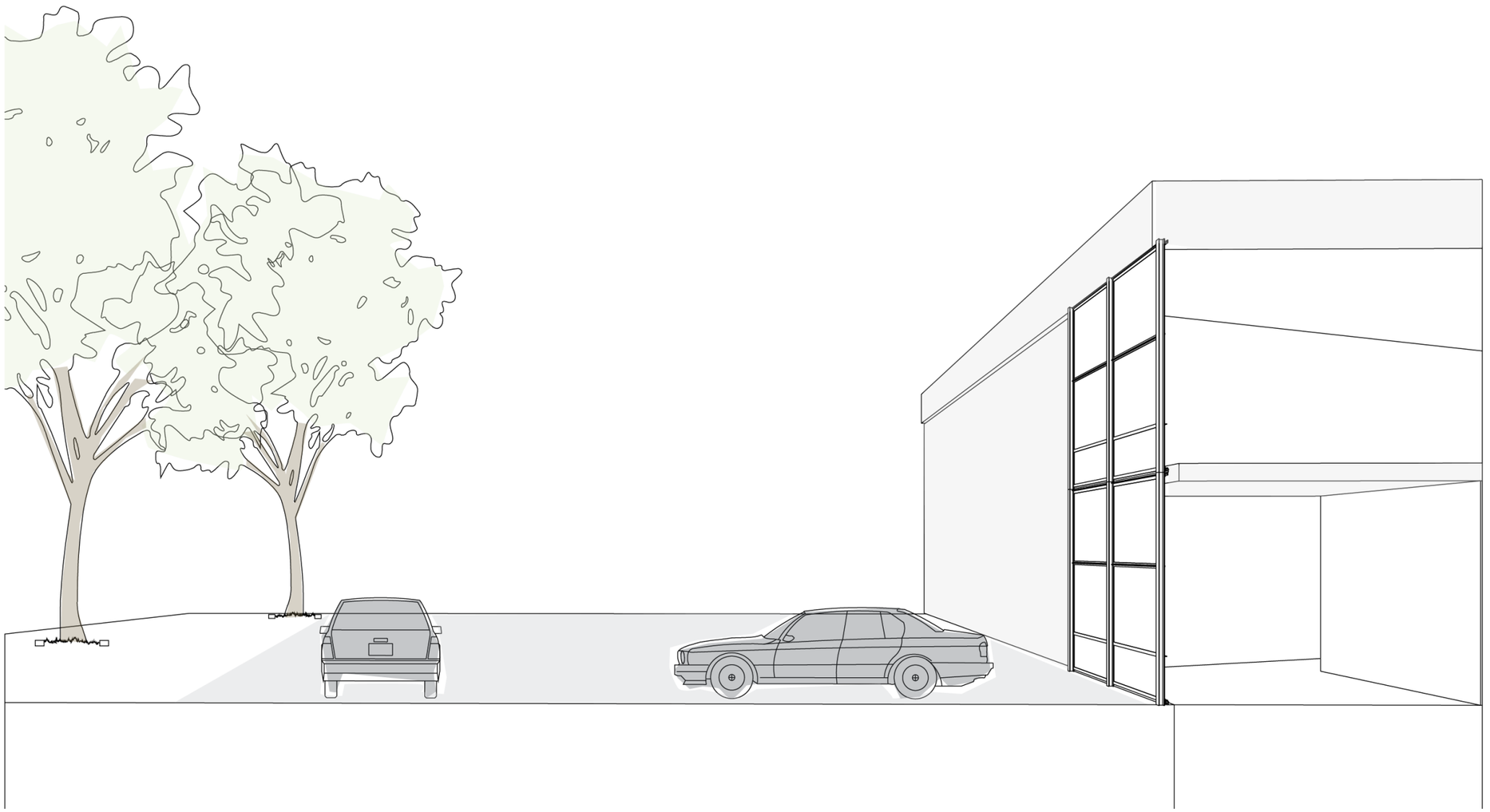


Situation | EWI as a heart of the campus meaning the building has to reach out into its surroundings

EWI Low-rise | Ground floor in context

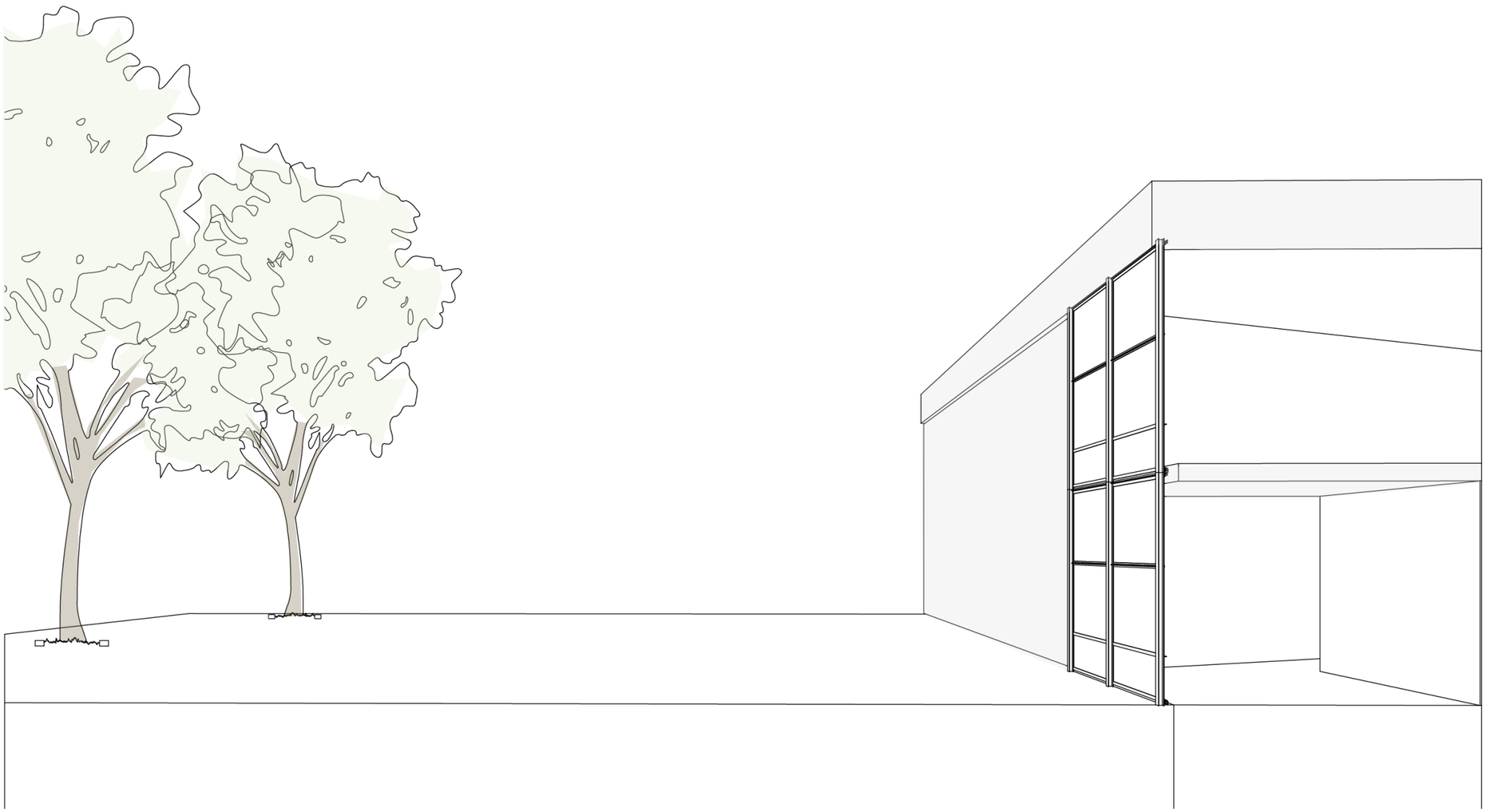
Situation | Qualities of the context

EWI Low-rise | Extension construction sequence



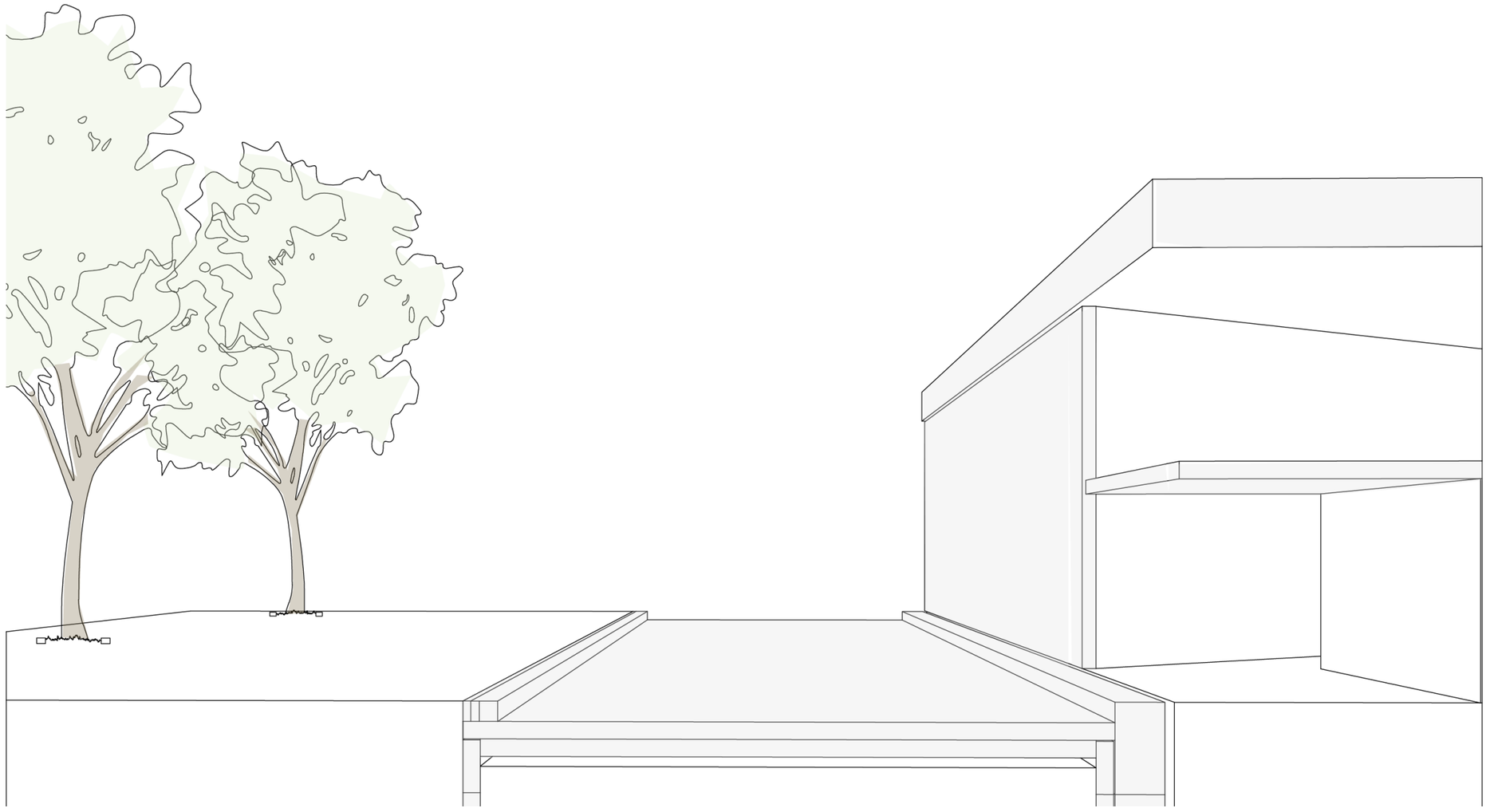
Step 0 | EWI low-rise current situation

EWI Low-rise | Extension construction sequence



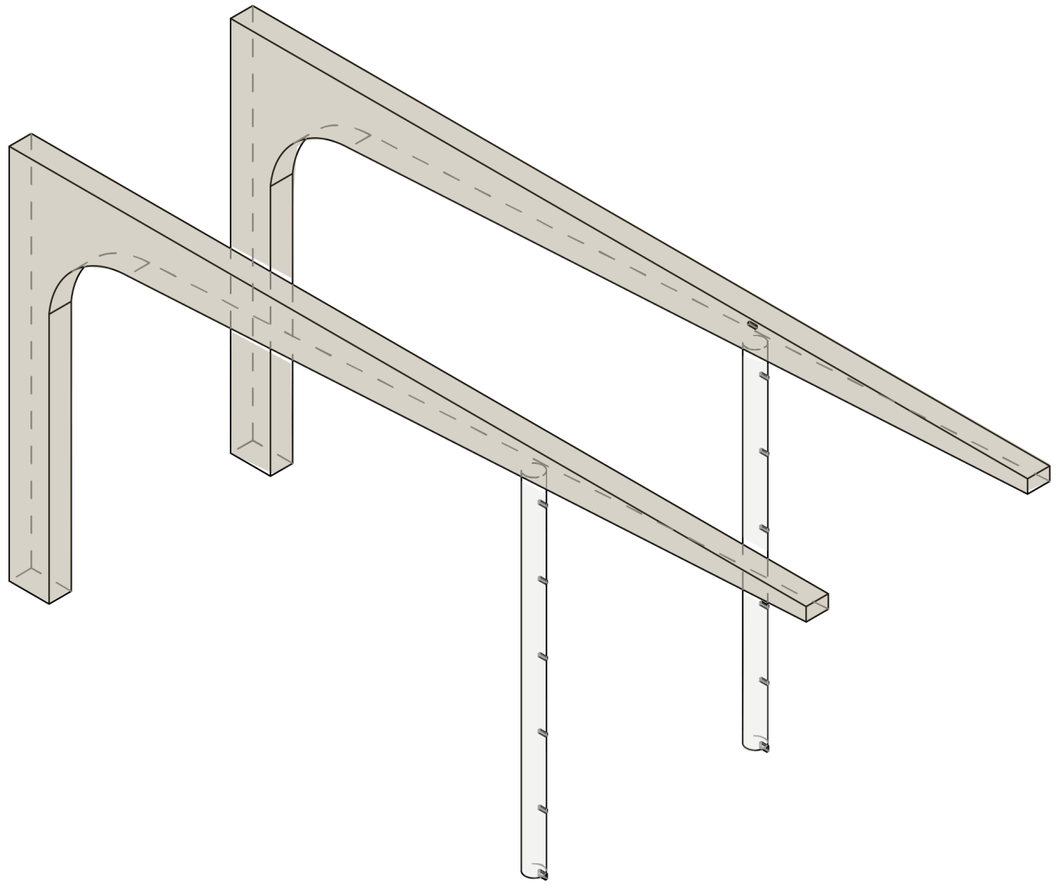
Step 1 | Remove car infested infrastructure

EWI Low-rise | Extension construction sequence



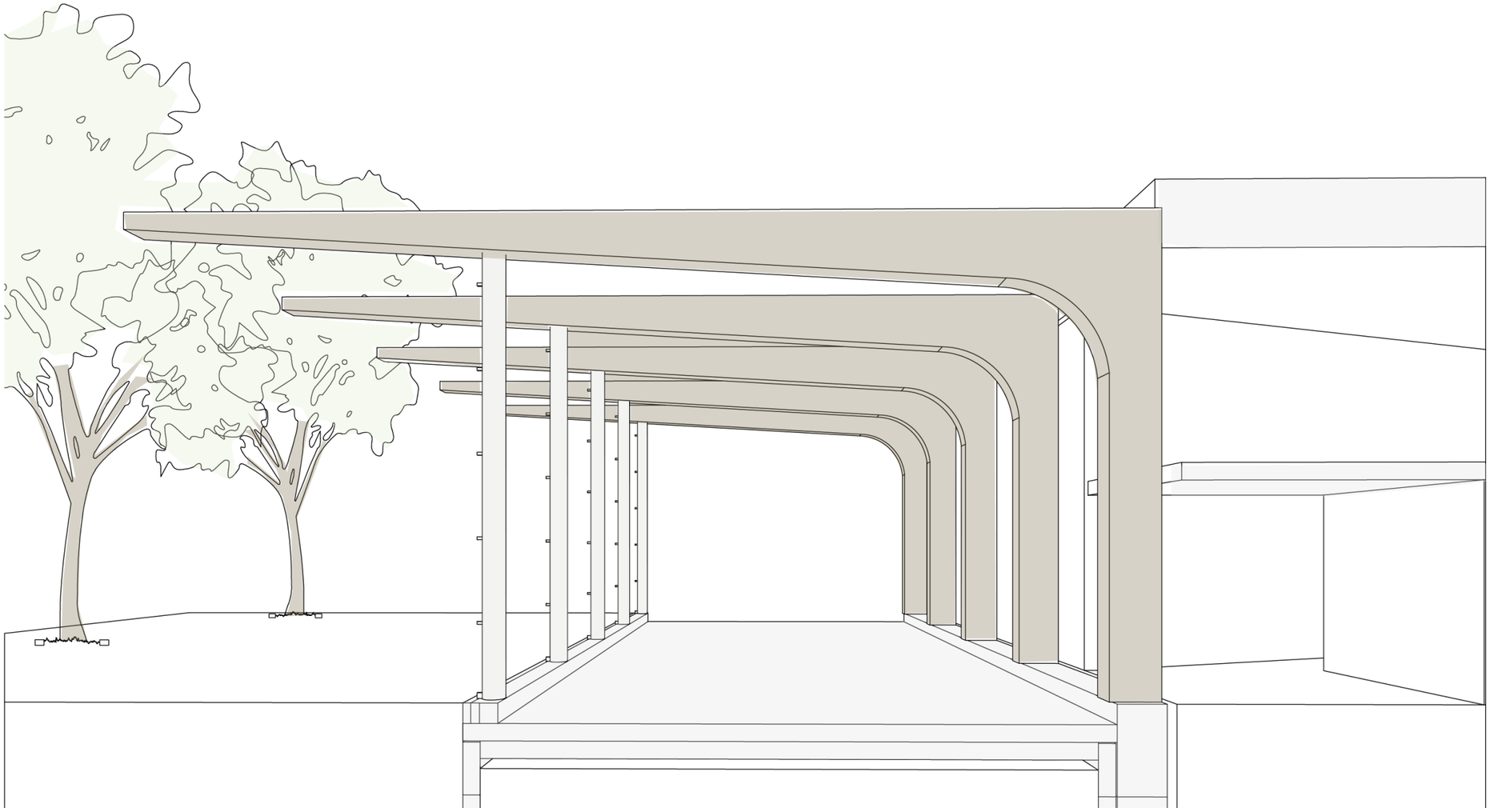
Step 2 | Create new adjacent foundation

EWI Low-rise | Extension construction sequence



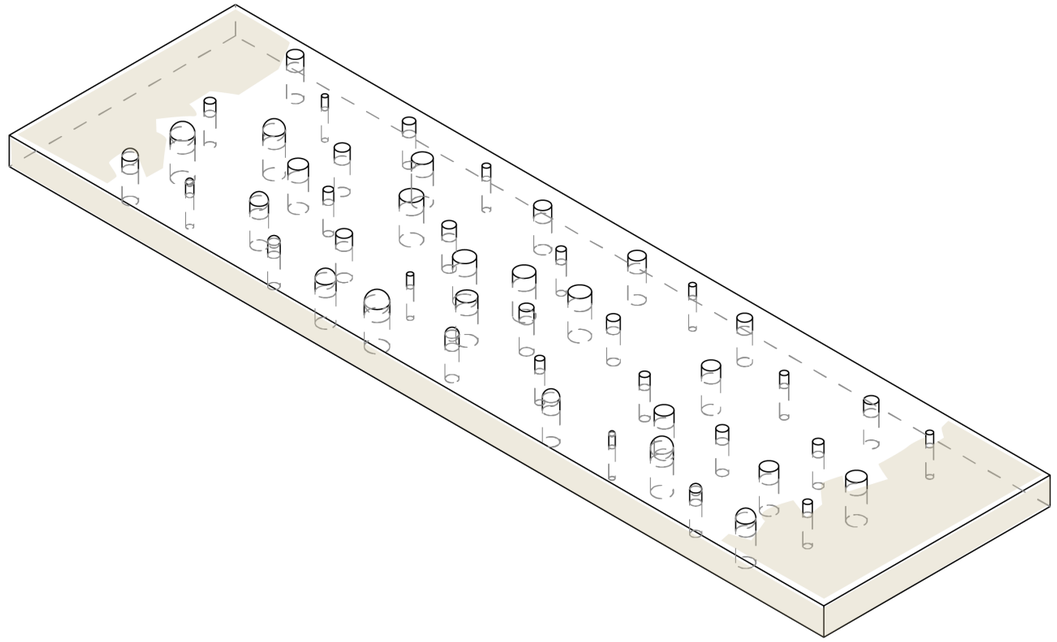
Step 3 Elements | Connect to context as trees / forrest area inspires construction design

EWI Low-rise | Extension construction sequence



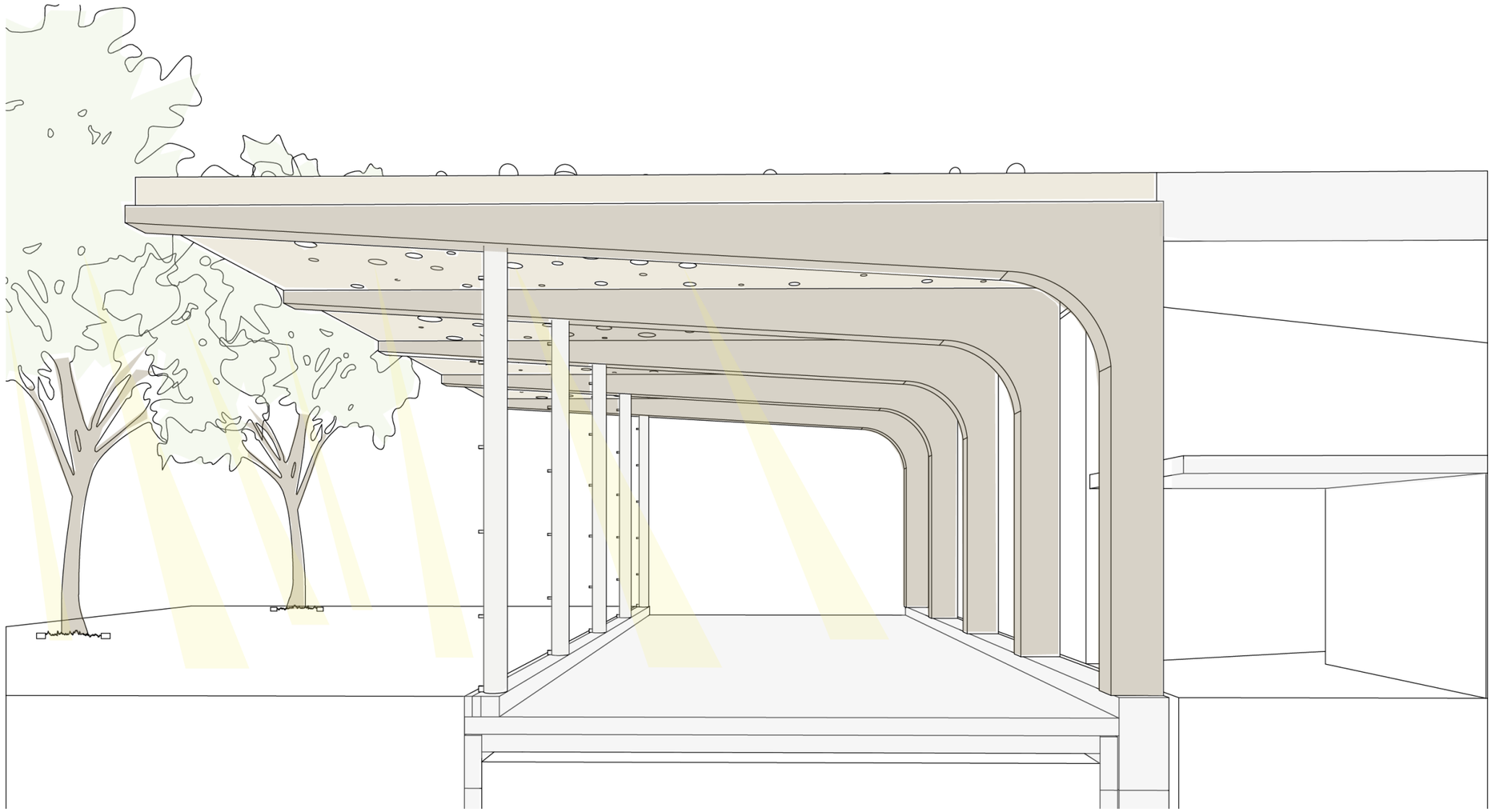
Step 3 | Place the new construction

EWI Low-rise | Extension construction sequence



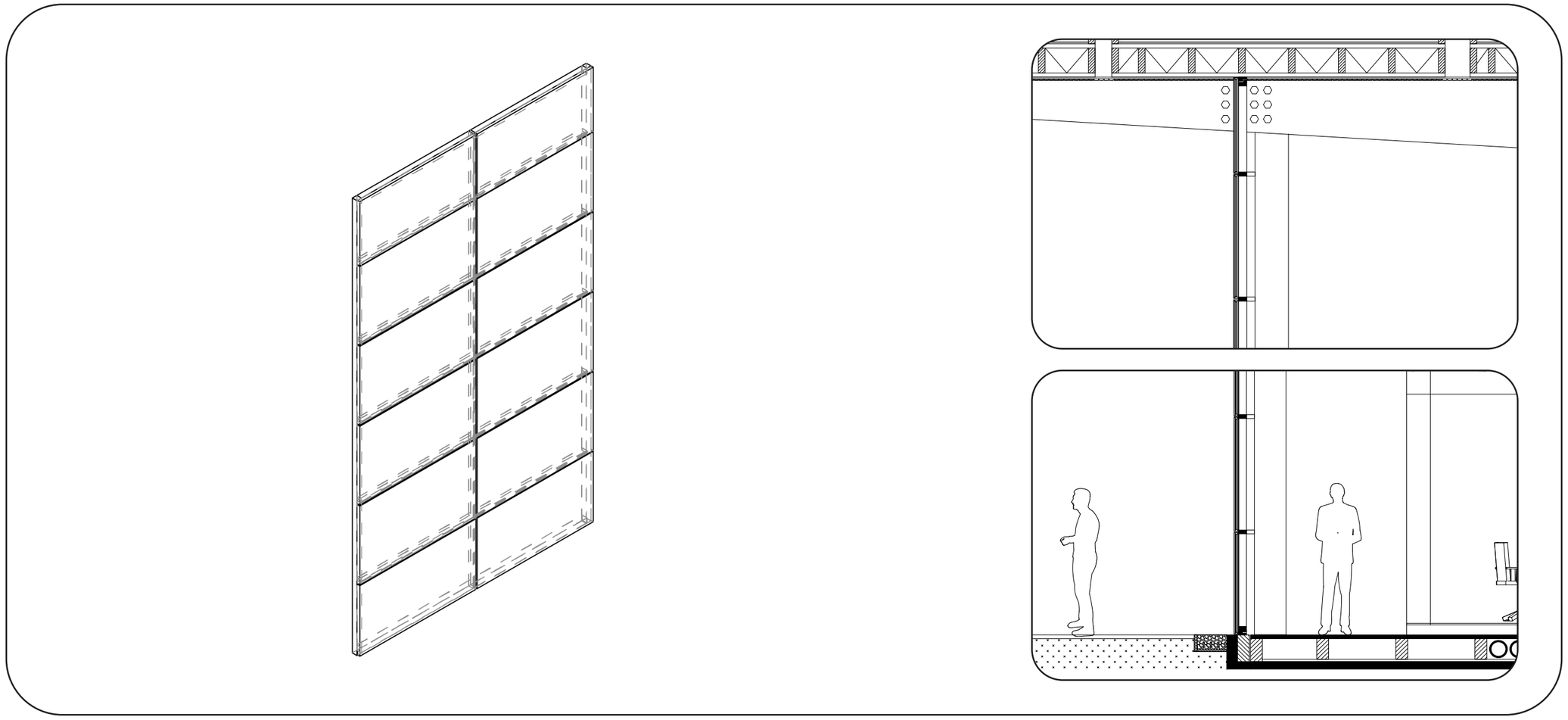
Step 4 Elements | Connect to context as light through the leaves inspires roof design

EWI Low-rise | Extension construction sequence



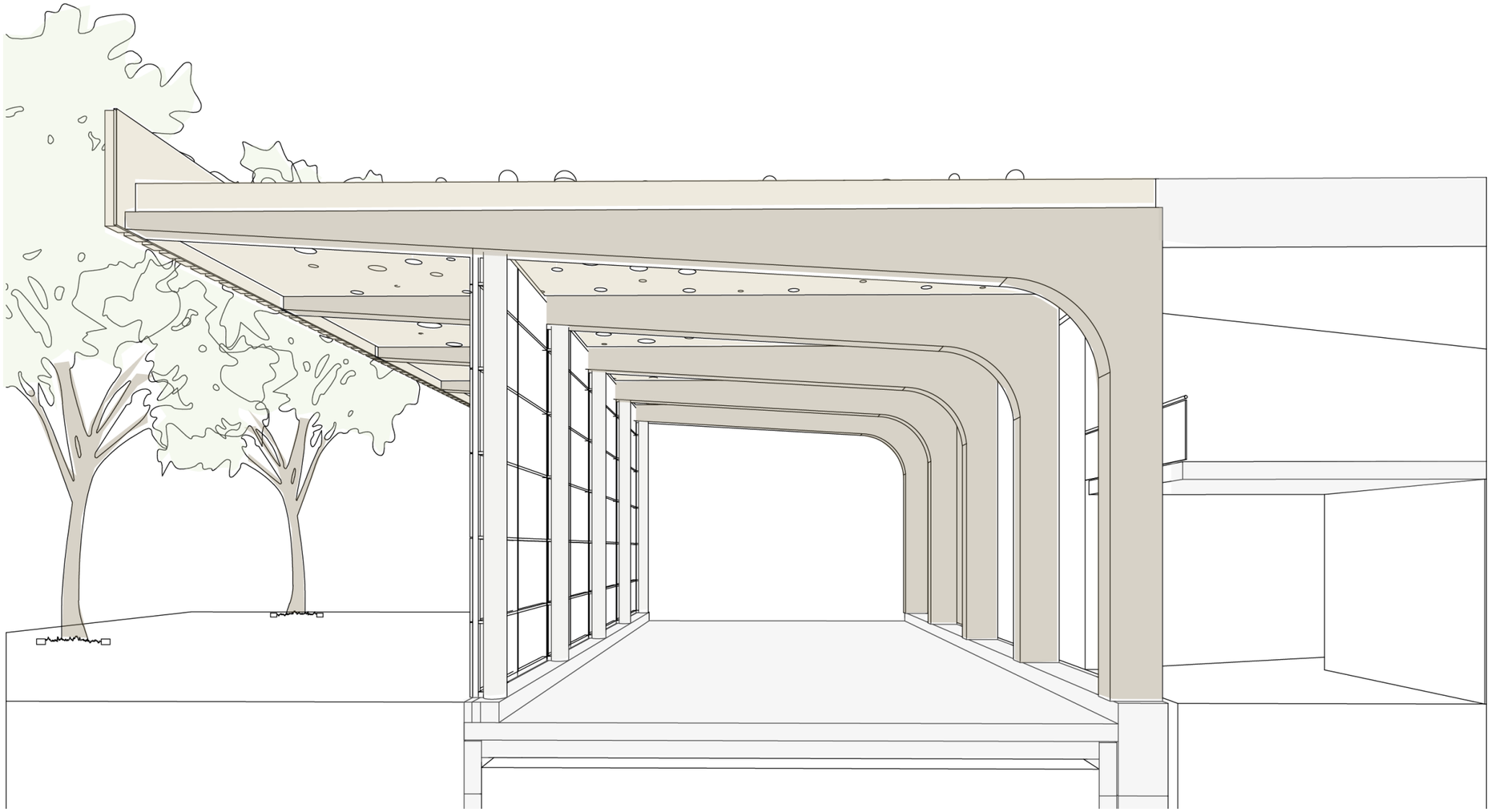
Step 4 | Lower roof elements onto the construction

EWI Low-rise | Extension construction sequence



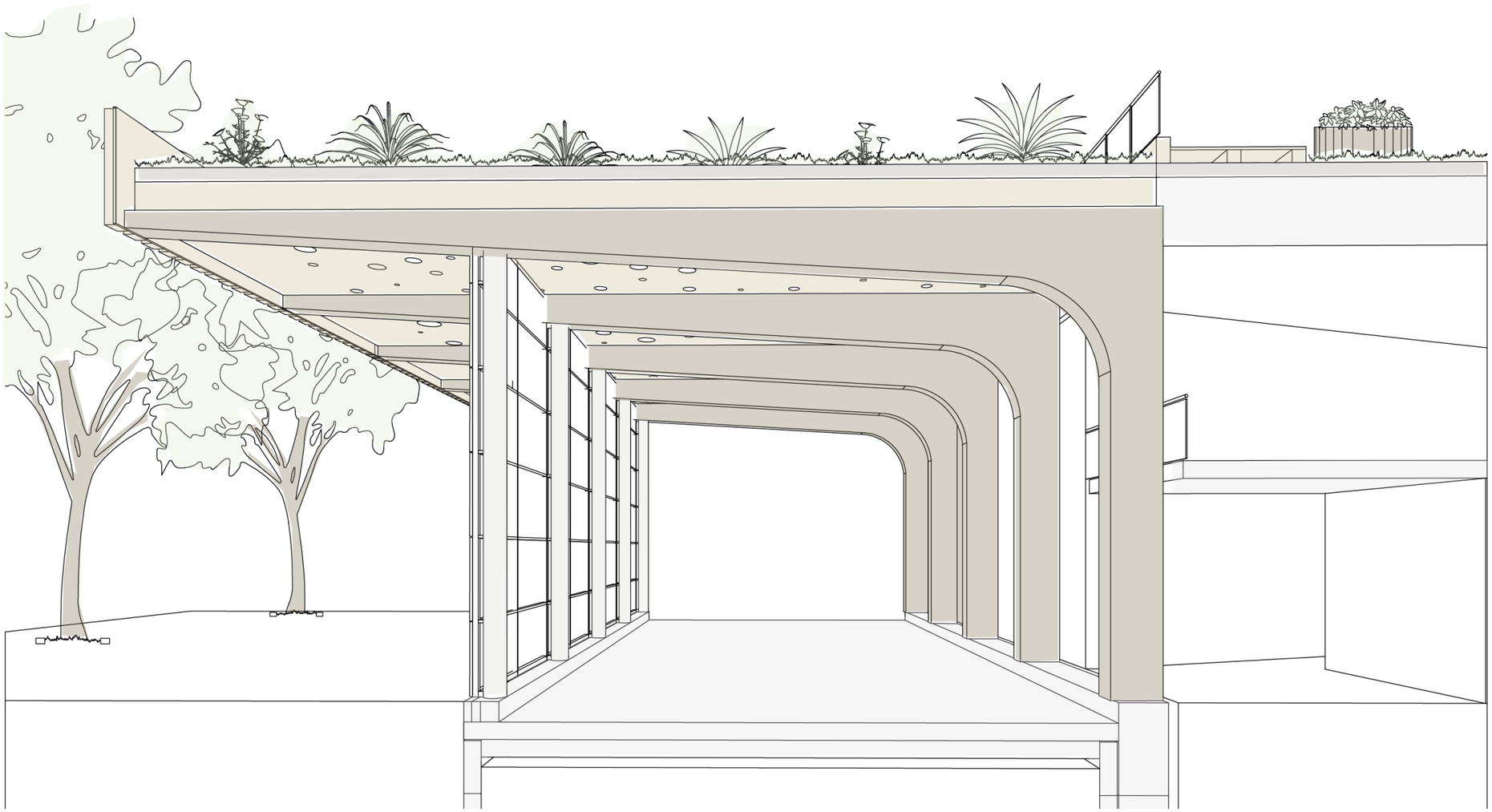
Step 5 Elements | Minimalizing the obstacles between inside and outside by glass curtain wall

EWI Low-rise | Extension construction sequence



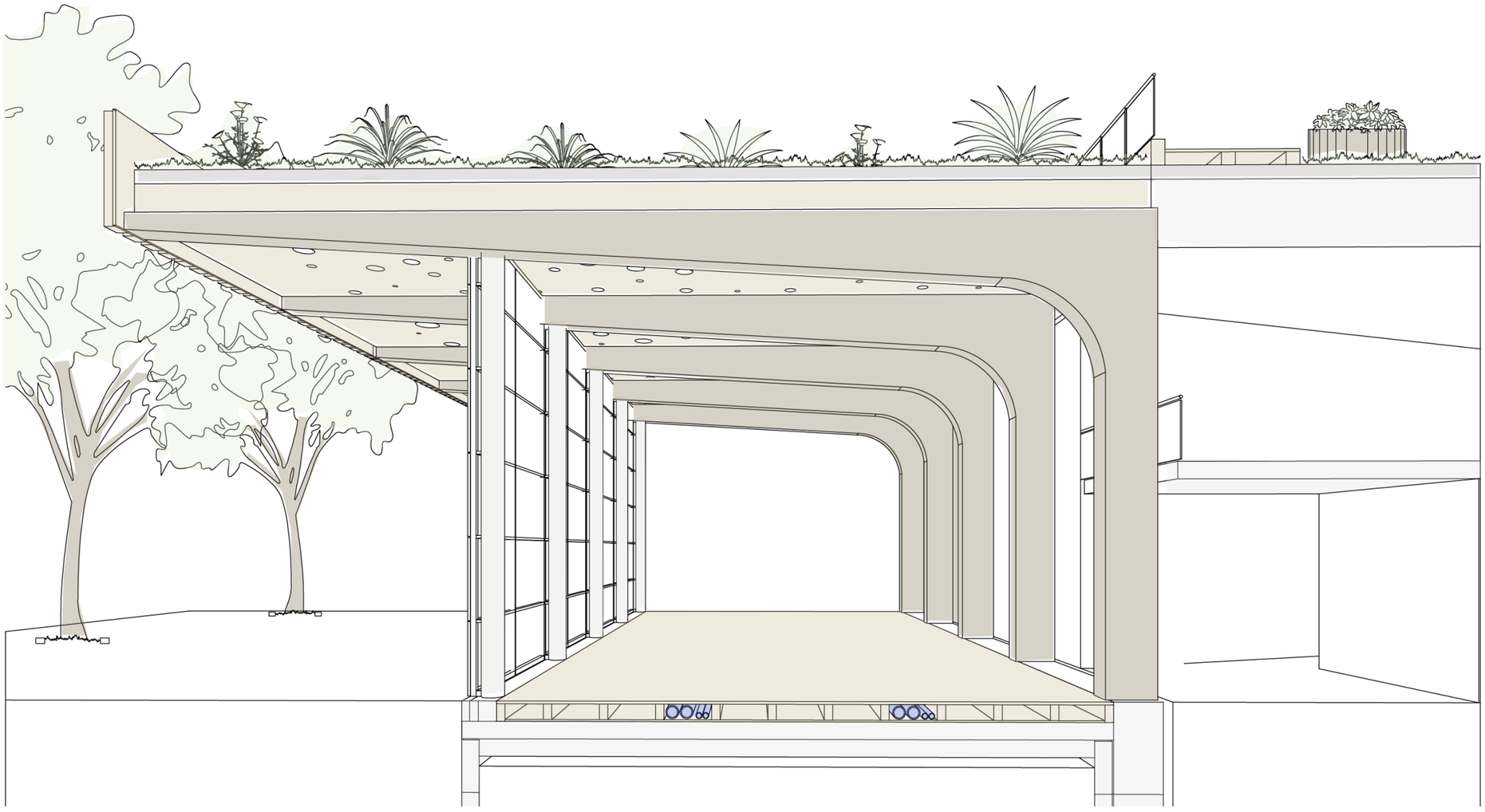
Step 5 | Install the glass curtain wall

EWI Low-rise | Extension construction sequence



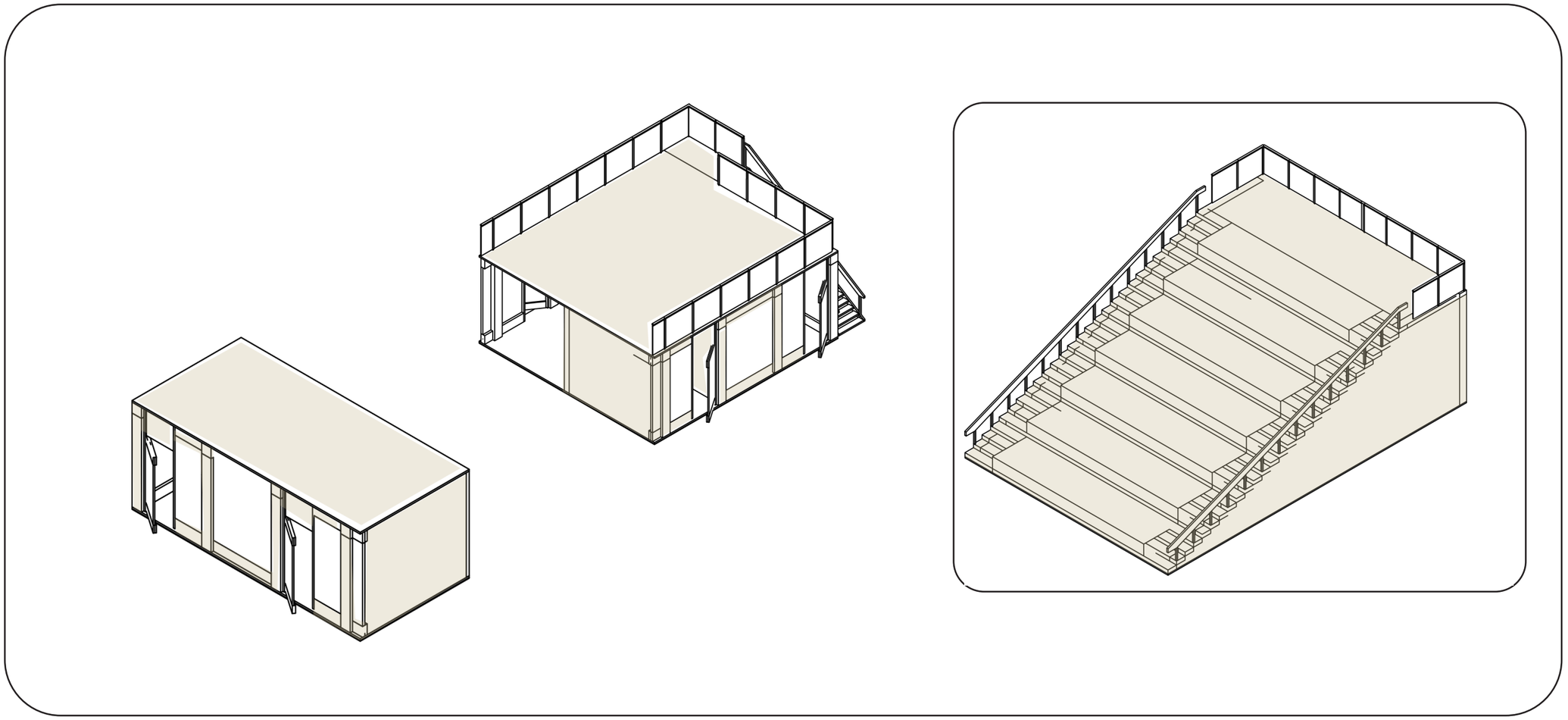
Step 6 | Add soil, plants and decking for the green roof and roof terrace

EWI Low-rise | Extension construction sequence



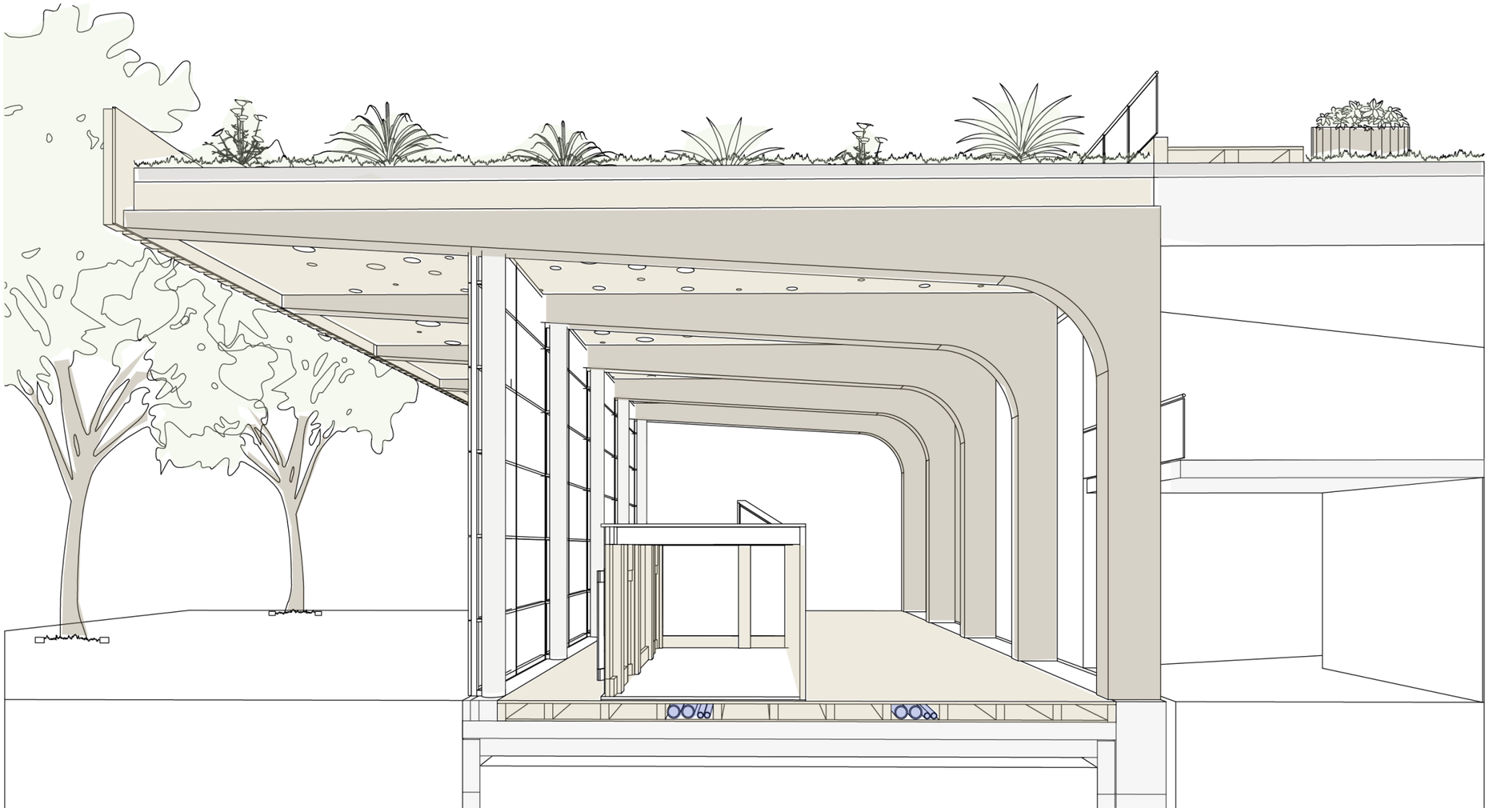
Step 7 | Install the raised floor system and flooring

EWI Low-rise | Extension construction sequence



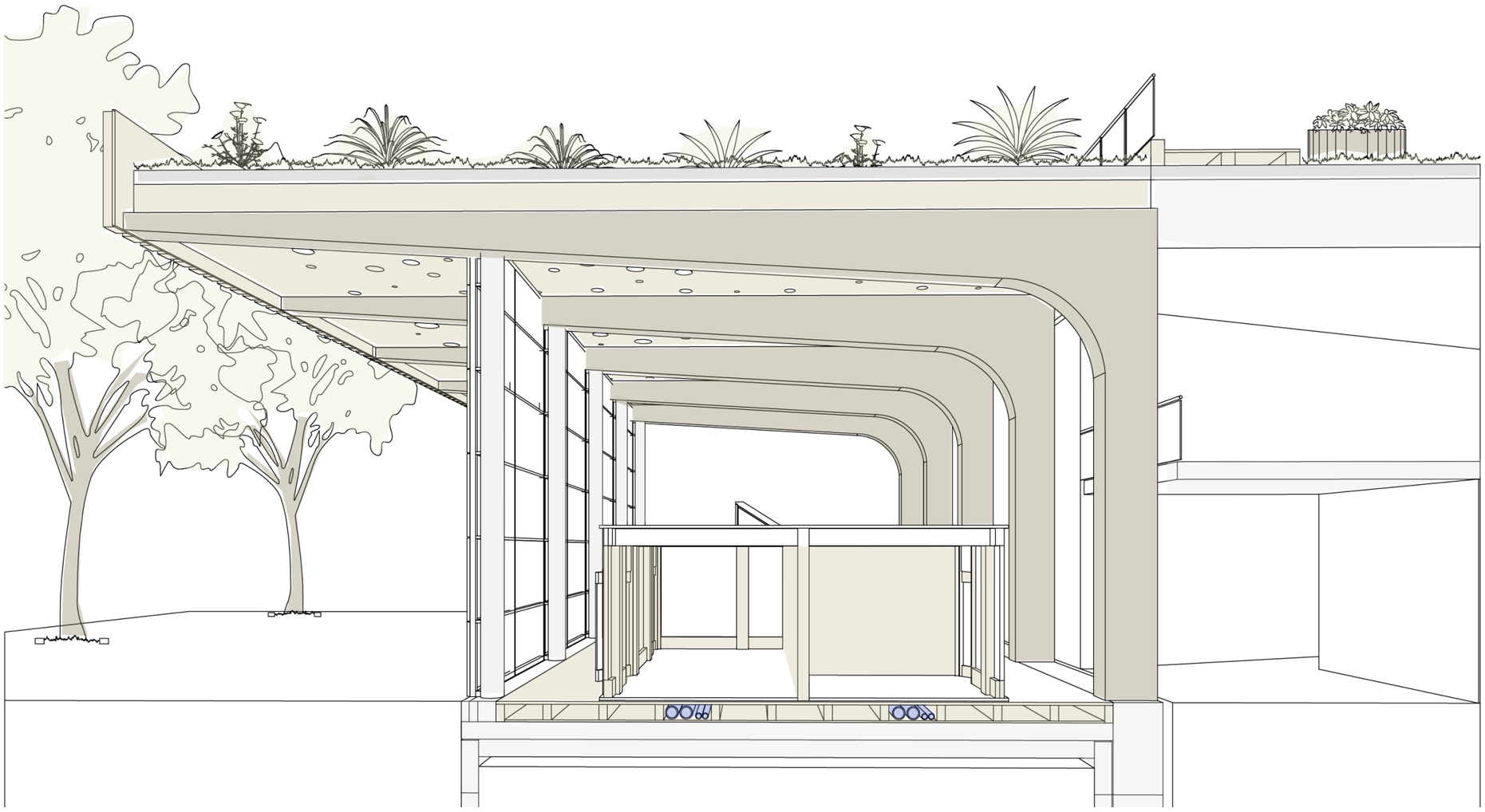
Step 8 Elements | Demountable interior space elements for adaptable and future proof education (Infill)

EWI Low-rise | Extension construction sequence



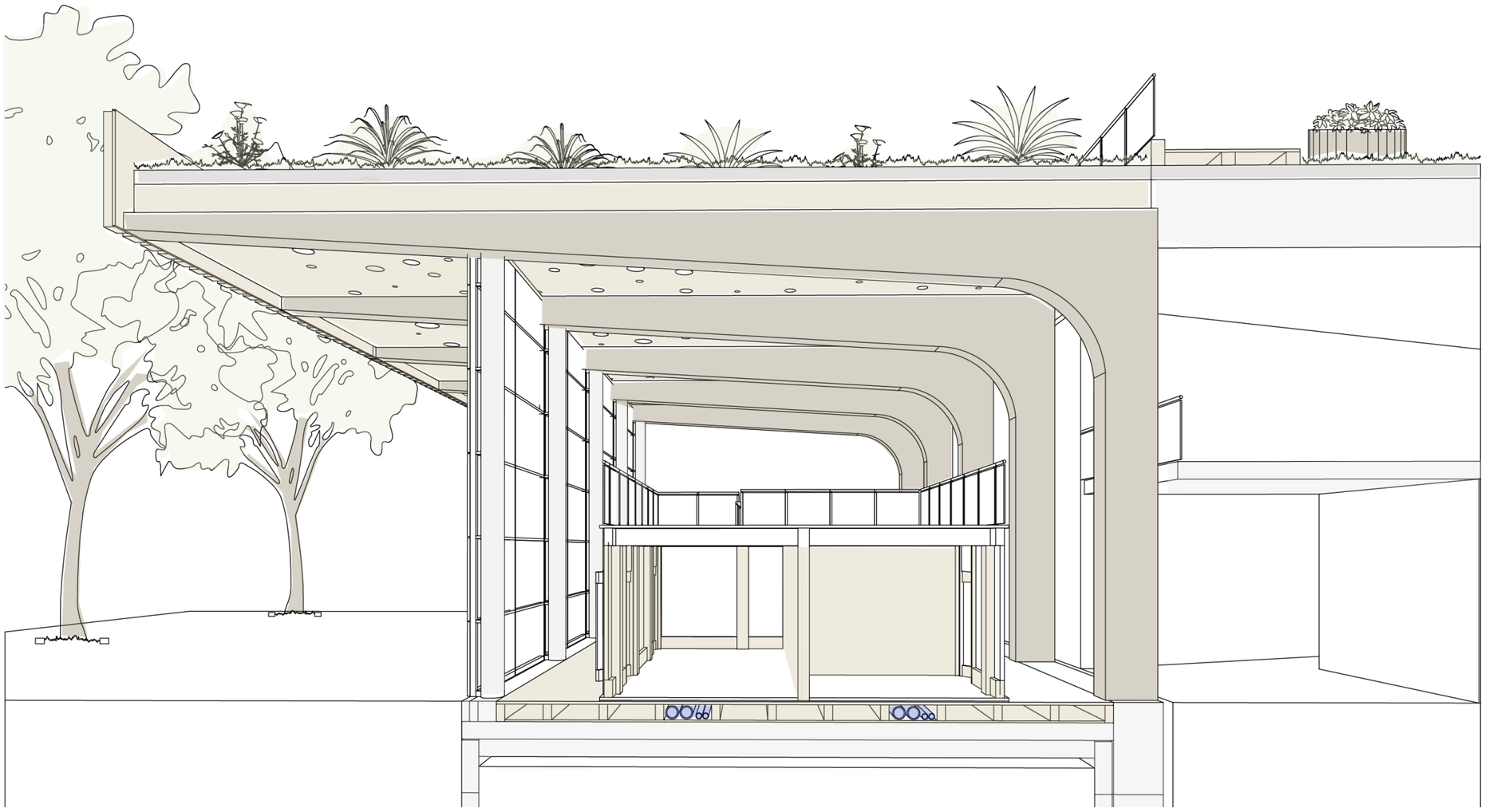
Step 8 | Place the demountable interior space elements and connect them to the services (if needed)

EWI Low-rise | Extension construction sequence



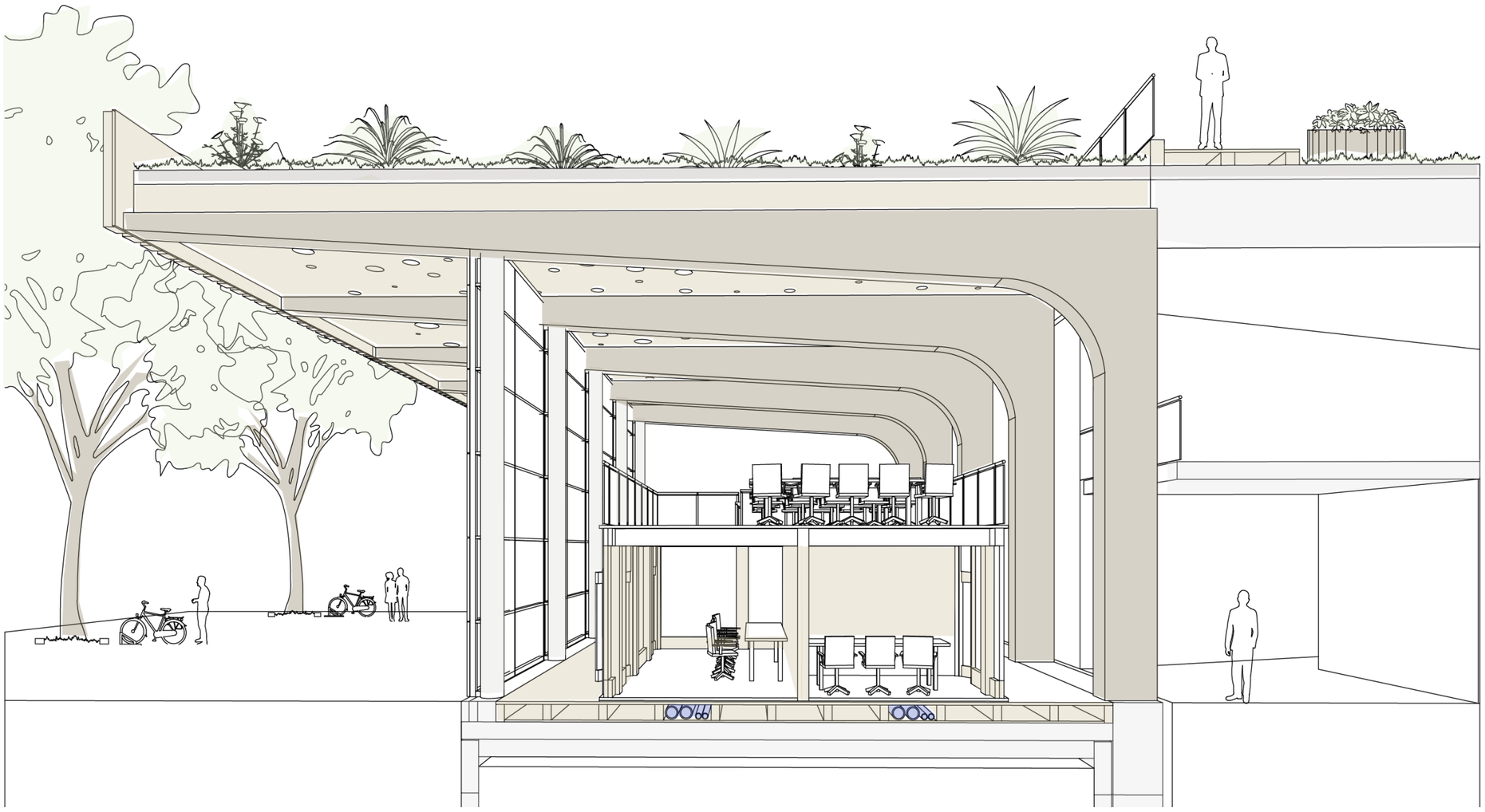
Step 9 | Connect the interior space elements

EWI Low-rise | Extension construction sequence



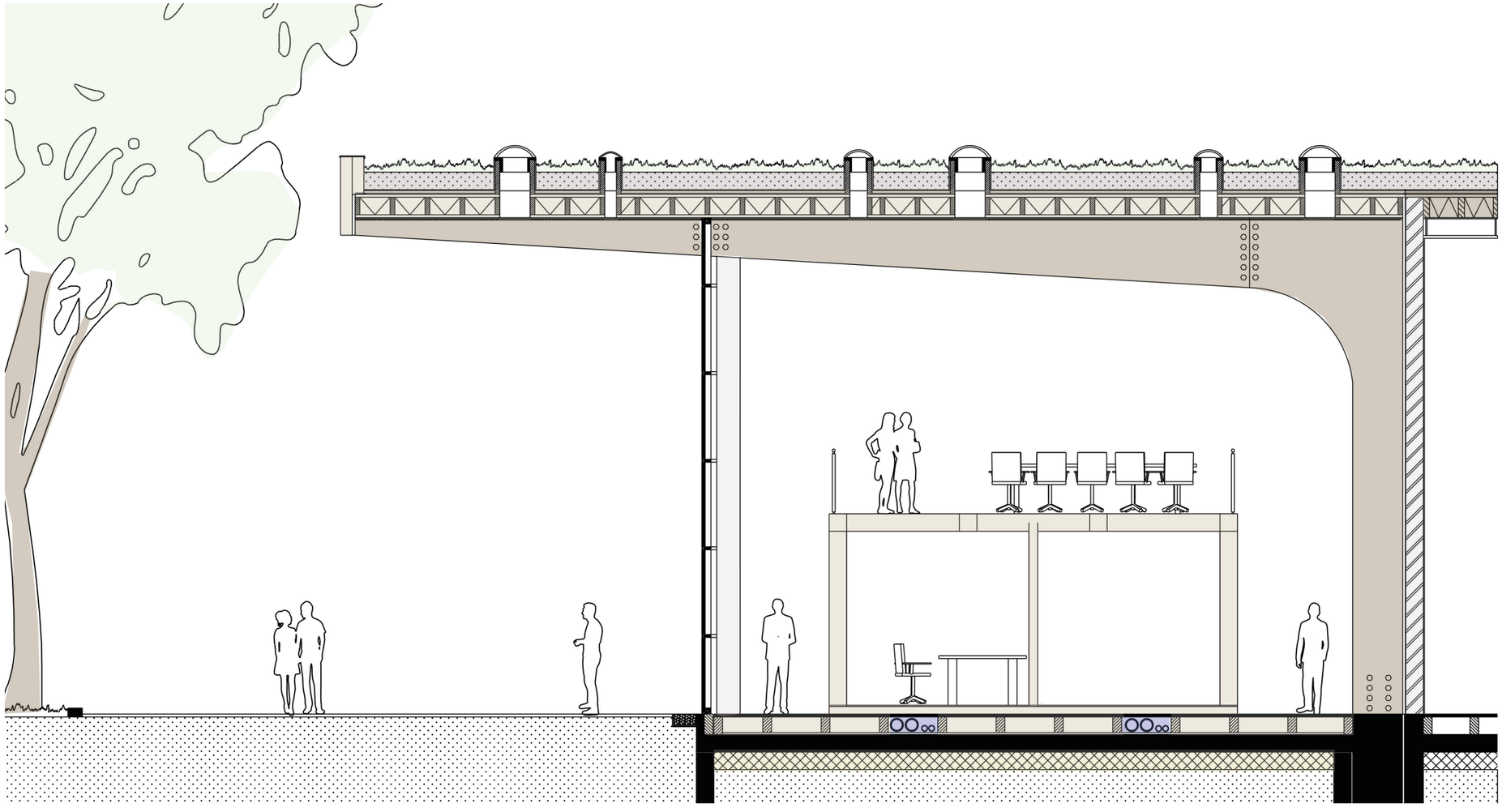
Step 10 | Finish installing interior space elements by placing fences

EWI Low-rise | Extension construction sequence



Finished result | Modular and prefabricated building extension with an adaptable infill system

EWI Low-rise | Extension



Section | Connection between building and context and as an educational landscape under one roof

EWI Low-rise | Visual representation

Render Outside | Construction from within to outside strenghtening the connection with its context

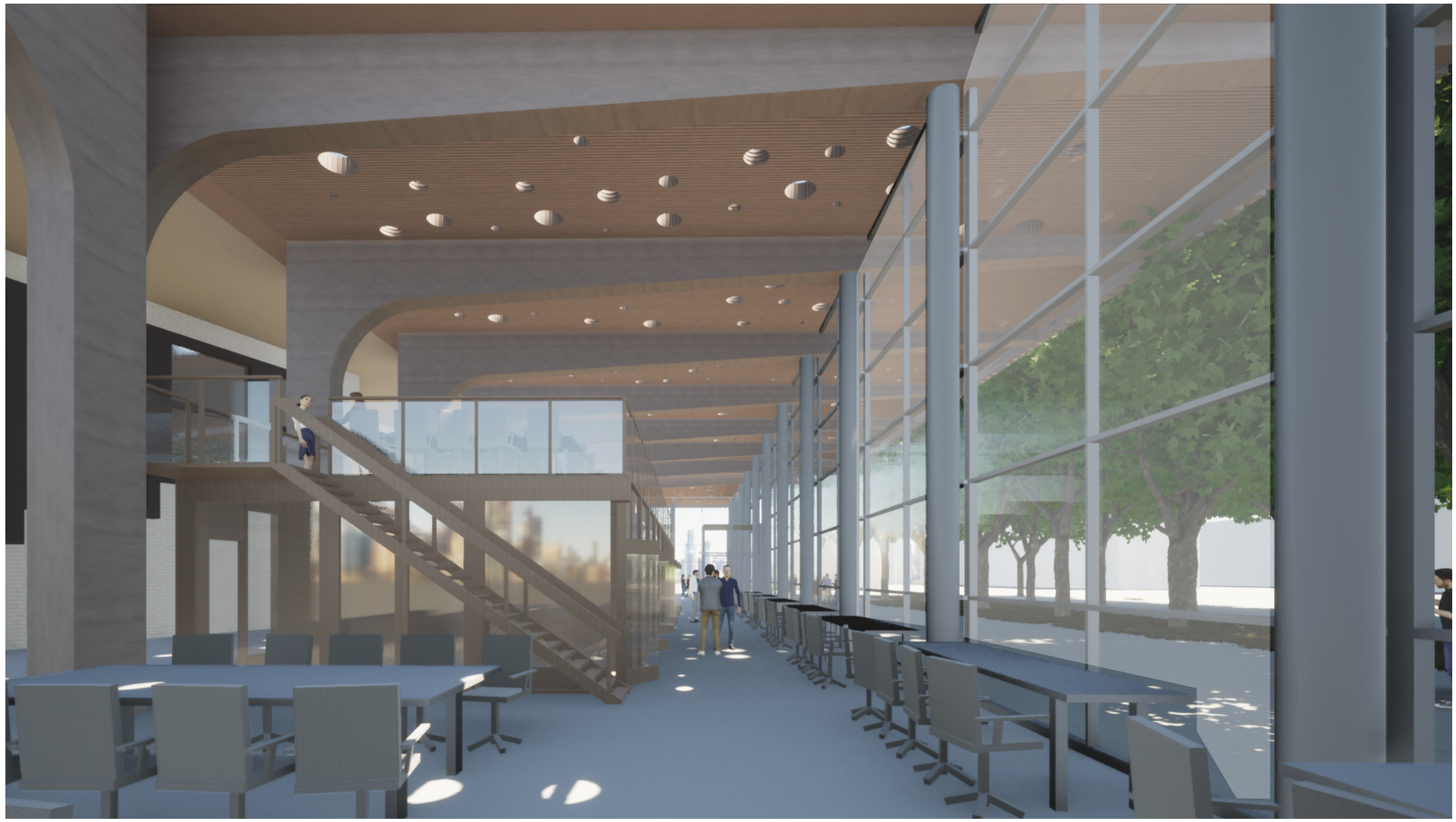
EWI Low-rise | Visual representation

Render Outside | Perforated roof functions as a roof of leaves allowing some lightrays to get through

EWI Low-rise | Visual representation

Render inside | Open building creates space for elements to dictate the use of the campus building

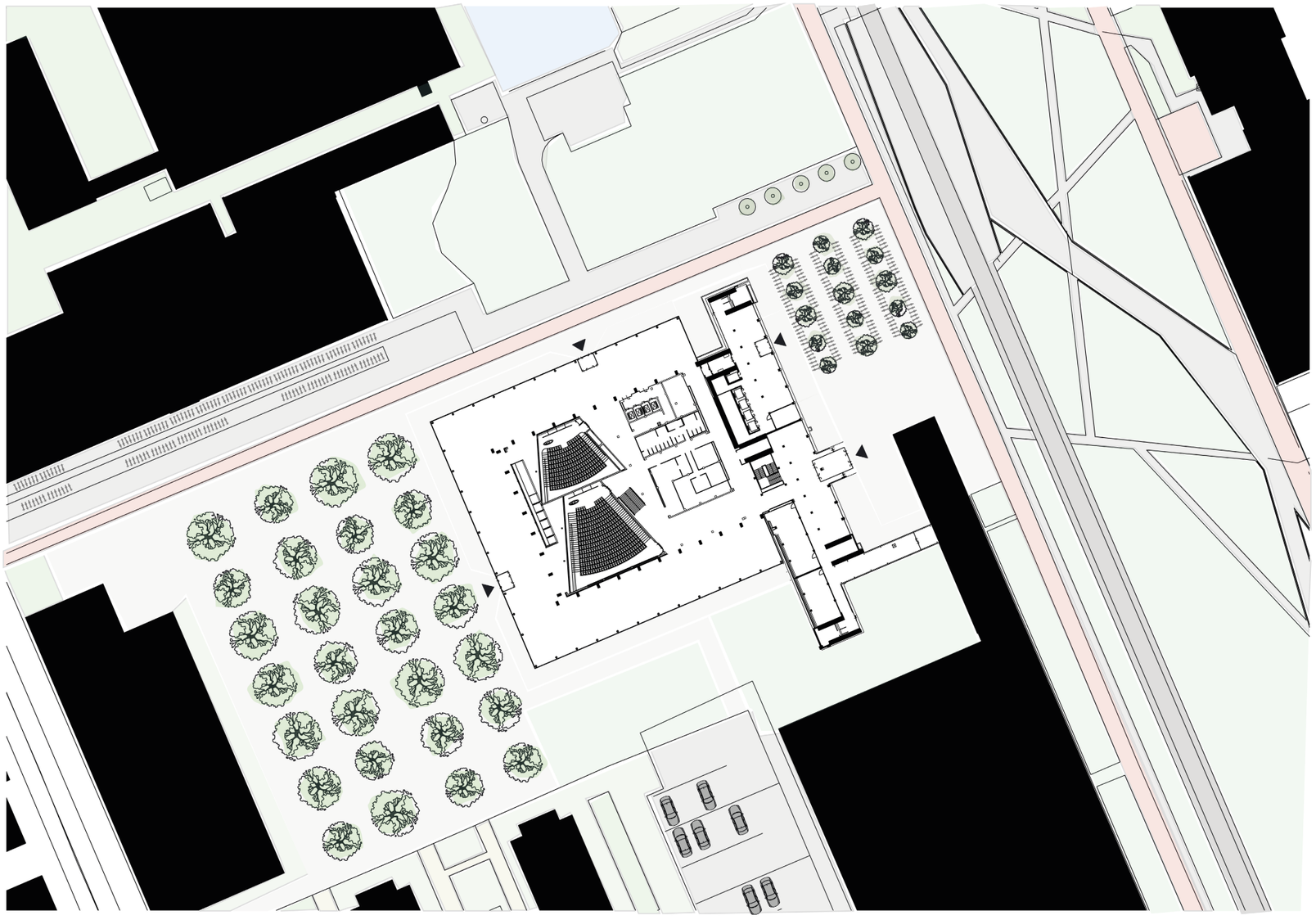
EWI Low-rise | Visual representation



Render inside | Educational landscape underneath a one roof (of leaves) creating (self) study spaces

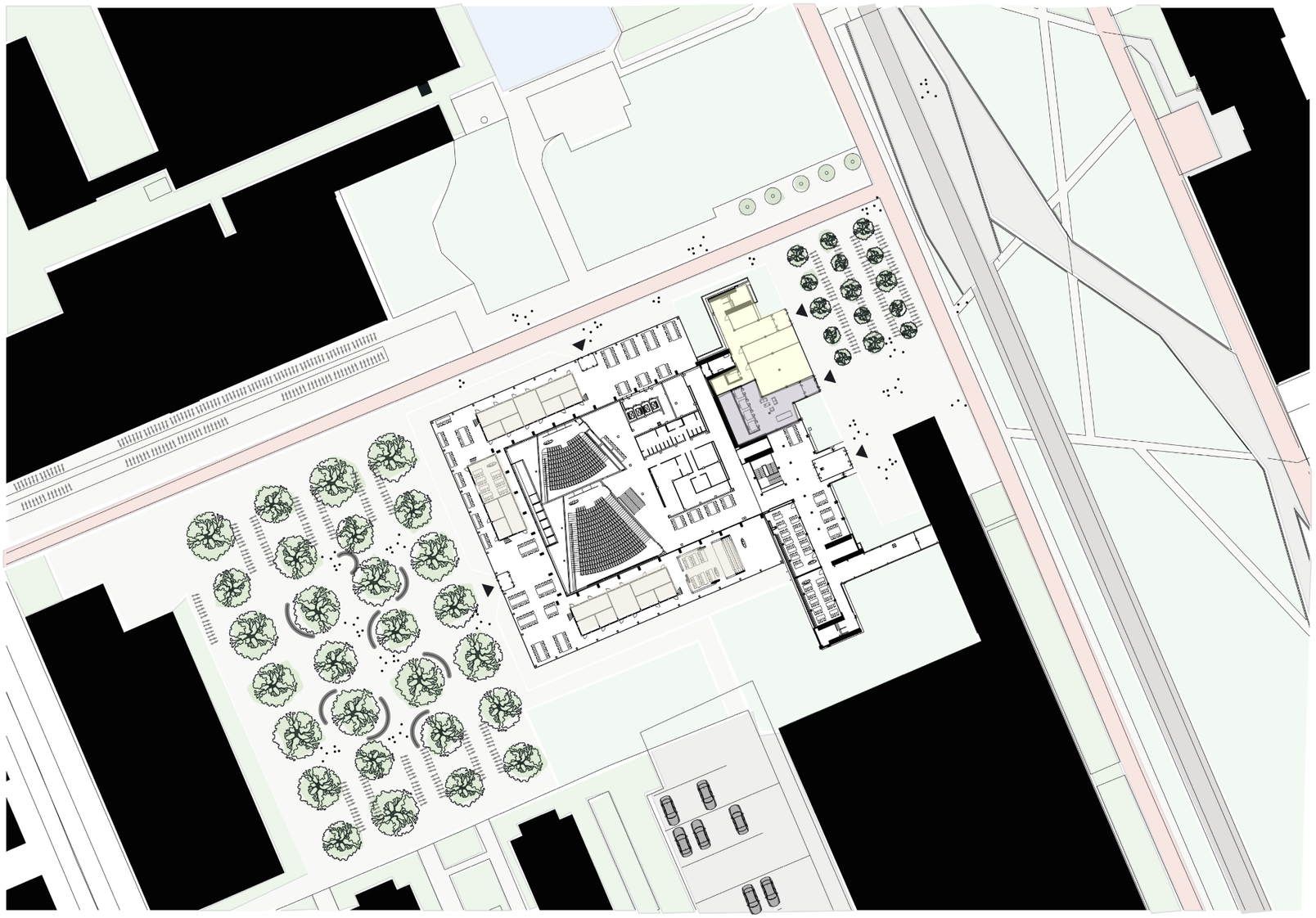
Render inside | The lightrays comming in during the day change the way the interior space is percieved

EWI Low-rise | Ground floor in context



Situation | Entrances (education & living) facing towards the surrounding area

EWI Low-rise | Ground floor in context



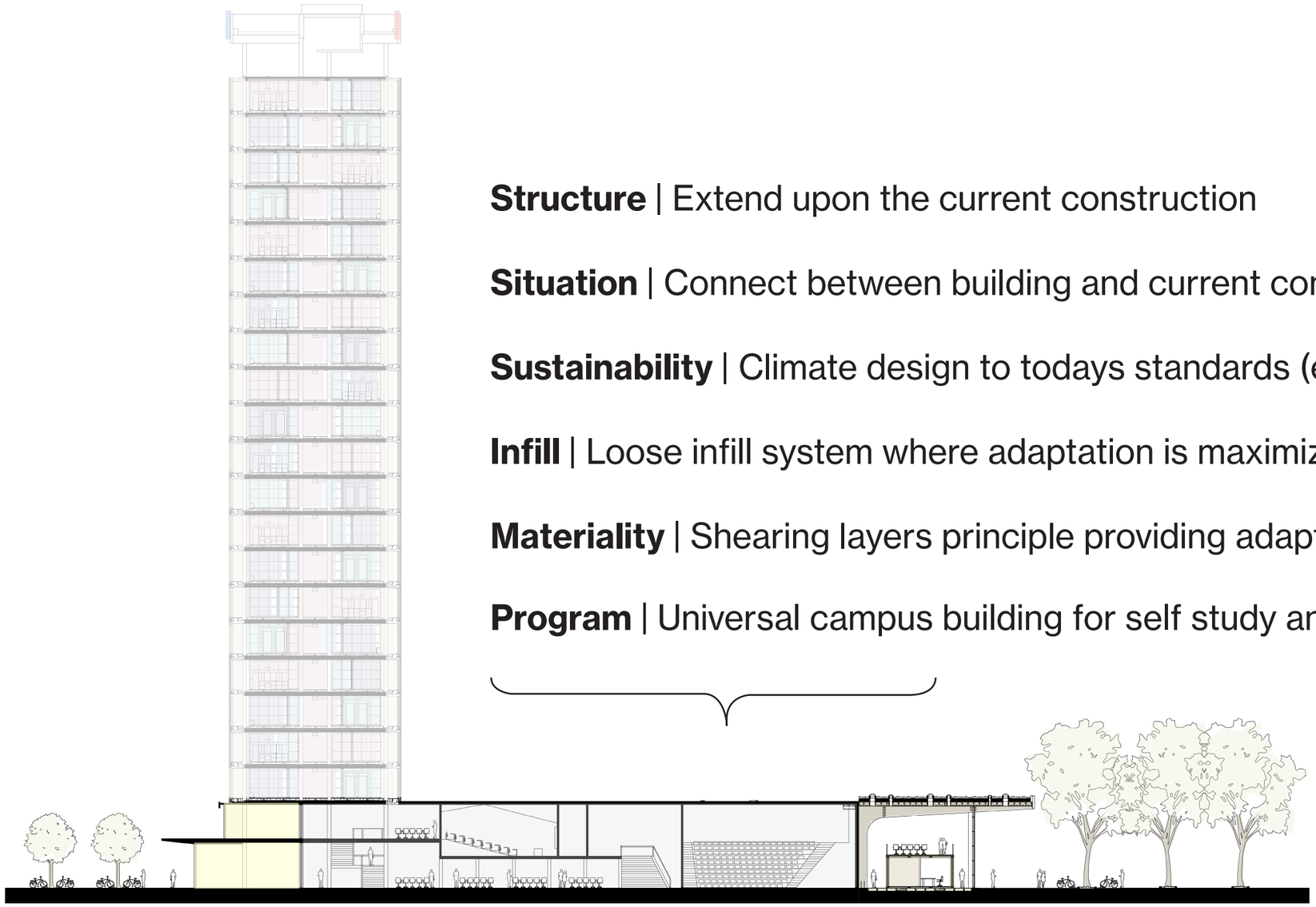
Situation | Extended space creates possibilities for adaptability and thereby longevity

EWI Low-rise | Visual representation

Render Entrance | Improved EWI Mekelpark side connection between campus and building

Render Entrance | Front square as part of heritage which is referenced by low-rise extension

EWI | Section



Structure | Extend upon the current construction

Situation | Connect between building and current context

Sustainability | Climate design to todays standards (energy neutral)

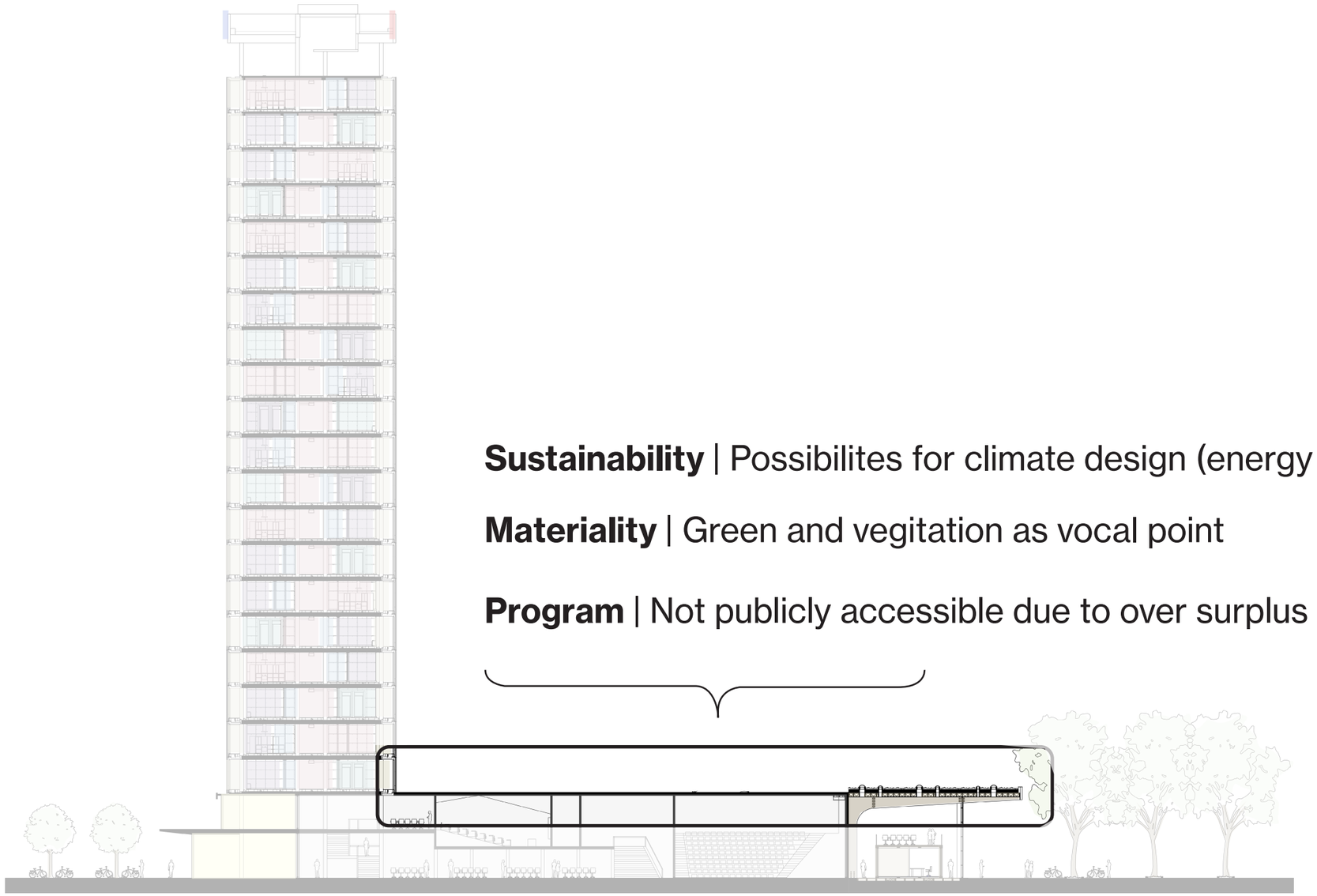
Infill | Loose infill system where adaptation is maximized

Materiality | Shearing layers principle providing adaption over time

Program | Universal campus building for self study and lectures

Situation | EWI low-rise achievements

EWI | Section



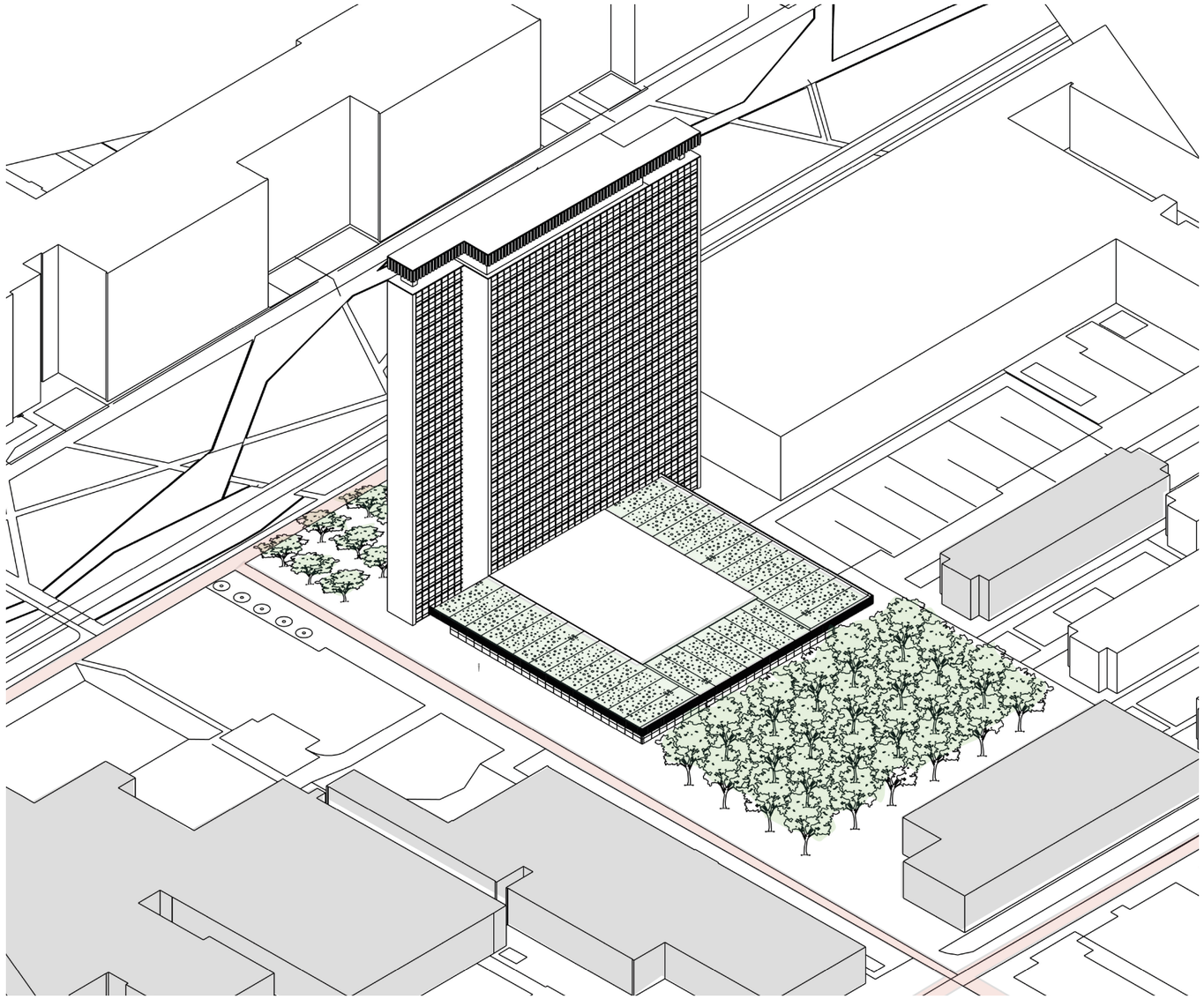
Sustainability | Possibilites for climate design (energy neutral)

Materiality | Green and vegitation as vocal point

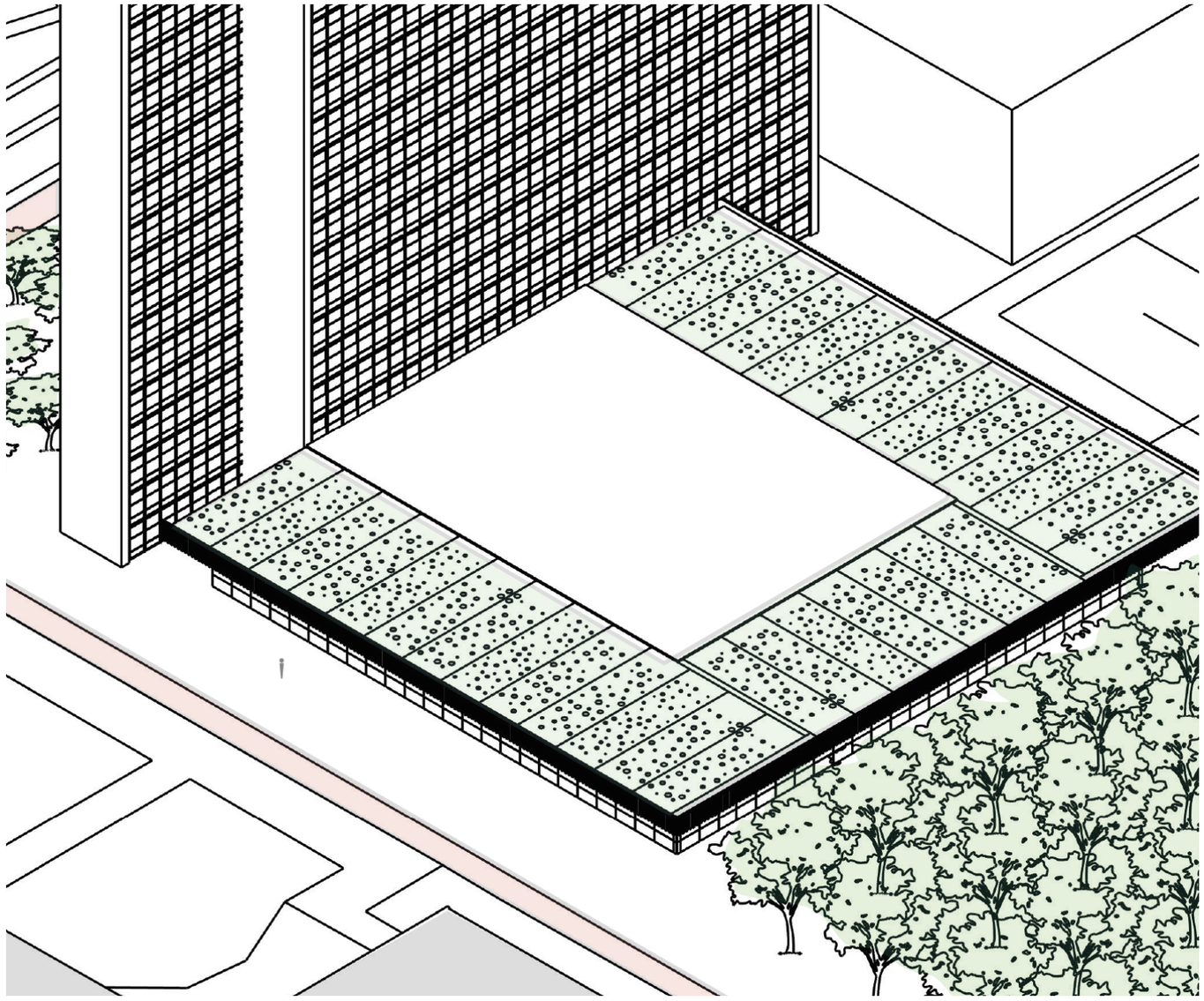
Program | Not publicly accessible due to over surplus

Situation | EWI low-rise roof goals

EWI Low-rise | Roof design

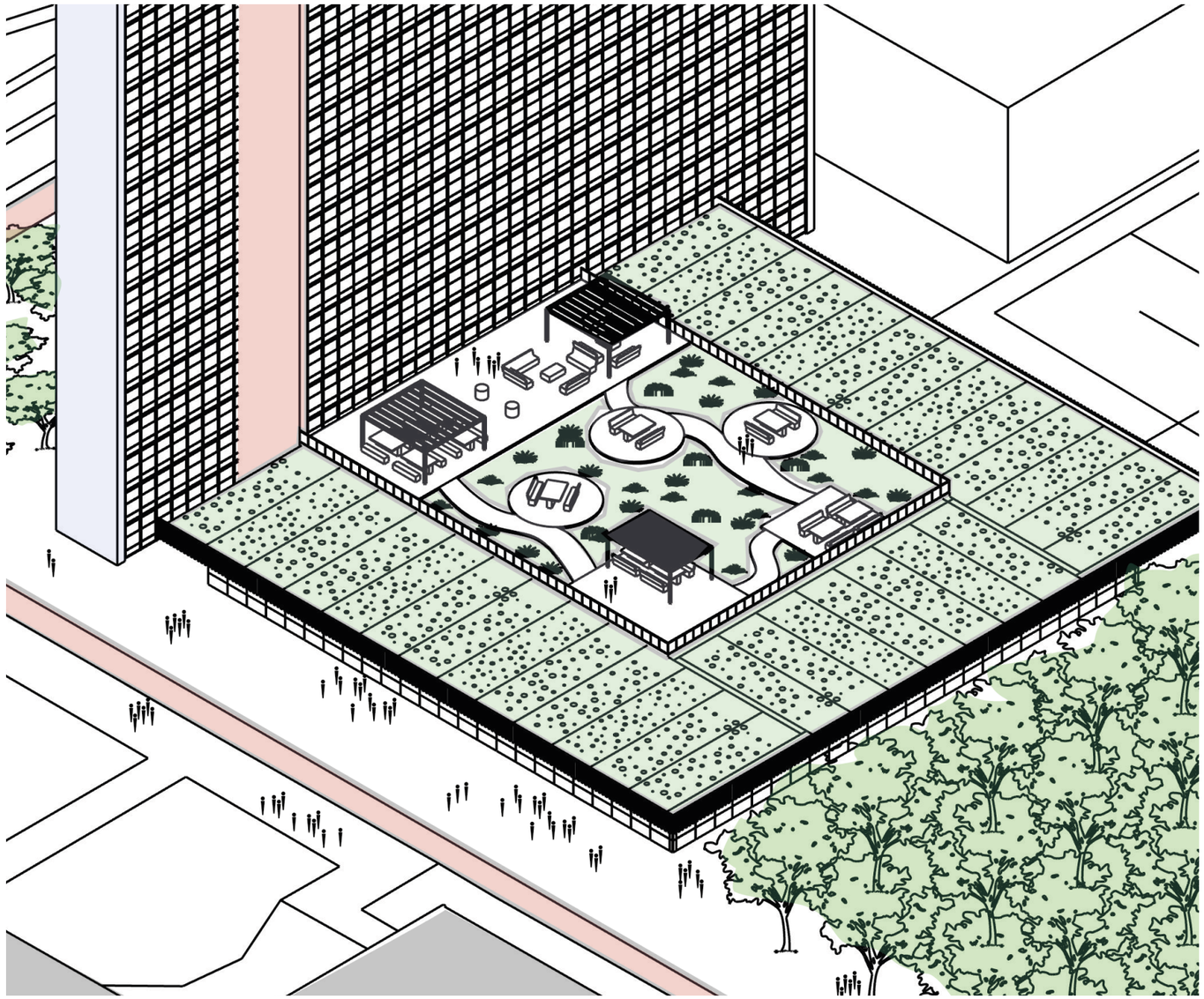


Situation | Extension from the existing structure towards the surrounding

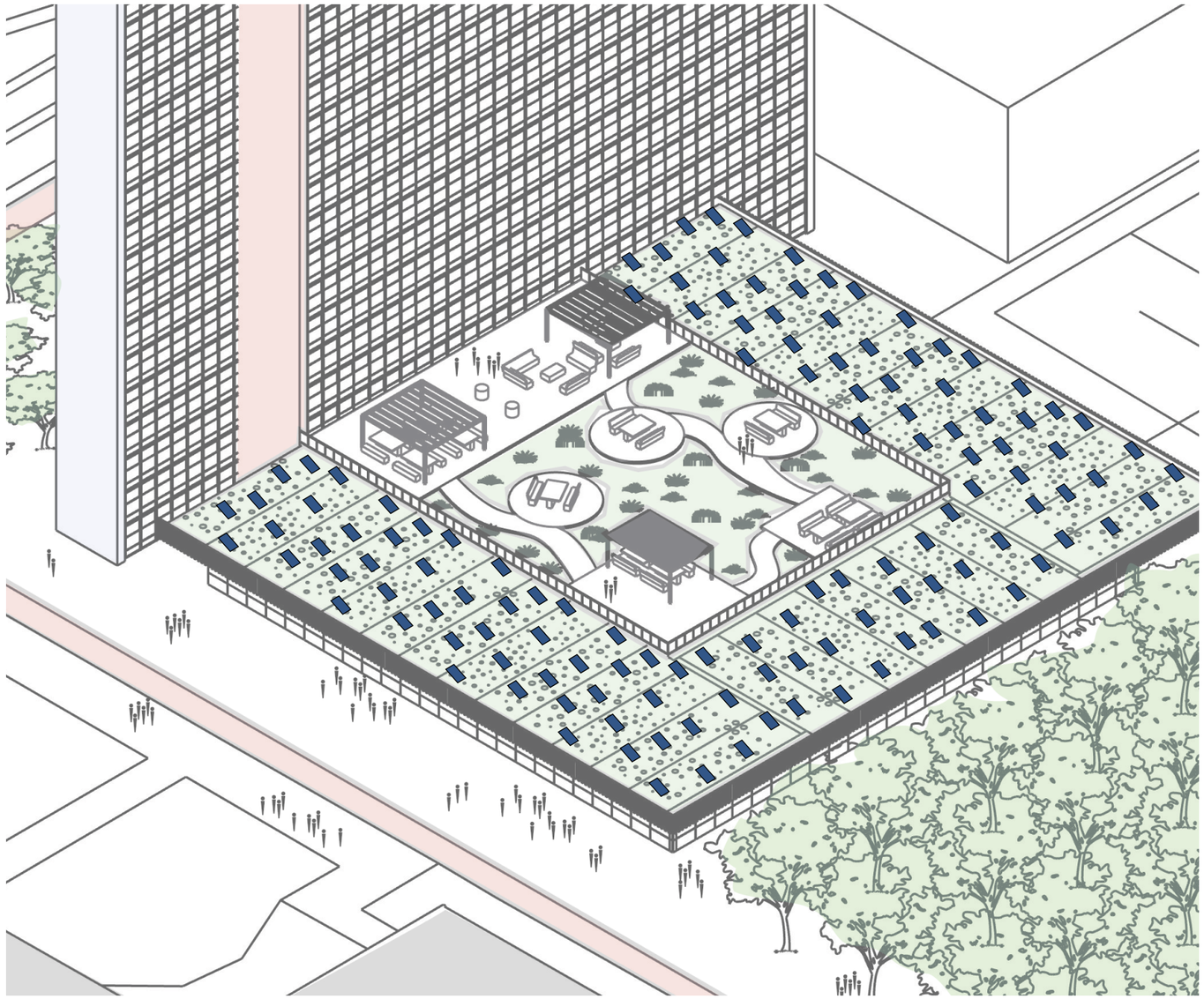


Situation | Outside ring is determined by space for green and not humans

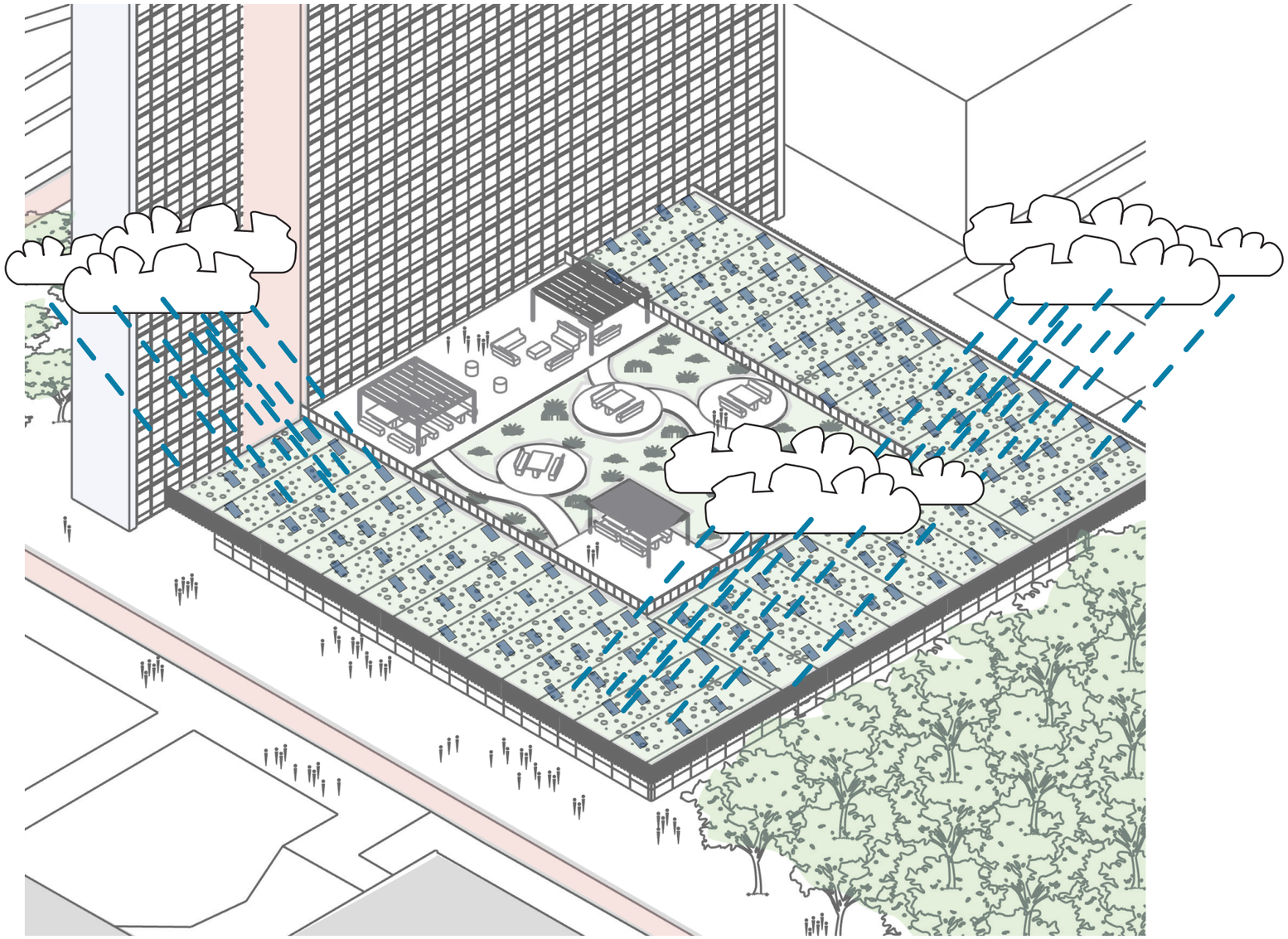
EWI Low-rise | Roof design



Situation | The roof of the current building will be used as common outside space for EWI inhabitants



Situation | Possible generation of energy for the educational functionalities underneath the roof

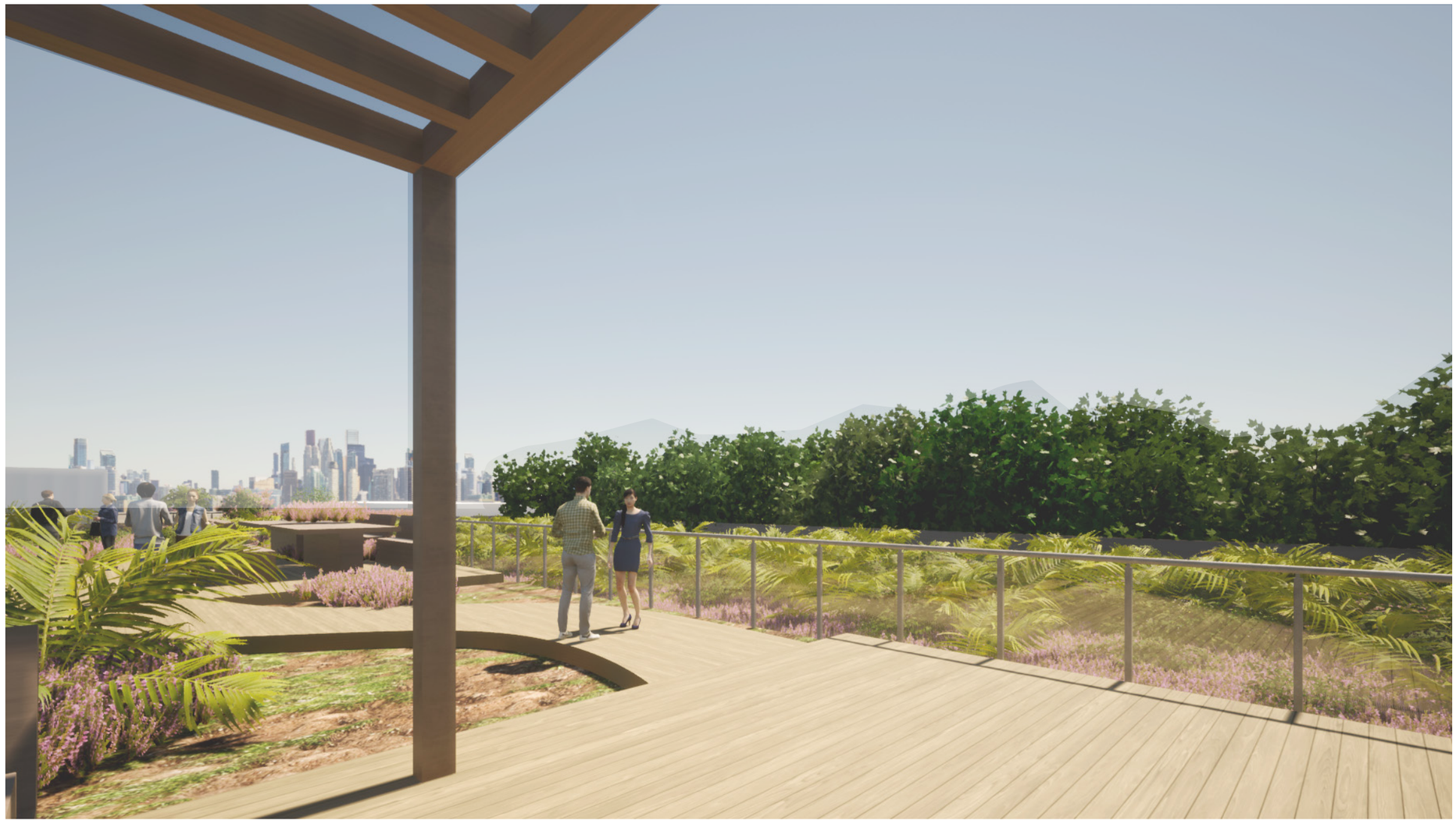


Situation | Captured water of the rain is used as grey water within the building

EWI Low-rise | Roof design visual representation

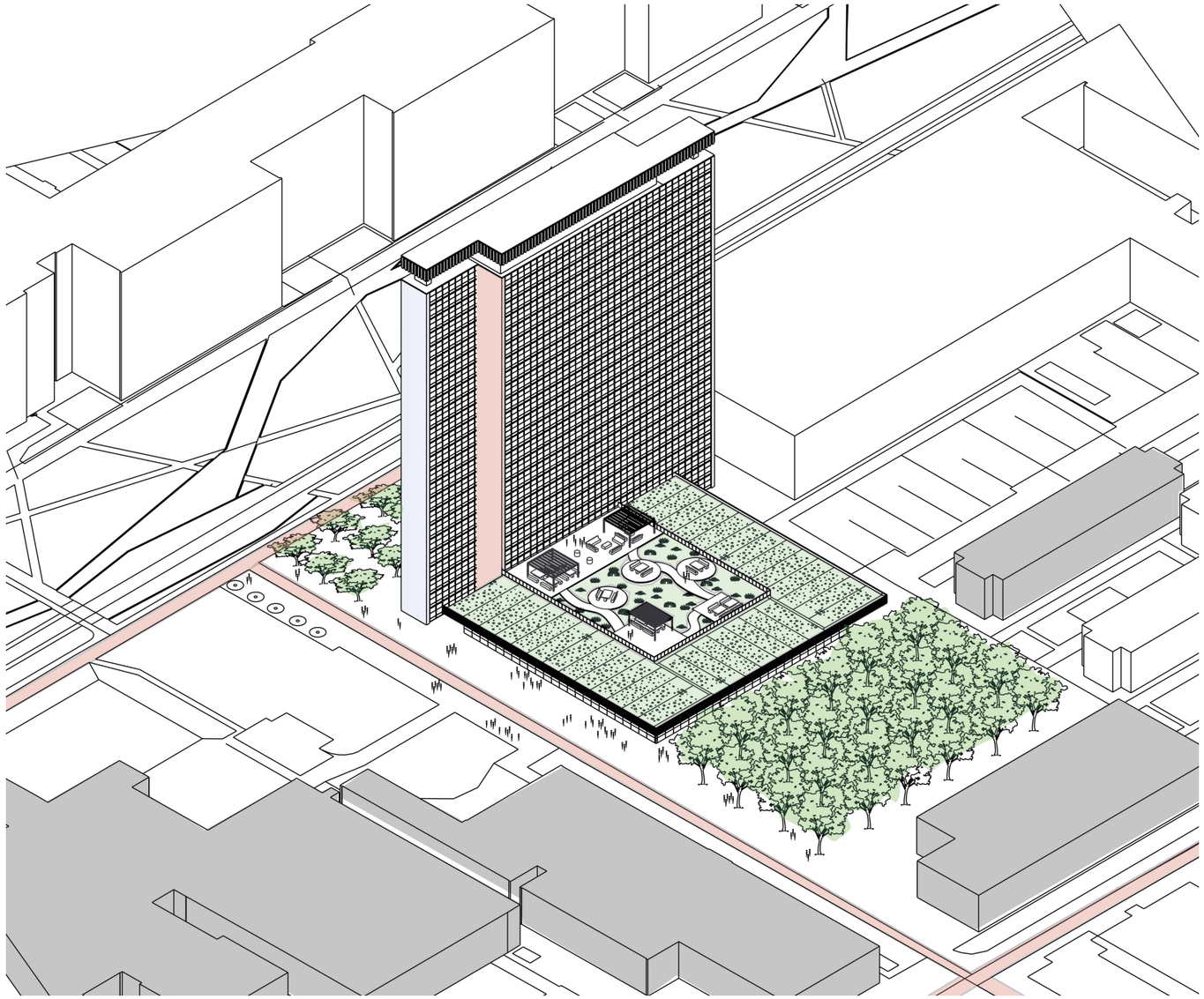
Render roof | Green oase above ground level creates intimacy and privacy from busy public campus area

EWI Low-rise | Roof design visual representation



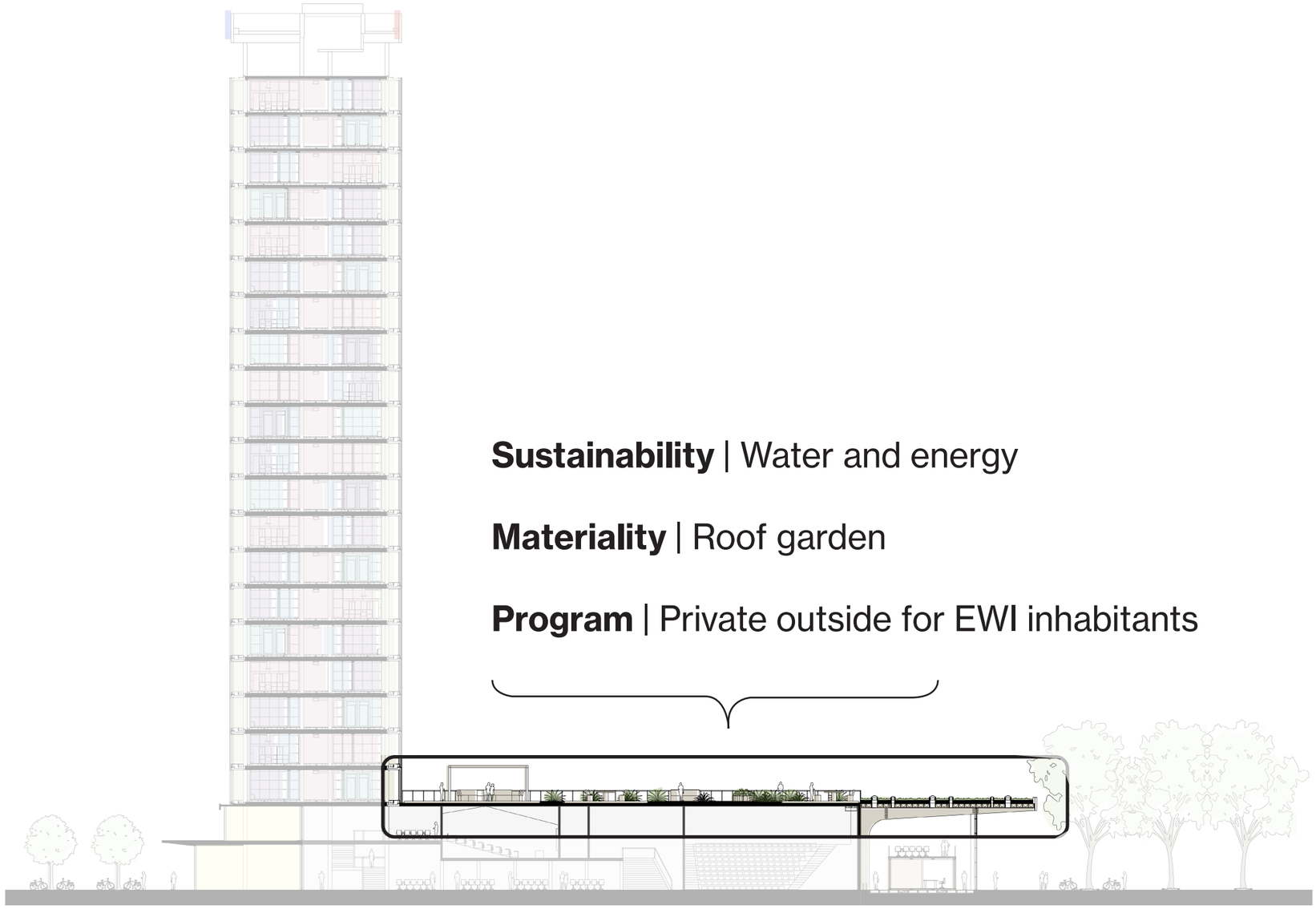
Situation | Creating a space for people from the EWI to meet and share

EWI | Axonometric view



Situation | A green roof as example for the rest of the TU Delft buildings

EWI | Section



Sustainability | Water and energy

Materiality | Roof garden

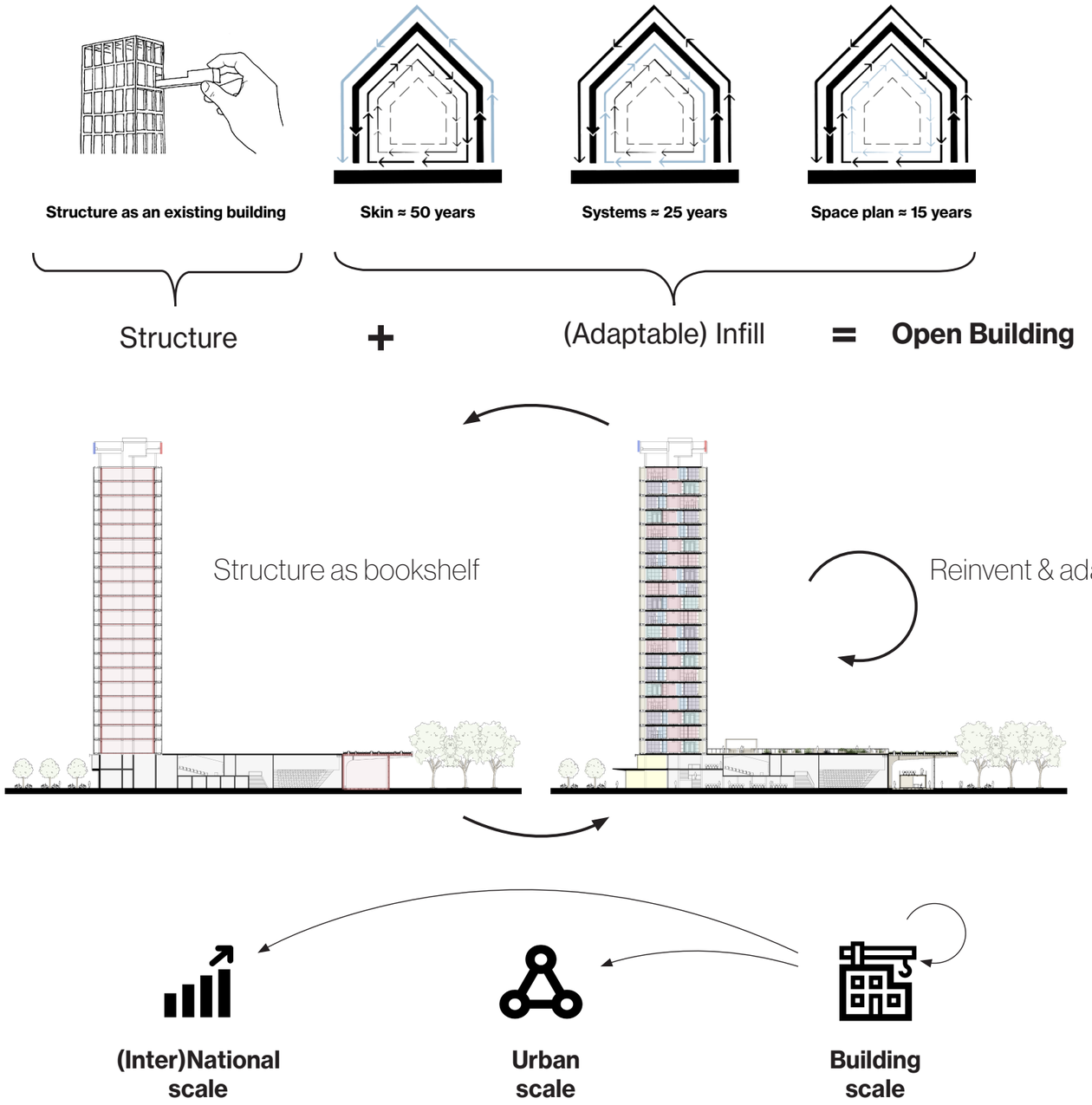
Program | Private outside for EWI inhabitants

Situation | EWI low-rise roof achievements

EWI | Section

Situation | Entire building section

EWI | Reinventable structure



Adaptability | Sustainability (as longevity) in the flexibility of the structure through the modular infill system

Render project | The new EWI as a future proof adaptable building in the heart of the campus

Render project | The new EWI as a future proof adaptable building in the heart of the campus in real weather

P5 Presentation
aE Studio

Youri Warfman
4836545

Architectural Engineering Studio
Start **Spring 2023/24**
Design tutor Mo Smit
Research tutor Pieter Stoutjesdijk
Building technology tutor Engbert van der Zaag

Adaptive reuse of campus buildings towards a living campus