Reappropriating Post-Industrial Sites for Environmental Remediation:

The Adaptive Reuse of Hollinger Gold Mine in Timmins

by

Pascal Rocheleau

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The Faculty of Graduate Studies
Laurentian University
Sudbury, Ontario, Canada

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APPROVED/APPROUVÉ

Thesis Examiners/Examinateurs de thèse:

Dr. Emilie Pinard
(Thesis Advisor/Directeur(trice) de thèse)

Georges Quirion
(Thesis Second Reader/Deuxième lecteur(trice) de thèse)

Carol Phillips, OAA
(External Examiner/Examinateur(trice) externe)

Approved for the Faculty of Graduate Studies
Tammy Eger, PhD
Vice-President Research
Vice-rectrice à la recherche
Laurentian University / Université Laurentienne

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Abstract

Over the course of the 20th century, precious metal mining flourished in all parts of Northern Ontario. Ranging from small operations to large scale corporations, thousands of mines assisted in the development of various communities across the province. Today, many of those infrastructure are abandoned and continue to cause environmental damage. They however constitute important historical and cultural artifacts for the local population. Therefore the thesis addresses the question: how can industrial heritage principles guide the adaptive reuse of abandoned mining structures to remediate the landscape they inhabit? Stemming from writings on adaptive reuse, three main research topics guide this thesis: 1) materiality; 2) spatial, visual and structural qualities, and 3) sustainability and remediation. These existing historical assets help determine design interventions, more specifically geared towards the adaptive reuse of the Hollinger Gold Mine located in Timmins. The project revolves around a program anchored on urban agriculture, designed to counter the disassociation between the public and the process of remediation. Blurring the lines of public and private spaces, the project invites members of the community to savor locally grown crops, within a historically rich, reused industrial landmark.

Key Words:

Industrial Heritage, Adaptive Reuse, Remediation, Urban Agriculture, Mining, Northern Ontario

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1

Introduction

Over the course of the 20th century, precious metal mining flourished in all parts of Northern Ontario. Ranging from small operations to large scale corporations, thousands of mines assisted in the development of various communities across the province. Up until 1991, closure and remediation plans were not required as part of a mine's life cycle plan, which resulted in the desertion of infrastructure to be left to decay.[1] In 2005, the Ministry of Northern Development and Mines identified 5600 abandoned mine sites across Ontario, 70% of which continue to cause environmental damage and pose a threat to the public safety.[2] Within the scope of an architectural thesis, it is important to question the potential impact the profession has on all fields of sustainability, more specifically the impact the built environment poses to the natural landscape. The rise of eco-awareness in the 1960's began to question how buildings could minimize their negative impact on the environment by means of efficient usage of materials, energy and the development of spaces leading to what is now referred to as sustainable architecture. Sources have therefore stated that designers seeking to reduce the environmental footprint of architecture on the natural landscape, should consider more sustainable practices of design such as adaptive reuse.[3]

1 Staff. "Abandoned Mines: A Historic Problem in Ontario • Ontario Society of Professional Engineers." Ontario Society of Professional Engineers, August 5, 2020. https://ospe.on.ca/community/abandoned-mines-historic-problem-in-ontario/.

2 McCarter, Jim. Rep. 2005 Annual Report of the Office of the Auditor General of Ontario. Toronto, Ontario: Queens Printer for Ontario, 2005.

3 Barto, Nick. "Adaptive Reuse in NYC: Planning for Site Remediation." Henson Architecture, January 16, 2017. https://www.hensonarchitect.com/adaptive-reuse-in-nyc-planning-for-site-remediation/.

Adaptive reuse not only aims to limit negative environmental impacts by forming design interventions which recycle existing infrastructure, but also considers the architectural heritage and its impact on the site and broader community. Therefore, this provides the opportunity for architecture to not only reduce its ecological footprint, but also begin to consider how it could reverse previous devastation; also known as remediation.[4] In addition, learning from social and material cultural aspects within existing infrastructures, also known as industrial heritage can guide the approach of adaptive reuse. More specifically, this thesis will investigate abandoned mine sites in Northern Ontario, in single industry communities such as Timmins. Therefore, the research question of this thesis is:

How could industrial heritage principles guide the adaptive reuse of abandoned mining structures to remediate the landscape they inhabit?

The thesis will begin (Chapter 2) by establishing the environmental impact of the mining industry, the concept of industrial heritage, as well as the approach of adaptive reuse in architecture. This chapter will demonstrate the causes leading to this ecological burden brought on by local abandoned mines. Then, adaptive reuse principles will be analyzed, to explain how it constitutes a viable response to bring new life to abandoned buildings and infrastructure. Lastly, principles and concepts of industrial heritage which sources have deemed impactful on adaptive reuse projects will be explored, to guide future design concepts and interventions. The thesis then progresses (Chapter 3) by evaluating specific adaptive reuse principles, supported by concepts of industrial heritage, which have been carefully selected for this thesis. Reinforced by case studies, this chapter will begin by studying material ; an aspects of architecture which plays a large role on the overall look and feel of the architecture. Following is a similar research stream focusing on the significance of layout and placement of components in a space, more specifically spatial, visual and structural qualities. Finally, the chapter is concluded with an exploration of sustainability and remediation, with a focus on methods of soil decontamination. This includes the concept

4 Hornby, Albert Sydney. Oxford Advanced Learner's Dictionary of Current English / [by] A.S. Hornby ; Editor Jonathan Crowther. Oxford, England :Oxford University Press, 1995.

of phytoremediation - the process of using plants to decontaminate chemical or metal filled polluted soil.[5] Studying and combining this body of research will allow for the identification of opportunities and establish design principles and interventions for adaptive reuse, in the context of abandoned mine structures in Northern Ontario.

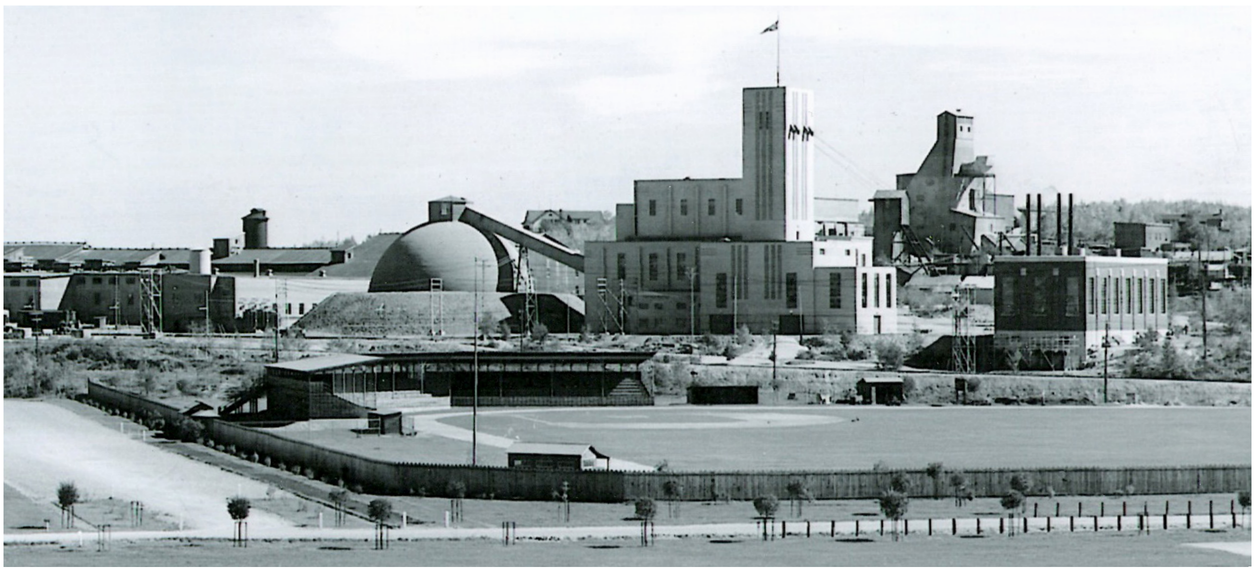

Figure 1 Hollinger Gold Mine buildings

As a local resident of the city of Timmins, it was deemed appropriate to begin studying and examining the abandoned mining structures located in various parts of the city. For the purpose of this thesis, Hollinger Gold Mines (Figure 1), a landmark placed in the heart of the city was selected as the site of interest based on factors explored in the body of research such as materiality, structure, light, shadow and spatial qualities. This mine was one of the first in Canada to build their head frame out of solid concrete, contrary to classic wooden and metal structures.[6] Therefore, the subsequent section (Chapter 4) of the thesis focuses on the local site, studying relevant historical events, communal impact at an urban scale, as well as a detailed analysis at site and building scale.

5 Dillalogue, Eric. "Phytoremediation: The Power of Plants to Clean up the Environment." Visionlearning Blog, August 13, 2016. https://www.visionlearning.com/blog/2014/07/12/phytoremediation-power-plants-clean-environment/.

6 Barnes, M. (1995). Timmins: The porcupine country. Toronto, ON: Stoddart.

The fifth and final chapter poses the hypothesis of an adaptive reuse approach on the Hollinger Gold Mine, based on the collaboration of industrial heritage principals as previously stated, sustainability and remediation techniques to improve site conditions, as well as design interventions which begin to include the community within the scope of the reuse of this local landmark. This chapter will showcase a detailed program breakdown, including all systems which contribute to the adaptive reuse and remediation techniques specified for the project. This section is followed by the project concept development process, based on the design principles researched in the previous chapters. A detailed project description demonstrates how this proposed architecture and environment could support remediation and adaptive reuse techniques to provide new public spaces for local members of the city of Timmins.

Finally, the conclusion comes back on the objectives stated in the body of this thesis research, and acknowledges that projects focused on remediation require a multi phase approach, proposing theoretical future interventions for the site of the Hollinger Gold Mine.

2

Impacts and Opportunities of Abandoned Mining Infrastructure

In the early 20th century, the introduction of railway transportation in Northern Ontario eventually led to land exploration from prospectors of nearby regions. This resulted in the emergence of numerous single-industry communities such as the case for Timmins, Ontario. Single-industry communities are typically dominated by a single company, not only offering employment but also means of housing and services.[7] However, one problem generally associated with these types of communities is their predicted lifespan based on the relative dependence on non-renewable, single economic activities such as mineral extraction.[8] Over time, infrastructure whose functions are no longer needed, fall into abandonment. Deserted, these structures not only inhabit and pollute space which could be given back to the natural landscape, but also hinders the reputation of the community in which it resides.

Acknowledging the ecological footprint of the industry and the interest to rectify the large scale damage using architectural interventions unravels opportunities embedded in the local industrial landscape of the sites and cities. By placing emphasis and building upon existing features, the existing built environment will benefit from the maintenance and preservation of these significant cultural assets.

This chapter establishes the relevance of the research, by outlining the cause of damage within the industry and methods to attempt visualizing a new life for these previously damaging spaces. Within the scope of this thesis, the research is directly related to the potential solutions located within the local mining infrastructure of Timmins, Ontario.

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7 Torlone, Joe G. "The Evolution of City of Timmins: A Single-Industry Community." Thesis, ProQuest LLC, 1979.

8 Ibid

2.1 Ecocide

"The destruction of the natural environment by deliberate or negligent human action." [9]

The subject of this thesis research stems first and foremost from the exploitation of sites from mining operations. The varying phases of mining operation such as prospecting, exploration, construction, operation, maintenance, expansion, decommissioning, abandonment and repurposing have a direct and indirect impact on the environment it surrounds.[10] Although various forms of material extraction methods exist, it is important to identify the operations happening in the area of study. Northern Ontario is home to two more prominent types of operations, open pit mining and underground mining, both of which have their own negative impacts on the surrounding environment.

Open-pit mining, sometimes referred to as opencast mining, is a technique which utilizes a large open hole to extract the material, similarly to the current operations being concluded neighboring the Hollinger Mine site (Figure 2). This method is used if the sought out material is located near the surface, or if the soil is deemed unsuitable or unstable for tunnel extraction. Even before the beginning of operation, the realization of this mine will result in the complete loss of the existing ecosystem. Since the site will be completely stripped and excavated to access the sought out material, all natural life forms will be pulverized. Secondly, since ore and other types of material represent such a small percentage of the contents of the site, the large amount of material displacement will leave a massive hole which needs to be remediated once complete. However this is not always as simple as it seems. During the crushing process, the rock potentially exposes radioactive material, such as asbestos like material as well as metallic dust.[11] Once mixed with water, these radioactive liquids could very well leak back into the

9 Hornby, Albert Sydney. Oxford Advanced Learner's Dictionary of Current English / [by] A.S. Hornby ; Editor Jonathan Crowther. Oxford, England :Oxford University Press, 1995.

10 Haddaway, Neal R., Steven J. Cooke, Pamela Lesser, Bilijana Macura, Annika E. Nilsson, Jessica J. Taylor, and Kaisa Raito. "Evidence of the Impacts of Metal Mining and the Effectiveness of Mining Mitigation Measures on Social–Ecological Systems in Arctic and Boreal Regions: a Systematic Map Protocol," 2019. https://environmentalevidencejournal.biomedcentral.com/track/pdf/10.1186/s13750-019-0152-8.pdf.

11 Environmental Risks of Mining. Accessed November 6, 2020. https://web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html.

bedrock below, and spread to other ecosystems and water sources in the surrounding environment.[12] Therefore, even when properly contained, open pit mines and tailing sites can take decades to recover the burden of the operations.[13]

Underground mining operations take place when the ore body tends to lie quite deeply below the surface. To excavate this ore by means of open pit mining would result in an excessive and unnecessary waste. This results in the need for underground operation techniques to be considered.[14] Similarly to open pit mining, underground operations share the same burden of potential radioactive liquids, thankfully at a smaller scale. Less material is excavated in tunnel mining, leaving less opportunity for contamination. However underground mining comes with its own environmental impacts, such as the potential for the collapsing of tunnels, resulting in land subsidence.[15] Additionally, the blasting which takes place during operations disturbs the surface ecosystem by displacing the valuable layer of topsoil containing numerous seed banks, making it difficult for vegetation to recover.[16]

In the case of Hollinger Gold Mines, both mining techniques took place on site. Initially, underground mining was used to extract the precious metals until 1968.[17] Up until this point, the mine had roughly 970 kilometers of underground tunnels, which were taken out of service in 1980, when the extractions were converted to various small open pit operations.[18] Hence, design interventions subject to remediation strategies are to consider the local damage which occurred on site.

12 Environmental Risks of Mining. Accessed November 6, 2020. https://web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html.

13 Dilthey, Max Roman. "Open Pit Mining Pros & Cons." Sciencing, March 2, 2019. https://sciencing.com/open-pit-mining-pros-cons-12083240.html.

14 "Underground Mining." Encyclopædia Britannica. Encyclopædia Britannica, inc. Accessed December 26, 2020. https://www britannica.com/technology/mining/Underground-mining.

15 Environmental Risks of Mining. Accessed November 6, 2020. https://web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html.

16 Ibid

17 Torlone, Joe G. "The Evolution of City of Timmins: A Single-Industry Community." Thesis, ProQuest LLC, 1979.

18 Barnes, Michael. Gold in Ontario. Erin, Ontario: Boston Mills Press, 1995.

Figure 2   Aerial photograph of Newmont Porcupine open pit operations, Timmins

2.2 Industrial Heritage and Reuse

Although mines all over Ontario most definitely have negative impacts on the natural landscape, it is important to see the potential that arises from the problems they created. The Ontario Ministry of Energy, Northern Development and Mines produced a database in 2018 containing all known abandoned and inactive mine sites in Ontario (Figure 3). This source demonstrates how these sites were either never developed, still in operation to this day, or currently uninhabited or abandoned. Considering many towns and cities stemmed from the anchorage of these industrial structures, they've become part of the story these human settlements have to tell. In other words, these now abandoned structures are part of the urban fabric of the cities, and also part of the local heritage of the place. Without them, many parts of Ontario would not be where they are today. Therefore it is important to note that these abandoned mine sites also represent the location in which they are found. Hollinger Gold Mines having such a pivotal role in the development of the city of Timmins leads to this idea of heritage; more specifically industrial heritage formed from the type of culture created within the community as a direct link from the impact of the industry. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), Industrial Heritage can be defined as all of the social and material culture directly or indirectly related to the people engaged in the creation of infrastructure and the production and distribution of raw materials, objects, and energy.[19]

Considering the definition of industrial heritage is based on culture from the impact of industry, this specific type of heritage is therefore classified as a form of cultural heritage. UNESCO further describes it as being categorized in either tangible or intangible cultural heritage, falling under the tangible components, more specifically immovable cultural heritage which includes monuments, archaeological sites and buildings.[20] By placing industrial heritage as a form of cultural heritage allows us to create an identity as a community since it creates a framework for the preservation of sites or buildings which have significance and historical value.

Establishing the importance to preserve these sites allows for the opportunity to explore different approaches, such as the maintenance of said sites to be used as landmarks, to restore them for their original function, or to re-appropriate them for a new use, also known as adaptive reuse. Sometimes referred to as recycling and conservation, adaptive reuse implies the reuse of a building by adapting it to

19 Definition of the Cultural Heritage: United Nations Educational, Scientific and Cultural Organization." Accessed November 6, 2020.

20 Ibid

accommodate a new use or uses.[21] This type of approach is most likely the most interesting approach for these types of structures, since their original use is no longer suitable, and the space in which they occupy is simply too vast to be considered as a monument. Being re-developed for new purposes ensure the preventions of demolition of these cultural assets. As Marta Bottero explains:

"When the adaptive reuse approach is used for heritage, the expected outcome is not only the building protection, but the preservation of its historical and heritage significance, and the trade-off between the retention of symbolic values and the adaptation to new alternative uses becomes of paramount importance."[22]

By re-adapting these sites, the local aesthetic of the community is maintained, while celebrating the local heritage embedded within the built environment of the city. In the next chapter, the thesis will evaluate certain adaptive reuse principles, supported by concepts of industrial heritage such as material, spatial visual and structural qualities as well as sustainability and remediation.

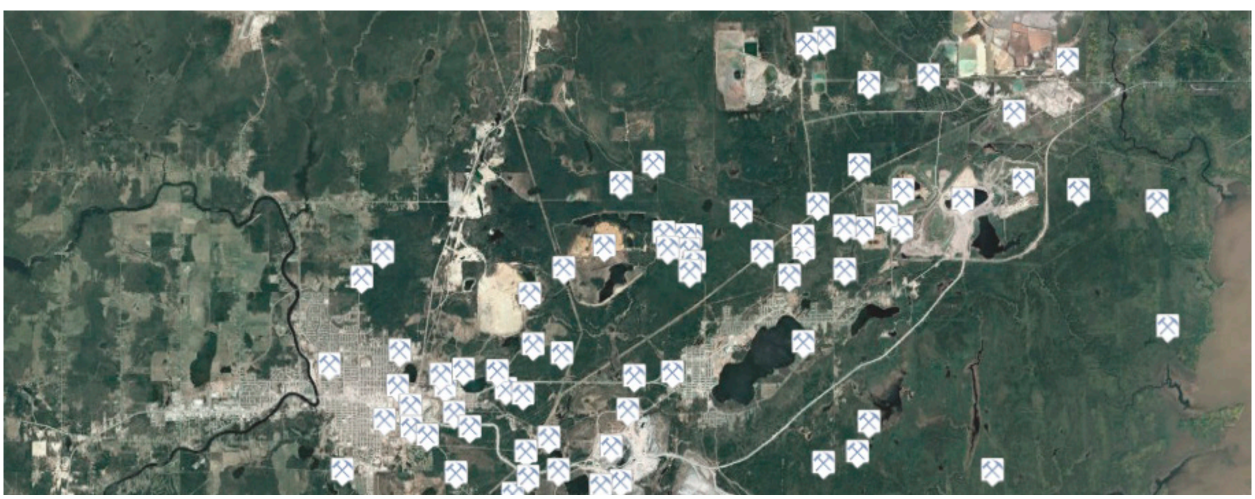

Figure 3 Mine operation mapping of the Timmins area

21 Caves, Roger W. Encyclopedia Of The City. Routledge, n.d. (p.4)

22 Bottero, M., D'Alpoas, C., & Oppio, A. (2018, December 29). Ranking of Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts: A Multiple Criteria Decision Aiding Approach. Retrieved October 25, 2020, from https://www.mdpi.com/2071-1050/11/3/785

3

Conceptual Framework: An Adaptive Reuse Approach to Industrial Heritage

When considering to utilize the adaptive reuse approach on an industrial heritage site such as Hollinger Gold Mines, it is important to evaluate the feasibility of using said approach. This can be determined by evaluating which circumstances or factors will influence the success or failure of the project. In most cases, the results of an adaptive reuse approach on a project are guided by cultural, economic, environmental, legislative, locational, "new-use" and/or social factors.[23] This combination of factors help designers narrow down the most suitable informed design decisions of the site they are investigating. Keeping this in mind, there could never be a single solution which could begin to express what composes a "successful adaptive reuse project". Instead, a juxtaposition of various factors come together to result in a successful outcome. [24] By reviewing the literature on adaptive reuse projects, we can begin to understand these factors in more detail. According to Conejos et al., Larkham and UNESCO, the following elements or criteria help label an adaptive reuse project as successful: [25]

1. Project maintains the cultural heritage value of the place
2. Considers the sites surrounding environment
3. Contributes a positive aesthetic to the streetscape
4. Maintains spatial and visual qualities of the original building
5. Preserves structural clarity of the original building
6. Conserves significant artifacts
7. Provides a unique environment
8. Provides a unique visitor experience
9. Explores a juxtaposition of materials
10. Explores the variation of light and shadow
11. Contributes to a sustainable future
12. Maintains economic viability and efficiency
13. Accounts for financial sources required to undertake the project

23 Sugden, E., & Khirfan, L. (2017). The adaptive reuse of industrial heritage buildings: A multiple-case studies approach(Master's thesis, University of Waterloo, 2017). Waterloo. Retrieved October 25, 2020, from https://uwspace.uwaterloo.ca/handle/10012/12823.

24 Burchell, R. W., & Listokin, D. (1981). The adaptive reuse handbook: Procedures to inventory, control, manage, and reemploy surplus municipal properties. New Brunswick, NJ: Rutgers University, Center for Urban Policy Research.

25 Conejos, S., Langston, C., & Smith, J. (2013). AdaptSTAR model: A climate-friendly strategy to promote built environment sustainability. Habitat International, 37, 95-103. doi:10.1016/j.habitatint.2011.12.003. | Larkham, P. (1996). Conservation and the city. London; New York: Routledge. | UNESCO. (2007). Asia conserved, lessons learned from the UNESCO Asia-Pacific heritage awards for culture heritage conservation (2000–2004). Lord Wilson Heritage Trust and UNESCO. Retrieved from http://unesdoc.unesco.org/images/0015/001557/155754e.pdf

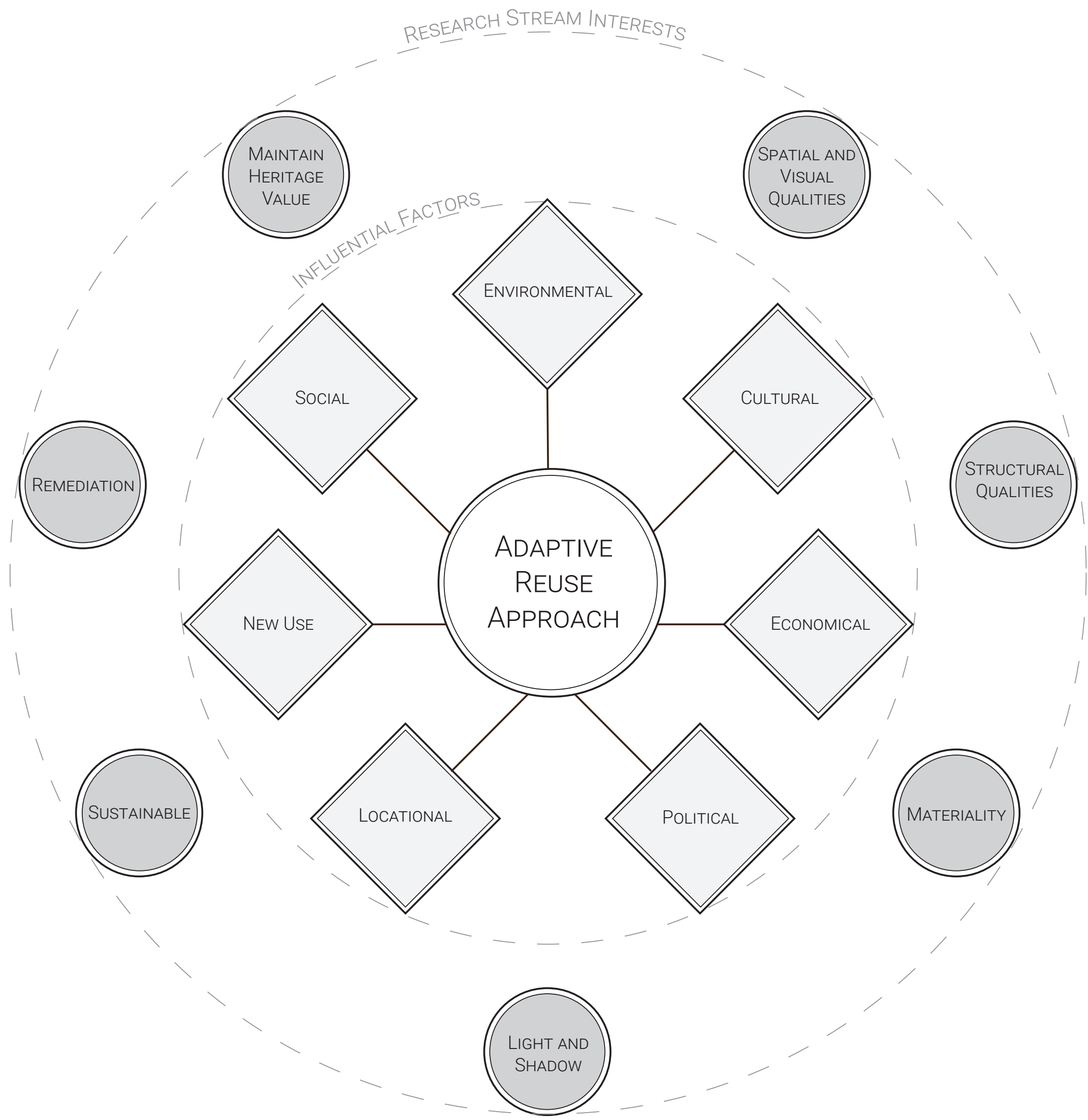

Figure 4 Adaptive Reuse Approach, Influential Factors and Research Stream Interests

While comparing this list of attributes to the site selected for this thesis, some factors sparked particular interest for further theoretical and design investigations (Figure 4). As further explained in chapter four, the Hollinger Gold Mines site was selected based on the interesting material use of concrete compared to typical wood and metal structures. Also, this thesis aims to transform an abandoned mine infrastructure through site and environmental remediation. Therefore, some of the attributes listed previously can then be combined based on their similarities, and form three main subjects of research for this thesis: 1) materiality; 2) spatial, visual and structural qualities; and 3) sustainability and remediation.

3.1 Material

"Each material has its own message." [26]

If one was to compare architecture with music, materials would be like the music notes of the melody.[27] Within this comparison lies an inseparable connection between architecture and materials. Many contextual factors in architectural design influence the composition and selection of materials, such as functional needs, available resources, the climate the project resides in, traditions, aesthetics.[28] Each of these factors are also influenced by their own set of variables, such as historical, graphical, economic or cultural context. This intricate and inseparable bond between architecture and material based on contextual factors is also known as material culture. Material culture often refers to specific physical objects, sources and/or spaces that humans use to identify their culture.[29]

In the case of Hollinger Gold Mines, resource extraction and gold mining is part of the community's history and cultural development, resulting in its impact on the material culture of the buildings on the site. In other words, the heritage of ideas, customs and traditions are transmitted through objects and their chosen materials.[30] This means architectural designs can be a perfect reflection of the tradition to which they belong, and the materials are a means to communicate the culture behind the project.[31] Therefore, by working to maintain and build from the present materials of the site, one can create a new bridge between past, present and future, without losing the cultural importance of the site. Having established the interest of preserving the building's cultural heritage through material culture, this raises the question of how it can be achieved.

26 Wright, Frank Lloyd, and Frederick Gutheim. On Architecture: Selected Writings: 1894 - 1940. New York: Duell, Sloan & Pearce, 1941.

27 Florim. Material culture: the heritage of architecture. Accessed December 17, 2020. https://blog.florim.com/en/material-culture-the-heritage-of-architecture.

28 Ibid

29 "Sociology." Accessed December 18, 2020. https://www.cliffsnotes.com/study-guides/sociology/culture-and-societies/material-and-nonmaterial-culture

30 Florim. Material culture: the heritage of architecture. Accessed December 17, 2020. https://blog.florim.com/en/material-culture-the-heritage-of-architecture.

31 Ibid

Transforming an existing building, while retaining the historical culture located within its materials can occur when conducting a more conservative disassembly approach with the goal to reuse the materials once removed. When buildings are demolished or disassembled, the spatial qualities tend to be deconstructed. However, the material connection to the site and space can remain intact, maintaining the heritage significance.[32] More common demolishing methods typically use large and heavy machinery to disassemble parts of the building. These methods tend to destroy, crush, and eliminate all materials.[33] However, if a mechanical separation technology is used, certain portions of the building can be reused, and the materials salvaged from this extraction process can be reused in new parts of the building. Certain components such as doors, windows, bricks, metals, plumbing, lumber or architectural ornaments can be removed and set aside, to eventually be repurposed. For example, one of the structures located on the Hollinger Gold Mine property consist of a brick facade (Figure 5), which could be extracted and reused elsewhere in and around the building should part of the structure be removed. Not only does this assist in maintaining the cultural heritage of the historic building, but also helps from choking the landfill with large amounts of debris.[34] Since this thesis aims to lead the site to a more sustainable future, this idea of recycling material goes a long way to contribute to a more positive impact on the environment.

Figure 5 Hollinger Gold Mine, hoist control room

32 Rathmann, Kurt. "Sustainable Architecture Module: Recycling and Reuse of Building Materials." Dissertation, National Pollution Prevention Center for Higher Education, 2005. (p.64)

33 Ibid

34 Ibid

Over the past decades, the planet has experienced growing effects of climate change, and it is important to acknowledge that buildings and the built environment are one of the leading sources of global energy demand.[35] This is in the form of material extraction, material production, building assembly among others. According to Goldsmith Borgal and Co., "one square foot of brick in a wall is the equivalent of 1 gallon of gasoline in terms of energy required to make the brick, bring it to a site, and erect it".[36] Since these previously built buildings have their own form of embodied energy, it would only create higher levels of greenhouse gases for its demolition and new construction. Conejos et al. found opportunities in adaptive reuse projects such as this one to address the growing impact of climate change by reducing energy consumption while at the same time improving the buildings performance.[37] Salvaged materials tend to be durable and widely adaptable, which can begin to excite the imagination of the designer.[38] They also begin to represent the symbols of the building's beauty, while demonstrating the inevitable and natural decay of the original building.[39] Unfortunately, not all materials can simply be removed and placed elsewhere, such as concrete. However, this does not negate the opportunity for them to be incorporated into the building in different ways. Certain materials can be demolished and reintroduced into the material production process.

Kunsthaus Zürich, an art museum in Switzerland is an ideal example of this material recycling approach (Figures 6, 7and 8). During the development of the expansion, the project used recycled concrete as aggregate during the production stage. Using recycled concrete reduced the quantity of virgin aggregate required to produce the material, which in turn significantly reduces energy consumption to acquire the aggregate. This recycled concrete finds itself throughout 95% of the overall concrete used to build the extension.[40] This case study relates heavily to the selected site for this research project, since the main body of the buildings on the site are built of reinforced concrete. Therefore, design interventions integrated in the adaptive reuse of the Hollinger Gold Mine can be supported by principles outlined in this section.

35 Wong, L. (2017). Adaptive reuse: Extending the lives of buildings. Basel: Birkhäuser. (p.30)

36 Goldsmith Borgal & Company Ltd. (2012). The Cooper Site (locomotive Repair Sheds) Public Consultation Report (Canada, The City of Stratford, The City of Stratford). Retrieved from https://www.stratfordcanada.ca/en/insidecityhall/resources/ReportsAndPublications/Borgal_Report.pd

37 Conejos, S., Langston, C., & Smith, J. (2013). AdaptSTAR model: A climate-friendly strategy to promote built environment sustainability. Habitat International, 37, 95-103. doi:10.1016/j.habitatint.2011.12.003 (use this when talking about successful adaptive reuse attributes)

38 Rathmann, Kurt. "Sustainable Architecture Module: Recycling and Reuse of Building Materials." Dissertation, National Pollution Prevention Center for Higher Education, 2005. (p.64)

39 Ibid

40 "Visionary Architecture, Sustainably." LafargeHolcim.com, October 16, 2020. https://www.lafargeholcim.com/building-largest-art-museum-switzerland-sustainable-cement.

Figure 6 Kunsthaus Zürich Art Museum exterior render

Figure 7 Kunsthaus Zürich Art Museum entrance render

Figure 8 Kunsthaus Zürich Art Museum exhibition render

3.2 Spatial, Visual and Structural Qualities

"Form ever follows function" [41]

Generally, when speaking about industrial design, form almost always follows function. This principle was highly associated with architecture in the late 19th and early 20th century, expressing that the shape of the building typically relates to its intended use or purpose.[42] This phrase was coined by Louis Sullivan in 1896, in his essay "The Tall Office Building Artistically Considered".[43] He argued that a building's facade (form) should reflect the program that takes place within the spaces (function). This principle demonstrates relevance in this case due to the nature of the buildings of the Hollinger Gold Mine. Buildings of this time and use were built for the purposes they were intended for. Therefore the spaces located within its walls begin to demonstrate what took place within them. For the most part, industrial structures demonstrate an open floor plan, high ceilings and access to natural sunlight.[44] For example, the crushing plant at Hollinger Gold Mines depicts the previously mentioned attributes (Figure 9). This spatial flexibility was useful and practical to accommodate the large industrial machinery needed for the industrial operation of mineral extraction. Therefore, individual spaces were being utilized for a specific purpose. In other words, to this day, the spaces within the building speak of the history and life of the previous use of these buildings. Therefore by maintaining this spatial, visual and structural language that the industry has laid out, we can begin to pay homage to the industrial heritage significance of the building. Similarly to the first research streams anchored on materiality, the spatial, visual and structural qualities of the building also embody the history of the building's initial use. Therefore, by considering maintaining the look and feel of the old building through spaces and their structure, we can begin to honor the building's heritage by expanding upon the existing character rather than obscuring it.

41 Sullivan, Louis H. The tall office building artistically considered. Lippincott's Magazine, March 1896.

42 Rathmann, Kurt. "Sustainable Architecture Module: Recycling and Reuse of Building Materials." Dissertation, National Pollution Prevention Center for Higher Education, 2005. (p.64)

43 Ibid

44 Lexter, Insights. "A Guide To Industrial Architecture." Jonite. Accessed May 3, 2021. https://insights.jonite.com/a-guide-to-industrial-architecture.

Figure 9 Interior photograph of Hollinger Mine's crushing plant

1960 Mandela - American Steel by JRDV Urban International is an adaptive reuse project which successfully introduced a new program while paying homage to the original industrial use of the building (Figure 10 and 11). The factory was formally an American Steel producer, which had a large impact on the history of the city of Oakland California.[45] For decades these buildings have been a local source of employment, originally as a steel producer, but more recently for pioneering artists, by becoming a transformation space for art, innovation and community.[46] Due to the large volume of space, the project was able to accommodate this idea of "flexible-futures".[47] This approach for the new use created the opportunity for the building's program to grow with the evolving community, which ensures the longevity and sustainability of this reused building. The designers tackled this project with the aim to preserve the legacy of this historical building by expressing and placing emphasis on the buildings existing spatial and structural assets.

45 1960 Mandela - American Steel, Oakland, California, USA." JRDV, August 15, 2019. https://jrdv.com/work/1960-mandela-american-steel/.

46 Ibid

47 Ibid

Figure 10: 1960 Mandela American Steel render

Figure 11: 1960 Mandela American Steel render

Within the scope of this thesis, the project aims to explore similar avenues and investigations to preserve the structure and spatial qualities of the Hollinger Gold Mine structural system. Like previously mentioned during the first section of this chapter, buildings and their production process encompass a large portion of the world's energy consumption.[48] This also applies to the structural aspects of the building. By conserving or adapting the structure with a new program, we once again reduce energy consumption which would be required to produce completely new structural elements.[49] This positively influences the sustainability of the new space by using lesser amounts of energy to reach the building goals.

48 Wong, L. (2017). Adaptive reuse: Extending the lives of buildings. Basel: Birkhäuser. (p.30)

49 Rathmann, Kurt. "Sustainable Architecture Module: Recycling and Reuse of Building Materials." Dissertation, National Pollution Prevention Center for Higher Education, 2005.

3.3 Sustainability and Remediation

"The action of remedying something, in particular of reversing or stopping environmental damage." [50]

Broadly stated, one of the major aims of this thesis is to develop a method to 'reverse', or remediate the environmental damage of the mining industry on the natural landscape. Issued in 2019, the neighboring Hollinger Park underwent construction to include beautification and remediation methods endorsed by the city of Timmins.[51] Some of these methods include the introduction of a geotextile fabric separation to help protect the top layer of soil from the toxins located below. This layer was then covered with twenty inches of clean fill to allow for a toxin free Hollinger Park.[52] Directly after completion, the site is then considered safe for public use. Unfortunately, this type of approach removes the process and visual results between the contaminated soil prior and post remediation efforts. For the Hollinger Mine, the remediation methods researched allow the public to view and participate in the process, resulting in the appreciation and knowledge of preserving the natural landscape.

Merging the Latin words for plant and remedy, phytoremediation is the process of using plants to decontaminate chemical or metal filled polluted soil.[53] This technology has evolved as a more cost-effective, non-invasive, and widely embraced method of removing toxins from the environment.[54] Within the realm of phytoremediation is found different types of toxin neutralization techniques such as phytofiltration and rhizofiltration, phytoextraction, phytoimmobilization, phytostabilization, phytodegradation, and rhizodegradation.[55] Phytoremediation is considered to be a low risk and potentially attractive method of decontaminating a site. Considering the plants grown for this purpose may lead to levels of toxic metals and chemicals within their bodies, fences and other types of barricades

50 Hornby, Albert Sydney. Oxford Advanced Learner's Dictionary of Current English / [by] A.S. Hornby ; Editor Jonathan Crowther. Oxford, England :Oxford University Press, 1995.

51 L360 Architecture. Hollinger Park Beautification. August 1, 2019. https://timmins.bidsandtenders.ca/Module/Tenders/en/Tender/Detail/51f5ce67-b069-42c9-ae8b-7dc0e879664e.

52 Ibid

53 Dillalogue, Eric. "Phytoremediation: The Power of Plants to Clean up the Environment." Visionlearning Blog, August 13, 2016. https://www.visionlearning.com/blog/2014/07/12/phytoremediation-power-plants-clean-environment/.

54 Arthur, Ellen L., Pamela J. Rice, Patricia J. Rice, Todd A. Anderson, Sadika M. Baladi, Keri L. D. Henderson, and Joel R. Coats. "Phytoremediation - An Overview," January 18, 2007. https://pubag.nal.usda.gov/download/15902/PDF.

55 Ibid

are put in place to retrain wildlife from feeding on contaminated organisms.[56] Using plants to remediate contaminated soil is a method making the site more attractive than other strategies. The use of plants native to the site and area is recommended to reduce the attraction of nuisance animals or pests, and to ensure the plant is better adapted to the local conditions.

In 2016, the City of Timmins, the Porcupine Health Unit (PHU) and the Ministry of the Environment and Climate Change met to analyze the condition of the soil of the Hollinger Park. These reports yielded above normal toxicity levels of lead (Pb), arsenic (As) and antimony (Sb) in various areas of the surface soil.[57] Since these mine tailings consist of the same soil found within the limits of the selected site, it is expected that the soil on the site of the mine be contaminated with the same metals and chemicals as the Hollinger Park. In response to these toxicity results, remediation strategies explored for this thesis fall within the subject of phytoextraction.

Phytoextraction is known as the ability for plants to extract inorganic materials (primarily heavy metals) from contaminated soil.[58] Following extraction, the removal and recovery of contaminated plants is considered more environmentally and financially attractive in contrast to disposing of polluted soil.[59] According to Alan Baker, plants tend to adopt one of two main survival strategies when presented with contaminated soil. Plants known as excluders have learned to survive the toxic condition of the soil by keeping the heavy metals within the plant roots, where they are detoxified. While most metal-tolerant plants are more or so common, most do not have the ability to store high levels of metals in their aboveground parts.[60] However, plants known as hyperaccumulators tend to perform the opposite action. Once exposed to high levels of heavy metals, the plant harvests the metals into the above ground biomass where it is not affected by phytotoxicity symptoms.[61] Like previously mentioned, the toxicity report completed in 2016 resulted in elevated levels of lead (Pb), arsenic (As) and antimony (Sb) in various portions of the surface soil at the Hollinger Park. For this reason, hyperaccumulators with the ability to

56 Office of Solid Waste and Emergency Response. "A Citizen's Guide to Phytoremediation." EPA, September 2012. https://www.citationmachine.net/chicago/cite-a-website/custom.

57 "What You Need to Know about Heavy Metals in Hollinger Park." Heavy Metals in Hollinger Park. Accessed April 22, 2021. https://www.porcupinehu.on.ca/en/your-community/healthy-environments/heavy-metals-in-hollinger-park/.

58 McCutcheon, Steve C., and Jerald L. Schnoor. Phytoremediation: Transformation and Control of Contaminants. Hoboken, NJ: Wiley-Interscience, 2003.

59 Suman, Jachym, Ondrej Uhlik, Jitka Viktorova, and Thomas Macek. "Phytoextraction of Heavy Metals: A Promising Tool for Clean-Up of Polluted Environment?" Frontiers in Plant Science 9. 2018

60 Brooks, Robert R. "Plants That Hyperaccumulate Heavy Metals." Plants and the Chemical Elements, January 1998, 87–105. https://doi.org/10.1002/9783527615919.ch4.

61 Baker, A. J. "Accumulators and Excluders -Strategies in the Response of Plants to Heavy Metals." Journal of Plant Nutrition 3, no. 1-4 (1981): 643–54. https://doi.org/10.1080/01904168109362867.

extract these components were explored. The following plants are reported to be the most effective for these specific materials (Figure 12). Firstly, sunflowers, Indian mustard as well as white willow are known to be used in phytoremediation to extract traces of lead (Pb). [62] Secondly, sun flowers and Cretan brake fern are used to extract traces of arsenic (As) from contaminated soil.[63] Lastly, Cretan brake fern is also known to be used to extract traces of antimony (Sb).[64] In addition to the materials found within the toxicity report, Indian grass in conjunction with white willow were also included to extract traces of Petroleum Hydrocarbons and Diesel. Depending on concentrations in the toxicity levels, Cornish et al. calculated that soil decontamination could be achieved in approximately 20 years.[65]

Figure 12 Sun Flower (Helianthus Annuus L.), Indian Mustard (Brassica Juncea L.), White Willow (Salix Species), Cretan Brake Fern (Pteris Cretica) and Indian Grass (Sorghastrum Nutans)

62 Malik, Junaid Ahmad, Aadil Abdullah Wani, Khursheed Ahmad Wani, and Muzaffer Ahmad Bhat. "Role of White Willow (Salix Alba L.) for Cleaning Up the Toxic Metal Pollution." Bioremediation and Biotechnology, May 16, 2020, 257–68. https://doi.org/10.1007/978-3-030-35691-0_12.| Boi, Jay. "5 Best Plants For Phytoremediation." Land8, November 30, 2015. https://land8.com/5-best-plants-for-phytoremediation/.

63 Feng, Renwei, Chaoyang Wei, Shuxin Tu, Shirong Tang, and Fengchang Wu. "Simultaneous Hyperaccumulation of Arsenic and Antimony in Cretan Brake Fern: Evidence of Plant Uptake and Subcellular Distributions." Microchemical Journal 97, no. 1 (2011): 38–43. https://doi.org/10.1016/j.microc.2010.05.010.

64 Ibid

65 Cornish, J.E., Goldberg, W.C., Levine, R.S., & Benemann, J.R. Means, J.L., & Burris, D.R. (Eds.). (1995). Phytoremediation of soils contaminated with toxic elements and radionuclides. United States: Battelle Press.

Park De Ceuvel is a circular office park which was once a former shipyard on the Johan van Hasselt kanaal off the river IJ in Amsterdam.[66] The park covers an area of roughly 4470m^2 and was designed and envisioned as a short term project with offices (Figure 14 and 15).[67] With elevated levels of heavy metals, asbestos and others, the site was planned to be mechanically excavated to remove contaminated soils. Due to a lack of funding, the project was converted to accommodate more natural means of remediation, resulting in phytoremediation.[68] A rather vast combination of plants such as mature trees, perennials and grasses were introduced to encourage the extraction and degradation of contaminants. Also included in the scope of the project were elevated spaces for micro-greenhouses, gardens used to purify water, and the Cafe De Ceuvel. This program combination led the project to reach sustainability levels of 100% for renewable sources of energy, water and wastewater management. The project also managed to utilize 60-70% site nutrient regeneration and 10-30% food production on site.[69]

This case study selection was mainly based on the similarities in comparison to the Hollinger Park Beautification project. Bringing clean soil from an external source created a disconnect between the history of the site and the future use of the remediated space (Figure 13). Instead, phytoremediation enables opportunities for educational and societal value, generating clean soil within the limits of the site.

In the following chapters, the adaptive reuse attributes and approaches studied will be synthesized to formulate design interventions, in direct correlation to the analysis of the Hollinger Gold Mine Site.

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66 Admin. “General Information.” De Ceuvel. Accessed April 27, 2021. https://deceuvel.nl/en/about/general-information/.

67 “PARK DE CEUVEL_NL.” POWER PLANTS PHYTOREMEDIATION. Accessed May 4, 2021. https://powerplantsphytoremediation.com/park-de-ceuvel

68 Ibid

69 Metabolic (2014) Cleantech Playground: research quarterly report #1. May. Amsterdam: Metabolic

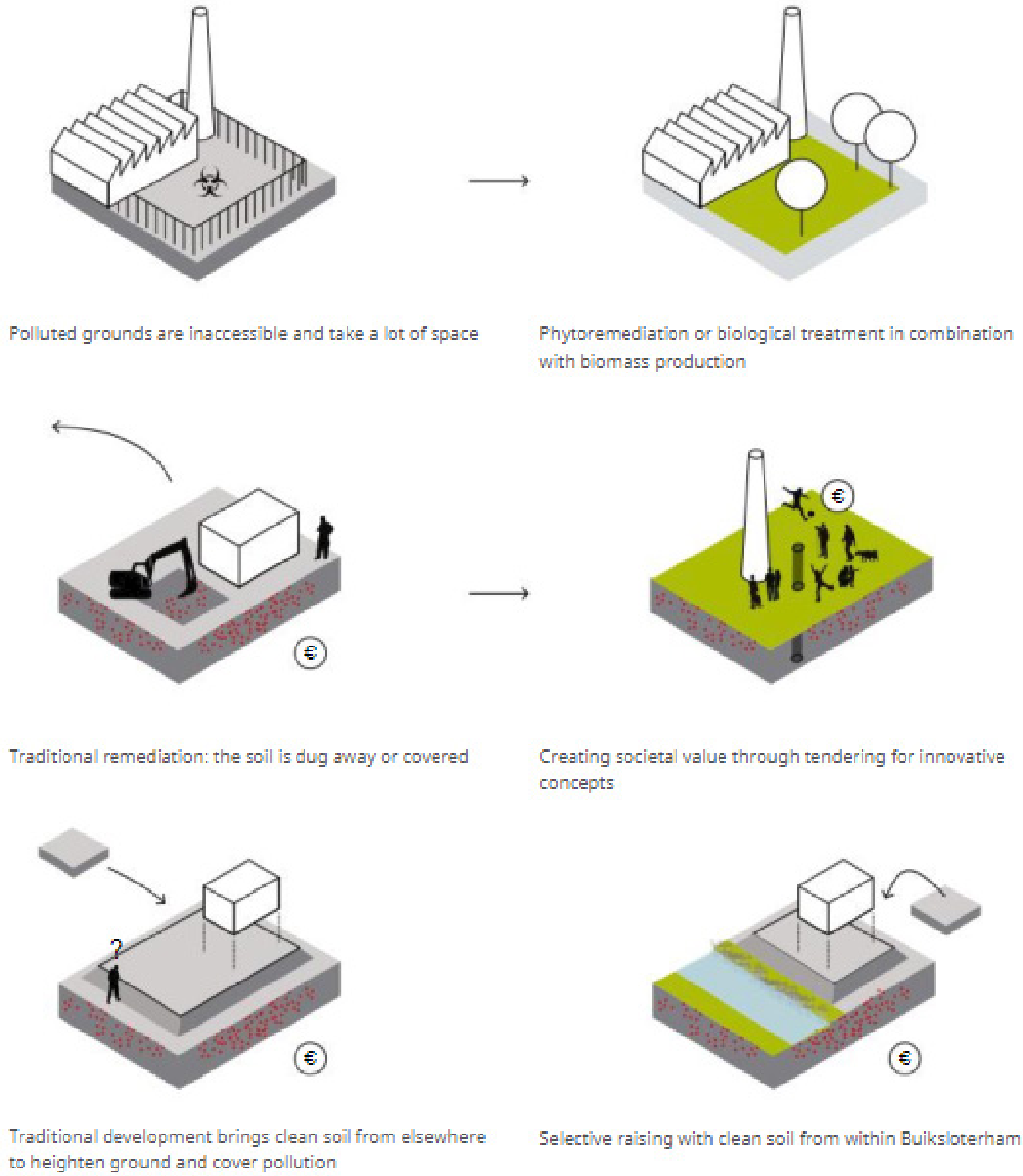


Figure 13 Park de Ceuvel action plan

Figure 14 Park de Ceuvel perspective render

Figure 15 Park de Ceuvel site plan

4

Analysis: The Site of Hollinger Gold Mines

"As an architect, you design for the present, with an awareness of the past for a future which is essentially unknown." [70]

This chapter presents the historical and site analysis conducted on the Hollinger Gold Mine buildings, and more broadly the city of Timmins (Figure 16). This analysis began by exploring old history books, to outline the main events which helped shape the community. This research also led to identifying which events had a direct impact on the Hollinger Mine site, as well as its immediate surroundings. Secondly, the current site conditions were analyzed at three varying scales. The first looked at the contextual surrounding of the site, to identify which services and attractions were located at an urban scale. The second focused on the limits of the site, to identify the current site conditions such as hierarchy of volumes, sun qualities, site limits as well as vegetation at an infrastructure scale. Lastly, the most intimate scale dissects interior and exterior spaces of the Hollinger Gold Mine buildings, to identify elements of interest and concerns in direct relation to the ideas and concepts developed in the previous chapter (material, spatial qualities, structural qualities, etc.)

70 Foster, Norman. "Norman Foster on Green Architecture." Ted Talk. Lecture presented at the Ted Talk, November 21, 2015.

4.1 Historical Context

Over the course of the thesis research, an evolving historical timeline was developed to demonstrate the history of the city of Timmins and the specific site for the thesis project (Figure 17). This timeline not only serves as a means to visually demonstrate the impactful events which took place on the site, but also to learn more about the chronology of events and develop links between the cause and effect relationships formed during this period of time. This historical timeline is used as a reference to guide design interventions which reflect a more sustainable outcome for the site. Also, the timeline was used as a secondary tool to visualize how the project could influence the current conditions of the site (Chapter 5) and how the vision for the site could impact its future state (Chapter 6). The events included within the timeline are those which had a direct impact on the development of the site, to result in its current conditions. It is important to note that as a single-industry community, the Hollinger Gold Mine were, among other companies, the owners and commissioners of the majority of services provided for the community. Without the mine, these services and infrastructure would have likely been established by another mine operation or industry.

Figure 16 City of Timmins welcome signage

Timmins Ontario is located on the Abitibi Greenstone Belt, the largest greenstone belt in the world.[71] This 85 000km2 of precious metal rich soil launched the exploration and mapping by prospectors in the area. In the early 1900's, the federal government established the need for a railway to cross the Canadian Shield.[72] The provincial government's response took place in 1903, with the Temiskaming and Northern Ontario Railway (T&NO). By 1909, many regions of the world had overheard of the success and wealthy discoveries in "The Porcupine". Members from other communities made their way to the area, to purchase land claims in their early development. Hollinger Gold Mines was one of the three major operations to take shape in 1910. Unfortunately, these preliminary settlements were essentially destroyed in a disastrous fire in 1911[73]. In response to the fire and the expected wealth of "The Porcupine", the Timmins Town site Company, under the direct supervision of Noah Timmins, began to lay out the foundations for the City of Timmins.[74] With a population of 600 residents, he began to plan the extents of the town site, sold the various land plots, and gave the town his name. From this point until 1916, Timmins began to develop all necessary infrastructure to become a permanent community, such as electricity and a 10 bed hospital in 1912, as well as the incorporation of water works in 1915. In attempts to lure more prospectors and potential miners and their families to the city, one of the local green spaces was turned into a golf course in 1922, named the Hollinger Golf Course. However, golf was not the only summer sport to appear for the community. In 1930, the mine chose to fill one of the small nearby lakes with gold mine tailings, flattening the ground and built a baseball field which resulted in highly contaminated soil. The buildings currently located on the site were built in 1939, and operated as an underground mining operation until 1968. Up until this point, the mine had roughly 970 kilometers of underground tunnels, which were taken out of service in 1980, when the extractions were converted to various small open pit operations.[75] The main Hollinger Gold Mine head frame was demolished in 2010, to allow for the current large scale open pit operation to take place.

71 M. (1991). Geological Survey of Canada (pp. 17-24). Ottawa, CA: Canadian Government Publishing Centre.

72 Torlone, Joe G. "Evolution of the City of Timmins: a Single-Industry Community." Thesis, Wilfrid Laurier University, 1979.

73 Barnes, Michael. Timmins: the Porcupine Country. Erom, Pm: The Boston Mills Press, 1991.

74 Torlone, Joe G. "Evolution of the City of Timmins: a Single-Industry Community." Thesis, Wilfrid Laurier University, 1979.

75 Barnes, Michael. Gold in Ontario. Erin, Ontario: Boston Mills Press, 1995.

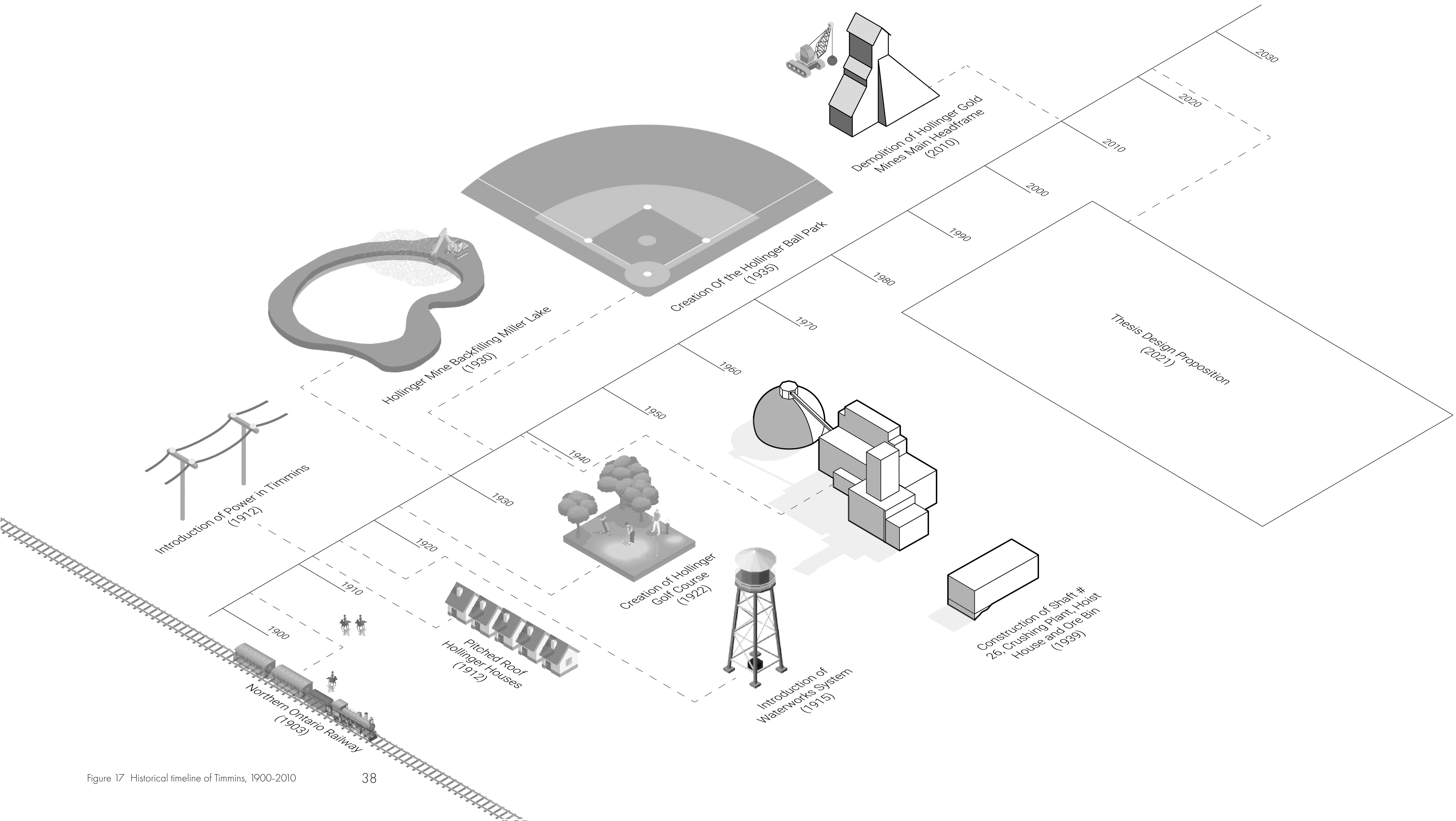


Figure 17 Historical timeline of Timmins, 1900-2010

4.2 Site Analysis

Understanding the current site conditions along with the challenges and opportunities that can arise from reusing such a rich site is a crucial step of this research. This analysis covered three scales of interventions, from the surrounding context of the site to the infrastructure and building details.

4.2.1 Urban scale

This larger scale analysis allowed for a better understanding of the types of programmatic spaces present in the vicinity of the site, but also for identifying which spaces or public services are absent in the area. Establishing the community's programmatic needs was important in order to develop a program which would not only respond to the project's goals, but also contribute to the development of the urban fabric of the city and its sustainability. The following map outlines the buildings and spaces within the direct vicinity of Hollinger Gold Mines (Figure 18). Existing public spaces include retail stores, commercial spaces, gas stations, grocery stores, hotels, a pharmacy, restaurants, and exterior green spaces. Also, amenities include emergency services, public transit, the Timmins Museum, and the Timmins Public Library. Lastly, private spaces include residential neighborhoods, private commercial companies, and most significantly the Newmont Porcupine open pit operations.

Following this contextual analysis, the surrounding context of the Hollinger Gold Mine site has proven to be quite rich with programmatic diversity. However, the surrounding programs offer singular amenities to the community, which for the most part do not include the public and opportunities for meeting and engagement as part of their core functions. It was concluded that the city of Timmins would greatly benefit from a space where the public and the community can come together, not only for gathering purposes, but also to engage in some kind of communal purpose. The program presented in the following chapter was developed with such intentions.

Figure 18 Contextual site analysis plan, 1-5000

4.2.2 Infrastructure scale

The second phase of the site analysis focused on the immediate limits of the site. This more direct analysis was supported by multiple site visits, to study the landscape, buildings and other elements located on the site. The current installations consists of four individual buildings (Figure 19). Firstly, the #26 mine shaft and the ore crushing plant was the direct link between the underground mining operations and the above ground buildings to process the excavated soil. This building was used to hoist miners and ore in and out of the underground tunnel system. Following extraction, the ore would go through a crushing process, allowing for future sorting to extract the precious metals. This building consists entirely of a steel embedded concrete structure. According to old photographs of its construction, this type of structure allowed for large interior spaces, suitable to house the large machinery equipment required for operations. Following the crushing process, the ore was transported to the second building on the site, the ore storage bin. This spherical structure was used as a large storage space, to house the crushed material prior to processing. This building showcases an exposed steel structure, with a facade consisting of a shingled envelope, perhaps made of asphalt or similar materials. The third building on the site, the hoist control room served to house the hoisting equipment. According to old photographs, large cable winches would connect the hoist control room to the hoist tower through a system of pulleys. This would allow for large heavy loads to be raised out of the tunnel system. Similarly to the ore storage bin, this building also consists of an exposed interior steel structure, however red brick walls make up the exterior facade. Lastly, the fourth building on the site is the City of Timmins water tower, which is not owned by the same proprietor of the site. Since this tower is part of the city's public works, its ownership lies within the City of Timmins. Subsequently, the exterior conditions of the site were identified, such as the sun qualities, material ground conditions, physical site limits and access points (Figure 20) as well as the vegetation in and surrounding the site (Figure 21). Resulting from the data presented in the site analysis, the following list includes some of the site potentials which are relevant to this thesis project:

- Large abundance of sunlight on various locations of the site
- Large fenestration in various parts of the buildings offers large quantities of interior natural lighting
- Buildings offer some areas of shaded space, which could serve as protection from direct sunlight
- Underground tunnel system is still present under the building, which offers opportunities for above and below ground developments
- Building's structure suggests open floor plan, which can promote flexible opportunities for new spaces
- Although placed near the core of the city, the site is located in a semi-private setting, lowering the level of automobile traffic
- Existing site vegetation and greenery demonstrates some preliminary conditions of the soil. Although contaminated, the site demonstrates potential for expanding the possibilities of site vegetation
- Material diversity of buildings promotes the opportunity for a unique juxtaposition of material culture
- Certain building materials such as the brick promotes potential for material disassembly and reuse
- Certain building materials such as the brick and concrete promote the potential of thermal mass opportunities

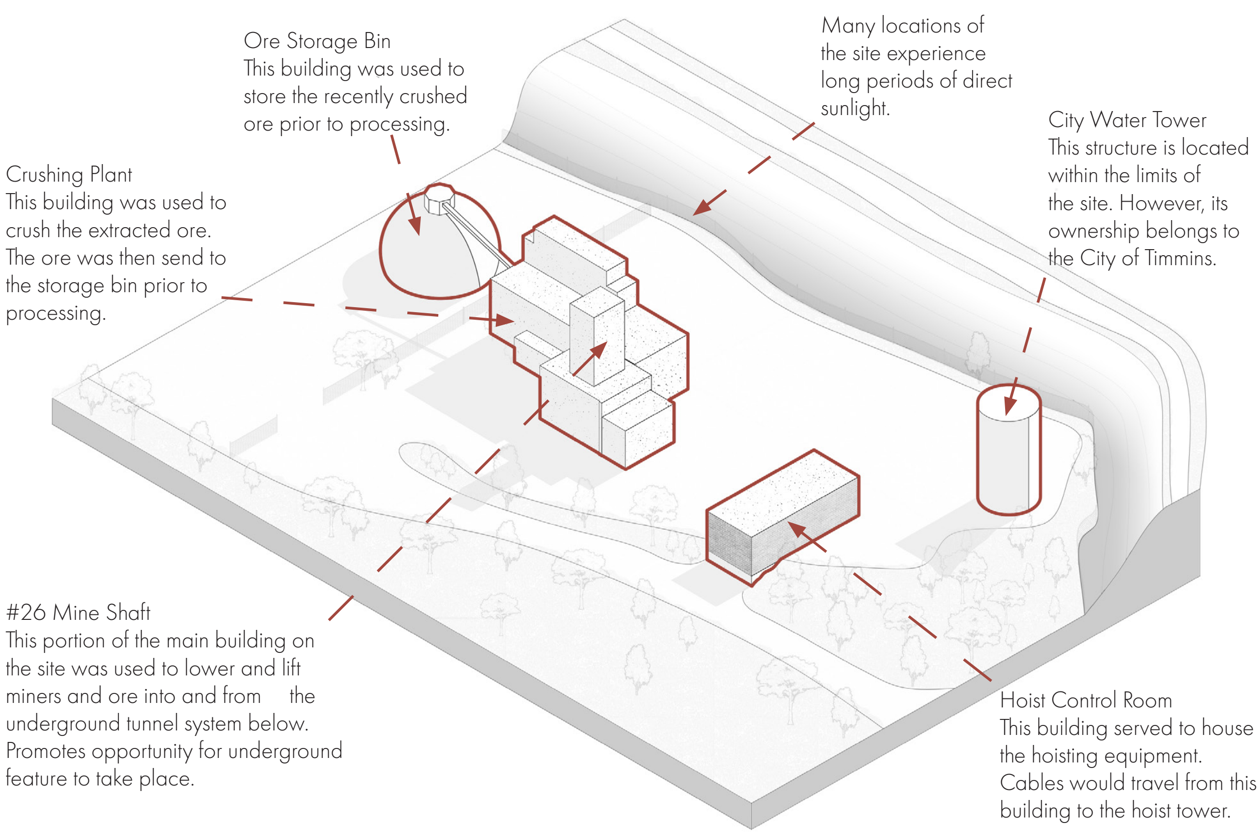


Figure 19 Hierarchy of scale and sun qualities axonometric

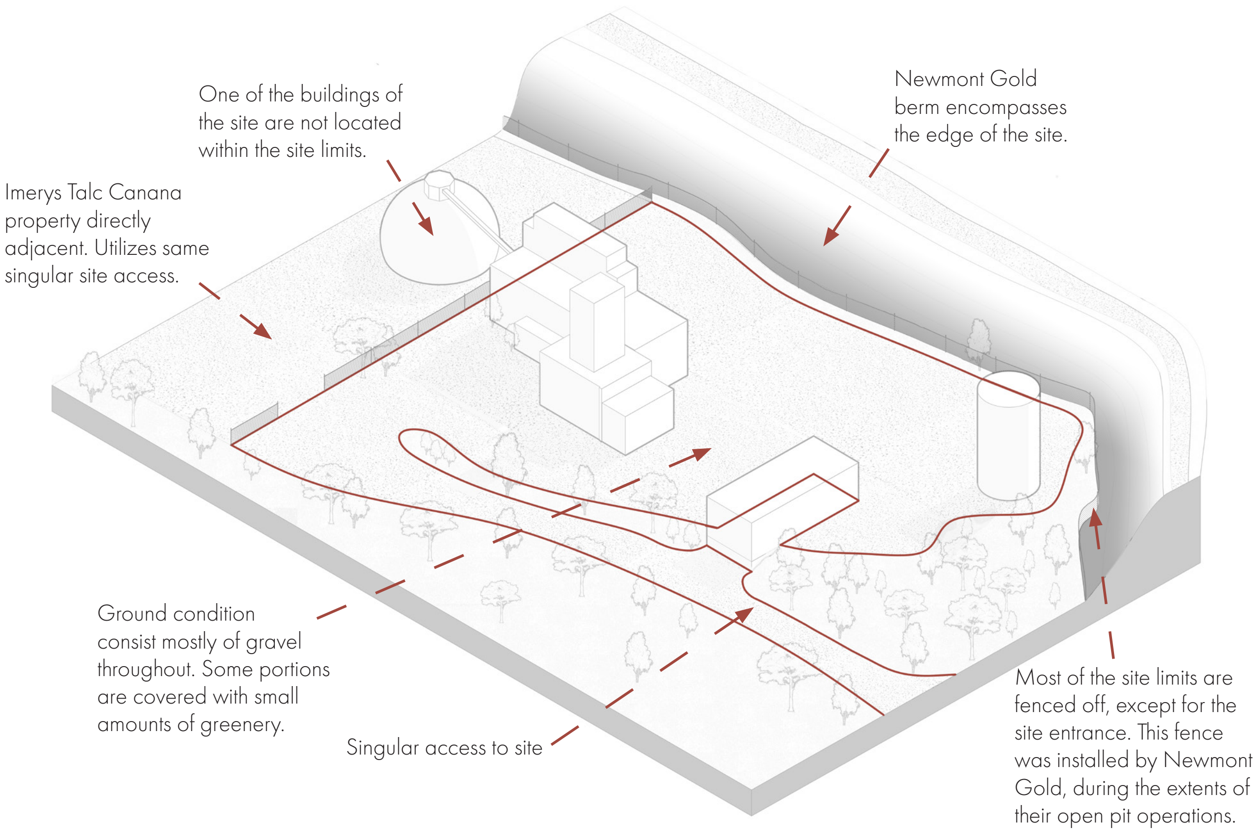


Figure 20 Site limits axonometric

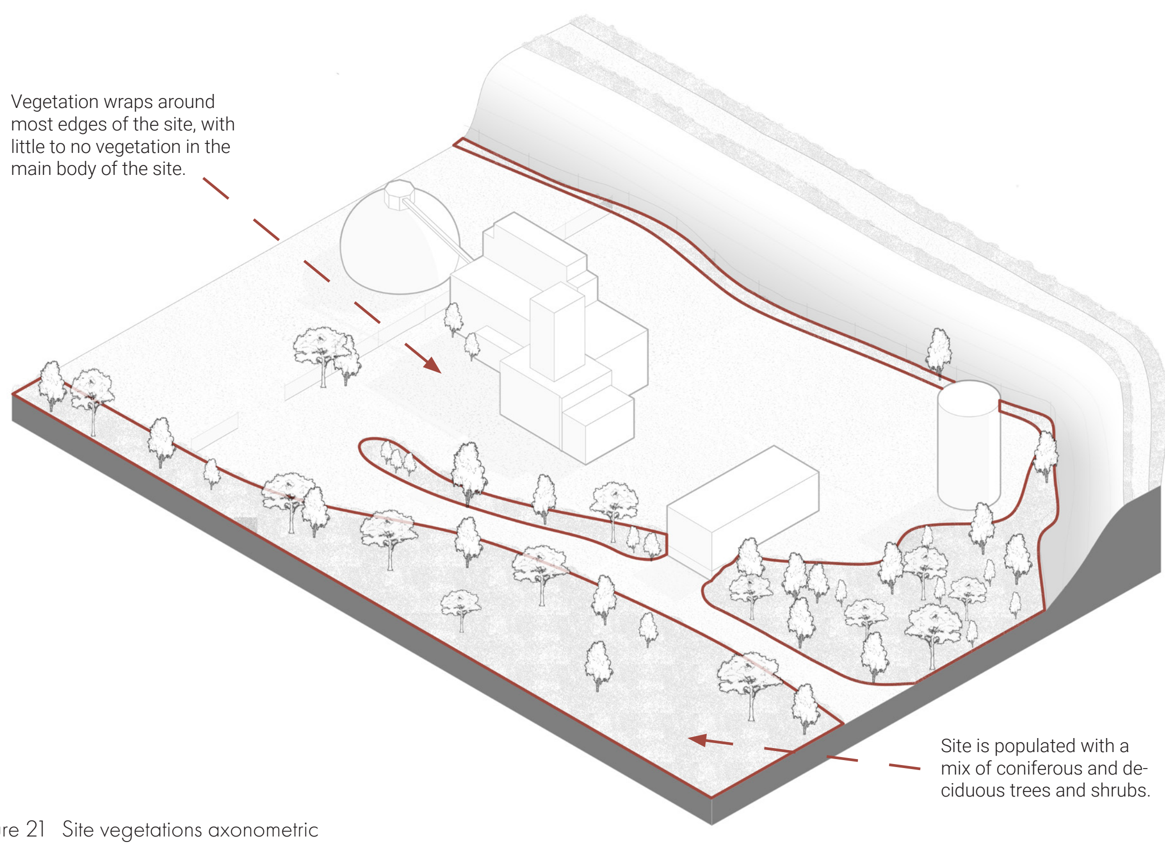
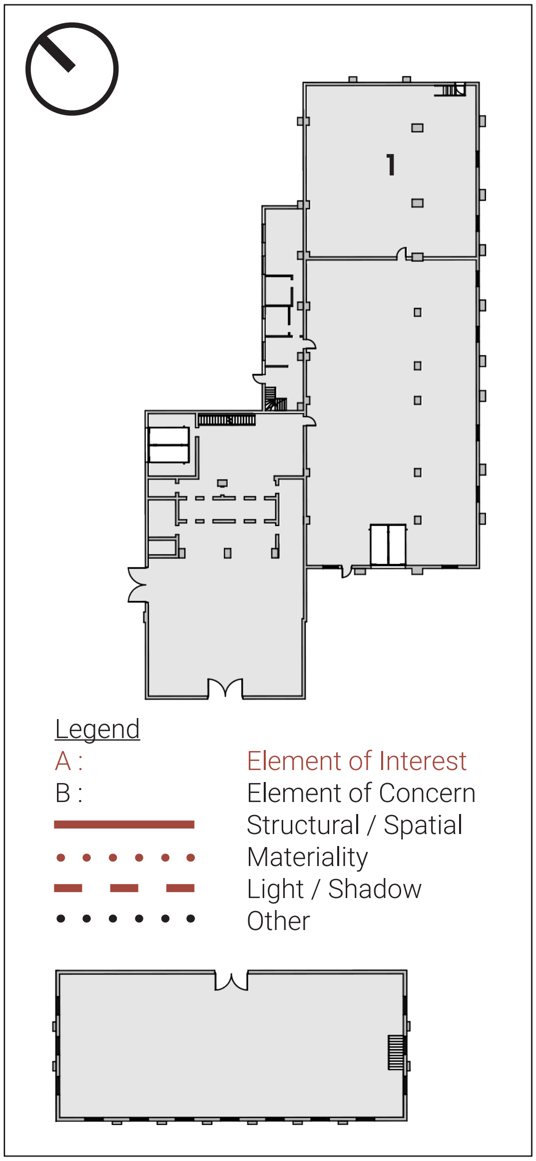


Figure 21 Site vegetations axonometric

4.2.3 Building scale

Finally, the site analysis was conducted at the most intimate scale: the buildings and their details. Supported by recent photographs, six of the building's significant spaces were dissected from the interior and exterior. These included the three largest spaces on the ground floor plan of the crushing plant (Figure 22,23 and 24), the space within the hoist control room also located on the ground floor (Figure 25), as well as two interesting spaces located at the second level (Figure 26 and 27).

Each space found within this step of the research was analyzed to identify elements of interest and concerns in direct relation to the ideas and concepts developed in the previous chapter, more specifically aspects related to materiality, structural and spatial qualities, and conditions of light or shadow. Firstly, key materiality aspects include exterior ornamentation, concrete and brick facade conditions, instances of stacked brick walls, existing wooden and metal doors, gypsum wall board finish, carpeted flooring as well as existing machinery of a rusted steel texture. Secondly, spatial and structural qualities include high or low ceilings, multi-level connections, concrete beams and columns, changes in roof elevations, south and north facing spaces, an exposed steel structure as well as the identification of vast or narrow spaces. Lastly, key elements of light or shadow include the lack or presence of fenestration, instances of covered fenestration, dark nooks and corners, and the lack or presence of artificial lighting. The aspects enumerated here will contribute to the effective decision making of design interventions for the project.

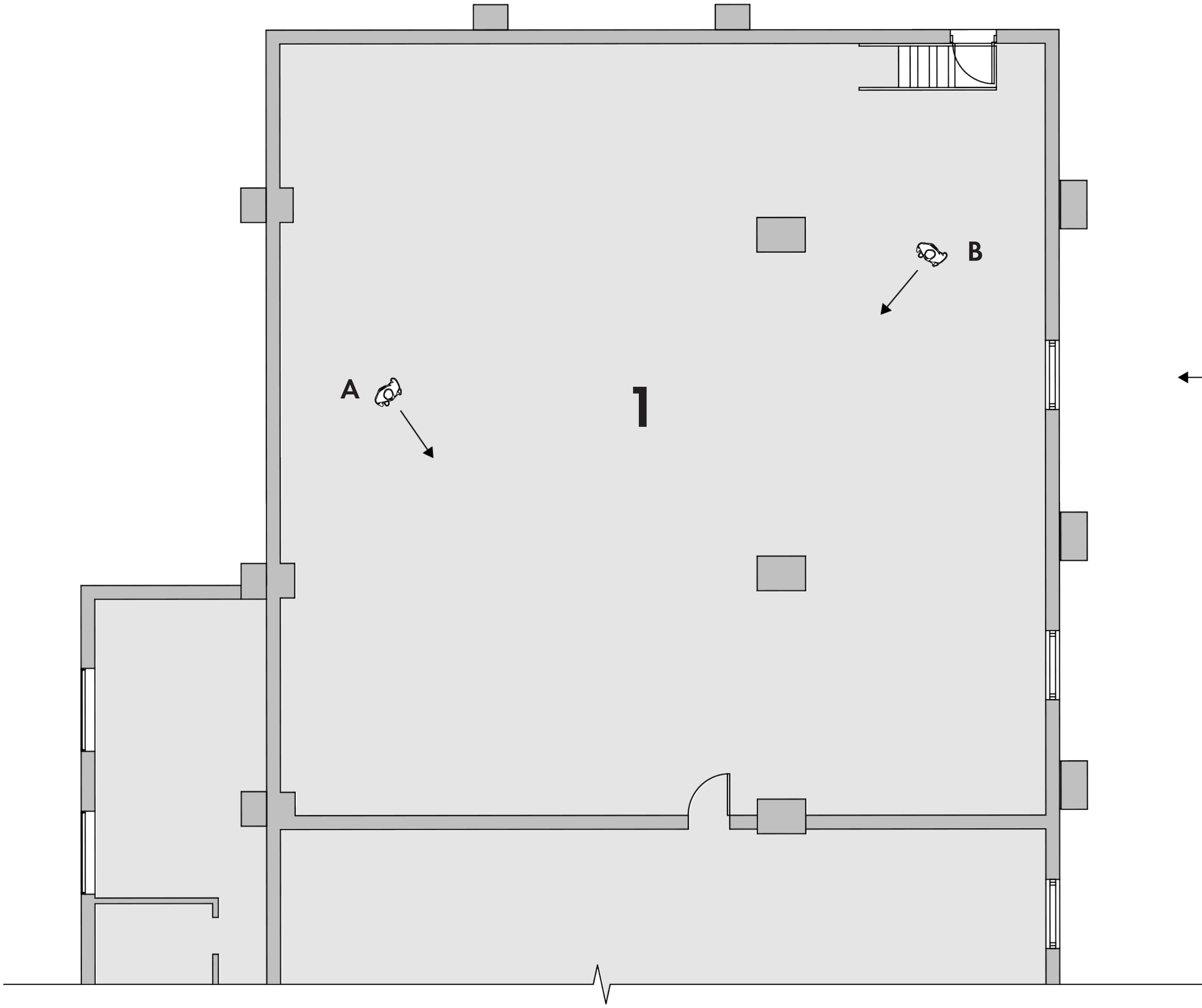


Key Plan 1 : 750

Exterior Ornamentation
Covered Fenestration
Worn Concrete Facade
South Facing Space
Difference in Floor Level and Grade

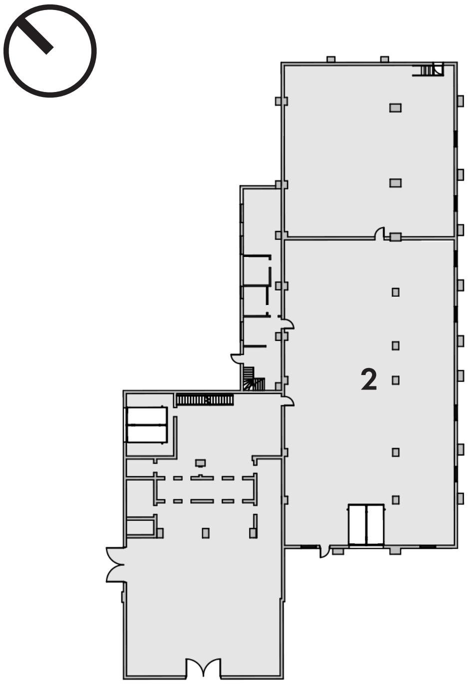
High Ceilings
Multi Level Connection
Dark Nooks and Corners
Concrete Columns
Lack of Fenestration
Stacked Brick Wall
Lack of Artificial Lighting
Open Floor Plan

Figure 22 Existing building analysis, #1



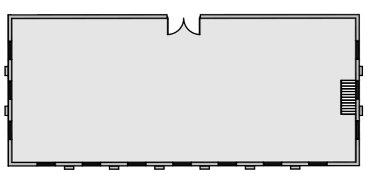
1 : 150

High Ceilings
Multi Level Connection
Dark Nooks and Corners
Concrete Columns
Lack of Fenestration
Stacked Brick Wall
Lack of Artificial Lighting
Open Floor Plan

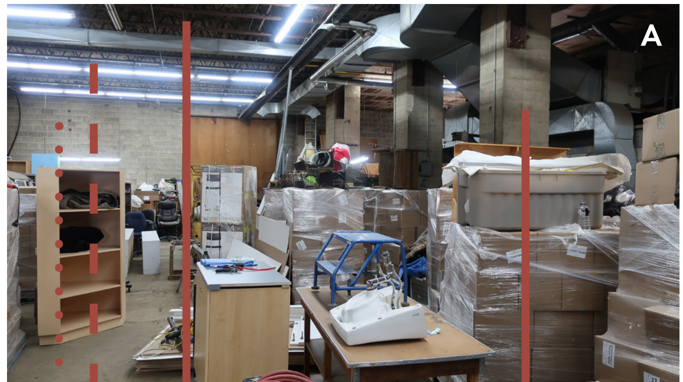


Legend

A :	Element of Interest
B :	Element of Concern
(solid line)	Structural / Spatial
(red dotted line)	Materiality
(dashed line)	Light / Shadow
(black dotted line)	Other



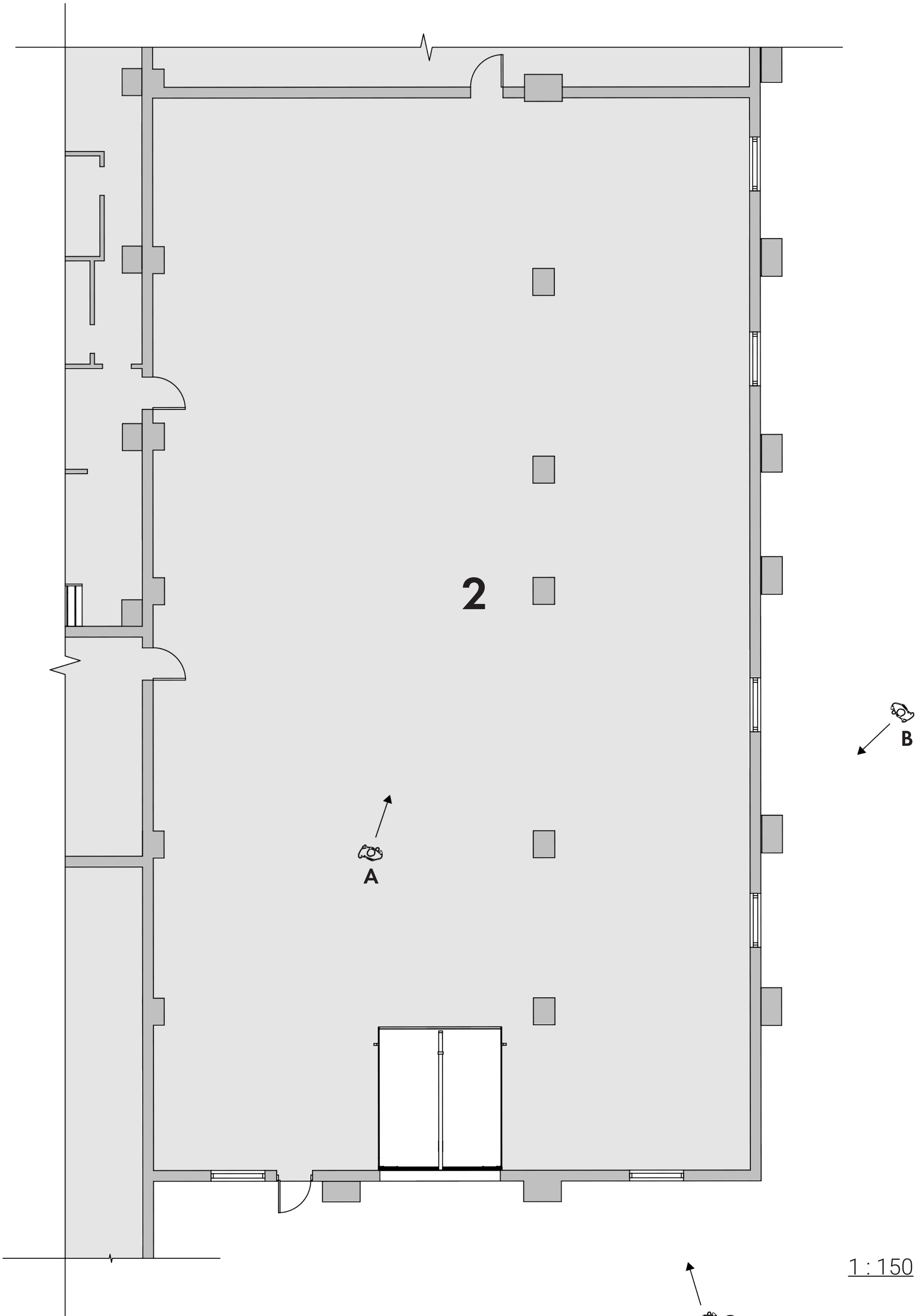
Key Plan 1 : 750



Lower Ceilings
Artificial Lighting
Stacked Brick Wall
Concrete Columns

Worn Concrete Facade
Covered Fenestration
South Facing Space
Exterior Ornamentation
Grade and Floor Level Even

Figure 23 Existing building analysis, #2


2
A
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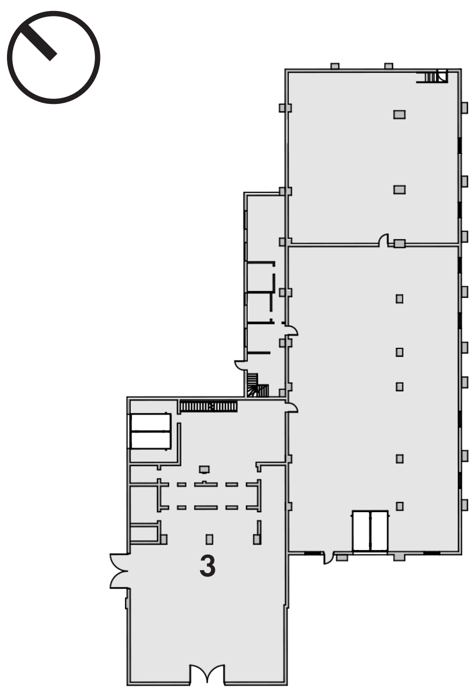
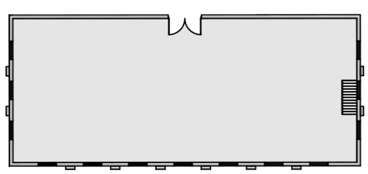


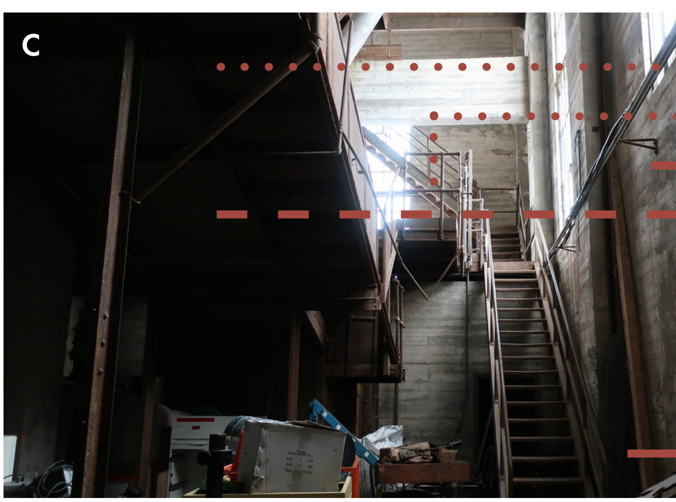
Legend

A : Element of Interest
B : Element of Concern
Structural / Spatial
Materiality
Light / Shadow
Other



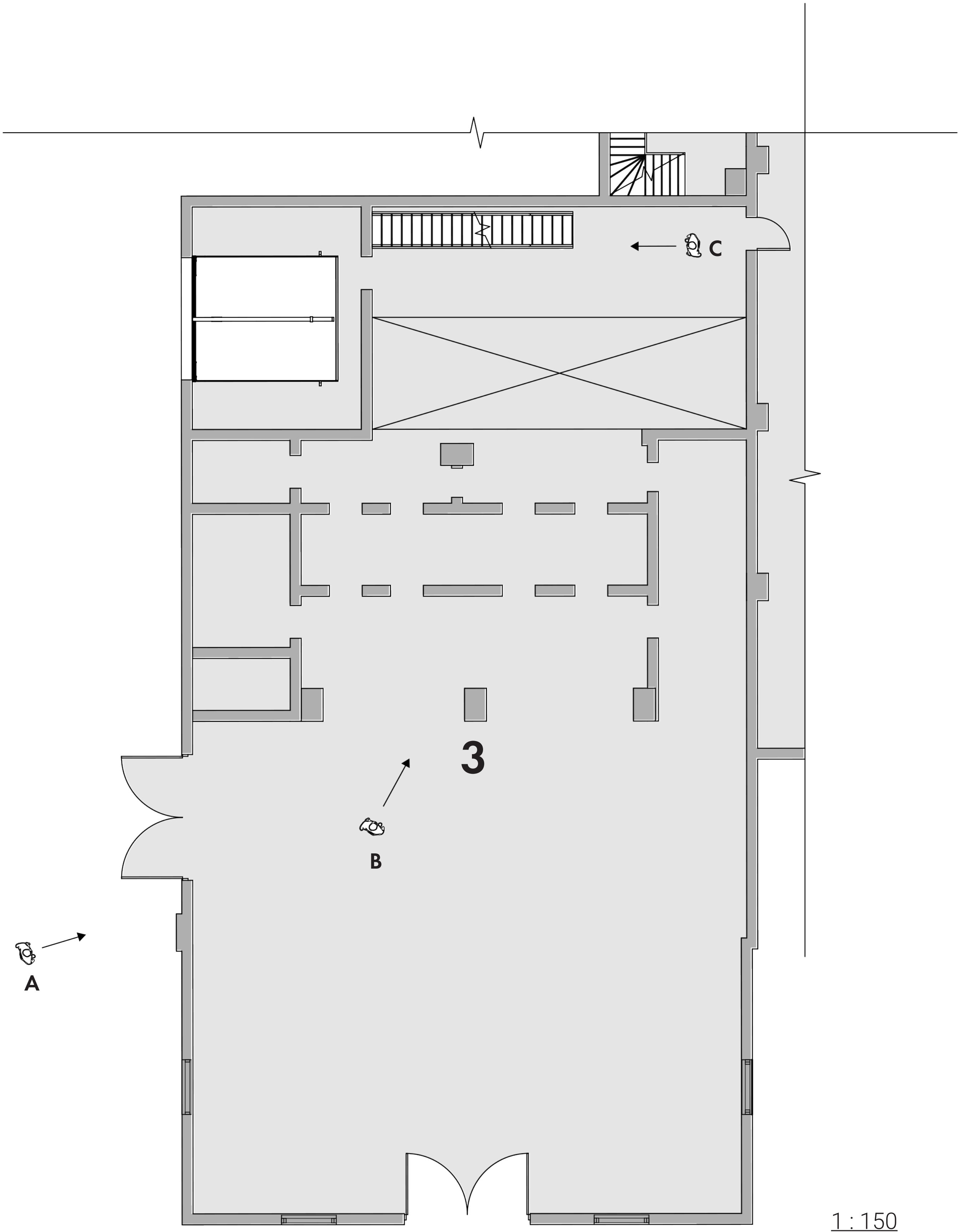
Key Plan 1 : 750

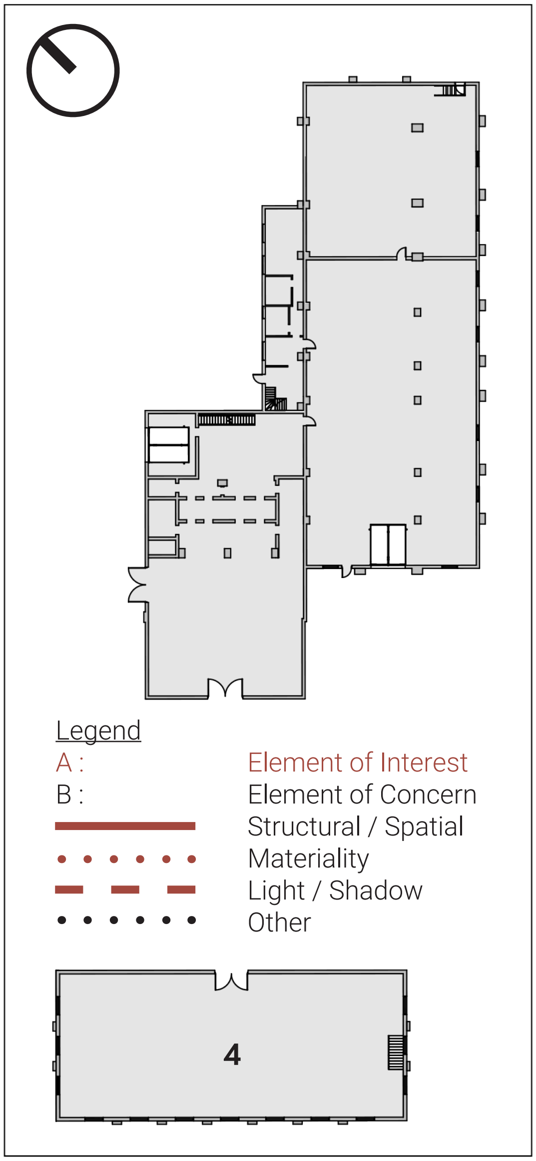
Change in Roof Elevation
Covered Fenestration
Existing Wood Doors
Embedded Brick
Facade Ornamentation
Grade and Floor Level Even



Existing Mining Machinery
Existing Steel Stairways
Lack of Fenestration
Dark Nooks and Corners
Lack of Artificial Lighting
South Facing Space
Existing Industrial Doors
Concrete Columns
North Facing Space

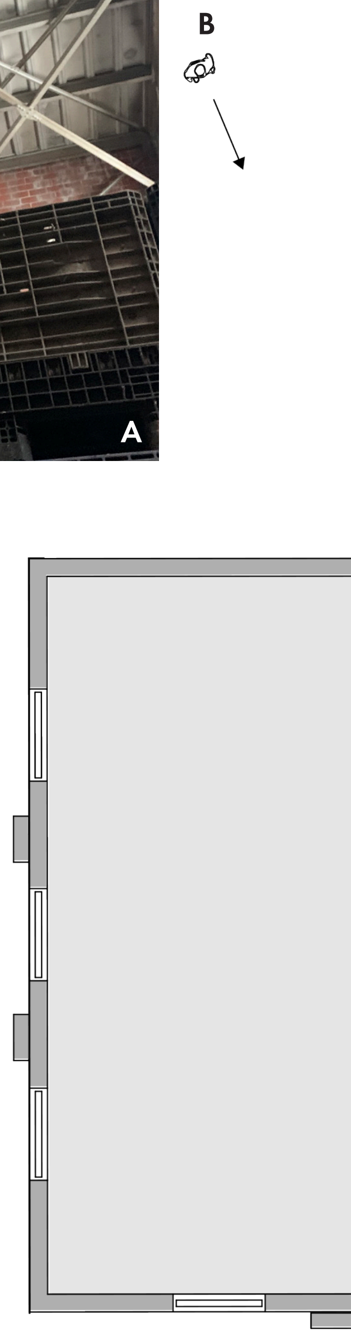
Figure 24 Existing building analysis, #3


C
3
B
A
1 : 150



Key Plan 1 : 750

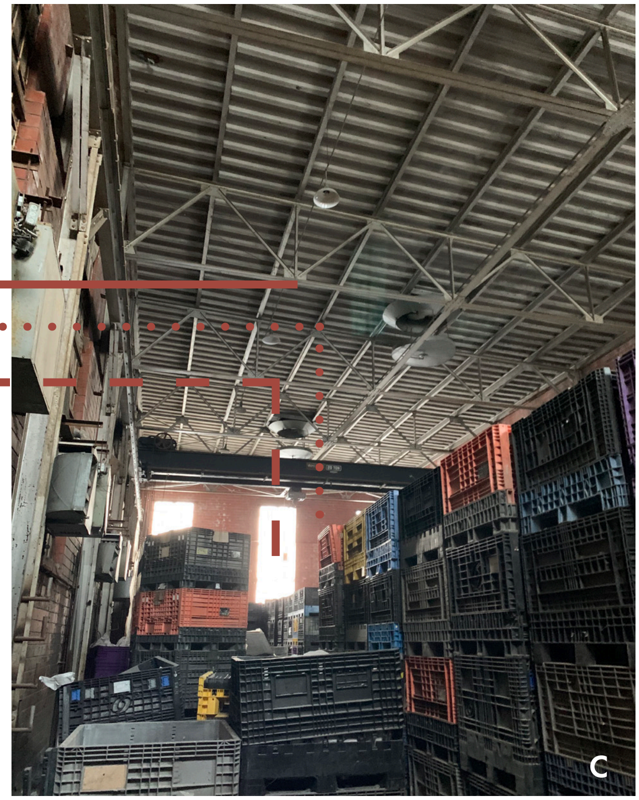
Exposed Steel Structure
Exposed Exterior Brick Wall
Completely Open Floor Plan
Abundant Fenestration
Access to Direct Sunlight
Potential for Manipulation

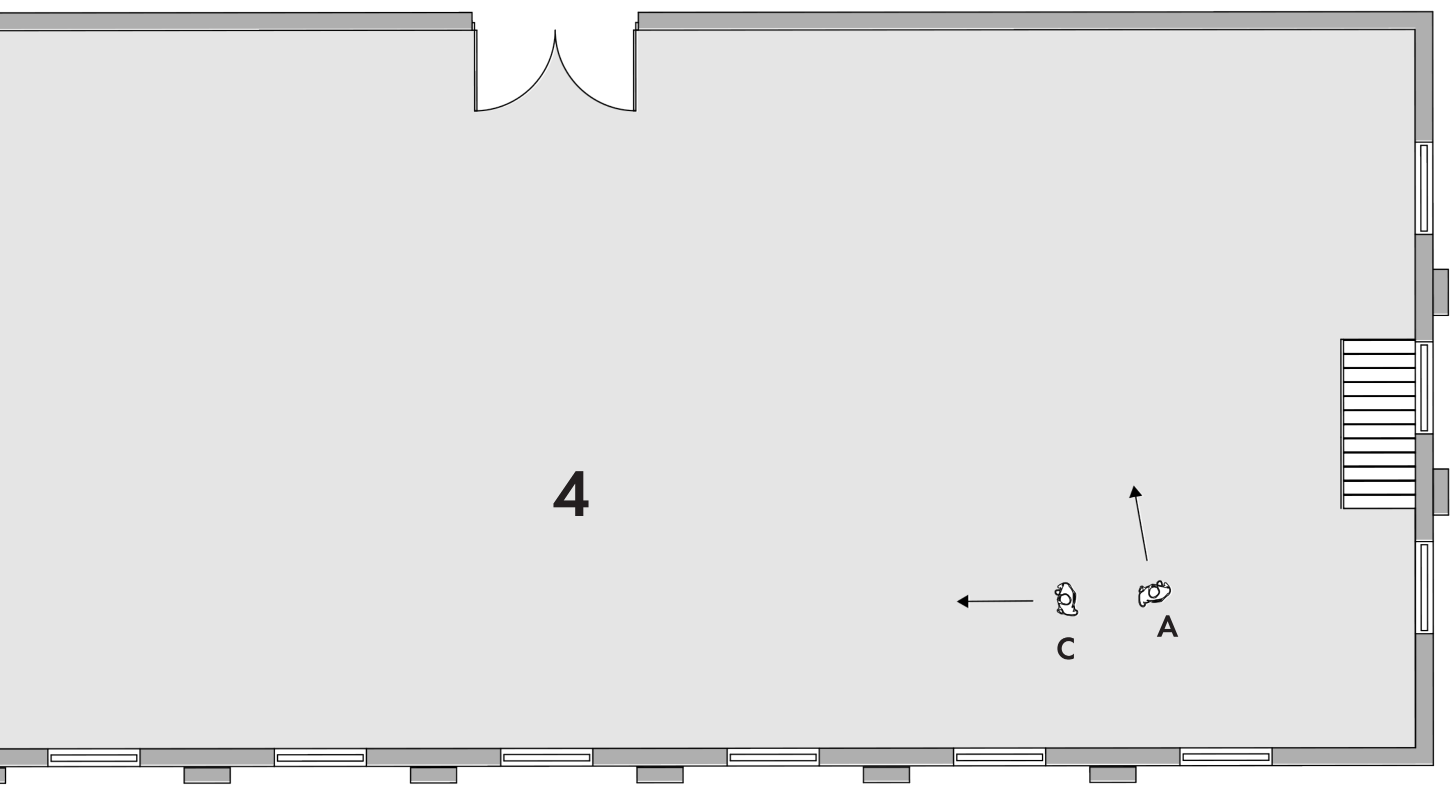


Completely Open Floor Plan
Adjacent to Other Structure
Existing Wood Doors
Grade and Floor Level Even
Potential for Manipulation

Figure 25 Existing building analysis, #4

Exposed Steel Structure
Exposed Exterior Brick Wall
Abundant Fenestration
Completely Open Floor Plan
Access to Direct Sunlight
Potential for Manipulation





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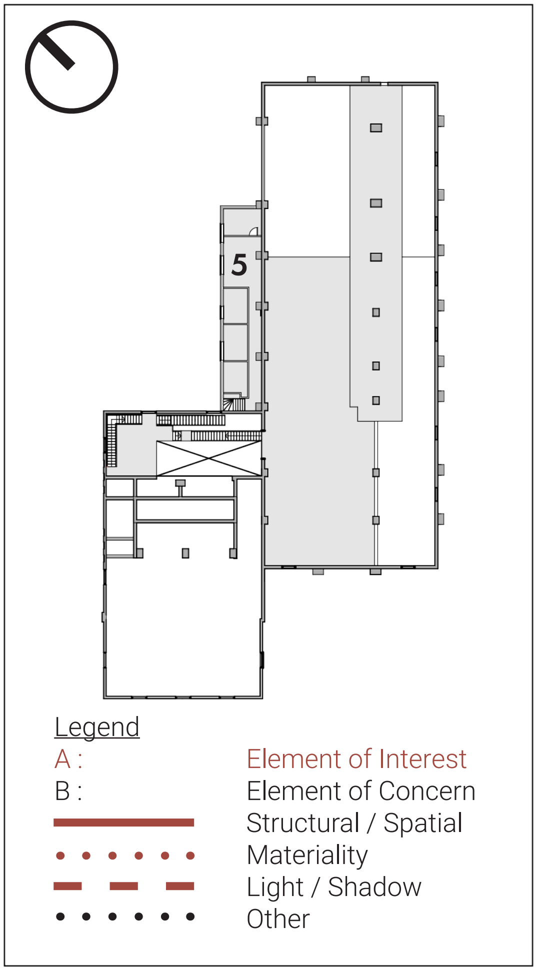
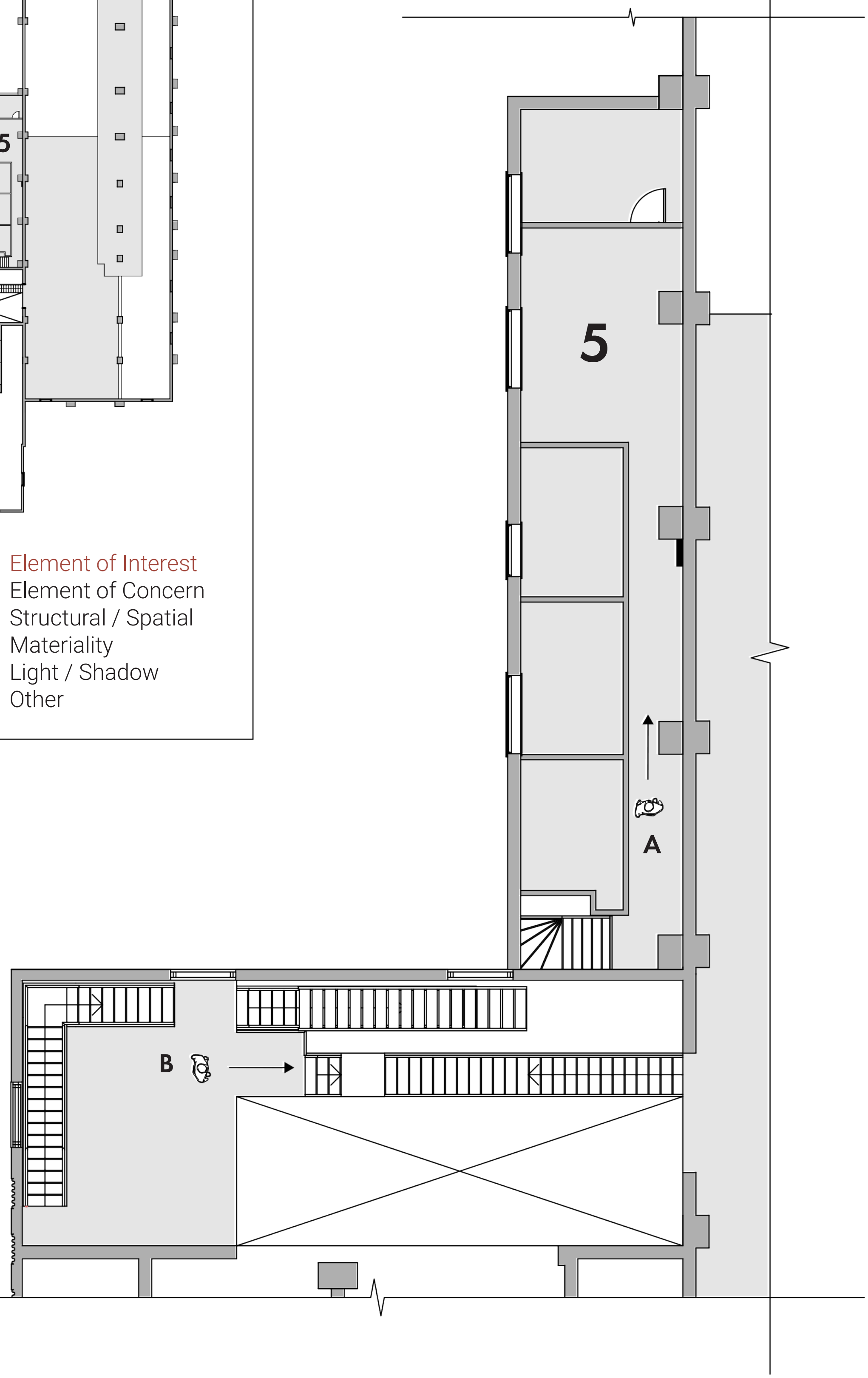


Key Plan 1 : 750

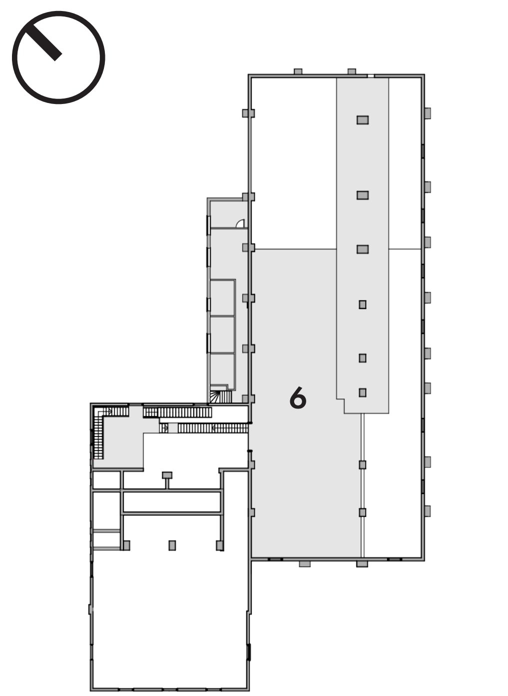


1 : 150

Figure 26 Existing building analysis, #5

No Direct Access to Sunlight
Disconnected from Remainder
Artificial Lighting
Grade and floor Level Even
Small Fenestration
Demonstrates Signs of Being an Extension
Potential for Manipulation
Gypsum Board Finish
Extremely Narrow Space
Carpet Flooring

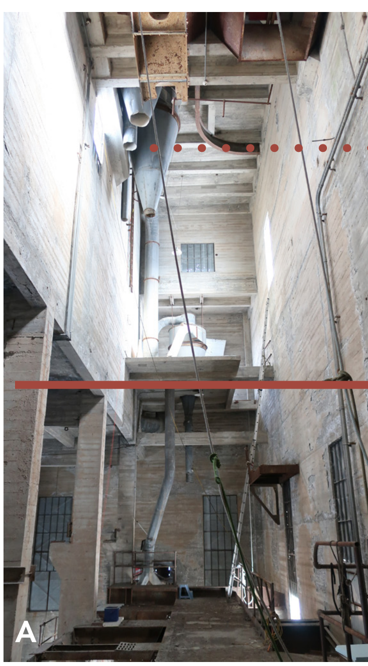
Concrete Beams
Existing Mine Machinery
Rusted Steel Texture
Fenestration
Access to Second Storey
No Direct Sunlight
Potential For Manipulation
History of Site



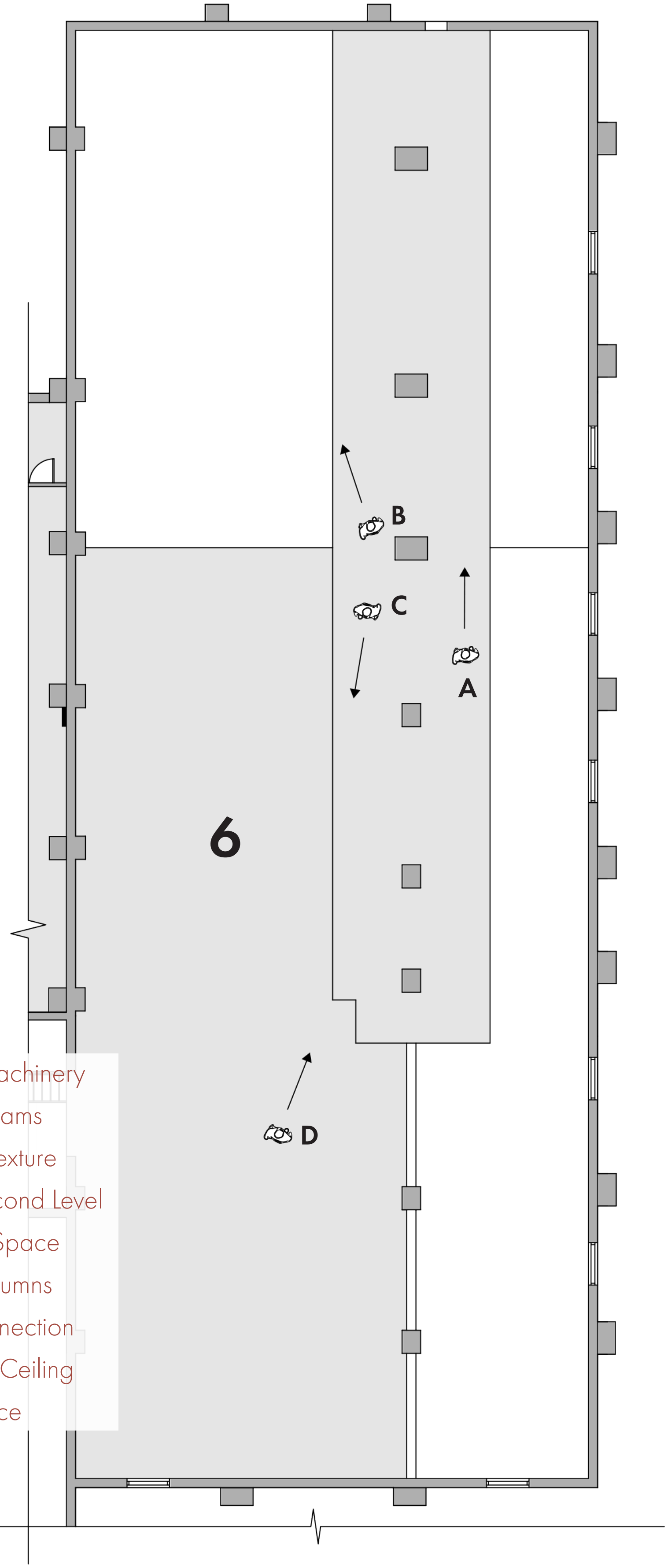
Legend

A :	Element of Interest
B :	Element of Concern
▬▬▬	Structural / Spatial
• • • • • • (red)	Materiality
▬ ▬ ▬	Light / Shadow
• • • • • • (black)	Other

Key Plan 1 : 750



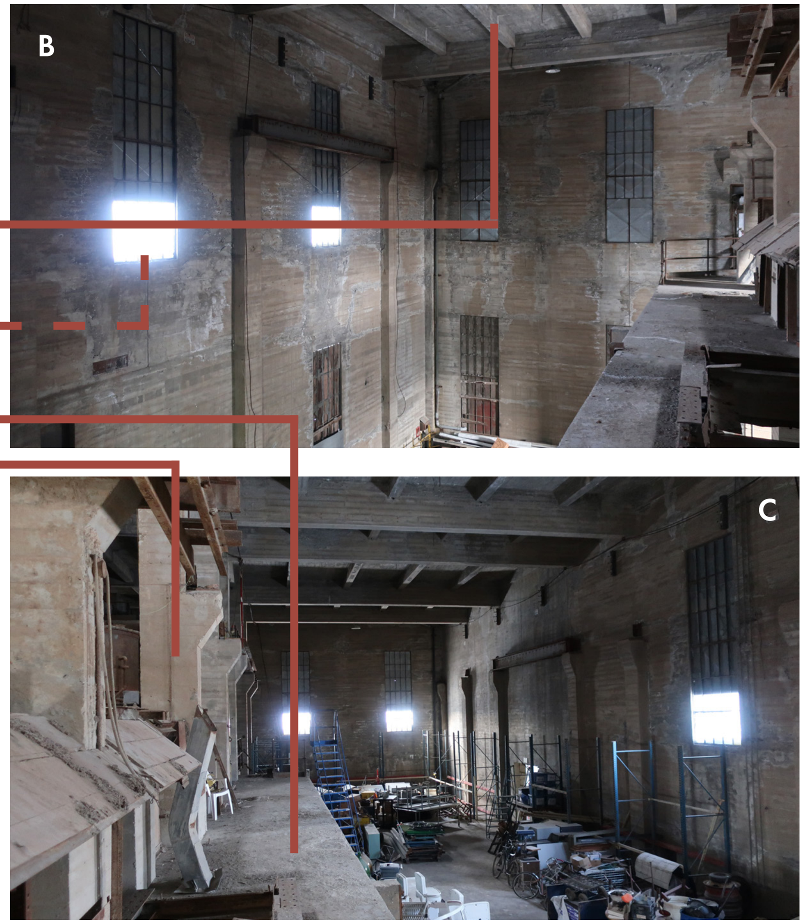
Existing Mine Machinery
Concrete Beams
Rusted Steel Texture
Fenestration at Second Level
South Facing Space
Concrete Columns
Multi Level Connection
Extremely High Ceiling
Large Space

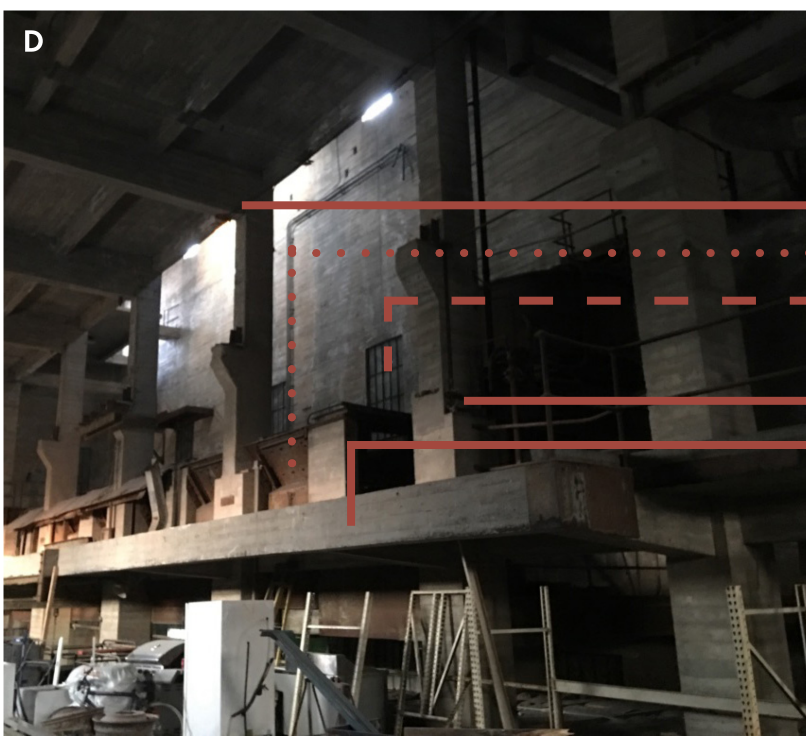


1 : 150

Figure 27 Existing building analysis, #6

Existing Mine Machinery
Concrete Beams
Rusted Steel Texture
Fenestration at Second Level
South Facing Space
Multi Level Connection
Concrete Columns
Extremely High Ceiling
Large Space





Concrete Beams
Rusted Steel Texture
Covered Fenestration
South Facing Space
Concrete Columns
Multi Level Connection
Extremely High Ceiling
Large Space

5

Design: Urban Agriculture in the Heart of the City

The outcome of the site analysis established the need for spaces which provides the opportunity for the community to come together. As previously mentioned, the surrounding context of the site offers singular amenities not promoting a sense of community within the city of Timmins. Therefore, it was determined that a program involving urban agriculture could engage the objectives of this thesis and the various needs of the site outlined in the site analysis. This chapter begins by outlining the program guiding the adaptive reuse of the Hollinger Gold Mine. The following section features a detailed description of the different systems driving the production of urban agriculture. The last section of the chapter describes the project and the design interventions applied in response to the research conducted in this thesis.

5.1 Program

Broadly stated, the aim of this thesis is to develop a method to 'reverse', or remediate the environmental damage of the mining industry on the natural landscape. In contrast to other remediation methods, this thesis also aims to incorporate the community in the process. This leads to explorations on how the adaptive reuse of an abandoned mine structure could attract members of the community, while still segregating parts of the site to allow for the natural remediation of the soil. Considering the historical use of the site focused on the extraction and destruction of the natural landscape, one way to respond is to include a program focusing on providing the site with the opposing approach: production and regeneration. Therefore, urban agriculture was selected as the main program leading the adaptive reuse of this site. To alleviate the burden on the existing soil of the site, this approach includes the growing and harvesting of plants and crops within the buildings themselves, rather than on the exterior landscape. The following three types of agriculture spaces anchor the remainder of the project, growing outwards to develop supporting public spaces (Figure 28).

To begin, the underground tunnels below the mine remain intact, accessible through the vertical shaft #26 located in the center of the crushing plant. This provides the opportunity to not only utilize this abundant space, but also make a historical connection between the above and below ground fabric of the site. Humid and warm, the current conditions of the underground tunnels are almost ideal for the growth of plants. Hydroponics is the process of growing plants in a soilless medium, such as a nutrient filled water solution. These systems are better known for growing leafy greens, such as lettuces, kales and micro-greens. By introducing a small list of amenities such as water and electricity, the incorporation of a hydroponic growing farm in the underground tunnels below the mine provide the opportunity for the growth of crops, allowing for the contaminated soil above ground to be regenerated.

Secondly, the current condition of the Hollinger Shaft # 26 is a dimly lit vertical space. Visible from virtually any part of the city, this portion of the building is a landmark for the residents of Timmins. For this reason, this space was programmed in a manner to maintain its exterior facades and historical significance. Therefore, low light agriculture for the growth of crops which thrive in shaded areas such as mushrooms, bean sprouts and rhubarb among others, was incorporated inside the shaft.

Thirdly, the hoist control room is currently framed with a steel structure, covered by a red brick facade. Since the brick is not being used as a structural member, the analysis established this to be a feature which could be potentially modified. In addition, an underground service tunnel linked to the crushing plant, is accessible through the basement level of this building. For these reasons, the hoist control room was chosen to host a greenhouse, modified to expose the south facades for optimal sunlight inclusion. In addition, the service tunnel stemming from this building will also be utilized to host a modified version of the hydroponic system, further explained in the project description (Section 5.2). Since the hydroponic system promotes the growth of leafy greens, the greenhouse is designed to grow more structurally demanding crops, such as cucumbers, tomatoes, and melons. The diversity of each type of agriculture allows for the growth of a range of crops, while taking advantage of the current conditions of the spaces they occupy.

The remainder of the spaces are programmed to complement and add to the production and public sector of the building. To attract community members to the site, public spaces provide the opportunity for members to enjoy the consumption of the fresh crops grown on site in one of two ways. First, members of the community can enjoy small freshly prepared meals from the cafe/restaurant. This space also allows for more flexible usage, included in the small lounging space or by accessing the exterior patio directly facing the cafe. In contrast, visitors looking to creatively prepare home cooked meals, can purchase prepackaged produce from the market style food cooperative to bring home to include in their favorite meals and recipes. In addition, users looking to receive more information or to study the systems included on site, can be directed to the educational space. This public space provides the community with reading materials, a flexible space to study them and also the flexibility to hold small educational sessions and talks for learning.

Although private, the production spaces were designed with views from the public spaces, to allow users to experience the agricultural systems. Following the growing of crops, all agriculture is transported to the harvesting and processing space. Here, crops are cut and cleaned, ready to be either consumed in house or packaged. Paying homage to the mining history of the site, a conveyor transports the crops from this space to the packaging and exportation space. In addition to the in-house food cooperative and restaurant, this space also incorporates the opportunity for the export and distribution of fresh produce to local grocery stores, markets and restaurants. This space is programmed for the weighing, separating and packaging of crops to be exported at the loading dock, or sold in the cooperative.

Figure 29 represents the spaces described above in three dimensions, colored in red for production space or gray for public space. This diagram begins to identify where spaces are located within the adaptive reuse of the Hollinger Gold Mine, as well as their direct connection between one another. Sizing, elevation level and a short description of each space can be observed in the spatial requirements table (Figure 30).

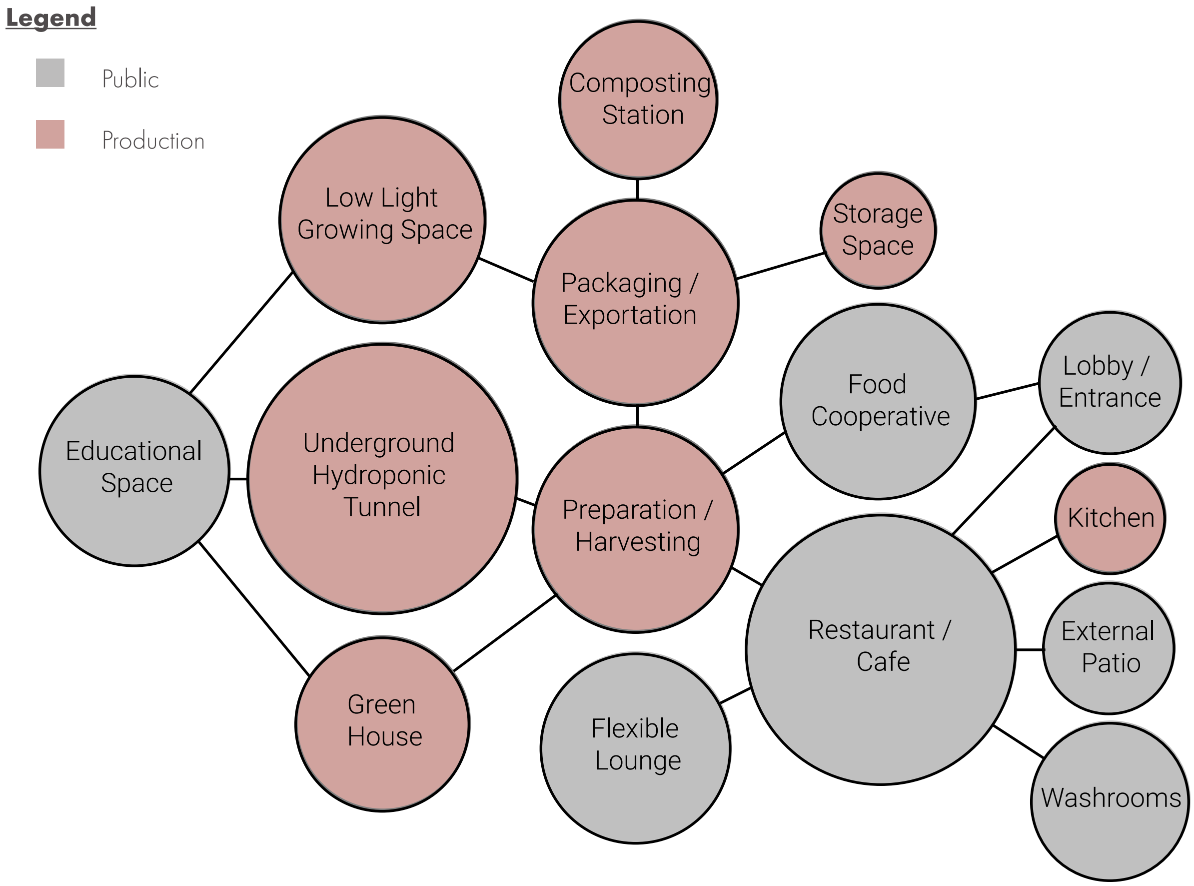


Figure 28 Programmatic space relation diagram

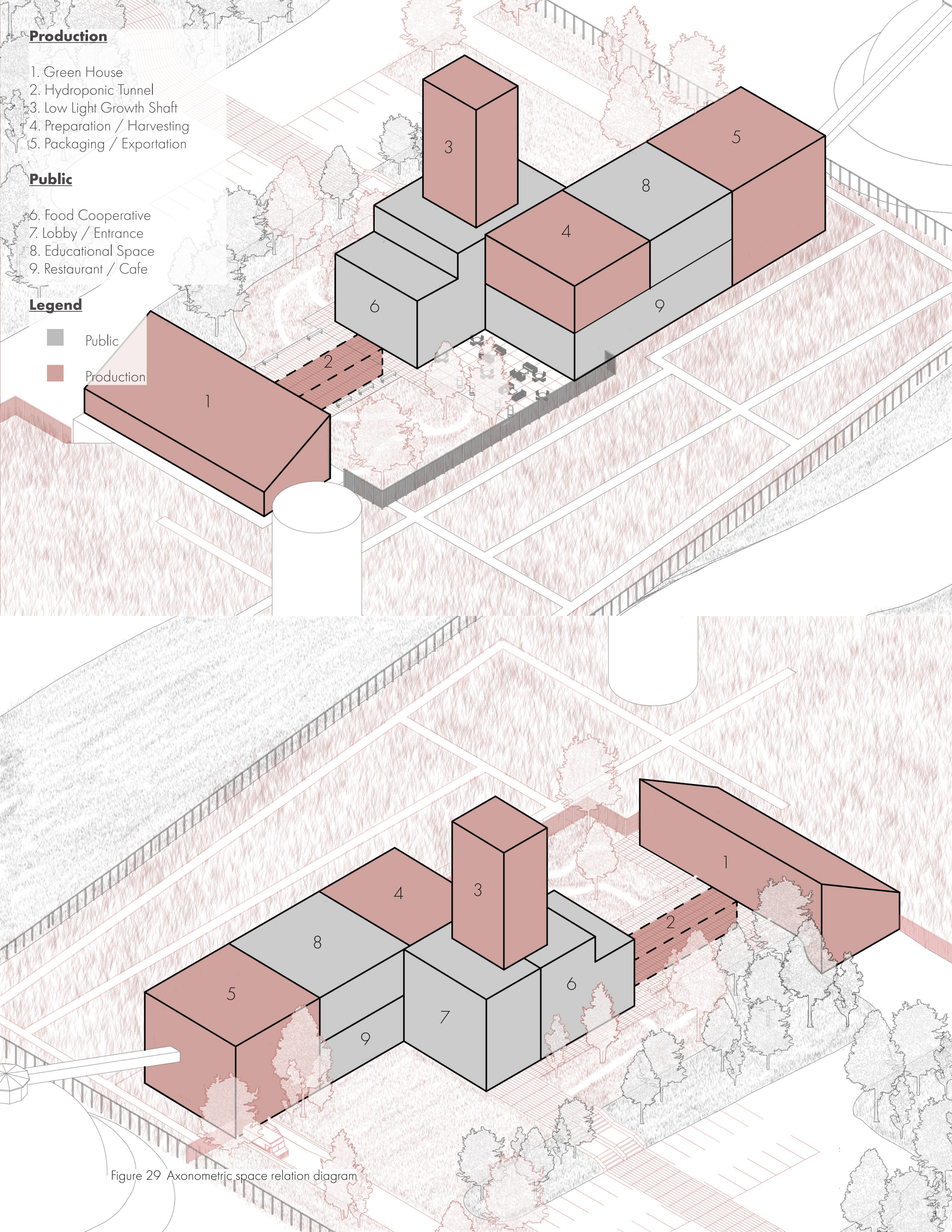


Figure 29 Axonometric space relation diagram

Spatial Requirement Table

Space	Location	Area (Ft^2)	Area (M^2)	Description
Public Spaces				
Lobby / Entrance	Ground Level (1)	670 Ft^2	65 M^2	Members are greeted by this high ceilinged, historical space filled with decommissioned mining equipment.
Food Cooperative	Ground Level (1)	2390 Ft^2	225 M^2	Small retail space offering freshly grown foods from the greenhouse and hydroponic growing spaces
Restaurant / Cafe	Ground Level (1)	3050 Ft^2	280 M^2	Restaurant style cafe offering small meals and beverages prepared with ingredients grown on site.
External Patio	Ground Level (1)	2490 Ft^2	230 M^2	External space for cafe to expand during warmer summer months.
Washroom	Ground Level (1)	620 Ft^2	60 M^2	N/A
Flexible Lounge	Ground Level (1)	1250 Ft^2	120 M^2	Space adjacent to cafe furnished with lounge type seating and enlarged sitting staircase.
Educational Space	Second Level (2)	1380 Ft^2	130 M^2	Flexible space to educate community members on the subject of hydroponics and remediation.
Rooftop Terrace	Roof Level (3)	3370 Ft^2	315 M^2	Exterior rooftop terrace offering unseen views of the city and surrounding site context.
Production Spaces				
Underground Hydroponic Tunnel	Underground Level (-200 Ft +)	N/A	N/A	Sterilized growing space featuring long lengths of the modified hydroponic system.
Underground Service Tunnel	Underground Level (-1)	1865 Ft^2	175 M^2	Small scale tunnel showcasing a miniature version of the underground hydroponic system.
Composting Station	Underground Level (-1)	1475 Ft^2	135 M^2	Space with composting equipment converting natural waste to provide soil for greenhouse.
Storage Space	Underground Level (-1)	3115 Ft^2	290 M^2	Large storage space for greenhouse planters, plant racks and other equipment for production systems.
Green House	Ground Level (1)	3795 Ft^2	355 M^2	Fenestrated, south facing space populated with large planter beds for plant growth.
Packaging and Exportation	Ground Level (1)	3135 Ft^2	290 M^2	Space utilized for preparing freshly grown food for packaging and local export.
Kitchen	Ground Level (1)	615 Ft^2	60 M^2	Small commercial kitchen for restaurant / cafe.
Preparation and Harvesting Space	Second Level (2)	1660 Ft^2	155 M^2	Space utilized to prepare and harvest food directly from hydroponic system prior to packaging.
Low Light Growing Space	Roof Level (3+)	1380 Ft^2	130 M^2	Dimly lit space utilized for the growth of crops such as mushrooms, rhubarbs, bean sprouts etc.
Other				
Solar Panels	Roof Level (3+)	2640 Ft^2	245 M^2	Roof area covered with solar panels to fulfill the sites energy needs.
Green Roofs	Roof Level (3+)	5940 Ft^2	550 M^2	Roof area covered with green roofs designed to harvest rain water to fulfill the sites water needs.
Circulation	All Levels (-1,1,2,3)	3005 Ft^2	280 M^2	N/A

Figure 30 Spatial requirement table

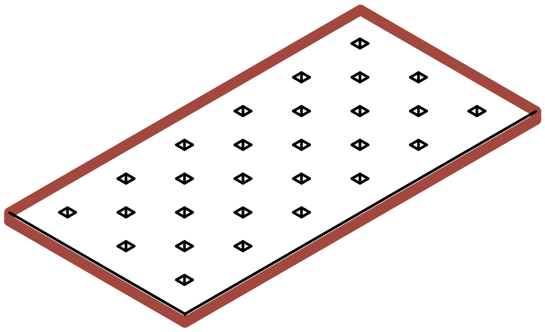
5.1.1 Self sustaining agricultural system

Intended to limit its ecological impact on the environment as much as possible, the consumable demand of the agriculture systems was established and analyzed. Simply put, each system requires two basic components; water and electricity. In addition, the goal for a circular production system led to a research on the combination of different systems to create a self-sustaining agricultural operation. This section demonstrates each of the systems used on site including the hydroponic agriculture, rainwater collection, solar energy collection as well as a compost system (Figure 33).

Growing plants in nutrient solutions (water with fertilizer) with or without an artificial medium such as vermiculite, sand, peat moss, gravel, rockwool, perlite, coir, or sand dust is identified as hydroponics. As a result, the plant will benefit from mechanical assistance from the medium. In addition, hydroponic systems may be classified as open or closed. An open hydroponic system means that after the nutrient solutions have reached the plant roots, they cannot be reused. In contrast, the surplus solvent in a closed hydroponic system could be recovered, replenished, and recycled. This hydroponic method is also extremely effective, environmentally sustainable, and water efficient. In this type of agriculture scheme, controlling and balancing the root and aerial ecosystem is an important and main concern. As a result, the processing takes place in a controlled environment that regulates root and air temperatures, plant nutrients, water, light, and adverse climate.[76] Because of their ideally balanced nutrient solutions, hydroponic gardens grow the healthiest crops with the highest yields and vitamin content. This results in healthier plants, hence higher yields. By cultivating crops in a sterile environment under suitable conditions, hydroponics saves money on soil care, insecticides, fungicides, and losses due to drought and field floods.[77] Since this system is located below ground where sunlight is not accessible, it needed to incorporate led lighting, optimized for plant growth. Depending on the crop, color and intensity of light can be modified to alter the outcome of plant size and taste. Within the scope of the course ARCH 5326 - Fabrication 2, the hydroponic system was developed as an artifact, to determine its production capabilities (Figure 31 and 32). This production analysis came to the conclusion that each square foot of hydroponic system would produce roughly 17.5 plants per harvest. Therefore, this system could be multiplied in large quantities within the 970 kilometers of tunnels located below the site.

76 Jensen, Merle H. “Hydroponics.” Dissertation, Department of Plant Sciences, 1997.

77 Roberto, Keith. “How to Hydroponics.” Farmingdale, New York: FutureGarden, Inc., 2000.



Deep Water Culture Raft Boards

Each deep water culture raft boards are 2′ x 4′ and have 28, 1″ tapered holes. These holes result in the production density of 3.5 plants per square foot. (sq/ft)

These raft boards are most efficient for growing leafy green crops, such as lettuce, kale, chard, mustard, collards, basil, mint and most herbs.

In hydroponics, these types of crops are ready for harvest within 3-4 weeks. Therefore each board can potentially produce 28 crops within this time frame.

2 Deep Water Culture Raft Boards

Considering the framework I have created for my specific hydroponic system is 4′ x 4′ in size, 2 deep water culture raft boards can be placed in one drawer as shown on the right.

Placing two raft boards enables the system to grow 56 plants per drawer, doubling the output. However, this does not change the production output of the board, remaining at 3.5 plants per sq/ft.

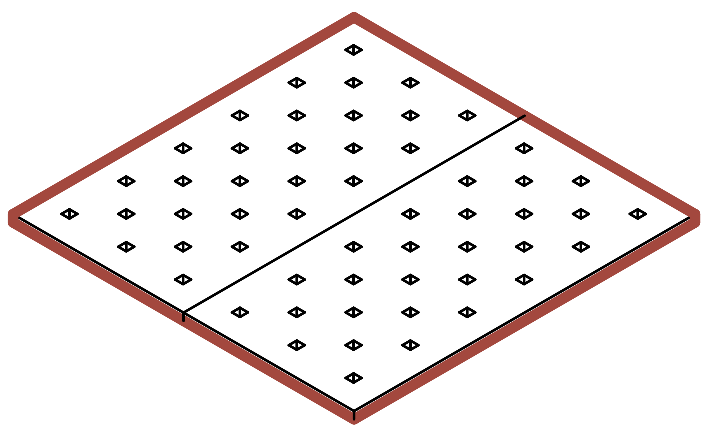
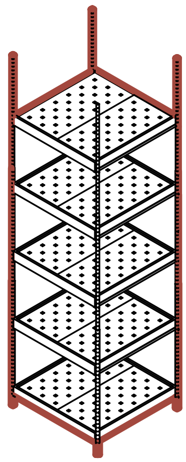


Figure 31 Hydroponic production capabilities, #1



5 Drawer Hydroponic Rack

By placing multiple drawers within the pegged racking system, we can begin to multiply the productivity of production per square foot. The diagram on the right represent a racking system with 5 drawers. The amount of drawers placed into the rack is determined based on the height requirements of the plant being grown.

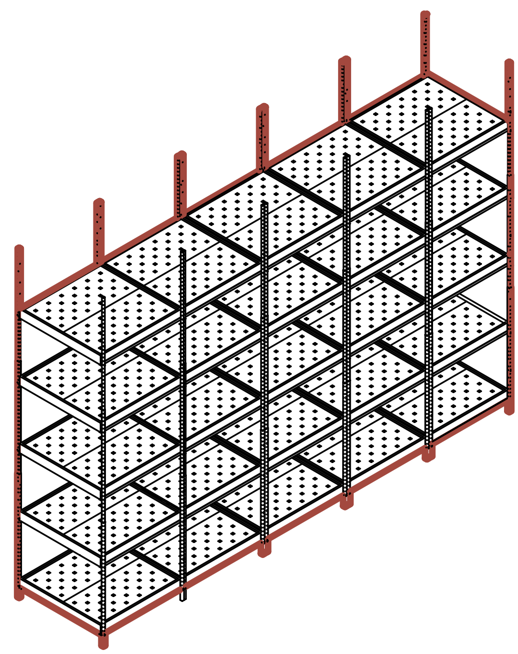
With 5 drawers, the production level increases from 3.5 plants per sq/ft to 17.5 plants per sq/ft. In other words, this example would provide 280 plants per harvest.

20 Feet Span

Once the racks have been assembled, we can begin to expand the number which are placed in a row. The diagram on the right demonstrates a length of 20', including 5 racks which feature 5 drawers per rack.

However, since these racks would be lining the underground tunnels of the mine, a row of racks would be placed on each side of the tunnel, doubling the amount of production for the same 20' section. In total, this 20' span would output double the plants per harvest.

Implementing a large network of this hydroponic system provides the opportunity to stagger the planting date of each drawer, resulting in fresh produce being harvested weekly or daily.



Example

A system resembling the 20' diagram on the left would output the following crops:

1400 8 oz lettuces in roughly 3-4 weeks
or
400 6 oz containers of micro greens in 7-14 days
or
1400 7 oz containers of baby kale in 3-4 weeks

Figure 32 Hydroponic production capabilities #2

The second system incorporated provides for water usage on site. Due to the high volume of water required for the agricultural components of the program, the design looked at how water usage could be limited to a minimum using a more sustainable source. This was found in the integration of a rainwater collections system, more specifically through the use of green roofs. Provided with many areas of flat roofs, the Hollinger Gold Mine buildings are great candidates for the incorporation of green roofs. During periods of rain, water landing within the limits of the green roofs are harvested through the spacious substrate and directed toward large cisterns to hold the bodies of water. From here, collected water undergoes sanitation measures including pressurization, particle filters, carbon extraction and ultra violet purification.[78] Once processed, water can be distributed where required, such as the hydroponic system, greenhouse or general use within the building.

The third system incorporated provides for electricity usage on site. The electricity needs for lighting, pumps and other requirements of the buildings and systems are met with solar energy collection through the use of solar panels. Once again, this next system also takes advantage of the building's flat roofs to mount the panels. Although able to accommodate vertical or slanted surfaces, the rooftops were selected for space management and aesthetic purposes. During sunlight hours, solar energy is collected through the panels and stored in large batteries. From here, the energy is processed through a power inverter, converting it into DC power. This power is compatible with daily use electrical requirements, and is dispersed in the building using a main electrical breaker panel.[79]

The fourth and final system incorporated considers the possible soil needs of the other systems. Components such as the green roofs and the green house require clean soil for optimal production and maintenance. Therefore, a composting system was included within the systems of the building. Not only able to compost food waste from the restaurant/cafe, this system is able to turn the following components into usable healthy soil: trimmings and plant roots discarded from the hydroponic, green house, low light growing space, lawn or site. Once disposed, the organic materials are fed into a drum, which allows for the specific control of the environmental conditions such as temperature, moisture and air intake. The drum proceeds to be mechanically rotated for several weeks, producing large quantities of fresh compost.[80]

78 The Civil Engineering Department Narula Institute of Technology. "Harvesting Water." Draft Project Proposal on Rainwater Harvesting at NIT Campus, n.d.

79 Richardson, Luke. "How Do Solar Panels Work? The Science, Step by Step: EnergySage." Solar News. EnergySage, April 22, 2021. https://news.energysage.com/solar-panels-work/.

80 "Types of Composting and Understanding the Process." EPA. Environmental Protection Agency, August 29, 2016. https://www.epa.gov/sustainable-management-food/types-composting-and-understanding-process.

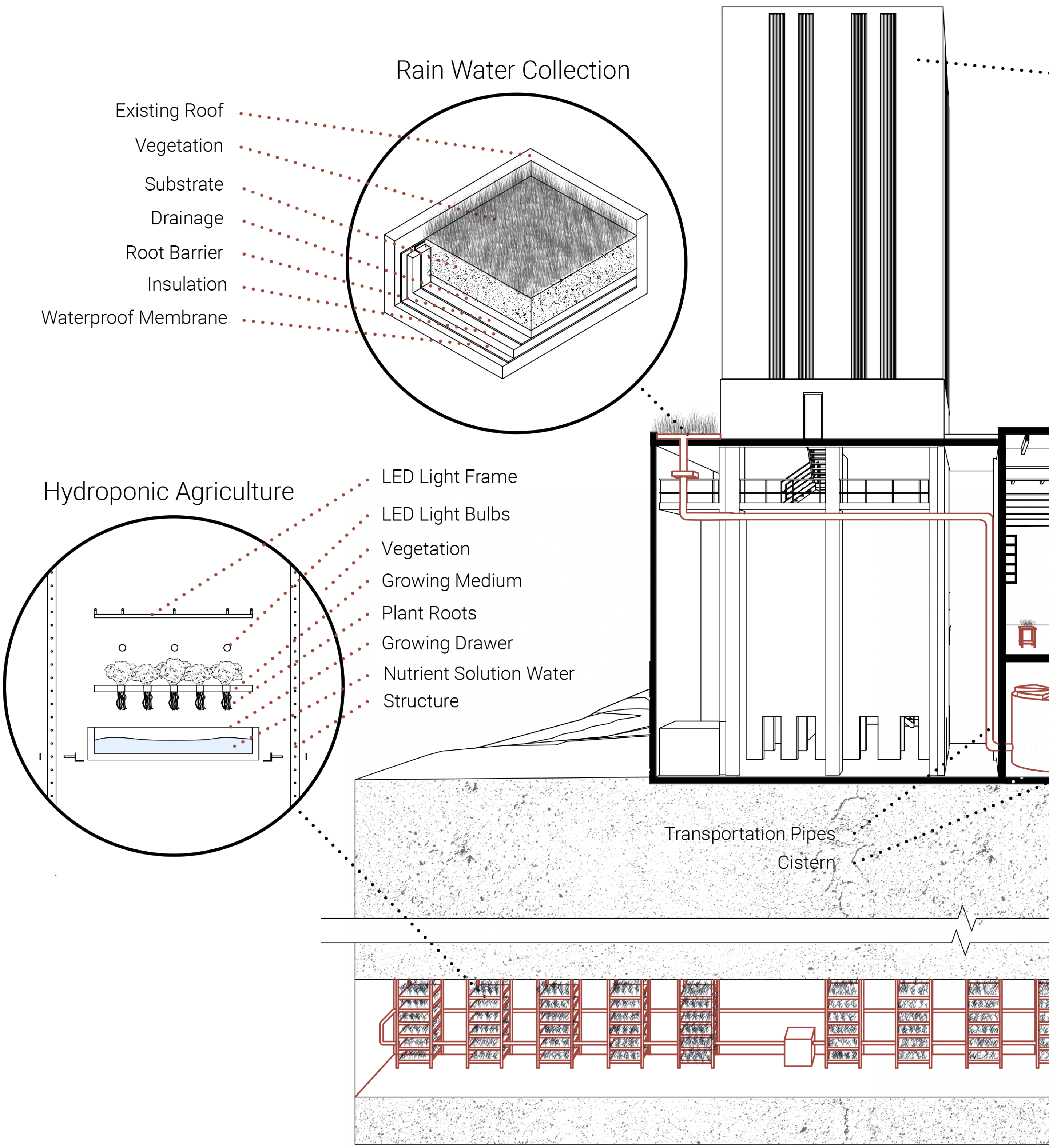
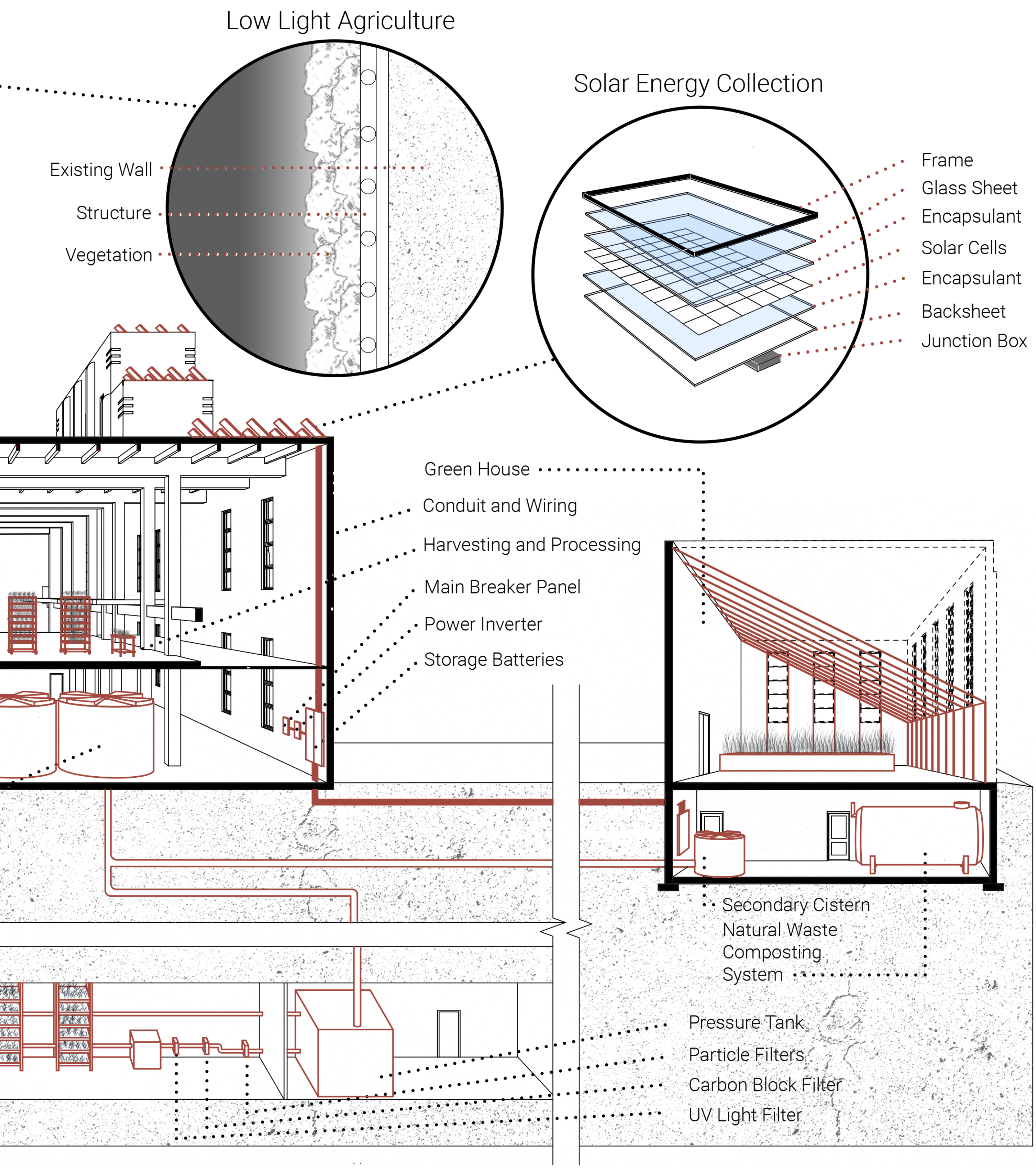


Figure 33 Adaptive reuse systems diagram


Low Light Agriculture
Existing Wall
Structure
Vegetation
Solar Energy Collection
Frame
Glass Sheet
Encapsulant
Solar Cells
Encapsulant
Backsheet
Junction Box
Green House
Conduit and Wiring
Harvesting and Processing
Main Breaker Panel
Power Inverter
Storage Batteries
Secondary Cistern
Natural Waste
Composting
System
Pressure Tank
Particle Filters
Carbon Block Filter
UV Light Filter

5.2 Project Description

The historical timeline presented in chapter four is brought back here to demonstrate and summarize the proposed design interventions of the project (Figure 34). At first glance, the drawing shows the pedestrian connection from the site to the urban Hollinger Park, exterior public spaces, and the remediation strategies located on the south side of the site, directly next to the Newmont Porcupine berm. Also showcased within this timeline are some of the collection systems, such as the green roofs and rooftop solar panels. The following visuals and drawings produced for this chapter all have the same phasing system, demonstrating existing project components in gray and new project components in red. This identification system is crucial in identifying aspects added or modified during this adaptive reuse project.

The contextual site plan (Figure 35) demonstrates the urban interventions designed to incorporate this public program within the urban fabric of the city of Timmins. Located directly next to the Hollinger Park, a pedestrian walkway creates a link to the existing parking, drawing community members to the site. The singular vehicular access on the south face leads to the new parking space on the west. Occupying roughly 50% of the exterior spaces, the east portion of the site is dedicated to the remediation of the soil conditions. Hyperaccumulation plants (see Chapter 3) populate this space, extracting the contaminants of the soil over a period of several decades. In addition, building volumes on site begin to demonstrate exterior connections made between the negative spaces of the site.

Upon arrival on site, patrons are guided upward and into the entrance lobby, using ground textures and the buildings facade (Figure 36). Prior to entering, generous exterior spaces provide the opportunity for exterior events in the warmer months, or simply space for children and families to play and explore. At the same time, users get their first glance at the rooftop terrace, acknowledging its existence and creating multi-level connections. This type of connection is represented throughout the spaces of the building, hinting towards the above and below ground connections related to the history of the site. The exterior floor pavers lead into the main volume, where the facade has been pulled in to encourage entry to the building. Throughout the project, instances of pushing and pulling facades and other architectural elements have been introduced. Instances where the facade indents itself into the space represent a space of entry or inclusion. In contrast, bump outs and extrusions in the facade or volume signifies a visual connection generated between the interior and exterior spaces, similar to the view of the staircase leading to the second storey shown in figure 36. This promotes transparency and a sense of fluidity between the spaces.

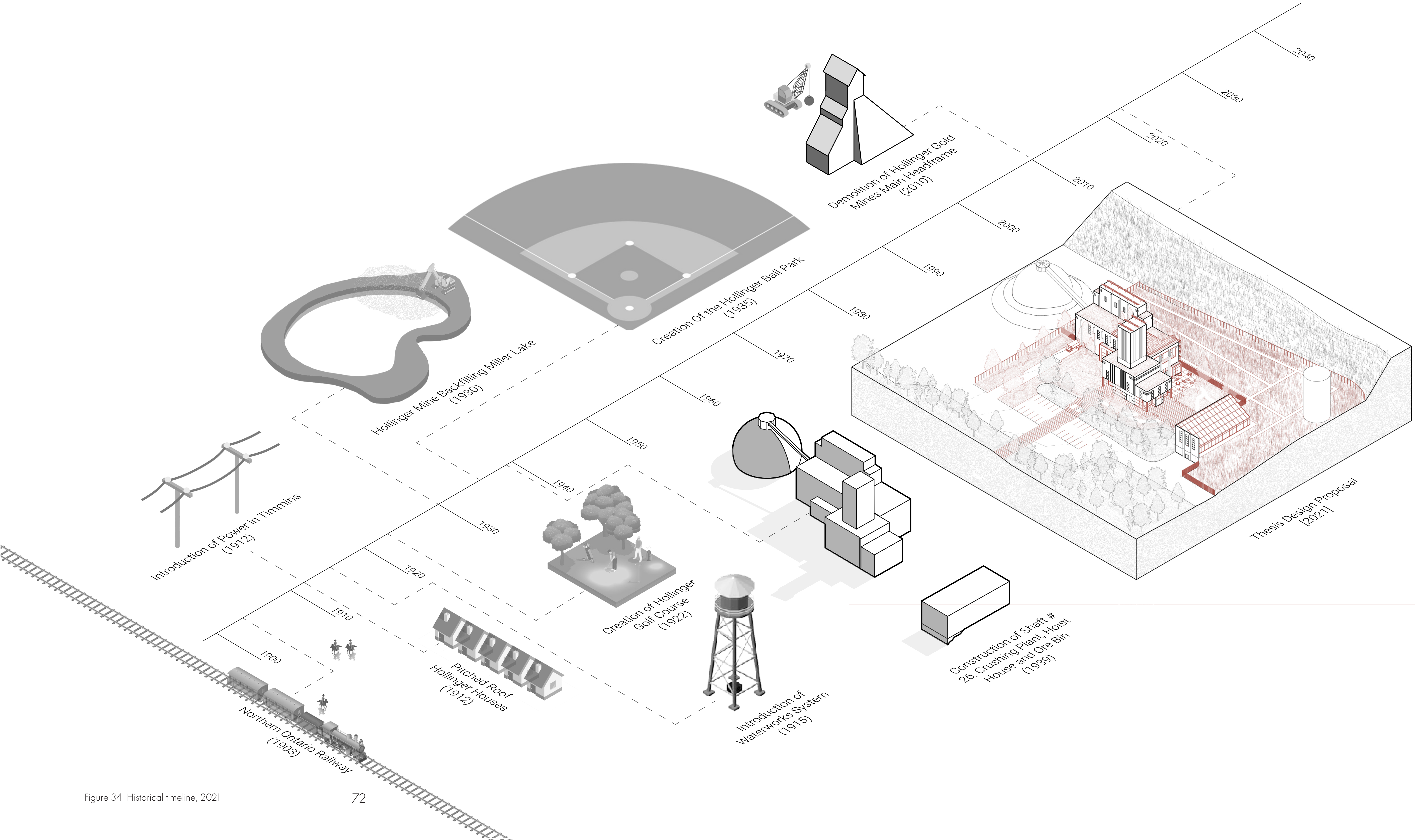


Figure 34 Historical timeline, 2021

The ground level floor plan (Figure 37 and 38) demonstrates these instances of pulling and pushing of the facade. This is clearly depicted in the restaurant/cafe, fresh food cooperative as well as the greenhouse. The cafe gives onto an exterior patio, where a large garage door can be opened to accommodate larger venues or simply to enjoy the heat of a hot summer day. The food cooperative has a similar program in mind with large existing wooden doors opening to the exterior courtyard. Leading directly into the greenhouse, this flexible exterior space could be utilized to host specialized events such as farmers markets for the community to sell their goods. This encourages the community to view this revived architectural landmark as a place to gather, but also as space which encourages the exchange of goods at a community level. The exterior view into the greenhouse allows users to see agricultural employees at work in the sun and plant filled growing space. Located to the north of the ground floor, visitors can also view workers in the exportation space, packaging and labeling fresh crops to be sent out locally to community members.

Accessible through a fenestrated staircase, the second floor plan hosts spaces geared more towards the production aspect of the program (Figure 39). The staircase leads directly into the educational space, where tables, white boards and reading materials are provided. This space can be used daily for the public to inform themselves on the systems included on site or to host more private sessions, for classroom type learning for the younger community. Directly adjacent to this space is the fresh produce processing space. Once again, views through the curtain wall reveals the working members harvesting the fresh crops coming directly from the agriculture racks. Within this space, the produce is cut, cleaned and loaded onto the conveyor leading toward the ground floor packaging space.

At the roof level, the generous rooftop terrace is furnished with seating and tables (Figure 40). This elevated surface not only provides unseen views of the site, but also of the city. Users can view the Hollinger Park, the mine operations by Newmont Porcupine and Gillies Lake among many other spaces within the community. Trees and planters outline the perimeter of the terrace, dividing the remainder of the roof surface containing solar panels and green roofs. At this level, public access is given to the vertical shaft # 26. Within this space is located the low light agriculture, where crops such as mushrooms and rhubarbs are being produced. Revolving staircases leading upward into the vertical volume outline the space near the walls, separated by a surface of vegetation.

Lastly, the underground floor plan houses aspects of the project more geared toward production (Figure 41). Located directly below the greenhouse is a space designated for the production of fresh compost. Large composting drums hold organic waste, turning it into fresh compost in the matter of weeks. Directly adjacent is a large storage space, for housing all types of spare equipment for all systems on site. Also located at this level is one of the mines service tunnels. Considering the first mining tunnel is located roughly 200 feet below the ground's surface, this would make public visitation of the hydroponic system a large commitment. Looking to include people visiting for shorter periods of time, this underground tunnel was designed to house a demonstration of the system. A scaled down version of the system including racks, filters and tanks showcase the process of the system. Community members get to experience the hydroponic process as they enter the space, followed by fresh tasting of crops directly from the root. This not only makes for an interesting experience, but also reinforces the sense of locality, physically demonstrating to the public where their food source is stemming from.

The north-south section (Figure 42) and east-west section (Figure 43) show the vertical scale of each space of the building. The existing structure provided the project with generous ceiling heights ranging from roughly 12 feet to 60 feet in some areas. These grand spaces are often populated with mining machinery, such as in the lobby and cafe. These artifacts and spatial qualities anchor the public back into the space, reminding them that they are standing in a building which was once involved in industrial production. Also demonstrated in these sections are the multi-level connections between the various spaces of the building. Views of the production spaces located above can be seen from spaces such as the lobby and cafe, creating a transparency between workers and visitors (Figure 44). Material, light, shadow, structure and spatial qualities all come together to create a unique experience between the past, current and future possibilities of the Hollinger Gold Mine.

Finally, views of the food cooperative can be experienced from the interior (Figure 45) and exterior (figure 46). From the inside, shoppers bathe in the sunlight of the south facing space, almost similarly to the way their fresh crops grew in light just moments prior. Not only selling products from within, this fresh food cooperative provides local farmers and butchers a storefront to sell their goods to members of the community. The fluidity between the cooperative and the greenhouse encourages the public to step out from one, and into the other. Once again this permits the experience of visually experiencing the process of growing the crops, reassuring the public of the products they are putting into their bodies. Also seen from the exterior is the material approach in regards to new and existing components. Both structures on the site were both relatively monotone in terms of material. The crushing plant was composed mostly of poured concrete, whereas the hoist control room mostly consisted of red brick. During the modification to accommodate the greenhouse, the red brick removed is salvaged and placed in other parts of the site when modifications were made. This is clearly seen on the facade of the food cooperative at the ground floor (Figure 46).

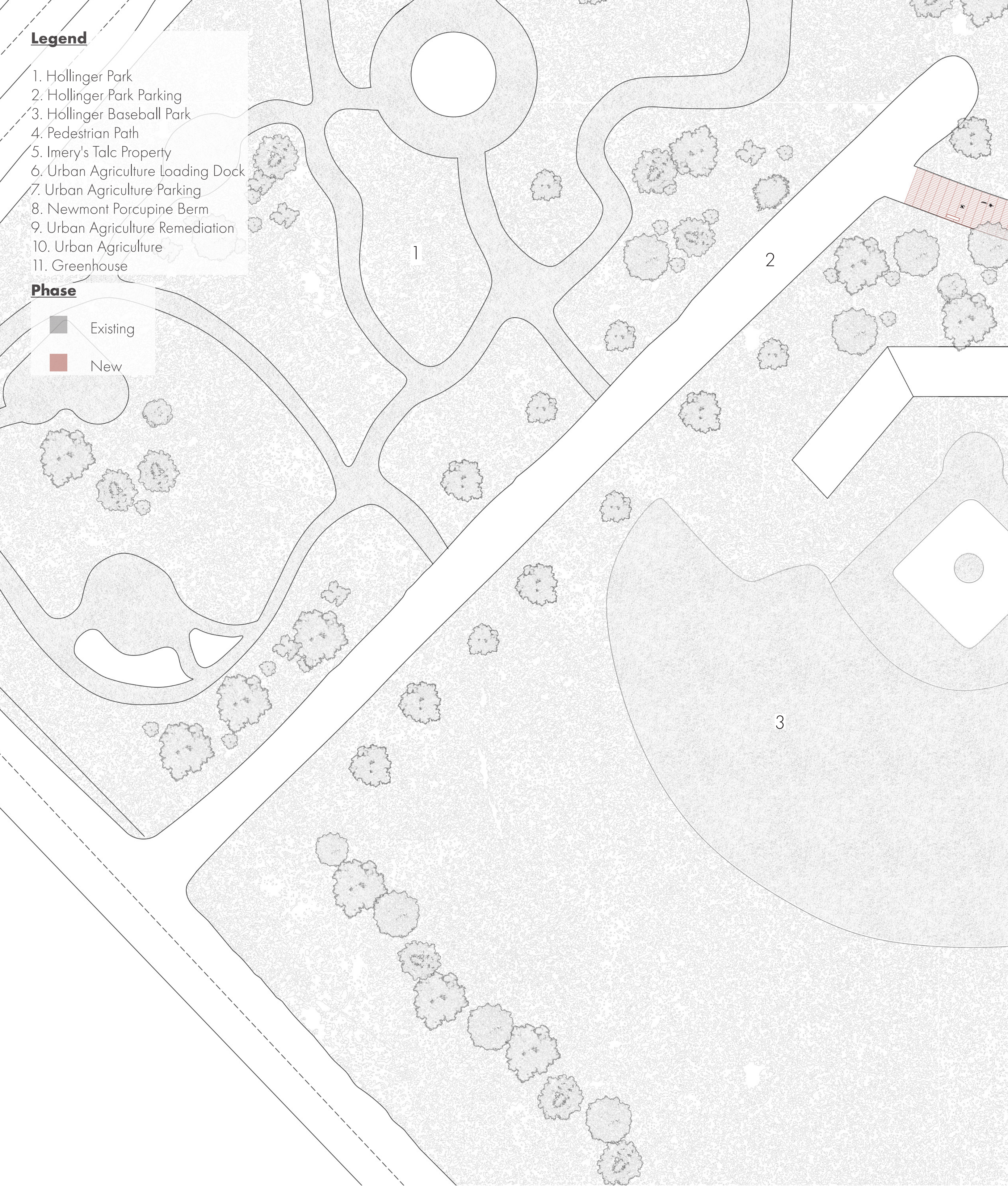
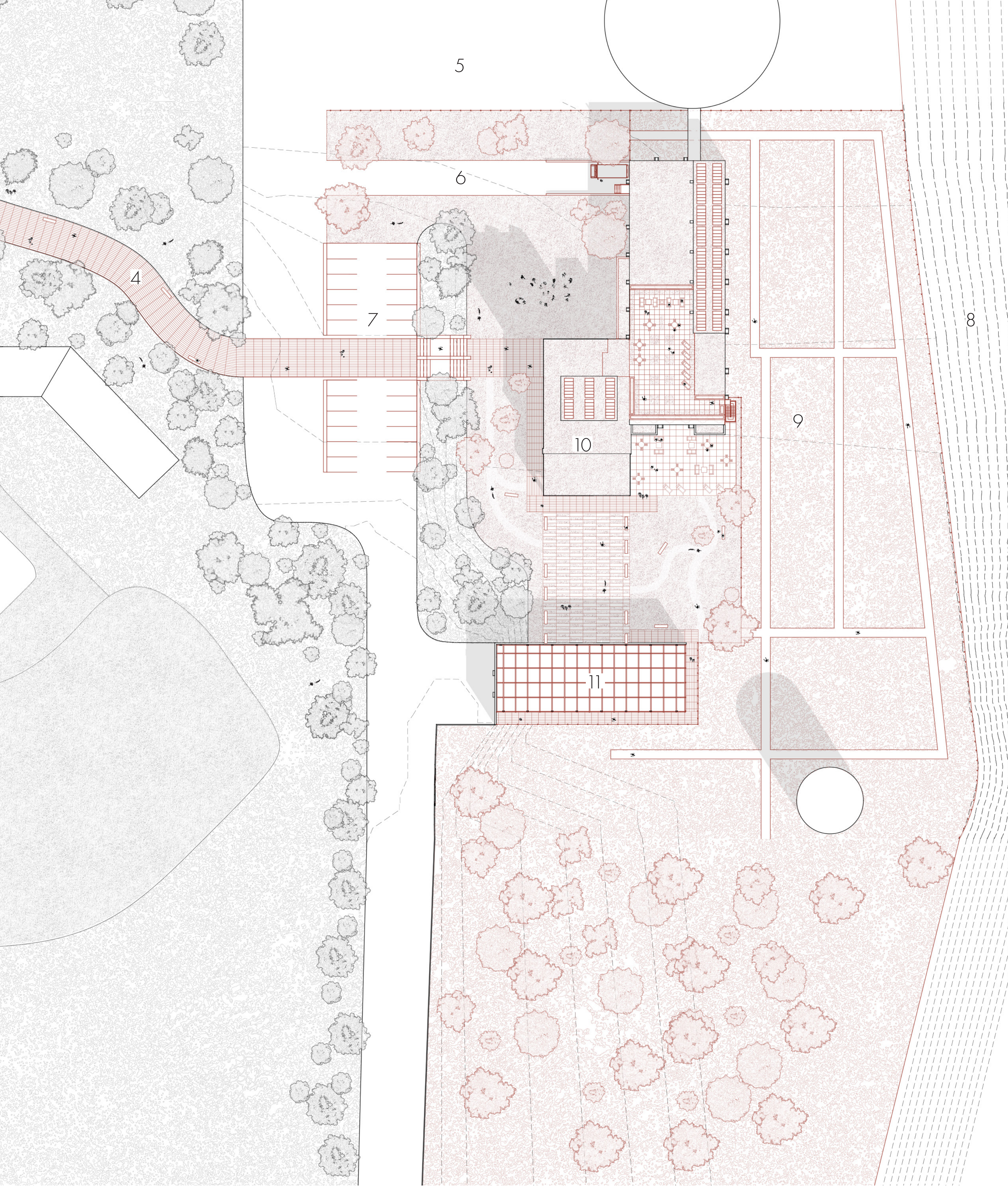


Figure 35 Contextual site plan, 1:1000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11

Phase

Existing

New

Figure 36 Exterior entrance perspective

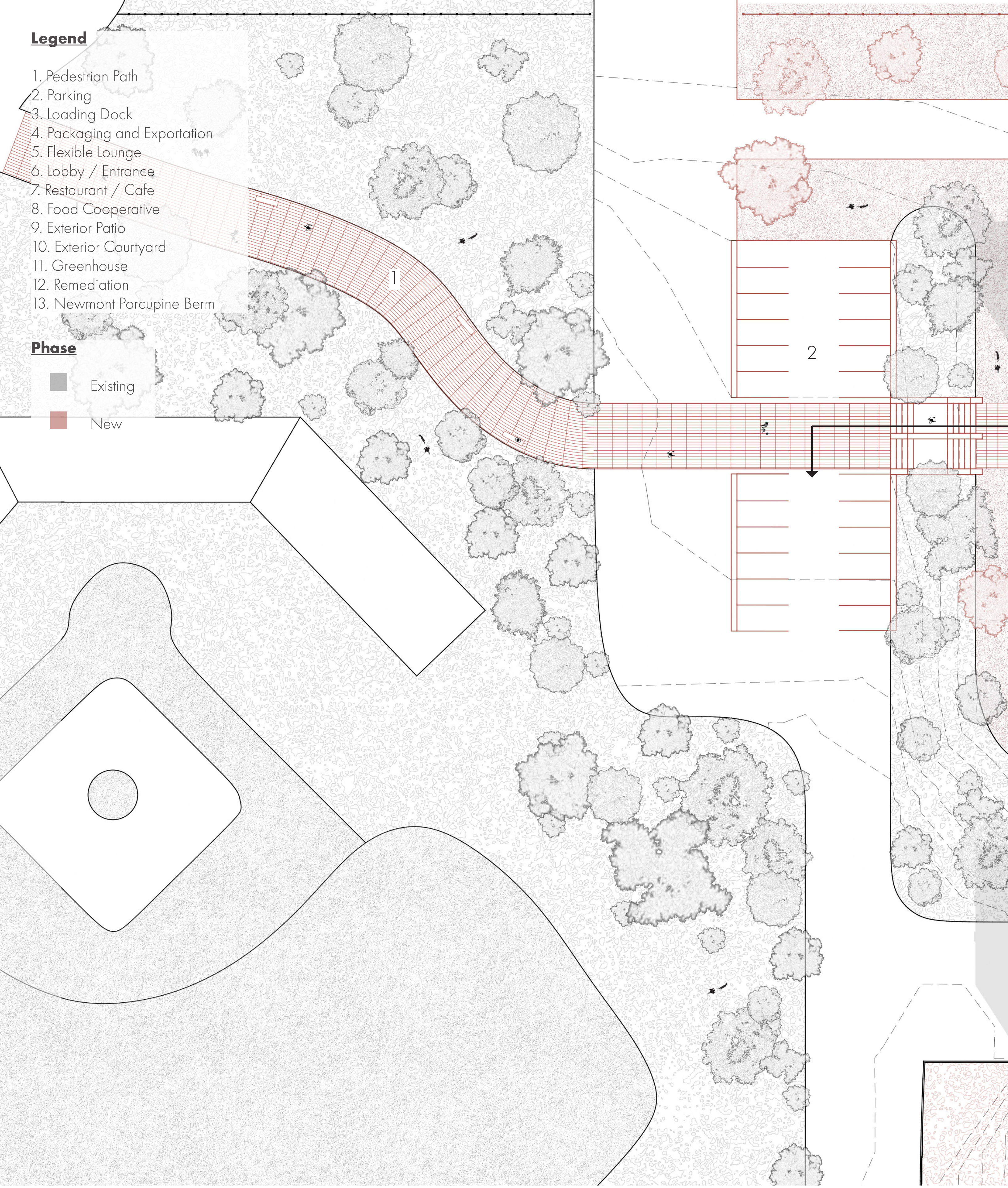

Figure 37 Ground level floor plan, 1:500

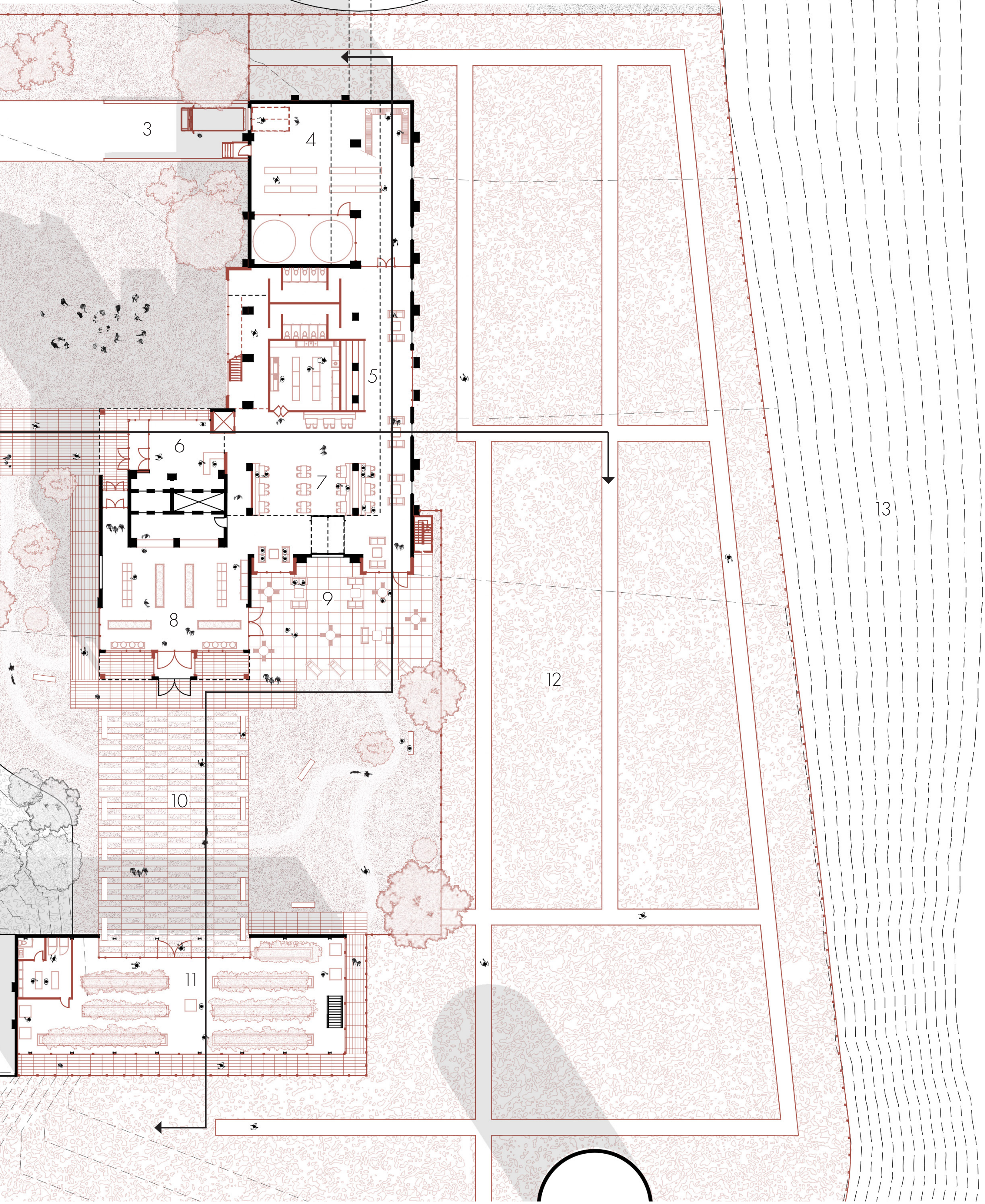
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Figure 38 Ground level floor plan, 1:250

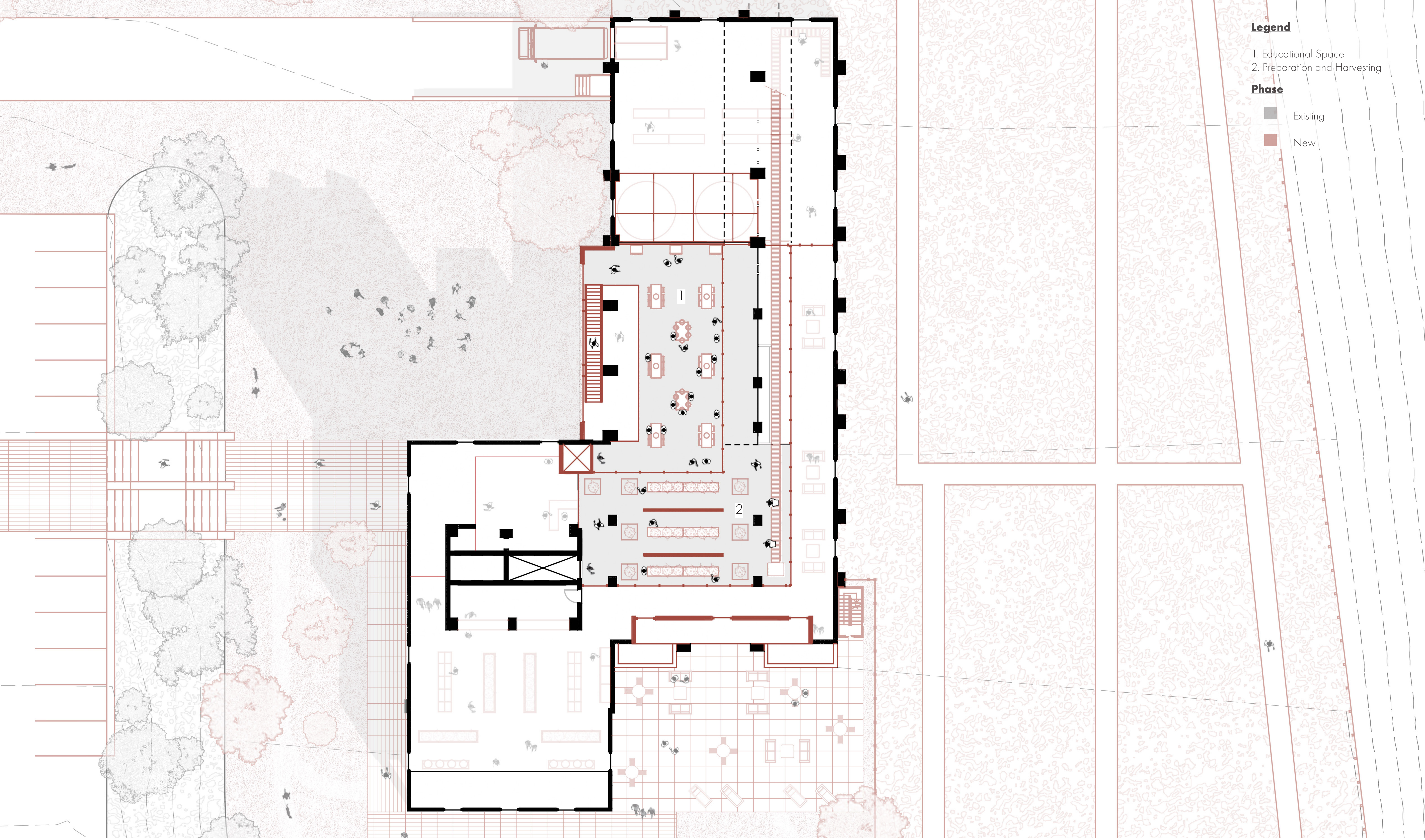


Figure 39 Second level floor plan, 1:250

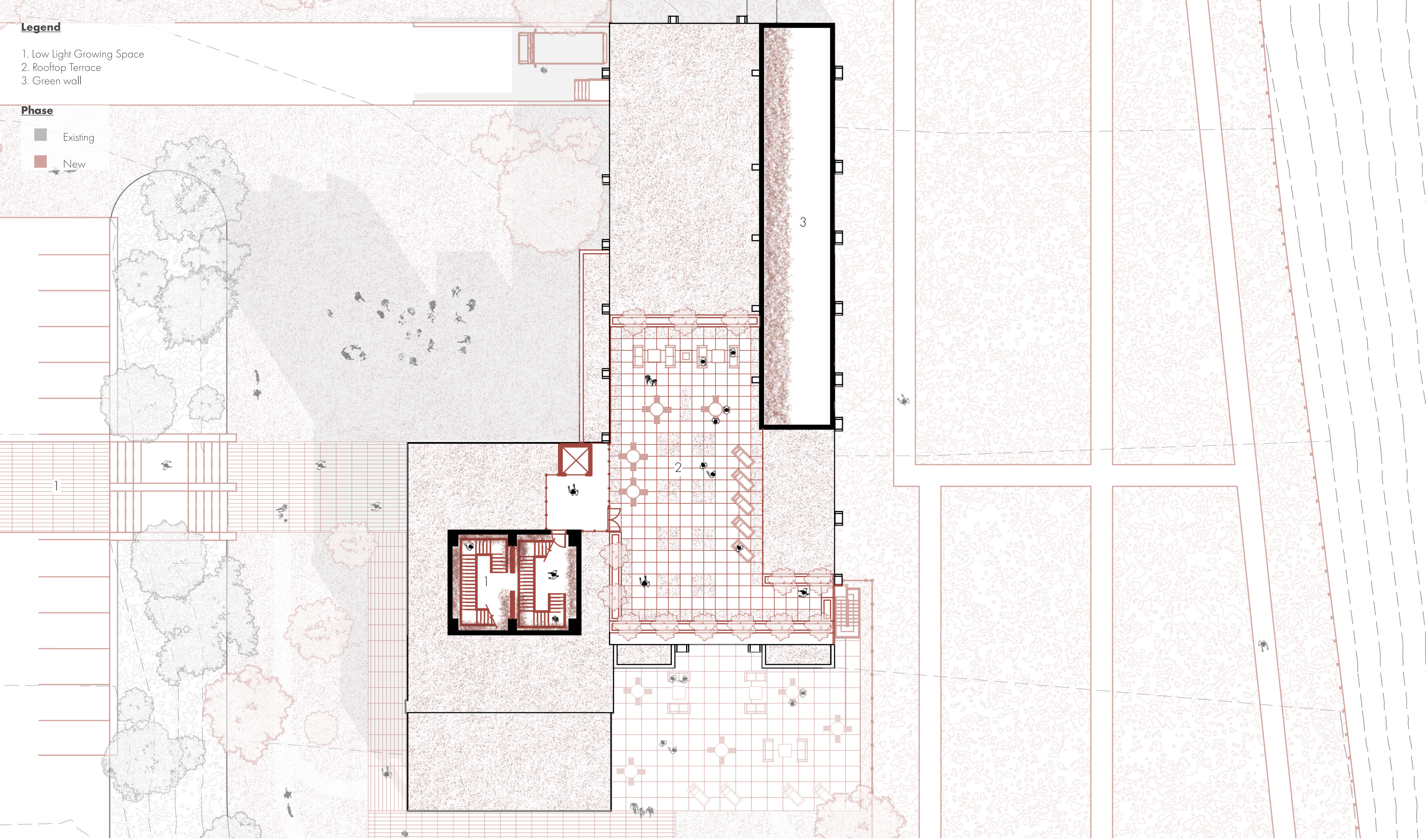


Figure 40 Rooftop level floor plan, 1:250

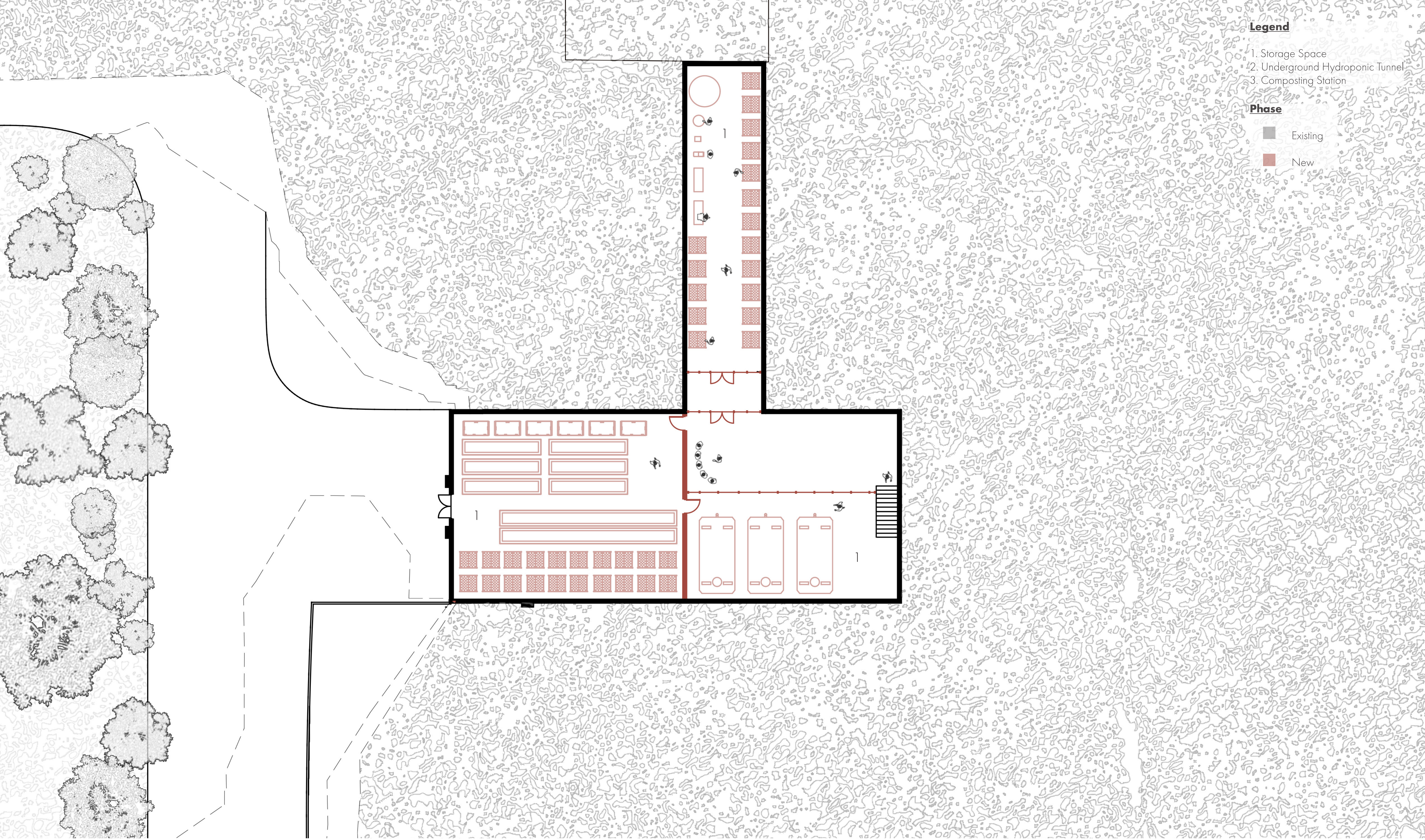


Figure 41 Basement level floor plan, 1:250

Phase

Existing

New

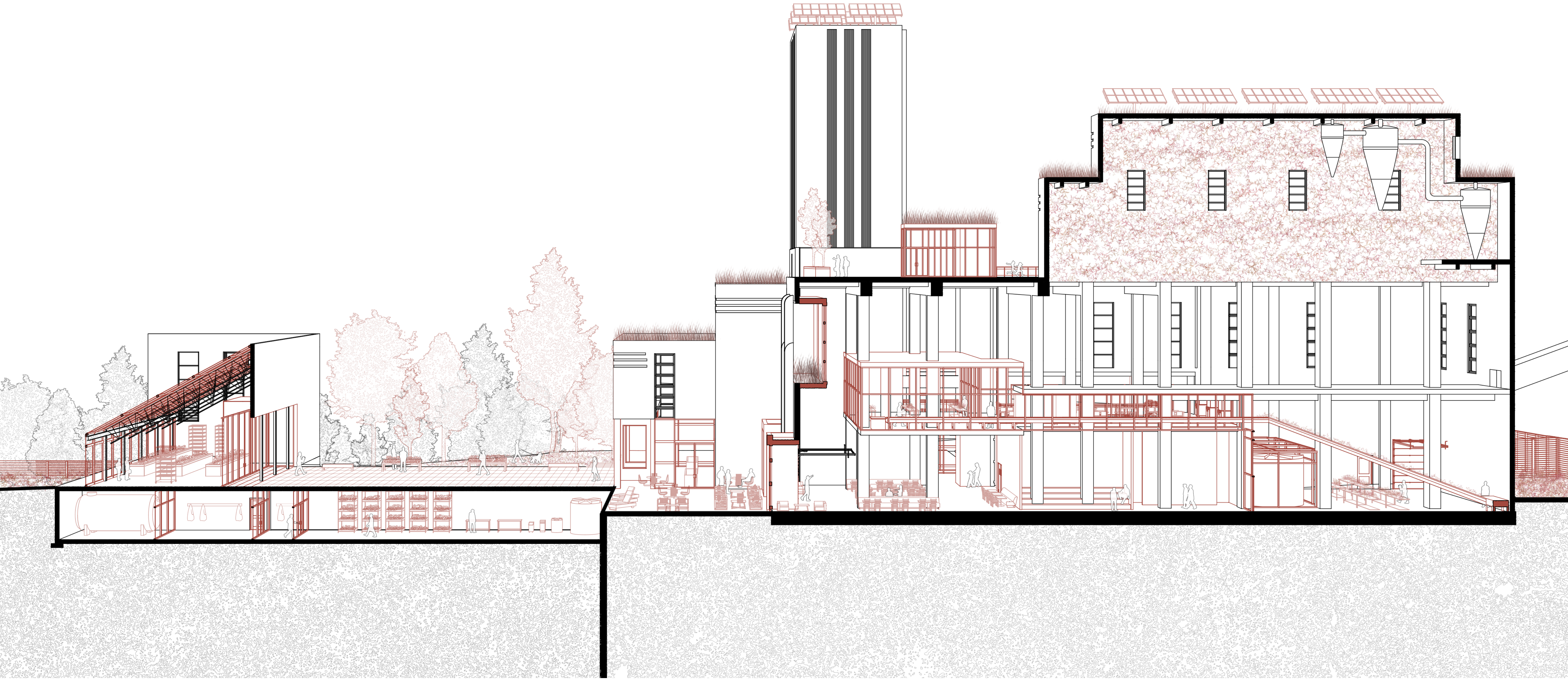


Figure 42 North-south section, 1:250

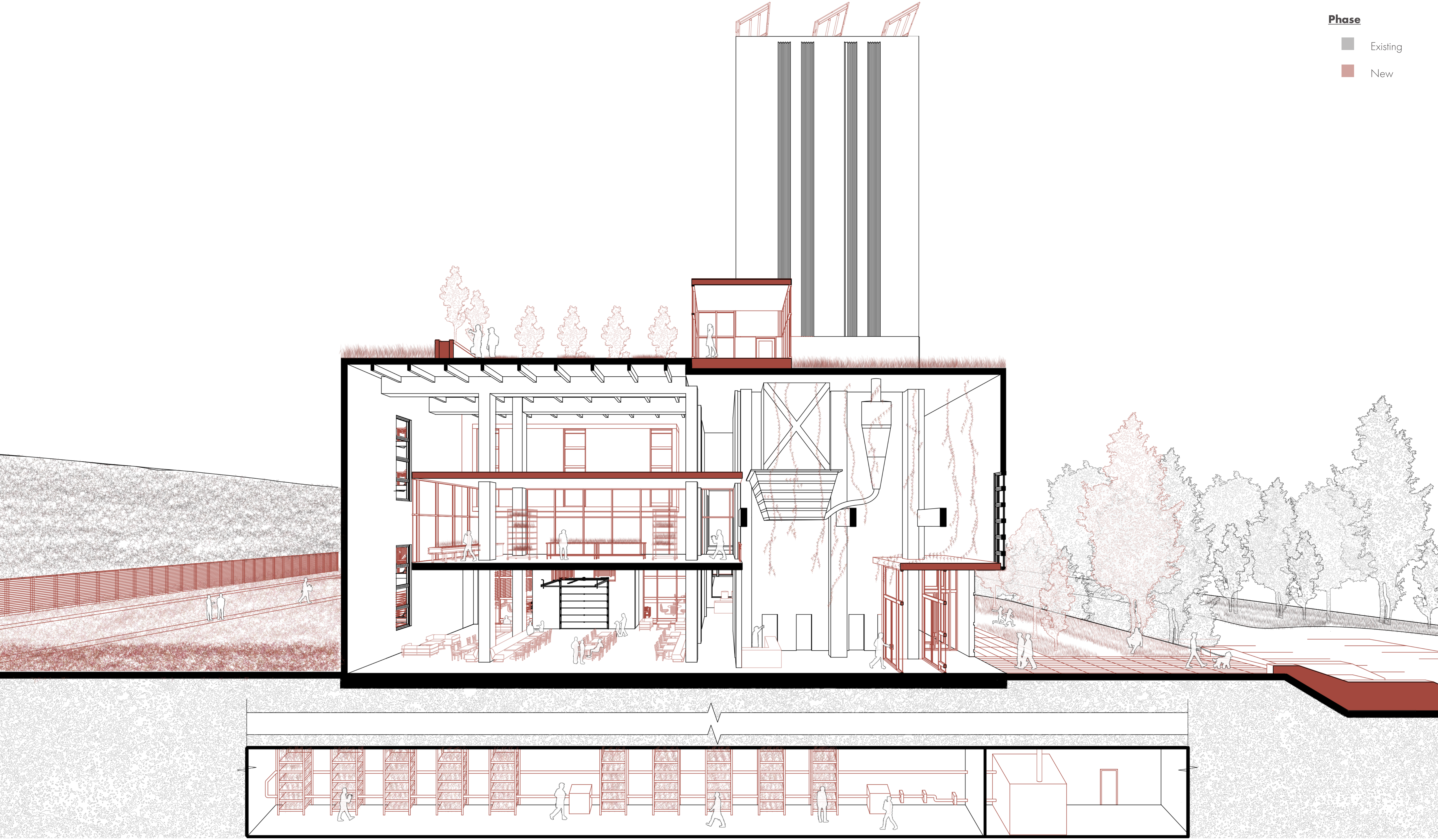


Figure 43 East-west section, 1:200

Figure 44 Restaurant/cafe interior perspective

Figure 45 Food cooperative interior perspective

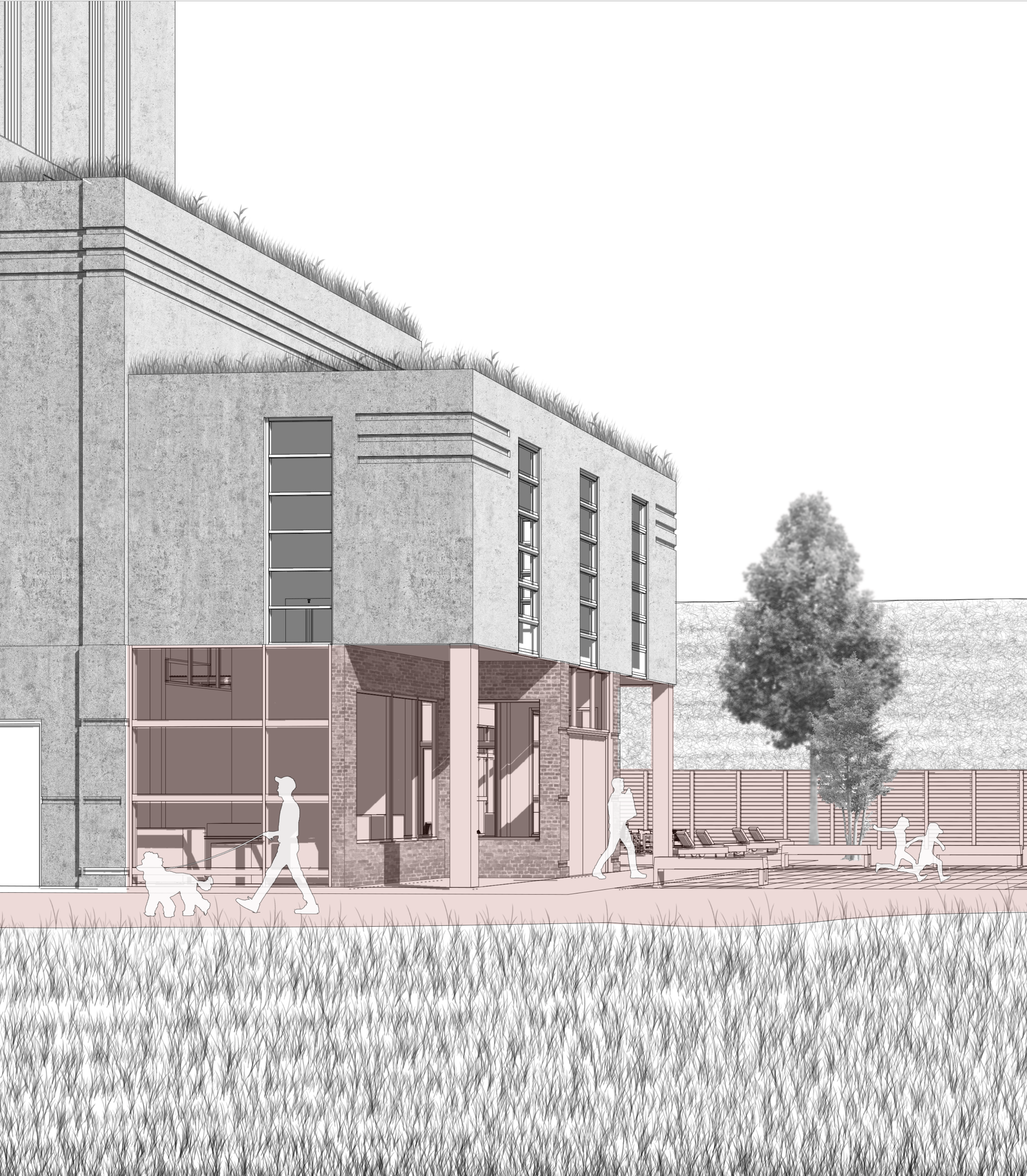
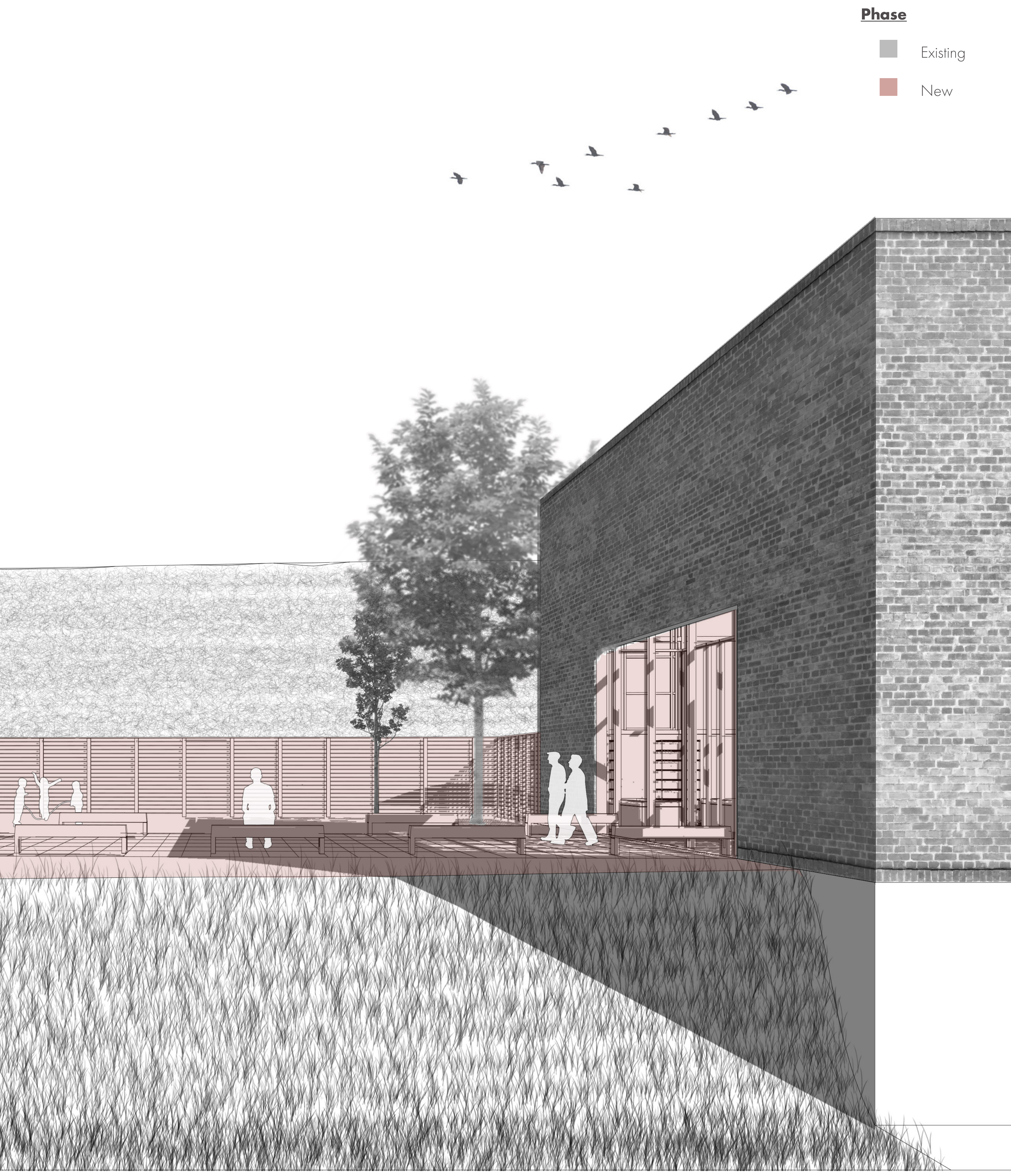


Figure 46 Exterior courtyard perspective


Phase
Existing
New

6

Conclusion

The objective of this thesis was to develop an architectural project which directly responds to the historical contamination of a site, more specifically reusing the abandoned infrastructure which inflicted this damage in the first place. In addition, the research aimed to determine whether or not the community could be directly implicated in the remediation process, one of which is usually done privately behind construction barriers. The adaptive reuse of the Hollinger Gold Mine buildings was based on a theoretical framework which explored more specifically the existing building components that possess a historical and cultural significance. Hence, the thesis aimed to answer the following question:

How could industrial heritage principles guide the adaptive reuse of abandoned mining structures to remediate the landscape they inhabit?

This project accepts the harsh realities of environmental ecocide resulting from the mining industry. Rather than trying to ignore these historical events, the project aimed to shed light on the positive outcomes, and encourage the community to embrace the history of their city. This is demonstrated by emphasizing positive aspects, such as principles of material, structural and visual qualities which contribute to the preservation of the historical significance of the site.

The project developed in this thesis applies directly to the city of Timmins, more specifically the site of the Hollinger Gold Mine. However, it would be interesting to take this thesis as a research model, which could be applied to other sites throughout the city, or even beyond the city limits to other communities province wide. Although the location and site conditions would vary, which in turn would affect the context of the research (type of contamination, historical events, building components of historical significance), the objective would remain the same. The resulting design project could then be analyzed, and compared in contrast to the outcomes of this thesis, to determine the similarities or differences embedded in both design projects.

Through this research, it has come to my attention that means of remediation cannot be limited to a singular point in time. Contaminated and scarred landscapes require time to recover, meaning interventions should be considered with the intent to transform, evolve and reshape throughout the future of the site. Therefore, a third version of the historical timeline was created for the purpose of this conclusion (Figure 47). The third and final iteration of this timeline imagines the site in just a few decades, to predict changes which could occur. Firstly it shows that the project could undergo a second phase, which would include the third building as part of the Hollinger Gold Mine buildings. The physical connection linking the crushing plant and the ore storage bin could be brought back into use, as a reminder of its past for the production of agriculture for the community of Timmins. Secondly, the current proposed underground hydroponic system could be refined, perfected and expanded throughout the immense quantity of tunnels located below the mine. This would increase the volume of production, perhaps expanding local export further than city limits, providing fresh produce for neighboring communities in search of such products. Thirdly, exterior spaces would require redevelopment, to accommodate new urban interventions. For example, in this future scenario, the neighboring Newmont Porcupine open pit will now house an extension to the urban Hollinger Park, including scenic walks, a new lake and beach as well as a lookout over the new landscape. The project would then be located in the middle of this larger urban park, and should consider how the public navigates the site. Therefore paths and walkways coming and going between the urban spaces should facilitate movement and encourage pedestrian interventions.

Lastly, the remediation interventions put in place in the current phase of the project should have successfully extracted sufficient contaminants from the soil to consider it as no longer toxic. Therefore, spaces currently inaccessible would require to be re-evaluated as public spaces, perhaps creating new opportunities to expand the program of urban agriculture.

In the end, the project proposed in this thesis encourages the adaptive reuse of the Hollinger Gold Mine, anchored on the production of urban agriculture. This program integration would alleviate the pressure of typical remediation techniques while removing the usual barriers between the site and the public during this phase of remediation. In contrast, the program was designed to attract community members into the core of the site, to experience this process first hand and contribute in the development of a local circular economy at an urban scale. The architectural infrastructure is revived to accommodate public spaces such as a restaurant, a fresh food cooperative as well as a greenhouse, not only to provide for the community but to act as a means to educate members of the public. Lastly, the project aimed to place itself within the urban fabric of the city, while considering past, present, and future conditions taking place in and around the immediate context of the Hollinger Gold Mine.

Remnants of the past are scattered across the landscape as a reminder of the environmental footprint human infrastructure can impose on nature. It is up to the future generation of designers to acknowledge the past, remediate the present, and sustain the future to leave the landscape in a better condition than initially found.

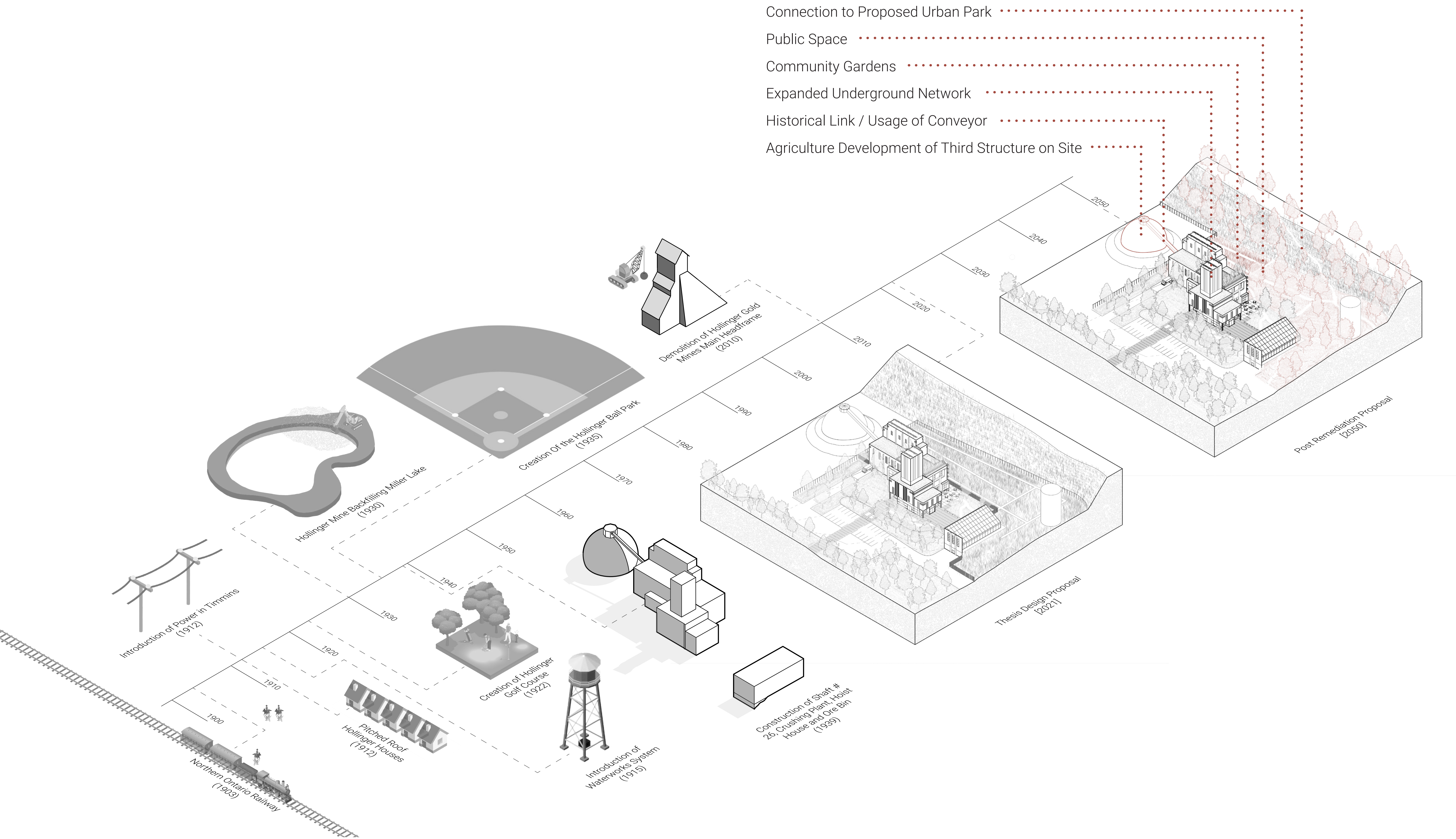


Figure 47 Historical timeline, 2050

Bibliography

Admin. “General Information.” De Ceuvel. Accessed April 27, 2021. https://deceuvel.nl/en/about/general-information/.

Arthur, Ellen L., Pamela J. Rice, Patricia J. Rice, Todd A. Anderson, Sadika M. Baladi, Keri L. D. Henderson, and Joel R. Coats. “Phytoremediation - An Overview,” January 18, 2007. https://pubag.nal.usda.gov/download/15902/PDF.

Baker, A. J. “Accumulators and Excluders -Strategies in the Response of Plants to Heavy Metals.” Journal of Plant Nutrition 3, no. 1-4 (1981): 643–54. https://doi.org/10.1080/01904168109362867.

Barnes, M. Gold in Ontario. Erin, Ontario: Boston Mills Press, 1995.

Barnes, M. Timmins: The porcupine country. Toronto, ON: Stoddart. 1995

Barto, Nick. “Adaptive Reuse in NYC: Planning for Site Remediation.” Henson Architecture, January 16, 2017. https://www.hensonarchitect.com/adaptive-reuse-in-nyc-planning-for-site-remediation/.

Boi, Jay. “5 Best Plants For Phytoremediation.” Land8, November 30, 2015. https://land8.com/5-best-plants-for-phytoremediation/.

Bottero, M., D’Alpoas, C., & Oppio, A. (2018, December 29). Ranking of Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts: A Multiple Criteria Decision Aiding Approach. Retrieved October 25, 2020, from https://www.mdpi.com/2071-1050/11/3/785

Brooks, Robert R. “Plants That Hyperaccumulate Heavy Metals.” Plants and the Chemical Elements, January 1998, 87–105. https://doi.org/10.1002/9783527615919.ch4.

Burchell, R. W., & Listokin, D. (1981). The adaptive reuse handbook: Procedures to inventory, control, manage, and reemploy surplus municipal properties. New Brunswick, NJ: Rutgers University, Center for Urban Policy Research.

Caves, Roger W. Encyclopedia Of The City. Routledge, n.d. (p.4)

Conejos, S., Langston, C., & Smith, J. (2013). AdaptSTAR model: A climate-friendly strategy to promote built environment sustainability. Habitat International, 37, 95-103. doi:10.1016/j.habitatint.2011.12.003.

Cornish, J.E., Goldberg, W.C., Levine, R.S., & Benemann, J.R. Means, J.L., & Burris, D.R. (Eds.). (1995). Phytoremediation of soils contaminated with toxic elements and radionuclides. United States: Battelle Press.

Definition of the Cultural Heritage: United Nations Educational, Scientific and Cultural Organization.” Accessed November 6, 2020.

Dillalogue, Eric. “Phytoremediation: The Power of Plants to Clean up the Environment.” Visionlearning Blog, August 13, 2016. https://www.visionlearning.com/blog/2014/07/12/phytoremediation-power-plants-clean-environment/.

Dilthey, Max Roman. “Open Pit Mining Pros & Cons.” Sciencing, March 2, 2019. https://sciencing.com/open-pit-mining-pros-cons-12083240.html.

Environmental Risks of Mining. Accessed November 6, 2020. https://web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html.

Feng, Renwei, Chaoyang Wei, Shuxin Tu, Shirong Tang, and Fengchang Wu. "Simultaneous Hyperaccumulation of Arsenic and Antimony in Cretan Brake Fern: Evidence of Plant Uptake and Subcellular Distributions." Microchemical Journal 97, no. 1 (2011): 38–43. https://doi.org/10.1016/j.microc.2010.05.010.

Florim. Material culture: the heritage of architecture. Accessed December 17, 2020. https://blog.florim.com/en/material-culture-the-heritage-of-architecture.

Foster, Norman. "Norman Foster on Green Architecture." Ted Talk. Lecture presented at the Ted Talk, November 21, 2015.

Goldsmith Borgal & Company Ltd. (2012). The Cooper Site (locomotive Repair Sheds) Public Consultation Report (Canada, The City of Stratford, The City of Stratford). Retrieved from https://www.stratfordcanada.ca/en/insidecityhall/resources/ReportsAndPublications/Borgal_Report.pd

Haddaway, Neal R., Steven J. Cooke, Pamela Lesser, Bilijana Macura, Annika E. Nilsson, Jessica J. Taylor, and Kaisa Raito. "Evidence of the Impacts of Metal Mining and the Effectiveness of Mining Mitigation Measures on Social–Ecological Systems in Arctic and Boreal Regions: a Systematic Map Protocol," 2019. https://environmentalevidencejournal.biomedcentral.com/track/pdf/10.1186/s13750-019-0152-8.pdf.

Hornby, Albert Sydney. Oxford Advanced Learner's Dictionary of Current English / [by] A.S. Hornby ; Editor Jonathan Crowther. Oxford, England :Oxford University Press, 1995.

Jensen, Merle H. "Hydroponics." Dissertation, Department of Plant Sciences, 1997.

Larkham, P. (1996). Conservation and the city. London; New York: Routledge

Lexter, Insights. "A Guide To Industrial Architecture." Jonite. Accessed May 3, 2021. https://insights.jonite.com/a-guide-to-industrial-architecture.

L360 Architecture. Hollinger Park Beautification. August 1, 2019. https://timmins.bidsandtenders.ca/Module/Tenders/en/Tender/Detail/51f5ce67-b069-42c9-ae8b-7dc0e879664e.

M. (1991). Geological Survey of Canada (pp. 17-24). Ottawa, CA: Canadian Government Publishing Centre.

Malik, Junaid Ahmad, Aadil Abdullah Wani, Khursheed Ahmad Wani, and Muzaffer Ahmad Bhat. "Role of White Willow (Salix Alba L.) for Cleaning Up the Toxic Metal Pollution." Bioremediation and Biotechnology, May 16, 2020, 257–68. https://doi.org/10.1007/978-3-030-35691-0_12.

McCarter, Jim. Rep. 2005 Annual Report of the Office of the Auditor General of Ontario. Toronto, Ontario: Queens Printer for Ontario, 2005.

McCutcheon, Steve C., and Jerald L. Schnoor. Phytoremediation: Transformation and Control of Contaminants. Hoboken, NJ: Wiley-Interscience, 2003.

Metabolic (2014) Cleantech Playground: research quarterly report #1. May. Amsterdam: Metabolic

Office of Solid Waste and Emergency Response. "A Citizen's Guide to Phytoremediation." EPA, September 2012. https://www.citationmachine.net/chicago/cite-a-website/custom.

"PARK DE CEUVEL_NL." POWER PLANTS PHYTOREMEDIATION. Accessed May 4, 2021. https://powerplantsphytoremediation.com/park-de-ceuvel

Rathmann, Kurt. “Sustainable Architecture Module: Recycling and Reuse of Building Materials.” Dissertation, National Pollution Prevention Center for Higher Education, 2005. (p.64)

Richardson, Luke. “How Do Solar Panels Work? The Science, Step by Step: EnergySage.” Solar News. EnergySage, April 22, 2021. https://news.energysage.com/solar-panels-work/.

Roberto, Keith. “How to Hydroponics.” Farmingdale, New York: FutureGarden, Inc., 2000.

“Sociology.” Accessed December 18, 2020. https://www.cliffsnotes.com/study-guides/sociology/culture-and-societies/material-and-nonmaterial-culture

Staff. “Abandoned Mines: A Historic Problem in Ontario • Ontario Society of Professional Engineers.” Ontario Society of Professional Engineers, August 5, 2020. https://ospe.on.ca/community/abandoned-mines-historic-problem-in-ontario/.

Sugden, E., & Khirfan, L. (2017). The adaptive reuse of industrial heritage buildings: A multiple-case studies approach(Master's thesis, University of Waterloo, 2017). Waterloo. Retrieved October 25, 2020, from https://uwspace.uwaterloo.ca/handle/10012/12823.

Sullivan, Louis H. The tall office building artistically considered. Lippincott's Magazine, March 1896.

Suman, Jachym, Ondrej Uhlik, Jitka Viktorova, and Thomas Macek. “Phytoextraction of Heavy Metals: A Promising Tool for Clean-Up of Polluted Environment?” Frontiers in Plant Science 9. 2018

The Civil Engineering Department Narula Institute of Technology. “Harvesting Water.” Draft Project Proposal on Rainwater Harvesting at NIT Campus, n.d.

Torlone, Joe G. “The Evolution of City of Timmins: A Single-Industry Community.” Thesis, ProQuest LLC, 1979.

“Types of Composting and Understanding the Process.” EPA. Environmental Protection Agency, August 29, 2016. https://www.epa.gov/sustainable-management-food/types-composting-and-understanding-process.

“Underground Mining.” Encyclopædia Britannica. Encyclopædia Britannica, inc. Accessed December 26, 2020. https://www.britannica.com/technology/mining/Underground-mining.

UNESCO. (2007). Asia conserved, lessons learned from the UNESCO Asia-Pacific heritage awards for culture heritage conservation (2000–2004). Lord Wilson Heritage Trust and UNESCO. Retrieved from http://unesdoc.unesco.org/images/0015/001557/155754e.pdf

“Visionary Architecture, Sustainably.” LafargeHolcim.com, October 16, 2020. https://www.lafargeholcim.com/building-largest-art-museum-switzerland-sustainable-cement.

“What You Need to Know about Heavy Metals in Hollinger Park.” Heavy Metals in Hollinger Park. Accessed April 22, 2021. https://www.porcupinehu.on.ca/en/your-community/healthy-environments/heavy-metals-in-hollinger-park/.

Wong, L. (2017). Adaptive reuse: Extending the lives of buildings. Basel: Birkhäuser. (p.30)

Wright, Frank Lloyd, and Frederick Gutheim. On Architecture: Selected Writings: 1894 - 1940. New York: Duell, Sloan & Pearce, 1941.

1960 Mandela - American Steel, Oakland, California, USA.” JRDV, August 15, 2019. https://jrdv.com/work/1960-mandela-american-steel/.