Reassembling Moments in Aldershot Quarry, Burlington: A Narrative Outside of Time

by
Han Guo

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

Just as stardust reassembles into life, Earth's materials are continuously broken down, transported, and reshaped, whether by natural forces or human intervention. Quarrying represents a moment of acceleration in this process, where human activity directs the pace and scale of material redistribution. However, this also brings disputes between industry, environmental conservation, and local communities about environmental degradation, community impact, and resource over-extraction. The thesis reads the quarry from the perspective of material movements, understanding extraction sites as dynamic landscapes where geological, biological, and human-driven forces intersect. Treating site rehabilitation as a media to reveal the material movements. This thesis asks, "What are the design principles for revealing the assembly moments and integrating human activities into natural processes on a post-extraction landscape?"

Aldershot Quarry is selected as the site because it contains ecologically sensitive areas and water systems, is close to transportation, and is part of a growing urban area. The site is a Queenstone shale quarry, which includes two active sites and an undeveloped one. The thesis focuses on the West Quarry and the existing Meridian Brick plant as the basis for the design proposal.

This thesis explores three design principles: "Expose", "Encounter", and "Unfinish". Expose identifies key elements in the Aldershot Quarry. Encounter defines spaces where visitors can read and experience material reassembly moments, integrating public interaction with the site evolving. Unfinish challenges conventional rehabilitation by leaving natural and social forces to shape the site beyond the designer's control. These principles guide the thesis structure as well, transitioning from

the research of material movements in a quarry to the site analysis of Aldershot Quarry, developing a design proposal that applies these principles to a quarry rehabilitation project.

The design proposal engages with the existing extraction and rehabilitation process, integrating site-specific interventions to reappear reassembly moments by revealing material movements and ecological succession. Factory as the symbol of site memory, and the core elements push the materials movements, are regenerated as a community centre to invite the public to build connections with the site. Water strategies expand former quarry ponds into wetlands, reinforcing the local hydrological connectivity and improving water quality. Quarry landforms are preserved and reassembled into walking and cycling trails, making the naked geological surface an interactive experience. Some areas are left intentionally unfinished, fostering passive ecological succession and allowing plant and habitat regeneration. Inspired by the Memorial Park of IBC and Don Valley Brickworks Park, this approach balances natural adaptation with human intervention.

By defining quarries as dynamic landscapes, this thesis challenges the traditional dichotomy between industrial extraction and natural restoration. The design proposal locates Aldershot Quarry as a site where material movements, ecological processes, and public engagement are gathered. Instead of treating quarries as land scars that need to be erased, the research identifies their potential as evolving spaces that bridge industrial heritage, ecological renewal, and material reassembly.

ACKNOWLEDGEMENTS

I am extremely grateful to my thesis supervisor, Rick Andrighetti. His broad knowledge of design and his insightful understanding of architecture, space, art, and sociology sparked many inspiring conversations. Each discussion helped clarify and expand my research. I could not have completed this journey without his patience, generous listening, and unwavering encouragement.

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To my partner, Jie. "Thank you" will never be enough because you are part of my life. You are the reason I had the courage to start this journey and the strength to finish it. And, to my parents—especially my mother, who designed and sewed a coat for my defence day so that everything, down to the colour, would feel just right. Your love and support have always been my quiet foundation.

As the Book of Changes (Yijing) says, the Great Dao provides fifty principles, of which forty-nine govern the workings of Nature, but one is left hidden. This escape represents a potential for a flourishing world beyond our expectations. My gratitude goes finally to the Dao philosophy that shaped my thinking and gave this thesis its direction.

DEDICATION

To my grandfather, this is a goodbye that I will never have a chance to say.

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CHAPTER 1. INTRODUCTION

"Every atom in your body came from a star that exploded. And, the atoms in your left hand probably came from a different star than your right hand."

Lawrence M. Krauss

Chapter 1

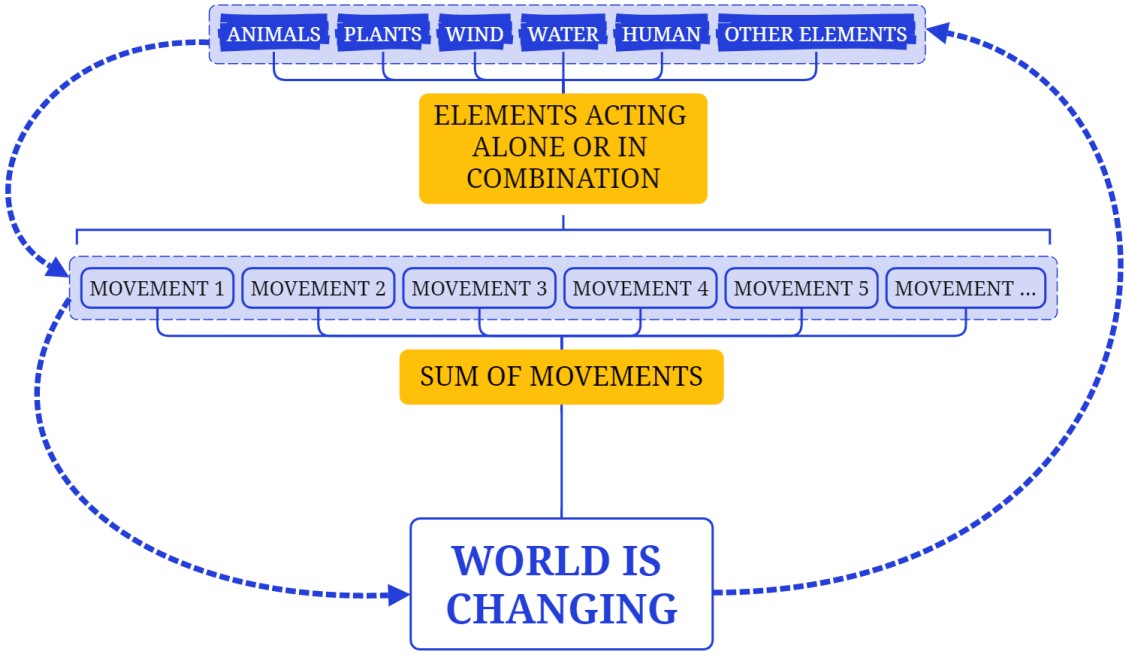

Fig 1.1 A diagram of relationships between changes, movements, and elements. Produced by author.

Introduction

We are the result of stardust reassembling. This is a poetic understanding of life, which treats life as a matter temporarily assembled and sees death as a transformation rather than an ending. It reveals the fact that the world is changing every second and reshaping the landscapes around us. The changes are the sum of the movements, including animals, plants, winds, people, etc. Usually, the movements are driven by multiple elements together. Shifting this lens to aggregate quarries, as one of the most visual sites of human interaction with geologic processes, its forming, extraction, and rehabilitation cycle reflects the material exchange and reassembly and becomes a dynamic participant in a broader material cycle. However, due to operational necessity and safety issues, the quarries are always inaccessible, limiting the visibility of these material cycles to only those within the industry. To satisfy regulation requirements, safety issues, and urbanization demands, most rehabilitation projects, whether they turn into communities, agricultural lands, landfills, or parks, will erase these movement traces and cover the site's history and the complexity of material reassembly. In addition, quarry products are typically treated before their integration into our daily lives, challenging their identification. Therefore, the aggregate quarry is far from the public during its whole lifecycle, while the disputes surrounding it never stop. This thesis selected the aggregate quarries as an ideal research object due to its high demand and density of distribution, which gives the research the potential to become a universal solution.

Chapter 1

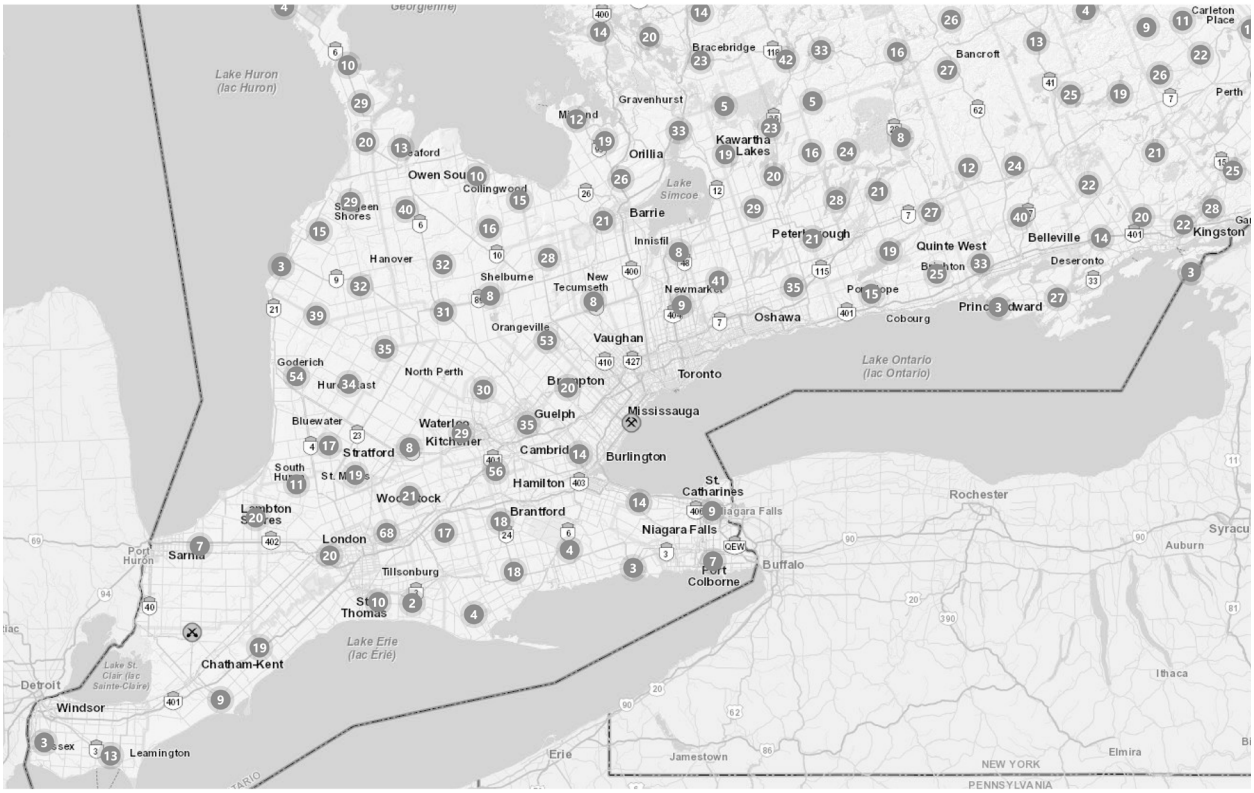

Fig 1.2 Authorized aggregate sites in Southern Ontario, 2025. Data from: Ministry of Natural Resources, Ontario Pits and Quarries Online.

1.1 Aggregate and Dispute

Aggregate is a wide concept, and as defined by the *Aggregate Resources Act*, it includes gravel, sand, clay, earth, shale, stone, limestone, dolostone, sandstone, marble, and granite.[1] Aggregate is a core construction material that has a wide usage hidden in our daily lives, from infrastructure projects to environmental purposes. The usage of aggregates is mainly driven by the construction industry. During the 2010-2014 period, around 79% of the total aggregate consumption in Ontario was used in construction works.[2] Urban expansion and population growth are key factors that push aggregate consumption. Over the past 20 years, Ontario has consumed an average of 164 million tonnes of aggregate annually.[3] The Greater Golden Horseshoe Region (GGH), as the most densely populated and rapidly urbanizing region, accounts for over half of Ontario's aggregate consumption.[4]

Aggregate quarrying raises disputes due to occupying lands and environmental transformations. The extraction activities change landscapes such as woodlands, wetlands, and farmlands, which are critical for biodiversity, water drainage, and agricultural productivity.[5] Besides, because of the "close-to-market" policy, which prioritizes extraction near urban centres to reduce transportation costs, air pollution, and greenhouse emissions, most extraction happens near population areas.[6] Communities close to pits and quarries express strong concerns about the adverse effects of quarrying on their environment. As a result, applications for new or expanded pits often face strong resistance.[7] Another debate is about the potential oversupply of aggregate products. The Ministry of Natural Resources and Forestry (MNRF), responsible for regulating aggregate resources, failed to provide accurate and up-to-date data on supply and demand. As a result, the information

gap made many stakeholders believe that enough aggregate sites are already approved. This contributes more opposition to new or expanded quarries.[8] These disputes make quarries become conflict sites and trigger a wide discussion in society.

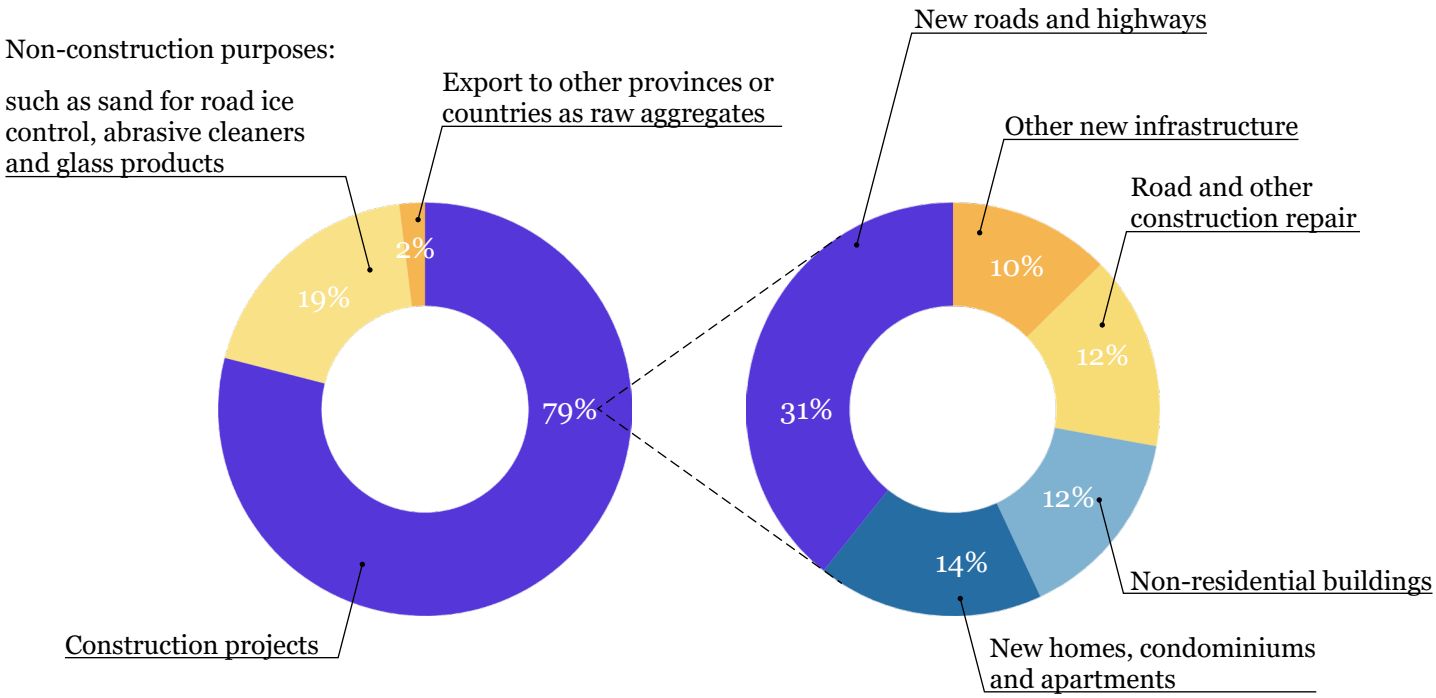

Fig 1.1.1 Breakdown of End Uses of Raw Aggregates in Ontario, 2010–2014. Produced by author. Data from: Office of the Auditor General of Ontario. Management of Aggregate Resources. Ministry of Natural Resources and Forest, December 2023, 6.

Introduction

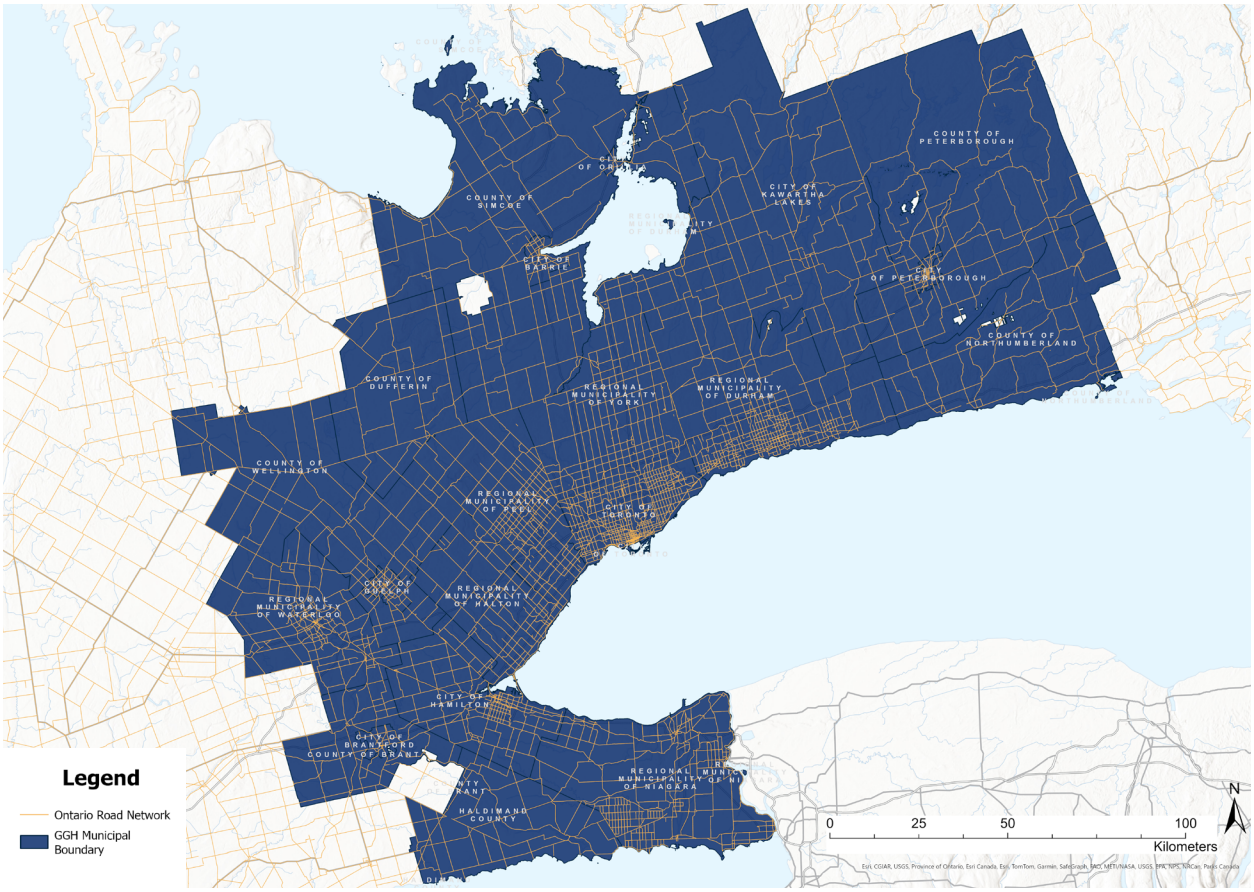

Fig 1.1.2 Greater Golden Horseshoe (GGH) Region boundary and Ontario Road Network. GIS mapping. Produced by Author. Data from: Ontario GeoHub.

1.2 A Perspective From Landscape Architecture

Though disputes remain, aggregates are essential for everyone. This means the conflicts brought by the quarrying are not simply a matter of right or wrong but a question of how society understands and interacts with these landscapes. From the perspective of landscape architecture, quarrying alters the original landscapes, but it also leaves spaces for new ecological, cultural, and recreational possibilities. This thesis does not stand for supporters or opponents but treats the quarry as a platform for regeneration, creating a new landscape narrative and revealing movements of materials, ecosystems, and human engagement. The rehabilitation proposal defines such a post-extraction landscape as a living park and community centre that shows the material reassembly moments. By opening it to the public, especially surrounding communities, the design invites visitors to the ongoing movements of the site, allowing people to witness and engage with the site's reassembly over time. This shift in perspective develops a more informed and responsible relationship between resource consumption and environmental impact. The design approaches transform a "return to nature" model into participation landscapes, which offer a new option to mediate disputes, where quarries are recognized as integral to daily life rather than distant, restricted industrial sites. Therefore, the thesis explores the research question: "What are the design principles for revealing the assembly moments in a quarry and integrating human activities into natural processes on a post-extraction landscape?"

1.3 Thesis Overview

Chapter 1 is the introduction, which establishes the foundation of the research and highlights the existing disputes surrounding quarrying. This chapter outlines the motivation of the study and its potential contributions to material ecologies and post-extraction design strategies and frames the research question: "What are the design principles for revealing the assembly moments and integrating human activities into natural processes on a post-extraction landscape?"

Chapter 2 provides the theoretical and technical foundations for understanding quarries as dynamic sites through a detailed explanation of the quarry process. It explores the material movements and their essential elements involved in extraction and rehabilitation. Case studies compare methods of rehabilitation and their achievements in preserving, transforming, or erasing material movement histories. Based on the theoretical research and case studies, the chapter establishes the research and design principles of "*Expose"*, "*Encounter"*, and "*Unfinish"*.

Chapter 3 shifts focus to the specific site: Aldershot Quarry and Meridian Brick Factory in Burlington, Ontario. It begins with *"Expose"* by analyzing the factors influencing quarry locations. Apply "*Encounter*" by using GIS mapping to explain the site selection process. The *"Unfinish"* reveals the ongoing site movements through the quarry's history, operational plans, community disputes, hydrogeological conditions, and topography transformations.

Chapter 4 develops a design proposal for a quarry park and factory reuse based on the quarry's operational plans. *"Expose"* refers to making elements visible on the site and easy to identify by visitors, such as quarry topography, industrial structures, quarry ponds, and

historic extraction routes. *"Encounter"* means the space is designed for containing the elements. *"Unfinish"* is used to push element movements through setting up site programs.

Chapter 5 introduces a strategy for allowing natural and social forces to continue shaping the site beyond the designer's control. *"Expose"* finds the potentially uncertain elements, such as waste brick and the factory wall. *"Encounter"* identifies the best places for element interaction. *"Unfinish"* invites passive rewilding in specific areas to lead to an uncertain future for the site.

Notes

1 *Aggregate Resources Act*, RSO 1990, c A.8, s. 1 (1). https://www.ontario.ca/laws/view.

2 Office of the Auditor General of Ontario. *Management of Aggregate Resources*. Ministry of Natural Resources and Forest, December 2023, 6, https://auditor.on.ca/en/content/annualreports/arbyyear/ar2023.html.

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4 Golder Associates Ltd. *Supply and Demand Study of Aggregate Resources Supplying the Greater Golden Horseshoe*. Ministry of Natural Resources and Forestry, August 2016, 10, https://www.ontario.ca/page/aggregate-resources-study.

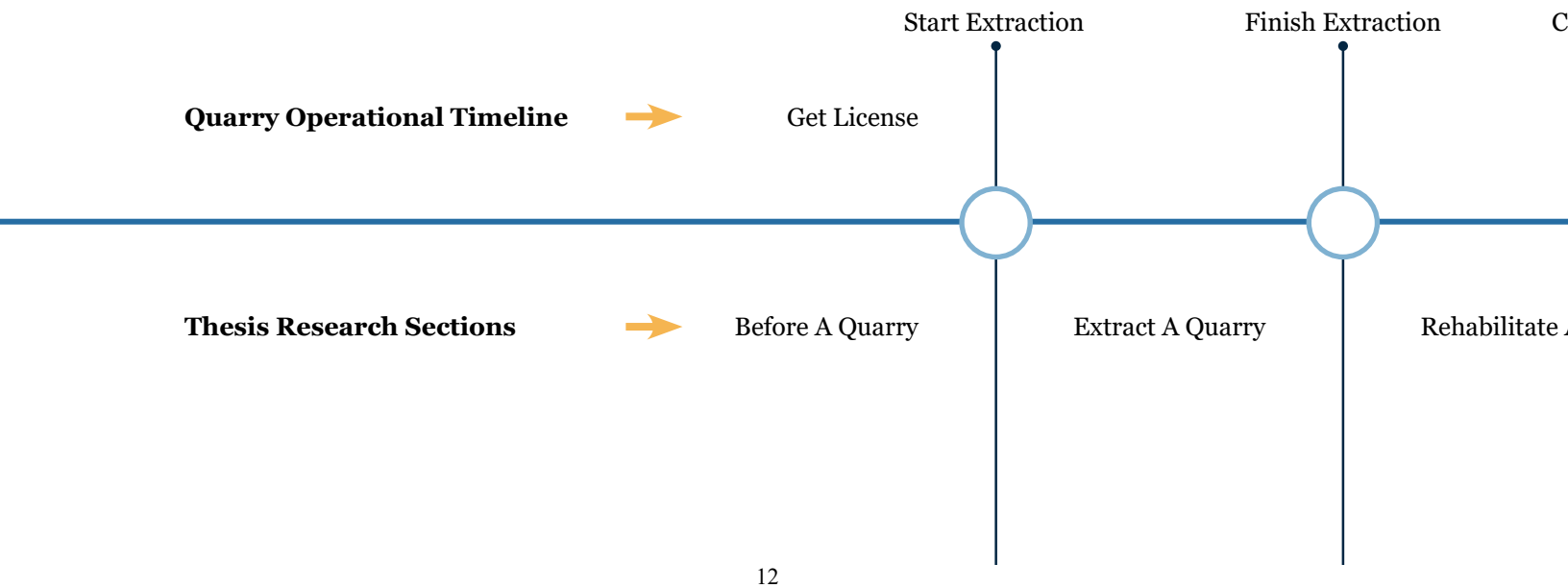
5 Office of the Auditor General of Ontario. *Management of Aggregate Resources*. Ministry of Natural Resources and Forest, December 2023, 1, 8, https://auditor.on.ca/en/content/annualreports/arbyyear/ar2023.html.

6 Ministry of Natural Resources and Forest. *The State of the Aggregate Resource in Ontario Study: Consolidated Report*. Queen's Printer for Ontario, 2010, 17-18, https://www.ontario.ca/page/aggregate-resources-study.

7 Office of the Auditor General of Ontario. *Management of Aggregate Resources*. Ministry of Natural Resources and Forest, December 2023, 8, https://auditor.on.ca/en/content/annualreports/arbyyear/ar2023.html.

8 Office of the Auditor General of Ontario. *Management of Aggregate Resources*. Ministry of Natural Resources and Forest, December 2023, 3, 31-32, https://auditor.on.ca/en/content/annualreports/arbyyear/ar2023.html.

Fig 2.1 Quarry operational timeline and research structure. Produced by author.



CHAPTER 2. A QUARRY AS A PLACE OF REASSEMBLY

Typically, quarrying activities are understood within a solid timeline—beginning when a site is licensed for extraction and concluding when rehabilitation is completed. However, from the perspective of material movement, aggregate deposit formation started millions of years ago, and its material movement lasts after restoration is complete. Therefore, this chapter reclassifies a quarry into three sections according to element movement pattern changes (mainly referring to human activity): (1) slow geological transformations, where aggregates form through material movement; (2) human intervention, where extraction and aggregate production accelerate material movements; and (3) post-extraction evolution, where human activity shifts from extraction to rehabilitation, impacting how the following change of site. These sections clarify the quarry extraction workflow, outline current regulations and stakeholders, and establish a theoretical foundation for exploring the thesis design principles.

Chapter 2

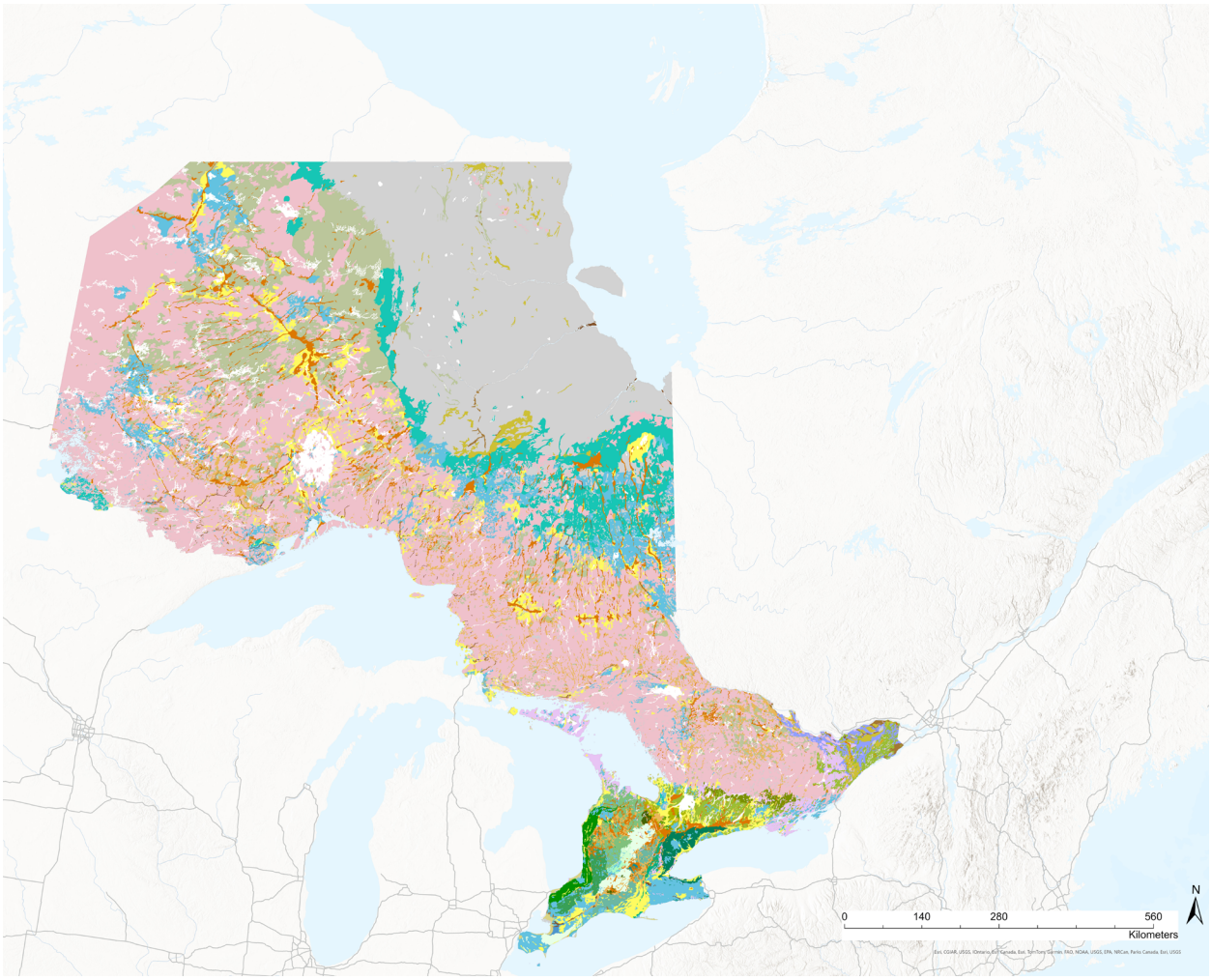


Fig 2.1.1 Quaternary Geology of Ontario. GIS mapping. Produced by Author. Data from: https://data.ontario.ca/dataset/quaternary-geology-of-ontario.

A Quarry as A Place of Reassembly

Legend

32 Organic deposits: peat, muck and marl

31 Fluvial deposits: gravel, sand, silt and clay deposited on modern flood plains

30 Lacustrine deposits: sand, gravelly sand and gravel nearshore and beach deposits

29 Lacustrine deposits: silt and clay basin or quiet water deposits

PLEISTOCENE

28 Fluvial deposits: gravel, sand, silt and clay deposited on abandoned flood plains, terrace remnants

27 Glaciomarine and marine deposits: sand, gravelly sand and gravel nearshore and beach deposits

26 Glaciomarine and marine deposits: silt and clay basin and quiet water deposits

25 Glaciomarine deposits: sand, gravelly sand and gravel nearshore and beach deposits

24 Glaciomarine deposits: silt and clay, minor sand basin and quiet water deposits

23 Glaciofluvial outwash deposits: gravel and sand includes proglacial river and deltaic deposits

22 Glaciofluvial ice-contact deposits: gravel and sand minor till includes esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits

21 Till: undifferentiated, fine grained, predominantly silty clay to silt matrix, commonly clast poor, high matrix carbonated content

20 Till: undifferentiated, predominantly sand matrix, extremely stony, bouldery and high in total matrix carbonated, often associated with stratified sediments

19 Till: undifferentiated, predominantly sandy silt to silt matrix, commonly rich in clasts, often high in total martix carbonate content

18 Till: undifferentiated, predominantly sand to silty to silt matrix, commonly rich in clasts, often low in matrix carbonate content

17 Halton Till (Ontario-Erie lobe): predominantly silt to silty clay matrrix, high in matrix carbonate content and clast poor

16 Kettleby Till (simcoe lobe): predominantly silt to silty clay matrix, highly calcareous, clast poor

15 St. Joseph Till (Huron-Georgian Bay lobe): Silt to silty clay matrix, clay content increases southward, clast poor

14 Wentworth Till (Ontario-Erie lobe):sandy silt to silt matrix becoming finer grained to silty clay near Lake Erie, highly calcareous, clast content moderate to low decreasing southward

13 Newmarket Till (Simcoe lobe): sandy silt to silt matrix, moderate to high in martix carbonate content, clast content moderate to high

12 Dunkeld Till (Huron-Georgian Bay lobe): silt matrix, high matrix carbonate content, clast poor

11 Rannoch Till (Huron-Georgian Bay lobe): silt to clayey silt matrix becoming finer grained southward, highly calcareous, clast poor

10 Elma Till (Huron-Georgian Bay lobe):sandy silt to silty matrix, clayey silt along southern margin, moderatey stony, strongly calcareous

9 Port Stanley Till (Ontario-Erie lobe): silt to sandy silt matrix becoming silt to silty clay near Lake Erie, stongly calcareous, moderate to low clast content decreasing southward

8 Wartburg Till (Huron-Georgian Bay lobe): silty clay matrix, high carbonate content in matrix, clast poor

7 Stratford Till (Huron-Georgian Bay lobe): sandy silt matrix, strongly calcareous, moderately stony

6 Mornington Till (Huron-Georgian Bay lobe): silty clay matrix, moderate to high matrix carbonate content, clast poor.

5 Tavistock Till (Huron-Georgian Bay lobe): sandy silt to silt matrix, silty clay matrix in south and north, moderate to high carbonate content, clast content decreases from moderate to poor northward

4 Maryhill Till (Erie lobe): silty clay to clay matrix, moderate to high matrix carbonate content, clast poor

3 Catfish Creek Till: sandy silt to silt matrix, strongly calcareous, moderately stony to stony

PALEOZOIC

2 Bedrock: undifferentiated carbonate and clastic sedimentary rock, exposed at surface or covered by a discontinuous, thin layer of drift

PRECAMBRIAN

1 Bedrock: undifferentiated igneous and metamorphic rock, exposed at surface or covered by a discontinuous, thin layer of drift

2.1 BEFORE A QUARRY

Aggregates were formed through long-term geological processes before human civilization. Their formation is a historical record of Earth's movements, shaped by volcanic activity, glacial movements, wind, rivers, and seas over millions of years.[1] Sand and gravel deposits are the product of bedrock erosion, where rock fragments are transported, abraded, and deposited.[2] In Ontario, most aggregates are glacial deposits formed by the advance, melting, and retreat of continental ice masses, reflecting the diverse environmental conditions that have shaped the province's landscapes.[3]

While humans do not create aggregate deposits, they play a key role in identifying, mapping, and planning where to extract resources. Quarry locations are selected based on resource availability, bedrock quality and economic feasibility, such as the "close to market supply" policy as per the *Provincial Policy Statement* (2005).[4] As a result, site selection is a power-driven decision that manages material movement, transforms ecosystems and affects communities. The distribution of quarries is tied to urban expansion and transportation networks, making quarry locations a highly controversial issue among industry, policymakers, and residents.[5]

In Ontario, the Ministry of Natural Resources and Forestry (MNRF) regulates aggregate pits and quarries under the *Aggregate Resources Act* (ARA), which was enacted in 1990.[6] Additionally, provincial laws and land-use plans—including the *Planning Act* (Provincial Policy Statement, 2020), the *Greenbelt Act, 2005* (Greenbelt Plan, 2017), and the *Provincial Parks and Conservation Reserves Act, 2006*—provide supplemental guidelines for aggregate operations.[7] Besides MNRF, multiple stakeholders are involved in Ontario's aggregate resource management:

The Ontario Aggregate Resources Corporation (TOARC), under MNRF's delegation, oversees fee collection, quarry rehabilitation, and extraction data reporting.

The representatives of the industry producers and suppliers include the Ontario Stone, Sand & Gravel Association (OSSGA).

The institutes that support a sustainable plan for aggregate extraction include the Top Aggregate Producing Municipalities of Ontario (TAPMO).

Provincial ministries, such as the Ministry of Transportation and the Ministry of the Environment, Conservation and Parks, also influence aggregate policies.

Moreover, civil society and environmental advocacy groups cannot be ignored either, including Gravel Watch Ontario, Environmental Defence, Reform Gravel Mining Coalition, the Canadian Environmental Law Association, and the Toronto and Area Road Builders Association.[8]

These stakeholders do not operate in isolation. They cooperate, negotiate, and challenge each other to shape the future of aggregate extraction in Ontario. For instance, industry groups like OSSGA promote increased extraction, while environmental entities such as Environmental Defence push for stricter oversight, which leads to regulatory negotiations under the jurisdiction of MNRF. Therefore, before quarrying begins, the landscape is already transformed through political, regulatory, and economic decisions that determine where, how, and when extraction occurs. Understanding these factors that affect quarry site selection, especially human influences, helps in exploring the major movements brought by extraction activity in the next section.

Fig 2.1.2 Entities Involved in the Oversight of Aggregate Resources. Produced by author. Data from: Ministry of Natural Resources and Forest. Management of Aggregate Resources. Dec. 2023.

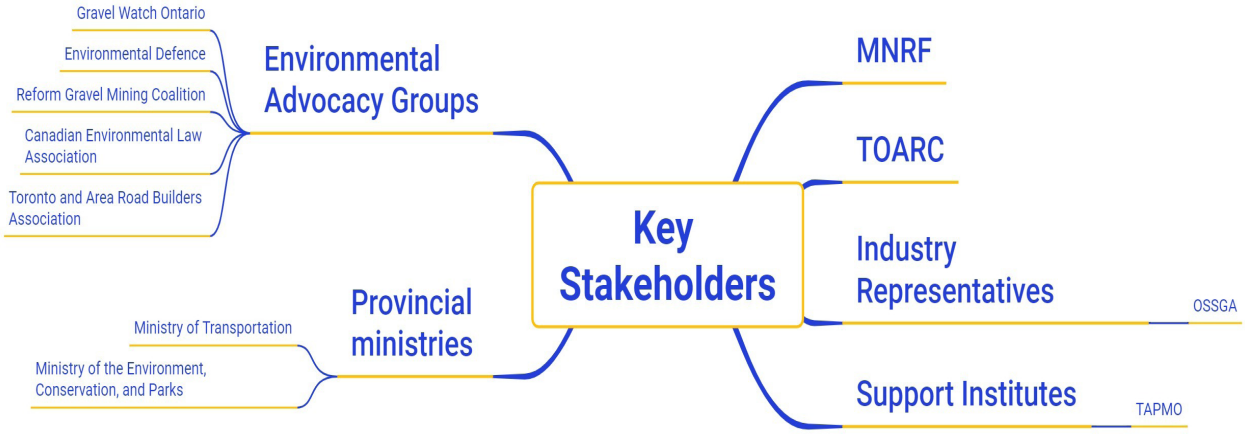


Fig 2.1.3 Key stakeholder mapping. Produced by author. Data from: Ministry of Natural Resources and Forest. Management of Aggregate Resources. Dec. 2023.

2.2 EXTRACT A QUARRY

Quarry operators begin their work after obtaining a license (for private land) or a permit (for Crown land) from the MNRF.[9] The preliminary work involves vegetation and topsoil removal that reshapes landscapes, alters ecological systems, and causes hydrological changes, while original species need to migrate or adapt to the altered landscape.[10] The removal of overburden, which is often stockpiled on-site for rehabilitation but sometimes also transported off-site or reworked into berms and sound barriers.[11] Another essential change is water, which affected differently depending on whether a quarry is located above or below the water table.[12]

Above the water table: Though no direct dewatering is required, quarries still use water for dust control, aggregate washing, and site drainage. Water runoff from exposed surfaces can change natural drainage patterns, affecting nearby wetlands, streams, and groundwater recharges.

Below the water table: Quarries below the water table require constant dewatering, which can lower surrounding water tables, reduce groundwater availability for wells and change local hydrological flows.[13]

Whether above or below the water table, quarries often create ponds on-site, which have the potential to form unique hydrological ecosystems.[14]

Quarry extraction is not a one-way process of removal. Extracted aggregates travel outside of the site for use in construction, road building, and infrastructure projects, and other materials return in the form of recycled aggregates and rehabilitation stockpiles. Recycled aggregate materials, such as concrete and asphalt, are sometimes crushed and reused on-site for backfilling or road construction.[15]

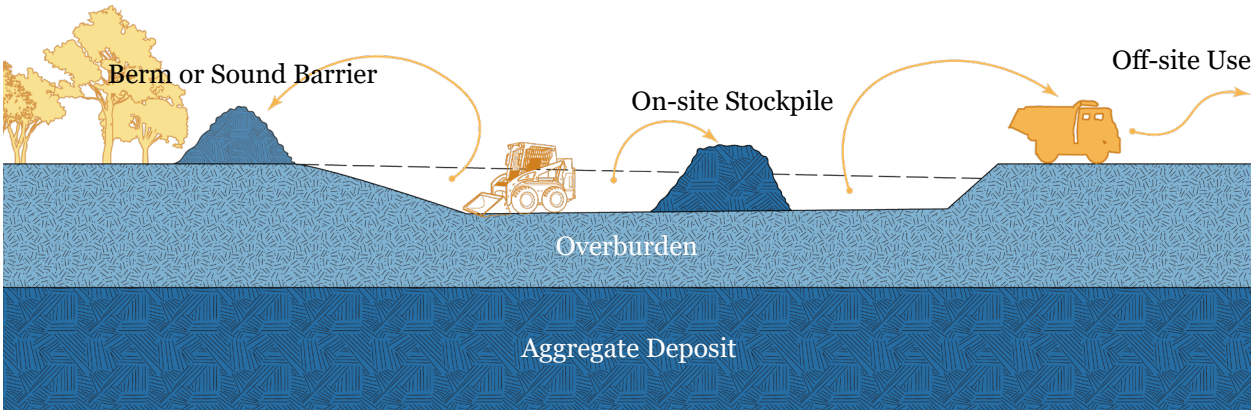


Fig 2.2.1 Overburden movements in quarry preliminary work. Produced by author.

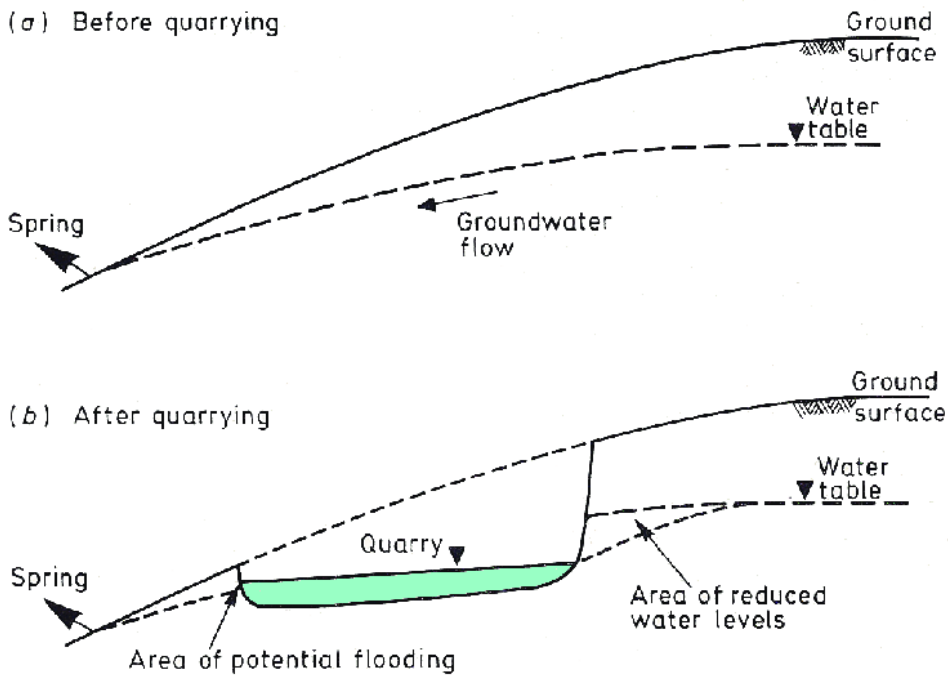


Fig 2.2.2 The groundwater changes in the Pilkington Quarry. Data from: Brassington, Rick. (2021). Hydrogeological problems caused by Quarrying.

Through the lens of material reassembly, quarry extraction is not just a landscape-changing but a dynamic point in a long geological and material process. The extracted materials carry the memory of past geology and are redistributed, while some will return to the site in new forms as rehabilitated landscapes, structural foundations, or newly processed aggregates. In this sense, quarries become a transitional space full of disassembly and reassembly moments where the boundaries between past, present, and future are blurred.

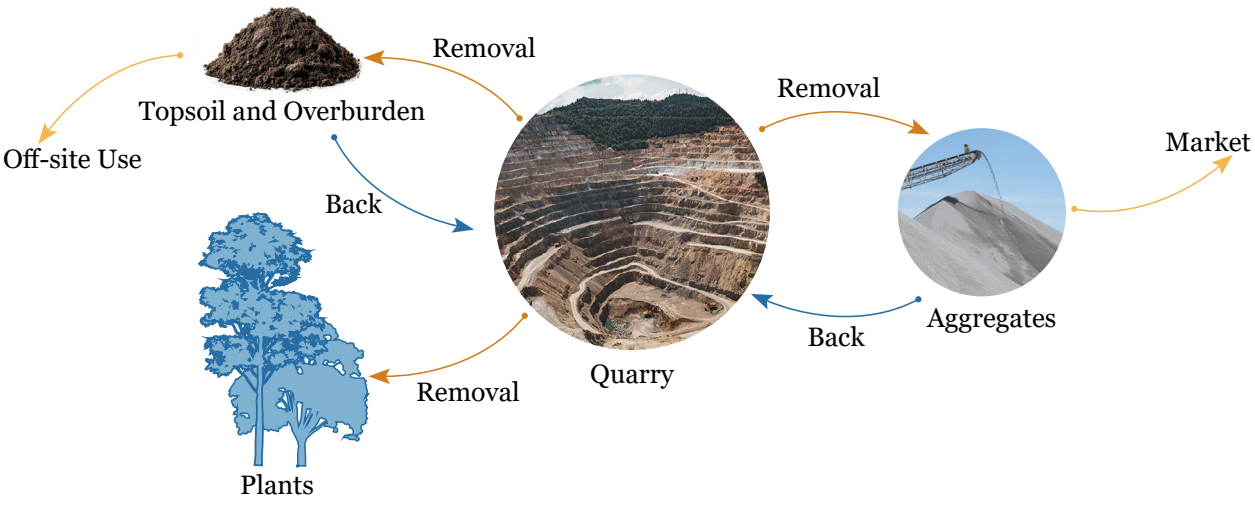


Fig 2.2.3 Material movements when extracting a quarry. Produced by author.

2.3 REHABILITATE A QUARRY

Work Frame

The factors that influence quarry rehabilitation include the legal framework, stakeholders, operators and site commodities, and the natural environment. Legal frameworks establish minimum requirements for restoration.[16] In Ontario, rehabilitation is regulated by the *Aggregate Resources Act, R.S.O. 1990, c. A.8*, with the *Aggregate Resources* (Provincial Standards) acting as a supplementary resource, which requires all licensed quarries and pits to complete rehabilitation after use. It means that to ensure the sites can transition into productive post-extraction landscapes, operators need to start a rehabilitation plan before extraction.[17] Stakeholders work together on shaping rehabilitation outcomes. The MNRF implements restoration regulations, and TOARC oversees funding and research for restoration projects.[18] Industry groups like OSSGA promote active restoration practices, and environmental groups aim for ecological sustainability.[19] The capacity and resilience of the natural environment can determine feasible or necessary restoration techniques.[20]

According to ARA, quarry rehabilitation refers to restoring the site to its original use or an alternative productive use that aligns with surrounding land uses.[21] There are two primary forms of rehabilitation in Ontario. One is progressive rehabilitation, which starts rehabilitation in phases during active extraction, allowing parts of the site to be restored while other sections are still in use to reduce environmental impacts. Another is final rehabilitation, a mandatory step once all extraction is complete, which fully restores the remaining areas to their intended post-extraction use and can be treated as the final step of progressive rehabilitation, such as the removal of a processing plant.[22]

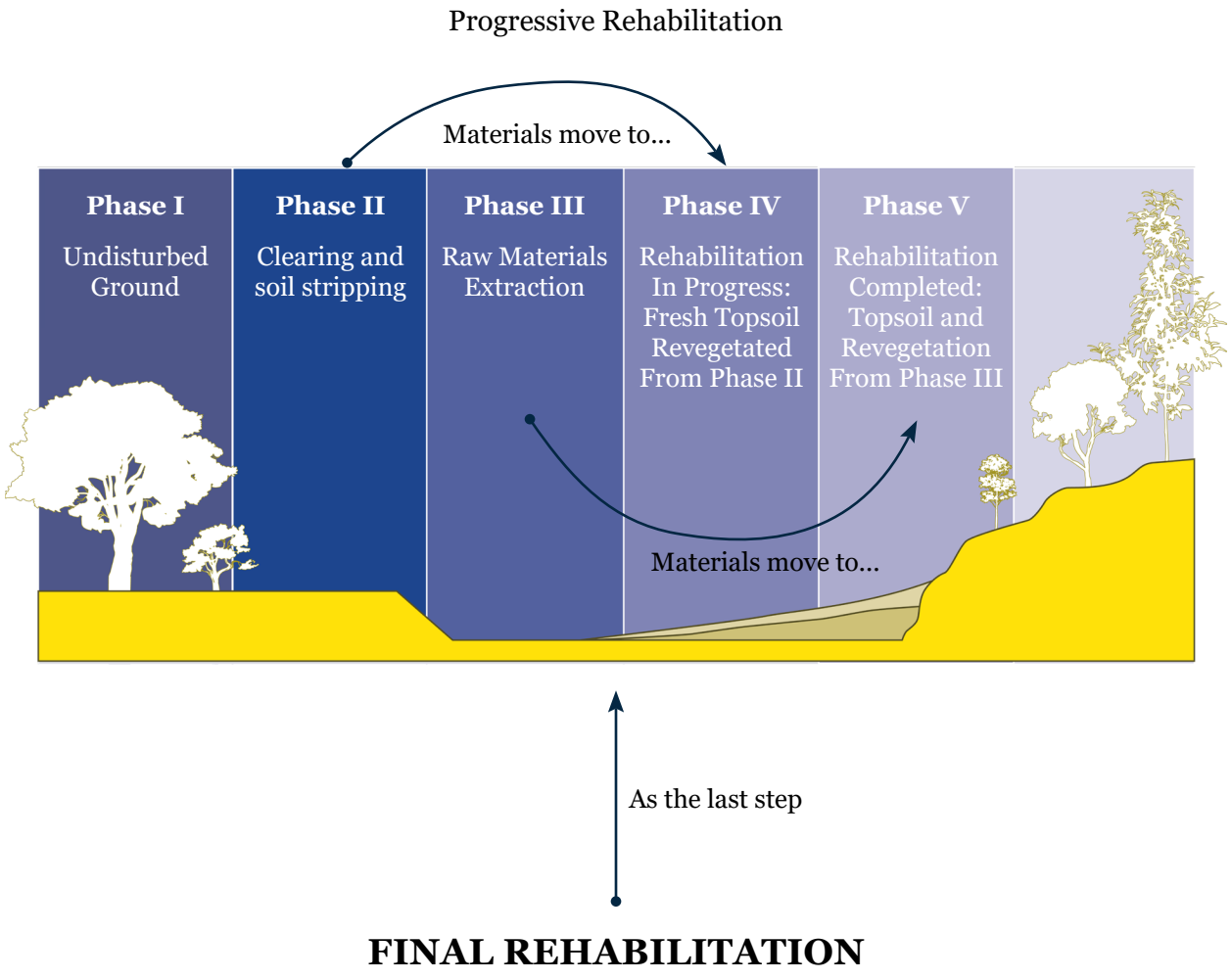


Fig 2.3.1 Two primary forms of rehabilitation in Ontario. Produced by author.

Restoration can be broken down into sections: site preparation, topsoil replacement, vegetation establishment, water management in terms of ponds or drainage systems, and monitoring and maintenance.[23] Quarries will take post-rehabilitation assessments to evaluate if they meet revegetation targets, water quality, and slope stability criteria.

Site preparation includes grading the land and making a stable slope that is no steeper than 3:1 for pits and 2:1 for quarries to support vegetation growth and resist erosion.[24] Clean filling for backfill is necessary to reshape steep for future use,[25] and in deep quarries, terrace landforms can be introduced to prevent the failure of large-scale slopes.[26]

Reintroducing soil is important to support vegetation growth and restore ecological functions. In Ontario, quarry operators are required to store and reuse topsoil and overburden that are removed during extraction, as they contain native seeds, nutrients, and microorganisms that benefit ecological regeneration.[27] During extraction, topsoil and subsoil are often stored separately and redistributed in a layered approach to restore natural soil conditions.[28] When native topsoil is insufficient, A soil substrate that has high organic matter and moderate water-holding capacity needs to be introduced. To improve soil fertility and support plant growth.[29]

Vegetation establishment is one of the most visible and ecologically significant steps in quarry rehabilitation. Aims to stabilize the land, improve soil structure, and create self-sustaining plant communities. Native species are considered a priority as they are better suited to local conditions and support regional wildlife. In large quarries, hydroseeding[30] is commonly used for quick revegetation. In smaller

projects, direct planting of trees and shrubs is preferred. Planting often occurs in phases, beginning with grasses and legumes to stabilize the soil, followed by shrubs and trees that gradually form a new forested or naturalized ecosystem.[31]

Water management in the rehabilitation process, especially for quarries below the water table, needs to ensure that water bodies are stable, functional, and ecologically valuable. Many quarries are flooded to form recreational lakes, wetlands, or aquatic ecosystems. Sites that do not transform into quarry lakes require drainage systems to control runoff, prevent erosion, and maintain groundwater recharge.[32]

Rehabilitation is not a one-time effort. It requires long-term monitoring to track vegetation growth, soil stability, and hydrological changes.[33] Tracking species diversity and population recovery and assessing soil nutrient cycling and plant establishment by soil and vegetation tests.[34] Giving regular inspections for drainage systems to stay in good condition.[35] If original rehabilitation plans do not meet ecological or structural stability requirements, adaptive strategies will be applied, such as regrading landforms or reintroducing different vegetation species.[36]

Besides the minimum requirements, rehabilitation offers opportunities to enhance biodiversity by creating wildlife-friendly landscapes. Rehabilitated quarry ponds are able to attract waterfowl, amphibians, and fish by planting aquatic vegetation that creates shelter and feeding areas. Former quarries can be transformed into habitats for bees, butterflies, and other pollinators by planting wildflowers and shrubs, and the restoration of woodland creates a connected habitat for varied species.[37]

The rich restoration elements allow these post-extraction places to develop in diverse directions. During the period from 2010 to 2014, OSSGA conducted evaluations on 701 pits and quarries. These assessments showed that the rehabilitated sites had wide uses. 25% of sites are restored as naturalized landscapes and increase local biodiversity, such as forests, meadows, or wetlands. 21% developed for agricultural purposes, such as farm or grazing land, to support food production. 15% of sites are converted into parks, conservation areas, and community spaces, while 10% of former quarries become lakes and ponds that benefit local water.[38]

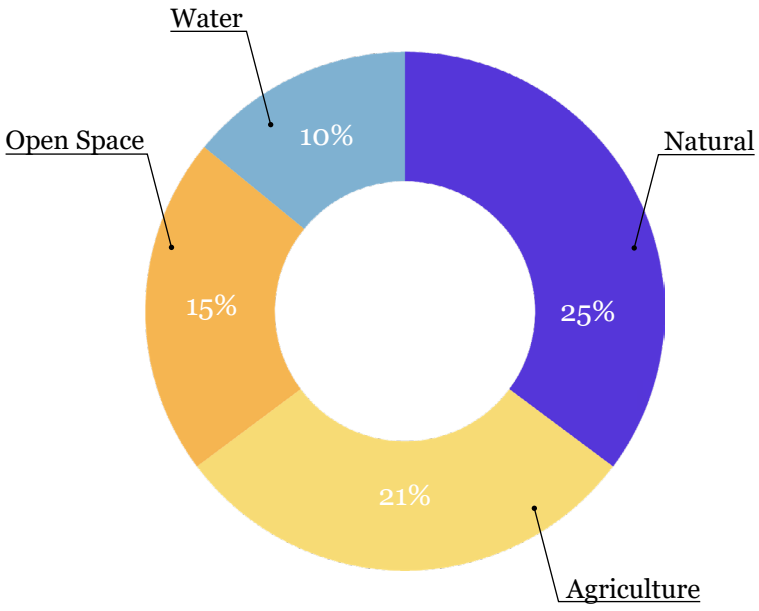


Fig 2.3.2 Land use for rehabilitated aggregate sites. Produced by author. Data from: Rehabilitation of Pits & Quarries [Brochure]. OSSGA, Feb. 2018.

Case Studies

Aligning with the view of material reassembly, quarry rehabilitation is the process of reintegrating the soil, water, vegetation, and landforms into the site. This section aims to reveal the reassembled matters generated in the rehabilitation process by comparing seven cases, which are the Royal Botanical Gardens (RBG) in Hamilton, the Don Valley Brickworks Park (Evergreen Brick Works) in Toronto, the Jinyun Quarry in China, the Be'er Sheva Quarry Park in Israel, The Memorial Park of the 19th International Botanical Congress (IBC), in China, the Kerncliff Park in Burlington, and the Professor's Lake in Brampton.

Background of Selected Cases

The Royal Botanical Gardens (RBG), established in the early 20th century, occupies over 2,400 acres of diverse landscapes, including gardens, arboretums, and extensive nature sanctuaries. Parts of RBG's grounds were quarries that have been rehabilitated into natural habitats and public spaces.[39]

The Don Valley Brickworks is a transformation example of an industrial quarry into an environmental community centre and naturalized park. It was established in 1889 by the Taylor brothers and originally as a brick manufacturing facility using the clay and shale deposits of the Don Valley. The Don Valley Brickworks supplied materials for many Toronto buildings, including Casa Loma, Massey Hall, the Ontario Legislature, and some University of Toronto buildings. After being revoked in 1989, the former quarry was transformed into a series of wetlands

and wildflower meadows. The industrial buildings were preserved and repurposed as an environmental community centre managed by Evergreen.[40]

Jinyun Quarry was a hand-mining stone quarry for over a thousand years. This traditional industry nourished the local economy and left a remarkable cultural heritage. However, as society and the economy changed, these quarries were gradually abandoned. For economic revitalization and cultural preservation, nine of these quarries were regenerated in 2021.[41]

The Be'er Sheva Quarry Park was an Ottoman-era limestone quarry that was abandoned as quarrying activities stopped, leaving a void in residential neighbourhoods. The project transformed the abandoned quarry into a dynamic public park that emphasizes the site's historical quarrying processes, showcasing exposed geological layers.[42]

The Memorial Park of the 19th International Botanical Congress (IBC) is a transformative project in 2019 located at the confluence of the Shenzhen and Xinzhou River estuaries in Shenzhen, China. This site was a construction waste landfill adjacent to the Futian Mangrove National Nature Reserve and facing the Mai Po Ramsar Wetland in Hong Kong.[43]

Kerncliff Park was the Nelson Quarry, and this limestone extraction site ceased operations in 1981. The City of Burlington acquired the 40-acre site to create an environmental park. Kerncliff Park officially opened to the public in 2005.[44]

The Professor's Lake was a sand and gravel quarry that was operational from 1918 to 1973. During this period, approximately 20 million tonnes

of aggregate were extracted, contributing to regional construction works. After the extraction activities finished, the quarry was naturally filled with groundwater to form a lake. The site was subsequently acquired by the German-based developer Lehndorff Corp., whose president, Dr. Hans Abromeit, lent his nickname, "Professor," to the new lake. Professor's Lake is now encircled by a community and serves as a recreational hub.[45]

The comparison includes four themes: topographic changes, water solutions, plant back and habitat rebuild, and spatial narrative.

Topographic Changes

The landform transformation varies depending on the rehabilitation approaches, from maintaining and reusing the industrial past to creating gentle slopes that entirely cover the quarry traces. The rehabilitation of Jinyun Quarry, Kerncliff Park, and RBG presents three approaches to reassembling quarry topography that reflect different priorities in transforming post-extraction landscapes.

Jinyun Quarry took the minimum design intervention to deal with the original quarry walls, which integrated the exposed rock into new spatial functions. The quarry's landform has been entirely maintained to reassemble the industrial memory and turn past excavation scars into stages for cultural exchange.[46] Kerncliff Park represents an approach that partly maintains the quarry traces. Compared with Jinyun, Kerncliff Park allows plants and wetlands to reclaim the site gradually, while the cliff faces of the Niagara Escarpment are maintained as a visible geological history of the site. The boardwalks and viewing platforms

frame the transformation happening on the site, driving visitors to experience the land reassembly moments.[47] The RBG Rock Garden takes the idea of completely erasing the quarry landform. The site was filled, reshaped, and replanted, and industrial traces are no longer visible. This method follows a design philosophy where extraction activities are completely overwritten by new material and ecological layers.[48]

Fig 2.3.3 Jinyun Quarry. Photo by Author, Dec. 2023

Fig 2.3.4 Kerncliff Park. Photo by author, Oct. 2023

Fig 2.3.5 The Rock Garden of RBG. Data from: Holmes, Damian. “The New Rock Garden Offers a Fresh and Uniquely Canadian Horticultural Collection.” World Landscape Architecture, 20 Feb. 2017.

Water Solutions

Depending on whether the site is above or below the water table, quarries may be transformed into lakes, wetlands, or engineered drainage systems. Some sites use water to flood the quarry naturally, creating biodiverse aquatic ecosystems, while others redirect and improve water through designed interventions. Professor's Lake and Don Valley Brickworks Park are good comparisons to show the different approaches.

Professor's Lake is a 26-hectare lake that was formed by a fully flooded sand and gravel pit. The passive flooding process allows the natural water table to reclaim the site.[49] Compared with Professor's Lake, Don Valley Brickworks Park takes an active reassembly approach to restore natural water flows and improve local water by wetlands. The site set up three ponds to gain sufficient and steady water supply from Mud Creek to form the wetlands and collect stormwater runoff from Mud Creek and assist in filtering it before it joins the Don River and Lake Ontario.[50] These case studies reveal that water reassembly in quarry rehabilitation can range from passive to active intervention.

Plant Back and Habitat Rebuild

Vegetation return is one of the most visible steps in material reassembly, influencing how plant communities establish and interact with post-extraction landscapes. Some rehabilitation efforts rely on passive rewilding, allowing nature to regenerate at its own pace, while others use active restoration strategies such as hydroseeding, direct planting, or soil

Fig 2.3.6 Professor's Lake. Photo by author, Oct. 2023

Fig 2.3.7 Wetlands of the Don Valley Brickworks Park. Photo by author, Feb. 2024

amendments to accelerate ecosystem recovery. The Memorial Park of the 19th International Botanical Congress (IBC) and Don Valley Brickworks Park are presentations of these two philosophies in revegetation and habitat rebuilding.

The Memorial Park of IBC follows a passive rewilding strategy. The design refrains from direct planting. Instead, 1,545 cubic meters of soil were relocated from various parts of Shenzhen, allowing native vegetation to re-establish naturally.[51] This approach fosters a self-sustaining wild vegetation community, where plants recolonize based on soil seed banks, wind dispersal, and ecological succession. The strategy minimizes human intervention, enhancing long-term biodiversity resilience. However, passive rewilding requires a longer timeline that may take decades to reach full completion. Don Valley Brickworks Park took an active restoration strategy to speed up revegetation because brick-making activities had stripped the natural soil layers, and the rehabilitation process required more intervention. One unique aspect of Don Valley Brickworks Park is that it provides interactive spaces for visitors to observe plant growth and ecosystem evolution in real time.[52] Therefore, passive rewilding promotes a more organic and long-term ecological adaptation, and active restoration ensures faster stabilization and controlled biodiversity outcomes. Both approaches reflect different priorities in balancing time, ecological resilience, and human intervention.

Spatial Narrative

Whether intentionally designed or not, rehabilitated quarries build

Fig 2.3.8 The Memorial Park of IBC. Data from: The Memorial Park of the 19th International Botanical Congress (IBC) by Guangzhou Turen Landscape.

Fig 2.3.9 Plants in the Don Valley Brickworks Park. Photo by author, Feb. 2024

spatial narratives that influence how visitors experience and read the reassembly of materials and landscapes. These sites are montages of past industrial traces and ecological movements. Be'er Sheva Quarry Park and Jinyun Quarry display two unique approaches to speaking about these reassembly moments within their landscapes.

Be'er Sheva Quarry Park provides a participatory landscape by being partly unfinished, leaving space for visitors to shape their interactions with the site. This approach highlights the temporal character of quarry rehabilitation, where landscapes are never truly static. The unfinishedness of Be'er Sheva Quarry Park challenges traditional notions of rehabilitation as "completion," proposing that quarries can remain dynamic and adaptable, shaped by both ecological and cultural influences.[53] Jinyun Quarry is situated in an old town where a hand-mining stone quarry had been the main income for local people. As a result, Jinyun's rehabilitation is connected to the local community, as quarrying was a collective memory shared by generations. The project bridges past and present experiences and emphasizes historical continuity and local identity by integrating past quarry traces into the current landscape.[54]

In conclusion, rehabilitation can be framed as a process of material movements happening inside a post-extracted landscape shown in two forms, which are passive and active processes. It gives thinking that rather than designing separately, rehabilitation needs social activities and natural forces shaping the site together and evolving during their interaction.

Fig 2.3.10 Spaces for community, Jinyun Quarry. Photo by author, Dec. 2023

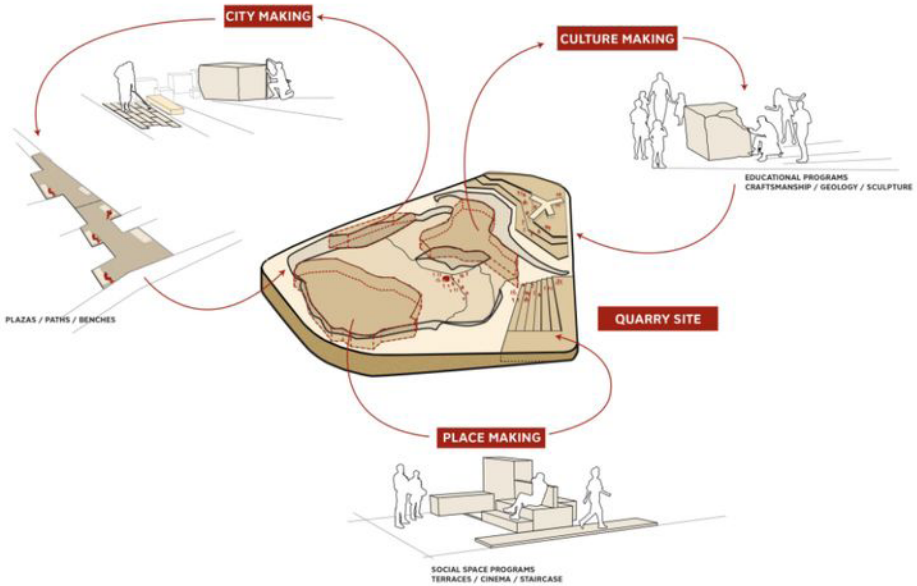


Fig 2.3.11 Unfinished Space, Be'er Sheva Quarry Park. Data from: "Be'er Sheva Quarry Park." SCAPE.

2.4 DESIGN PRINCIPLES

By locating quarries at the intersections of materials, landscapes, and human activities over long-term geological movements, this thesis aims to use a quarry rehabilitation project to develop a design proposal that does not treat rehabilitation as a "repair" or "restore", but locates it as an opportunity to display, engage, and continue the material reassembly moments. The design intends to reframe the public perception of extraction activity by preserving and reappearing elements of quarry heritage, bridging the isolated understanding of human intervention and natural processes, and developing three design principles for responding to the research question.

Research Question: *What are the design principles for revealing the reassembly moments and integrating human activities into natural processes on a post-extraction landscape?*

"Expose" identifies and marks the important elements where their movements drive the site changing. Quarrying involves rich elements and events, and it is difficult to involve all for a design. So, selecting and showing the key factors is the foundation to reveal the reassembly moments in the quarry.

"Encounter" provides places, whether in reality or on a virtual platform, to gather the key elements identified by "Expose", making these elements and their movements able to be read. This principle is inspired by progressive rehabilitation, which demonstrates multi-layer

narratives of time and proves that the different reassembly moments can coexist on-site.

“Unfinish” encourages new movements to happen in the places provided by “Encounter”. To include the timeline before and after extraction to turn a concept of quarries into landform transformation processes, the design not only needs to highlight the past but also leave space for the observation of reassembly moments in the future.

Notes

1 Staff, P&Q. *"P&Q University Lesson 3- Geology | Pit & Quarry."* PIT&QUARRY, August 16, 2019. https://www.pitandquarry.com/pq-university-lesson-3-geology/.

2 Langer, William H., et al. *Aggregate and the Environment*. American Geological Institute, 2004, 17-19.

3 The Ontario Aggregate Resource Corporation. *"Rockin' In the Real World: An Introduction to Aggregate Resources in Ontario."* Ontario Envirothon Program, 23, Accessed April 12, 2024. https://assets.ctfassets.net/e09p19lzfrfe/5YVBb1I0RquQ4iueOQvT0I/630ebd6bccbcd90cdf73a4d3d5d0c2b6/FO_AggregateResources_StudyGuide-WEB_REV.pdf.

4 Ministry of Natural Resources and Forest. *The State of the Aggregate Resource in Ontario Study: Consolidated Report*. Queen's Printer for Ontario, 2010, 17. https://www.ontario.ca/page/aggregate-resources-study.

5 Office of the Auditor General of Ontario. *Management of Aggregate Resources*. Ministry of Natural Resources and Forest, December 2023, 8, https://auditor.on.ca/en/content/annualreports/arbyyear/ar2023.html.

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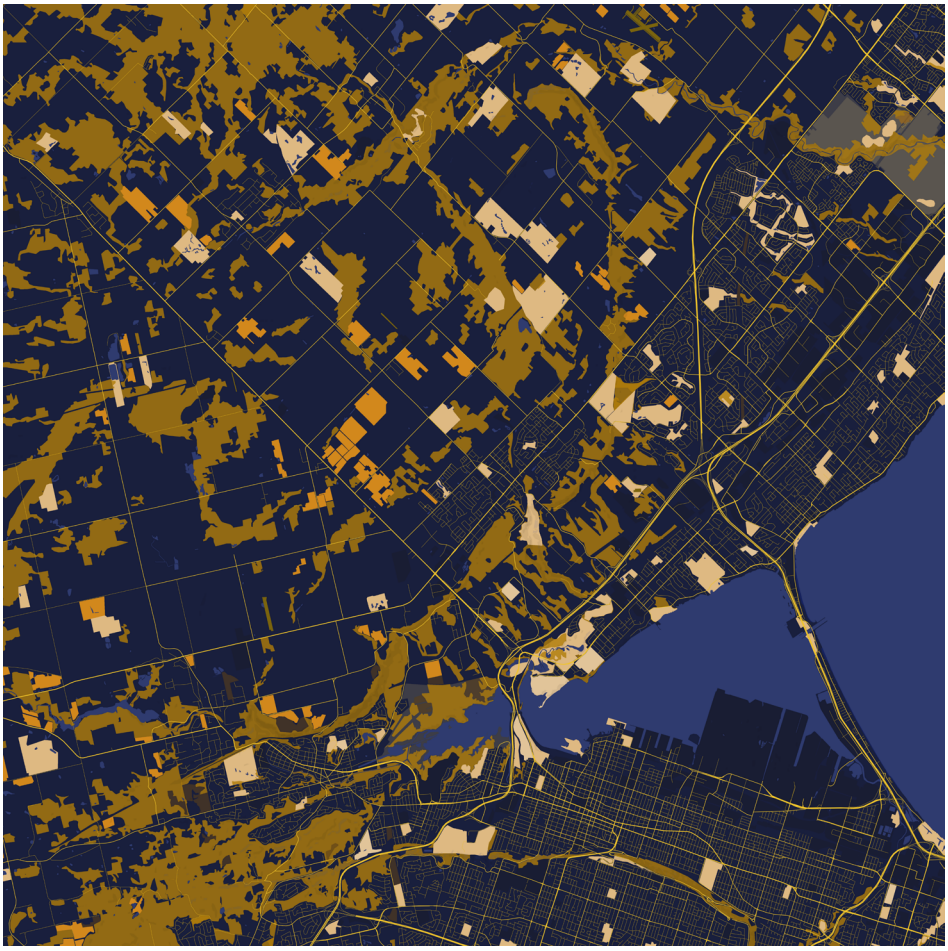


Fig 3.1 Land use and road network fabric in Burlington and Hamilton area. Produced by author.

CHAPTER 3. ALDERSHOT QUARRY AND MERIDIAN BRICK FACTORY SITE

Expose—Indicate the key elements

Encounter—Overlap these elements

Unfinish—Identify the constant movements of elements

This chapter gives the Aldershot Quarry background research by applying design principles. First, “Expose” key elements that most affect quarry operations, highlighting the environmental and social sensitivities that influence the rehabilitation. Next, make these elements “Encounter” via the GIS platform, leading to the site selection process, and point out the Aldershot Quarry. This Queenston shale quarry, operating since 1998 and starting its brick factory in 2001, has constantly transformed the site landscape and driven surrounding material movements till now. So, “Unfinish” becomes the most distinctive feature of Aldershot Quarry and provides a clue to understand site development as a dynamic model.

3.1 Greenbelt, Natural Heritage System (NHS), and Greater Golden Horseshoe (GGH) Region

According to Chapter 2, the site selection is the start for a quarry that transforms the landscape invisibly, as well as the beginning of an extraction dispute because it directly influences both environmental conditions and social well-being. Ontario has rich aggregate deposits, but not all locations are suitable for extraction due to environmental risks and regulatory constraints. The primary environmental factors are the Greenbelt, the Natural Heritage System, the water bodies, and the watercourses. Besides, Ontario's aggregate site is affected by urban expansion, population growth, and transportation networks as well.

Ontario's Greenbelt is the world's largest permanently protected green space that was established in 2005 under the Greenbelt Act. It covers approximately two million acres of farmland, forests, wetlands, rivers, and lakes to safeguard essential ecological and hydrological features, support agriculture, and offer recreational opportunities.[1] The Greenbelt includes the Protected Countryside, Niagara Escarpment, Urban River Valley, Specialty Crop Areas, and Oak Ridges Moraine. These areas are important for filtering and recharging groundwater across Ontario's Greater Golden Horseshoe and providing habitats for various species, including those at risk.[2] As a result, quarrying inside or near the Greenbelt is highly regulated.

The Natural Heritage System (NHS) is a provincially certified network of natural features and areas, including forests, wetlands, rivers, and wildlife corridors, and it is protected under Ontario's Provincial Policy Statement (PPS). This system is designed to preserve biodiversity, maintain ecological functions, and support native species communities.[3] Extraction activities in these areas could lead to habitat loss,

fragmentation, and long-term ecological degradation.

The Greater Golden Horseshoe (GGH) is one of North America's fastest-growing urban areas, including Toronto, Hamilton, and surrounding municipalities. As of 2021, the region contains around 9.7 million residents, contributing more than 20% of Canada's total population and over 54% of Ontario's population.[4] The transportation plan in GGH supports economic development and population growth, anticipating a rise from 10 million to 14.9 million residents by 2051.[5] Therefore, the aggregate resource demand in GGH has an expectation of increasing.[6]

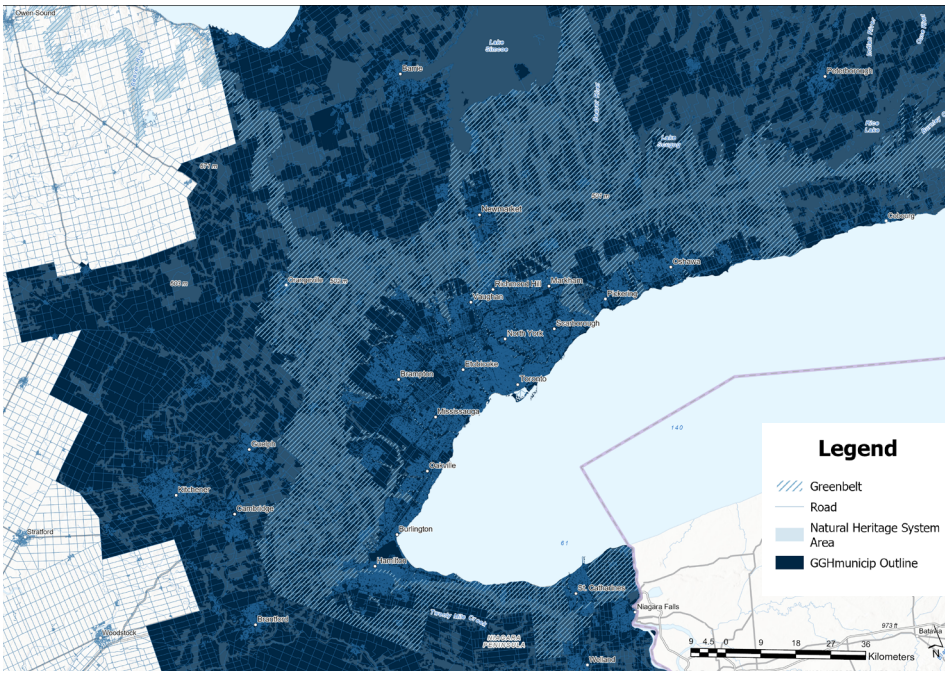


Fig 3.1.1 The Greenbelt, Natural Heritage System (NHS), and Greater Golden Horseshoe (GGH) Region. GIS mapping. Produced by Author. Data from: Ontario GeoHub.

3.2 SITE SELECTION

To identify the best site that reflects the design concept of showing a series of material reassembly moments required the location to have rich environmental elements, present potential conflicts with the communities, connect to the transportation networks, interact with water systems, and align urban expansion trends. The GIS mapping method was applied to find the site by overlaying multiple key spatial data layers. The site selection process involved a multi-step geospatial analysis, including the following layers:

1. Defining the Search Area: The Greater Golden Horseshoe (GGH) region was chosen as the study area because it is Ontario's core economic zone, where urban expansion and aggregate demand are most concentrated.

2. Overlaying Active Aggregate Sites: Active aggregate sites in the GGH region were marked with type symbols to tell if they were pits or quarries.

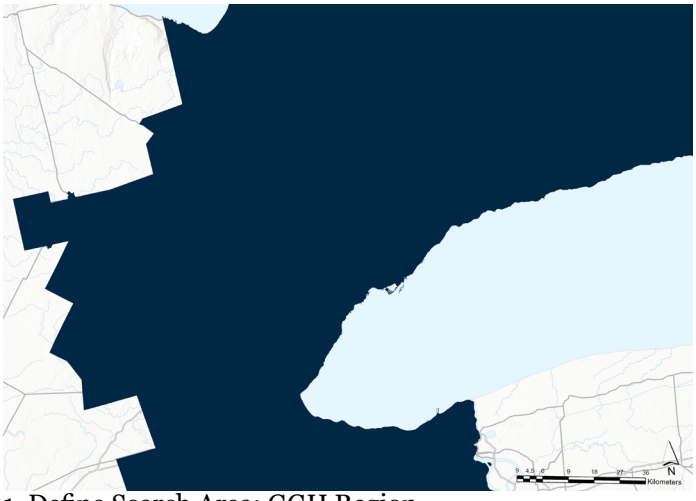
3. Identifying Environmentally Sensitive Areas: Greenbelt and Natural Heritage System (NHS) data layers were added to highlight ecologically protected zones, guaranteeing that the selected site has strong environmental interactions and rehabilitation potential.

4. Mapping the Transportation Network: Roads and railway systems were applied to show how extracted materials move into the market and local transportation connectivity.

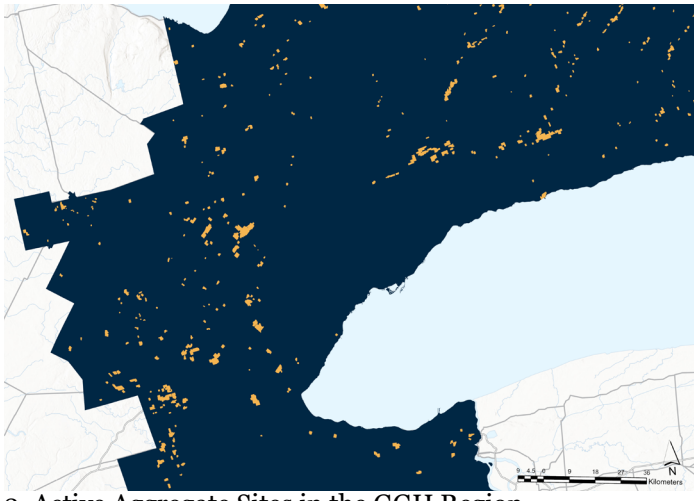
5. Analyzing Urban Expansion Trends: GGH-built boundaries and growth centres were overlaid to show the urban development, making the site located near expanding urban centres where quarry-community interactions are most dynamic.

6. Assessing Future Population Growth: GIS-based population growth forecast calculations were applied to map future densely populated areas, helping to find sites where urban development may conflict with quarrying activities.

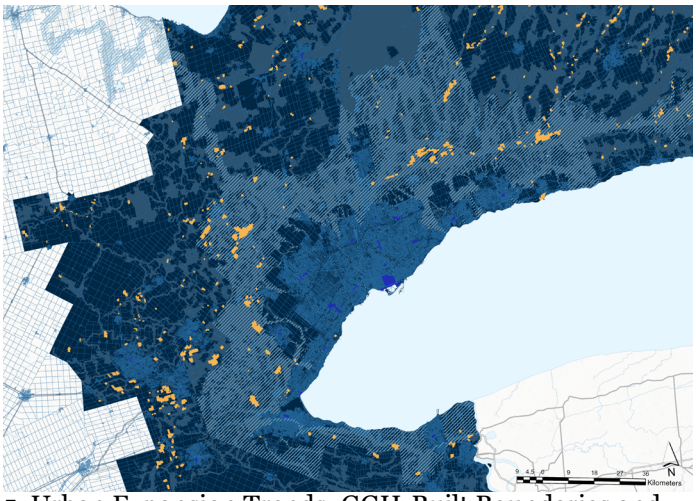
7. Mapping Water-Sensitive Areas: Water bodies and watercourses were added to figure out the water-sensitive areas, tying the quarry water to the local hydrology.



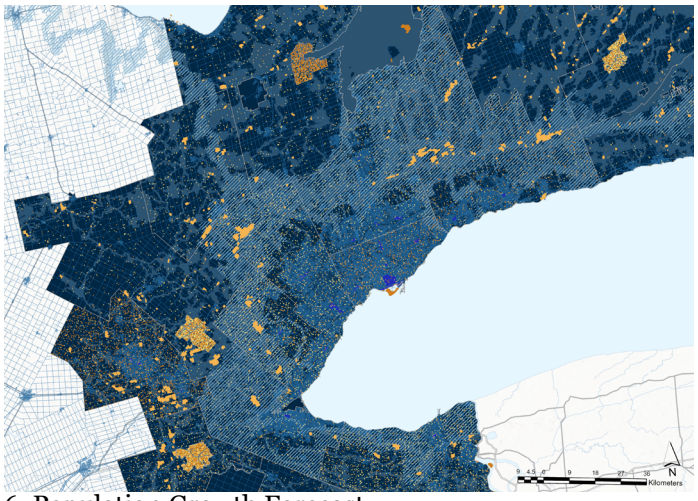
1. Define Search Area: GGH Region



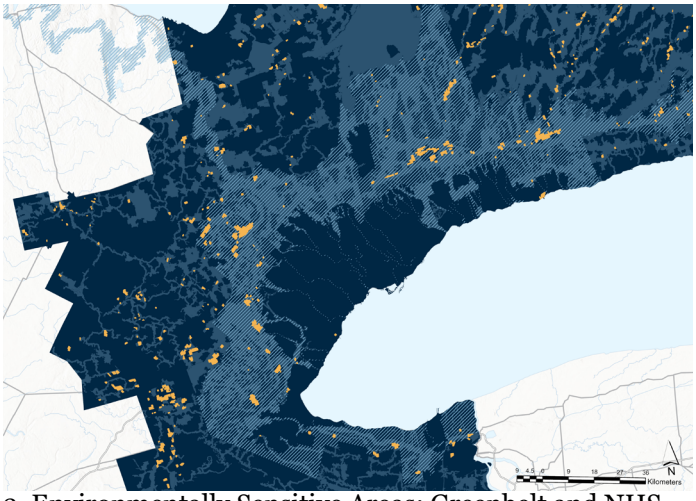
2. Active Aggregate Sites in the GGH Region



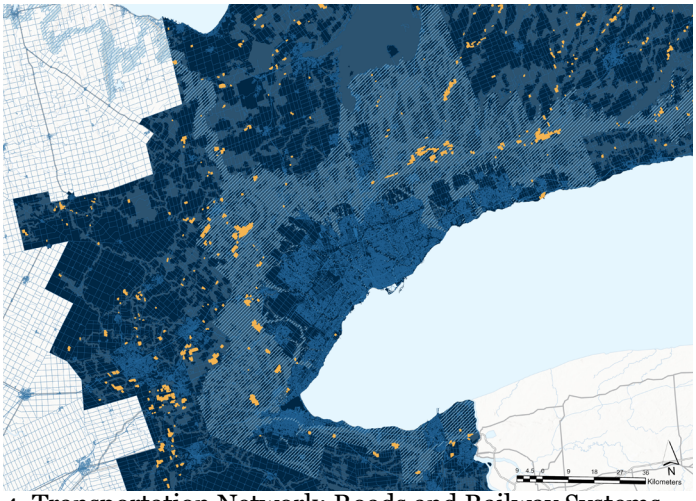
5. Urban Expansion Trends: GGH-Built Boundaries and Growth Centres



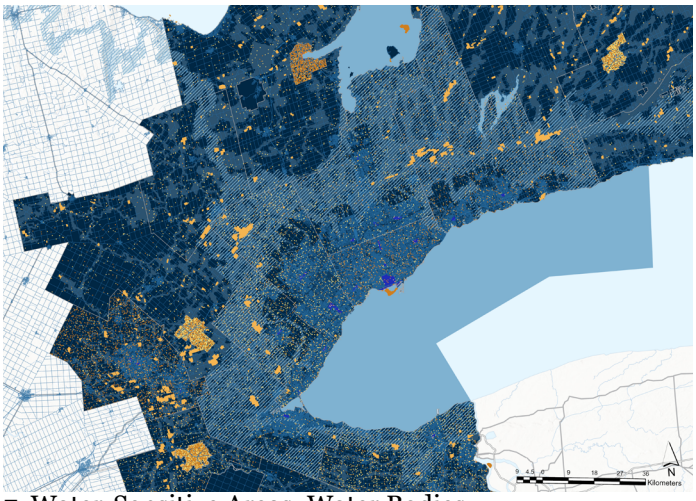
6. Population Growth Forecast



3. Environmentally Sensitive Areas: Greenbelt and NHS



4. Transportation Network: Roads and Railway Systems



7. Water-Sensitive Areas: Water Bodies

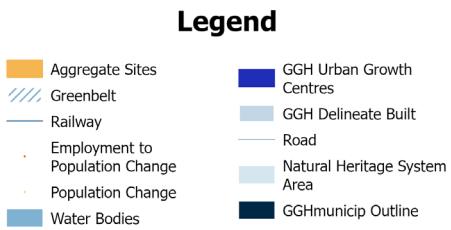
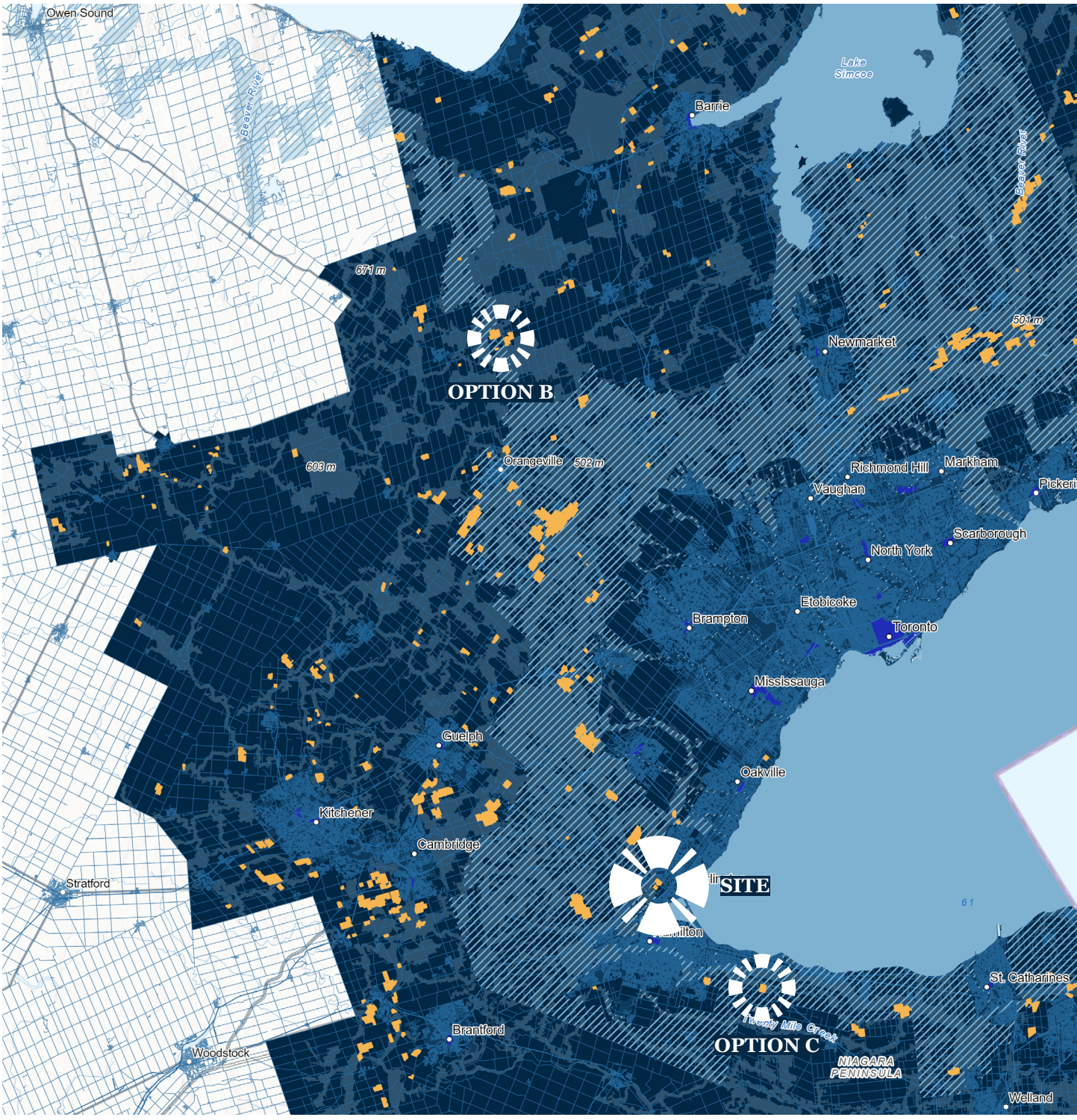
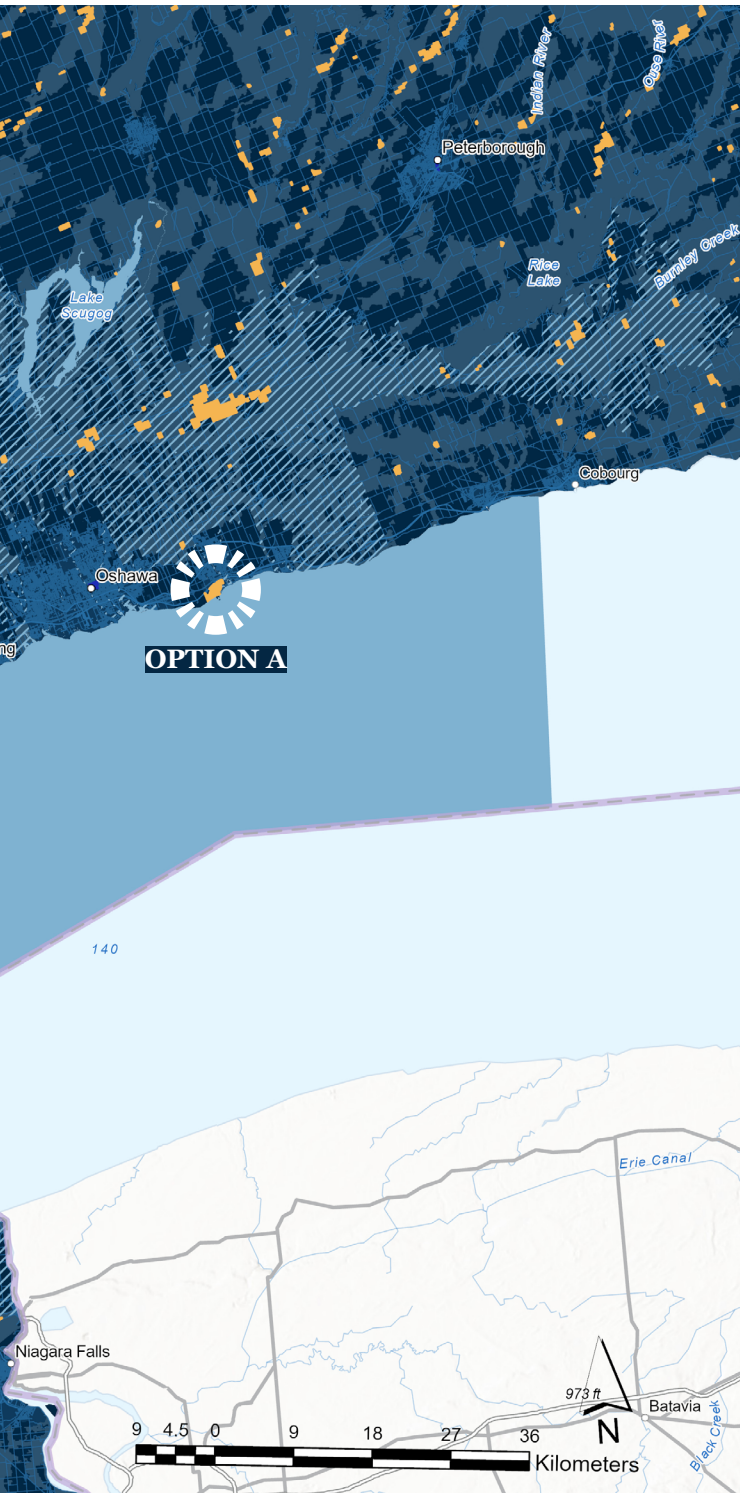
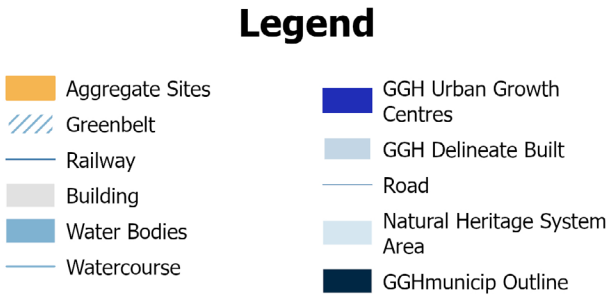


Fig 3.2.1 Site selection process. GIS mapping. Produced by Author. Data from: Ontario GeoHub.


Owen Sound
Beaver River
Lake Simcoe
Barrie
Beaver River
671 m
OPTION B
501 m
Newmarket
603 m
Orangeville
502 m
Richmond Hill
Markham
Vaughan
Pickeri
Scarborough
North York
Etobicoke
Brampton
Toronto
Mississauga
Guelph
Oakville
Kitchener
Cambridge
Stratford
SITE
61
St. Catharines
Twenty Mile Creek
Brantford
OPTION C
NIAGARA PENINSULA
Woodstock
Welland

Aldershot Quarry and Meridian Brick Factory Site





SITE: Adlershot Quarry, Burlington

OPTION A: Bowmanville Quarry, Bowmanville

OPTION B: The Parsons Pit, Mono; Violet Hill Pit (Application), Mono

OPTION C: Stoney Creek Quarries, Hamilton

Fig 3.2.2 Site selection result and potential options. GIS mapping. Produced by Author. Data from: Ontario GeoHub.

Through this multi-layered GIS analysis, Aldershot Quarry in Burlington was identified as the site that best suits the design proposal because it aligns with the criteria below:

The quarry touches the edge of the Greenbelt and is partially within the NHS region, saying the site has high ecological value and potential to expand the Greenbelt, contributing to local biodiversity corridors through rehabilitation. In addition, the ideal location that is close to the existing ecological networks makes it easier to develop passive ecological reassembly moments.

There are multiple watercourses crossing the site and connecting to Lake Ontario, so the location is sensitive to hydrological changes. This provides an opportunity to form water narratives.

Aldershot Quarry is situated near Highway 403 and adjacent to both a GO Train and GO Bus station, promising high accessibility for future visitors. The transportation connectivity supports the spread of new quarry narratives, expanding public engagement with the extraction sites.

GIS data shows that the quarry is near expanding GGH urban boundaries, forecasting its population growth and increasing material demand as well.

The quarry is almost touching the nearest community boundary, and it represents the high possibility of conflicts between extraction actions and the community while creating more opportunities for the locals to reshape their understanding of extraction activities.

Aldershot Quarry and Meridian Brick Factory Site

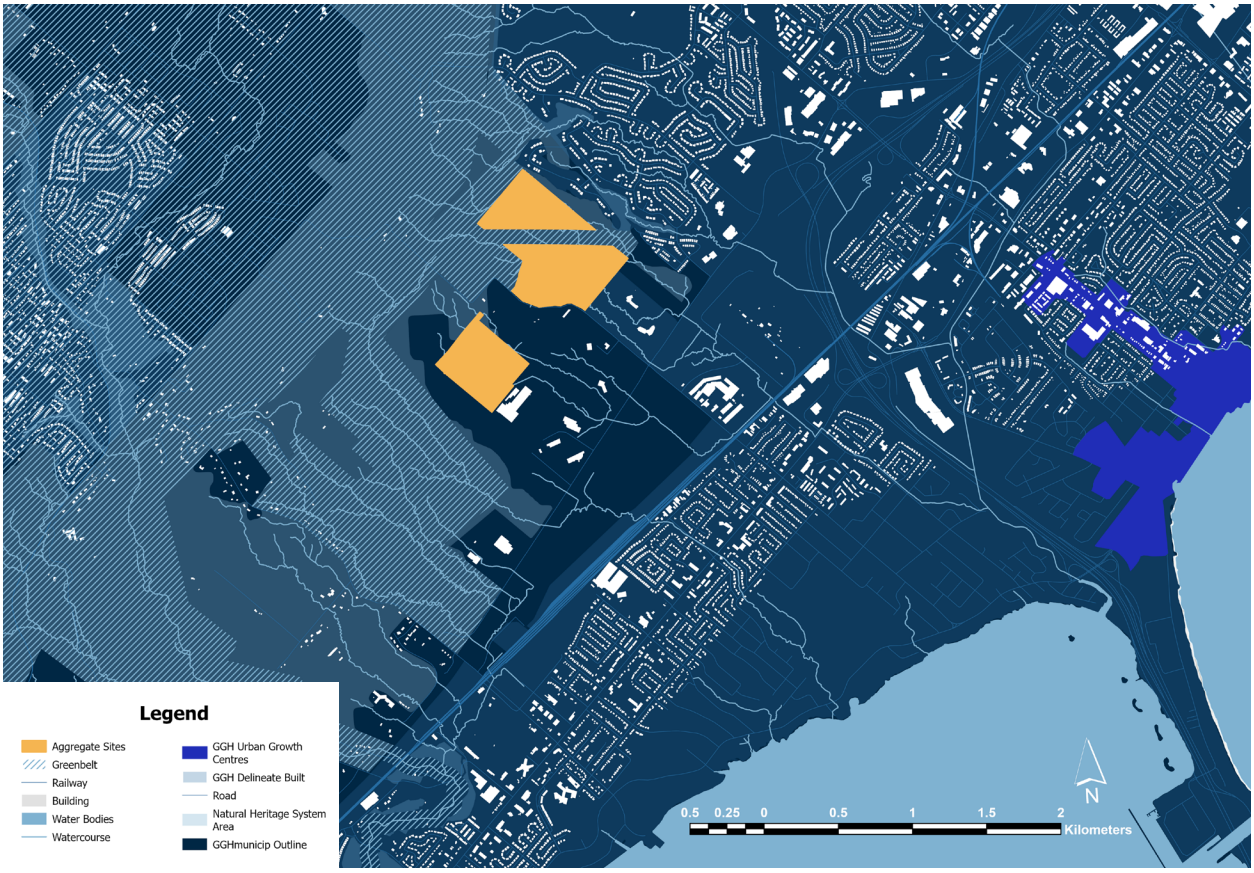


Fig 3.2.3 The overlaid data layers point out the Aldershot Quarry in Burlington. GIS mapping. Produced by Author. Data from: Ontario GeoHub.

While other sites align with some of the criteria established for this thesis, they do not offer the same research depth or spatial complexity as the Aldershot Quarry. The three options below represent reasons for the unselected sites:

Option A: Bowmanville Quarry, Bowmanville. This site offers a strong hydrological context and is well-connected to the regional road systems, such as Highway 401. However, it is spatially disconnected from adjacent communities and far from urban growth centres. The limited potential for community conflict makes it less suitable for exploring public engagement strategies in post-extraction landscapes.

Option B: Parsons Pit and future Violet Hill Pit, Mono. These sites form

Fig 3.2.4 Option A: Bowmanville Quarry in Bowmanville. GIS mapping,. Produced by Author. Data from: Ontario GeoHub.

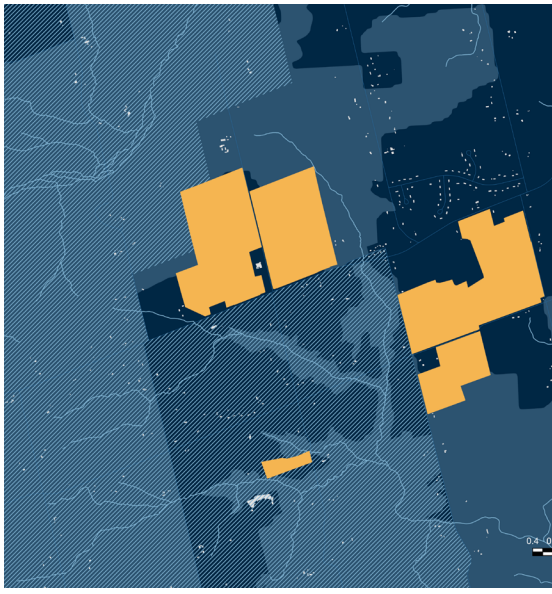
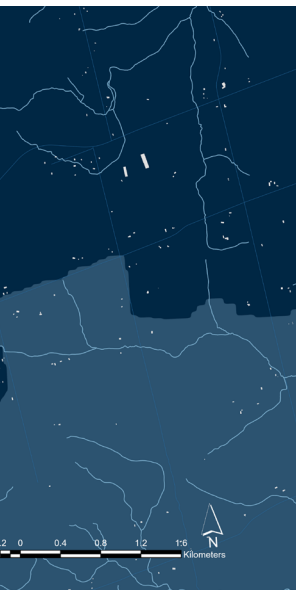


Fig 3.2.5 Option B: The Parsons Pit in Mono and th Mono. GIS mapping. Produced by Author. Data fro

a cluster of extraction operations, providing the potential for a long-term, multi-phase rehabilitation proposal. However, their location is within a low-density area and a limited transportation access region. Moreover, missing information in the Ontario Mineral Inventory results in research limitations, especially in data collection and verification.

Option C: Stoney Creek Quarries, Hamilton. This site presents a strong potential for community interaction as it is located near a high-density residential zone. However, it is separated from Lake Ontario by urban development, increasing the inconclusiveness of water purification through quarry rehabilitation.



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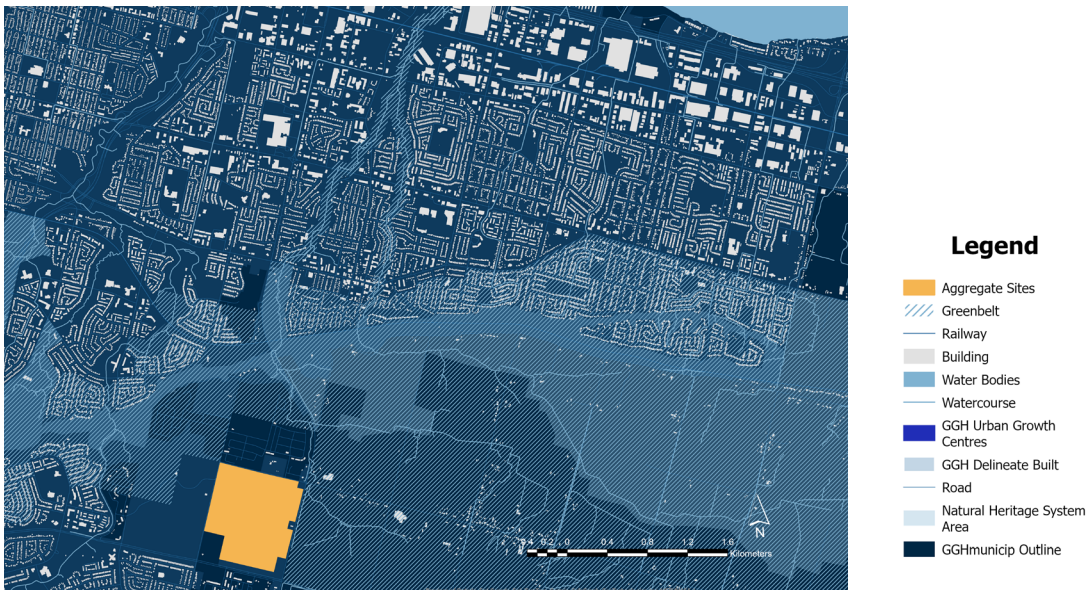


Fig 3.2.6 Option C: Stoney Creek Quarries in Hamilton. GIS mapping. Produced by Author. Data from: Ontario GeoHub.

3.3 ALDERSHOT QUARRY AND MERIDIAN BRICK FACTORY

Aldershot Quarry, located in East Flamborough, Southern Ontario, is a Queenston shale deposit, which is an important raw material for clay brick production. The Aldershot area has been an important clay and shale extraction site since the early 20th century. The Dominion Sewer Pipe Company established a plant in the area in 1904 to extract and process the clay and shale resources. In the 1920s, National Sewer Pipe consolidated local operations, and the site continued as a main supplier of brickmaking materials. Currently, the Aldershot Quarry is operated by Meridian Brick, which is one of the largest producers of clay bricks in North America.

Canada Brick got the licensed property from the National Sewer Pipe in 1990 and started extracting shale from the site in 1998 in preparation for the brick plant construction. The first commercial production started in April 2001. The official opening and full production of the brick plant were done in May 2002.[8]

The site consists of three quarries: Aldershot West, Aldershot Centre, and Aldershot East. The West and Centre quarries are nearing depletion, which presents an urgent need for a rehabilitation project.[9] Meanwhile, the East Quarry hasn't started extraction yet and contains the Queenston shale reserves for continued operations.[10] The process of brick manufacturing mainly occurs in the West Quarry, where the brick plant is located. The shale is extracted from the quarry and moved to the plant for twice crushing into grinds. Then, it is mixed with water to extrude clay strips and cut into a specific brick size. After experiencing drying, firing, and painting procedures to achieve the final brick products. During this process, it is unavoidable to produce clay

waste. Because there are no foreign materials outside of the site, the waste is safe to collect and send back to the quarry to mix with raw shale for the next extraction action.[11] This cycle keeps materials circulating within the site, reducing waste and reinforcing the narrative of material movements and reassembly. Therefore, compared with the Centre and East quarries, the West Quarry provides a unique opportunity to tell the reassembling narratives and becomes the ideal location for developing design proposals.

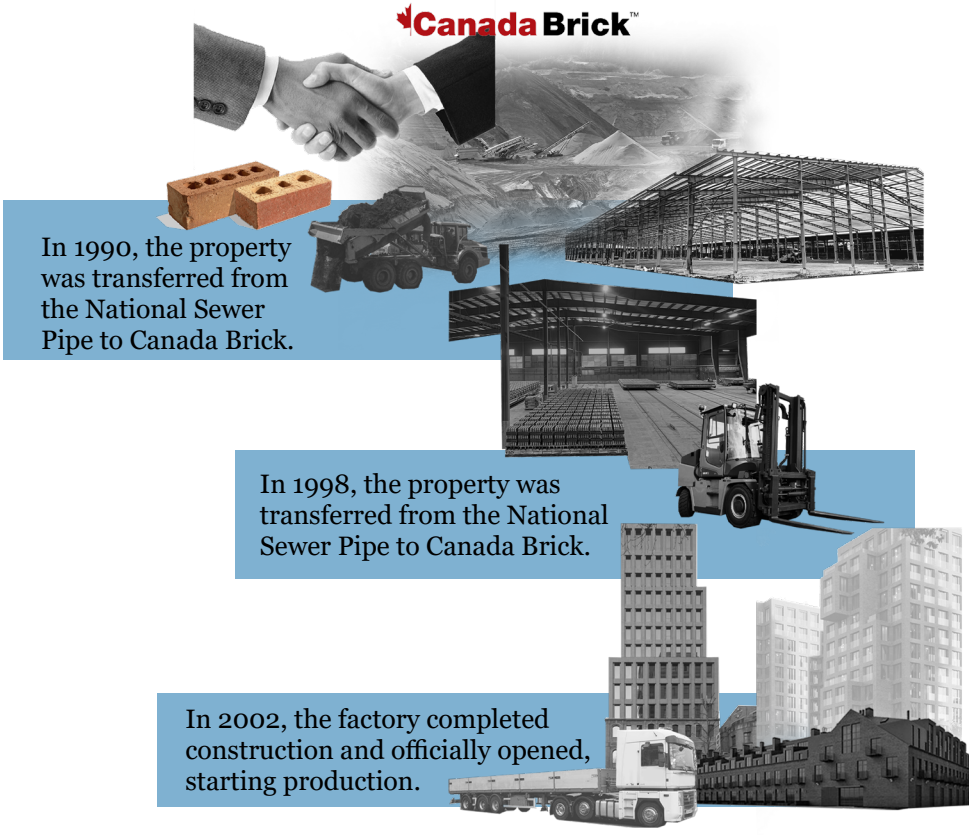
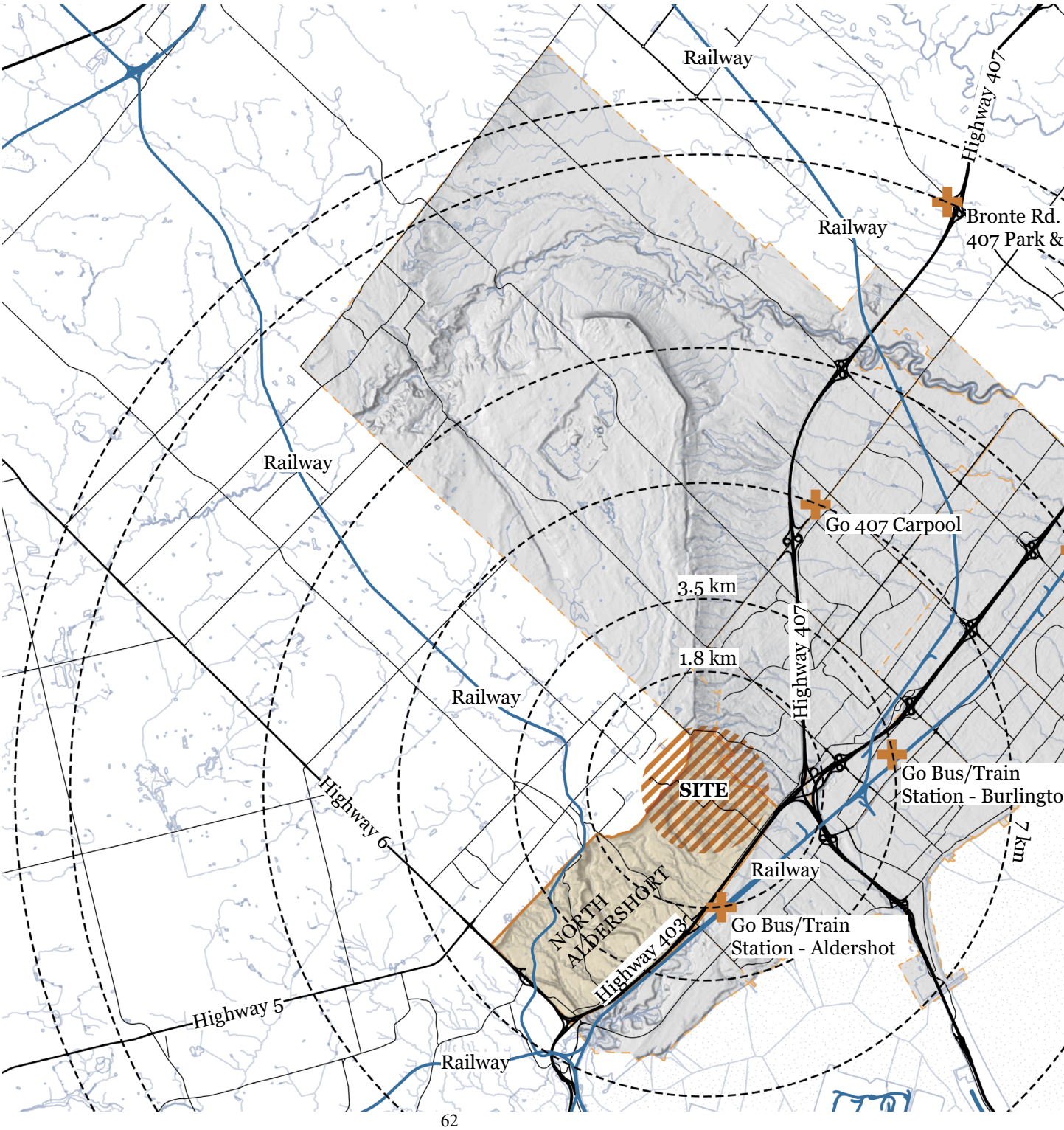


Fig 3.2.7 Timeline of Ownership and Development of the Aldershot Quarry Site and Brick Factory. Produced by author.

As Meridian Brick changed its ownership multiple times, a clear timeline helps reduce the confusion brought by the company's name:

1956 – 2003: Operated as Canada Brick.
2003–2014: Merged and operated under Hanson Brick.
2014–2016: Acquired by Boral Brick.
2017–Present: Became part of Meridian Brick.[7]


Railway
Highway 407
Bronte Rd.
407 Park &
Railway
Railway
Go 407 Carpool
3.5 km
1.8 km
Highway 407
Railway
SITE
Go Bus/Train
Station - Burlingto
7 km
Highway 6
Railway
NORTH
ALDERSHOT
Highway 403
Go Bus/Train
Station - Aldershot
Highway 5
Railway

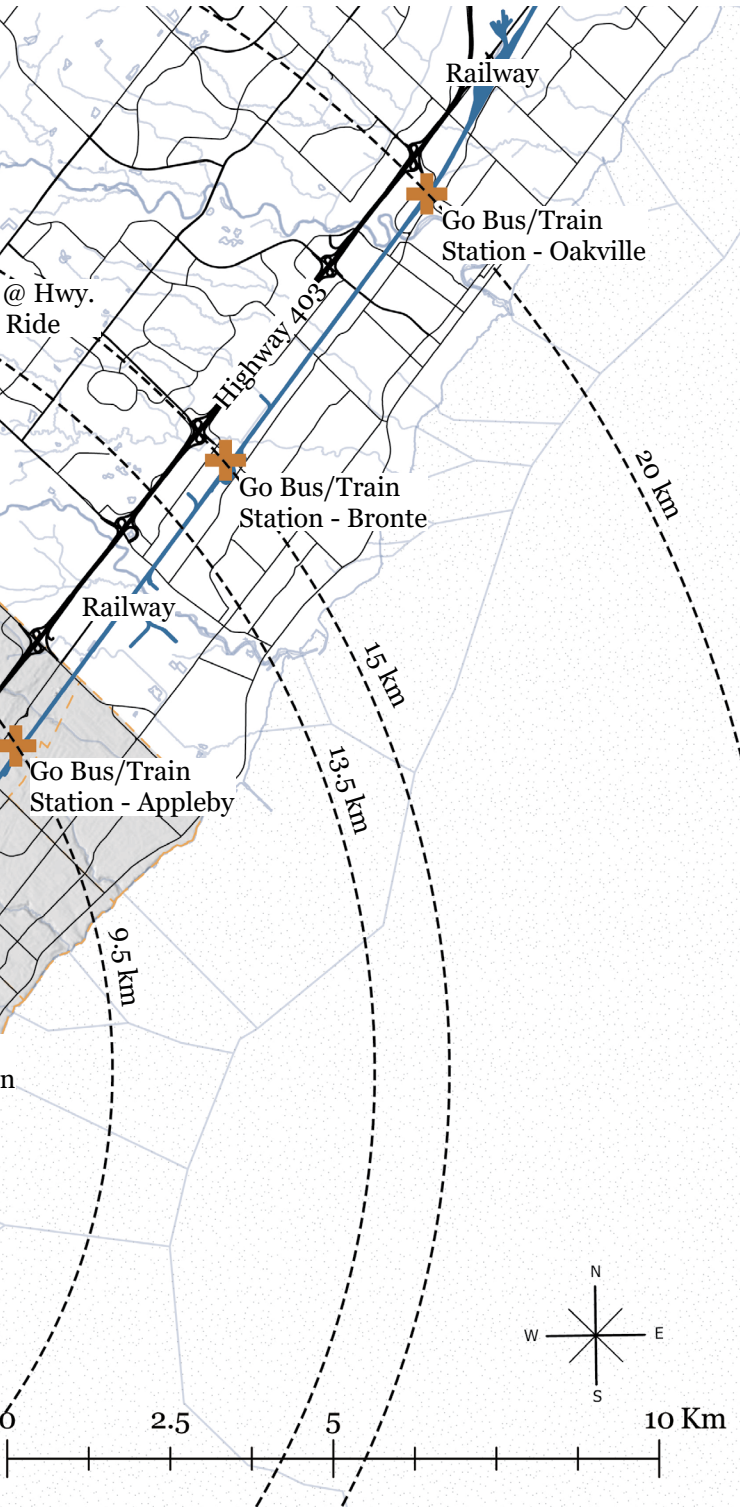


Fig 3.2.8 Site location,1:80,000. Produced by author.

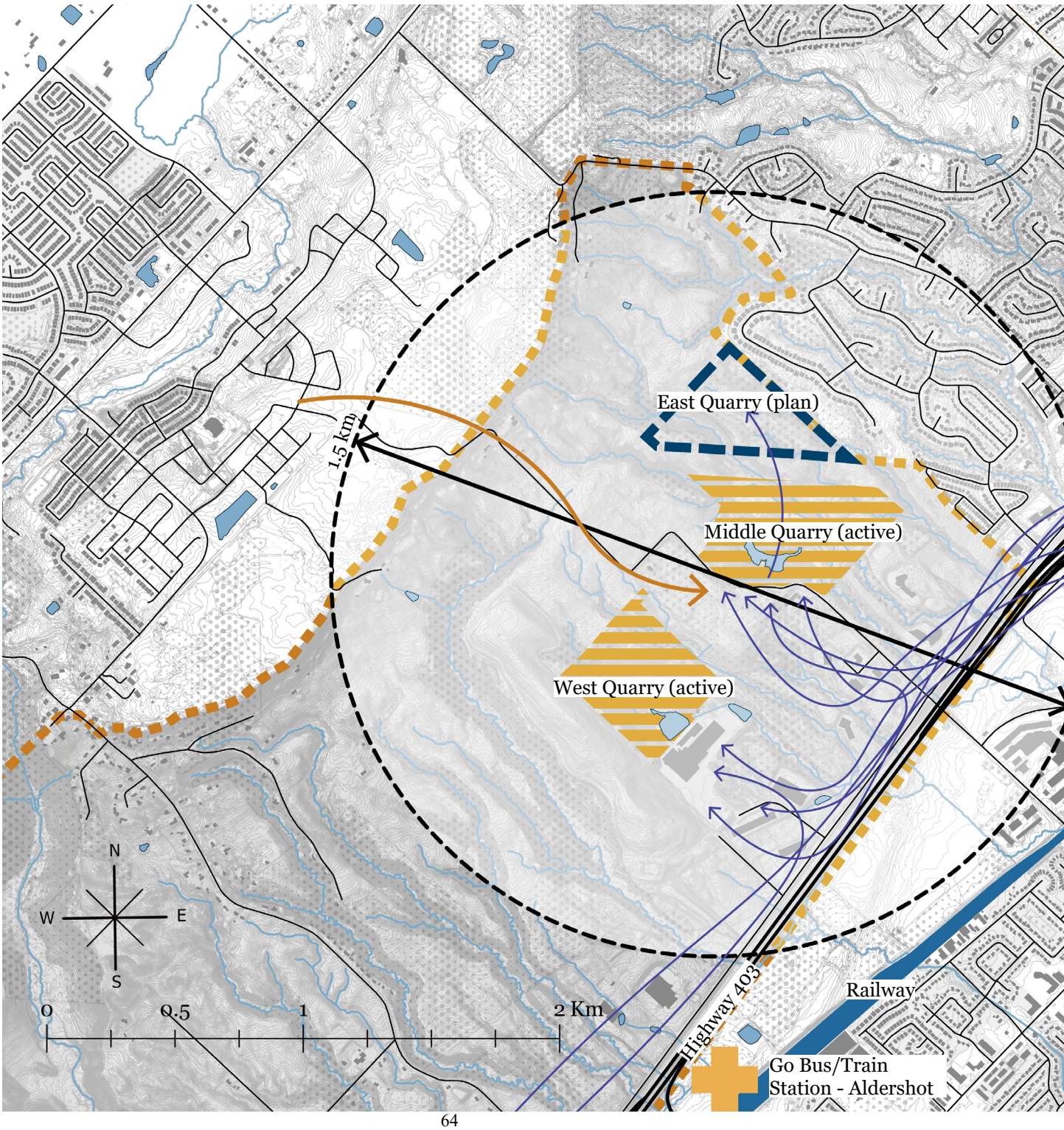

East Quarry (plan)
1.5 km
Middle Quarry (active)
West Quarry (active)
N
W
E
S
0
0.5
1
2 Km
Highway 403
Railway
Go Bus/Train
Station - Aldershot

Fig 3.2.9 Site transportation,1:15,000.
Produced by author.

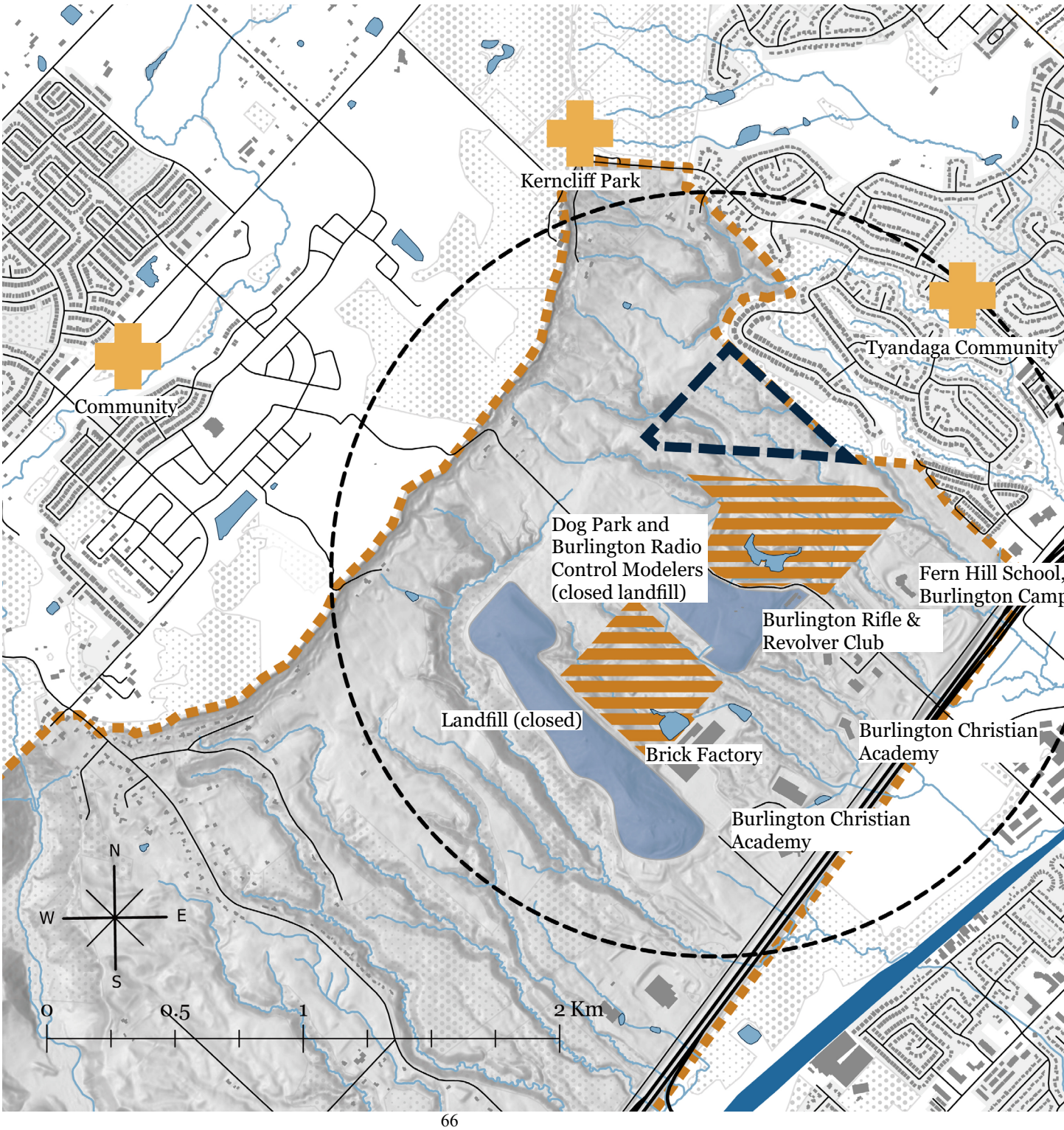
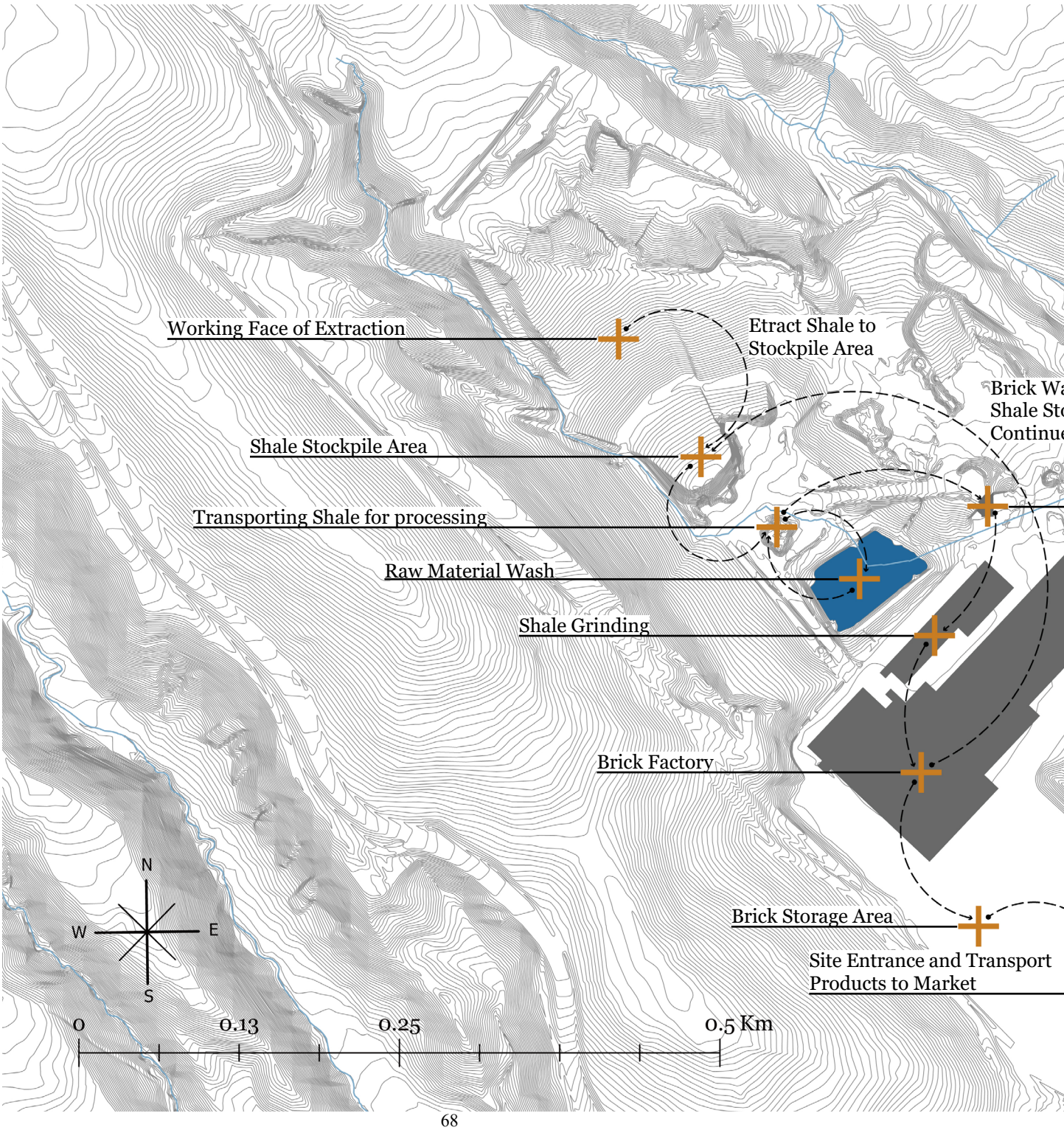

Kerncliff Park
Tyandaga Community
Community
Dog Park and
Burlington Radio
Control Modelers
(closed landfill)
Fern Hill School,
Burlington Camp
Burlington Rifle &
Revolver Club
Landfill (closed)
Brick Factory
Burlington Christian
Academy
Burlington Christian
Academy
N
W
E
S
0
0.5
1
2 Km

Fig 3.2.10 Site context,1:15,000. Produced by author.


Working Face of Extraction
Etract Shale to Stockpile Area
Shale Stockpile Area
Transporting Shale for processing
Raw Material Wash
Shale Grinding
Brick Factory
Brick Storage Area
Site Entrance and Transport Products to Market
N
W
E
S
0
0.13
0.25
0.5 Km

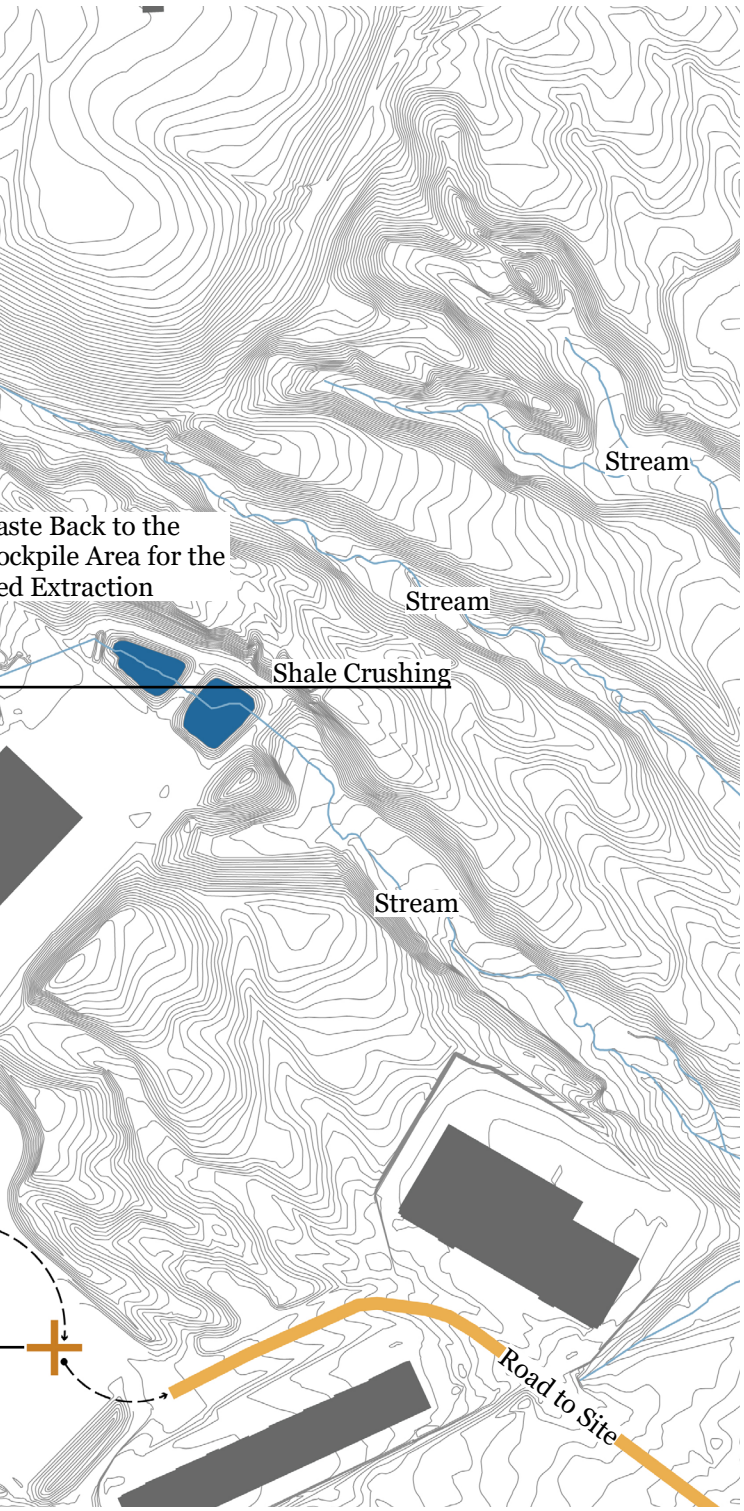


Fig 3.2.11 Material movements in the Aldershot Quarry West Site,1:3,000. Produced by author.

3.4 COMMUNITY DISPUTES

The Aldershot Quarry has a long history of disputes between the quarry operator, Meridian Brick, and the surrounding communities. Though the quarry has been a clay brick production site for over a century, the conflicts have intensified because of its location in the adjacent residential areas and ecologically sensitive places.

The most disputed issue is the planned East Quarry development. The project was approved in 1998 under the *Ontario Municipal Board's* (OMB)[12] decision but faced opposition from residents living in Tyandaga West. At the time, developers conducted noise and dust studies to demonstrate that the residential area could be compatible with the East Quarry site.[13] Besides, local environmental advocates have pointed to the quarry's impact on biodiversity, particularly regarding species at risk. The East Quarry area is home to sensitive wildlife, including endangered salamanders. In response, Meridian Brick commissioned multiple studies and committed to mitigation strategies such as habitat protection zones and species-at-risk management areas.[14] Meridian Brick has emphasized its commitment to responsible extraction practices and community engagement by highlighting its compliance with all relevant provincial regulations, including the Aggregate Resources Act, the Endangered Species Act, and the Greenbelt Plan.[15] In addition, it has implemented a progressive rehabilitation plan to reforest extracted areas, aiming to plant around 1,600 trees per hectare in rehabilitated zones.[16] The company made adjustments to its plans in response to community feedback. For example, it introduced phased tree removal and set up a 150-meter buffer near the residential areas to minimize environmental and social disruptions.[17] However, due to concerns about air quality, noise pollution, and the loss of tree cover, residents continue

to push for further environmental assessments and stronger regulatory oversight before the East Quarry begins.

In this context, the dispute at Aldershot Quarry demonstrates the necessity of innovative design interventions to bridge the gap between extraction activities and environmental restoration. The Aldershot Quarry conflict represents the challenge of balancing industrial resource extraction with urban development and ecological preservation. As urban areas continue to expand into historically industrial zones, conflicts between aggregate activities and local communities may intensify. The case also raises questions about the long-term rehabilitation efforts of whether they are sufficient in addressing ecological concerns and joining the environmental conservation system, such as expanding the Greenbelt boundary.

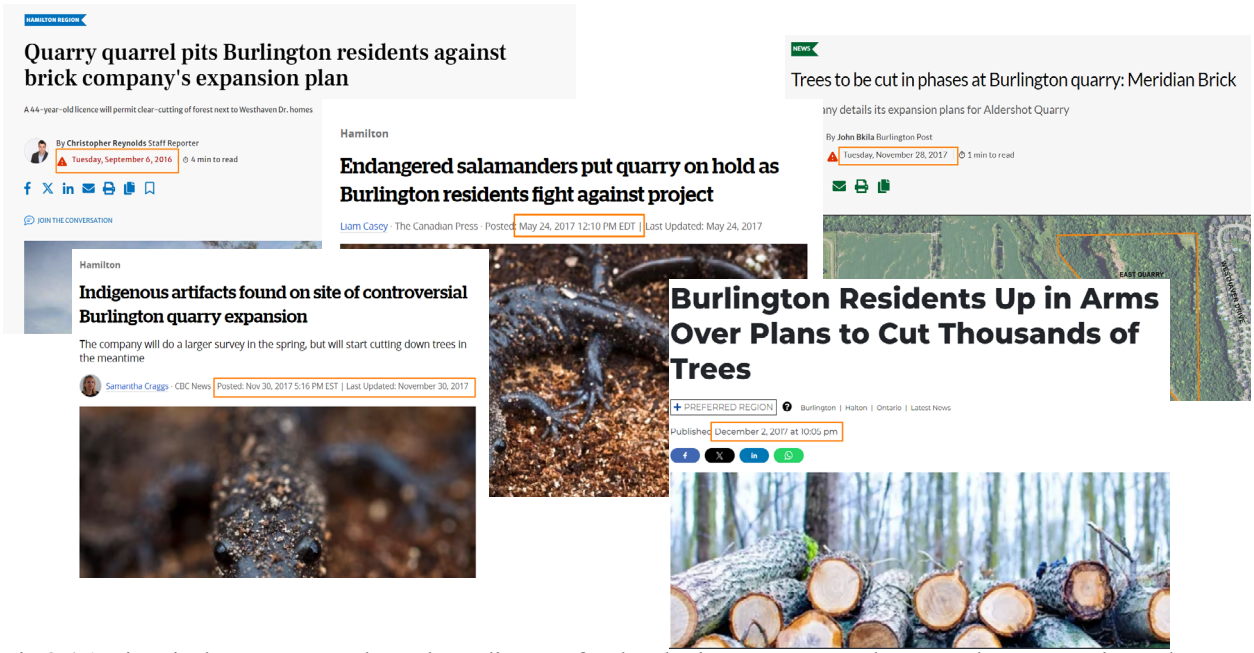


Fig 3.4.1 Historical news' screenshots about disputes for developing East Quarry between the community and Meridian Brick. Data from websites.

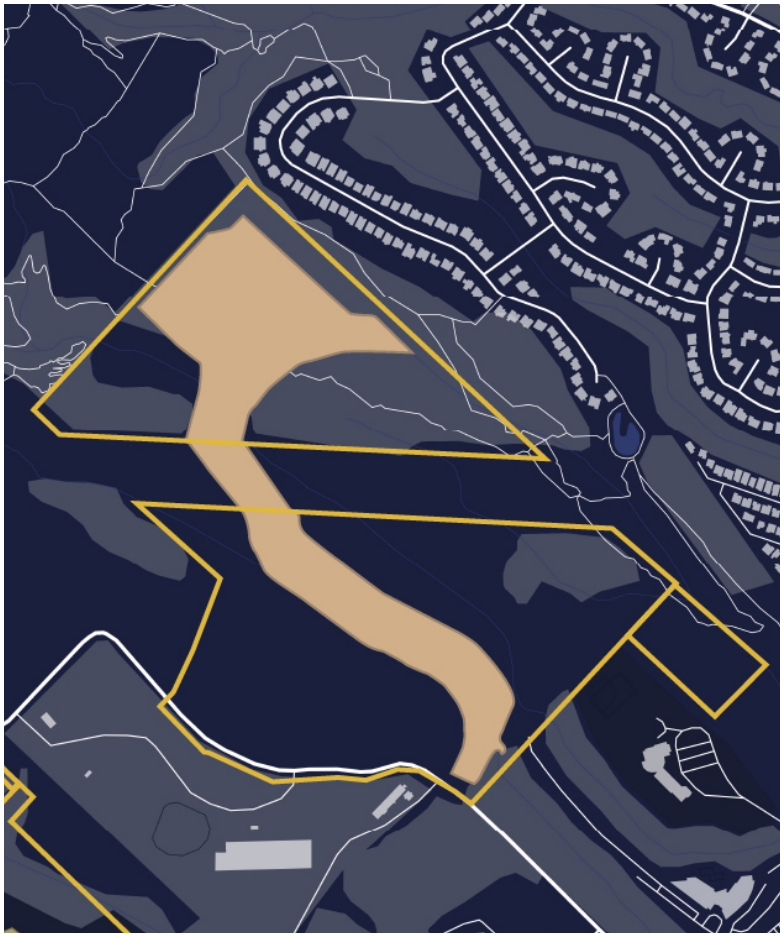
Stage One: Year 1 to 5

Stage Two:

Fig 3.4.2 Extraction plan for Middle and East Quarry, 2010. Produced by Author. Data from the Meridian Brick Aldershot Office

Year 6 to 15

Stage Three: Year 16 to 25



3.5 WATERS IN THE QUARRY

The Aldershot West Quarry is located within the Indian Creek and Falcon Creek watersheds, both of which drain into Lake Ontario. The site's hydrogeology condition is a shallow groundwater system influenced by fractured Queenston shale, which allows water to cross the quarry area. Groundwater movement at the site happens in two primary systems: a shallow, active flow system within the upper shale and a deeper groundwater system within lower-permeability shales. The shallow groundwater follows the site's topography, flowing southeast towards Lake Ontario, while the deeper groundwater system expresses slow movement due to the shale's lower permeability. The site adjacent to the closed Burlington and Bayview Park landfills brings concerns about potential groundwater contamination. However, there are no significant increases of contaminants observed in the stormwater management ponds, which means landfills' contamination effects on the surface water can be ignored.

To control surface water runoff and potential flooding, the quarry site includes three stormwater retention ponds (SWM 1, SWM 2, and SWM 3), helping to regulate water levels and mitigate erosion. The collected water is monitored and discharged in compliance with environmental regulations. The stormwater discharges into local waterways with quality testing. The annual monitoring estimates that around 105,600 m^3 of water, including quarry runoff and groundwater, was discharged through the stormwater ponds in 2023. The total pond inflows are balanced with pond outflows, ensuring a stable hydrological condition at the site.

The Aldershot West Quarry's water management strategies highlight the balance of industrial operations with environmental responsibility. The future rehabilitation plans should integrate water-sensitive design strategies, considering both ecological restoration and community concerns.[18]

Aldershot Quarry and Meridian Brick Factory Site

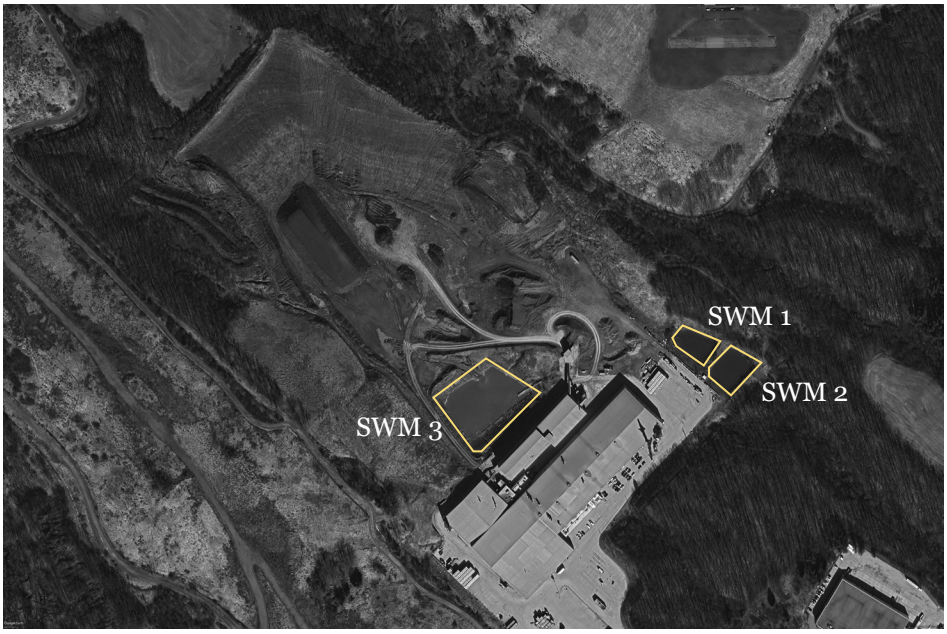


Fig 3.5.1 Alddershot West Quarry Pond locations. Produced by author. Data from the Meridian Brick Aldershot Office.

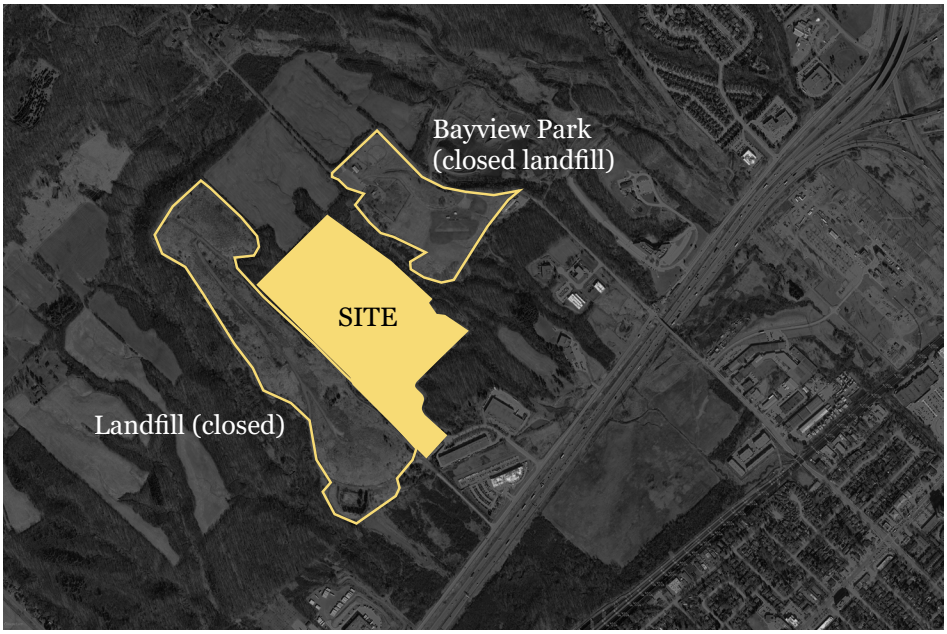


Fig 3.5.2 Former Landfills close to the West Quarry. Produced by author. Data from the Meridian Brick Aldershot Office.

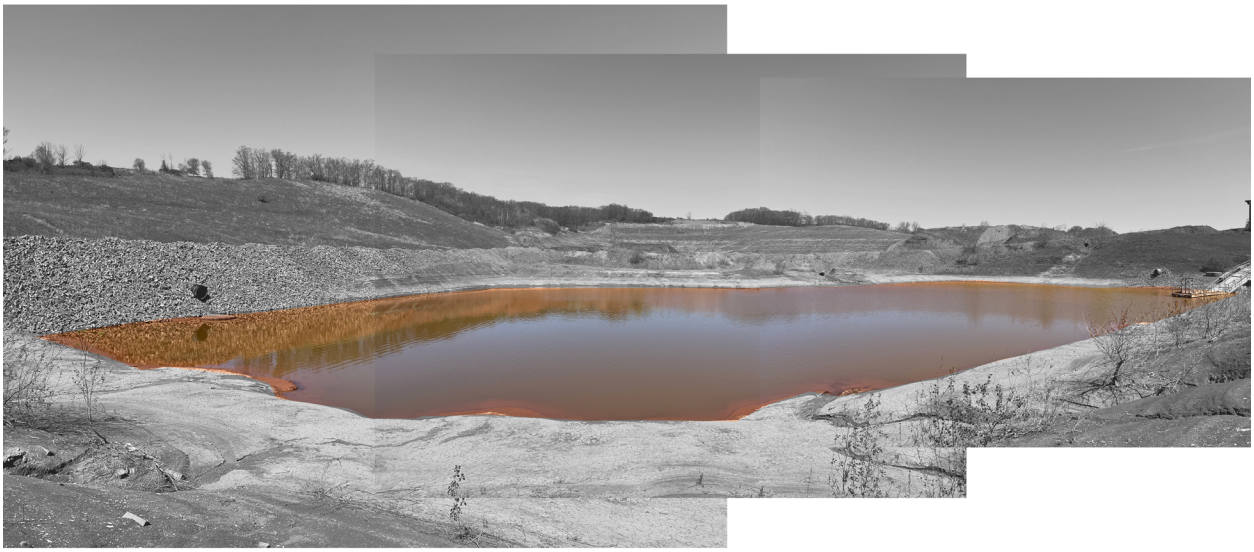


Fig 3.5.3 Pond SWM 3. Photo and produced by Author.

Fig 3.5.4 Pond SWM 1 & 2. Photo and produced by Author.

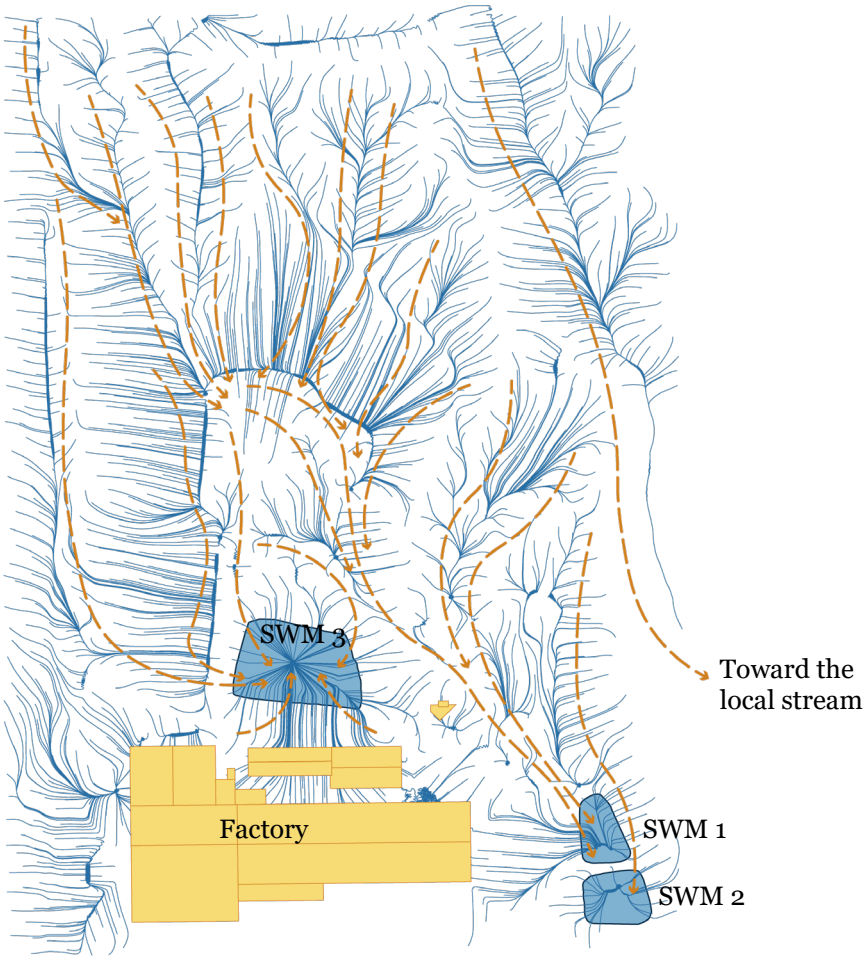


Fig 3.5.5 Current West Quarry runoff flow simulation. Top view. Produced by author.

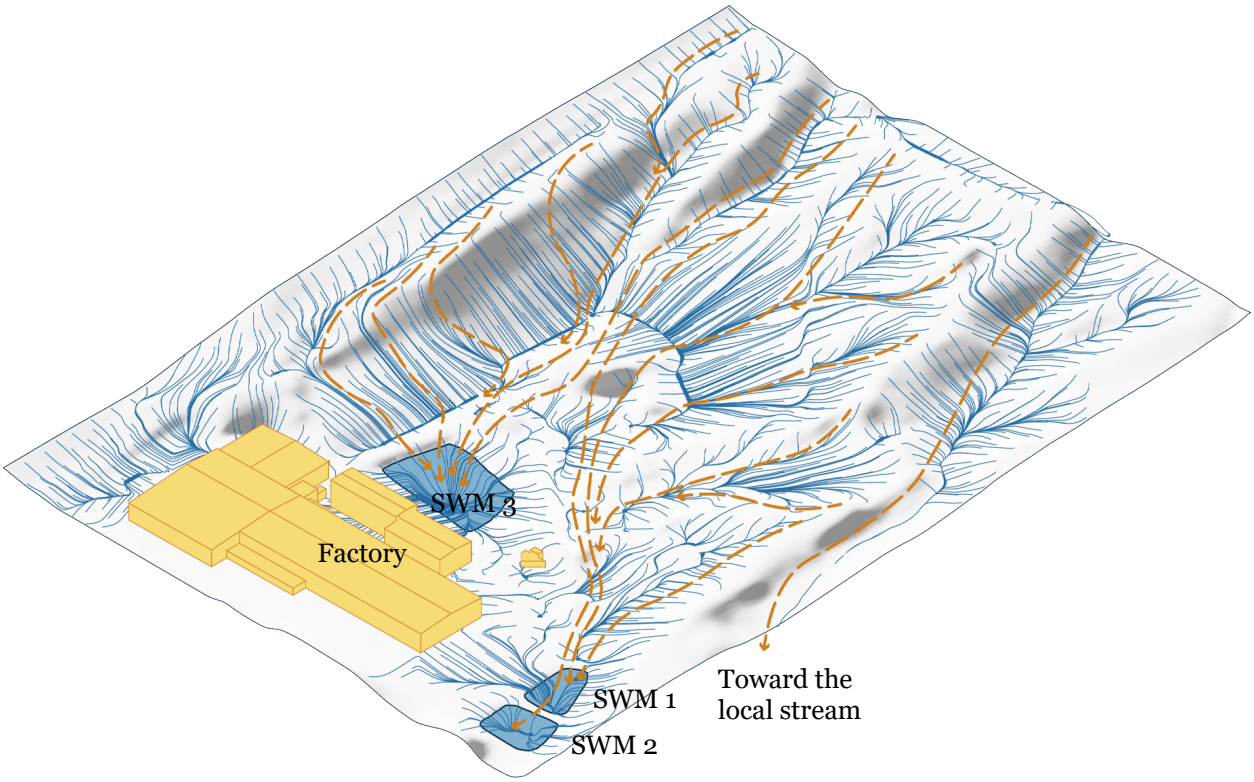


Fig 3.5.6 Current West Quarry runoff flow simulation. Southeast Isometric View. Produced by author.

3.6 QUARRY TIME TOUR

To capture the dynamic changes, a collection of historical maps from the past 20 years becomes a site time tour that exposes the evolving landscape and provides a foundation for understanding how the site has been shaped by industrial activity. A series of site maps retrieved from Google Earth capture the gradual expansion of the site. To highlight the changes, a set of abstract diagrams is generated by modelling site sections and tracing site plans, which express the movements of topography, plants, and water that occurred on the site. By exposing these material and ecological movements, the diagrams serve as a visual foundation for identifying reassembly moments in the quarry's lifecycle.

Besides, site development drawings based on phased site plans provided by the company establish the quarry's actual timeline of past, present, and future. These axonometrics serve a dual purpose: defining the current site conditions at the starting point of the design proposal and providing a comparison between the real-world extraction timeline and the thesis design interventions that make the design concept convincing.

https://www.youtube.com/watch?v=GEIJ-AT2k8A

Fig 3.6.1 Video of Aldershot Quarry and Meridian Brick Factory in Burlington. Produced by author.

Fig 3.6.2 West Quarry maps from 2

2004.11

2014.11

2017.11

2021.06

Aldershot Quarry and Meridian Brick Factory Site

2004 to 2024. Data from Google Earth Pro.

2005.12

2009.09

2013.09

2015.06

2016.04

2016.10

2018.05

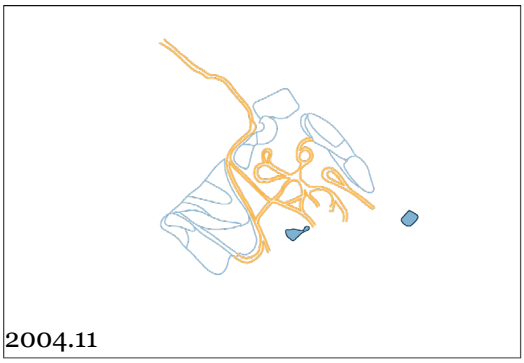
2019.09

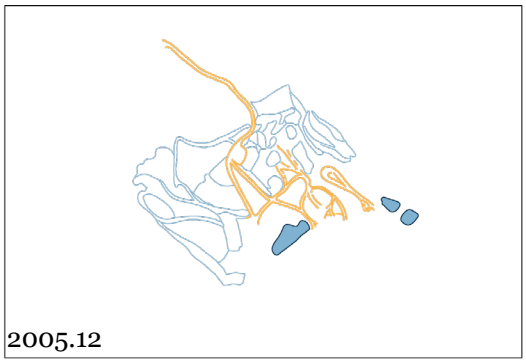
2020.09

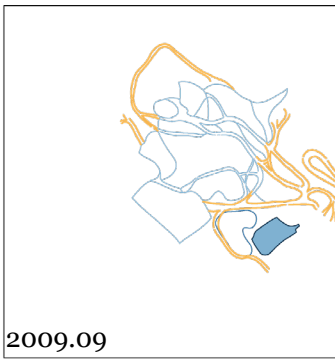
2021.11

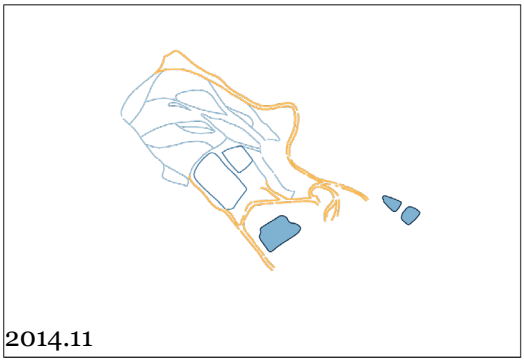
2022.10

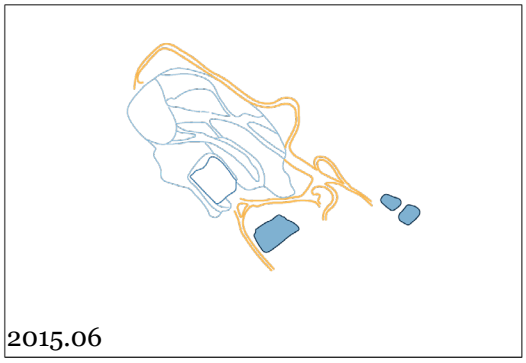
2024.12

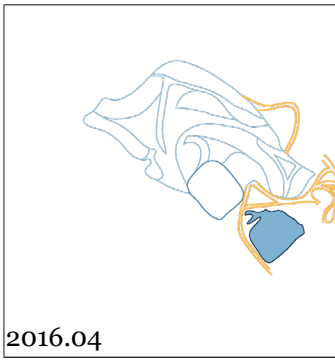

2004.11

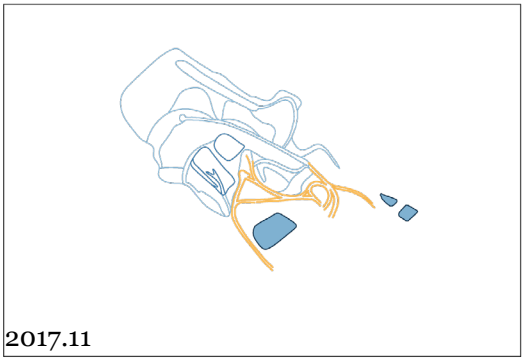

2005.12

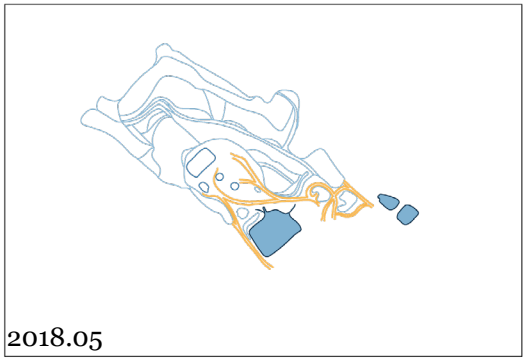

2009.09

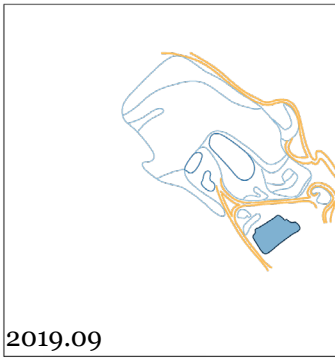

2014.11

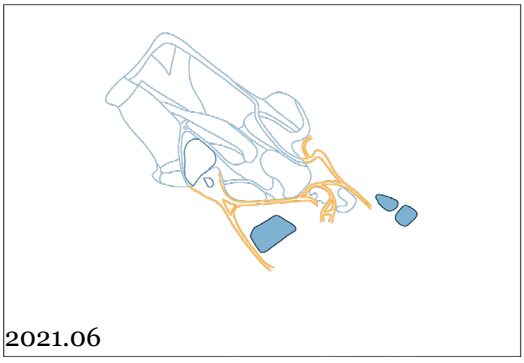

2015.06

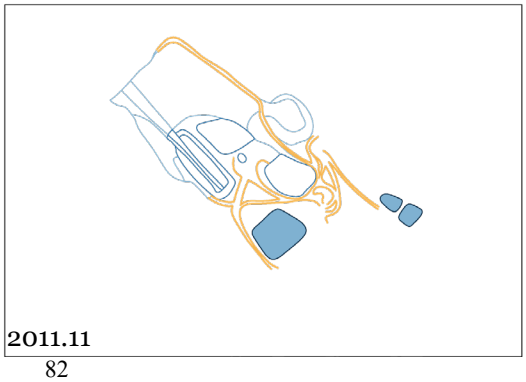

2016.04

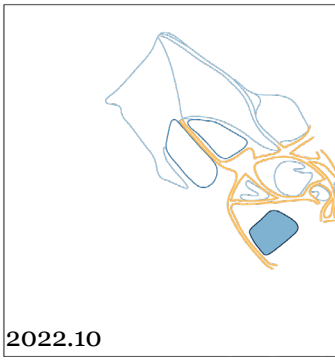

2017.11


2018.05


2019.09


2021.06


2011.11


2022.10

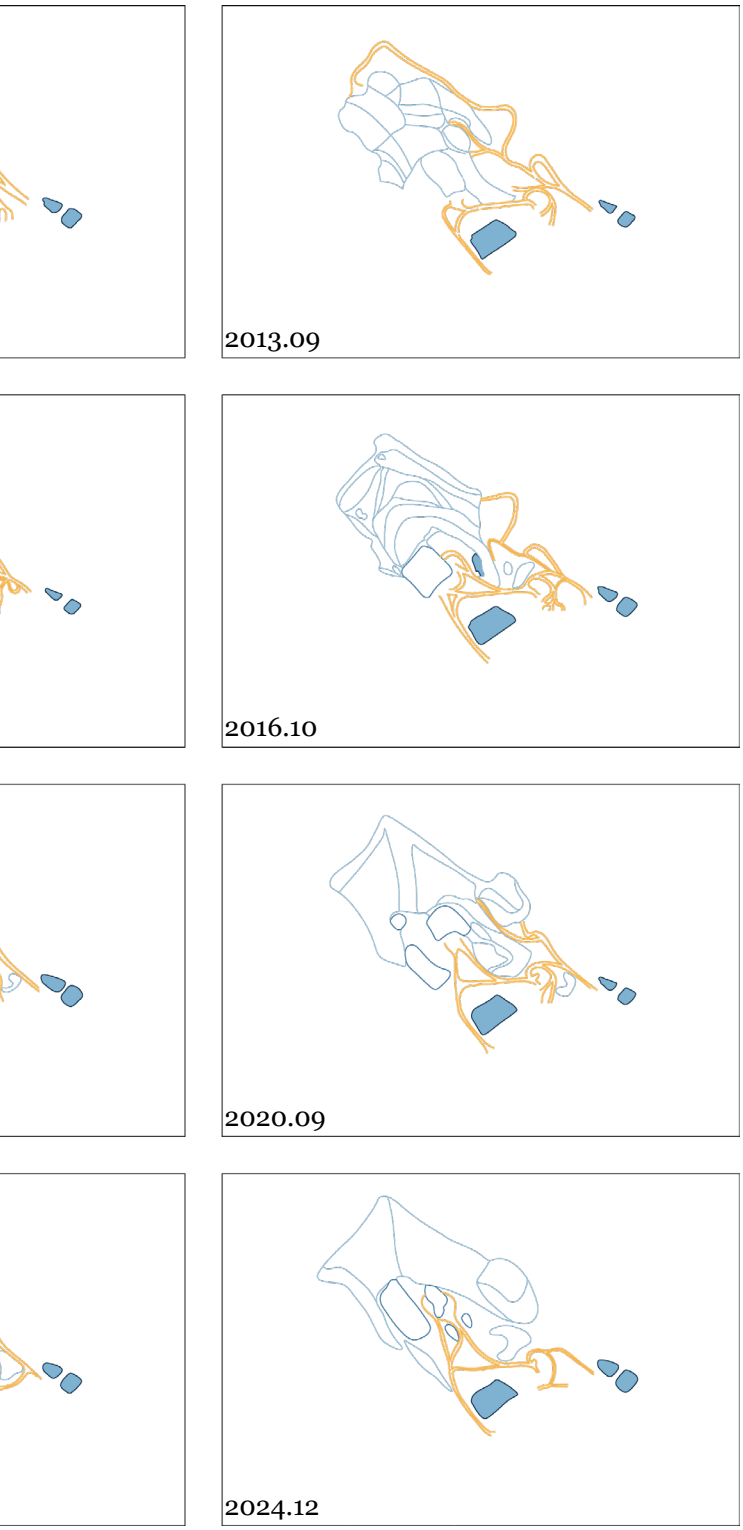
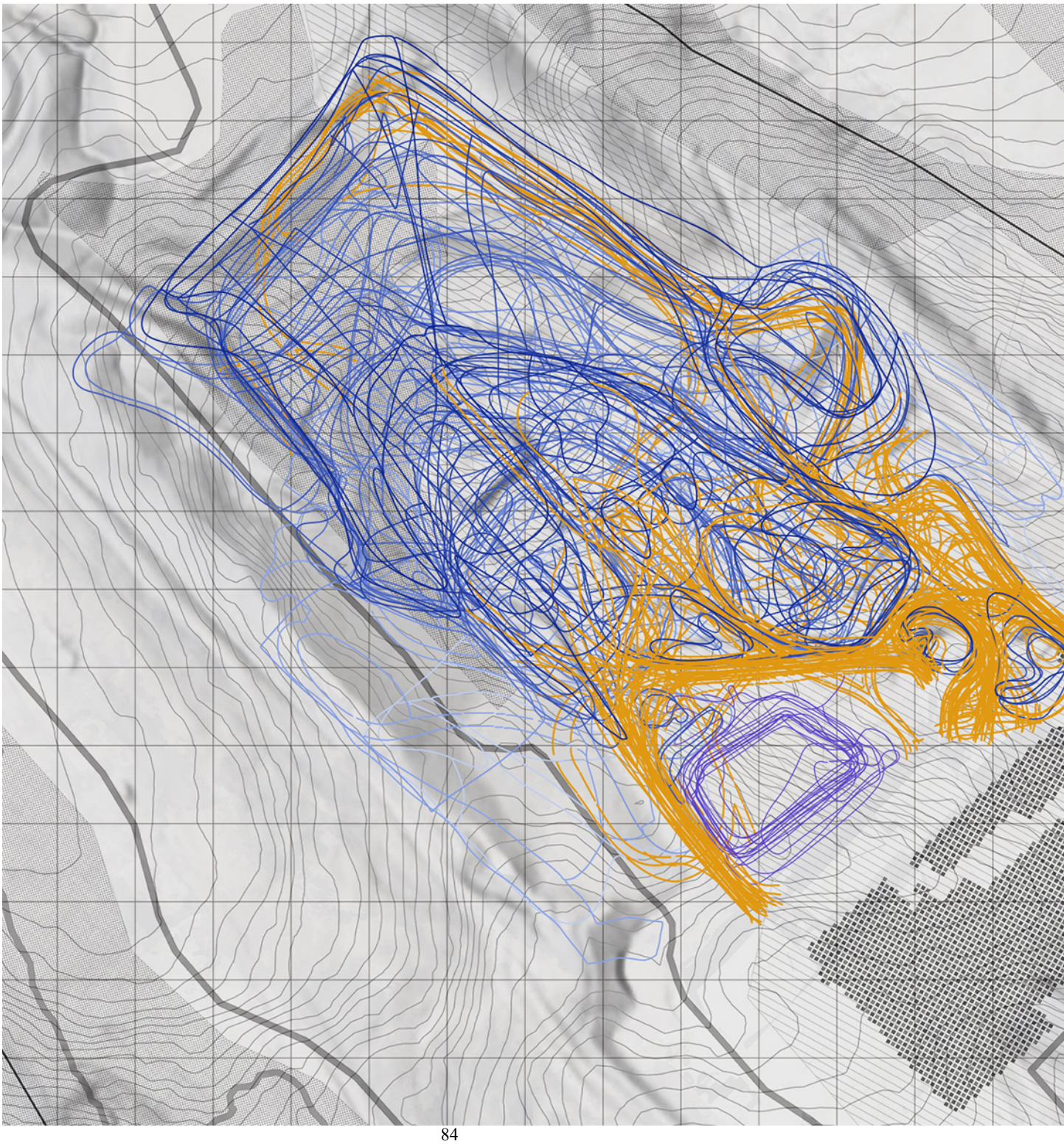


Fig 3.6.3 The material and road movement traces in West Quarry from 2004 to 2024. Produced by Author, Data from Google Earth Pro.



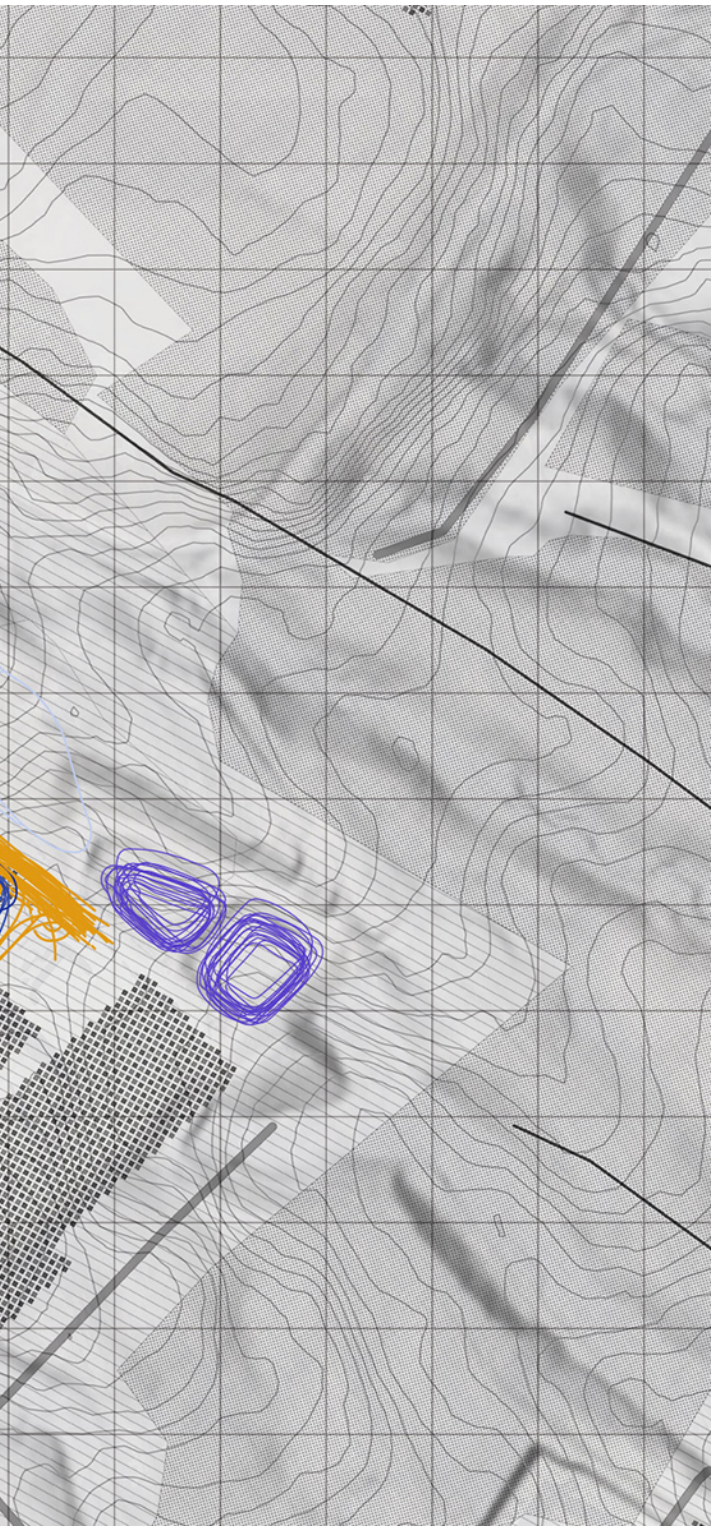


Fig 3.6.4 The material and road movement traces overlaid in West Quarry from 2004 to 2024. Produced by Author.

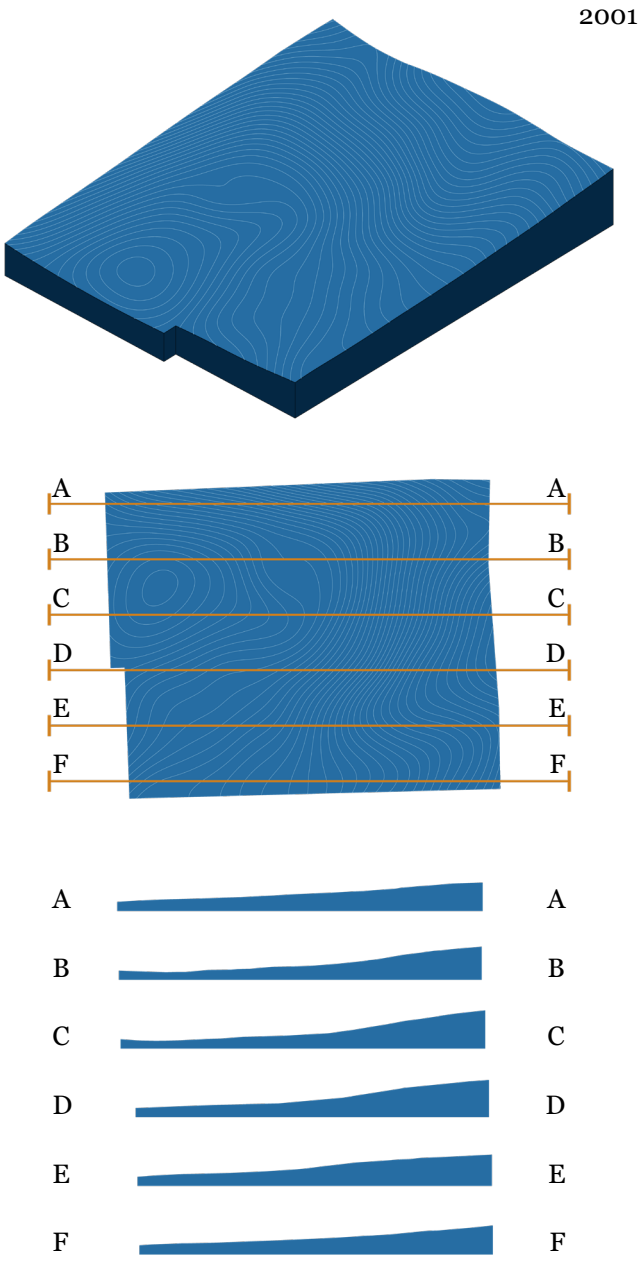
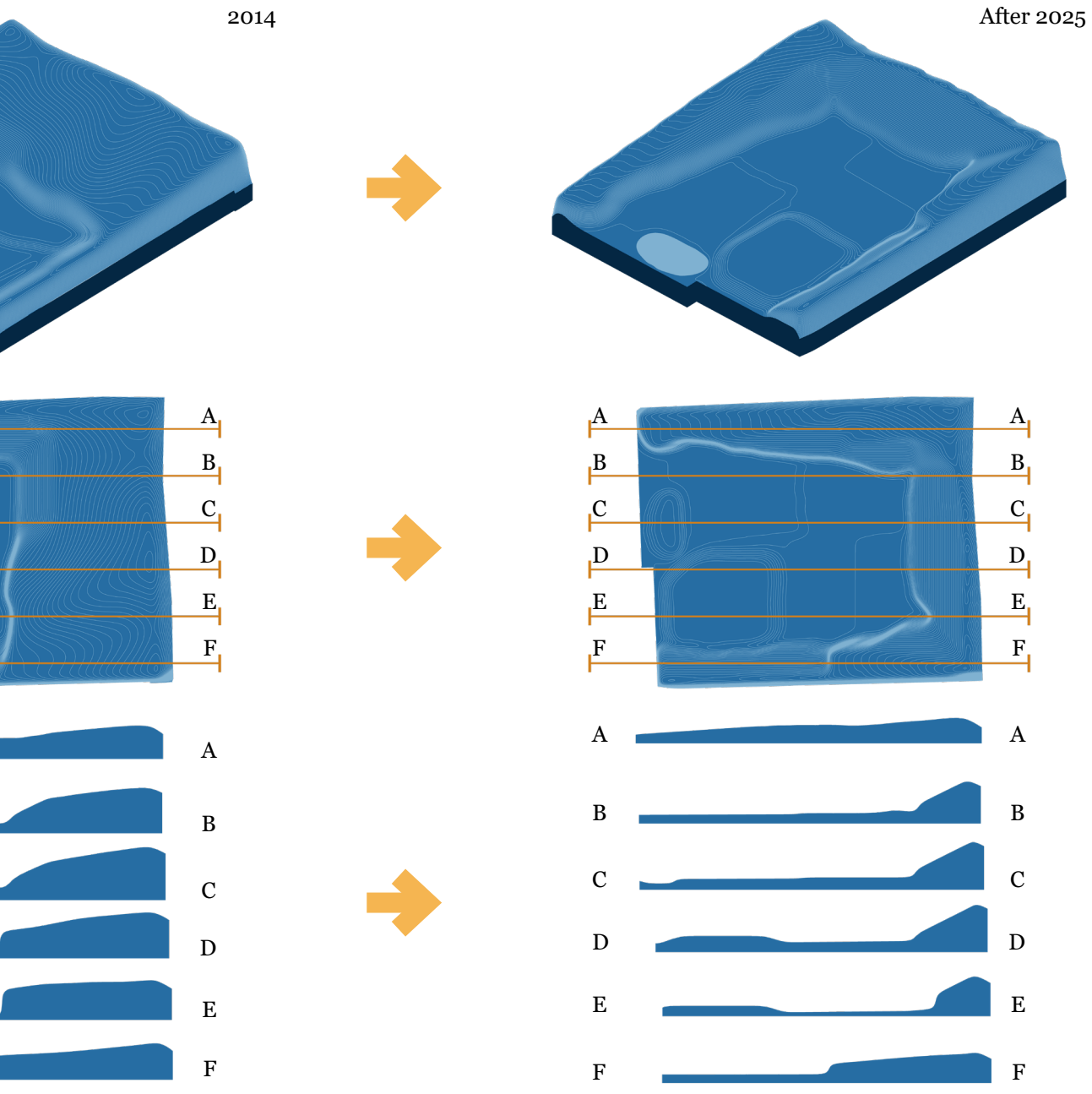


Fig 3.6.5 West Site before extraction. Produced by Author.

Fig 3.6.6 West Site in first extrac



ction phase. Produced by Author.

Fig 3.6.7 West Site in last extraction phase. Produced by Author.

Notes

1 Greenbelt Foundation. “Learn How Ontario Thrives Thanks to the Greenbelt.” Accessed February 20, 2025. https://www.greenbelt.ca/learn.

2 EcoSchools Canada. “Greenbelt Biodiversity.” Accessed February 20, 2025. https://ecoschools.ca/greenbelt-biodiversity/.

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4 Neptis Foundation. “Context of the Greater Golden Horseshoe,” October 25, 2013. https://neptis.org/publications/chapters/context-greater-golden-horseshoe.

5 “Planning Transportation for the Greater Golden Horseshoe | Ontario.Ca.” Accessed February 20, 2025. http://www.ontario.ca/page/planning-transportation-greater-golden-horseshoe.

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7 Meridian Brick. *Aldershot Quarry Community Meeting*. 2017, https://aldershotquarry.ca/wp-content/uploads/2017/05/Meridian-Brick-Community-Meeting-Presentation-FINAL.pdf.

8 Ontario Mineral Inventory - Dataset - Ontario Data Catalogue. “Ontario Mineral Inventory.” Accessed February 17, 2025. https://data.ontario.ca/dataset/mineral-deposit-inventory-of-ontario.

9 “Aldershot Quarries Site Plan,” July 2010. https://0dd061.a2cdn1.secureserver.net/wp-content/uploads/2017/05/Site-Plan-Aldershot-Quarry.pdf.

10 Meridian Brick. “Aldershot Quarry Community Meeting.” Crossroad Centre, Burlington, ON, CA, 2017. https://aldershotquarry.ca/wp-content/uploads/2017/05/Meridian-Brick-Community-Meeting-Presentation-FINAL.pdf.

11 Story from the Meridian Brick staff, interviewed by the Author, December 2024.

12 *Ontario Municipal Board Act*, R.S.O. 1990, c. O.28. Accessed February 21, 2025. https://www.ontario.ca/laws/statute/90o28.

13 Meridian Brick. “Aldershot Quarry Community Meeting.” Crossroad Centre, Burlington, ON, CA, 2017. https://aldershotquarry.ca/wp-content/uploads/2017/05/Meridian-Brick-Community-Meeting-Presentation-FINAL.pdf.

14 “Aldershot Quarry Report.” Meridian Brick, 2018. https://0dd061.a2cdn1.secureserver.net/wp-content/uploads/2017/05/AldershotQuarryReport2-1.pdf.

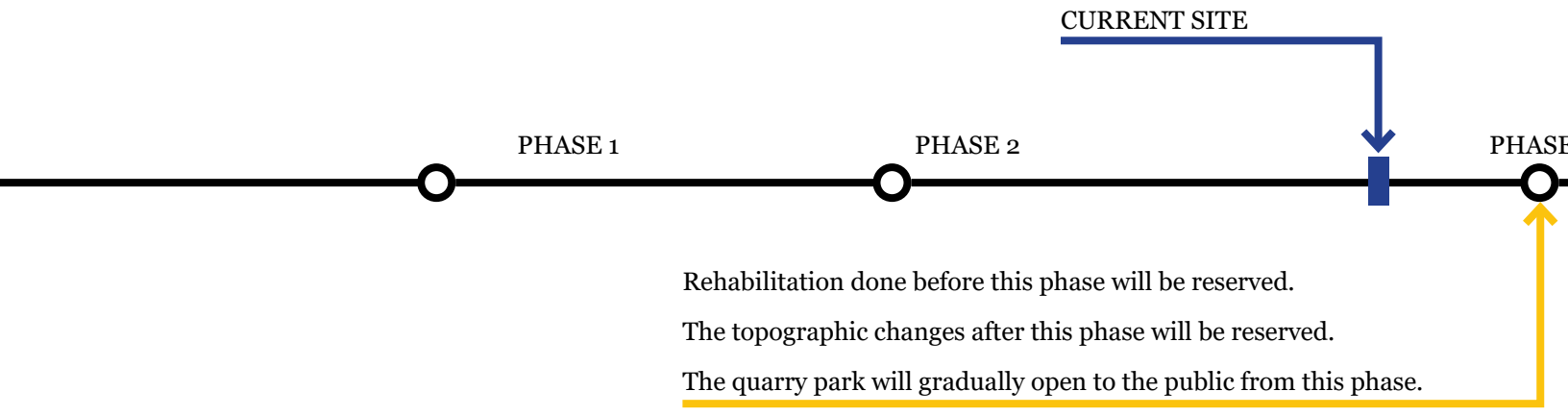
15 Meridian Brick. “Quarry Community Meeting.” Crossroad Centre, Burlington, ON, CA, 2017. https://0dd061.a2cdn1.secureserver.net/wp-content/uploads/2017/05/Quarry-Community-meeting.pdf.

16 Meridian Brick. “Aldershot Quarry Community Meeting.” Crossroad Centre, Burlington, ON, CA, 2017. https://aldershotquarry.ca/wp-content/uploads/2017/05/Meridian-Brick-Community-Meeting-Presentation-FINAL.pdf.

17 “Aldershot Quarry Report.” Meridian Brick, 2018. https://0dd061.a2cdn1.secureserver.net/wp-content/uploads/2017/05/AldershotQuarryReport2-1.pdf.

18 WSP Canada Inc. “Canada Brick, Aldershot Plant and West Quarry, Aldershot, Ontario:2023 Monitoring Report.” Canada Brick, March 2024, 2-10.

Fig 4.1.1 Aldershot West Quarry and Design intervention timeline. Produce by author.

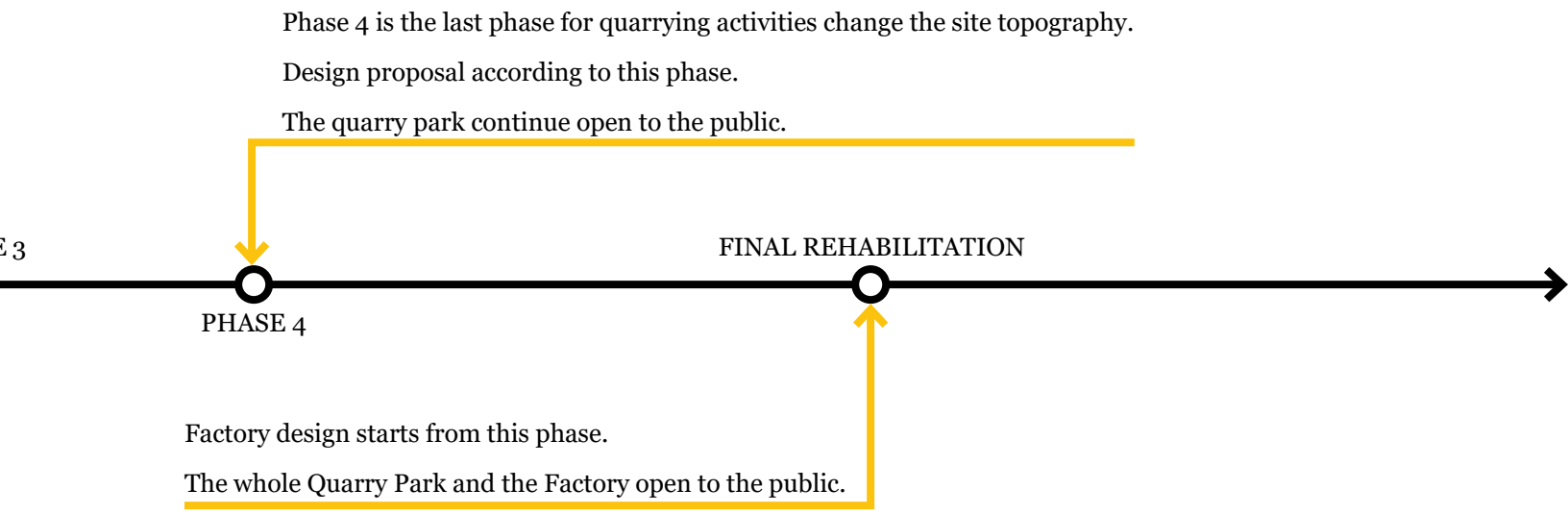


CHAPTER 4. A NARRATIVE OUTSIDE OF TIME

Expose—Make the elements visible

Encounter—Spaces contain elements

Unfinish—Element movements through programs



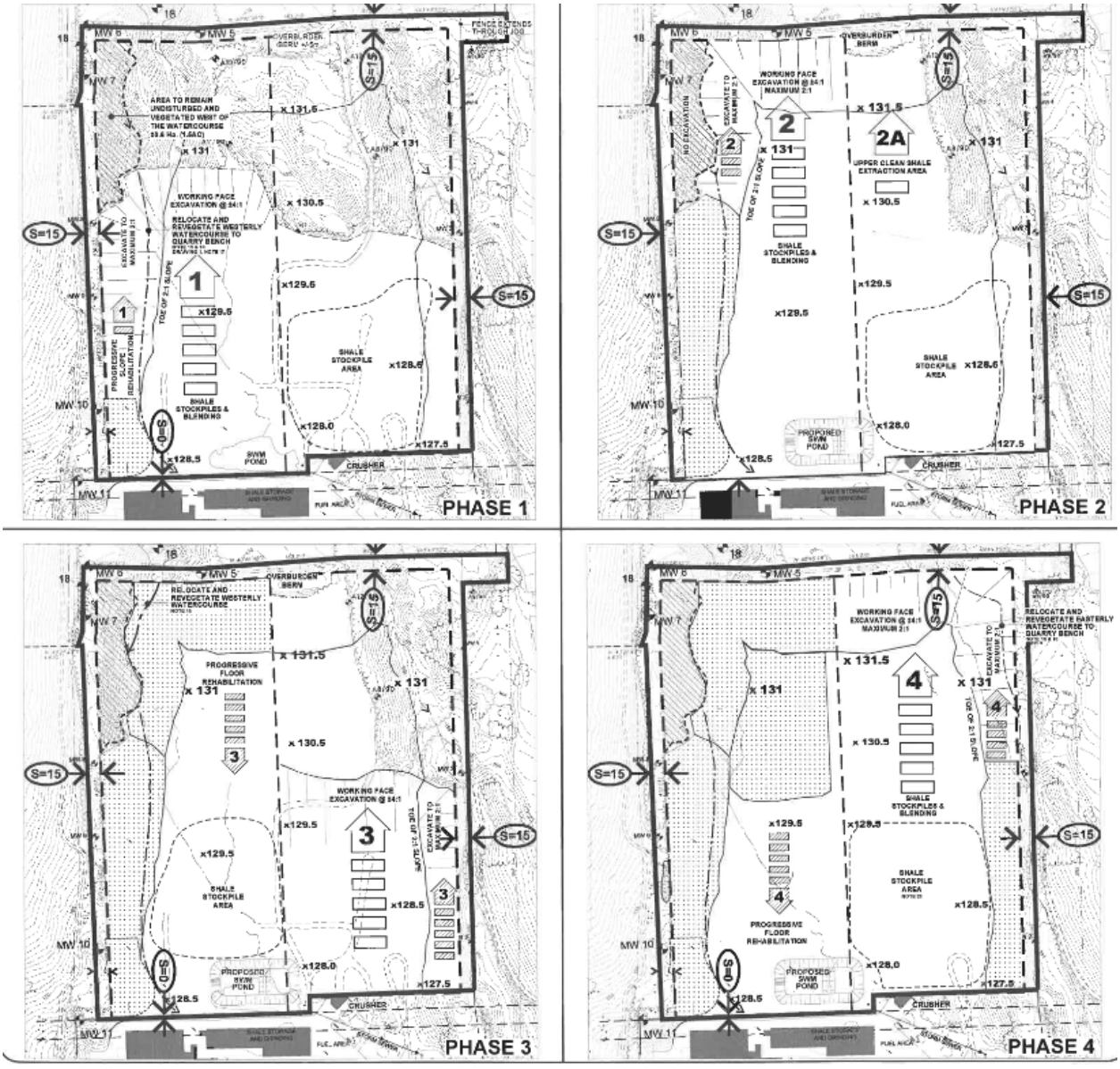


Fig 4.1.2 Aldershot West Quarry Operational Plan. Data from the Meridian Brick Aldershot Office

4.1 SITE OPERATION

Just as progressive rehabilitation begins while a quarry is still active, the design intervention can also be initiated before extraction is fully completed. According to operational plans from the Aldershot Brick Plant Office, the West Quarry is currently approaching Phase Three, where the west slope and part of the north slope have already been rehabilitated, and slope 3 is being prepared for backfilling as the next rehabilitation step. Design intervention begins from Phase 3, which is closest to the present site conditions. To make the most use of the resources, all the completed rehabilitation work before this phase will be preserved. At the same time, the extraction working faces that happened after phase 3 keep their topography instead of backfilling to maintain the quarry characteristics. In this phase, area 1 will open to the public. Phase Four represents the final stage of quarry operations, marking the completion of extraction and setting the groundwork for final rehabilitation. In this phase, area 2 will open to the public. After Phase Four is the end of extraction, the start of final rehabilitation, and abandoning the factory. This phase demonstrates the full quarry heritage elements, industrial remains, material traces, and reshaped landforms that can be integrated into the design proposal. The Quarry Park and the reused factory will totally open to the public.

To ensure the final proposal has a cohesive spatial experience and integrates with its surroundings, the design establishes the final vision first. The site plan can then be strategically phased, aligning each design intervention with the quarry's operational plans and progressively opening the site. This approach preserves key material reassembly moments and allows for a gradual transition from extraction to public engagement that emphasizes the site's evolving process.

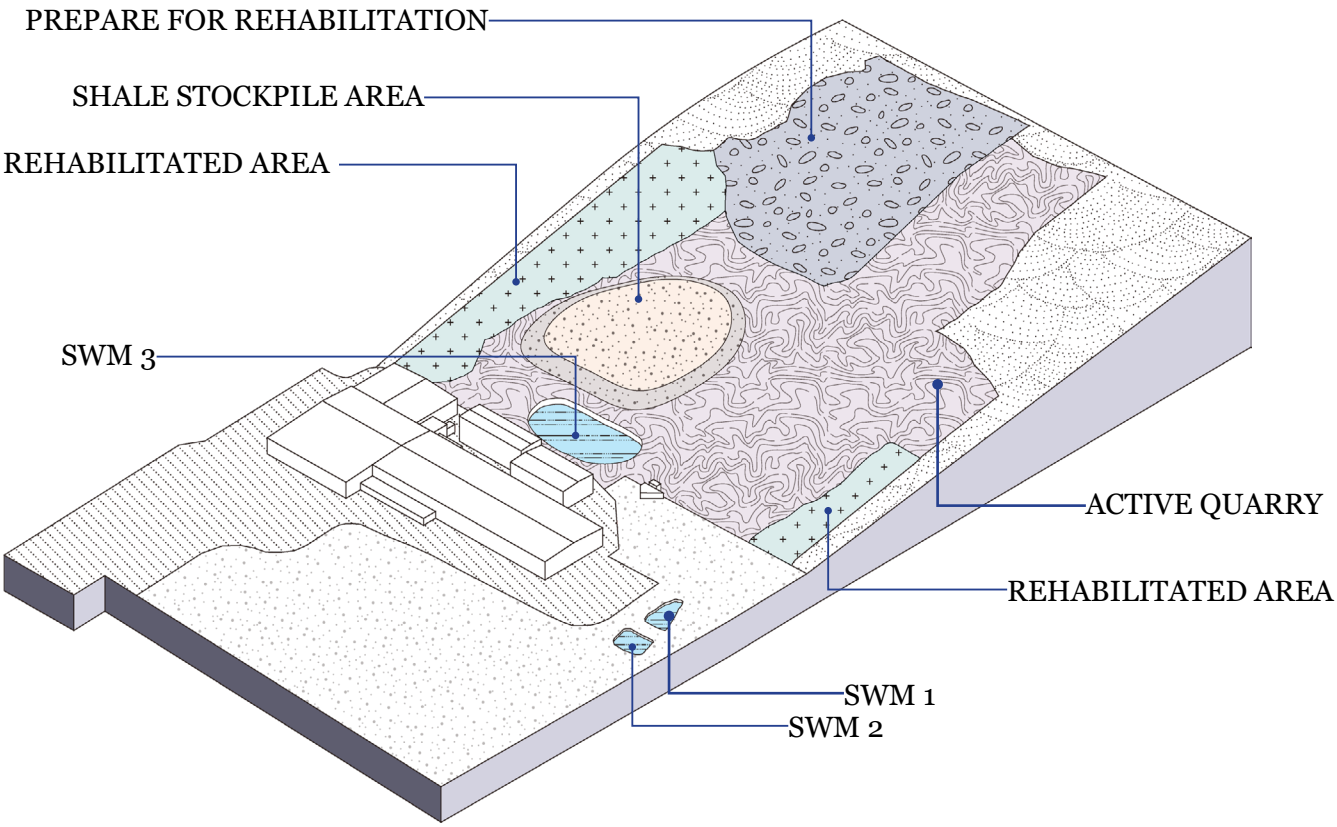


Fig 4.1.3 Aldershot West Quarry Operational Plan, Phase 3. Produced by author. Data from the Meridian Brick Aldershot Office.

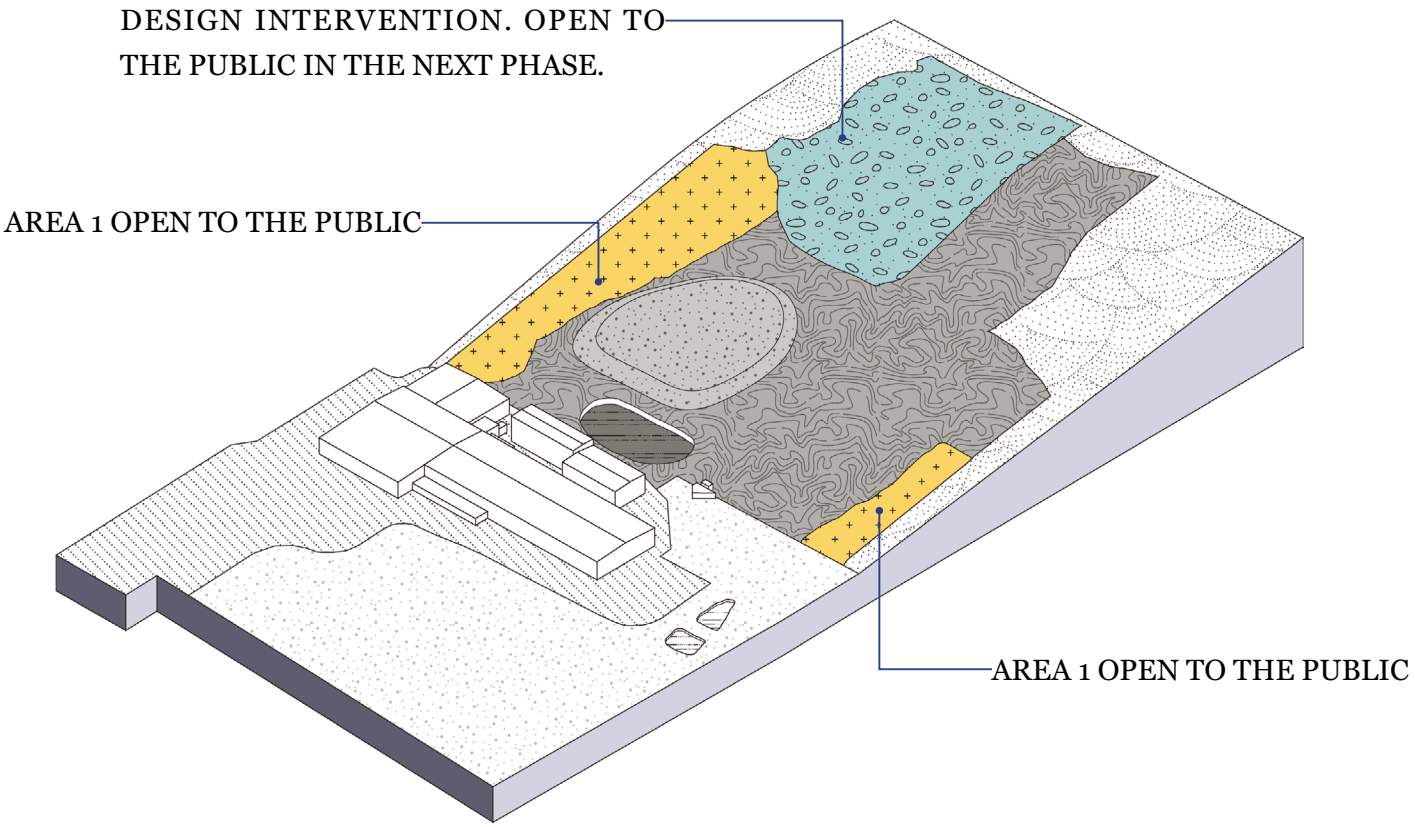


Fig 4.1.4 Quarry Park Operational Plan, Step 1. Produced by author.

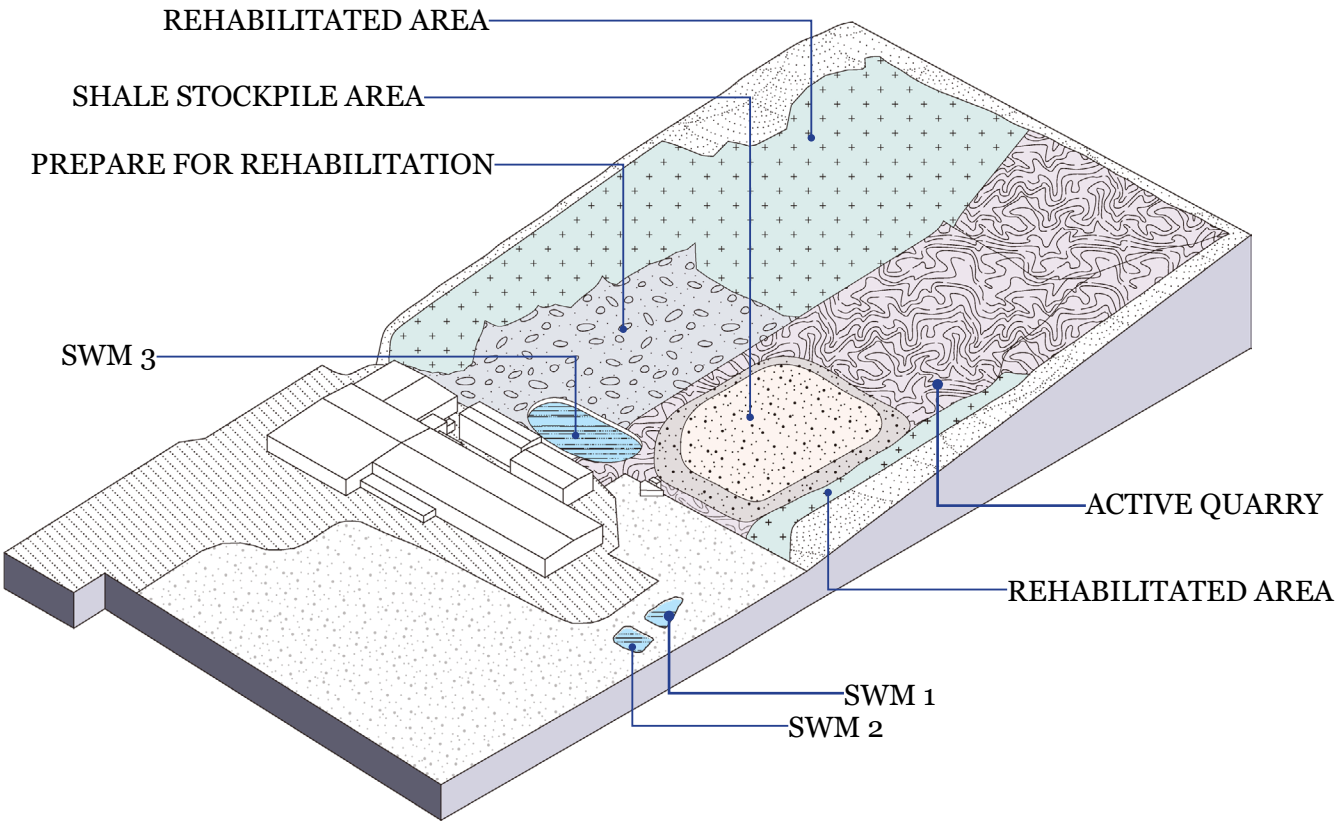


Fig 4.1.5 Aldershot West Quarry Operational Plan, Phase 4. Data from the Meridian Brick Aldershot Office. Produced by author.

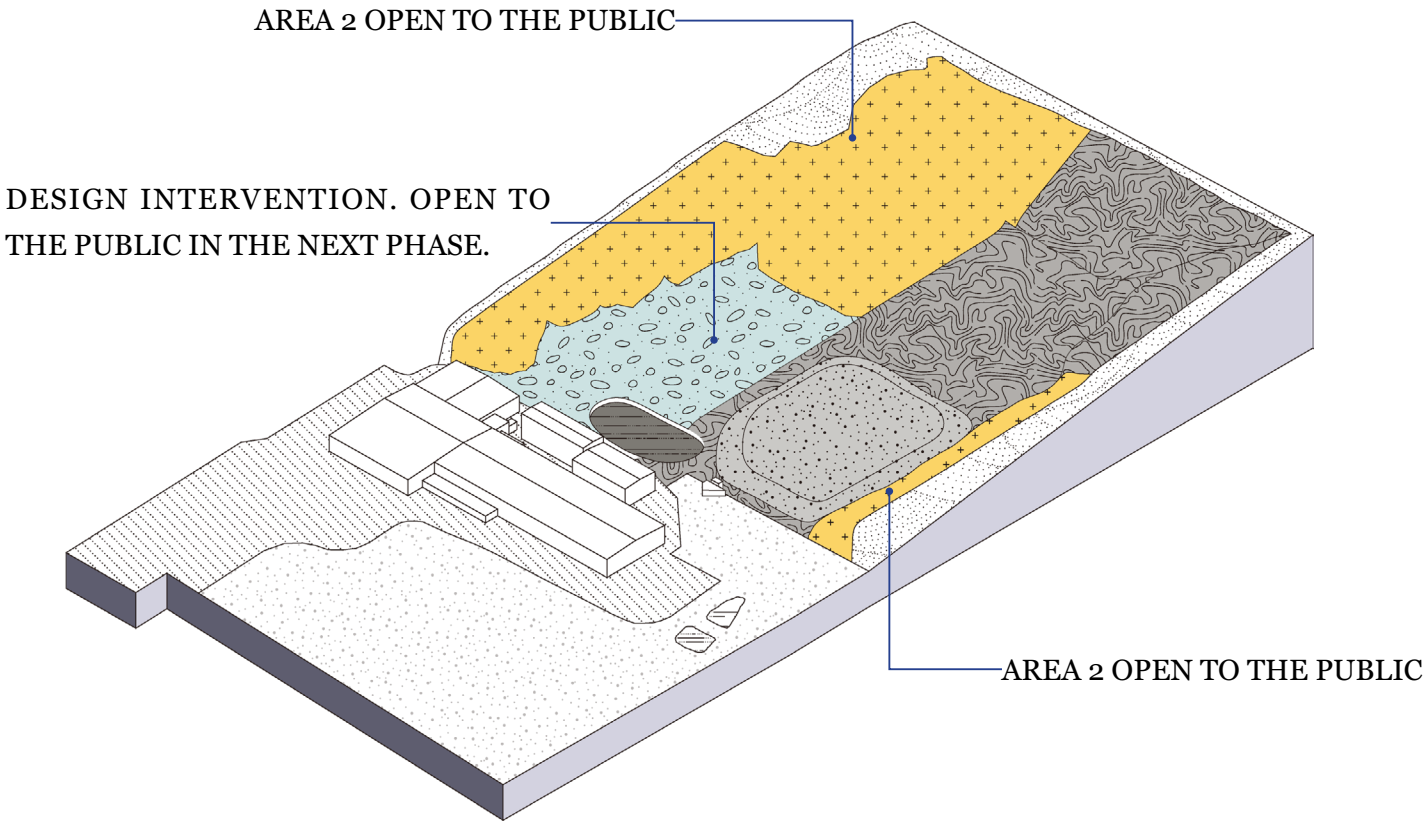


Fig 4.1.6 Quarry Park Operational Plan, Step 2. Produced by author.

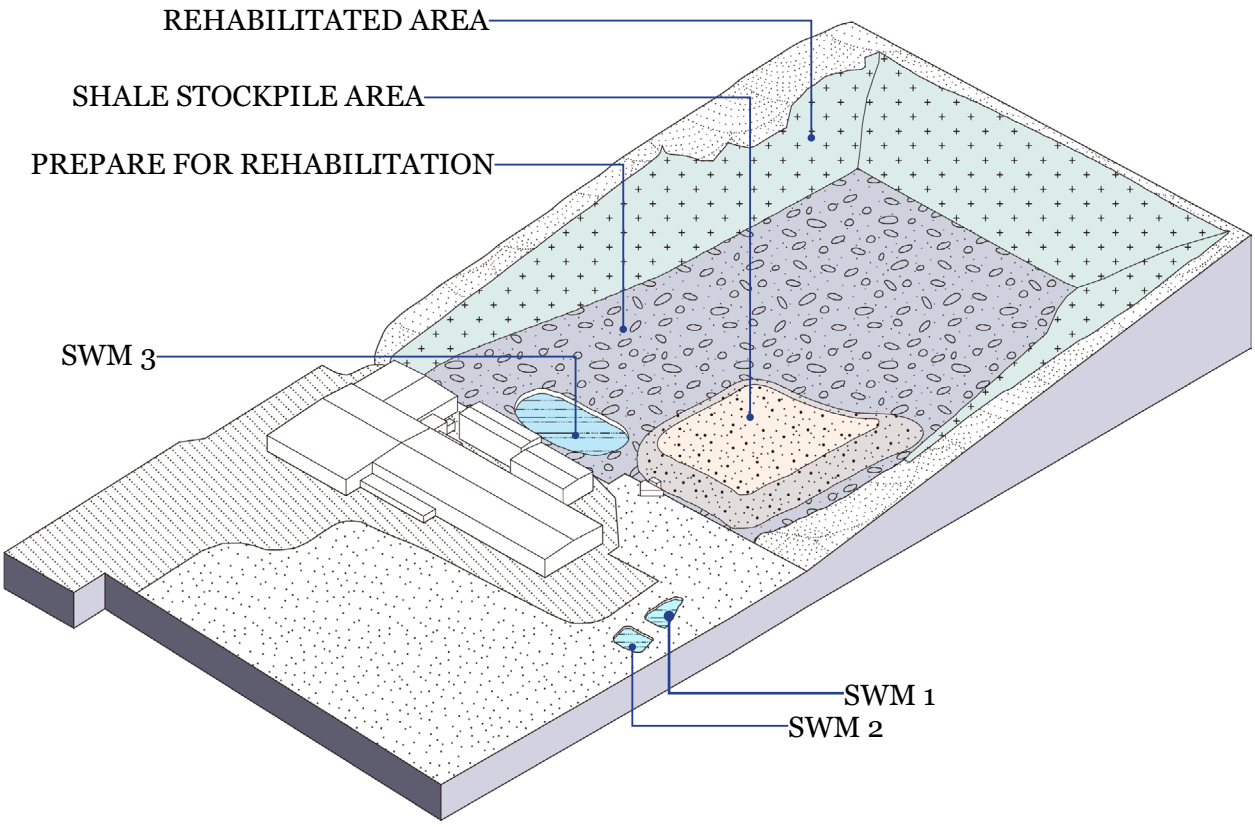


Fig 4.1.7 Aldershot West Quarry Operational Plan, Final rehabilitation. Data from the Meridian Brick Aldershot Office. Produced by author.

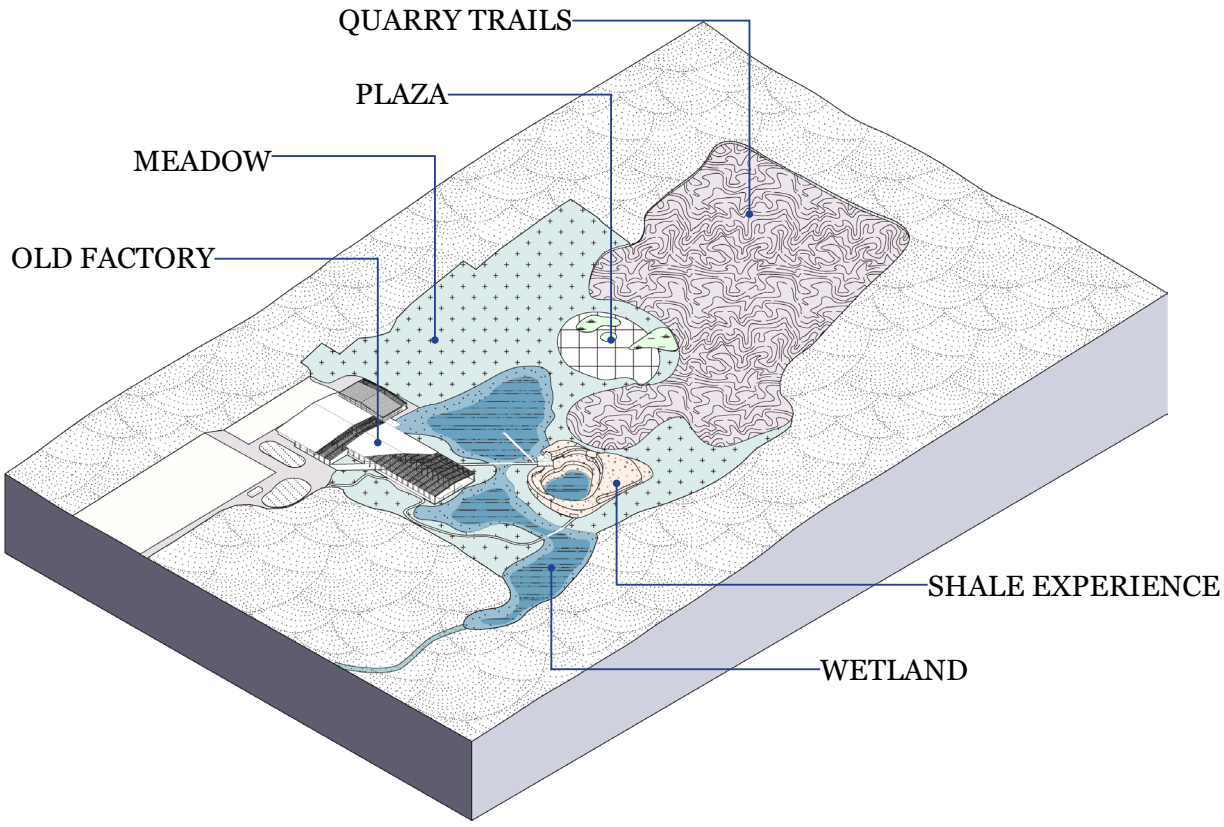


Fig 4.1.8 Quarry Park Functional Plan, Step 3. Produced by author.

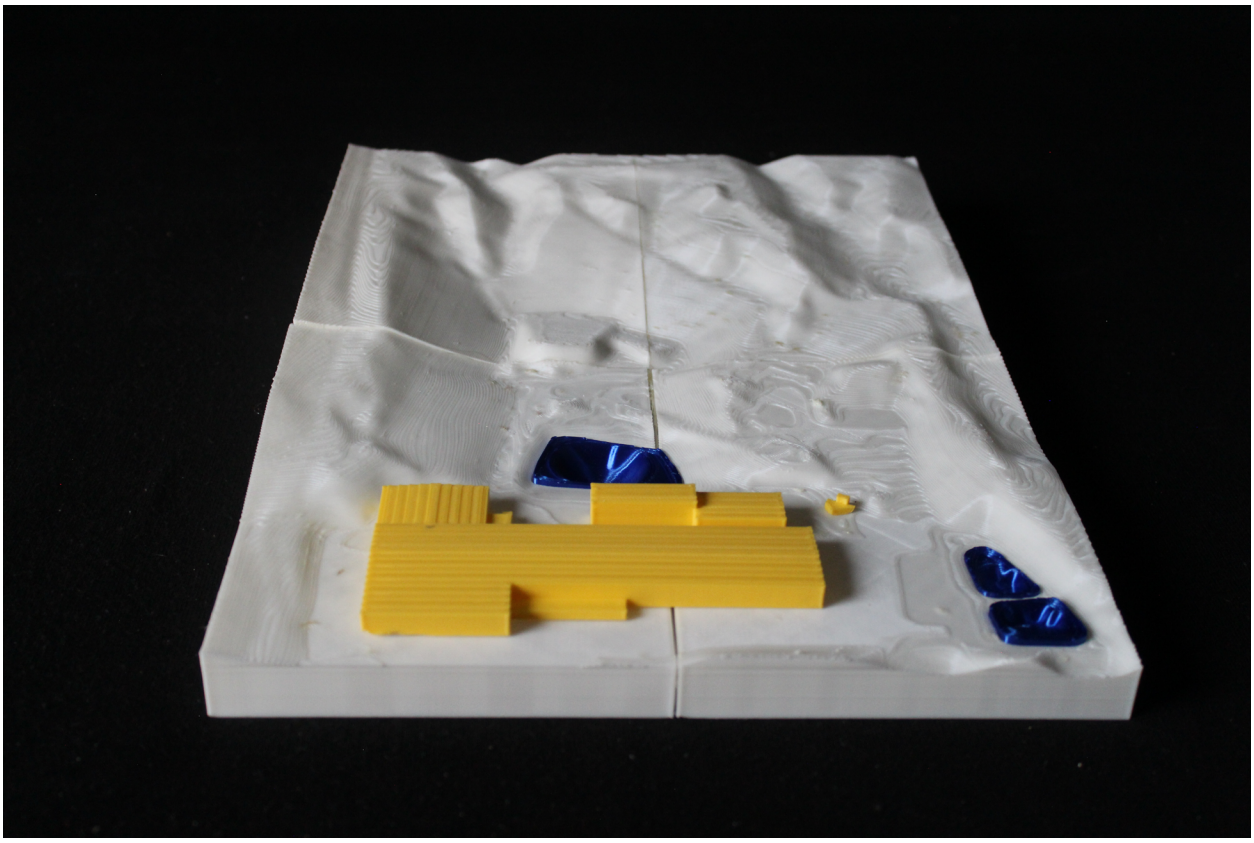


Fig 4.1.9 Model of current West Quarry topography. Made and photo by author.

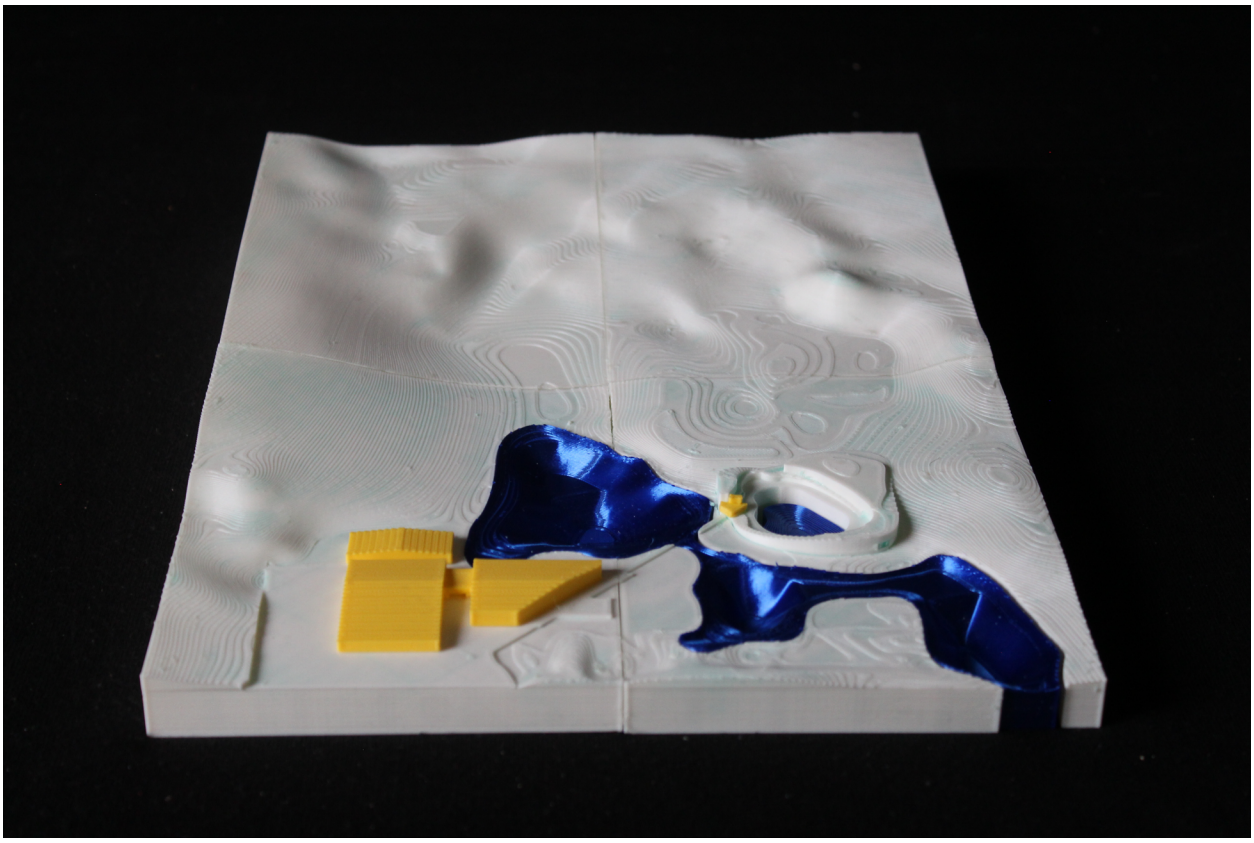


Fig 4.1.10 Model of proposed West Quarry topography. Made and photo by author.

4.2 QUARRY PARK

The extraction working face since phase 4 will become the place that reappears in the quarry's historical landforms through cut and fill work. They are developed into walking trails and cycling trails. One allows visitors to experience the quarry topography at a close distance, and another makes industrial topography become an interactive part, which gives quarries a positive impression from the public. To reduce the cut and fill workload, the relatively flat ground located in the middle of the site is turned into a plaza, providing gathering space. The reserved shale stockpile perfectly touches on the small building, which is used for the first crushing work. The stockpile is a typical material-gathering work from humans and is one of the symbols for a quarry, making it reasonable to become a main entrance with reuse of the crusher building as a service centre. Moreover, its height is enough to mediate the site's elevations. Another main entrance follows the road traces that have been used most in the past 20 years. This design strategy is also applied to the walking trails and park roads, so the circulation on the site reflects both accessibility and the site's history. By overlaying all historical road traces to form the road network of the quarry. These routes are then categorized by different pavement types for representing their years of existence. As the raw materials and products from the site are durable, the pavement system is constructed from materials from all stages of the brick manufacturing process, including raw shale, crushed shale, and the broken brick fragments. This approach transforms the paths into experience spaces of the quarry's lifecycle. Visitors encounter the physical evolution of materials under their feet and connect this change with time.

To deal with the site drainage issue and avoid the water pollution risk

from the surrounding landfills, it is ideal to have a solution that works both on water-collecting and water-cleaning. GIS mapping has identified a creek at the lower elevation, south of the site, that drains into Lake Ontario. Inspired by Don Valley Brickworks Park, treating wetlands as filters and connecting them to the local watercourses helps a lot in water quality improvement. The West Quarry contains three ponds for quarry drainage, which means their locations meet the drainage requirements in topography. Considering the flooding resilience, expand the three ponds into two wetlands and make them semi-disconnected. They will naturally combine into a bigger lake when there is too much water in the site.

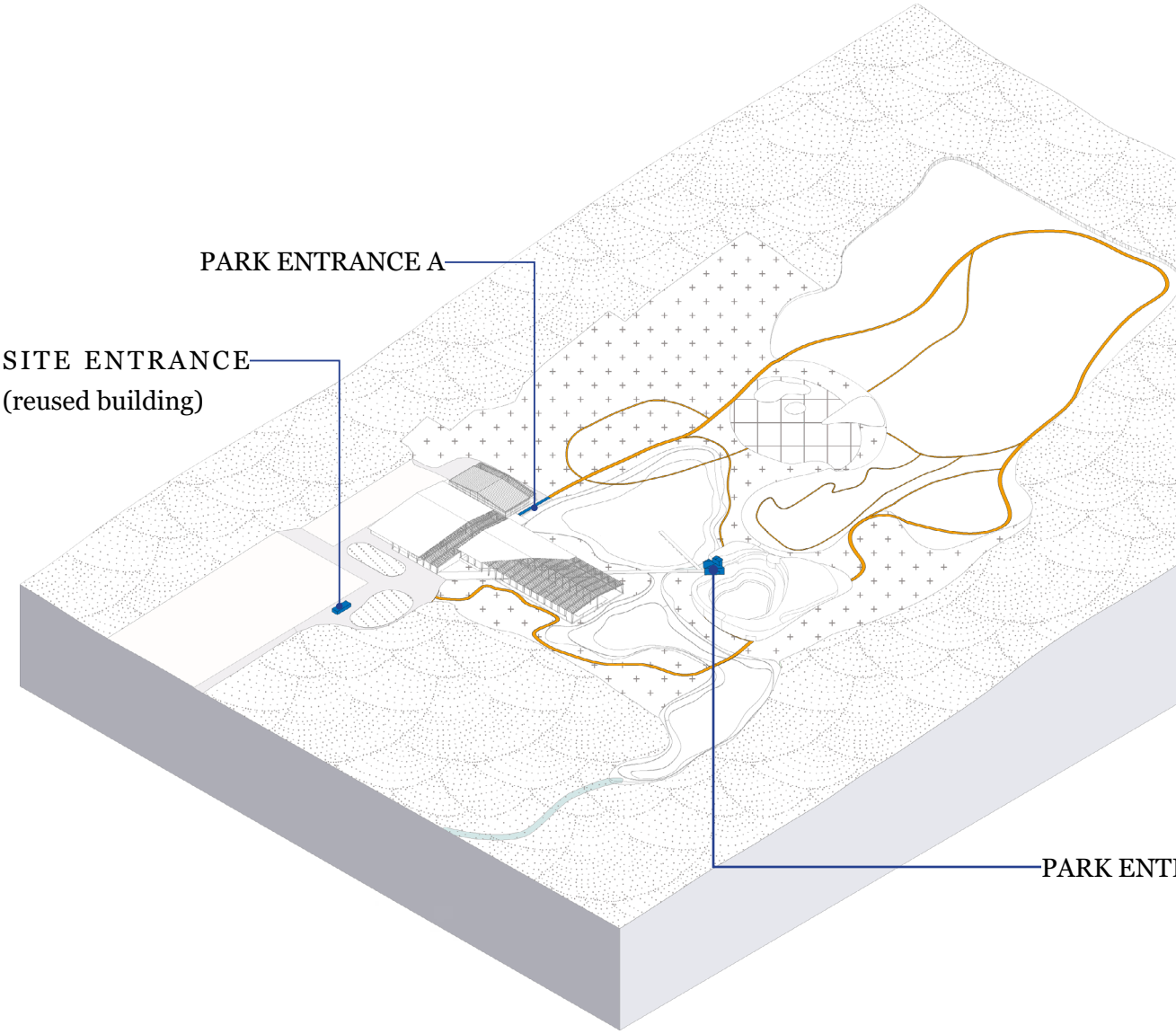
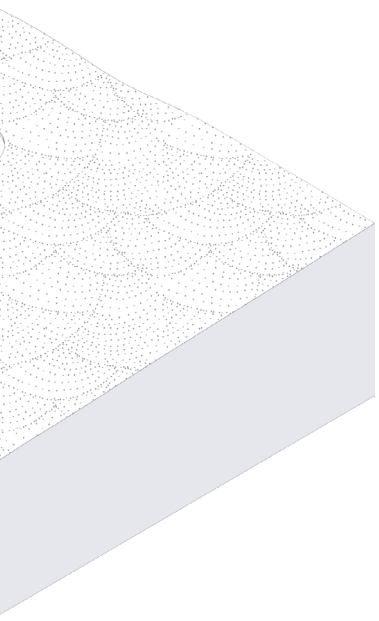
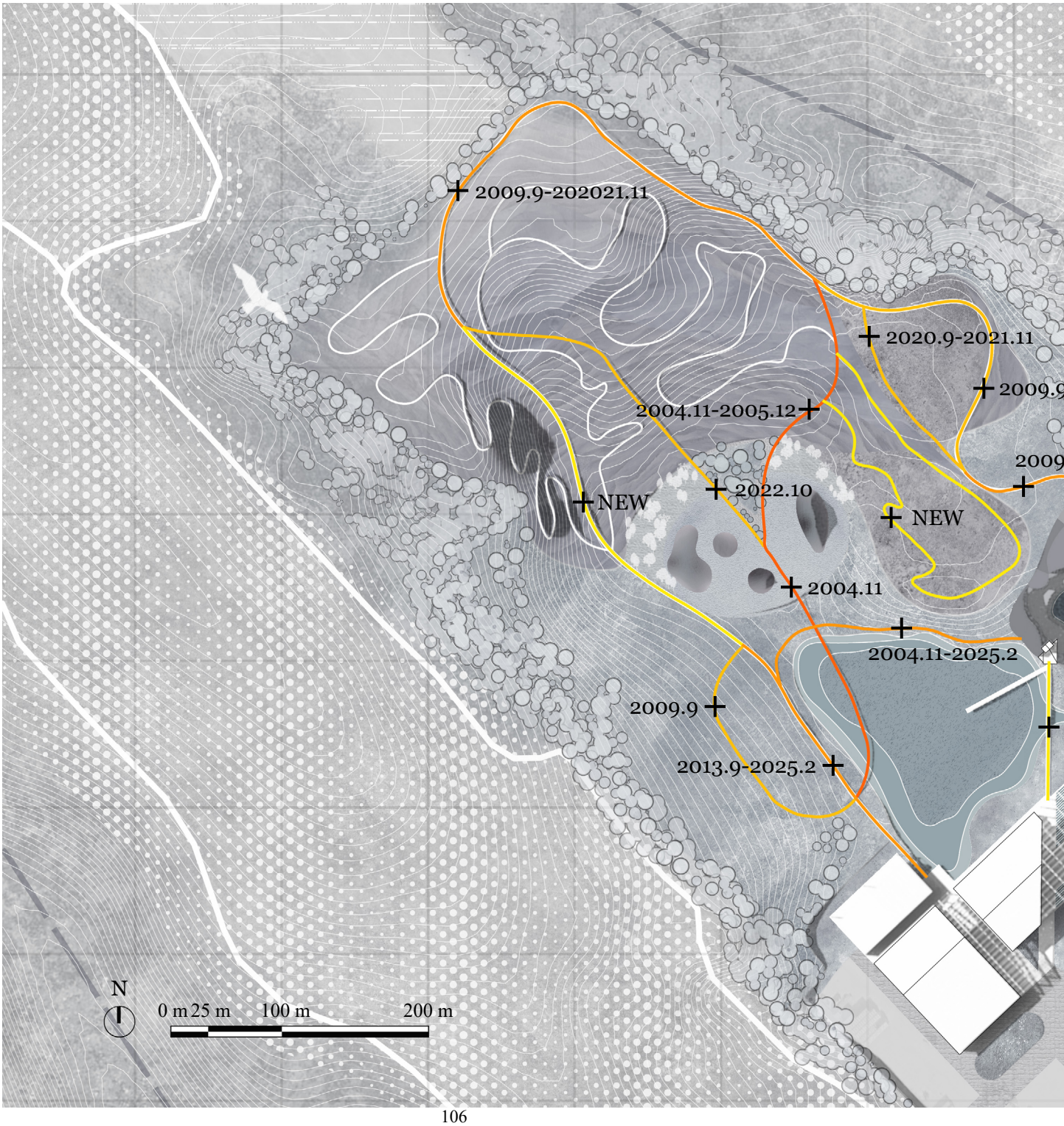


Fig 4.2.1 Quarry Park Entrances and main road. Produced by author.



RANCE B (reused building)

Fig 4.2.2 Site historical road overlay and Quarry Park road finding. Produced by Author.


2009.9-202021.11
2020.9-2021.11
2009.9
2004.11-2005.12
2009
NEW
2022.10
NEW
2004.11
2004.11-2025.2
2009.9
2013.9-2025.2
N
0 m 25 m
100 m
200 m

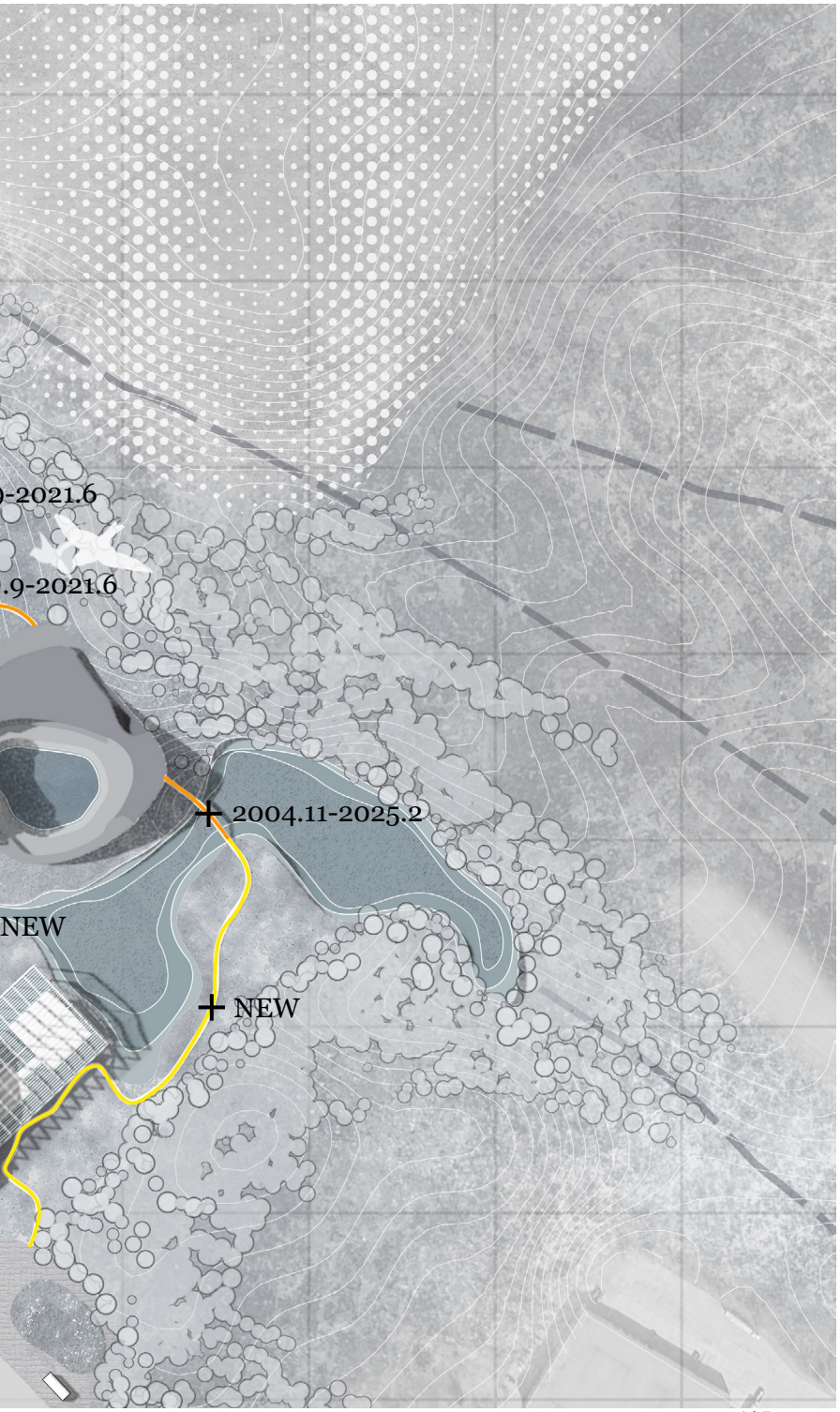


Fig 4.2.3 Trail map and pavement method in Quarry Park, Produced by Author.

Trails follow the earliest historical roads. Pavement method refers to (1)

Trails follow the historical roads that appeared most in the past 20 years. Pavement method refers to (2)

Trails follow the historical roads that appeared a few times in the past 20 years. Pavement method refers to (3)

Apply the broken clay bricks. Pavement method refers to (4)

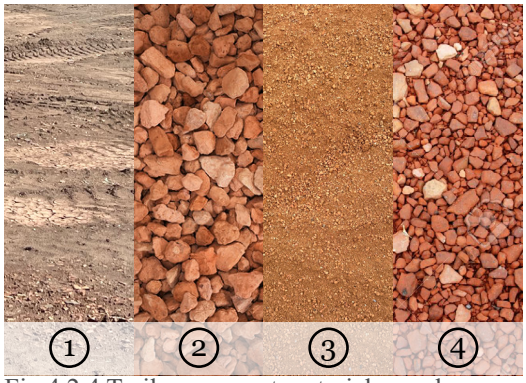


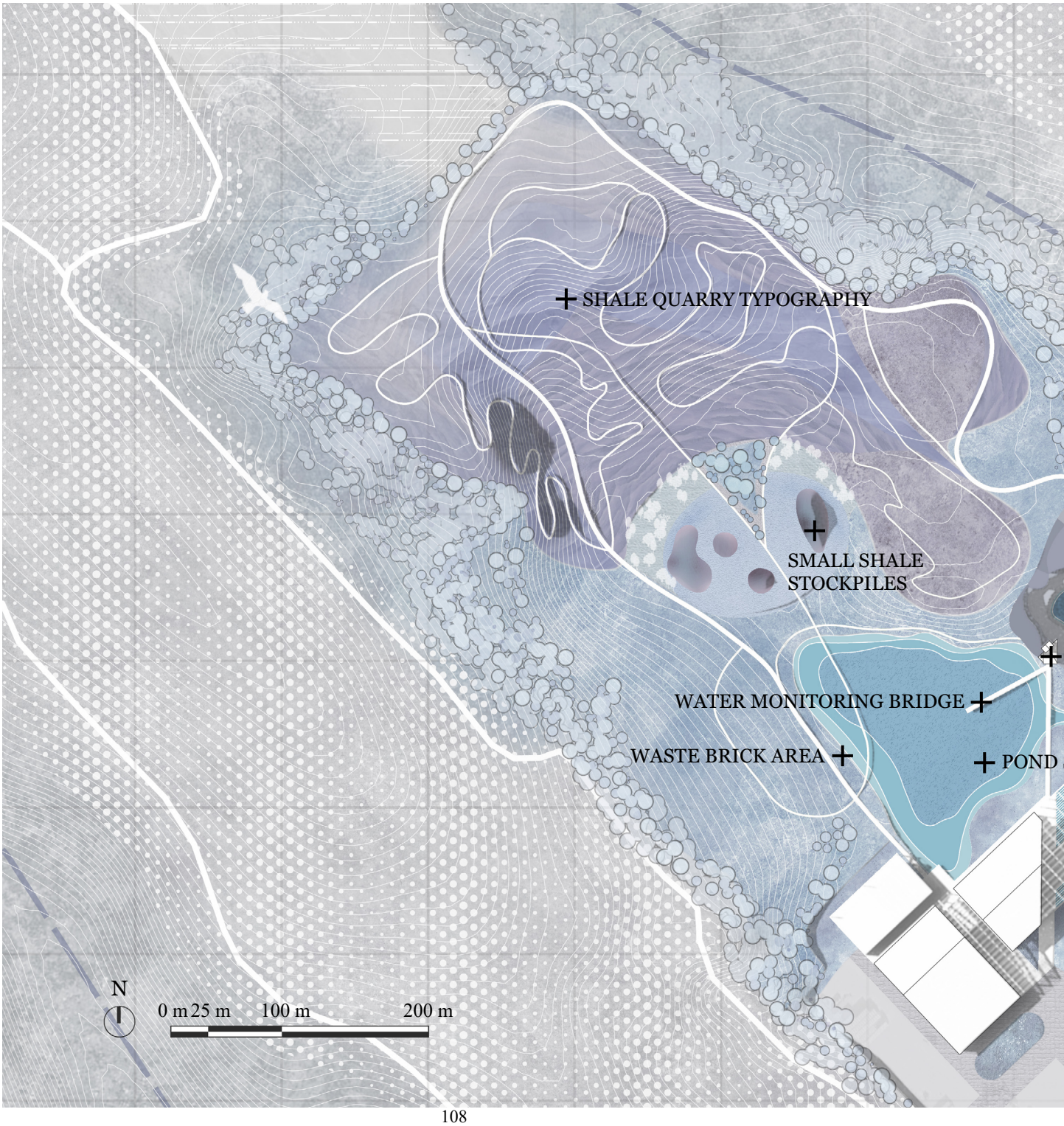
Fig 4.2.4 Trails pavement material samples, Produced by Author.

(1) Apply the site raw materials, Queenstone shale.

(2) Apply the rough crushed shale.

(3) Apply the finely crushed shale.

(4) Apply the broken clay bricks.


SHALE QUARRY TYPOGRAPHY
SMALL SHALE
STOCKPILES
WATER MONITORING BRIDGE
WASTE BRICK AREA
POND
N
0 m 25 m
100 m
200 m

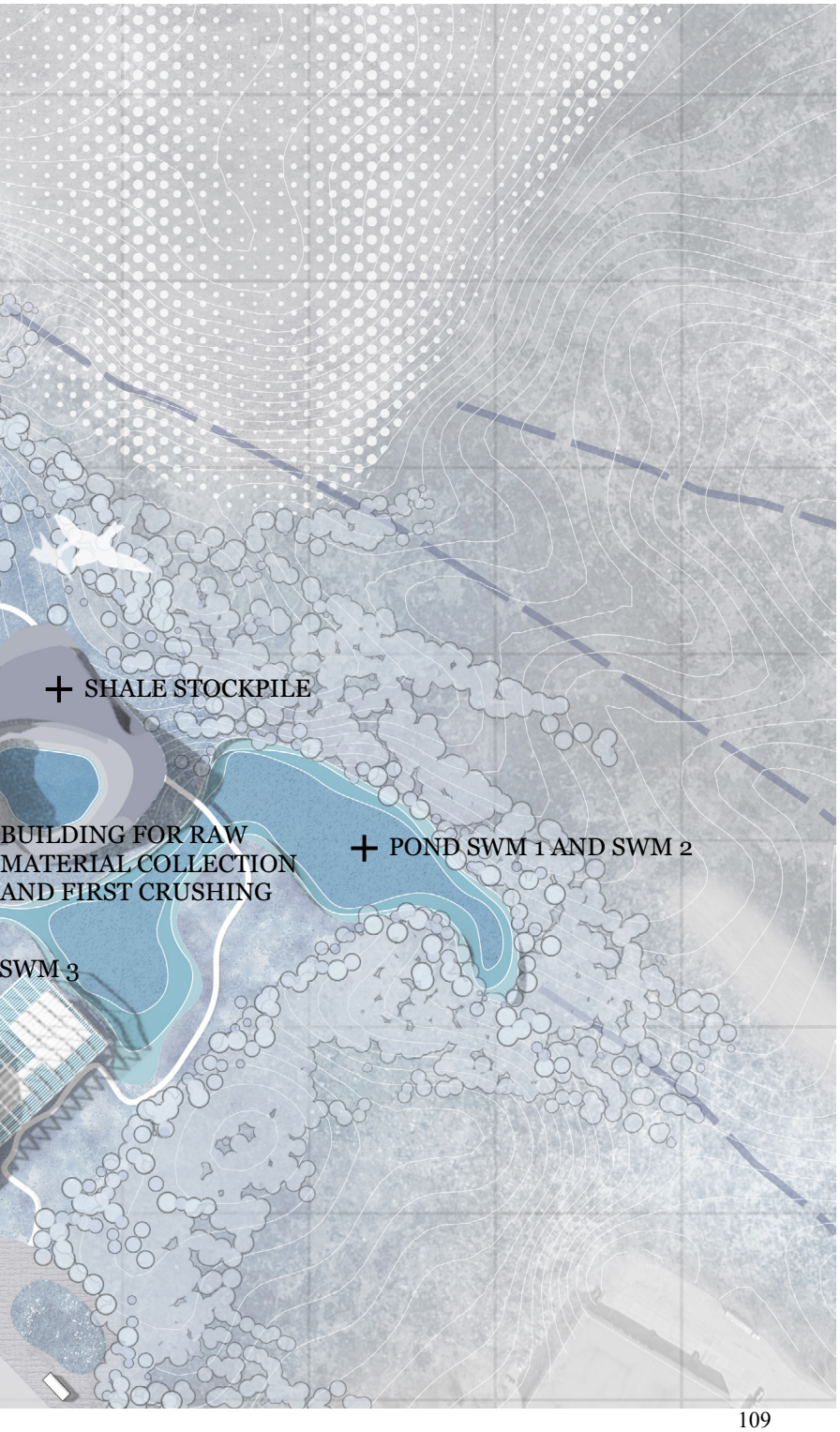
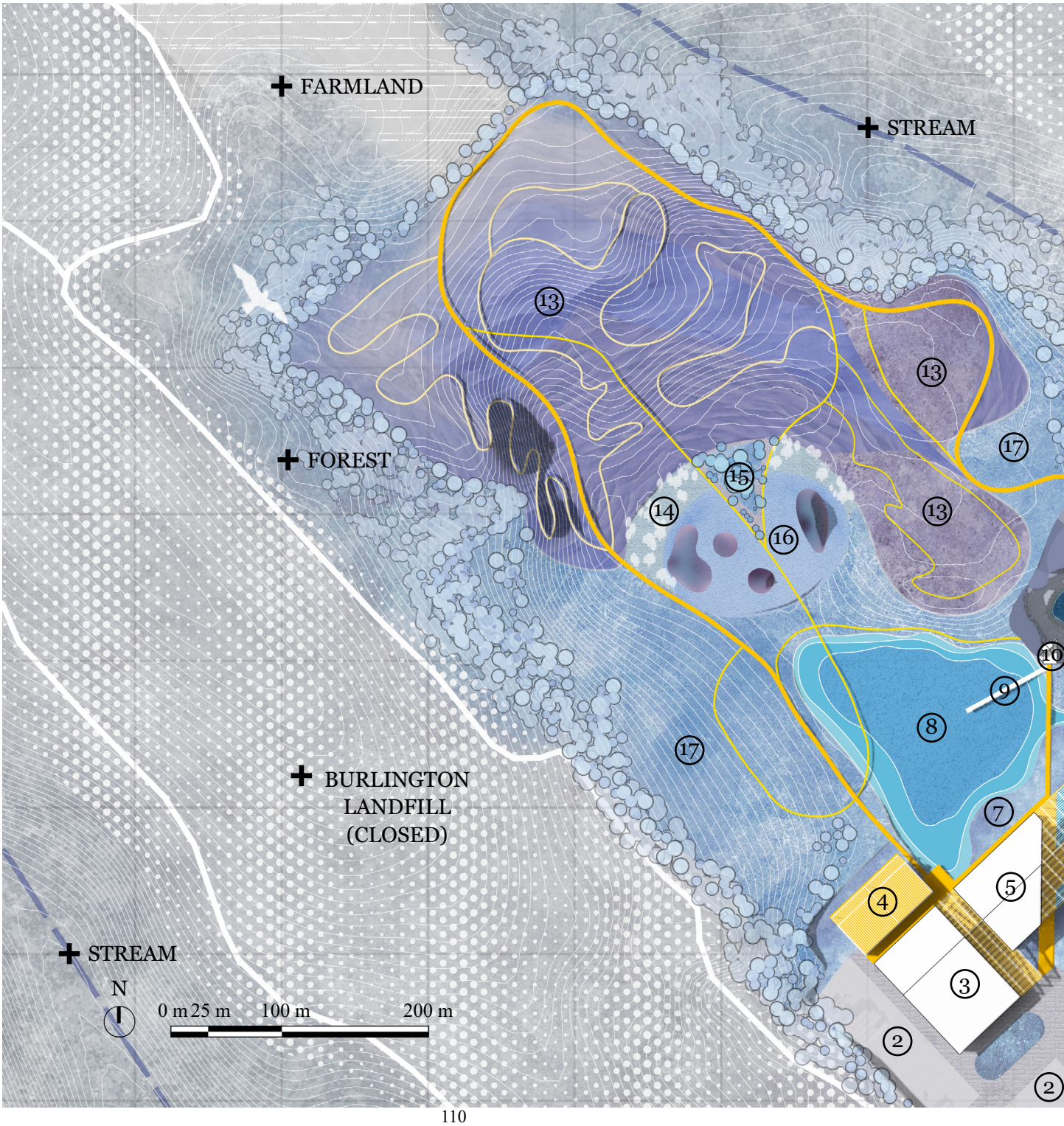


Fig 4.2.5 Site historical and memory points, Produced by Author.

1. WASTE BRICK AREA
2. POND SWM 3
3. WATER MONITORING BRIDGE
4. BUILDING FOR RAW MATERIAL COLLECTION AND FIRST CRUSHING
5. SHALE STOCKPILE
6. POND SWM 1 AND SWM 2
7. SMALL SHALE STOCKPILE


FARMLAND
STREAM
FOREST
BURLINGTON
LANDFILL
(CLOSED)
STREAM
N
0 m 25 m
100 m
200 m
13
13
13
17
15
14
16
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8
17
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5
4
3
2
2

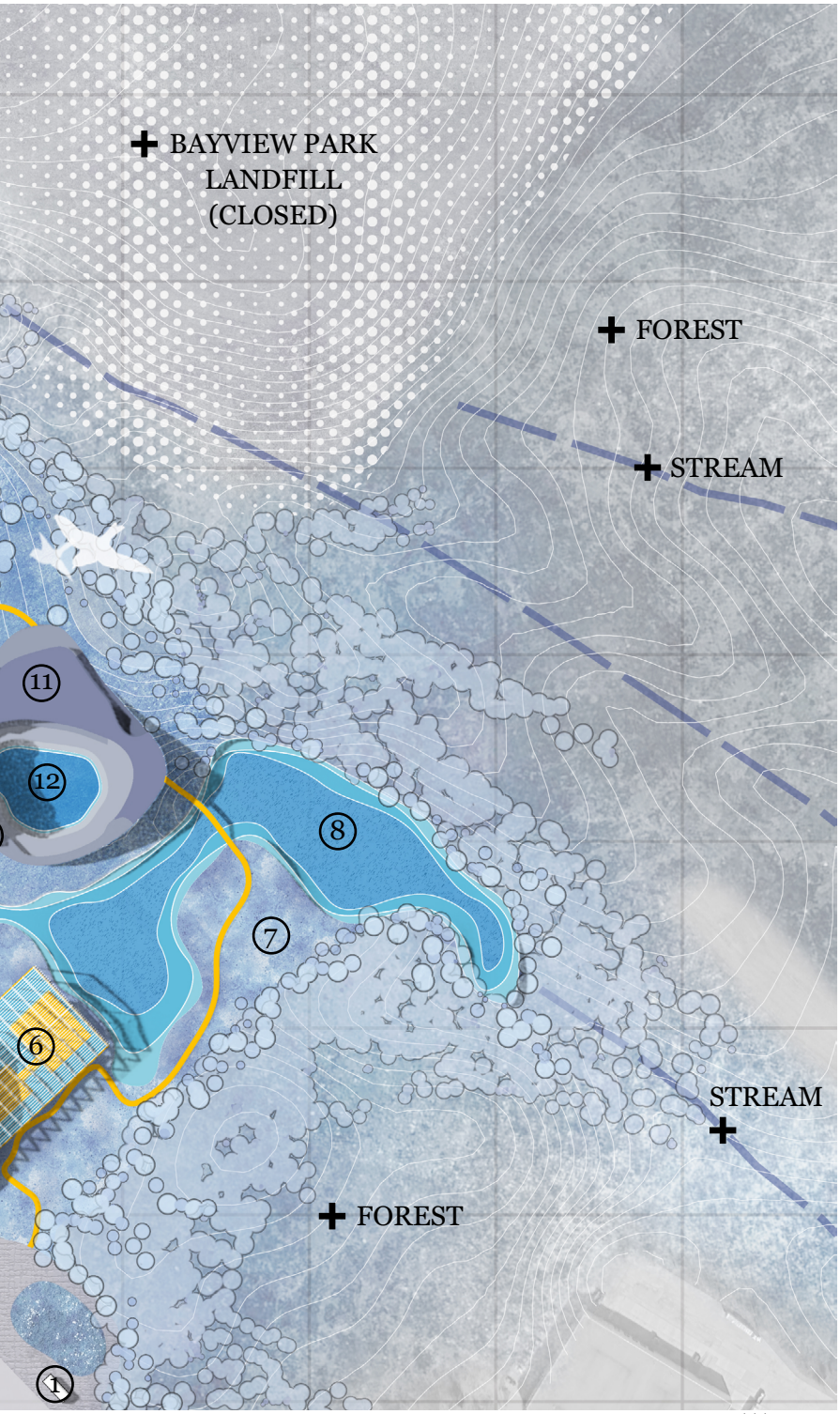
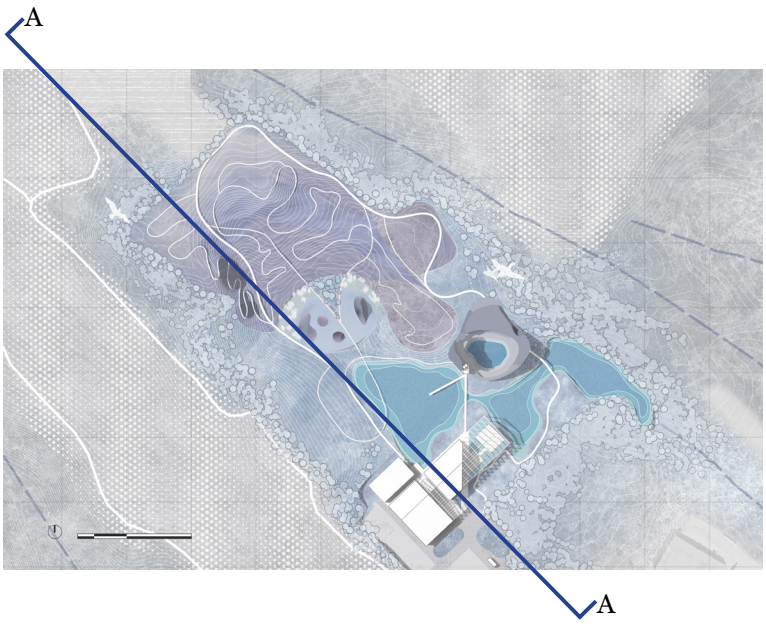


Fig 4.2.6 Site plan. Produced by Author.

TRAIL 1
TRAIL 2
BIKE TRAIL

1. ENTRANCE SERVICE (REUSED BUILDING)
2. PARKING
3. MUSEUM AND GALLERY (REUSED FACTORY)
4. BOTANIC RESTAURANT (REUSED FACTORY)
5. MATERIAL MARKET AND WORKSHOP (REUSED FACTORY)
6. OUTDOOR ACTIVITIES (REUSED FACTORY)
7. MEADOW
8. WETLAND
9. OLD BRIDGE
10. SERVICE CENTRE (REUSED FACTORY)
11. STOCKPILE EXPERIENCE (REUSED STOCKPILE)
12. STOCKPILE POND
13. QUARRY EXPERIENCE
14. WOODLAND AREA
15. PLAZA GARDEN
16. SHALE PLAZA
17. REHABILITATED SLOPE



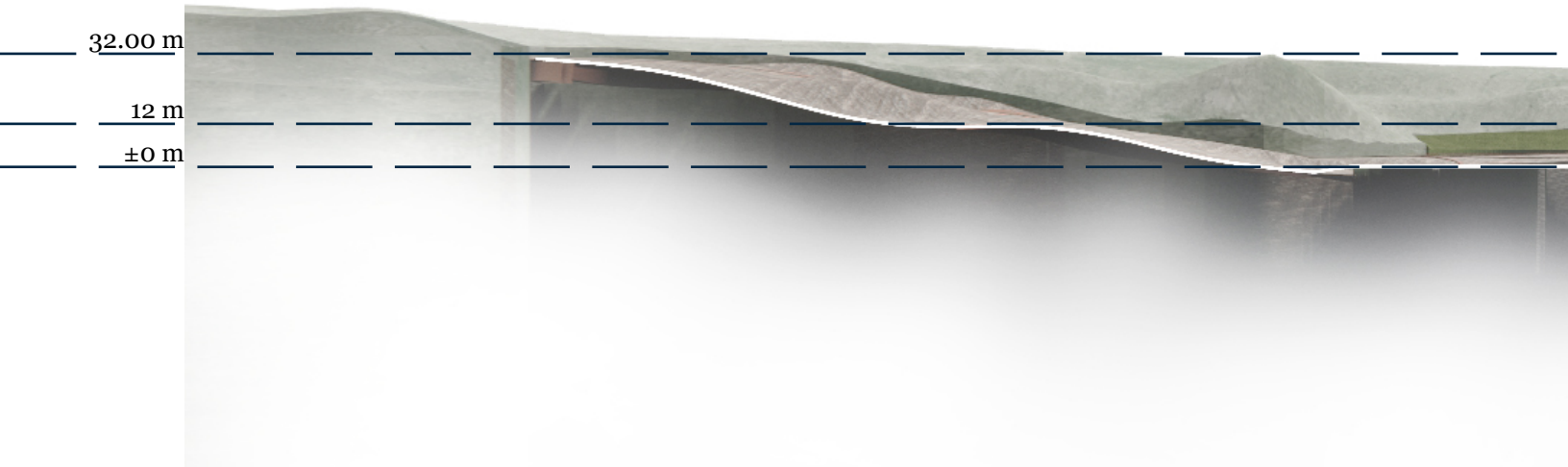


Fig 4.2.7 Site plan section AA. Produced by Author.

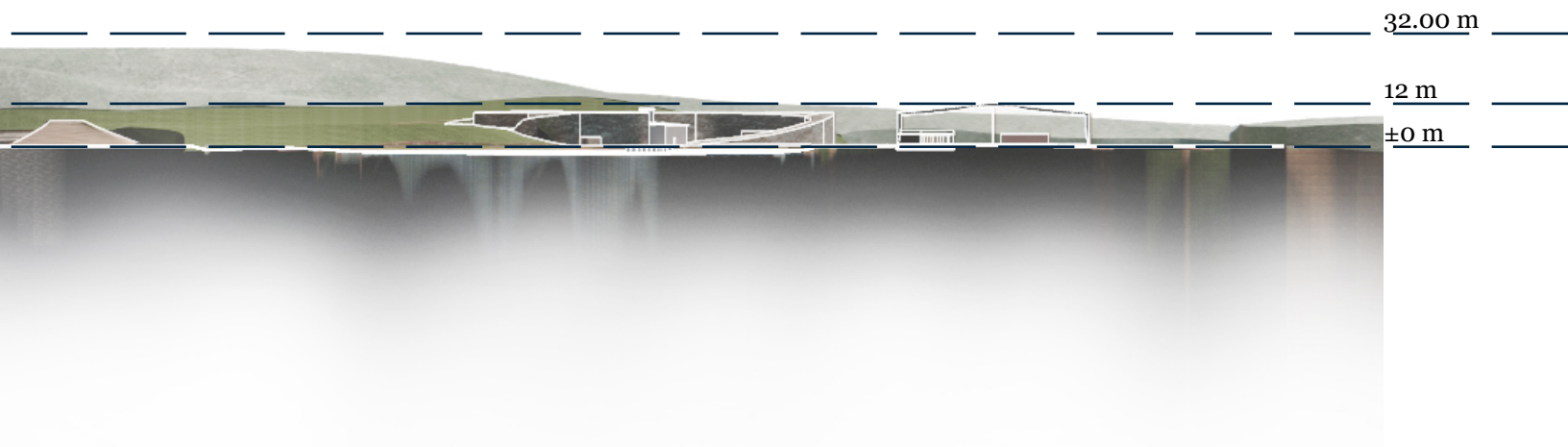
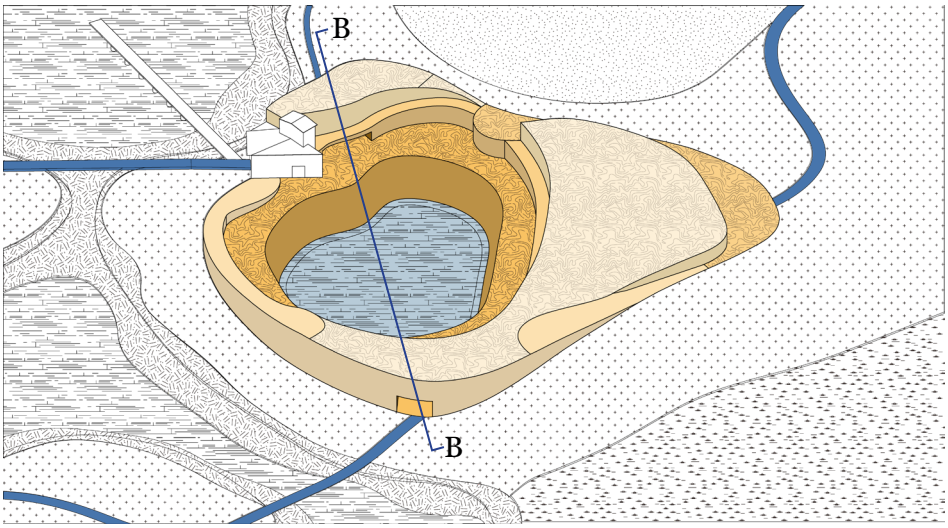

32.00 m
12 m
±0 m

Fig 4.2.8 Shale experience area. Produced by Author.



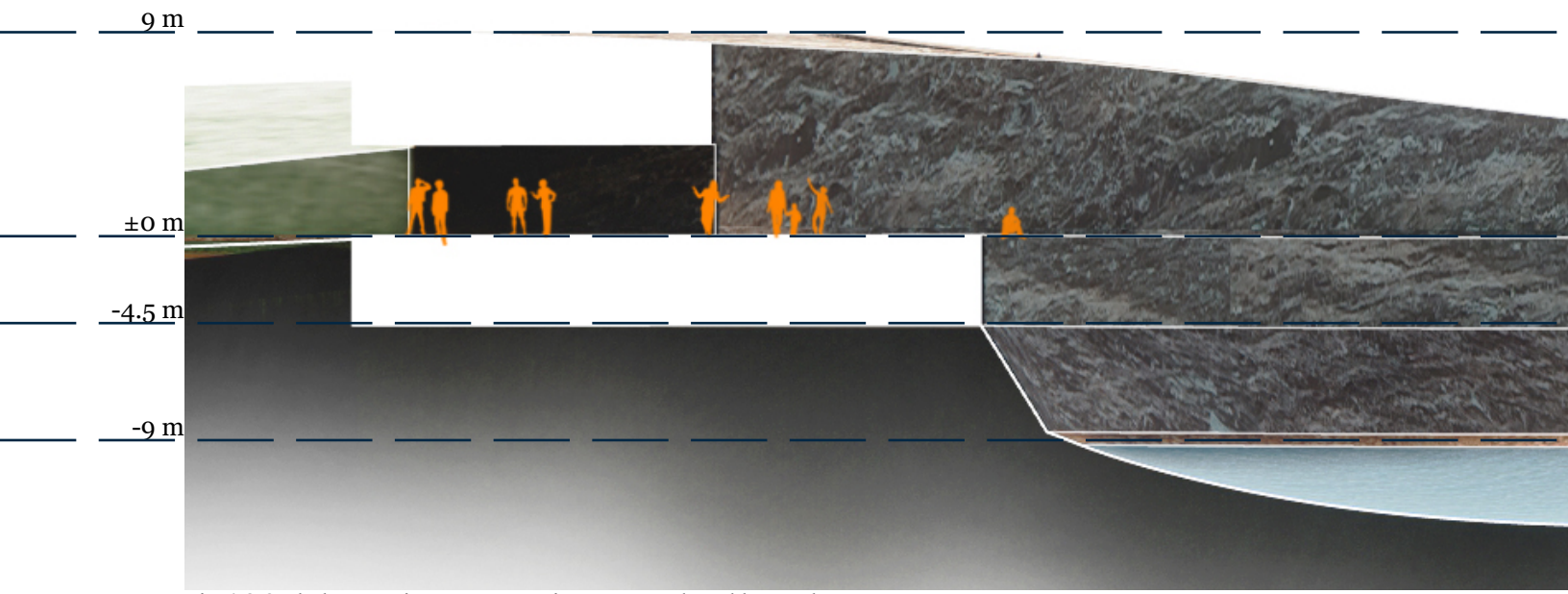
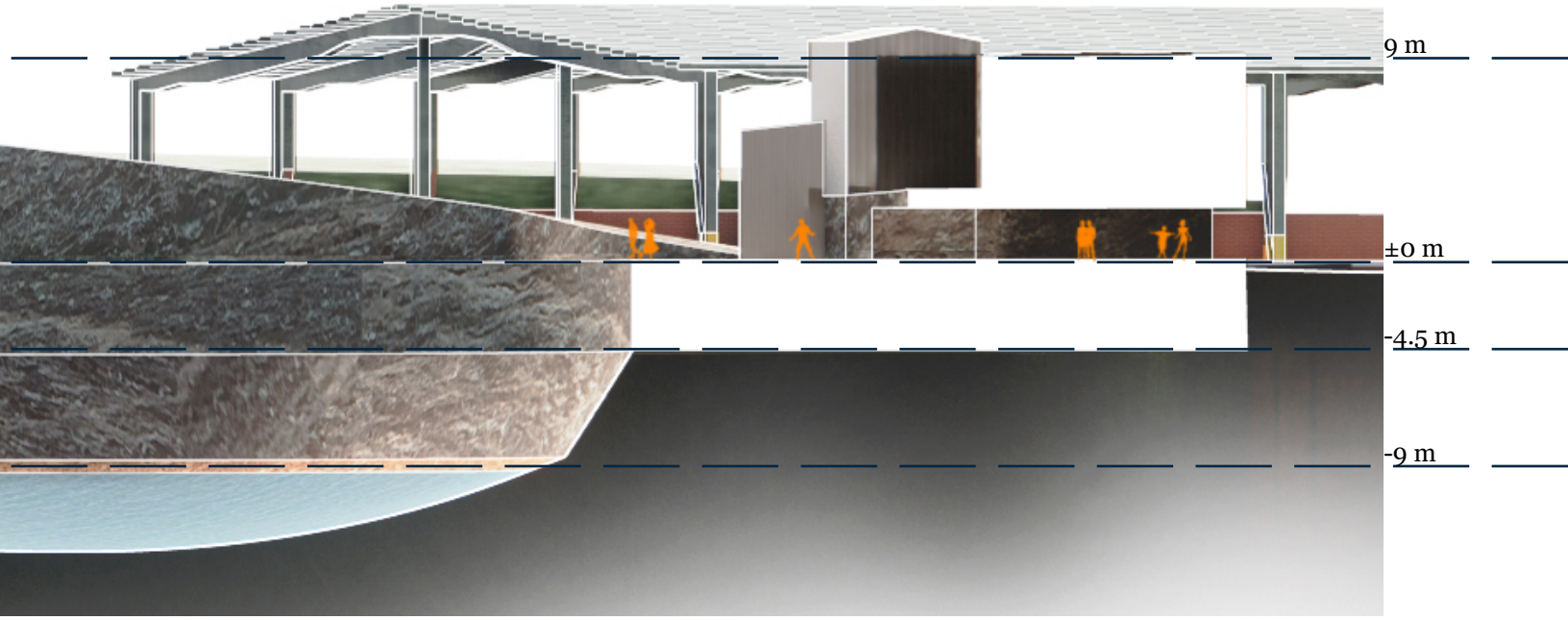
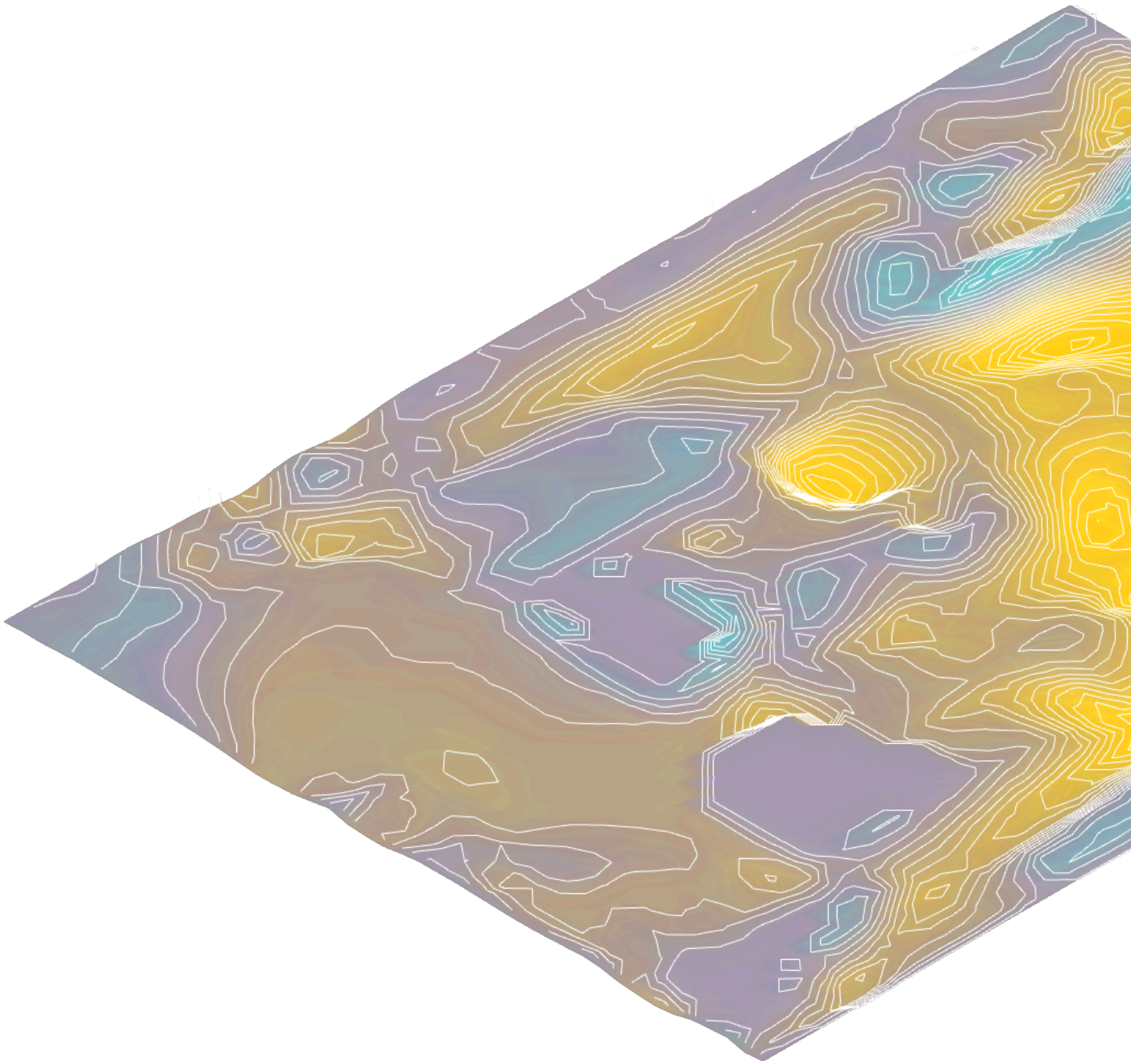


Fig 4.2.9 Shale experience area section BB. Produced by Author.


9 m
±0 m
-4.5 m
-9 m



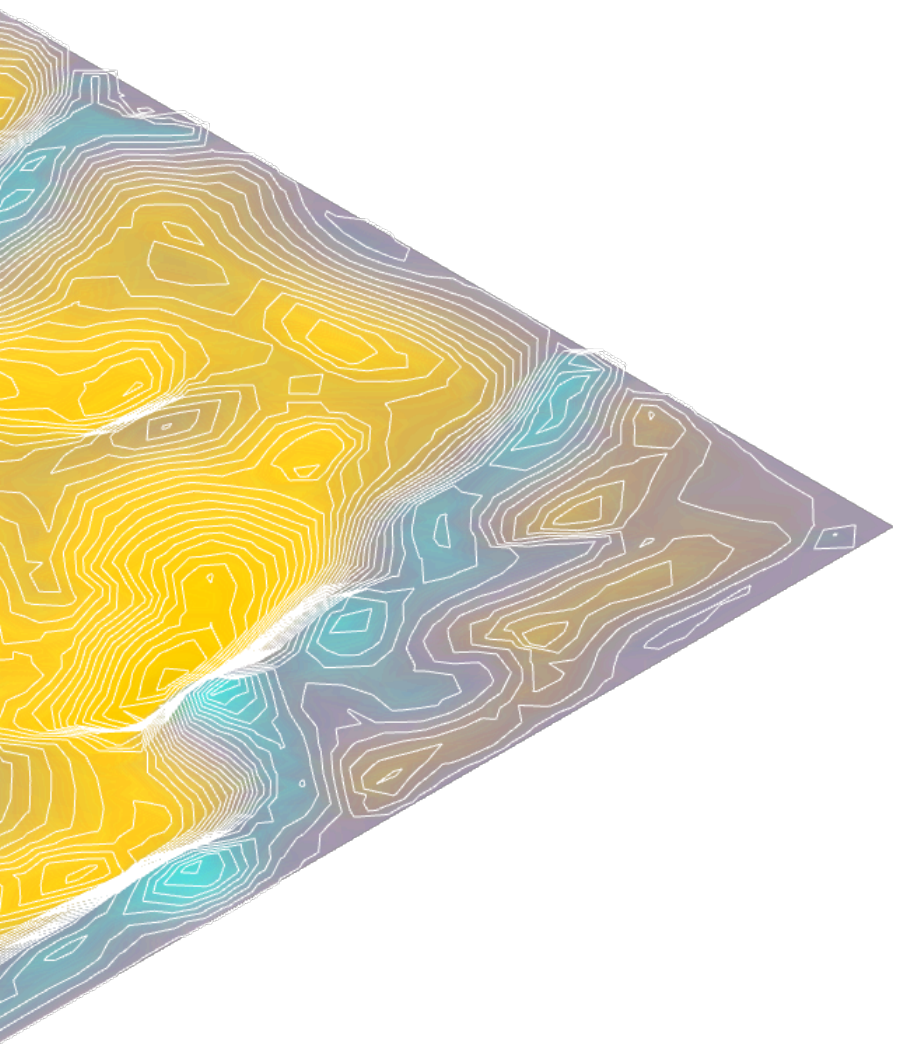


Fig 4.2.10 Cut and Fill analysis of the current site and the proposed plan. Produced by Author.

Material Excavation (Cut):

Around 1.2 million cubic meters.

Material Deposition (Fill):

Around 150 thousand cubic meters.

Total:

Continue extract 1 million cubic meters.

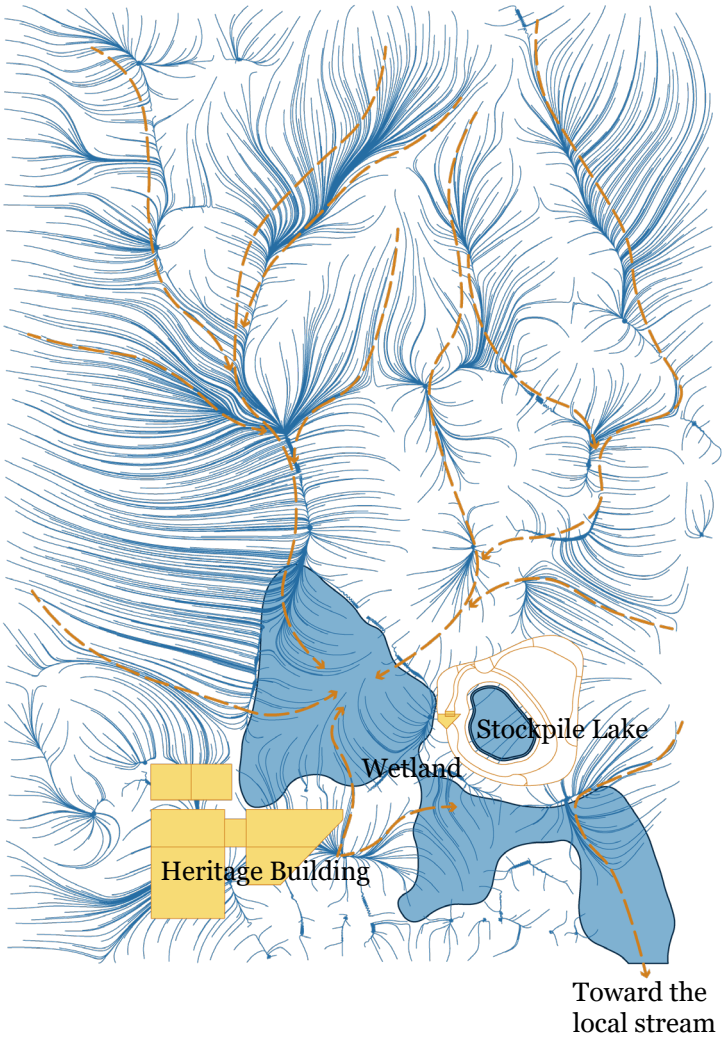


Fig 4.2.11 Proposed West Quarry runoff flow simulation. Top view. Produced by author.

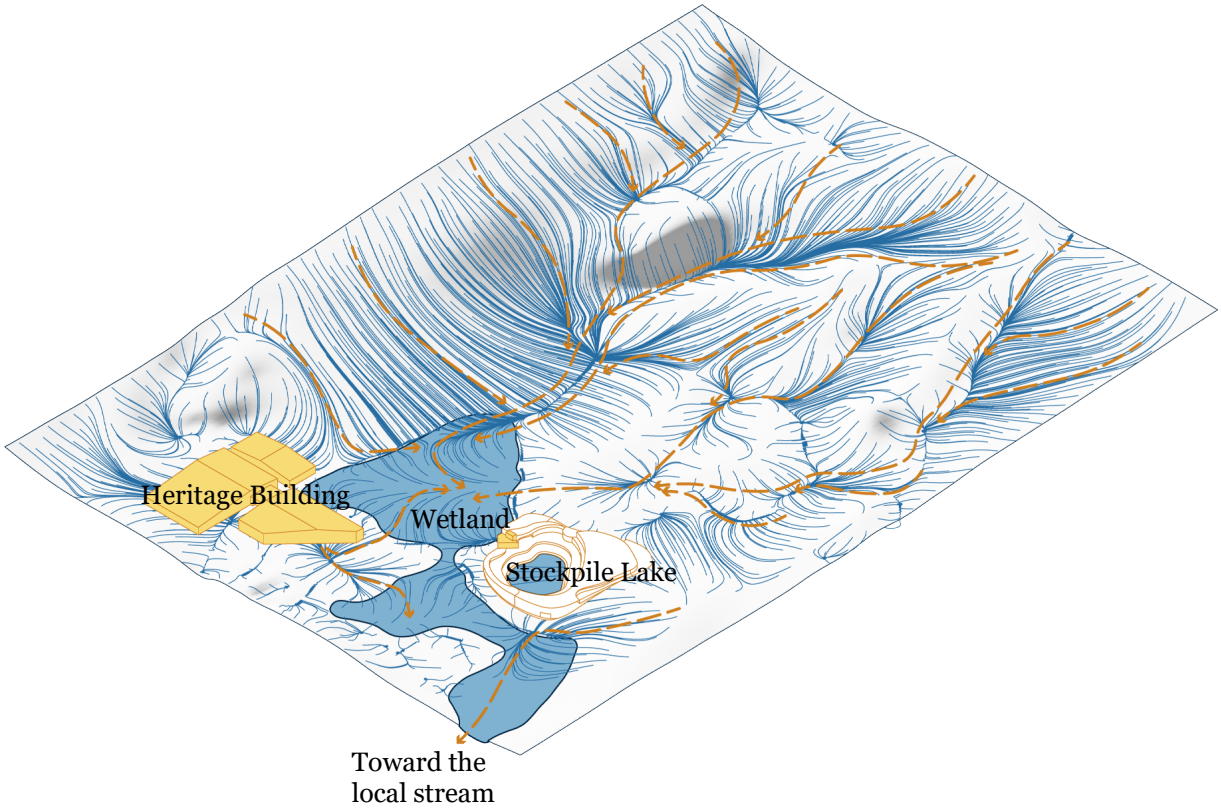


Fig 4.2.12 Proposed West Quarry runoff flow simulation. Southeast Isometric View. Produced by author.

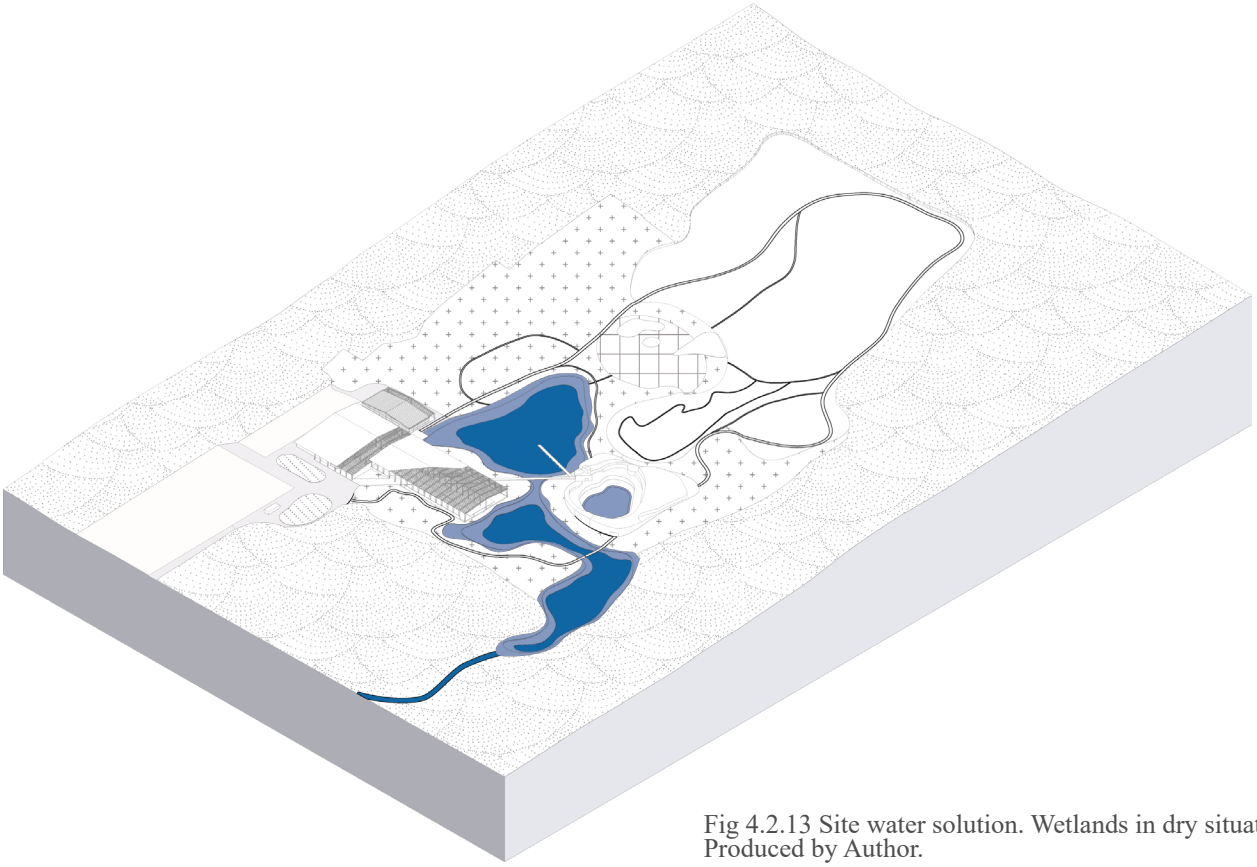


Fig 4.2.13 Site water solution. Wetlands in dry situations. Produced by Author.

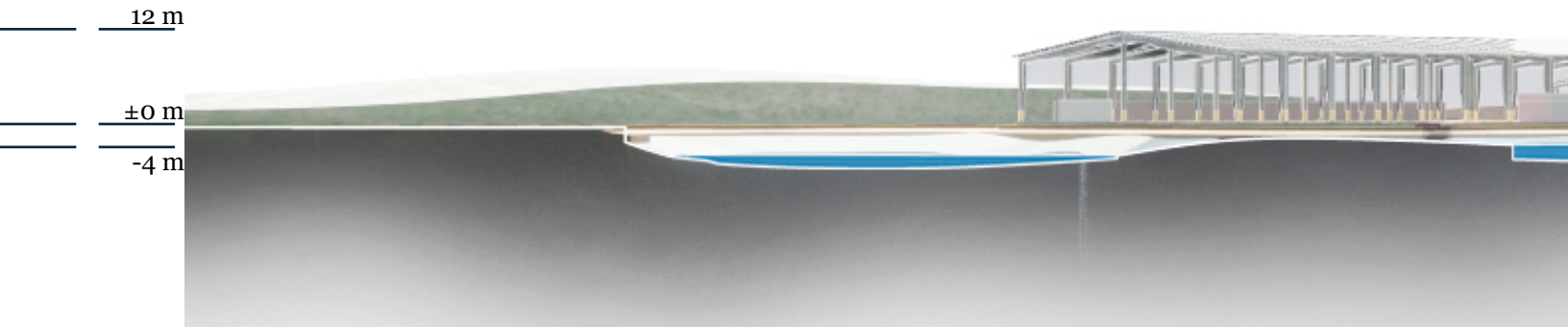
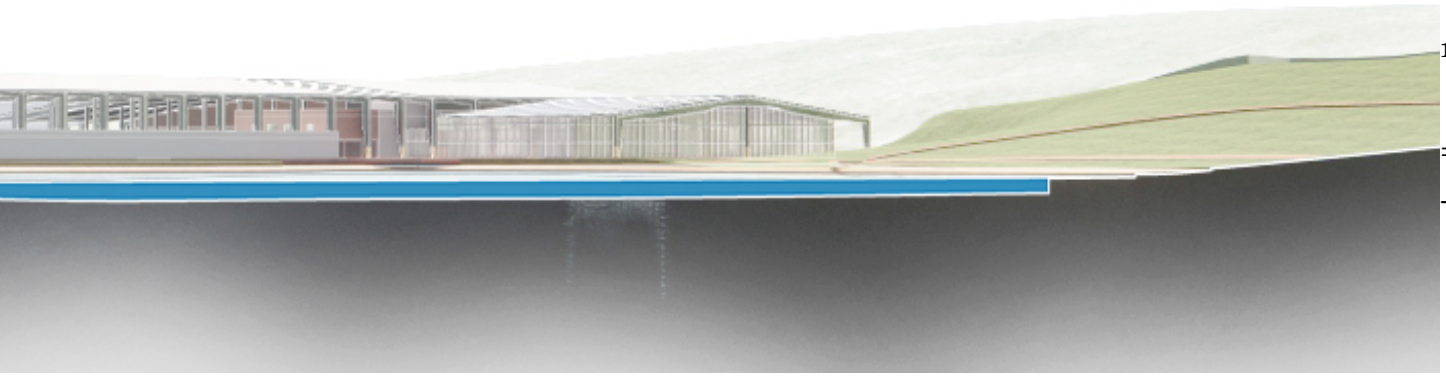


Fig 4.2.14 Site water solution. Section for wetlands in dry situations. Produced by Author.


12 m
±0 m
-4 m

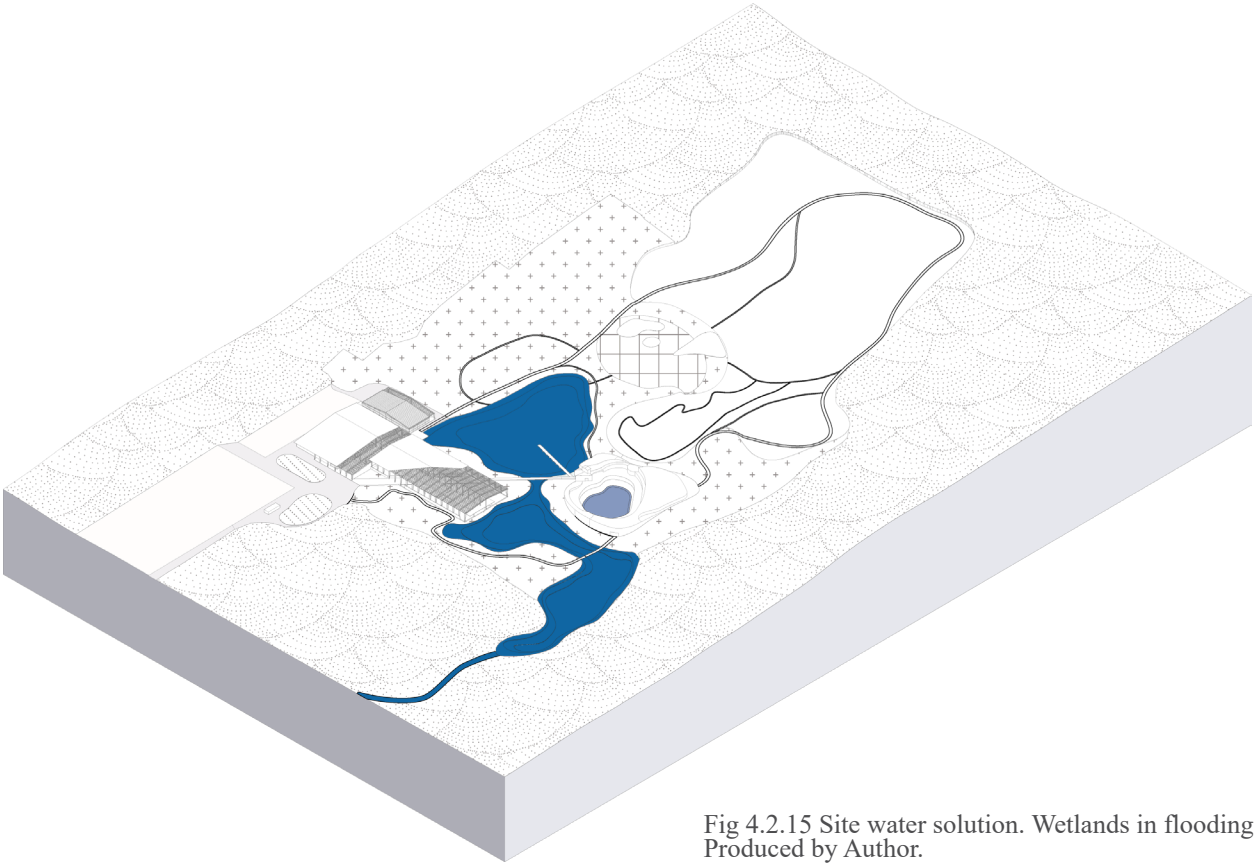


Fig 4.2.15 Site water solution. Wetlands in flooding situations. Produced by Author.

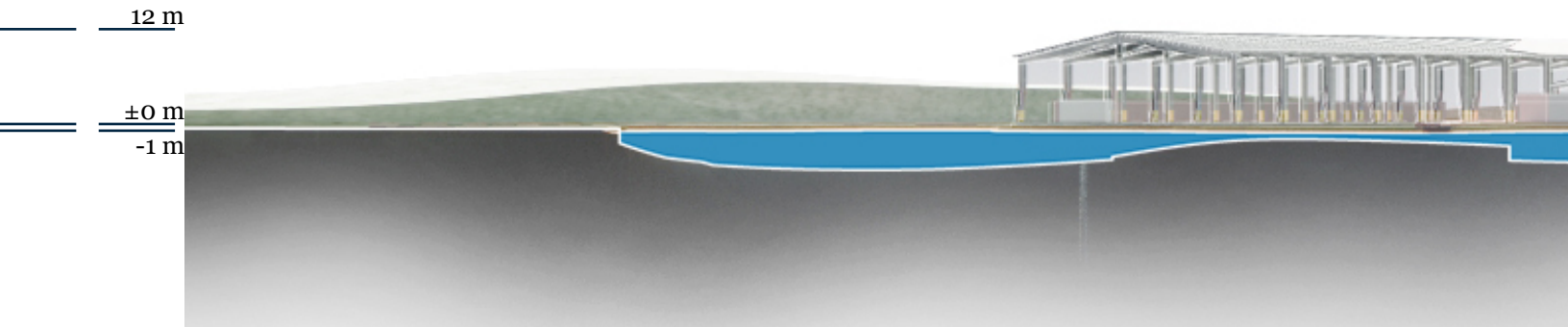


Fig 4.2.16 Site water solution. Section for wetlands in flooding situations. Produced by Author.

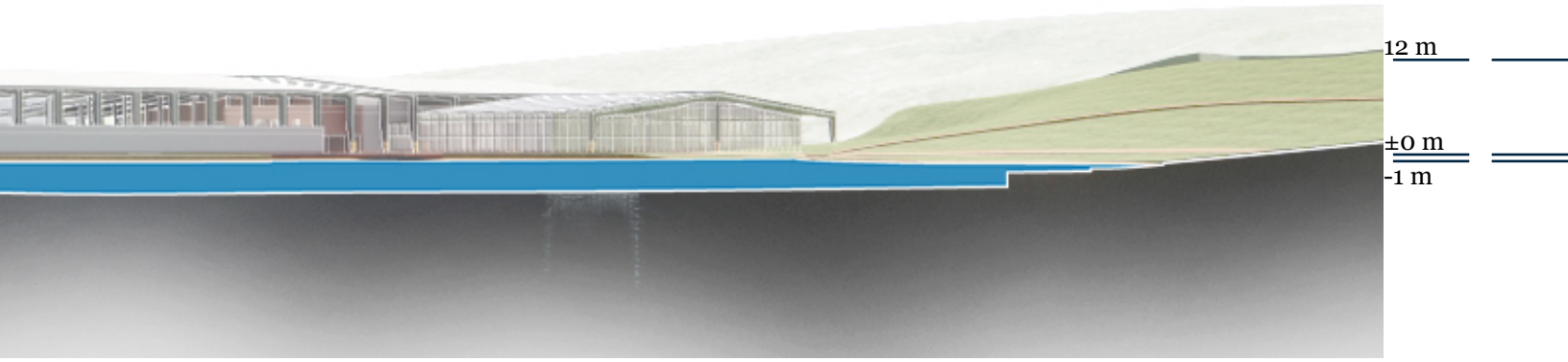

12 m
±0 m
-1 m

Fig 4.2.17 Waste brick area and the pond SWM 3.
Photo and produced by Author.

Fig 4.2.18 Rendering from the Old Bridge facing the waste brick alon

ngside the lake. Produced by Author.

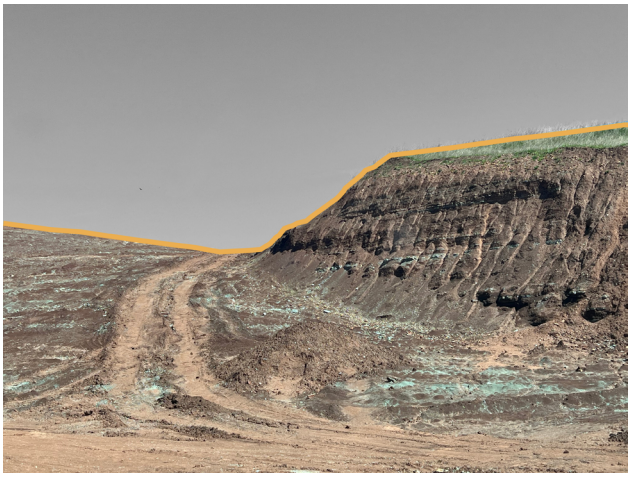


Fig 4.2.19 West Quarry's current working face. Photo and produced by Author.

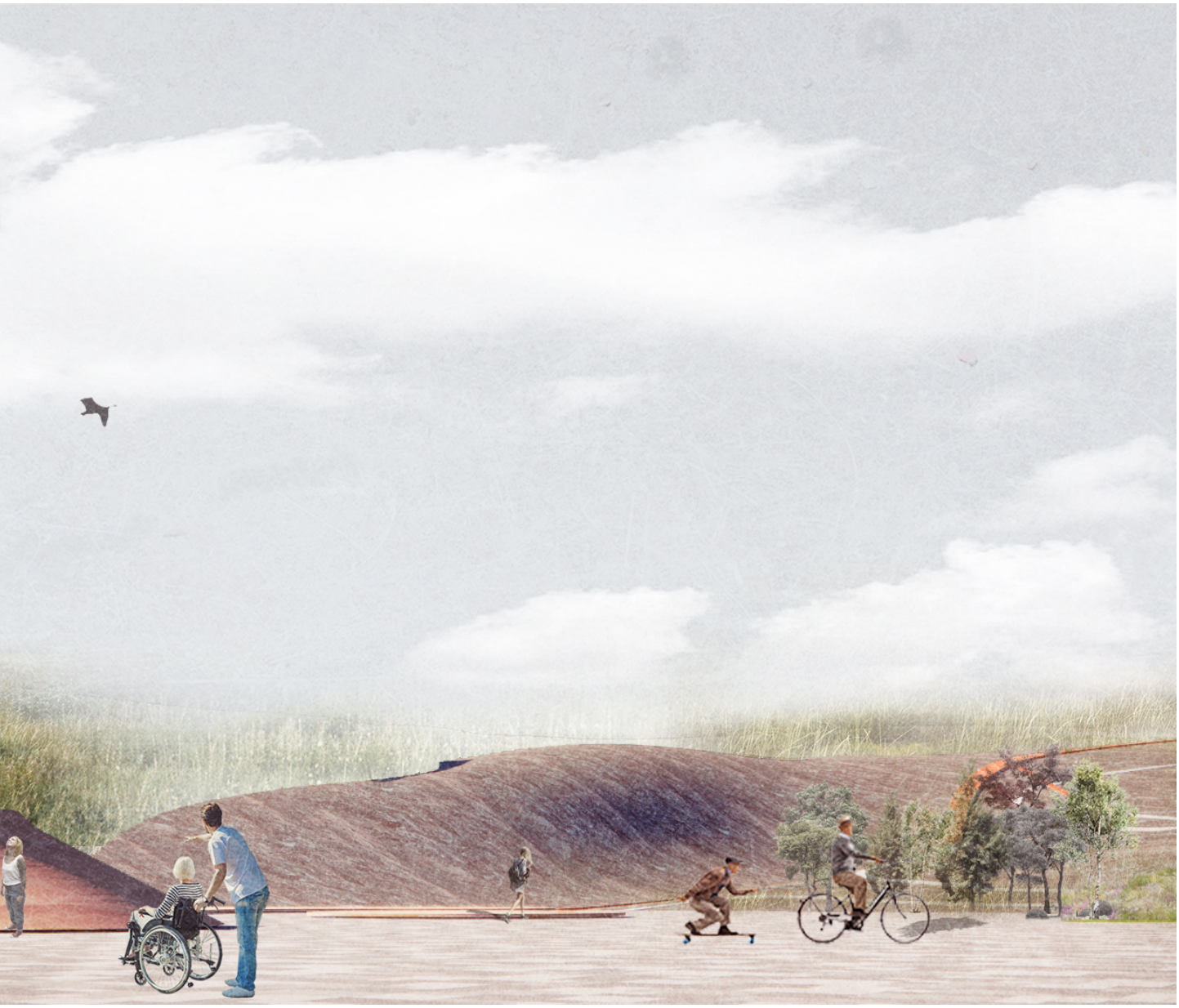
Fig 4.2.20 Rendering of the Quarry trail. Produced by Author.

A Narrative Outside of Time

Fig 4.2.21 Shale stockpile area. Photo and produced by Author.

Fig 4.2.22 Rendering of Plaza. Produced by Author.

A Narrative Outside of Time



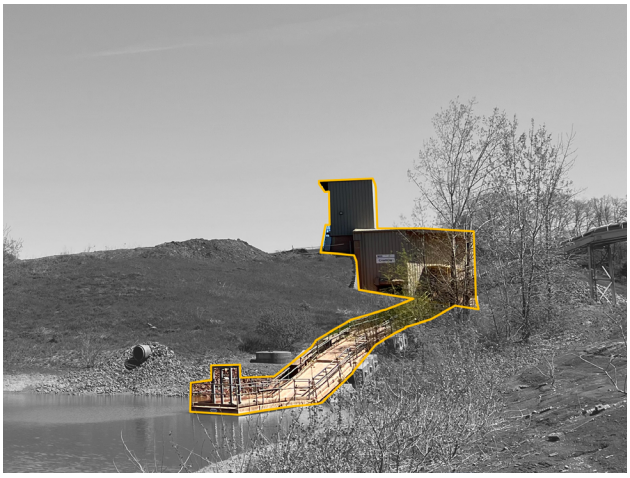


Fig 4.2.23 Water monitoring bridge and the building for raw material collection and first crushing. Photo and produced by Author.

Fig 4.2.24 Rendering of the Shale Experience area. Produced by Auth

A Narrative Outside of Time

nor.

4.3 HERITAGE AND RUINS

On the southeast side of the site, near the main entrance, Meridian Brick established an industrial area at Aldershot West Quarry, including administrative offices and on-site clay brick manufacturing. This area includes a large brick plant and two smaller buildings dedicated to shale crushing. The office is located on the southern edge of the plant, facing the site entrance. The factory was built in 2001 and owns a modern steel-frame structure. Except for a single red brick façade oriented toward visitors, the others are applied in metal sheathing. The factory occupies around 22,000 square meters, which concealed the quarry's operations while making itself a landmark of the site's industrial memory and has driven the material movement on the site.

There are two challenges for reusing the factory: its huge volume and its visual and spatial disconnecting with the quarry. These challenges suggest a shift in function, which is transforming the factory from an industrial enclosure into a site gateway and a platform for public engagement. The adaptive reuse strategy addresses these challenges by repurposing the space to provide strong spatial clues that lead visitors into Quarry Park, and a community hub that introduces social and community activities to bridge the gap between quarrying and the public.

Aligning with the design principle of "Expose", the intervention applies a subtraction strategy, splitting the factory into spatial gaps, revealing glimpses of the quarry. These breaks create visual and physical links of the entrances between the site and the park. The remaining space is broken down into smaller spaces to suit social and community activities. To preserve the industrial narrative, structural elements of the original factory are largely retained, while the roof is selectively removed to

expose the steel framework, making the architectural structure a visible artifact. Some of the brick walls remain, while new walls constructed from white bricks produced on-site create a dialogue between past and present materials. The “Encounter” of factory structures, existing brick walls, and new walls establishes a layered visual language, where elements from different time periods come together.

The spatial program is arranged as a metaphor for the quarry narrative timeline and human intervention process. From west to east, the factory’s functions are:

Botanical Garden Restaurant: Before quarrying, a light intervention.

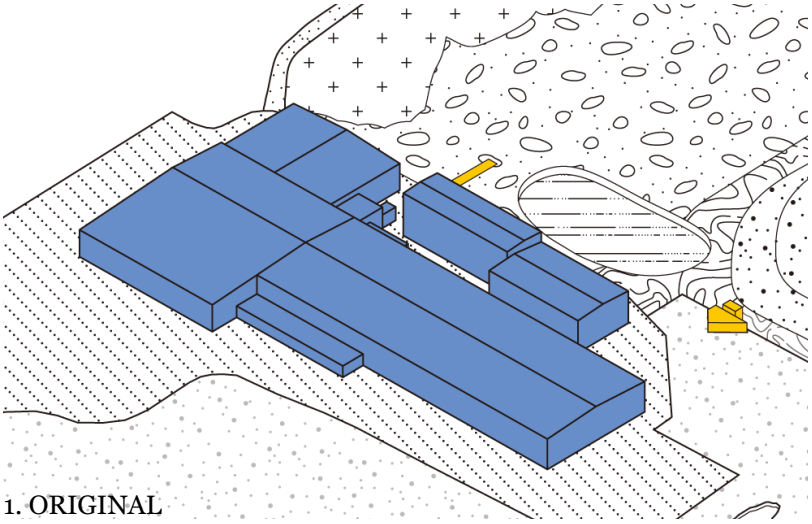
Site History Gallery and Material Recycling Market: Quarrying dominates the movement of materials within the site.

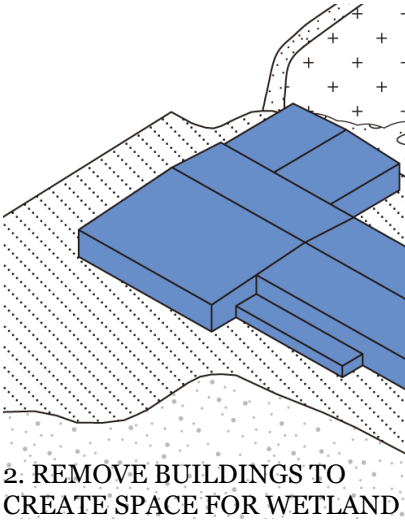
Outdoor Activity Plaza: End of quarrying, reducing interventions while development public engagement

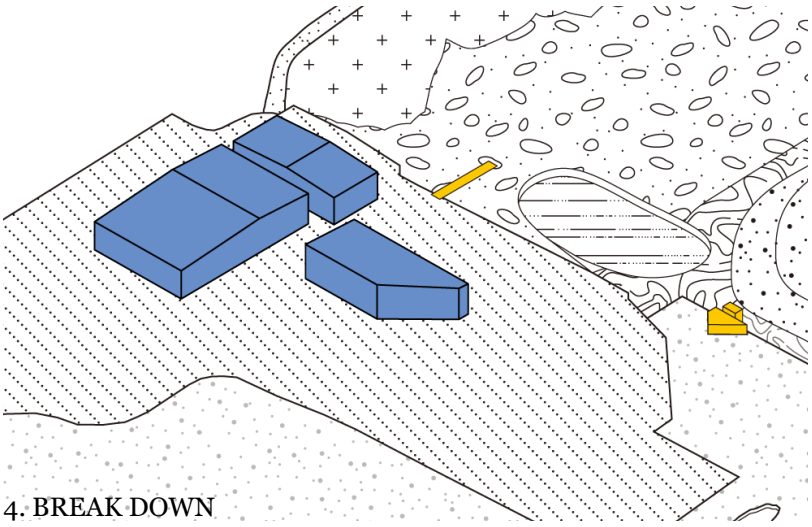
Ruins of the Old Wall: Rehabilitation, a minimal intervention.

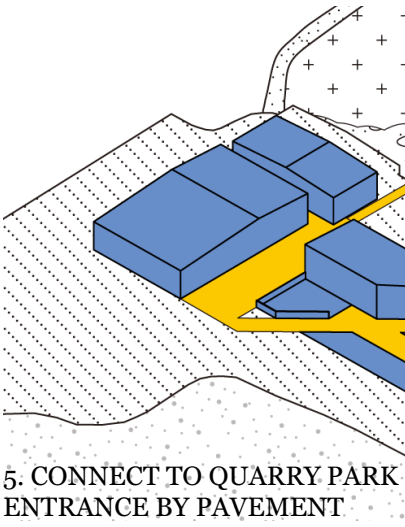
This spatial sequence establishes a loop system between the factory and the park by linking the Botanical Garden Restaurant with the restored green slope of the Quarry Park and the Ruins with the wetlands. Meanwhile, the park’s landscape and paving materials come from the recycling workshop, and the abandoned landscape materials will flow to the material recycling market. The exchange between space, program, and material keeps the site in transformation, reflecting the design principle of “Unfinish”.

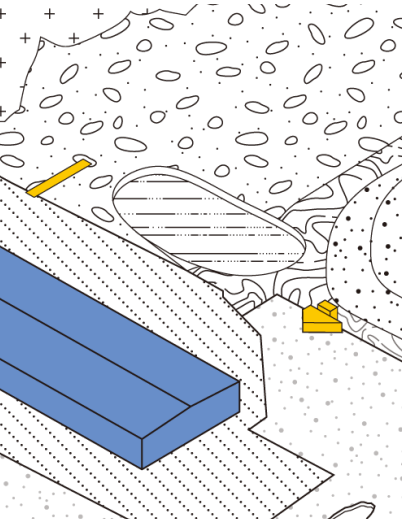
Fig 4.3.1 Factory design strategy. Produced by Author.

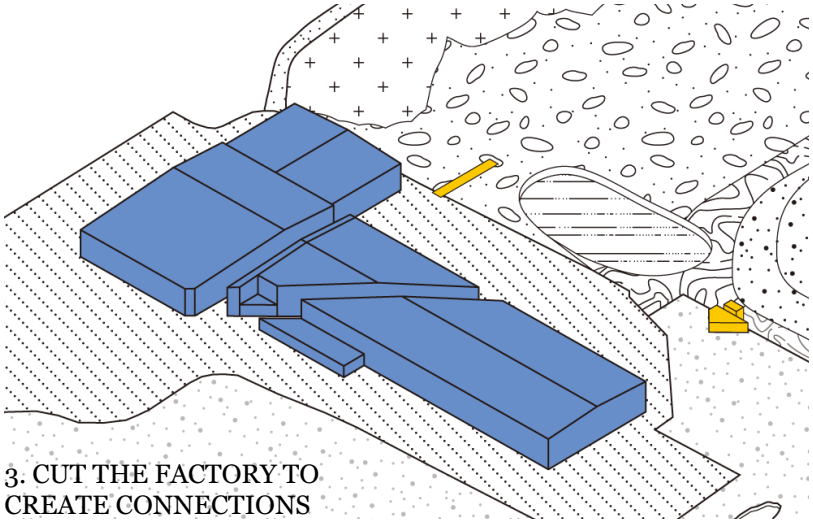




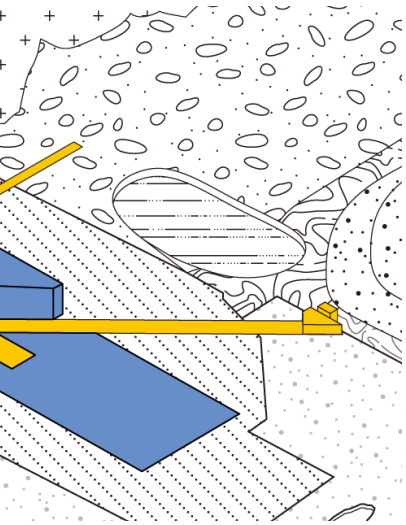


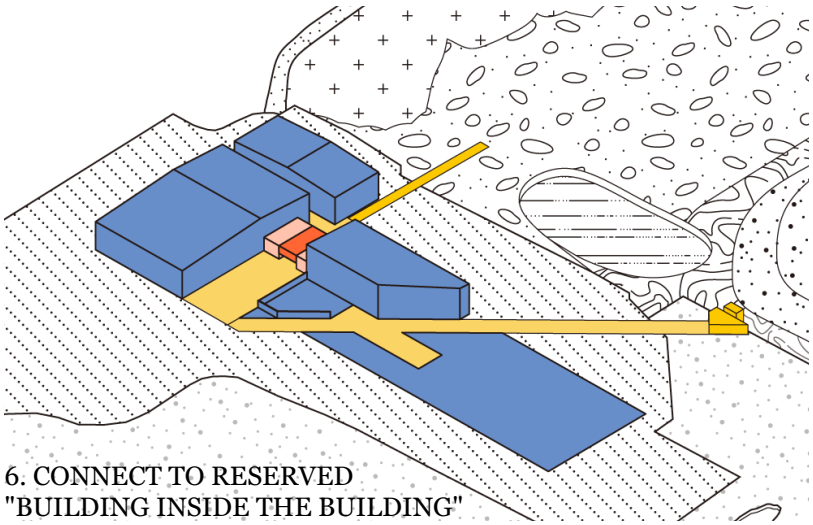






3. CUT THE FACTORY TO
CREATE CONNECTIONS





6. CONNECT TO RESERVED
"BUILDING INSIDE THE BUILDING"

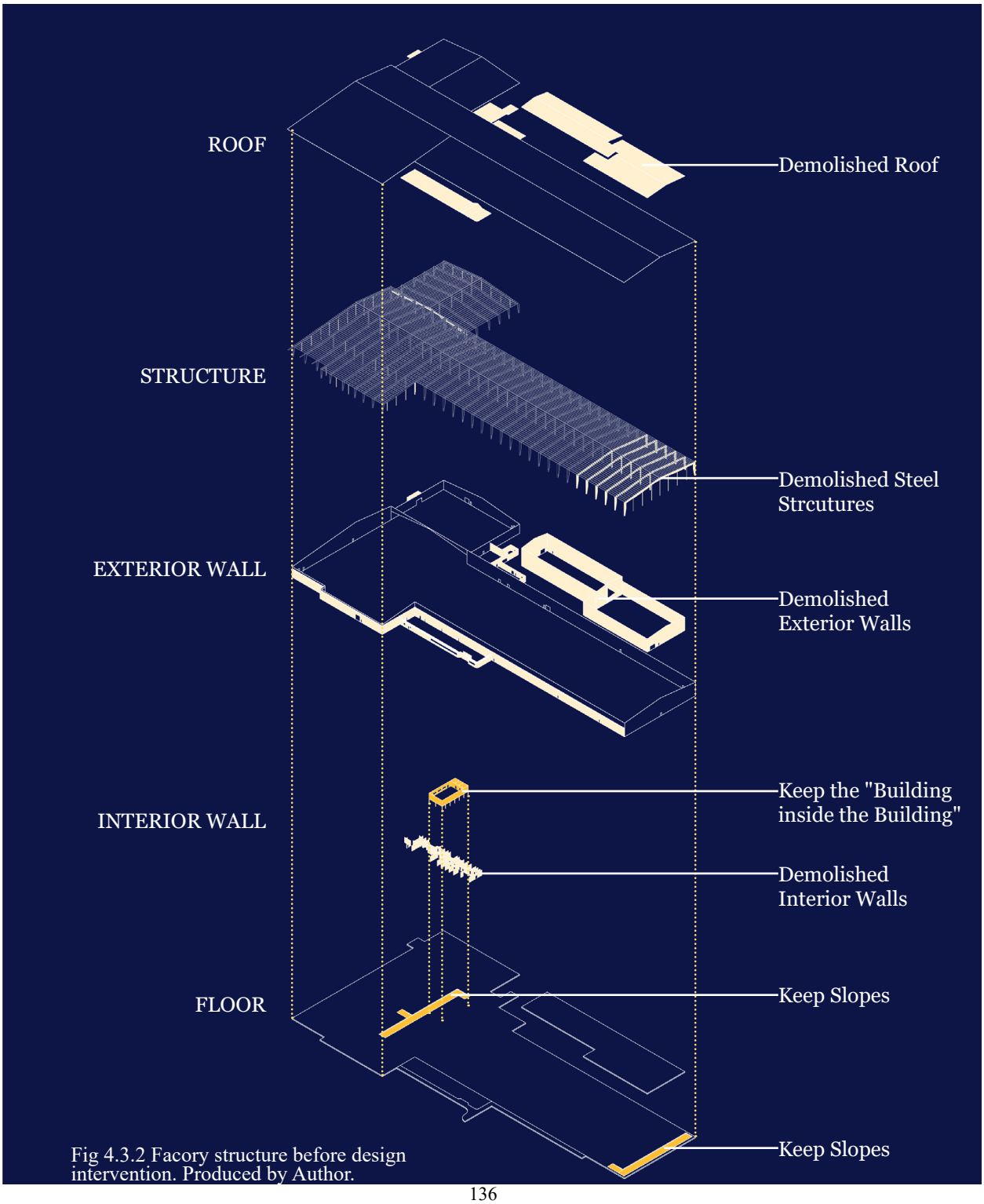


Fig 4.3.2 Facory structure before design intervention. Produced by Author.

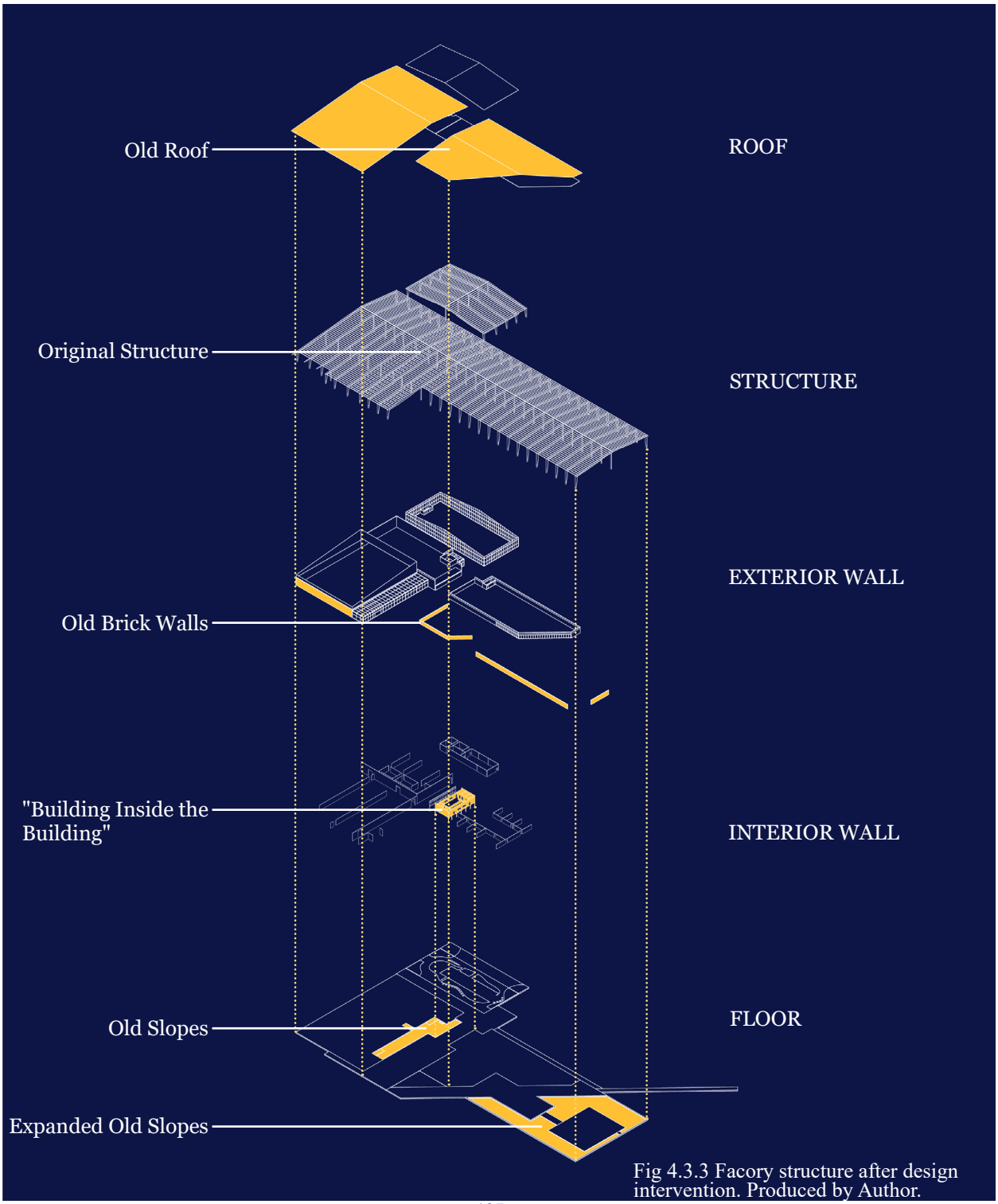
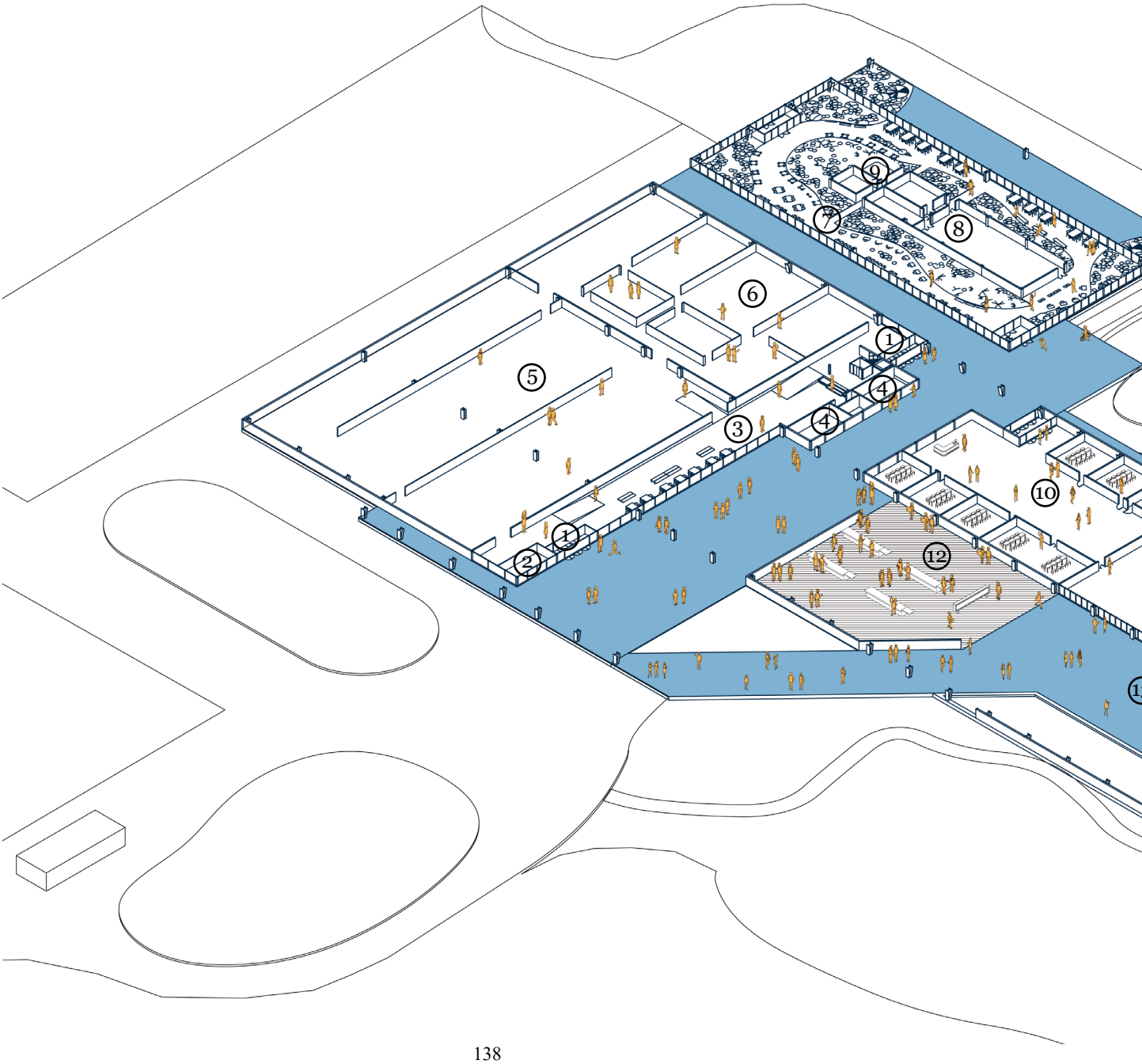


Fig 4.3.3 Facory structure after design intervention. Produced by Author.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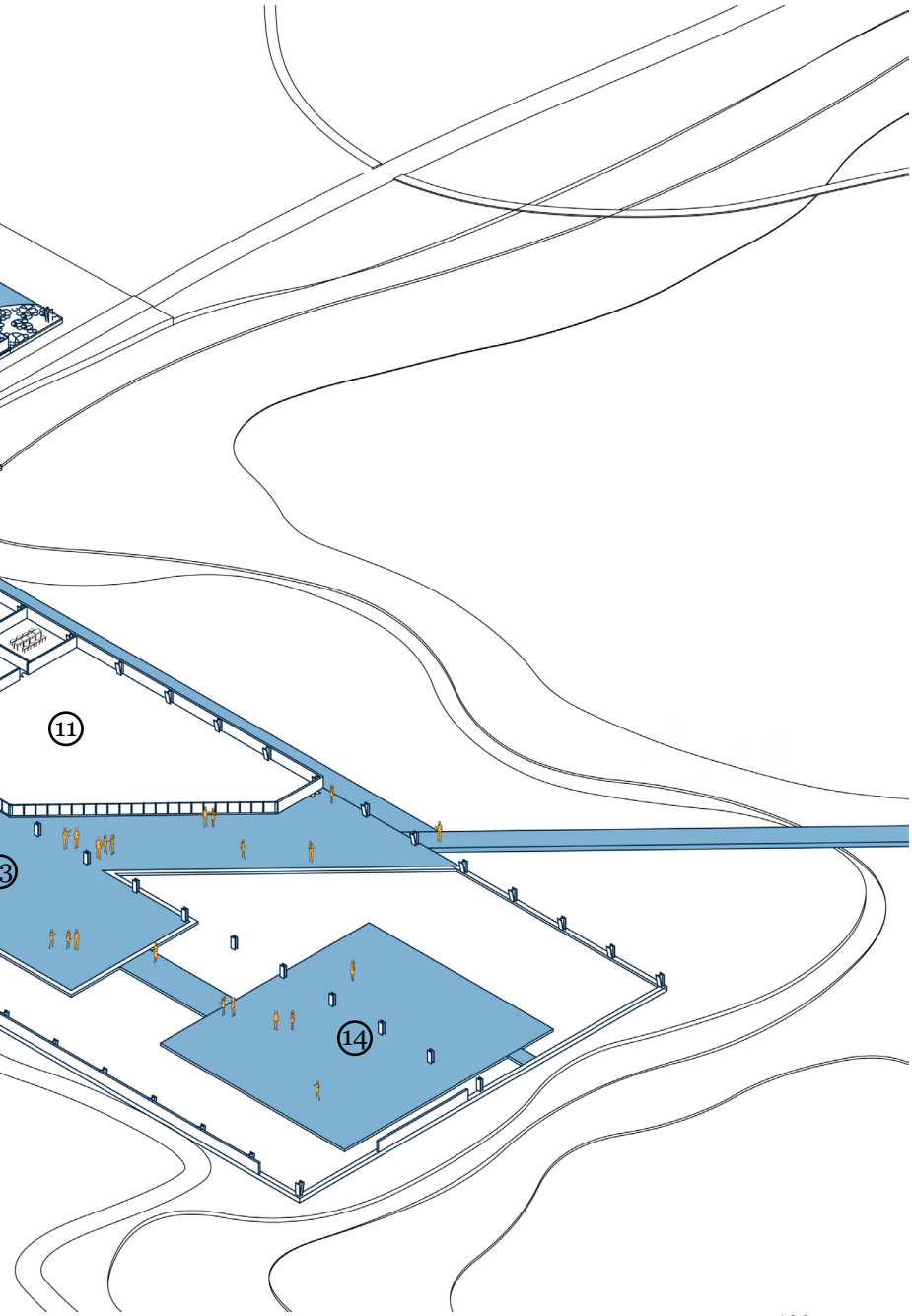
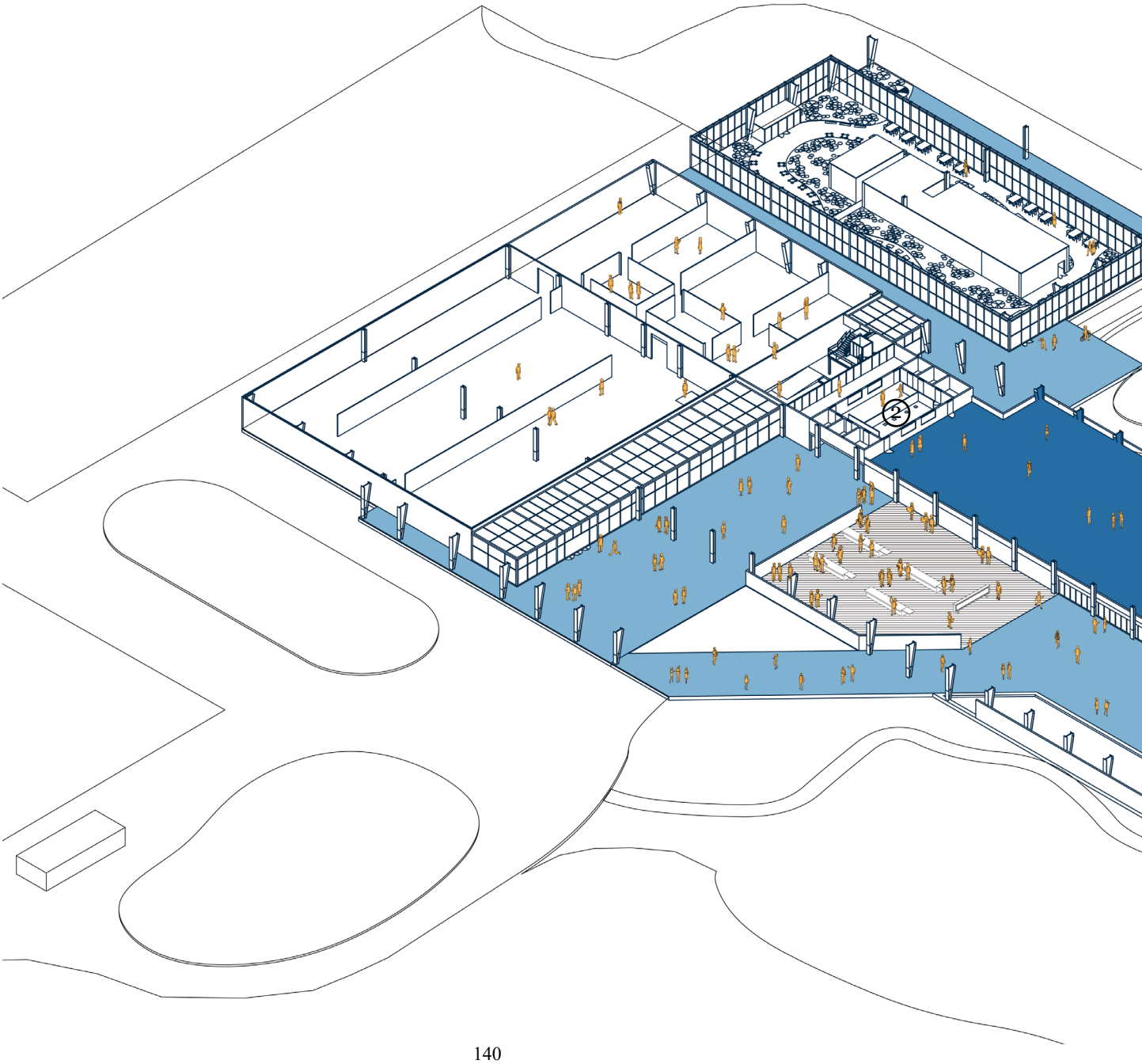


Fig 4.3.4 Factory Ground Floor.
Produced by Author.

1. Community Centre Entrance
2. Community Centre Staff Office
3. Community Centre Cafe
4. Community Centre Washroom
5. Quarry History Museum
6. Community Gallery
7. Botanic Restaurant
8. Botanic Restaurant Kitchen
9. Botanic Restaurant Washroom
10. Aggregate Products Restore and Recreation Workshop
11. Aggregate Products Cutting and Cleaning Room
12. Outdoor Recycled Aggregate Products Market
13. Yard
14. Plaza



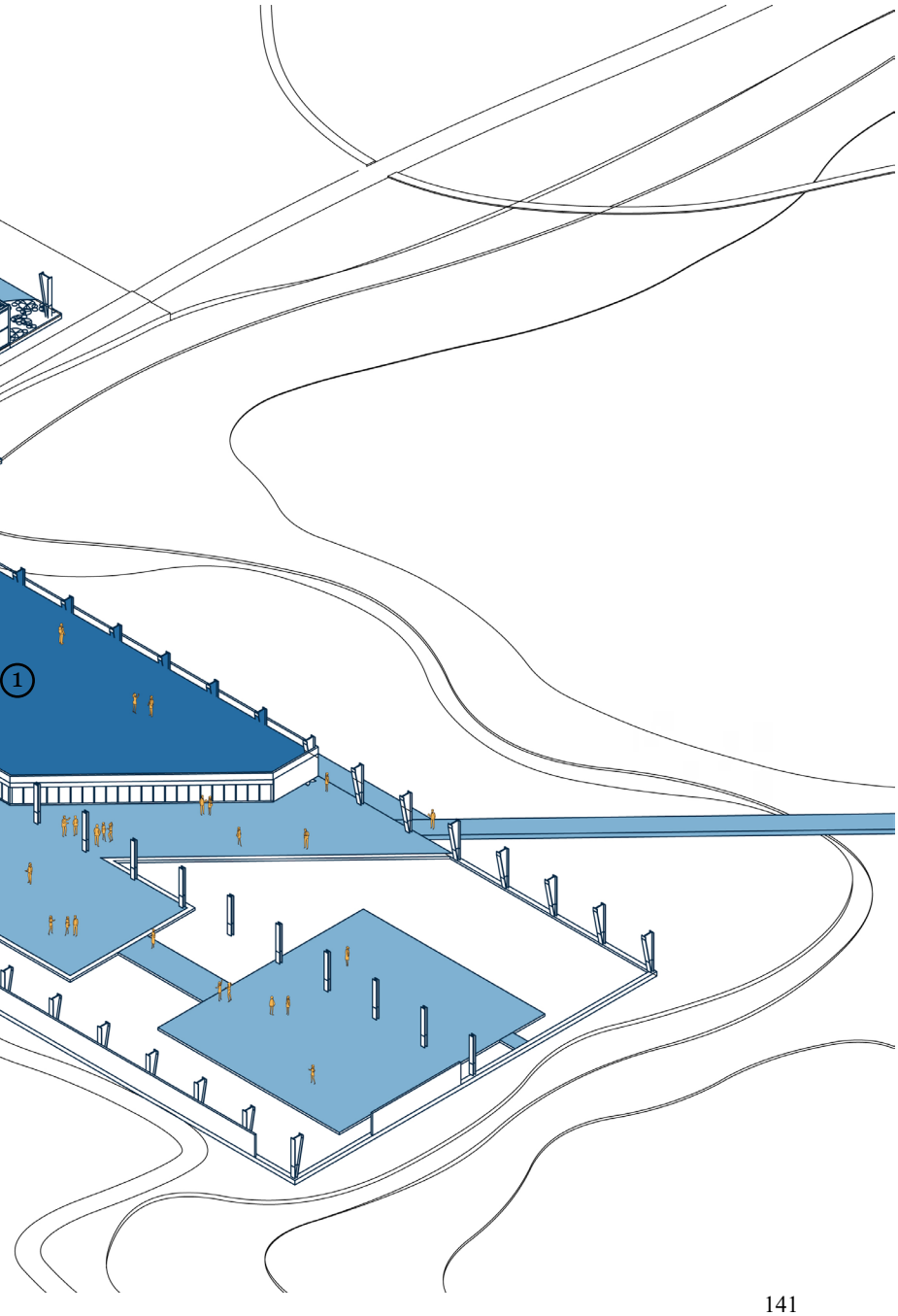
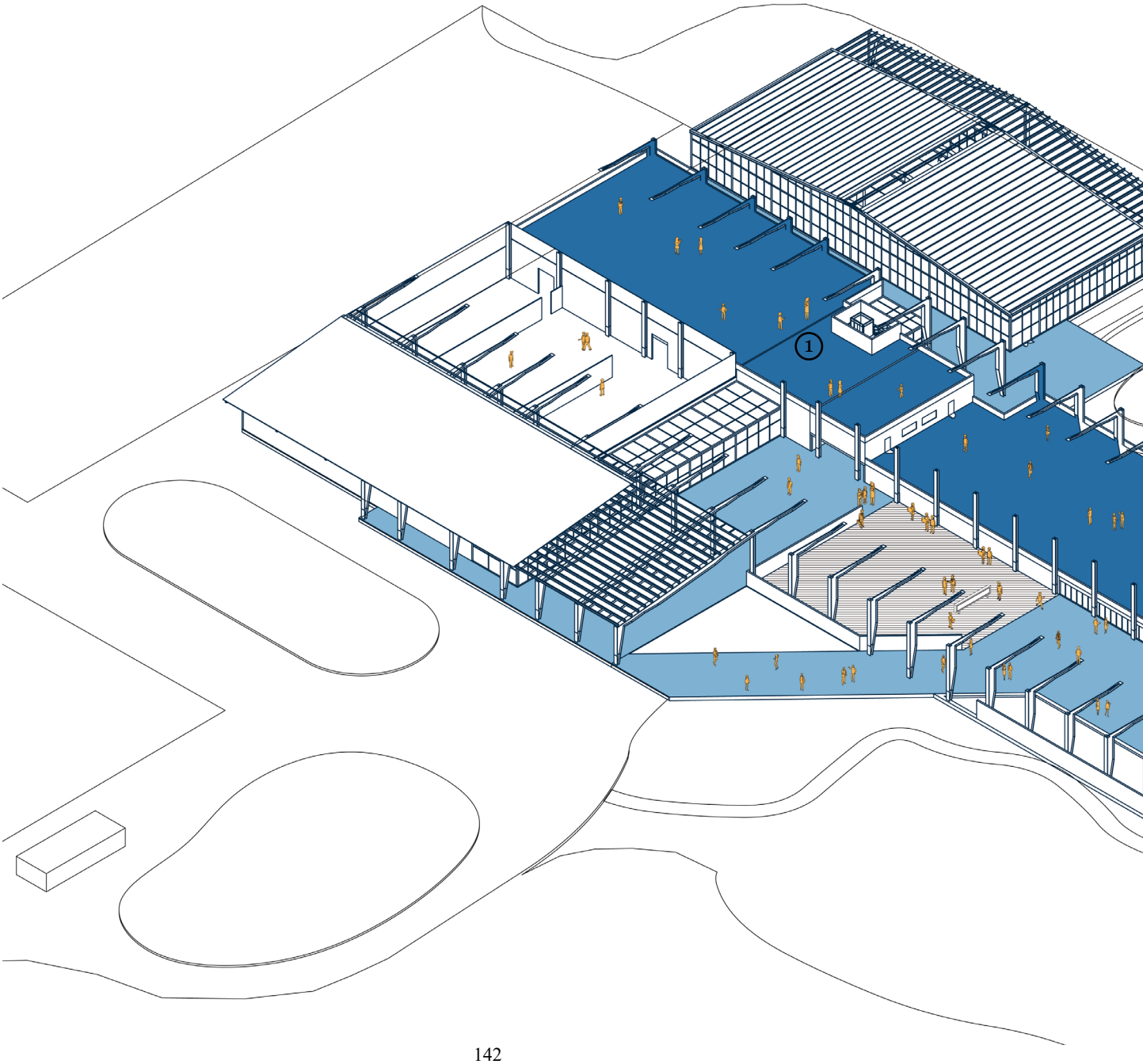


Fig 4.3.5 Factory Second Floor.
Produced by Author.

① Roof Garden

② "Building inside Building" Reused as Staff Office and the Bridge Connect the Roof Garden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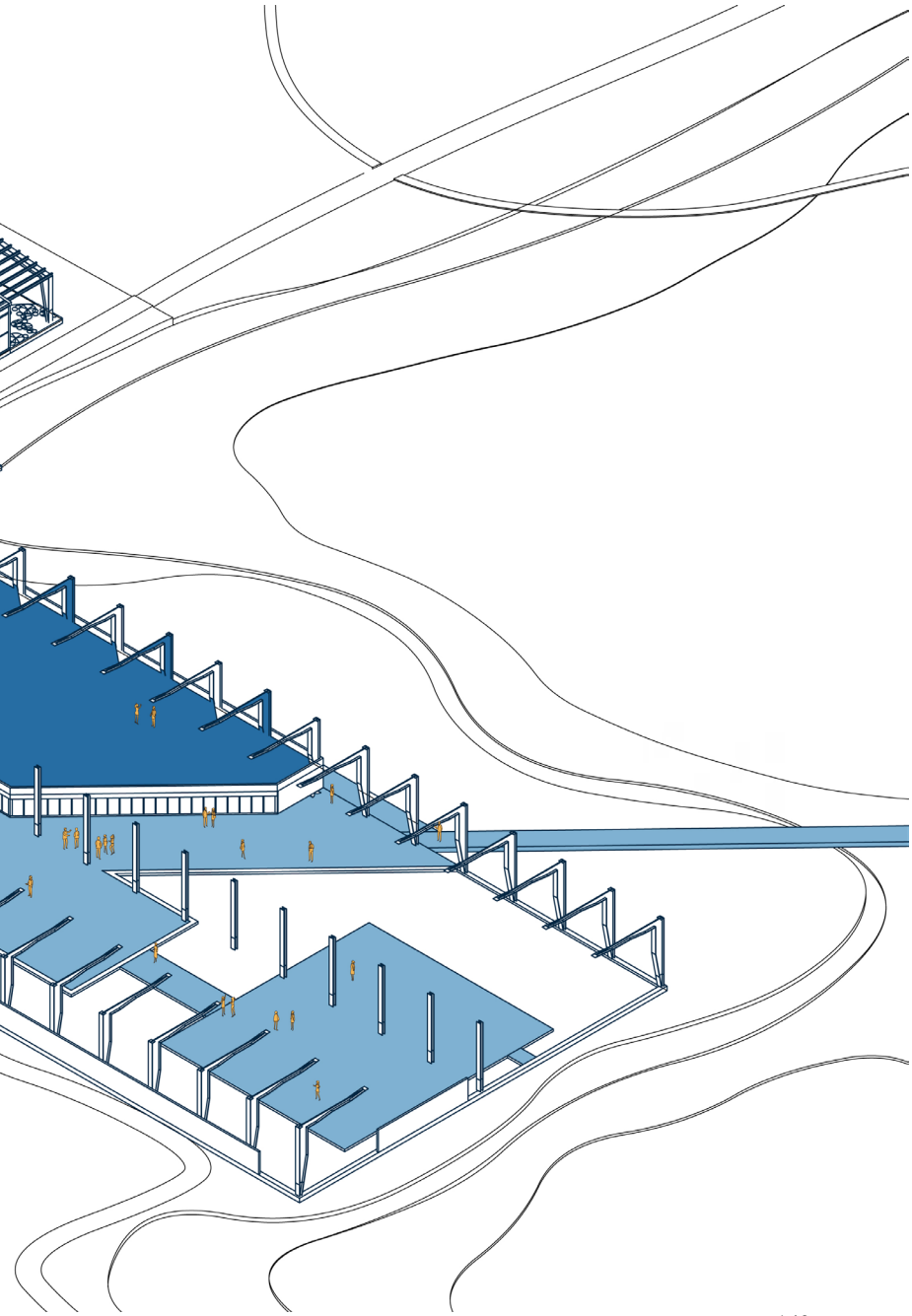
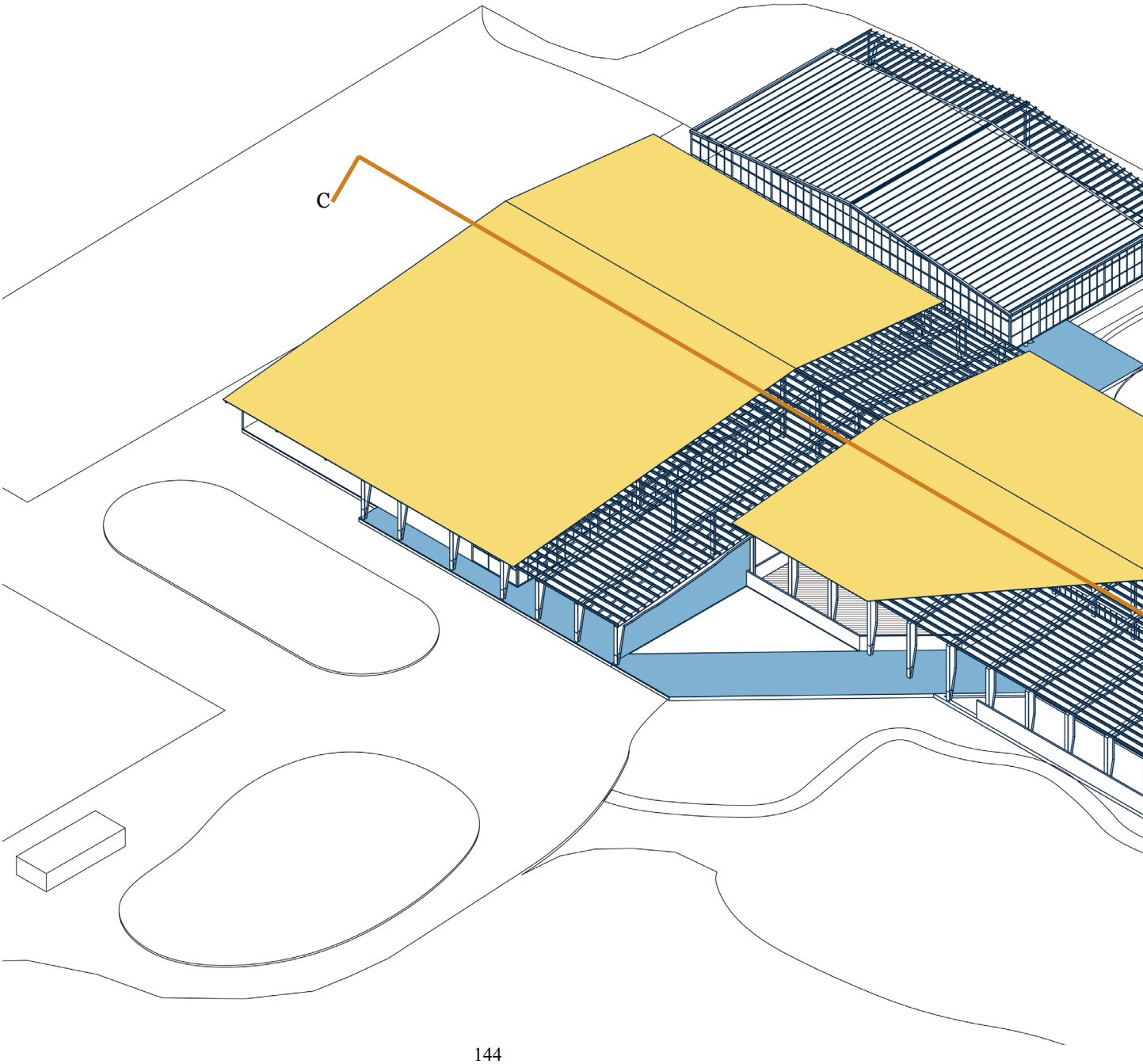


Fig 4.3.6 Factory Third Floor.
Produced by Author.

① Roof Garden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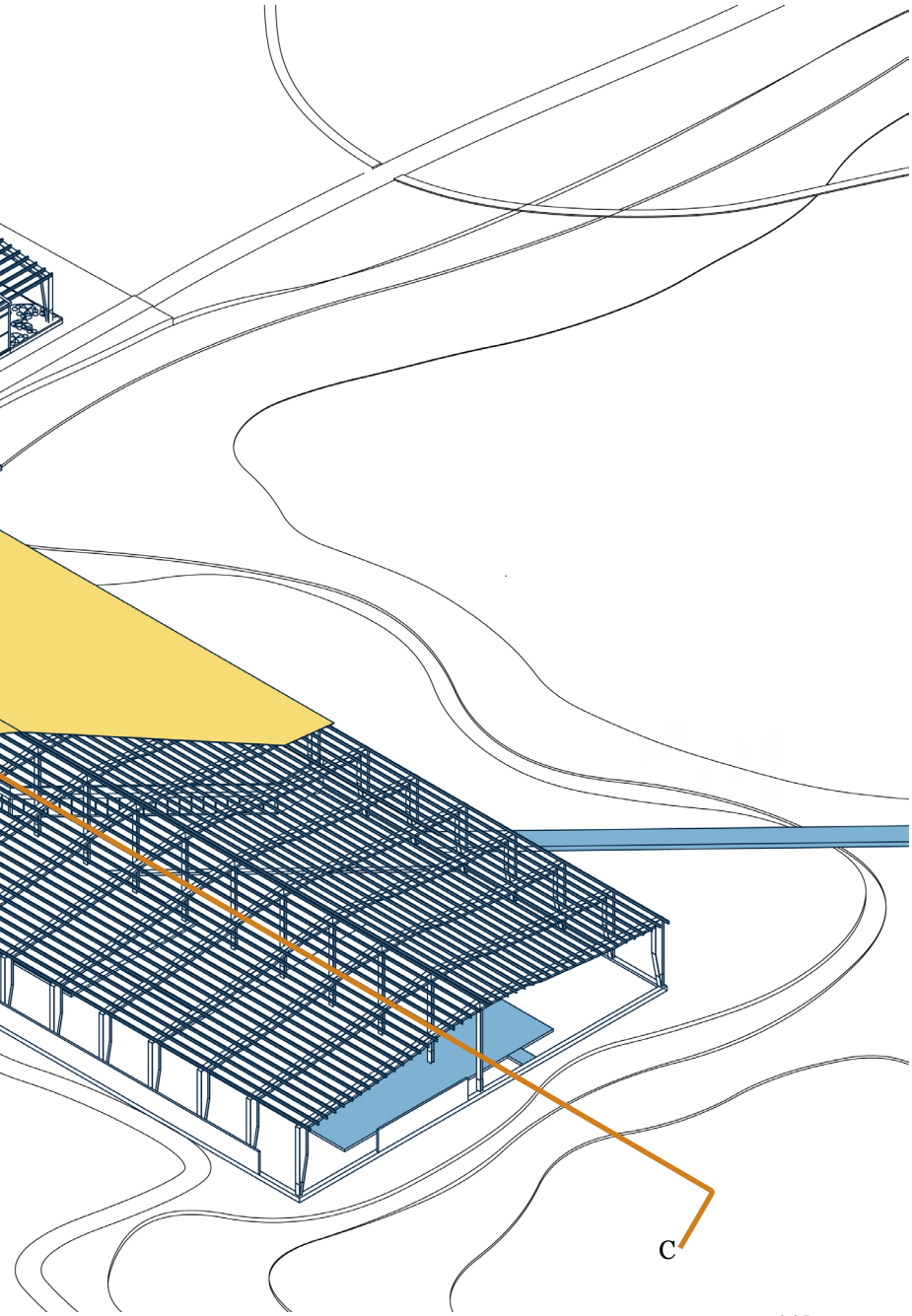

Fig 4.3.7 Factory Axonometric.
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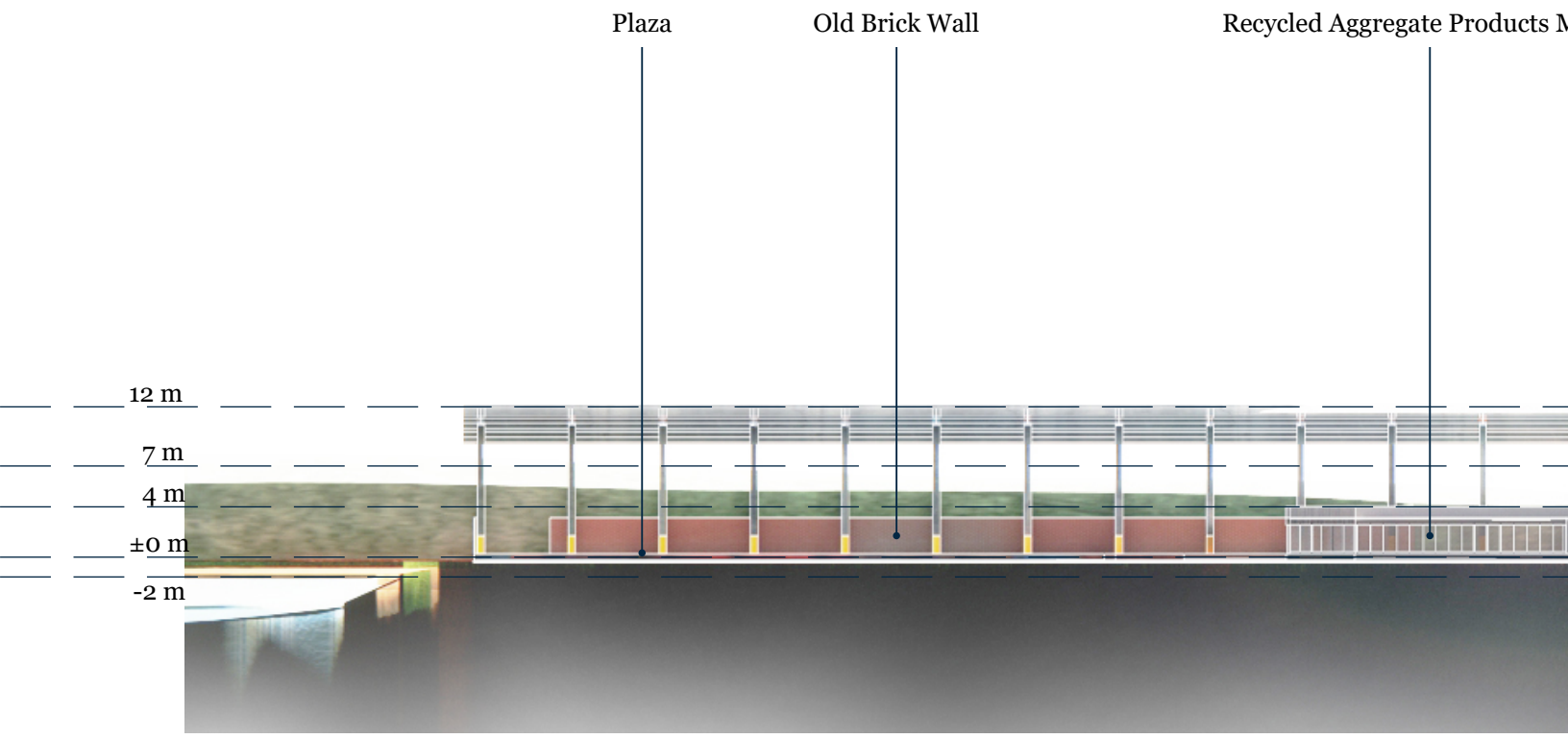
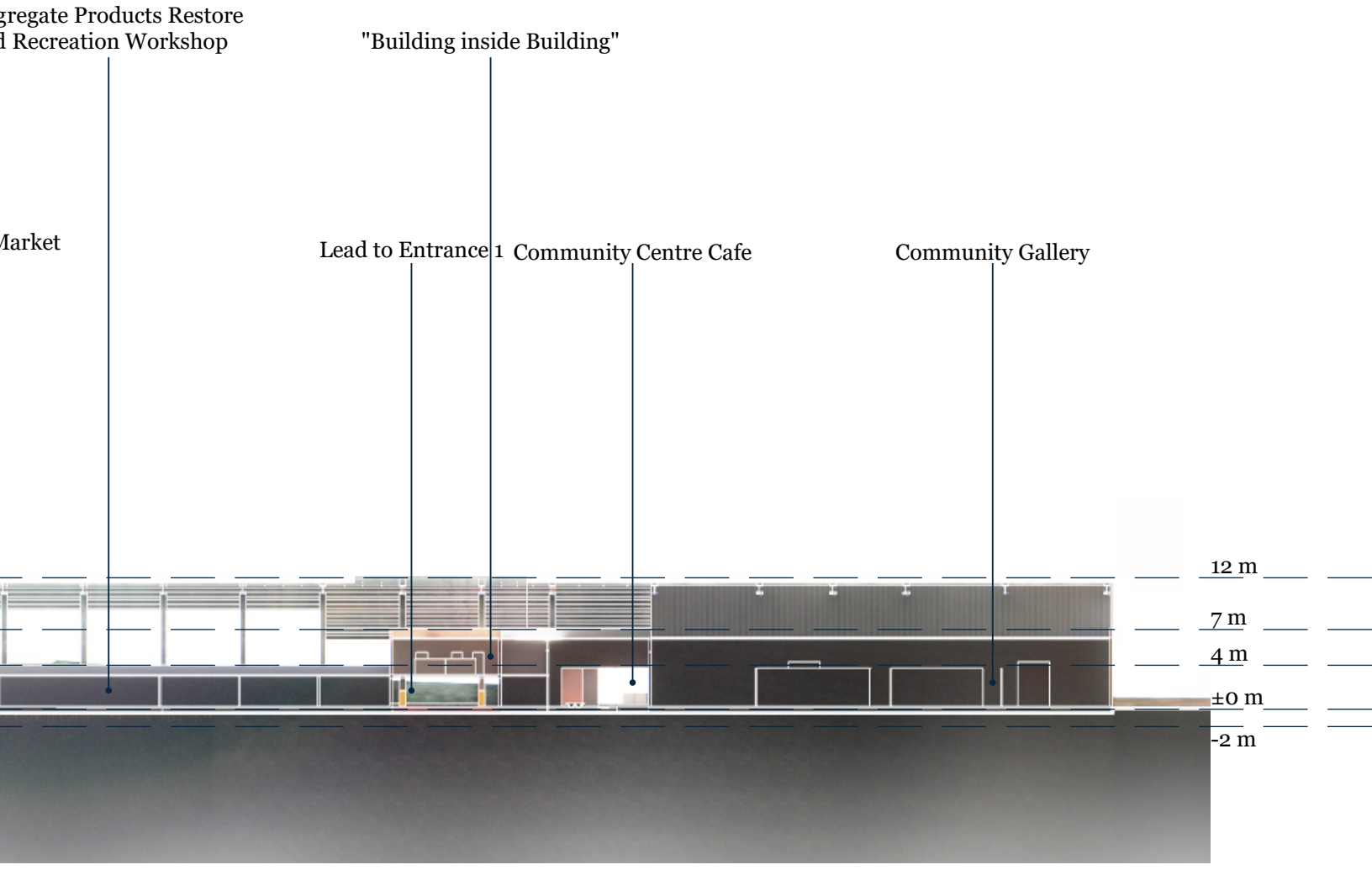


Fig 4.3.8 Factory Section CC. Produced by Author.


gregate Products Restore
d Recreation Workshop
"Building inside Building"
Market
Lead to Entrance 1
Community Centre Cafe
Community Gallery
12 m
7 m
4 m
±0 m
-2 m

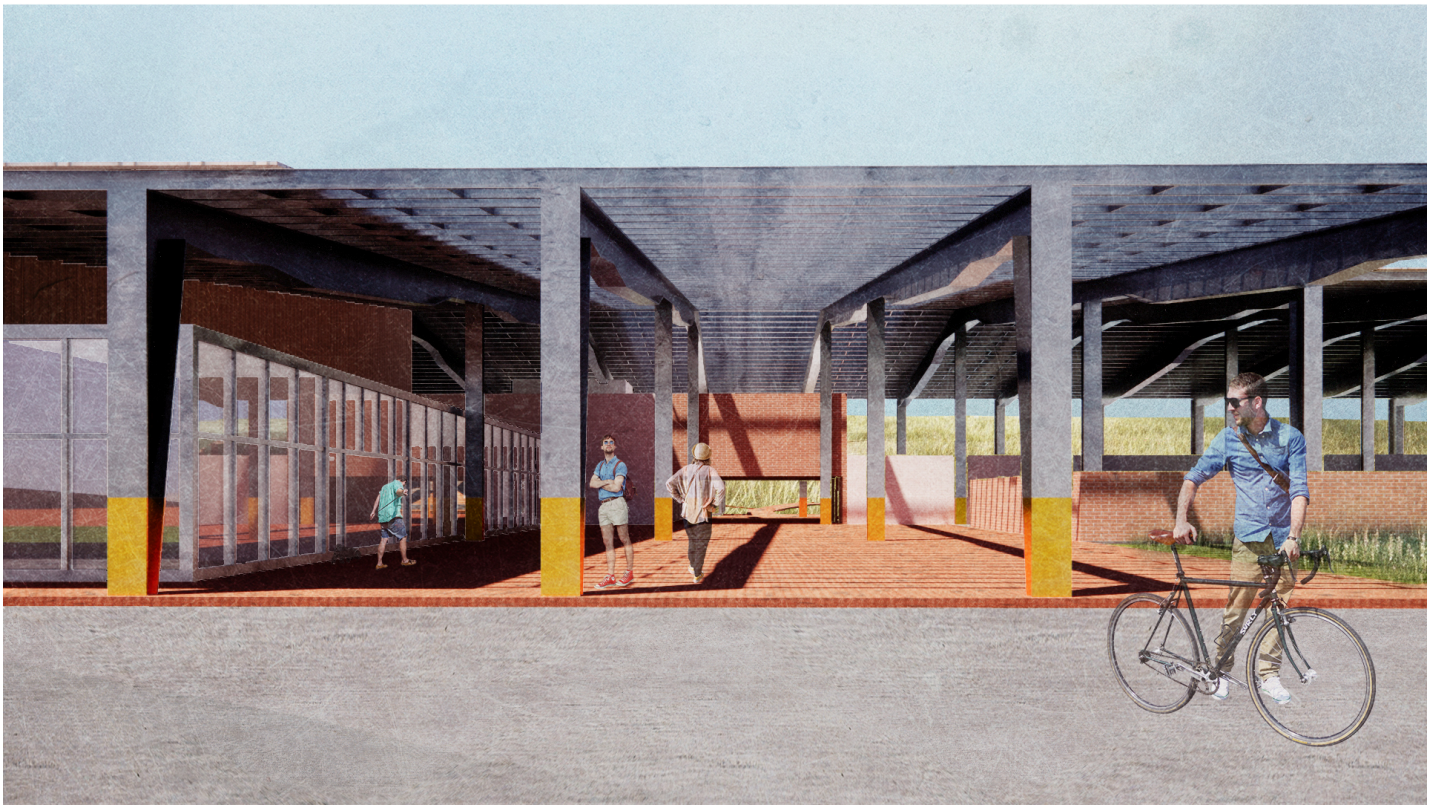


Fig 4.3.9 Factory Rendering of Entrance 1. Produced by Author.

Fig 4.3.10 Factory Rendering of Entrance 2. Produced by Author.

Chapter 4

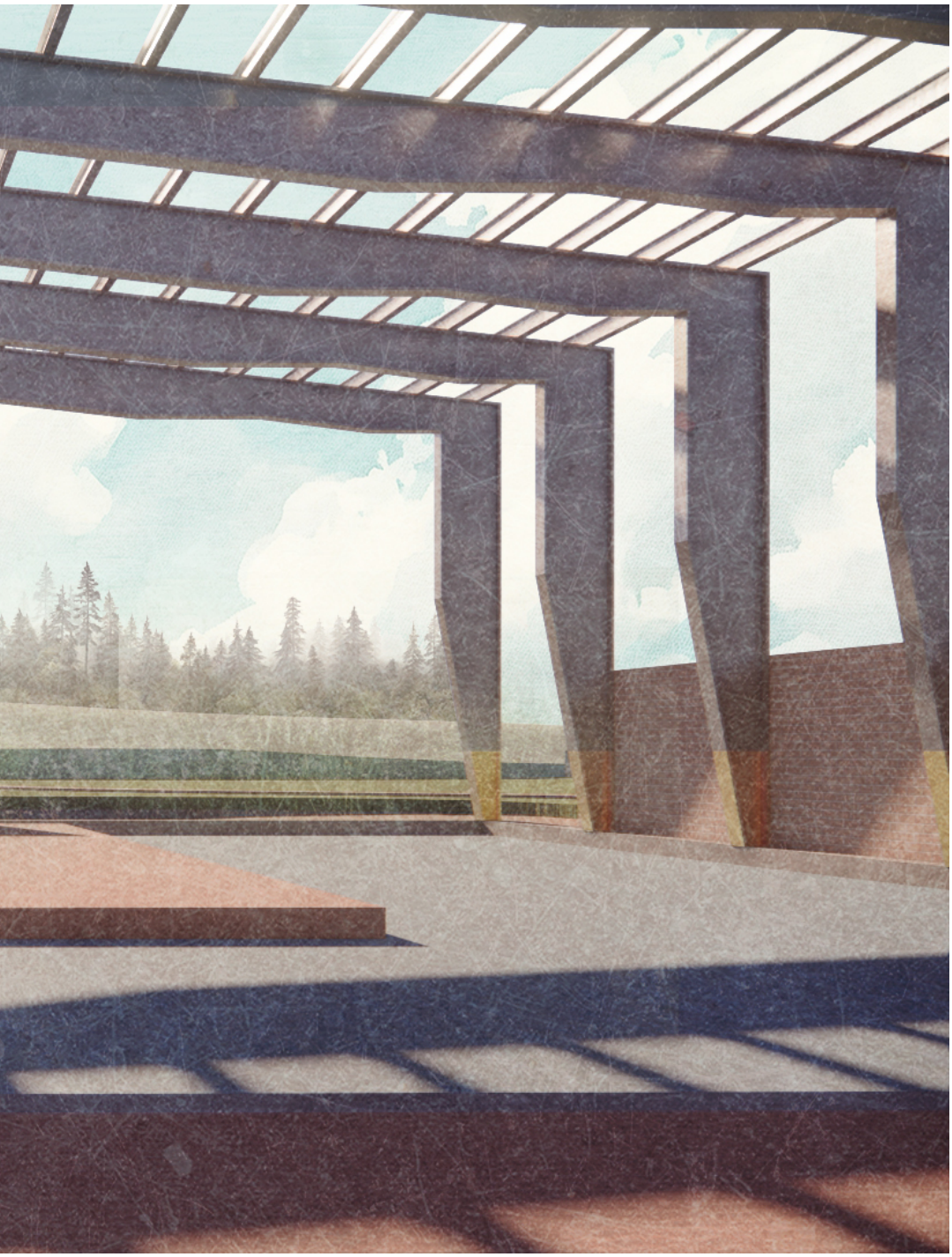
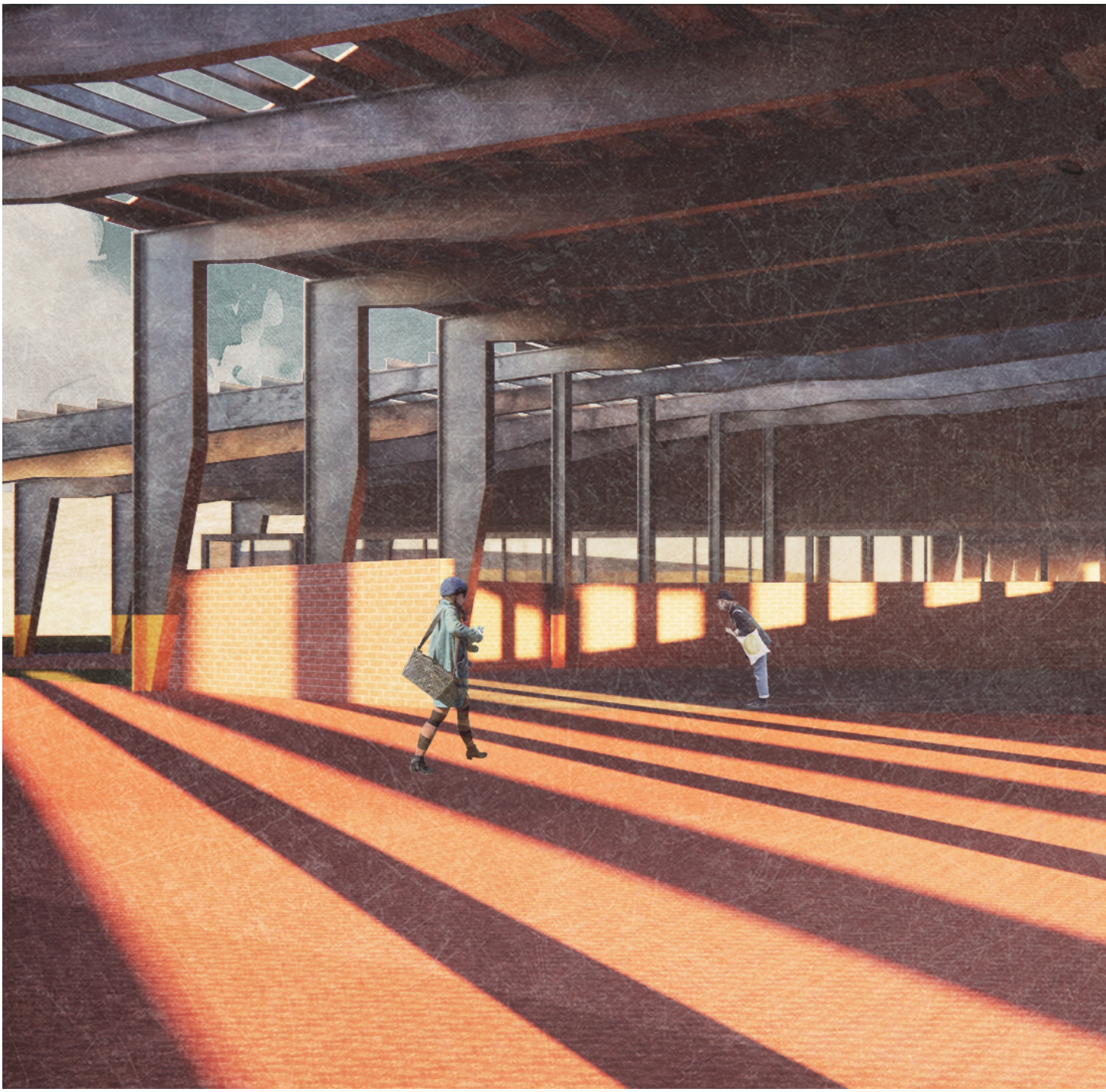


Fig 4.3.11 Factory Rendering of Plaza. Produced by Author.

Chapter 4



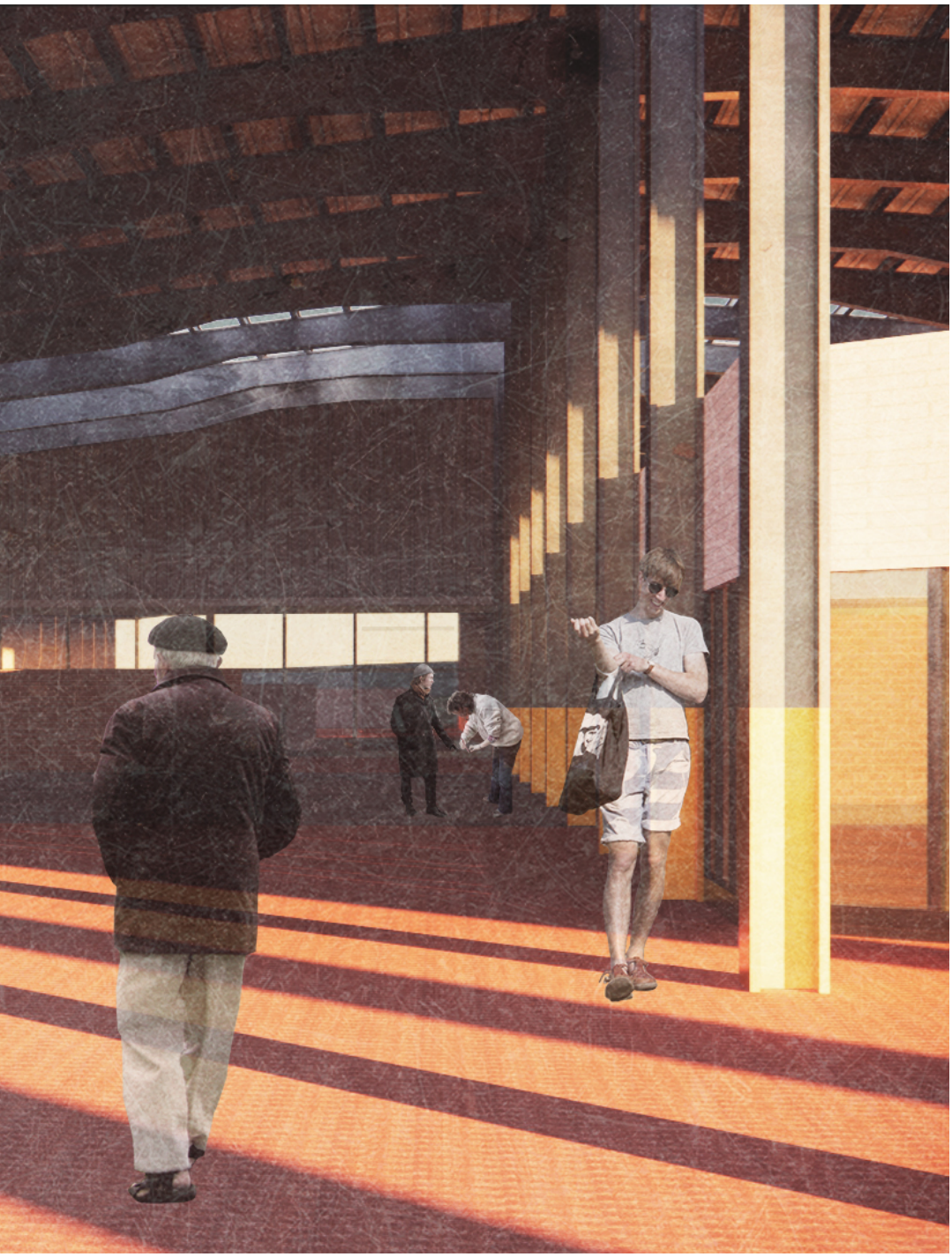


Fig 4.3.12 Factory Rendering of Recycled Aggregate Products Market. Produced by Author.

Chapter 4

Fig 4.3.13 Factory Rendering of Gallery Cafe. Produced by Author.

Chapter 4

Fig 4.3.14 Factory Rendering of Botanic Restaurant. Produced by Author.

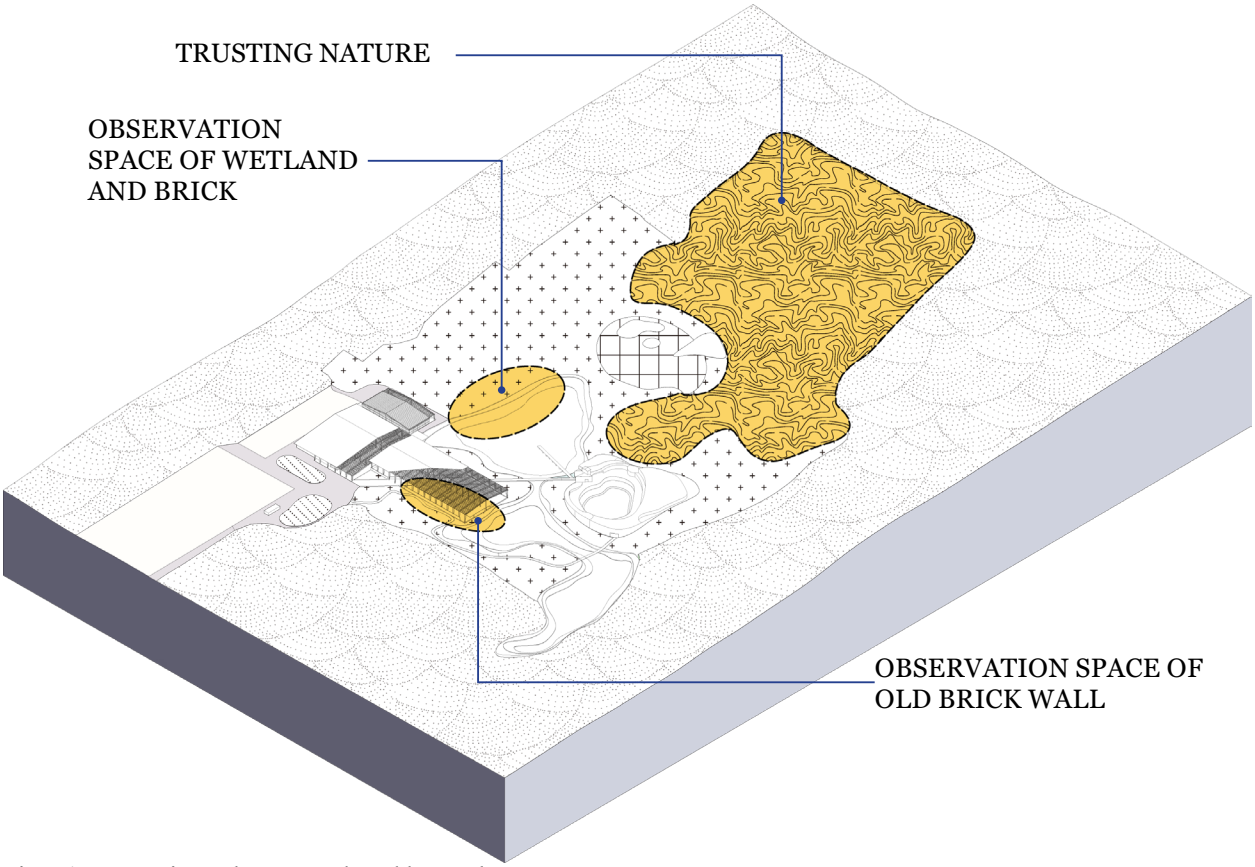


Fig 5.1 Uncertainty Places. Produced by Author.

CHAPTER 5. A SPACE FOR UNCERTAINTY

Expose—Demonstrate the uncertain elements

Encounter—Places for elements interaction

Unfinish—Escape from the design

Chapter 5 pushes the design beyond the control of interventions, including uncertainty as a necessary part. There is no fixed design outcome, but exploring how design can “Expose” the elements that are most visible to change. It identifies materials such as brick fragments and exposed quarry surfaces. These elements are positioned within specific spatial conditions to “Encounter” external elements such as water, plants, or human engagement. Finally, the principle of “Unfinish” challenges conventional rehabilitation by stepping back from complete control, leaving certain areas to keep evolving on their own.

5.1 GROWING GREEN AND TRUSTING NATURE

Inspired by the passive rewilding strategy of the Memorial Park of IBC, the proposal trusts in nature's resilience. This is not passive neglect, but a strategic decision based on the site close to the Greenbelt and the NHS region, where the rich biodiversity and ecological connectivity support natural regeneration. The site's existing rehabilitation efforts of reforestation have already begun, giving an advantage for plant spread. Besides, the naked quarry surfaces provide different geological and soil conditions for plant succession, which brings more uncertainty.

5.2 OBSERVATION SPACES

Materials themselves are reassembled through natural forces. To make this process visible, the design intentionally leaves certain materials exposed in different forms to interact with weathering, water, and plant growth. Exposing portions of the factory's brick walls to outdoor conditions without maintenance. Showing how bricks gradually weather, crack, or are occupied by plants. Maintain the broken bricks along the wetland edges. These fragments will shift, erode, and integrate into the soil and vegetation. Emphasize the concept that materials never truly disappear. They become part of other reassembled matters and exist in different forms. By framing these slow, material movements as part of the design, the proposal blurs the line between natural and artificial. Industry and ecology are often treated as opposites, yet this approach indicates that human activity is part of the broader material cycle.

THIS IS NOT THE END

The proposal accepts that all material movements, whether geological, biological, or industrial, are part of the same system, instead of drawing a strict line between “natural” and “artificial”. Quarrying is a moment within a narrative of reassembly.

Make the site grow—even the designer doesn’t know what it will look like in years.

And

Create A place of uncertainty.

Fig 5.2 Collage of Trusting Nature. Produced by Author.

Fig 5.3 Collage of Obseervation space, Wetland and Bricks. Produced by Author.

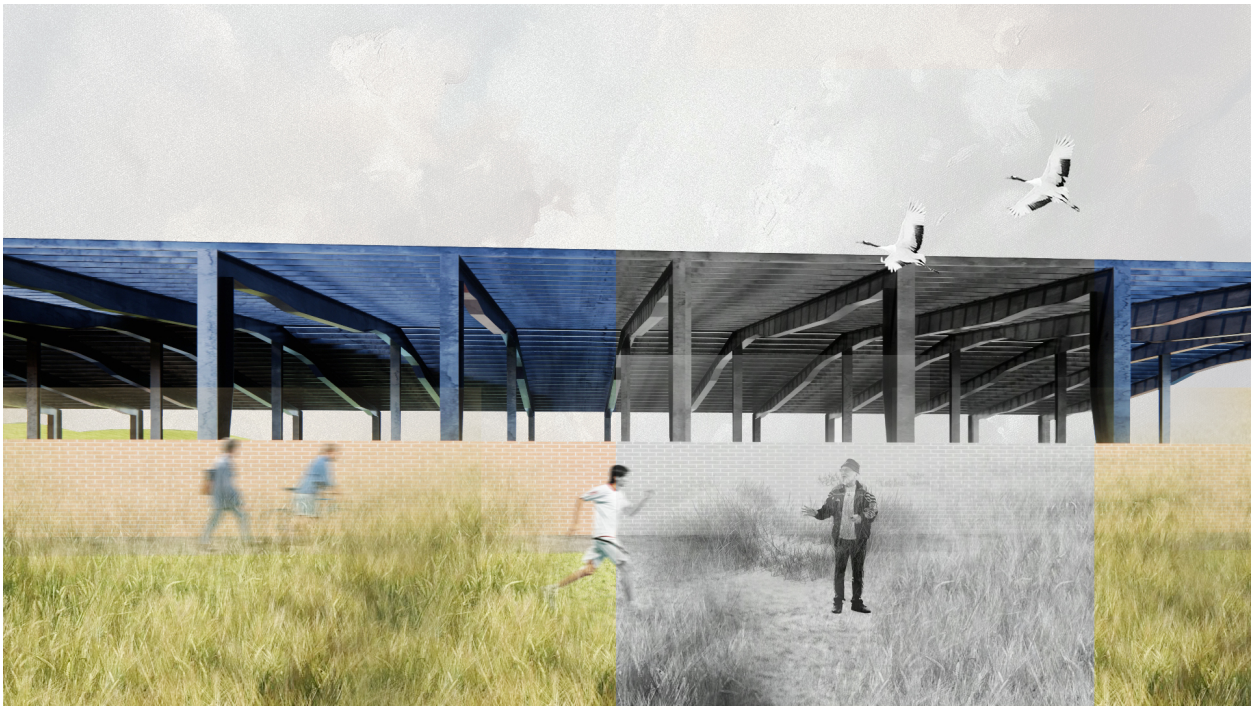


Fig 5.4 Collage of Observation Space, Old Brick Wall. Produced by Author.

Fig 6.1 Night rendering. Produced by Author.

CHAPTER 6. CONCLUSION

Chapter 6

This thesis provides an alternative perspective of aggregate quarry that includes human activities as a part of natural movements, which participate in the landscape reshaping with animals, plants, and natural forces together. Aggregates are essential to everyone but have caused disputes due to their environmental and social impacts. The physical segregation between the quarry and the public during the whole extraction process makes conflicts last because of the non-transparent information. Moreover, the conventional rehabilitation approaches tend to erase the traces of extraction, which serve regulations but cover the material movements brought by quarries and further distance the public from the quarry. But what if we keep the extraction traces visible and turn these post-industrial landscapes into living archives of material exchange, bridging the gap between extraction and public awareness? Studying quarry rehabilitation is beyond an analysis of landscapes, which is an exploration of time, materiality, and human perception. This thesis tried to redefine what it means to 'restore' a quarry, arguing that post-extraction sites should not be seen as land scars to be healed but as moments in an ongoing material reassembly. Therefore, the research posed the following question: What are the design principles for revealing material assembly moments and integrating human activities into natural processes on a post-extraction landscape?

Typically, rehabilitation is framed as a process that returns the land to a stable, predefined state, such as agricultural land, parkland, or residential development. The research recognized material exchange as a design medium, looking for a more open engagement with the realities of extraction. Through the research and design intervention at the West site of Aldershot Quarry, the rehabilitation project integrated

public engagement and accessibility and created places for observation, interaction, and ecological succession. There are three design principles developed in this thesis: “Expose”, “Encounter”, and “Unfinish”.

Expose identifies the key site elements involved in the material movements, history, and transformations visible to visitors. These elements are presented as evidence of the site’s past and ongoing change, bringing a deeper understanding of how landscapes evolve. By reappearing working quarry faces, repurposing stockpiles, and integrating historical extraction routes, the project ensures that material reassembly is not abstract but physically present, allowing visitors to see and experience the quarry’s transformation.

Encounter provides places to gather the elements, both in reality and virtually, and create a narrative of movements. These places invite people to read and engage with the process of material reassembly. The site is designed as places where visitors are walking and cycling along exposed cut-and-fill topography, experiencing the Queenston shale geological features, and observing the interaction of water, soil, vegetation, and animals in the wetland system. Public programs within the repurposed factory provide additional opportunities for participation, which ensure visitors do not passively observe but actively experience the process of site reshaping.

Unfinish emphasizes that the material movements are endless and puts the extraction sites in a dynamic model. The design encourages uncertainty by allowing nature and human activity to continue shaping the site out of the designer’s control. Specific areas are left for passive rewilding, where plants recolonize at their own pace. The waste bricks

near the water and a brick wall from the former factory are reserved, left to weather and break down to create a record of material decay and reassembly.

While this thesis proposes a new perspective to engage post-extraction landscapes through the lens of material reassembly, its implementation still has challenges. Quarry rehabilitation is shaped by regulatory policies, ecological uncontrollability, and public perception, all of which present potential obstacles to realizing the proposed design approach.

One of the challenges is policy restrictions. Current rehabilitation policies often prioritize stability and predictability, aiming to return extraction sites to predefined land uses such as agricultural fields, parks, waters, or urban developments. These regulatory frameworks leave little room for experimental, evolving landscapes that contain uncertainty. Allowing a site to remain “unfinish” challenges conventional ideas of environmental management, requiring policymakers and stakeholders to reconsider how quarries are integrated into long-term land-use planning. Another challenge is ecological uncontrollability. The rate of plant colonization, the resilience of new habitats, and the long-term impacts of climate change introduce variables that cannot be fully predicted. The interaction between human intervention and natural succession will require lasting monitoring and adaptive management. Public perception and engagement also present difficulty in implementing this strategy. Many communities hold doubts about extraction sites, either because of environmental concerns or the longstanding physical and psychological distance between quarries and the public. The success depends on whether visitors can form effective connections with the site and whether they are willing to experience material movements. Lastly,

the gaps between the long-term ecological and social impacts of treating quarries as sites of material reassembly require follow-up studies. How do human interactions influence the site's ecological succession? What are the implications of leaving industrial landscapes exposed for decades or centuries? Further research needs to compare traditional models with open-ended rehabilitation strategies in terms of biodiversity, environmental resilience, and public engagement.

The design principles and strategies proposed in this thesis turned the West site into an experimental case and a comparison with the Middle site, which follows the conventional rehabilitation plan. It provides an opportunity to break the border between the public and the Aldershot Quarry by inviting the local citizens into a quarry narrative and bringing an extra option for mediating the disputes surrounding the Aldershot Quarry extension plan of the East site, which is located adjacent to the community and has been a site of conflict for a few years.

Furthermore, this design proposal could go beyond Aldershot Quarry and offer a framework for rethinking where post-extraction landscapes are heading. The principles developed in this thesis can be adapted to various types of post-extraction landscapes, including limestone quarries and sand and gravel pits. While the circumstances of each site are different, the strategy of integrating material reassembly as a design approach remains relevant. This adaptability suggests that the methodology applied at Aldershot Quarry can serve as a prototype for rehabilitating extraction sites, particularly in areas where aggregate resources are critical but controversial. Future research could explore how this approach could be localized to different environmental conditions, material types, and socio-political contexts. This research

encourages policymakers and planners to rethink how extraction sites are integrated into urban, ecological, regional planning and inspires a shift to flexible, evolving rehabilitation policies that allow for gradual ecological processes, public engagement, and ongoing material movements. It also indicates the importance of public access to industrial landscapes, especially for urban expansion areas, where the industrial sites often become contested spaces between environmental conservation, economic development, and public use. If extraction is necessary to sustain urban growth, then making these landscapes accessible becomes a tool for the public to develop a more informed and responsible relationship between resource consumption and environmental impact.

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APPENDIX

a. RESOURCES FROM THE MERIDIAN BRICK FACTORY, BURLINGTON OFFICE

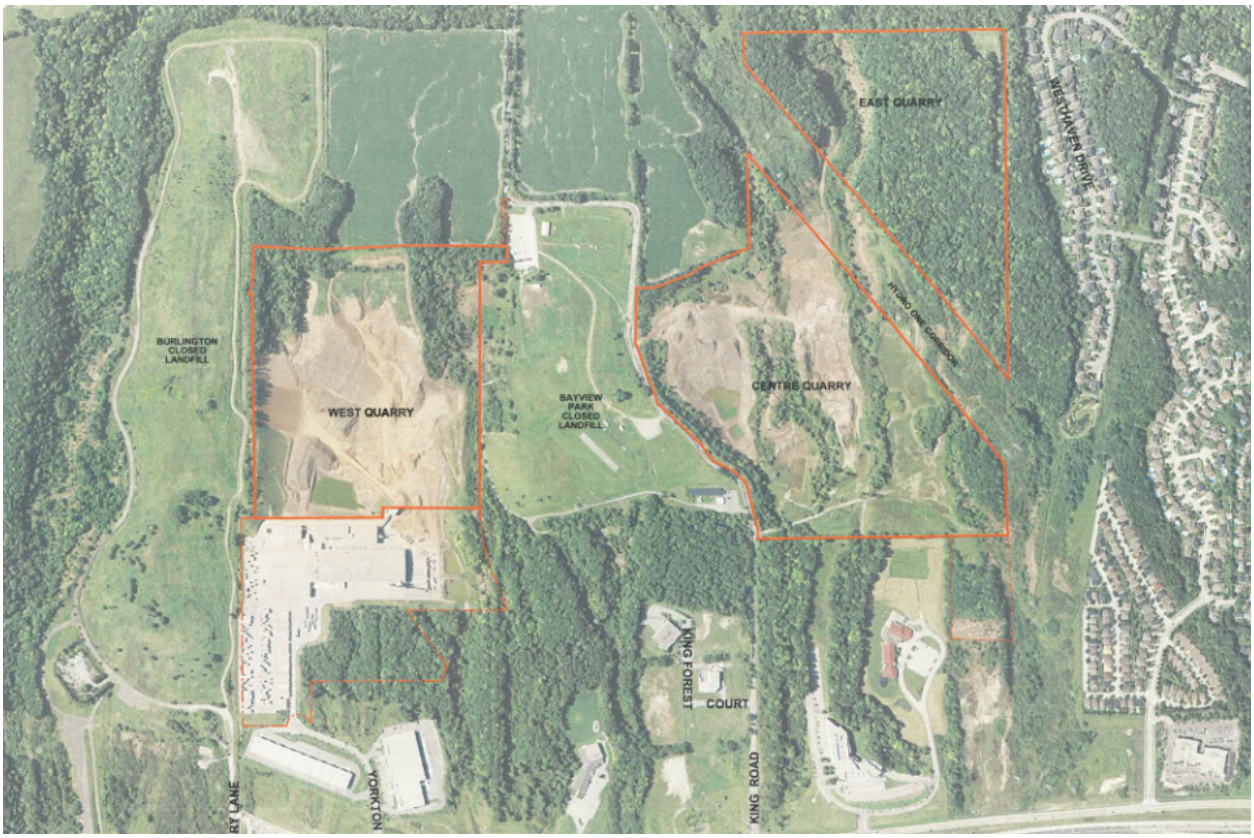


Fig 8.1.1 Alddershot Quarry site locations. Data from the Meridian Brick Aldershot Office.

Appendix

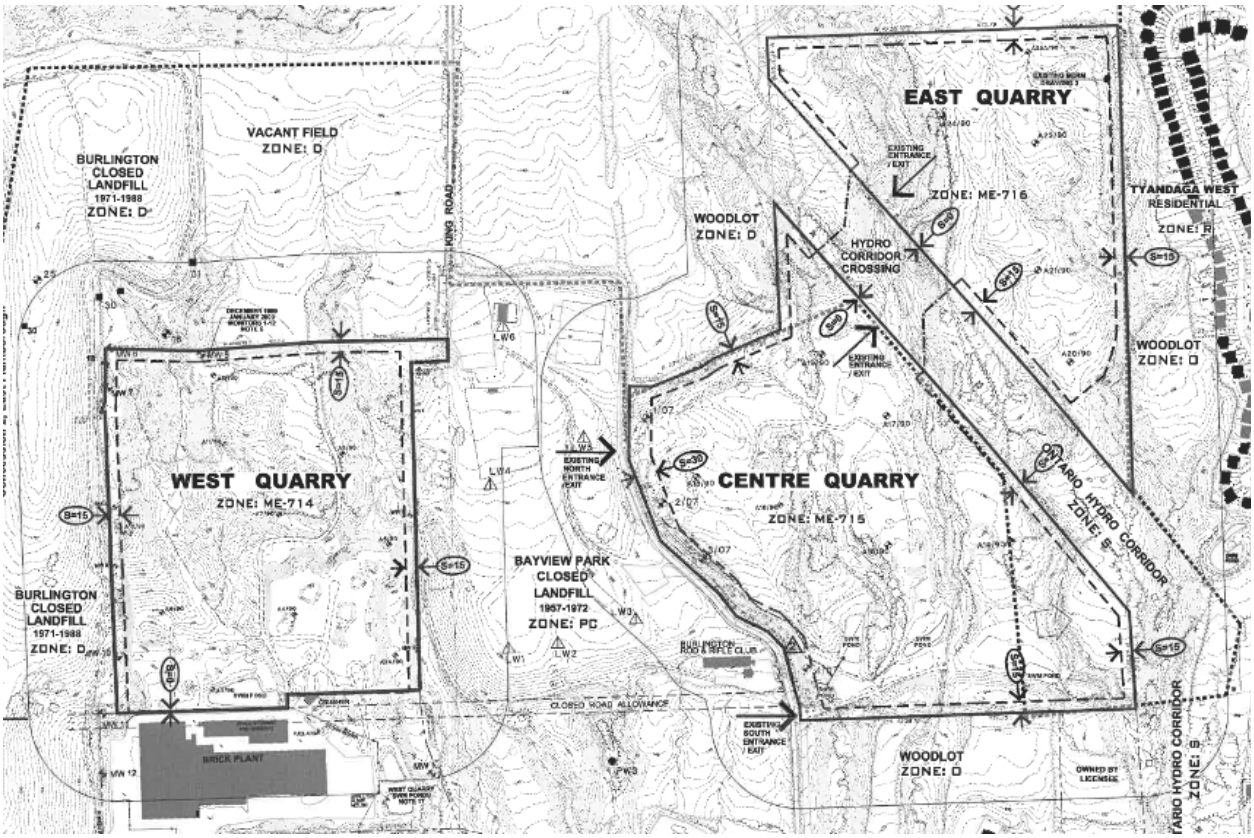


Fig 8.1.2 Alddershot Quarry Site Plan. Data from the Meridian Brick Aldershot Office.

Appendix

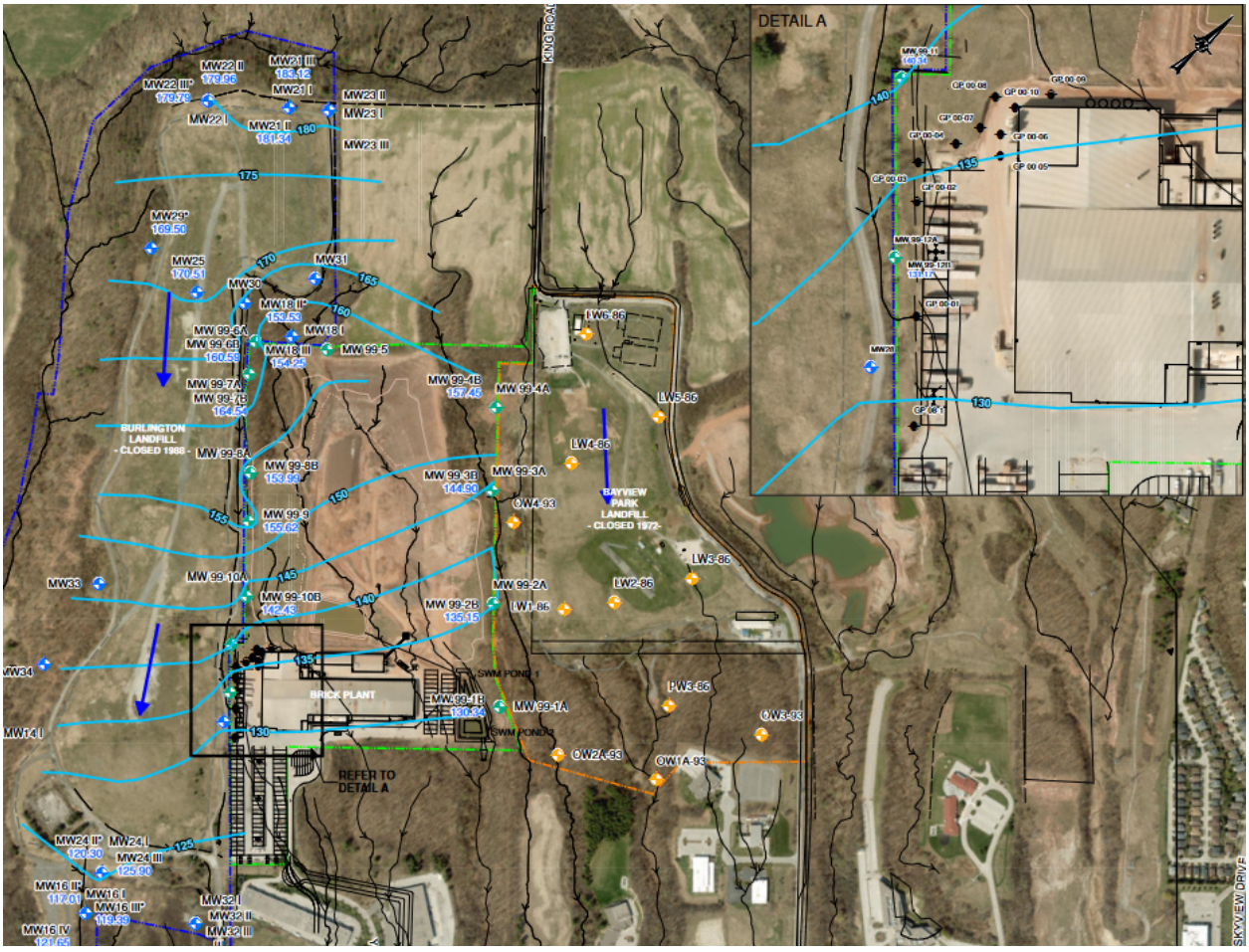


Fig 8.1.3 Alddershot West Quarry shallow groundwater flow. May, 2023.
Data from the Meridian Brick Aldershot Office

Appendix

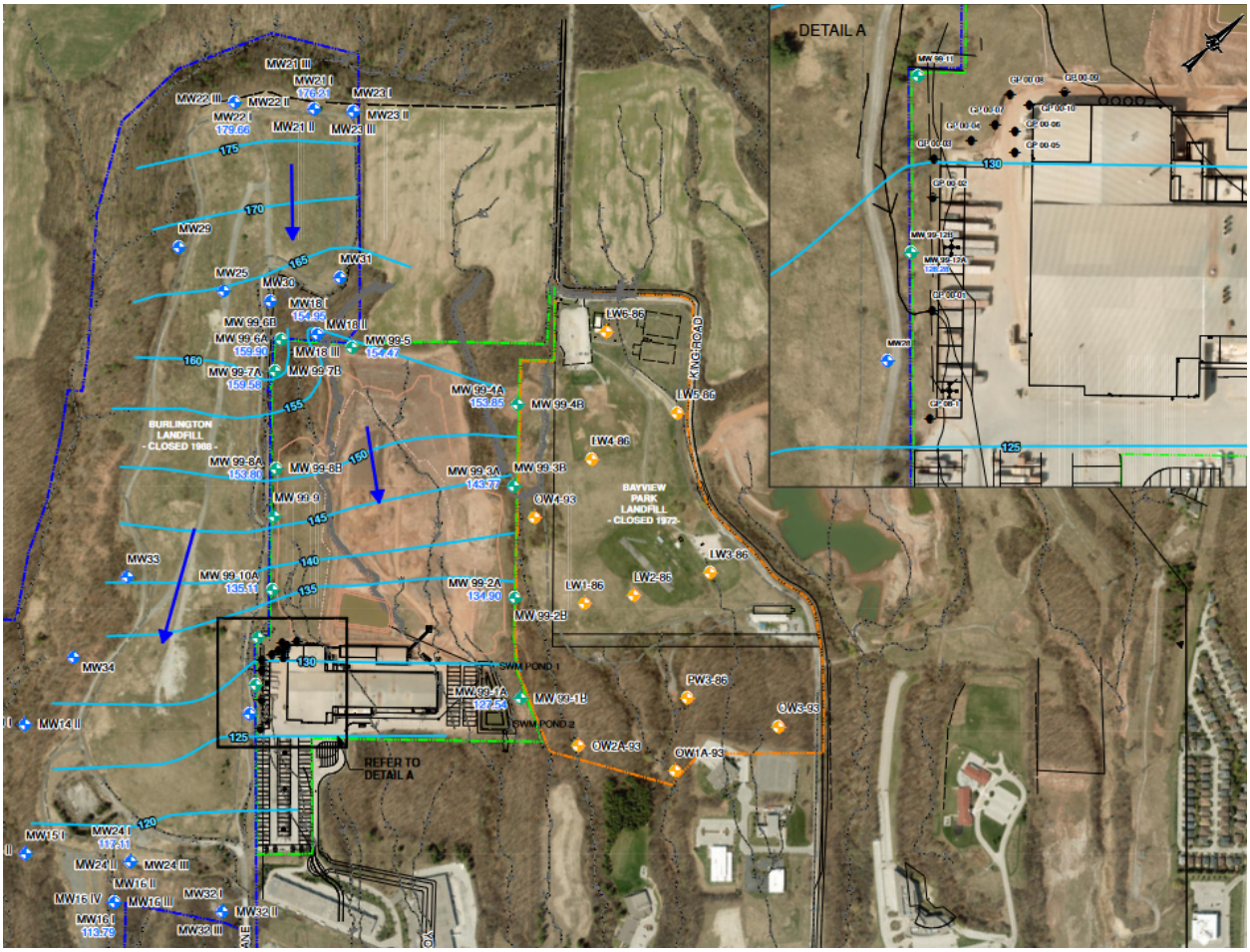


Fig 8.1.4 Alddershot West Quarry deep groundwater flow. May, 2023.
Data from the Meridian Brick Aldershot Office

Appendix

Hanson

HANSON BRICK - ALDERSHOT
EMERGENCY RESPONSE PLANT LAYOUT

NOTE:
(1) VEHICLE DOORS #1-15
(2) PEDESTRIAN DOORS A1
(3) DRAWING IS A REPRESE

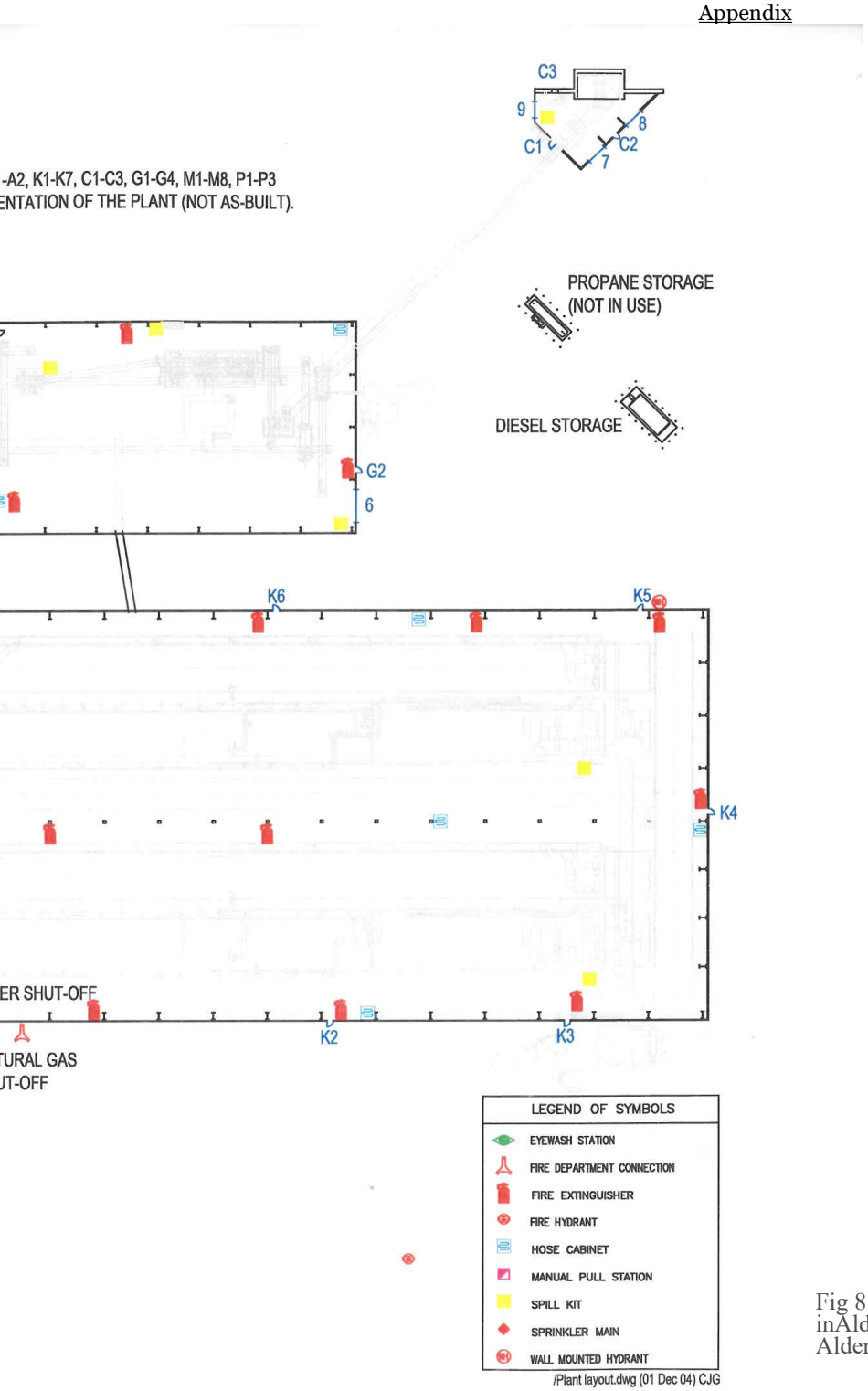
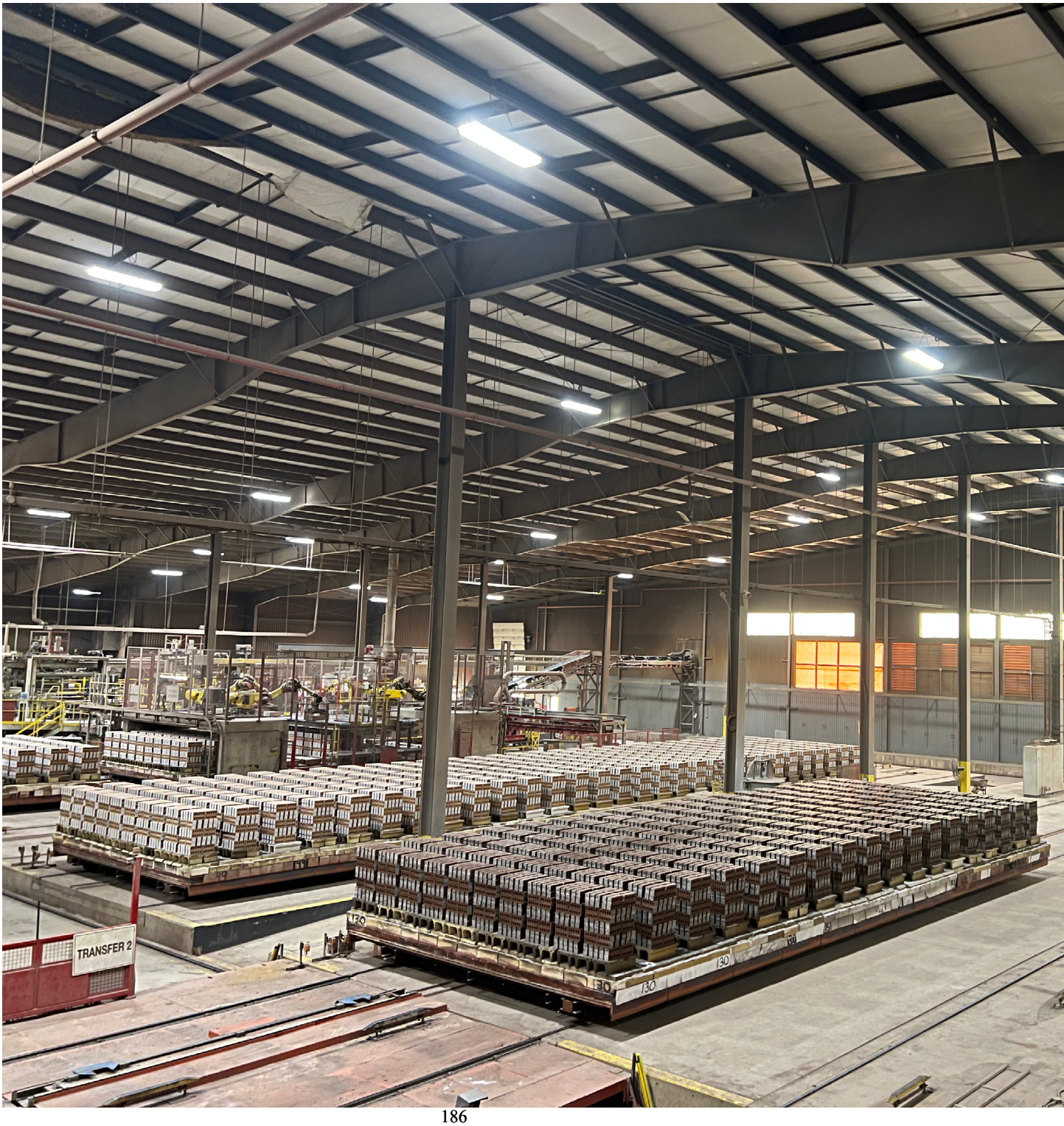


Fig 8.1.5 Floor Plan of Meridian Brick Plant inAldershot Quarry. Data from the Meridian Brick Aldershot Office.

Appendix

Fig 8.1.6 Meridian Brick Plant, interior stairs and the "Building inside Building". Photo by author.

Appendix



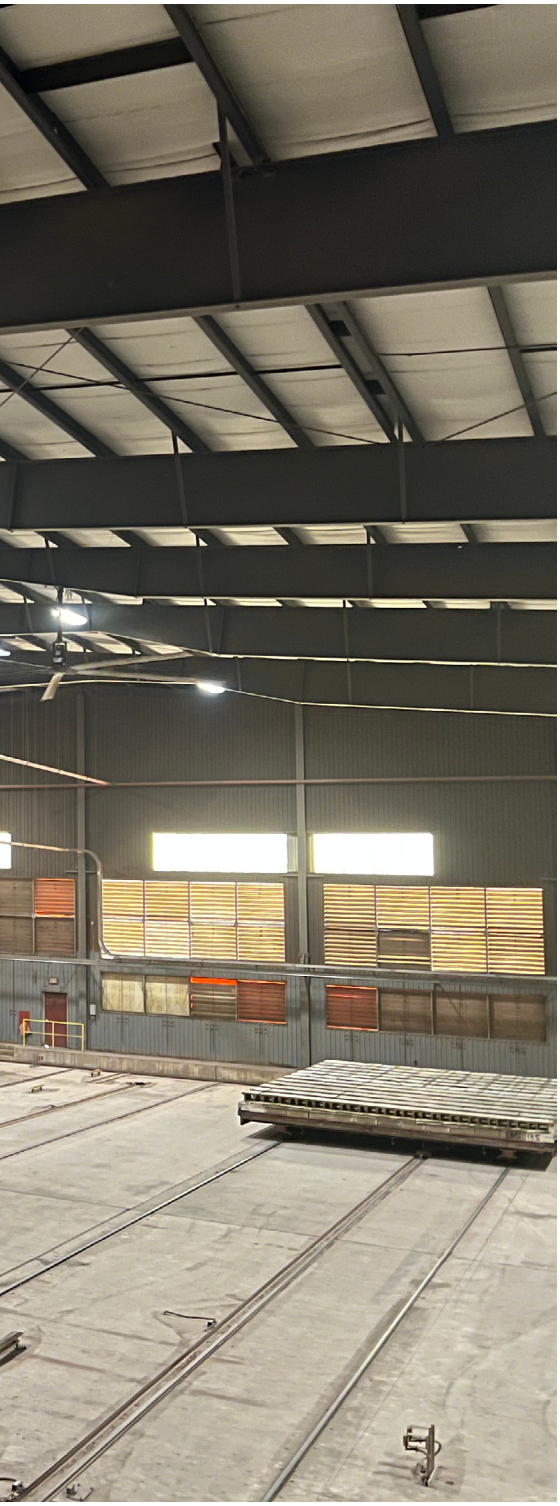


Fig 8.1.7 Meridian Brick Plant, Brick and the Packing Robot. Photo by author.

Appendix

Fig 8.1.8 Brick Product A from the Aldershot Quarry Plant. Photo by author.

Appendix

Fig 8.1.9 Brick Product B from the Aldershot Quarry Plant. Photo by author.

Appendix

b. SITE SAMPLES AND MODELS

Fig 8.2.1 Shales from Aldershot Quarry. Photo by author.

Appendix

Fig 8.2.2 Shales from Aldershot Quarry. Photo by author.

Appendix

Fig 8.2.3 Rough shales from the first crush. Photo by author.

Appendix

Fig 8.2.4 Finely shales from the second crush. Photo by author.

Appendix

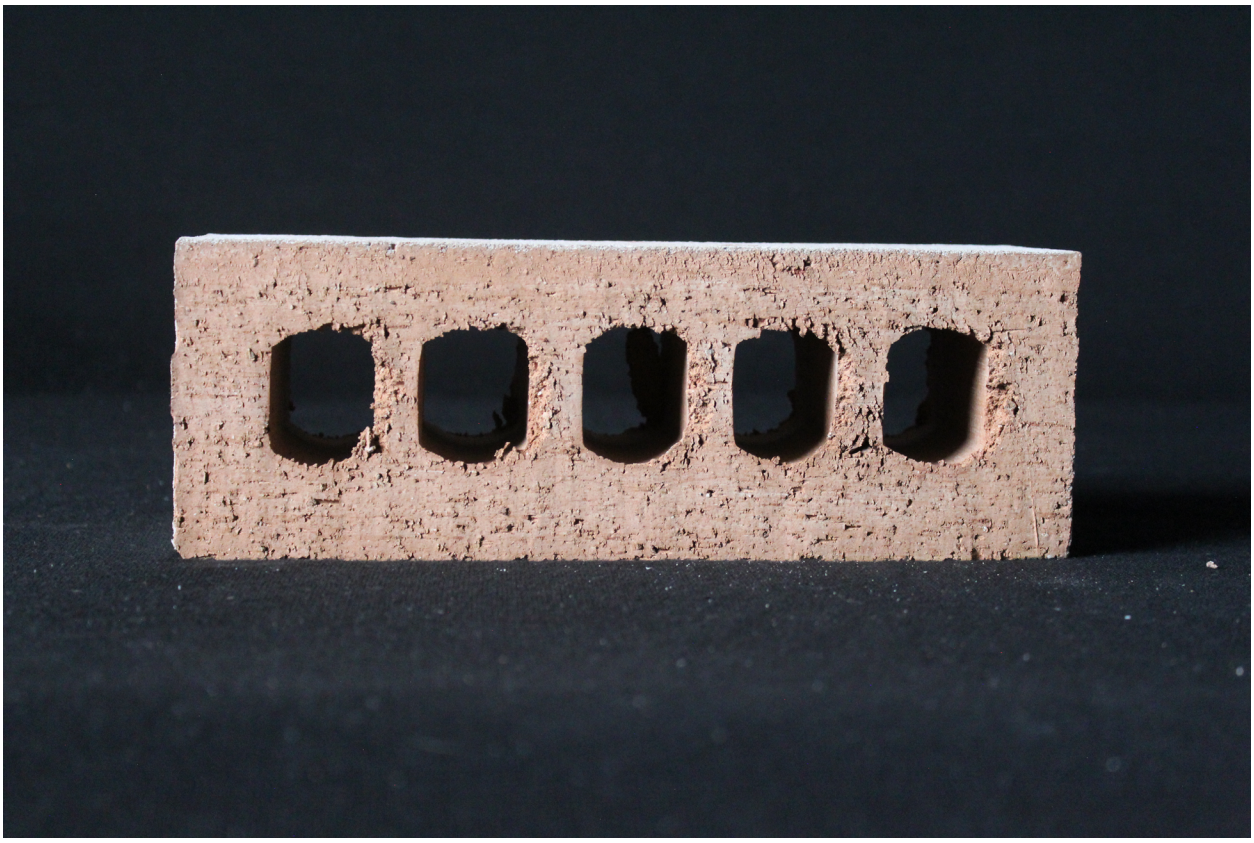


Fig 8.2.5 Clay brick from the plant. Photo by author.

Appendix

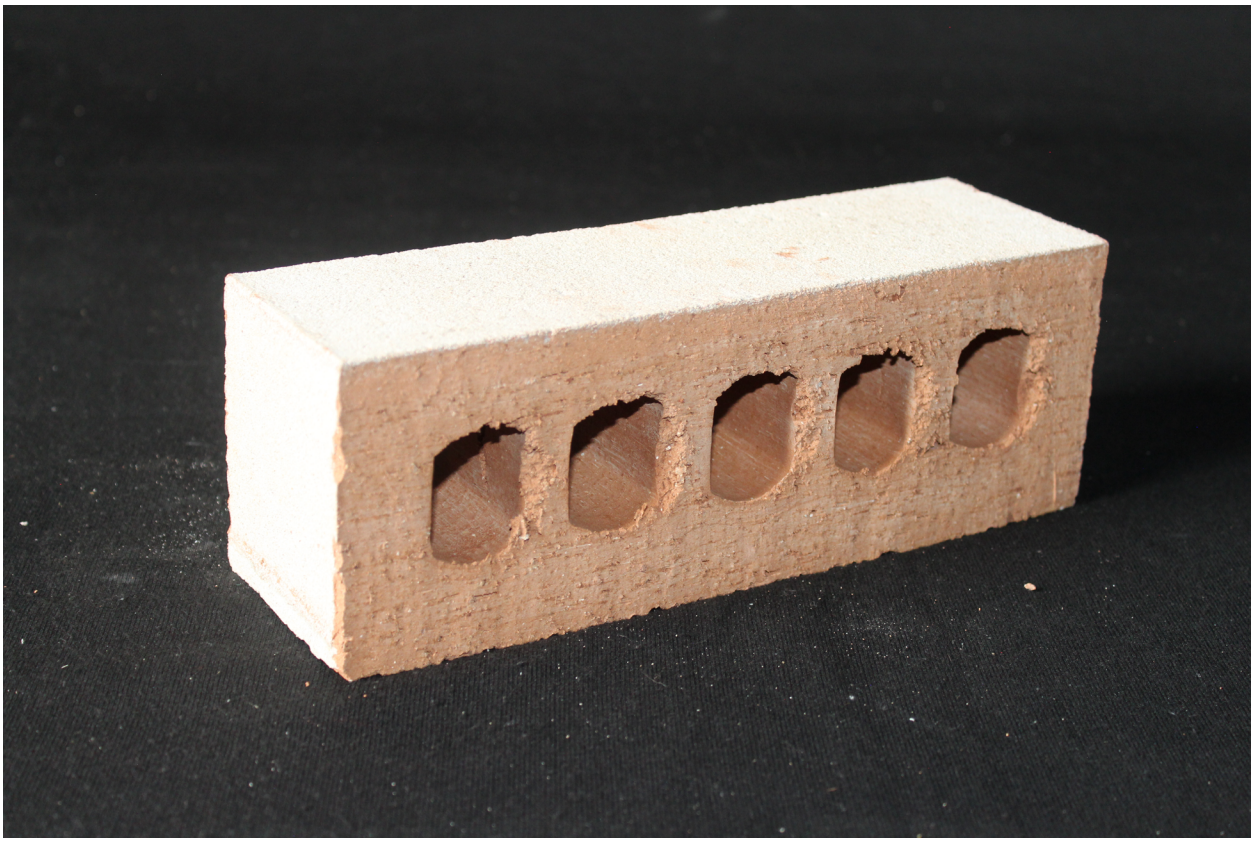


Fig 8.2.6 Clay brick from the plant. Photo by author.

Appendix

Fig 8.2.7 Clay waste during the production process. Photo by author.

Appendix

Fig 8.2.8 Waste brick. Photo by author.