The New SUB Urban

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ABSTRACT

By pairing the unique and varying physical conditions of open-pit mines with the contextual situations and issues that surround them, these often abandoned and overlooked gaps in the earth can be rethought as a new landscape for creating future infrastructures that uniquely address national and global issues that are likely to increasingly effect our world in the future. This thesis project aims to rethink and restore purpose to these numerous vacant gaps left in the earth to determine how their unique conditions can provide a greater benefit to society through adaptive reuse.

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CHAPTER ONE
THESIS STATEMENT

By pairing the unique and varying physical conditions of open-pit mines with the contextual situations and issues that surround them, these often abandoned and overlooked gaps in the earth can be rethought as a new landscape for creating future infrastructures that uniquely address national and global issues that are likely to increasingly effect our world in the future. This thesis project aims to rethink and restore purpose to these numerous vacant gaps left in the earth to determine how their unique conditions can provide a greater benefit to society through adaptive reuse.

Open-pit Mines

Open-pit mines are a distinguished type of mine or spatial void in the earth as they are the results of excavated mineral deposits close enough to the surface that underground mining is not needed.[1] Encompassed within this typology of mines includes quarries, which are open-pit mines used to extract building materials and dimension stone.[2] Although useful in the production stage of a mine's lifecycle, these massive manmade holes in the earth are often abandoned and left with no purpose.

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[1]"OPEN-PIT MINING." OPEN-PIT MINING Meaning | Ecology Dictionary. Accessed December 01, 2016.
[2] "Open Pit Mining Techniques|Surface Mines|Rock or Mineral Extraction." Open Pit Mining Techniques|Surface Mines|Rock or Mineral Extraction. Accessed November 30, 2016.

Langston, Yung, and Chan note that “Adaptive reuse is an international issue that has risen to prominence due to a need to preserve heritage buildings that have become obsolete, to save resources through in-situ reuse of materials rather than demolition and new build, and to improve built environment sustainability by making better use of existing infrastructure”.[3] When considering the term “adaptive reuse” in architecture, most think of repurposing or bringing life back to an old building or more traditional forms of built structures. However, the uniqueness of the spatial typology of an open-pit mine lends itself to the same questions that a sustainable and innovative architect might ask about a large building that has been abandoned. That is, how can this structure be reused to solve some sort of problem facing our economy, environment, and/or society? By rethinking these large and often abandoned manmade voids in the earth as structures that can be reused or built within to return purposes of value to them, we can begin to see how their distinct conditions might act as a framework in which infrastructures can be built to uniquely address issues facing our nation and world in new and provocative ways.

[3] Langston, Craig, Esther Hiu-Kwan Yung, and Edwin Hon-Wan Chan. Habitat International-The Application of ARP Modelling to Adaptive Reuse Projects in Hong Kong. Vol. 40. 2013.

CHAPTER TWO
CASE STUDIES

InterContinental Shimao Shanghai Wonderland Hotel

The InterContinental Shimao Shanghai Wonderland Hotel is an adaptive reuse project located in Songjiang, China. The designers looked at ways in which they could give life back to an abandoned local quarry, repurposing it to act as a luxury resort. Seen in Figure 2.1. It is clear a great deal of thought went into the design of this building. Some of the design elements relate back to the quarry itself such as the glass façade which was designed to look like a waterfall spilling over the edge.[4] Here, the designers created just one of many viable possibilities for use of these forgotten spaces seen all across the world. If not for these innovative designs this abandoned quarry would almost certainly have become a landfill or would have continued to be an unsafe place for the local community. Although it is designed to hold a space for people in only a temporary setting, this case demonstrates how the unique conditions of these sites, such as the verticality, might hold the potential for building residential structures in the future. We can begin to see how such buildings might begin to occupy the edges of these sites. Seen in Figure 2.2.

[4] @livinspaces. "INTO THE DEEP: THE SONGJIANG QUARRY HOTEL IN SHANGHAI | Livin Spaces." Livin Spaces. 2016. Accessed October 15, 2016.

Figure 2.1 Wonderland Hotel Current. Source: @livinspaces. “INTO THE DEEP: THE SONGJIANG QUARRY HOTEL IN SHANGHAI | Livin Spaces.” Livin Spaces. 2016. Accessed October 15, 2016.

Figure 2.2 Wonderland Hotel Proposed. Source: @livinspaces. “INTO THE DEEP: THE SONGJIANG QUARRY HOTEL IN SHANGHAI | Livin Spaces.” Livin Spaces. 2016. Accessed October 15, 2016.

The Eden Project

The Eden Project, located in the United Kingdom, is one example of an adaptive reuse project that demonstrates the potentiality of these unique spaces to take on a greater purpose through architectural design. It serves as a form of inspiration and guidance for this thesis. In 1995, the site that would eventually be reused was just a clay pit, what was left of an existing quarry. Seen in Figure 2.3. Seeking an ambitious space to highlight “the world’s most important plants,” visionary Tim Smit began looking for a massive space. Stumbling upon this clay pit that was “nearing the end of its economic life,” conceptual designs of giant domes began to be drawn out, as their shapes could be molded to fit almost anywhere, including oddly shaped landscapes.[5]

During the construction phase of the project, many concerns arose about the pit flooding after heavy rains. To help correct this problem, an ingenious drainage system was constructed underneath the pit located below the water table. The Eden Project completely changed the future for this landscape by engineering these geodesic domes to return life to this open-pit mine. The collaborators were able to recreate soil to be used on the site from some of the local mine wastes. From there, they were able to populate the domes with plants creating miniature rainforest environments. The site has become a popular location for hosting innovative economical innovations, including Live 8, a call for

[5] “Homepage.” Top Eco Visitor Attraction - Rainforest, Gardens & Educational Charity - Eden Project Cornwall UK. Accessed November 29, 2016.

action against poverty, and the world's first eco-auto show. The Eden Project has introduced the idea of a few new projects on the site including the first geothermal energy plant in the United Kingdom and holding the first redwood forest in Europe.[6] This project is an example of how the uniqueness of these sites can be used to create infrastructures that serve many purposes and can be rethought to enhance society in many ways, including to address environmental issues. Seen in Figure 2.4.

Figure 2.3 Eden Project Before. Source: "Homepage." Top Eco Visitor Attraction - Rainforest, Gardens & Educational Charity - Eden Project Cornwall UK. Accessed November 29, 2016.

[6] "Homepage." Top Eco Visitor Attraction - Rainforest, Gardens & Educational Charity - Eden Project Cornwall UK. Accessed November 29, 2016.

Figure 2.4 Eden Project After. Source: “Homepage.” Top Eco Visitor Attraction - Rainforest, Gardens & Educational Charity - Eden Project Cornwall UK. Accessed November 29, 2016.

CHAPTER THREE
ANALYSIS OF SITE

Site plays a crucial role in this thesis, acting as the backbone to the entire project. The entire project revolves around the investigation of a unique type of site and how the unique properties of this type of site might serve as groundwork for solutions to future issues through architectural design.

As designers, we must be able to see the greater picture of a site's potential in order to enhance the future of our built environment and consequently enhance the future of our world. In the case of this thesis project, the true test was determining how to salvage and give renewed purpose to a site that has been abandoned with no considerations placed on what to do with it after it has served its original purpose. Abandoned open-pit mines are extremely unique site conditions, as the excavation of material from the ground, or quarrying, has created these massive holes or voids in the earth's surface. These massive voids have the potential to be filled in unique ways that address environmental, social, and economic problems that will likely have increasing impacts on our nation's future. However, this requires deep investigation into the various aspects that make these site conditions unique and the varying conditions and contexts that make them promising for different adaptive reuse purposes.

By looking at the unique aspects of these sites—for instance, as they deal with such concepts as verticality, void, and sub-ground—we can already see how

the unique conditions available through these sites hold potentiality for provocative reuse strategies. The sheer verticality and depth of some of these spaces lends the question of whether they could be reused for storage or hiding purposes in the future. Such depth might also be useful to creating more controllable environments in locations where environmental concerns are growing at a fast pace and threatening society.

Overall, by matching the distinctive features and contexts of open-pit mines with the issues that they might resolve, the appearance of a unique structural container for potentially inserting various types of urbanisms or infrastructures emerges. By understanding the site and the conditions that make it particularly suitable or unsuitable for certain reuse possibilities, we can better determine how the distinctive aspects of these sites can best be used for addressing global and national issues in new and provocative ways.

CHAPTER FOUR
PROGRAM

Program acts as the driving factor in furthering the life of the site. The original program to these abandoned sites was to extract materials and minerals from the earth to serve a growing economy that is in high demand. These open-pit mines will still serve the needs of our lifestyles; however, they will do this in completely different ways than before. These sites will be formed into something of even greater purpose—something that aims to encompass many functions. The program of these spaces must change our way of thinking about these places. Oftentimes open-pit mines are left abandoned with no clear understanding of what will happen next. With the application of new ideas to the site, it can become something completely different and change the experiences the site creates.

While there are many roles that these spaces can take on, it was important to identify the needs of this country that these spaces can address both now and in the future. This includes but is not limited to the growing concerns for housing for people effected by poverty and also the ways in which climate changes is effecting our everyday lives. Programming these spaces to better address these concerns will start to pave the way for future exploration and rethinking of these spaces. The program looks to reverse the negative connotations that have surrounded abandoned open-pit mines, to take a space

that once contributed to the betterment of society and return its role of improving society in new but valuable ways.

CHAPTER FIVE
METHOD

Though many contextual issues and concerns may surround these abandoned open-pit mines, they provide extremely unique land conditions that deserve further investigation in order to rethink their futures. In most cases of determining adaptive reuse strategies for an abandoned site, the condition of the site as well as the context surrounding the site are considered in order to understand the opportunities for reuse. In the case of abandoned open-pit mines, the same type of method would be used as other adaptive reuse projects.

By examining the unique physical conditions of these sites and understanding the contexts that surround them, we begin to consider how to repopulate these massive manmade gaps in the earth or rethink how to build inside them to address some of the rising national and/or global concerns.

To help answer these questions, an in-depth investigation of this unique spatial typology—the open-pit mine—was necessary. In order to understand what types of urbanisms or infrastructures could potentially fill these voids, a survey of numerous open-pit mines was conducted. This investigation began by selecting 16 abandoned open-pit mines across the U.S. This sample was used to create a taxonomy of open-pit mine conditions and contexts that would allow for better design decisions regarding the possibilities for reuse based on the conditions that might best address local, national, and/or global issues.

To create a taxonomy of types of open-pit mine conditions, each mine was analyzed based on a variety of criteria that was determined to be influential to its potentiality for adaptive reuse. The physical criteria for assessing open-pit mine conditions included size and depth. In addition, the contexts surrounding each mine were evaluated based on climatic region, material mined, state of toxic concern, and proximity to life. By measuring a variety of variables for each open-pit mine in the sample, a taxonomy of quarry conditions that could serve as a map for identifying possibilities for reuse was created.

Next steps in the research required the identification and development of adaptive reuse possibilities for these open-pit mines that address the larger critical issues facing the nation or world. A set of criteria for each reuse possibility will need to be developed in order to pair the most suitable open-pit mine conditions with their most suitable future uses. The research continued upon this method of investigation in order to elaborate upon these potentialities and dug deeper to determine how these specific conditions serve specific purposes.

CHAPTER SIX
CIRCUMSTANCE

Role of Circumstance

This thesis aims to redefine what is known about open-pit mines and set a path for future architectural endeavors in such mines in order to transform these spaces from barren wastelands into grounds for infrastructures and urbanizations that will make positive impacts on the future of our country. As in any architectural endeavor, the circumstances that influence the nature and implementation of the project are essential to understand. Circumstance plays a major role in this thesis project as the futures of these open-pit mines, like the future of any space, can have varying uses based on the differing contexts or circumstances that surround them. Knowing the circumstances that led to this unique spatial typology, from the history of open-pit mining to the decision to stop mining to the current state of such mines, are key to truly grasping the situation at hand and the potential problems that might affect the reuse of these conditions. Understanding these problems will allow for the determination of the work needed in order to overcome such obstacles and provide future solutions to these problems.

A clear understanding of the contextual circumstances surrounding these abandoned open-pit mines also play a vital role, as they help in seeing the mines' potentials for reuse. Whether it is looking at the climatic region in which they are

located, whether they are in extremely populated urban regions or areas where little human life surrounds them, or whether the material extracted holds an environmental or safety threat to the societies around them, many contextual factors will need to be considered in this project for the purpose of adaptive reuse. In addition to the contextual situations and issues that surround the mines themselves, the larger issues at play are an equally important component to understand in order to see how these unique physical conditions and contexts address larger global or national issues in the future. Therefore, by understanding the whole of the circumstance, from the history to the abandonment to the context surrounding the mines themselves and the greater issues at play, we begin to see their potential for reuse and what greater purposes they could serve in the future.

History

The activity of mining and quarrying has an undeniably long history, extending back to the Paleolithic Period with indication of mining as early as 40,000 years ago.[7] Open-pit mining, also known as quarrying, was also seen largely in ancient eras, from China's Tongling copper mine from the mid Shang Dynasty to Egypt's Timna mine.[8] From extracting stone to create the Great Pyramids of ancient Egypt to modern day quarrying, excavating stone and other

[7] Fagan, Brian M., and Charlotte Beck. The Oxford Companion to Archaeology. New York: Oxford University Press, 1996. Accessed December 01, 2016.
[8] Warf, Barney. Encyclopedia of Geography-Open-Pit Mining. Thousand Oaks, CA: Sage Publications, 2010. Accessed December 02, 2016.

materials to build structures has been a largely common practice across societies throughout time.[9] During the Industrial Revolution, the excavation of material from the earth was even more emphasized as increased urbanization lead to a crucial need for coal and iron ore to generate electricity and build urban infrastructure, causing a significant growth in mining for these materials.[10] Other metals like titanium, aluminum, and platinum were recognized to be of use as technology progressed during this time as well.[11] Mines grew to become massive operations as wealth increased, generating demand for gold and diamonds.[12] As the necessity for mining grew, so did the excess number of these spatial voids left in the earth.

Abandonment

Excavating various minerals from the ground has been and continues to be of indisputable importance to societies as these grounds are mined to obtain resources needed to create everything from our buildings and countertops to our roadways and cellphones. However, the activity of mining is temporary at any set site.[13] This activity can last from as little as a few years to decades, depending on the "size and quality of the mineral deposit being extracted" as well as the

[9] Society, National Geographic. "Quarry." National Geographic Society. 2012. Accessed December 02, 2016.
[10] Warf, Barney. Encyclopedia of Geography-Open-Pit Mining. Thousand Oaks, CA: Sage Publications, 2010. Accessed December 02, 2016.
[11] ibid
[12] ibid
[13] "What Happens to Mine Sites after a Mine Is Closed." What Happens to Mine Sites after a Mine Is Closed. Accessed December 02, 2016.

state of economic benefit from such extraction.[14] Oftentimes, little to no thought is given to the aftereffects of these mines once companies have packed up and gone home.

The frequent act of mining followed by the closing of these mines over time has led to an abundant and continuously growing amount of vast unnatural voids in the earth's surface, essentially forming large unused wastelands. Abandoned, these spaces not only become eyesores to the people surrounding them but oftentimes become breeding grounds for unsafe and unhealthy environments. It is estimated that the U.S. contains upwards of 500,000 abandoned mines.[15] This project focused on the reuse of these frequently abandoned open-pit mines across our nation to understand how their unique spatial typologies might be rethought to fill the voids and restore purposes of value to them.

Concerns

The abandonment of mines can pose many concerns related to health, safety, and the environment.[16] Now, regulatory laws are in place to ensure that when mining operations shut down the appropriate actions take place to guarantee the site is left in a condition that will not harm the environment or

[14] ibid
[15] "Introduction." Home. Accessed November 28, 2016.
[16] "Introduction." Home. Accessed November 28, 2016.

society.[17] However, “the high cost of rehabilitation strategies and resources to ensure enforcement of laws and regulations prohibits effective enforcement” and many of these open-pit mines were abandoned before such regulations were in place.[18] Therefore, continuous concerns exist and must be considered when evaluating these sites for reuse.

There are many environmental concerns surrounding open-pit mines, as the methods used in these mining processes have caused “marked environmental degradation” with environmental effects such as erosion, sedimentation, and landslides.[19] The lack of soil left from abandon quarries typically hinders the reappearance of life to that area.[20] These abandoned quarries sometimes leave safe and clear lakes for people and aquatic animals to swim; however, sometimes these waters are dangerous if mining equipment is left at the bottom or exposed toxic material escapes into the water.[21] These concerns were important aspects to consider when evaluating an open-pit mine’s potentiality for adaptive reuse in the future.

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[17] “What Happens to Mine Sites after a Mine Is Closed.” What Happens to Mine Sites after a Mine Is Closed. Accessed December 02, 2016.
[18] Warf, Barney. Encyclopedia of Geography-Open-Pit Mining. Thousand Oaks, CA: Sage Publications, 2010. Accessed December 02, 2016.
[19] ibid
[20] Society, National Geographic. “Quarry.” National Geographic Society. 2012. Accessed December 02, 2016.
[21] ibid

Global and National Issues

To understand how the unique conditions of open-pit mines might be used to address national and global issues, it is important to understand the economic, social, and environmental issues that will increasingly effect our future. Understanding these greater issues might facilitate the rethinking of these mines and their futures.

Economic and Social Issues

Economic and social issues facing the U.S. are important aspects to consider when determining how these spatial voids in the earth might best be used to make positive impacts on our futures. For instance, the nation's increasing population is a trend that is projected to continue well within the next 25 years and beyond. This is an important element of the overall circumstance to consider as an increasing population is likely to lead to an increase in housing demand.[22] Therefore, possibilities for residential usage of these spaces emerged.

Another factor that could cause the demand for housing to increase is the Syrian refugee crisis facing the entire world. While the United States has currently only given refuge to 2,000 Syrians, this number could increase to five

[22] "Demographic Challenges and Opportunities for U.S. Housing ..." Accessed December 02, 2016.

times that number.[23] Homelessness is also a pressing issue facing our nation today and is projected to increase in the future due to overcrowding and poverty. It is estimated that "1.4 million veterans are at risk of homelessness".[24] These crises call for a need for new residential spaces that can serve many people in many ways and present the question of whether these quarries might be used to address these issues.

Environmental Issues

Many environmental issues face our world today and will increasingly face our world in the future. Climate change is no doubt the most pressing environmental concern facing our world today. It is important for architects as well as many other disciplines to seek out new and innovative ways to combat the various problems that climate change causes and will continue to cause on our communities.

Most of our world's most extreme environmental concerns are closely linked to climate change.[25] For instance, water scarcity is a pressing issue that is increasingly facing our world and nation as climate change and an increasing population are resulting in more droughts.[26] It is estimated that "by the middle of

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[23] Nimani, Armend. "America as Bystander to the Refugee Crisis - The Boston Globe." BostonGlobe.com. 2016. Accessed December 08, 2016.
[24] "2016's Shocking Homelessness Statistics." Social Solutions. 2016. Accessed December 05, 2016.
[25] "The 6 Most Pressing Environmental Issues—and What You Can Do to Help Solve Them." Inhabitat Green Design Innovation Architecture Green Building. 2016. Accessed December 07, 2016.
[26] ibid

this century more than a third of all counties in the lower 48 states will be at higher risk of water shortages with more than 400 of the 1,100 counties facing an extremely high risk".[27] This issue gives rise to such questions as, could these mines potentially be used to increase water efficiency or contribute to a solution to this problem in some way? Aside from drought, other extreme weather conditions like wildfires, heat waves and flooding will increasingly result from climate change.[28] This requires innovative thinking on how to reduce carbon emissions and create a more energy efficient future.

Another pressing issue resulting in part by climate change and in part by our growing infringement on wildlife habitats is a loss of biodiversity.[29] This issue raises the question: Could open-pit mines be used to create some type of infrastructure that preserves these wildlife habitats or addresses this environmental issue in some provocative way? Other environmental concerns like pollution, deforestation, soil erosion and degradation, and many others provoke thinking on how these unique spaces might be able to be reused to address such environmental issues in the future.

[27] ibid
[28] ibid
[29] ibid

CHAPTER SEVEN
DESIGN STRATEGIES

The next step of the project was taking into account all of these factors and applying them to an actual site. The focus of this project was a quarry in Nashville, TN. Based on a variety of factors, including the populous and growing region, depth and width of the Quarry. The quarry itself is 37 acres at the widest point and has a depth of 360 feet of depth. Located five miles outside downtown Nashville the quarry is located in a unique area that can begin to look at factors that affect the city. It was determined, from this information, that this vacant gap in the earth could best be refilled and repurposed by turning it into an efficient and innovative residential dwelling. The surrounding city population is growing at a increasing population. The unique nature of the quarry itself gave way to a mixed use living retail and office. Figures 7.1-7.6, below are what became of this thesis research.

The design that has been purposed consist of over 900 housing units and over a million square feet of retail and office space. This design utilized the quarry to combat the growing suburban population and the loss of land that comes with the building of these new homes. Without the use of the quarry over 300 acres would have to be utilized to build a similar number of homes. These acres used also wouldn’t include the millions of square feet utilized for retail and office use. As part of this design the surrounding area that is being saved by this

intervention will serve as the recreation for the people that will live in the quarry, it will act as a retreat space.

This thesis serves as a starting point for future exploration into these unique spatial typologies. Instead of avoiding these manmade gaps in the earth or turning them into merely recreational spots, the question that should start being asked is: how can the uniqueness of these spaces be used and repurposed through design to solve a larger problem facing our country or the world today?

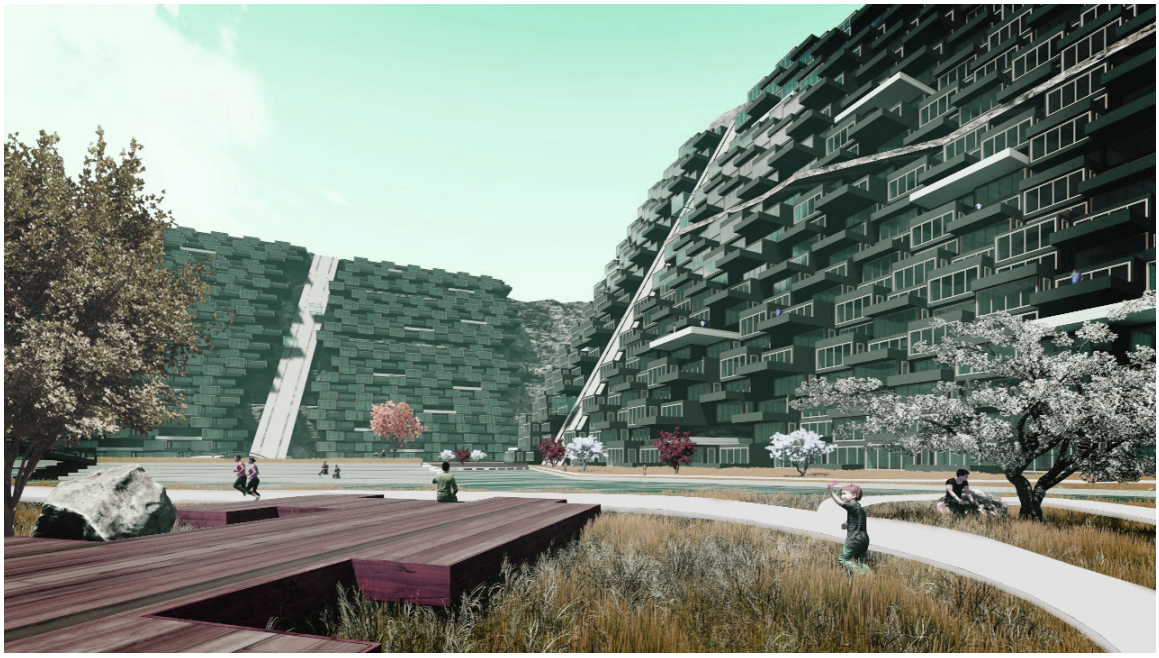

Figure 7.1 View from Quarry Bottom West. Source: Author

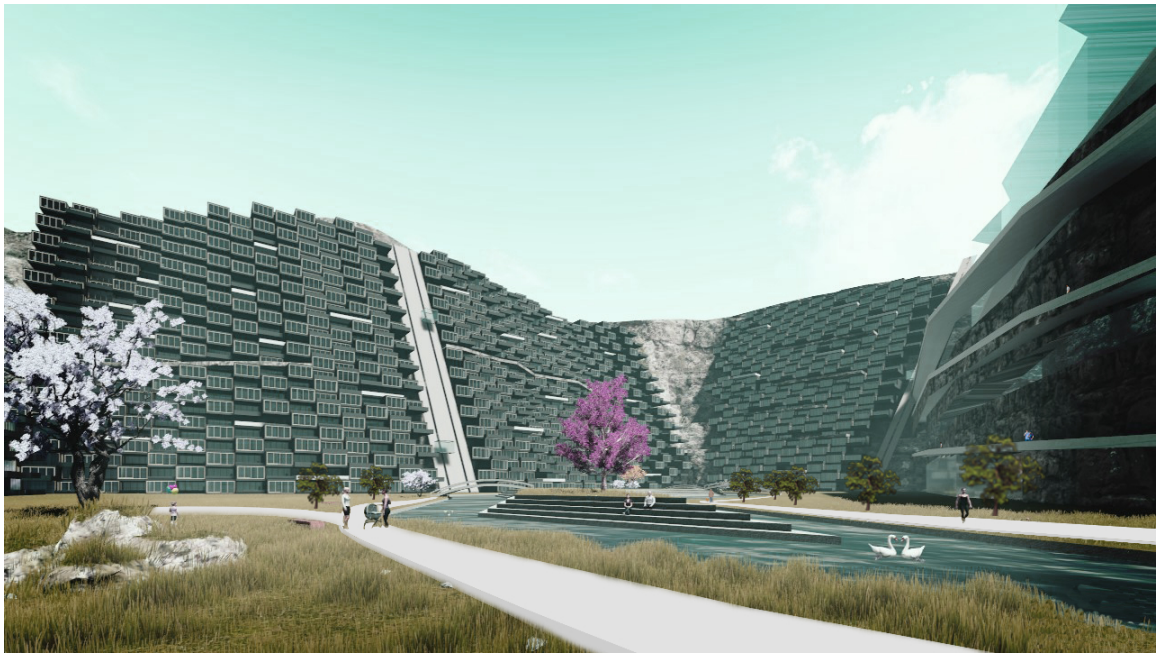

Figure 7.2 View from Quarry Bottom East. Source: Author

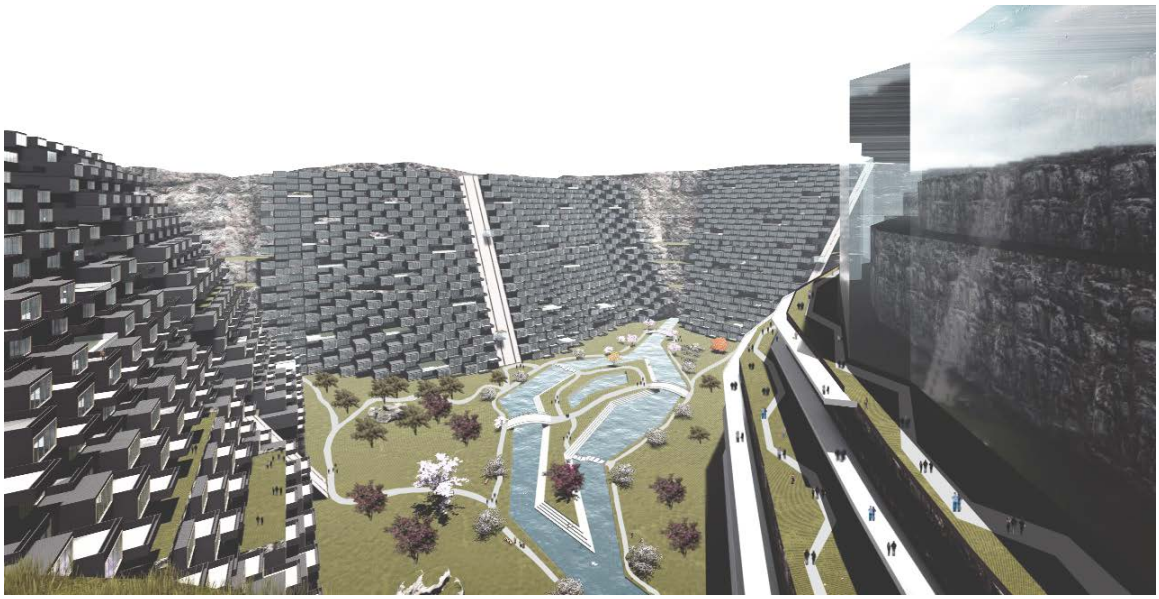

Figure 7.3 Perspective View of Quarry. Source: Author

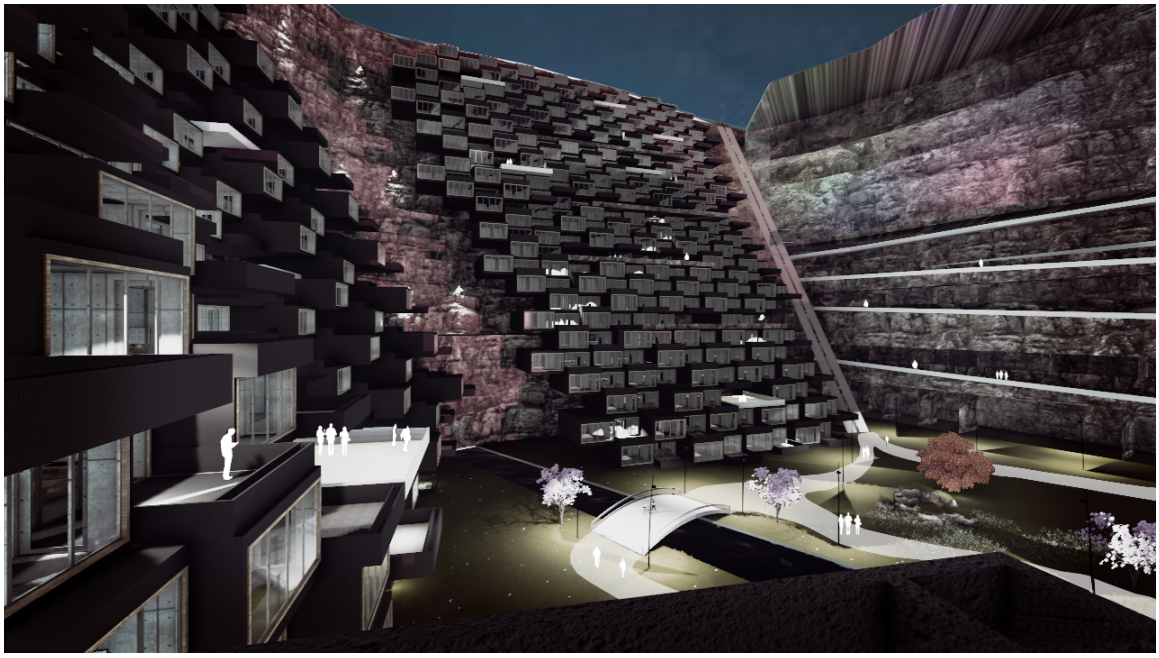

Figure 7.4 Perspective View from Housing. Source: Author

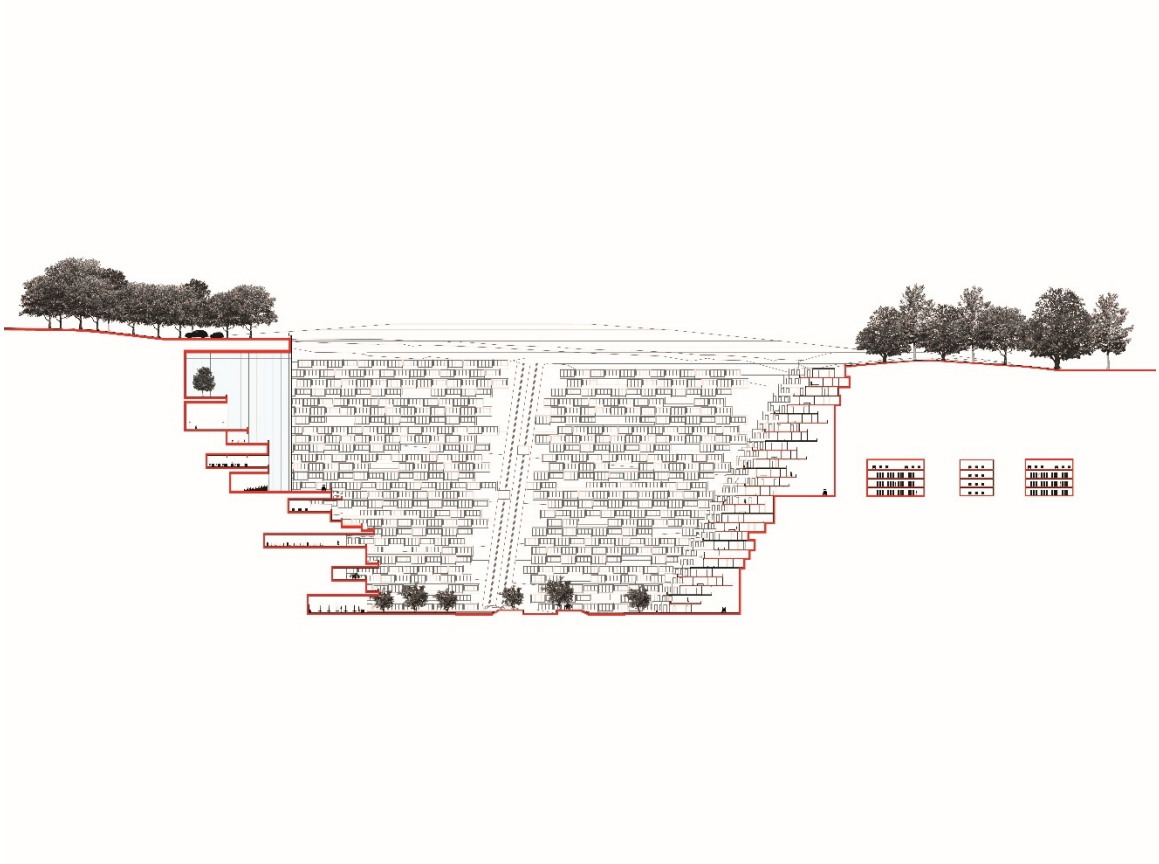

Figure 7.5 Section Cut of Quarry. Source: Author

Figure 7.6 Site Plan of Purposed Quarry. Source: Author

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VITA

Brad Lee Herr was born in Atlanta, Georgia, then soon after moved to Chattanooga, Tennessee. Brad lived in Chattanooga into his high school years where he then moved to Franklin, Tennessee, where he finished out his high school years. Having lived in Chattanooga most of his life he decided to return there for his undergraduate degree at the University of Tennessee at Chattanooga. While there he obtained his BS in Interior Design. Brad always knew he wanted to go further with his education, which is why he enrolled at the University of Tennessee at Knoxville to obtain his Masters of Architecture degree. After graduation Brad plans to return home to the Nashville area to become licensed while working for a nationally renowned architecture firm in downtown Nashville.