Landscapes in Process: Designing Future Relationships between the National Mall and Cockeysville Quarry

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Abstract

This thesis explores relationships between the National Mall and the quarries that supported its construction. It focuses on the Washington Monument and its source of material, the Cockeysville Quarry, Maryland. By studying the movement of stone, the thesis begins to understand both sites as landscapes in process. It then examines the sites' histories including landforms, immigrated laborers and railways changes associated with quarrying and construction. It happens that Ian McHarg also studied both sites fifty years ago in Design with Nature. Mcharg's analysis overlooks the potential of the industrial quarry to recharge the Marble Valley aquifer and does not account for the projected sea level rise on the National Mall. It is necessary to examine the two sites again. McHarg's ecological principles and methods are still the basic evaluation criteria for the examination (especially his understanding of landscapes as process.) The design project of this thesis uses shifting hydrologies at both sites to drive new uses, earthwork, urban forest (tree canopies), and axial relationships, inspired by the materials, forms, and historical links between the two landscapes. By looking at the landscapes as a pair, the design recalls the past connections between the sites and constructs new relationships ideologically and physically.

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General Audience Abstract

It is common for there to be a separation between quarries and the buildings and landscape we create from their materials. People rarely realize the materials are the records and links of the history, culture, society and ecology of the paired landscape between construction and material producer. This thesis starts from investigating the origin of building stones used for the memorials on the National Mall. Tracing stone sources links the National Mall landscape and the quarries that supported its construction. It focuses on the Washington Monument and its source of material, the Cockeysville Quarry, Maryland.

The thesis examines the geographic, hydrological and physiographic information of the landscape between the National Mall and the Cockeysville Quarry based on ecological methods, especially the understanding of both sites as landscapes in process. It also studies the sites' histories including landforms, immigrated laborers, and railways changes associated with quarrying and construction. The thesis design project explores the question of how the relationships can be reflected and applied in the intervention of the two landscapes. Within the framework generated by the relationship study, water issues have been identified as the main common problem. Protecting the Marble Valley aquifer and dealing with the thread of the sea level rise on the National Mall is the major consideration. The main strategy of design is to use the anticipated hydrologies to drive the new uses, earthwork, urban forest (tree canopies) at both sites. The second strategy of design is to use history, form and material relationships to inspire new connections between the sites ideologically and physically.

This book is dedicated to:

My thesis committee, Nathan Heavers, Paul Kelsch, Dennis Carmichael.

My family in China.

Also to all my friends and WAAC people.

Thank you for your patience and support.

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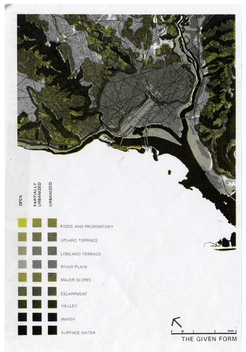


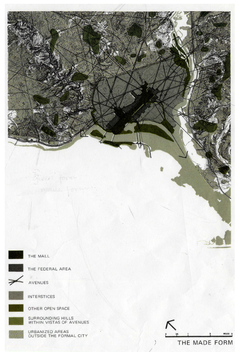


Figure 1.2 : The given form and made form of Washington DC.
Ian L. McHarg, *Design with Nature.* Natural History Press,
New York, 1969

01 INTRODUCTION

It is common for there to be a separation between quarries and the buildings and landscapes and we create from their materials. Even for very important landscapes and buildings, we don't often recall the source of their materials. For example, there are many memorials in Washington, DC. The building stones used in the memorials have given these landscapes special meanings. Only a very few people considers that origins of these stones matter. We rarely realize that the stones are not only the significant aspects of the design, but also the records and links of the history, culture, society and ecology of the landscapes supplying the materials.

This thesis investigates the origin of building stones used for the memorials on the National Mall. Tracing stone sources links the quarries and National Mall landscape. Two questions drive the thesis: what is the relationship of the two landscapes? How does the relationship inform the future design?

Jane Hutton (2013) addresses the importance of studying paired landscape between construction and material producer:

> These accumulated urban stocks produce at once ecological (the material exchanges produced through construction), economic (the trade made possible through infrastructural networks) and social (the discourse enabled through the public commons) conditions in situ. At the same time, the construction materials that designers specify are implicated in the ecological, economic and social relations of their own extraction, production and reuse. Materials in landscape architecture are physical fragments of remote quarries, factories and forests and their production is responsible for landscape transformation elsewhere. (Hutton, 2013, p. 40)

In her essay, reciprocal landscapes: material portraits in New York City and elsewhere, three

cases are examined: the landscapes of the Fox Islands and Central Park, the Ambridge and Riverside Park, and the Amazon Forest of Northern Brazil and the High Line. They are three paired sites linked by material displacement. The construction of Central Park during the late nineteenth century "controlled the cycles of boom and bust employment for granite cutters of the Fox Islands" (Hutton 2013: 45); As the tropical lumbers Ipê have been widely used in the decking and benches on the High Line, the High Line became the "strategic place" from which to evoke the attention of illegal logging, deforestation and slave labor in Brazil launched by rainforest protection organizations; the covering of the rail tracks at Riverside Park ordered 5,400 metric tons of structural steel from the American Bridge Company to cover New York Central's tracks, and the city's construction related to the New Deal legislation "both facilitated the construction of massive infrastructural works as well as stimulated the widespread organization of trade workers"(Hutton, 2013, p. 45).

The three cases provide good examples of how to study the relationship of paired landscapes through history. However, although the author calls for the expansion of site and scale that landscape architect might practice from built landscape to its related production landscape, it does not account for how the relationships can be reflected and applied in the intervention of the two landscapes.

In Design with Nature (McHarg, 1969), both the areas, the Cockeysville Marble Valley and the National Mall were discussed. In the chapter "A Response to Values"(figure1.1), McHarg studied the seventy square mile valley north of Baltimore, Maryland. The Cockeysville Marble Valley was at the east end; in the chapter "The City, Process and Form"(figure1.2), he analyzed the nature form and man-made form of Washington D.C.

The fundamental principle of the book is that nature is process. We are not able to understand nature without knowing the process. Ecology is "the single indispensable basis for landscape architecture and regional planning". Because it can reveal the process and tell us the "intrinsic form".

The final goal is to understand the relationship of the nature and built. In the book, the Marble Valley is the subregional area waiting for development. The ecological method reveals the advantages and vulnerability of the area as a valley. It indicates the future land use and prohibitions exhibited by natural processes. Washington D.C is an existing singular city. The ecological method can make a distinction between the "given form" and "made form". It allows people to understand the natural landscape characteristics. It could be used to examine whether the successive stages of urbanization adapt to the given form or not.

However, there are some things missing in McHarg's analysis of the two areas:

First, McHarg overlooked Cockeysville. The proposal for the Maryland valley is only applied within the boundary extending from the Beltway to the northern slope of the Western Run, from Reisterstown Road and the Western Maryland Railroad to the Baltimore-Harrisburg Expressway. Cockeysville was excluded. It is probably because McHarg's project project was only to help the wealthy residents to preserve the scenic beauty and environmental quality of the area. (Sprin, 2001). The Cockeysville valley, which had already been developed for industrial use, had nothing to do with beauty and to McHarg, it seemed useless, dead.

Secondly, for Washington D.C., McHarg appreciated L'Enfant's plan. He thought it respected, preserved and enhanced the natural characteristics rather than obliterated them. He has written, "L'Enfant had an overriding concern for the axial arrangement of spaces, the flanking buildings and diagonal avenues with the perceptiveness to the subtleties of land from" (McHarg, 1969, p.181). In particular, he thought that "the Mall unites the Potomac with the Capitol, the cross axis unites the White House, the Tidal Basin and the Jefferson memorial"(McHarg,1969, p.181). However, McHarg did not mention the development of DC after L'Enfant's plan. He did not point out that L'Enfant's plan has not been fully realized. Like Dan Kiley (2003) said, the Senate Park commission plan "failed to appreciate the power and significance of L'Enfant's original scheme"(p.297). Kiley pointed out in his

"a Critical Look at the McMillan Plan " that "the original L'Enfant's vision of Venice-like Washington, bequeathed to the city by nature and extending outward to the region, was defeated and replaced by a closed, insular design" (p.297). In addition, McHarg's analysis did not project the future of Washington D.C., especially under the threat of sea level rise.

Despite these neglected issues, McHarg's ecological principle is the foundation for the analysis in the thesis.

Firstly, nature is process, presenting its form through a series of changes such as earth uplifting, sink and erosion, water rising and fall. Neither process of the two sites ever stops. By the analysis of geology, topographic surface, groundwater, and floodplain, the processes will tell us what the nature will be in the future.

Secondly, after knowing the natural characters, understanding the relationships between the built form and natural form for the two sites, is critical for the study. Each site has evolved into its own forms in separate ways. Due to the construction of the Washington Monument, their paths were intersected during a relatively short time period. Looking for the relationship is to look for the impacts of the intersection on their forms.

A series of history maps suggest the development of the built forms. In Cockeysville, the built form comes from quarrying activities. As for the National Mall, the built form comes from the nonstop plans and designs for the city. By further studying the related history associated with people, earth change and infrastructure, the links embedded in the built forms will be revealed. It indicates that all the associated historical events left marks on the landscapes, but evolved to different effects due to the unequal plans. These explained the different features of the two areas we see today.

Thirdly, by overlapping the built forms and the natural forms, we are not only able to examine whether the current forms respect and adapt to the natural process, but also able to identify the

influences of the interrelated history on the landscapes in the long run. As for the National Mall, the Washington Monument ground shaping has changed the relationship of the land and the Potomac River dramatically. Geological change and ecological change resulted from the construction of monument itself. As for Cockeysville, these changes are in part the result of the National Mall construction. The construction of the Washington Monument, from a long-run perspective, stimulated the development of the site in Washington D.C. as national capital core area and Cockeysville as an industry town and thus speeded up the geological and ecological changes.

The book Humans as Geologic Agents (Ehlen, 2005) estimates that average material movement from construction and agricultural activity surpassed that resulting from all geological processes. If we look at the huge hole and hydrology change, we will know that this fact is also true in Cockeysville and the National Mall: the rate of ecological change caused by quarrying activities far exceeds that caused by past natural processes.

In the thesis design project , the futures of the two sites are envisioned. It explores the question of how to relate the paired landscapes through future intervention. The relationship study generates a framework for examining the sites futures. By applying a version of McHarg's method above, water issues have been identified as the main common problem. The strategy then is to use the anticipated hydrologies to drive the new uses, earthwork, urban forest (tree canopies) at both sites. History, form and material relationships inspire new connections between the sites. In Cockeysville, the dispersive, unrelated links embedded in the built form are reorganized by applying the strategy which L'Enfant used for the plan of Washington D.C. Its axis responds to the north- south axis on the National Mall. Thirdly, the material and the edge of the quarry in Cockeysville inspired the design of the water edge on the National Mall.

Table 2.1 : By studying the construction time and the materials used for the memorials, the stone origins and the quarry current conditions are found. (Data from USGS)

Monument and Memorial	Construction time	Material	Quarry name	Quarry Current situation	Quarry Location	Quarried by
Washington Monument	**1848-1858** **1878-1888**	Cockeysville Marble	Texas Quarry	Active	Texas, Maryland	Lee Marble Company Hugh Sisson of Baltimore, Md
			the Beaver Dan Quarry	abandoned	Sheffield, Massachusetts	
		Lee Marble			Cockeysville, Maryland	
Lincoln Memorial	**1914-1922**	**Exterior** Walls and exterior columns: Colorado Yule marble.	Colorado Yule marble Quarry	active-abandoned-active	Marble, Colorado	Colorado-Yule Marble Company Alabama Marble Company The Georgia Marble Company
		Exterior Tripods: Pink Tennessee marble. **Interior** **Floor and wall base:** Pink Tennessee marble **Interior** **Pedestal and platform for statue:** Tennessee marble.			Knoxville, Tennessee	
		Interior **Walls and columns:** Indiana limestone			Bedford and Bloomington, **Indiana**	
		Interior **Ceiling:** Alabama marble saturated with paraffin for translucency.	Gannts quarry	active	Sylacauga, Talladega County	
		Statue: White Georgia marble	Georgia white marble quarry	active	Pickens County, **Georgia**	
Thomas Jefferson Memorial	**1939-1943**	**Ceiling:** Indiana limestone.			**Indiana**	
		Exterior walls and columns: Imperial Danby Marble	Vermont Danby Marble Quarry	active	Danby, Vermont	
		Interior floor: Tennessee pink marble.			**Tennessee**	
		Interior wall panels: Georgian white marble.			**Georgia**	
Vietnam Veterans Memorial	**1982**	Black granite			Bangalore, India	the Cold Springs Granite Company
Korean War Veterans Memorial	**1993-1995**	**Wall:** "Academy Black" granite	Academy Black granite quarry	active	Clovis, California	the Cold Springs Granite Company
		Pool of Remembrance: black granite			Canada	
Franklin Delano Roosevelt Memorial	**1997**	**Walls and paving stones:** Pink Carnelian Granite.	Milbank, South Dakota	active	The border between South Dakota and Minnesota	the Cold Springs Granite Company
National World War II Memorial	**2001-2004**	**Vertical elements :** "Kershaw"	Kershaw Granite Quarry	active	Kershaw,South Carolina	New England Stone Industries (Kershaw) North Carolina Granite Corporation
		Main plaza paving stone: "Green County"	Green County Granite Quarry	active	Green County, Georgia	
		Accent paving on the plaza: "Rio Verde" and "Moss Green"			Brazil	
		Rainbow Pool : "Academy Black"	Academy Black granite quarry	active	Clovis, California	
		Rainbow Pool : Mount Airy"	The Rock Quarry	active	Mount airy, North Carolina	
Martin Luther King Jr. Memorial	2007-2011	Stone of Hope: White granite			China	

02 BACKGROUND

STONES

One years ago, I read The Marble Industry of Vermont by chance. It was the first time that I heard about Vermont marble. It was also the first time that I heard of the Arlington Memorial Amphitheater, which was entirely constructed of Vermont marble. In the small booklet, the author made a comparison, "The stone was planned and reared in the midst of struggle and privation and hardship, the work of hands trained to the axe and the plough; it was simply given a place in the cemetery and then left to fight its own way through the centuries. The other is a masterpiece of design, produced largely by modern machinery amid surroundings conductive to faultless workmanship. It will be given intelligent care and a setting worthy of subject"(The Marble Industry of Vermont, 1920, p.18) .

One kind of stone is raw, rough, primitive and made by handwork; the other is "masterpiece", designed by "modern machine" and "faultless workmanship". The comparison between them is interesting. Several questions were raised :

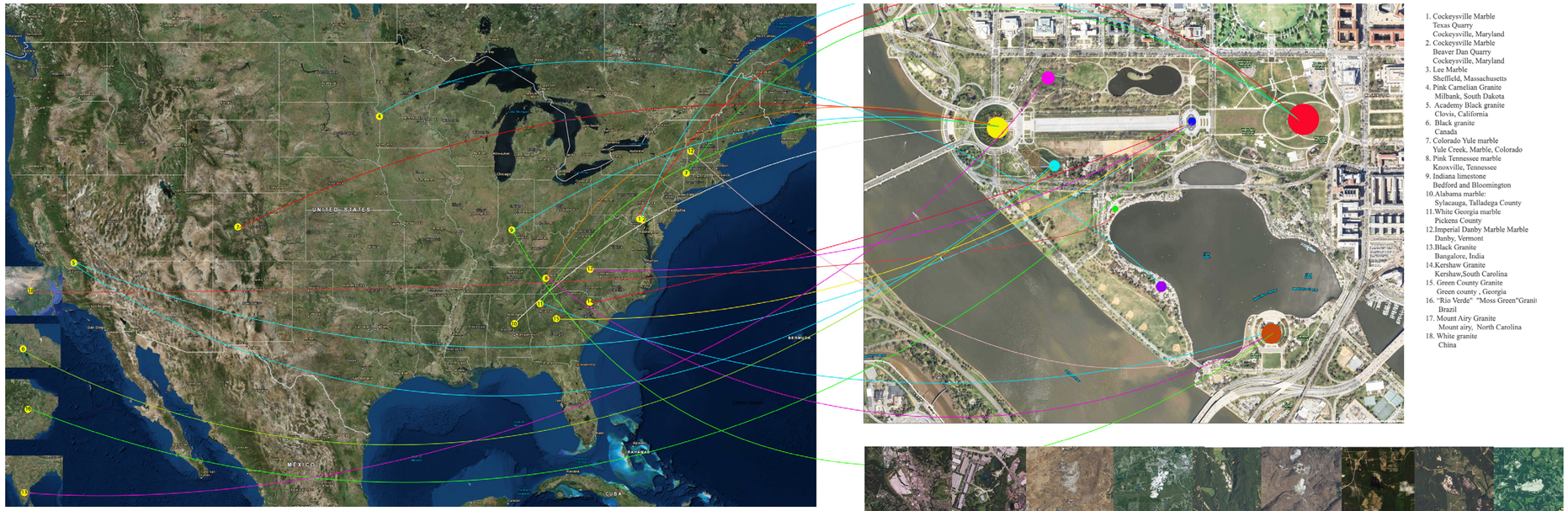
what are the stones used in the memorials on the National Mall?

where do they come from?

What do these places look like?

Based on these question, I started tracing the stones of the memorials on the National Mall (table 2.1).

Figure 2.2 : The map shows the connection of the memorials and their material suppliers.



1. Cockeysville Marble
Texas Quarry
Cockeysville, Maryland
2. Cockeysville Marble
Beaver Dan Quarry
Cockeysville, Maryland
3. Lee Marble
Sheffield, Massachusetts
4. Pink Carnelian Granite
Milbank, South Dakota
5. Academy Black granite
Clovis, California
6. Black granite
Canada
7. Colorado Yule marble
Yule Creek, Marble, Colorado
8. Pink Tennessee marble
Knoxville, Tennessee
9. Indiana limestone
Bedford and Bloomington
10. Alabama marble:
Sylacauga, Talladega County
11. White Georgia marble
Pickens County
12. Imperial Danby Marble Marble
Danby, Vermont
13. Black Granite
Bangalore, India
14. Kershaw Granite
Kershaw,South Carolina
15. Green County Granite
Green county , Georgia
16. "Rio Verde" "Moss Green"Granit
Brazil
17. Mount Airy Granite
Mount airy, North Carolina
18. White granite
China

From 1848-2011, eight memorials were designed and built on the National Mall (figure2.2). Each memorial is composed of different materials. The stones were gathered from 18 discrete places, including overseas. Tons of materials were transported to the National Mall by train, ship and truck. Stones have linked the National Mall and the remote quarries.

However, the construction of the National Mall and the excavation in the remote quarries take not only place, but also time (Carlisle, 2015). In the map, each of the lines represents a process, rather than just place to place. For example, the construction of the Lincoln Memorial lasted 8 years. During this period of time, the Potomac River on the National Mall had been filled while the stone from Colorado, Tennessee, and Indiana was extracted. What accompanied the change of the landform was the change of water flow, vegetation, infrastructure, land use and laborers.

In order to better understand the process, the paired landscape, the Washington Monument and its quarries in Cockeysville are examined in the thesis. There are two reasons for the selection: first, 90% of the exterior marbles of the Washington Monument came from the same place. Secondly, the Washington Monument was the first built memorial on the National Mall. Its design and construction has a great impact on the landscape of the National Mall (figure 2.3, 2.4).

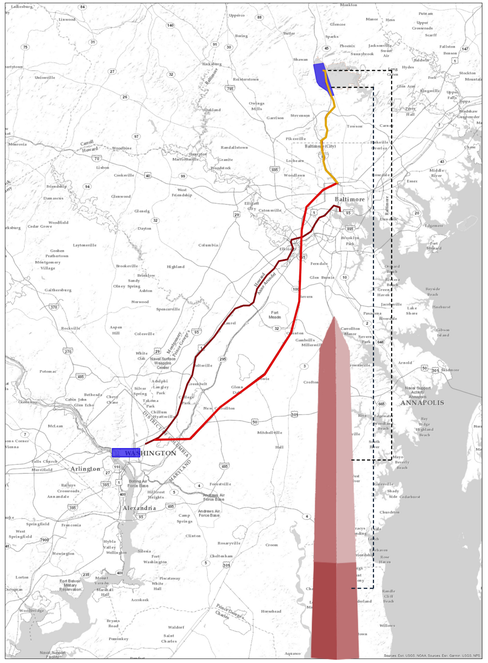


Figure 3.2 : Aerial photos of Cockeysville marble valley (top left), National Mall (top right). (from google earth)

Figure 3.1 : The map shows the locations of the Cockeysville Marble Valley and the National Mall, and their railroad connections.(left)

03 SITE ANALYSIS

Paired sites: Cockeysville, Marble Valley, the Washington Monument

The construction of the Washington Monument lasted 40 years. It began in 1848, and was halted from 1854 to 1877. The second phase was from 1880–1884. The final structure was completed in 1884. Cockeysville marble composed the whole outer surface of the Washington Monument. Each stone is 14 to 18 inches thick and 2-foot high. During the first phase from 1848-1854, its white marble exterior came from the Texas quarry in the 19th-century town of Cockeysville, Maryland. In the second phase, three courses, from 152–156 feet came from Sheffield, Massachusetts. All other courses of white marble came from the Beaver Dam quarry, also in Cockeysville .

Cockeysville is a town located to the north of the Baltimore Beltway along Interstate 83 and York Road . It is in the valley underlain with white marble. The Texas quarry was named after the town's old name which is known as Texas by old local people. Today the Texas quarry is operated by Lafarge Company which produces crushed stone and high-purity calcite. Beaver Dam quarry is flooded and has been used as swimming pool since 1930s.

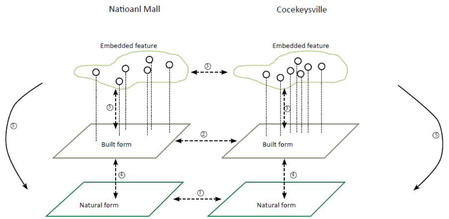


Figure 3.3 : Layered study of the relationship of the two sites

STUDY METHOD

Layered study is applied in the analysis of the two sites(figure 3.3). The site is divided into three layers: the natural form, the built form and the physical elements associated with the construction of the Washington Monument and stone quarrying in Cockeysville. Comparisons are made among them in order to understand their relationships:

① The natural form are studied through physiography, hydrology and geology. Each site has their own natural form. It reveals its intrinsic character. The characters of the two sites are very different, but the common feature is they are both in process.

② The built form of each site is presented as the sequence of the historic development of the places. In Cockeysville, it is from quarrying activities. On the National Mall, it comes from the plans and designs for the city. The construction of monument and the National Mall made the Cockeysville Marble history famous and stimulated the growth of the form in Cockeysville.

③ The elements left by constructing the Washington Monument and quarrying stones simultaneously are embedded in the built forms. They could be found by the study of the interrelated history associated with laborers, earth change and railroads.

④ The built form changes the geology of the sites. Some of them preserve and enhance the identity of the natural form, some do not adapt to it.

⑤ Ecological change caused by the process of the construction of the Washington Monument and quarrying stones in Cockeysville increased the effects of the past development of the built forms on the natural forms.

INTERRELATED HISTORY

In history, the Baltimore & Ohio railroad and the Baltimore & Potomac Railroad played important roles in transporting marbles from Cockeysville to Washington DC. The Washington Branch of Baltimore & Ohio railroad was opened in 1835. The Baltimore & Potomac Railroad was completed in 1872. The two railroads speeded up the development of the town Cockeysville as the materials

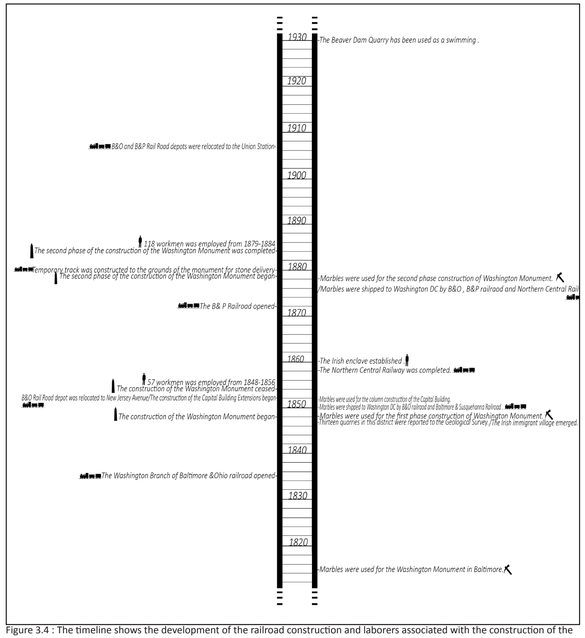


Figure 3.4 : The timeline shows the development of the railroad construction and laborers associated with the construction of the Washington Monument landscape and the marble production in Cockeysville.

supplier for Washington DC. According to the report *A history of Washington Monument* , during the construction time of the Washington Monument, marbles from the quarries were delivered to Washington D.C by the Baltimore & Ohio and Baltimore & Potomac Railroad. Marbles "had been dragged through the streets of Washington by workmen and anyone else who could seize a line of the cumbersome vehicle transporting it from the railroad station to the site"[1]. In 1880, a new track was built for transporting stones. "With the permission of the District authorities, the marble contractor was authorized to construct this track to the grounds of the Washington Monument from the Baltimore & Potomac tracks on Maryland Avenue. This permitted delivery of marble from the quarry in Maryland direct to the stone sheds" [2].

Today, we can experience the route of marble shipping by taking the Maryland Area Regional Commuter (MARC) train from Washington DC to Baltimore, then to Cockeysville by transferring to Light Raillink on the Northern Center Railway (figure 3.1). The MARC runs on some of lines of the old B&O Railroad. The Northern Center Railway was completed in 1858. Before that, there was Baltimore & Susquehanna Railroad running from Baltimore to the end York Road in Cockeysville. These two railroads were responsible for the stones transportation from the quarries to Baltimore before being loaded to the B& O and B&P railroad during the first and second phase of construction.

The construction of the monument was not only speeded up by the railroad, but also the increasing number of laborers. In Washington DC, according to the records of payrolls from 1848 to 1856, 57 workmen were employed, including stone masons, stone cutters, carpenters, helper, riggers, laborers and watchmen. This number was increased to 118 during the second phase[3]. In Cockeysville, Irish immigrants escaping Ireland's Great Famine came and settled down in the area. They made their livings by working in the quarry mines. According to the research, they first settled the village in 1847. It was just one year before the construction of the Monument. The village was transformed into an established Irish enclave by 1860. But due to the discoveries of cheaper and

1. See "Laying of the cornerstone " in Chapter II of A history of Washington Monument. https://www.nps.gov/parkhistory/online_books/wamo/history/contents.htm.
2. See "Ironwork" in Chapter V of A history of Washington Monument. https://www.nps.gov/parkhistory/online_books/wamo/history/contents.htm.
3. Ibid.

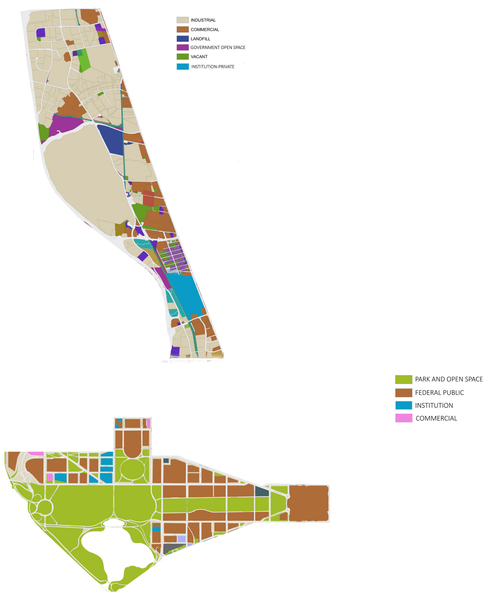


Figure 3.5 : The current landuse of Cockeysville (top), and National Mall (bottom) shows the different developments of the two area.

better quality marble and limestone in other places in the first several decades of the 20th century, many quarry owners abandoned the Texas quarries. Fewer workers were needed. The village of Texas finally dried up. Today, the St. Joseph's Parish built by the Irish immigrants in 1852 and stone houses built in the mid-1800s can be found along Church Lane[4].

Earth movement, infrastructure for transportation and laborers were indispensable parts of the process of quarrying and building the monument .They left marks on the two sites simultaneously. However, these marks evolved to different forms due to different developments (figure 3.5). In Washington the B&O Rail depot was relocated from Pennsylvania Avenue to the New Jersey Avenue in 1851. In 1907, both the New Jersey Avenue Depot and the B&P Railroad Station which was located on the National Mall were relocate to the new Union Station as the National Mall was planned to be a public space in the McMillan Plan (Steckelberg, 2016). The filled land around the Washington Monument grounds were redesigned in 2013. In Cockeysville, all the marks remained there due to a lack of plan. We can see the holes, the mound, the train stations and a historic Irish church and houses. They only grow or disappear with the rise and decline of the quarrying industry.

Figure 3.6: The map shows the railroad station and tracks before removing on the National Mall in 1900

4.See Archaeology Project Digs Up Forgotten Texas History. Retrieved August 21, 2017, from https://patch.com/maryland/huntvalley/archaeology-project-digs-up-forgotten-texas-history.

BUILT FORM

Figure 3.7 :The built form of Cockeysville

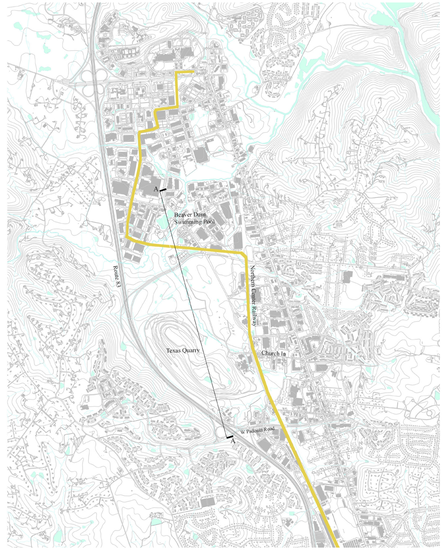


Figure 3.8 :The physical links with the National Mall left by quarring

Vertical cut edge of the pit

Ramp

Industrial Facilities on the edge of the pit

Lightlink rail

Abandoned Texas Marble Quarry

Figure 3.10 :The built form of National

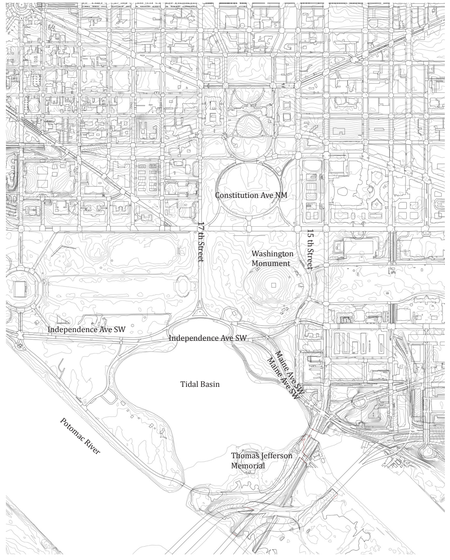


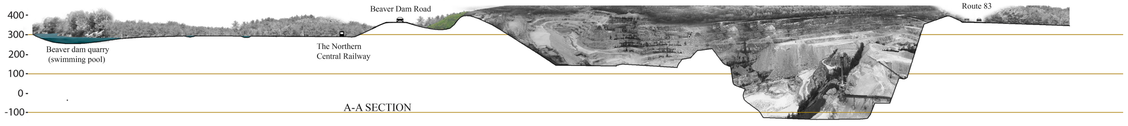
Figure 3.11 :The physical links with Cockeysville

Washington Monument in 2014

Uncompleted Washington Monument in 1860

The physical links are embedded in the built forms. In Cockeysville, they are hidden in the disperse elements, while on the National Mall, they are not there anymore, except the Monument.

Figure 3.9 :Section A-A of Cockeysville



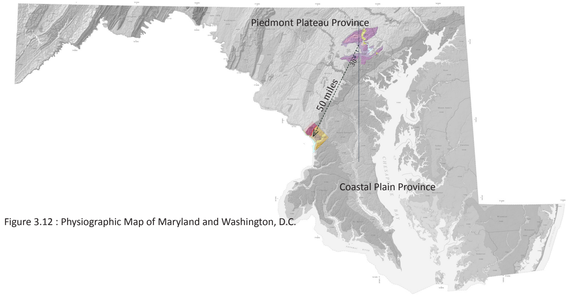


Figure 3.12 : Physiographic Map of Maryland and Washington, D.C.

Washington DC is on the coastal plain. The National Mall is within the Potomac Estuary & Lowlands District, which is sitting on the flood plain of Potomac River and the lowest part of the city.

Cockeysville is in the Piedmont Plateau Province. It is located in the Timonium Valley District, which is a broad flat- bottomed valley underlain by Cockeysville Marble. Chemical weathering of the marble produces a distinctive dolomite sand and numerous pinnacles and residual boulders. It is surrounded by four interconnected,gently rolling to subdued hilly dome-like uplands underlain mainly by Baltimore Gneiss.

Figure 3.13 : Physiographic Map of Washington,D.C

Potomac Estuary & Lowlands Dsitrict

Figure 3.14 : Physiographic Map of North Baltimore

Chattolanee Upland District

Timonium Valley District

Figure 3.15 : Profile

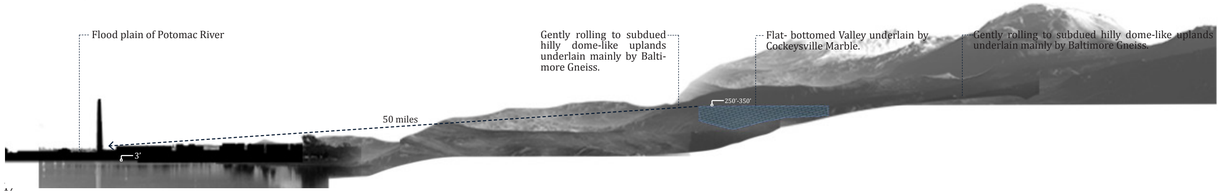


Figure 3.16 : The Potomac River watershed

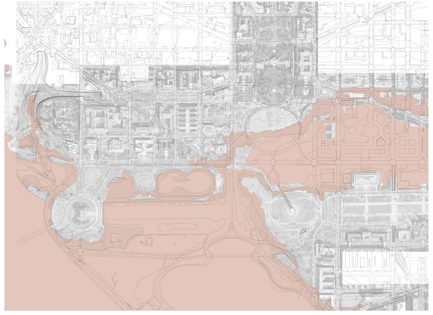


Figure 3.17 : 100-year flood zone

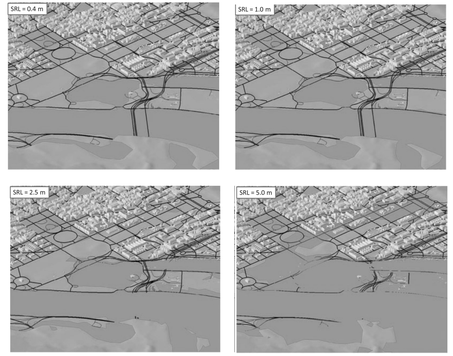


Figure 3.18 : Prediction and impact of sea level rise on the National Mall. Ayyub Bilal, Prediction and Impact of Sea Level Rise on Properties and Infrastructure of Washington, DC. *Risk Analysis:* 32/11.

Located in the flood plain of Potomac River, the National Mall has experienced periodic flooding from Potomac River flooding and stormwater flooding since its completion in 1880s. The effects will be intensified by the global climate change in the future. The area is under higher threat of the sea level rise, because it is on the lowest part of the coastal plain and facing directly with the rising water level.

Figure 3.19 : The Loch Raven Reseroir watershed

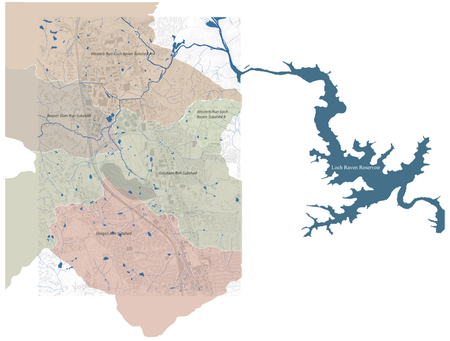


Figure 3.20 : The subwatershed of the Loch Raven Reservoir watershed

Cockeysville is in the Loch Raven Reservoir watershed. It is influenced by the Beaver Dam Run subshed, Oregon subshed, Goodwin Run subshed and Western Run Loch Raven Subshed. The main surface water of Goodwin Run and Beaver Dam Run flows north-east to the Loch Raven Reservoir. The loch Raven Reservoir watershed occupies a large area of Baltimore County and provides drinking water for the City of Baltimore and most of Baltimore County, Maryland.

Determined by the physiographic characters, the weathered limestone forms underground with many pocket-like holes. It can hold large amounts of groundwater. Surface water disappears in some places through sink holes. The water table in the area is high.

The current quarrying activities in the area keep pumping the water out of the pit, increasing the risk of groundwater level drop. In addition, the quarrying generates more sink holes on the surface, aggravating the pollution of aquifer.

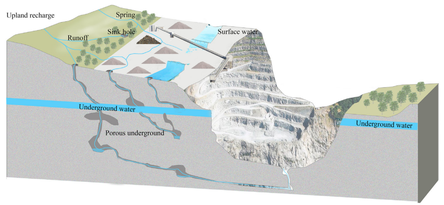


Figure 3.21 : Underground condition overlaid with quarry

MASTER PLAN - COCKEYSVILLE (AFTER CLOSURE)

The design aims at transforming the severely damaged place into a beautiful, healthy and public enviroment by respecting its natural processes and industrial history.

1. Quarry lake
2. Goodwin Run
3. Wetland
4. Beaver Dam swimming pool
5. Remained facility
6. Main entrance
7. Visiting center
8. Parking lot
9. Open lawn
10. Ramp
11. View platform
12. Texas station
13. Warren Road station

Figure 4.1: Master plan

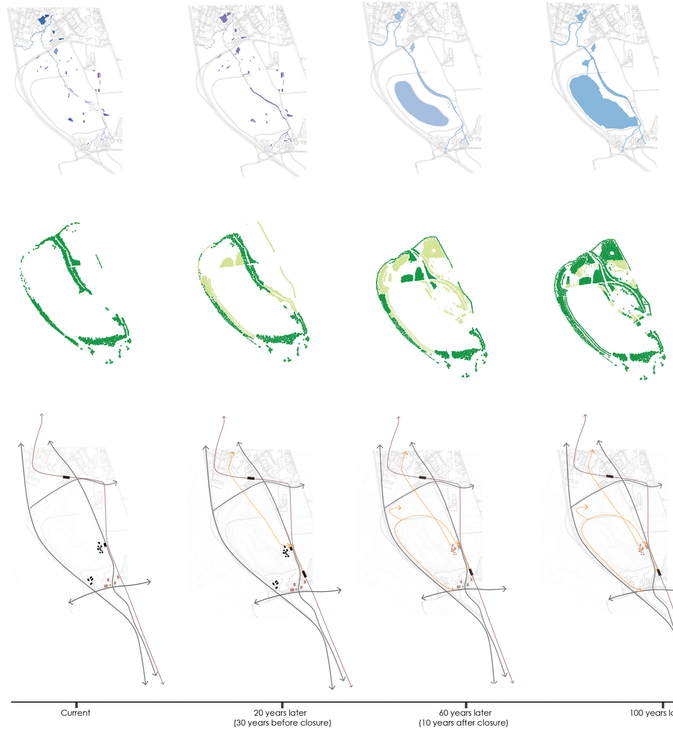
PHASING - COCKEYSVILLE

Figure 4.2: Landscape evolution over the next 100 years

Hydrology

Vegetation

Circulationn and buildings



The landscape will grow over time. As the underground water level rises in the pit natually, the shifting hydrology drives new uses, earthwork, circulation and tree planting on the site.

Figure 6.2: Landscape evolution over the next 100 years

Figure 4.3: Pierre Charles L'Enfant, "Map of Dotted Lines," 1791. Dan Kiley, *The Mall in Washington, 1791-1991.* Washignton, D.C.: NGW-Stud Hist Art.

"It was L'Enfant's idea that seminal source of the design for Washington would be the meeting of the city and the river, and that the design of the city would join the force of the region, the Potomac River... So from the White House, there would have been a great sweeping view upon down a long stretch of the Potomac, and from the Capitol a vista across an expanse of the water of the river as a foreground for the Virginia hills."

- Edmund N. Bacon, Design of Cities ,p.222

In L'Enfant's plan for Washington DC, major buildings were put on the high points of the land. Two axes united the White House and the Capitol Building with the Potomac River. Diagonal lines connected other elements , creating dynamic interrelationships with the region.

The form inspired the design structure of the Cockeysville site. The structure integrates distributed individual elements into a whole system. The character and history of the site can be read through the design entirety, rather than just the fragments. The force of lines sets in motion the growing process of the landscape.

Axis

An axis unites the hill, the bank, the ramp and the lake. It starts from the highest point of the site, goes through the lake, crosses the gap between the hills and disappears into the mountains.

Gap

The gap in the woods points to the Washington Monument.

Triangle

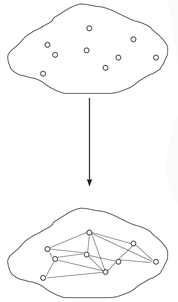
The equilateral triangle and right triangle links mount, river, facilities, creating interrelationship among major features on the site.

Circle

The circles indicates the growing force of the land.

Figure 4.5: The geometry of the organization

Interrelationships are created among distributed elements, revealing the embedded links with the National mall.



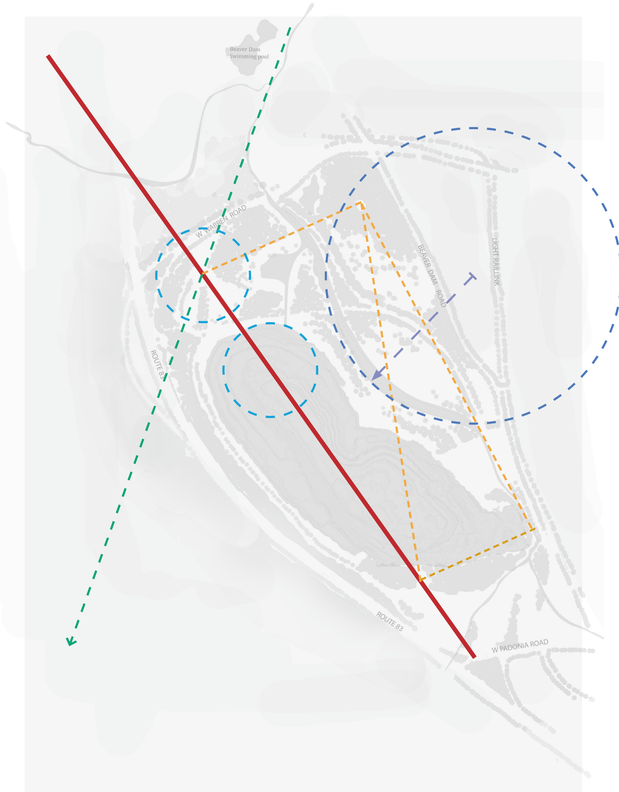


Figure 4.4: The organization of the major elements

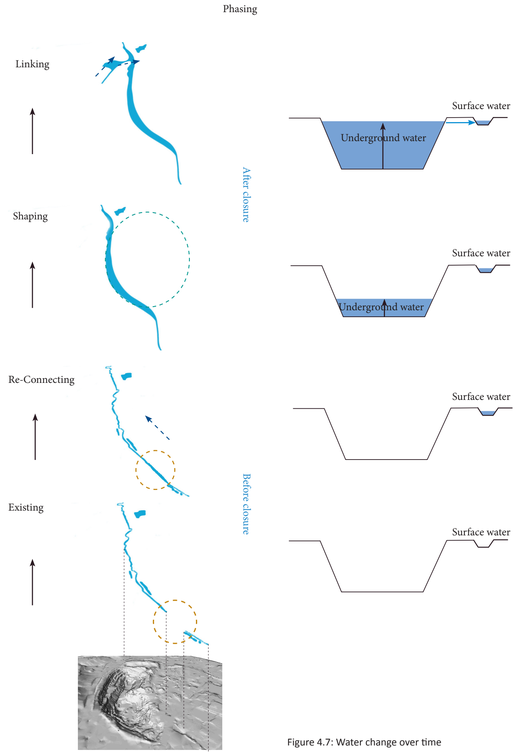


Figure 4.7: Water change over time

Figure 4.6: Water circulation

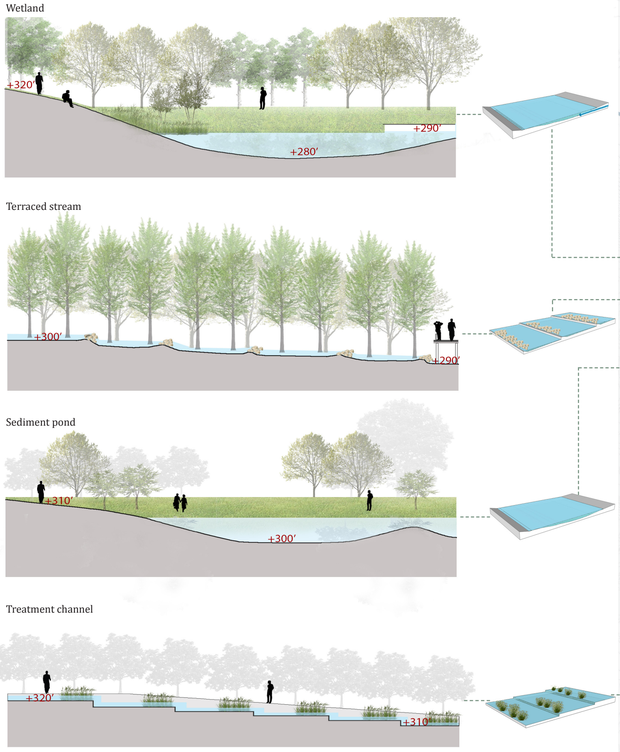


Figure 4.9: Water cleaning strategies. Several strategies are applied to purify the Goodwin Run water before it recharges the aquifer and flows out of the area to the Loch Raven Reservoir.

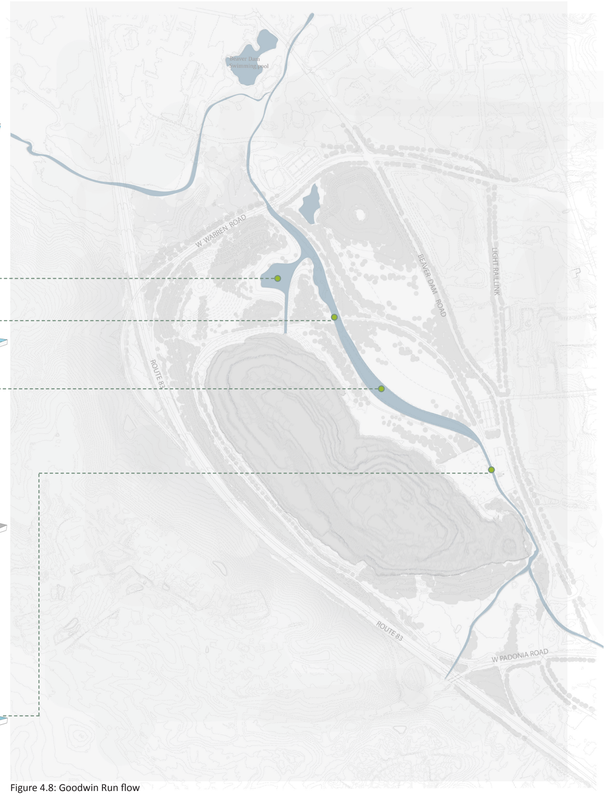
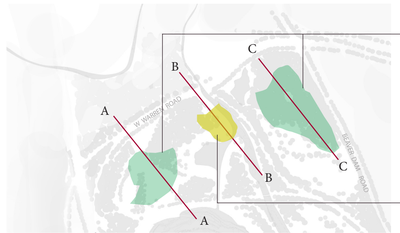
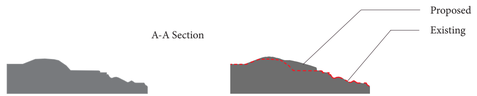


Figure 4.8: Goodwin Run flow



Build
Soil cut from excavation during quarrying is added. Land is growing within the design structure.

Remove
Soil is removed, allowing the connection of the wetland and the Goodwin Run.



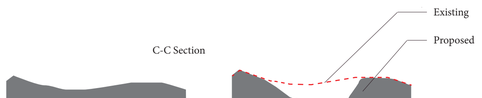


Figure 4.11: Earth work strategies

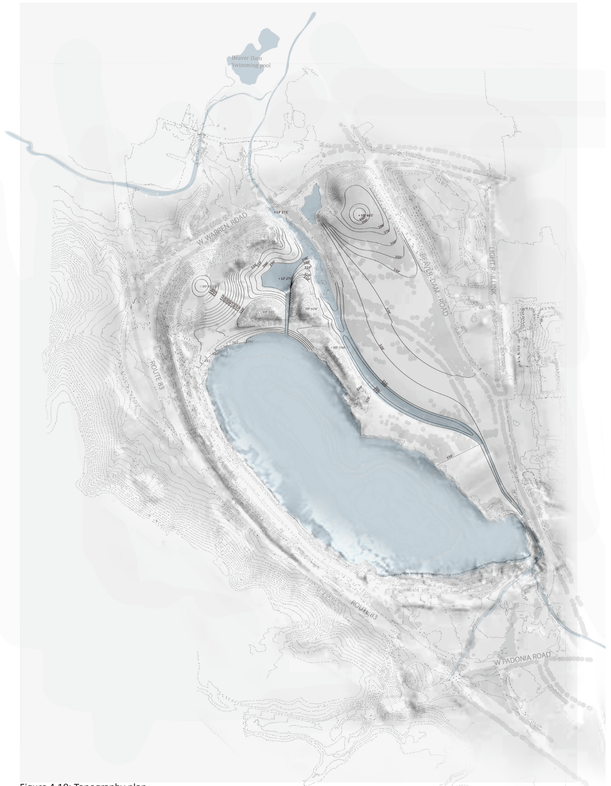


Figure 4.10: Topography plan

Figure 4.12: Planting plan

Figure 6.16: Warren Road Station

A main new oak loop trail is designed based on the existing loop. Several other trails linked by the main loop providing multiple experiences for visitors.

Figure6.15: Uncompleted Texas Station

There were plans to add an infill station at Texas. It is still uncompleted. In this project, the Texas station is very important. It is not only the start of the trail connecting the existing Warren Road station, but also recalls the old name Texas of the area when it was the quarry for the Washington Monument.

The water trail under the W Warren Road Bridge, brings people to the old quarry site, the abandoned Beaver Dam quarry.

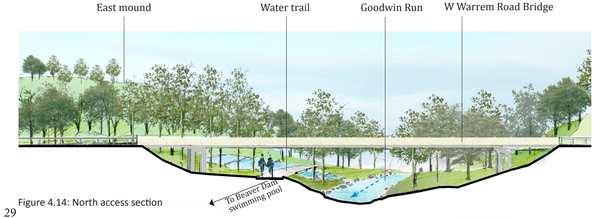


Figure 4.14: North access section

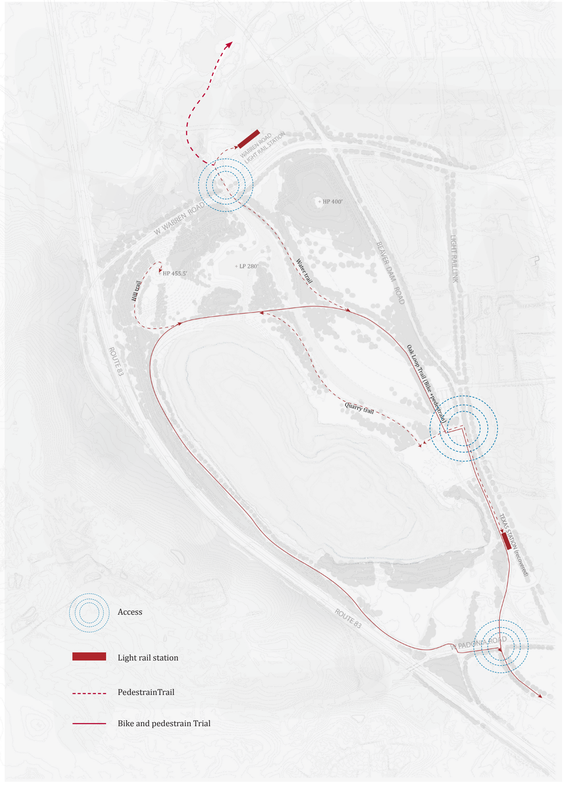


Figure 4.13: Circulation plan

Figure 4.17 : Industrial facilities are transformed to be the visitor center and recreational structure.

Figure 4.18: Detail plan

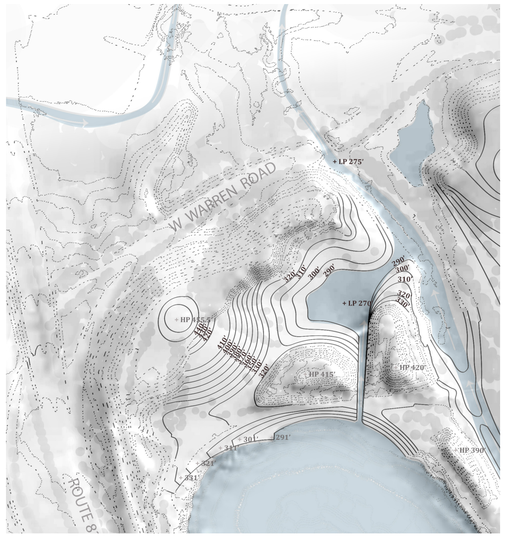
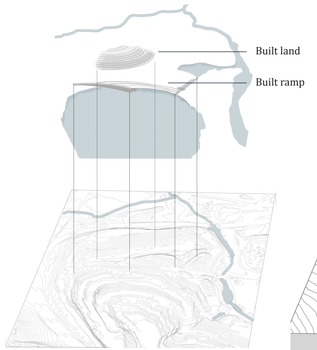


Figure 4.19: Topographic design

Figure 4.21: Existing ramp on site



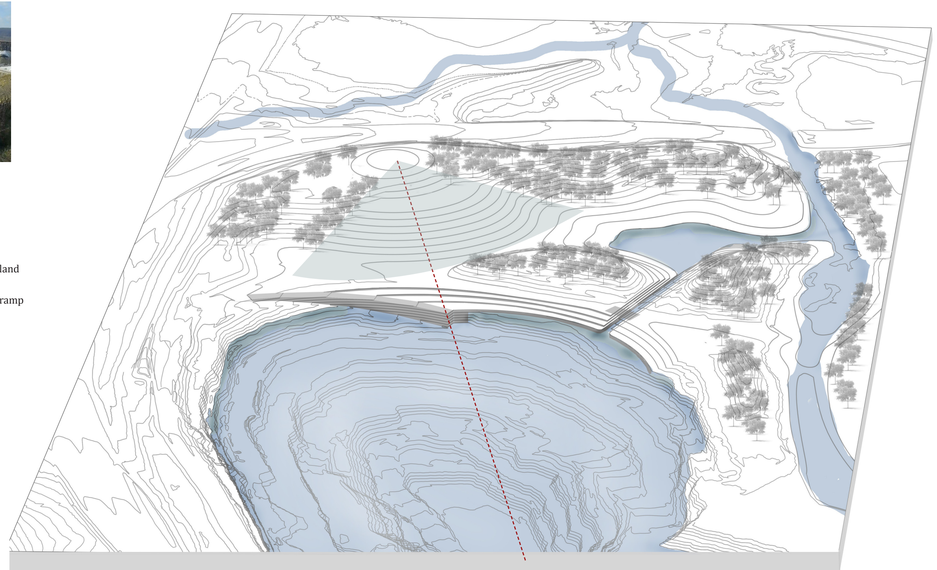
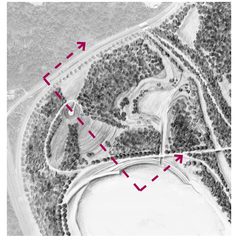


Figure 4.20: Bird-eye view. Existing ramp is maintained. New designed retaining walls heighten the unique vertical edges of the quarry hole.



The designed height from the bottom of the quarry to the summit of the mound constructs connection with the Washington Monument ideologically.

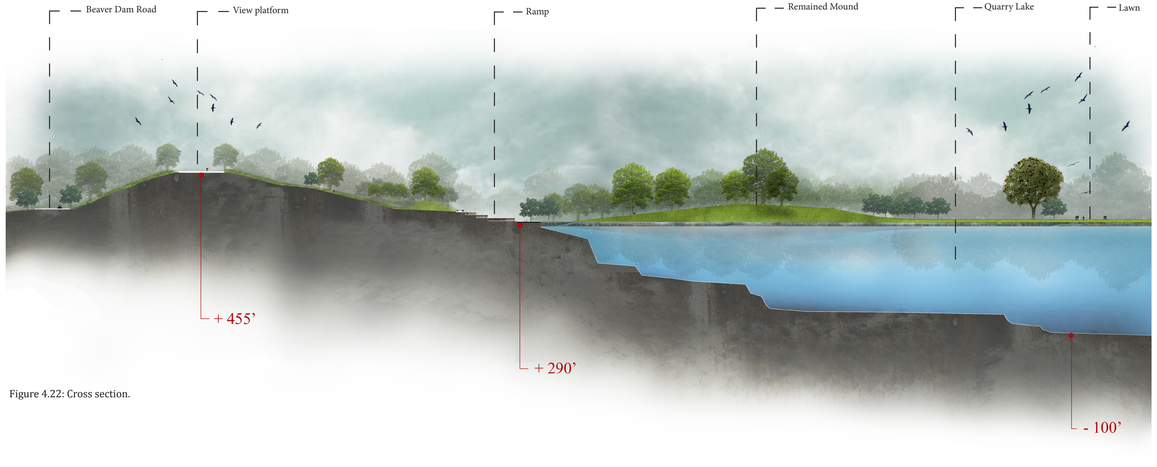
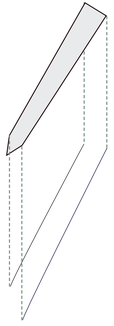


Figure 4.22: Cross section.



The size of the canal reminds visitors of the identity of the site as the material source of the Washington Monument.

The proportion of the stones and people recalls the anicent quarrying history.

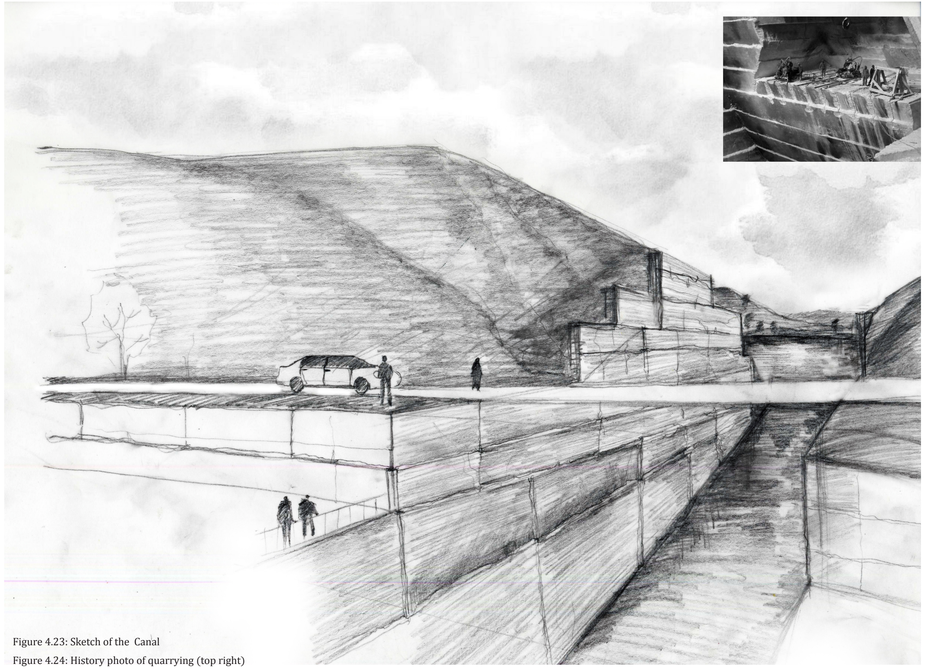


Figure 4.23: Sketch of the Canal

Figure 4.24: History photo of quarrying (top right)

MASTER PLAN - NATIONAL MALL

The design explored the landscape around the Tidal Basin after the sea level rises in the future. Two canals are created to adapt to the rising water . A new island will appear on the south end of the National Mall, recalling L'Enfant's North-South axis.

1. Canal
2. Tidal Basin
3. Cherry Hill
4. Washington Monument
5. Martin Luther King Jr. Memorial
6. Jefferson Memorial
7. Franklin Delano Roosevelt Memorial
8. Marsh
9. Cherry Tree Allees

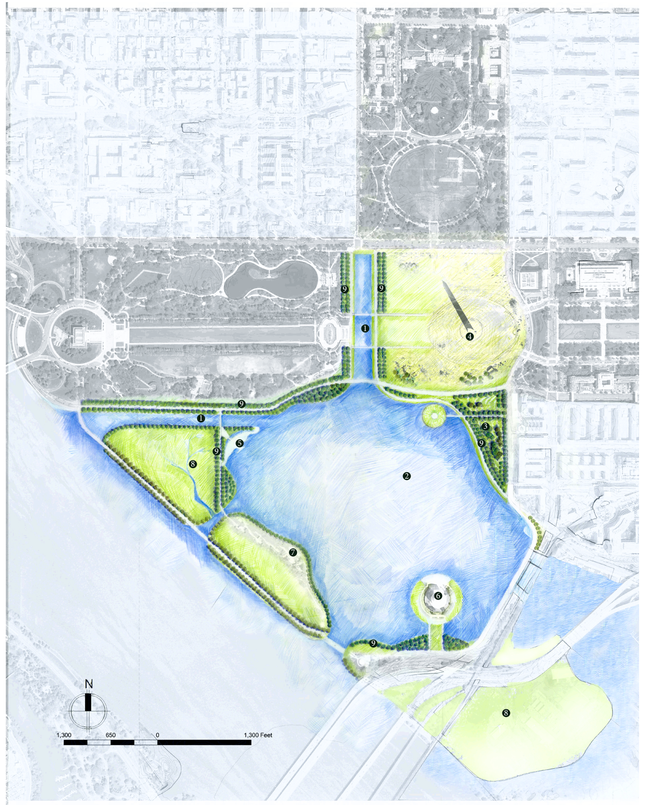


Figure 4.25: Master plan

PHASING - NATIONAL MALL

Figure 4.26: Tidal Basin changes over the sea level rise

The landscape will grow over time. As the sea level rises, the Tidal Basin will acquire different forms at different phases. The changing water levels require new earthwork, circulation and tree planting at the National Mall.

Figure 4.27: Detail plan

Figure 4.28: Topographic design

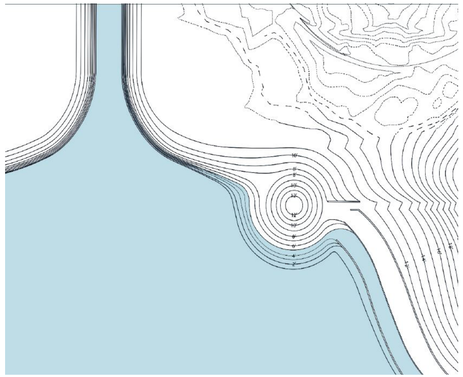


Figure 4.29: Cockeysville quarry edge

The form of the quarry edge in Cockeysville inspired the waterfront design of the Tidal Basin for the adaption to the sea level rise.

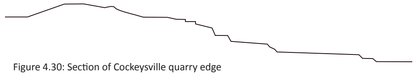


Figure 4.30: Section of Cockeysville quarry edge

Figure 4.31: Abstract: terrace form

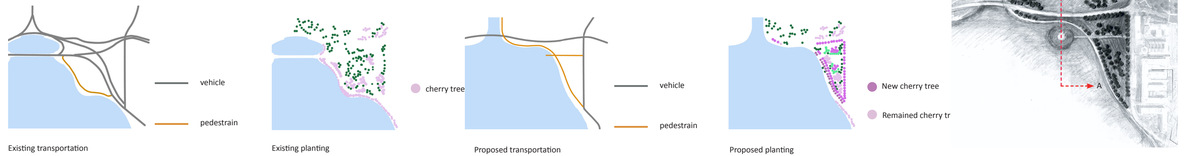


Figure 4.32: Transportation and tree canopy

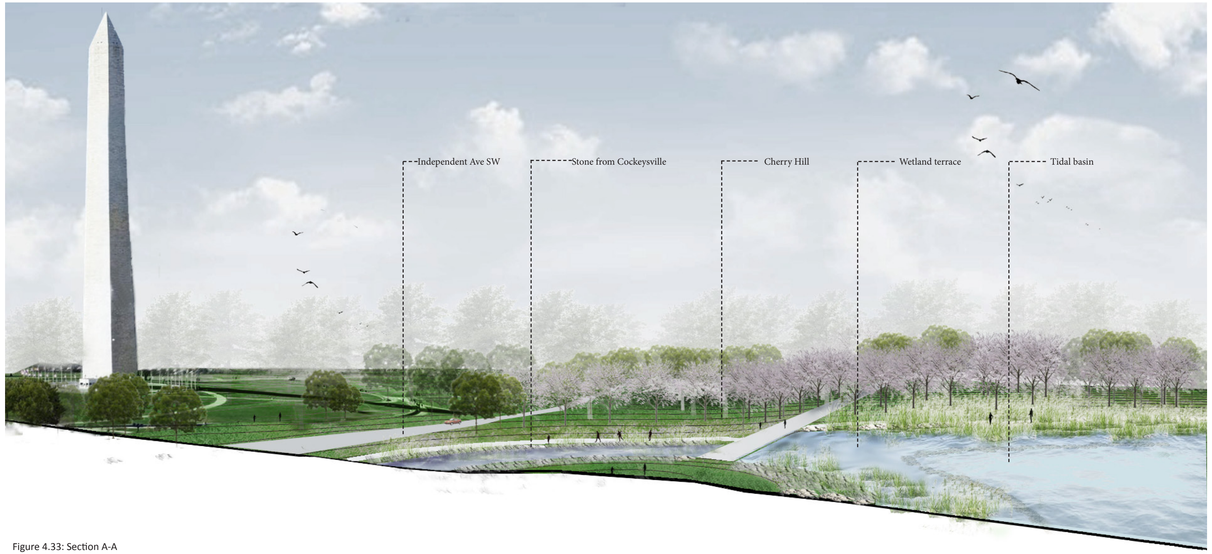
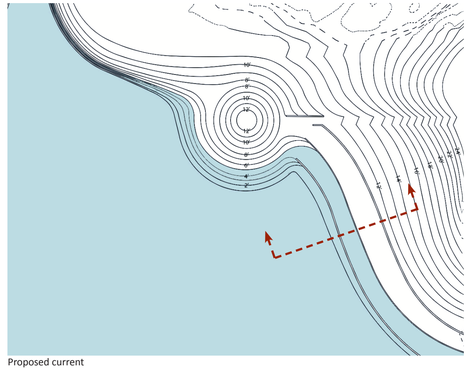
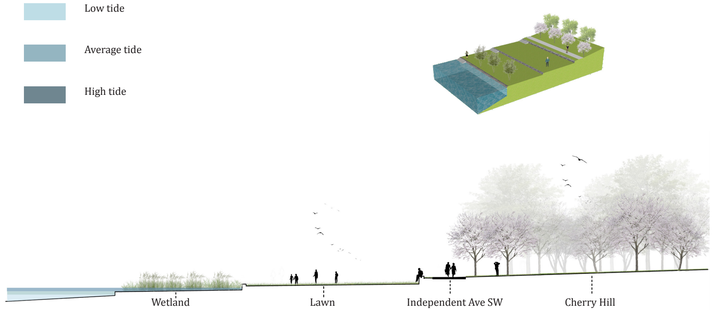


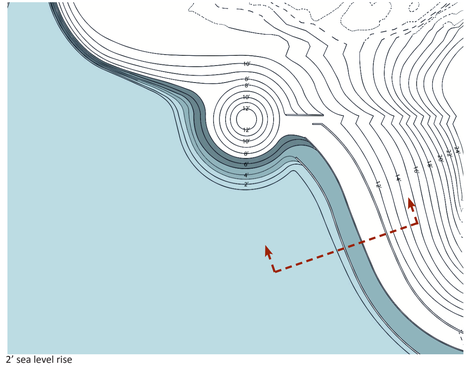
Figure 4.33: Section A-A

Figure 4.34: Cherry Hill waterfront changes as sea level rises

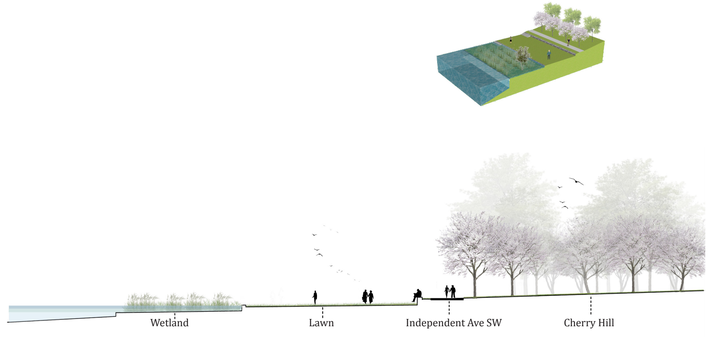


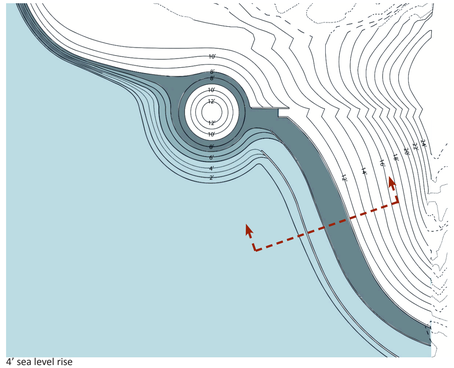
Proposed current



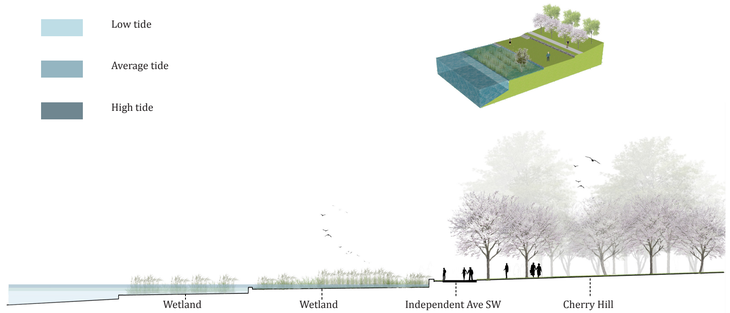


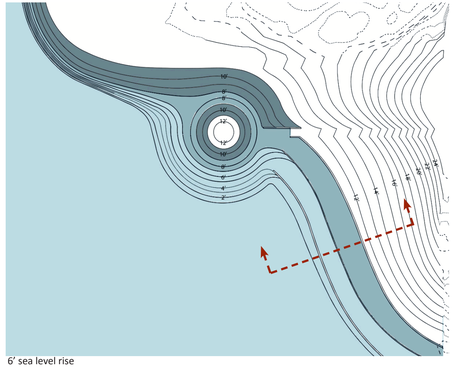
2' sea level rise



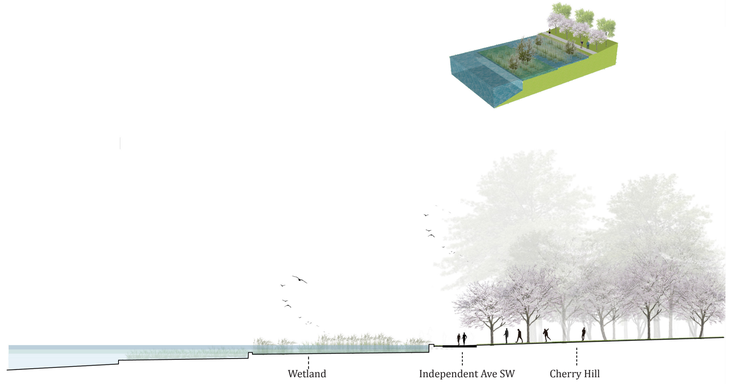


4' sea level rise





6' sea level rise



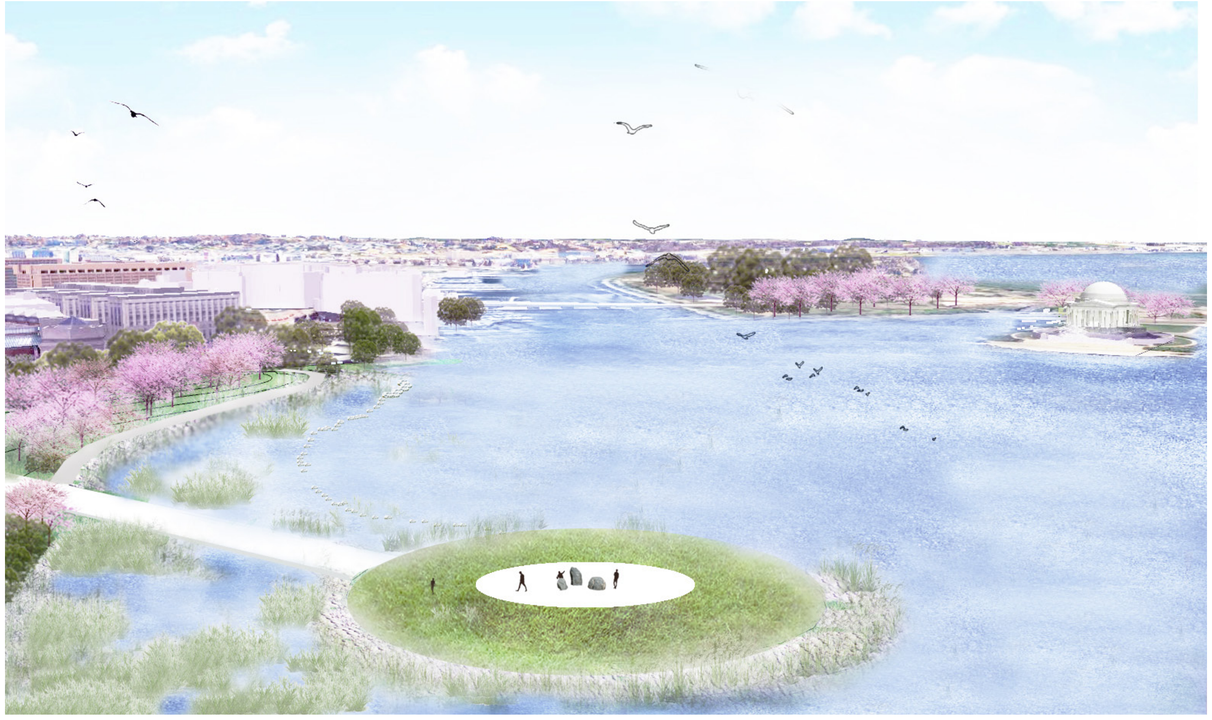


Figure 4.34: The island on L'Enfant's North-south axis as sea level rises.

05 CONCLUSION

This thesis studied the National Mall and the quarries that supported its construction. Understanding their relationships and how the relationships can inform the future design of the two landscapes is the goal and challenge of the thesis.

McHarg's writing about the two landscapes in Design with Nature is a critical starting point for the exploration. The key method applied here is to distinguish the built form from natural form of the each site and make comparisons among them.

The design of the two sites aims at creating landscapes that respect and adapt to the natural processes. By using shifting hydrologies at both sites, new land uses, earthwork, urban forest (tree canopies) in the future can be imagined. At the same time, materials, forms, and histories discovered in the study link the two landscape design. The designs recall the past connections between the sites and construct new physical and symbolic relationships.

PHOTO CREDITS

Figure 1.1 : The Physiogarohic features of the Valley and its bird's eye view.
Ian L. McHarg, Design with Nature. Natural History Press, New York, 1969. Page 88,92.

Figure 1.2 : The given form and made form of Washington DC.
Ian L. McHarg, Design with Nature. Natural History Press, New York, 1969. Page 180,182.

Figure 3.2 : Aerial photos of Cockeysville marble valley, National Mall.
From google earth

Figure 3.6 : The map of the National Mall in 1900.
Aaron Steckelberg, A 200-year transformation. The Washington Post, August 23, 2016.
From https://www.washingtonpost.com/graphics/lifestyle/the-evolution-of-the-national-mall/

Figure 3.8 : The physical links with the National Mall left by quarring.
From https://www.youtube.com/watch?v=ekrobArD_RM

Figure 3.11 :The physical links with Cockeysville
https://en.wikipedia.org/wiki/Washington_Monument

Figure 3.18 : Prediction and impact of sea level rise on the National Mall.
Ayyub Bilal, Prediction and Impact of Sea Level Rise on Properties and Infrastructure of Washington, DC. Risk Analysis 32/11, 1901-1918.

Figure 4.3: Pierre Charles L'Enfant, "Map of Dotted Lines".
The Mall in Washington, 1791-1991. Washignton, D.C.: NGW-Stud Hist Art. Page 175.

Figure 4.21: Existing ramp on site.
From https://www.youtube.com/watch?v=ekrobArD_RM

Figure 4.29: Cockeysville quarry edge
From https://www.youtube.com/watch?v=ekrobArD_RM

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