



WASHINGTON D.C. AQUARIUM

AN EXPLORATION OF SHAPING THE WATER : BUILDING SCULPTURE ALONG THE EXISTING LANDSCAPE

NGAN DINH

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THESIS SUBMITTED TO THE FACULTY OF VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

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MASTER OF ARCHITECTURE IN ARCHITECTURE

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ABSTRACT

THE SITE IS LOCATED ON A PROMINENT WATERFRONT IN SOUTHWEST DC. AFTER STUDYING THE SURROUNDING PUBLIC BUILDINGS, IT APPEARS AN AQUARIUM WOULD BE THE BEST FIT FOR THE AREA.

THE AQUARIUM, WHICH IS A HOUSE FOR LIVING AQUATIC ANIMALS, SEEMS TO BE A CHALLENGING PROJECT FROM THE START. THERE ARE MANY TECHNICAL PROBLEMS THAT ARISE SUCH AS CONCERNS WITH HOW THE PEOPLE CIRCULATE INSIDE THE AQUARIUM AND HOW TO CONNECT THE BUILDINGS WITH THE REST OF THE SITE TO CREATE A RECREATIONAL PUBLIC WATERFRONT WALKWAY.

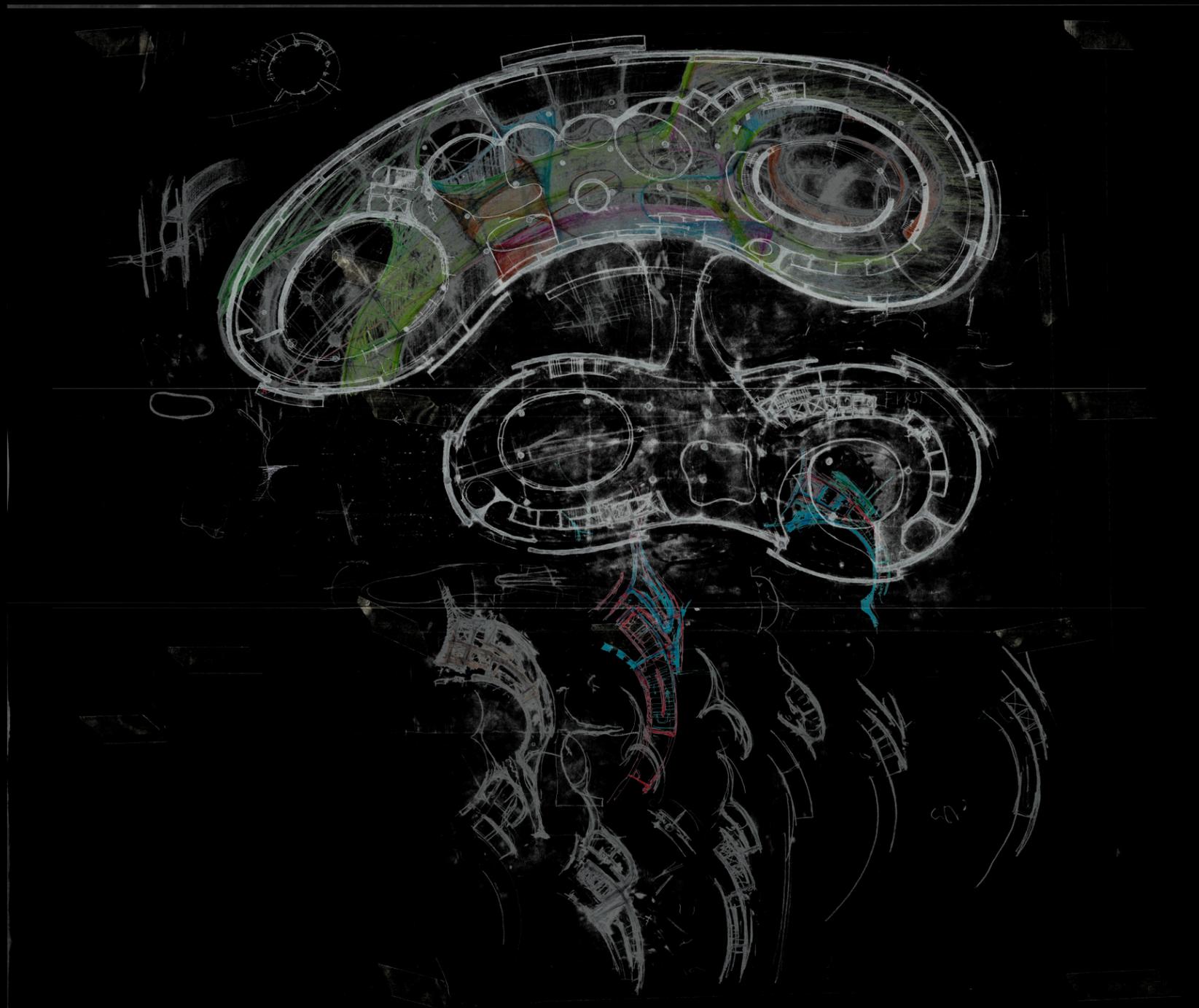
THE FOLLOWING QUESTIONS STIMULATE THE RESEARCH AND THE DEVELOPMENT OF THE AQUARIUM PROGRAM: WHAT IS AN IDEAL SPACE THAT AQUATIC ANIMALS WOULD LIKE TO LIVE? WHAT KIND OF LIGHTING, WATER, MATERIALS SHOULD BE ACCOMMODATED TO COMFORT THE LIVING AQUATIC ANIMALS?

THE DESIGN BEGINS WITH THE QUESTION OF "WHAT KIND OF ENVIRONMENT IS APPROPRIATE FOR AQUATIC ANIMALS?" THE AQUATIC ANIMALS MOVE IN CURVES, WHICH AIDS IN REDUCING THE WATER PRESSURE AGAINST THEM WHILE THEY ARE SWIMMING. THE ABSTRACT OF FISH MOVEMENT IS REFLECTED ON THE BUILDING'S SHAPE. FURTHERMORE, THE MOVEMENT OF THE WATER IS REDIRECTED TO STIMULATE THE ENJOYABLE ATMOSPHERE FOR THE PEOPLE. THIS PROJECT IS COMBINED STUDY OF ADVANCED STRUCTURE, ARCHITECTURAL EXPRESSION, AND LANDSCAPE ARCHITECTURE OF THE SHORE. AS A RESULT, THIS AQUARIUM IS DESIGNED TO BECOME ONE OF THE MANY ICONIC BUILDINGS TO THE CITY'S ATTRACTIONS.

IT TOOK OVER A YEAR TO FINISH THE DESIGN. THIS THESIS PROJECT HAD MANY STAGES WHICH WILL BE DISPLAYED TO YOU AS YOU READ THROUGH THE BOOK. IT HAD FAILED AT ONE POINT, WHICH WAS A PERFECT STOPPING POINT TO REALLY RE-EVALUATE THE WHOLE PROJECT. IT WAS AN INCREDIBLY CHALLENGING JOURNEY; NONETHELESS, IT ACTUALLY AWAKENED MANY SENSES AS ONE WALKED THROUGH THE PROCESS. ALTHOUGH IT FELT REAL TO THE TOUCH, IT MIGHT BE JUST A DREAM.

THIS PROJECT HELPED ME TO REFLECT ON THE DARKEST AND THE WEAKEST PARTS OF MY MIND, BUT IT MADE ME REALIZE HOW MUCH MORE THERE IS TO DISCOVER ABOUT MYSELF.

I WANT TO EXPRESS A DEEP APPRECIATION TO ALL OF MY FACULTIES WHO WERE THERE TO HELP ME THROUGH THE UPS AND DOWNS ON THE PROJECT. THEIR WISDOM, PATIENCE AND KINDNESS ENLIGHTENED MY FOOLISHNESS. THAT GAVE ME MORE STRENGTH AND BELIEF IN MYSELF. I WOULD ALSO LIKE TO THANK MY FAMILY AND FRIENDS, WHO WERE UNDERSTANDING AND EXPRESSED SYMPATHY WITH THE WORK I DO. I HOPE YOU ALL ENJOY THE OUTCOME, AND I WILL BE MORE THAN HAPPY TO RECEIVE ANY COMMENTS AND THOUGHTS.



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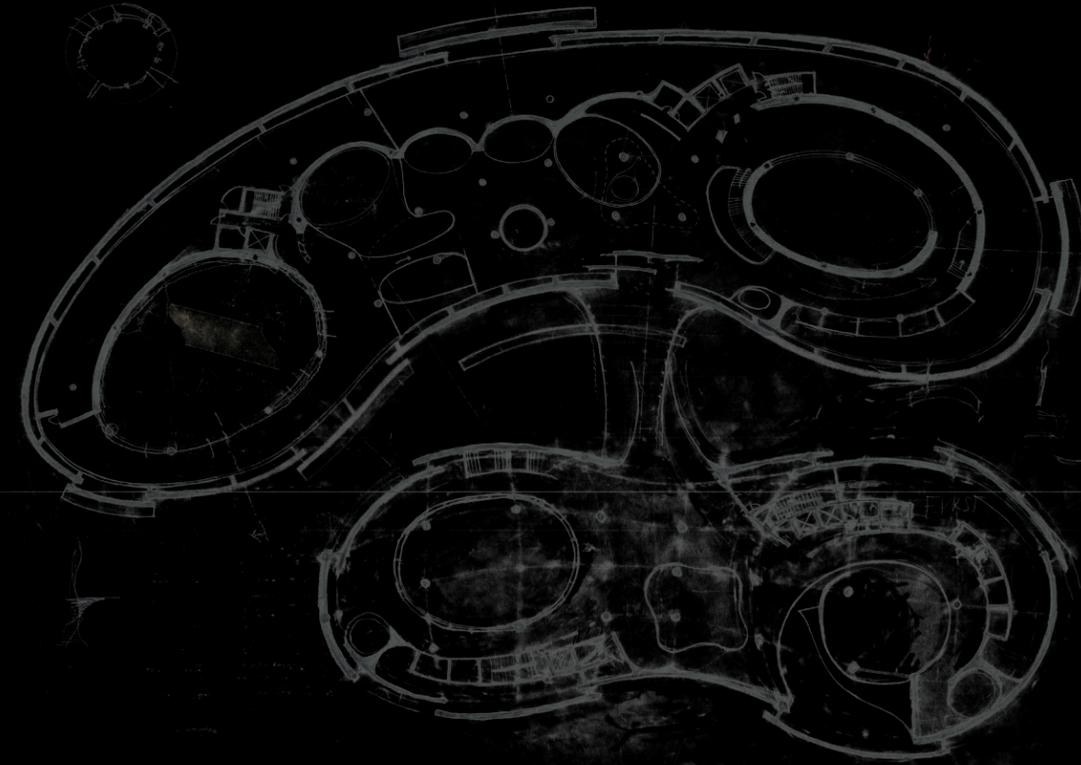
GENERAL AUDIENCE ABSTRACT

THIS THESIS IS A STUDY OF AN AQUARIUM'S PROGRAM. THE SITE IS LOCATED AT THE WATERFRONT NEAR THE FISH MARKET IN SOUTHWEST, WASHINGTON D.C. THE AQUARIUM IS ONE OF THE BEST DESIGN'S OPTIONS, WHICH ARE SUITABLE FOR THE AREA'S DEVELOPMENT. IN FACT, THIS AQUARIUM IS DESIGNED TO BE AN ICONIC ARCHITECTURE FOR WASHINGTON D.C. THEREFORE, THE DESIGN'S GOAL IS NOT ONLY TO DEVELOP AN AQUARIUM'S PROGRAM, WHICH SERVES LIVING AQUATIC ANIMALS AND THE PEOPLE, BUT ALSO TO BUILD AN ATTRACTION TO THE CITY.

THIS AQUARIUM'S PROGRAM IS DESIGNED TO CONNECT TO THE CENTER OF THE CITY THROUGH THE NATIONAL MALL. THE URBAN STUDY OF THE AREA SHOWS THE IMPORTANCE OF OTHERS' PROMINENT ARCHITECTURES SUCH AS THE WHITE HOUSE OR THE WASHINGTON MONUMENT. THIS SITE'S STUDY HELPS TO DEVELOP CONNECTED POINTS BETWEEN THE AQUARIUM'S PROGRAM AND THE REST OF THE AREA. THE PROGRAM'S CIRCULATION HAS BEEN DEVELOPED TO GIVE THE VISITORS THE BETTER EXPERIENCES THROUGHOUT THE BUILDINGS. THE WATER AT THE WATERFRONT HAS INSPIRED THE IDEAS OF BRINGING THE WATER TO THE SITE TO CREATE ATTRACTIVE WATERFLOW'S CURVES. AS A RESULT, THIS AQUARIUM INTERACTS TO THE WATER AND THE OTHER PARTS OF THE CITY EFFECTIVELY.

THE BUILDING'S FACADE IS DESIGNED TO STIMULATE THE FISH'S MOVEMENTS, WHICH LIFTS UP THE AQUARIUM'S SPIRIT. THE ARCHITECTURE IS BUILT INTO TWO SEPERATED BUILDINGS, WHICH ARE CONNECTED TO ONE ANOTHER BY ENCLOSED BRIDGES. FURTHERMORE, THERE ARE GREENROOFS ON TOP OF THE TWO BUILDINGS, WHICH BRINGS LIGHT TO THE ENTIRE BUILDINGS. THESE GARDENS ARE DESIGNED AS WATER FILTERS FOR WATER CIRCULATION THOUGHOUT THE WHOLE BUILDING. THE WATER CIRCULATION SYSTEM HAS THE MAIN MECHANICAL BASE AT THE BOTTOM UNDERGROUND LEVEL. THE PROGRAM FOCUSES ON HOW TO BRING WATER EFFEICIENTLY TO EACH TANK TO HABITAT THE FISHES, AND HOW TO SHOW THE BEAUTY OF THE WATER IN DIFFERENT FORMS SUCH AS VARIETY OF COLORS, MOTIONS OR SHAPES.

IN SHORT, THE AQUARIUM'S DESIGN BRINGS AN EXCIMENT TO THE CITY. THE DEVELOPMENT OF WATERFRONT AND THE LANDSCAPE OF THIS ARCHITECTURE DIRECTLY INFLUENCE THE PEOPLE, THE ECONOMY, AND THE ENVIRONMENT IN THE AREA. THUS, THIS AQUARIUM'S PROGRAM SHOULD BE THOUGHTFULLY DESIGNED TO SATISFY ALL OF THE CONCERNED ASPECTS.



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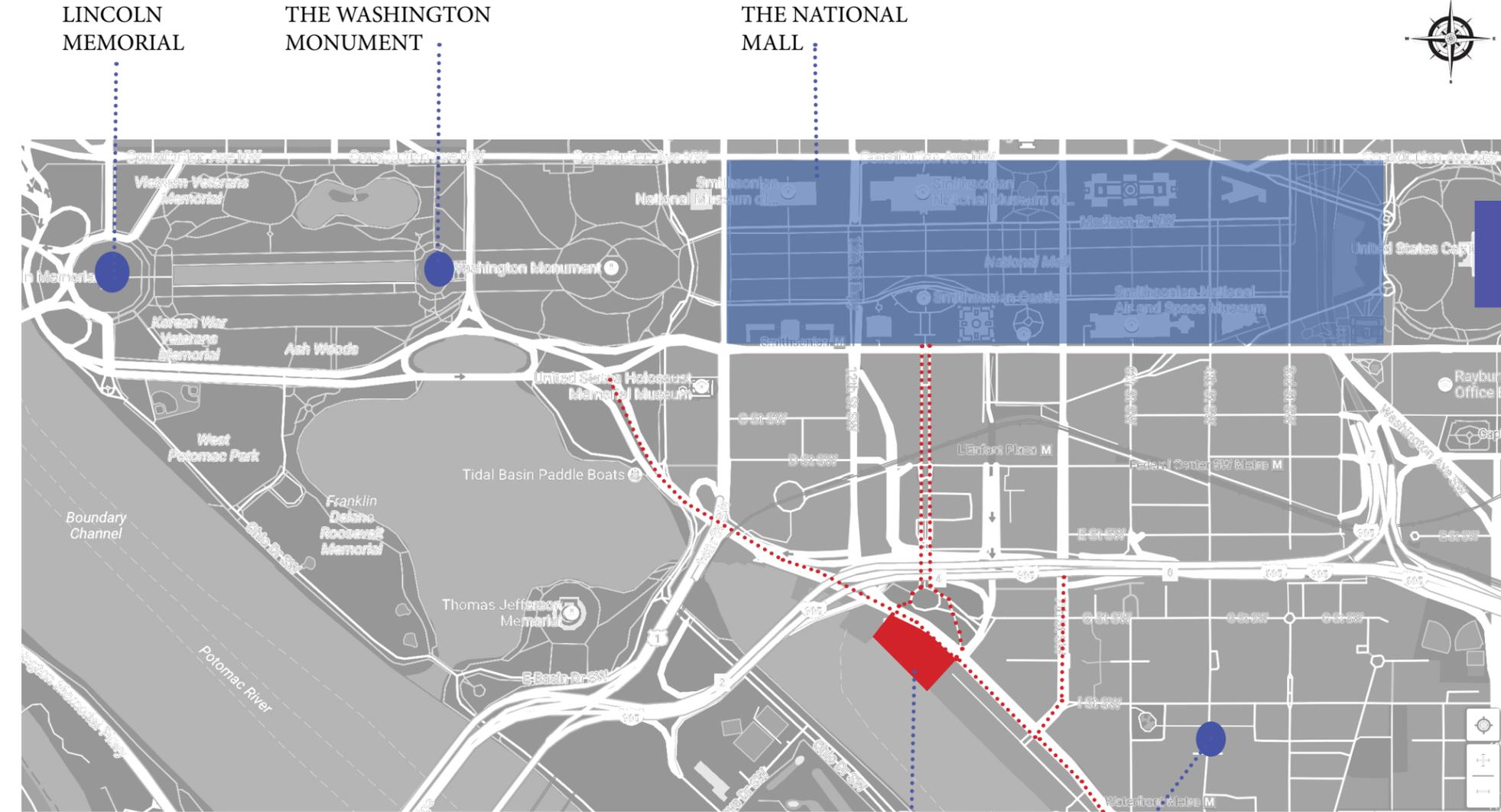
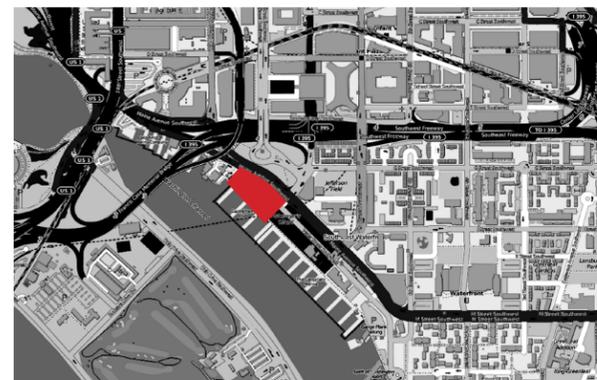
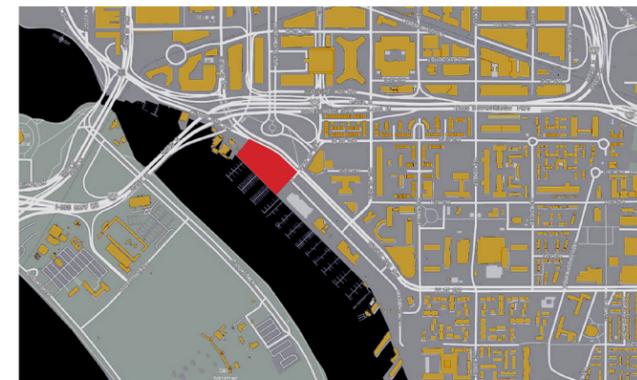
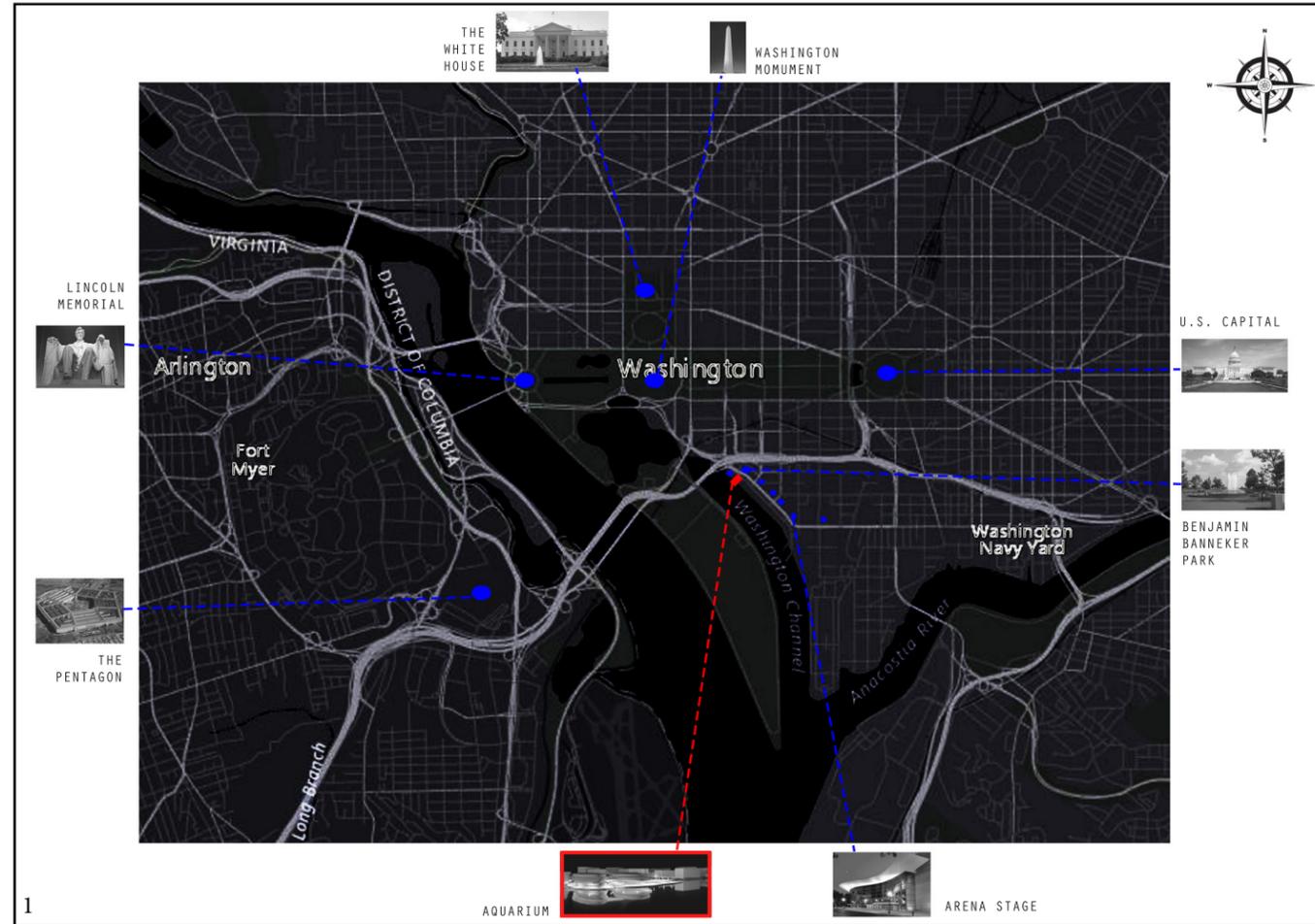
BIBLIOGRAPHY - 53

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PROJECT SITE

THE AQUARIUM IS LOCATED AT THE WATERFRONT IN SOUTHWEST WASHINGTON, DC. THERE ARE MANY SIGNIFICANT SURROUNDING BUILDINGS SUCH AS THE WASHINGTON MONUMENT, THE WHITE HOUSE, LINCOLN MEMORIAL AND SMITHSONIAN MUSEUM. ALL ARE LOCATED WITHIN A 20 MINUTES WALK FROM THE SITE. THEREFORE, THE AQUARIUM SITE HOLDS AN IMPORTANT ROLE TO CONTRIBUTE ITS GLORY TO THE AREA. TOURISTS WALK DIRECTLY FROM THE NATIONAL MALL TO BANNAKER PARK. FROM THERE, THEY CAN CROSS THE STREET TO WALK TO THE AQUARIUM.

1. WASHINGTON MAP & ARCHITECTURES
2. WASHINGTON BUILDING DENSITY
3. WASHINGTON TRAFFIC DENSITY
4. SITE MAP



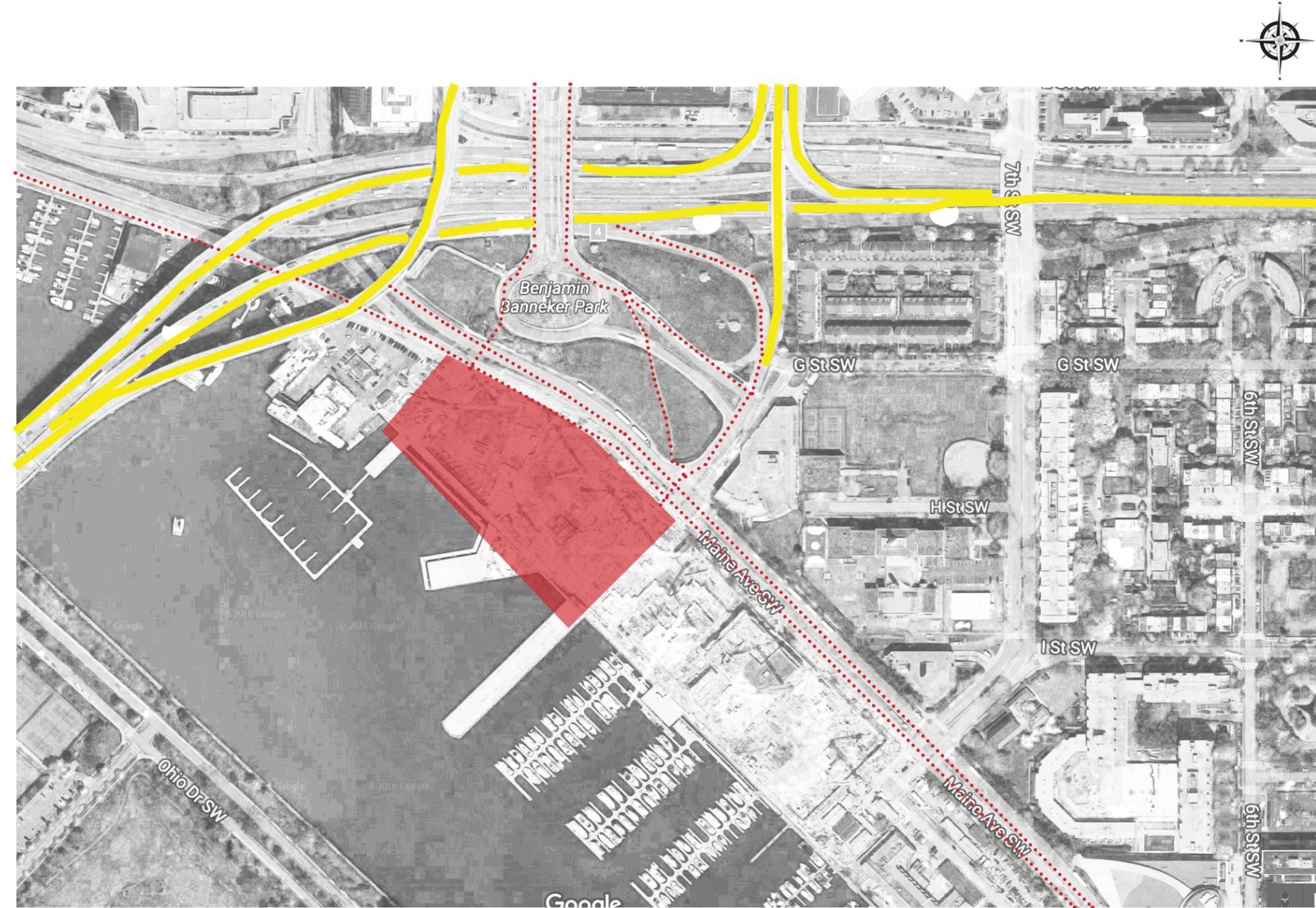
THE AQUARIUM THE ARENA STAGE

SITE DETAIL

PROPOSED PROJECT: AQUARIUM
 PERIMETER: 15442 FT
 AREA: 140,000 SF
 TYPE: PUBLIC BUILDING

THESE SEPERATED LAYERS OF TOPOGRAPHY, BUILDINGS AND STREET DISPLAY THE RELATIONSHIP BETWEEN THE AQUARIUM AND ITS SURROUDINGS. THE RED SHAPE IS THE BUILDING'S SITE. THE BUILDING DENSITY SURROUNDING THE SITE ISN'T CROWDED. THE LAND IS COVERED WITH 40% OF GREEN SPACE. THE SITE IS ACTIVELY CHANGING BY MODERN DEVELOPMENT. HOWEVER, AS THE ORIGINAL SITE STUDY, THE SITE IS LOCATED IN THE MOST INTERACTIVE AND ENERGETIC AREA. THERE IS A HIGHWAY BRIDGE FROM THE WEST, A NATIONAL MALL AND PARKS FROM THE NORTH-EAST, AN APARTMENT COMPLEX FROM SOUTH-EAST, AND THE WATERFRONT FROM SOUTHWEST.

1. LAYERS
2. COMBINATION OF ALL THE LAYERS AND SITE LOCATION
3. OVER ALL SITE PLAN



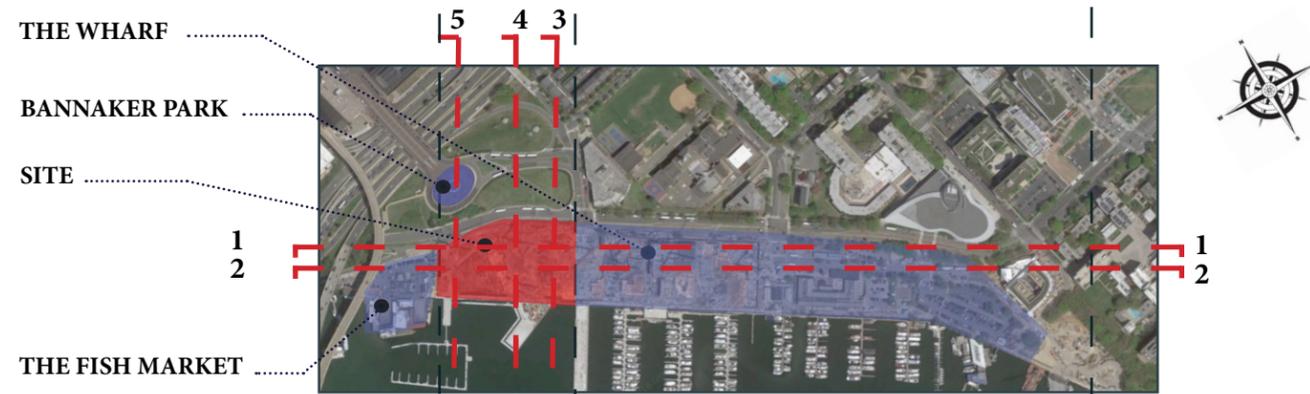
SCALE: 0' 100' 200' 400'

SITE SECTIONS

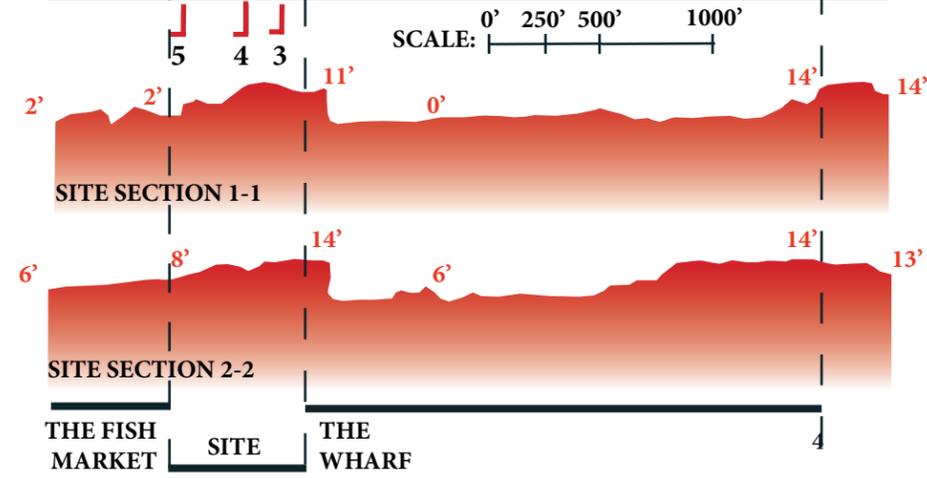
THE STUDY OF ELEVATION OF THE SITE IS VERY IMPORTANT IN THE PROJECT. GOOGLE EARTH IS USED TO EXPLORE THE SITE. THIS GIVES THE IDEA OF THE RELATIVE HEIGHT OF THE SITE COMPARES TO THE STREET. ACCORDING TO THE RESULTS OF CUTTING THROUGH THE SITE ON GOOGLE EARTH, THE SITE IS RELATIVELY 2' ABOVE THE WATER LEVEL. ALSO, THE STREET IS AT 9', AND BANNAKER PARK IS ABOUT 43' ABOVE THE WATER LEVEL. THEREFORE, VISITORS CAN OVERLOOK THE AQUARIUM WHILE APPROACHING FROM THE PARK.

THE FISH MARKET AND THE WHARF ARE THE TWO NEIGHBORING BUILDINGS OF THIS AQUARIUM. THE SITE IS RELATIVELY THE HIGHEST BASED ON HORIZONTAL CUT 'S DIAGRAM.

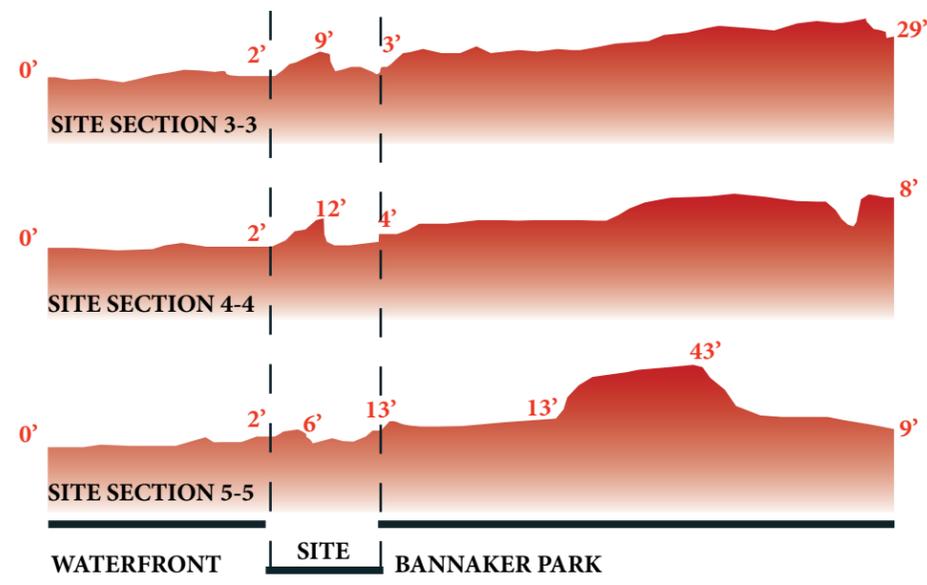
ALSO, SINCE THE PROJECT REVOLVES AROUND WATER, THE STUDY OF LOW TIDE AND HIGH TIDE IS A SIGNIFICANT EFFECT TO THE PROJECT'S ELEVATIONS. THE REGULAR WATER TIDE IS +/- 3' AND WHEN THE FLOODING SEASON ARRIVES, IT COULD RISE TO +5' / +7' ABOVE THE WATER LEVEL.



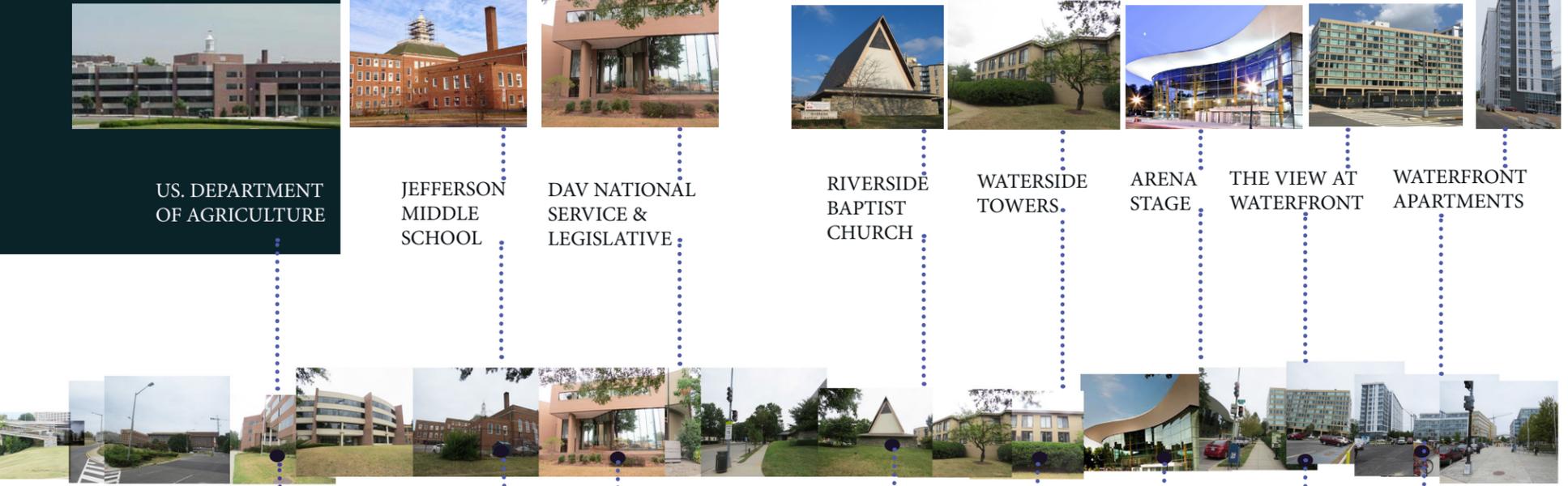
HORIZONTAL CUT



VERTICAL CUT



SITE ELEVATION



THESE SURROUNDING BUILDINGS ARE LOCATED ON MAINE AVE IN SOUTHWEST, DC. PUBLIC BUILDINGS SUCH AS GOVERNMENT BUILDINGS, THEATERS, CHURCHES, OR APARTMENTS ARE EXPECTED TO BE HIGHLY POPULATED IN THE NEXT DECADE. THERE IS A METRO STATION ON THE WATERFRONT, LOCATED ON M STREET NEAR APARTMENT BUILDINGS, WHICH PROVIDES A CONVENIENT ACCESS TO THE AQUARIUM.



SCALE: 0' 250' 500' 1000'

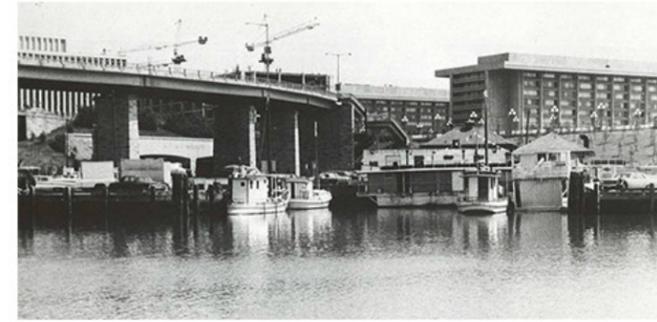
SITE HISTORY

THE SITE HAS BEEN DEVELOPED THROUGHOUT THE HISTORY. THE SITE WAS A TRADING LOCATION 200 YEARS AGO. THE FISH MARKET, ON THE LEFT OF THE SITE, WAS BUILT ABOUT 100 YEARS AGO. THE PLACE HAS SERVED AS AN IDEAL FISHING SPOT AS WELL AS A SOCIAL PLACE FOR PUBLIC. BY RESEARCH, THERE IS ANOTHER PROPOSAL TO RENOVATE THE FISH MARKET TOO.

THE SITE IS PART OF THE WHARF, WHICH IS BELONGED TO PN HOFFMAN, MADISON MARQUETTE DEVELOPMENT COMPANY. THERE ARE APARTMENT BUILDING COMPLEXES WHICH WILL BE BUILT AT THE SITE. HOWEVER, SINCE THE SITE IS LOCATED IN A SYMBOLIC AREA, A PROPOSED ICONIC ARCHITECTURAL BUILDING, SUCH AS THE AQUARIUM, WILL BE A MAGNIFICENT PLACE TO ATTRACT TOURISTS TO THE AREA.



1800-1900, Became a principle commercial waterfront of the city for farming, trading, and slaves, also served as a military base during the Civil War



Early 1950s, redevelopment of Southwest Water with proposed highway and Maine street development



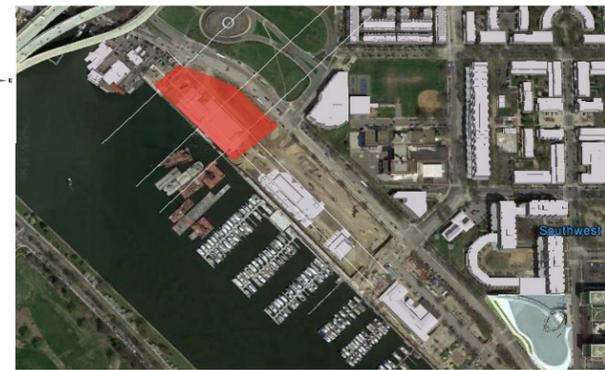
Early 1900s, the Senate recomended a plan to improve the waterfront and; as a results, piers, streets, a fish market, Yatch club were developed



Today, Hoffman-Madison Waterfront developed the waterfront as a mixed use waterfront community



L'Enfant's plan 1800s



Current Site Plan, 2016

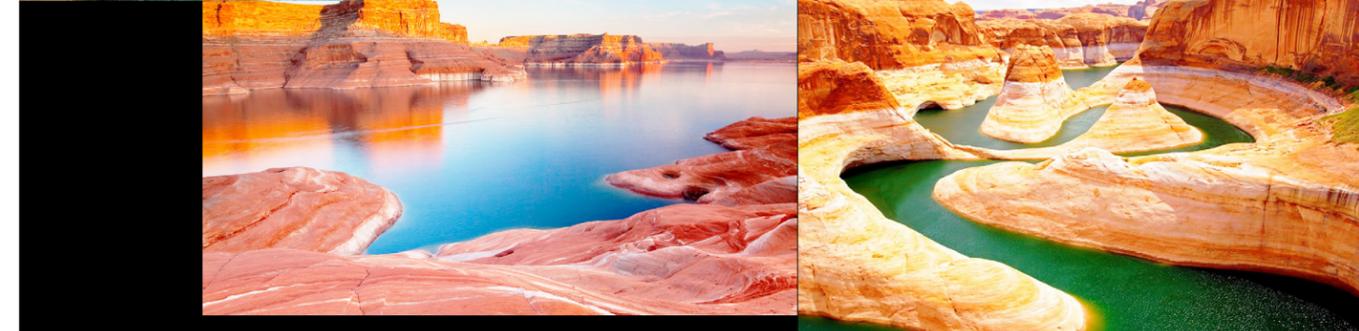
SITE INSPIRATION

THERE ARE MANY SURROUNDING STRUCTURES THAT HAVE ELEGANT, GLAMOROUS CURVES AND SHADOWS. THESE DETAILS ARE THE FIRST IMPRESSION UPON GAZING, SURVEYING THE SITE, WHICH INFLUENCES THE AQUARIUM IN A NUMBER OF WAYS. THE ARENA STAGE IS ONE OF THEM. IT STANDS OUT AS THE MOST ATTRACTIVE, WHICH MAKES ME FALL IN LOVE WITH THE CURVES OF THE WALL AND TALL COLUMNS. THIS BUILDING IS BUILT LIKE A CORE AND SHELL STRUCTURE. THE TOP SIX PICTURES ARE INTERESTING CORNERS AT THE ARENA STAGE.

THE BOTTOM PICTURES DISPLAY A NATURAL COMPOSITE OF THE GRAND CANYON. THE BEAUTIFUL LAYERS OF BEDROCK WITH RIVER CURVES OF EROSION STIMULATE THE IDEA OF BUILDING THE PROJECT IN LAYERS.



1



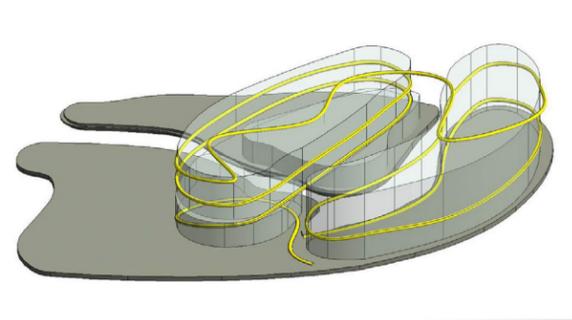
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BUILDING DIAGRAM

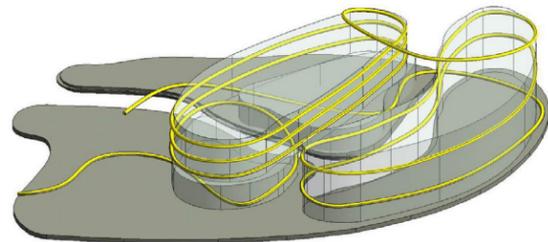
THE BASE OF THE AQUARIUM PROGRAM HAS BEEN ESTABLISHED. THE MASSING ELEMENTS DISPLAY THE IDEA OF THE BUILDING'S FUNCTION IS ALSO DISPLAYED IN THE DIAGRAM. THEORETICALLY, THERE ARE FIVE MAIN PARTS: THE BASE - THE LANDSCAPE SITE WHICH INCLUDED TWO SEPERATED PLATFORMS, ONE IS CONNECTED TO THE EXISTING SITE, THE OTHER IS AN ISLAND; THE BUILDING MASSES SUCH AS THE RESTAURANT, A GATHERING SPACE, THE OCEAN KINGDOM ON TOP OF THE PLATFORMS, AND THE RIVERTOWN MASS ON TOP OF THE RESTAURANT AND GATHERING SPACE. ALSO, THE GARDENROOF WILL BE PLACED ON TOP OF THE OCEAN KINGDOM AND RIVERTOWN.

THE STUDY OF BUILDING MOVEMENT IS DISPLAYED IN THREE DIFFERENT WAYS. THIS HELPS TO DEVELOP THE PROGRAM IN MORE DETAIL.

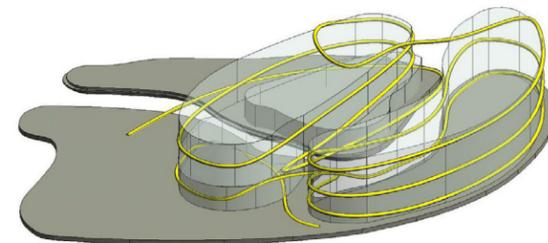
1. PROGRAM DIAGRAM
2. CIRCULATION I
3. CIRCULATION II
4. CIRCULATION III



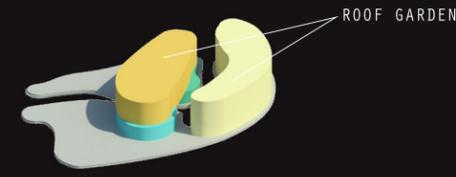
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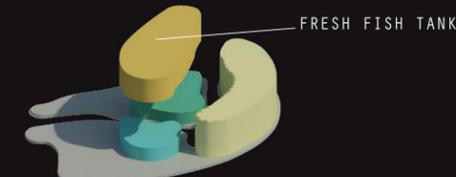
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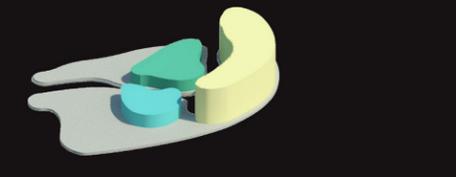
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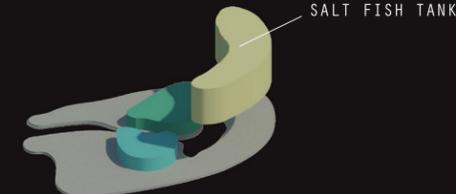
ROOF GARDEN



FRESH FISH TANK



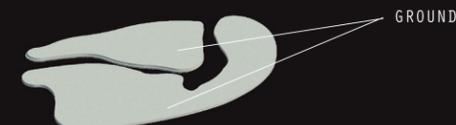
SALT FISH TANK



RESTAURANT
GATHERING SPACE



GROUND



1

SITE RENOVATION

THE TOP COMPOSITE PICTURE IS TO DISPLAY THE PROPOSED DEVELOPMENT OF BANNAKER PARK WHICH HAS A DIRECT RELATIONSHIP TO THE FUTURE AQUARIUM. THE GOAL OF THE PARK'S RENOVATION IS TO BRING A NEW FRESHNESS, GREEN SPACES AND PLAYGROUND TO THE AREA. THERE IS A PROPOSED DIRECT WALKWAY FROM THE PARK TO THE SITE WHICH AIDS IN BRNGING TOURISTS DIRECTLY FROM THE NATIONAL MALL TO THE SITE.

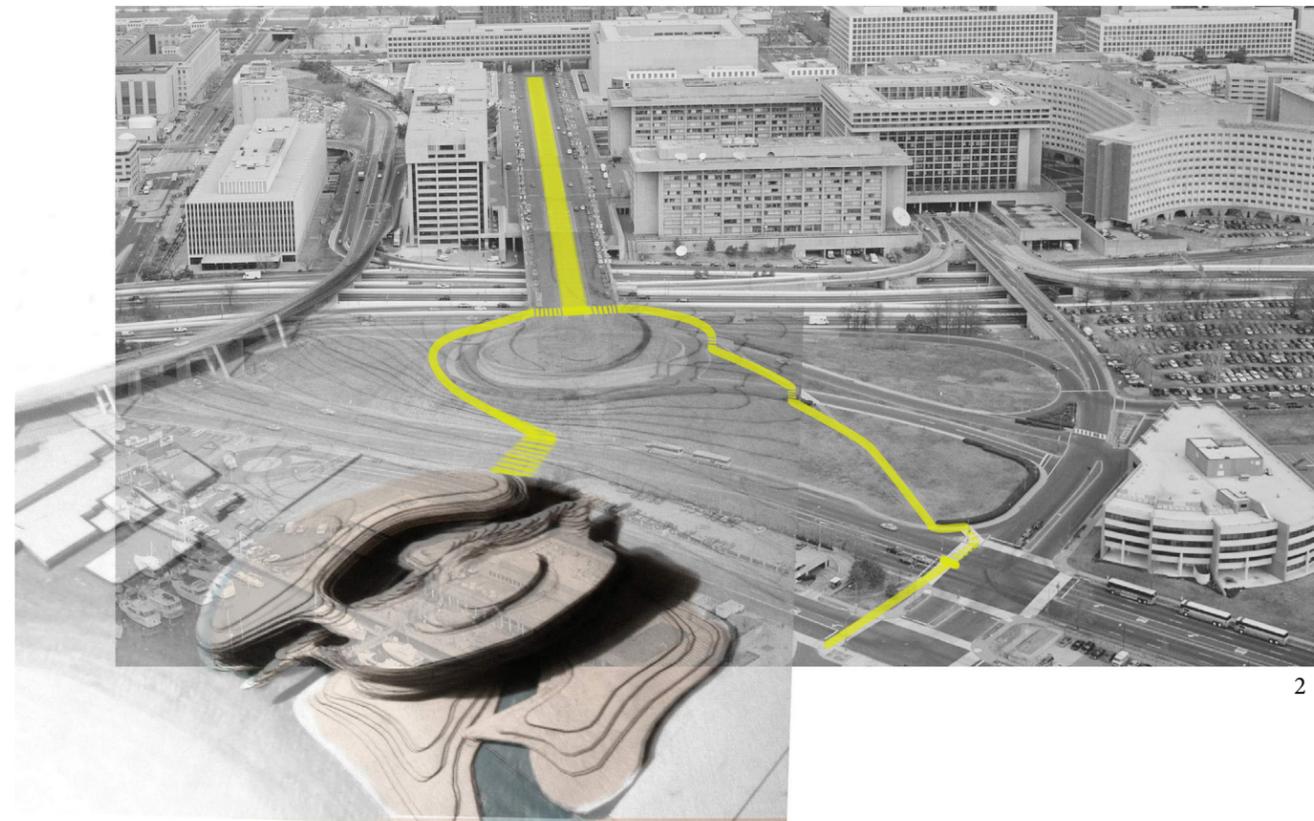
THE PROPOSED AQUARIUM IS DISPLAYED IN THE PICTURE BELOW, WITH THE CONNECTED WALKWAY HIGHLIGHTED IN YELLOW. THIS WOULD HELP IN VISUALIZING THE CIRCULATION OF THE SITE. THE TWO MAIN ENTRANCES OF THE AQUARIUM WILL BE LOCATED AT THE NORTHEAST AND SOUTHEAST.

1. THE RENOVATION OR BANNAKER PARK
2. THE PROPOSED BUILDING ON THE SITE



Incorporate green walls

1



2

SITE MODEL

THE SITE MODEL SHOWS THE LOCATION OF THE PROPOSED AQUARIUM WITH THE RELATIONSHIP TO THE NEARBY BUILDINGS.

ACCORDING TO THE CITY TOPOMAP AND SITE CUT SECTIONS, THE SITE IS LOWER THAN THE STREET, AND BANNAKER PARK IS THE MOST ELEVATED. THE MASSING OF THE AQUARIUM IS TO DEMONSTRATE THE OVERALL LAYOUT OF THE BUILDINGS. THIS SITE MODEL ALSO HELPS TO ORIENT THE ROTATION OF THE BUILDING RELATIVE TO BANNAKER PARK IN ORDER TO GET A DIRECT VIEW FROM THE PARK TO THE WATERFRONT.



SCALE: 0' 100' 200' 400'

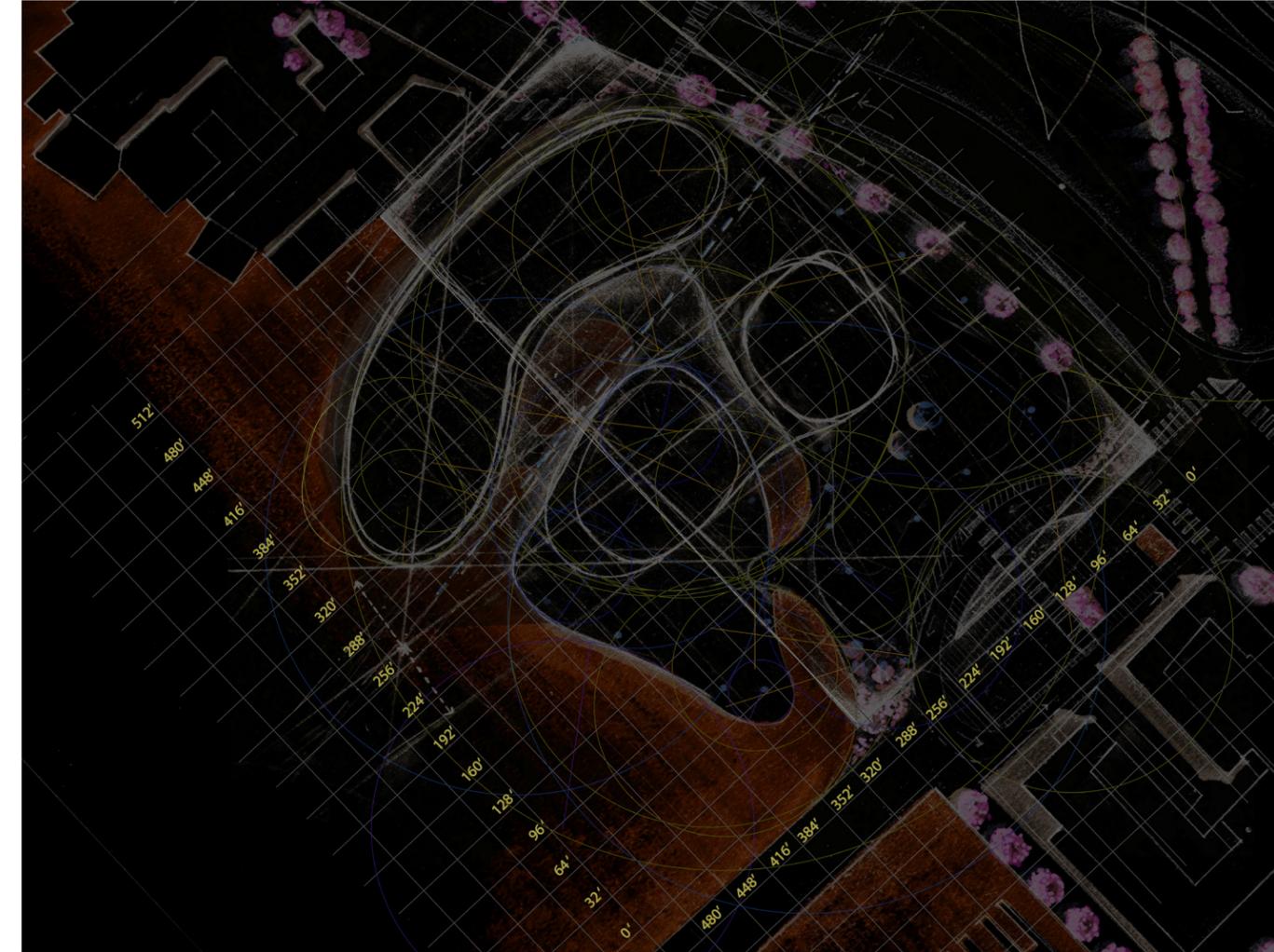


BUILDING THEORY

THE BUILDING'S CURVES ARE DESIGNED AS A SET OF CONSTRUCTION CURVES. THE DRAWING SHOWN ON THE RIGHT PROPOSES A WAY TO LOCATE EACH CURVE ON THE SITE.

THE METHOD IS PRETTY SIMPLE. THE SITE IS DIVIDED INTO GRID, WHICH HAS THE ORIGIN AT THE CORNER ON THE WATER SITE. THIS WILL HELP TO DERIVE ANY CURVES ON THE GRID BY ITS RADIUS AND ITS CENTER POINT. THIS SET OF CURVES CAN ALSO BE LOCATED EASILY BY A COMPUTER PROGRAM.

AS A RESULT, THE CONSTRUCTED CURVES ARE MODIFIED TO PROJECT THE SMOOTH MOVEMENT OF FISH. LATER ON, THOSE CURVES WILL BE DEVELOPED INTO THE GROUND, WALLS, FLOORS, AND ROOF. THERE IS AN INTERCONNECTION BETWEEN CURVES WHICH CONNECT TO COMPOSE A SHAPE. ALSO, EACH SHAPE IS RELATED TO ONE ANOTHER IN A WAY THAT THEY ALL APPEAR TO HAVE A DYNAMIC MOVEMENT FOR THE SITE TO THE BUILDING.



SCALE: 0' 50' 100' 200'

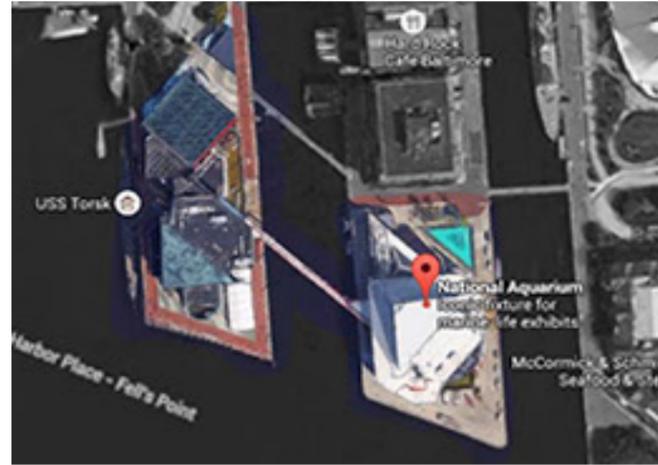


STUDY PROJECTS

IN ORDER TO UNDERSTAND THE IDEA OF WHAT AN AQUARIUM IS ABOUT, STUDYING AQUARIUM PROGRAMS FROM EXISTING AQUARIUMS IS VERY IMPORTANT. THE BALTIMORE NATIONAL AQUARIUM IS THE FIRST STUDY MODEL. ITS SITE IS AS BIG AS THE D.C. AQUARIUM. THE PROGRAM IS SEPERATED INTO THREE MAIN BUILDINGS, WITH THEIR OWN PROGRAMS, EVEN THOUGH THEY ARE ALL CONNECTED AS ONE ENCLOSED BUILDING.

ADUBON AQUARIUM AND BLUE PLANET AQUARIUM ARE ANALYZED WITH PLANS AND LAYOUTS. THIS STUDY GIVES AN ESTIMATE OF HOW BIG THE TANK SIZES WOULD BE FOR EACH PARTICULAR AQUATIC ANIMAL. THEREFORE, IT HELPS IN DESIGNING THE D.C. AQUARIUM IN REALISTIC SIZED TANKS WHICH WOULD ASSIST IN DEVELOPING AN EFFECTIVE BUILDING PROGRAM.

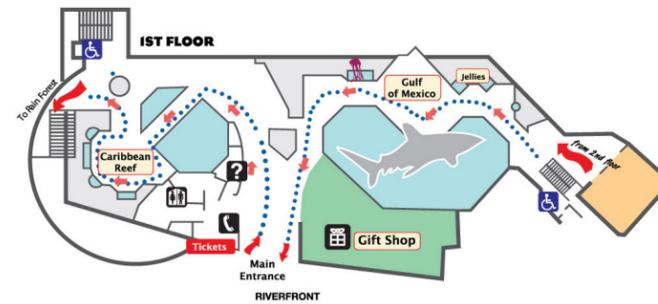
- 1, 2. BALTIMORE AQUARIUM PLAN / PHOTO
- 3, 4. ADUBON AQUARIUM FIRST FLOOR / SECOND FLOOR
- 5, 6. BLUE PLANET AQUARIUM PLAN / PHOTO



1



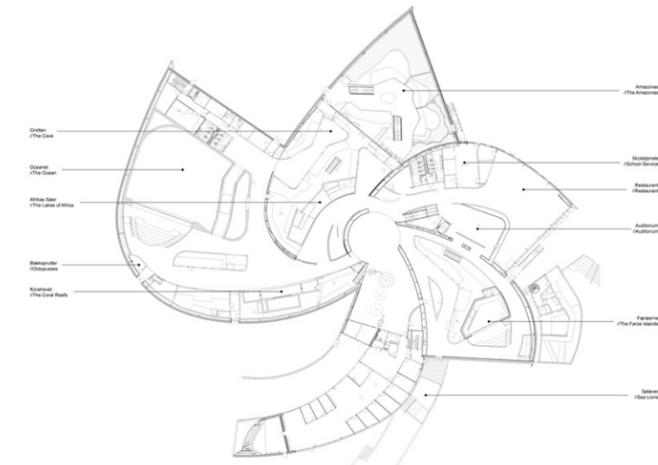
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3



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5



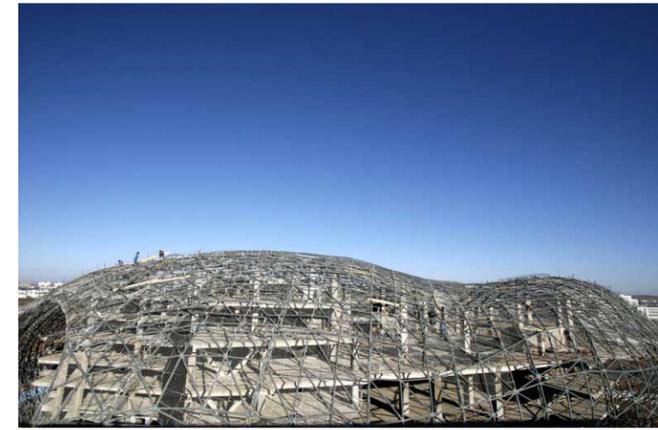
6

STUDY PROJECTS

THE IMAGES ON THIS PAGE ARE PHOTOS OF THE ORDOS MUSEUM IN CHINA. THE BUILDING DISPLAYS A SIMILAR CONSTRUCTION METHOD AND FACADE SYSTEM. THEREFORE, THE STUDY OF THE ORDOS MUSEUM'S FACADE SYSTEM HELPS IN DEVELOPING THE SHELL SYSTEM OF THE D.C. AQUARIUM. THE BUILDING STRUCTURE OF THE ORDOS MUSEUM, SHOWN IN PIC #3, HAS A FLOOR AND COLUMN SYSTEM AS ITS MAIN CORE STRUCTURE AND A SHELL STRUCTURE SPANNING OVER THE BUILDING TO ENCLOSE IT.

THE SHELL STRUCTURE IS CONSTRUCTED BY TWO MAIN PARTS: A STEEL FRAME AND METAL PANEL SYSTEM. THE RIDGID STEEL FRAME IS BUILT BY WELDING THE STEEL PIECES TOGETHER. AS FOR THE METAL PANEL SYSTEM, IT IS BUILT ON TOP OF THE STEEL FRAME TO GIVE IT A FINISHED LOOK AND SERVES AS PROTECTION FOR THE BUILDING.

- 1, 2. ORDOS MUSEUM STEEL FRAME STRUCTURE
- 3, 4. ORDOS MUSEUM METAL PANEL SYSTEM
- 5, 6. ORDOS MUSEUM PHOTOS



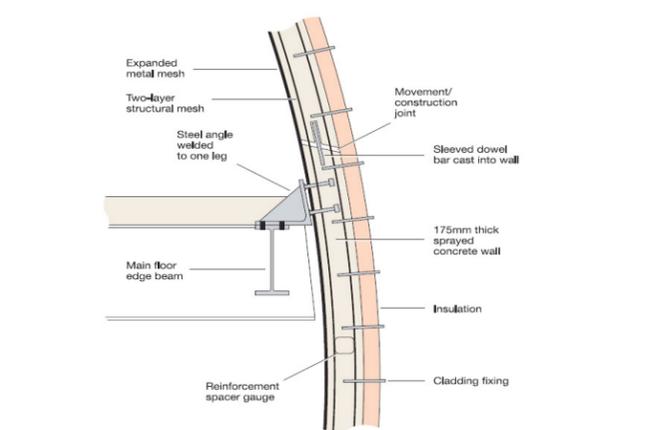
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2



3



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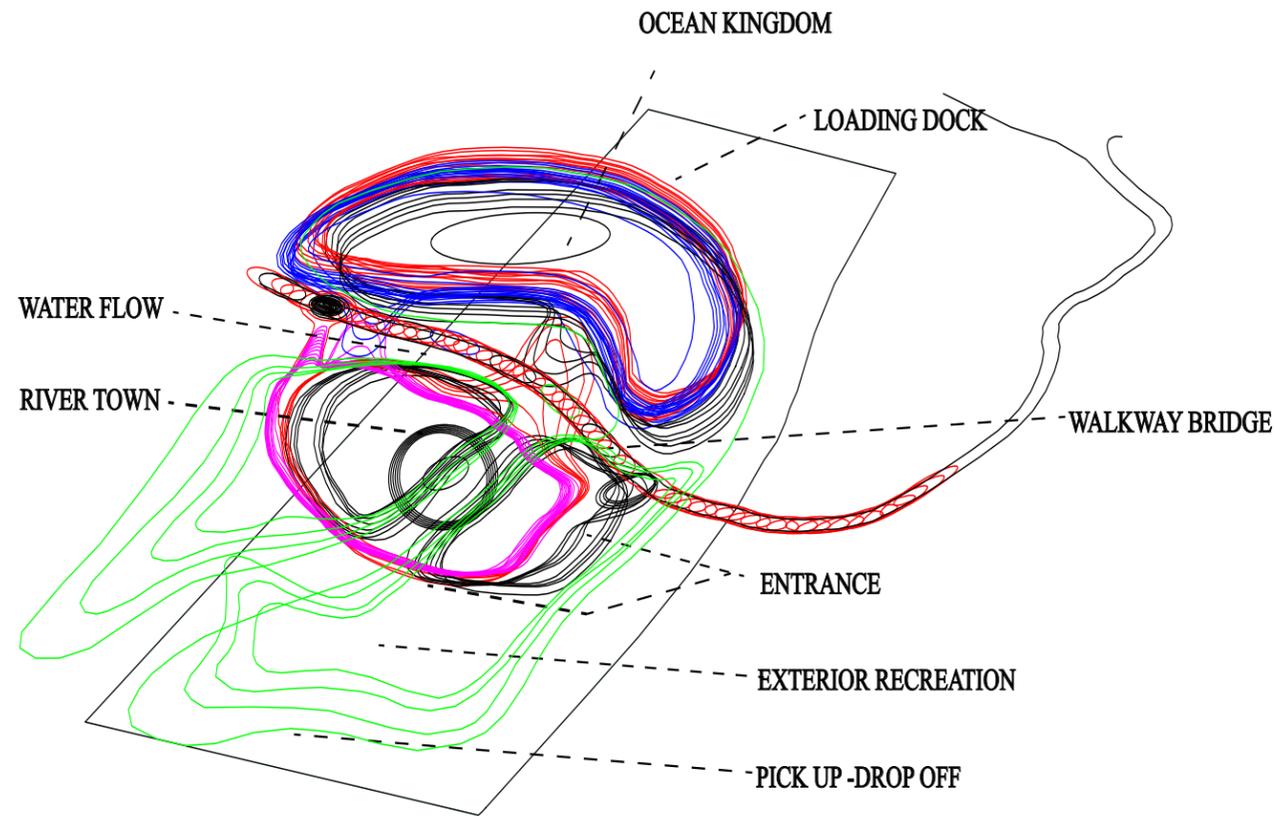


6

AQUARIUM PROGRAM

THE PROGRAM IS MORE DETAILED AND MORE SPECIFIC WITH TANKS AND PROPOSED LEVELS. THE SITE PROVIDES A PICK UP/ DROP OFF AREA AND THE LOADING DOCK FOR THE AQUARIUM. IT ALSO HAS THE MAIN ENTRANCE LOCATED AT THE GROUND FLOOR, WHERE PEOPLE CAN OBTAIN TICKETS AND GATHER BEFORE THE TOUR.

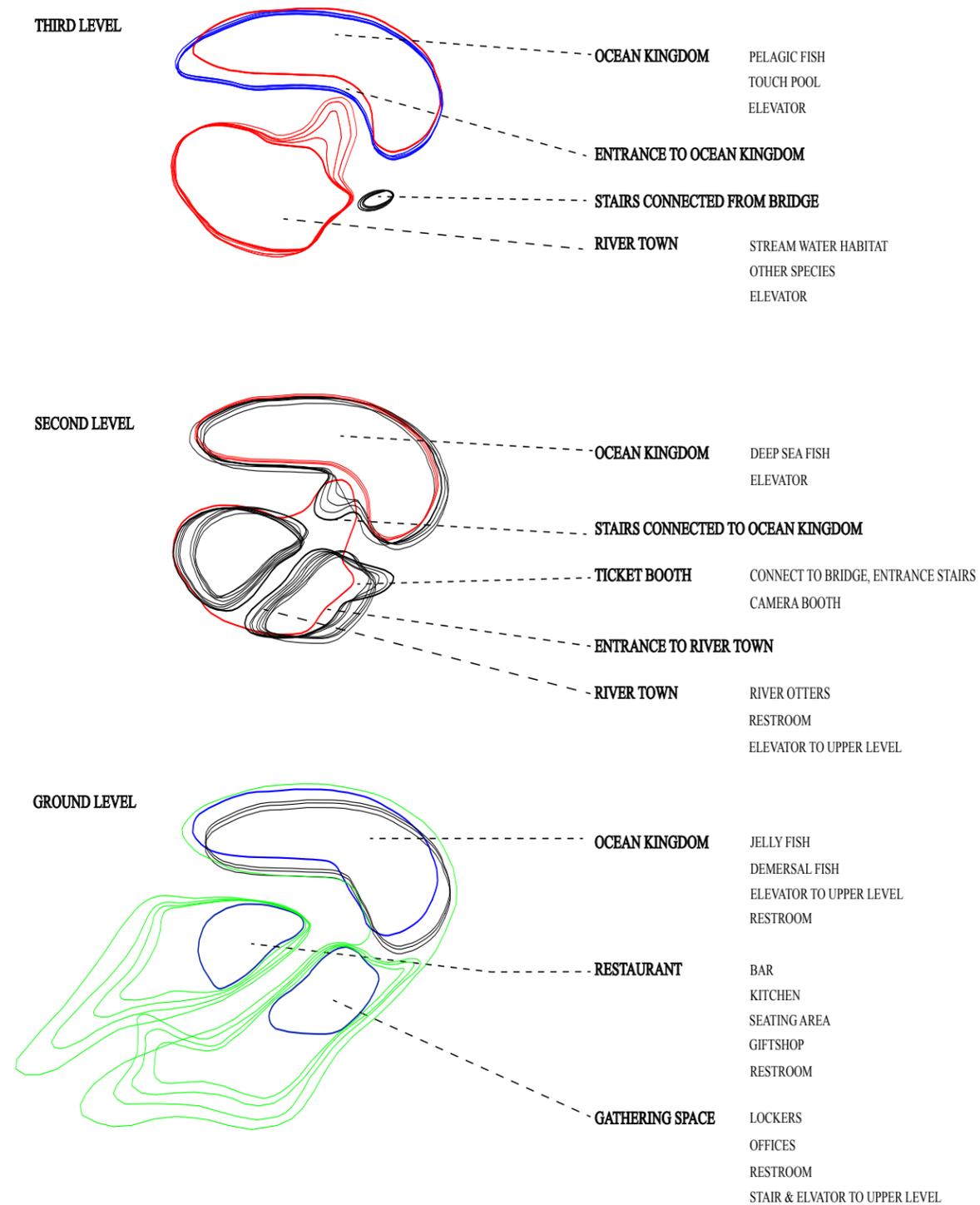
FOR PEOPLE WHO JUST WANT TO ENJOY THE WALK ALONG THE RIVER, THERE IS A CONNECTED WALKWAY AROUND THE AQUARIUM WHERE PEOPLE CAN FEEL THE FRESH BREEZE FROM WATER LANDSCAPE. THE WALKWAY IS RECONNECTED TO THE WATER LINE AT THE FISH MARKET WALKWAY. THERE IS A BUILT-IN RESTAURANT AT THE WATERFRONT, RIGHT BENEATH THE AQUARIUM. THE RESTAURANT IS BUILT WITH AN OPEN VIEW AND WILL SUPPORT THE AQUARIUM ABOVE BY A SET OF COLUMNS. THE IDEA IS TO PROVIDE A RELAXING OPEN VIEW TO THE WATER FRONT.



AQUARIUM PROGRAM

THE AQUARIUM IS DESIGNED TO GIVE AN INTERACTIVE AND DYNAMIC PROGRAM WHERE PEOPLE CAN CIRCULATE VERTICALLY AND HORIZONTALLY. THE BUILDING INCLUDES FOUR MAIN BLOCKS: THE RESTAURANT (AT GROUND), GATHERING (AT GROUND), RIVER TOWN - FRESH WATER TANKS (RIGHT ABOVE THE RESTAURANT AND GATHERING, AND A BIG BLOCK OCEAN KINGDOM - SALT WATER TANKS (AT GROUND TO ROOF).

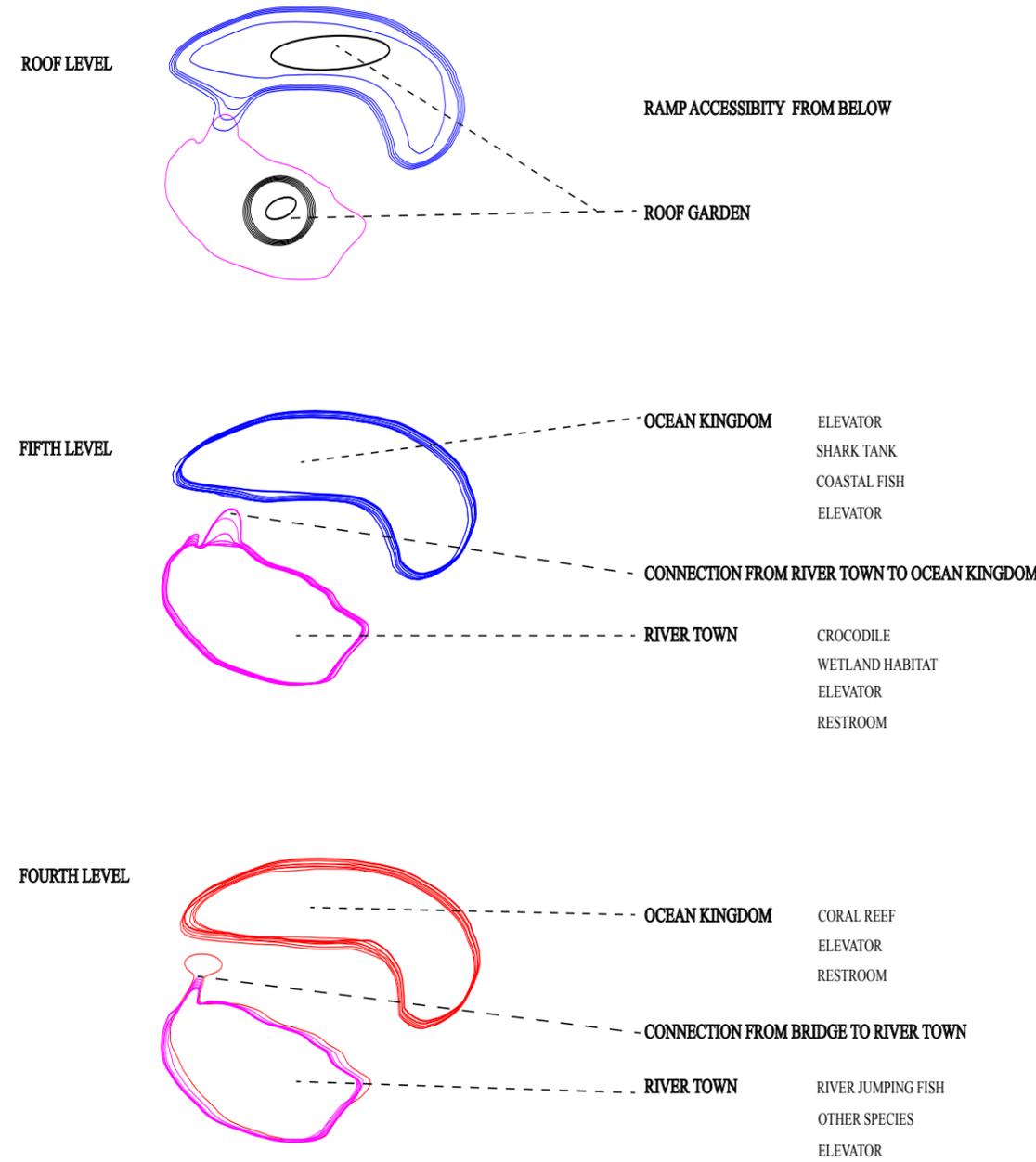
THERE ARE FOUR PROPOSED BRIDGES: THE TWO SMALL BRIDGES AT THE GROUND LEVEL TO CONNECT THE WALKWAY WITH THE ISLAND RESTAURANT; THE OTHER TWO BRIDGES CONNECT THE RIVER TOWN AND OCEAN KINGDOM AT DIFFERENT LEVELS TO CREATE A LOOP. BRIDGES ARE BUILT WITH ETFE GLASS, WHICH GIVES A CLEAR VIEW TO THE WATER.



AQUARIUM PROGRAM

THERE ARE MANY WAYS TO CIRCULATE THROUGHOUT THE BUILDING, BUT ALL CIRCULATIONS WILL HAVE TO GO THROUGH THE TWO BRIDGES. ONE DEMONSTRATION IS A LOOP CIRCULATION. WHEN PEOPLE ARE IN THE GATHERING SPACE, THEY CAN WALK UP TOWARDS THE RIVERTOWN. WHEN THEY GET TO THE ROOF ON THE RIVER TOWN, THEY CAN WALK DOWN TO THE GROUND LEVEL AND EXIT THERE OR LOOP BACK ANOTHER WAY UP TO THE SECOND FLOOR, CROSSING THE LOW BRIDGE TO WALK BACK TO THE GATHERING AREA.

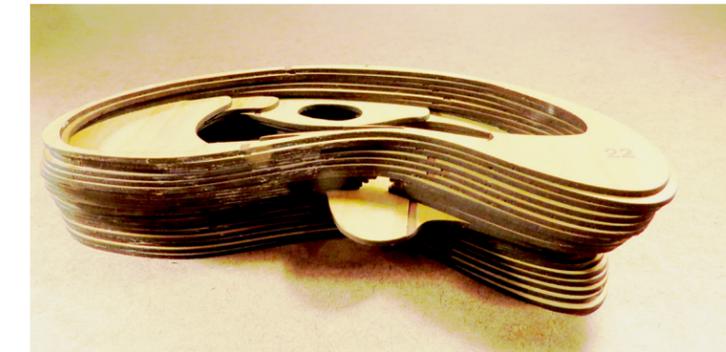
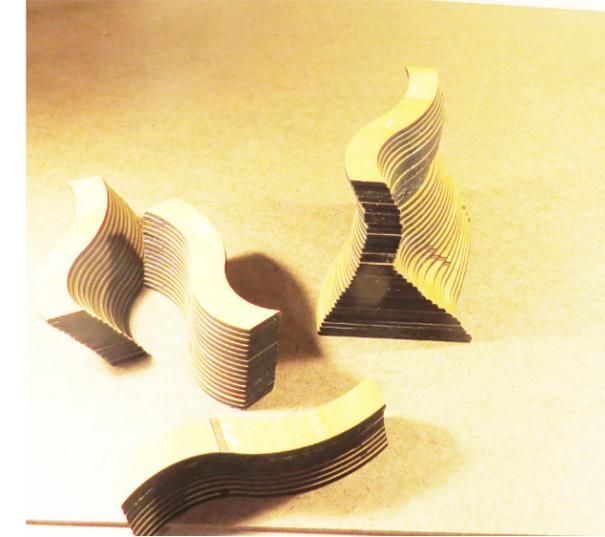
THIS PROGRAM HELPS TO DEFINE CONSTRAINT TO THE SPACCE OF THE BUILDINGS, ESPECIALLY FOR THE HEIGHT AND THE MATERIAL TO A SPECIFIC FUNCTION. THIS DIAGRAM IS USED TO STUDY MORE OF WHAT KIND OF BUILDING STRUCTURE SHOULD BE USED IN ORDER TO CREATE A DYNAMIC PROGRAM.



STUDY MODELS

THE FUNDAMENTAL IDEA OF THE BUILDING STRUCTURE IS STACKING PLATFORMS OF CONCRETE ON TOP OF EACH OTHER IN A WAY THAT WILL CREATE AN EXTERIOR CURVED WALL. THE CURVED WALL MODELS TO THE RIGHT ARE CONSTRUCTED BY STACKING LAYERS OF WOOD. THE CURVE IS CREATED TO BE HELD BY GRAVITY; AND THE STUDY OF IT REALLY SHAPES THE CURVES IN A MATHEMATICAL WAY.

THE TWO LAST PICTURES ON THIS PAGE ARE OF THE STUDY MODEL OF OCEAN KINGDOM USING THE STACKING LAYER METHOD. THE MODEL DEMONSTRATES THAT THE BUILDING IS CONSTRUCTED BY ONE MATERIAL. THE LAYER OF CONCRETE IS CASTED IN SUCH A WAY THAT IT CREATES MOVEMENT OF THE WALL AND THE INTERIOR SPACES. ALSO, THE LAYERS OF CONCRETE CAN BECOME WALLS, FLOORS, OR ROOF. THE STUDY WILL BE SHOWN MORE IN DRAWINGS BELOW.

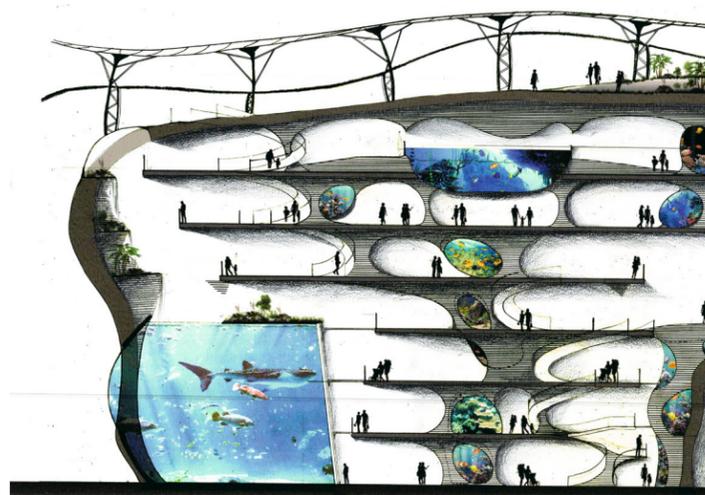
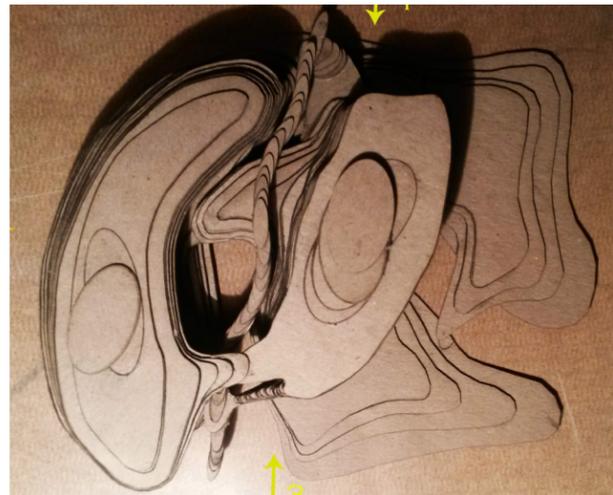


STUDY MODELS

THE FIRST TWO PICTURES DISPLAYED TO THE RIGHT ARE THE CLAY COLUMNS. THE PURPOSE OF THE MODELS IS TO EXPLORE THE POSSIBILITY OF THE FLEXIBILITY AND FLUIDITY OF THE STACKING LAYERS OF THE CONCRETE. WHAT KIND OF SPACE CAN IT CREATE? THE INTERACTION BETWEEN THE CURVED SHAPE AND THE SPACE UNDERNEATH ARE UNCERTAIN. THIS RAISES QUESTIONS TO REALLY PUSH THE IMAGINATION. BY CREATING THESE LAYERS, I AM NOT ACTUALLY DESIGNING A BUILDING, BUT A SPACE WITHIN A BUILDING INSTEAD. JUST LIKE CARVING A PUMPKIN TO CREATE HOLES INSIDE, THESE SPACES ARE CONNECTED TO MAKE A WAY TO CIRCULATE THROUGHOUT THE BUILDING.

TESTING THE STACKING METHOD IS QUITE A CHALLENGING EXPERIENCE. NEVERTHELESS, THE SMOOTH CONTINUOUS CONCRETE WALL IS EASIER TO BE CASTED IN ONE PIECE THAN CASTING EACH LAYER OF CONCRETE. THE WHITE CURVING WALL TO THE RIGHT IS A STUDY OF THE AESTHETIC OF A CURVING WALL.

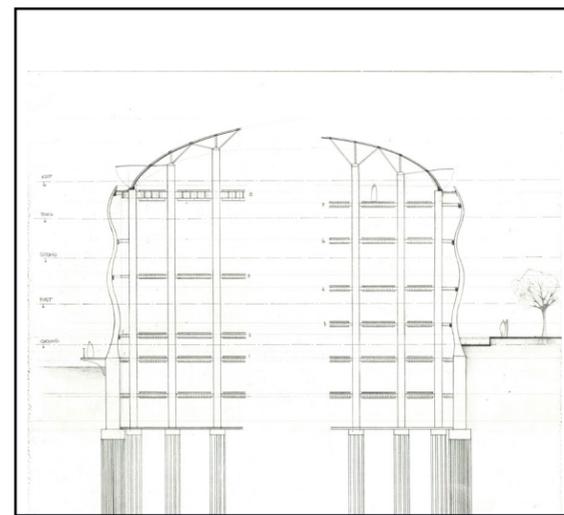
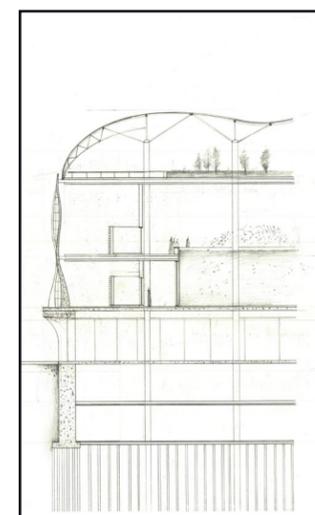
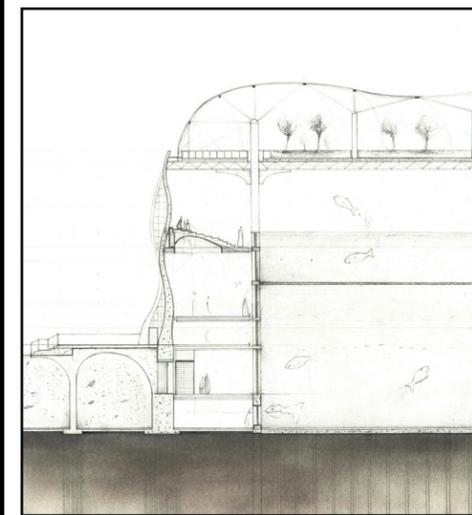
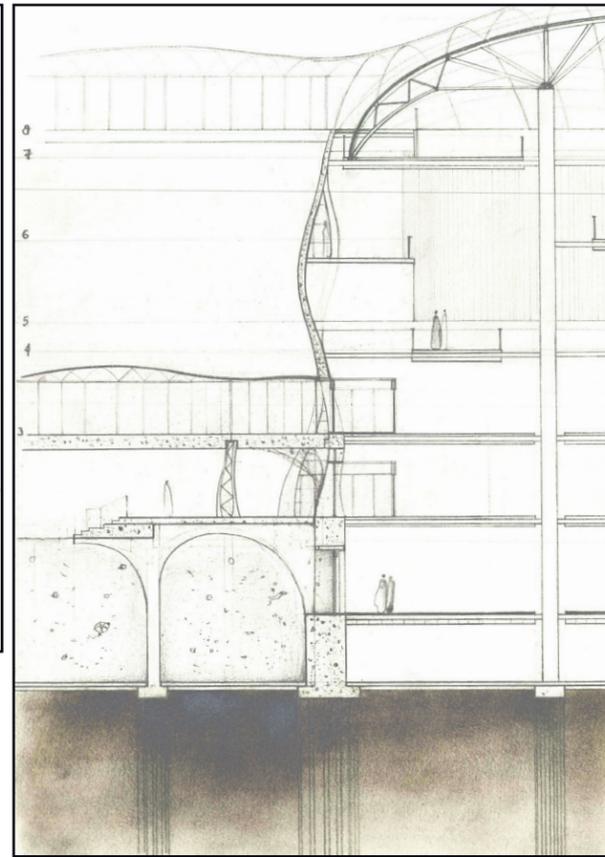
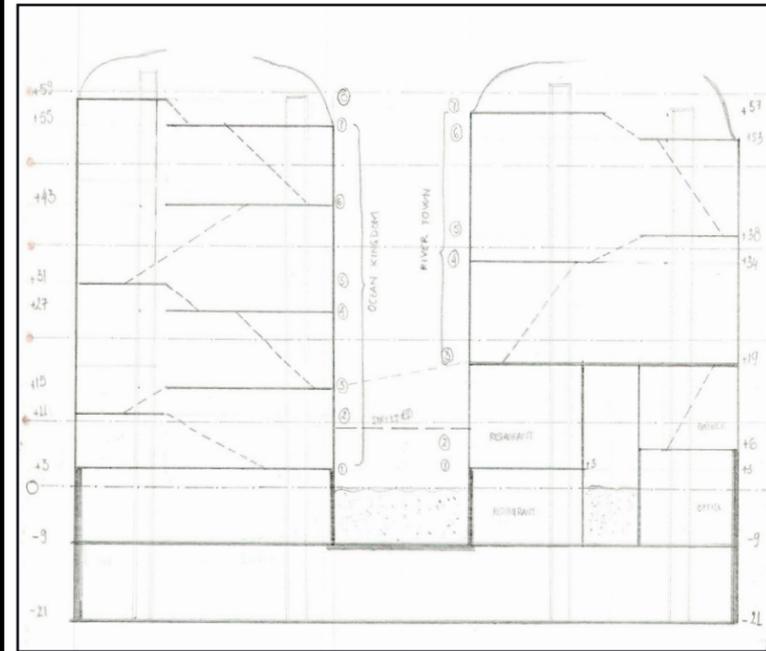
THE LAST DRAWING IS A DEMONSTRATION OF THE IDEAS BY STUDYING THROUGH THE BUILDING SECTION.



BUILDING STUDY

THE MOST CHALLENGING PROBLEM OF THE BUILDING IS SOLVING THE BUILDING'S ENCLOSURE PROBLEM. THE CURVED SHAPE AND ROOF GARDEN HAVE MADE IT MORE PROBLEMATIC IN CREATING A FACADE SYSTEM WHICH HAS TO PROVIDE ENOUGH LIGHTING, A VIEW OF THE WATER, AND ATTRACTION TO THE AREA. THERE ARE TWO MAIN FACADE SYSTEMS: THE CONCRETE CURVED WALL SYSTEM AND THE STEEL FRAME METAL PANEL SYSTEM. BOTH SYSTEMS HAVE TO BE SELF-SUPPORTED AND ALSO HAVE TO BE DESIGNED WITH THE LISTED CRITERIA ABOVE.

THESE CUT SECTION DRAWINGS ARE MOSTLY A STUDY OF THE CONCRETE CURVE WALL SYSTEM; THE RELATIONSHIP BETWEEN AN EXTERIOR AND AN INTERIOR ARE ALSO EXPRESSED IN THE DRAWINGS TO THE RIGHT. IN FACT, THESE SECTIONS HELP TO UNDERSTAND THE LAWS OF GRAVITY. HOW DO YOU BUILD A SUFFICIENT CURVING WALL AND STILL BE ABLE TO GIVE AN AESTHETIC TO THE BUILDING? UNFORTUNATELY, THE CURVED CONCRETE WALL IS NOT FLEXIBLE ENOUGH TO SATISFY ALL OF THE REQUIREMENTS. THEREFORE, THE STEEL FRAME AND METAL PANEL SYSTEM ARE USED AS AN ALTERNATIVE.

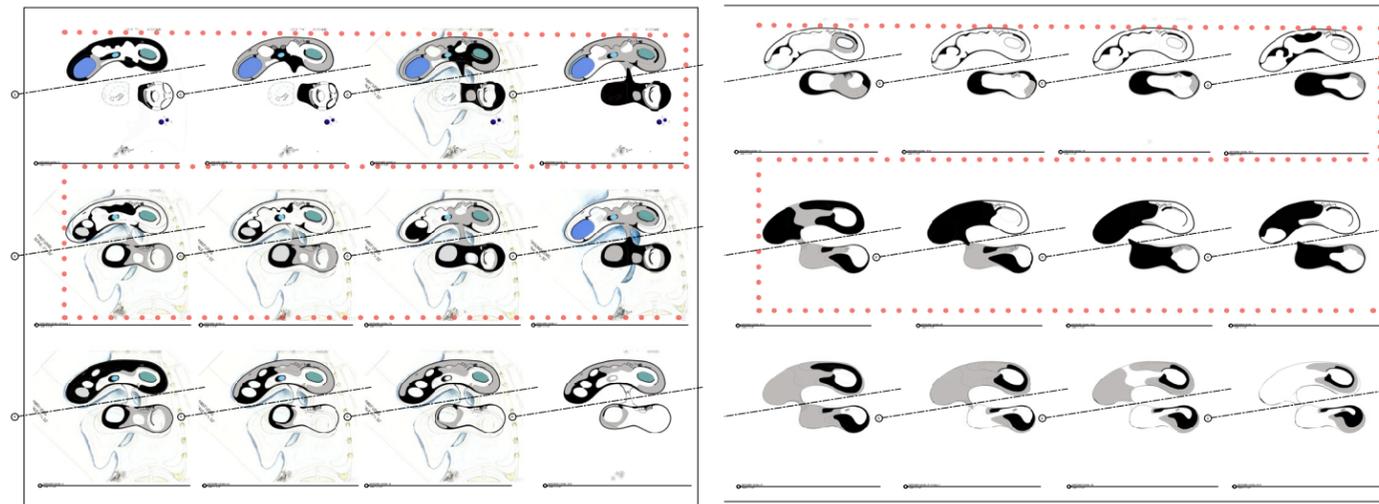
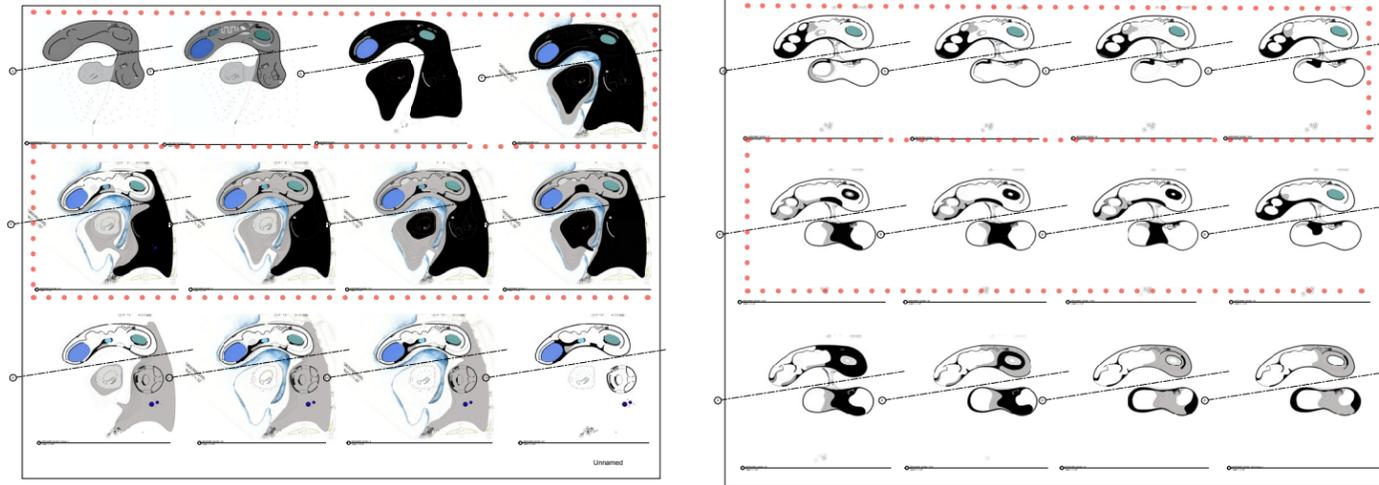


STUDY of LAYERS

ONE OF THE MOST IMPORTANT IDEAS FOR THE DESIGN WAS "BUILDING IN LAYERS". THIS METHOD WILL ELIMINATE THE DEFINITION OF ALL PARTS OF THE BUILDING BECAUSE EVERY PART OF THE BUILDING WAS DESIGNED FROM ONE IDEAL LAYER UP. THEREFORE, THE STACKING LAYER COULD BECOME FLOORS, COLUMNS, WALLS, AND EVEN A CEILING.

EACH LAYER OF CONCRETE IS CASTED 18" THICK AND IS SHAPED IN SUCH A WAY THAT IT WILL CREATE MOVEMENT OF CURVES IN THE WALLS. AT ONE POINT, THIS STUDY WAS VERY INTENSIVE BUT IT WAS NOT A REALISTIC PROPOSAL. NEVERTHELESS, ITS SPIRIT WAS INSPIRING AND CARRIED ON UNTIL THE END OF THE PROJECT.

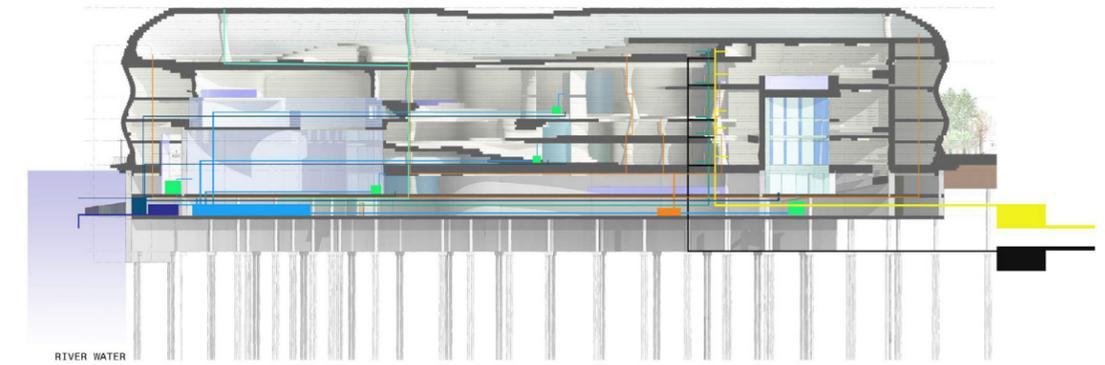
THE PICTURES TO RIGHT ARE DIAGRAMS OF ALL THE CONCRETE LAYERS THAT DISPLAY THE RELATIONSHIP OF ONE LAYER TO ANOTHER, IN PROGRESSION. IT WOULD BE EASIER TO INTERPRET IF READING ALONG THE DOTTED LINES.



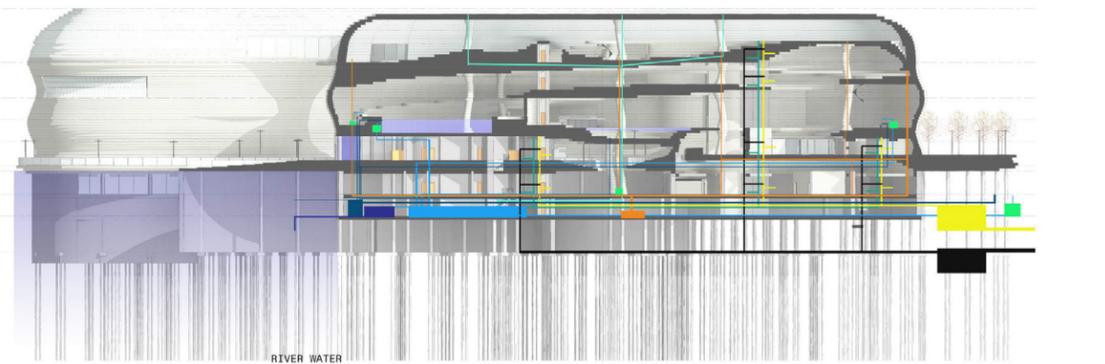
FUNCTION STUDY

THE WATER CIRCULATION IS ESSENTIAL IN THIS PROJECT. THE CUT SECTIONS TO THE RIGHT SHOWS HOW DIFFERENT TYPES OF WATER ARE DISTRIBUTED THROUGHOUT THE BUILDING. THIS STUDY PROPOSES A BETTER UNDERSTANDING OF THE WATER STORAGE AND TREATMENT OF THE WATER BEFORE BEING REFILLED BACK TO THE TANK. ALSO, THE PATH OF THE WATER MOVEMENT SHOULD BE TRAVELING THROUGH THE BACKHOUSE EXCEPT THE BASEMENT LEVEL-THE MECHANICAL FLOOR. THIS IS WHERE THE STORAGE TANK WOULD BE SET UP TO HELP THE DISTRIBUTION OF THE WATER MORE EFFICIENTLY.

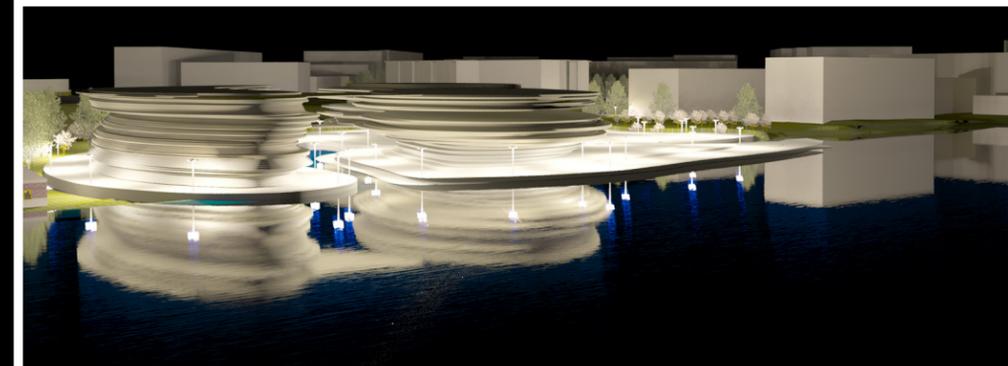
THE RENDERING PICTURE AT THE BOTTOM IS THE PROPOSAL OF THE LAYER IDEAS. THIS SHOWS THE GLORY OF THE BUILDING MASS ON THE SITE.



WATER AND HEATING SYSTEM DIAGRAM OCEAN KINGDOM CUT SECTION



WATER AND HEATING SYSTEM DIAGRAM OCEAN KINGDOM CUT SECTION

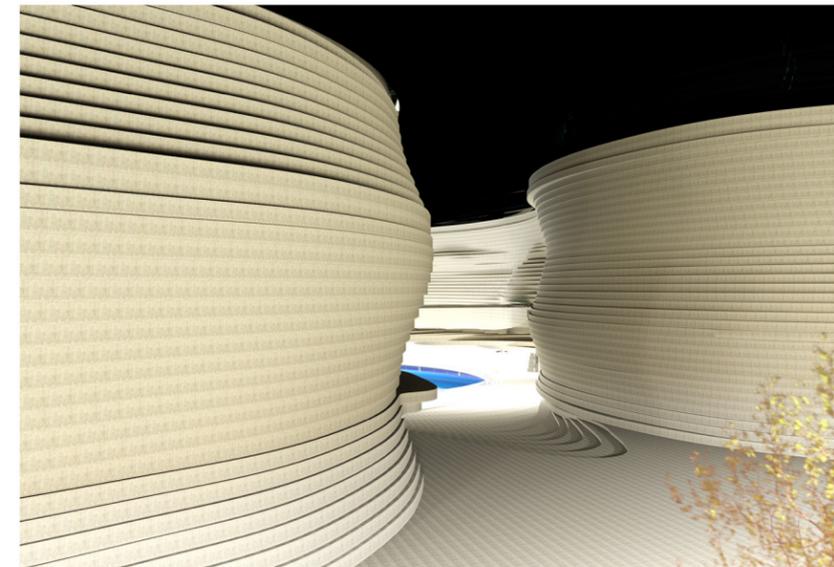
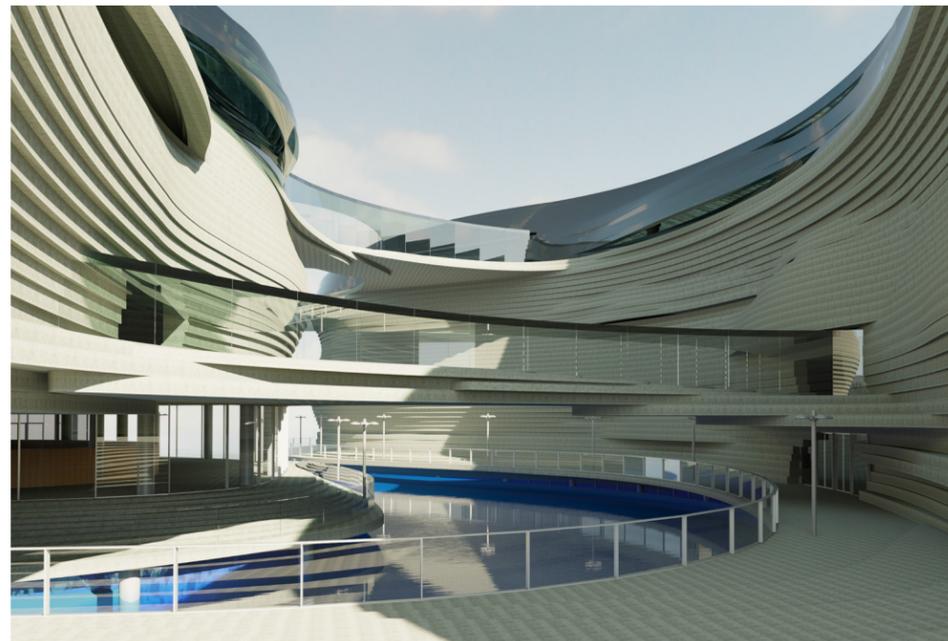


- WATER FROM RIVER COLLECTED
- TREATMENT WATER TANK
- INDIVIDUAL MIXING WATER TANK
- RETURN WATER FROM FISH TANK TO RIVER
- CITY FRESH WATER
- TEMPERATURE CONTROL SYSTEM
- RETURN BLACK WATER TO CITY TREATMENT PLAN

RENDERINGS

THE IDEA OF BUILDING THE AQUARIUM IN LAYERS IS DEVELOPED BASED ON THE MATHEMATICAL CURVES. THE ORDER OF THESE LAYERS PRODUCES IDEAL PRITINE CONCRETE CURVES. THESE CURVES WOULD INTERACT WITH THE WATER.

THE CONSTRUCTION METHOD TO BUILD THESE CONCRETE LAYERS IS UNREALISTIC. THE LACK OF KNOWLEDGE ON THE MATERIALS AS WELL AS THE STABILITY OF THE STRUCTURE MAKES IT DIFFICULT TO BUILD A UNIQUE BUILDING IN LAYERS. AS A RESULT, THE BUILDING STRUCTURE HAS CHANGED TO A BEAM AND COLUMN SYSTEM AS A CORE STRUCTURE. THE FACADE, A SHELL, IS BUILT AS A STEEL FRAME AND METAL PANEL SYSTEM. THE NEW TYPE OF STRUCTURE IS DISPLAYED IN PHASE FOUR, FINAL PROJECT.

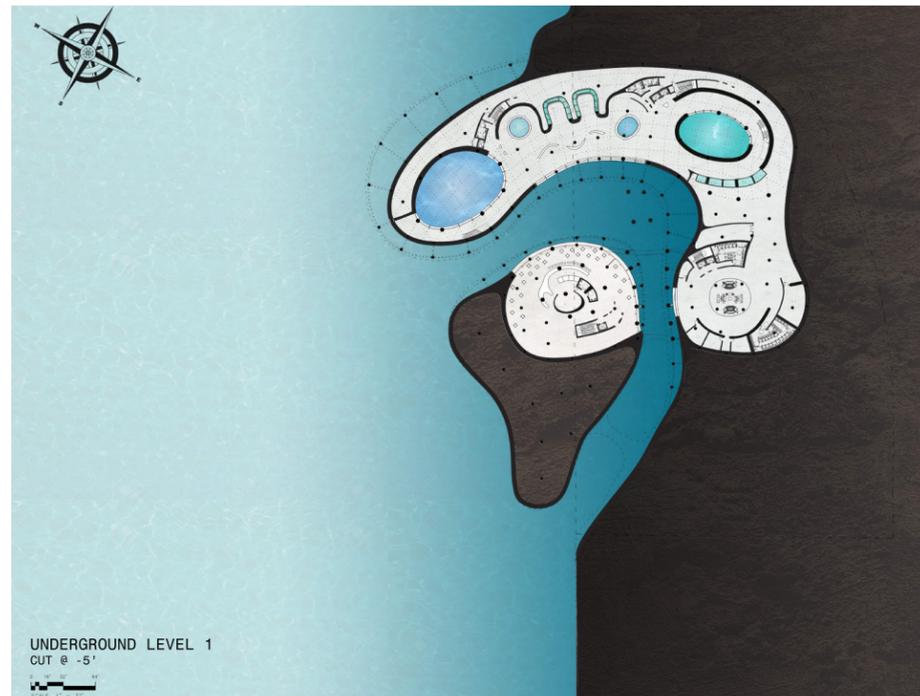
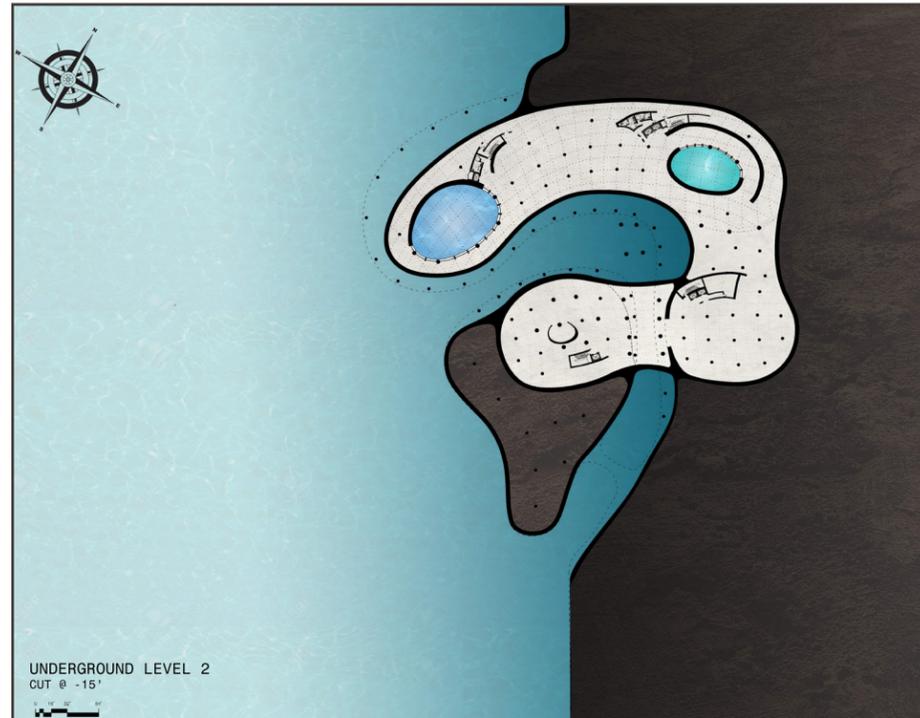


FLOOR PLANS

THE FINAL AQUARIUM DESIGN HAS TWO LEVELS BELOW GROUND, FIVE LEVELS ABOVE GROUND, AND THE ROOF GARDEN. THE FINAL PROGRAM IS MORE SPECIFIC WITH COMPATIBLE STRUCTURES AND MATERIALS.

THE UNDERGROUND LEVEL 2 IS THE MECHANICAL LEVEL, LOCATED AT 21 FEET BELOW THE WATER LEVEL. AS THE DRAWING SHOWS, THE DOLPHIN AND PACIFIC REEF TANKS ARE THE ONLY TWO TANKS AT THIS LEVEL. THIS GIVES AN OPPORTUNITY FOR EMPLOYEES TO TAKE CARE OF THE FISH BETTER AT THIS LEVEL. THE FOUR FIRE STAIRS AND ELEVATORS ARE ALSO CONNECTED TO THIS LEVEL FOR EMPLOYEES' PATH AND EMERGENCY ESCAPE. RIGHT UNDERNEATH THIS LEVEL IS JUST THE FOUNDATION, RETAINING WALLS, AND PILES TO HELP THE STABILITY OF THE BUILDING. THIS WILL BE SHOWN MORE CLEARLY IN SECTIONS AND ELEVATIONS DRAWINGS.

THE UNDERGROUND 1 IS LOCATED AT 9 FEET BELOW THE WATER LEVEL. IT IS FOR RESTAURANT AND AQUARIUM. MOREOVER, THERE IS OFFICE AND EMPLOYEE LOUNGE RIGHT BELOW THE GATHERING SPACE. THE OFFICE CONNECTS TO THE OCEAN KINGDOM AT THIS LEVEL, THAT LETS EMPLOYEES CIRCULATE EASILY IN THE BACKHOUSE.



AQUARIUM PROGRAM:

1. DROP OFF/ PICK UP
2. BACK HOUSE DOCK
3. WALKWAY ALONG THE WATER
4. AIR MECHANICAL SPACE
5. ELECTRICAL TRANSITIONAL STATION
6. TICKET BOOTH
7. GIFT SHOP
8. KITCHEN
9. BAR/ CAFETERIA
10. AQUARIUM BACK HOUSE
11. OFFICES
12. STORAGE
13. LAUNDRY
14. MECHANICAL CLOSET
15. EMPLOYEE'S BREAKROOM
16. DOLPHIN'S STAGE
17. MAIN ENTRANCE
18. SECONDARY ENTRANCE
19. EMERGENCY HALLWAY
20. FIRE STAIR I
21. FIRE STAIR II
22. FIRE STAIR III
23. FIRE STAIR IV
24. WOMEN'S RESTROOM
25. MEN'S RESTROOM
26. MEN'S/ WOMEN'S RESTROOM
27. EMPLOYEE MEN'S RESTROOM
28. EMPLOYEE WOMEN'S RESTROOM
29. OPEN TANK
30. ENCLOSED BIG TANK
31. ENCLOSED SMALL TANK
32. PENGUIN'S POOL
33. FLYING FISH
34. JELLY'S FISH
35. DOLPHIN'S POOL
36. CORAL REEF
37. COLUMN TANK
38. FALLING WATER POOL
39. BRIDGE I
40. BRIDGE II

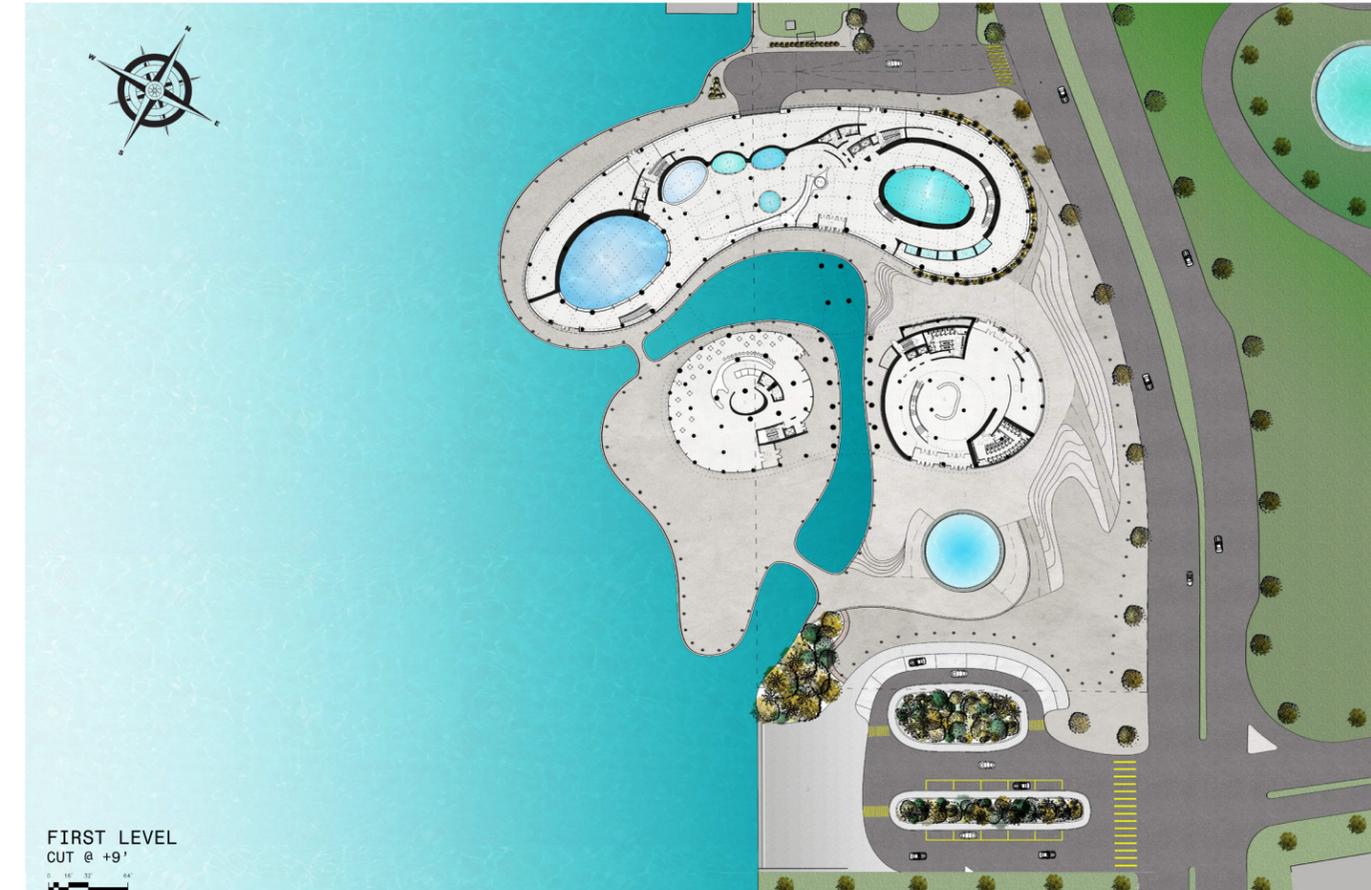
FLOOR PLANS

GROUND PLAN

THE GROUND PLAN SHOWS THE CIRCULATION FROM THE OUTSIDE TO THE INSIDE OF THE PROJECT. THERE IS DROP OFF/ PICK UP AT SOUTHEAST SIDE. THE AREA IS DEVELOPED LIKE A PUBLIC SQUARE WITH GREENSPACE AND A WATER WALKWAY. ON THE OTHER SIDE, THERE IS A LOADING DOCK FOR THE AQUARIUM'S INVENTORY. THERE ARE DRIVEWAYS TO CONNECT TO THESE LOCATIONS. THE STREET IS AT +9 FEET ABOVE WHILE THE FIRST FLOOR AT OCEAN KINGDOM AND RESTAURANT IS AT +3 FEET; AND THE GATHERING SPACE IS AT +6 FEET. THEREFORE, THE LANDSCAPE OF THE EXTERIOR GROUND IS DESIGNED IN A WAY THAT DIRECTS PEOPLE TO APPROACH THE BUILDING GRADUALLY. THERE ARE RAMPS, STEPS FOR DIFFERENT LEVELS; AND BRIDGES TO CONNECT THE GROUND TO THE ISLAND RESTAURANT.

TOURISTS CAN OBTAIN TICKETS, CHECK IN THEIR BELONGINGS, AND USE THE RESTROOM AT THE GATHERING SPACE BEFORE WALKING UP TO THE AQUARIUM ABOVE.

THE GROUND LEVEL AT THE OCEAN KINGDOM HAS FISHES' TANKS, BACKHOUSE AND RAMPS FOR CIRCULATION IN THE BUILDING.

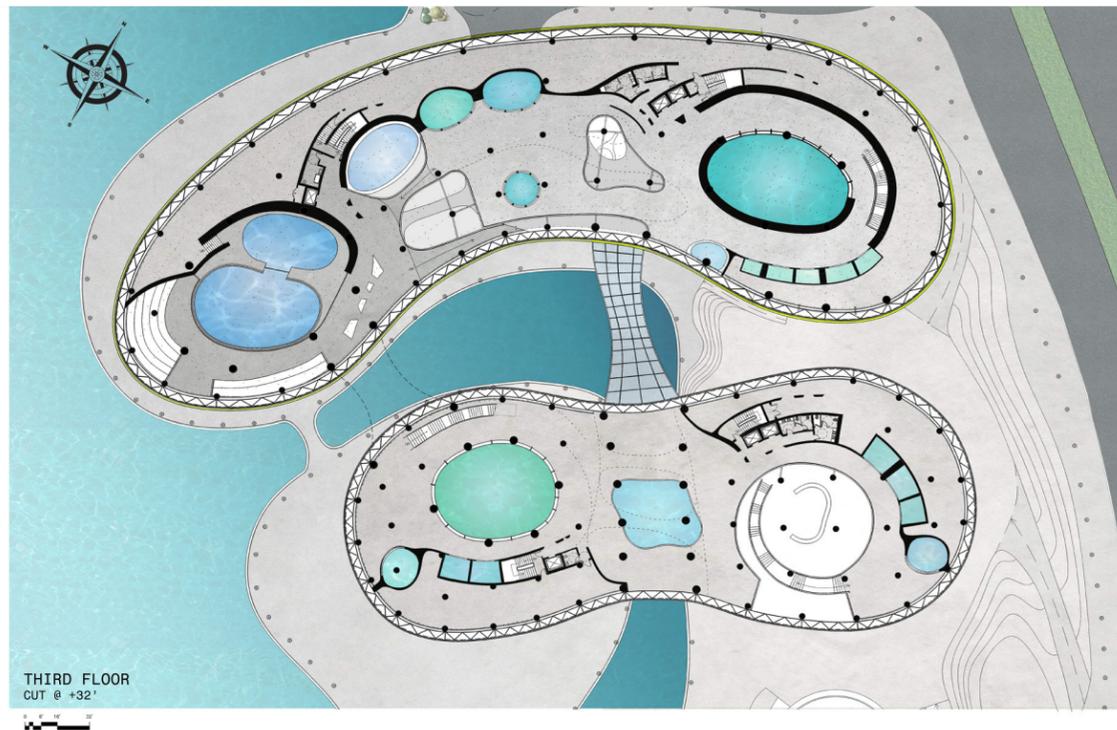
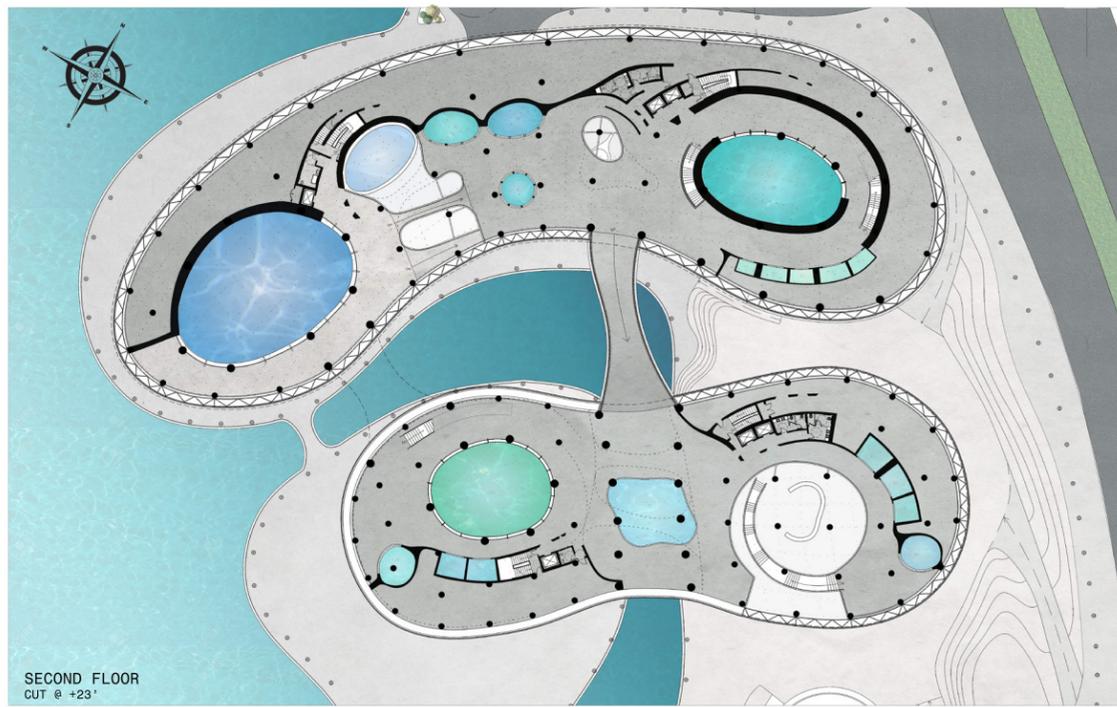


FLOOR PLANS

THERE ARE FOUR FIRE STAIRS: TWO LOCATED AT OCEAN KINGDOM AND THE OTHER TWO LOCATED AT THE RIVER TOWN. IN ADDITION, THERE ARE FOUR EXTERIOR BRIDGES TO CONNECT THE ISLAND TO THE GROUND; AND THE OCEAN KINGDOM TO THE RIVER TOWN. EACH FLOOR FROM THE SECOND FLOOR OR ABOVE ARE DESIGNED AS BROKEN FLOORS, WHICH HAVE TWO SEPERATED PLATFORMS SHIFTED FEW FEET ABOVE FROM ONE ANOTHER TO CREATE DIFFERENT PERSPECTIVES WHILE PEOPLE MOVE FROM ONE LEVEL TO ANOTHER LEVEL. THESE PLATFORMS ARE CONNECTED BY CONCRETE RAMPS.

THE LOW SECOND FLOOR IS AT +11 FEET, AND THE HIGH SECOND FLOOR IS AT +15 FEET ON THE OCEAN KINGDOM. THE RIVERTOWN IS AT +19 FEET. THERE ARE LOW BRIDGE CONNECT THE FLOOR FROM +15 FEET TO +19 FEET.

THE LOW THIRD FLOOR IS AT +27 FEET, AND THE HIGH THIRD FLOOR IS AT +31 FEET ON THE OCEAN KINGDOM. AT THE CONNECTED RAMP FROM +27' TO +31', PEOPLE CAN ENJOY THE WATER FALL AND LOOK DOWN THROUGH THE GROUND LEVEL. THE FLOOR AT +31' IS MAINLY A DOLPHIN'S SHOW FLOOR.

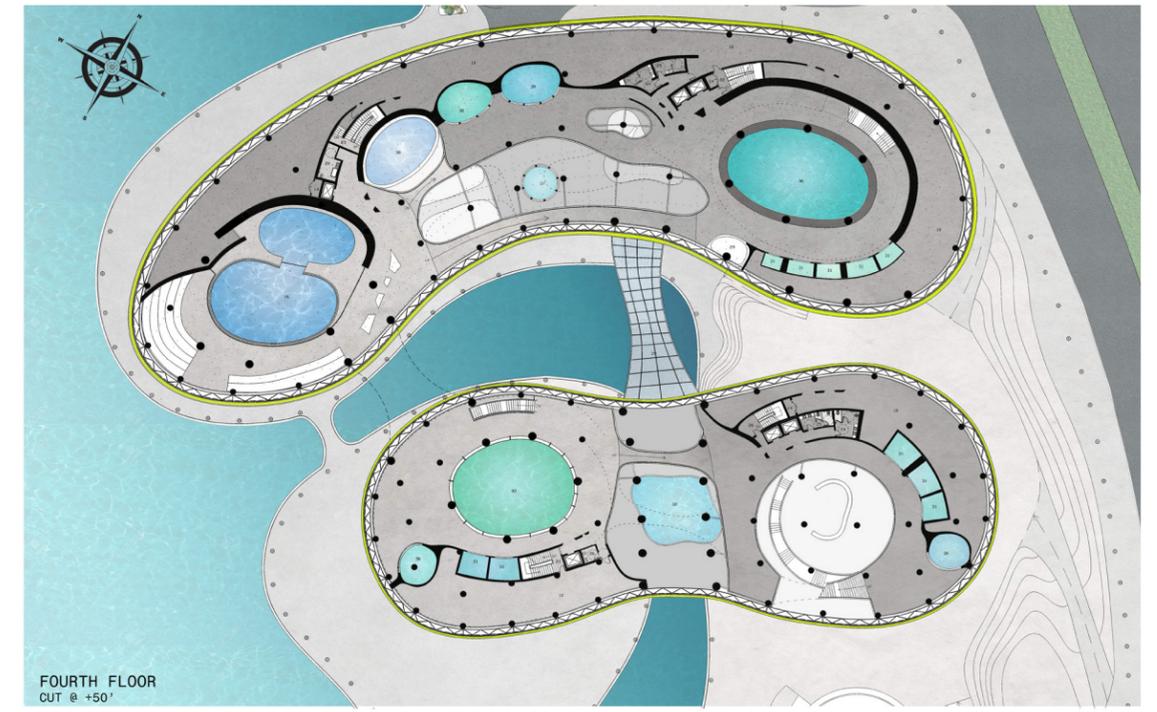


FLOOR PLANS

THERE IS A LONG RAMP TO CONNECT THE HIGH THIRD FLOOR TO THE FOURTH FLOOR. THE FOURTH LEVEL AT OCEAN KINGDOM IS AT +43'. IT HAS AN OPENED CORAL REEF TANK WITH STRUCTURAL COLUMNS AROUND THE TANKS. THERE IS A BIG SKYLINE ABOVE THIS TANK IN ORDER TO BRING LIGHT TO THE FISH. PEOPLE CAN ALSO SEE OTHER TANKS AND THE RESTROOMS AT THIS LEVEL. THERE IS A RAMP TO GO UP TO THE ROOF LEVEL FROM THIS LEVEL.

AT RIVER TOWN, THE LOW THIRD LEVEL IS AT +36', AND THE HIGH ONE IS AT +38'. THERE IS A JUMPING FISH TANK AT THE LOW LEVEL, THE SKYLIGHT IS AT THE CONNECTING RAMP BETWEEN THE TWO LEVELS. AT THE HIGH LEVEL, PEOPLE CAN WALK AROUND THE OPENING CIRCLE. ALSO, THERE IS A STAIR TO CONNECT TO THE ROOF FROM THIS LEVEL.

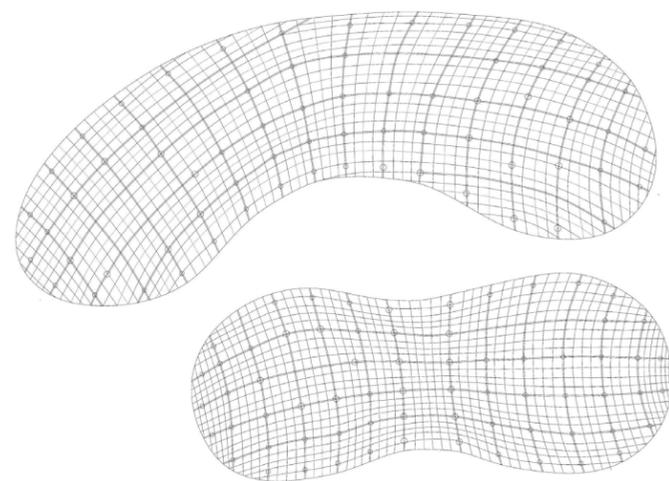
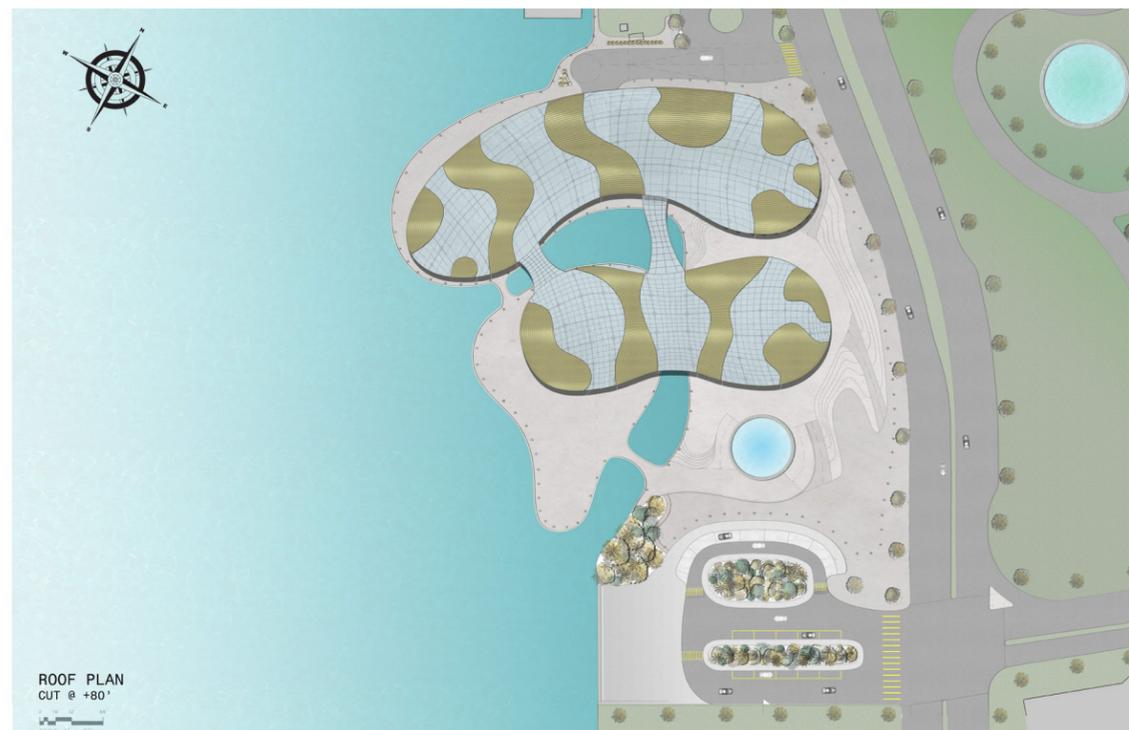
AT THE ROOF, THERE ARE RAMPS TO CONNECT TO LOW ROOFS AND HIGH ROOFS FOR BOTH BUILDINGS. IN ADDITION, THERE IS A HIGH BRIDGE TO CONNECT TWO BUILDINGS. THERE IS GREEN SPACE AND CAFETERIA AT THE ROOF LEVEL. FURTHERMORE, THERE IS A SKYLIGHT SHAPED AS A RUNNING WATER AT THE ROOF, WHICH PROVIDES LIGHT, VIEWS AND AESTHETIC TO THE BUILDING'S



ROOF PLANS

THE OVERALL ROOF PLAN DISPLAYS THE RELATIONSHIP BETWEEN THE BUILDING AND ITS SURROUNDINGS. THE METAL PANEL SYSTEM, WHICH APPEARS IN YELLOW ON THE ROOF, REFLECTS THE MOVEMENT OF THE WATER. BESIDES, THE ETFE GLASS SYSTEM, A LIGHTWEIGHT GLASS SYSTEM, IS FILLED BETWEEN THE METAL PANEL SYSTEM ON THE ROOF. THE GLASS SYSTEM ALLOWS LIGHT TO TRAVEL TO THE GARDEN AND TO THE LEVELS BELOW.

THE ROOF FRAME BELOWN SHOWS THE STEEL FRAME UNDERNEATH OF THE METAL PANEL SYSTEM. THE STEEL FRAME SYSTEM IS SUPPORTED BY THE COLUMN SYSTEM. IT HAS THE MAIN STEEL GIRDER SPAN FROM ONE COLUMN TO ANOTHER COLUMN IN HORIZONTAL AND VERTICAL DIRECTIONS. IT ALSO HAS A SMALLER BEAM SYSTEM SPAN FROM ONE GIRDER TO ANOTHER GIRDER TO SUPPORT THE METAL PANEL AND ETFE GLASS SYSTEM ABOVE.



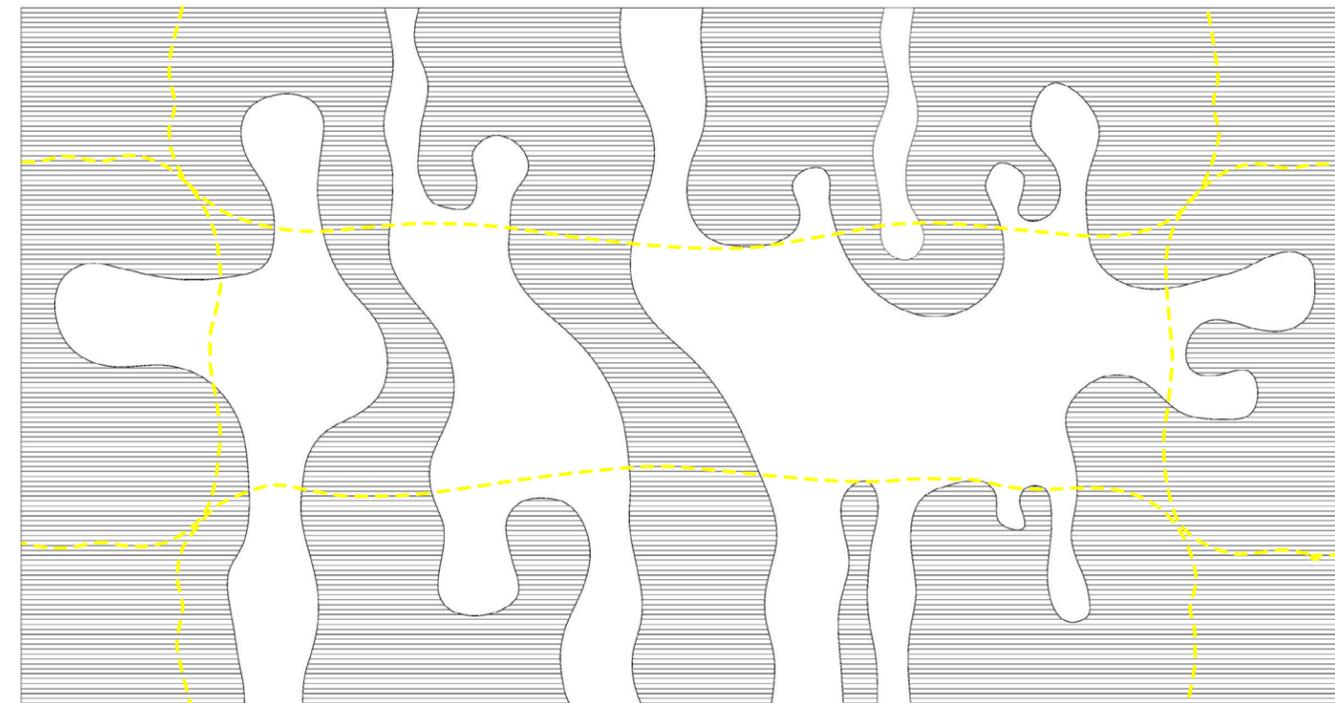
ROOF FRAME



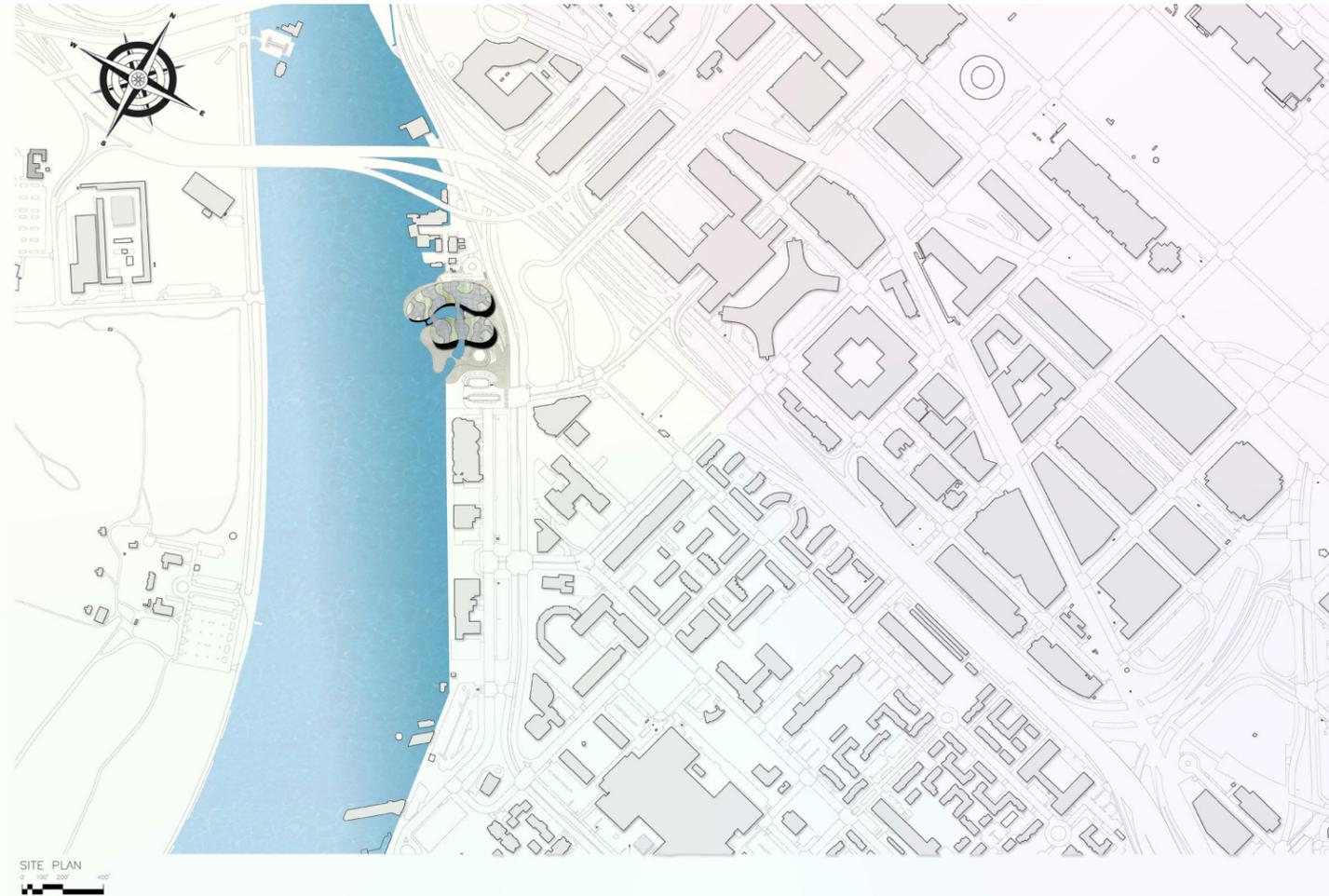
FACADE IDEA

THE IDEA OF DROPPING WATER ON THE CURVED SURFACE WILL CREATE A CONTINUOUS RUNNING SURFACE. WHEREVER THE WATER RUNS, IT WILL BE DEVELOPED AS PANELED GLASS; AND THE REST OF THE SURFACE WILL BE A METAL PANEL SYSTEM.

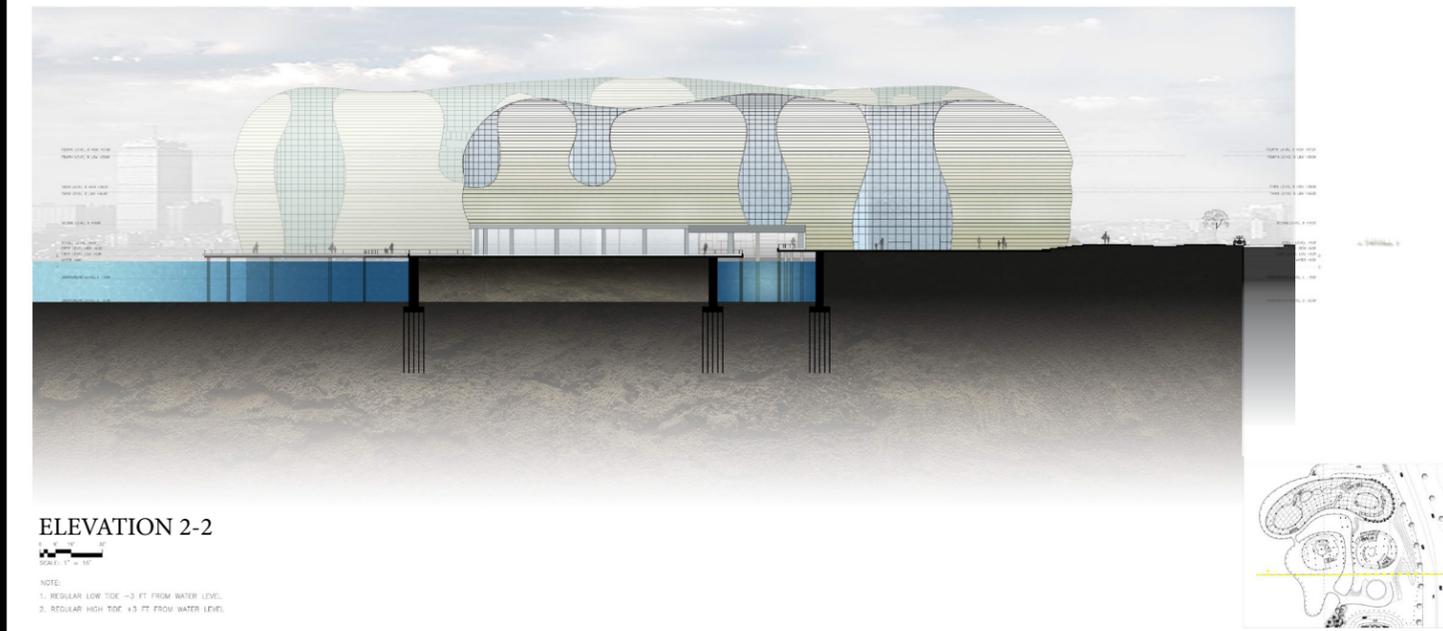
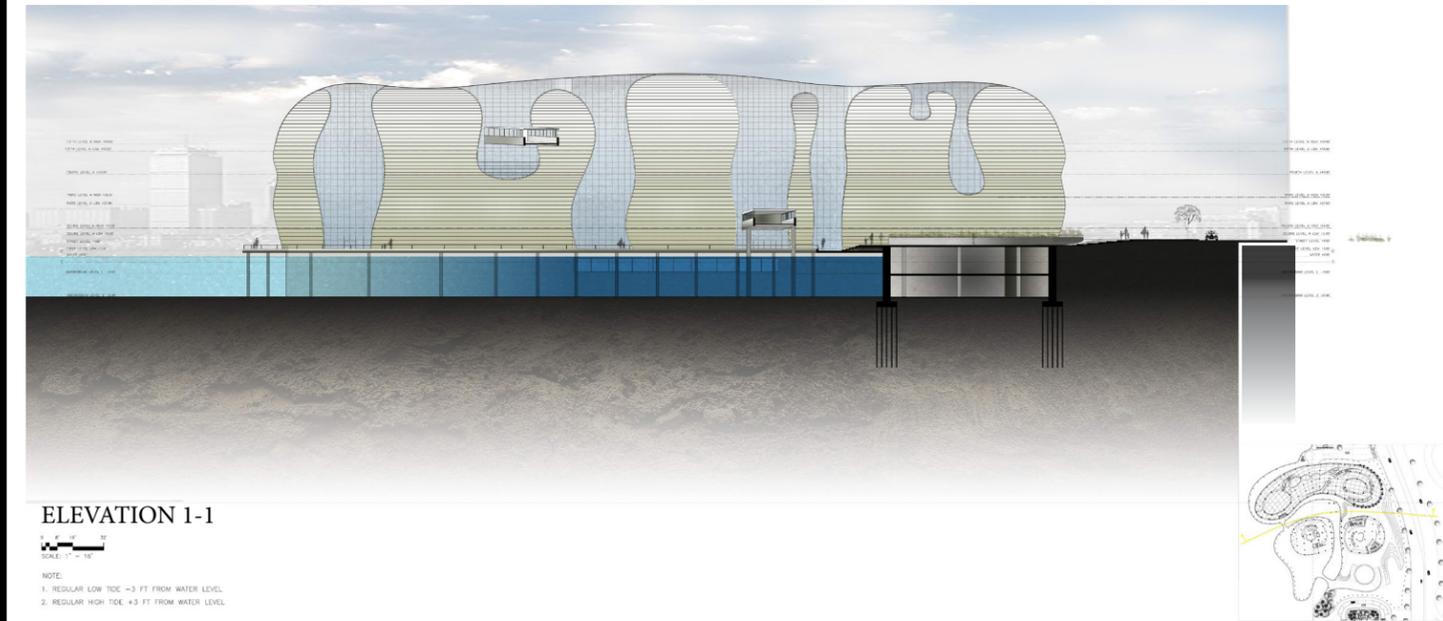
ON THE DIAGRAM OF THE FACADE IDEA TO THE RIGHT, THE YELLOW DASHES DEMONSTRATES THE FOUR BUILDING ELEVATIONS. THE BLACK PATTERN SHOWS THE METAL PANEL SYSTEM AND THE WHITE EMPTY PART SHOW THE ETFE GLASS SYSTEM. THE LAYOUT HELPS TO SHOW THE RELATIONSHIP BETWEEN METAL PANEL AND ETFE GLASS SYSTEM OF THE BUILDING EXTERIOR.



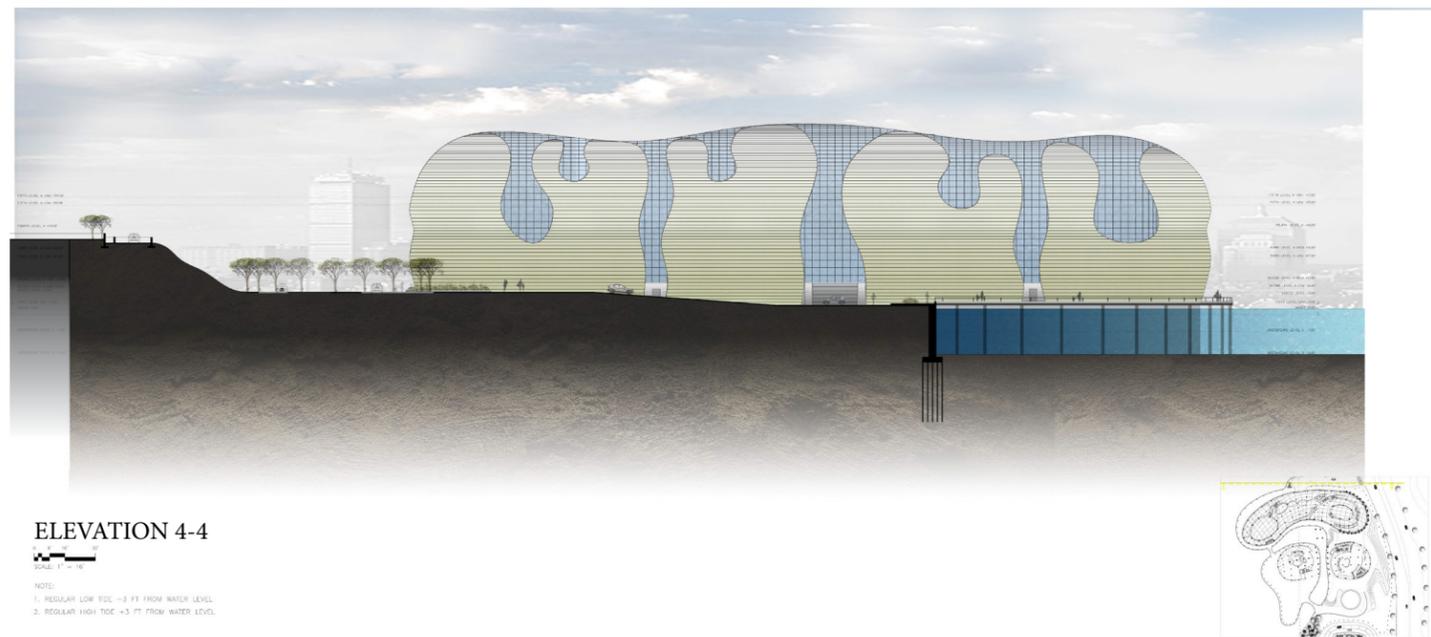
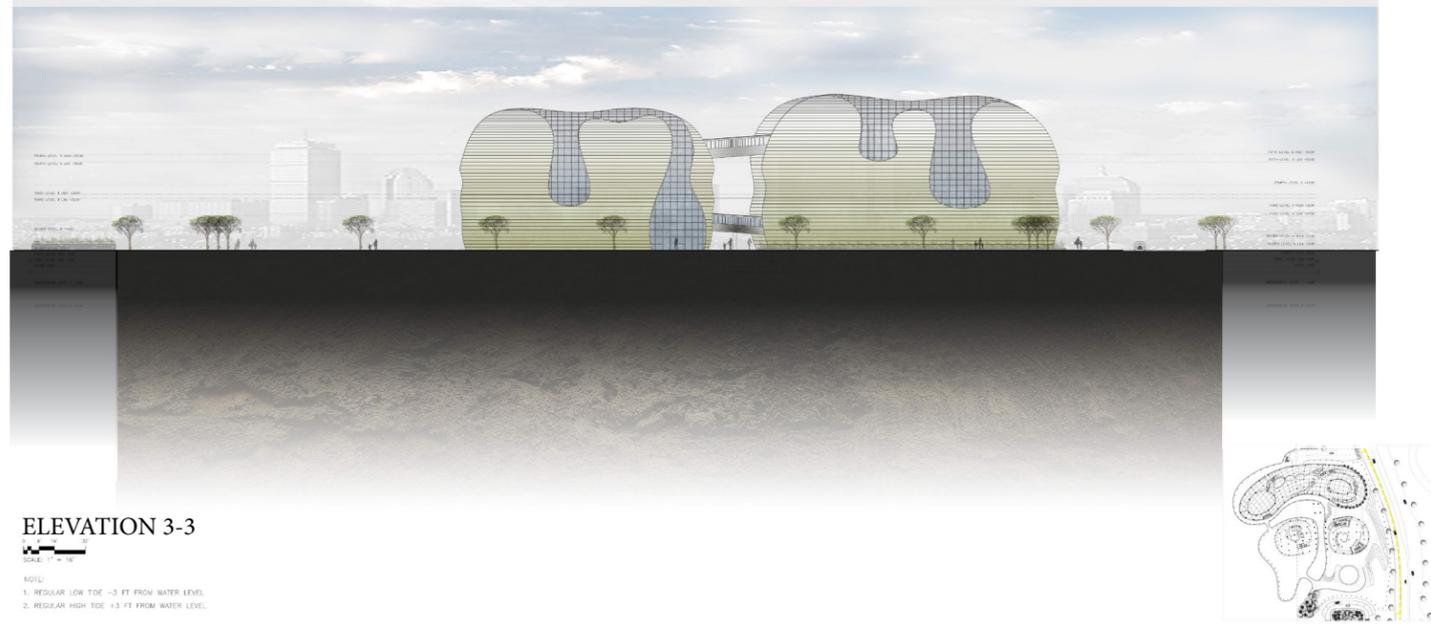
SITE PLAN



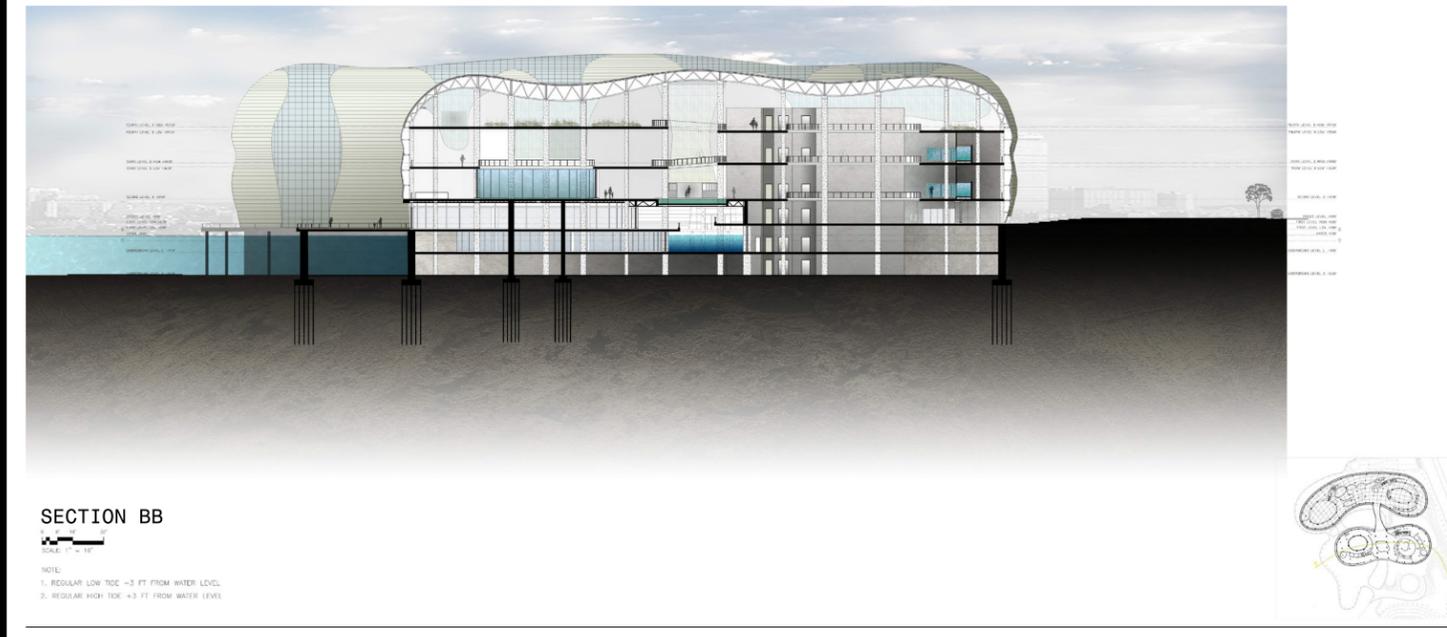
ELEVATIONS



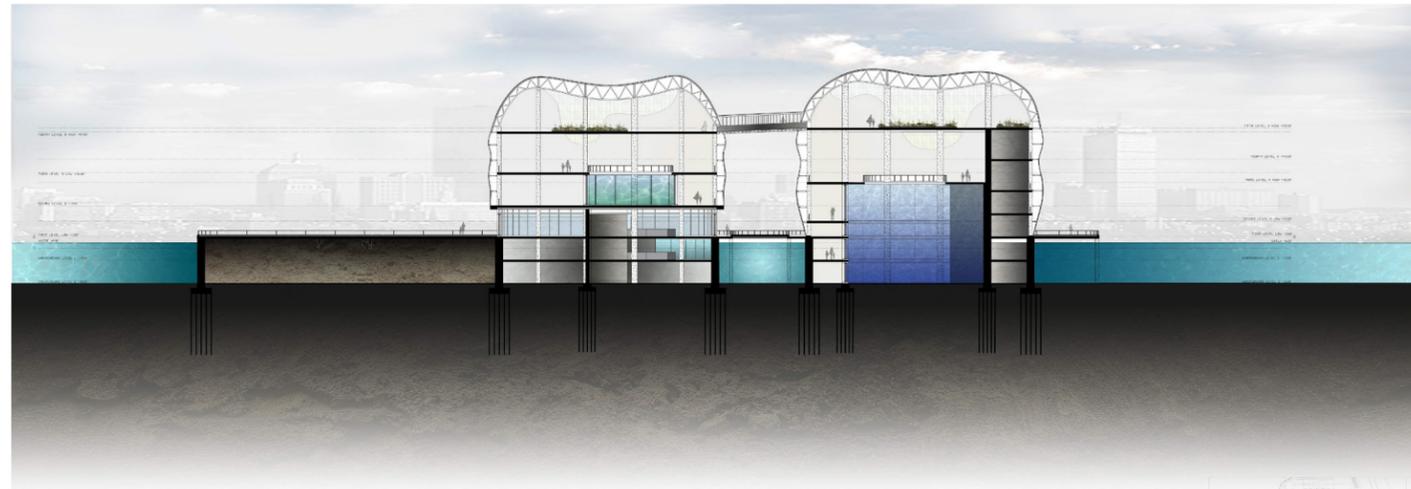
ELEVATIONS



SECTIONS

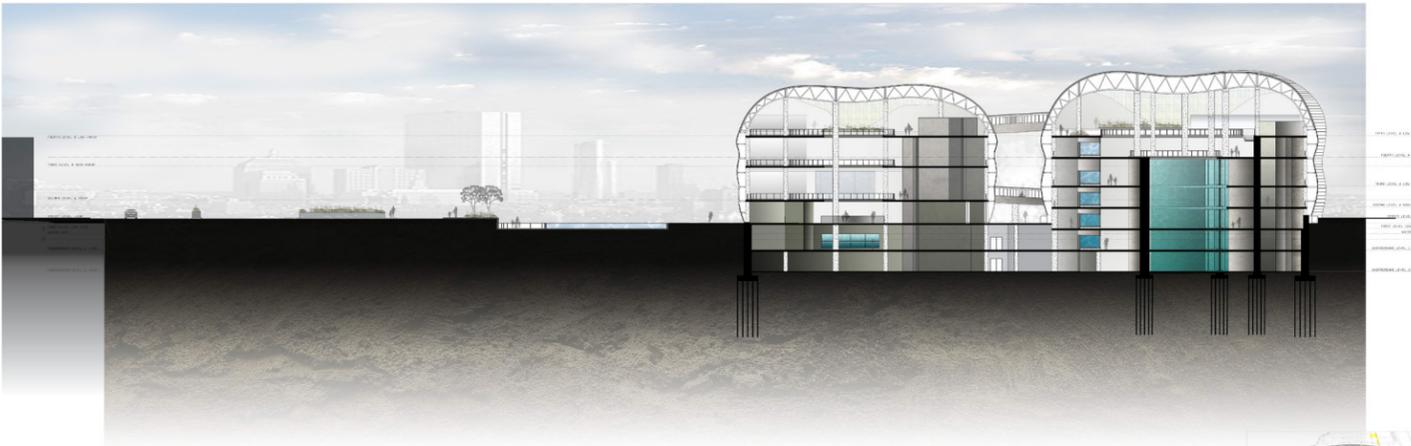


SECTIONS



SECTION CC

NOTE:
 1. REGULAR LOW TIDE -3 FT FROM WATER LEVEL
 2. REGULAR HIGH TIDE +3 FT FROM WATER LEVEL



SECTION DD

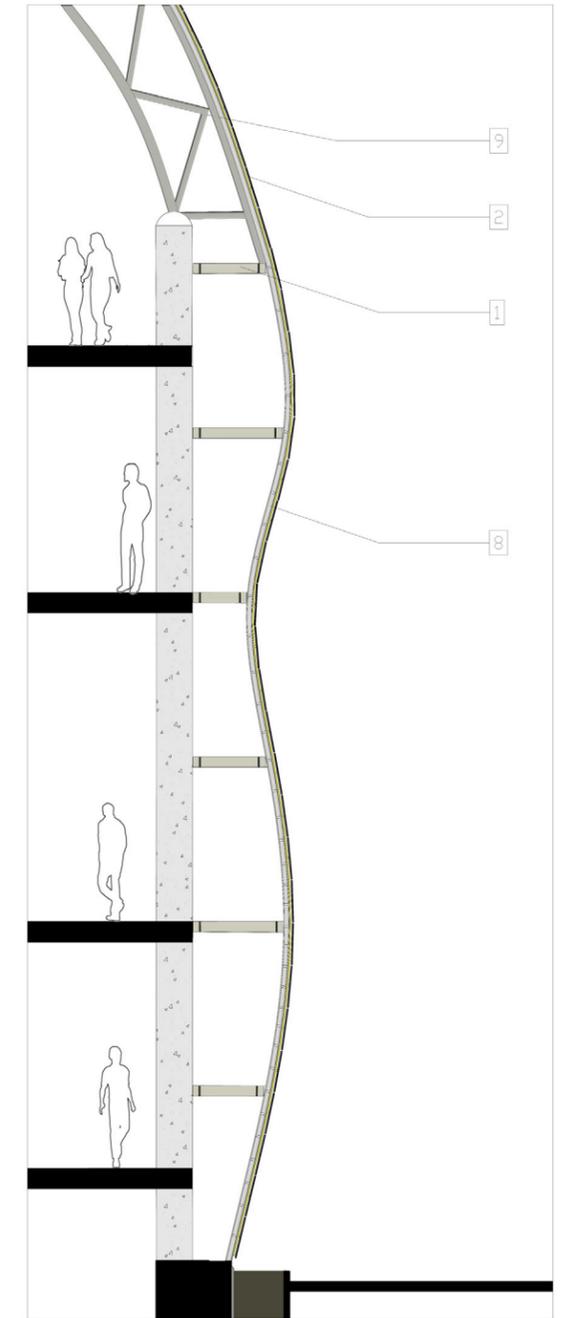
NOTE:
 1. REGULAR LOW TIDE -3 FT FROM WATER LEVEL
 2. REGULAR HIGH TIDE +3 FT FROM WATER LEVEL



DETAILS

FACADE DETAIL LISTS:

1. HORIZONTAL STEEL BRACE FRAME
2. METAL SHEET PANEL
3. ETFE GLASS PANEL
4. HORIZONTAL METAL PANEL TRACK
5. VERTICAL METAL PANEL TRACK
6. TPO ROOF MEMBRANE
7. SHEATHING METAL SHEET
8. RIGID INSULATION
9. ROOF TRUSS
10. ROOF FRAME
11. FLASHING



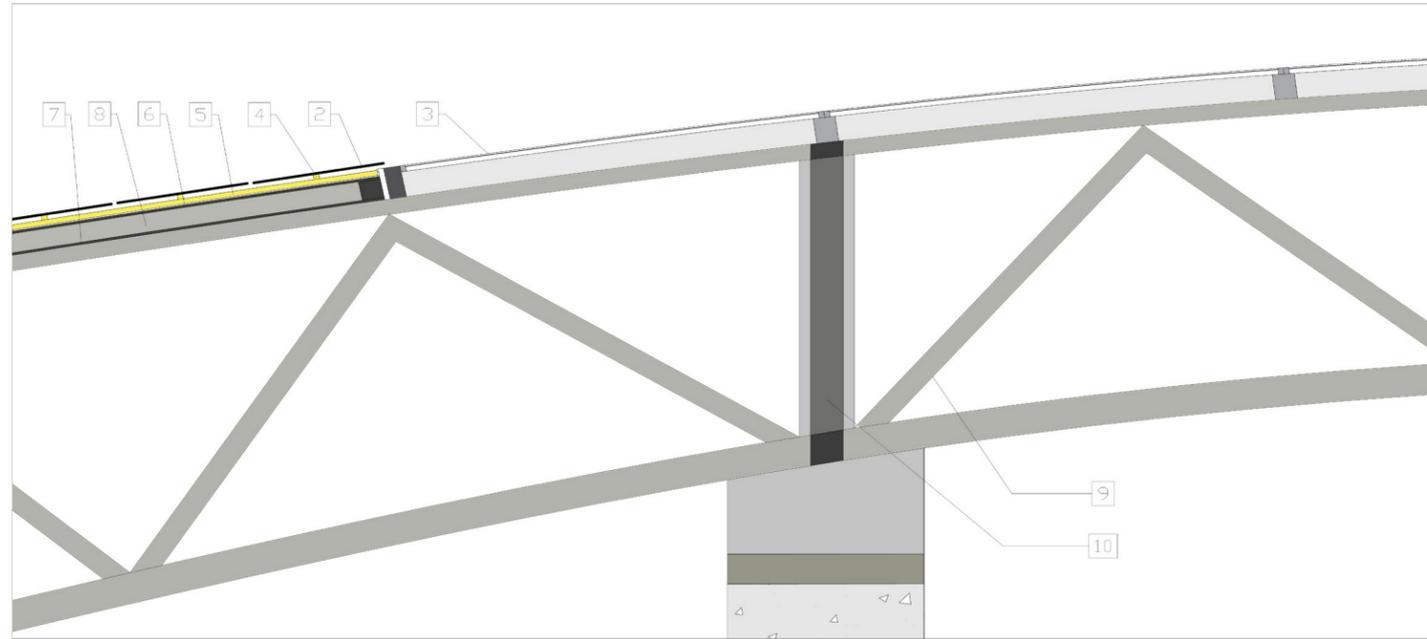
FACADE METAL SHEET

0 1.5' 3' 6'
 SCALE: 1" = 3'

DETAILS

FACADE DETAIL LISTS:

- | | |
|---------------------------------|--------------------------|
| 1. HORIZONTAL STEEL BRACE FRAME | 7. SHEATHING METAL SHEET |
| 2. METAL SHEET PANEL | 8. RIGID INSULATION |
| 3. ETFE GLASS PANEL | 9. ROOF TRUSS |
| 4. HORIZONTAL METAL PANEL TRACK | 10. ROOF FRAME |
| 5. VERTICAL METAL PANEL TRACK | 11. FLASHING |
| 6. TPO ROOF MEMBRANE | |



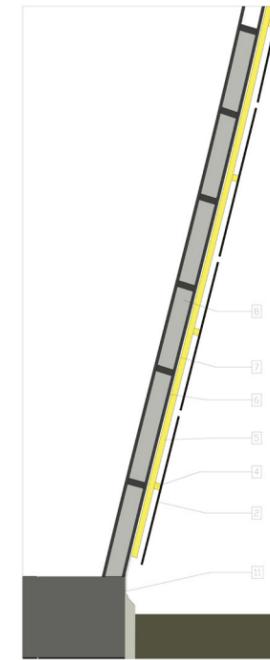
METAL PANEL AND ETFE GLASS TRANSITION © ROOF



DETAILS

FACADE DETAIL LISTS:

1. HORIZONTAL STEEL BRACE FRAME
2. METAL SHEET PANEL
3. ETFE GLASS PANEL
4. HORIZONTAL METAL PANEL TRACK
5. VERTICAL METAL PANEL TRACK
6. TPO ROOF MEMBRANE
7. SHEATHING METAL SHEET
8. RIGID INSULATION
9. ROOF TRUSS
10. ROOF FRAME
11. FLASHING

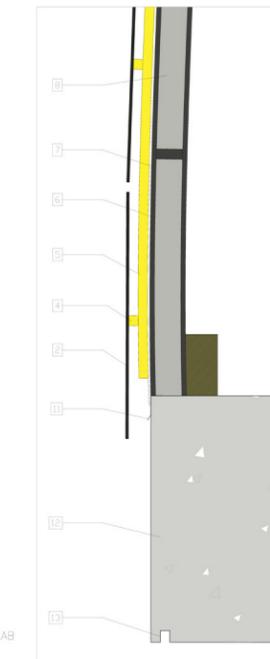


METAL PANEL © TREE BOX



FACADE DETAIL LISTS:

1. HORIZONTAL STEEL BRACE FRAME
2. METAL SHEET PANEL
3. ETFE GLASS PANEL
4. HORIZONTAL METAL PANEL TRACK
5. VERTICAL METAL PANEL TRACK
6. TPO ROOF MEMBRANE
7. SHEATHING METAL SHEET
8. RIGID INSULATION
9. ROOF TRUSS
10. ROOF FRAME
11. FLASHING
12. CONCRETE SLAB
13. CONCRETE DRIP

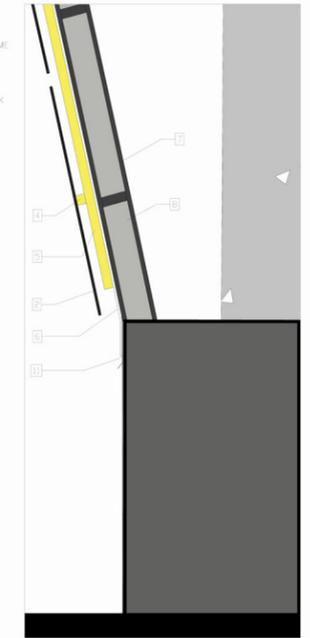


METAL PANEL © CONCRETE SLAB



FACADE DETAIL LISTS:

1. HORIZONTAL STEEL BRACE FRAME
2. METAL SHEET PANEL
3. ETFE GLASS PANEL
4. HORIZONTAL METAL PANEL TRACK
5. VERTICAL METAL PANEL TRACK
6. TPO ROOF MEMBRANE
7. SHEATHING METAL SHEET
8. RIGID INSULATION
9. ROOF TRUSS
10. ROOF FRAME
11. FLASHING

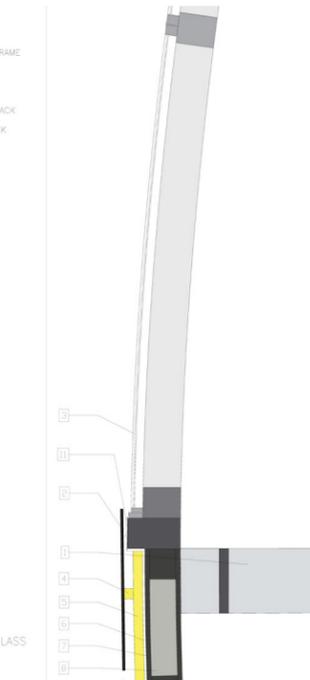


METAL PANEL © GROUND



FACADE DETAIL LISTS:

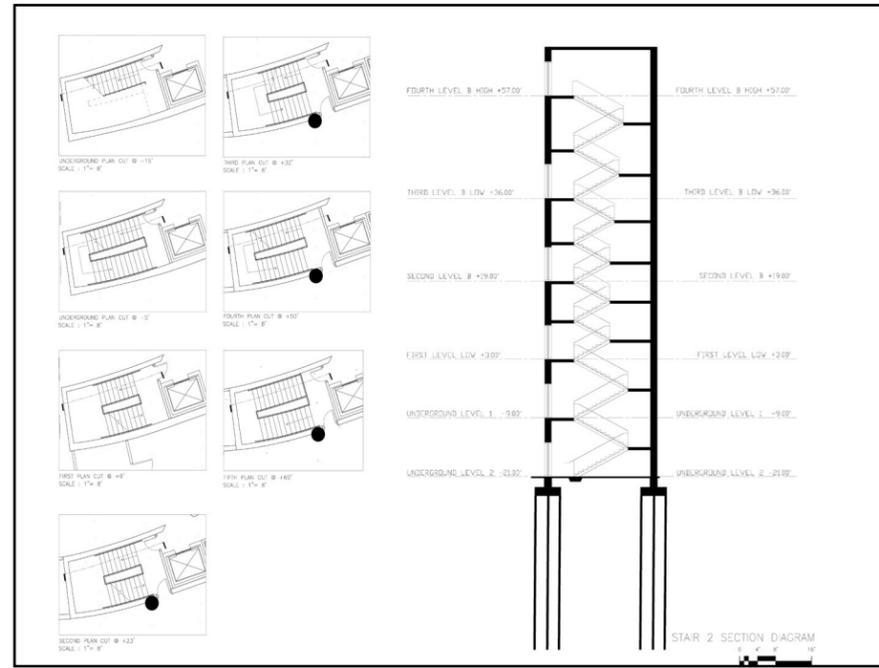
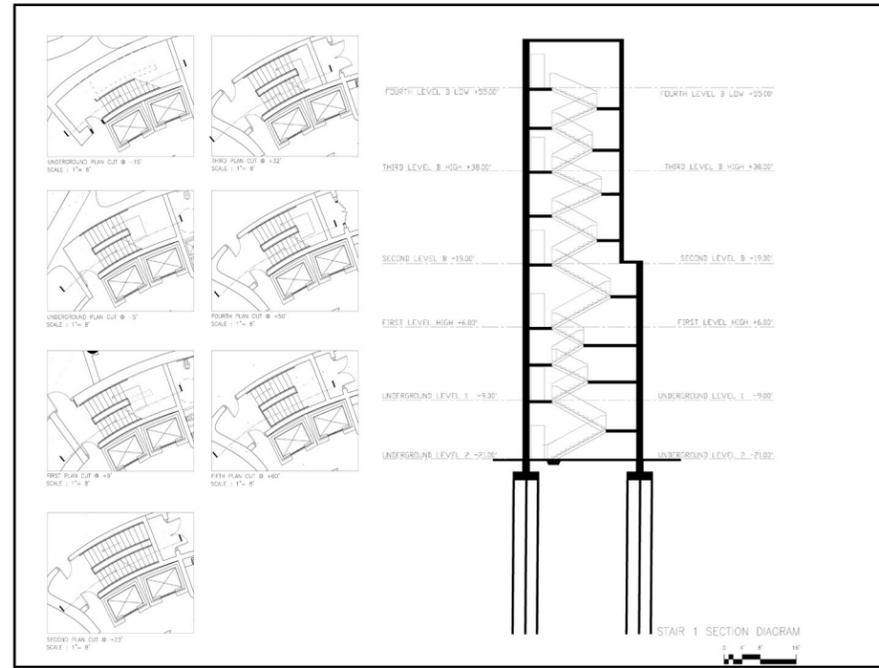
1. HORIZONTAL STEEL BRACE FRAME
2. METAL SHEET PANEL
3. ETFE GLASS PANEL
4. HORIZONTAL METAL PANEL TRACK
5. VERTICAL METAL PANEL TRACK
6. TPO ROOF MEMBRANE
7. SHEATHING METAL SHEET
8. RIGID INSULATION
9. ROOF TRUSS
10. ROOF FRAME
11. FLASHING



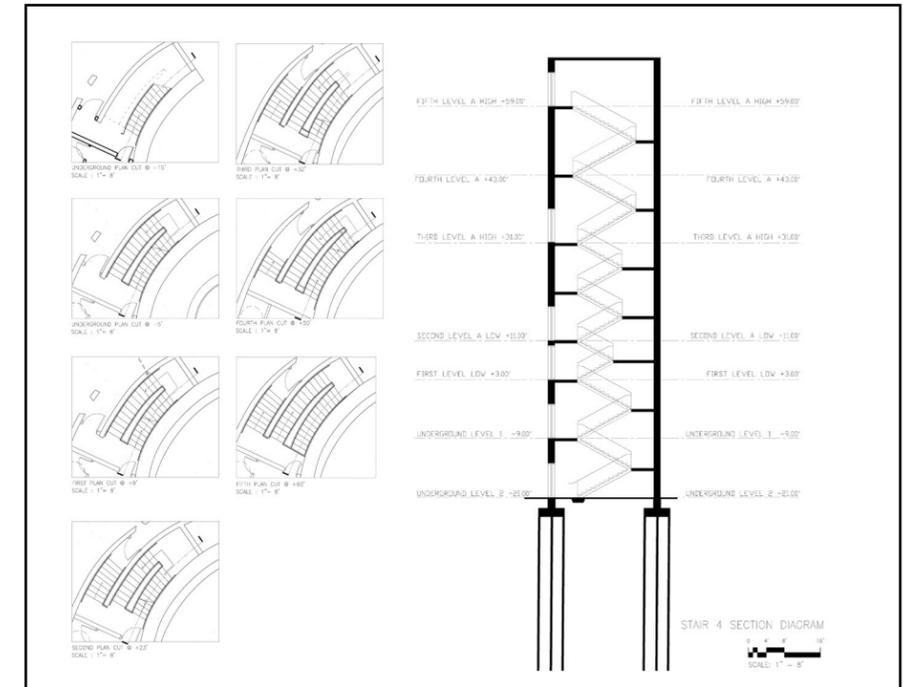
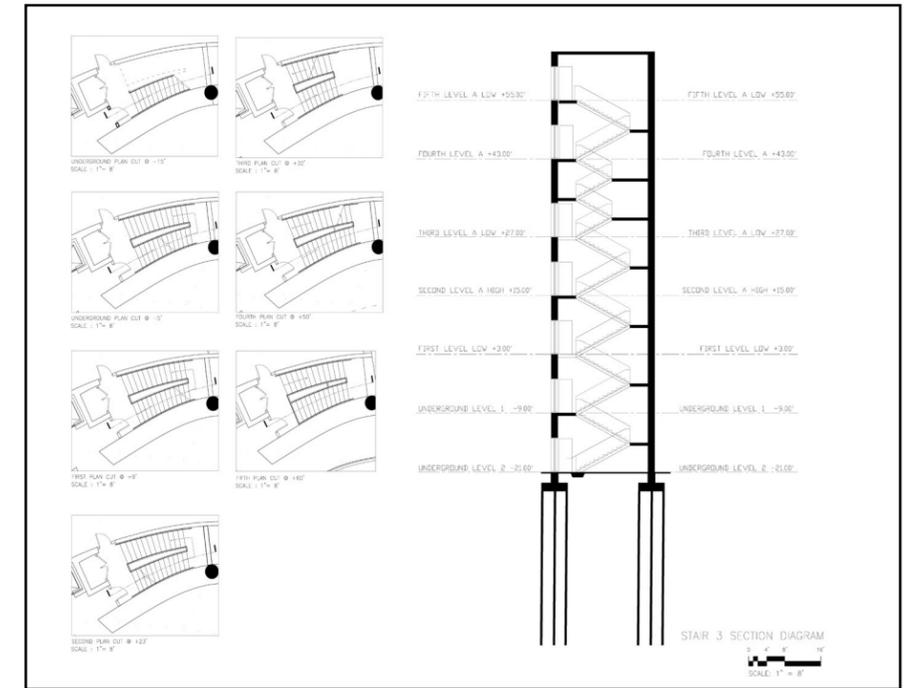
METAL PANEL © ETFE GLASS



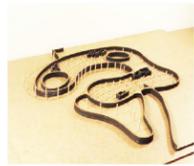
STAIRS DETAILS



STAIR DETAILS



CONSTRUCTION DEMONSTRATION



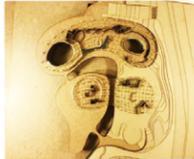
EXCAVATING TO THE UNDERGROUND, BUILD THE RETAINING WALL AND SET OF COLUMNS. THE UNDERGROUND AT 21 FT UNDER WATER LEVEL IS BUILT



SECOND UNDERGROUND LEVEL IS BUILT AT 9 FT UNDER WATER LEVEL WITH THE RETAINING WALL AND STRUCTURE GLASS WALL TO ALLOW VIEWS INTO WATER



FIRST FLOOR (GROUND) IS BUILT AS A CONTINUOUS PLATFORM WITH A RECREATION OF LANDSCAPE TO CONNECT THE SITE WITH THE WALKWAY ALONG THE WATER



SECOND FLOOR OF BUILDING A (OCEAN KINGDOM) IS BUILT



SECOND FLOOR OF BUILDING B (RIVER TOWN) IS BUILT



THE LOW BRIDGE CONNECTING FROM BUILDING A TO BUILDING B IS CONSTRUCTED

CONSTRUCTION DEMONSTRATION



LOW PART OF THE THIRD FLOOR OF BUILDING A IS CONSTRUCTED



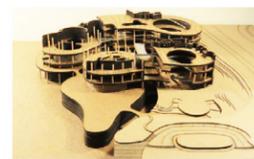
HIGH PART OF THE THIRD FLOOR OF BUILDING A IS CONSTRUCTED



THIRD FLOOR OF BUILDING B CONSTRUCTED



FOURTH FLOOR OF BUILDING A IS CONSTRUCTED



LOW PART OF FIFTH FLOOR OF BOTH BUILDING IS CONSTRUCTED



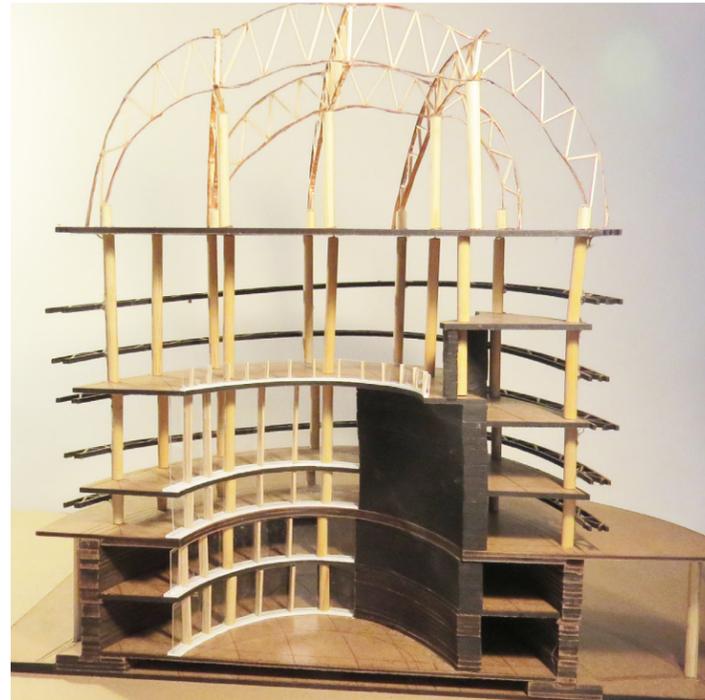
HIGH PART OF FIFTH FLOOR OF BOTH BUILDING IS CONSTRUCTED

CONSTRUCTION MODELS

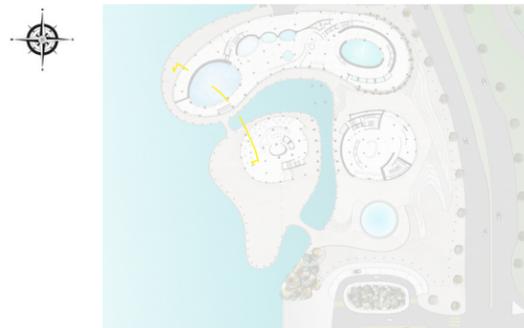
1,2 . SECTIONAL MODELS
3. CONSTRUCTION MODELS.



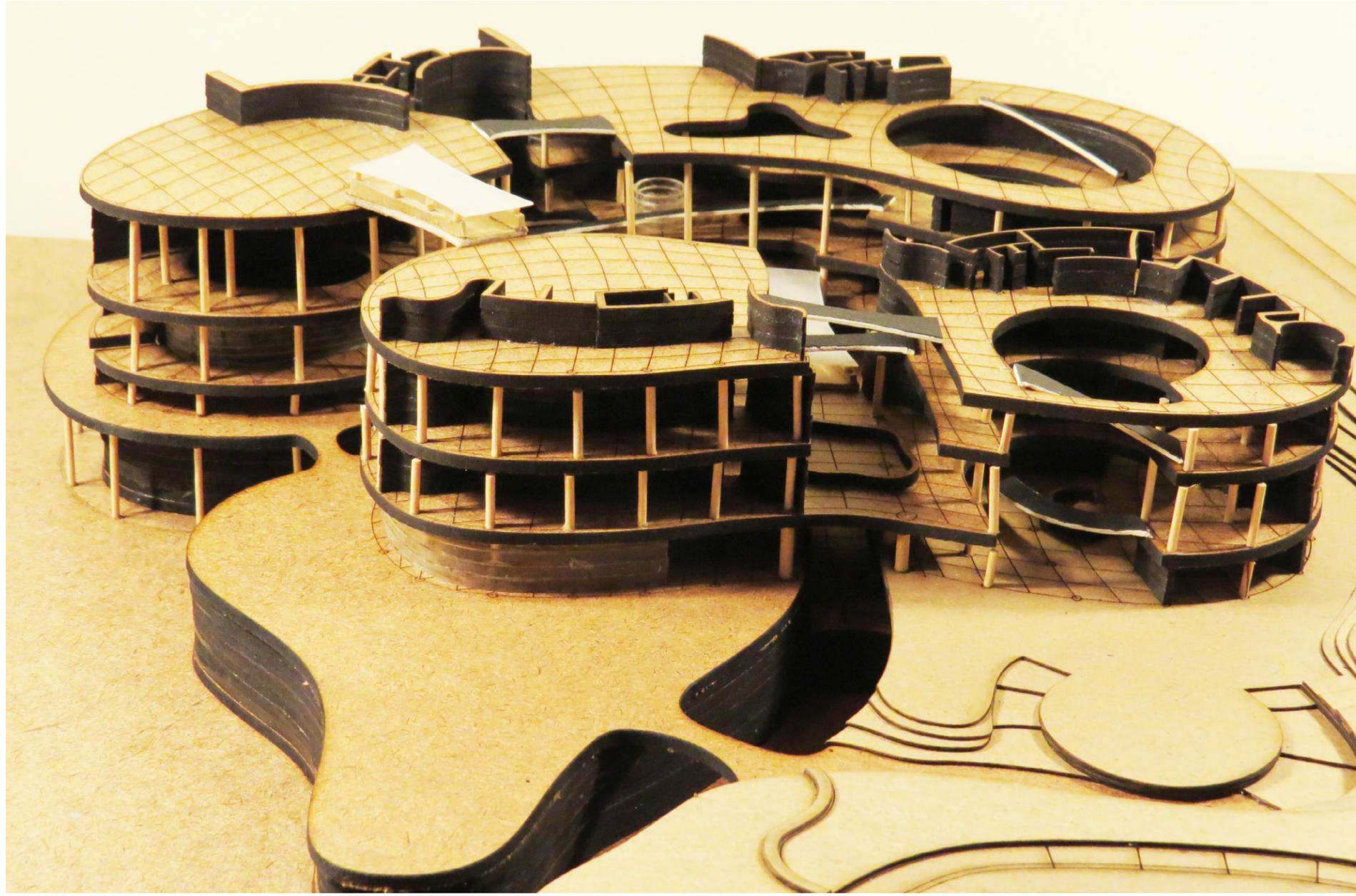
1



2



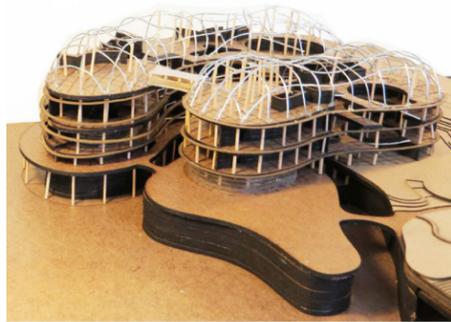
KEY MAP



3

MODELS

THREE PICTURES ON THIS PAGE SHOWS CONSTRUCTION'S STEPS FOR APPLYING THE FACADE TO THE BUILDING'S MODEL. THE FIRST PICTURE IS THE NAKED MODEL WITH STEEL FRAME AND THE COLUMNS. THE SECOND PICTURE SHOWS THE MEMBRANE UNDER THE FACADE SYSTEM: THE ROOF MEMBRANE AND THE ETFE GLASS FRAME. THE LAST PICTURE SHOWS THE FACADE LAYER APPLIED TO THE BUILDING.



ROOF TRUSS APPLIED ON TOP OF THE FIFTH LEVEL WHICH IS SUPPORTED BY THE COLUMNS



ROOF FRAME IS CONSTRUCTED ALONG WITH THE STEEL FRAME STRUCTURE ON THE EXTERIOR. ONE LAYER OF INSULATION IS INSTALLED. THEN ROOF MEMBRANE IS APPLIED ALL OVER



FACADE METAL SHEET SYSTEMS AND THE ETFE GLASS PANELS ARE APPLIED TO APPROPRIATE LOCATION



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IMAGE 1, PAGE 12. ARENA STAGE. [HTTP://WWW.ARCHDAILY.COM/89124/ARENA-STAGE-BING-THOM-ARCHITECTS](http://www.archdaily.com/89124/arena-stage-bing-thom-architects)

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IMAGE 3-4, PAGE 21. ADUBON AQUARIUM. [HTTP://AUDUBONNATUREINSTITUTE.ORG/AQUARIUM](http://audubonnatureinstitute.org/aquarium)

IMAGE 5-6, PAGE 21. BLUE PLANET AQUARIUM. [HTTP://WWW.3XN.COM/#/ARCHITECTURE/BY-YEAR/71-NATIONAL-AQUARIUM-DEN-BLÅ-PLANET](http://www.3xn.com/#/architecture/by-year/71-national-aquarium-den-blå-planet)

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