

AQUA TOURIST CENTER

THESIS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Architecture degree

By

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**DEPARTMENT OF ARCHITECTURE SCHOOL OF
BUILDING AND ENVIRONMENT**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY) Accredited with Grade “A” by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI
- 600 119

JUNE 2021



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DEPARTMENT OF ARCHITECTURE BONAFIDE CERTIFICATE

This is to certify that this Thesis Report is the bonafide work of **B DINESH KUMARAN (3621021)** who carried out the thesis entitled **“AQUA TOURIST CENTER”** under our supervision from January 2021 to June 2021.

Internal Guide

Ar. Kaviya

Internal Review Member

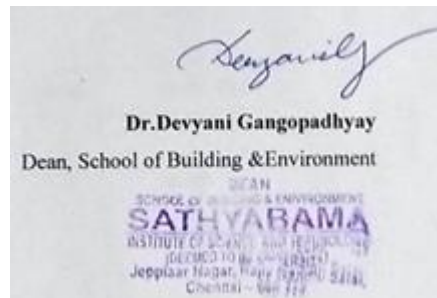
Ar. Deepa

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Dean and head of department

Dr. DEVYANI GANGOPADHYAY



Submitted for Viva voce Examination held on _____

Internal Examiner

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DECLARATION

I, **B DINESH KUMARAN** hereby declare that the Thesis Report entitled “**AQUA TOURIST CENTER**” done by me under the guidance of **Ar.KAVIYA** (Internal Guide) and **Ar. PRADEEP VARMA** (External Guide)

Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Architecture Degree.

DATE:

PLACE: Chennai

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **Sathyabama** for their kind encouragement in doing this Thesis and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. Devyani Gangopadhyay**, Dean and Head of the Department, **Dr.Suresh kuppuswamy**, design chair of School of Building and Environment, Department of Architecture and providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Thesis Internal Guide **Ar. KAVIYA**, Internal review members **Ar. Deepa** and External guide **Ar.** their guidance, suggestions and constant encouragement which paved the way for the successful completion of my thesis works.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Architecture** who were helpful in many ways for the completion of the Thesis .

ABSTRACT

Aquatic center is a educational space which exhibits aquatic species through which it attracting tourist, where it creates an impact on current ocean pollution through built form. Aqua tourist center is a marine based tourist hub which helps in educating people about marine life and experiencing the present nature of mangroves .Pondicherry act as a tourist hub is one of lush location which is known worldwide and millions of people visit there yearly , so creating a Aqua tourist Centre encourages tourism there and improve the amenities and make that place known worldwide.

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1. INTRODUCTION

1.1 AIM

To design a Aquatic tourist hub where it creates a impact on tourist about the marine and plant species around them through this building , and to create a recreational hub to engage tourist and people all around .

1.2 OBJECTIVE

- To create an oceanarium for tourist and to educate people about the mangrove forest through oceanarium
- To create a pleasant staying experience on the bank of a mangrove forest
- To create knowledge about the cultural value of the coastal region and protect depletion of forest due to improper maintenance of tourist

1.3 SCOPE OF THE PROJECT

- The main scope of the design is to create an oceanarium , recreational space and a stay space for the tourist.
- To educate people through this building where they learn about marine species and plants
- To create research place for coastal species and plant where it helps in preserving coastal eco system
- Aqua tourism is the new developing sector in tourism where it is less in India
- To encourage people to benefit the pleasant nature of mangrove through riding deep into it the forest

1.4. SITE JUSTIFICATION

- Site is located next to the mangrove forest of Pondicherry which is a tourist spot where people come here to visit the sea shore and mangrove nearby . Creating a Aqua tourist center helps in increasing tourism and revenue generation for the local and also helps in educate people about marine life and mangrove .
- The site is located in Thengaithittu near Pondicherry where it is a island surrounded by water all around which has a beautiful view of sea shore and a mangrove eco system nearby
- Government of Pondicherry has announced the site zone as special tourism zone for development



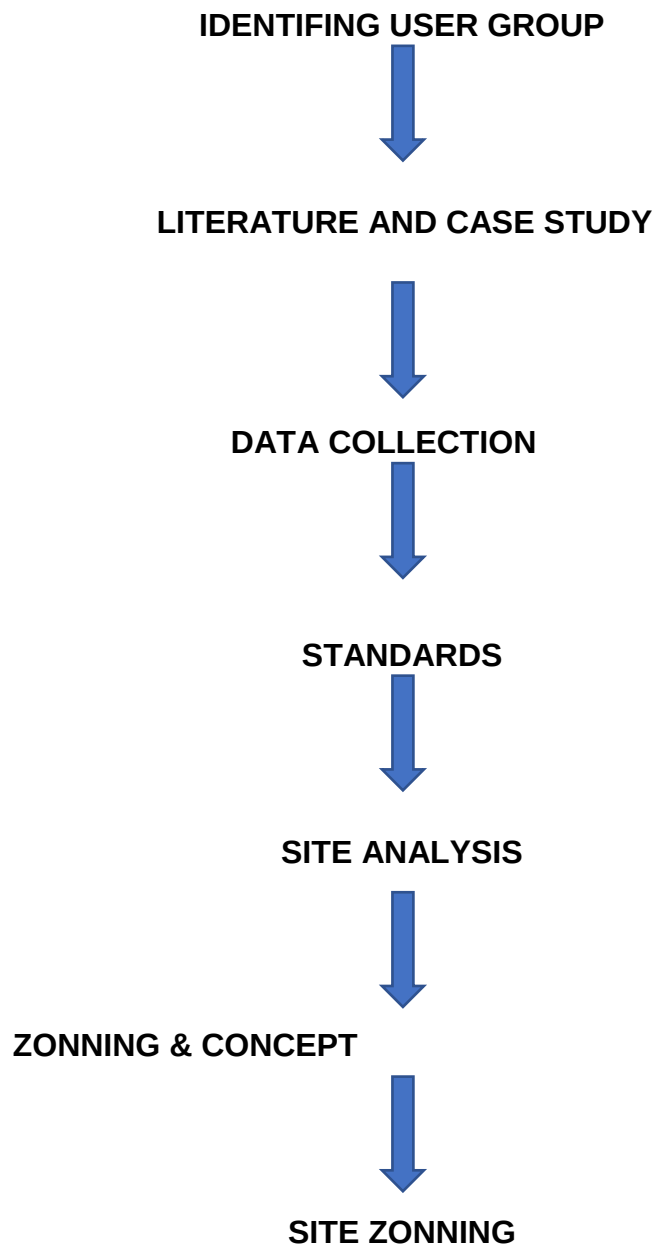
**SPECIAL DEVELOPMENT ZONE
(SDZ)**

A Special Development Zone in an area of 1000 acres is on the anvil and it shall comprise of :

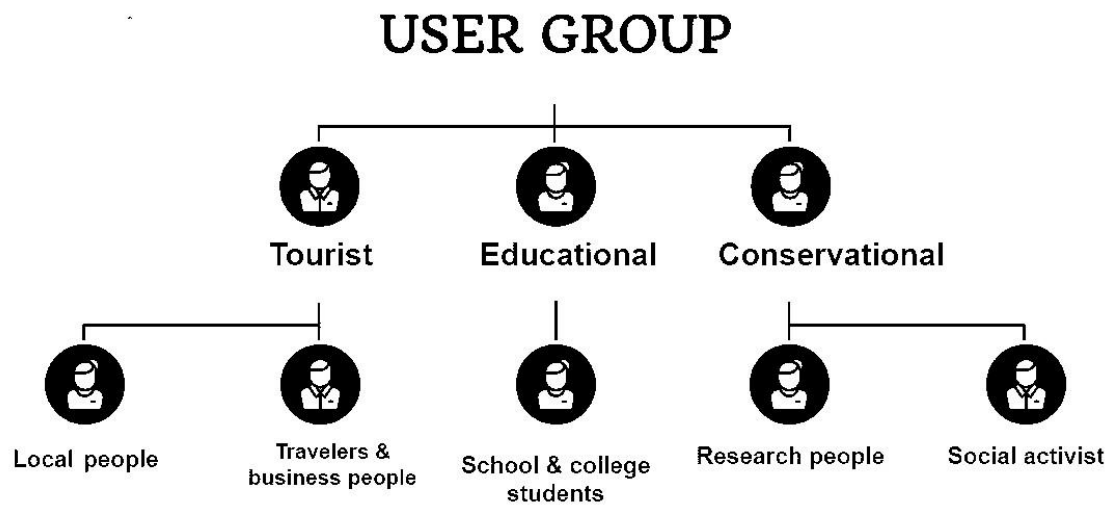
- ❖ All civic infrastructure.
- ❖ All Government offices
- ❖ Special Tourism Zone, Educational Zone, Market Complex, Truck terminal, Urban greenery among others.

Land acquisition is in progress

1.4. METHODOLOGY



2. IDENTIFYING USER GROUP



3. LITERATURE CASE STUDY

3.1 SHANGHAI OCEAN AQUARIUM

3.1.1 INTRODUCTION

- Location - Pudong special Development zone Shanghai, China
- Architect - CAM CROSSLEY
- Company - Crossley Architects Pty Ltd (Australia)
- Site Area - 8,400 sq.m
- Client - Shanghai Ocean Aquarium Co Ltd
- Project value - US 55,000,000
- Construction Commenced - April 1999
- Completed - 2002



This prestigious project was completed in 2002, and is located immediately adjacent Shanghai's most significant tourist attraction the Oriental Pearl Tower in Pudong, Shanghai . The theme , Across Continents through worlds of water captures the essence of the broad scope of exhibits on display in the facility.

3.1.2 AREAS

Site area

- 8,400 sq.m

Building Area - 20,000 sq.m over 5 levels

3.1.3 Major Exhibits

Coastal Reef , Kelp Cave , Shark Cove	- 2,200 cub.m
Coral Reef aquarium	- 700 cub.m
Open ocean	- 330 cub.m
Under the Amazon	- 240 cub.m
Exhibit tank	- 650 cub.m
Australian billabong	- 217 cub.m
Under the cold water stream	- 110 cub.m
Penguin encounter	- 100 cub.m
Chinese alligator - Ancient survivor	- 25 cub.m
Endangered chinese freshwater fishes	- 65 cub.m
Various small marine and freshwater Aquariums	- 19 in total (10-50 cub.m)



3.1.4 About the project

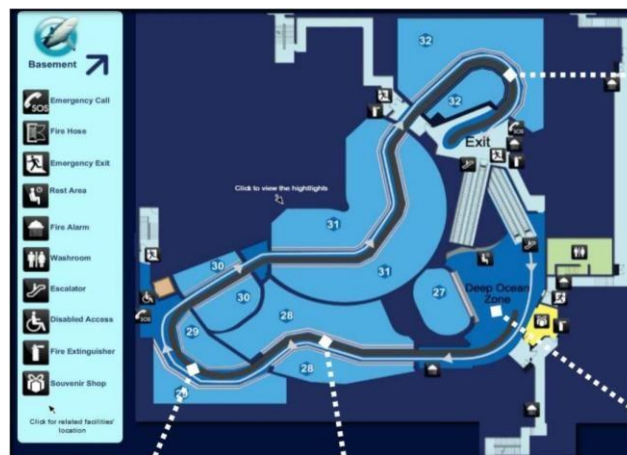
Beginning with the China zone , visitors pass through representative countries of south america ,Australia ,Africa and the temperate zones that show coldwater fish and later ,

penguins . The sea provides the theme for the second phase of the visitors experience where they view some of the more unusual life from colour changing giant cuttlefish and baby sharks to the giant japanese spider crabs and the miniature seahorses of the seaweed forest.

The climax of the visitors experience is the showcase oceanarium consisting of 120 meters of travelator passing through five contrasting marine environments the coastal reef , the open ocean, the kelp cave, shark cove, and the coral reef . This awesome experience is one of the longest aquarium tunnel exhibits in the world.

3.1.5 Ground floor plan

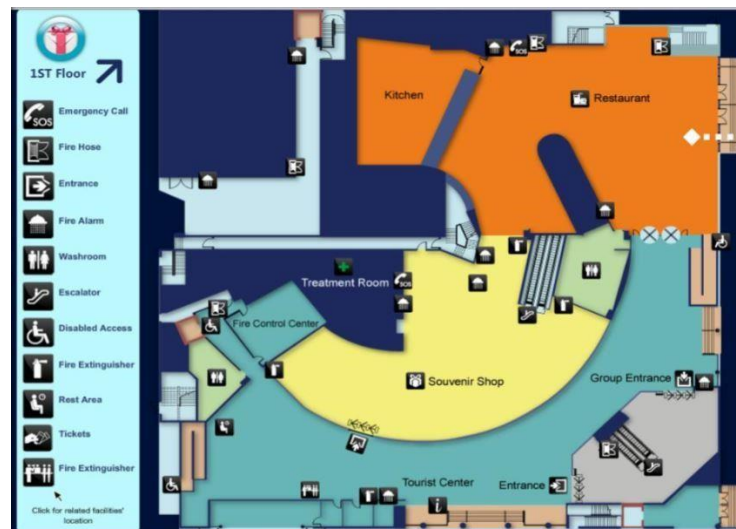
The underwater tunnel located in basement is one of the longest underwater tunnels in the world. Its total length is up to 155 meters. The whole tunnel is made up of Acrylic glass of 75cm, with the thickest aquarium up to 220 cm. According to different groups of fish, the tunnel is divided into 5 sections. An automated walkway is installed on the ground of the tunnel. Walking on it, visitors can feel the fishes swimming above their heads





3.1.6 Recommended Itinerary

- After buying tickets on the first floor, visitors start the tour of the main building by going up to the third floor, ultimately making their way down to the basement.
- The third floor has seven exhibition areas, i.e. the VIP hall, science education room and a waterfall. The China, South America, Australia zones and Special Exhibitions Zone are also located on this floor.
- The second floor has the Africa, Southeast Asia, Cold Water and Polar Zones. The Sea and Shore exhibit is also located here.
- The basement is the main part of the aquarium where Deep Ocean Zone is located. The submarine viewing tunnel enables visitors to a wonderful tour here. After touring the basement, visitors may return to the first floor for meals and to purchase souvenirs and gifts.



- i) **Southeast Asia region** - the southeast Asia tropical rainforests is one of the world's oldest tropical rain forest , high forest coverage , the magnificent natural landscape and rich biodiversity , rich food and an ideal habitat for biological living here ground
- ii) **Polar region** - to listen to the roaring of the wind , penguin friends are waiting to welcome you soon



- iii) **South America regions** - South America has the targets type and quantity of freshwater fish . Arapaima as one of the largest freshwater scale bony fish also thrived here.



3.1.7 SERVICES

Services provided included architectural design and documentation, co-ordination of aquarium specialist work requirements, the interior design of exhibit spaces, exhibit design, design of graphics and interpretive panels, preparation of tender documentation for aquarium specialist works, interiors and special exhibitory. Contract administration of specialist works. ground level constitutes the overall service area of the shanghai ocean aquarium along with the extra supporting area on each floor.

3.1.8 WATER SUPPLY

To limit the consumption of water, the 8 million gallons (30 283 KL) of tanks in the aquarium use a semi-closed system with manufactured seawater which allows as much water as possible to be reused. Water is replaced from local sources only when required due to evaporation.

i) Aquatic Life Support:

- 6.2 million (23 470 KL) gallons to fill open ocean tank;
- 54 in. (1.4 m) diameter piping,
- 218 pumps (4,160 hp (3102 kW] to circulate 261,000 gpm (16 469 L/s));
- 4,035 valves;
- 25 miles of wiring:
- 31 pump water motion system circulating 29,500 gpm (1861 L/s);
- 24 in thick acrylic viewing wall weighing 238,000 lbs (107955 kg); and
- 34 saltwater and 11 freshwater tanks holding 8 million gallons (30 283 kl) for 100,000 fish.

ii) **Acrylic Panel**

Dimensions

Coastal Reef, Kelp Cave, Shark Cove 180° tunnel - 66.0 x 2.4sq.m

Coral Reef Aquarium -180° tunnel - 23.0 x 2.4sq.m

Open Ocean – Flat panel - 8.0 x 4.65 x 0.27m

Under the Amazon – 180° tunnel - 12.0 x 2.4sq.m

Australian Billabong Inclined 180° tunnel - 12.0 x 2.4sq.m

Flat Panel - 9.0 x 1.6 x 0.08m

Under the cold water Stream – 90° tunnel - 9.6 x 0.75mR

Penguin Encounter – Flat Panel - 10 x 2.9 x 0.12m

Chinese Alligator – Ancient Survivor

Cantilevered panels - 5.0 x 1.83 x 0.07m

Endangered Chinese Freshwater Fishes - 4.2 x 2.0 x 0.09m

Flat Panels - 3.0 x 1.4 x 0.07m

Water is been distributed to the overhead hanging PVC pipes needing at least a free space of 1m above clear height, it has a closed filtration system.

Instead of direct sunlight fluorescent tubes and large neon lamps are been used all time in accordance to duranal and nocturnal usage.

The plant is been setup in the basement adjacent to the main building and duct are exposed to the surrounding as an interior treatment the supporting area is kept with special provision for both heating and cooling

The walls from the inner side have high acoustic - Treatment so that the sound of water flowing through And the working staff doesn't travel outside at the galleries arena

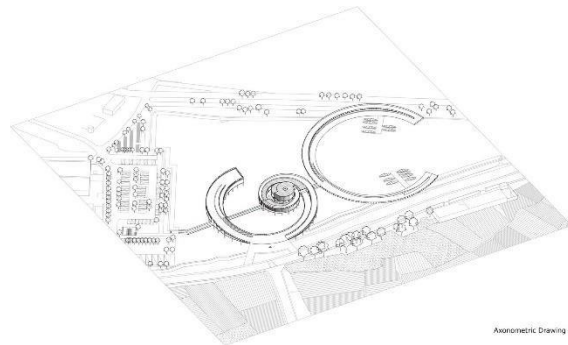
3.1.9 CONCLUSION

The basic challenge for designing the aquarium was dealing with the extremely technical nature of the designs while meeting the client requirement for a creative theme. The team continually balanced creativity with practicality. The result is a worldclass aquarium with a safe and comfortable environment for animals and humans.

3.2 DUSHAN LEISURE CENTER

3.2.1 INTRODUCTION

- Location - Lishui, China
- Architect - Tiantian Xu
- Company - Zhang xin studio
- Site Area - 1,647 sq.m ○
- Completed - 2018



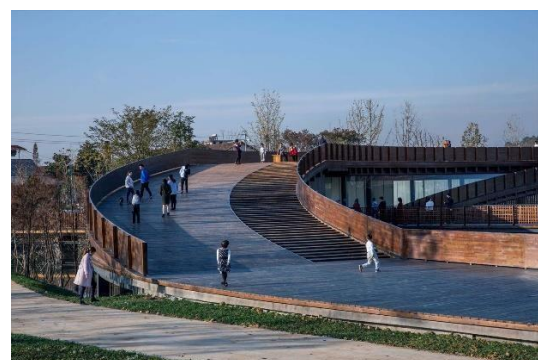
The new leisure center is located at the triangular wetland at the foot of Dushan Mountain adjacent to the Songyin River, the mother river of Songyang County. It is also one of the key tourism projects of the Songyin River Scenic District Development, including a visitor center, water sports facilities, and a gym for water sports athletes



They took this project as the first meeting point of local residents and tourists in the county by considering the entire triangular harbor as a water park shared by both tourists and local communities. The architectural programs are organized through a spiral with the visitor facilities at the center and a gym at the far end, connected by an east-west walkway as a shortcut.

A “C” shape dike connects to the Songyin River will also become the passage for pedestrians, bicycles and tourism electric shuttles. The overall configuration provides an undulating walkway for above the harbor, with constantly changing views of the Mountain & Water.

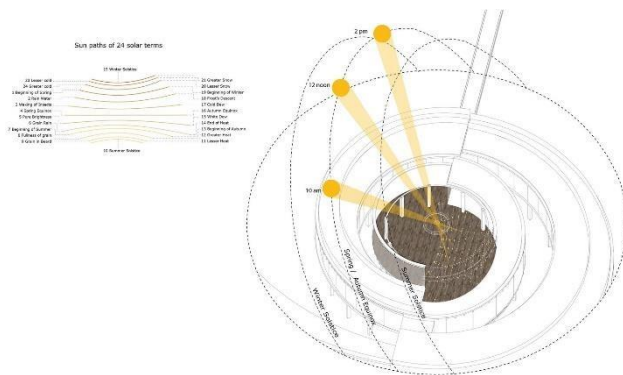
The project adopts timber structure as natural material, low-carbon construction, and traditional special quality. Glass curtain walls with different gradient of translucency bring subtle shift on building facades as misty surfaces on the water. Layers of indoor and outdoor space create interplay of views, like the traditional Chinese landscape garden.



The meditation room on second floor is also a multi-function room. The opening on the roof casts the trace of sun on the floor with bronze plates of different hours in the Chinese 24 solar terms, creating a dialogue with the nature and time



The openings at curve structure allows the light to create patterns at the interior of the building where the light evenly spreads through the structure



3.2.2 INTERIOR



DAY



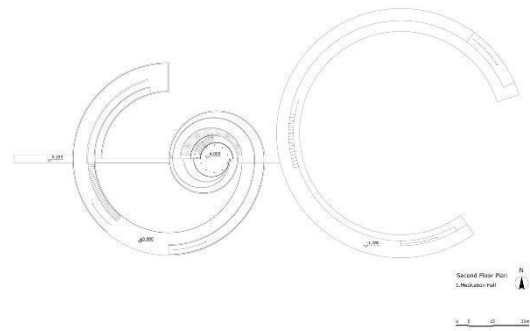
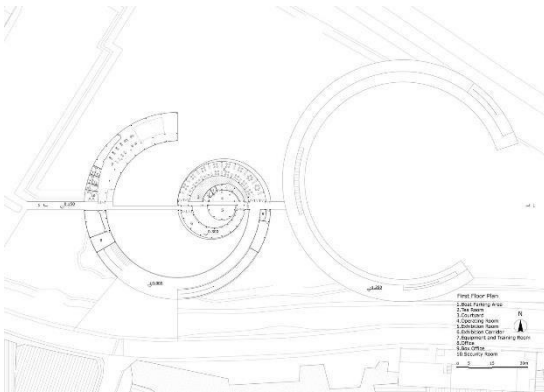
NIGHT

Connecting bridge

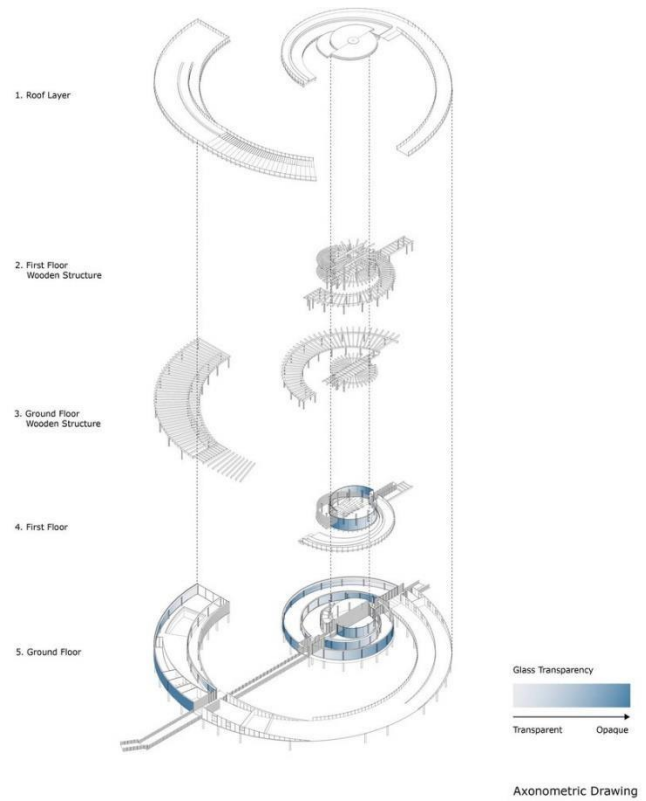
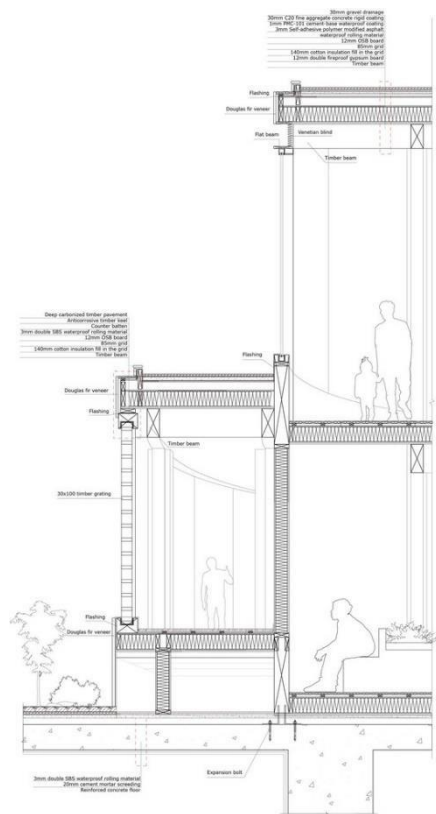
Both the circular structure is connected with a bridge at the first floor which has water bodies at both the side of the pathway . which leads to the boating space .



3.2.3 FLOOR PLAN



3.2.4 SECTION



3.3.1 INTRODUCTION

Location - Kastrup , Denmark

Architect - 3XN

Company - Flowcrete

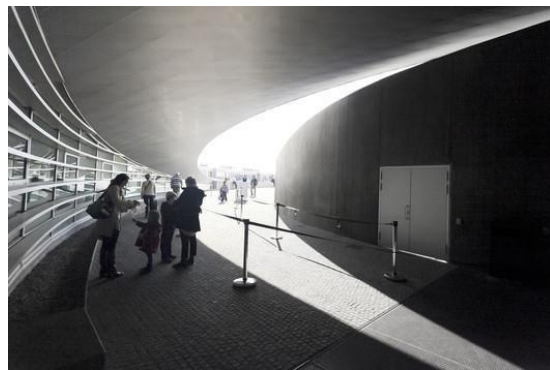
Site Area - 10,000 Sq.m

Consulting engineer - Moe &
Brodsgaard

Completed - 2013



The Blue Planet is Europe's largest and most significant aquarium with an outstanding location on the shores of Oresund, only eight kilometres from the Copenhagen City Hall Square. Moreover, the aquarium in Tårnby Municipality is ideally located with motorways, Copenhagen Airport, the Oresund Bridge, Metro and international trains within few hundred meters.



The Blue Planet will be one of Denmark's five most prominent tourist attractions. At the tourism conference "A New Way to Grow" 2012, the Blue Planet was chosen as Denmark's best lighthouse project within experience economy, because of its potential for growth, influence on regional development, innovation, realization as well as its uniqueness and 'reason to go'.

Denmark's Aquarium was founded by civil engineer and contractor Knud Højgaard. It opened for the public in 1939 just four months before the break out of World War II and

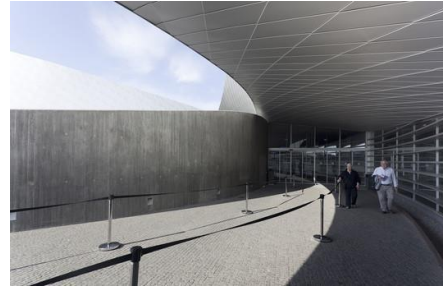
seven months before the occupation of Denmark. The consequence was closed borders and considerable problems in getting hold of exotic animals to the aquarium. However, through an impressive effort with Danish and home reared fish the aquarium was kept open and active. After the war, the aquarium was in a bad shape, and Knud Hojgaard initiated extensive renovations. During the next decades the building went through several modernizations and enlargements.

For more than 73 years the original building in Charlottenlund was the setting for enjoyment and education for all ages. For the last years, however, the establishment was run down and a continuous demand for expansions and high end technologies was the order of the day.



3.3.2 Design Process

Already in the mid-90s, Jesper Horsted, curator of Denmark's Aquarium, outlined the first ideas on how a totally new and modern aquarium should be designed. The old building needed a total renovation which would be costly without even providing guests with a significant better experience. A much needed enlargement was neither possible at the site nor economically feasible with regard to the overall improvement of the attraction of the aquarium.



3.3.3 Need Of This Project

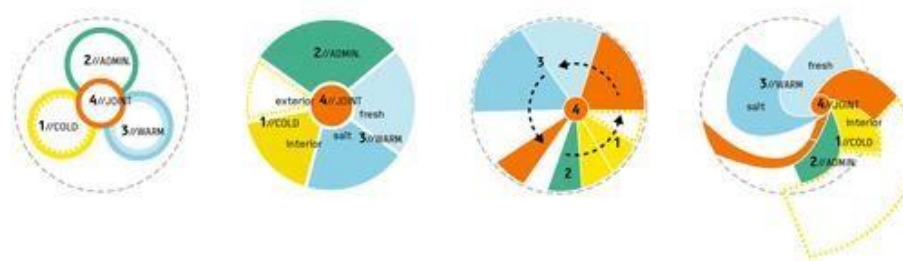
Needed requirement was a new location and new framings to give coming generations of visitors new and outstanding adventures. Inspired by visits to the world's most exciting aquariums and spiced up with ideas of his own, Jesper Horsted formulated his wishes for the design of a totally new Danish Aquarium. Principles which were later to become the fundament for the international competition of The Blue Planet.



Now, Denmark's Aquarium is again at the international forefront with world class architecture, thousands of animals from all over the world and advanced presentation technologies.

3.3.4 Process

The Round Room is a centre of navigation in the aquarium, and this is where visitors choose which river, lake or ocean to explore. Each exhibition has its own face towards the Round Room, each with its own entrance, starting with a buffer zone – a platform where sound and images are used to introduce the atmosphere communicated in the ensuing exhibition room.

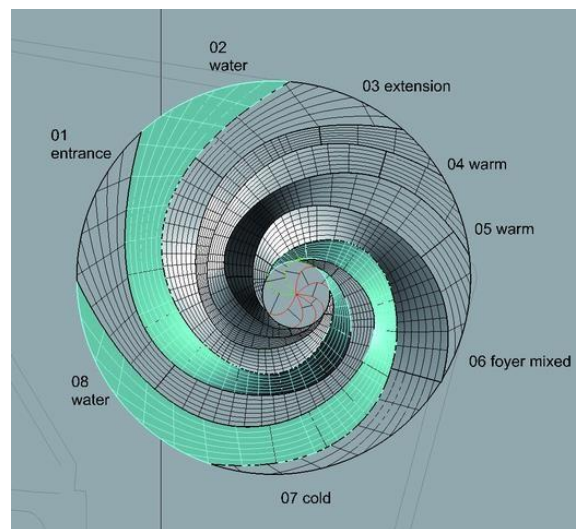


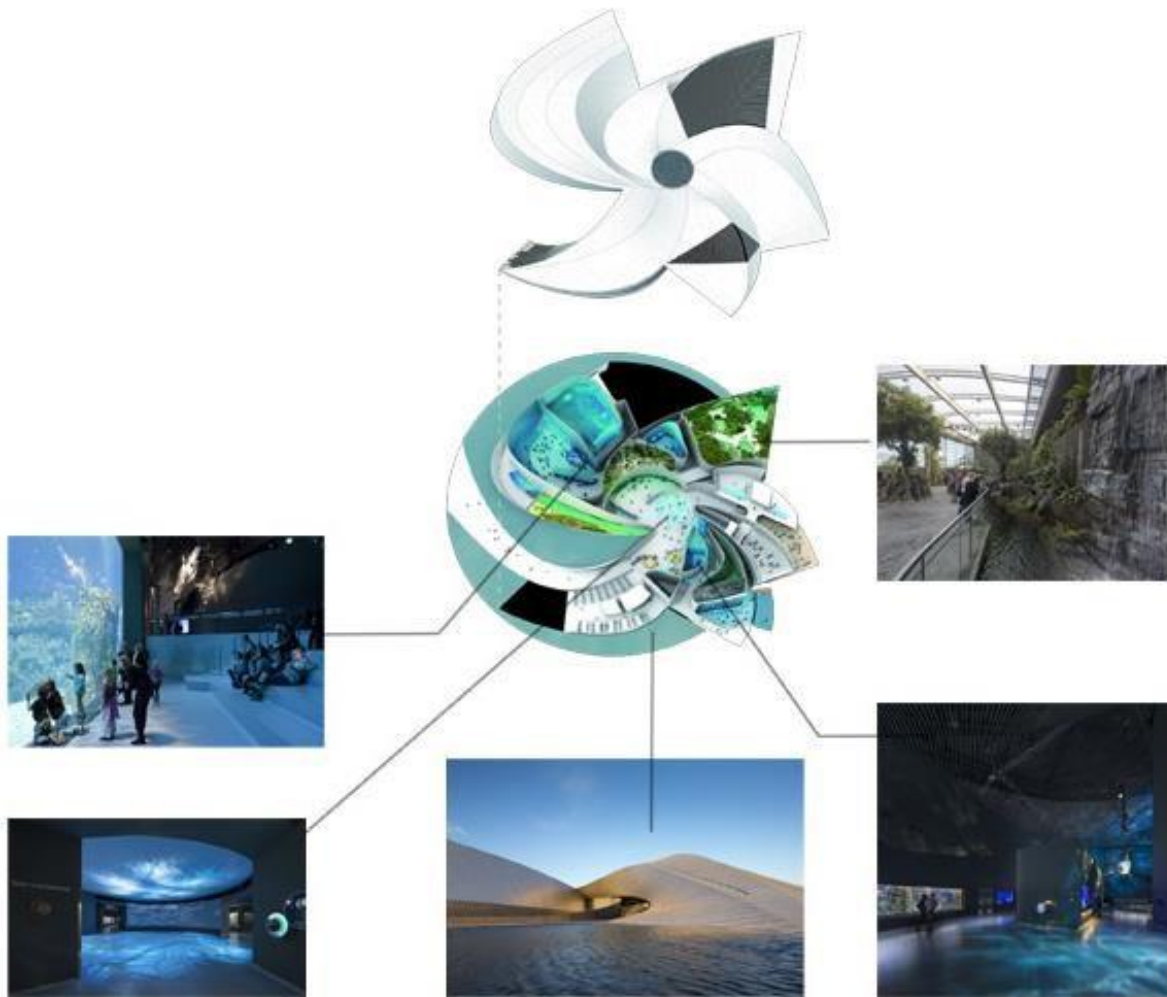
3.3.5 Elevation

Raised a few metres above the terrain, The Blue Planet is a reflection of strong coherence; greatness in the smallest of things, all water in the world being inextricably linked, from the enormous forces of tsunamis to the infinitely tiny, spinning molecules. Overlooking the oresund, the building connects land and sea, drawing both the great outdoors and visitors inside.



Zoning





3.4 ANTALYA AQUARIUM

3.4.1 INTRODUCTION

Location - Antalya, Turkey

Architect - Bahadır kul Architects

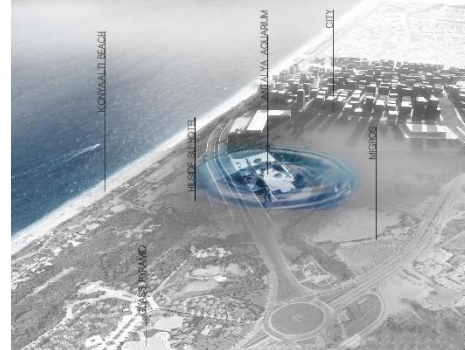
Company - Loytec

Site Area - 12,000 sq.m

Completed - 2012



The main design decisions of Antalya Aquarium project are determined with desire of vanishing in silhouette and creating harmony with topography. Pulling back of the ground floor, a shaded public area is created to beware from sun and profit from wind.



The ramp in this public area, reaches the public exhibition site with the entrance of aquarium and snow world. The travel path starts with aquarium information and sea fish. The path continues with cave fish, world rivers, jellyfish, Turkey fish, predatory fish, sharks, the main 5 million liters tank and finals with 131 m tunnel. The each stop in this path is designed with its own character.



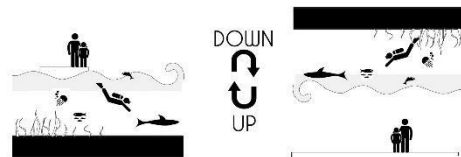
This shaded public area is the point of approach, gather and diffusion of the aquarium project. Also the shell of this area determines the information and fast-food areas, amphitheater and box office with its curves and waves.

This design mainly has focus on the aquarium at the center and frontage has the recreational spaces like cafe , halls . and the topography of the site leads to a open seating space at the other end which has a nice view of Konyaalti beach.

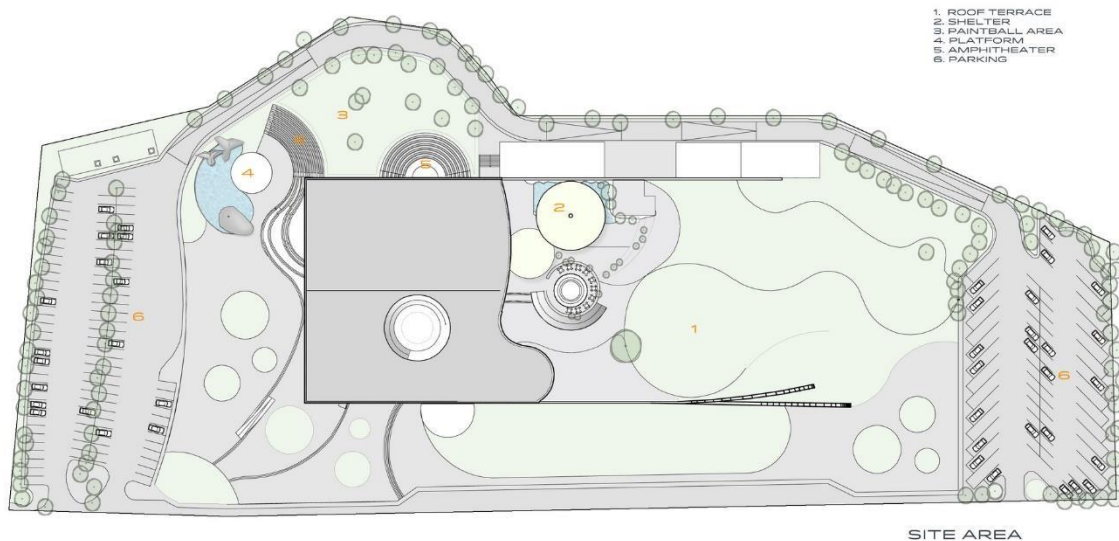


3.4.2 Concept

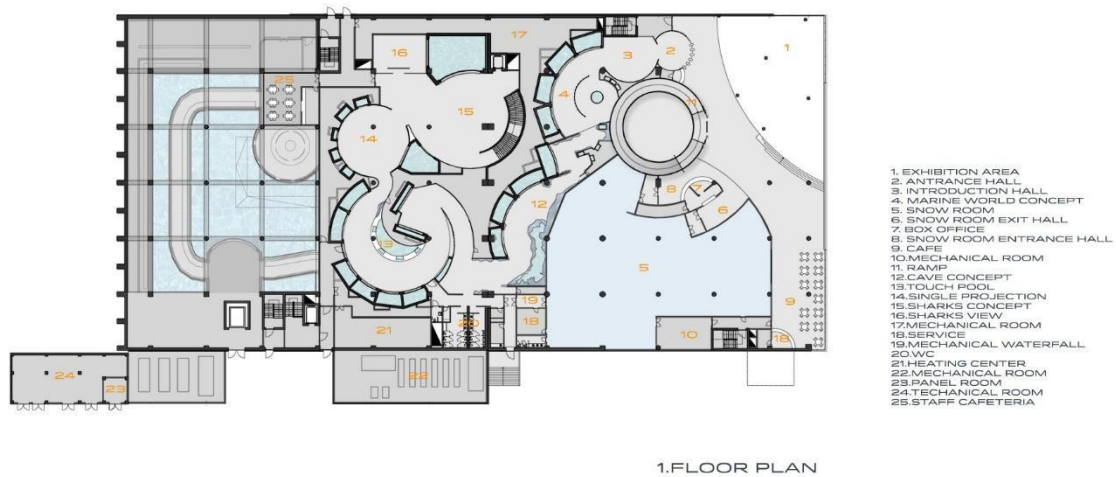
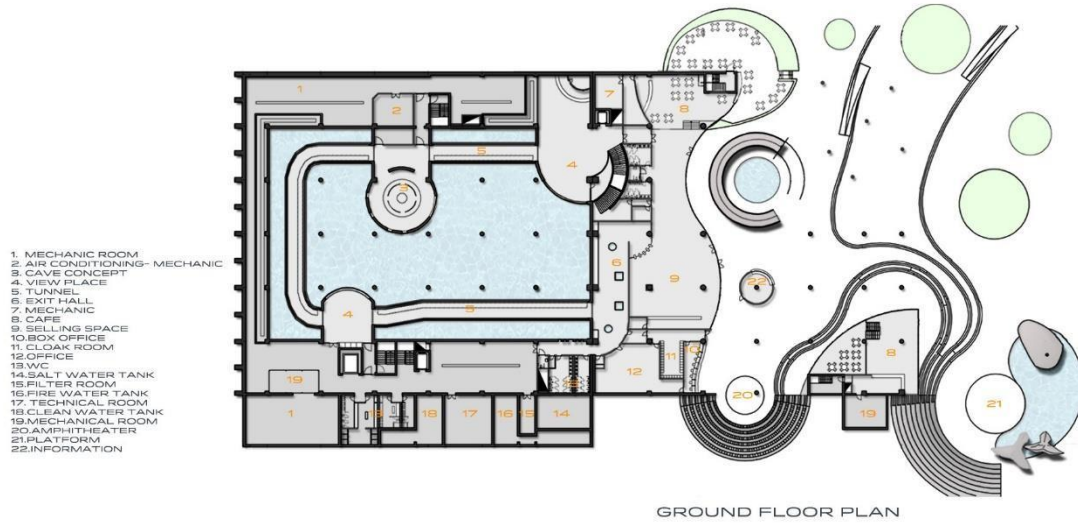
Concept of this aquarium is a up and down view which is created by levels of floor where the visitors are able to vist the deep ocean from the ground floor and from the first floor they can view the fishes at the ground level from the top



3.4.4 Site plan



3.4.5 Floor plan



3.4.6 Interior spaces

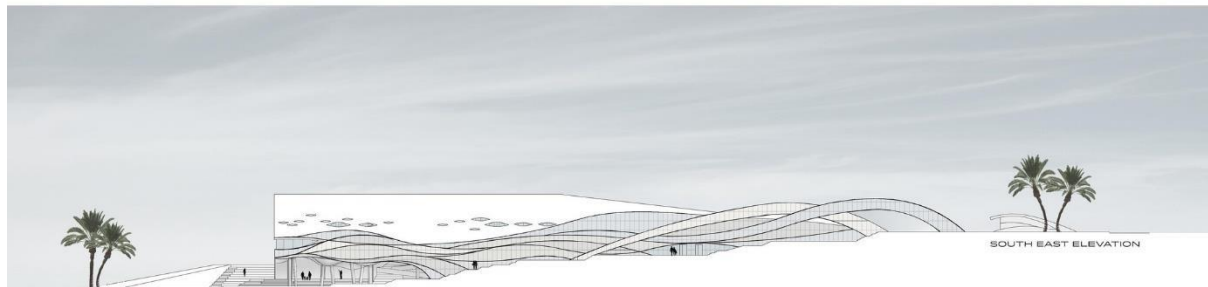


SHARK CONCEPT

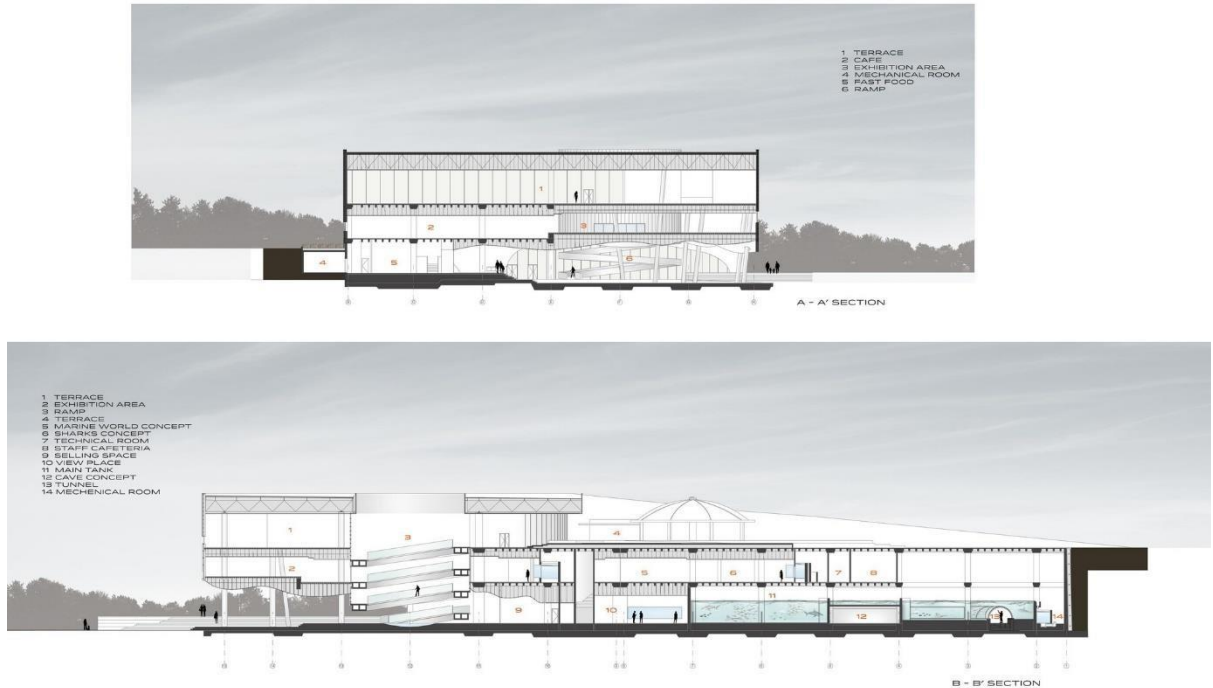
SINGLE PROJECTION

BOX OFFICE

3.4.7 Elevations



3.4.8 Section



3.5 TARAPOREWALA AQUARIUM

3.5.1 INTRODUCTION

Location - Marine drive ,
Mumbai

Architect - Sachin Sata
Architects

Owner - City of Mumbai

Site Area - 2,437 sq.m

Completed - 2015



3.5.2 AIM

Aquarium's mission is to be India's world-class recreational & educational center.

3.5.3 SITE CONNECTIVITY

The site is located along Marine Drive near Charni Road railway station.

3.5.4 WATER BODIES NEAR THE SITE

The site selected to construct the aquarium at the queen's necklace—Marine Drive could not have been more appropriate, as the Mumbai of yesterday was a fishing village and the site has a sea-face.

3.5.5 TOPOGRAPHY

The aquarium is built on flat terrain without any contours.

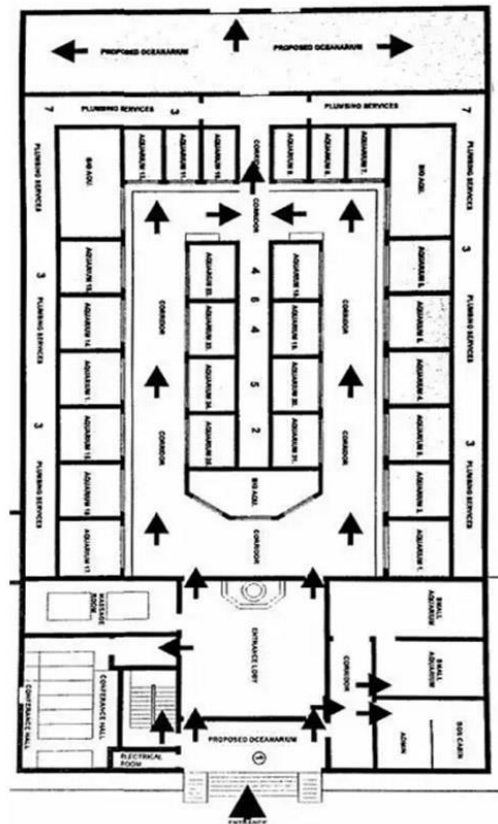
3.5.6 CLIMATIC CONDITIONS

The climate of Mumbai is a tropical wet and dry climate described as moderately hot with a high level of humidity. Its coastal nature and tropical location ensure temperatures won't fluctuate much throughout the year.

The mean average is 27.2°C and the average precipitation is 242.2 in (95.35 inches).

The mean maximum average temperatures in about 32°C (90°F) in summer and 30°C (86°F) in winter, while the average minimums are 25°C (77°F) in summer and 20.5°C (68.9°F)

In the aquarium's 16 seawater tanks and nine freshwater tanks, there are 31 types of fish, while 32 tropical tanks contain 54 kinds of fishes. The tropical section of the aquarium already features different ecosystems such as the “moss aquarium” for pregnant fishes, the “plantation aquarium” that features imported varieties of water lilies and other aquatic plants, and the “island aquarium”.



3.5.7 Main Section

There are 16 tanks for marine/ salt-water specimens along the periphery which the 3 tanks in center of the hall display freshwater specimens. In all, there are 66 tanks with glass frontage 1.1/4 inches thick. The capacity of each tank ranges from 10005000gallons. The tank interior is decorated so as to give an effect on the natural environment.

The tank seems to be literally framed and looks like pictures framed in mosaic partitions. The exterior surface is claded with marble tiles with timber railing preventing visitors from coming too close to the tanks. Display boards on top of each tank give information above the contents of the tank.

Ventilation of hall is by exhaust fans and there is consideration darkness in the hall so as to highlight the lighted tank inter-view.

To the right of the hall (south side) are:

1. Curators office
2. Conditioning-room
3. Staffroom
4. Service corridor or a small chemical lab.

All specimens either for display or for study are kept in the conditioning tank for observation before introduction into main aquarium tanks. This tank/s is also called a quarantine tank wherein specimens are tested on.

i) First Floor

It has been set aside for research administration purposes. The north end has the marine biological lab. South end has the office of the director of fisheries and his staff.

There are 2 labs with a dozen research workers and up-to-date facilities like arrangement for supply of running sea and freshwater, ducts to ensure proper aeration, gas, paraffin baths, and optical instruments, and special tanks where specimens can be studied under controlled conditions.

ii) Second Floor

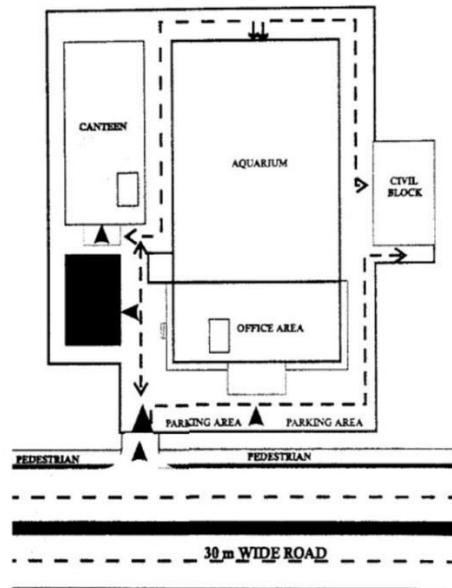
The library and offices have occupied it.

3.5.8 GEOMETRY & STRUCTURE OF THE BUILDING

i) Foundations

The foundations of the aquarium rest on reinforced concrete piles, mainly of which have been driven to 30ft. deep so that the building may be claimed to be earthquake-proof.

The building is three-storied and 200(61ft) away from the sea wall. It is rectangular in form with its long axis running from west to east.



ii) CIRCULATION

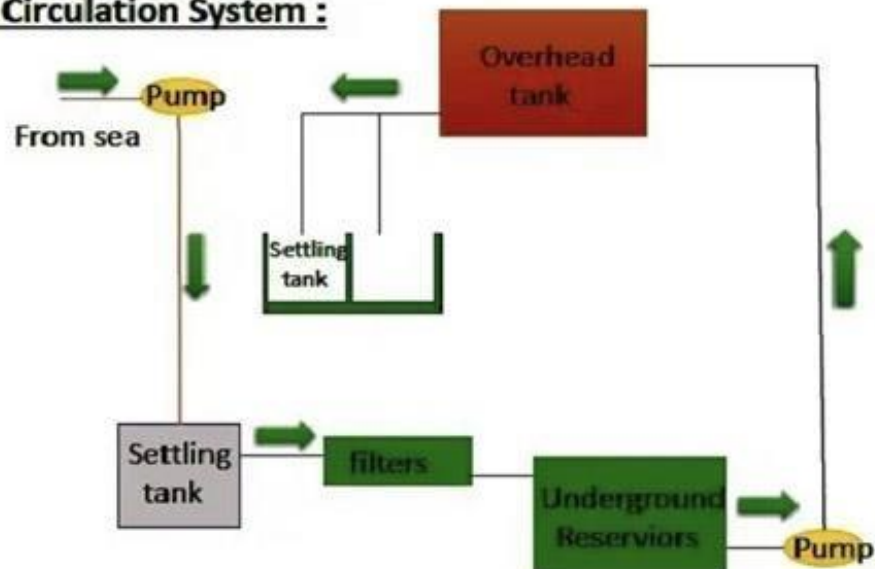
- The three-storied building has an aquarium and related offices on the ground floor. The first floor has an Administration and research department. The second floor is occupied entirely by the library.
- public circulation path for the aquarium is inverted u- form with an entry on the right side and exit on the left side.
- Service passage lines peripherally around the display tanks and remains visually and functionally independent.

3.5.9 SERVICES

i) WATER CIRCULATORY SYSTEM

The circulatory system adopted for changing the water in the display tanks is a closed system. The same water is used over and over again for a period of 1 month. After which new supply is taken. This helps to maintain the ph and chlorine level in the water and is also less tedious.

Water Circulation System :



ii) AREA STUDY

Area of Plot	4136.55 sqm
Area occupied by Garde	620.48 sq.m
Total Area.	2895.60 sq.m
F.S.I. permissible	1.33
Area permissible for construction	3860.74 sq.m

The existing structures are inclusive of aquarium and non-aquarium activities

Nonaquarium activities

Annex Bldg (Inclusive of rddf by adf by statistics dept.)	992.60sq.m
Canteen inclusive of Accounts Dept	380sq.m
Garage.	43.00sq.m
Total Area of Annexes Building	1415.60sq.m

Aquarium Activities

Taraporewala Aquarium	2055.30sq.m
Filter Tank	34.89 sq.m
Fish Food Shed	9.84sq.m
Pump Shed	12.92 sq.m
Salt Water Settling Tank	158.67 sq.m
Total Area of Aquarium Activities	2271.62 sq.m
Area available for future expansion	165.62 sq.m

4. DATA COLLECTION

4.1 FRESHWATER AQUARIUM VS SALTWATER AQUARIUM

When choosing between a freshwater setup and a saltwater setup it is important to realize the difference in the level of difficulty and level of a core required. As stated earlier, freshwater fish are harder in general because of their adaptive nature. They are capable of being in a wider range of water parameters as well. On the other hand, saltwater fish are generally more demanding of specific water parameters and required habitat. While the market value of fish can vary depending on the season and distance from the coastal lines marine fish are much more expensive compared to most freshwater species.

4.2 FRESHWATER SETUPS

Just like saltwater fish, there are many colorful and attractive freshwater fish including cardinal tetras, fancy guppies, killifish, bettas, and cichlids, just to name a few. Even within the scope of freshwater aquariums, there is a great variety of tank setups available. Freshwater tropical community tanks are one of the most popular aquarium setups for both novice and advanced fish keepers. While it is relatively inexpensive to set up and maintain one can also appreciate a great variety of fish in a single aquarium

For community tanks, however, it is important to understand the requirements of each species in the community in order to ensure compatibility. Since different species have different swimming patterns, combining top-level swimmers, middle-level swimmers and bottom dwellers can be an attractive effect in a community

tank. Basic components in freshwater aquarium setup include filtration, lighting, and heating. For freshwater aquariums without a heating mechanism, coldwater fish are most suitable. Coldwater fish includes goldfish and white cloud mountain minnows, among many other small river species

4.3 SALTWATER SETUPS

There is a great abundance of colorful marine fish with striking patterns and body formations. One type of marine tank setup is fish only with live rock(FOWLR) saltwater aquariums. Live rocks, which are pieces of mature coral reefs, allows colonization of various marine life such as invertebrates and sponges. Since live rocks house an abundance of beneficial bacteria. It aids infiltration and maintaining desirable water parameters. The most challenging type of aquarium, more so than FOWLR, aquariums, is the reef aquarium. In reef aquariums, the primary focus is placed on the corals. invertebrates and anemones. While fish can be present in a reef aquarium, they are considered an accessory of the entire setup. Reef aquariums require specific water parameters, lighting conditions, and water flow that must be maintained on a very regular basis.

4.4 AQUATIC NEEDS

Common information about fishes

- Avoid mercury thermometer cause it might break and poison the tank.
- During winters heaters and during summers coolers shall be used
- Water circulation must be sufficient to diffuse heat evenly. This circulation must be maintained either by creation by an adequate number of fishes active enough to ensure this.

4.5 LIGHTING

- Lighting is very important for an aquarium and is always neglected to have the appropriate light that simulates natural daylight in the tank.
- Fluorescent lights the best light in the tank they don't let the fish go awol, they are also very easy to install and make feeding and cleaning of the tank very easy. Avoid incandescent lights as they give too much heat which could stress the fish as well as evaporates more water from the tank.

4.6 WATER SUPPLY SYSTEM

There are 3 types of water supply system

- 1) Open water system
- 2) Semi-closed water system
- 3) Closed water system

4.6.1 OPEN WATER SYSTEM

In open systems, the water flows through the aquarium once and is discarded. This provides water equality comparable to that of the The natural environment and there is no build up of toxic metabolic wastes; however, the temperature control and pumping are usually costly and filtration often is necessary. Hence an open system is not preferred.

4.6.2 SEMI-CLOSED WATER SYSTEM

Semi-closed are the same as closed systems except that there is a constant connection to the water supply and the problem of dissolved wastes is controlled by the regular addition of new water. this system is more economical than the open type in terms of temperature control and pumping.

4.6.3 CLOSED WATER SYSTEM

Water is continuously re-circulated in closed systems and is only renewed periodically. Metabolic wastes must be treated since they are not continuously flushed from the system. An important problem is that ammonia must be rapidly removed or transformed because

it is harmful even at very low concentrations. In the aquarium the bacteria that convert ammonia to nitrite reside primarily in the filter material and slow and filter with a large surface area is usually provided to ensure their abundance.

Plant growth in the aquarium, especially in marine systems is not usually sufficient to utilize the entire nitrate produced by bacteria from nitrite. Although some aquariums have operated for many years with a minimum of water renewal, it is normally necessary to replace from 1 to 10% of the water per month to maintain a low level of nitrates.

The use of charcoal in both freshwater and seawater systems helps to slow down the accumulation of nitrogenous wastes. Metabolic wastes also cause an increase in the acidity of water. Carbonate compounds are commonly used to maintain an optimal level of acidity particularly when water renewal is frequent.

4.7 SALINITY

The salinity level is the amount of saltwater present in water is the first thing that one should consider while setting up a tank. Unfortunately, people tend to forget the importance of salinity once they have their tanks under control. It is straightforward to use a hydrometer. There is a scale attached to each hydrometer. The reading should be in the range of **1.021 to 1.023 at 75f.** since salinity varies with temperature it is quite common for hydrometers to have a thermometer included.

Salinity refers to the amount of dissolved salt per kilogram in water and it has the unit of ppt, for example, 30 ppt means 30g of salts in 1kg of water. Te natural seawater has an **average salinity of 35 ppt.**

There are many reasons for the unwanted algae that grow in a tank. One of them is a low salinity level in the tank. However, the reason for keeping a stable salinity is related to the saltwater fishes osmoregulation. There is usually a difference between the salinity in an aquarium and then in the fish cells. The surrounding water will immediately start flowing into the cells. Meanwhile, the fish tries to release its excess salt into the ambient water in order to stabilize the flow. This is called osmoregulatory behavior.

Osmoregulatory behavior refers to the constant adjustments that the fish must undertake in order to maintain a balance between two different salinity levels.

4.8 FILTRATION AND LIFE SUPPORT

In nature tidal fluctuations, current, incorporation by plant and algae life, and many other processes help in the removal of animal wastes. A sustainable life support technology must rely upon the principles of water mechanical.

4.8.1 Biological filtration

It is the conversion of nitrogenous wastes such as ammonia(NH_3) or nitrate(NO_2) into less harmful nitrates or nitrogen gas. this is accomplished through the action of the bacteria living on suitable substrates such as gravel beds or plastic structures called "bio-media".

4.8.2 Mechanical filtration

It is the removal of the dissolved suspended particles from the water by some type of filter or medium such as sand or floss, rapid sand.

The filter is an example of mechanical filtration as it uses a layer of sand and fine coal to stop particles.

4.8.3 Chemical filtration

Is the removal of the dissolved organic compounds. Dissolved organic materials can cause the water to have a yellowish appearance. This is remedied by using also activated carbon filter, a foam fractional, or ozone. Many harmful compounds and medications can be removed through chemical filtration,

When it comes to creating a healthy environment for marine fish, mammals, and invertebrates biological filtration is by far the most critical consideration. While chemicals and mechanical filtration play important roles they are primarily supplements to and supportive of the biological process.

The best designs should not only result in the crystal clear water that every visitor and curator wants to see but also the stable and sustainable water quality that closely parallels a natural aquatic environment. Indicators of a stable environment can be identified by, but are not limited to, common water quality criteria, including water temperature

dissolved oxygen, pH, and dissolved organic carbon(DOC). While these are common water quality indicators, the life support engineer knows how the design approach will change when creating a system that must sustain animals as diverse as a delicate jellyfish and a 1,500pound manatee.

Regardless of the size or species of animal, biological respiration within their aquatic habitat requires that emphasis placed upon the biological filtration design. The reason from what occurs at the macroscopic and microscopic level in a mechanical sand filter and on all substrates in a marine aquarium.

The science and biochemistry of this process are extremely complex, but there are two microbiological activities that are essential for good aquarium water quality managing them dictates the proper cultivation and management of heterotrophic and autotrophic bacteria.

Autotrophic organisms are important for the biological oxidation of harmful ammonia and nitrites in an aquarium exhibit. Because the output of these substances by the animals in an aquatic exhibit is fairly constant, stable autotrophic populations within mechanical sand filters and biological filters process these substances easily.

Heterotrophic bacteria are responsible for a significant portion of the processing of DOC and suspended organic carbon (SOC) from animal waste and food. Carbon will accumulate to harmful levels if a life support design is not effective. Therefore, the uptake and control of carbon are critical in managing the biological oxygen demand.

5. STANDARDS

5.1 Category II (CRZ -II):

The area that have already been developed up to or the shoreline. For this purpose, '**Developed Area**' is referred to as that area within the municipal limits or in other legally designated urban areas which is already substantially built up and which has been provided with drainage and approach roads and other infrastructural facilities, such as water supply and sewerage mains.

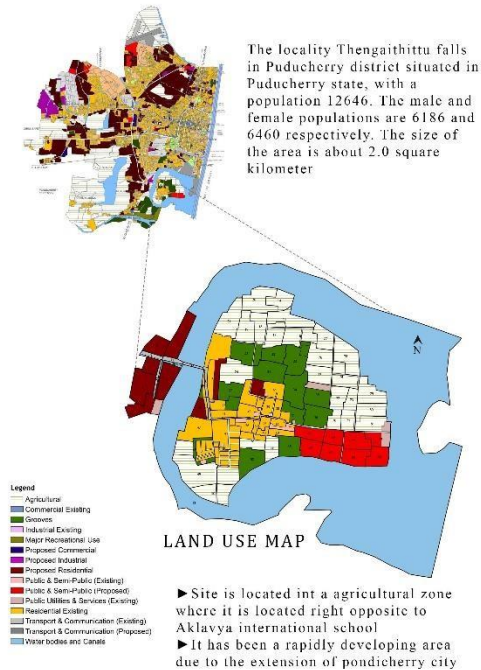
5.2 Regulations:

- a) Buildings shall be permitted neither on the seaward side of the existing road(or roads proposed in the approved Coastal Zone Plane of the area) nor on the seaward side of the existing and proposed road. Existing authorized structures shall be subject to the existing local Town and Country Planning regulations including the existing norms of FIS/FAR
- b) Reconstruction of the authorized building to be permitted subject to the existing FSI/FAR norms and without change in the existing use.
- c) The design and construction of buildings shall be consistent with the surrounding landscape and architectural style

SITE ANALYSIS

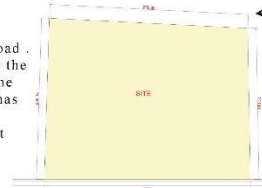
SITE AREA - 66,883 sq.m (16.53 Acres)

LOCATION - Fishing Harbour Rd, Thengathittu, Puducherry, 605004



ON SITE FACTORS

Site is located 3 ft below from the road . The predominant green cover around the proposed site is Prosopis juliflora. The site is marshy with stagnant water. It has a pleasant view on eastern side with mangrove near the shore . Due to port development road near site is been extending 2m wide.



MORPHOLOGY OF THE SITE



2005



2010



2015

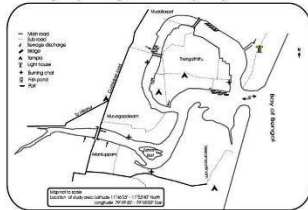


2021

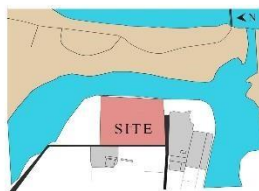
AQUA TOURIST CENTER

SITE ANALYSIS

NEIGHBOURHOOD & SURROUNDINGS



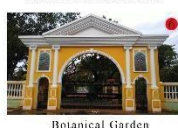
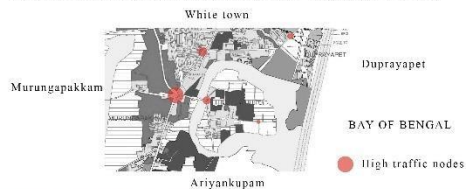
NEIGHBOURING ROADS



Fishing harbour road Harbour road

Site has backwater all around thengathittu and Site is connected with two roads, upplam road on the north and Thengathittu main road on the west. Preferring fishing harbour road as a main entry to the site which has 8m wide road

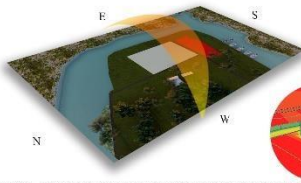
NEIGHBOURING AREAS & HIGH TRAFFIC ZONE



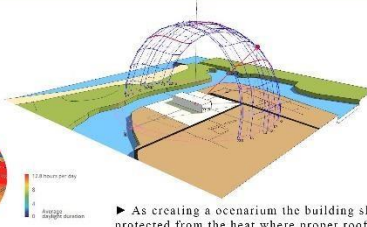
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SITE ANALYSIS

SUN PATH

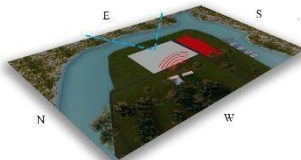


► Sun path is right perpendicular to the site where more heat is on the top of the building



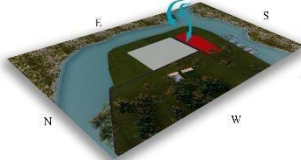
► As creating a oceanarium the building should be protected from the heat where proper roof covering material should be identified

NOISE & VIEW POINT



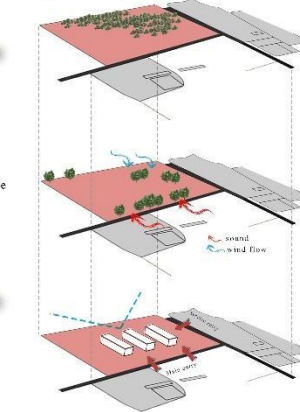
► Predominant noise pollution is from the road side
► It has a wide view on the eastern side into mangroves

WIND DIRECTION



► The predominant average hourly wind direction in Pondicherry varies throughout the year.
► Where creating a dynamic structure with opening all around the site creates a good air flow into the site

VEGETATION



► shrubs are presented all around the site which should be removed

► where trees are present only at the front next to the road and near the backwater

Introducing more trees on the east and west side helps in reducing noise and maintains proper wind flow

► Main entrance can be placed on the west side where the road is wide

► Creating a building on this site makes a view from all direction

S Floating population in Pondicherry near site is high
Mangrove near site attracts birds
It is located near sea which has a pleasant view

W No proper waste disposal
Site is low from the road where rainwater is settled on the site
It can only be axised through two roads

O Creating tourist center helps in economy of local people
Helps in educating people about marine eco system
Act as recreational space for public

T Improper drainage disposal creates health hazards
Gum arabic tree is spread all around site which is threat to ground water



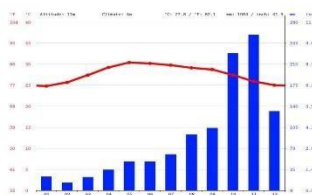
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SITE ANALYSIS

CLIMATE SUMMARY

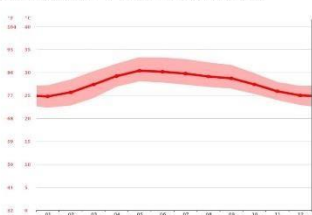
Pondicherry is 11m above sea level. Pondicherry has a tropical climate. In winter, there is much less rainfall than in summer. The Koppen-Geiger climate classification is Aw. The average annual temperature is 27.8 °C | 82.1 °F in Pondicherry. About 1064 mm | 41.9 inch of precipitation falls annually.

CLIMATE / WEATHER GRAPH



The driest month is February, with 13 mm | 0.5 inch of rainfall. Most precipitation falls in November, with an average of 259 mm | 10.2 inch

AVERAGE TEMPERATURE



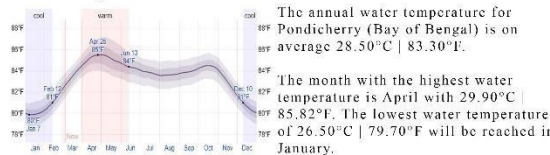
The warmest month of the year is May, with an average temperature of 30.4 °C | 86.8 °F. In January, the average temperature is 24.8 °C | 76.7 °F. It is the lowest average temperature of the whole year

WEATHER AVERAGE

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	24.8 °C (76.7 °F)	25.1 °C (77.3 °F)	27.4 °C (81.4 °F)	29.2 °C (84.6 °F)	30.4 °C (86.8 °F)	30.2 °C (86.4 °F)	28.8 °C (83.8 °F)	28.2 °C (82.8 °F)	26.8 °C (80.3 °F)	27.4 °C (81.4 °F)	25.9 °C (78.7 °F)	25 °C (77.1 °F)
Min. Temperature °C (°F)	22.4 °C (72.2 °F)	22.8 °C (73.1 °F)	24.9 °C (76.9 °F)	26.9 °C (80.5 °F)	28.1 °C (82.6 °F)	27.8 °C (82.1 °F)	27.4 °C (81.3 °F)	26.9 °C (80.3 °F)	25.9 °C (78.7 °F)	26.3 °C (79.3 °F)	24 °C (75.2 °F)	22.9 °C (73.3 °F)
Max. Temperature °C (°F)	27.3 °C (81.1 °F)	28.6 °C (83.3 °F)	30.3 °C (86.5 °F)	32 °C (89.6 °F)	33.4 °C (92.1 °F)	33.2 °C (91.8 °F)	33 °C (91.4 °F)	33.2 °C (91.8 °F)	31.7 °C (89.1 °F)	28.9 °C (84 °F)	28 °C (82.3 °F)	27.1 °C (80.8 °F)
Precipitation / Rainfall mm (in)	23 (0.9)	13 (0.5)	22 (0.9)	34 (1.3)	46 (1.8)	48 (1.9)	60 (2.4)	93 (3.7)	104 (4.1)	228 (9)	259 (10.2)	132 (5.2)
Humidity(%)	74%	74%	74%	75%	71%	67%	65%	70%	74%	79%	80%	77%
Rainy days (d)	4	2	3	4	5	7	8	10	11	15	14	8

The difference in precipitation between the driest month and the wettest month is 246 mm | 10 inch. The average temperatures vary during the year by 5.6 °C | 42.1 °F.

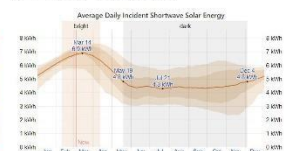
WATER TEMPERATURE PONDICHERRY(BAY OF BENGAL)



The annual water temperature for Pondicherry (Bay of Bengal) is on average 28.50 °C | 83.30 °F. The month with the highest water temperature is April with 29.90 °C | 85.82 °F. The lowest water temperature of 26.50 °C | 79.70 °F will be reached in January.

	January	February	March	April	May	June	July	August	September	October	November	December
Min. Water Temperature °C (°F)	26.5 (79.7)	26.9 (80.4)	28.1 (82.6)	28.9 (84.0)	29.7 (85.5)	29.7 (85.5)	28.7 (83.7)	28.4 (83.1)	26.8 (80.3)	26 (78.8)	27.8 (82.1)	26.7 (80.1)
Avg. Water Temperature °C (°F)	26.7 (80.1)	27.4 (81.3)	28.7 (83.7)	29.7 (85.5)	29.9 (85.8)	29.9 (85.8)	28.9 (84.0)	28.7 (83.7)	26.9 (80.3)	26.3 (79.3)	28.4 (83.1)	27.2 (81.0)
Max. Water Temperature °C (°F)	26.8 (80.2)	28 (82.4)	29.2 (84.6)	29.9 (85.8)	29.9 (85.8)	29.4 (84.9)	28.1 (82.6)	26.9 (80.3)	26.9 (80.3)	26.1 (79.0)	29.1 (84.4)	27.8 (82.1)

SOLAR ENERGY



The brighter period of the year lasts for 2.1 months, from February 9 to April 12, with an average daily incident shortwave energy per square meter above 6.4 kWh. The brightest day of the year is March 14, with an average of 6.9 kWh.

The darker period of the year lasts for 6.5 months, from May 19 to December 4, with an average daily incident shortwave energy per square meter below 4.8 kWh. The darkest day of the year is July 21, with an average of 4.3 kWh.

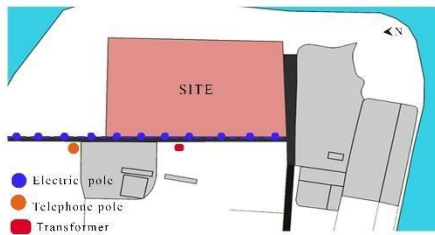
BEST TIME OF YEAR TO VISIT

The tourism score favors clear, rainless days with perceived temperatures between 65 °F and 80 °F. Based on this score, the best time of year to visit Pondicherry for general outdoor tourist activities is from late December to mid February, with a peak score in the third week of January.

AQUA TOURIST CENTER

SITE ANALYSIS

SERVICES

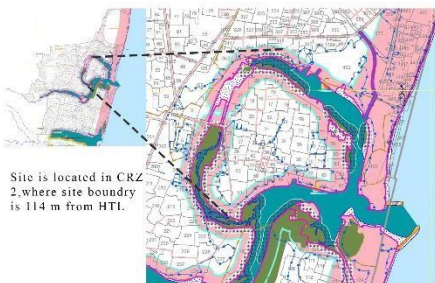


- Site has 11 electric pole with lights on the adjacent road.
- One nearby transformer is on the oppsite to the site near Achariya Bala Siksha Mandir
- Telephone pole is located on the entry of the fishing harbour road

SOIL

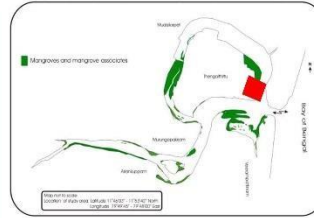
Fluvial land form - Deep , excessively drained , brown , sand , mildly alkaline surface soil, and brown to dark yellowish brown , loamy sand , strongly alkaline subsoil, 1 to 3% slope ; slightly eroded.

CRZ MAP



Site is located in CRZ 2, where site boundry is 114 m from HTL.

ECO SYSTEM



Mangroves nearby



Acanthus ilicifolius



Acanthus ebracteatus



Avicennia marina



Bruguiera cylindrica



Bruguiera gymnorhiza



Rhizophora apiculata



Rhizophora mucronata

Birds identified

1. Egretta garzetta
2. Vanellus indicus
3. Anastomus oscitans
4. Ardeola grayii
5. Himantopus himantopus
6. Ardea cinerea
7. Phalacrocorax niger
8. Nycticorax nycticorax
9. Podiceps ruficollis
10. Amaurionis phoenicurus
11. haliastur indus
12. alcedo atthis

► Creating a watch tower at this site creates a pleasant view of birds and sea for the public

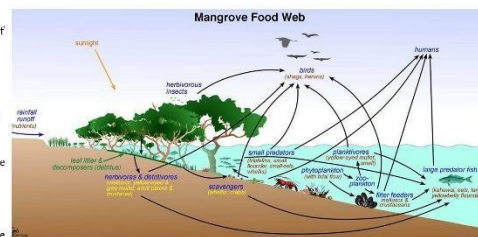


SPECIES

► Pisces - 39 species of fishes belonging to 24 family have been identified in the surrounding

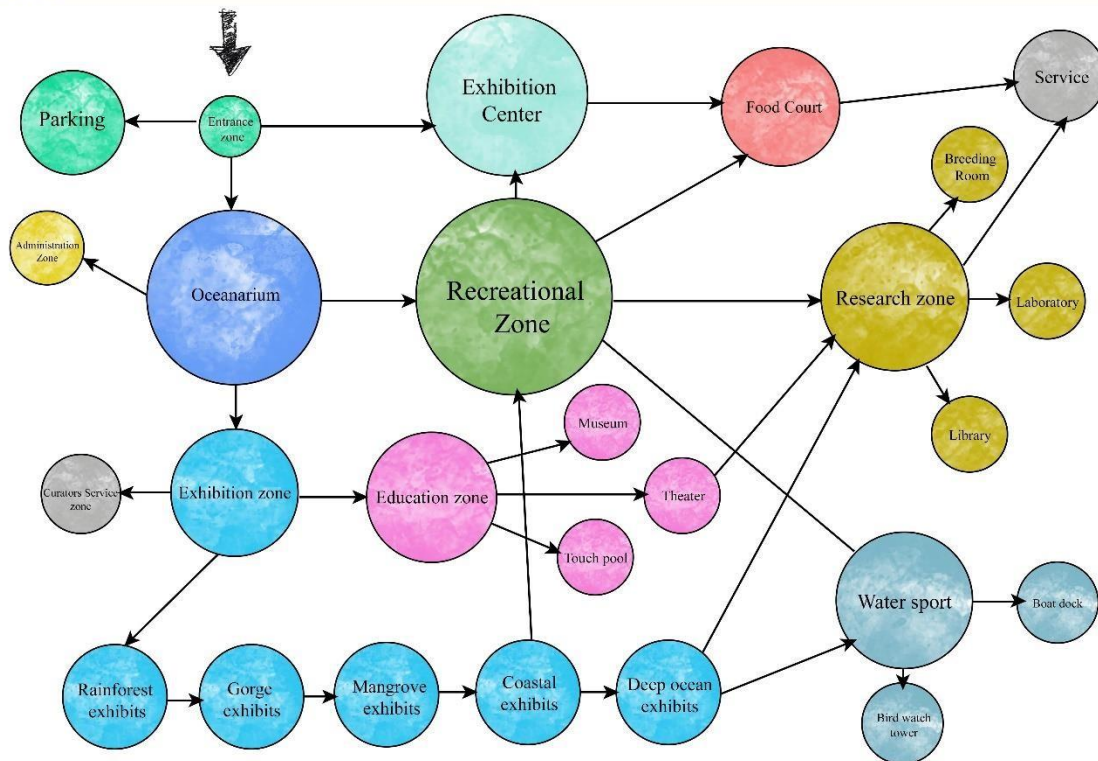
► Prawn - 5 species of prawns are identified on the surrounding which is belongs to five family

► Crabs - 9 species of crabs is in the neighbouring of the site



AQUA TOURIST CENTER

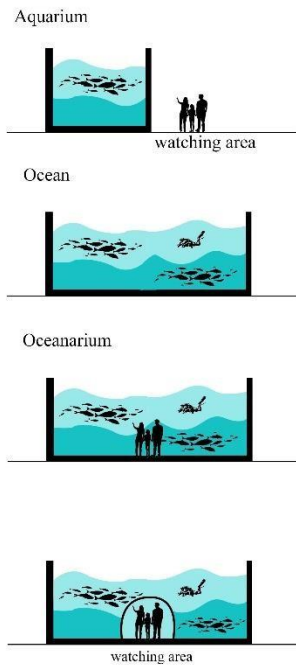
ZONING



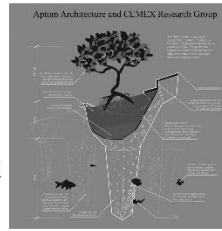
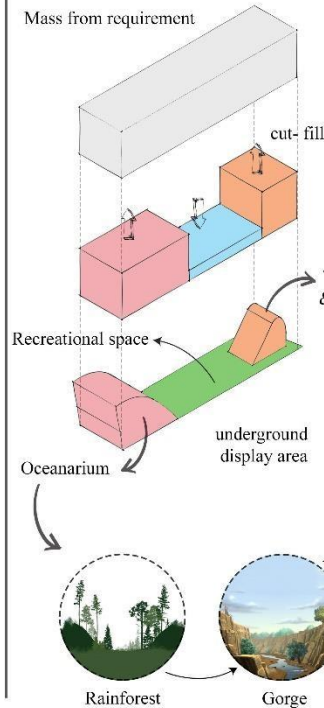
AQUA TOURIST CENTER

CONCEPT

"SPACE BETWEEN THE SPACES"

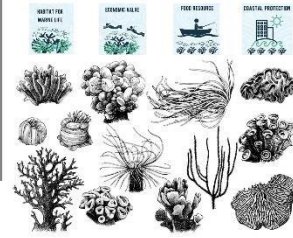


Mass from requirement



Research center

Importance of coral reefs



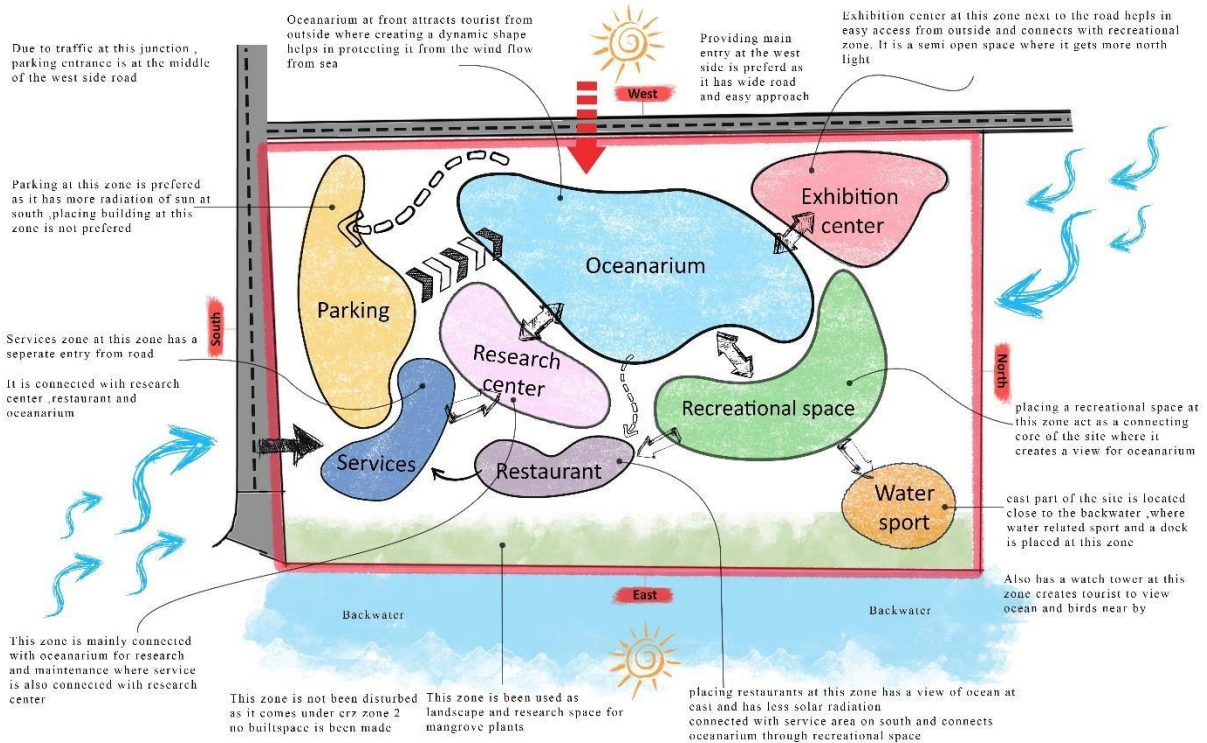
Coral reef has different shapes and different patterns which inspired me to design outer facade

mimic of a fish is been abstracted for the oceanarium

circulation of the oceanarium is been from the forest to deep sea where it leads to a underground tunnel and exit at water sports zone

AQUA TOURIST CENTER

SITE ZONING



AQUA TOURIST CENTER