GOVERNMENT OF INDIA

NATIONAL FISHERIES DEVELOPMENT BOARD (NFDB)

REQUEST FOR PROPOSAL

SECTION-IV: PROJECT INFORMATION MEMORANDUM (PIM)

Development of 'Integrated Coastal Aquaculture Facilities' Mulapolam, Srikakulam District, Andhra Pradesh.

Public Private Partnership (PPP) Mode

April 2023

National Fisheries Development Board (NFDB)

Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India.

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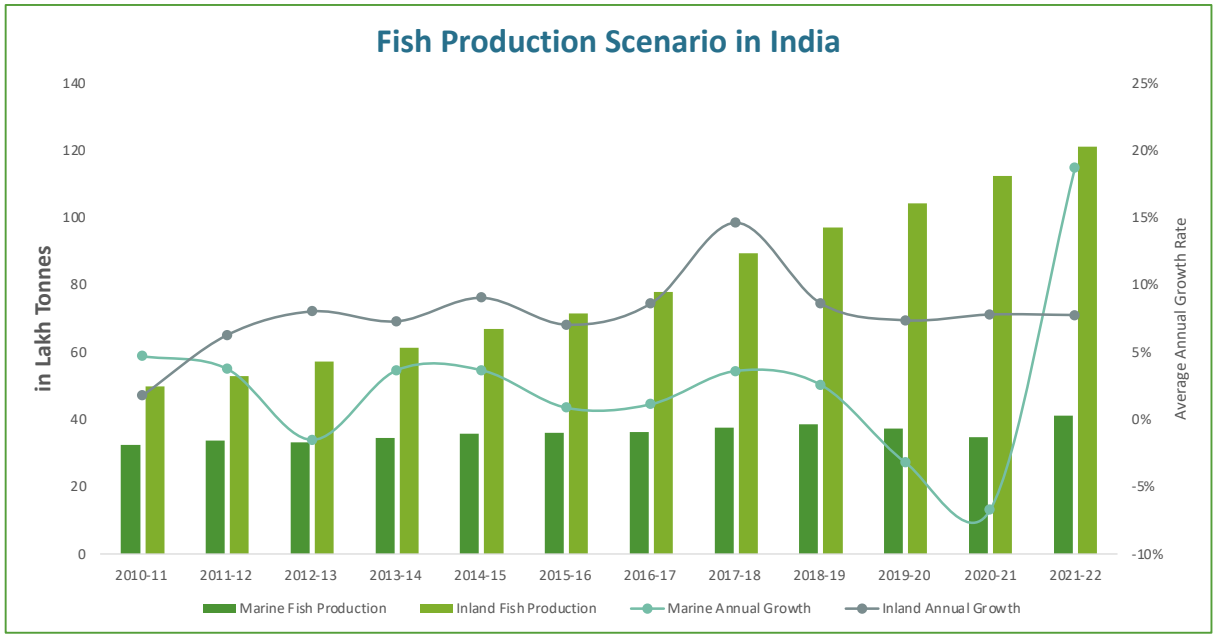
1. Introduction

1.1. Overview of the Industry

Fisheries and Aquaculture constitute an important economic activity, with a vast potential for sustainably harvesting a wide variety of Inland and Marine Fisheries resources in the Country. India, as a key player in global seafood supplies, now ranks second after China in Aquaculture production. Indian seafood products are being exported to more than 120 countries across the globe. USA and China are the major importers of Indian Seafood.

India is the 3rd largest fish and aquaculture producing country and accounts for about 16% of total inland and 5% of total global marine fish production respectively. In 2021-22, India's total marine and inland fish production stood at 162.48 lakh tonnes, which includes 121.21 lakh tonnes and 41.27 lakh tonnes from inland and marine sectors, respectively. The fish production in India has increased from 56.56 lakh tonnes in 2000-01 to 162.48 lakh tonnes in 2021-22. A snapshot of key statistics of the Sector are shown below:

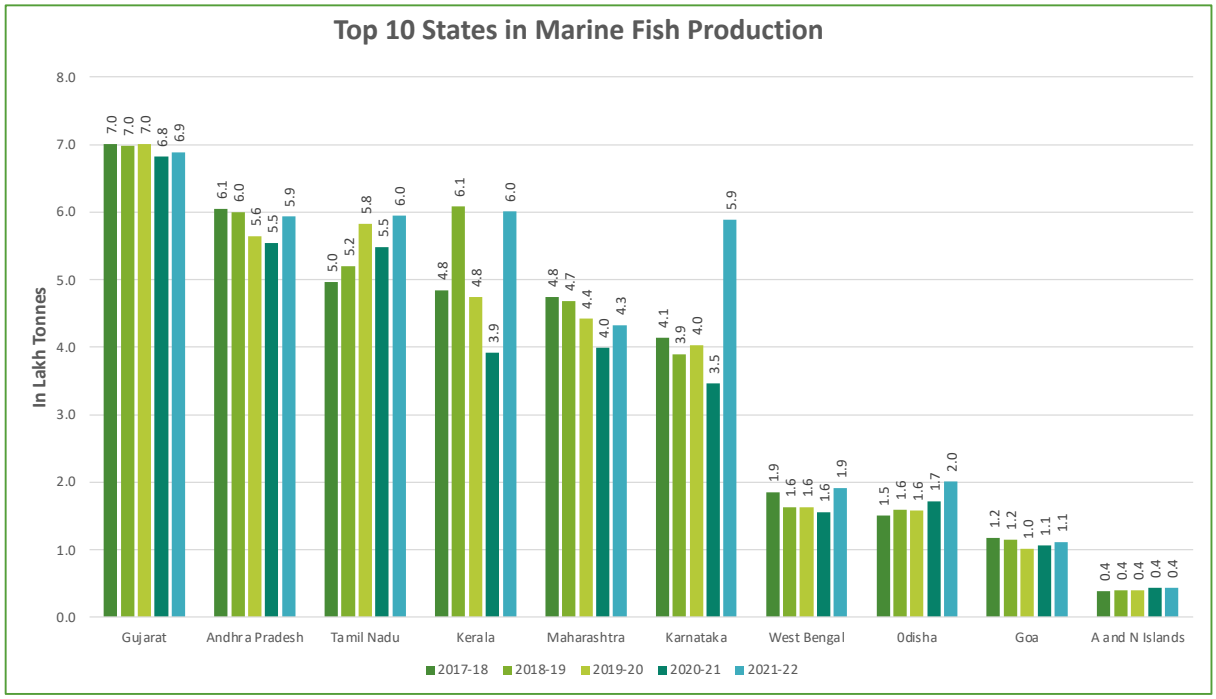
Figure 1: Fish Production Scenario in India



Source: Department of Fisheries, States Government / UTs Administration

India is among the top 5 fish exporting countries in the world at third place preluded by China & Indonesia. In 2021-22, the country exported 1.36 million MT of seafood worth US$ 7.76 billion which is all time high export by value. Andhra Pradesh, West Bengal, Karnataka, Odisha and Gujarat evolve to be the five major fish producing states in India during 2021-22. The figure below reflects the top 10 States in terms of Marine Fish production over the last 5 Years.

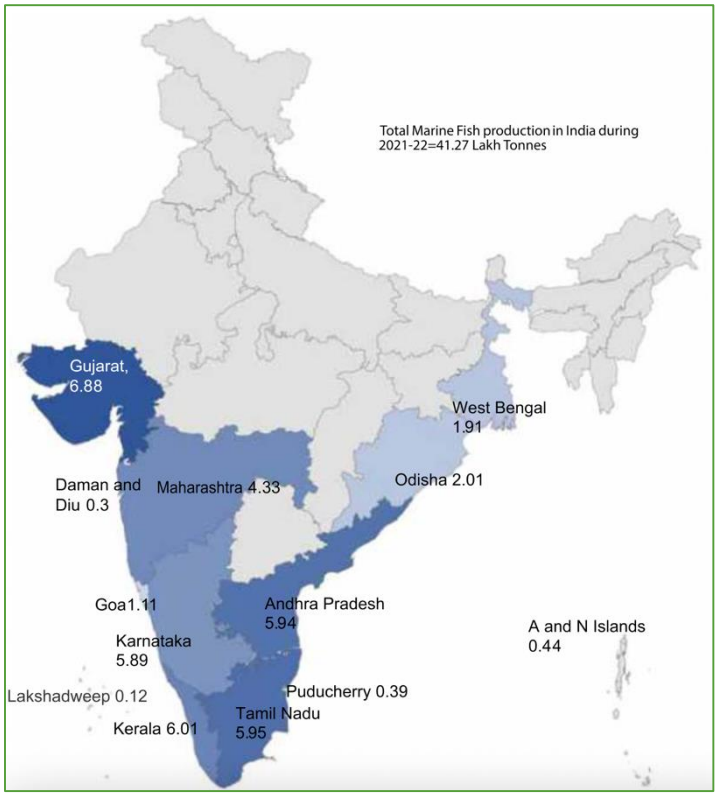
Figure 2: Top 10 States based on the Volume of Marine Fish Production



Source: Department of Fisheries, States Government / UTs Administration

The Map below also indicates the geographic contribution of the Coastal States and UTs in terms of Marine Fish production in FY.2021-22.

Figure 3: Map showing State-Wise Contribution to Marine Fish Production in FY.2021-22 (in Lakh Tonnes)



Source: Handbook on Fisheries Statistics: 2022

1.2. Outlook and Policy Developments

India has a huge potential for Marine Fisheries with 2.2 million km2 of Exclusive Economic Zone (EEZ), 0.5 million km2 of continental shelf, 8.129 km of coastline, 1.2 million hectares of brackish water and 20 million hectares for Marine farming. Mariculture is one of the fastest growing sub-sectors of Aquaculture, making an important contribution to the global food basket and nutritional security. Apart from augmenting seafood production, Mariculture also provides sustainable alternative livelihood avenues and employment opportunities for Coastal communities. In spite of the vast Marine resources, the Country is still at an early stage in world as far as Marine and Coastal Fin Fish production is concerned with just about 3.08% contribution during 2018 (FAO, 2020).

The projected Mariculture production potential in the Indian Region is 4 to 8 MM Tonnes whereas the current Mariculture production is less than 0.01 MM Tonnes. Technological developments like sea cage farming, breeding and Seed production of candidate Marine species (Cobia, Pompano, Sea Bass etc.) in Coastal Mariculture systems augment the production from Marine Sector. These are candidate species with standardized breeding technologies and has good commercial value both in domestic and international markets. Availability of required number of Seeds of these species is one of the major limiting factors.

Keeping this in view, The Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying is implementing a flagship scheme **"Pradhan Mantri Matsya Sampada Yojana" (PMMSY)** to bring about Blue Revolution through sustainable and responsible development of Fisheries Sector in India" with the investment of INR 20,050 Crore for a period of five years with effect from the financial Year 202021 to 2024-25 in all States/Union Territories (UTs).

1.3. Overview of the Current Project

The main objective of the project is to produce & supply required number of quality Marine & Brackish Water Fin Fish Seed, Mud Crab Seed, Scampi Seed and Polychaetes (SPF), which is the need of the hour for the development of Marine Fisheries Subsector including Mariculture, as Seed availability is the limiting factor and there is a huge gap in demand and supply. National Fisheries Development Board (NFDB) intends to bridge the gap in Marine Fin Fish and Crab Seed requirement in the Country by producing and supplying Seed to support alternate species Culture and to enhance Marine Fish production.

NFDB is an autonomous organization under the administrative control of Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, has been playing a vital role in enhancement of Fish production and productivity in the Country and coordinating Fisheries development in an integrated and holistic manner.

NFDB has purchased 99.185 Acres of land at Mulapolam Village, Sompeta Mandal, Srikakulam District, Andhra Pradesh for development of 'Coastal Aquaculture Facilities'. The site has fresh water, seawater water and brackish water resources, making the site suitable for Coastal Aquaculture activities. The project envisages to create facilities for the development of Marine Fisheries by establishing hatcheries for the production of Marine / brackish water Fish seed, Mud

Crab seed and Scampi seed so as to make them available for Fish Farmers and Mariculture activities.

The 'Key Objectives' of the 'Integrated Coastal Aquaculture Facilities' Project at Mulapolam are:

- Establish Multi Species Marine Fin Fish Hatchery (Cobia, Pompano, Sea Bass etc.) to produce & supply Marine Fin Fish Seed.
- Establish Mud Crab Hatchery to produce & supply good quality Seed material (instars) to aqua-farmers.
- Establish Scampi Hatchery to produce and supply Scampi seed.
- Establish Polychaete (SPF) Production facility.
- Encourage diversification of Aquaculture by ensuring production and supply of Seed material.
- Demonstrate Best Management Practices in Marine Fin Fish Culture and Crab Culture
- Create employment opportunities in the Country.

NFDB has undertaken technical studies, Environmental Impact assessment and has developed the master plan for the overall development with approximate cost of 120 Crores in 2 phases. All the necessary statutory approvals such as Coastal Aquaculture Authority (CAA) for taking up Coastal Aquaculture Activities, NOC from AP Pollution Control Board, Forest Department permission for laying of Seawater intake pipeline (Stage-I) were obtained for the entire facility and stage-II Forest Department Permission, CRZ clearance from APCZMA and permission from AP Maritime Board are in progress.

Now, it is proposed to take up 'Operation & Management' (O&M) of the Phase-1 of the Coastal Aquaculture Facilities and Development of the Phase-2, on "Develop, Build, Finance, Operate & Transfer" (DBFOT) basis for an 'initial Concession Period' of 15 Years extendable by another 15 Years based on the mutual agreement.

2. About the Project

2.1. Site Location and Connectivity

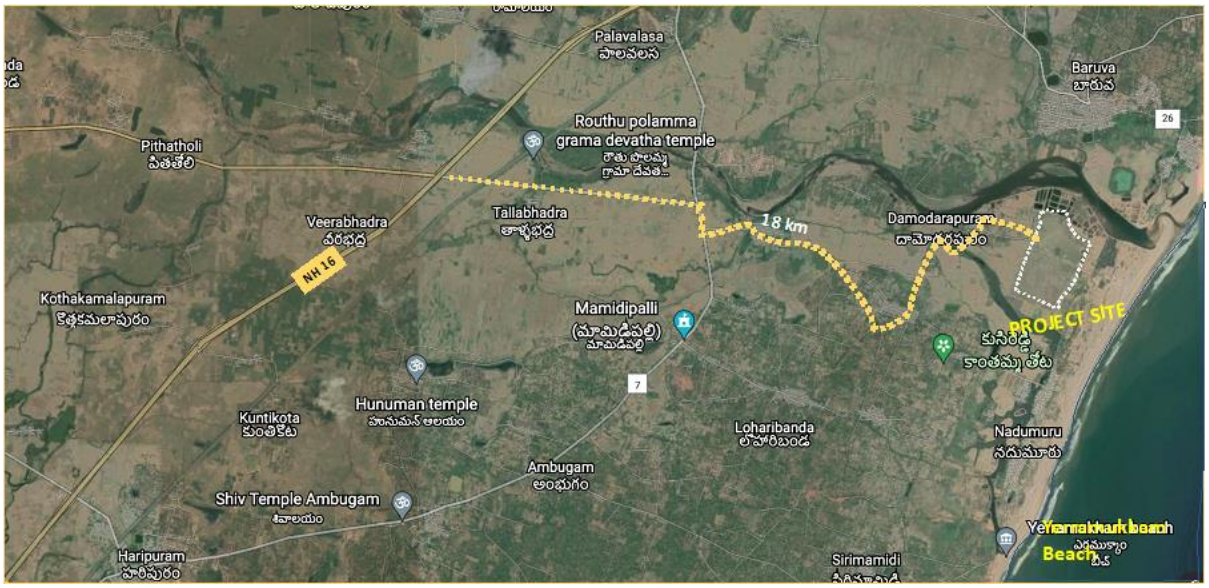
The project site spread is located at Mulapolam Village, Sompeta Mandal of Srikakulam District, Andhra Pradesh. The proposed site is located at ~10 Km. from Haripuram, ~110 Km. from Srikakulam Town, ~230 Km. from Visakhapatnam City and the Site is well connected by National Highway 16 (NH16) by 18 km.

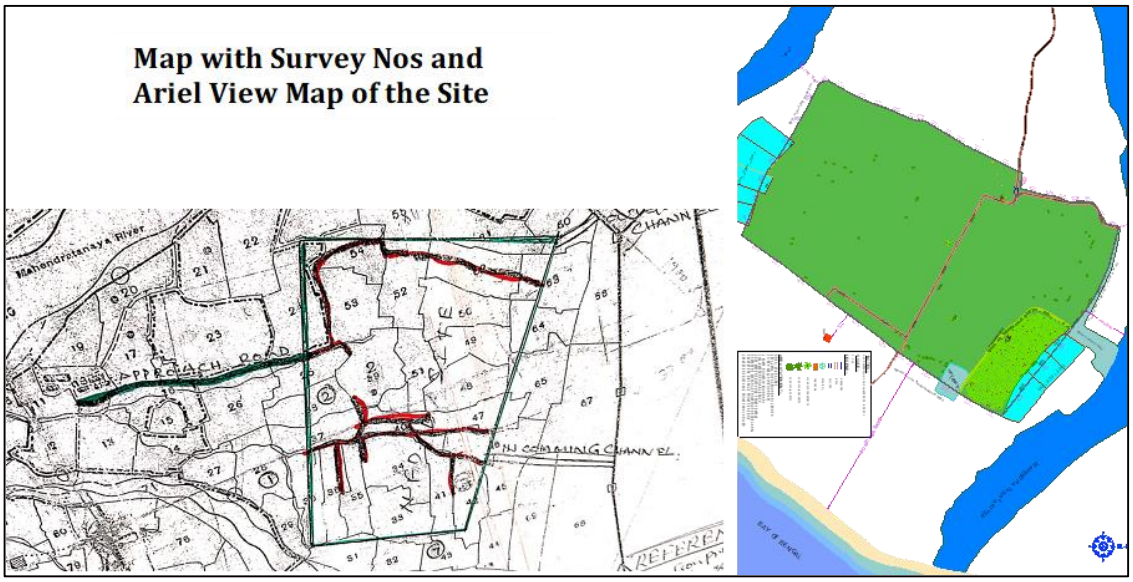
Figure 4: Site Location

The project site with co-ordinates 18°52'14" N latitude and 84°34'43" E Longitude, has fresh water, seawater and brackish water resources, making it more suitable for Coastal Aquaculture activities. The project site has excellent road connectivity as it is connected to NH16 (Chennai – Kolkata) at a distance of 18 Km. via Haripuram.

The Site is 500 Mtrs. from the Sea Shore and abutting to the Mahendra Tanaya River at the Confluence with Brackish Waters.

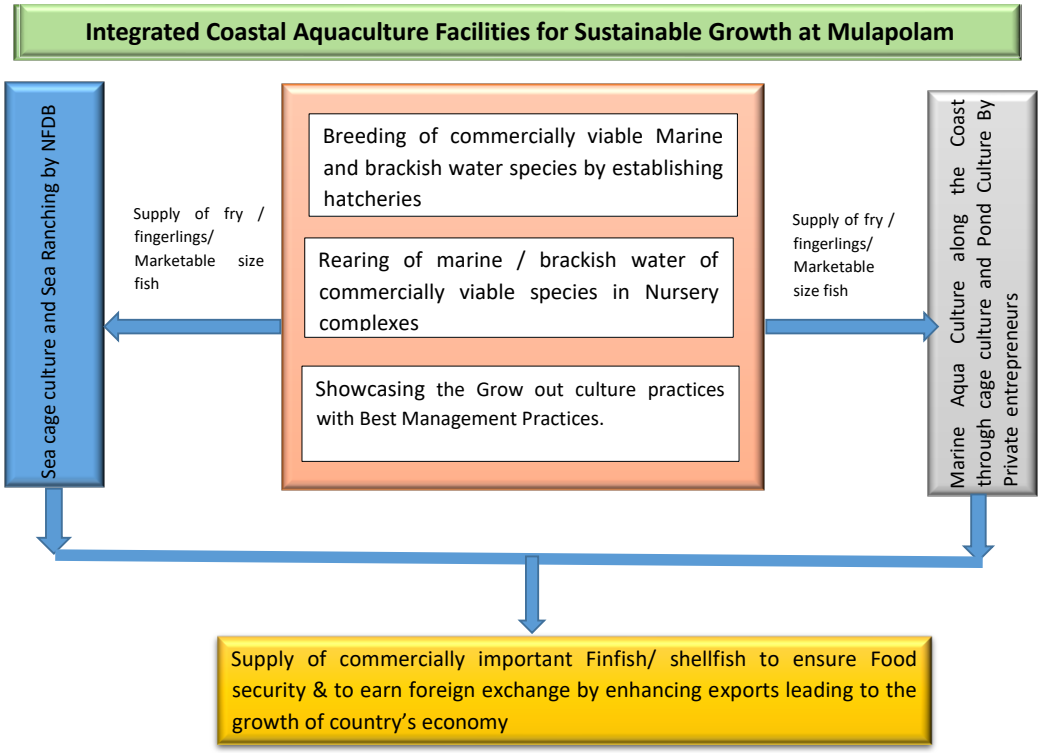
Figure 5: Approach Road to the Project Site from NH-16





2.2. Project Outline

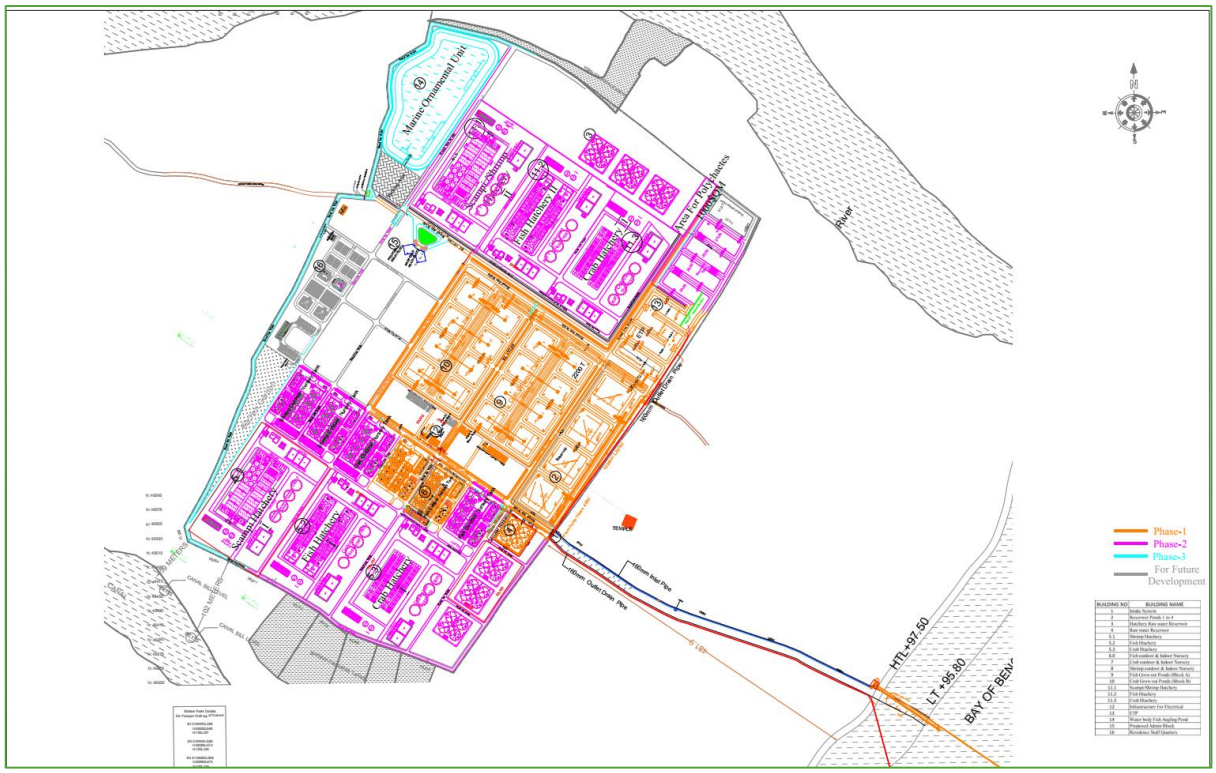
As of now Marine fisheries is mostly capture based in the country and resources are also over exploited and catches are depleting. In order to give impetus to marine fisheries, it is proposed to focus more on marine and brackish water alternative species culture for which both breeding and culture technologies are standardized. In order to achieve sustainable development in culture based marine fisheries subsector, the following schema of model is proposed at Mulapolam site (1) Encourage marine culture along the coast through cage culture and aqua ponds and (2) Sea ranching for enhancing the fish stock in natural resources.



2.3. Project Master Plan

NFDB got the proposed Master Plan of the Coastal Aquaculture Facility done in the Project Site at Mulapolam. For the convenience of execution, the development of integrated 'Coastal Aquaculture Facilities at Mulapolam has been proposed in Two Phases. The proposed Master Plan of the Overall Coastal Aquaculture Facility at Mulapolam is as provided below:

Figure 6: Site Master Plan including Water Inlet / Outlet Systems



2.4. Description of the Facilities Designed as per Master Plan - Phase 1 Developments

As part of the Phase-1 development, NFDB has already undertaking the developments in 25 acres and creation of facilities indicated below:

- Nursery Rearing tank Complexes 2 nos. for nursery rearing
- Two blocks of Grow out Earthen Ponds (Block-A & Block-B) for farming of marketable size Marine Fin Fish (Cobia, Pompano & Sea Bass) and Mud Crabs
- Effluent Treatment Plant
- Earthen Sea water Reservoir - 4 nos.
- Raw seawater Circular Reservoir 1 no.
- 250 KVA Electricity arrangements and Generator
- Water Management System: Sea Water Intake and Outlet Arrangements, Filtration, Fresh Water Supply with Pipelines, Outlet Channels.
- Other Structures: Internal Roads, Water Supply Arrangements, Drains.
- Office Building
- Existing facilities: Chain link fencing with guard room and 5 KVA electricity supply.

NFDB entrusted the construction of the above mentioned facilities of Phase-1 to 'Central Public Works Department' (CPWD) with an estimated project cost of Rs.24.25 Crores and all the works pertaining to the Phase-1 are expected to be completed by June 2023. The overall investment made by NFDB till date, infrastructure Development and approvals and other activities is Rs 24.25 Crores.

Detailed description of each of the facilities in Phase 1 is provided below.

2.4.1. Nursery Complex for Fish Rearing

Each complex will have the following components.

1. Nursery Building:
   a) **Indoor Nursery Tanks:** An Indoor facility with 16 nos. of 4m diameter concrete tanks with a gross capacity of 18 T each. This facility will be used to rear the small Fry to bigger sized Fingerlings. The system will be able to handle nearly 0.5 million Fry per batch. This facility will have roof on the top and will be open on all the four sides including gable ends.
   b) **Outdoor Nursery Tanks:** An outdoor facility with 16 nos. of 5.6m diameter concrete tanks with gross capacity of 37T each. This facility will be used to rear the early Fingerling to advanced Fingerling or to the juvenile size. This facility can handle nearly 1 million Fry or 0.5 million Fingerlings per batch. Capacity will depend on the stocking size and the harvest size and also as per the species of Fish.
2. **Treated Water Reservoirs:** Two reservoirs of 8.5 m diameter HDPE lined tanks of 110 T gross capacity each are constructed by making the circular walls of the tank using framed concrete columns and beams with concrete block works and concrete central drainage system, keeping the other bottom as earthen base. The tanks will be completely lined on the inner side using the HDPE liners to make the tanks totally waterproof. Water is filtered through a set of sand filter, activated carbon filter before the water enters the treated reservoirs.
3. **Water Treatment cum Blower cum Panel Room:** There will be a room (11.6mx6.4m) to house the treatment plant, blowers and the panel boards.
4. **Used Water Treatment Plant:** This facility is required to treat the drain water from the nursery tanks and then drain to central ETP. This consists of three tanks of 36T each made of framed concrete walls with concrete blocks, earthen base with complete inner lining using HDPE material for water proofing.
5. **Office cum Accommodation:** This facility consists of an office, manger accommodation, technical staff accommodation, feed store room, general stores, canteen, and common bathroom facilities with total area of 510 m2 (30 m x 8.5m).
6. **Freshwater Tank:** A ground level platform has been created to accommodate two 10 Ton Vertical HDPE tanks. Water from the outside source or from the borewell will be filled in to these tanks. The water from this platform will be supplied to the entire facility using pressure pump.
7. **Septic Tank:** Septic Tank has been proposed for the accommodation as per standards with soak pit arrangement.

2.4.2. Nursery Facility for Crab Rearing

Each complex will have the following components.

1. Nursery Area
   a) Indoor Nursery Tanks: An Indoor facility with 16 nos. of 4m diameter concrete tanks with a gross capacity of 18 T each. This facility will be used to rear the instar to Crablets . The system will be able to handle nearly 0.5 million instar per batch. This facility will have roof on the top and will be open on all the four sides including gable ends.
   b) Outdoor Nursery Tanks: An outdoor facility with 16 nos. of 5.6m diameter concrete tanks with gross capacity of 37T each. This facility will be used to rear the Crablet to bigger size for stocking in the ponds. This facility can handle nearly 1 million Fry or 0.5 million instar per batch. Capacity will depend on the stocking size and the harvest size
2. **Treated Water Reservoirs:** Two reservoirs of 8.5 m diameter HDPE lined tanks of 110 T gross capacity each are required. These tanks are constructed by making the circular walls of the tank using framed concrete columns and beams with concrete block works and concrete central drainage system, keeping the other bottom as earthen base. The tanks will be completely lined on the inner side using the HDPE liners to make the tanks totally waterproof. Water is filtered through a set of sand filter, activated carbon filter before the water enters the treated reservoirs.
3. **Water Treatment cum Blower cum Panel Room:** There will be a room (11.6mx6.4m) to house the treatment plant , blowers and the panel boards.
4. **Used Water Treatment Plant:** This facility is required to treat the drain water from the nursery tanks and then drain to central ETP. This consists of three tanks of 36T each made of framed concrete walls with concrete blocks, earthen base with complete inner lining using HDPE material for water proofing.
5. **Office cum Accommodation:** This facility consists of an office, manger accommodation, technical staff accommodation, feed store room, general stores, canteen, and common bathroom facilities with total area of 510 m2 (30mx8.5m)
6. **Freshwater Tank:** A ground level platform has been created to accommodate two 10 Ton Vertical HDPE tanks. Water from the outside source or from the borewell will be filled in to these tanks. The water from this platform will be supplied to the entire facility using pressure pump.
7. **Septic Tank:** Septic Tank has been proposed for the accommodation as per standards with soak pit arrangement.

2.4.3. Grow Out Pond System (Block A) for Fish

This facility has been proposed for Fish grow out from fingerlings to Table size Fish.

		
Seabass (*Lates Calcalifer*)	Cobia (*Rachycentron Canadum*)	Silver Pompano (*Trachinotus Blochii*)

The components of this system will be

1. **Grow Out Ponds - Lined:** There will be 8 numbers of 0.1 Ha ponds with water holding capacity of nearly 1600 m3 in each pond. All the ponds will be constructed with earthen dyke and covered completely using HDPE liners. These ponds will have piped water supply from reservoirs.
   a) **Central Drainage:** A central drainage point in the centre of pond constructed in concrete with embedded HDPE polylock on the edges for fusion with the HDPE liners to provide water tight jointing. A pipeline from this structure is laid at a suitable depth to the reach the outlet structure on the drainage canal. Entry side will have perforated vertical and lateral pipes covered by mesh scree to prevent the escape of the reared Fishes
   b) **Outlet Structure for Ponds:** Outlet structure for the ponds will be on the outer side of the pond in the drain canal, with stand pipe controls to regulate the water drainage from the ponds. These structures are as shown in the drawing.
2. **Office cum Accommodation cum Store:** This facility consists of an office, manger accommodation, technical staff accommodation, feed storeroom, general stores, canteen, and common bathroom facilities with total area of 510 m2(30mx8.5m)
3. **Panel cum Blower Room:** There will be a 11.60mx6.40m building to accommodate the panels and blowers required for aeration of the ponds. The aeration will be done through a network of pipelines.
4. **Freshwater Tank:** A ground level platform has been created to accommodate two 10 Ton Vertical HDPE tanks. Water from the outside source or from the borewell will be filled into these tanks. The water from this platform will be supplied to the entire facility using pressure pump.
5. **Septic Tank:** Septic Tank has been proposed for the accommodation as per standards with soak pit arrangement.

2.4.4. Grow Out Pond System (Block B) for Crab

This facility has been proposed for Crab grow out culture from crab lets to market size as per the management decisions.

The components of this system will be -

1. **Earthen Ponds:** There will be 8 numbers of 0.1 Ha ponds with water holding capacity of nearly 1600 m3 in each pond. All the ponds will be constructed with earthen dyke. These ponds will have piped water supply from reservoirs.

Mud Crab (Scylla Serrata)

   a) **Central Drainage:** A central drainage point in the centre of pond constructed in concrete. A pipeline from this structure is laid at a suitable depth to the reach the outlet structure on the drainage canal. Entry side will have perforated vertical and lateral pipes covered by mesh scree to prevent the escape of the reared Crabs
   b) **Outlet Structure for Ponds:** Outlet structure for the ponds will be on the outer side of the pond in the drain canal, with stand pipe controls to regulate the water drainage from the ponds. These structures are as shown in the drawing.

The capacities under each category is summarized in the tables below:

Table 1: Estimated Capacities, Outputs and Supplies at Nursery and Grow Out Complexes in Phase I by Private developer (2 Blocks)

A. Nursery Complex (2 Blocks)											
S. No.	**Species**	**No. of Indoor Tanks – 18T capacity**	**No. of outdoor Tanks – 37 T capacity**	**Output of Fingerlings in Lakhs per year**	**To be supplied to NFDB - for Pond culture**			**To be supplied to NFDB -for Sea ranching**			
					Estimated size of finger lings	**Cost of Fingerlings per piece in Rs.**	**No. of fingerlings to be supplied to NFDB in lakhs**	**Estimated size of finger lings**	**Cost of Fingerlings per piece in Rs.**	**No. of fingerlings to be supplied to NFDB in lakhs**	
1	Pompano	6	6	15	6-8 cm	20.90	3	10-12 cm	33.25	1	
2	Seabass	8	8	17	6-8 cm	32.30	6	10-12 cm	43.70	1	
3	Cobia	2	2	2.5	8-10 cm	28.50	1	14-15 cm	42.75	0.5	
4	Mud crab	16	16	8.45	2-5 gm	20.90	3				
B. Grow out Complexes (Block A & B)											
S. No.	**Species**	**No of ponds with 1600 cc**	**Production of marketable size Fish KG**	**Estimated Size at harvest in Kg**	**Farm gate price of marketable fish per KG in Rs**						
1	Pompano	3	16800	0.5	300						
2	Seabass	4	17920	1.0	400						
3	Cobia	1	6400	2.5	300						
4	Mud crab	8	6912	0.6	600						

2.4.5. Sea Water Supply System

Sea water Supply system consists of intake suction line to bring the water to the pumps, pump station and the delivery pipe line up to the reservoir.

1. **Sea Water Intake System:** Two types of intake suction line has been planned in the project as below

a) **Shallow Vertical Filter Point System:** There will be two sets of shallow vertical filter point system with individual header suction line to individual pumps. Each set will have a network of 8 bores of 160mm PVC pipe with required fittings and accessories as shown in the sketch. These shallow bores are done up to a depth of 8ft from the ground level in the location just below the lowest low tide level of the locality. All the 8 bores will be suitably coupled together to a common suction line leading to one pump. Similarly, the next set of 8 bores have to be connected to the second pump. The delivery from the two pumps will be connected together to a common header and from the header one single delivery line will take the water to the circular primary reservoir. The beach bore well system is designed for 150 m3 per hour supply to the primary reservoir.

b) **Open Sea Water Intake System:** There will be one single intake pipeline made of HDPE to be installed to have the end of suction line at the depth of – 2.5metre from the LLTL with proper strainer at the end and anchoring to keep them in position against the tides. There will be set of concrete blocks each weighing 30kg to be kept at the top and bottom bolted with stainless steel bolts and nuts with suitable rubber padded grips to keep the block in position without moving. The entire pipeline will be 425 metres from the pumphouse to the suction end of the pipeline inside the sea. There will be 320 metres of pipelines requiring concrete block anchor at a spacing of 2 metre each to keep the pipelines in position at the bottom. As a part of installation, these blocks will be arranged in the pipeline and the whole pipeline will be moored in to the sea and immersed in position by suitable technical executors.

2. **Pump House:** A pump house to accommodate four numbers of 20 hp pumps has been planned to supply water to the reservoirs. For each intake system , there will be two pumps , one as working and the other as stand bye .

3. **Main Water Supply Line:** The water from the pump house will be carried over a distance of nearly 500 m through a set of pipelines to the reservoir ponds and to the primary circular reservoir separately but could be redirected to one another by a control system

2.4.6. Reservoir Systems for Sea Water

1. **Reservoir Ponds:** There will be a network of four reservoir ponds (R1,R2,R3 and R4), each of size 2060 m2 with water storage capacity of 4150 m3. Total reservoir capacity will be 16600 m3. These reservoirs can meet the daily requirement of the two pond systems at a maximum water exchange of 20 percent per day. These are earthen ponds with HDPE Liner on the top covered for the entire inner side of the reservoir ponds.

2. **Dissipation box and Filtration system:** These reservoirs will receive water from the sea through a sequence of dissipation box in the beginning with a three set of filtration systems having bag filter screens of different mesh sizes of 100 mesh, 80 mesh and 60 mesh in a sequence.

3. **Feeder Canal and Inlets:** Post filtration, water will be supplied to the individual reservoirs through inlet pipes installed in the HDPE lined open trapezoidal feeder canals. Water from the reservoirs will be pumped using water pumps directly in to the pond systems A and B through a network of pipelines and controls.

2.4.7. Primary Circular Reservoir Tanks

There will be a network of 4 nos. Circular Reservoir tanks (1 unit with 4 tanks) each of which has 350T gross capacity. These reservoirs supply water to the secondary treated water reservoirs positioned in all the hatchery complexes, nursery complexes, Recirculating systems complexes, Intensive circular grow out tank's complexes and other facilities in the project to be executed in different period of time in a sequence.

2.4.8. Administrative Block

A 4300 sq. ft Administrative Building is being constructed for the management of the centre with required facilities.

2.5. Description of the Facilities Designed as per Master Plan - Phase-II Facilities *(To be developed by the PPP Developer)*

2.5.1. Hatchery Complexes

It is proposed to have four hatchery complexes in this centre two hatchery complexes each for Marine Fin Fish, Crab, and Scampi seed production separately.

1. **Multi Species Marine Fin Fish Hatchery Complexes - 2 Units :** This facility shall have different component units to take care of different activities such as Process units viz. Outdoor Brood Stock Holding, Indoor Brood Stock Maturation, Spawning, Hatching, Early Fry Rearing, Fry Rearing, supporting Live Feed units such as Rotifer Production, Chlorella Production, Stock Culture, Secondary Treated Reservoir System, Power Room, Generator, Machinery Room for Water Treatment Plants, Blowers and Pumps, Laboratory Facilities, Office Room, Staff Room, Stores, Packing facilities, Bio security arrangements such as fencing, foot dips, hand dips, working uniform change rooms, etc., as appropriate. Each hatchery unit proposed will have the capacity to produce 5 million Fry per annum (Total Capacity for two hatcheries 10 million per year).
2. **Crab Hatchery Complexes - 1 Unit :** This facility shall have different component units to take care of different activities such as Process units viz. Indoor Brood Stock Holding, Maturation, Spawning, Hatching, Crab Instar Rearing, Crablet Rearing, supporting Live Feed units such as Artemia, Algal Stock Culture, Algal Mass culture, Secondary Treated Reservoir System, Power Room, Generator, Machinery Room for Water Treatment Plants, Blowers and Pumps, Laboratory Facilities, Office Room, Staff Room, Stores, Packing facilities, Bio security arrangements such as fencing, foot dips, hand dips, working uniform change rooms, etc., as appropriate. The hatchery unit proposed will have the capacity to produce 5 million Crab instars per annum.

3. **Scampi Hatchery Complexes – 1 Unit :** This facility shall have different component units to take care of different activities such as Process units viz. Indoor Brood Stock Holding, Indoor Brood Stock Maturation, Spawning, Hatching, Larval Rearing, Post Larval Rearing, supporting Live Feed units such as Artemia, Algal Stock Culture, Algal Mass culture, Secondary Treated Reservoir System, Power Room, Generator, Machinery Room for Water Treatment Plants, Blowers and Pumps, Laboratory Facilities, Office Room, Staff Room, Stores, Packing facilities, Bio security arrangements such as fencing, foot dips, hand dips, working uniform change rooms, etc., as appropriate. The hatchery unit proposed will have the capacity to produce 100 million PLs per annum.

   The Private Developer would develop four hatcheries – two for the multi-species Fishes, one for mud-Crab and one for rearing Scampi. The expected capacities and outputs for Hatcheries that are to be provided by the Developer in Phase 2 are shown in the Table below.

   It is mandatory that the quality of the Seed - the Fish seed (Fry) should be healthy, actively swimming, without any deformities, external injuries, parasites and diseases. Similarly, the Scampi Post Larvae (PLs) shall be healthy, actively swimming and should pass the stress test and –ve (negative) for all the OIE listed diseases. All the produce shall be tested disease-free and certified prior to the purchase by NFDB.

Table 2: Hatcheries with Estimated Capacities and Targeted Output under Phase 2 to be Developed by the Private Developer:

A. Hatchery Complexes							
S. No	**Species**	**Hatcheries capacity**	**Area required acres incl. Nursery**	**Estimated production of Fish Fry in millions (@ 60 % survival)**	**Estimated size of fry**	**Cost of Fry per piece in Rs**	**Fry to be supplied to NFDB (in lakhs)**
1	**Multispecies Marine Fin Fish Hatchery Complexes -2 Nos**						
a.	Silver/Indian Pompano	Total 10 Million for two hatcheries @ 5 Million per Hatchery. annum	10 Acres (5 acres per hatchery)	1 X 2 = 2 (20 Lakhs)	**2.5-3 cm**	5.70	5
b	Asian Sea bass			1 X 2 = 2 (20 Lakhs)	**2.5-3 cm**	12.35	6
c	Cobia			0.50 X 2 = 1.00 (10 Lakhs)	**4-5 cm**	14.25	2
d	Milk Fish			0.25 X 2 = 0.50 (5 Lakhs)	**2-3 cm**	5.70	2
e	Pearl Spot			0.25 X 2 = 0.50 (5 Lakhs)	**2-3 cm**	7.60	2
2	**Mud crab Hatchery Complex-1 No**	5 million crab instars per annum	5 Acres	3 million (30 Lakhs)	0.5-0.8 cm	8.55	11
3	**GI Scampi Hatchery -1 No**	100 million PLs per annum	5 Acres	60 million PLs per annum (600 Lakhs)	0.008 -0.01 gm	0.93	200

2.5.2. Nursery Complexes

Two Nursery Complexes shall be developed by the developer for rearing of fry/PLs in to Fingerlings/ juveniles, in addition to the 2 Nursery complexes already developed in Phase-I.

The Private Developer would develop indoor and outdoor tanks with the indicative capacities shown below for handling various categories of Fish, Mud Crab and Scampi. The expected capacities and outputs for Nurseries that are to be provided by the Developer in Phase 2 are shown in the Table below.

It is mandatory that the quality of the Seed - the Fish seed (fingerlings) should be healthy, actively swimming, without any deformities, external injuries, parasites and diseases. Similarly, the Scampi juveniles shall be healthy, actively swimming and should pass the stress test and –ve (negative) for all the OIE listed diseases. All the produce shall be tested disease-free and certified prior to the purchase by NFDB.

Table 3: Nurseries with Estimated Capacities, Targeted Output and Supplies under Phase 2 to be developed by the Private Developer (2 nos. in phase 1 and 2 nos. in phase 2 , total 4 Blocks):

B Nursery Complexes										
S. No.	**Species**	**No. of Indoor Tanks – 18T capacity**	**No. of outdoor Tanks – 37 T capacity**	**Fingerlings produced in Lakhs per year**	**To be supplied to NFDB - for Pond culture**			**To be supplied to NFDB -for Sea ranching**		
					Estimated size of fingerlings	**Cost of Fingerlings per piece in Rs.**	**Fingerlings to be supplied to NFDB (in lakhs)**	**Estimated size of finger lings**	**Cost of Fingerlings per piece in Rs.**	**Fingerlings to be supplied to NFDB in lakhs**
1	Silver / Indian Pompano	10	10	25	6-8 cm	20.90	2	10 -12 cm	33.25	1.0
2	Asian Sea bass	10	10	22	6-8 cm	32.30	3.5	10 -12 cm	43.70	1.0
3	Cobia	4	4	5	8-10 cm	28.50	1	14- 15 cm	42.75	0.5
4	Milk Fish	4	4	4	6-8 cm	12.35	1	8- 10 cm	14.25	0.5
5	Pearl Spot	4	4	8.50	5-6- cm	11.40	1	8- 10 cm	17.10	0.5
6	Mud crab	16	16	8.50	2-5 gm	20.90	3			
7	GI Scampi	16	16	50	5-6 gm	6.65	30			
8	SPF Polychaetes (Rupees per kg)			1500- kgs per annum in 2 cycles		4275 per kg	200 kg			

2.5.3. Polychaete (SPF) Production Facility

Shrimp farming Sector relies on rearing quality brood stocks of Shrimps viz. Black Tiger Shrimp (*Penaeus Monodon*), *Litopenaeus Vannamei*, Indian Prawn (*Fenneropenaeus Indicus*), Giant Fresh Water Prawn (*Macrobrachium Rosenbergii*) etc. which is being achieved by providing them with nutrient rich Broodstock diet especially specific pathogen free Polychaete worms, which are currently being imported from abroad or exploited from the wild (Sea shores and mangroves). The wild collections always come with the risk of contaminants and pathogens. This crisis needs to be addressed by breeding, production and steady supply of Polychaete (SPF) worms to the hatcheries in a specific pathogen free manner.

Thus, mass production and supply of Polychaete Broodstock such as *Marphysa Gravelyi* and *Neries Virens* for supplying to commercial Aquaculture hatcheries is envisaged for supplying to Aquaculture hatcheries especially Shrimp and Scampi in live or frozen form.

With adequate supplement feeding with formulated feed, a production of 1 to 3 Kgs. /square meter of Polychaete Broodstock can be achieved in 6 months culture period. Anticipated production of Polychaete Broodstock/year is 1.5 Tons @ 1.5 Kg. production/m2 in 2 culture cycles. A total annual realization @Rs.5000/kg (Rupees 1000 less international market value) will be 200 Lakhs. This production facility can support majority of Shrimp hatcheries by supplying SPF Polychaetes Broodstock for their in-house Polychaetes (SPF) production.

Table 4: Polychaete (SPF) Production Facility with Estimated Capacity and Targeted Output under Phase 2 to be developed by the Private Developer:

Species	Area Required	Target Production Per Year	Cost Of Polychaetes (SPF) Per Kg. In Rs.
Production and Supply of Specific Pathogen Free Polychaete Worms - *Marphysa gravelyi* and *Alitta Virens* (Formerly *Nereis Virens*)	320 Sq.Mt.	1500 Kgs.	4500

All hatchery operations, Fry rearing and culture operations should be in compliance with the Coastal Aquaculture Authority Guidelines/GoI Guidelines/State Fisheries Departments norms etc. from time to time, following Best Management Practices.

2.5.4. Additional Circular Seawater Reservoir Tanks

There will be a network of 12 Nos circular reservoir tanks(3units with 4 tanks each), each of which has 350T gross capacity. These reservoirs supply water to the secondary treated water reservoirs positioned in all the hatchery complexes, nursery complexes, Recirculating systems

complexes, Intensive circular grow out tank's complexes and other research and development facilities in the project to be executed in different period of time in a sequence.

2.5.5. External Works

The following works have to be taken up as a common activity for effecting water supply and drainage system for process water, rainwater drainage system, Road systems, etc.,

1. **Process Water Drainage System:** It consists of a network of pipeline suitably connected from the used water treatment of individual units to carry the water to the sedimentation point of the ETP. These pipeline systems will have inspection chambers at suitable intervals, junction points and in direction change points.
2. **Rainwater Drainage System:** It is basically an earthen canal along the sides of the road to carry the rainwater to the exit point of ETP with proper crossing culvert pipes across all the roads.
3. **Road System:** There will be a network of Water Bound Macadam (WBM) roads in the project connecting all the individual units. The main road will be developed to 10 metre with WBM topping to 4 metre width. Sub roads will be developed to 8m width with WBM topping to 3 metre width.

2.5.6. Additional Infrastructure for Electrification

In addition to the 250 KVA electricity connection being executed by NFDB, infrastructure required for additional electricity to be carried out by the developer.

2.5.7. Additional Effluent Treatment Plant

Water from all the process facilities of the project will be drained into the Effluent Treatment Ponds before discharging them into the creek. It will have two different sections as Sedimentation Ponds and Depuration Ponds. Water from all the Ponds will reach the sedimentation pond through a master drain culvert in the end of the master drain canal while the process water from nursery will reach through a network of drainage pipe system to this entry point of the sedimentation. From sedimentation, it will flow to the depuration ponds through a controlled sedimentation culvert structure, after which water will flow to the creek through a final ETP culvert control structure. During high tides, if required, pumping out will be done.

2.5.8. Additional Reservoir Systems for Brackish Water

1. **Reservoir Ponds:** There will be a network of two reservoir ponds (R5 and R6), each of size 2450m2 with water storage capacity of 4900 m3. Total reservoir capacity will be 9800 m3. These are earthen ponds with HDPE Liner on the top covered for the entire inner side of the reservoir ponds.
2. **Dissipation box and Filtration system:** These reservoirs will receive water from the creek through a sequence of dissipation box in the beginning with a three set of filtration systems having bag filter screens of different mesh sizes of 100 mesh,80 mesh and 60 mesh in a sequence.
3. **Feeder canal and Inlets:** Post filtration, water will be supplied to the individual reservoirs through inlet pipes installed in the HDPE lined open trapezoidal feeder canals. Water from

the reservoirs will be pumped using water pumps directly in to the pond systems Block C, Block D and Block E through a network of pipelines and controls.

2.6. Scope of the Project

The project scope of the selected agency would include the following major activities:

I. **Operation & Management of the Phase-1 of the Facilities:**
   - Operating & Management of the facilities created by NFDB as per the "Minimum Performance Obligations" prescribed in RFP.
   - Operational flexibility will be provided to the PPP Developer for operating & managing the facility within the prescribed framework

II. **Design, Build, Finance, Operate & Maintain the Phase-2 Facilities are elaborated** in Section 2.5. The Private Developer is expected to develop the Facilities and Capacities specified below for the Phase 2 of the Development. The Private Developer would have to provide these as minimum obligations in the Project. The Developer, however, would have a freedom to design the facility based on its expertise in the Sector. There are two categories of herbivore Fish (Milk fish and Pearl Spot) that is included as minimum requirements under the Project. The Developer is encouraged to increase the variety and production of the herbivorous fish over the above requirements indicated below.
   - Planning of Phase 2 largely aligned with the Master Plan provided by the NFDB
   - Preparation & Submission of Development Plan to NFDB
   - Implementation of the project with latest technological interventions
   - Operating the overall Project as per the terms and conditions of the Concession Agreement.

3. Project Cost

3.1. Capital Expenditure

The capital expenditure relates to the expenditure that needs to be incurred by the private Sector developer for developing Phase 2 of the Project. The capacities of various facilities required under the Phase 2 of the Project to be designed and developed by the Private Developer are discussed in Section 2.5 of this report. The itemized detail of the estimated costs expected to be incurred by the private Sector is provided in the Table below:

Table 5: Itemized Capital Costs to be invested by the PPP Developer

(all figures in Rs. Lakhs)

S.No.	Facility	Area (Sq. Mtrs)	Estimated Project Cost (In Rs.Lakhs)
1	Scampi Hatchery Complex-1 No	15,000	800.00
2	Multi Species Marine Finfish Hatchery Complex--2 Nos	40,000	1600.00
3	Crab Hatchery Complex—1 No	18,000	500.00
4	Nursery tanks Rearing Complex 2 nos.	6,000	550.00
5	ETP-2	13,000	8.47
6	Reservoir Earthen Pond 2 nos.	10,000	70.00
7	Raw water Circular Reservoir 3 nos.	6,000	168.00
8	Transformer 4 nos.	6,000	73.53
9	Additional water supply facilities for Phase II Area	2,000	200.00
10	External Works Electrical	2,000	150.00
11	Additional Road facilities in Phase II Area	10,000	100.00
12	Polychaete (SPF) Production Facility	320	252.00
13	Permanent Compound Wall (2500 m approx)	2,500	200.00
	Sub Total for Phase 2	**1,28,320**	**4672.00**

The overall project is expected to be completed over an 18-month period with an estimated 70% of total cost getting incurred in the Year 1 while the remaining expenditure in the Year 2 after the

signing of the agreement. It is estimated that there would be a cost escalation of about 4% per annum in the hard costs of the project.

In addition to the pure hard costs for the project development, the PPP Developer would also incur costs towards project preparation, consultancy, contingencies for cost overruns, and interest during construction. An overall grouped total project cost over the construction period is shown in the Table below:

Table 6: Break-up of the Total Project Cost estimated to be incurred by PPP Developer

(all figures in Rs. Lakhs)

Construction Cost Phasing	FY.2024	FY.2025	Total
Capex – Hatcheries and Nurseries	2,415	1,087	3,502
Capex – Reservoirs	167	75	242
Capex – Polychaete (SPF) Production	176	79	256
Capex – Water Supply System + ETP	146	66	212
Other Support Infrastructure (Roads etc)	366	165	531
Total Hard Costs	**3,270**	**1,472**	**4,742**
Preliminary Expenses	65	29	95
Consultancy Charges	65	29	95
Contingencies	65	29	95
Project Development Expenses	65	29	95
Interest During Construction	141	358	499
Total Capital Cost	**3,673**	**1,947**	**5,621**

TOTAL ESTIMATED PROJECT COST	**Rs.118.89 Crores**

3.2. Revenue Model

The revenue model for the current project is straightforward and is the basis of selection of preferred bidder. As stated earlier, the project is structured in a manner under which the NFDB underwrites to purchase Guaranteed Buy-back of the produce from various facilities and varieties (Hatcheries, Nurseries and Polychaete (SPF) excluding produce from Grow-out ponds) as per the capacities indicated in the Bidding Documents and at a price that is determined based on the bid of the Preferred Bidder, for the first six years of the Contract. It may be noted that there will not be any escalation in price to be paid by the NFDB in these first six years. Under this 'take-or-pay' contract or Guaranteed Purchase, the NFDB would be required to pay for the committed purchase irrespective of whether it actually purchases the product or not. The Private Developer would therefore have a revenue protection and demand risk shared by NDFB during the first six years from the date of signing the agreement.

After the initial six years, the Private Developer would have an established operations and upside potential under which it would be free to sell the entire product in the open market without any

price restrictions by the NFDB. It is assumed that the open market sale would be more attractive to the Private Developer in terms of pricing.

3.3. Payments to NFDB – Lease Amount and Royalty

There are two key payments that the NFDB would receive from the private developer. One is towards the Lease Amount payable for development rights on land given to the Developer. The second one is the Royalty payment on the total "Sales Proceeds" which is the Payment that is to be made by the Private Developer throughout the Concession Period.

3.3.1. Lease Amount

The total land area handed over to the private developer including land for Phase 1 and that for new development is 56.7 Acres. For Phase 1, the land is 24.7 Acres and for the Phase 2 development it is 32 Acres. The NDFB has reserved the remaining land for future development. The lease has been computed at 5% of the Land Value with an escalation of 10% every 3 years. The Land Value has been computed based on sub-registrar current value of land (Rs.3.85 Lakhs/Acre). The lease value in first Year would start at Rs.11.00 Lakhs per annum and would be escalated at 10% every 3 years.

3.3.2. Royalty to NFDB

Towards providing the rights to operate and manage the Phase 1 facility and towards the development rights provided for Phase 2 facility, the Private Developer shall pay Royalty @ **2% of the total 'Sale Proceeds'** during the initial 6 years and from 7th year onwards, Royalty payable shall be **@8% of the total 'Sale Proceeds'** during the balance Concession Period.

4. Proposed Project Structure and Formation of Bid Parameter

4.1. Project Structure

The Authority would commit to purchase back the Guaranteed Buy-back from the developer at a predetermined lowest price quoted during the bid selection process.

4.2. Bid Parameter

The financial bid is based on the lowest price offered to NFDB. Given that there are multiple categories of services and products, it is ideal to consider a weighted average price based on the category-wise prices quoted by the Bidder. Towards arriving at the appropriate weights that are to be considered for computing the weighted average price, the capacity of facility and contribution of the category to the overall estimated revenues of the project are taken into account. Only capacities and revenue contribution from Hatcheries and Nurseries have been considered as they are the only produce that the NFDB is guaranteeing to buy from the Developer. The prices quoted will be binding upon the Preferred Bidder and will be the price at which NFDB would purchase the output for the first six years from the date of signing of the Agreement. There will be no escalation of price during the first six years period.

The Polychaete (SPF) being a small component, the same has not been considered for weighted average formula. The Concessionaire would be informed the price of the Polychaete (SPF) that will be fixed in the Bidding Document @ Rs. 4,275/kg) and not be sought in the financial proposal. Similarly, Price for Sea Ranching purchase shall be fixed at 1.5 times the Nursery (Pond) prices(Approx.).

Using the weights, a weighted average formula based on revenue weights and capacity weights have been designed as below:

$$\Sigma\ [\text{Revenue weight of category}] \times [(\text{capacity weight of category}) \times (\text{price of the category})]$$

$$35\% \times (5\%xa1+5\%xb1+2.5\%xc1+2.5\%xd1+2.5\%xe1+7.5\%xf1+75\%xg1)$$

$$+$$

$$65\% \times (15\%xa2+25\%xb2+7.5\%xc2+5\%xd2+5\%xe2+12.5\%xf2+30\%xg2)$$

Where, the letters a1 – g1 represent the price of outputs from Hatcheries and a2 – g2 represent the price of outputs from Nurseries quoted by the private developer in its financial proposal.

'Unit Price' quoted by the Bidder for each of the Species under various categories shall be within the Cost Bracket fixed by NFDB for each of the Species

Snapshot of Phase-1 'Work in Progress' at Mulapolam