CPGD-Kerala

DETAILED PROJECT REPORT
FOR
NATIONAL ADAPTATION FUND

PROMOTION OF INTEGRATED FARMING SYSTEM OF KAIPAD AND POKKALI IN COASTAL WET LANDS OF KERALA
2015-2016 TO 2018-2019

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List of Abbreviations

ADAK	: Agency For Development of Aquaculture, Kerala
C	: Carbon
CAA	: Coastal Aquaculture Authority
CH_4	: Methane
CIFT	: Central Institute of Fisheries Technology
CMFRI	: Central Marine Fisheries Research Institute
CO_2	: Carbon Dioxide
CPWD	: Central Public Works Department
CUSAT	: Cochin University of Science and Technology
FAO	: Food & Agriculture Organisation
Fe	: Ferrum (Iron)
GHG	: Green House Gases
GMP	: Good Management Practice
HYV	: High Yielding Variety
IPCC	: Intergovernmental Panel on Climate Change
KAU	: Kerala Agriculture University
KUFOS	: Kerala University of Fisheries and Ocean Studies
LSG	: Local Self-Government
Mg	: Magnesium
NA	: Not Applicable
Na	: Sodium
NABARD	: National Bank for Agriculture and Rural Development
NAPCC	: National Action Plan on Climate Change
NRM	: Natural Resource management
RCC	: Reinforced Cement Concrete
RKVY	: Rashtriya Krishi Vikas Yojana
SalTol2TC	: Salt tolerance Gene
SAPCC	: State Action Plan on Climate Change
SOC	: Soil Organic Carbon
SOR	: Scheduled Of Rates
UNFCCC	: United Nations Frame Work Convention on Climate Change
VTL2	: Vyttila II-Pokkali
VTL1	: Vyttila I-Pokkali
WSA	: Water Spread Area

PART I- Project Background

1.1 Restoration and Management of Coastal Wetlands for climate resilient farming

With increasing impacts of climate change and other change factors, yields and profits of mono-aquaculture systems in ecologically sensitive areas has been declining. As a result of these negative impacts, many aquaculture farmers in the region have shifted back to integrated farming methods as an adaptive strategy. Rice and shrimp aquaculture in coastal areas in the Mekong Delta is among those integrated farming systems in which rice is farmed in the wet season, and shrimp is farmed extensively or semi-intensively in the dry season (high water salinity). Integrated farming methods can be considered as climate smart practice to enhance resilience of aquaculture communities to climate change especially sea level rise that results in severe salinity intrusion. Based on data and information collected from My Xuyen district, SocTrang province, evaluated the potential of rice and shrimp aquaculture rotation as a climate smart strategy adopted by local farmers to cope with increasing impacts of climate change (sea level rise and climate variability)[1]. Findings showed integrated farming practices, in general, have proved its advantages over other models under impacts of climate change. The integration of dry season shrimp farming into rice fields has significantly raised incomes for farmers in saline affected areas.

Aquaculture is important, supporting incomes and livelihoods of thousands of small scale farmers in India. **Integrated farming methods can be considered as climate smart practice to enhance resilience of aquaculture communities to climate change especially sea level rise that results in severe salinity intrusion.** Rice and shrimp aquaculture rotation is a climate smart strategy adopted by local farmers to cope with increasing impacts of climate change (sea level rise and climate variability). Findings showed integrated farming practices, in general, have proved its advantages over other models under impacts of climate change. The integration of dry season shrimp farming into rice fields has significantly raised incomes for farmers in saline affected areas. By integrating shrimp with rice, pond sediments were used to fertilize rice crops that results in reducing chemical fertilizer use in rice production. Whereas, rice crop works as a natural filtration system to minimize risks of disease outbreak for shrimp crops (30% less risk compared to mono-shrimp). Shrimp and rice farming integration also contributed to improving the efficiency of land use, as well as to the reduction of land degradation.

1.2 Pokkali & Kaipad wetlands of Kerala

Coastal intertidal wetlands are one of the most productive ecosystems on earth supporting high biodiversity. Traditional agriculture, animal husbandry and fisheries in these coastal wetlands have supported the livelihood of local communities immensely over many centuries. Saline tolerant paddy cultivation and traditional capture based aquaculture in coastal wetlands are practiced in many places especially in tropical countries. Such traditional integrated paddy-

[1] Trinh Q. Tu, Tran V. Nhuong, Phan T. Lam ," Integrated rice-shrimp as a smart strategy to cope with climate change in the Mekong Delta, Vietnam," Climate Smart Agriculture 2015- Global Science Conference, March 16-18 , 2015, Le Corum, Montepellier, France

shrimp farming system is popular in India and is known by different names locally. Bheries/Bhasabhada of West Bengal, Khazan of Goa, Gazani of Karnataka, Pokkali of Central Kerala and Kaipad of North Kerala are such traditional integrated farming systems. The use of salt tolerant, traditional tall paddy varieties for agriculture and brackish water species of shrimp and fish for traditional capture based aquaculture in these coastal marshes offer an opportunity for popularisation of this traditional farming system, which are on decline over the last few decades for various reasons.

This farming system needs to withstand the vagaries of climatic changes including flooding due to uneven monsoon or rise in sea water level due to global warming, tidal flow and moderate changes in temperature. It is also expected that more wetlands adjacent to coastal wetland may get inundated by sea level rise in near future.[2] Hence management of coastal wetland for coastal protection as well as for its continued use for livelihood support need immediate attention. Promotion of climate adaptive traditional agriculture and aquaculture systems like Pokkali or Kaipad gets relevance in these contexts.

Traditional brackish water paddy-shrimp farming system of Northern Kerala called Kaipad farming is an 'integrated organic farming system', where rotational farming of paddy and shrimps is practiced. During monsoon season, when the salinity is very low a crop of paddy is grown here. Shrimps/fish are grown mainly during the rest of the year. However simultaneous farming of another crop of shrimps along with paddy is also practiced to small extent. The farming practice followed is a traditional capture based aquaculture system which is known as Traditional Paddy cum prawn filtration. About 4000 hectares of these wetlands exists in Kasaragod, Kannur and Kozhikode districts, as a major extent and 2500 hectares, in Kannur district.[3] A similar system of Pokkali Paddy-shrimp cultivation is prevalent in Ernakulam, Thrissur and Alappuzha districts of Central Kerala. About three decades back over 25000 hectares of these wetlands existed in these districts. But in the recent past, even here the farming has reduced significantly. Only 2200 hectares are under farming now. There is urgent need to revive farming in these areas also.

About four decades back, around 2500 hectares of Kaipad land was under rice farming in Kannur district including the Kaipad lands of Kattampally region (930 ha). When Kattampally regulator was opened to allow tidal influx in 2009, these areas became available for reviving Kaipad farming. However at present only 400 hectares of Kaipad is under farming in the district. These areas lie in Ezhome, Cherukunnu, Kannapuram, Puzhathi, Kolachery and Chelora Gram Panchayats. In central Kerala presently there is 8,200 hectares of Pokkali filtration fields out of which only 2200 hectares is utilised. About 5,765 hectares remains not

[2] The relevant pages from the Kerala SAPCC have been included in the Annexure with the relevant passages underlined

[3] Sahadevan, P.C. 1966. Rice in Kerala Agriculture information service, Department of Agriculture, Kerala State. Pp.239

utilised or partially utilised. Many of the paddy cum filtration fields become non-operational due to broken bunds and insufficient bund height in many places due to the increase in high tide level especially during the spring months.

Figure 1: Kaipad lands Ezhome village of Kannur district

The over flow of water over the bunds cause damages to the bunds and paved way for the spread of shrimp disease from one farm to another. This also leads to escape of fish/shrimp grown in the farms. This situation compels the farmers who operate the farms to refrain from both paddy and shrimp farming. ADAK has accessed the possibility to bring back the paddy cum shrimp farming practice in the presently unutilised or under-utilised areas. The revival is possible in 1100 hectares of the Kaipad land in Kannur district of Northern Kerala and 5765 hectares in Ernakulam, Thrissur and Alappuzha districts of Central Kerala. So in order to motivate farming activity, the farmers are to be assisted for heightening and strengthening of bunds, installation of proper sluice gate and pumps. They are also to be assisted with necessary input for the farming operations. In this proposal 300 hectares of Kaipad lands in Northern Kerala and 300 hectares of the Pokkali fields in Central Kerala are proposed to be developed and operated. This has to be extended for the entire fields available in future projects in a phased manner.

Table 1: Area of Kaipad lands in Various Gram Panchayats of Kannur District

Name of Local Body	Area of Kaipad land(hectares)	Presently farmed area of Kaipad land(hectares)	Area of Kaipad land that can be Revived(hectares)
Ezhome	425	110	120
Pattuvam	200	20	90
Cherukunnu	350	90	120
Kunhimangalam / Cheruthazham	100	-	50
Kannapuram	100	30	30

Name of Local Body	Area of Kaipad land(hectares)	Presently farmed area of Kaipad land(hectares)	Area of Kaipad land that can be Revived(hectares)
Mattool	40	-	10
Pappinisseri	35	-	15
Thaliparamba	60	25	15
Pinarayi	40	05	15
Chirakkal	120	0	90
Narath	170	10	120
Puzhathi	130	50	50
Kolachery	110	40	60
Elayavoor	05	0	05
Mundari	140	10	120
Kuttiyattoor	20	0	10
Mayyil	05	0	0
Chelora	250	30	190
TOTAL	2300	420	1100

Source: ADAK Survey Report, PAN FISH BOOK (2011) published by Dept. of Fisheries

Figure 2: Map of Kannur District showing Kaipad Farming Area

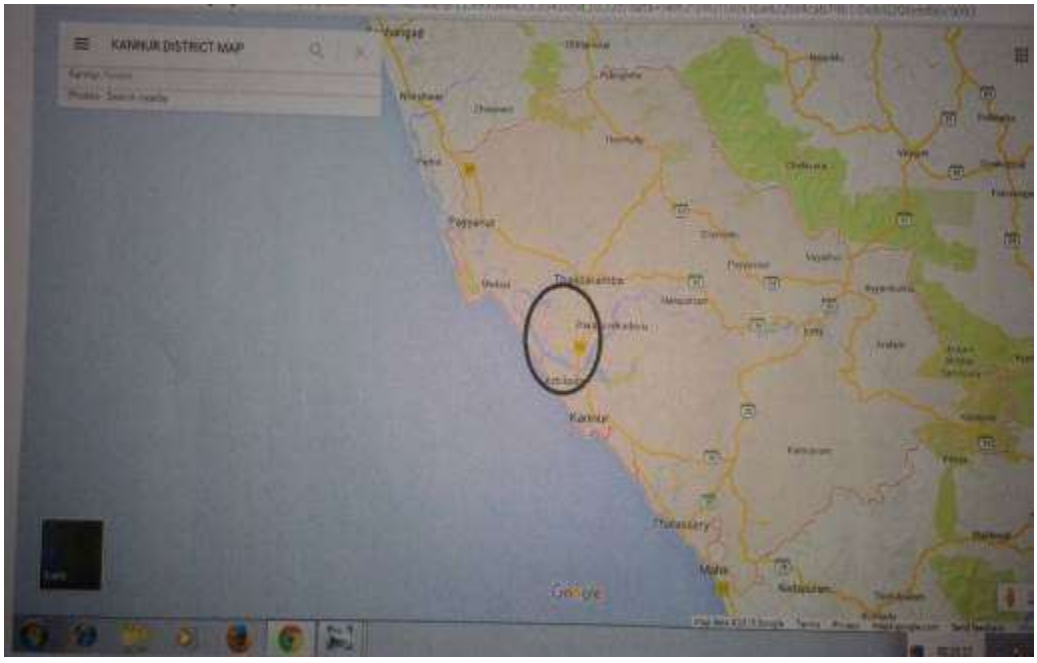


Table 2: Area of Pokkali lands in Central Kerala

Sl. No.	Name of Local body	Area of Pokkali /prawn filtration fields (hectares)	Presently farmed area of Pokkali /prawn filtration fields (hectares)	Area of Pokkali / prawn filtration fields land that can be revived (hectares)
ERNAKULAM DIST				
North Paravur Taluk				
1	Puthanvelikkara	9.39	2.8	6.57
2	Vadakkekara	27.37	8.21	19.16
3	Paravur	29.08	8.72	20.36
4	Karumalore	16.67	5.00	11.67
5	Kottuvally	328.42	98.52	230.00
6	Ezhikkara	382	115.00	267.00
7	Varappuzha	227.18	68.15	159.00
8	Chittattukara	4.86	1.5	3.36
	Sub Total	**1024.97**	**307.9**	**717.12**
Kanayannur Taluk				
1	Kadamakkudy	507.22	152.00	355.22
2	Cheranallur	167.41	50.00	117.41
3	Kochi	21.69	6.5	15.69
4	Mulavukadu	372.32	111.00	261.32
5	Thripunithura	135.93	40.00	95.93
6	Maradu	196.11	50.00	146.11
7	Kumbalam	75.64	22.00	53.64
8	Udayamperoor	96.99	29.00	67.99
	Sub Total	**1573.31**	**460.5**	**1113.31**
Kochi Taluk				
1	Pallippuram	54.66	16.00	38.66
2	Kuzhuppilly	287.07	86.00	201.07
3	Edavanakad	212.8	63.84	148.96
4	Nayarambalam	418.6	125.58	293.02
5	Njarakkal	182.42	54.73	127.69
6	Elamkunnapuzha	101.34	30.4	70.94
7	Palluruthi	201.79	60.53	141.26
8	Kochi	48.18	14.45	33.73
9	Kumbalanghy	584.32	175.00	409.32
10	Chellanam	349.21	104.00	245.21
	Sub Total	**2440.39**	**730.53**	**1709.86**

Sl. No.	Name of Local body	Area of Pokkali /prawn filtration fields (hectares)	Presently farmed area of Pokkali /prawn filtration fields (hectares)	Area of Pokkali / prawn filtration fields land that can be revived (hectares)
THRISSUR DISTRICT				
Kodungallur Taluk				
1	Poyya	123	37.00	86.00
2	Mala	45	13.5	31.5
3	Puthenchira	152.57	45.77	106.79
4	Vellangalur	396.6	119.00	277.6
5	Kodungallur	226.4	67.92	158.48
6	Sree Narayanapuram	10	3	7
7	Padiyoor	4	1.2	2.8
	Sub Total	957.57	287.39	670.17
ALAPPUZHA DISTRICT				
Cherthala Taluk				
1	Aroor	235	70.5	164.5
2	Ezhupunna	515	155.00	360.00
3	Kodamthuruthu	432	130.00	302.00
4	Kuthiathod	111	33	78.00
5	Thuravoor	393	118.00	275.00
6	Pattanakkad	190	57.00	133.00
7	Arookutty	10	3.00	7.00
8	Thycattussery	110	33	77.00
9	Pallippuram	33	10	23.00
10	Vayalar	145	44	101.00
11	Kadakkarappally	10	3.00	7.00
12	Panavally	33	10.00	23.00
13	Perumbalam	6	1.8	4.2
	Sub Total	2223	668.3	1554.7

Source: ADAK Survey Report, PAN FISH BOOK (2011) published by Dept. of Fisheries

Figure 3: Map of Ernakulam District showing Pokkali farming area

Figure 4: Map of Thrissur District showing Pokkali farming area

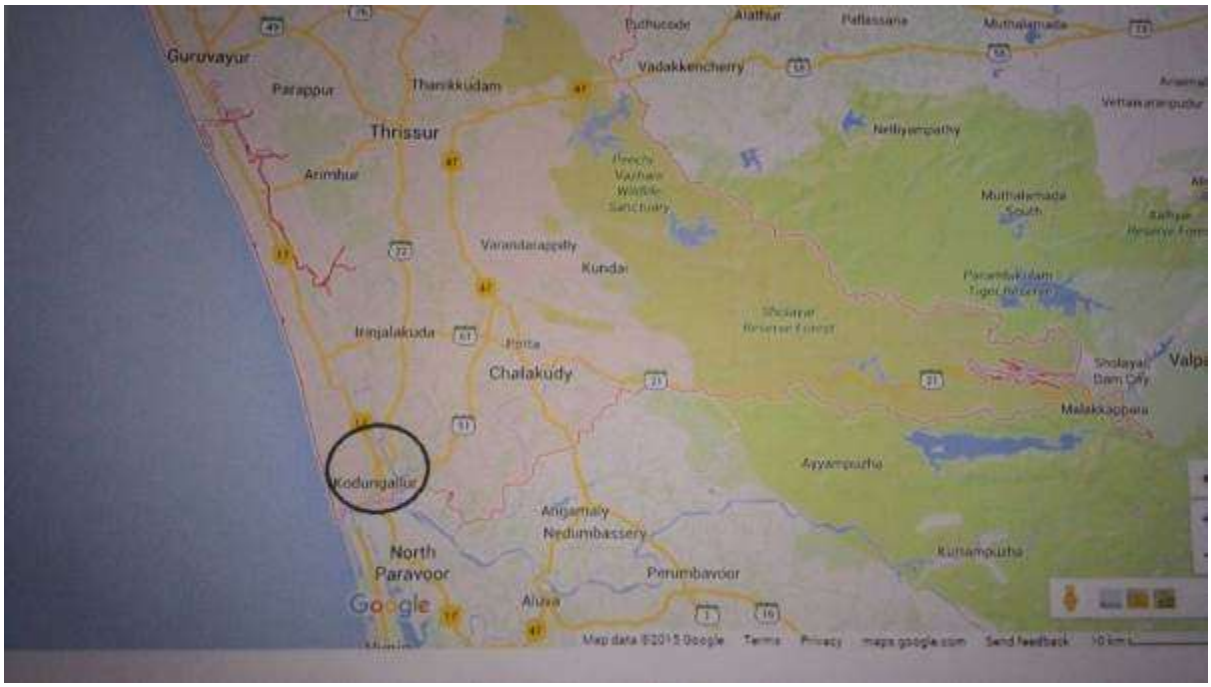
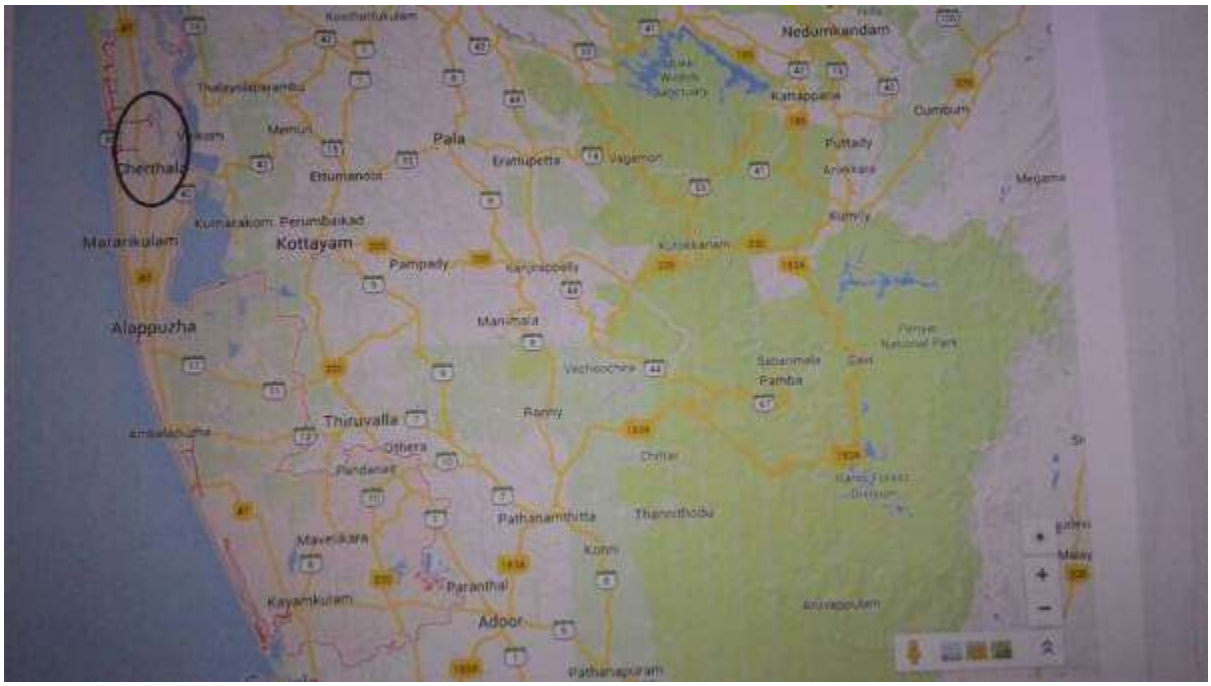


Figure 5: Map of Alappuzha District showing Pokkali farming area



The decline in extent and farming areas of both Kaipad and Pokkali are due to various reasons.

1. Conversion of wetlands for other agricultural purpose like coconut plantations;
2. Reclamation for infrastructure development;
3. Construction of barriers for preventing saline intrusion like Thanneermukkom regulator in Alappuzha and Kattampally regulator in Kannur district;
4. Collapse of bunds of paddy polders (padasekaram) and increasing tidal level/surges;
5. Pollution;
6. Fallowing of lands due to displaced farm labourers;
7. Invasion of alien species like Water Hyacinth, Hydrilla etc.

Large areas of both Kaipad and Pokkali have been converted for other agriculture or reclaimed for various developmental purposes. The conversion of wetlands especially saline wetlands would results, in addition to the loss of economic and ecologic benefits received from these wetlands, also obstruct the carbon sequestration process from these wetlands, and more, result in increased emissions of GHGs like CO_2 and CH_4. Construction of barriers to prevent tidal flux also resulted in total collapse of the ecology of Kaipad and Pokkali wetlands. The acid sulphate soils of these wetlands need regular tidal flux and monsoon fresh water runoff to neutralise the acidity and sulphur content of the soil. The increase in acidity and sulphur content of the soil render the wetlands unsuitable for farming besides increase in growth of undesirable

species of plants. The decrease in salinity in certain areas of Pokkali wetlands have resulted in excessive growth of exotic weed-water hyacinth, *Eichhornia crassipes*, the total removal of which is practically difficult.

Figure 6: Growth of exotic weed, *Eichhornia crassipes*, in Pokkali wetlands

Figure 7: Destruction of Kaipad wetlands of North Kerala

The only remedy to prevent conversion/reclamation of wetlands like Pokkali/Kaipad is to ensure its economic utilisation for livelihood support to the local community, which also ensures the ecosystem services including carbon sequestration. Generally paddy soil, especially coastal soil, sequesters more carbon than upland soil. At a given C input, the C sequestration efficiency was greater in paddy soil than in upland soil, which may be attributed to lower microbial activity but greater chemical (i.e., oxalate-soluble Fe) and physical stabilizations (i.e., soil structure) in paddy field. Research indicate that paddy soil may sequester more SOC, with higher efficiency, than upland soil does.[4] In Pokkali/Kaipad system since most of the vegetative part of the paddy is left in the field to add to the sediment and the post-harvest vegetation also add to the soil sediments, C sequestration efficiency would be much more.

1.3 Selection of project sites

In order to select 600 hectares for the project (300 hectares of Kaipad land from Kannur District and 300 hectares of Pokkali land from Ernakulam, Thrissur and Alappuzha districts) a survey of Kaipad and Pokkali lands were carried out. In the tables below we provide the details of the surveyed Kaipad and Pokkali lands.

Table 3: Surveyed Kaipad lands in Kannur District

Sl No.	Location(Grama panchayat / Municipality/ Corporation)	Area (Ha)
1	Mundari	20
2	Kolachery	20
3	Pattuvam	20
4	Cherukunnu	30
5	Chirakkal	202
6	Chelora	35
7	Ezhome	65
8	Dharmadom	15
9	Eranholi	20
10	Pinarayi	20
11	Narath	10
12	Ramanthali	5
	TOTAL	**462**

Table 4: Surveyed Pokkali lands

Kochi Taluk

Sl. No.	Location(Grama panchayat / Municipality/ Corporation)	Area (Ha)
1	Nayarambalam	31.00
2	Narakkal	14.00

[4] (Crooks, S. et al. 2011)

3	Elamkunnapuzha	8.00
4	Kumbalanghi	44.00
5	Chellanam	26.00
	Sub Total	**123.00**

Kodungallur Taluk

Sl. No.	**Location(Grama panchayat / Municipality/ Corporation)**	**Area (Ha)**
1	Poyya	13.00
2	Mala	5.00
3	Puthenchira	16.00
4	Vellangallur	42.00
5	Kodungallur	24.00
6	S.N.Puram	1.00
	Sub Total	**101.00**

Cherthala Taluk

Sl. No.	**Location(Grama panchayat / Municipality/ Corporation)**	**Area (Ha)**
1	Ezhupunna	38.00
2	Kuthiathode	8.00
3	Kodamthuruth	32.00
4	Thuravoor	29.00
	Sub Total	**107.00**

Once the project begins we will begin the process of site selection at the micro-level through the use of an extensive list of selection criteria. The official selection criteria developed by the Department of Fisheries has been provided below for reference:

Figure 8: Selection criteria for Pokkali and Kaipad lands for project activity

Agency For Development of Aquaculture ,Kerala(ADAK)

Paddy/shrimp culture project-Grading chart

		Maximum Mark	Mark obtained by group
1.	**Culture fields proposed by the group**		
a.	Owned by Group	10	
b.	Leased by Group	5	
a.	Suitable for paddy/shrimp culture	10	
b.	Can be made suitable for paddy/ Shrimp culture	5	
a.	Operational throughout the year	10	
b.	Operational in one season only	5	
2.	**SC representation in the group**		
a.	Above 50%	10	
b.	Between 25-50%	8	
c.	upto 25%	7	
d.	No representative	6	
3.	**Residing place of Group members**		
a.	Near to the culture field	10	
b.	Around one km	8	
c.	Outside 1 km	5	
	Total Marks	**50**	

Place

Date

Name of grading committee members

Signature,Designation

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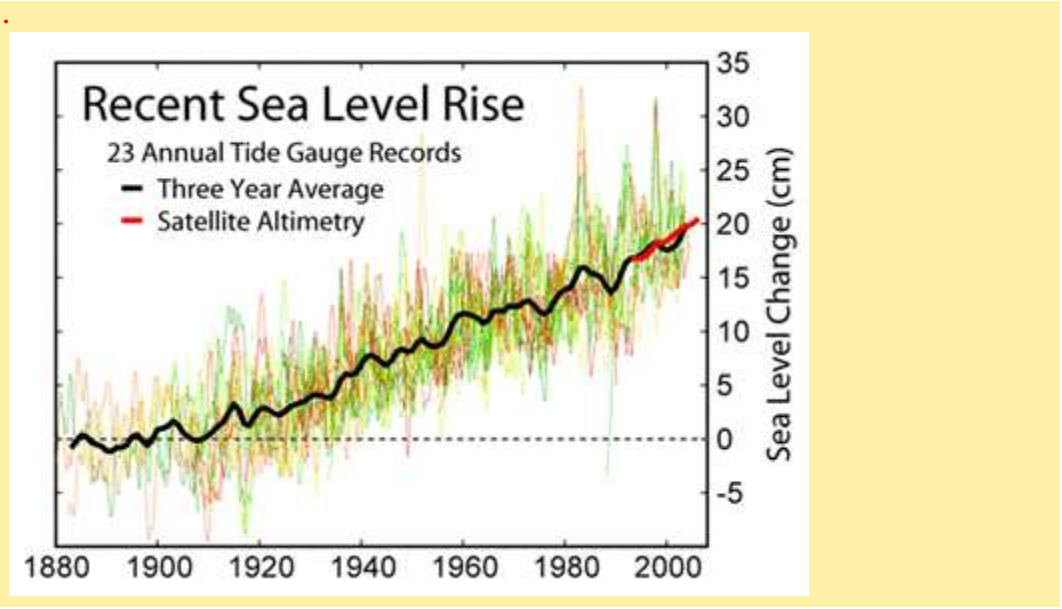
1.4 Pokkali/Kaipad wetlands and sea level rise

Since the mid-19th century, sea level has been rising, primarily as a result of human-induced climate change. During the 20th century, sea level rose about 15-20 centimetres (roughly 1.5 to 2.0 mm/year), with the rate at the end of the century greater than over the early part of the century. Satellite measurements taken over the past decade, however, indicate that the rate of increase has jumped to about 3.1 mm/year, which is significantly higher than the average rate for the 20th century. Projections suggest that the rate of sea level rise is likely to increase during the 21st century.

Figure 9: Sea-Level Rise Trend



Source: wildwildweather.com

According to the IPCC, even the best-case scenarios indicate that a rising sea level would have a wide range of impacts on coastal environments and infrastructure. Effects are likely to include coastal erosion, wetland and coastal plain flooding, salinization of aquifers and soils, and a loss of habitats for fish, birds, and other wildlife and plants. The Environmental Protection Agency estimates that 26,000 square kilometres of land would be lost should sea level rise by 0.66 meters, while the IPCC notes that as much as 33% of coastal land and wetland habitats are likely to be lost in the next hundred years if the level of the ocean continues to rise at its present rate. Even more land would be lost if the increase is significantly greater. And this is quite possible in Kerala where there is shift or increase in extent of wetlands like Pokkali and Kaipad with increase in salinization, the adaptive measure for these wetlands would be farming of saline tolerant tall paddy varieties and farming of euryhaline species of fish and shrimps.[5]

[5] Sea-level rise and projections for Kerala, Dept. of Environment, details in Page number 29 and 30 (SAPCC Kerala, 2014).

1.5 Climate change and wetlands

There is overwhelming consensus amongst climate scientists that the Earth's warming in recent decades has been caused primarily by human activities that have increased the amount of greenhouse gases (GHGs) in the atmosphere. To mitigate the most serious impacts of climate change a range of different strategies to lower GHG concentrations in the atmosphere are required. One approach is to reduce the emissions from human activity and another one is to prevent or reduce emissions from natural sources. Vast amount of organic carbon is retained in water bodies and sediments. Healthy coastal wetlands store vast amounts of organic carbon in sediments and biomass. This carbon is released as CO_2 into the atmosphere when ecosystems are damaged or lost. Ongoing coastal ecosystem conversion and degradation, in many places exceeding the rates of ecosystem loss on land, lead to continuous and significant emissions. Working with nature to reduce GHG emissions and to enhance carbon sequestration—or ecosystem based mitigation—is not a new concept. The United Nation Framework Convention on Climate Change (UNFCCC) as well as the Kyoto Protocol make clear reference to reducing emissions by sources and removals by sinks in natural systems. Coastal wetlands and marine ecosystems sequester carbon within standing biomass, but even more within soils. In many cases these peat-like soils have been continuously building for over 5,000 years, or longer.[6] **Wetlands in saline environments have the added advantage of emitting negligible quantities of methane, a powerful greenhouse gas, 25 times potent than CO_2**[7], whereas methane production in freshwater systems partially or wholly negate short-term carbon sequestration benefits. **However, over multi-century time scales all coastal wetlands are net GHG sinks**. The formation of methane occurs in low salinity or non-saline environments and requires strictly anaerobic conditions. Methane production is generally intense in brackish and freshwater tidal flats and marshes because of the high organic matter content of the soils at anoxic depths. Methane production decreases by two orders of magnitude, to negligible levels, as salinity increases to roughly ½ that of seawater because of the impact of sulphate on biogeochemical processes.[8]

1.6 Carbon sequestration by Coastal wetlands and near-shore marine ecosystems

Coastal wetlands consist of a mosaic of habitat types that include mudflats, salt marshes, brackish marshes, mangroves, freshwater tidal wetlands, and high intertidal forested and scrub wetlands, and coastal peat lands. All coastal wetlands are long term net sinks for atmospheric

[6] Crooks, Stephen; Herr, Dorothee; Tamelander, Jerker; Laffoley, Dan and Vandever, Justin," Mitigating Climate Change through Restoration and Management of Coastal Wetlands and Near-shore Marine Ecosystems Challenges and Opportunities" March 2011

[7] Crooks, Stephen; Herr, Dorothee; Tamelander, Jerker; Laffoley, Dan and Vandever, Justin," Mitigating Climate Change through Restoration and Management of Coastal Wetlands and Near-shore Marine Ecosystems Challenges and Opportunities" March 2011

[8] Crooks, Stephen; Herr, Dorothee; Tamelander, Jerker; Laffoley, Dan and Vandever, Justin," Mitigating Climate Change through Restoration and Management of Coastal Wetlands and Near-shore Marine Ecosystems Challenges and Opportunities" March 2011

CO_2 through production of standing biomass and burial of primarily root and rhizome organic matter in sediment. The amount of carbon stored can be variable depending upon wetland type and landscape setting. Where present, vegetation sequester carbon within soils in a manner very similar to intertidal wetlands, producing deposits of organic rich sediments. Occupying only 2% of seabed area, vegetated wetlands represent 50% of carbon transfer from oceans to sediments.[9] This carbon can remain stored for millennia. Drainage of coastal peat lands, forested tidal wetlands, tidal freshwater wetlands, salt marsh and mangroves emits large amounts of CO_2 directly to the atmosphere, and also leads to decreased carbon sequestration. Improved management of our wetland system would slow or reverse current loss of carbon sequestration capacity. Sustainable management of coastal wetlands and near-shore marine ecosystems also offer a wide range of co-benefits, including shoreline protection, nutrient cycling, water quality maintenance, flood control, habitat for birds, other wildlife and harvestable resources such as fish. Together, these increase the resilience of coupled ecological and social systems to the impacts of climate change. The coastal wetlands of Kerala, occupying 13%[10] of the total geographical area of the state plays important roles in ecology, economy and social well-being of the people. The brackish water tidal mudflats in addition to the carbon sequestration process over the many thousands of years also offer an opportunity for agriculture and aquaculture production for the last two thousand years. The integrated farming system of Pokkali and Kaipad where saline tolerant paddy is cultivated along with integration of fishery offers an opportunity of climate resilient farming practice in the event of the change in climate scenario particularly in the recent decades.

[9] Crooks, Stephen; Herr, Dorothee; Tamelander, Jerker; Laffoley, Dan and Vandever, Justin," Mitigating Climate Change through Restoration and Management of Coastal Wetlands and Near-shore Marine Ecosystems Challenges and Opportunities" March 2011

And

Duarte, C.M., Middelburg, J.J., Caraco, N., "Major Role of Marine Vegetation on the Oceanic Carbon Cycle. Biogeosciences" 2:1–8.

[10] National Wetland Atlas, Kerala (Ministry of Environment and Forest, Govt. of India) (2010)

PART II: Brackish water paddy farming systems of Kerala

2.1 Pokkali farming

The term Pokkali refers to a salt tolerant rice cultivar grown in the coastal saline soils of Kerala. The areas of Pokkali cultivation are famous as Pokkali land and the rice produced in this tract is famous as Pokkali rice. Many value added products are produced from Pokkali rice

Majority of Pokkali lands lie between Vembanad Lake and the Arabian Sea and are distributed in 33 Panchayats, two municipalities and one city corporation area in the districts of Ernakulum, Thrissur and Alappuzha. The fields are submerged with saline water during most of the periods and tidal amplitude has direct impact on the salinity and water level in the field. As distinct from the saline soils elsewhere in India, the origin, genesis and development of these soils are under peculiar climatic and environmental conditions. Soil is stiff impervious clay, rich in organic matter, bluish black in colour and is more than 1 m deep. The soil is hard and it creates deep fissures when dry and sticky when wet. With regard to the nutrient status, the soil is highly fertile with respect to major nutrients

During summer months, due to ingression of salt water from the sea, the soil becomes saline. However, when the salinity is washed off in heavy monsoon rains, the inherent acidity of the soil regenerates. The soil is highly acidic, the pH being 3.0-4.5. Water soluble salts like sulphates and chlorides of Na and Mg are present in high proportion. In dry conditions, white encrustations of aluminium hydroxide develop on the soil surface. With the onset of monsoon, the salinity of the soil gradually decreases and the water becomes fresh and fit for cultivation of paddy. A special system of farming viz. Pokkali rice cultivation has been evolved through ages by the farmers of the area for the maximum utilization of available resources without affecting the ecosystem. After the paddy cultivation, the fields are used for prawn/fish cultivation. In more than 90 percent of single cropped lands, rice cultivation is done during the low saline phase from May-June to September –October. Different stages of Pokkali/ Kaipad cultivation are shown below.

Figure 10: Different stages of Pokkali/Kaipad fields

2.2 Pokkali Varieties and their importance

Pokkali system mainly depends on traditional Pokkali cultivars and high yielding varieties derived from these cultivars. Choottupokkali, Cheruviruppu, Kuruka, Anakodan, Eravapandy, Bali, Orkayama, Orpandi and Pokkali are the traditional cultivars prevalent in this tract. Improved varieties developed from the Rice research Station. Vyttila (VTL-1 to VTL-8) Kerala Agricultural University, are now popular mainly with respect to high yield. Pokkali land races are world famous for their salinity tolerance gene SalTol QTL and are in wide use in the international rice improvement programmes for salinity tolerance. They are also tolerant to soil acidity and submergence, which make them suitable for adaptive agriculture in the event of increasing salinity and submergence.

In a recent study conducted at the Rice Research Station, Vyttila, to explore the medicinal values of Pokkali rice, it is proved that the Pokkali varieties are very rich in antioxidants like oryzanol, tocopherol and tocotrienol. These contents are even higher than that of the medicinal rice njavara. The taste of Pokkali rice is well known particularly rice flour, rice bran, rice flakes and many breakfast items made out of it. The local people of this tract relish the kanji made out of Pokkali rice. The Pokkali rice is rich in amylase content and hence it can be popularized as rice which is good for diabetic patients.

2.3 Kaipad Rice cultivation

Kaipad system of rice cultivation is an integrated organic farming in which rice cultivation and aquaculture go together in brackish water marshes. Rice faming in Kaipad is carried out in a peculiar way in a low to medium saline phase of production cycle during June to October. No-chemicals /organic fertilizers are used in rice farming. Soils of Kaipad have always been naturally fertile. Possible reasons for high fertility of Kaipad areas include organic matter coming along with river water which is from forest waste of mountains, remnants of sea creatures and excretion of migratory birds. Tidal flows make field highly fertile through a symbiotic relationship between rice crop and prawn, shrimp, fish etc. Rice crop draws nutrients from the excrement and other remnants of sea creatures. On Harvest of paddy only the seed part (panicle) is taken as harvest leaving the rest of rice plant to decay in increasing saline water. This decomposing increases fertility of soil and forms food of shrimp and fish in following culture. Another reason for fertility is of high degrading capacity of marine fungi seen in Kaipad.

Rice varieties at Kaipad lands are salt resistant and non-lodging growing to a height of 154 cm on an average. Most common varieties cultivated are Kuthir, Orkayama. Other local varieties which are cultivated at certain pockets of Kannur and Kozhikode districts and need a revival is Chovverian, Kandarkutty, Bali, Kuttoosan, Orpandi and Orthadiyan.

Kaipad varieties are high yielding with an average yield of 3000Kg/Hectares. Harvesting is done by second week of October. Though all are sown at the same period Kaipad variety differs in their time of harvest. Kuthir variety can be harvested by end of October while Orhkyma is ripe enough to be harvested only by second week of November. Since the rice plant is 5-6 feet

long and cannot be carried for long distance only the seed part is taken as harvest leaving the rest of rice plant to decay in increasing saline water.

Kaipad Paddy absorbs large quantities of Carbon acting as a carbon sink. Kaipad and all wetlands avoid carbon emission and is a promising option for climate change mitigation.

2.4 Traditional Shrimp Filtration

Traditional prawn filtration known as chemeenkettu is an age old practice in Kerala .The farming is undertaken in the low lying paddy fields close to the estuaries and lower reaches of rivers. This type of farming is mostly confined in Ernakulum, Thrissur, and Alappuzha Districts in Central Kerala and in some parts of North Kerala.

The preparation for prawn filtration starts soon after the harvest of paddy. By this time the rainy season is over and the salinity of water reaches a level conducive for large scale ingression of post larvae and juveniles of shrimp in the coastal inlets and adjoining rice fields. November-April is the normal period of this filtration. As part of the preparation bunds are strengthened and sluices installed for the exchange of tidal water. In order to facilitate free exchange of water channels are provided along the periphery and centre of the paddy field.

Once the preliminary preparation is over the field is ready for trapping and holding of the shrimp/fish seed. The water is allowed to enter the fields during high tide with great force which carry sizable quantity of shrimp/fish seed. As the force of the incoming tide water decrease, the sluice is closed with shutter plank. With the onset of low tide, water is let out through the sluice fitted with screens to prevent the escape of entered animals and to facilitate entry of water during the next high tide. Once the level of water inside the field has reached a minimum, the sluice is closed with shutter. During the next high tide water is allowed to get in again and the process is repeated for 2-3 months. After this period harvesting of shrimp is carried out during the low tide, using a conical filtration net fitted in the sluice. Water is allowed to pass thorough the net with force during the low tide. The shrimp carried along the water current are collected in the cod end of the filtration net. This type of harvesting is carried out towards the end of the season for about 8 days in a fortnight in the spring tide phase, just before and after the full and new moon. The final harvesting is done by draining the field and resorting to cast netting and even hand pricking.

Figure 11: Traditional sluice gates

Figure 12: Bag net in operation

Figure 13: Harvested shrimp

2.5 Women in Pokkali/Kaipad farming

The total Pokkali lands were originally estimated to be 25,000 hectares. Large areas are converted for coconut cultivation and other purposes. The present area is estimated to be 9,000 hectares. Year by year the area under Pokkali cultivation is declining. The present area under regular cultivation is 2,000 hectares. In another 5,000 hectares paddy cultivation is done occasionally i.e., only when the climatic conditions are favourable.

Kaipad and Pokkali is a traditional indigenous method of cultivation and have a great role in maintaining the eco-system of the region. The raising of fish in paddy fields either together with rice or after the harvesting of paddy is an age-old system. The system of fish culture varies depending on the ecological settings of the rice fields. However it is carried out on a significant scale in the coastal wetlands than on the upland rice fields.

The practice of taking a paddy crop followed by prawn filtration practice provides labour and regular income to the farmers all around the year. The number of farmers involved in regular

Pokkali cultivation is estimated to be 11,605[11]. The total labour involved for Pokkali farming in 207 man days per hectare- 84 men and 123 women. Labour requirement of seasonal Pokkali fields for Chemeenkettu is estimated at 246 per hectare-181 man and 65 women. Pokkali work is generally hard because all the work has to be done in muddy water and without needed expertise it is impossible to do the work. On the traditional front of rice – fish cultivation, due to decline in extent of farming, the labour days of women and their income is systematically getting reduced.

The maximum number of work days for an expert female worker can be calculated as 30 days. In reality an expert female worker can expect 15-20 days of work in one season under the best possible environment. During the seasonal Chemeenkettu, i.e. from December to April, prawn peeling and hand picking of fish are the main source of income for women. During the five months of prawn harvest women get prawns for around 60/70 days. Every month there will be two thakkams (prawn availability period; one thakkam is seven days.). During this time one woman may get around 5 kilos of prawns for peeling. The rate of peeling is ₹ 4/kg for high quality and ₹ 8 for thelly[12]. After Kettukalakkal (final harvest) on April 14, traditional practice of rice/ fish farming the maximum workdays of a female worker can be calculated something like 30 days during Pokkali, 70 days during chemeenkettu and 45 days after kettukalakkal. That is, a total of 145 days per annum. From the available 123 man days /hectares for women, an individual woman is getting hardly 30 days of work due to the large number of women labourers available and the consistent decline in the area of Pokkali cultivation.[13]

Conversion of Pokkali and Kaipad fields can ultimately result in displacement of female labourers who are traditionally farm hands. On the traditional front of rice-fish cultivation the labour days of women and their income is systematically getting reduced. There is displacement. Low wage are forcing women folk to move on to other jobs. Concentration of shrimp peeling sheds is providing job opportunity to these displaced women agricultural labourers. Shrimp peeling sheds are capable of providing 150-200 days of employment to these women. Due to the absence of export oriented peeling sheds the displaced women are not easily absorbed. The age factor along with the geographical structure and lack of transportation facility in the coastal Panchayat prevents the women from finding out job opportunities elsewhere. Moreover our social structure prevents women from migrating.

[11] Shyna, P.A. and Joseph, Sheela," A Micro Analysis of Problems of Displaced Women Agricultural labourers with Special Emphasis to the Pokkali fields of Vypinkara"

[12] Shyna, P.A. and Joseph, Sheela," A Micro Analysis of Problems of Displaced Women Agricultural labourers with Special Emphasis to the Pokkali fields of Vypinkara"

[13] Purushan, K.S. 2004

Figure 14: Women in Pokkali/Kaipad farming

Revival of Pokkali/ Kaipad farming would provide more employment opportunities to the local community especially women folk. Traditionally, in paddy farming, most of the activities like preparation of seed for sowing, sowing of sprouted seed, harvesting, winnowing and other post-

harvest processing are mostly done by women. In traditional shrimp filtration, the sorting of shrimps, its packing is mostly done by women. In addition, collection of shrimps in traditional ways like thappal (hand-picking of shrimps), and therakkal (aggregation and collection of shrimp in shallow waters) are common in Pokkali/ Kaipad wetlands which also give additional income to women. Fodder from Pokkali/ Kaipad wetlands support cattle rearing of nearby areas, which also provides additional income mainly to women.

PART III- The Proposal

3.1 Introduction

The proposal is to revive 300 hectares of Pokkali wetlands (100 hectares each in Thrissur, Ernakulum and Alappuzha districts) and 300 hectares of Kaipad wetlands in Kannur districts. For this extensive earthen bunds have to be constructed along the margin of the rivers/backwaters (marginal bunds) and along the periphery of each paddy polders (padasekarams). An adequate number of sluice gates have to be provided to regulate water level and to facilitate fish/shrimp harvest. Suitable species of mangroves will be planted along the periphery of the marginal bunds to protect the bunds from damage due to heavy monsoon fall, waves, increase in water level and tidal surges. Though 5 hectares is proposed as an individual unit to be taken up by each beneficiary group, many such units can be clustered in a common wetland, farming activity taken by all beneficiaries groups together. The developmental/farming cost for each unit on an average comes to 20.815 lakhs. It is expected that the revival of Pokkali/Kaipad farming would result in considerable increase in production of paddy and fish from these wetlands, giving more employment opportunities to local people, especially rural women.180 number of man-days of work will be generated from each hectare of these wetland so that revival of 600 hectares of wetlands would generate.1, 21,680 man days employment in an year, of which 43,200 number would be for women. 2.5 tonnes of paddy and 0.75 tonn of fish/shrimp are expected to be produced from each hectare of wetland, so that a total of 1500 tonnes of paddy and 450 tonnes of fish can be produced in a year from 600 hectares of such wetlands. Total revenue generated from paddy fish production from 600 hectares would be to the tune of 23.25 crores/year.

3.2 Project Objectives

The main objectives of the proposal are

- To provide the main infrastructure facility of strong outer bunds for wetlands and with sufficient height to withstand the rise in sea level, flood and sudden tidal surges due to climate change.
- To promote adaptive farming practices by using tall varieties of salt tolerant paddy and integrating fishery with euryhaline fish/shrimp species in the event of rising water level and salinity in coastal wetlands in the event of climate change.
- To enhance overall productivity of the wetland eco-system culture and pisci culture.
- To sustain paddy cultivation and reduce cost of production.
- To increase per capital income of farmers and labourers and to generate more employment opportunities in rural areas.
- To increase foreign exchange earnings through increased exports of shrimp.
- To maximize the inland fish production through sustainable aquaculture.
- To ensure ecosystem service provided by these wetlands in the event of global climate change.

3.3 Project Components and Financing

Table 5: Project components and financing

No.	Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (crores`)
1.	Bund/ embankment formation with sluice gates at required intervals and to provide other facilities to operate the farms	Construction of a strong earthen bund Construction of sluice gates at regular intervals in order to regulate water level and to facilitate fish harvest and water management	Retain water level to support paddy and fish farming by preventing un necessary influx of water and to prevent the escape of farmed animals and spread of disease Regulate water level in paddy polders, facilitate water exchange, fish harvest and to check entry of high saline water to potable water sources.	15.7136
2	Shrimp Farming (summer crop)	Production of shrimp twice in a year increasing earnings for local farmers	Generation of additional livelihood options for local farmers Reclamation of land threatened by sea level rise Reduce displacement of labourers from nearby areas	4.8109
3	Rice and Shrimp Farming	Simultaneous cultivation of rice and shrimp / fish during one season (monsoon season) in low lying wetlands where there was previously no cultivation	Generation of additional livelihood options for local farmers Reclamation of land threatened by sea level rise Reduce displacement of labourers from nearby areas	4.4536
4	Capacity Building for Farmers			0.0992
5	Survey Expenses, Verification, Extension & Awareness Creation & documentation			0.30

No.	Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (crores`)
6	Mid Term and Final Review			0.50
7	Contingency			2.5877
8	Project Managerial expense to executing entity			4.2697
9	Fee for Project implementation Entity			0.9962
	Total Project Cost			33.7309

3.4 Projected Calendar

The farming calendars for Pokkali and Kaipad farming has been provided below:

Figure 15: Pokkali Farming Calendar

S.No.	Activity	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Soil Preparation for Paddy Cultivation												
2	Paddy Sowing												
3	Paddy culture												
4	Harvestof Paddy												
5	Preparation for Shrimp/ fish Farming												
6	Shrimp/fish Farming												
7	Shrimp/ Fish Harvest												

	Shrimp/Fish Crop
	Paddy Crop

Figure 16: Kaipad Farming Calendar

S.No.	Activity	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	Land Preparation for Paddy Cultivation												
2	Release of fish/ shrimp seeds after planting of paddy												
3	Paddy Farming (1st crop)												
4	Shrimp Farming (1st crop)												
5	Pond Preparation for shrimp/ fish farming (2nd crop)												
6	Shrimp/ fish Farming												

	Shrimp Crop
	Paddy Crop
	Combined activities for shrimp and paddy

3.5 Awareness/capacity building

Before beneficiary selection is carried out, awareness programmes would need to be conducted in potential areas of Pokkali/kaipad wetlands so that beneficiaries would be motivated to taken up farming activities. Thereafter process of beneficiary selection would be started with the help of LSG's. Selected beneficiaries would be imparted training in all aspects of integrated paddy-shrimp farming practices. Survey of all Pokkali and Kaipad lands would also be done during the first year of the project.

3.6 Project Justification

3.6.1 Component-wise details and justification of the project components

(i) **Bund/Embankment formation**

Baseline Scenario-

The bunds that currently exist were built decades earlier and are in a state of disrepair. In many area bunds are almost non-existent. In the absence of paddy farming and shrimp filtration, the annual maintenance work of bunds and sluices are not done. Due to this, more salt water from the sea routinely enters into adjoining the Kaipad/Pokkali lands and seeps into adjoining fresh water areas. The sea water intrusion is also causing coastal erosion and large tracts of Pokkali or Kaipad area are being left fallow due to increased flow of tidal water into these areas in the absence of proper bunds and sluices.

Figure 17: A view of Kaipad fields with weak bunds

Adaptation Activities-

The Kaipad/Pokkali wetlands, which have remained fallow for the last 5-50 years, are envisaged to be brought back to farming in the present project. Construction of earthen bunds

on the margin of rivers/backwater (marginal bunds) and peripheral bunds (on the periphery of padasekarams) form an important activity in the project for proper regulation of water level to support both paddy farming and fish farming. For this, damaged bunds will be rebuilt. New bunds will be formed in areas where there is no bund at present. Near the riverside, bunds will be raised and strengthened to prevent overflow and flooding. Sluice gates with shutters will be provided to regulate water flow into the Kaipad or Pokkali farms in appropriate places. Outer margin of the bunds along the riverside would be planted with suitable species of mangroves or its associates so as to provide protection to these bunds. Channels which gradually slope towards the sluice gate will be provided along the inner margin of the peripheral bunds while excavating soil for bund formation. Shrimp can retreat to these channels when the water level is low. A nylon / velon mesh screen will be fixed on the sluice to prevent the escape of shrimp to the back waters/ river. Adequate height has to be provided to the bunds and sluices to meet the uneven rise in water level due to flooding/tidal surges. In appropriate places where more than one unit will be clustered together with a common embankment and sluice gate. This will help to reduce the capital cost and enhance the profitability of the project. In the case of such clustering, the units will be brought in to a single umbrella organization.

Figure 18:Bund Formation in Pokkali & Kaipad fields

Figure 19: Sluice construction in Pokkali & Kaipad fields

Contribution to climate resilience-

The earthen bunds and sluice gates will prevent and regulate the seepage of saline water into the land adjoining the Pokkali/Kaipad land. This will improve the quality of the fresh water sources as well as reduce coastal erosion. The planting of mangrove trees will further reduce erosion, improve soil quality and enhance biodiversity.

Mangroves for bund protection

Mangroves extensively grow on intertidal mud flats. They protect the shore area from erosion besides increasing biodiversity of the wetlands. It also acts as a safe place for many aquatic fauna, serving as nursery ground for many fish, shrimp, and crabs. It generally increases the fish wealth of the wetlands. Its role in protection of wetlands and adjoining lands in storms and sudden sea surges are evident in the tsunami related incidents. They act as protective cover for the wetlands in many areas. Mangroves ridge formation is an adaptation from sudden waves and tidal surges. If suitable species of mangroves and mangrove associates are planted along the outer periphery of the marginal bunds, it would provide adequate protection to these bund from vagaries of monsoon rainfall, storms, waves and tidal surges, so that cost for annual maintenance of the bunds would be very much reduced. Species suitable for planting along the periphery of the marginal bunds are *Rhizophora mucronata, Rhizophora apiculate, Avicennia officianalis and Avicennia marina.*

Figure 20: Mangrove ridge along Kuppam river in Kannur district, Kerala

Species suitable for planting along the peripheral bunds are smaller species like *Aegiceras corniculatum, Kandelia candel, Bruguiera sp.* etc. and many mangrove associates. Root systems of mangroves are very effective at binding of soil. Many of the mangroves and mangrove associates have varied economic use to local people including medicinal use. Leaves of *Avicennia caseolaris* and *Avicennia marina* are used as cattle/goat feed, rich in protein content. Many of the plant species which are considered as mangrove associates are also useful for preventing erosion and bund protection. Species like Cyperus, Fimbristylis, Cynodon, etc. can also be planted along the periphery of the bunds.

Figure 21: Mangrove species useful for coastal protection

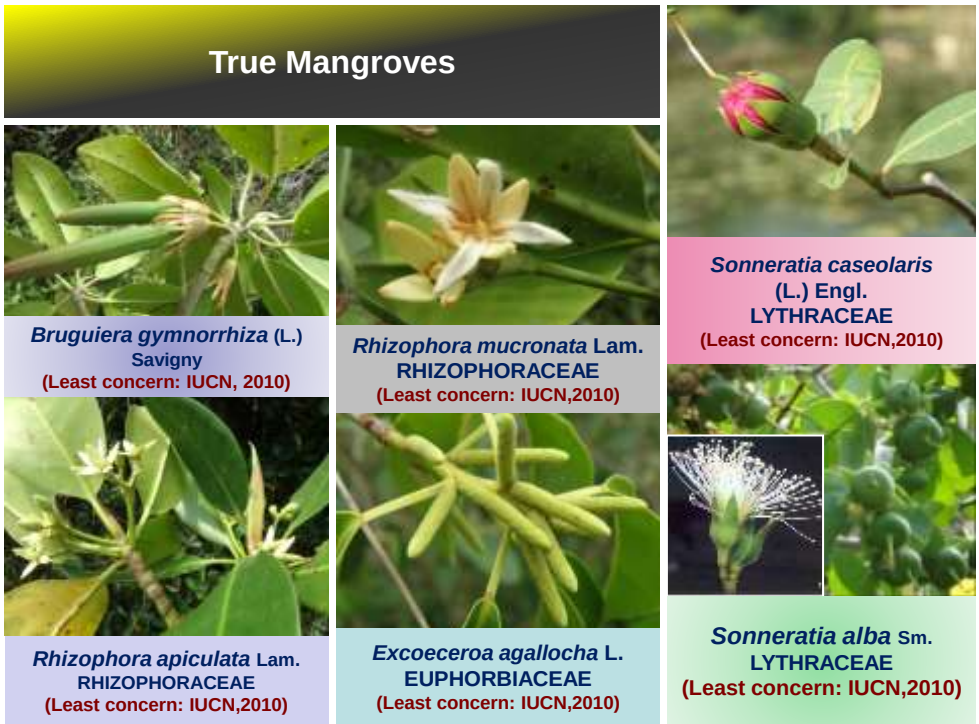


Figure 22: Root system of mangroves




(ii) Rice farming

Baseline Scenario-

Currently the Kaipad/Pokkali land has been lying fallow for many years and are in threat of reclamation for other plantation like coconut or are used for other purpose with no ecologic benefits and no economic benefits are derived to local population. Due to lack of proper bunds, over flow high saline water in certain periods of the year, make rice farming impossible.

Adaptation Activities-

Kaipad/Pokkali farming practice is unique. In this, no fertilizer or insecticides are applied. The soil is acidic and saline. Initial application of lime and dolomite improves the soil condition. The land is sun dried for about six weeks during April- May. The sun drying improves the fertility of the soil. Rice seeds are sown on mounds. For this, mounds are prepared by scoops of soil. Mount preparation is completed before the onset of monsoon. A few showers of monsoon wash away the excess salinity and acidity on these mounts creating a favourable condition for seeds to sprout. Seeds which are about to sprout or just sprouted (by soaking in water for a day and kept in shade for another day) are sown on the mounds.

Figure 23: **Pokkali/Kaipad paddy varieties can withstand vagaries of climate change**

The seedlings will be ready for scattering by July. For this the seedlings on mounds will be scooped with hoe and scattered throughout the field. In Kaipad/Pokkali farming transplantation as practiced in modern rice farming is not done. There is no purposeful removal of weeds in this farming system.

The paddy is ready for harvest by October and harvesting in all fields can be completed by the end of October. Mechanization for harvest is not feasible in knee deep mud of Kaipad/Pokkali lands.

Contribution to climate resilience-

Rice farming on the Kaipad land will be done in an organic manner minimizing the environmental impact of farming. The farming activities will also help in the reclamation of land and will reduce coastal erosion. The farming activities will also improve local soil quality. This project envisages the use of saline resilient paddy varieties which will be able to adapt to the saline content in the Pokkali/ Kaipad soil. During the monsoon season, the salinity levels falls enough to allow rice farming using saline resilient varieties. This activity will generate livelihoods and improve the disposable incomes of local farmers. No inorganic fertilizer or pesticides are used for the farming operation. **Use of saline tolerant traditional rice varieties offer an opportunity in future for adaptive farming of paddy in saline affected areas due to inundation of coastal wetlands and salinisation of the adjoining wetlands due to sea-level rise**. Gene pool of this paddy has already been utilised by agriculture scientists for development of high yielding varieties of paddy for farming in saline areas as an adaptive agricultural practice.

Figure 24: Development of HYV of Kaipad paddy by KAU

(iii) Seasonal filtration (shrimp culture after the harvest of paddy)

For seasonal filtration the channels in Kaipad/Pokkali lands are cleared and bunds and sluices repaired in the month of November. Application of lime to a low level is recommended during this period. Tidal water is allowed to enter the field which brings in the seeds of fin fish and shell fish. The flooded condition during December – February period is ideal for growth of fishes. Supplementary stocking of *Penaeus monodon /Penaeus indicus* will be done in the month of November to January. Water level and water exchange in Kaipad will, be regulated through sluices. Peak harvest season is from March to the middle of April when tidal level starts receding.

In Pokkali fields also bunds will be heightened and strengthened to control the over flow and to facilitate to water control and water quality management. The sluice gates are fixed with screens to prevent escape of animals and facilitate trapping of stocked animals. Supplementary stocking is done with *Penaeus monodon* seeds. Supplementary feeding will be done. The shrimp is grown for 3-4months and harvested in Thakkams in March-April months.

Contribution to climatic resilience-

Shrimp farming on the Kaipad/Pokkali land will be done in an organic manner minimizing the environmental impact of farming. The farming activities will also help in the reclamation of land and will reduce coastal erosion. The farming activities will also improve local soil quality. The rice cum shrimp farming will have symbiotic benefits. The increase in salinity of water is not deterrent to shrimp farming as saline water is actually preferred. Use of euryhaline species of shrimp/fish for farming is an adaptive strategy in the event of climate change and related increase or decrease in salinity of water. This activity will generate livelihoods and improve the disposable incomes of local farmers.

(iv) Shrimp / fish and rice farming

Baseline Scenario-

Currently the Pokkali/Kaipad land has been lying fallow for many years and no economic benefits are being derived from it. Due to the current condition of the bund and sluice gates it has become impossible to regulate the flow of water thereby preventing shrimp/paddy culture. In Pokkali fields only paddy cultivation is possible in monsoon months due to the traditional right of the fishermen/agricultural labourers to fish in canals of paddy fields in these months. So paddy cultivation is only proposed in Pokkali fields during monsoon.

Adaptation Activities-

Rice farming and monsoon filtration

Shrimp culture is practiced during cropping period of paddy i.e. during monsoon in Kaipad lands. The shrimp/fish seed brought into the Kaipad fields are allowed to grow there for a period and then captured at the sluices using a conical bag net during low tide time. The capture is done during a few days associated with the full moon and new moon called 'thakkom'. Since natural recruitment by tide is less supplementary stocking of seeds is proposed to be undertaken. Tiger Shrimp (*Penaeus monodon*) is ideal for stocking during monsoon when salinity is very low.

For monsoon fishery the channels of Kaipad is cleared and bunds repaired by the month of May. Seed of shrimp is stocked @ 20,000 per hectare or fish @ 1500 fingerlings per hectare of WSA (water spread area) in the third week of June in the Nursery and then released throughout the field when scattering of mounds with paddy seedlings is completed. Shrimp seed is obtained from hatcheries. Fishes like Mullet, Pearl Spot, Milk Fish (*Chanos chanos*) etc. are also stocked @ 1500 per hectare according to the availability of seed. No additional feeding is required for fish. Harvesting can be started in September and completed immediately after the harvest of paddy. Milk fish fingerlings are expected to be grown to 400 gm. in 6 months.

3.7 Details on Economic, Social and Environmental benefits of the project

Table 6: Economic, Social and Environmental Benefits of the project

No.	Components/ Activities	Key Benefits (Direct)		
		Social	**Economic**	**Environmental**
1.	Bund / embankment formation and plantation of mangrove and mangrove associates.	Improved quality of life for local farmers through higher disposable incomes with job opportunities. Improved access to fresh water as peripheral bunds will prevent seepage of sea water to fresh water sources.	As there is high demand for shrimp paddy within Kerala and also there is export demand for shrimp, the project will be financially sustainable.	Bunds will act as a barrier against wave action and sudden sea surges and prevent coastal erosion. It will protect freshwater sources from seepage of saline water in to it. The plantation of mangrove trees around the bund will improve soil conditions and protect biodiversity.
2.	Rice Farming	Improved quality of life for local farmers through higher disposable incomes Capacity Building Protect eco-friendly rice farming practice and the indigenous organic type of rice	Given the high local demand for rice, the project activity would improve the disposable incomes of local farmers and ensure food security.	The project activity aims to use organic farming practices which would eliminate the run-off of chemical fertilizers and pesticides since natural fertilizers would be used. Protecting local biodiversity through the use of local paddy varieties.
3.	Shrimp Farming	Improved quality of life for local farmers through higher disposable incomes Capacity Building Increase job opportunities to agricultural labourers and fishermen	Given the healthy demand for shrimp (both local and international), the project would improve the disposable incomes of local farmers and will help in improving export and earning Foreign exchange	The project activity aims to use organic farming practices which would eliminate the run-off of chemical fertilizers and pesticides since natural fertilizers would be used Improvement of soil quality leading to improved rice yields as well as fish production Protecting local biodiversity through the use of indigenous fish/ shrimp varieties

No.	Components/ Activities	Key Benefits (Direct)		
		Social	**Economic**	**Environmental**
4	Rice and shrimp farming	Improved quality of life for local farmers through higher disposable incomes. Capacity Building Increase job opportunities to agricultural labourers and fishermen.	Given the high local demand for rice, the project activity would improve the disposable incomes of local farmers and ensure food security. Given the healthy demand for shrimp (both local and international), the project would improve the disposable incomes of local farmers and will help in improving export and earning Foreign exchange Rice and shrimp farming reduce the cost of production of both rice and shrimp and give a dual crop from the same land at a time	The project activity aims to use organic farming practices which would eliminate the run-off of chemical fertilizers and pesticides since natural fertilizers would be used. Protecting local biodiversity through the use of local paddy varieties improvement of soil quality leading to improved rice yields as well as fish production Protecting local biodiversity through the use of indigenous fish/ shrimp varieties

3.8 Sustainability intervention and negative impacts

Since farming is practiced in an organic way (without the use of any inorganic fertilizers and pesticides), no adverse impact on environment is expected. Planting of mangroves on the outer boundary of the bunds (on the river side) protects the bunds and creates a favourable condition for increased biodiversity and for improvement of fishery wealth. Besides, the dead and decayed mangrove vegetation increases the overall fertility of the wetlands. Bunds with mangroves along the river side act as a barrier to wave action and sudden sea surges.

Management of wetland like Pokkali/Kaipad offer the following, in addition to other ecosystem services provided to the local community.

- The straw and stubble retained in the rice field after paddy harvest can be profitably utilized for fish culture as they provide nutritious decrial supplements for fin fish/prawn.
- Integration of shrimp/fish in rice will not only improve rice yield and fertility status, but also check the pest and weed problems and avoid the use of pesticides, weedicides and inorganic fertilizers.
- Rice/shrimp rotational practice will check the present undesirable trend of reclamation of wetland.

- Rice shrimp rotational practice round the year check the use of the wet land as space for waste disposal
- Utilization of rice field for shrimp culture, especially during the flood season will help to reduce flood effects as it provided large surface area to accommodate flood waters.
- This will provide year round livelihood to the farmers.

Studies conducted by Kerala Agricultural University (KAU) have proved that rice- fish sequential farming is economically profitable for both small and large padasekarams.

Possible Negative impacts:

- Spread of mangroves inside the paddy field, in the event of fallowing of lands for a few years, will make it unsuitable for paddy farming in the future;
- Accidental stocking of shrimp seed affected with diseases cause spread of diseases in nearby water bodies;
- Turbidity of water maybe increased locally while scooping of mud for bund construction, which may disturb aquatic fauna for a few days.

3.9 Analysis of the cost-effectiveness of the proposed project

(i) A comparison of the chosen options vis-à-vis alternative options has been provided in the table below:

Table 7: List of proposed activities and benefits

No.	Proposed Activity	Baseline	Alternatives	Benefits of proposed Activity
1	Earthen bund formation	Currently bunds are repaired annually by individual farmers	Permanent bund construction using reinforced cement concrete	Reduced cost of construction. No adverse ecological impact. Increased biodiversity
2	Construction of traditional wooden sluice gates along bunds	Currently sluice gate are repaired annually by individual farmers	New sluice gates using reinforced cement concrete	Reduced cost of construction. No adverse ecological impact. Easy for repair. Operational convenience. Can be translocated to suitable locations if needed.
3	Planting mangroves	Mangroves are currently rarely planted in an effective manner	Use of geo-textiles to cover/ protect bunds	Strengthen the bunds from breakage so that annual maintenance would be minimal, Increase the biodiversity and productivity of the wetland Reduced cost
4	Paddy farming	Paddy farming is declining due to rising salinity and	Reclamation for other	The ecological role of wetland is protected. Ecosystem services provided by the wetlands are

No.	Proposed Activity	Baseline	Alternatives	Benefits of proposed Activity
		paddy and shrimp farming does not occur simultaneously	agricultural/infrastructure facilities	ensured. Increase biodiversity and fishery wealth
5	Shrimp / fish farming	Currently shrimp/fish farming is not very productive due to low productivity	Traditional filtration	Supplementary stocking with selected high value species and other inputs increase the production and productivity and income so that farmers are motivated to take up both paddy and fish farming. Take active participation in protection of wetlands as it gives more economic benefit to the farmers

(ii) The funding allocation for investment activities, capacity building activities and project management activities has been provided in the table below:

Table 8: Funding allocation break-up

Type of Activity	List of Activities	Funding Requirement in (Rs Crores)
Investment Activities	► Construction of bunds and sluice gates ► Preparation of Kaipad/Pokkali land for shrimp and rice farming ► Purchase of shrimp and rice seeds for first year	24.9781
Capacity Building Activities	► Capacity building of local farmers to cultivate shrimp and rice in Kaipad/Pokkali land ► Capacity building to maintain bunds and sluice gates	0.09920
Project Management Activities	► Monitoring of the project ► Co-ordination between various stakeholders ► Oversight of operational activities ► Nodal point for Mid-year Review and Final Review	4.2697

3.10 Alignment with the National and State Action Plans and other Policies / Programmes

This project is aligned with both the National Action Plan on Climate Change (NAPCC) as well as Kerala's State Action Plan on Climate Change (SAPCC). Under the NAPCC this activity would fall under the National Mission for Sustainable Agriculture. In SAPCC for Kerala, in the part of Climate Change Vulnerability Assessment of Kerala, it was mentioned that arable land along the coast lines are bound to be reduced as an intrusion of saline water. Coastal erosion, submergence of shorelines could mainly affect agriculture through inundation of low lying lands. This proposal is to promote an adaptive agriculture and aquaculture practice in the context of increase in salinity and flooding of coastal wetlands in the event of climate change, by the use of saline tolerant tall varieties of paddy and euryhaline fish/shrimp species. Concerns on loss of water spread area due to reclamation of backwaters for the purposes of agriculture, urbanization, housing, aquaculture, port constriction, etc. brought about a reduction in the extent of backwaters in Kerala were expressed in the action plan. This proposal, among other economic, ecological and social benefits would also help in protecting the wetland. In sector wise key strategies of the SAPCC under Fisheries and Coastal Resource, among other activities, suggest, Promotion of Sustainable inland fisheries activities, Mangrove Conservation, Sustainable Livelihood Approach of fishermen Community etc. This proposal covers these important aspects.

3.11 Component-wise Technical Standards

Table 9: Technical standards

Sl. No	Activity	Applicable Standard	Application to Project
1	Bund formation	CPWD rate	The rate for bund formation is as per CPWD rate 2014
2	Shrimp farming	As per GMP of CAA	The stocking density is as per CAA guidelines There is no use of antibiotics, chemicals. Water quality is maintained as per CAA guidelines. Guidelines have been issued by Coastal Aquaculture Authority of India, Under Coastal Aquaculture Authority Act, 2005 for shrimp farming. (http://caa.gov.in/uploaded/doc/Guidelines-Englishnew.pdf). Maximum stocking density allowed for shrimps- *Penaeus monodon* and *P. indicus* is one lakh numbers per hectare. Registration certificates issued by CAA, shows the permitted stocking density of shrimps. In integraed farming systems low stocking density is preferrered. In this proposal,

			maximum stocking density suggested for shrimp is only 40,000 numbers of Post larvae per hectare. The stocking density suggested for fish like *Chanos chanos* (Milk fish) is only 4000/hectare. No chemicals of any kind, except lime and dolomite, are used in Pokkali/kaipad shrimp farming, which is permitted. Farmer groups selected for this project would be registered under CAA, and guideline issued by CAA would be followed in aquaculture.
3	Rice farming	As per norms of Department of Agriculture	Lime and dolomite are used for paddy farming, which are used in organic farming. No other fertilizers or chemicals of any kind are used in integrated organic farming system of Pokkali/kaipad

3.12 Duplication Check

Table 10: Duplication Check

1) A Pilot project on Fin fish culture in Pokkali fields of Ernakulum and Thrissur district – RKVY – NIRAVU

Government have accorded administrative sanction for the implementation of the following projects under RKVY 'Niravu Programme' during 2012-13 with a total cost of ₹94.5 lakhs and Government share ₹47.25 lakhs each in North Paravur and Kodungallur constituency.

a) A pilot project on Fin fish culture in Pokkali fields in North Paravur constituency in Ernakulum district – Targeted area of 30 ha covered under the scheme 23 farmers are benefited and infrastructural development works done. 2,40,000 nos. of fish seed stocked.

b) A pilot project on Fin fish culture in Pokkali fields in Kodungallur constituency in Thrissur district. Targeted area of 30 ha covered under the scheme. 18 farmers are benefited and infrastructural development works done. 2,40,000 nos. of fish seed stocked. The amount was fully utilized and Utilisation Certificate was submitted on 14-8-2013 & 24-9-2013.

By utilizing the amount fish culture in Pokkali field was carried out in 98.63 ha area, 123.85 ton fish was produced and 72 nos. of farmers were benefited.

2) Upgradation of traditional filtration fields for increasing shrimp production

As per G.O(Rt) No.1425/09/AD dated 14-8-2009 Administrative sanction was accorded for this project at a total cost of Rs.57.60 lakh. The target was to develop the infrastructure in 100 ha and Development of Aquaculture in 135 ha. The project was completed and the amount was fully utilized. Utilisation Certificate was submitted on 22-7-2011. By utilizing the amount 490.07 ha area was developed. 549.9 ton shrimp was produced and 168 farmers were benefited.

3) Ecofriendly Shrimp culture in Pokkali fields of Alappuzha, Ernakulum and Thrissur districts 2012-13

As per G.O (Rt) No.485/12/F&PD dated 11-6-2012 Administrative Sanction was accorded for this project for a total cost of ₹100 lakh.

The programme target was to develop 60 ha area during 2012-13 with the budget provision of ₹100 lakhs (Government budget 2012-13 under the Head of account 2405-00-101-71).

An area of 443.31 ha was covered under the scheme. 134.03 lakh nos. of shrimp seeds were stocked. 34497 kg shrimp harvested. The Utilisation Certificate was submitted on 27-2-2013 and 30-5-2013.

4) Ecofriendly Shrimp culture in Pokkali fields of Alappuzha, Ernakulum and Thrissur districts 2013-14

As per G.O(Rt) No.833/2013/F&PD dated 7-10-2013 Administrative sanction was accorded for an amount of ₹100 lakh. The amount was fully expended and Utilisation Certificate was submitted on 31-1-2014. By utilizing an amount of ₹100 lakh, ₹177.13 ha Pokkali fields was developed and stocked with 46.26 lakh *P.monodon* seeds. 5964m^3 bund constructed. Shrimp production is 630kg/ha.

5) Promotion of rice cum Shrimp farming in Kaipad lands -2012-13

Administrative sanction as accorded as per G.O(Rt) No.834/2013/F&PD dated 7-10-2013 for a total cost of ₹2 crore. The project was implemented in the *Kaipad* lands of Kannur, Kasaragod and Kozhikode Districts. About 108.60 ha of '*Kaipad*' lands in Kannur, Kasaragod and Kozhikode district covered under this scheme for rice-shrimp farming by forming 18 Self-Help Groups (SHGs) / activity groups during the year 2012-13. The amount was fully utilized and the Utilisation Certificate was submitted on 31-1-2014 & 23-3-2014.

108 ha area was developed for promotion of rice cum shrimp farming in Kaipad lands. 38677.73 m^3 bund constructed. 63669 kg shrimp and 2500 kg paddy harvested.

6) Promotion of rice cum Shrimp farming in Kaipad lands -2013-14

As per G.O(Rt) No.486/12/F&PD dated 11-6-2012 Administrative sanction was accorded for this project for a total cost of ₹200 lakh. About 90 ha of Kaipad lands in

Kannur, Kasaragod and Kozhikode districts was revised for rice-shrimp farming. During 2013-14, 93 ha area was developed in Kaipad lands by utilizing an amount of ₹200 lakh. 23756m^3 bund constructed. 2142 kg shrimp and 28690 kg paddy harvested.

As per G.O(Rt) No.457/14/F&PD dated 12-6-2014 Administrative sanction was accorded for the project "Integrated farming of fish/prawn/shrimp in rotation with paddy in selected districts of Kerala" implemented during the year 2014-15 (200 lakhs). 205 ha area was developed in Pokkali fields. Nursery bund construction was 9277 m^3. Moreover, 92 ha area was developed in Kaipad lands.
Presently there is no sanctioned project for the integrated farming in Kaipad and Pokkali farming systems

3.13 Learning and knowledge management

Learning and knowledge management for this project will have two distinct hierarchical levels. The first level will focus on recording and cataloguing all the knowledge that goes into effectively implementing the project effectively at the farm-level, this will include the types viable of shrimp, fish and paddy species, the optimum time for harvest, optimum land preparation techniques and ratios of nutrients to be used, the optimum stocking density, feed requirements, bund and sluice construction and maintenance techniques, the annual yield etc. These knowledge components will be recorded by the individual farmers for their individual plots of land. They will also be responsible for periodically sharing this information with ADAK so that it can be collated for all four project districts. This information will help create a repository of key information that can be used by future project Kaipad/Pokkali proponents to design their own projects.

In the second level, the project implementation agency (ADAK) will maintain thorough records of expenditure, in-flow and out-flow of cash, inventory of equipment purchased, man-days used in the construction of bunds and sluice gates and the preparation of the land for shrimp and paddy cultivation. ADAK will also be responsible for cataloguing the various challenges and gaps that emerge during the implementation phase and other similar project parameters. ADAK will also be responsible for preparing an annual report for each project year communicating the major outcomes and successes of that particular year. The publication will also contain all challenges faced during implementation and the method by which they were overcome. ADAK will also keep track of all capacity building activities in terms of beneficiaries and other benefits and also any future training requirements. All of these project parameters will be reported to the project implementing entity (NABARD) the frequency of which will be mutually agreed upon at the start of the project.

3.14 Details on Stakeholder Consultation

In order to carry out the project, we would require the buy-in of local farmers and villagers. The project area cover many Grama Panchayats. Extensive consultations were carried out with

the Grama Panchayats at the Project Formulation Stage. The project has received approval from Grama Panchayats.

Figure 25: Interaction with stakeholders-Kannur district

Stake Holders Consultations

ADAK has conducted 6 stake holders consultation meeting for the Project formulation and to know the acceptance of the project by the farmers.

One was at St.Antony's Church Hall, Pullut, Kodungallur for farmers of Thrissur District on 6.11.2015. Thirty Five stake holders participated in the meeting and the opinions of the farmers were obtained through discussions. Many of the farmers accepted the project.

In Ernakulum District ADAK has conducted a stake holders meeting at Ezhava Marananthara sahaya sangham hall, Ezhikkara, North Paravur for farmers of Ernakulum District on 6.11.15. Thirty Two stake holders were participated in the meeting. Opinions of the farmers were collected.

In Alappuzha District ADAK has conducted stake holders meeting at Vettakkal, Pattanakkad Panchayat near Cherthala for farmers of Alappuzha District on 7.11.15. Thirty Six farmers participated. Opinions of the farmers were collected and almost all the farmers agreed with the project.

Recommendations of the Stake holders' consultation meeting held at Thrissur Ernakulum and Alappuzha District in connection with the formulation of projects for National Adaptation Fund on Climate change

1. The Pokkali paddy is produced by human effort only without any mechanisation. And cost of production is high and this demand high price for the produce. Hence Government has to ensure better price for Pokkali rice;

2. The stakeholders demanded the formation of Green Army in every Pokkali farming area to provide enough labourers to support Pokkali paddy farming;

3. Allocation of sufficient fund should be there in the project for construction of strong bund with enough height to withstand the flood and high tides;

4. Provisions for pumps should be included in the project to dewater and fill the farms for paddy and shrimp farming;

5. Provisions for solar lights to be provided in the farm sheds in the project;

6. A provision of RCC platform for post-harvest handling of paddy and shrimp in each field should be included in the project;
7. Deepening of outer canals of Pokkali fields is essential to increase the water flow and ingress of wild shrimp and fishes;

8. Farm roads for transport and insulated boxes for preservation of shrimp is to be included;

9. Timely supply quality seeds is to be ensured;

10. A maximum of 4 months is required for paddy farming. Hence Government may give permission to do shrimp farming in the rest of the months in a year;

11. Many of the farmers requested to provide provisions for coconut planting instead of mangrove plantation in newly formed bunds as the mangrove plantation may increase the concentration of birds, rats and otters in wetlands;

12. Provision for bio-fencing, canoes and heightening of rubble protection in the places were old rubble protection exists;

13. The farmers of Cherthala in Alappuzha District demanded permission for the rice cum shrimp farming in the monsoon season in Pokkali fields to compensate the loss in undertaking paddy farming alone. But presently it is not possible because of the resistance of local people who fish in canals of the fields during monsoon periods

In Kaipad region in Kannur District 3 stake holders meeting were conducted in connection with the project formulation. The details of the meeting area as follows

Stake holder consultation- 1.

Date & Time: 5.11.2015; 3.00 P.M
Site: Kannapuram Grama Panchayat
No. of Participants: 14
Location of people: Localities of Kannapuram, Thaliparambu Municipality
Venue: Keezhara Vayanasala, Kannapuram.

Stake holder consultation- 2.

Date & Time: 6.11.2015 ; 3.00 P.M
Panchayat: Kolachery Grama Panchayat
No. of Participants: 17
Location of people: Localities of Kolachery Grama Panchayat
Venue: Community Hall, Chelerimukku.

Stake holder consultation- 3.
Date & Time: 5.11.2015; 3.00 P.M
Site: Kannur Corporation
No .of Participants: 34
Location of people: Localities of Chelora
Venue: Varamkadavu L.P.School, Kadangode

Major outcomes of consultation.

- There was an overwhelming response from farmers / participants for implementing Kaipad based Project. Important components and intention of project was explained in respect of creating awareness among farmers;
- A Kaipad farmer emphasized about the rich biodiversity of Kaipad lands and need to protect this fragile area from pollution and other anthropogenic activity, which is possible through such projects implemented by Government;
- At Consultation site 3, stakeholders where enthusiastic that they carried the meeting to form groups then and there. Six Units were formed with a total area of 35 Ha that could be brought under project;
- Members of ongoing projects confidently said that integrated Paddy-shrimp farming in Kaipad lands has helped to revive their otherwise fallow land, improve soil quality (pH, and soil fertility), and was economically advantageous. They said financial assistance through subsidy alone as the reason for reviving their fallow Kaipad lands and to construct Bunds which require a huge sum;
- Participants consider this project as eco-friendly and organic farming. No issues of salinity intrusion was raised in above three consultation;
- They opine construction of strong bunds is only preventive measure that could be taken to protect their crops from sudden flood due to unexpected climatic variations. Construction of bund and its maintenance is most expensive and limitation in Kaipad culture system;

- Farmers emphasized Mechanisation for rice cultivation in Kaipad land as the need of hour;
- Scarcity of labourers in Kaipad wetlands is another bottleneck in culture activity.

3.15 Justification for funding for Adaptation

The main investment is in bund formation. The bund formation is inevitable to prevent the sea surge and the over flow of water due to increase in high tide levels because of global warming. If there are no proper bunds, the area cannot be used for both paddy and shrimp farming. To overcome the increase in high tide levels an anticipated increase in bund height is given and this increase the investment expected in bund formation.

Many farms which were operational are now non-operational and come to the state of disrepair. The farms need to be brought back to the eco-friendly farming of paddy and shrimp. Otherwise these fields will remain fallow or underutilized and uneconomic. This will be harmful to the environment stability. Hence the farmers are to be motivated for operating the farms by providing input assistance for the integrated paddy and shrimp farming.

3.16 Sustainability of project outcomes

Table 11: Sustainability of Project Outcomes

Activity	Expected outcomes	Expected concrete outputs	Sustainability Mechanism	Responsible party/ies
Construction of bund and sluice gates and planting of mangroves/ mangrove associates	► Regulation of water level to support paddy and shrimp/fish farming	► Construction of strong earthen bund ► Construction of sluice gates at regular intervals in order to check the seepage of saline water	► Capacity building of local farmers ► There is buy-in from locals who appreciate the improved livelihood opportunities	ADAK
	► Reduce the inflow of saline water into potable water sources inland	► Construction of strong earthen bund ► Construction of sluice gates at regular intervals in order to check the seepage of saline water	► Capacity building of local farmers ► Improved access to fresh water by reducing the seepage of saline water ► There is buy-in from locals who appreciate the improved access to potable water	ADAK

Activity	Expected outcomes	Expected concrete outputs	Sustainability Mechanism	Responsible party/ies
	► Strengthening of bunds made out of clayey soil.	► Planting mangroves/mangroves associates along the periphery of the marginal bunds ► Mangroves increase biodiversity and fertility of the wetlands	► Capacity building of local farmers ► Use of locally viable mangrove associates	ADAK
Rice/Shrimp Cultivation	► Generation of additional livelihood options for local farmers	► Simultaneous cultivation of rice and shrimp / fish during one season (monsoon season) and shrimp cultivation during the second season in low lying wetlands where there was previously no cultivation	► Capacity building of local farmers ► Generation of income which will ensure continued activity ► There is buy-in from locals who appreciate the livelihood generation	ADAK
	► Reclamation of land threatened by sea level rise	► Protection of the land for simultaneous cultivation of rice and shrimp / fish during one season (monsoon season) and shrimp cultivation during the second season in low lying wetlands where there was previously no cultivation	► Capacity building of local farmers ► Generation of income which will ensure continued activity ► There is buy-in from locals who appreciate the livelihood generation	ADAK

3.17 Overview of the Environmental and Social impacts and risks identified as being relevant to the project

Table 12: Environmental and Social Impacts

No.	Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks- further assessment and management required for compliance
1.	Compliance with the Law	√	NA
2.	Access and Equity	√	NA
3.	Marginalized and Vulnerable Groups	√	NA
4.	Human rights	NA	NA
5.	Gender Equity and Women's empowerment	NA	NA
6.	Core Labour Rights	√	NA
7.	Indigenous Peoples	NA	NA
8.	Involuntary Resettlement	NA	NA
9.	Protection of Natural Habitats	√	NA
10.	Conservation of Biological Diversity	√	NA
11.	Climate Change	√	NA
12.	Pollution Prevention and Resource Efficiency	√	NA
13.	Public Health	√	NA
14.	Physical and Cultural Heritage	NA	NA
15.	Lands and Soil Conservation	√	NA

PART IV- Implementation Arrangements

4.1 Arrangements for Project implementation

- ADAK will act as the agency for the implementation of the project.
- Extension and Technical Support: Project Assistants possessing professional degree in Fisheries Science/ Agriculture Science are required to be appointed on contract basis who are expected to provide extension and technical support to the farmers. In addition to Project Assistants, two Overseer for engineering survey and other duties will be recruited. The consolidated monthly pay for Field staff / Project Assistants/Overseer will be ₹25000/- per month. This expenditure will be met from the project managerial cost.
- **Capacity building requirement**: Required up- gradation training (in both rice farming and shrimp farming) will be arranged through ADAK.
- **Quality assurance system:** ADAK will arrange f**or** Quality assurance utilizing the available facility in ADAK and will depend on KUFOS or CUSAT, CMFRI, CIFT etc. for the quality assurance of the products and services provided to the beneficiaries and the public by this project.
- **Operation and maintenance:** It will be done by selected beneficiary group.
- **Monitoring system:** A monitoring committee consisting of the District Fisheries Officer, Representative of Executive Director ADAK, representative of the beneficiary groups and Regional Executive ADAK (convenor) will be constituted in each District.
- Separate project implementation unit will be constituted at Kannur for Kaipad farming and at Ernakulum for the three Pokkali Districts for the smooth and effective implementation.
- Policy decisions regarding the implementation of the project will be taken by the Governing Body and Executive Committee of ADAK.
- Applications from the eligible farmers will be invited and beneficiaries will be selected on the basis of the eligibility criteria fixed by ADAK. This will depend on the requirement of adaptability of the site and willingness of the farmers or groups.
- The engineering wing and Extension machinery of ADAK will visit the site and initial engineering and biological survey will be conducted. The detailed estimate for farm development will be prepared. The estimate along with the project report with specific recommendations will be forwarded to banks for loan assistance. The Calendar of Activities for the project for one year is shown in Annexure-1, and it will be repeated for the consecutive years.
- The beneficiaries themselves will complete the farm development works as per the plan and estimate approved by ADAK. On completion of work the engineering wing will conduct the final inspection and assess the work under each component. Accordingly the eligible grant-in-aid under each component will be calculated and sanctioned. The components and subsidy availed by the farmers may vary according to the requirement of the farms and the nature of padasekarams and also based on the number of eligible applicants.
- The farmers will be provided the eligible grant-in-aid as back ended subsidy.

4.2 Description of the measures for financial and project risk management including environmental and social risk

Table 13: Risk Management Framework

No.	Risk	Rating (High / Medium / Low)	Mitigation Measure
1.	Lack of Market for shrimp, fish and paddy	Low	Market linking activities to ensure a ready market for all shrimp, fish and rice produced.
2.	Heavy rainfall leading to damage of bunds and sluice gates	Low	The bund and sluice gates will be constructed robustly in order to minimize damage, periodic checks will be carried out to check for damage.
3.	Salinity levels in the soil prevent rice cultivation	Low	Soil will be dried thoroughly and dolomite will be used to ensure ideal pH balance of the soil. Saline resistant paddy varieties will be used to further ensure success
4.	Price of rice, shrimp and fish seeds go up unexpectedly	Medium	The project will ensure the use of paddy seeds from previous harvest to reduce market dependence and shrimp seed cost will be monitored by Govt.
5.	Low rainfall during monsoon season	Low	In case of low rainfall during monsoon, rice cultivation may no longer be viable for that season, in its place additional crop of shrimp/fish can be cultivated.
6.	Lack of buy-in from local community	Low	A consultation in the project area has already been conducted in concerned Grama Panchayats and whole heartedly accepted project.
7.	Occurrence of Viral disease in shrimp rearing	Medium	PCR tested quality assured seeds are used for the shrimp culture.

4.3 Monitoring and Evaluation Plan

Organizational Responsibility:

- A three level monitoring and evaluation system is proposed at the Executing Agency level, District level and State level
- District level committee may include President of the District Panchayat, District Collector, AGM NABARD, Principal Agricultural Officer, District Fisheries Officer , Regional Executive, ADAK and Chairperson/Presidents of the LSGD institutions where project is proposed to be implemented)
- State level committee under the chairmanship of Minister/Principal Secretary
- Executing Agency Level committee would include the team lead as chairman as well as the local team leads from the various districts

Monitoring Plan:

- For bund construction, weekly records will be maintained (at each district) on length of bund constructed (in metres), unique identifiers for the area in which bund construction has been carried out (e.g. longitude and latitude details), and total land area protected (in hectares) through bund construction. The weekly data would be aggregated to arrive at cumulative total progress against quarterly / annual targets. Weekly data would also include qualitative information including: nature of activities carried out in the particular week, any challenges faced, and reasons for delays, if any. After bund construction is completed, monthly monitoring will be carried out from the second year onwards to check for damage.
- For sluice gates construction, weekly records will be maintained on number of sluice gates constructed in that week as well as the cumulative total for the year. After sluice construction is completed, monthly monitoring will be conducted from the second year onwards to check for damage.
- For rice/shrimp farming, monthly records will be maintained of crop production (kg), yield (kg / hectare), use of inputs (fertilizer, seeds, etc.), production of seeds for future plantation, and income generation. Monthly logs would also include qualitative information on nature of activities carried out in the particular month, any challenges faced, and reasons for delays in production, if any.
- For mangrove plantation, weekly records will be maintained for number of mangroves planted. Once plantation is completed, the growth and health of mangrove plantations will be monitored once in two months (including estimation of total number of mangrove trees and height of mangrove trees, through sampling study). The need for plantation of more mangroves would be identified based on this monitoring.
- Quality of fresh water: A survey will be carried out to check the level of salinity in fresh water resources in the inland areas adjacent to the bunds.
- Financial outlay will be monitored on a monthly basis. Monthly reports would capture the expenditure under various heads, and the utilization of funds in the particular month.

Evaluation Plan:

- The Mid-Term and Final Evaluations will be conducted by third-parties selected after a competitive bidding process. The parameters that will be evaluated will include efficiency, effectiveness, relevance, sustainability and impacts of the project. Some of the impacts which will be assessed during the evaluation will include the livelihood generation for farmers and the impact of the coastal management initiatives on fresh water resources.

Our detailed plan has been provided in the table below:

Table 14: Detailed Monitoring and Evaluation Plan

No.	Monitoring and Evaluation Plan Activity	Responsible Person	Yr.1	Yr. 2	Yr. 3	Yr. 4	Total (Rs in Lakhs)	Timeframe
1	Bund formation	Implementing officer / District Level monitoring committee/State level monitoring committee	Monitor on a weekly basis the length of bund constructed, area served, activities carried out, challenge s / delays faced (52 days)	Monitor for damages (26 days) *	Monitor for damages (26 days)	Monitor for damages (26 days)	₹ 6.5 Lakhs	Total 130 days
2	Construction of sluice gates	Implementing officer/ District Level monitoring committee/State level monitoring committee	Monitor on a weekly basis the number of sluice gates constructed, activities carried out and challenges faced (52 days)	Monitor for damages (26 days)	Monitor for damages (26 days)	Monitor for damages (26 days)	₹ 6.5 Lakhs	Total 130 days
3	Planting mangrove	Implementing officer/ District Level monitoring committee/State level monitoring committee	Weekly monitoring of the number of trees being planted (52 days)	Monitoring health and growth of mangrove plantations (16 days)**	Monitoring health and growth of mangrove plantations (16 days)	Monitoring health and growth of mangrove plantations (16 days)	₹ 5 Lakhs	Total 100 days

No.	Monitoring and Evaluation Plan Activity	Responsible Person	Yr.1	Yr. 2	Yr. 3	Yr. 4	Total (Rs in Lakhs)	Timeframe
4	Shrimp/fish farming	Implementing officer/ District Level monitoring committee/State level monitoring committee	Monthly monitoring of production, yield, inputs used, seed production, activities carried out, challenges faced (30 days)	Monthly monitoring of production, yield, inputs used, seed production, income generation, activities carried out, challenges faced (30 days	Monthly monitoring of production, yield, inputs used, seed production, income generation, activities carried out, challenges faced (30 days)	Monthly monitoring of production, yield, inputs used seed production, income generation, activities carried out, challenges faced (30 days)	₹ 6 Lakhs	Total of 120 days (Monthly monitoring during the crop cycle of 210 days per year)
5	Paddy + shrimp farming	Implementing officer/ District Level monitoring committee/State level monitoring committee	Monthly monitoring of production, yield, inputs used, activities carried out, challenges faced (30 days)	Monthly monitoring of production, yield, inputs used, seed production, income generation, activities carried out, challenges faced (30 days)	Monthly monitoring of production, yield, inputs used, seed production, income generation, activities carried out, challenges faced (30 days)	Monthly monitoring of product-ion, yield, inputs used, seed produ-ction, ncome generation, activities carried out, challenges faced (30 days)	₹ 6 Lakh	Total 120 days (Monthly monitoring during the crop cycle of 210 days per year)

No.	Monitoring and Evaluation Plan Activity	Responsible Person	Yr.1	Yr. 2	Yr. 3	Yr. 4	Total (Rs in Lakhs)	Timeframe
6	Quality of fresh water in the inland areas adjacent to the bunds	Third –Party	1 day	1 day	1 day	1 day	₹ 2 Lakhs	4 days
7	Mid-Term Evaluation	Third-Party	NA	NA	Evaluate the performance in terms of effectiveness, efficiency, relevance, impact and sustainability	NA	₹ 24 Lakhs	180 days
8	Final Evaluation	Third-Party	NA	NA	NA	Evaluate the performance in terms of effectiveness, efficiency, relevance, impact and sustainability	₹ 24 Lakhs	180 days

The expense for one visit is calculated as ₹ 5000/-

Table 15: (E&F) Results Framework for the Project Proposal

Outcome/ Output	Indicator	Baseline	Target	Source of Verification	Risk Assumptions
Construction of bund and sluice gates and planting of mangroves/ mangrove associates					
Outcome 1	Regulation of water level to support paddy and shrimp/fish farming	Currently salinity levels are too high to carry out rice farming	Reduce salinity through construction of bund		Assumptions: ► Reducing salinity will promote rice farming Risks: ► Salinity levels may still be too high for rice cultivation
Output 1.1	Construction of strong earthen bund	Bund in disrepair	Construct 17km long bund		
Output 1.2	Construction of sluice gates at regular intervals in order to check the seepage of saline water	Sluice gates in disrepair	Construct sluice gates at regular intervals	Weekly records	
Outcome 2	Reduce the inflow of saline water into potable water sources inland	Currently seepage of saline water is impacting fresh water sources	Prevent seepage through construction of bund and sluice gates		Assumptions: ► Constructing bund will prevent seepage of saline water Risks: ► Incomplete construction of bund due to lack of local buy-in
Output 2.1	Construction of strong earthen bund	Bund in disrepair	Construct strong bund	Weekly records	
Output 2.2	Construction of sluice gates at regular intervals in order to check the	Sluice gates in disrepair	Construct sluice gates at regular intervals	Weekly records	

Outcome/ Output	Indicator	Baseline	Target	Source of Verification	Risk Assumptions
	seepage of saline water				
Outcome 3	Strengthening of bunds made out of clayey soil.	Newly formed bunds are destroyed by a few years due to wave action and heavy downpour during monsoon	Extensive root system of mangroves/mangrove associates effectively binds soil, to protect it from wave action and monsoon showers and mangrove cover protect bunds from heavy rain	Monthly Records	Assumptions: ► Constructing bund will prevent seepage of saline water Risks: ► Incomplete construction of bund due to lack of local buy-in
Output 3.1	Planting mangroves/mangroves associates along the periphery of the marginal bunds	Newly formed bunds prone to destruction in the absence of vegetative cover	Planting mangroves/mangroves associates along the periphery of the marginal bunds and mangrove associates along peripheral bunds	Monthly Records	
Output 3.2	Mangroves increase biodiversity and	Primary production in the wetlands	Vegetation of mangroves prompts succession of other	Monthly records	

Outcome/ Output	Indicator	Baseline	Target	Source of Verification	Risk Assumptions
	fertility of the wetlands	based on planktons and hydrophytes	species of plants along the bunds. Faunal elements also increase. Leaf litter of mangroves and increased biodiversity increases the fertility of the wetland		
Rice/Shrimp Cultivation					
Outcome 4	Generation of additional livelihood options for local farmers	Currently local livelihoods have been affected due to lack of commercial activity on Kaipad land/Pokkali fields	Generation of a minimum of 2,64,000 man days of employment annually		Assumptions: ► Buy-in from local farmers Risks: ► Lack of buy-in or capacity of local farmers
Output 4.1	Simultaneous cultivation of rice and shrimp / fish during one season (monsoon season) and shrimp cultivation during the second season in low lying wetlands	No shrimp or rice cultivation	Production of 1800 tons of rice Production of 540 tons of shrimp/fish	Monthly records	

Outcome/ Output	Indicator	Baseline	Target	Source of Verification	Risk Assumptions
	where there was previously no cultivation				
Outcome 5	Reclamation of land threatened by sea level rise	Currently due to lack of activity the Kaipad land is being slowly eroded	Reclamation of 600 hectares of Kaipad land and Pokkali fields		Assumptions: ► Buy-in from local farmers Risks: ► Lack of buy-in or capacity of local farmers
Output 5.1	Protection of the land for simultaneous cultivation of rice and shrimp / fish during one season (monsoon season) and shrimp cultivation during the second season in low lying wetlands where there was previously no cultivation	No shrimp or rice cultivation	Production of 1800 tons of rice Production of 540 tons of shrimp/fish	Monthly records	

4.4 Detailed Budget

Table 16: Unit Economics of Kaipad Farming (5 hectares)

Capital Cost

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Bund Work	4400m^3	₹ 228.45	₹ 10,05,180.00	Average Estimate of Bund Work required for Development of Kaipad farming under Promotion of Integrated farming system of Kaipad and Pokkali in coastal wet land of Kerala. An average 4400 m3 has been applied based on actual results of five different locations.	CPWD SOR 2014 @ of ₹228.45/m3
	Sluice gate	1 per unit	₹ 1,00,140.00	₹ 1,00,140.00	Engineer's Report countersigned by Director of Fisheries Department	CPWD SOR 2014, ₹ 1,00,140.00
	Farm equipment (pumps 5 HP, trays, net frames, bag - nets and water testing kit etc.)	5 Hp pumps = 2 Feed tray= 10 Net Frames= 2 Water Testing Kit= 1	5 Hp pumps = ₹ 39,466 Feed tray= ₹450 Net Frames= ₹3,012 Bag Nets= ₹3,900	₹ 1,16,653.00	Quantities are based on Approved Costing of Dept. of Fisheries	Approved Vendor Quote KC Traders dated 9/11/2015- Feed Tray= ₹ 450 each Approved Vendor Quote Galin Abraham dated 9/11/2015 Cast

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
		Bag Nets= 2 Solar Lamp= 1	Water Testing Kit= ₹1,217 Solar Lamp= ₹18,180			net = ₹ 3300 each Bag net = ₹ 3900 each Approved cost needed for net frames= ₹ 3012 Approved cost needed for water testing kit= ₹1217 Approved Vendor Deepa dated 15/10/2015 cost needed for pumps= ₹39,466 Approved cost for Solar Lamp= ₹18,180
	Farm shed (Temporary shed) (3x 6 metres)	1	₹ 24,678.00	₹ 24,678.00	Only one shed is needed	Abstract for farm shed as per CPWD SOR 2014= ₹ 24678

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Planting of Mangroves/ Mangrove associates	260 trees[14]	₹ 20 per sapling	₹ 5,200.00	"Land from Sea: The mangrove afforestation program for Bangladesh" Peter Saenger and N.A. Siddiqui (1993) Chapter 5 Page 7, minimum spacing for mangrove trees is 1.2x1.2m, we have taken 1.5m x 1.5m. Therefore the total number of trees to be planted has been calculated based on the average of 5 sample sites which gives a total bund length of 1279 m for an area of 48.7 hectares. Hence the peripheral bund length for 5 hectares is 130 metres. The total tree is 130 into 3 divided by 1.5= 260 trees.	Approved Minutes of the 47th Executive Committee Meeting of ADAK held on 05/01/2015 in the Chamber of Principal Secretary to Government (Fisheries). ₹ 20 per sapling
	SUBTOTAL			**₹ 12,51,851.00**		
B	**Operational Cost (1st Crop) Shrimp/ Fish farming**					
	Land lease	5 hectares	₹ 5,000	₹ 25,000.00	Being done for a standard 5 hectare piece of land	Copy of lease agreements for Pokkali and Kaipad

[14] Saenger P., Siddiqi N.A., "Land from Sea: The mangrove afforestation program for Bangladesh" School of Environment, Science and Engineering Papers, Southern Cross University (2010)

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
						areas, provided in Annexure
	Shrimp seed 40,000/ hectare or 200,000 for 5 hectares Nos. x ₹ 0.45 or Fish seed at 5,000 per hectare at ₹5 per seed, the project will fund 3,000 seed per hectare for a total of 15,000 seeds per unit at ₹ 6 each= ₹ 90,000[15]	2,00,000 for shrimp seed 15,000 for fish seed	₹ 0.45 each for shrimp seed ₹ 6 each for fish seed	₹ 90,000.00	Figures from stocking density used in previous projects implemented by ADAK	Fisheries and Ports Department G.O.(Ms) No. 62/12/F&PD dated 31/07/2012. Tiger Prawn (P. monodon) Rate per 100 numbers= ₹ 45 Decision No. 38 dated 28/05/2013. Advanced fingerlings (>8cm)= ₹ 6 per fingerling
	Labour charge	246 days	₹ 350 per man-day	₹ 86,100.00	Shyna, P.A. and Joseph, Sheela, "A Micro analysis of problems of displaced women agricultural	Govt. of Kerala rate for Class IV/workers

[15] Even though the standard stocking density of fish seed is higher, we will provide the same level of monetary support as for shrimp seed

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
					labourers with special emphasis to the pokkali fields of Vypinkara" The article clearly states that 246 man-days are required for prawn filtration. For prawn filtration operation the man power requirement for 1 hectare and 5 hectare is almost the same because the watch and ward, the sluice gate operator and the net operators are the same persons who work on the farm.	dated 28/10/2014. Man-Day rate= ₹ 350
	Shrimp or Fish feed	2,000 Kg	₹ 98	₹ 1,96,000.00	As per estimate provided by Department of Fisheries and approved by Secretary, the feed requirement per unit is 2,000 kg	Quote from approved vendor Godrej Agrovet 9/11/2015= ₹ 2450 per 25kg bag, cost per kg= ₹ 98
	Pond preparation items 5000/ Hectares	720 kg per unit	₹ 8	₹ 5,760.00	Estimate for pond preparation in Pokkali fields sets the quantity of dolomite required at 720 kg.	Estimate for Pond Preparation in Pokkali fields sets the cost at ₹ 8 per kg.

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Seed quality test	1 per unit	₹ 4,000.00	₹ 4,000.00	NA	As per G.O. (MS) no. 76/14/ F & PD dated 31/12/14, Govt. issued order for revising the fees for PCR test- a quality test for shrimp seeds. ₹ 4000 per test
	SUB TOTAL			**₹ 4,06,860.00**		
C	**Operational cost 2nd crop (2nd Crop)Rice and shrimp/fish farming**					
	Paddy seed	400 kg	₹ 50	₹ 20,000.00	Approved Govt. of Kerala Rate	Kerala Agricultural University Revised Price List No. R1/68289/2002 dated 29/12/2014. Price of Pokkali rice= ₹ 50 per kg
	Shrimp seed or Fish Seed	1,00,000 for shrimp seed or 7,500 for fish seed	₹ 0.45 each for shrimp seed or ₹ 6 each for fish seed	₹ 45,000.00	Figures from stocking density used in previous projects implemented by ADAK	Fisheries and Ports Department G.O.(Ms) No. 62/12/F&PD dated 31/07/2012. Tiger Prawn (P. monodon)

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
						Rate per 100 numbers= ₹ 45 Decision No. 38 dated 28/05/2013. Advanced fingerlings (>8cm)= ₹ 6 per fingerling
	Wages for paddy and shrimp/fish	750 man-days	₹ 350 per man-day	₹ 2,62,500.00	Shyna, P.A. and Joseph, Sheela, "A Micro analysis of problems of displaced women agricultural labourers with special emphasis to the pokkali fields of Vypinkara" The article clearly states that 246 man-days are required for prawn filtration. For prawn filtration operation the man power requirement for 1 hectare and 5 hectare is almost the same because the watch and ward, the sluice gate operator and the net operators are the same persons who work on the farm.	Govt. of Kerala rate for Class IV/workers dated 28/10/2014. Man-Day rate= ₹ 350

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Shrimp or Fish feed	1,000 Kg	₹ 98	₹ 98,000.00	As per estimate provided by Department of Fisheries and approved by Secretary, the feed requirement per unit is 1,000 kg	Quote from approved vendor Godrej Agrovet 9/11/2015= ₹ 2450 per 25kg bag, cost per kg= ₹ 98
	Pond preparation items 5000/ Hectares	720 kg per unit	₹ 8	₹ 5,760.00	Estimate for pond preparation in Pokkali fields sets the quantity of dolomite required at 720 kg.	Estimate for Pond Preparation in Pokkali fields sets the cost at ₹ 8 per kg.
	Seed quality test	1 per unit	₹ 4,000.00	₹ 4,000.00	NA	As per G.O. (MS) no. 76/14/ F & PD dated 31/12/14, Govt. issued order for revising the fees for PCR test- a quality test for shrimp seeds. ₹ 4000 per test
	SUB TOTAL			**₹ 4,35,260.00**		
	Total Operating Cost (B+C)			**₹ 8,42,120.00**		

A	Item	Quantity	Rate (in Rs)	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
D	**Revenues**					
	Production	**Rate**	**1st Crop Quantity**	**2nd Crop Quantity**	**1st Crop Revenue**	**2nd Crop Revenue**
	Shrimp[16]	₹ 350 per kg[17]	3,000 kg[18]	1,500 kg	₹ 10,50,000.00	₹ 5,25,000.00
	Rice	₹ 50 per kg[19]	0	15,000 Kg[20]	0	₹ 7,50,000.00
	Operating Income				₹ 10,50,000.00	₹ 12,75,000.00
E	**Total Operating Income**		**₹ 23,25,000.00**			
F	Net Operating Income	E-(B+C)	**₹ 14,82,880.00**			

[16] We have only considered revenue from shrimp and not fish in order to avoid confusion, in our previous projects the revenue from shrimp and fish farming were similar
[17] Cheruvat, D (2013), "Kaipad Krishiyum Jaiva Vavidhyavum- Kaipad: Agriculture and Biodiversity" publishers Malabar Natural History Society, Kozhikode
[18] Cheruvat, D (2013), "Kaipad Krishiyum Jaiva Vavidhyavum- Kaipad: Agriculture and Biodiversity" publishers Malabar Natural History Society, Kozhikode
[19] Govt. of Kerala approved rates, evidence in Annexure
[20] Refer to footnote 11

Table 17: Unit Economics of Pokkali Farming (5 hectares)

Capital Cost

A	Item	Quantity	Rate	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Bund Work	4410m^3	₹ 228.45	₹ 10,07,464.50	Average Estimate of Bund Work required for Development of Pokkali farming under Promotion of Integrated farming system of Kaipad and Pokkali in coastal wet land of Kerala. An average 4410 m3 has been applied based on actual results of five different locations.	CPWD SOR 2014 @ of ₹228.45/m3
	Sluice gate	2 per unit	₹ 1,00,140.00	₹ 2,00,280.00	Engineer's Report countersigned by Director of Fisheries Department	CPWD SOR 2014, ₹ 100139.20
	Farm equipment (pumps 5 HP, trays, net frames, bag -nets and water testing kit etc.)	5 Hp pumps = 2 Feed tray= 10 Net Frames= 4	5 Hp pumps = ₹ 39,466 Feed tray= ₹450 Net Frames= ₹3,012	₹ 1,22,677.00	Quantities are based on Approved Costing of Dept. of Fisheries	Approved Vendor Quote KC Traders dated 9/11/2015- Feed Tray= ₹ 450 each Approved

A	Item	Quantity	Rate	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
		Water Testing Kit= 1 Bag Nets= 2 Solar Lamp= 1	Bag Nets= ₹3,900 Water Testing Kit= ₹1,217 Solar Lamp= ₹18,180			Vendor Quote Galin Abraham dated 9/11/2015 Cast net= ₹ 3300 each Bag net= ₹ 3900 each Approved cost needed for net frames= ₹ 3012 Approved cost needed for water testing kit= ₹1217 Approved Vendor Deepa dated 15/10/2015 cost needed for pumps= ₹39,466 Approved Cost of Solar Lamp= ₹18,180

A	Item	Quantity	Rate	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Farm shed (Temporary shed) (3x 6 metres)	1	₹ 24,678.00	₹ 24,678.00	Only one shed is needed	Abstract for farm shed as per CPWD SOR 2014= ₹ 24678
	Planting of Mangroves/ Mangrove associates	600 trees[21]	₹ 20 per sapling	₹ 12,000.00	The average bund length where mangroves and mangrove associates will be 4320 m for 24 hectares based on samples taken. Therefore the length for one hectare is 180 m. The planting distance will be 1.5 metres for each mangrove. Therefore, 120 mangroves will be planted per hectare or 600 for 5 hectares	Approved Minutes of the 47th Executive Committee Meeting of ADAK held on 05/01/2015 in the Chamber of Principal Secretary to Government (Fisheries). ₹ 20 per sapling
	SUBTOTAL			**₹ 13,67,099.50**		
B	**Operational Cost (1st Crop) Shrimp/ Fish farming**					
	Land lease	5 hectares	₹ 5,000	₹ 25,000.00	Being done for a standard 5 hectare piece of land	Copy of lease agreements for

[21] Saenger P., Siddiqi N.A., "Land from Sea: The mangrove afforestation program for Bangladesh" School of Environment, Science and Engineering Papers, Southern Cross University (2010)

A	Item	Quantity	Rate	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
						Pokkali and Kaipad areas, provided in Annexure
	Shrimp seed 40,000/ hectare or 200,000 for 5 hectares Nos x ₹ 0.45 or Fish seed at 3,000 per hectare at ₹6 per seed, the project will fund 3,000 seed per hectare for a total of 15,000 seeds per unit at ₹ 6 each= ₹ 90,000[22]	2,00,000 for shrimp seed 15,000 for fish seed	₹ 0.45 each for shrimp seed ₹ 6 each for fish seed	₹ 90,000.00	Figures from stocking density used in previous projects implemented by ADAK	Fisheries and Ports Department G.O.(Ms) No. 62/12/F&PD dated 31/07/2012. Tiger Prawn (P. monodon) Rate per 100 numbers= ₹ 45 Decision No. 38 dated 28/05/2013. Advanced fingerlings (>8cm)= ₹ 6 per fingerling

[22] Even though the standard stocking density of fish seed is higher, we will provide the same level of monetary support as for shrimp seed

A	Item	Quantity	Rate	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Labour charge	212 days	₹ 350 per man-day	₹ 74,200.00	A Micro Analysis of Problems of Displaced Women Agricultural labourers with Special Emphasis to the Pokkali fields of Vypinkara. The article mentions 246 as the no of man days, however 212 has been considered because of duplication of activities which have been subtracted	Govt. of Kerala rate for Class IV/workers dated 28/10/2014. Man-Day rate= ₹ 350
	Shrimp or Fish feed	2,000 Kg	₹ 98	₹ 1,96,000.00	As per estimate provided by Department of Fisheries and approved by Secretary, the feed requirement per unit is 2,000 kg	Quote from approved vendor Godrej Agrovet 9/11/2015= ₹ 2450 per 25kg bag, cost per kg= ₹ 98
	Pond preparation items 5000/ Hectares	720 kg per unit	₹ 8	₹ 5,760.00	Estimate for pond preparation in Pokkali fields sets the quantity of dolomite required at 720 kg.	Estimate for Pond Preparation in Pokkali fields sets the cost at ₹ 8 per kg.

A	Item	Quantity	Rate	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Seed quality test	1 per unit	₹ 4,000.00	₹ 4,000.00	NA	As per G.O. (MS) no. 76/14/ F & PD dated 31/12/14, Govt. issued order for revising the fees for PCR test- a quality test for shrimp seeds. ₹ 4000 per test
	SUB TOTAL			**₹ 3,94,960.00**		
C	**Operational cost 2nd crop (rice farming)***					
	Paddy seed	400 kg	₹ 50	₹ 20,000.00	Approved Govt. of Kerala Rate	Kerala Agricultural University Revised Price List No. R1/68289/2002 dated 29/12/2014. Price of Pokkali rice= ₹ 50 per kg
	Wages for paddy farming	820 man-days	₹ 350 per man-day	₹ 2,87,000.00	A Micro Analysis of Problems of Displaced	Govt. of Kerala rate for Class

A	Item	Quantity	Rate	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
					Women Agricultural labourers with Special Emphasis to the Pokkali fields of Vypinkara. The article mentions 207/ha, however 164 per hectare has been considered because of duplication of activities[23]	IV/workers dated 28/10/2014. Man-Day rate= ₹ 350
	SUB TOTAL			**₹ 3,07,000.00**		
	Operating Cost (B+C)			**₹ 7,01,960.00**		
D	**Revenues**					
	Production	**Rate**	**1st Crop Quantity**	**2nd Crop Quantity**	**1st Crop Revenue**	**2nd Crop Revenue**
	Shrimp[24]	₹ 350 per kg[25]	3,000 kg[26]	0	₹ 10,50,000.00	0
	Rice	₹ 50 per kg[27]	0	10,000 Kg[28]	0	₹ 5,00,000.00

[23] Shyna, P.A. and Joseph, Sheela," A Micro Analysis of Problems of Displaced Women Agricultural labourers with Special Emphasis to the Pokkali fields of Vypinkara"

[24] We have only considered revenue from shrimp and not fish in order to avoid confusion, in our previous projects the revenue from shrimp and fish farming were similar

[25] Cheruvat, D (2013), "Kaipad Krishiyum Jaiva Vavidhyavum- Kaipad: Agriculture and Biodiversity" publishers Malabar Natural History Society, Kozhikode

[26] Cheruvat, D (2013), "Kaipad Krishiyum Jaiva Vavidhyavum- Kaipad: Agriculture and Biodiversity" publishers Malabar Natural History Society, Kozhikode

[27] Govt. of Kerala approved rates, evidence in Annexure

[28] Refer to footnote 17

A	Item	Quantity	Rate	Total Cost per unit (5ha.)	Basis for Quantity	Basis for Price
	Operating Income				₹ 10,50,000.00	₹ 5,00,000.00
E	**Total Operating Income**		**₹ 15,50,000.00**			
F	Net Operating Income	E-(B+C)	**₹ 8,48,040.00**			

*****In Pokkali fields there are some traditional rights for the local citizens to fish in canals of the fields from April 15 to November 15 in a year (Sustainable Aquaculture Policies in Pokkali and Kole Lands in Kerala, Dept. of Fisheries 2013). Shrimp farming period is from November 15 to April 15. So it is not possible to do shrimp farming in these fields as the public catch out the crop. So in this project rice farming is only proposed in monsoon season and hence the pond preparation cost is not included in the second crop.[29]

[29] Jayan P R, Nithya Sathyanathan. Overview of farming practices in the water-logged areas of Kerala, India. Int J Agric & Biol Eng, 2010; 3(4): 28—43.

4.5 Budget Estimate

Table 18: Costs

Sl. No.	Particulars	Unit Cost (crores)	Total Cost (In Crores)	Grant %	Grant-in-aid From Adaptation Fund	Beneficiary Contribution
1	**Capital Cost**					
a)	Capital cost in Kaipad	₹ 0.13	₹ 7.5111	80.00%	₹ 6.0089	₹ 1.5022
b)	Capital cost in Pokkali	₹ 0.14	₹ 8.2025	80.00%	₹ 6.5620	₹ 1.6405
2	**Operational Cost 1st Crop**					
a)	Operational cost in Kaipad	₹ 0.0406	₹ 2.4411	80.00%	₹ 1.9528	₹ 0.4883
b)	Operational cost in Pokkali	₹ 0.0395	₹ 2.3698	80.00%	₹ 1.8958	₹ 0.4740
3	**Operational Cost 2nd Crop**					
a)	Operational cost in Kaipad	₹ 0.0435	₹ 2.6116	80.00%	₹ 2.0893	₹ 0.5223
b)	Operational cost in Pokkali	₹ 0.0307	₹ 1.8420	80.00%	₹ 1.4736	₹ 0.3684
4	***Capacity Building for Farmers(₹15500x64program)***		₹ 0.09920	100.00%	₹ 0.09920	
5	***Survey Expenses, Verification, Extension & Awareness Creation & documentation***		₹ 0.3000	100.00%	₹ 0.3000	
6	***3rd Party Mid-Term and Final Review***		₹ 0.5000	100.00%	₹ 0.5000	
	Project Cost		₹ 25.8773			
7	***Contingency (10% of project cost)***		₹ 2.5877	100.00%	₹ 2.5877	
	Net Project Cost		₹ 28.465			
8	Project Managerial Expenses		₹ 4.2697	100.00%	₹ 4.2697	
9	Fee for Project Implementation Entity (NABARD)		₹ 0.9962	100.00%	₹ 0.9962	
	Total Project Cost		**₹ 33.7309**		**-₹ 28.7352**	**₹ 4.9957**

Size of 1 Unit	**5 hectares**
Total Area (300 hectares of Kaipad in Kannur and 300 hectares of Pokkali in Trissur, Ernakulum & Alappuzha districts)	600
Total Units	120

Table 19: Revenues

Product	No. of unit	Revenue from first crop per unit (crores)	Total Revenue from first crop (crores)	Revenue from second crop per unit (crores)	Total Revenue from second crop (Crores)
Rice					
Kaipad	60	₹ 0.000	₹ 0.000	₹ 0.075	₹ 4.500
Pokkali	60	₹ 0.000	₹ 0.000	₹ 0.050	₹ 3.000
Shrimp					
Kaipad	60	₹ 0.105	₹ 6.300	₹ 0.0525	₹ 3.150
Pokkali	60	₹ 0.105	₹ 6.300	₹ 0.000	₹ 0.000
Total		₹ 0.210	₹ 12.600	₹ 0.1775	₹ 10.650

Total Annual Revenue (Crores)	**₹ 23.25**

Budget Note

The Project Budget is prepared considering the inevitable development of infrastructure in both Kaipad and Pokkali lands so that these wetlands can be used for human benefits conserving the biodiversity and the environment of the wet lands in total. The bund formation costs are estimated based on the CPWD rate and considering the possible sea level rise and the unpredictable heavy monsoon in short period and the possible draught that may happen in the vicinity of the project areas. The requirement of bund height is different for Kaipad and Pokkali lands. This is estimated according to the prevailing tidal variation and possible flood levels. The bund cost for one unit of Kaipad cultivation is 10.05 lakhs and that for Pokkali farming system is 10.07 lakhs. The sluice gates are inevitable and hence two sluice gates have been included. The cost of sluice/unit in pokkali is ₹ 2 lakhs and that of Kaipad is ₹1 lakh . The other development works inevitable for operation of the farms is only included in the cost. The mangrove planting is included so that the bund will be protected from increased sea level rise, sea surges and the possible soil erosion due to unpredicted monsoon occurred as a result of climate change. Mangrove planting also help to reinforce the bunds against the unpredicted flow and high level flood due to heavy showers

This project protects the wetland and the users from the threat of climate change. The farming practice in these wet lands has to be made economic and eco-friendly. So the farmers are proposed to be assisted with input subsidy for the first year crop at 80% of the input cost and 80% of the infrastructure development costs. In Kaipad lands one crop of Rice and shrimp will be conducted in monsoon season and in Pokkali lands only rice cultivation will be done in monsoon. In summer season shrimp farming is done both in Kaipad and Pokkali lands. The

detailed unit cost and economics is included in the budget. The annual maintenance cost of bund is to be met from the revenue generated from the 1st year crop by the farmers themselves.

The total estimate of the project is comes to ₹ 33.7309 crores .Out of this **₹ 28.7352crores** will come from the NAF grant and remaining ₹ 4.9957 crores will be the beneficiary contribution.

4.6 Disbursement Schedule

Table 20: Disbursement Schedule

Project Activity	**Date of Disbursement**
Construction of Bund and Sluice Gates	September 2015
Capacity Building	September 2015
First Shrimp Crop	September 2015
First Rice and Shrimp Crop	January 2016
Project Management and Contingency (25% of total allocation to be remitted at the start of project year)	September of each year
Mid-Year Review	October 2017
Final Review	October 2019

PART V- Endorsement by Government and Certification by the Implementing Entity

5.1 Details of Project Executing Entity

a)

Table 21: Overview of ADAK

Name	Agency for Development of Aquaculture, Kerala (ADAK)
Registration No. and Date	411/89 dated 24.05.1989
Registered Address	Thiruvananthapuram
Project office address	T.C.15/1494,Reeja,MinchinRoad,Thiruvananthapuram-695014

b) Available technical manpower for the proposed project implementation

ADAK (Agency for Development of Aquaculture, Kerala) is a non-profit making Government Agency established for the development of aquaculture in the State. The projects are implemented by utilising the services of its own technical staff and project staff on contract basis/daily wages. Since ADAK has no non plan support from the Government to meet the salary, wages and the office expenses, it is essential to provide a project management assistance for the implementation

c) Three largest climate change Adaptation Project handled (already implemented)

Table 22: Overview of Past Experience

Sl. No	Project	Objectives	Amount Sanctioned (Rs in Lakhs)	Funding Agency	Geographical Coverage	Implementation Period & outcome
1	Sustainable fish stock enhancement of fishermen, in Vellayani lake	1.Replenish Fish resource 2. Conservation of lake	67.0	Department of Environment and Climate change	2009 -12	1.Fish catch rate increased from 9.5 to 22 ton 2.Income of fishermen increased 3.Awareness created among locals in protecting the lake
2	Controlled fresh water fish farming under the	1. Replenish fish resource 2. Conservation of lake	10.0	Department of Environment	2013 -15	1. Fish catch 2. Rate increased

Sl. No	Project	Objectives	Amount Sanctioned (Rs in Lakhs)	Funding Agency	Geographical Coverage	Implementation Period & outcome
	project Eco restoration of wetland scheme for conservation of Vellayani lake			and climate change		3. Income of fishermen increased 3.Awareness created among 4. Locals in protecting the lake
3	Upgradation of traditional filtration fields for increasing shrimp production	To enhance overall productivity of the wet land eco system To provide food security and protein food To promote sustainable aquaculture practices through integration of agriculture and pisci culture To sustain paddy cultivation and reduce cost of production	57.60	RKVY fund	2009 -12	Area covered-490.07 hectares Shrimp production-549.9 ton No. of beneficiaries -168
4	A pilot project on fin fish culture in Pokkali fields	-same as above-	₹94.5 lakhs	RKVY	2012 -14	Fin fish culture in 98.63 hectares area beneficiaries – 77 no's Increase in fish production-123.85 ton

The Project on Eco-Friendly shrimp culture in Pokkali fields in Alappuzha, Ernakulam and Thrissur districts and promotion of rice-cum-shrimp farming in Kaipad land was implemented during the years 2012-13 & 2013-14 (State Plan Scheme)

By utilising an amount of ₹ 100 lakhs 125 hectares area was developed for culture in Pokkali fields of Alappuzha, Ernakulam, and Thrissur districts during the year 2012-13. 41763m^3 bund construction was done. 34,497 kg. Shrimp was harvested in Pokkali fields during the year 2013-14 by utilising an amount of ₹ 100 lakhs. 177.13 hectares of Pokkali fields was developed and

stocked with 46.26 lakh *Penaeus monodon* seeds. 5,964 m^3 bund constructed. Shrimp production is 630 kg/hectares.

108 hectares area was developed for promotion of rice cum shrimp farming in Kaipad land during the year 2012-13. 38677.73m^3 bund constructed. 63669 kg. Shrimp and 2500 kg. paddy harvested. An amount of ₹200 lakhs was utilised for the implementation.

During the year 2013-14, 93 hectares area was developed in Kaipad lands by utilising an amount of ₹200 lakhs. 23756 m^3 bund constructed .2142kg shrimp and 28690 kg paddy harvested.

The project, "Integrated farming of fish/prawn/shrimp in rotation with paddy in the selected districts of Kerala" was implemented during the year 2014-15 by utilizing 200 lakhs .205 hectares area was developed in Pokkali fields. Nursery bund construction of 9277m^3 was conducted in Pokkali fields. And an area of 92 hectares was developed in Kaipad lands. Cultural activities are currently going on.

But no fund was allotted for the implementation of the project on "Integrated Pokkali and Kaipad lands" during this financial year 2015-16.

d) Three largest community based NRM project handled

We have implemented no such projects

e) Three largest climate change Adaptation/NRM projects of State/Central Government

We have implemented no such projects

f) All infrastructure and equipment needed for the implementation is either already available or will be procured as per all applicable state-level procurement guidelines

g) ADAK is not blacklisted, banned from implementation of projects, faced any charges/legal cases related to mismanagement of projects and funds

5.2 Change in Rainfall

A decline in monsoon rainfall since the 1950's has already been observed. The frequency of heavy rainfall events has also increased.

Table 23: Trend of Rainfall since 1901

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	JF	MAM	JJAS	OND
1901	34.70	38.60	17.80	38.90	50.60	113.20	241.40	271.60	124.70	52.40	38.70	8.20	1,030.80	73.20	107.30	751.00	99.30
1902	7.40	4.20	19.00	44.10	48.80	111.70	284.90	201.00	200.20	62.50	29.40	25.20	1,038.40	11.60	111.90	797.80	117.20
1903	16.70	8.00	31.10	17.10	59.50	120.30	293.20	274.00	198.10	119.50	40.30	18.00	1,195.90	24.70	107.70	885.60	177.80
1904	14.90	9.70	31.40	33.70	73.80	165.50	260.30	207.70	130.80	69.80	11.20	16.40	1,025.10	24.50	138.80	764.30	97.40
1905	24.70	20.30	41.80	33.80	55.80	93.70	253.00	201.70	178.10	54.90	9.60	10.10	977.50	45.00	131.40	726.40	74.70
1906	21.40	49.90	31.40	15.80	37.20	177.00	286.50	251.40	183.90	50.60	17.70	26.30	1,149.20	71.30	84.40	898.90	94.60
1907	16.00	45.50	37.40	62.00	32.70	153.10	225.40	308.30	95.40	23.00	23.10	12.90	1,034.80	61.50	132.10	782.20	58.90
1908	19.90	17.10	8.30	31.00	45.40	125.60	320.50	306.00	150.80	38.40	6.80	7.40	1,077.40	37.00	84.70	903.00	52.70
1909	22.70	15.20	6.60	61.60	51.20	207.20	302.30	228.70	157.70	37.50	10.00	27.90	1,128.50	37.90	119.40	895.70	75.40
1910	13.50	10.30	13.70	29.00	40.80	211.90	247.20	283.40	185.90	108.20	34.60	5.40	1,183.90	23.80	83.50	928.50	148.20
1911	40.40	5.50	43.00	23.10	48.20	191.30	163.10	209.90	178.50	71.50	42.40	12.10	1,028.90	45.80	114.30	742.80	126.00
1912	20.30	21.60	19.90	37.90	43.80	107.10	326.30	259.20	119.20	58.20	51.70	5.30	1,070.40	41.90	101.60	811.80	115.20
1913	6.30	38.10	23.70	25.70	72.90	214.80	269.80	192.60	109.60	68.60	16.80	23.20	1,061.80	44.40	122.20	786.70	108.50
1914	5.00	26.90	25.40	42.80	67.90	157.00	342.00	239.70	191.30	45.50	20.70	21.60	1,185.90	31.90	136.10	930.00	87.90
1915	19.80	37.50	44.10	33.60	63.90	155.10	227.90	226.90	171.70	90.50	45.20	8.20	1,124.40	57.30	141.60	781.50	143.90
1916	4.60	20.10	11.00	35.20	59.40	232.00	265.00	309.70	199.60	139.20	46.30	2.90	1,324.80	24.70	105.60	1,006.20	188.40
1917	7.60	37.90	20.50	40.10	74.00	230.70	282.70	292.80	278.10	161.30	29.10	9.30	1,463.90	45.50	134.50	1,084.30	199.60
1918	11.80	4.00	36.60	35.80	103.60	212.30	183.80	240.90	111.80	19.50	44.70	15.50	1,020.20	15.80	176.00	748.80	79.60
1919	48.80	20.20	19.10	32.70	59.50	194.70	304.60	285.30	163.10	91.50	50.10	18.20	1,287.90	69.00	111.40	947.70	159.80
1920	23.90	21.30	55.10	38.20	52.50	163.70	295.70	191.60	123.00	45.90	25.20	3.00	1,039.10	45.20	145.70	774.10	74.00
1921	37.60	7.40	17.80	43.90	51.20	193.90	293.70	274.40	203.30	70.50	16.10	15.30	1,225.00	45.00	112.90	965.20	101.90
1922	28.90	9.80	14.30	33.00	48.80	204.90	314.90	218.90	199.80	62.00	55.60	13.30	1,204.20	38.70	96.10	938.40	131.00
1923	21.60	38.90	21.20	31.00	58.10	102.00	337.80	272.80	173.80	58.00	17.60	15.80	1,148.60	60.50	110.30	886.40	91.40
1924	21.10	21.90	14.00	30.70	61.40	136.80	328.70	255.40	238.40	65.80	57.10	14.60	1,245.90	42.90	106.10	959.30	137.60
1925	13.00	11.20	15.30	44.10	100.80	204.70	300.90	234.50	140.20	67.20	41.50	16.10	1,189.50	24.30	160.20	880.20	124.80
1926	28.30	10.30	55.70	39.40	57.80	98.70	316.90	330.50	210.10	57.30	10.90	10.30	1,226.20	38.70	152.90	956.20	78.50

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	JF	MAM	JJAS	OND
1927	13.10	34.70	22.40	36.30	50.40	177.70	346.60	253.20	173.60	69.30	57.20	10.10	1,244.60	47.90	109.10	951.10	136.60
1928	20.90	40.30	21.10	34.60	54.40	178.90	303.50	229.00	144.00	127.70	21.60	24.40	1,200.20	61.10	110.00	855.40	173.70
1929	29.60	18.60	14.40	54.60	65.90	194.10	296.70	241.00	125.50	92.90	19.60	40.10	1,193.20	48.20	134.90	857.40	152.70
1930	23.50	23.20	28.90	51.00	55.90	181.50	288.60	212.00	174.10	96.70	53.00	10.30	1,198.50	46.70	135.80	856.10	160.00
1931	12.40	32.90	19.00	37.30	59.40	134.50	319.60	303.90	191.10	120.50	41.40	21.00	1,292.80	45.20	115.70	949.10	182.80
1932	9.20	22.90	20.10	31.00	85.70	141.70	328.30	237.90	181.90	69.40	60.30	14.40	1,202.90	32.20	136.80	889.80	144.10
1933	16.50	29.60	25.10	48.10	102.40	215.10	279.70	313.40	211.60	93.60	20.50	16.50	1,372.00	46.00	175.60	1,019.80	130.60
1934	23.30	11.50	16.10	46.80	47.30	217.70	284.80	294.40	166.80	65.80	32.40	10.50	1,217.50	34.70	110.20	963.70	108.70
1935	26.90	20.70	19.00	41.50	36.80	159.40	313.50	246.90	185.30	49.90	16.70	11.20	1,127.90	47.70	97.30	905.20	77.80
1936	12.30	41.80	37.80	33.50	82.70	245.80	292.50	236.70	193.90	66.40	57.20	21.20	1,321.80	54.10	154.10	968.80	144.70
1937	6.30	50.60	19.00	56.30	58.00	162.20	336.20	208.20	174.00	94.60	20.30	18.90	1,204.40	56.90	133.20	880.60	133.80
1938	29.90	30.70	33.40	34.20	70.90	273.40	300.20	249.70	171.60	75.40	16.20	5.00	1,290.50	60.60	138.50	994.80	96.60
1939	13.30	32.10	30.60	40.70	40.60	172.90	272.40	231.50	154.90	91.20	29.60	1.70	1,111.60	45.50	111.90	831.80	122.50
1940	13.00	25.80	47.70	26.90	80.80	173.80	308.40	278.10	125.50	63.00	40.90	17.40	1,201.30	38.80	155.40	885.80	121.30
1941	22.90	16.40	20.40	31.50	81.00	171.80	238.70	228.40	154.00	62.10	26.50	20.30	1,073.90	39.30	132.80	792.80	108.90
1942	21.40	46.00	20.60	44.70	63.70	191.50	339.60	287.00	182.50	34.50	17.70	23.50	1,272.90	67.50	129.00	1,000.70	75.80
1943	56.80	9.80	32.50	47.90	94.30	167.80	308.90	228.40	211.40	89.00	17.10	5.20	1,269.20	66.60	174.70	916.50	111.30
1944	27.60	37.80	54.90	31.90	61.00	155.60	349.10	287.00	156.20	92.30	29.40	15.60	1,298.50	65.40	147.80	948.00	137.40
1945	34.20	10.20	20.10	47.10	53.60	159.10	333.30	246.70	214.50	80.60	17.90	4.90	1,222.00	44.30	120.80	953.50	103.40
1946	4.40	19.10	24.50	48.00	71.30	214.00	318.30	296.30	145.00	84.40	76.00	35.80	1,337.20	23.50	143.90	973.60	196.20
1947	22.40	18.30	26.00	39.10	55.90	130.10	314.40	290.40	240.00	69.80	7.20	22.60	1,236.30	40.80	121.00	974.90	99.60
1948	25.20	29.00	39.50	42.50	91.30	164.10	347.70	282.70	178.00	61.20	71.10	10.00	1,342.20	54.20	173.30	972.40	142.30
1949	12.60	28.80	24.10	53.00	89.30	164.30	316.80	243.20	227.00	95.10	10.60	4.70	1,269.60	41.40	166.40	951.30	110.50
1950	35.40	25.40	36.70	28.70	49.40	135.70	331.60	235.60	202.60	57.70	27.50	7.90	1,174.20	60.80	114.80	905.50	93.10
1951	15.70	12.10	44.40	54.40	59.40	163.30	252.70	222.80	124.60	73.90	31.30	5.80	1,060.60	27.80	158.30	763.40	111.10
1952	10.50	19.80	37.40	32.40	69.70	165.60	286.60	256.60	120.00	79.60	9.20	22.50	1,110.10	30.30	139.50	828.90	111.30
1953	30.20	10.60	25.30	38.30	47.10	162.20	323.10	299.20	179.90	85.80	12.30	8.00	1,222.10	40.80	110.70	964.40	106.10
1954	37.60	37.20	17.10	22.80	53.90	145.50	297.20	232.00	246.70	73.80	3.60	13.90	1,181.40	74.90	93.90	921.30	91.30
1955	20.80	4.10	21.30	30.60	72.60	177.70	236.80	313.80	215.70	146.30	26.40	9.30	1,275.40	24.90	124.50	944.00	182.00
1956	17.00	11.10	31.50	28.10	85.50	211.00	354.10	254.30	163.90	150.10	44.00	11.90	1,362.60	28.10	145.00	983.30	206.10
1957	31.10	10.90	24.20	39.50	71.20	153.20	300.80	265.40	131.70	64.00	28.60	11.30	1,131.90	42.00	134.90	851.10	103.80

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	JF	MAM	JJAS	OND
1958	12.40	16.50	19.10	36.90	80.50	123.70	316.90	324.90	225.70	114.70	30.00	10.90	1,312.30	28.90	136.50	991.30	155.70
1959	31.80	23.80	21.30	25.90	75.30	169.80	375.50	265.10	237.30	119.70	26.00	5.30	1,376.90	55.60	122.60	1,047.70	151.10
1960	13.80	2.70	35.20	20.00	57.70	157.30	320.00	252.90	184.70	68.50	33.70	8.30	1,154.80	16.50	112.80	914.90	110.50
1961	26.10	34.80	26.00	28.50	77.60	192.90	336.60	287.60	234.90	122.20	21.70	10.40	1,399.20	60.90	132.10	1,052.00	154.20
1962	12.60	21.60	16.00	43.60	70.80	137.10	281.60	276.90	211.00	78.40	18.30	29.90	1,198.00	34.30	130.40	906.60	126.70
1963	6.80	9.80	41.70	50.60	60.90	168.00	258.60	316.70	164.90	99.10	28.40	15.50	1,220.90	16.60	153.10	908.20	142.90
1964	18.60	14.10	19.00	40.00	52.10	177.20	345.70	273.70	200.40	67.40	22.80	13.30	1,244.40	32.70	111.10	997.00	103.50
1965	11.80	28.10	26.70	45.10	52.70	116.10	270.10	192.80	129.50	34.00	18.20	22.20	947.40	39.90	124.60	708.50	74.40
1966	13.10	25.40	20.30	30.60	57.20	178.80	252.50	212.50	143.90	56.10	51.00	16.70	1,058.00	38.50	108.00	787.80	123.70
1967	11.10	14.20	63.30	29.50	42.80	144.00	305.60	264.30	170.30	40.60	12.10	56.10	1,154.00	25.30	135.60	884.20	108.90
1968	29.40	19.80	27.50	32.60	46.70	149.60	309.90	212.80	129.50	67.10	21.80	12.60	1,059.30	49.20	106.80	801.70	101.60
1969	12.70	14.50	20.10	39.70	63.40	130.20	317.80	273.40	172.70	55.00	35.80	12.70	1,147.80	27.20	123.10	894.00	103.40
1970	23.20	27.30	25.90	29.20	69.70	215.90	245.60	313.00	212.70	75.30	15.70	1.60	1,255.00	50.50	124.80	987.10	92.60
1971	16.10	23.60	10.80	52.80	75.00	229.90	267.20	267.30	146.50	99.90	15.90	12.00	1,216.90	39.70	138.60	910.80	127.80
1972	10.30	27.60	21.60	37.10	55.30	123.30	204.00	219.50	127.50	65.70	31.40	23.70	947.10	37.80	114.00	674.30	120.90
1973	21.00	21.80	21.20	27.50	56.50	149.90	277.40	311.00	182.10	114.60	18.90	17.70	1,219.50	42.80	105.20	920.30	151.20
1974	16.10	12.90	20.50	33.70	64.20	122.00	283.60	232.50	145.30	101.60	10.70	12.10	1,055.30	29.10	118.40	783.40	124.40
1975	15.40	20.80	28.70	28.30	50.20	175.60	310.70	292.50	224.60	121.90	22.80	3.30	1,294.80	36.10	107.30	1,003.40	148.00
1976	11.50	24.50	25.50	36.30	45.40	160.30	294.10	294.00	144.20	33.00	55.00	7.60	1,131.60	36.00	107.30	892.70	95.60
1977	21.00	10.20	14.60	68.30	84.40	187.20	323.40	245.40	147.80	85.60	65.80	16.10	1,269.70	31.20	167.30	903.80	167.40
1978	12.30	27.00	44.20	33.10	60.20	208.80	290.00	282.00	161.90	49.10	49.90	18.80	1,237.20	39.30	137.40	942.70	117.80
1979	20.90	35.00	28.90	21.20	54.20	140.50	239.60	210.60	136.80	51.80	76.10	14.40	1,030.20	55.90	104.30	727.60	142.40
1980	12.80	22.30	32.50	34.60	55.30	227.80	295.00	263.80	145.70	49.30	24.20	19.00	1,182.30	35.10	122.50	932.40	92.40
1981	29.30	20.40	48.00	37.30	67.10	151.30	309.10	237.00	184.50	45.10	27.40	14.00	1,170.70	49.70	152.40	882.00	86.60
1982	23.80	24.20	45.70	49.80	59.00	137.80	230.80	276.90	124.90	51.70	46.00	13.90	1,084.40	48.00	154.50	770.40	111.50
1983	18.50	23.30	43.40	57.00	70.10	150.80	282.20	304.30	251.60	85.90	10.80	22.90	1,320.90	41.70	170.50	988.90	119.70
1984	19.00	35.90	22.80	45.30	60.40	192.30	291.90	256.50	144.60	61.00	15.70	15.30	1,160.80	54.90	128.50	885.40	92.00
1985	23.20	9.90	20.10	39.50	63.00	156.50	290.10	231.70	149.60	114.10	18.80	28.40	1,144.90	33.10	122.60	827.90	161.40
1986	15.50	36.60	29.90	50.00	49.40	182.60	264.20	228.30	128.40	74.70	49.60	28.40	1,137.60	52.00	129.30	803.60	152.70
1987	13.20	23.80	28.80	43.90	67.00	133.90	223.20	242.10	152.20	94.40	44.40	21.90	1,088.90	37.00	139.80	751.40	160.70
1988	10.40	28.70	53.70	41.70	70.40	161.80	374.80	295.30	217.70	53.60	16.20	17.80	1,342.10	39.10	165.80	1,049.60	87.70

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	JF	MAM	JJAS	OND
1989	15.40	15.30	28.80	34.60	57.50	184.70	302.30	236.20	163.10	51.90	20.30	17.20	1,127.40	30.70	121.00	886.30	89.40
1990	16.00	44.20	54.00	43.80	112.90	191.30	282.90	293.60	197.40	104.10	30.20	31.00	1,401.40	60.30	210.70	965.20	165.30
1991	14.30	28.10	27.80	51.70	68.90	184.70	279.20	268.10	140.70	61.80	30.20	14.70	1,170.20	42.30	148.50	872.70	106.80
1992	16.00	16.50	24.80	26.10	59.30	139.70	262.50	274.00	171.70	64.70	41.60	5.60	1,102.70	32.50	110.20	848.00	112.00
1993	18.20	25.60	41.60	27.00	71.30	172.10	305.40	203.20	208.50	87.90	30.50	16.50	1,207.80	43.80	139.90	889.30	134.90
1994	25.00	27.90	25.20	45.90	53.10	205.70	350.00	282.20	149.40	82.80	25.50	22.60	1,295.30	52.90	124.10	987.40	130.90
1995	31.30	29.40	28.30	32.40	82.40	143.30	323.40	269.00	179.00	78.00	36.80	9.20	1,242.40	60.70	143.00	914.70	123.90
1996	22.90	23.20	32.10	31.40	56.00	185.70	262.10	292.40	146.10	100.50	13.60	16.90	1,182.90	46.10	119.60	886.20	130.90
1997	14.30	10.40	30.30	46.00	48.60	171.70	281.50	261.90	151.40	61.10	57.60	48.30	1,183.10	24.70	124.80	866.50	167.00
1998	16.40	28.20	39.10	36.30	49.20	163.90	278.40	243.80	196.50	107.40	39.30	10.30	1,208.80	44.60	124.60	882.60	157.00
1999	13.70	11.20	8.80	19.30	94.90	169.90	261.70	213.20	183.00	117.20	20.00	3.70	1,116.60	24.90	122.90	827.90	141.00
2000	18.40	28.20	17.90	34.70	71.60	179.00	263.50	221.10	134.50	41.90	14.60	10.00	1,035.40	46.60	124.30	798.10	66.40
2001	6.50	9.60	19.20	43.20	61.10	215.60	278.70	205.20	111.50	100.50	19.00	6.30	1,076.20	16.00	123.40	811.00	125.80
2002	17.20	20.90	23.10	38.00	58.40	169.90	143.50	244.80	136.60	56.40	15.60	5.50	930.10	38.20	119.50	694.80	77.60
2003	7.50	41.60	35.20	35.40	39.70	166.60	305.30	246.70	183.80	92.40	10.80	17.40	1,182.30	49.10	110.30	902.50	120.50
2004	25.10	11.30	11.60	52.50	76.80	167.70	242.10	254.00	125.80	94.30	17.90	7.00	1,086.20	36.40	140.90	789.70	119.20
2005	39.80	49.30	43.90	37.80	52.20	148.50	333.70	195.20	201.80	97.70	27.40	11.30	1,238.70	89.20	133.90	879.20	136.40
2006	20.50	11.70	33.80	29.50	79.00	149.30	294.00	303.50	180.20	52.50	34.30	14.00	1,202.40	32.30	142.30	927.10	100.80
2007	2.80	36.40	37.60	34.70	51.90	200.10	296.40	257.80	213.90	56.30	15.50	16.40	1,219.80	39.20	124.20	968.20	88.20
2008	25.80	19.30	37.80	33.00	45.70	210.90	251.90	263.90	164.90	51.40	27.20	12.40	1,144.10	45.10	116.50	891.50	91.00
2009	13.00	12.80	15.90	25.80	57.30	86.70	282.20	190.80	141.10	70.90	54.10	11.10	961.80	25.90	99.00	700.80	136.10
2010	7.70	18.20	17.90	43.80	76.90	138.70	296.30	271.20	194.40	67.20	56.40	23.30	1,212.10	25.90	138.60	900.60	146.90
2011	6.80	25.80	22.40	41.10	53.10	183.50	246.00	284.90	186.90	38.10	20.10	7.60	1,116.30	32.60	116.60	901.30	65.80
2012	26.50	12.70	11.30	47.50	31.70	117.80	250.20	262.40	193.50	58.70	30.70	11.70	1,054.70	39.20	90.50	823.90	101.10
2013	11.30	40.10	15.70	30.30	57.80	219.80	310.10	254.90	152.60	129.30	14.00	6.70	1,242.60	51.40	103.80	937.40	150.00
2014	19.30	27.40	36.10	22.10	72.90	95.20	261.10	237.40	187.90	60.10	14.40	10.70	1,044.60	46.70	131.10	781.70	85.20

A 2^0C rise in the world's average temperature will make India's summer monsoon highly unpredictable.

A 4^0C rise in world's average temperature will make India's summer monsoon extremely wet. Normally this extreme monsoon happen once in 100 years but it is projected to occur every 10 years by the end of the century because of the climate change.

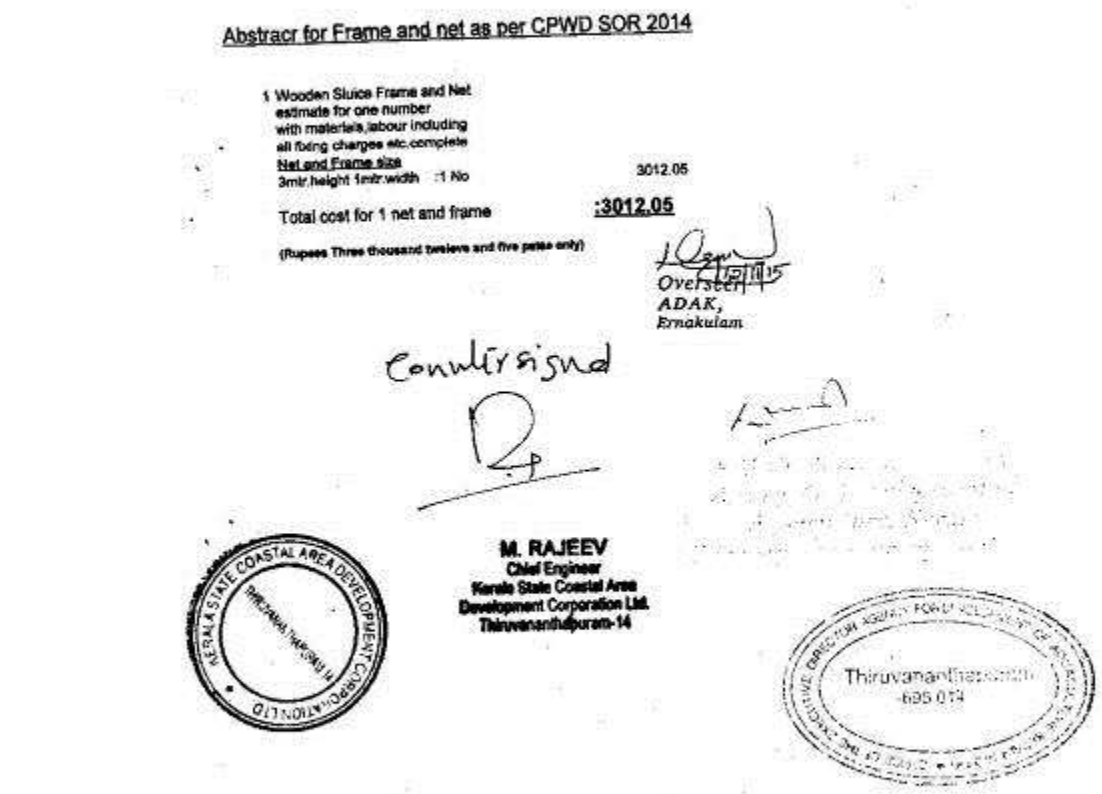
An abrupt change in the monsoon could precipitate a major crisis, triggering more frequent droughts as well as greater flooding in large parts of India.

Dry years are expected to be drier and wet years wetter.

Annexure

Supporting documents for financials:

Exhibit 1: Evidence for price and quantity for net and frame for Pokkali and Kaipad



Abstracr for Frame and net as per CPWD SOR 2014

1 Wooden Sluice Frame and Net estimate for one number with materials,labour including all fixing charges etc.complete
Net and Frame size
3mtr.height 1mtr.width :1 No 3012.05

Total cost for 1 net and frame :3012.05

(Rupees Three thousand twelve and five paise only)

Overseer
ADAK,
Ernakulam

Conurtr signed

M. RAJEEV
Chief Engineer
Kerala State Coastal Area
Development Corporation Ltd.
Thiruvananthapuram-14

KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION LTD

Thiruvananthapuram
695 014

②

SLUICE FRAMES AND NET estimate as per CPWD 2014 SOR.

Rate for 1 Nos

8737	Stainless steel wire guage (grade-304) aperture 1.4mm and 0.50mm dia	m^2	840 x $3m^2$ = 2520.00
0449	Brass Screed 50mm	100Nos	220 x 50Nos = 110.00
1198	II^nd class Kail Wood in planks cudm (260x10)	Cudm	260 x 0.02 = 52.00
0156	Carpenter Av	day	417 x 0.720 = 300.24
			2982.24
		Add 1% Water Charges	29.8224
		Say @ 3012.05/-	3012.0624

Countersigned

Overseer
ADAK,
Ernakulam

M. RAJEEV
Chief Engineer
Kerala State Coastal Area Development Corporation Ltd.
Thiruvananthapuram-14

Thiruvananthapuram
695 014

③

CPWD 2014 SOR.

Data for Sluice Frame and Net

8737 Stainless Steel wire guage (grade - 304) aperture 1.4mm and 0.50mm dia Wire = Rs. 840/ m^2.

0449 Brass Screws 50 mm (l) 100 Nos - Rs. 020/-.

1198 IInd class Teil Wood in planks Cudm - Rs. 260/-

0156 Carpenter Av day = Rs. 417/- 0.700 (9.13)

Quantity Estimate.

I Wood - 4 Nos $3m \times 0.05m \times 0.025m = 0.015$

$- A_H \times 1m \times 0.05m \times 0.025m = 0.005$

$0.02\ m^3$.

II Mesh - 3m(height) x 1m(width) = $3\ m^2$.

Countersigned

M. RAJEEV
Chief Engineer
Kerala State Coastal Area
Development Corporation Ltd.
Thiruvananthapuram-14

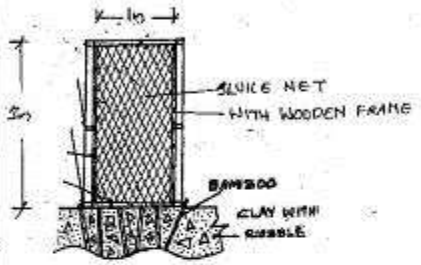
KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION

Overseer
ADAK,
Ernakulam

Thiruvananthapuram
695 014

(4)

SLUICE FRAME AND NET



CROSS SECTION

SCALE 1:50 1CM = 0.50M

Overseer
ADAK,
Ernakulam

Countersigned

M. RAJEEV
Chief Engineer
Kerala State Coastal Area
Development Corporation Ltd.
Thiruvananthapuram-14

KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION LTD.

Thiruvananthapuram

Exhibit 2: Evidence for price of farm implements

K.C. TRADERS
Kottapuram, Kodungallur
Pin : 680 667, Trichur (Dist)

Ph : 2804339 (Off)
Mob: 8907718660

To,
Regional Executive
ADAK
Ernakulam.

Date 9-11-2015

1) Rate for 34% Protein Shrimp feed –
of Godrej Agrovet 25kg - Bag - Rs - 2450-00.

2) Dolomate powder: 50kg Bag Rs - 400-00

3) Feed Tray – (75CM X 75CM)
with 6 MM Rod including –
Net
Rs 450/Each

Thanking you,
Yours faithfully
K. C. PIUS

For K.C. TRADERS
Managing Partner

QUATATION

GALIN ABRAHAM

N. Paravoor

No. 451 Date 9/11/2018

Name Regional Executive ADAK, Ernakulam

Sl No.	Particulars	Qty.	Rate	Rs.	Ps.
	Cast net (6 muzham)	1	3300	3300	00
	Bag net (Colure 1metr)	1	3900	3900	00
	Total				

GALIN ABRAHAM
Nylon Nets Dealer
N. Paravur - 683 513

Manager.

Exhibit 3: Evidence for price of 5 HP Pump set

TIN.No: 32150832434
(Tax Payer's Identification Number)

CST Reg.No :32150832434C

ORIGINAL COPY

DEEPA
UCO COMPLEX
ALUVA ROAD, ANGAMALY.
PH.2453302. 2464273
E-Mail :deepa@deepaagencies.com
THE KERALA VALUE ADDED TAX RULES 2005
FORM NO. 8B
(For Customers when input tax credit is not required)
[See Rule 58(10)]
RETAIL INVOICE
CASH/CREDIT
(To be Prepared in Duplicate*)

Name and Address of the Purchasing Dealer :
Cash
JOSE .M.P
MADASSERY
MOOKANNOOR
Telephone No : Fax :
E-mail :
TIN : CST Reg.No :

Invoice No : B /10116
Date : 15-Oct-2015
Del.Note.No & Date :
Pur.ord.No & Date :
Despatch Doc.No & Date :
Terms of Delivery :

Sl.No	Schedule With Entry No Commodity Item	Com Code	Tax %	Unit Price	Quantity	Gross Value	Cash Discount	Net value	Tax Amount	Total
1	CG 5HP 80/80 De-Watering Pump DWA05 60101060973		5	28,190.47	1 No	28,190.47		28,190.47	1,409.52	29,599.99
2	DOL Starter 6-10A MK1 LT		14.50	1,484.71	1 No	1,484.71		1,484.71	215.28	1,699.99
3	CI H/Collar 80mm		5	115.00	3 No	345.00		345.00	17.25	362.25
4	Hose Clip 75mm		5	21.00	3 No	63.00		63.00	3.15	66.15
5	PVC Foot Valve 80mm		5	228.57	1 No	228.57		228.57	11.43	240.00
6	Green Hose 75mm 3" Duroflex		5	273.01	30.0 Mt	8,190.30		8,190.30	409.52	8,599.82
7	G.I Bend 80mm		5	374.00	1 No	374.00		374.00	18.70	392.70
8	G.I.Socket 80mm ISI		5	195.50	1 No	195.50		195.50	9.78	205.28
	Round off									(-)0.17
	TOTAL			0		39,071.55		39,071.55	2,094.83	41,166.00

GRAND TOTAL IN WORDS : Indian Rupees Forty One Thousand One Hundred Sixty Six Only

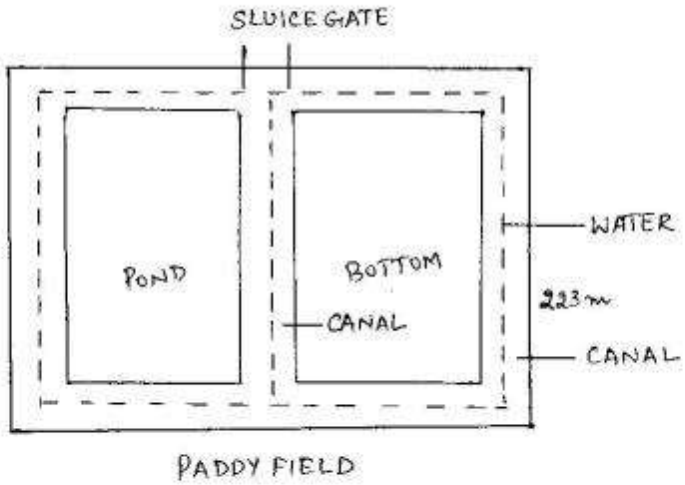
(*Orginal for the Buyer and Duplicate to be retained with the Seller.)

Authorised Signatory
[With Status & Seal]

Exhibit 4: Evidence for requirement of two 5 HP Pump set for Pokkali and Kaipad lands

The requirements for final Harvest of shrimps from Kaipad and Pokkali farming systems

All the Pokkali fields are elevated than the lowest low tide level. Hence it is easily drainable for shrimp harvest and land preparation for paddy farming. On draining the whole pond bottom will be exposed to sunlight and air. The remaining water will be there in the peripheral and central drain canal of the paddy field with average depth of 30 cm (20-40 cm).



The total quantity of water remain in the canal at this stage is estimated as follows: The length of canal = 223 m x 5 sides = 1115 m, the width of the canal is 3 m. The average depth of the canal is 30 cm. So the water available for full drainage of the canal = 1115 m x 3 m x 0.3 m = 1003.5 M^3 ie = 1003500 litre. The discharge of one 5 HP pump is 20.5 l/second in the minimum head. So the requirement of pump to drain the unit area

$$= \frac{1003500 \text{ litre}}{20.5 \text{ l/second} \times 60 \times 60} = 13.59 \text{ Hrs. ie. } 14 \text{ hrs.}$$

Hence in a unit of 5 Ha paddy field 5 HP pump is enough to pump out the water from canals in 14 hours. So it is portable, economical, effective and handy to use in wet lands of Pokkali and Kaipad area.

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Automobile Parts & Spares Engine & Engine Spare Parts

Phool Chand Electro Diesels

Siliguri, West Bengal

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- End Section Pumps
- Agri Engines
- Agri Pumpsets
  - AV1-NW2+ 5 Hp Water-Cooled
  - AV1XL-N1 5 Hp Water Cooled Water Pumping Sets
  - AV1XL-N2 8 Hp Water-Cooled Pumping Sets
  - AV1XL-N3 8 Hp Water Cooled Pumpset
  - AV1XL-N4 8 Hp Water-Cooled

View All

- Concrete Mixers
- Equipments
- Domestic Pumps
- Generator

Ask for Details

- Water Pump Price
- Submersible Pump
- Centrifugal Pump

[redacted]

Agri Pumpsets

AV1-NW2+ 5 Hp Water-Cooled

FEATURES

- Power rating: 5 hp.
- Starting: Hand start.
- Type of fuel injection: Direct injection.
- Overall Dimensions of the standard engine: 617 X 504 X 843 (Length X Width X Height)
- Head range: 12.8 - 17.8 metres
- Discharge range: 21.5 - 13.0 litres per second

Ask Price

Engine type:
Vertical, Single Cylinder, Water-Cooled, Four-Stroke Cycle, Compression Ignition Diesel Engine.

AV1XL-N1 5 Hp Water Cooled Water Pumping Sets ← HP

Features

- Power rating: 5 hp.
- Starting: Hand start.
- Type of fuel injection: Direct injection.
- Overall Dimensions of the standard engine: 450 X 445 X 635 (Length X Width X Height)
- Head range: 12.4 – 17.8 metres
- Discharge range: 20.8 - 10.0 litres per second ← output

Ask Price

Engine type:

- Vertical, Single Cylinder, Water-Cooled,
- Four-Stroke Cycle, Compression Ignition Diesel Engine.

AV1XL-N2 8 Hp Water-Cooled Pumping Sets

Features

- Power rating: 8 hp.
- Starting: Hand start.
- Type of fuel injection: Direct injection.
- Overall Dimensions of the standard engine: 450 X 445 X 635 (Length X Width X Height)
- Head range: 16.1 - 22.3 metres

Exhibit 5: Evidence for price and quantity of solar lamps

Comments on Unit Economics of Both Pokkali and Kaipad Lands from ADAK

In unit Economics of Pokkali and Kaipad the cost of 1 number of pump, 1 number of feed tray and 1 number of Net frames, 1 Bagnet is only included but the actual minimum requirement for each unit of 5 ha are as follows

1. 5 Hp pumps - at least 2 nos/5ha for both pokkali and kaipad lands
2. Feed Tray - 10 nos/per unit for both pokkali and kaipad
3. Net Frames - 2 nos/each sluice gate i.e in pokkali 2 sluices are there in each unit and hence 4 Net Frames are required But in Kaipad only one sluice is there hence 2 net frames are required
4. Bag nets - 2nos of bagnet for each sluice gate is required . So for pokkali.– 4 nos and for Kaipad 2 nos of bagnets are required per unit.
5. Water testing kit - one per unit for both pokkali and Kaipad
6. Additionally one solar lamp set per unit is required at a cost of Rs.18,180/-(evidence :-quotation submitted along with)

Hence the cost of farm equipments may be revised accordingly.

EXECUTIVE DIRECTOR
Agency for Development of Aquaculture, Kerala
Thiruvananthapuram – 695 014

REVERIE CONSTRUCTIONS & SOLAR SOLUTIONS (PVT) LTD.

Quotation

Regional Executive
ADAK Ernakulam

PI # : 20151126
Date : 26.11.2015

No.	Description	Qty (pcs)	Unit Price (INR)	Total (INR)
1.	Solar system for Prawn farms designed to work 7w 4 numbers led bulb for 10 hrs using 70 W Poly crystalline Solar Panel, DC solar control unit, 40AH Exide solar battery, 7W DC Bulb 3 nos ,cost of installation including cost of wiring etc complete Transportation will be having an additional cost Tax 1%	1 No.	18,000.00	18,000.00 180.00
TOTAL INDIAN RUPEES EIGHTEEN THOUSAND ONE HUNDRED EIGHTY ONLY				18,180.00

WARRANTY- Warranty for battery 5 years, solar control unit for 2 year , DC bulb for 1 year

Expecting your valued order

Thanks with regards

Sunil K R
Director

EXECUTIVE DIRECTOR
Agency for Development of Aquaculture, Kerala

1st Floor, Mathew Paulo Arcade, K.M.K. Junction, North Paravoor, Ernakulam (Dist), Kerala, India, Pin: 683513, Tel : +919946882575 / 9747548694
0091 484 2440109 (office), info@reverieasolar.com , www.reverieasolar.com

Exhibit 6: Evidence for price of farm sheds for Pokkali and Kaipad lands

Abstract for Farm Shed ①

1 Farm shed estimate Nos.
with Materials, labour
including all fixing
Charges etc complete
Floor Size. 6m x 3m - 18m² x 1371/m² - 24,678/-

Rupees twenty four thousand six hundred and
seventy eight only

18/11/15

Countersigned

M. RAJEEV
Chief Engineer
Kerala State Coastal Area
Development Corporation Ltd.
Thiruvananthapuram-14

KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION LTD.
THIRUVANANTHAPURAM-14

Thiruvananthapuram
695 014

(2)

Farm Shed estimate as per CPWD SOR 2014

Data Preparation

0315	Bamboo 25mm ø 2.5 long	Score	1	350	= 350.00
1198	II nd class Rail laid in planks	cubm	1	260	= 260.00
7052	400g Polythene Sheet	m^2	1	15	= 15.00
	Labour				
0115	Coolie	day	1	329	= 329.00
0156	Carpenter AV	day	1	417	= 417.00
					1371.00

Checked
SDAE
Ernakulam

Countersigned

M RAJEEV
Chief Engineer
Kerala State Coastal Area
Development Corporation Ltd.
Thiruvananthapuram-14

KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION LTD

Executive Director
Agency for Development of
Aquaculture, Kerala

EXECUTIVE DIRECTOR AGENCY FOR DEVELOPMENT OF AQUACULTURE
Thiruvananthapuram
695 014

(2)

Farm Shed

Data

Materials

0305 - Bamboo 25mm dia 5.5m long @ 350/score (Set of 20 nos)

1108 IInd class Country wood in planks @ 260/10 cu dm

7755 - 40mic polythene sheet - Rs 15/m^2

Labour

0115 - Coolie - 329

0156 - Carpenter Average - 417

Quantity Calculation size of Shed 6m x 3m

Sides = 2 nos x 6m x 2.10 h = 25.20

" = 2 nos x 3m x 2.10 h = 12.60

Roof = 2 nos x 7m x 1.80m = 25.20

65 m^2

Bamboo for Roofs and Side Partition 2.5m long

18/0.50m = 36 Nos

2x7/0.50m = 28 Nos

64 nos / 20 nos = 3.20 score

Planks for platform

1, 6m x 3m x 0.025m = 0.45 m^3

Countersigned

M. RAJEEV
Chief Engineer
Kerala State Coastal Area
Development Corporation Ltd.
Thiruvananthapuram-14

Overseer
ADAK

Thiruvananthapuram
695 014

KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION LTD. THIRUVANANTHAPURAM-14

Exhibit 7: Evidence for price and quantity of planting mangroves and mangrove associates in Pokkali lands

Estimate for Mangrove Planting

Outer Bund Length for 24 ha. = 4320 m

For 1 ha = 180 m

Planting Distance - 1.5 mtr

Requirement of mangrove seeds = 180/1.5 = 120

Mangrove seed rate : Rs. 20/- per piece

Total cost for 5 ha = 120x5x20 = Rs.12000/-

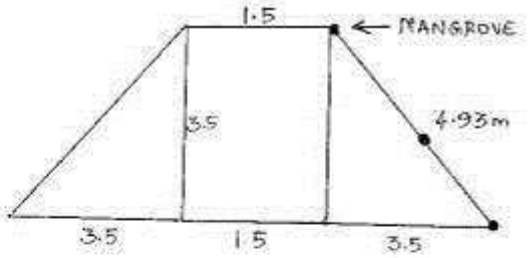
Exhibit 8: Evidence for price and quantity of planting mangroves and mangrove associates in kaipad lands

Estimate for Mangrove planting in Kaipad Lands

The length of outer bund (Main bund) in 5 sample sites surveyed in Kaipad:

Site No.1	– 210 m
Site No.2	– 150 m
Site No.3	– 325 m
Site No.4	– 110 m
Site No.5	– 484 m
Total length	**1279 m**

The total area of the 5 sites surveyed is 48.7 Ha. So the average peripheral bund length per Hectare is 26 m. For 5 Ha area, ie, for 1 unit, the length is 130 m. Mangroves are planted 1.5 m apart in three rows for protection of bund on its slope. The slope of the bund is having a width of 4.93 m.



Hence the total requirement of Mangrove plants to be planted in three rows is 260, ie,

$$\frac{(130 \times 3)}{1.5\ m}$$

So cost of Mangrove planting is Rs.5200/- ie (260 x Rs.20).

Exhibit 9: Evidence for costing of bund work for Kaipad lands

Average Estimate of Bund work required for Development of Kaipad farming under Promotion of Integrated farming system of Kaipad and Pokkali in coastal wet land of Kerala

2015-16 to 2018-2019

Site 1 Erhome	(6.4 ha)	:	5793 M^3
Site 2 Vellikkel	(12 ha)	:	5925 M^3
Site 3 Thaliparambe	(6.4 Ha)	:	6797.5 M^3
Site 4 Thaliparambe Municipality	(5.3 Ha)	:	5495 M^3
Site 5 Chelora	(18.6 ha)	:	18928 M^3
Total	48.7 ha	:	42938.5 M^3

42938.5/ 48.7 ha = 881.69/ ha

So the average quantity per ha is rounded as 880 M^3

So the average quantity of bund work required in Kaipad lands for 1 unit estimated as 880 x 5 ha = 4400 M^3

The rate of the bund work is calculated as per CPWD SOR 2014 and the rate per M^3 is Rs. 228.45. Thus the estimated cost of bund work per unit is 4400 M^3 xRs.228.45 = Rs 1005180/-

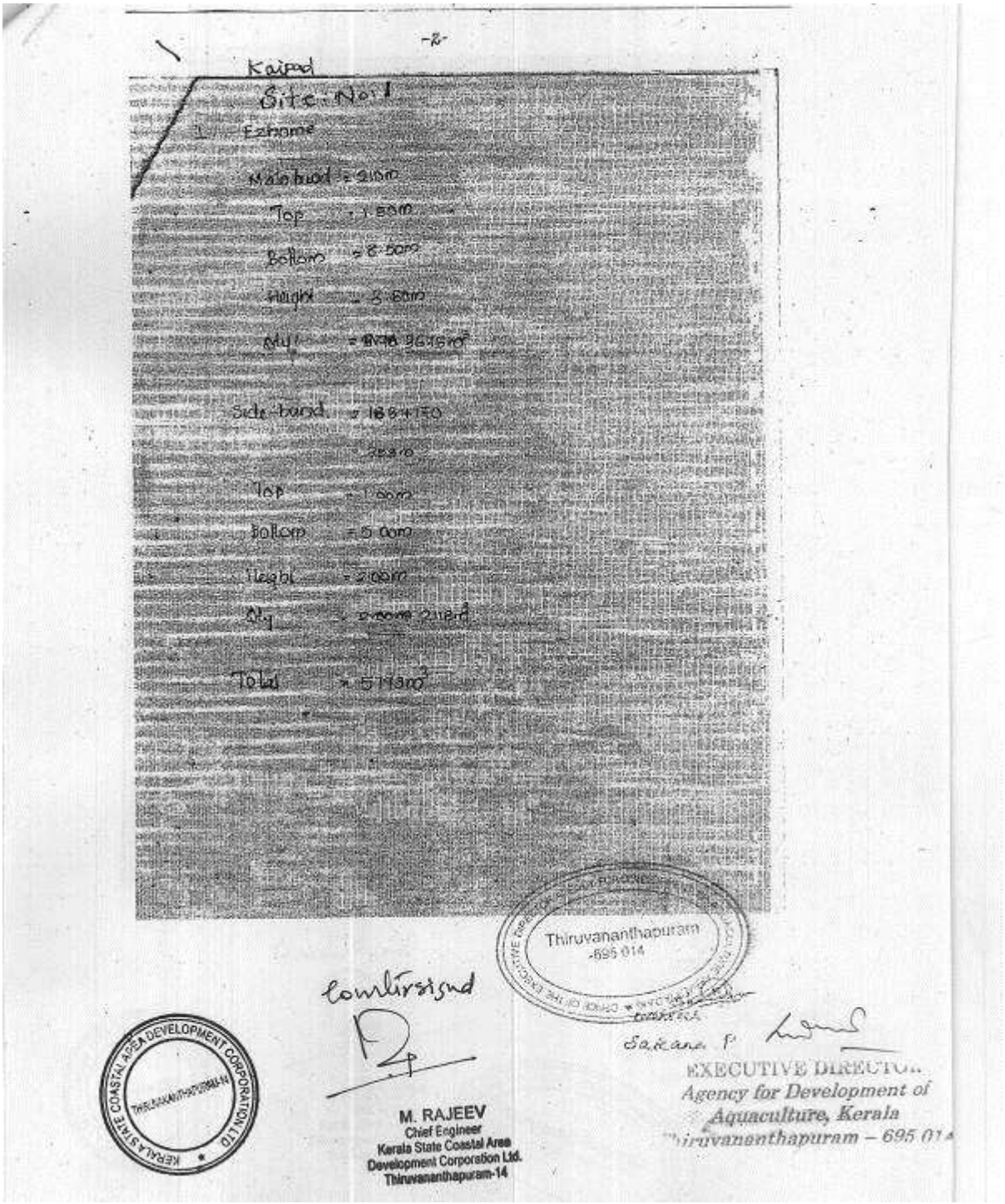
Confirmed

M. RAJEEV
Chief Engineer
Kerala State Coastal Area
Development Corporation Ltd.
Thiruvananthapuram-14

KERALA STATE COASTAL AREA DEVELOPMENT CORPORATION LTD

Agency for Development of Aquaculture, Kerala

Thiruvananthapuram -695 014



-8-

Kaipad

Site No: 1

1 Ezhome

Main bund = 21m

Top = 1.5m

Bottom = 8.5m

Height = 3.5m

Adj = [illegible]

Side bund = 18.5+15.0

= 33.5m

Top = 1.0m

Bottom = 5.0m

Height = 2.0m

Adj = [illegible]

Total = 5113m²

Thiruvananthapuram -695 014

Corrected

M. RAJEEV
Chief Engineer
Kerala State Coastal Area
Development Corporation Ltd.
Thiruvananthapuram-14

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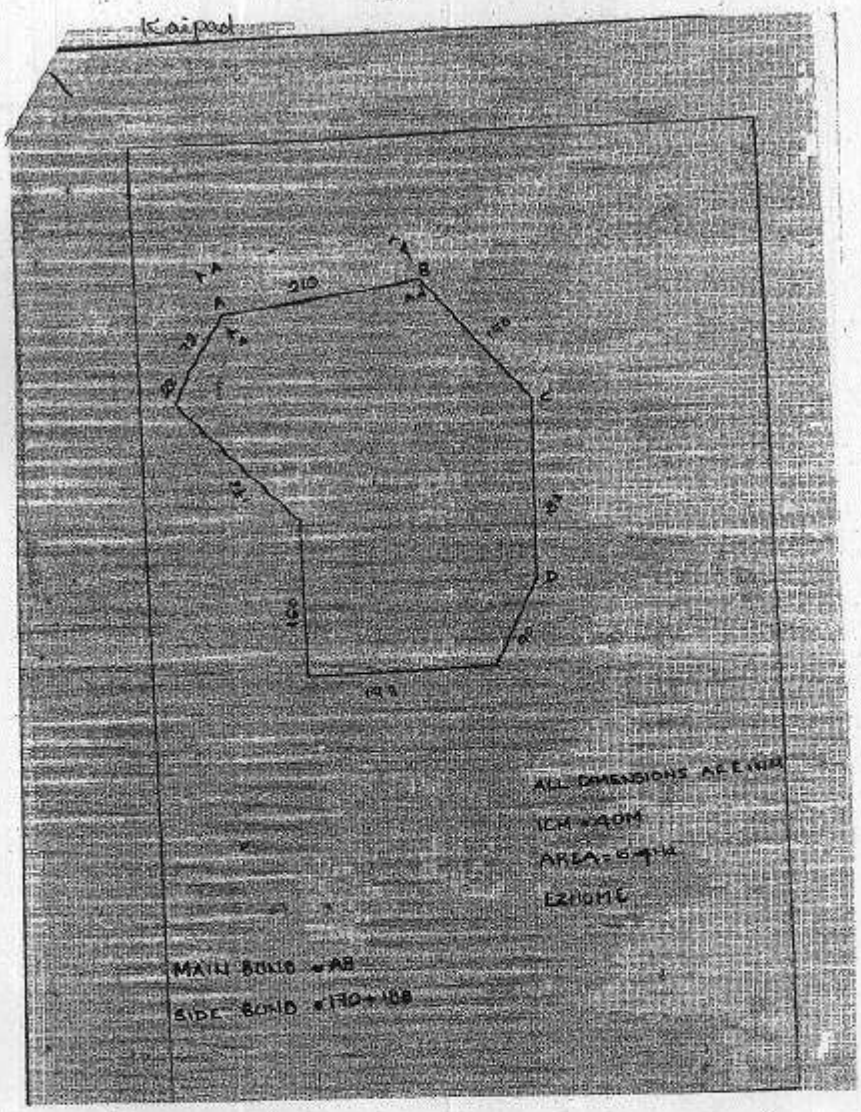

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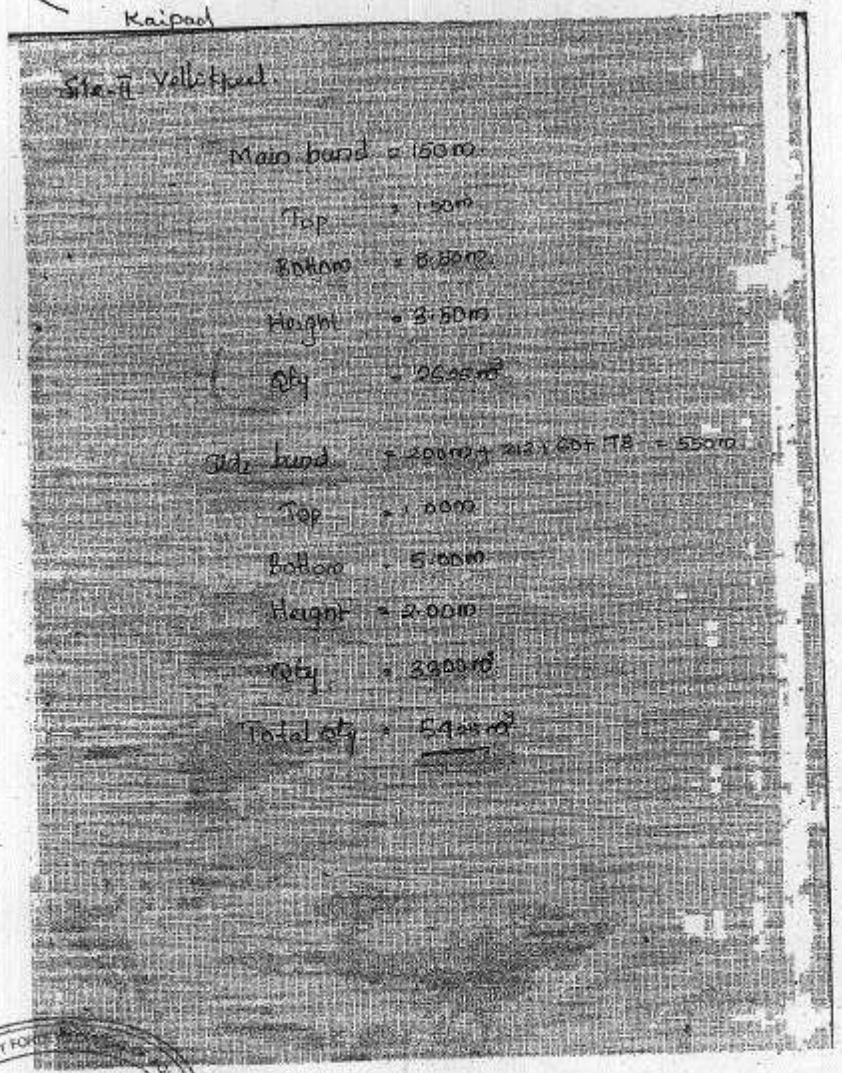

-4-

Kaipad

Site-II Vellikeel

Main bund = 150m

Top = 1.50m

Bottom = 8.50m

Height = 3.50m

Qty = 2625m³

Side bund = 200m + 200m + 150m = 550m

Top = 1.00m

Bottom = 5.00m

Height = 2.00m

Qty = 3300m³

Total qty = 5925m³

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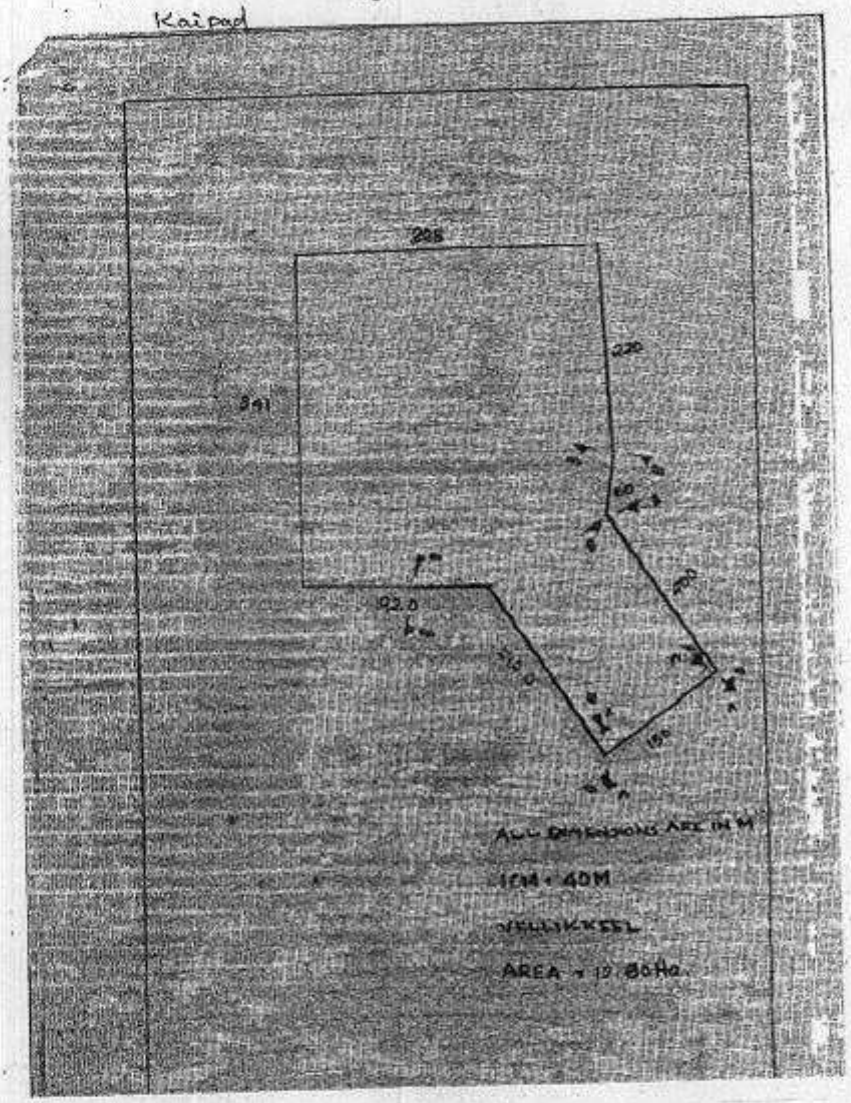
-5-



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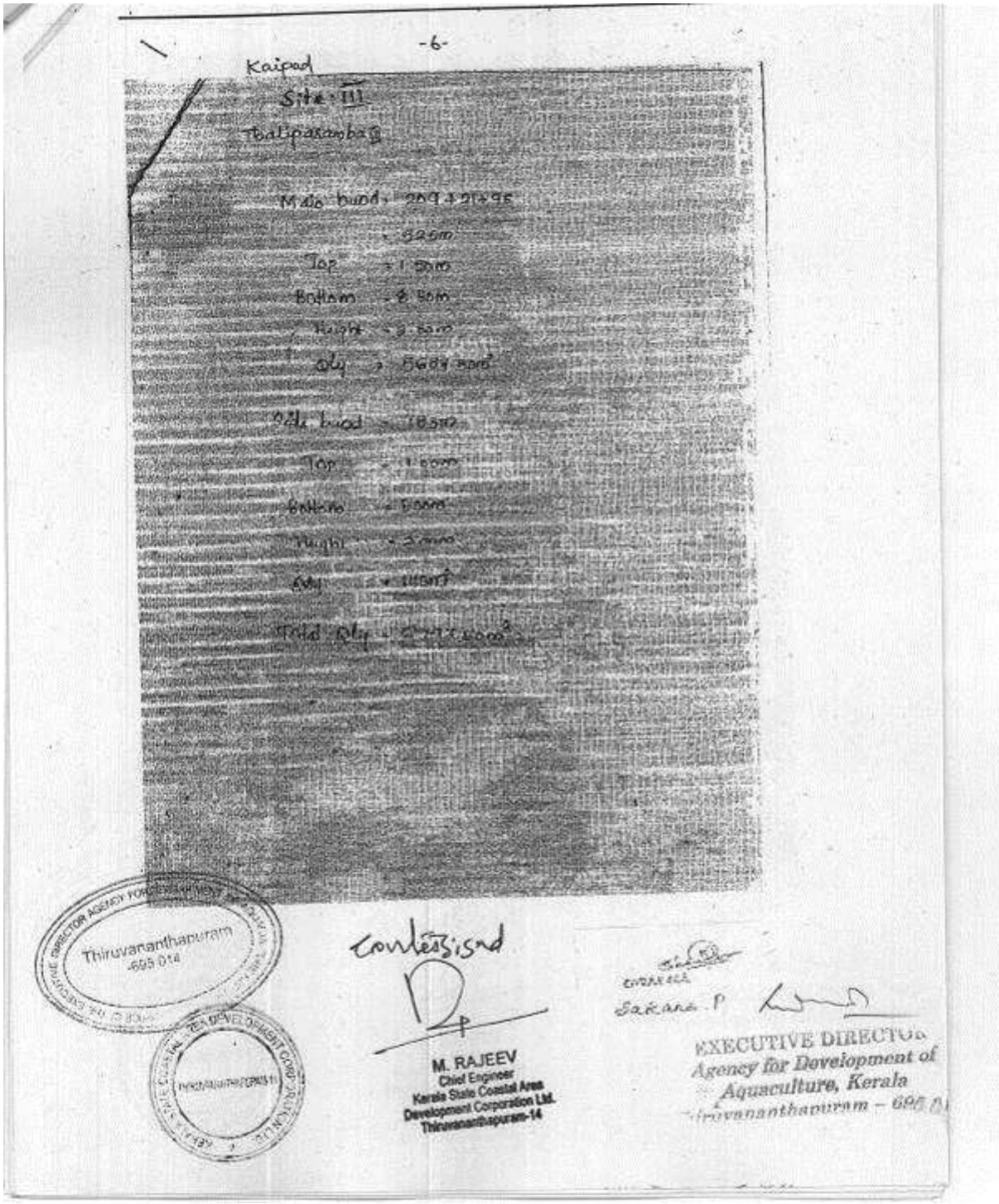
-6-
Kaipad
Site: III
Thaliparamba
Thiruvananthapuram
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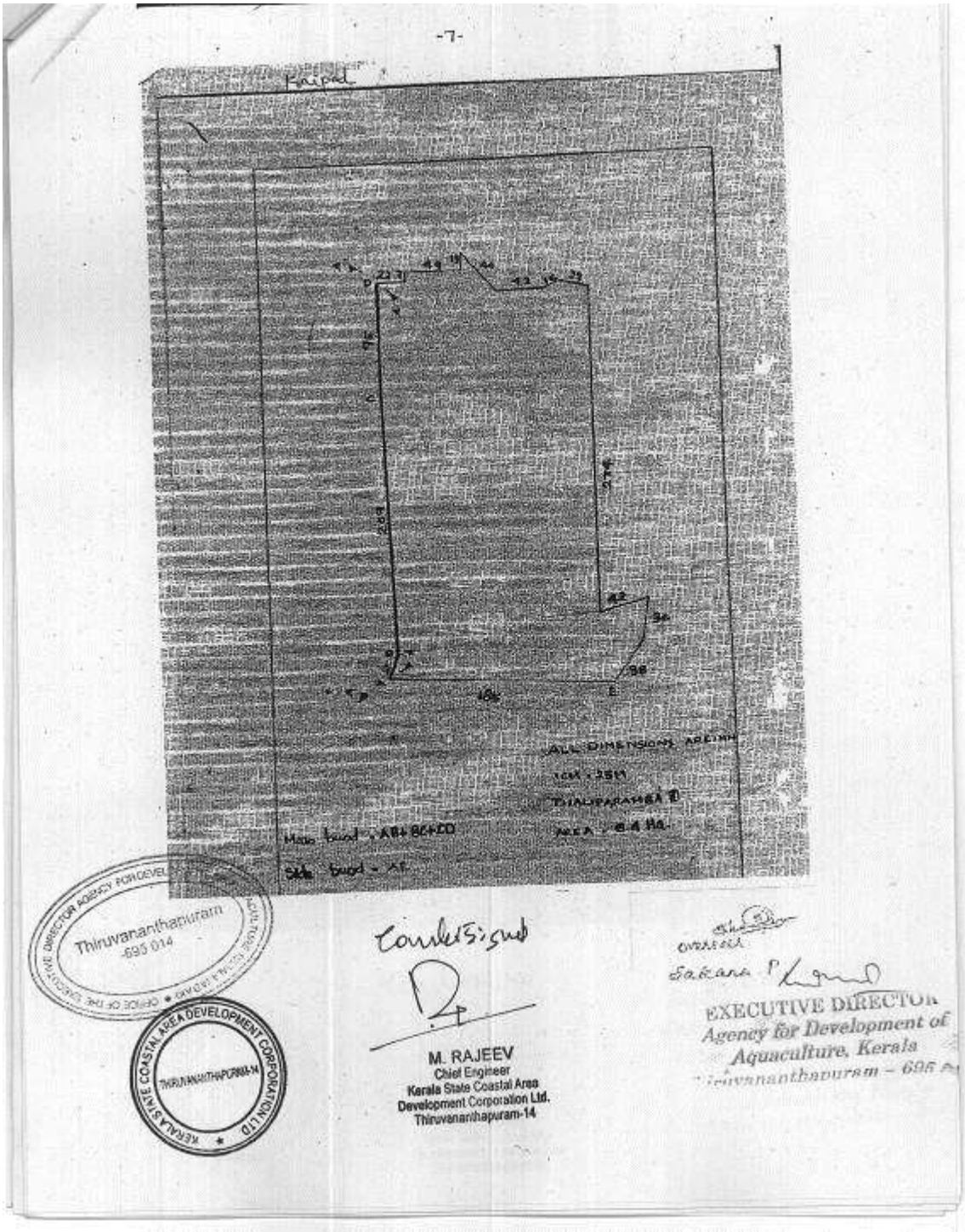

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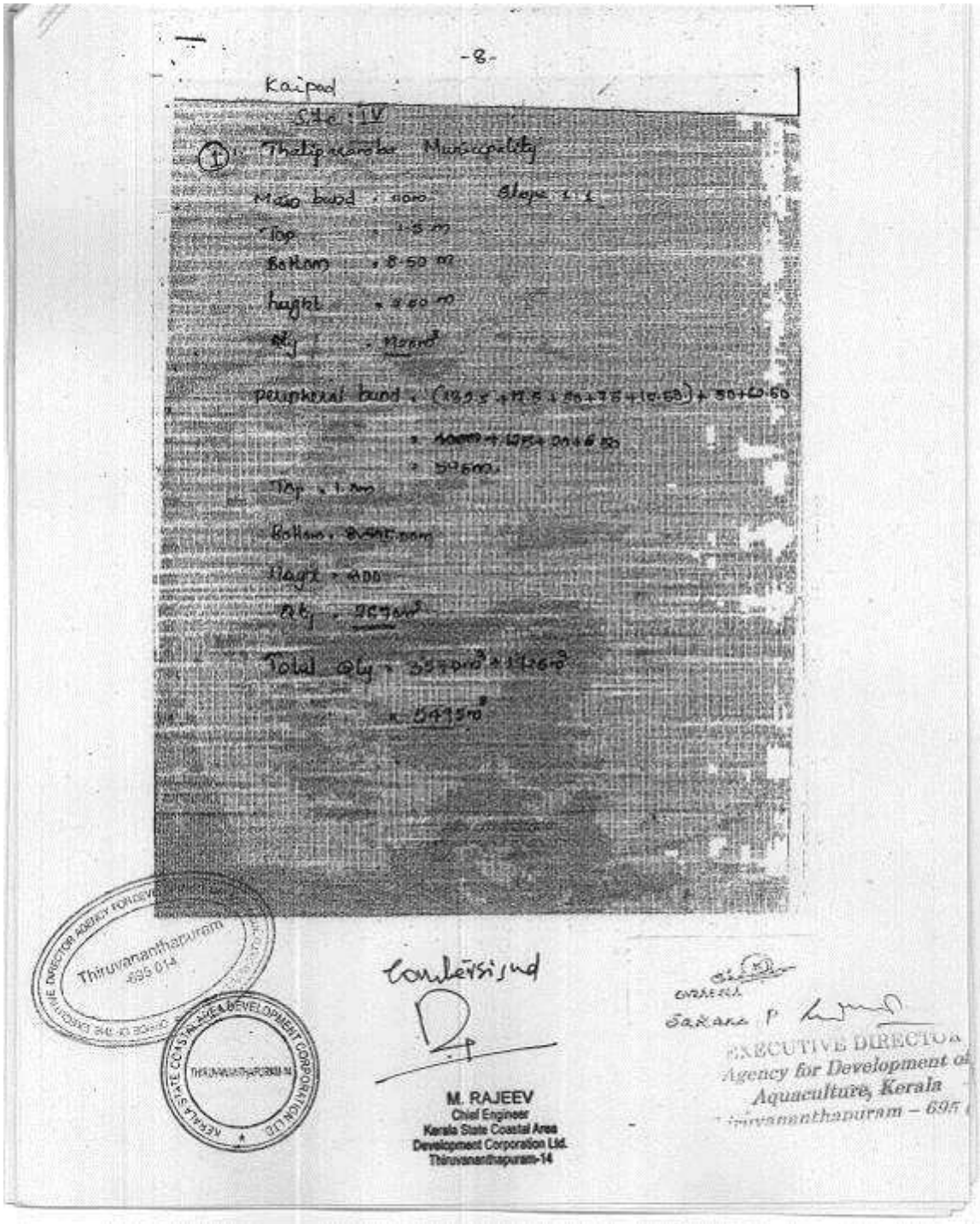

-8-

Kaipad

Calc : IV

① Thaliparamba Municipality

Main bund : 100m Slope 1:1

Top : 1.5 m

Bottom : 8.50 m

height : 2.00 m

Qty : Nil m³

peripheral bund : (183.5 + 11.5 + 50 + 35 + 10.50) + 50 + 50 + 50

: 100m + 179.5 + 50 + 50

: 379.5m

Top : 1.5m

Bottom : 8.50 m

Height : 1.00

Qty : 379.5m²

Total Qty : 379.5m² × 1.5m²

= 569.25m³

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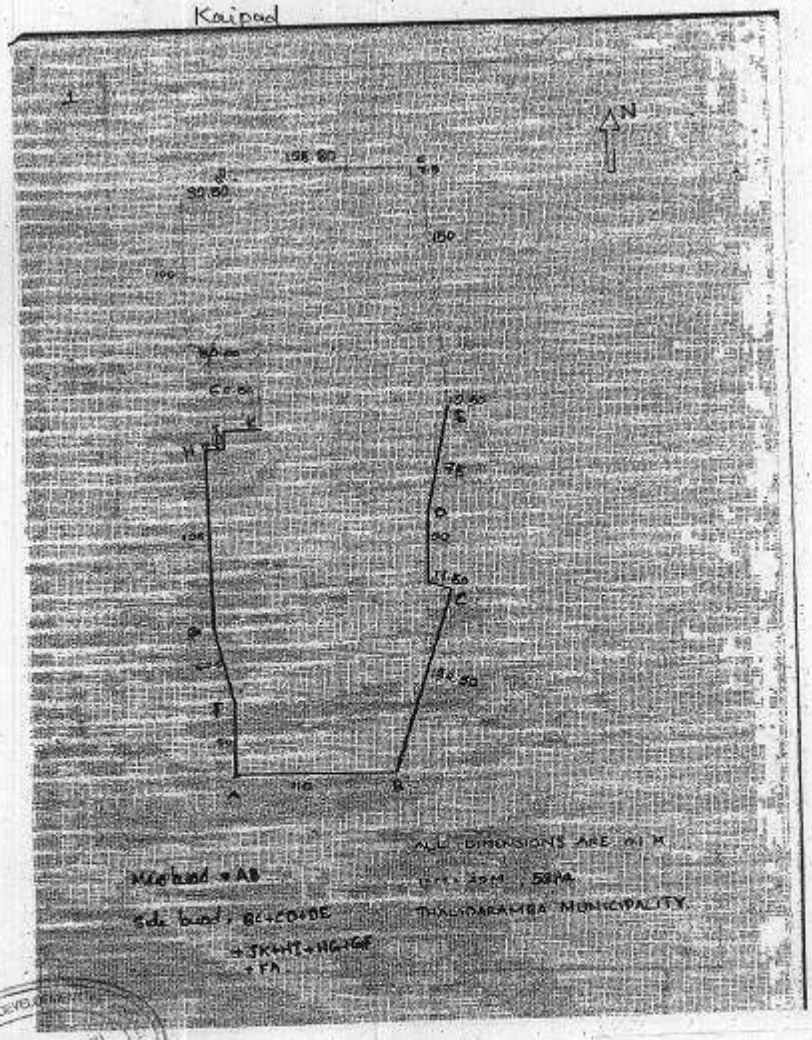
-9-

Kaipad



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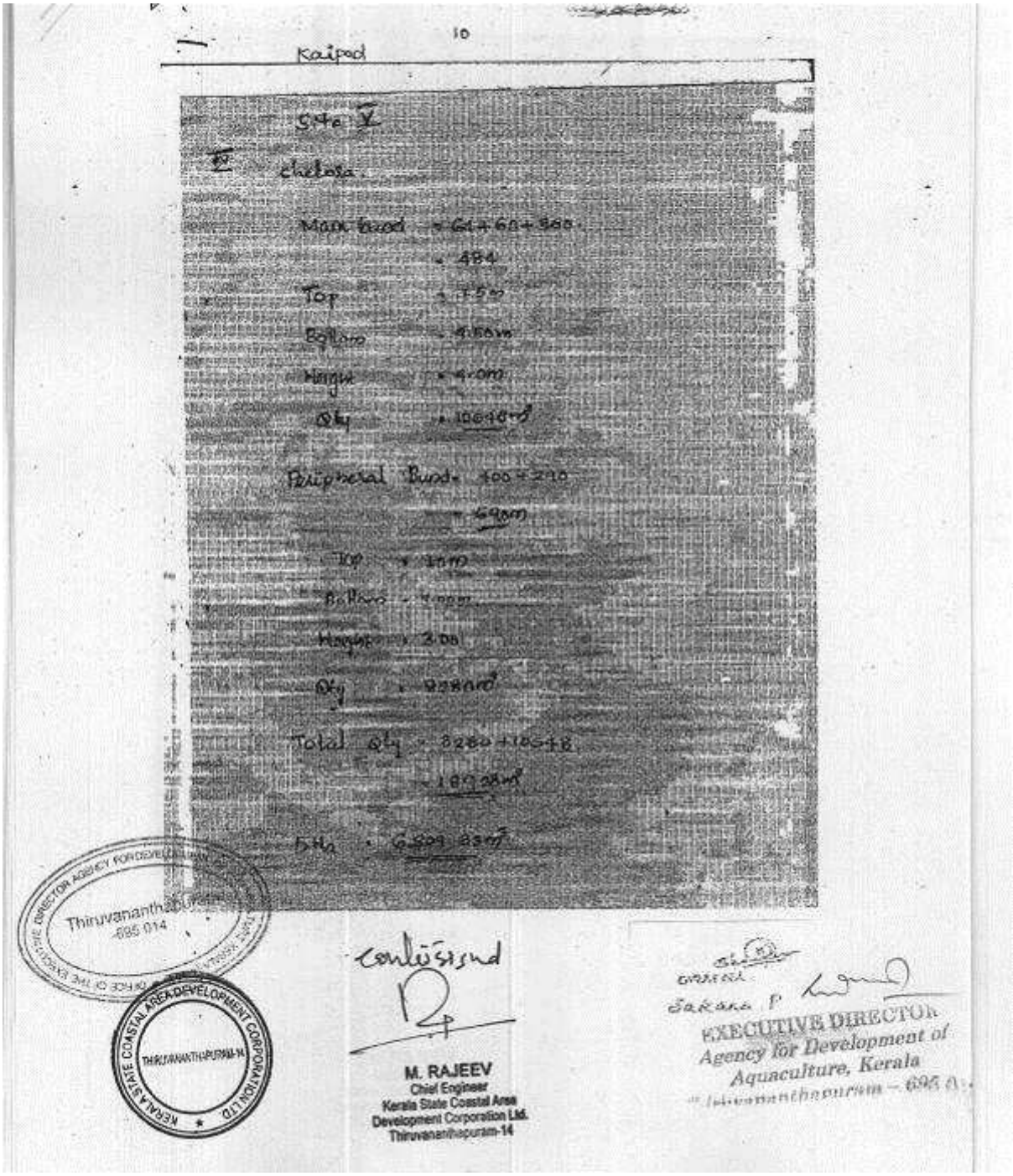

10

Kaipad

Site V

V chelola.

Main bund = 64+60+360

= 484

Top = 4.5m

Bottom = 4.60m

Height = 4.0m

Qty = 10648m³

Peripheral Bund = 100+210

= 310m

Top = 1m

Bottom = 1.20m

Height = 3.00

Qty = 2480m³

Total Qty = 8280+10648

= 18928m³

5th = 6309.83m³

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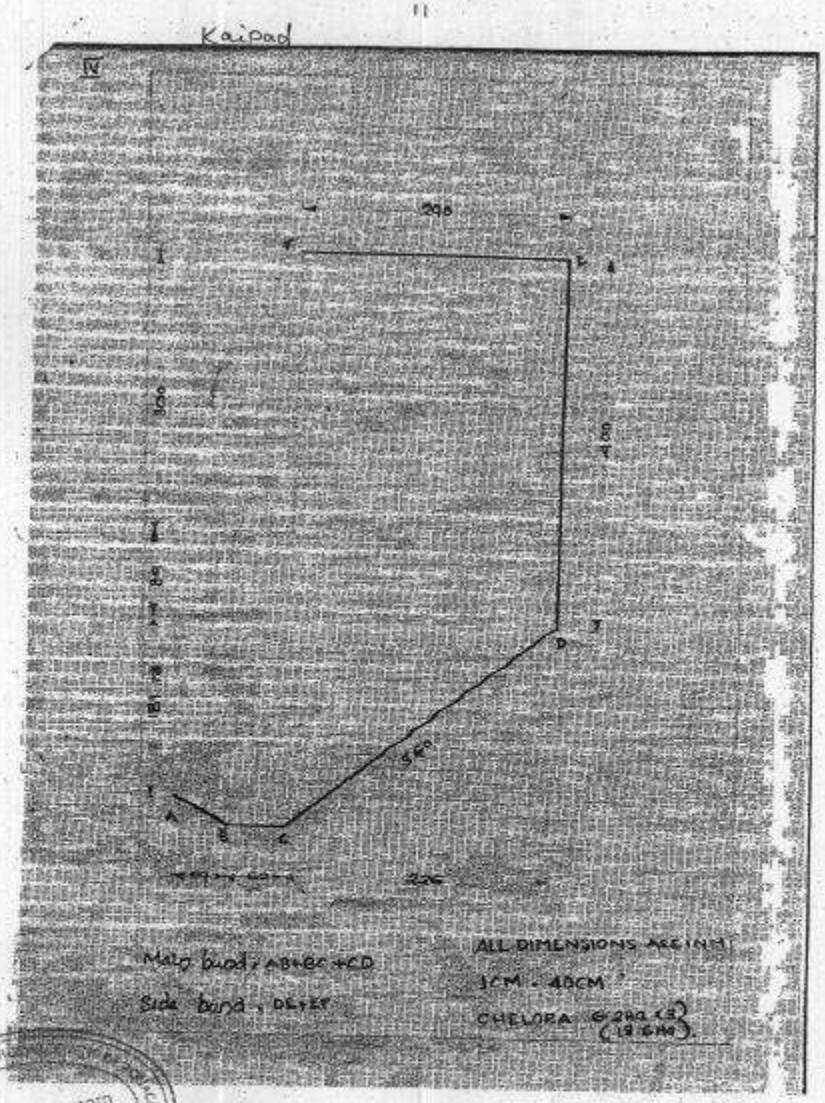

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Exhibit 10: Evidence for costing of bund work for Pokkali lands

Pokkali - Total 9 pages ①

Average Estimate of Bund work required for Development of Pokkali farming under Promotion of Integrated farming system of Kaipad and Pokkali in coastal wet land of Kerala

2015-16 to 2018-2019

Site 1(5.40 ha)	:	4410.00 M^3
Site 2 (5.18 ha)	:	4919.60 M^3
Site 3 (5.48 Ha)	:	3900.40 M^3
Site 4 (7.94 Ha)	:	7938.00 M^3
Total 24.00 ha	:	21168 M^3

21168 M^3 / 24 ha = 882 M^3/ 1ha

For 5 ha = 882 M^3 x 5 ha = 4410 M^3

So the average quantity of bund work required in Kaipad lands is estimated as 4410 M^3/ 5 ha units

The rate of the bund work is calculated as per CPWD SOR 2014 and the rate per M^3 is Rs. 228.45. Thus the estimated cost of bund work per unit is 4410 M^3 xRs.228.45 = Rs 1007465/-

Overseer
ADAK,
Ernakulam

Conversion

11/11/2015

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Peripheral Bund Work

Site 1 (5.40 Ha)

Quantity Calculation

I Section A A

Bottom = 5.50m

top = 1.50m

$\frac{7}{2} \times 2m \times 7m^2 \times 900m = 6300 m^3$ less 30%

$= 4410 m^3$.

Site - 2 (5.18 Ha)

Quantity Calculation

I Section A A

Bottom = 5.50m

top = 1.50m

$\frac{7}{2} \times 2m \times 7m^2 \times 1004m = 7028 m^3$ less 30%

$= 4219.60 m^3$.

Site - 3 (5.48 Ha)

Quantity Calculation

I Section A A

Bottom = 5.50m +

top = 1.50m

$\frac{7}{2} \times 2m \times 7m^2 \times 796m = 5572$ less 30%

$= 3900.40 m^3$.

Site - 4 (7.94 Ha)

Quantity Calculation

I Section A A

Bottom = 5.50m +

top = 1.50m

$\frac{7}{2} \times 2m \times 7m^2 \times 1620m = 11340 m^3$ less 30

$= 7938 m^3$.

Countersigned

11/11/2015

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SITE - 2
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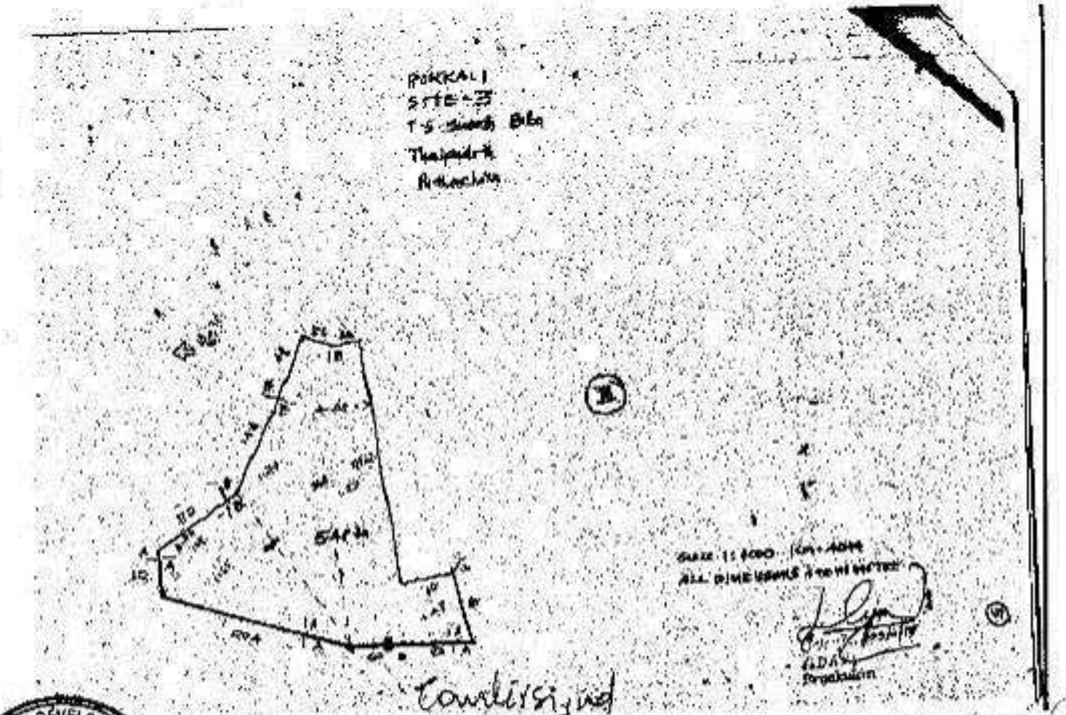

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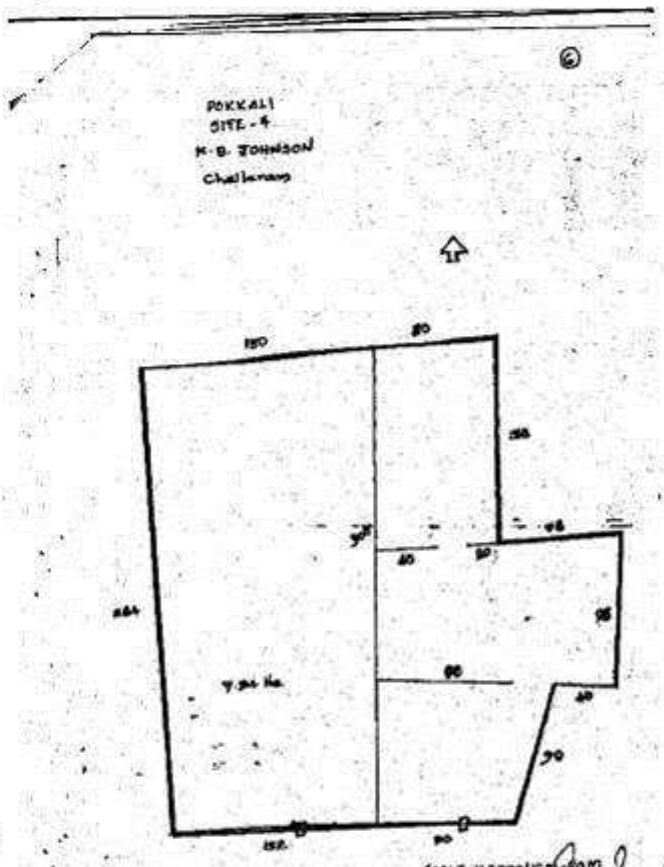

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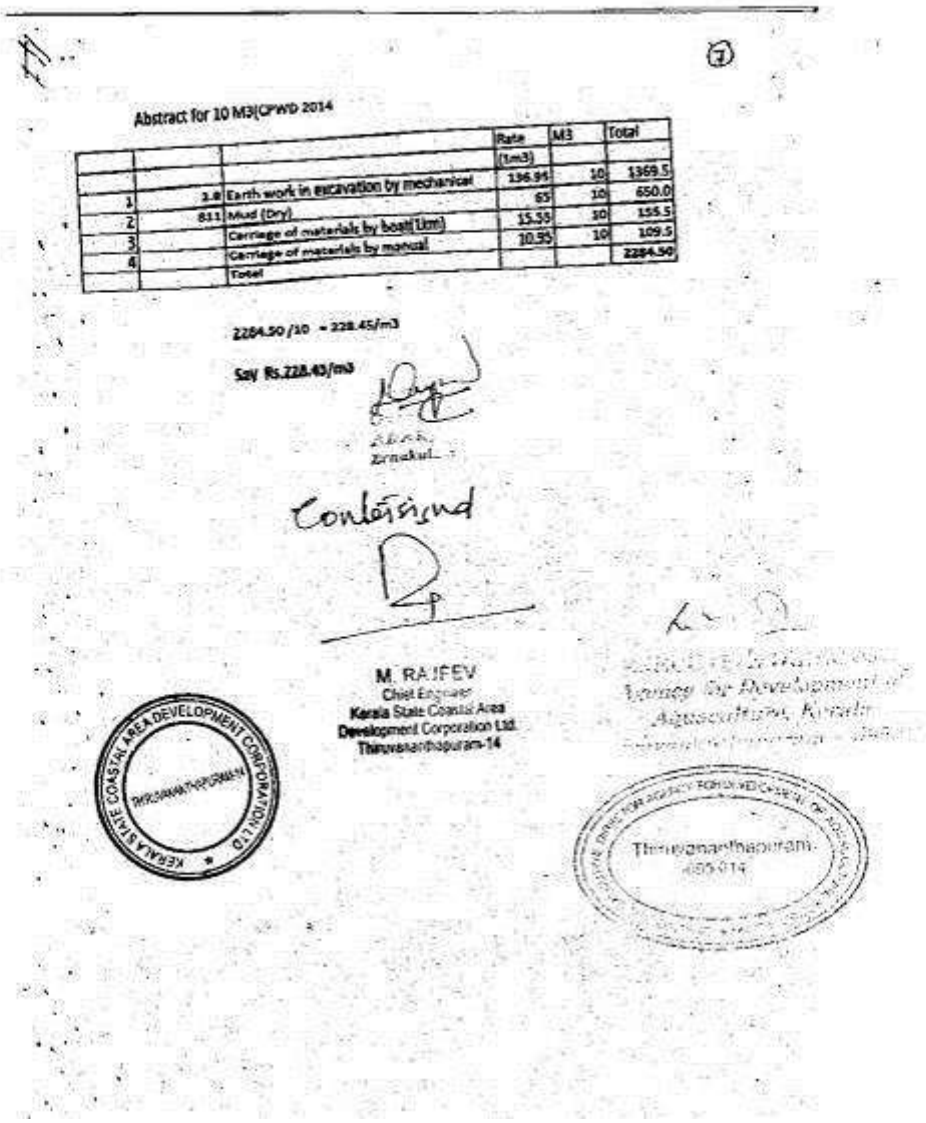
Exhibit 11: Evidence for costing per metre of bund work for Pokkali and Kaipad lands



Abstract for 10 M3(CPWD 2014

			Rate (1m3)	M3	Total
1	2.8	Earth work in excavation by mechanical	136.95	10	1369.5
2	811	Mud (Dry)	65	10	650.0
3		Carriage of materials by boat(1km)	15.55	10	155.5
4		Carriage of materials by manual	10.95	10	109.5
		Total			2284.50

2284.50 /10 = 228.45/m3

Say Rs.228.45/m3

Zirnakul

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Abstract for 10 m³

I	Earth work in excavation by Mechanical	136.95/m³ ×10	= 1369.50
II	Bail (dry)	65/m³ ×10	= 650.00
III	Carriage of Materials by Boat 1 km	15.55/m³ ×10	= 155.50
IV	Carriage of Materials by hand	20.95/m³ ×10	= 209.50
			2284.50

2284.50/10 = ₹ 228.45/m³

Say ₹ 228.45/m³

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Director for Development of Aquaculture, Kerala

EXECUTIVE DIRECTOR AGENCY FOR DEVELOPMENT OF AQUACULTURE
Thiruvananthapuram
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(1)

As per CPWD data 2014 (clay)

Data

I 2.8. Earth work in excavation by mechanical means (Hydraulic excavator)/ Manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 m² on plan) including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. all kinds of soil.

Details of cost for 10 m³ (Machinery)

0020	Hydraulic excavator (3D) with driver and fuel	day 0.041	5000	220.00
0018	Hire and running charges of loader	day 0.041	5000	246.25
0112	Mate/Beldar	day 0.40	363	145.25
0115	Coolie	day 2.050	307	674.15
				1355.70
	add water charge 1%			13.56
				1369.46

Cost of 1m³ = 1369.46/10 = 136.946/-

Say ₹ 136.95/-

II 0011 Hud (dry) - ₹ 65/m³

III Carriage of Materials by Lorry

1.1.2 Earth 53.44/6.4 m³ i.e., ₹ 15.54/m³ Say @ ₹ 15.55/m³

IV Carriage of Materials by Manual

1.2.2 Earth ₹ 103.64/1st 50 m Additional (25 m) i.e ₹ 0.81/m³ (upto 1 km)

i.e, 0.81 × 251 m = ₹ 203.31/ 250 m

i.e, 203.31 + 103.64 = 306.95/ 250 m

i.e, total 301 m = 306.95/ 28 m³ = 10.96/m³ for 1m distance

Say ₹ 10.95/m³ (for 1m)

Countersigned

[signature]

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[signature] 20/11/15

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AGENCY FOR DEVELOPMENT OF AQUACULTURE KERALA
Thiruvananthapuram

Exhibit 12: Evidence for the price of wooden sluice gates for Pokkali and Kaipad lands

Total 4 Pages

Abstract For Wooden Sluice gate as per CPWD SOR 2014

Rate for 1 sluice

1. Wooden Sluice Gate seasoning timber with materials,labour including all fixing Cost etc complete : 2.05 M3 x 48848.40 = Rs. 1,00,139.22/-

Say : Rs. 1,00,139.20 /-

(Rupees One lakh One hundred and thirty nine and twenty paise only)

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Quantity

I	H. Runner = 6 Nos x 4m x 0.15 x 0.10	= 0.36 m^3	
	Additional H Runner = 4 Nos x 4m x 0.15 x 0.10	= 0.24 m^3	
II	V. Runner = 10 Nos x 3m x 0.15 x 0.10	= 0.45 m^3	
	Inside Runner = 10 Nos x 1m x 0.15 x 0.10	= 0.15 m^3	
	Additional V-Runner = 6 Nos x 3m x 0.15 x 0.10	= 0.27 m^3	
III	Plates & Washers = 20 Nos x 1m x 0.25 x 0.025	= 0.50 m^3	
IV	Inside plates & Washers = 8 Nos x 1m x 0.025 x 0.25	= 0.05 m^3	
			2.02
		1% Wastage	0.0202
	@ 2.05 m^3		2.0402

Checked by
EAK, [illegible]

Countersigned

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Director of Development of Aquaculture, Kerala

DIRECTOR AGENCY FOR DEVELOPMENT OF AQUACULTURE Thiruvananthapuram

Estimate for Wooden Sluice gate as per CPWD 2014 SOR.

9.3.2

Kiln Seasoned and Chemically treated Hollock Wood.

2466	Hollock Wood in scantling 10 cubm		166	340	5644.00
2204	Carriage of timber	m^3	0.166	121.70	20.20
2504	Kiln seasoning of timber	m^3	0.166	750.00	124.50
9999	Chemical treatment	L.S.	18.200	1.78	32.40
	Labour				
0112	Carpenter 2nd class	day	1.00	399.00	399.00
0114	Beldar	day	1.00	329.00	329.00
9999	Sundries Screws etc	L.S	53.820	1.78	95.88
	Total				6644.32
	Add Water Charges 1%				66.45
	Total				6711.35
	Add C.P.O.H 15%				1006.70
	Cost of 0.158cum				7718.05

Cost of 1 cum = 7718.05 / 0.158 cum

= 48,898.42

@ 48,848.40/-

Checked

Countersigned

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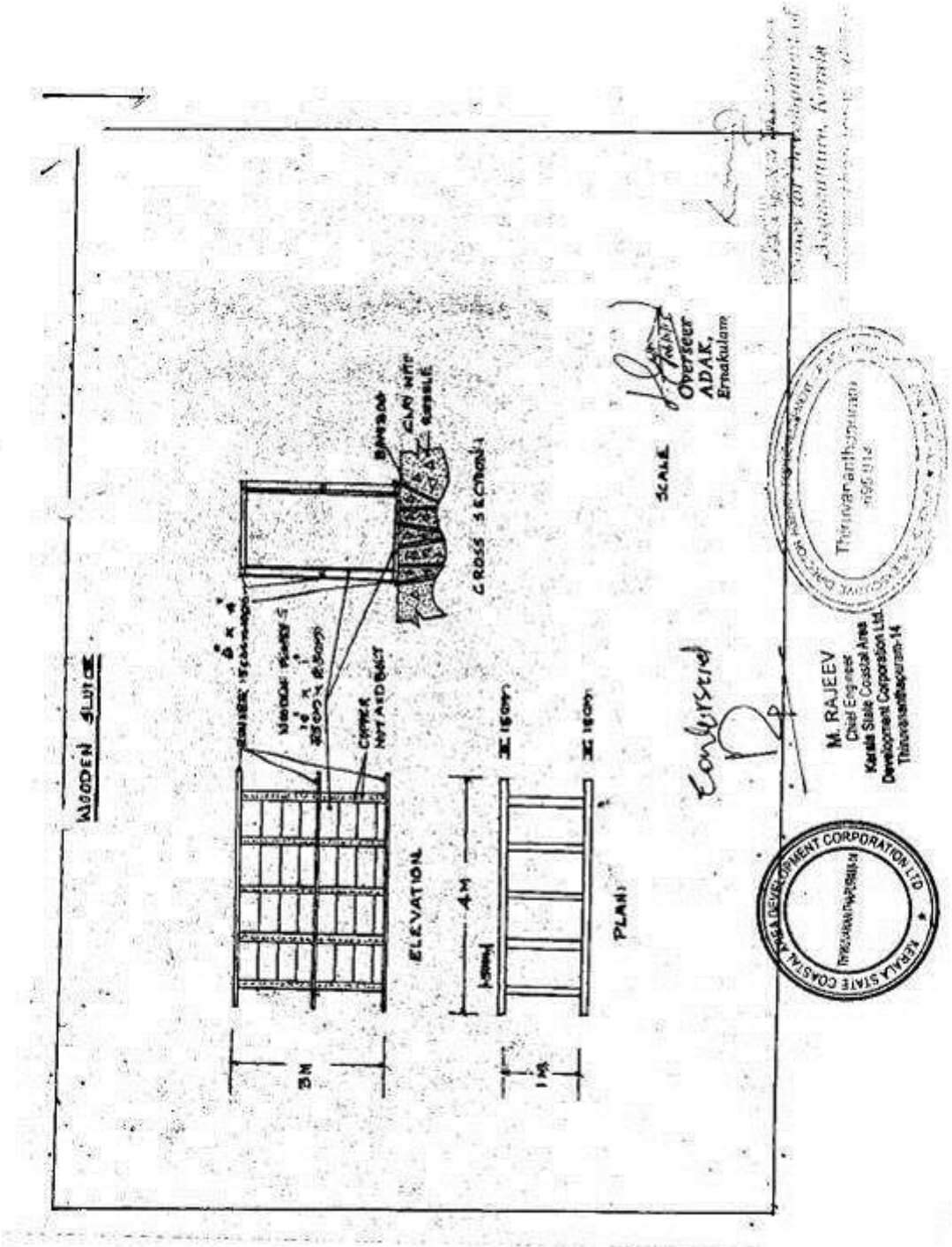
Executive Director
Agency for Development of Aquaculture Kerala

Executive Director Agency for Development of Aquaculture Kerala Thiruvananthapuram 695 014


WOODEN SLUICE
ELEVATION
PLAN
CROSS SECTION
SCALE
Overseer
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Ernakulam
M. RAJEEV
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Exhibit 13: Evidence for why two sluice gates are needed in Pokkali lands and only one in Kaipad lands

Two Sluices are required for Pokkali area and one sluice only for Kaipad Land

Pokkali fields are brackish water wetlands consisting of small podlers and are already in ownership of many persons. Many of the pond were constructed and exist with very small bunds demarcating the boundary of each persons or owners. Hence there is rare chance to make the areas as large ponds. In the circumstances in the envisaged project 5 ha. units will be having more than one ponds . Hence 2 numbers of sluices were proposed per unit in 5 ha. But in Kaipad lands the lands remain as continuous stretch without bunds separating the properties of individuals .So the ponds can be constructed as large ponds clubbing together the fields of many individuals. Hence one sluice for 5 ha unit is proposed .

Exhibit 14: Evidence for the requirements of lime on an average in Pokkali as well as Kaipad farming system

Estimate for Pond Preparation in Pokkali Fields

An alternate cropping pattern of paddy and shrimp is practiced in pokkali fields. The remains of straw decayed and other organic debris make the soil acidic. The acidity is washed away by the brackish water that enter the fields during initial days of summer(November).Normally the wet soil pH in the fields will be 5.5 For the successful farming operations, the soil pH is to be made optimum by the application of lime or dolomite . It will also act as disinfectant. The quantity of lime or dolomite per hectare is as follows.

Item	Qty(kg)	Rate(Rs.)	Amount(Rs.)
Lime/Dolomite	720 kg	Rs. 8/-	5760.00

K.C. TRADERS
Kottapuram, Kodungallur
Pin : 680 667, Trichur (Dist)

Ph : 2804339 (Off)
Mob: 8907718660

To,
Regional Executive
ADAK
Ernakulam.

Date 9-11-2015

1) Rate for 34% Protein Shrimp feed –
of Godrej Agrovet 25kg - Bag - Rs - 2450-00.

2) Dolomate powder 50kg Bag Rs - 400-00

3) Feed Tray – (75CM X 75CM)
with 6 MM Rod including –
Net
Rs 450/Each

Thanking you,
Yours faithfully
K. C. PIUS

For K.C. TRADERS
Managing Partner

Environmental friendly Prawn farming

Measures for effective nurturing &
prevention of diseases
by ADAK

ഉൽപാദനക്ഷമതയുള്ളതാക്കി മാറ്റാനും സാധിക്കുന്നു. അളവുതിനം എന്നെയുള്ള മണ്ണിൽ അളത്തിന്റെ തോത നുസരിച്ച് ഹെക്ടറിന് താഴെ പറയും വിധം കുമ്മായം ചേർക്കാവുന്നതാണ്.

മണ്ണിന്റെ അമ്ല-ക്ഷാരനില (pH)	ആവശ്യമായ കുമ്മായം (കിലോഗ്രാമിൽ)
4	1610
4.5	1430
5	1050
5.5	720
6	340
6.5	200

ഒരു അണുനാശകവസ്തു എന്നതിനോടൊപ്പം കുമ്മായം, മണ്ണിൽ ധാതുലവണങ്ങളുടെ ലഭ്യത വർദ്ധിപ്പിക്കാനും സഹായിക്കുന്നു. ജൈവവളങ്ങളും രാസവളങ്ങളും മണ്ണിലെ ലൈവകാർബൺ, നൈട്രജൻ, ഫോസ്ഫറസ് എന്നിവയുടെ അളവ് കണക്കിലെടുത്ത് പ്രയോഗിക്കണം. വളപ്രയോഗം ആവശ്യത്തിലധികമാകാതെ ശ്രദ്ധിക്കണം. വളപ്രയോഗത്തെ തുടർന്ന് നെൽച്ചെടി ആഴ്ചകൾക്കുള്ളിൽ വെള്ളത്തിന്റെ നിറം, സുതാര്യത എന്നിവ നിരീക്ഷിച്ച് സസൂക്ഷ്മവകങ്ങളുടെ വളർച്ച നിർണ്ണയിക്കാൻ കഴിയും. പൂർണ്ണമായും വെള്ളം വറ്റിച്ച് ഉണക്കാൻ പറ്റാത്ത കുളങ്ങളിൽ കല്ലുമ്മക്കായ്ക്കളെയും മറ്റും നഴിഗിക്കുന്നതിന് മഹുവചില്ലാക്ക്, ടീസീഡ് കേക്ക് എന്നിവ ഉപയോഗിക്കാവുന്നതാണ്. പൊക്കാളി നിലങ്ങളിൽ സാധാരണയായി ഹെക്ടറിന് 30 സെന്റീമീറ്റർ ആഴമുള്ള ജലത്തിൽ മഹുവചില്ലാക്ക് 500 മുതൽ 1000 കിലോഗ്രാംവരെയും, ടീ സീഡ് കേക്ക് 70 മുതൽ 100 കിലോഗ്രാംവരെയും ഉയോഗിക്കണം.

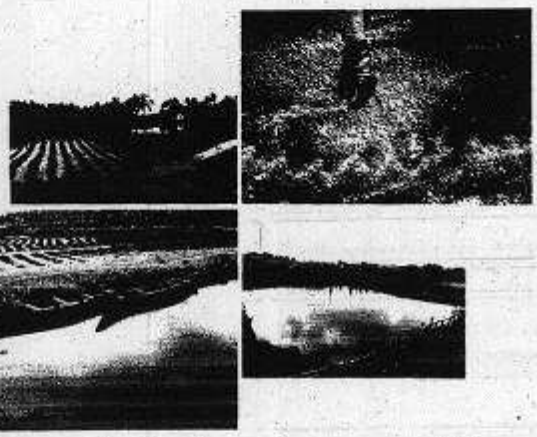
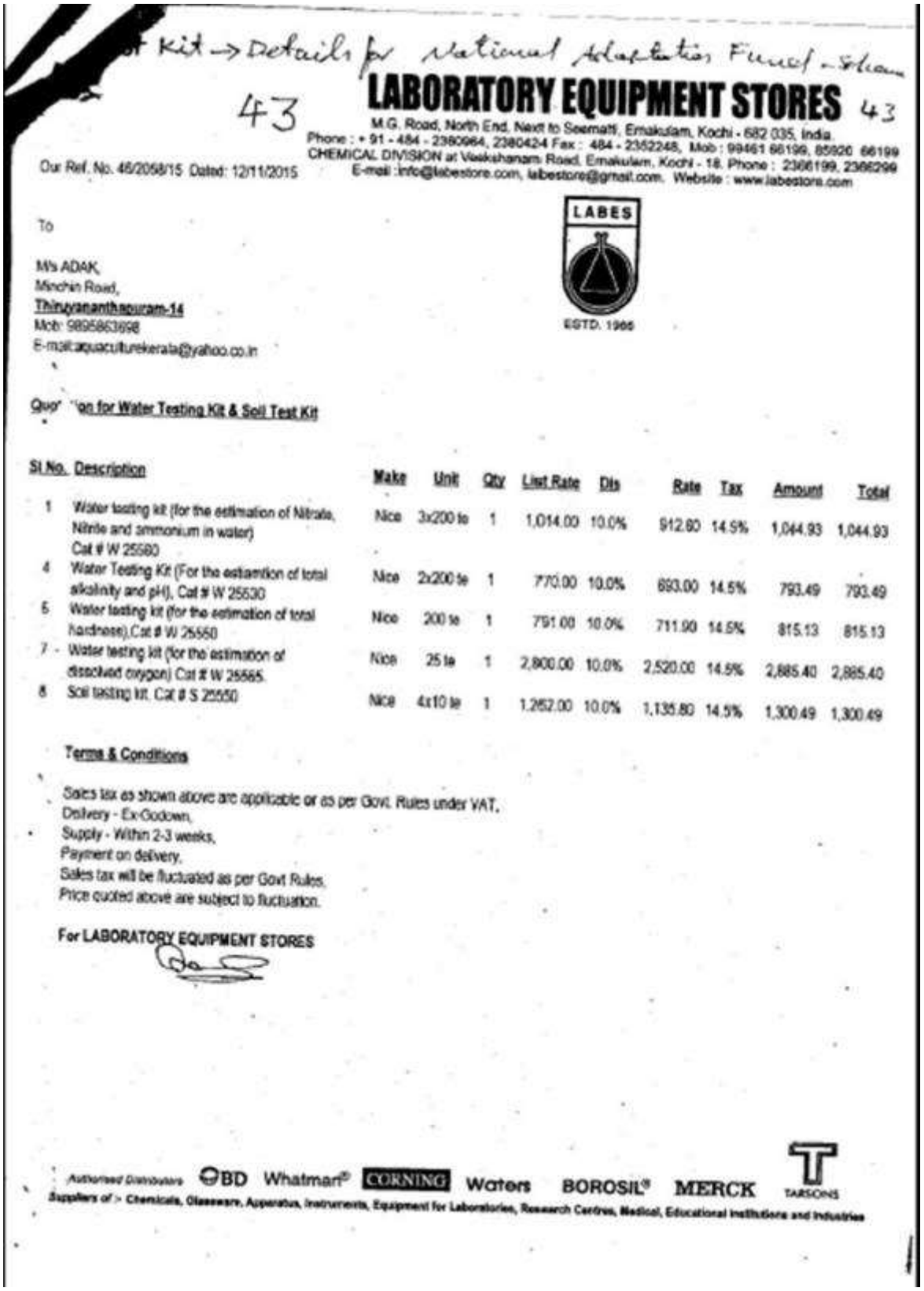


Exhibit 15: Evidence for the cost of water testing kits



Kit → Details for National Adaptation Fund - Kera

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LABORATORY EQUIPMENT STORES 43

M.G. Road, North End, Next to Seematti, Ernakulam, Kochi - 682 035, India.
Phone : + 91 - 484 - 2380964, 2380424 Fax : 484 - 2352248, Mob : 99461 66199, 85920 66199
CHEMICAL DIVISION at Vaikshanam Road, Ernakulam, Kochi - 18. Phone : 2366199, 2366299
E-mail :info@labestore.com, labestore@gmail.com. Website : www.labestore.com

Our Ref. No. 46/2058/15 Dated: 12/11/2015

LABES
ESTD. 1966

To

M/s ADAK,
Minchin Road,
Thiruvananthapuram-14
Mob: 9895863698
E-mail:aquaculturekerala@yahoo.co.in

Quotation for Water Testing Kit & Soil Test Kit

Sl No.	Description	Make	Unit	Qty	List Rate	Dis	Rate	Tax	Amount	Total
1	Water testing kit (for the estimation of Nitrate, Nitrite and ammonium in water) Cat # W 25580	Nice	3x200 te	1	1,014.00	10.0%	912.60	14.5%	1,044.93	1,044.93
4	Water Testing Kit (For the estaemtion of total alkalinity and pH), Cat # W 25530	Nice	2x200 te	1	770.00	10.0%	693.00	14.5%	793.49	793.49
5	Water testing kit (for the estimation of total hardness).Cat # W 25550	Nice	200 te	1	791.00	10.0%	711.90	14.5%	815.13	815.13
7	Water testing kit (for the estimation of dissolved oxygen) Cat # W 25565.	Nice	25 te	1	2,800.00	10.0%	2,520.00	14.5%	2,885.40	2,885.40
8	Soil testing kit. Cat # S 25550	Nice	4x10 te	1	1,262.00	10.0%	1,135.80	14.5%	1,300.49	1,300.49

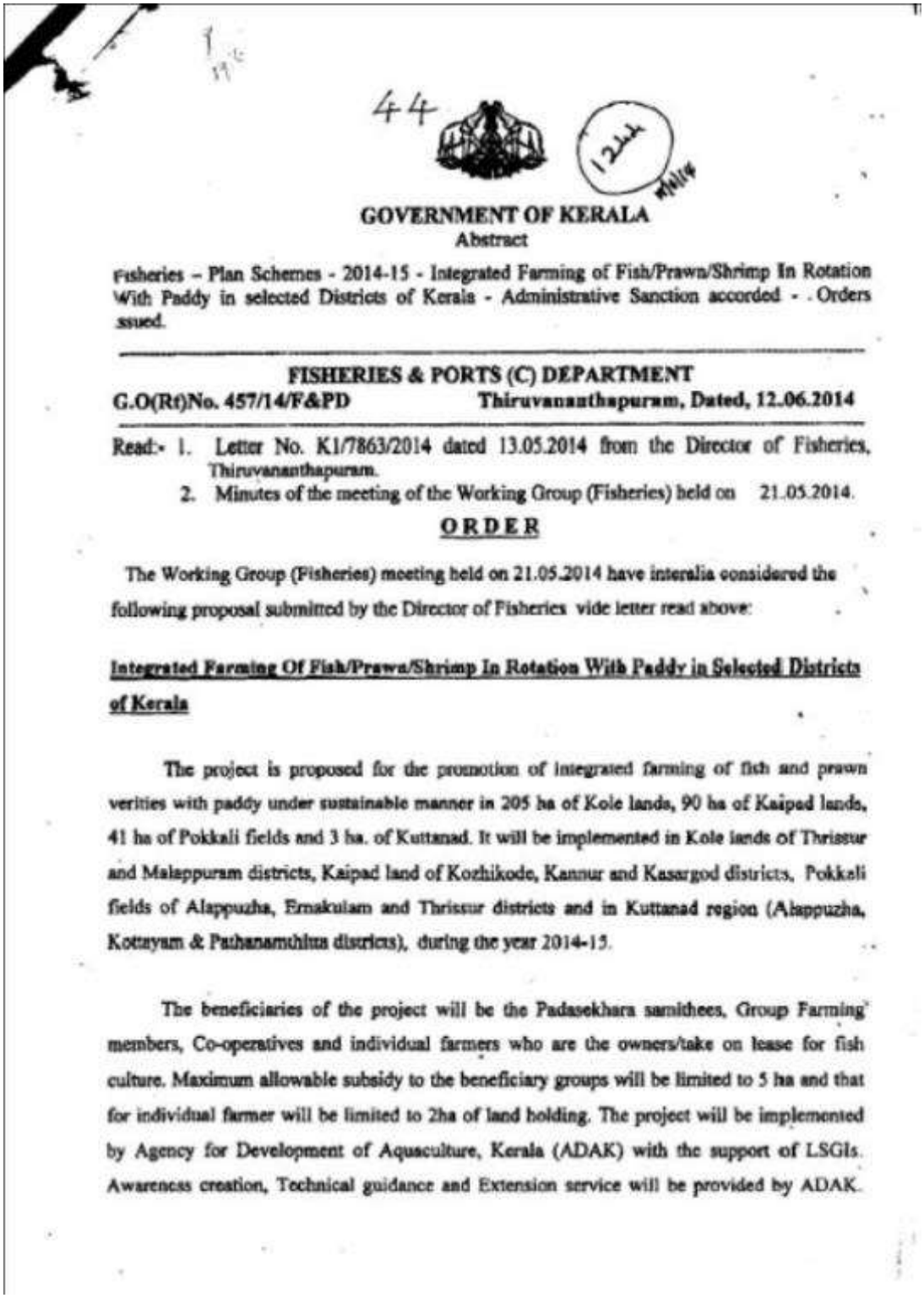
Terms & Conditions

Sales tax as shown above are applicable or as per Govt. Rules under VAT.
Delivery - Ex-Godown.
Supply - Within 2-3 weeks.
Payment on delivery.
Sales tax will be fluctuated as per Govt Rules.
Price quoted above are subject to fluctuation.

For LABORATORY EQUIPMENT STORES

Authorised Distributors BD Whatman® CORNING Waters BOROSIL® MERCK TARSONS
Suppliers of :- Chemicals, Glassware, Apparatus, Instruments, Equipment for Laboratories, Research Centres, Medical, Educational Institutions and Industries

Exhibit 16: Government order approving the integrated farming project in Pokkali and Kaipad already implemented by ADAK



44

GOVERNMENT OF KERALA

Abstract

Fisheries – Plan Schemes - 2014-15 - Integrated Farming of Fish/Prawn/Shrimp In Rotation With Paddy in selected Districts of Kerala - Administrative Sanction accorded - . Orders issued.

FISHERIES & PORTS (C) DEPARTMENT

G.O(Rt)No. 457/14/F&PD **Thiruvananthapuram, Dated, 12.06.2014**

Read:- 1. Letter No. K1/7863/2014 dated 13.05.2014 from the Director of Fisheries, Thiruvananthapuram.

2. Minutes of the meeting of the Working Group (Fisheries) held on 21.05.2014.

ORDER

The Working Group (Fisheries) meeting held on 21.05.2014 have interalia considered the following proposal submitted by the Director of Fisheries vide letter read above:

Integrated Farming Of Fish/Prawn/Shrimp In Rotation With Paddy in Selected Districts of Kerala

The project is proposed for the promotion of integrated farming of fish and prawn verities with paddy under sustainable manner in 205 ha of Kole lands, 90 ha of Kaipad lands, 41 ha of Pokkali fields and 3 ha. of Kuttanad. It will be implemented in Kole lands of Thrissur and Malappuram districts, Kaipad land of Kozhikode, Kannur and Kasargod districts, Pokkali fields of Alappuzha, Ernakulam and Thrissur districts and in Kuttanad region (Alappuzha, Kottayam & Pathanamthitta districts), during the year 2014-15.

The beneficiaries of the project will be the Padasekhara samithees, Group Farming members, Co-operatives and individual farmers who are the owners/take on lease for fish culture. Maximum allowable subsidy to the beneficiary groups will be limited to 5 ha and that for individual farmer will be limited to 2ha of land holding. The project will be implemented by Agency for Development of Aquaculture, Kerala (ADAK) with the support of LSGIs. Awareness creation, Technical guidance and Extension service will be provided by ADAK.

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The major economic benefit of the project will be additional production of Scamp/ Fish/ Shrimp from derelict paddy fields or not suitable for Monsoon crop. It is estimated that there will be an additional production of 115 ton of shrimp/prawn and 165 ton of fish. The project will create an expected 2.53 lakh number of man days. The cost of the project is Rs. 581.98 lakh, out of this Rs.400 lakh has to be met from the budgetary provision of State Government and the remaining amount of Rs.181.98 lakh will be met by beneficiary as credit or as their own. Eligible subsidy will be credited to the bank account of beneficiary after conducting proper scrutiny.

Cost estimate of the project.

(Rs. in lakh)

Sl.No	Components	Total Cost	Govt. Share	Beneficiary Contribution/ Bank loan
1	One Paddy One Fish in Kuttanad Region.	15.60	10.00	5.60
2	One Paddy One Fish in Kole Lands	142.75	90.00	52.75
3	One Paddy One Fish in Pokkali Fields	167.95	100.00	67.95
4	Promotion of rice cum shrimp farming in Kaipadu lands	255.68	200.00	55.68
	Total	**581.98**	**400.00**	**181.98**

a). **One Paddy One Fish in Kuttanad Region.**

(Rs. in lakh)

Sl.No	Particulars	Total Cost	Govt. Share	Beneficiary Contribution/ Bank loan
1	Total Development Cost	11.3948	6.8369	4.557936
2	Total Operational Cost	2.37	1.3275	1.0425
3	Project Managerial expenses	1.5	1.5	-
4	Training to farmers	0.2	0.2	-
5	Survey Expenses, Verification, Extension & Awareness Creation	0.1	0.1	-
6	Other unforeseen expenses	0.035596	0.035596	-
	Total	**15.6004**	**10.00**	**5.6004**

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b). **One Paddy One Fish in Kole Lands.**

(Rs. in lakh)

Sl.No	Project Components	Total Cost	Govt. Share	Beneficiary Contribution/ Bank loan
1	Development of Nursery bund	48.59254	29.1552 (60%)	19.43702(40%)
2	Pump Set	4.1	2.46	1.64
3	Sluice	6.15	3.69	2.46
4	Operational Cost			
5	Pond or nursery Preparation	1.025	0.76875 (75%)	0.25625 (25%)
6	Scampi seed (10000/ha)	20.5	20.5 (100%)	0
7	Fish Seed (3000/ha)	6.15	6.15 (100%)	0
8	Scampi & Fish feed (10000kg/4 Ha nursery)	15.375	11.53125 (75%)	3.84375 (25%)
9	Watch and Ward	12.3	0	12.3 (100%)
10	Harvesting and marketing	12.8125	0	12.8125 (100%)
11	Extension, Survey, awareness creation and documentation	2.2447	2.2447	0
12	Implementation cost	13.5	13.5	0
	Total	**142.75**	**90**	**52.74952**

c). **One Paddy One Fish in Pokkali Fields.**

(Rs. in lakh)

Sl.No	Particulars	Total Cost	Govt. Share	Beneficiary Contribution/ Bank loan
1	Total Development Cost	94.30	56.58	37.72
2	Total Operational Cost	53.30	23.0625	30.2375
3	Project managerial expenses	15.00	15.00	00
4	PCR test (Seed quality control)	4.0	4.0	00
5	Survey Expenses, Verification, Extension awareness creation and documentation etc.	1.25	1.25	00
6	Other unforeseen expenses	0.1075	0.1075	00
	Total	**167.9575**	**100.00**	**67.9575**

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d). **Promotion of Rice cum Shrimp Farming in Kainadu lands**

(Rs. in lakh)

Sl.No	Particulars	Total Cost	Govt. Share	Beneficiary Contribution/ Bank loan
1	Capital Cost	108.00	81.00	27.00
2	Operational cost 1st crop	55.35	41.5125	13.8375
3	Operational cost 2nd crop	59.40	44.55	14.85
4	Training to farmers	1	1	0
5	Survey Expenses, Verification, Extension & Awareness Creation etc.	1.75	1.75	0
6	Project managerial expenses	30	30	0
7	Other unforeseen expenses	0.18750	0.18750	0
	Total	255.6875	200.00	55.6875

2. The Working Group approved the proposal and recommended to release 1/3 of Administrative Sanction amount.

3. Considering the recommendation of Working Group (Fisheries), Government are pleased to accord Administrative Sanction for the proposal for Integrated farming of Fish/Prawn/Shrimp in rotation with paddy in the selected districts of Kerala with a Government share of Rs. 400 lakh (Rupees Four crore only) by meeting the expenditure from the budget provision provided under the head of account 2405-00-101-71(Plan) during 2014-15.

(By Order of the Governor)
K.R.JYOTHILAL
Secretary to Government

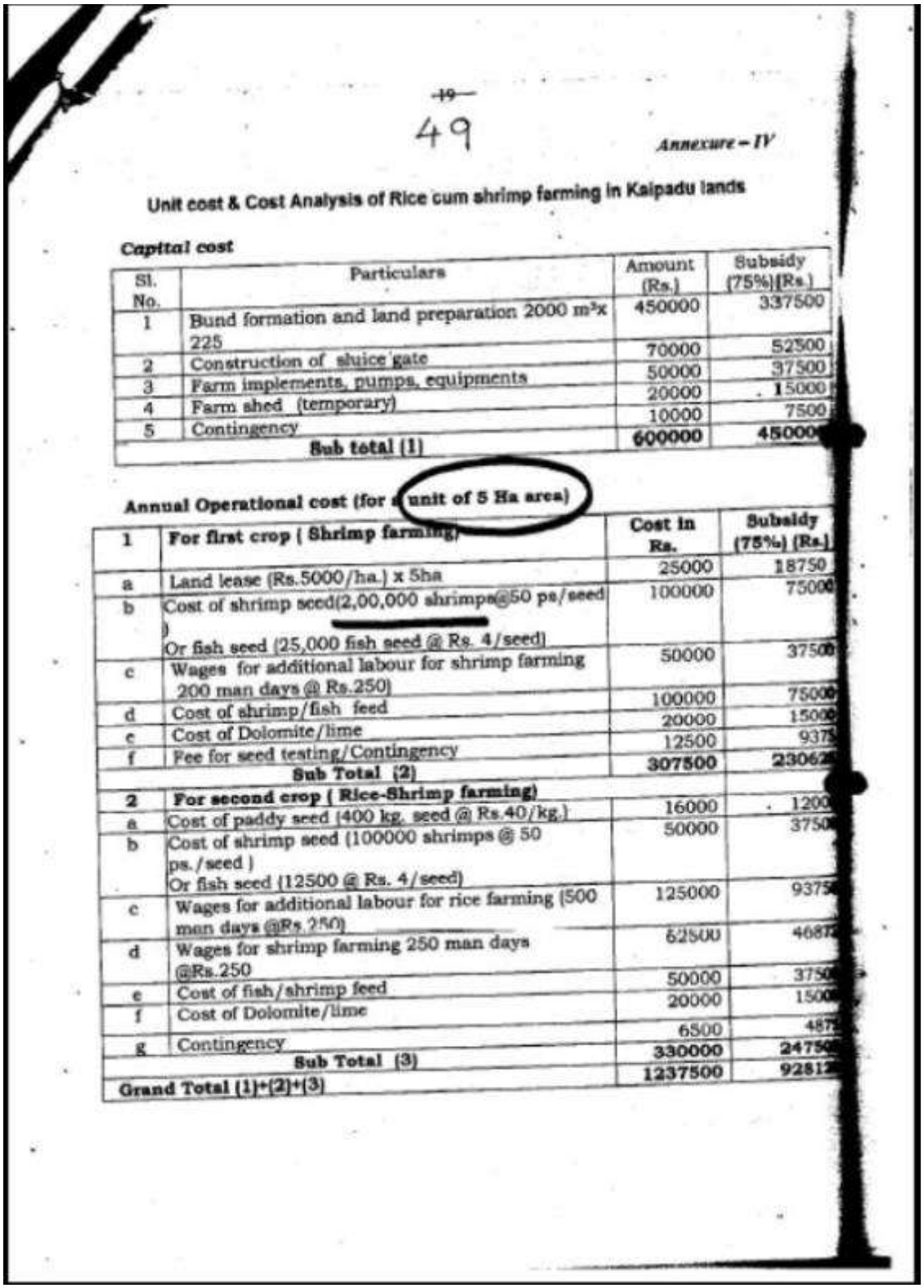
To

The Director of Fisheries, Thiruvananthapuram
The Executive Director, ADAK, Thiruvananthapuram
The Principal Accountant General (Audit) Kerala, Thiruvananthapuram
The Accountant General (A&E) Kerala, Thiruvananthapuram
The Chief, Agriculture, State Planning Board, Pattom, Thiruvananthapuram
The Finance Department
The Planning & Economic Affairs Department.
The Deputy Director II, Web & New Media (for uploading in the Government Website)
Stock file/OC

Forwarded/By Order

Section Officer

Exhibit 17: Evidence of unit cost and cost analysis of the rice cum shrimp farming in Kaipad lands



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Annexure – IV

Unit cost & Cost Analysis of Rice cum shrimp farming in Kaipadu lands

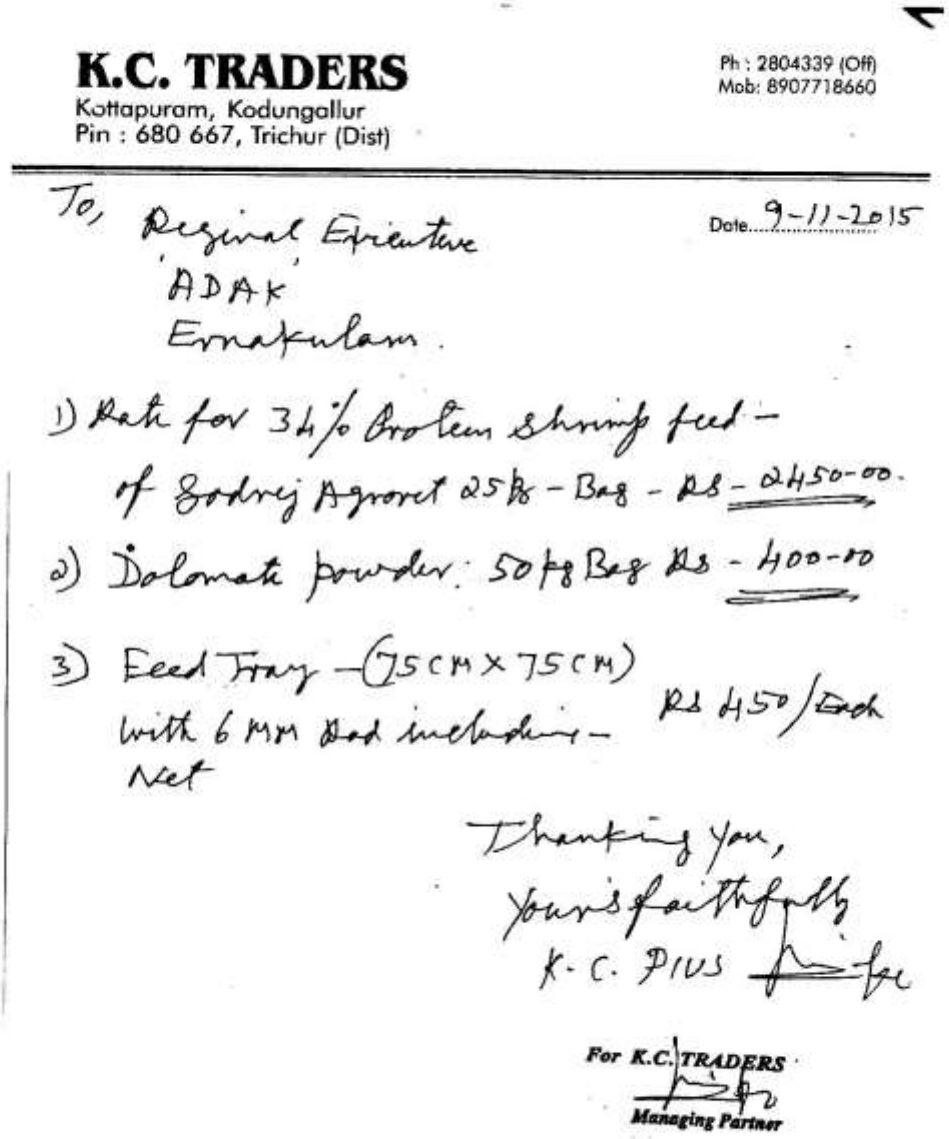
Capital cost

Sl. No.	Particulars	Amount (Rs.)	Subsidy (75%) (Rs.)
1	Bund formation and land preparation 2000 m³x 225	450000	337500
2	Construction of sluice gate	70000	52500
3	Farm implements, pumps, equipments	50000	37500
4	Farm shed (temporary)	20000	15000
5	Contingency	10000	7500
	Sub total (1)	**600000**	**450000**

Annual Operational cost (for a unit of 5 Ha area)

		Cost in Rs.	Subsidy (75%) (Rs.)
1	**For first crop (Shrimp farming)**		
a	Land lease (Rs.5000/ha.) x 5ha	25000	18750
b	Cost of shrimp seed(2,00,000 shrimps@50 ps/seed) Or fish seed (25,000 fish seed @ Rs. 4/seed)	100000	75000
c	Wages for additional labour for shrimp farming 200 man days @ Rs.250)	50000	37500
d	Cost of shrimp/fish feed	100000	75000
e	Cost of Dolomite/lime	20000	15000
f	Fee for seed testing/Contingency	12500	9375
	Sub Total (2)	**307500**	**230625**
2	**For second crop (Rice-Shrimp farming)**		
a	Cost of paddy seed (400 kg. seed @ Rs.40/kg.)	16000	1200
b	Cost of shrimp seed (100000 shrimps @ 50 ps./seed) Or fish seed (12500 @ Rs. 4/seed)	50000	3750
c	Wages for additional labour for rice farming (500 man days @Rs.250)	125000	9375
d	Wages for shrimp farming 250 man days @Rs.250	62500	4687
e	Cost of fish/shrimp feed	50000	3750
f	Cost of Dolomite/lime	20000	1500
g	Contingency	6500	487
	Sub Total (3)	**330000**	**24750**
Grand Total (1)+(2)+(3)		**1237500**	**92812**

Exhibit 18: Evidence of shrimp feed cost for Pokkali and Kaipad lands



K.C. TRADERS
Kottapuram, Kodungallur
Pin : 680 667, Trichur (Dist)

Ph : 2804339 (Off)
Mob: 8907718660

To,
Regional Executive
ADAK
Ernakulam.

Date 9-11-2015

1) Rate for 34% Protein Shrimp feed –
of Godrej Agrovet 25kg - Bag - Rs - 2450-00.

2) Dolomate powder: 50kg Bag Rs - 400-00

3) Feed Tray – (75CM X 75CM)
with 6 MM Rod including –
Net
Rs 450/Each

Thanking you,
Yours faithfully
K. C. PIUS

For K.C. TRADERS
Managing Partner

Exhibit 19: Evidence of the quantity of feed required for Kaipad and Pokkali lands

The requirement of Feed for Kaipad Farming System

In shrimp farming in Kaipad land, shrimps are reared by supplementary feeding, to a size of 7 grams during the first month.

The feed requirement is as follows:

1. Stocking rate of shrimp seed	– 2 lakhs/5 Ha unit
2. Survival rate	– 85% during the 1st month
3. Average body weight (ABW)	– 6 grams

Shrimp seed will grow to a size of 6 grams during the first month when the stocking density is 40000/Ha. Hence the Biomass after one month growth will be 1020 Kilograms. ie (2,00,000 x 85% x 6 = 1020).

The Food Conversion Ratio (FCR) is 1:1 when it is fed with 34% Protein feed. Hence the feed requirement for one unit is 1020 Kg and rounded to 1000 Kg. anticipating natural feed from the surroundings.

Feed Requirement for Pokkali Fields

In Pokkali farming system the shrimp farming in summer season is carried out in a traditional way. To increase the income from farming high value species "Penaeus monodon" shrimp seed is stocked. As the field is not irradicated, there is presence of other fishes and hence the stocked shrimp seeds are to be fed with pelleted feed for 45 days. The growth of shrimp seeds in 45 days is 10 grams with 80 percent survival. So weight of shrimps is 1600 Kg. ie (200000 x 80% x 10 g) FCR is 1:1.25. Hence the supplementary feed requirement is 2000 Kg per unit.

Exhibit 20: Evidence of rice productivity in Pokkali lands

Rice Production in Pokkali Fields

Production of Local Variety of Pokkali is given in pages 19 & 20 of the booklet Rice Research Station, Vyttila - an overview. The Production of pokkali in pokkali fields are different from Kaipad rice farming in Malabar Region. The average production of pokkali prevailing at present is 1.5 to 1.75 ton/ha. The production of Vyttila -1 is 1500kg/ha and Vyttila-2 is 1750kg/ha. Local varieties mentioned above are customarily used in pokkali fields due to present situation prevailing there. Hence the production of paddy in pokkali fields may be considered not exceeding 2 ton/ha.

RICE RESEARCH STATION
VYTTILA - AN OVERVIEW
(1958-2013)

Email: rrsvyttila@kau.in | Ph : 0484 - 2809963

and non availability of labourers for cultivation practices. The substantial income from the subsidiary prawn cultivation tempted the farmers to concentrate on prawn cultivation alone/round the year prawn cultivation without paddy cultivation. Apart from spoiling the sustainability, this practice caused several diseases to prawn and thereby the income has reduced drastically. Thus the farmers could realize that rice cultivation is an integral part of pokkali farming and the farming system involving rice followed by prawn/fish is the only sustainable model in the pokkali tract.

RESEARCH ACCOMPLISHMENTS

A. Rice Breeding

The varietal requirements for the pokkali ecosystem are

- Tolerance to salinity acidity and submergence
- Semi tall stature (120 – 130 cm) and non lodging
- Plant duration not above 125 days
- Should possess dormancy from 2 weeks to one month

a. Introduction - Germplasm collection and utilization

As a first step of rice improvement, land races from different pokkali ecosystem like Chellanam, Kumbalangi, Vypin, Kadamakkudy, N.Parur, Cherai, Thuravoor, Pattanakkad, Cherthalai etc were collected and evaluated the performance. The land races like Pokkali, Cheruvirippu, Chettivirippu, Kuruka, Karutha kuruka, Ponkuruka, Anakomban, Mundakan etc are some among them. Apart from the local collections, saline tolerant accessions from other states and from other countries were also introduced, evaluated and utilized for the breeding programme. Further, they were maintained in the germplasm. The national accessions include CSR-10, SR-26-B etc. The international accessions are IR-5, Nona Bokra etc. A saline tolerant germplasm of about fifty five accessions are now maintained in the germplasm bank.

b. Selection

Selection in the local varieties – both 'mass' and 'pure line' selection was attempted from the very beginning. Pure line selection was started in the two widely cultivated local varieties viz.Choottu pokkali and Cheruvirippu.

The first high yielding saline tolerant rice variety VTL-1 was evolved by pure line selection from Choottupokkali and released for cultivation by the Department of Agriculture. This variety has 10 – 15 % higher yield

than the local variety. The average yield of this variety is only 1500 kg/ha. But this variety has the *Saltol* QTL in chromosome number 1 which is the world's most saline tolerant gene QTL and is being used in the saline tolerant breeding programme of International Rice Research Institute, Manila, Philippines and other countries throughout the world.

The second high yielding saline tolerant rice variety VTL-2 was evolved by pureline selection from Cheruvirippu and released for cultivation by the Department of Agriculture. This variety has also 10 – 15 % higher yield than the local parent variety. The average yield of this variety is 1750 kg/ha.

c. Hybridization and selection

The rice hybridization programme commenced at the Rice Research Station, Vyttila, during 1975-76 period so as to combine the high yield of released high yielding varieties and abiotic stress tolerance of the pokkali land races. The first high yielding variety evolved by combination breeding was VTL-3 by crossing VTL-1 and Taichung Native-1. This variety has an average yield of 2500 kg/ha and was the predominant variety for about 10 years in the Pokkali ecosystem.

Another rice hybridization programme commenced at the station, during 1980-86 period was to combine the high yield of high yielding rice varieties developed by IRRI, Philippines and the abiotic stress tolerance of the pokkali land races. The second high yielding variety evolved by combination breeding was VTL-4 by crossing the land race Chettivirippu with IR 4630-22-2-17. This variety was released during 1994 and was the predominant variety for a period of ten years in the area. Even now this variety has good acceptance and is the predominant tall variety in the semi deep water areas.

d. Mutation Breeding

The people of Kerala prefer only red rice. Being organic rice, there is ample scope for export of Pokkali rice. Hence, a mutation breeding programme was initiated at this centre during 1984 - 86 period to evolve a white kernelled tolerant rice variety from Mahsuri. The mutant high yielding rice variety VTL. 5 with white kernel was evolved and released for cultivation. The average yield of this variety is also 3500 kg/ha.

e. Development of semi tall non lodging high yielding variety.

When the labour availability became a problem and labour charges

Pokkali Rice Production

The Pokkali movement: Bonding to save a dying rice variety

K. P. M. Basheer

Comment · print · T+ T+ -   T-

in 0

1

Students transplanting rice in the Pokkali paddy field (file photo)

Kochi, Sept. 21:

A unique rice variety. A unique farming practice. And, a unique way of financing farming.

A small band of activists and organic-farming enthusiasts have banded together to revive a dying farming practice in the coastal rice fields at Ezhupunna in Kerala's Alappuzha district.

The rice variety: Pokkali, a saline-and-flood resistant tall-stalk variety. The farming practice: alternate rice-and-prawn culture. The form of financing: 'Pokkali bonds.'

The Pokkali Samrakshana Samara Samiti (Pokkali conservation agitation committee), which has leased 140 acres of marsh-like Pokkali fields that have been fallow for a quarter century, has found a new way to finance its effort: by floating informal 'Pokkali bonds.'

Bonds have been floated at Rs 1,000 each. After the harvest, investment is returned in kind: organically cultivated, highly-nutritious and protein-rich Pokkali rice. "You have two options: you can either take your money's worth of rice or we will return your money, without interest, after six months," said Francis Kalathunkal, a socio-political activist and lecturer, who is the general convenor of the samiti. Already, over 120 people, mostly social activists, have purchased the bonds.

"This is a highly labour-intensive farming practice and hence the cost of production is high," Kalathunkal said. Groups of students from colleges, who fancy a day out in a rice field, occasionally help with the tasks.

GI-TAGGED RICE

Pokkali (pronounced Pokkaalli) rice, which is grown only on a few hundred acres in the coastal areas of central Kerala, was awarded the GI (Geographical Indication) tag in 2008. The large-grain rice has a distinct flavour and commands a higher price than ordinary varieties.

Pokkali is an ancient farming practice. One season of rice farming is alternated with another season of prawn culture. The rice variety's remarkable tolerance to salinity and floods makes it unique.

It is cultivated from June to early November when the salinity level of the water in the fields is low. From mid-November to mid-April, when the salinity is high, prawn farming takes over.

The prawn seedlings, which swim in from the sea and the backwaters after the rice harvest, feed on the leftovers of the harvested crop. The rice crop, which gets no other fertiliser or manure, draws nutrients from the prawns' excrements and other remnants. "Rice farming and prawn farming are mutually complementary," said Kalathunkal.

"The cultivation method is totally dependent on nature," pointed out V. Sreekumar, agronomy professor at Kerala Agricultural University's Rice Research Station at Vyttila, Kochi. "The south-west monsoon and the tidal action in the Arabian Sea are the critical factors." The high salinity of the water-logged fields caused by the up-tide is washed off by the monsoon rains.

Four decades ago, there were 26,000 hectares of Pokkali fields. Now, hardly 5,000 are left, of which only 500 is cultivated. Pokkali's productivity is very low — 1 to 2 tonnes per hectare. New high-yielding varieties of rice and high cost of production have contributed to its near-extinct status.

Pokkali Rice production.

10. PADDY-CUM-FISH CULTURE IN BRACKISH WATER

In certain areas of the world (states of W. Bengal and Kerala, in India - most populous areas in the country) tidal swamps in the coastal areas have been converted as rice fields. Rice culture operations here usually coincide with the rainy season (monsoons), when the coastal inundated areas become less saline. The paddy cultivated, as we have referred to, are long-stemmed (deepwater or floating) and salinity resistant varieties.

Culture of brackish-water prawn and fishes in Bengal is described by Pillay and Bose (1957) and Jhingran (1975). Paddy fields lying near irrigation canals are made use of for the culture of prawns and fishes. The canal water is maintained about 30 cm below that of the paddy field and at this time, before the onset of the South West Monsoon, the fields are manured and prepared and paddy seedlings planted. With the onset of the monsoon, the water level in the canal would increase with rainwater and salinity will be lowered. At this time the bunds surrounding the paddy fields are cut at selected places and fish and prawns fry, are allowed to enter the paddy fields and grown during the paddy cultivation period. The fish are cropped just before harvesting paddy. The fish in the canals are also harvested. In the brackish water paddy fields the fish productions works out to 100 – 200 kg/ha/year. Species cultured here are: Finfish - Mugil parsia, M. tade, Rhinomugil corsula, Lates calecrifer and Mystus gulio; Prawns - Palaemon carcinus, Macrobrachium rude, Metapenaeus monoceros, M. brevicornis and Penaeus semisulcatus.

Fish culture in brackish water rice fields in Kerala (S. W. Coast of India) is different. The low lying paddy fields are called 'Pokkali' and the culture of fish here has been described by several authors cited by Jhingran (1975). Raman (1968) describes an experiment on prawn-cum-tilapia culture in the brackish water paddy field, which is of special interest to us. The 'Pokkali' fields of Kerala are usually single crop paddy fields, extending to 10,000 acres and yielding and annual production of 5,000 tons. The paddy fields after paddy crop are usually used to trap through sluices high tide water along with prawns mainly, and then the water is let out through the filters during low tide (water filtered through net screen) and therefore is known as the paddy-field prawn filtration. A typical filtration field, in which the effect of size and number of sluice gates and area of the field on prawn catch has been studied, is shown in Raman and Menon (1963.

Paddy is usually cultivated in these fields during July - September (S.W. Monsoon active) when the brackishwater surrounding the paddy fields are low in salinity. In several cases prawns are trapped and caught (capture fishery) without allowing a growing phase for prawns, but in many cases the trapped prawns and fishes are allowed to grow as a culture fishery. The latter has been shown to yield better. After harvest of paddy when prawns are to be stocked the bunds provided with sluices are strengthened, and during high tide the incoming water brings in plenty of prawn fry. For every subsequent high tide during the autumn the prawn fry are trapped - it is taken that more fry are trapped in the high tide, and often a kerosine oil lamp is hung on the sluice gate to 'attract' prawn fry. At neap tides the prawns are retained inside the pond, by letting the water go out through the sluice, across a conical bag net having a rectangular frame, in the sluice, thus literally serving as a filter. The stocked prawns grow in the ponds until December; they are harvested from December till April (multiple harvest - 7 or 8 nights distributed over the full and new moon days).

Exhibit 21: Evidence for price of paddy for Kaipad and Pokkali lands

81.

KAIPAD RICE PRICE

Rice - Rs.50/-

Kuttoossan a traditional kaipad rice Variety which was at a verge of extinction is now revived through Rice cum shrimp farming in kaipad lands of Kannur. Farmers sells this rice at a marketable price of Rs.50/kg in Kannur and is of high demand being an organic farmed rice variety.

Thiruvananthapuram

EXECUTIVE DIRECTOR
Agency for Development of Aquaculture, Kerala
Thiruvananthapuram – 695

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No.R1/68289/2002 Dated, 29 - 12-2014 * Revised Price list - w.e.f. 01.01-2015		
KERALA AGRICULTURAL UNIVERSITY		
SALE PRICE OF SEEDS AND PLANTING MATERIALS		
Code No.	**Item**	**Rate/kg (Rs.)**
I	**Paddy seeds**	
1	B.S.	45.00
2	Coarse grain types	45.00
3	Fine grain types (Basumathi type)	60.00
4	F.S.	42.00
5	C.S./TLS	36.00
5.1	Paddy seed - Jeerakasala & Gandhakasala	60.00
6	Pre - release cultures	39.00
7.a	Medicinal rice -Njavara	**100.00**
7.b	Pokkali seed (Kg)	**50.00**
8	Mat nursery	40/m2
9	Ordinary nursery	20/m2
II	**Vegetable seeds - TLS**	**Rate/kg (Rs.)**
10	Amaranthus	1250.00
11	Ashgourd	1750.00
12	Bhindi (Okra)	1000.00
13	Bhindi F1 hybrid	3000.00
14	Bittergourd - Preethy and other varieties	2000.00
15	Bittergourd - Priyanka	2000.00
16	Bottlegourd	800.00
17	Brinjal	1500.00
18	Brinjal - F1 hybrid	10000.00
19	Capsicum	3000.00
20	Chilli	2800.00
21	Cluster bean	1200.00
22	Cowpea (Bush types including Anaswara)	600.00
23	Cowpea (Kanakamony)	350.00
24	Cucumber- Culinary melon (Vellayani - Sambar Vellari)	3000.00
25	Cucumber- Salad (AAUC-2)	2000.00
26	Cucumber-Opmelon (Mudikode/Arunima/Soubhagya)	1500.00
27	Dolicohos Bean	800.00
28	French bean	500.00
29	Muringa seeds	2200.00
30	Pumpkin	1500.00
31	Red gram	300.00
32	Ridgegourd/Smoothgourd	1000.00
33	Snakegourd	1800.00
34	Sword bean/Jackbean	1000.00
34.1	Clove bean	1500.00
35	Tomato	5000.00
36	Watermelon	2000.00
37	Winged bean	1000.00
38	Yard long bean	1500.00

Exhibit 22: Lease agreement from Thrissur provided as evidence for cost of leasing Pokkali lands

56

Translated Agreement copy -1

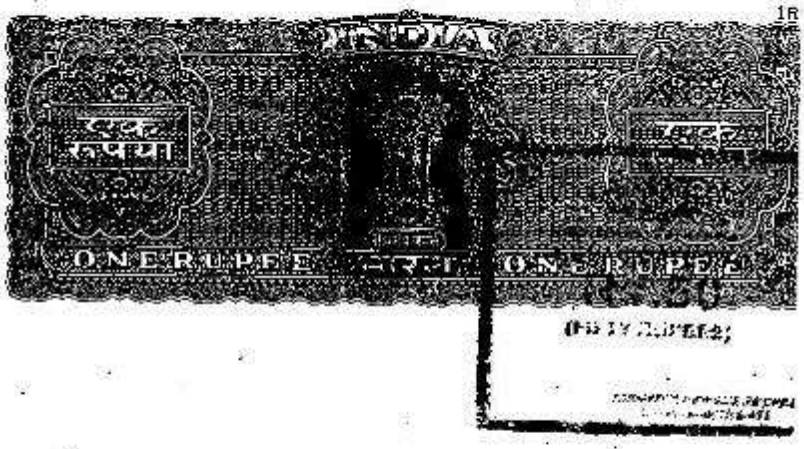
This lease Agreement executed on the 23rd day of June 2011 between (1) Smt.Shyla, Kulakkozhipadath Mannam P.O,N.Parur(2)Deepa, Kulakkozhipadath, Mannam P.O, N.Parur (3) Smt.Kumari, Thanipadath, Venmanissery, Mannam P.O herein after referred to as the lessor and of the one part and Sri.P.M.Hiran, Pookodan house, Mattathurkunnu P.O, Kodakara, Thrissur, pin- 680684 herein after referred to as the lessee of the other part

Where as the lessor is the owner of the pokkali field as per schedule attached in Mukundapuram Thaluk,Puthenchira village,Thrissur District survenoy 119/8,120/3,6,12,17 62/13,125/1 etc possessing an area of 2.44 ha(as per doc 23/2004 book no.1 , Mala Sub Registrar office)1.32 ha (as per document 33/2004 and 735/2005 book no. 1 Mala,Sub Registrar office)and 1.75 ha as per document no. 24/2004 book no. 1,Mala sub Registrar office)

And where as the lessee offered to take on lease the field described in the schedule 1,2& 3 for a period of 5 years in the existing condition on the following terms and conditions:-

1. The period of lease is 5years starting from 23.6.11 up to 22.6.2016
2. Yearly rent for the total area of 5.51ha is Rs. 75000/- and the total amount for the 5 year is Rs.3,75,000
3. Two years rent Rs. 150000 is received from the lessee as advance on this day and the rest of the amount is to be paid by lessee is two installments. The First installment of Rs. 1,50,000/- is to be paid on completion of one year starting from 23.6.2011 and the second installment of Rs. 75000 is to be paid on completion of two years from 23.6.2011
4. The lessee shall not sublet the fields leased and shall not make any alteration or improvements and shall retain the fields to the lessor in good condition on completion of lease period.
5. The lessee have the right to seek Govt. Technical Assistance for shrimp/fish culture and to receive the grant during the lease period.

EXECUTIVE DIRECTOR
Agency for Development of Aquaculture, Kerala
Thiruvananthapuram – 695 0..



1R

2

പെളിനിലം മാള രജിസ്ട്രേനിൽ 2004 ൽ 1-ാം പുസ്തകത്തിൽ രജിസ്റ്റർ ചെയ്ത 23-ാം നമ്പരാധാരപ്രകാരം 1-ാം പാർട്ടിയിൽ 1-ാം പേരുകാരിക്ക് സിദ്ധിച്ച് ടിയാളുടെ കൈവശം ഇരിക്കുന്നതും, 2-ാം നമ്പരായി വിവരിക്കുന്ന പെളിനിലം ടി രജിസ്ട്രേനിൽ 2004 ൽ 1-ാം പുസ്തകത്തിൽ രജിസ്റ്റർ ചെയ്ത 33.ം, 2005 ൽ 1-ാം പുസ്തകത്തിൽ രജിസ്റ്റർ ചെയ്ത 735.ം നമ്പരാധാരങ്ങൾപ്രകാരം 1-ാം പാർട്ടിയിൽ 2-ാം പേരുകാരിക്ക് സിദ്ധിച്ച് ടിയാളുടെ കൈവശം ഇരിക്കുന്നതും, 3-ാം നമ്പരായി വിവരിക്കുന്ന പെളിനിലം ടി രജിസ്ട്രേനിൽ 2004 ൽ 1-ാം പുസ്തകത്തിൽ രജിസ്റ്റർ ചെയ്ത

ന്നാം പാർട്ടി : 1. ലൈല 2. ദീപ 3. കുമാരി

രണ്ടാം പാർട്ടി : ഹിബൺ

(Agreement - 7 pages)

• Pakkal Field Lease Agreement –

Lessor – ① Shyla, Kulakkaglippadath, Mannam. P.O
North paravoor

② Deepa, Kulakkaglippadath, Mannam. P.O
North paravoor

③ Kumari Thanippadath, Vennenissery,
Mannam. P.O

Lessee – P.M. Hisan, Pookodan House, Mattathurkunnu
Kodakara, Thrissur. 680 684

• Total area of Paddy Farm – 5.51 Ha
• Amount – Rs. 7500/yr
• Date of Agreement – 23.6.2011 to 22.6.2016
(5 years)

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Translated Agreement copy -2

This lease Agreement executed on the 22nd day of October 2012 between (1) Sri.Vinod, Chambakulath house, Lokmalleswaram village, Kodungallur,Thrissur(2) Smt Jina, Chambakulath house, Lokmalleswaram village ,Kodungallur, Thrissur herein after referred to as the lessor and of the one part and Smt.Kamala Gopi, Oliparambil house,Pullut P.O, Kodungallur, Thrissur herein after referred to on the lessee of the other part.

Where as the lessor is the owner of the pokkali fields in Thrissur District,Kodungallur Taluk,Pullut village survey 432 having an extend of 3 acre.

And where as the lessee offered to take on lease the pokkali fields for a period of 5 years from 22.10.12 to undertake shrimp culture subject to the condition of total rent of 5000/3 acre/year. The lessee shall not have the right to undertake any other activity in this field except shrimp culture and has to pay the rent every year without any dues.

Thiruvananthapuram -695 014

EXECUTIVE DIRECTOR
Agency for Development of Aquaculture, Kerala
For Thiruvananthapuram – 695 014

भारतीय गैर न्यायिक

एक सौ रुपये Rs. 100

रु. 100 ONE HUNDRED RUPEES

भारत INDIA

INDIA NON JUDICIAL

കേരളം केरल KERALA N 884039

22. 10. 2012 [illegible]

[illegible]

[illegible]

[illegible] 1. വിനോദ്, [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

1 — [illegible] 1. വിനോദ്
2. [illegible]

2 — [illegible]

No: [illegible] Date: 22-10-12 Rs. 100/-
SOLD TO: [illegible]
T. Nagar [illegible]

17 OCT 2012

Annexure - 2 pages

- **Pokkali Field Lease Agreement**

Lessor – 1. Vinod, chambakkalath house, Lokamalleswaram Village, Kodungallur, Thrissur

2. Jina, chambakkalath house, Lokamalleswaram Village, Kodungallur, Thrissur

Lessee – Kamala Gopi, Olipparambil House, Pullut. P.O Kodungallur, Thrissur

- Total Area of Farm – 3 Acres
- Amount – Rs. 5000/yr
- Date of Agreement – 22.10.2012 to 21.10.2017 (5 years)

Exhibit 23: Lease agreement from Thrissur provided as evidence for cost of leasing Kaipad lands

73.

Lease agreement 1

This lease agreement is executed on day of 1st day of December of year Two thousand twelve between President/Secretary of Haritha Karshaka Group (Lesse) and leaseholder.

Whereas the lesser is the owner the Kaipad land owned and in Kannur District, Taliparamba Taluk, Cheleri village, Kolachery Panchayat, Cheleri Amsom, Noonjeri Desam having an area of 1600 cent, in Survey No 85/2, 85/3, 85/1/1, 86/1, 86/2, 92/7, 70/1 to the President and Secretary of Haritha Karshaka Group from 1.11.2012 for five years with an amount of 5000/- per Ha for culturing organic Rice-shrimp farming with cost finance assistance implemented by the Farm manager, Eranjoli Fish farm,Thalassery. We sign this agreement agreeing to protect the land for continuous culture for 5 years and for making necessary construction works.

കേരളം केरल KERALA P 774186

പാട്ടക്കരാർ

2012 ഡിസംബർ 1-ാം തിയ്യതി കണ്ണൂർ ജില്ലയിൽ തളിപ്പറമ്പ് താലൂക്കിൽ ചേലേരി വില്ലേജിൽ കൊളച്ചേരി പഞ്ചായത്തിൽ ചേലേരി അംശം നുഞ്ഞേരി ദേശത്തുള്ള താഴെ പേർ എഴുതി ഒപ്പിടുന്ന ഞങ്ങൾ ഹരിത കർഷക സമിതി ഗ്രൂപ്പിന്റെ ഗ്രൂപ്പ് ലീഡറായ ഖാലിദ് ദേശത്ത് ചേലേരി വില്ലേജിൽ അൽ ഹൈർ വീട്ടിൽ താമസം മമ്മു എന്നവർ മകൻ 56 വയസ്സുള്ള അബ്ദുൽ റസാഖ് സെക്രട്ടറിയായ നുഞ്ഞേരി ദേശത്ത് ചേലേരി വില്ലേജിൽ കുറ്റേരിക്കണ്ടി വീട്ടിൽ അബൂബക്കർ എന്നവർ മകൻ 27 വയസ്സുള്ള സിദ്ദീഖ് കെ.കെ എന്നിവർക്ക് എഴുതി കൊടുത്ത പാട്ടക്കരാർ.

താഴെ പറയുന്ന ഭൂ ഉടമകളായ ഞങ്ങളുടെ ഉടമസ്ഥതയിലും കൈവശാവകാശത്തിലുമുള്ള കണ്ണൂർ ജില്ലയിൽ തളിപ്പറമ്പ് താലൂക്കിൽ ചേലേരി വില്ലേജിൽ കൊളച്ചേരി പഞ്ചായത്തിൽ ചേലേരി അംശം നുഞ്ഞേരി ദേശത്തുള്ള ഭൂമി സർവ്വെ നമ്പർ 851/2, 851/3, 861/1, 861/1, 861/2, 911/7, 70/1 ലുള്ള 1600 സെന്റ് ഭൂമി ഹരിത കർഷക സമിതി ഗ്രൂപ്പിന്റെ ലീഡർ അബ്ദുൽ റസാഖ് സെക്രട്ടറി സിദ്ദീഖ് കെ.കെ എന്നവർക്ക് 2012 ഡിസംബർ 1ാം തീയ്യതി മുതൽ 5 വർഷത്തേക്ക് പ്രതി വർഷം ഹെക്ടറിന് 5000 രൂപ പാട്ട തുക നിശ്ചയിച്ച് സർക്കാർ ധനസഹായത്തോടെ അഡാക്ക് നടപ്പിലാക്കുന്ന നെല്ലും ചെമ്മീനും ഉൾപ്പെടുത്തി ഫാം മാനേജർ, എരഞ്ഞോളി ഫിഷ് ഫാം, തലശ്ശേരി വഴി നടപ്പിലാക്കുന്ന ഇരുപ്പ നെല്ല് - ചെമ്മീൻ കൃഷി ചെയ്യുവാനായി പാട്ടത്തിന് നൽകുവാൻ സമ്മതിച്ച് കൊള്ളുന്നു. കൃഷി ഭൂമി സംരക്ഷണത്തിനും മത്സ്യ ചെമ്മീൻ നെൽ കൃഷിക്കുമാവശ്യമായ നിർമ്മാണ പ്രവർത്തനങ്ങൾ നടത്തുന്നതിനും തുടർച്ചയായി 5 വർഷം കൃഷി നടത്തുന്നതിനും സമ്മതിച്ച് ഈ കരാർ ഒപ്പിട്ട് നൽകുന്നു.

Rs. 5000/Ha

ശേഷം 2-ാം പേജിൽ

32684

C. ABDUL RAZAK

Sidheeque K.K

Thiruvananthapuram
695 014

Lease agreement 2

This lease agreement is executed on day of 7th day of December of year Two thousand twelve between President/Secretary of Jaikisan Group (Lesse) and leaseholder.

Whereas the lesser is the owner the Kaipad land owned and in Kannur district, Kannur Taluk, Ezhome Village, Ezhome Panchayat, Ezhomei Amsom, Desam having an area of 16 Acre, 15 cent in Survey No 39/3 to the President and Secretary of Jaikisan Group from 1.11.2015 for five years with an amount of 5000/- per Ha for culturing organic Rice-shrimp farming with cost finance assistance implemented by the Farm Manager, Eranjoli Fish Farm, Thalassery. We sign this agreement agreeing to protect the land for continuous culture for 5 years and for making necessary construction works.

भारतीय गैर न्यायिक

एक सौ रुपये **Rs. 100**

रु. 100 ONE HUNDRED RUPEES

सत्यमेव जयते

भारत INDIA

INDIA NON JUDICIAL

കേരളം केरल KERALA W 160014

പാട്ടക്കരാർ

2012 ഡിസംബർ 7-ാം തീയ്യതി കണ്ണൂർ ജില്ലയിൽ കണ്ണൂർ താലൂക്കിൽ ഏഴോം വില്ലേജിൽ ഏഴോം പഞ്ചായത്തിൽ ഏഴോം അംശം ദേശത്തുള്ള താഴെ പേരെഴുതി ഒപ്പിടുന്ന ഞങ്ങൾ, ജയ് കിസാൻ പങ്കാളിത്ത കാർഷിക ഗ്രൂപ്പ് പ്രസിഡന്റ് ഏഴോം അംശം ദേശത്ത് ചെള്ളൻ പുതിയപുരയിൽ താമസിക്കും മജീദ് ഹാജി മകൻ 36 വയസ്സുള്ള സി.പി. സാജിദ., സെക്രട്ടറി ഏഴോം അംശം ദേശത്ത് പാലങ്ങാടൻ വയലിലെ വീട്ടിൽ താമസിക്കും കൃഷ്ണൻ നമ്പ്യാർ മകൾ 47 വയസ്സുള്ള കെ.വി. പുഷ്പലത എന്നിവർക്ക് എഴുതിക്കൊടുത്ത പാട്ടക്കരാർ.

താഴെപറയുന്ന ഭൂഉടമകളായ ഞങ്ങളുടെ ഉടമസ്ഥതയിലും കൈവശാവകാശത്തിലുമുള്ള കണ്ണൂർ ജില്ലയിൽ കണ്ണൂർ താലൂക്കിൽ ഏഴോം വില്ലേജിൽ ഏഴോം പഞ്ചായത്തിൽ ഏഴോം അംശം ദേശത്തുള്ള ഭൂമി സർവ്വെ നമ്പർ 39/3Aയിലുള്ള 16 ഏക്ര 25 സെന്റ് ഭൂമി ജയ് കിസാൻ പങ്കാളിത്ത കാർഷിക ഗ്രൂപ്പ് പ്രസിഡന്റ് സി.പി. സാജിദ, സെക്രട്ടറി കെ.വി. പുഷ്പലത എന്നിവർക്ക് 2012 നവംബർ 1-ാം തീയ്യതി മുതൽ 5 വർഷത്തേക്ക് പ്രതിവർഷം ഹെക്ടറിന് 5000രൂപ പാട്ടതുക നിശ്ചയിച്ച് സർക്കാർ ധനസഹായത്തോടെ അഡാക്ക് നടപ്പിലാക്കുന്ന നെല്ലും ചെമ്മീനും ഉൾപ്പെടുത്തി ഫാം മാനേജർ, എരഞ്ഞോളി ഫിഷ് ഫാം, തലശ്ശേരി വഴി നടപ്പിലാക്കുന്ന ജൈവ നെല്ല്-ചെമ്മീൻ കൃഷി ചെയ്യുവാനായി പാട്ടത്തിന് നൽകുവാൻ സമ്മതിച്ചുകൊള്ളുന്നു. കൃഷി ഭൂമി സംരക്ഷണത്തിനും മത്സ്യചെമ്മീൻ നെൽകൃഷിക്കു മാവശ്യമായ നിർമ്മാണ പ്രവർത്തനങ്ങൾ നടത്തുന്നതിനും തുടർച്ചയായി 5 വർഷം കൃഷി നടത്തുന്നതിനും സമ്മതിച്ച് ഈ കരാർ ഒപ്പിട്ട് നൽകുന്നു.

Rs. 5000/ha

Thiruvananthapuram 695 014

Agency for Development of Aquaculture, Kerala

...2

ജയ് കിസാൻ പങ്കാളിത്ത

നമ്പ് 30636 7.12.12

കാർഷിക ഗ്രൂപ്പ് 100

Exhibit 24: Evidence for the stocking density of brackish water fish species in Pokkali lands

Government of Kerala

- a mission towards blue revolution through aquaculture development with the co-operation of Local Self Governments and people participation -

GUIDELINES FOR THE IMPLEMENTATION OF MATSYA SAMRUDHI PROJECT

Department of Fisheries
Thiruvananthapuram
June 2012

- In case of groups/SHG/Society the limit shall go up to 15 ha and for Padasekharams this limit shall be 50ha (limited assistance). For the free seed supply the maximum rates of stocking of fish/shrimp/scampi are as follows:

  i. Fish seed - 5000/ha (Fingerlings not less than 4cm)
  ii. Scampi - 5000/ha (Juveniles -15 days old)
  iii. P.monodon - 25000/ha (Post larva-20 days old)
  iv. P.indicus - 50000/ha (Post larva- 20 days old)
  v. Karimeen -3500 seed/ha (actual seed cost limit Rs.25000/-)
  vi. Adukkalakkulam - 100 seed/pond

- Over and above the number of seed supplied under this programme, farmers can stock additional seed by meeting the cost by themselves. But the total stocking density and types of fish/shrimp culture programmes are as shown below.

  i. Fish – 6000/ha (Composite fish culture)
  ii. Scampi - 15000/ha (--do--)
  iii. Karimeen - 5000/ha (--do--)
  iv. *P.monodon* - 50000/ha (Modified traditional/extensive)
  iv. *P.indicus* - 60000/ha (--do--)

Feed subsidy

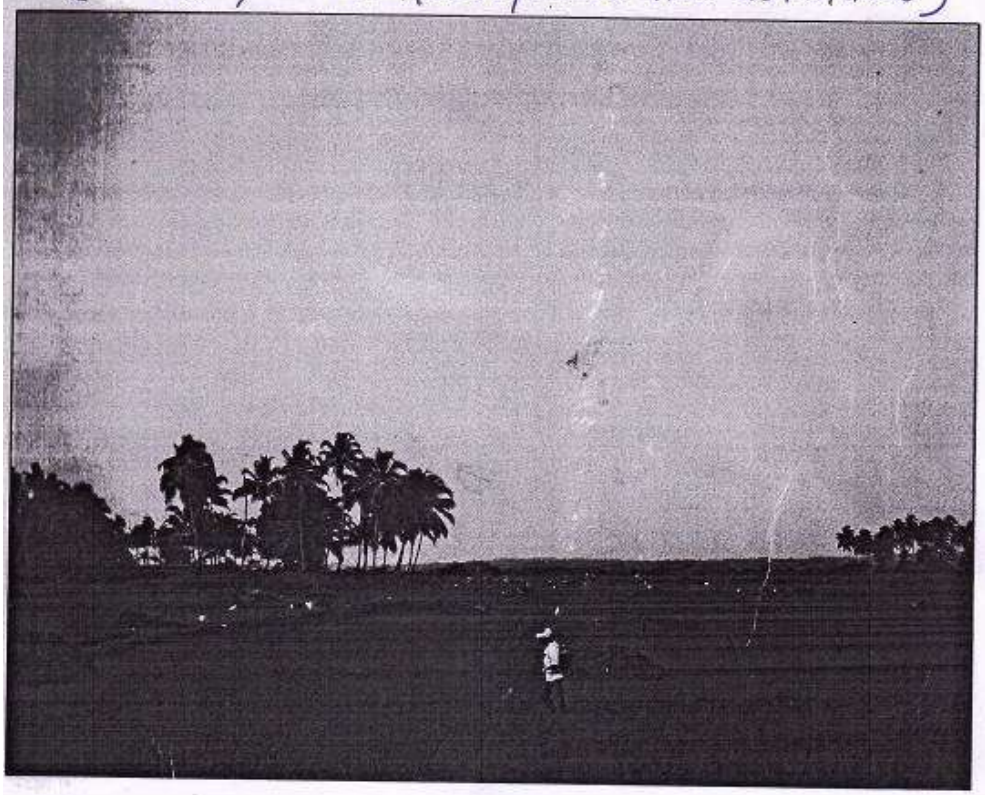
Feed subsidy will be limited to the amount after meeting the cost of seed from the input subsidy. The farmers can produce the bills/vouchers of feed cost and the concerned Chief Executive Officer of the FFDA can disburse the amount through bank account of the beneficiaries after approval of the District Committee. The maximum benefit will be limited to total input subsidy allowed. Separate instructions will be issued by the Special cell for the release of feed subsidy.

Exhibit 25: Evidence for the man-days required to construct bund for pokkali and kaipad lands

കേരളത്തിലെ
പൊക്കാളി, കൈപ്പാട്, കോൾ, കരി നിലങ്ങളിലെ
സംയോജിത കൃഷിയ്ക്ക് ബാധകമാക്കാവുന്ന
സബ്സിഡി മാനദണ്ഡങ്ങൾ
ശുപാർശ ചെയ്യാനുള്ള വിദഗ്ദ്ധ സമിതിയുടെ

റിപ്പോർട്ട്

Report on ~~Kaipa~~ Pokkali, Kaipad, Kol, Kari lands
(G.O.(Rt.)No. 3734/2008/LSGD dtd: 23/10/2008)



(Local Self Government Department)
തദ്ദേശസ്വയംഭരണ വകുപ്പ്
കേരള സർക്കാർ
(Govt. of Kerala)

29

2.4.1.1. കൈപ്പാട് നെൽവിത്തിനങ്ങൾ:

കുതിർ, ഓർക്കയമ, ഓർത്തഡിയൻ, ചൊവ്വേരിയൻ എന്നീ നെൽ വിത്തിനങ്ങളാണ് കൈപ്പാട് നിലങ്ങളിൽ സാധാരണയായി ഉപയോഗിച്ചു വരുന്നത്. ഇതിൽ ഓർത്തഡിയനും ചൊവ്വേരിയനും ഇന്ന് പ്രചാരത്തിലില്ലെന്ന് തന്നെ പറയാം.

ഓർക്കയമ വെള്ളക്കെട്ട് കൂടുതലുള്ള (ആഴം കൂടുതലുള്ള പുഴയോരത്തും മറ്റും) പ്രദേശങ്ങൾക്ക് അനുയോജ്യമാണ്. ഇത് സാധാരണ കരപ്പാടത്ത് വിതച്ച് ഞാറ് പറിച്ച് നടുകയാണ് ചെയ്യുന്നത്.

2.4.1.2. കൂന നിരത്തൽ

കുതിർ നെൽച്ചെടികൾ 1 1/2 മാസം പ്രായമാകുമ്പോഴേക്കും ഒന്നരയടിവരെ ഉയരത്തിലെത്തുന്നു. ഈ സമയത്ത് (ജൂലൈ രണ്ടാംവാരം) തൂമ്പ (കൈക്കോട്ട്) ഉപയോഗിച്ച് നെൽച്ചെടിയോടെ കൂനകൾ വെട്ടി ചെറുതുണ്ടുകളായി കൂനകൾക്കിടയിൽ പാടം മുഴുവൻ നിരത്തുന്നു. കൂനകൾക്കിടയിൽ വളരാൻ തുടങ്ങുന്ന പുല്ലുകൾ ഇതുവഴി നശിക്കുകയും ചെയ്യുന്നു. രണ്ടാഴ്ചകൊണ്ട് തന്നെ നെൽച്ചെടികൾ നിവർന്ന് ആരോഗ്യത്തോടെ വളരുന്നു. സെപ്തംബറോടെ പൂവിടുന്ന നെൽചെടികൾ ഒക്ടോബർ രണ്ടാം വാരത്തോടെ കൊയ്യുന്നതിന് പാകമാകുന്നു. ഓർക്കയമ ഒക്ടോബർ അവസാന വാരമാകുമ്പോഴെക്കും കൊയ്യാറാകും. ഹെക്ടറിന് 3 ടൺ ശരാശരി വിളവ് ലഭിക്കാറുണ്ട്.

Kaipad Paddy Farming : Farming labour per hactere

2.4.1.3. കൈപ്പാട് നെൽകൃഷി - കൃഷിച്ചെലവ് (ഹെക്ടറിന്)

1.	വിത്ത് വില 125 കി.ഗ്രാം @ 15/- രൂപ കി.ഗ്രാം	1875 രൂപ
2.	നിലമൊരുക്കൽ (കുന്നിടൽ) (40 പേരുടെ ജോലി 40 x 150 Land preparation - 40 mandays	6000 രൂപ
3.	വിത്ത് തയ്യാറാക്കൽ വിതയ്ക്കൽ (12 പേരുടെ ജോലി) 12 x 150 Preparation of Seed & Soning 12 mandays	1800 രൂപ
4.	കൂന നിരത്തൽ (44 പേരുടെ ജോലി) 44 x 150 Dispersal of Seedlings 44 mandays	6600 രൂപ
5.	കൊയ്ത്ത് (35 പേരുടെ ജോലി) 35 x 150 Reaping - 35 mandays	5250 രൂപ
6.	കറ്റകടത്ത്, മെതി, പാറൽ, പാക്കിംഗ് (30 പേരുടെ ജോലി) 30 x 150 Post harvest processing 30 mandays	4500 രൂപ
	ആകെ	26025 രൂപ

(ആകെ ഇരുപത്തി ആറായിരം രൂപ) = 26,000

2.4.2. കൈപ്പാട് നിലങ്ങളിലെ മത്സ്യബന്ധനം

വർഷക്കാലത്ത് നെൽകൃഷിയോടൊപ്പം വളരുന്ന പെമ്മീൻ/മത്സ്യകുഞ്ഞുങ്ങളെ പിടിച്ചെടുക്കുന്ന വർഷക്കെട്ട് എന്നറിയപ്പെടുന്ന ഒരു വിളയും കൊയ്ത്ത് കഴിഞ്ഞതിനു

Exhibit 26: Evidence for the man-days required for prawn filtration in kaipad and pokkali fields

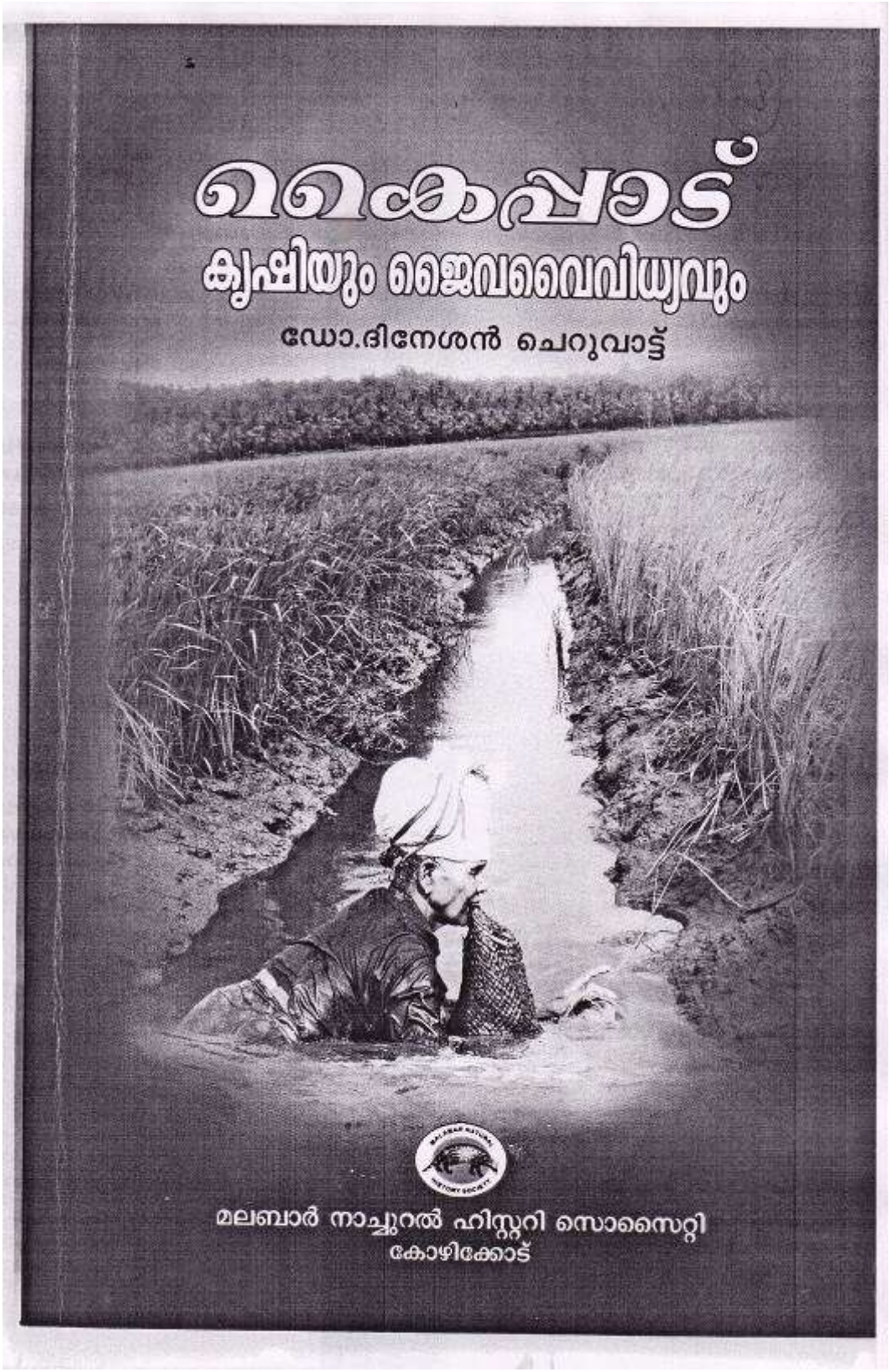
Ref: Comment PS 14

Reference :-**A Micro analysis of problems of displaced women Agricultural labourers with special emphasis to the pokkali fields of Vypinkara.**

By Shyna P.A and Sheela Joseph.

The article mentions that 246 mandays are required for prawn filtration. For prawn filtration operation the man power requirement for 1 ha and 5 ha is almost the same because the watch and ward, the sluice gate operator and the net operators are the same persons who work in the farm.The number of sluice gate operations,watch and ward ,the bagnet operations does not increase when the unit area is 1 ha or 5 ha

Exhibit 27: Evidence for paddy productivity in kaipad lands and evidence showing productivity of shrimp is only half during the second crop on kaipad lands



ശരാശരി 5-6 അടിയോളം വളരുന്ന നെൽച്ചെടി ഒക്ടോബർ രണ്ടാംവാരത്തോടെ കൊയ്യുവാൻ പാകമാകുന്നു. കൊയ്യുമ്പോൾ കതിരുൾപ്പെടുന്ന മുകൾഭാഗം മാത്രമാണ് അരിഞ്ഞെടുക്കുന്നത്. നെൽച്ചെടിയുടെ ശേഷിക്കുന്ന മുക്കാൽ ഭാഗവും പാടത്ത് അവശേഷിക്കുന്നു. തുലാവർഷം കഴിയുമ്പോൾ പാടത്തിൽ വെള്ളത്തിലെ ലവണാംശം വർദ്ധിക്കുന്നതോടെ വൈക്കോൽ ചീയാൻ തുടങ്ങുന്നു. ഇതിന്റെ ഒരു ഭാഗം ചെമ്മീനുൾപ്പെടെയുള്ള ജലജീവികൾക്ക് ആഹാരമായി തീരുകയും ശേഷിക്കുന്ന ഭാഗം പാടത്തെ ഫലപുഷ്ടി വർദ്ധിപ്പിക്കുകയുംചെയ്യുന്നു. ചീയൽപ്രക്രിയോടനുബന്ധിച്ച് വളർന്ന് വികസിക്കുന്ന സൂക്ഷ്മജീവികളുൾപ്പടെയുള്ള ജീവജാലങ്ങളും ഭക്ഷ്യശൃംഖലയുടെ ഭാഗമാകുന്നു. വൈക്കോൽ പാടത്ത്തന്നെ ബാക്കിവെക്കുന്ന ഫുക്കുവോക്ക കൃഷി മാതൃകയുടെ ഒരു പരമ്പരാഗത രീതിയാണ് ഇതെന്നും പറയാം.

ഓർക്കയമവിത്ത് സാധാരണയായി കൈപ്പാടിനോട് ചേർന്ന കരക്കണ്ടങ്ങളിൽ (കരയിലെ പാടങ്ങളിൽ) വിതച്ച് നെൽച്ചെടി ഒന്നര-രണ്ട് മാസങ്ങൾ കൊണ്ട് പറിച്ച് നടുകയാണ് ചെയ്യുന്നത്. കൈപ്പാടിൽ ആഴം കൂടുതലുള്ള ഇടങ്ങളിലാണ്. ഓർക്കയമ കൃഷിചെയ്യുന്നത്. കുതിരിനേക്കാൾ രണ്ടാഴ്ച മൂപ്പ് കൂടുതലാണിവയ്ക്ക്. അതുകൊണ്ടു തന്നെ കുതിര്നെല്ലിന്റെ വിളവെടുപ്പ് ഒക്ടോബർ അവസാനത്തോടെ പൂർത്തിയാകുമ്പോൾ ഓർക്കയമ വിളവെടുപ്പ് നവംബർ ആദ്യവാരത്തിലോ രണ്ടാംവാരത്തിലോ ആണ് പൂർത്തിയാകുന്നത്. കൈപ്പാടിലെ മറ്റൊരിനമായ കുട്ടൂസൻ കണ്ണൂർ ജില്ലയിൽ വെള്ളിക്കീൽ ഭാഗത്തും ഓർപ്പാണ്ടി കോഴിക്കോട് ജില്ലയിൽ കൊയിലാണ്ടി, ചേമഞ്ചേരി ഭാഗങ്ങളിലും വിരളമായി ഇന്നും കൃഷിചെയ്യുന്നുണ്ട്. ഒരേസമയത്ത് വിതക്കുന്നുവെങ്കിലും വിളപാകമാകുന്നതിനുള്ള കാലവ്യത്യാസം മൂലം കൈപ്പാടിൽ അടുത്തടുത്ത പാടശേഖരങ്ങളിൽ കൃഷിചെയ്യുന്ന പരമ്പരാഗതവിത്തിനങ്ങൾ തമ്മിൽ പ്രകൃത്യായുള്ള സങ്കലനം കുറവായിരിക്കും. കൈപ്പാടിനോട് ചേർന്ന് അധികം ഓരുകയറാത്ത കോഴിക്കോട് ജില്ലയിലെ ഉള്ളിയേരി ഭാഗത്ത് ഒറീസ എന്ന പേരുള്ള വിത്തും അപൂർവ്വമായി കൃഷി ചെയ്യുന്നു.

ശരാശരി അഞ്ച് മാസത്തോളം മൂപ്പുള്ള ഒരു ദീർഘകാലവിളയായ കൈപ്പാട് നെൽകൃഷി ലവണാംശം കുറഞ്ഞ ജൂൺ- ഒക്ടോബർ മാസങ്ങളിൽ ഒരുവിളമാത്രമേ ചെയ്യുവാൻ സാധിക്കുകയുള്ളുവെങ്കിലും ഉത്പാദനം വളരെ കൂടുതലാണ്. പരമ്പരാഗത ഇനങ്ങളിലെ ഒരു ഹെക്ടറിലെ ശരാശരി വിളവ് 2800 കിലോഗ്രാമാണ്. വളരെ അനുകൂല കാലാവസ്ഥയുള്ളപ്പോൾ ഇതിൽ കൂടുതൽ വിളവ് ലഭിക്കുമെന്ന് മിക്ക കൈപ്പാട്കർഷകരും പറയുന്നു. കൊയ്തെടുക്കുന്ന കറ്റകൾ മുട്ടോളം താഴുന്ന ചെളിയിലൂടെ ദൂരെ കരയ്ക്ക് എത്തിക്കുന്നതിന് പ്ര

Ref: Chemmut, D., 2013 Kaipad: Agriculture and Biodiversity

Kaipad: Paddy yeild 2800 kg/ha.

ത്ത് മാംസാവശിഷ്ടങ്ങൾ കെട്ടിയിട്ട് ഞണ്ടുകളെ ആകർഷിച്ച് ഇവയെ ചെറിയ കോരുവലകളിലേക്കിട്ട് പിടിക്കുന്ന രീതിയും നിലവിലുണ്ട്.

ജൂൺ മുതൽ ഒക്ടോബർ വരെയുള്ള വർഷകാലത്തും കൈപ്പാടിൽ തുമ്പുകളിലൂടെ മത്സ്യബന്ധനം നടത്താറുണ്ട്. എന്നാൽ നെൽകൃഷിക്ക് ശേഷം കിട്ടുന്ന പ്രധാന വിളവിന്റെ പകുതിയോളം മാത്രമേ ഈ സമയത്ത് ലഭിക്കാറുള്ളൂ.

ഒരു ചിറ(ബണ്ട്)ക്കുള്ളിലുള്ള മത്സ്യം വിളയുന്ന വിസ്തൃതമായ പാടശേഖരം അനേകം കൃഷിക്കാരുടെ ഉടമസ്ഥതയിലുള്ളതാണെങ്കിലും ഇവിടെ വളരുന്ന മത്സ്യങ്ങളെ പിടിച്ചെടുക്കുന്നതിനുള്ള അവകാശം പരമ്പരാഗതമായി ചിറയും മഞ്ചയും കൈവശം വെക്കുന്നവർക്കാണെന്നത് ഒരു വിരോധാഭാസമായി ഇപ്പോഴും തുടരുന്നു. മിക്കവാറും ചിറയും മഞ്ചയും ഒരു വ്യക്തിയുടേയോ കുടുംബത്തിന്റെയോ കൈവശമായിരിക്കാം. പലയിടങ്ങളിലും ഇത് കൃഷിക്കാരും ബണ്ടുടമകളും തമ്മിലുള്ള തർക്കങ്ങൾക്ക് കാരണമാകുന്നു. ചിലയിടങ്ങളിൽ ബണ്ടുടമകൾ കൃഷിക്കാർക്ക് ഒരു നിശ്ചിത തുക എല്ലാവർഷവും നൽകാറുണ്ട്. ചെമ്മീൻപണം എന്നപേരിൽ ലഭിക്കുന്ന ഈതുക കൊണ്ട് മുൻകാലങ്ങളിൽ കർഷകർക്ക് നെൽകൃഷിച്ചെലവുകൾ ഒരുപരിധിവരെ നിർവഹിക്കാനാകുമായിരുന്നു. എന്നാൽ ഇന്ന് ചെമ്മീൻ ഉത്പാദനം വളരെ കുറവാണെന്ന കാരണത്താൽ നാമമാത്രമായ തുകമാത്രമേ കർഷകർക്ക് നൽകാറുള്ളൂ. പലപ്പോഴും കർഷകർ സംഘടിതമായി പ്രശ്നങ്ങളുണ്ടാക്കുമ്പോൾ മാത്രമാണ് ഇത് ലഭിക്കുന്നതും ഇതിനെപറ്റി കൂടുതലായി ഏഴോം കൈപ്പാടിനെക്കുറിച്ചുള്ള ഭാഗത്ത് വിശദീകരിക്കുന്നുണ്ട്.

Exhibit 28: Evidence for sale price of shrimp per kilogram

1704

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PROCEEDINGS OF THE DIRECTOR OF FISHERIES, KERALA, THIRUVANANTHAPURAM

Sub: Fixation of selling price for fish produced in the Government Fish Farms and Hatcheries – Revised orders issued.

Read: Minutes of the meeting held on 3/6/15.

ORDER NO.C2/21009/10 DATED : 27/06/2015

As per the minutes of the meeting held on 3/6/15 Departmental technical committee decided to revise the price of fish produced in the Government farms and hatcheries. Hence sanction is hereby accorded to revise the rate of selling price of fish production in the Government farms and hatcheries as detailed below with immediate effect.

Rate for sale of Fish (in Rs)

Sl. No.	Item	Revised Rate
1	Catla	120
2	Rohu	120
3	Mrigal	100
4	Labeo	100
5	Cyprinus	100
6	Grass Carp	120
7	Silver Carp	120
8	Barbs (Paral)	100
9	Varal	200
10	Mushi	120
11	Attuvala	120
12	Aral	130
13	Managu	175
14	Pearlspot (Karimeen) 200 gm & above Below 200 gm	 350 300

30	Grouper (Karoopu) 1 Kg & above below 1 Kg	 200 150
31	Ethrinus (Aeri)	150
32	Vallipoomeen	100
33	Anabas (Karupu) big small	 100 70
34	Etta big small	 80 60
35	Leiognathus (Mullan) big small	 90 60
36	Mud Crab above 800 gm 550-800 g	 1000 700
37	Fresh Water Prawn (Attu Konchu)	350

Rate for Sale of Shrimp

Sl No.	Item	Count	Proposed rate (Rs./Kg)
38	Tiger Prawn (Kara)	10	700
		20	560
		30	450
		40	350
		50	280
		60	270
		80	260
		100 & above	250
39	White Prawn (Naran)	40	320
		50	300
		60	280
		70	270
		80	260
		90	250
		100	240
		120	230
		140	210
		160	200

Exhibit 29: Evidence of Climate Change and Sea-Level Rise in Kerala as per Kerala SAPCC

P.S-2 KERALA STATE ACTION PLAN ON CLIMATE CHANGE - PAGES-29 TO 34

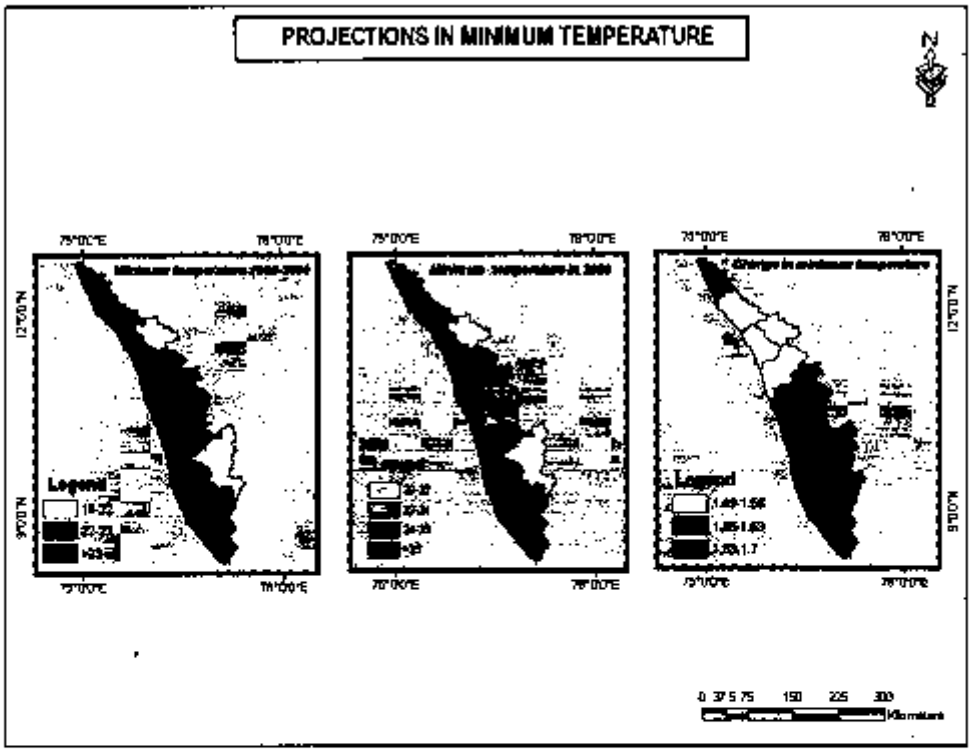

Fig 4.6 Change in average minimum temperature in 2050

4.4 Sea Level Rise and Projections

It is now established that the sea level is on the rise due to global warming and the projected Sea Level Rise (SLR) along Kerala coast on a conservative estimation is about 100 to 200 mm over the next 100 years. Vulnerability to Sea Level Rise would be of alarming to the majority coastal communities which live on sandy coasts, most of which are barrier beaches or spits. Backwater banks, islands and filtration ponds/paddy fields are other sections of the coastal zone which are highly susceptible to Sea Level Rise. If the sea level rises by one metre, 169 sq. km of the coastal region surrounding Kochi will be inundated.

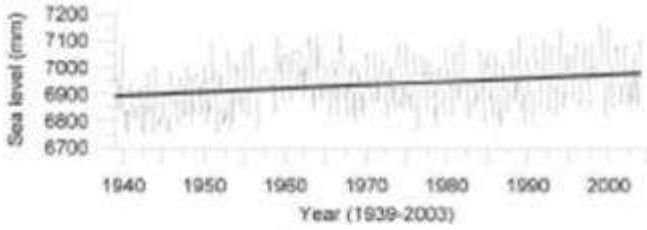

Fig. 4.7 Historic sea level rise in Kochi coast

The historic sea level rise for Cochin is estimated to have been 2 cm in the last one century (Emery and Aubrey, 1989; Das and Radhakrishan, 1993). The scenario of future sea level were obtained by adding the projected values for a given year to the local trend of 0,02 cm per year times the number of years from present (Fig. 2.5)

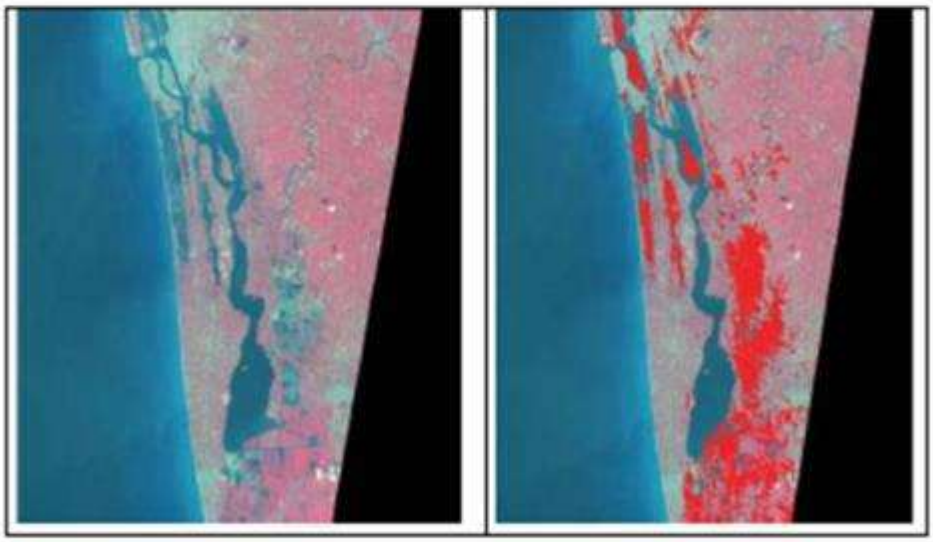

Fig. 4.8 Present and projected inundation area in satellite images. Source. Climate Change and India. 4*4 assessments.

Fig. 4.8 gives the satellite images, with the first one showing the current position of Kochi and second one showing inundation areas (red marks) for a 1 meter sea level rise in Kochi. It clearly shows that coastal region of Kerala is one of most vulnerable region in the country due to projected sea level rise. It is now established that the sea level is on the rise due to global warming and the projected Sea Level Rise (SLR) along Kerala coast on a conservative estimation is about 100 to 200 mm over the next 100 years[4]. Vulnerability to SLR would be of alarming to the majority coastal communities which live on sandy coasts, most of which are barrier beaches or spits. Backwater banks, islands and filtration ponds/paddy fields are other sections of the coastal zone which are highly susceptible to Sea Level Rise.

[4]. Climate Change and India. 4*4 assessments.

5. Climate Change Vulnerability Assessment of Kerala

5.1 Background

Vulnerability assessment is the process of identifying, quantifying, and prioritizing (or ranking) the vulnerabilities in a system. Within the range of climate change studies the most vulnerable are considered to be those who are most exposed to hazard, who possess limited resources to cope, heavily dependent on subsistence activities involving extraction natural resources and who have least resilience to climate shocks (Bohle, Bowling and Watts 1994)

Understanding the regional and local dimensions of vulnerability is therefore essential to develop appropriate and targeted adaptation efforts. Assessment of vulnerability to climate variability and change broadly helps in

- Understanding current vulnerability.
- identify the factors that render some districts more vulnerable than others.
- Inform and facilitate the decision-making process.
- Selection of adaptation strategies and practices

To date, hardly any studies providing through, comprehensive socio economic or environmental assessment of where the state is vulnerable from future Climate Change when and from what specific climate change impacts. Based on some general understanding of climate change and profile of the state following paragraphs depict the vulnerability to climate change

5.2 Climate Change Vulnerability Profile of Kerala

Vulnerability to climate change can be considered to be high in state due to unique social, economic, environmental and physical conditions that amplify susceptibility to negative impacts and contribute to low capacity to cope with and adapt to climate related hazards. Generally vulnerability profile of the state towards climate change as follows

- Kerala constitutes only 1.18 % of the total areas of India but accounts for about 3.1 % of Indian's population. The density of population is 859 persons/ sq. km which are the three times as densely settled as rest of India.
- High dependency of the state's socio-economic nature to climate sensitive sectors like Agriculture, fisheries and forests.
- Multi Hazards profile of the states which is more exposed to climate related hazards like flood and droughts.
- Kerala has a very long coastline of 570 km, out of which 322 km is prone to sever sea erosion.
- Occurrence of many fragile ecosystem of the state like Mangroves, Shola forest and Tropical evergreen forest, river Pozhi and Azhi etc and many biodiversity regions.

- Reduction in the availability of fresh water and impacts on agriculture production and food security due to predicted decline of rainfall.
- Boundary shifts for different forest types, with consequent implication for species diversity and forest dependent communities.
- Threats of sea level rise in the low lying areas along the coastal areas of the state.
- Changes of virulence and disease pattern especially vector borne and water borne diseases.
- Increase energy demands and subsequent impacts on climate sensitive infrastructure.
- Land degradation may also be exacerbated in the state, posing additional threats to human well-being and development if human pressures on lands intensify.

5.3 Coastal Kerala is risky zone to climate change impacts

The coastline of the state of Kerala is 580 km long where it consists of nine districts. The total areas of coastal districts are 22418 sq. km with population density of 2022/sq. km (2001 census) as against 859/sq. km in the state. It has the concentration of major population centers at low elevations including all five Corporations of the state i.e. Thiruvananthapuram, Kollam, Ernakulam, Trissur and Kozhikode. Coastal areas have vibrant geographical area in the state which influences all sectors of the state economy. The human presence, influence and activity of the coastal areas have reached in every parts of the state. Moreover natural ecosystems of the coast are gifted with beaches, dunes, barrier, beaches, salt marches, lagoons, backwater, mangroves forest and estuaries.

Coastal region of state will be particularly vulnerable to the climate change of present and anticipated risk. It is estimated that sea level rise by 3.5 to 34.6 inches between 1990 and 2100 would result in salinity intrusion to coastal groundwater, endangering wetlands and inundating valuable land and coastal communities and the most vulnerable stretches along the western Indian coast are parts of the Konkan coast and south Kerala (India's Second National Communication to UNFCC). It is also assessed that the sea level rise is 1.0 m and 2.0 m respectively 169 sq. km and 599 sq. km will be inundated in the coastal regions of surrounding Kochi. Another study shows if the sea level rise increase by 0.5 metre then 212 sq. km of wetland may loss the in the state (Sharma and Dwivedi). This clearly indicates the vulnerability of the coastal region where even with a few millimeter rises in sea level. The potential impacts of global climate change in coastal Kerala are salinity intrusion into aquifers and rise in salinity of wetlands (Thrivikramaji, 2008). The sea level rise for Cochin during the past century is estimated at 2 cm (Emery and Aubrey, 1989; Das and Radhakrishna, 1993). But the rate of increase is accelerating. It may rise at the rate of 5 mm per year in decades to come. This will accelerate erosion and increase the risk of flooding (Nicholls et al., 1999). The shore line change assessment of Kerala coast (SASCOM) for a