Nardave Medium Irrigation Project Village Nardave, Tal - Kankavali, Dist – Sindhudurg Maharashtra

Executive Summary

The Nardave Medium project is situated in the Kankavli Taluka of Sindhudurga district in the catchment area of Gad River

Components of the Project:

The major components of the project as being executed are as follows.

(I) Earthen Dam: Earthen Dam is proposed in a length of 1749 m and its maximum height and top width are 66.43 m and 6.50 m respectively. Nearly 61.50% of earth work is completed. Earthwork between RD 330 m to 702 m is completed up to RL 174.00m, RD 880 m to 1170 m is completed up to RL 175.00 m and between RD 60 m to 150 m is completed up to RL 155.00 m (Designed TBL is 193.60 m).

(II) Spillway: A cement concrete spillway having a length of 41 m. is proposed in the right flank. The spillway will have 3 Nos of Radial Gates of Size 12 X 5 m and approach channel, stilling basin and tail channel. Excavation for foundation of spillway and stilling basin up to designed level is nearing to completion. Falls are proposed in tail channel for energy dissipation construction of which are in progress. **Nearly 40% work of spillway is completed.**

(III) Irrigation cum Power Outlet:

Irrigation cum Power Outlet is proposed on left flank at RD 70m with discharging capacity of 7.66 cumecs and a dam foot power house having generation capacity of 3.00 MW. Generating units proposed under this project are 13.45 million units. Excavation excluding approach channel is completed. Construction of penstock for entire length as per design is completed. Construction of dry well up to RL 157.00 m is completed. **80% work of ICPO is completed.**

Work of power generation is entrusted to Laksh Power Private Limited, Mumbai on B. O. T. Same work is under supervision of Hydro Division.

(IV) K.T. Weirs:

Due to hilly nature of the country, canals are not economical. Hence in such hilly terrain, storage is built up behind series of KT weirs from where water is lifted for irrigation domestic and industrial use by individual beneficiaries or by formation of co-operative societies. Such schemes will have their own distribution system in the form of minors and field channels and need no special elaboration. The government will not incur any expenditure on lift schemes.

A series of 14 K.T. Weirs is proposed along the river course of Gad river to enable lifting of water for irrigating irrigable command area to the tune of 8084 ha (Cropped Area 12530 ha.) **Out of 14 K.T. Weirs 10 Nos. of K.T. Weirs are completed** so far and irrigation potential and its utilization to the tune of 757 ha against 8084 ha is achieved up to Dec 2016. Provision to the tune of 10.605 Mcum for domestic and 5.958 Mcum for industrial use is made. Other benefits of the project are fisheries and tourism

Salient Features of the Project

Sr. No.	Particulars	Details
1	Name of the Project	NARDAVE MEDIUM IRRIGATION PROJECT, Tal- kankavali, Dist - Sindhudurg
2	Scope of the scheme	"Nardave" Medium Irrigation Project having instead of canals, series of K.T. weir are provided. Irrigable area of this project is 8084 Ha.
3	Sources	River Gad
4	Location	Topo sheet 47H/15, 16,11,12 Latitude 16^0-12'-00"(N)Longitude73^0-54'-0"(E)
	State	Maharashtra
	Region	Konkan
	District	Sindhudurg
	Taluka	Kankavali
5	Upstream utilization	Nil
6	Yield &utilization of project	
	a) Catchment area	47.70 sq.km. (18.53 sq miles)
	b) Average rainfall	4450.10 mm.
	c) 75 % Dependable yield	126.60 Mcum.
	d) Utilization proposed	121.78Mcum.
7	Dam & Reservoir	
	a) Gross capacity of storage	123.74 Mcum
	b) Live storage	119.16 Mcum
	c) Dead storage	4.58 Mcum
8	Relevant levels	
	a) River Bed R.L.	127.17 M

Sr. No.	Particulars	Details
	b) Outlet sill level	144.30 M
	c) M.D.D.L.R.L.	146.80 M
	d) Full Reservoir level R.L.	190.00 M
	e) M.W.L.	190.60 M
	f) Top of Dam R.L.	193.60 M
	g) Spillway crest R.L.	185 M
9	**Submergence.**	
	a) Submergence	356.352 Ha.
	b) No. of villages under submergence	Jambhalgaon Nardave. Yavteshvar. Bhairavgaon Durganagar
	c) No. of Houses under Submergence	**Village** **No.of Houses.** Jambhalgaon 249 Nardave 327 Yavteshvar 56 Bhairavgaon 99 Durganagar 236 **Total** **967**
	d) No. of Souls affected	3849
10	**Type of Dam**	
	a) Type	Earthen Dam with Gated spillway
	b) Maximum height of dam above river bed	66.43 Mtrs
	c) Length of Dam. i) Earthen Dam. ii) Masonary Dam	=1790 M (total=earthan dam+Spillway) (R.D.-30 M to 1479.5 M & 1505 M to1740M) Total = 1749 M =(R.D 1479.5 M to1520.5 M) Total = 41.00 M
	d) Total quantity of earth work	136.11 lakh cum
	e) Total quantity of concrete works	0.53 lakh cum
	f) Total quantity of excavation	
	Soft Strata	1.78 lakh cum
	Hard rock	0.20 lakh cum
	TOTAL	1.98 lakh cum
11	Waste weir	
	a) Length of the waste weir	41.00 Mtr. (Including both side pier)
	b) Type	Gated
	c) Flood depth	0.60 M.
	d) Free Board	3.00 M.
	e) Design flood discharge	1504 cumecs
	g) Spillway Gates	12 M x 5 M = 3 Nos.
12	Outlet (Power)	
	a) Location	RD 70 M
	b) Full supply discharge	7.66 cumecs

13. Canals – instead of canals series of K.T. weirs are provided

Sr. No.	Name of Valley	Name of K.T. weir	Chainage	Length in M	storage in TM cum
1	Gad River Vally Basin	Nardave	1100 M	52	0.028
2		Jambhavade	2850 M	64	0.034
3		Kupavade	5 970 M	112	0.054
4		Digavale	8510 M	91	0.202
5		Pangamwadi	11100 M	110	0.168
6		Dariste	12250 M	91	0.191
7		Sangave	15400 M	91	0.491
8		Shivdav	17430 M.	110	0.511
9		Chichalwadi	1 8 8 70 M.	85	0.191
10		Shekhwadi	21870 M.	115	0.473
11		harkul bru.	23370 M.	103	0.337
12		Halwal	25350 M.	118	0.472
13		Kankavali	27350.M	112	0.498
14		Ramgad	38850 M	125	0.546

14	**Irrigable Area**	**8084 Ha**	
	a) Taluka benefited & village Benefited.	Taluka - Kankavali -30 villages. Taluka - Kudal -08 villages Taluka - Malvan -10 villages Total -48 villages	
15	**Proposed crop pattern**	**Crop**	**% age**
	1. Perennial	i) Coconut	15
		ii) With Black Pepper (Inter Crop)	
		iii) Mango	30
			45
	2. Kharif	i) Kh Paddy	46
		ii) Vegetable	9
			55
	3. Rabbi (Follow on crops)	i) Rabi paddy	7
		ii) Rabbi Vegetable	15
		iii) H W Pulses	13
		iv) H W Ground nut	5
		vii) Chillies Two seasonal	15
			55
		Total	**155**
	(b) Existing crop pattern	i) Paddy	42
		iii) Warai/Nagali	12
		iii) Pulses	8
		iv) Seams	1
		iv) Fruits	2
		v) Grass	3
		vi) Culturable	32

		Total	**100**
16	Cost of the Project	1) Rs. 44670.76 lakhs. (Third Revised) (As per D.S.R.05-06)	
		Third Administrative approval vide Marathi Govt. Order No. Naradave 2007/140/(47/2007)- MPR Mantralay Bombay dated – 19'th JUL 2007 (2) Latest Revised Amount Rs.1200.00 Lakhs (As per D.S.R. 2016-2017 (Under Finalization)	
	a) Cost of the Project (Original)	3243.78 lakhs (As per DSR 1986-1987)	
	b) Cost of the Project (I st Revised)	10298.20 lakhs (As per DSR 1993-94)	
	b) Cost of the Project (II nd Revised)	18990.67 lakhs (As per DSR 1997-1998)	
17	Cost per unit of i) Irrigable area	Rs 5.526 Lakh / Ha	
18	Cost per unit of storage		
	b) Gross storage/Mcum	Rs. 361.005 Lakh/Mcum	
19	Benefit cost ratio Irrigation	1.54	
20	Percentage of submergence to irrigable area.	4.40 %	
21	Percentage of annual utilization to 75 % Dependable yield	96.19 %	

The EIA EMP report has been prepared as granted Terms of Reference (ToR) vide Letter No. J-12011/7/2017-IA-I (R) dated 10th October 2017.

Description of the Environment

Study Area

Study area includes Dam Site, Catchment Area, Submergence Area, Command Area and Area within 10 km radius from dam Site

Location Topo sheet 47H/15, 16,11,12
Latitude16^0-12'-00"(N) Longitude73^0-54'-0"(E)

Study Period: October 2017 to May 2018

Meteorology

The Meteorological data of IMD Vengurla for the period of 1987 to 2008 is discussed below:

Temperature: The average maximum temperature is 34.21°C and average minimum temperature is 18.91°C recorded in last 21 year

Relative Humidity: During Pre-monsoon period, the monthly mean relative humidity was observed to be in the range of 67% - 89% at 0830 hrs and at 1730 hrs it occurred in the range of 55% - 72%. During the monsoon season, relative humidity ranges between 82% - 94% at 0830 hrs and 76% - 92% at 1730 hrs. In the post-monsoon season, the range was observed to be in the range 68.3% - 91% at 0830 hrs and at 1730 hrs.

Rainfall: The average annual rainfall observed to be 2464 mm

Wind Speed: The average wind speed in the region is observed to be in the range of 6.6 to 17.9 kmph.

Seismology: Project area falls in Seismic Zone III. It suggests that the area is a moderately affected

Ambient Air Quality: The ambient air quality monitoring were carried out at 8 location from submergence and command area of the project. Air quality measured at various stations were within the permissible limit.

Ambient Noise Level: The noise levels were measured at 8 locations. Noise levels recorded at various stations were within the permissible limit

Water Quality Study: Water sampling locations were selected from submergence and command area of the project. The samples were collected from river, lake/dam, dug well as well as bore well.

Surface water samples from 5 Location & Ground water samples from 9 locations were collected in winter and summer season.

Most of the physico-chemical parameters are found well within prescribed limits of IS 10500:2012.

Soil Quality: Soil is the naturally occurring, unconsolidated or loose covering on the Earth's surface. Soil samples from 13 representative areas were taken in winter and summer season.

In the project area, majority of the soils were found to be silty clay in nature. Soils found in the project area are fertile with moderate NPK and micro nutrients.

Ecology and Biodiversity: The vegetation survey of Nardave medium irrigation project area of Kankavli Taluka of Sindhudurga district reveals a total 147 plant species recorded during study period. Out of 147 species recorded 42 are herbaceous, 19 are shrubs, 17 are climbers, 7 are woody liana and 62 are tree species. In the study area dominating families are Papilionaceae 8 sp., Moraceae 8 sp., Euphorbiaceae 6 sp., Combretaceae & Apocynaceae 5 sp. each and Rubiaceae 4 sp.. In study area a monotypic endemic genera with single species namely Erinocarpus nimmonii is recorded representing family Tiliaceae. Only gymnosperm Gnetum ula is also recorded from Yavateshwar village. Seventeen (17) species, which are endemic to Western Ghats are occurring in the study area.

The Radhanagari Wild Life Sanctuary situated 0.75 to 2 kms away from from the project site.

Land Use Land Cover Study

Area Statistics for the catchment, Submergence & Command Area area

Class	Catchment Area (ha)	Submergence Area (ha)	Command Area (ha)
Water Body	36.35	13.7088	241.4592
Dense Forest	2099.87	78.6816	2790.086
Less Dense Forest	745.57	24.4224	4594.118
Settlement	97.34	54.3168	1466.266
Open Scrub	587.12	162.8928	3005.338
Barren Area	364.03	78.9696	3050.726
Agriculture	718.73	283.6224	5049.274
Vegetation Outside Forest	237.89	12.2688	3545.856
Plantation	71.60	0.1152	387.936
Total Area	**4958.50**	**708.9984**	24131.06

Socio Economic

The total 5 villages will be submerged. Total Households are 276. Village Naradave has the highest number of household & population while Yevteshwargaon village has the lowest number of population affected. The ratio of Male to Female is 49:51

SC and ST Population: Only Naradave village has the SC Population. SC population were not rcorded in submergence area. Aamong the total affected 5.69 % of SC population will be affected.

Literacy Status: Overall the ratio of literate & illiterate population is 70: 30. Among the literate, males have higher percentage in comparison to the females.

Working and Non-Working Population: About 58.37 % population is working while 41.63 % of the population is in non-working class.

Land Acquisition, Rehabilitation and Resettlement: For construction of earthen dam and its allied works, total 631.162 Ha land is required for submergence, dam seat, tail channel, alternative roads & other allied works which incorporates 585.772 ha Private Land, 11.25 ha Govt. Land and 34.14 ha Identified Forest Land. Out of this total 631.162 ha land acquisition procedure for 566.657 ha is completed and it is in possession of Water Resources Department. For remaining 64.505 ha land, present status is as under.

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Sr. No.	Component	Type	Acquired Land in hector	Remaining land in hector
1	Dam, Submergence, dam seat, tail channel, alternative roads & other allied works	Private Land	566.657	19.115
		Govt. Land	00	11.25
		Identified Forest Land	00	34.14

Present Position of Rehabilitation

Sr. No.	Details of Villages Affected			Details of Rehabilitation Villages		
	Affected Village	Population	No of Families	Name of new Gaothan	Present position	
					Land of Gaothan	**Creation of civic amenities**
1	Durganagar	881	236	Jambhavade	Acquired	40 % completed
2	Nardave	1240	327	Digawale	Acquired	90 % completed
3	Bhairavgaon	426	99			
4	Yawateshwar	402	56	Sangve (Samhajinagar)	Acquired	90% completed
5	Jambhalgaon	3229	249			
	Total	**3849**	**967**			

Status of completion of civic amenities is tabulated below

Sr. No.	**Name of Village**	**% age completion of civic amenities**	**Total no. of PAFs/ PAPs Affected**
1	Digawale	90	262
2	Jambhavade	40	260
3	Sangave (Sambhajinagar)	90	445
			967

Environmental Impacts of the Project

Features likely to be affected	Construction Activity	Borrowing of materials	Importing of labour	Evacuation	Compensation	Soil conservation and landscaping	Reservoir & KT Weir Filling	Irrigation
Air Quality	-1T	-1T	0	0	0	+1P	+2P	0
Noise Quality	-1T	-1T	-1T	0	0	0	0	0
Water Resources	-2T	-1T	-2T	0	0	+2P	+2P	+3P
Water Quality	-2T	-1T	-1T	0	0	+2P	+2P	+3P
Landuse	-1T	-1T	-1T	-2T	+1P	+3P	-1T	+3P
Soil	-2T	-1T	-1T	-1T	0	+3P	+1P	+3P
Ecology	-2T	-1T	0	-1T	+1P	+3P	+2P	+3P
Employment Status	+2T	+1T	+3T	-1T	+3P	+1P	+2P	+3P
Public Health	-1T	0	-1T	0	0	0	0	+2P
Aesthetics	-1T	0	-1T	0	0	+3P	+3P	+3P

Notes: Likely effect is symbolized as follows: **T = Temporary effect; P = Permanent effect**

	Low	Medium	High
Beneficial	+1	+2	+3
Detrimental	-1	-2	-3

Management during Dam & KT Weir Construction

The impacts during the construction stage of the proposed project on the environment are basically of transient in nature and are expected to reduce gradually on completion of the construction activities. The measures recommended to be undertaken for the proposed project during its construction phase are the following:

Recommendations:

- Clearing of submergence area is required wherever possible. This activity involves removal of trees, shrubs, vines etc. which otherwise would disintegrate or decay, and perhaps float / drift to the shore and get accumulated at the bottom.
- The shoreline subjected to erosion should be cleaned up to the extent to which the wave action is apprehended to affect.
- Trees should be demarcated first and cutting should be done in phases to recover the economic value.
- Trees and bushes should be cut right up to the bottom to avoid wood decay, which causes nuisance and deteriorates water quality.
- During excavation and transportation over un-metalled roads near the project site, there is a scope for local dust emissions. Frequent water sprinkling in the vicinity of the construction activity should be done and it should be continued even after the completion of the dam construction, as there is a scope for vehicular movement.
- Since there is likelihood of fugitive dust from the construction activity, material handling and from the truck movement in the vicinity of the project site, the authorities should go for tree plantation programme along the approach roads and the construction camps.
- The construction site should be provided with sufficient and suitable toilet facilities for workers to allow proper standards of hygiene.
- Collected waste from residential areas shall be transferred to community bin by hand-driven containerized carts or other small vehicle. Horticulture and construction / demolition wastes or debris shall be separately collected and disposed off.
- The depths, charge, matrix of holes and delay may be optimized to minimize vibrations and noise caused by the blasting operations.

- Though the noise effect on the nearest inhabitants due to construction activity will be negligible, it is advisable that on site workers using high noise equipment shall adopt noise protective devices like earmuff and earplugs. .
- It should be ensured that both gasoline and diesel powered construction vehicles/machinery are properly maintained to minimize smoke in the exhaust emissions. The vehicle maintenance area should be located in such a manner as to prevent contamination of surface and ground water sources by accidental spillages of oil. For this the surface water drain will be provided for vehicle parking and fuel storage areas and this drain will be isolated from that of surface and ground water sources. Unauthorized dumping of waste oil should be prohibited.
- As soon as construction is over the surplus earth and rubble should be utilized to fill up low-lying areas. The rubbish should be cleared and all un-built surface reinstated.
- Reclamation of borrow areas is imperative, however, in present case due care has been taken to identify the borrow areas within the submergence zone.
- To prevent unauthorized felling of trees for fuel wood in the nearby areas by construction workers, it should be ensured that the contractor provides alternative fuel (LPG / Kerosene) for cooking requirements.

The mitigation measures to be taken-up during the construction and operational phases are suggested below.

Surface Water Hydrology

- As the downstream trends of the river flows can adversely affect the reservoir regulation plan, a monitoring programme should be set up to investigate the trends which really exist so as to modify the regulation plan accordingly; and
- Definite criteria should be set up for the reservoir for minimum water release planning while taking downstream requirements into consideration.

Water Quality

- Care should be taken in clearing the vegetation from the submergence area to avoid eutrophication and release of obnoxious gases;
- A regular monitoring programme of water quality in the reservoir and in the downstream

river reaches should be undertaken to evaluate the actual alterations of water quality and their effects on fisheries resources and downstream water users; and

- In addition to the above, ground water quality and water table fluctuations in the vicinity of the dam, should be monitored.

Ecology & Biodiversity

- The judicious sequencing of construction, operation and appropriate location of labour camps, project colony etc.
- Cutting of existing trees should be carried out under the supervision of Forest Department and records maintained. The Department should provide adequate security to ensure that no illegal felling of trees takes place.
- The movement of vehicles should be strictly monitored and excessive blowing of horn and lighting in the night should be avoided. Such activities may cause disturbance to the local fauna.
- Restriction of construction activity from dawn to dusk to avoid impact on wildlife during night.
- A long-term Catchment Area Treatment Plan should be set up for the post impoundment period with following purpose:
  - ✓ Control of illegal agricultural activities in the remaining catchment area;
  - ✓ Provision for proper land utilization practices in the catchment area to reduce the losses of top soil and flash floods,
  - ✓ Afforestation of shifting cultivation areas by planting fast growing tree species &
  - ✓ Taking view of existing watershed activities in the catchment.
- Strict law enforcement should be undertaken for conservation of wildlife; and
- Conservation of species that are living or feeding along the shoreline of the reservoir and conservation of certain areas as habitat of water birds.

Fishery Conservation and Management Plan

The river Gad Originates from Sahyadri Mountains ranges. This river Originates mainly with three Nallas and number of small Nallas.The river Gad flows towards west and meets Arabian Sea near villages Revandi in Malvan Taluka. The river flows only in rainy season and no

commercial fishery activity is carried out, hence this cannot serve as a perennial fish culturing spot. When adequate water is available in the nalla fish are exploited to a beneficial extent and varieties such as minor carps and several other species of lesser importance are reared.

Vegetation and Wildlife Management Plan

1. The project area is close to Radhanagari Wild Life Sanctuary and there are occurrences of schedule wild life. Hence, sign boards/ Notice Boards at the site like, NO HORN PLEASE, SILENCE ZONE etc. will be fixed
2. Awareness program among the, drivers, school children & local community about the ecology & biodiversity.
3. Care is required to be exercised during the excavation and transportation over un-metalled roads near the project site, so that there is a no scope for local dust emissions. Frequent water sprinkling in the vicinity of the construction activity should be done
4. During construction and operation phases, strict instructions to the contractors, labourers to avoid cutting of vegetation of any kind in the project area as well as in the catchment of the dam
5. Instruction to the contractors, labourers, and workers to avoid any kind of activities in the dam or its periphery which might disturb feeding, breeding and roosting of aquatic birds and wildlife if any.
6. As a corporate social responsibility, project authorities should undertake plantation of native species in the catchment that is in the immediate vicinity of the wetland
7. Control of Poaching; taxidermy and Illegal Trade in Wild Animal and Plant Species is strictly prohibited as per the various laws related to the Wildlife Protection. In cases any of such things are noticed, it is required to be brought to the notice of the forest officials.
8. The movement of the project vehicles should be strictly monitored and excessive blowing of horn, lighting in the night should be banned. Such activities may cause disturbance to the local fauna.
9. Adequate allocation for the financial resources required to be made to implement the wildlife management plan.

Greenbelt should be developed in the following areas:

- Plantation along the Full Reservoir Level;
- Plantation at downstream of the dam and near KT weirs
- Plantation along approach roads; rehabilitation village area and
- Afforestration

Budgetary Allocation for Environment Management

Sr. No.	Particulars	Total (Rs.in Lakhs)
1	Rehabilitation and Resettlement Plan	7840.832
2	Green Belt Development / Afforestration	140.07229
3	Management of Physical and Environmental Resources	10
4	Catchment Area Treatment Plan	243.46
5	Fishery Management and Conservation Plan	10.00
6	Biodiversity and Wild Life Conservation Management Plan	15.00
7	Sanitation and Solid Waste Management Plan	05.00
8	Health Management Plan	68.58
9	Disaster Management Plan	25