

EXECUTIVE SUMMARY

**SONDUR RESERVOIR PROJECT
DISTRICT DHAMTARI, CHHATTISGARH**

Project proponent

**WATER MANAGEMENT DIVISION
DISTRICT DHAMTARI, CHHATTISGARH**

Environmental Consultant



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1 EXECUTIVE SUMMARY

1.1 BACKGROUND

Sondur Dam Project across river Sondur, a right bank tributary of Mahanadi, was contemplated by the erstwhile Madhya Pradesh Government in 1972, with a view to augment supplies in Ravi Shankar Sagar Project (RSP) under the ambitious Mahanadi Reservoir Project Complex (MRP). From its evolution, the project was conceived on Sondur river, in Tehsil and Block Nagri, District Dhamtari with a view to impound water of the river for feeding/ augmenting supplies in Dudhawa reservoir and downstream RSP reservoir both on Mahanadi. The intervention of Sondur River at present site ,with FRL 471.065 mamsl made it plausible for providing en-route irrigation to proposed command area of Kharif (12260 ha) in Nagri Tehsil ,besides augmenting supplies in RSP reservoir enroute Dudhawa reservoir otherwise it would have confluenced with Mahanadi near Gariaband ,a place afar downstream of the location of RSP ,without contributing to RSP for providing irrigation facilities to CCA (26210 ha) in Bhatapara Branch (km 45 to 85 km) .

1.2 NEED FOR THE PROJECT

The need for the Sondur dam project in the Mahanadi Basin has therefore been considered in context of food grain shortage in the region in general and in the country as whole. The project as a component of Mahanadi Reservoir Project Complex would provide irrigation facility to its command besides stabilizing irrigation in CCA of Bhatapara through Mahanadi canal system which shall create employment opportunity.

1.3 LOCATION AND APPROACH

The project has been constructed on Sondur river at geo-graphical coordinates at latitude 20⁰ 14'N and longitude 82⁰ 06' E near Mechka village in Nagri tehsil, district Dhamtari. The project site is about 90 km from district head quarter and about 167 km from state capital, Raipur. It is approachable from Dhamtari via SH-6 and is about 20 km from Nagri. Geographical locations of project area are covered under Survey of India Toposheet No. 64L /3; 64 L/4; 64H/15 and 64H/16.

1.4 PROJECT FEATURES

The project construction activities started in 1978 and by 1988 the dam was completed as per original design for FRL 471.065 mamsl and that by 1996 the construction of Sondur Feeder Canal and distributaries was completed. At present all civil and mechanical works are complete under the project, except works of B.K. minor under Nagri distributary. Under the project the following components were completed: -

- 3360 m long composite dam of homogeneous earthen section.
- Central masonry dam section with “ogee” shaped spillway with 5 bays fitted with radial gates (15mx10m) having non-overflow section to its left and right;
- Head regulator with two bays for conveying authorized head discharge of 28.3 cumecs;
- 15 km long Sondur Feeder Canal (SFC);

- Two distributaries viz., Nagri and Sihawa distributaries off-taking at RD 12.5km and 13.6km respectively of SFC has been completed,
- Total length of distributaries and minors (159.78 km).

1.5 ENVIRONMENT IMPACT ASSESSMENT

M/s Enviro Infra Solutions Private Limited, 301,302 &305, SRBC, Plot No., INS-12, Sector-9, Vasundhara, Ghaziabad (NCR) -201012, has conducted the Environment Impact study, as per TOR issued by MoEFCC, New Delhi, vide letter No. J-12011/23/2017-IA-I, Dated 6.09.2017.

1.6 METHODOLOGY

The methodology and techniques used for studying the various parameters of the environment viz. land, air, noise, water, flora, fauna and socio-economics in the study area are described as follows:

1.7 LAND ENVIRONMENT STUDY

- The Digital Satellite data IRS P6 LISS-III of project area was acquired from NRSA and evaluated on ERDAS Imagine Software.
- Toposheets on 1:50,000 scale of the directly draining catchment area were used for the study.
- Detailed field survey was conducted for study of soil characteristics of erosion prone areas and landslides in the reservoir area.

1.7.1 Air Quality Assessment

To generate, a database on the existing status of the pollutants, the study area was evaluated for setting up six locations to conduct air quality monitoring in respect of PM₁₀, SO₂ and NO_x.

1.7.2 Sound Level Measurement

The sound level was measured at six locations by sound level meter RS-232 (Digital-Instrument).

1.7.3 Soil Quality Assessment

Physical and chemical characteristics of the soil were studied in respect of six samples taken from the study area.

1.7.4 Water Environment Assessment

For evaluating physical, chemical and biological characteristics of surface and ground water samples were taken from thirty-five locations.

1.7.5 Aquatic Environment

Evaluation of the parameters related to aquatic environment has been done in respect of biological characteristics of river water.

1.7.6 Floral Study

It is based on extensive field survey of the area. One season study has been conducted. In this the phytosociology of plants and diversity of the forest vegetation was determined.

1.7.7 Faunal Study

Various transects were identified along the villages to carry out faunal studies as the village trails were the best options to cover-up the complete area. Observer walked at a constant pace for their observation.

1.7.8 Socio-economic Study

The data on socio economic and dependency aspects were collected. The process involved assessment of the study area to obtain an overall perspective of the project affected villages that were located in the submergence zone / 10 km radius from the dam including command area. In order to gather information on public perception of the proposed project the attitude/psychology survey was carried out which depicts the prevailing awareness and acceptance/no-acceptance about the project. Data collection from secondary sources has also been made to validate some of the information and to supplement the data on demographic aspects.

1.8 EXISTING STATUS OF ENVIRONMENT

1.8.1 Physical Environment

The physiographical location of the project area is in south eastern part of district Dhamtari of Chhattisgarh state covered under Chhattisgarh Plain. The command area of the feeder canal, a contour canal, is bounded by Nagri distributary on right and Sihawa distributary on left of Mahanadi. The average gradient of project area is gentle sloping towards Mahanadi.

1.8.2 Land use/Land Cover

The dominating land use classes are dense forest (45.25%), agriculture land (41.02%), open forest (9.77%), water body (1.52%), settlement (1.35%) and dry river bed (1.09%).

1.8.3 Total Land Requirement for Construction of the Project

304.43 ha private land under the project covered under five revenue villages was acquired for the project. Besides this, the forest land requirement of the forest land upto FRL (El. 471.065 mamsl) in respect of Sondur Reservoir Project was assessed as 2025.14 ha of which the Forest Department transferred only 944.92 ha. Diversion of balance 1080.22 ha forest land (529.70 ha under Sitanadi WLS and 550.52 under territorial forest) is still to be executed. Besides this diversion of 8.887 ha forest land is contemplated for construction of B.K. Minor at tail of Nagri distributary.

1.8.4 ARCHAEOLOGICAL / HISTORICAL MONUMENTS/SENSITIVE AREA

No archaeological monument of national importance lies either in the project area or in its submergence area. The project area including submergence area falls within Sita Nadi wild life Sanctuary.

1.8.5 SOIL QUALITY

The results of the soil analysis show that the soil is neutral to slightly basic at all the locations having pH varying from 7.65 to 8.12. The most commonly observed soil textures are loam and sandy clay loam. Available nitrogen content in the surface soils ranges between 80 to 155.5 mg /kg thereby indicating that soils are low in available nitrogen content. Available phosphorus content ranges between 7.35 to 10.3mg/kg thereby indicating that soils are medium in available phosphorus.

Available potassium content in these soils ranges between 175.2 to 250.8 mg/kg, thereby indicating medium to high potassium content in the soils of area. The organic carbon varies from 0.46 % to 0.67% thereby implying that soils have low to moderate organic carbon.

1.8.6 AIR AND NOISE ENVIRONMENT

The pollutants concentration in the air is well below the permissible limit as there are no industries in the area and the density of vehicular traffic is not alarming. The noise monitoring shows that day and night time noise levels are within the prescribed limits.

1.9 WATER ENVIRONMENT

The analysis results have been compared with the Tolerance limits for inland surface waters, Class – C as set forth in IS: 2296-1982. The results indicate that recorded pH values of all analyzed samples ranged between 7.6-8.2 and was within the permissible limit (6.5-8.5). The TDS levels ranged from 191.0 to 298.3mg/l and were well below the desirable limit of 500 mg/l. The chlorides level in surface water samples ranged from 23.45 to 33.5 mg/l and were below the permissible limit of 250 mg/l. The sulphates level ranged from 11.8 to 33.5 mg/l and were below the permissible limit of 200 mg/l. The fluorides level ranged between 0.35 to 0.60 mg/l was lower than the desirable limit of 1.0 mg/l.

The analysis results for ground water indicate that the pH ranged between 6.70 to 7.94, which is well within the specified standard of 6.5 to 8.5 limit. Total hardness was recorded to range from 146.3 to 285.2 mg/l, which is within the permissible limit 600 mg/l at all locations. The Total Dissolved Solids (TDS) concentration recorded ranged between 322.8 to 462.40 mg/l and was within the permissible limits (2000 mg/l). Chlorides at all the locations were within the desirable limits (250 mg/l) as it ranged between 45.0 – 70.32 mg/l. Sulphates at all the locations were within the permissible limits (400 mg/l) as it ranged between 19.3 to 34.80 mg/l. Fluorides recorded ranged between 0.23 to 0.82 mg/l and were within the desirable limit (1.0 mg/l). Nitrates were recorded to be ranging in between 23.8 to 42.2 mg/l and are found to be within the desirable limit (45mg/l).

1.10 STATUS OF BIOLOGICAL ENVIRONMENT

1.10.1 Flora of the Project Area

- During the surveys, an inventory of different plant groups found in the study area was prepared. In the study area, 137 species of plants were recorded. These include 53 trees, 14 shrubs, 30 species of herbs, 26 grasses and 11 species of climbers and 3 parasitic angiosperms.
- About 34 economically important plant species were recorded from the study area.
- About 15 important medicinal/ethnobotanical importance plant species were recorded
- No RET species falling under IUCN Red List was recorded/reported from study area.

1.10.2 Fauna

The faunal study for the proposed project was carried out in both the submergence and influence zone of both upstream and downstream

- 28 mammalian species were recorded /reported during the survey of which 08 belonged to Schedule-1 of WPA, 1972.

- 27 bird species were observed /reported during the survey.
- As many as 12 species of reptiles and amphibians were recorded /reported.
- 31 species of butterflies were observed /reported during the survey.
- 16 insect species were observed /reported during the survey.
- 24 species of fishes were recorded.

1.11 SOCIAL AND CULTURAL BACKGROUND OF THE AREA

1.11.1 Demography of Project Affected Villages

As per the Census of India 2011, the total population of the project affected villages comprising of 622 households' aggregates to 2544 of which male and female population is 1367 and 1177 respectively. The overall sex ratio is 861 females per thousand males. Total population of the scheduled caste and scheduled tribe is 255 (10.20%) and 1601 (62.93%) respectively. The male and female literate population is 1077 and 697 respectively, which implies that the total literacy rate of the project affected villages is 69.73 %. The main workers are 1428 (56.13%) and marginal workers are 109 (4.28%) respectively of the total population while the remaining 39.59% constitute non-workers.

1.11.2 Village-wise Land Acquired

There were five project affected revenue villages which were impacted due to acquisition of private land. The total private land acquired for the project from these villages was 304.43 ha. Besides three revenue villages three forest villages were fully submerged (**Table 1.1**).

Table 1.1 : Village -wise Land Acquired

S.No.	Name of Village	Private Land Acquired (ha)	Number of Displaced Families	Remark
A-Revenue Villages				
1	Kaslore	304.43	78	Fully Submerged
2	Boirgaon		64	Fully Submerged
3	Barpader		46	Fully Submerged
4	Belarbahara		5	Partially Submerged
5	Mechka		7	Partially Submerged
Sub Total (A) Revenue Villages		304.43	200	
B-Forest Villages				
1	Amamuda	0.00	30	Fully Submerged
2	Ujrwan		24	Fully Submerged
3	Karka		48	Fully Submerged
Sub Total (B) Forest Villages		0.00	102	
Grand Total (A+B)		304.43	302	

1.11.3 Agriculture

Agriculture is the main source of income and employment as more 90% of the population directly derive their livelihood from it.

1.12 IDENTIFICATION, PREDICTION AND EVALUATION OF IMPACTS

1.12.1 Impacts on the Micro-Climate of the Area

Due to construction activities of balance works, there shall be temporary and nominal effect on the ambient temperature and humidity. The operation stage project may not create any impact on the meteorology and climatology of the area.

1.12.2 Change in Land use / Land Cover

1.12.2.1 Construction Phase

The land use class of forest land, agriculture land (private land) and barren land falling in submergence changed into waterbody while for dam seat and other project components like SFC and distribution system it changed to built-up area. The change is permanent and irreversible. The forest land cover within the submergence area had reduced due to project construction and operation for more than two decades

1.12.2.2 Operational Phase

During the operation phase no change in land use is expected. Many of the redundant areas having no further usage will be brought under plantation.

1.12.3 Soil Erosion and Siltation

1.12.3.1 Construction Phase

Soil erosion due to excavation of different components of the project, construction of roads will accelerate soil erosion.

1.12.3.2 Operational Phase

Soil erosion due to project activities will not exist in the operation phase as the construction would be completed and landscape restoration work would also be implemented

1.12.4 Impact on Geology

The project is in seismic zone II, in a region of low seismic hazard, as per Seismic Zonation Map of India and designing of the dam and reservoir was as per design code. Therefore, possible occurrence of earthquake shall not pose any danger to the civil structures as suitable seismic co-efficient has been accounted for in the design. Since no underground construction was involved no geological surprises were encountered.

1.12.5 Impact on Hydrology

The project has been conceived with a view to harness the monsoon flows for irrigation and domestic purpose, by damming the river. This had brought a stark change in hydraulic regime of the river particularly during monsoon months. The flows downstream of the dam had considerably reduced. Every year the reduced volume shall be to the extent stored behind the dam for consumptive use. The average outflow from spillway was 35.8% of the inflow during monsoon months, which implies that downstream flow has been impacted by 64.2% of the inflow due to operation of reservoir.

For meeting environmental flows during monsoon months, it is proposed to release about 30% of inflow during normal rainfall year and not lesser than 20% in rainfall deficit years. There is practically no inflow during lean and non-monsoon period (November to May) in Sondur river.

Therefore, it is recommended that 0.40 MCM flow may be released during each of these months. This quantity shall be met from the storage of the reservoir.

1.12.6 Environmental Degradation due to Labour Immigration

The impact due to labour immigration pressure on land and water resource during project construction was of temporary nature and had ceased to exist after the completion of the work as the labour had repatriated from the construction site.

During the construction of balance works congregation of approximately 100 workers is likely to take place in the project area, for which temporary accommodation would be required. Due to labour influx, pressure on land and water resource would occur. The BOD load contributed by domestic sources will be about 238mg / litre. The sewage waste shall be disposed after treatment through STP. The effluent to be discharged should conform to the Standard adopted vide GSR1265(E), dated 13.10. 2017. It must be ensured the limits in respect of parameters are not exceeded.

1.12.7 Impacts on Air Environment

Temporary changes in air quality during construction phase are expected due to emission of hydrocarbons from vehicles and gases from blasting operations. The predicted ground level concentration in air for PM₁₀ due to fugitive dust emissions from construction activities of balance works (excavation involving drilling and blasting) at B.K. Minor has been found to be 4.75 µg/m³, while the resultant concentration shall be 42.75 µg/m³, which is within the limits. Due to increased transportation during construction phase at 25 m predicted concentration is 8.6 µg/m³, which reduces to 5.4 µg/m³, 3.2 µg/m³ and 1.0 µg/m³ at 50m, 150m and 500m respectively. Thus, the impact on the pollutant level (PM₁₀) due to increased traffic due to transportation of mineral shall be minimal. The increased GLC in respect of NO_x were insignificant being 0.12 µg/m³ up to 25m and 0.11 µg/m³ up to 50m and 0.10 µg/m³ up to 1km.

1.12.8 Impacts on Noise Environment

Temporary increase in noise levels are expected during construction phase only. The noise level of 69 dB(A) gets highly attenuated to 43 dB(A) and 37 dB(A) about 300m and 600 m respectively from the point source (work site). The estimated noise levels including the background level at two receptors at Tangapani and Khadapathra, due to running of construction machinery, shall be 38 dB(A) and 36 dB(A) which is less than the standard values

1.12.9 Impacts on Water Environment

Stratification can limit the mixing of the water body, leading to depletion of DO levels. This can lead to reducing conditions in waters. Since the depth of the reservoir is not very high, the annual variation up to MDDL would prevent formation of any significant temperature stratification. Thus, no problems related to reservoir stratification had been witnessed. Enrichment of impounded water with organic and inorganic nutrients will be the main water quality problem immediately on commencement of the operation. However, this phenomenon is likely to last for a short duration of few years from the filling up of the reservoir. Therefore, any significant impact on reservoir water quality is not anticipated.

The agro-chemical dosing is low in the area. Even in the post project phase, use of fertilizers in the project catchment area is not expected to raise significantly in view of the maximum rainfed crops being grown in the area. Due to low fertilizer usage in the area, there is no significant loading of nutrients in the waterbody. The problems due to eutrophication had not been witnessed in the reservoir

Apart from ground water recharge (59.432MCM) from the reservoir area and from application of water in command area, the quality of ground water will also improve in the entire area as the quality of surface water to be applied conforms to class "C" water as per IS:2296-1982

1.12.10 Impact due to Change in Hydrological Cycle

The quantity of the water abstracted from the river for consumptive use for irrigation in command area and for domestic, has reduced the river flow downstream and thus brought change in hydrological cycle in context to the project absolutely.

1.12.11 Impact due to Acidification of Reservoir

There will be no acidification of reservoir due to the alkaline nature of the river water at dam site and upstream having pH vary between 7.6-8.2.

1.12.12 Impacts on Flora

2025.14 ha of forest land has been brought under submergence. The number of trees impacted in the submergence was enumerated as 3,43,487 and the estimated volume of timber and fuel was assessed as 41410.21 cubic meter and 58200.27 cubic meter which implies that the state has incurred a total loss of Rs 1151.65 lakh.

183.81 ha of forest land has been lost due to construction of SFC and distribution system. The impact should not be construed in terms of loss of a few hectares of forest land, but it had allowed encroachment in forest land and caused imbalance to ecology due to human interference. Due to construction of dam, riverine regime of submergence area will change into lacustrine environments. The introduction of surface irrigation facilities in the command area had created sustained water availability which has resulted into improved soil-water regime in the area. Consequently, there had been improvement and increase in green cover which has led to overall improvement of wildlife habitats

The floral abundance of the project area in post construction phase will increase by many folds as the plantation under catchment area treatment, reservoir rim treatment, green belt, restoration and landscaping will be completed.

1.12.13 Impacts on Fauna

A good chunk of submergence area (529.70 ha) lies in the extended Sitanadi Sanctuary consisting of rich diversity of flora and fauna. The construction of canal and reservoir had fragmented the forest area and restricted the movement of wildlife. The canal section and structures had caused some hindrance for the free movement of wildlife. The edible fruits available in the forest on which the birds and animals depend may also be destroyed / consumed due to human interference Increase in temporary stress levels of wildlife during construction phase due to noise, human interference and reduction in present habitat. Threat due to poaching might increase. Improved habitat for water

birds, reptiles, mammals, amphibians and plankton due to reservoir creation. Improvement in food chain of some reptiles, birds and carnivorous mammals due to creation of reservoir and increase in humidity level.

1.12.14 Impacts on Aquatic Fauna

The creation and operation of the reservoir has provided an excellent source of reservoir fisheries. Applying Henderson and Welcome empirical formula for Sondur dam parameters, the average annual yield shall be 327 Tons, which can fetch a revenue of Rs 409 lakh.

The change in aquatic environment and increase in water spread area has created drying mudflats which provide suitable feeding sites for migratory birds in autumn and spring. The reed fringes provide good habitat for resident species of avi-fauna.

The water availability in fishing ponds and tanks in the command area has improved and consequently increased water spread area (694 ha) as the water from canal is made available to these waterbodies. This has resulted into increase in fish production by 23 tons /yr and consequently income of local fisherman shall increase.

1.12.15 Summary of Positive and Negative Impacts

The positive impacts are-

- Additional surface irrigation potential was created in area (12260ha).
- Augmenting supplies in Dudhawa reservoir and RSP reservoir both on Mahanadi.
- Increase in cropping intensity, higher yields by growing hybrid variety of paddy
- Better living Standards for famers of 66 villages under command area.
- Employment opportunities/fisheries.
- Benefits to economy and commerce.
- Access to improved infrastructure facilities.
- Improvement in environment by implementing CAT, Green belt development etc.
- Command Area Development.
- Better opportunities for cattle rearing due to generation of additional fodder (42475 T)
- Recharge of groundwater table (59.432 MCM).
- Development of a good habitat for avi-fauna.
- Decrease in soil erosion

The negative impacts are -

- Three revenue villages and three forest villages were fully submerged while two revenue villages were partially submerged.
- Due to project 302 families (total population 1518) were displaced.
- The loss of agriculture land (304.43 ha) and agriculture produce.
- Loss of livelihood and income of PAF.
- Loss of homestead and other assets over which the PAFs/DPs have developed affinity

- The change of river status from riverine to lacustrine regime.
- The loss of forest land (2034.027ha) due to construction of dam, reservoir and appurtenant works
- Disturbance to the fauna of the project/study area area during construction.
- Pressure on the existing Provincial / Link road will increase

1.13 IMPACT MANAGEMENT

To ameliorate the negative effects of the project construction and overall improvement of the environment following management plans are formulated for implementation concurrent to the project construction. The cost of the management plans is shown in **Table 8.2**.

Table 8.2 : Summary of Total Cost Estimate

S. No.	Plans	Cost (Rs. In Lakh)
1.	Catchment Area Treatment Plan	456.00
2	Command Area Development Plan	500.00*
3.	Compensatory Afforestation Scheme	15122.00
4.	Wildlife and Bio-diversity Management plan	2160.00
5.	Fisheries Management Plan	50.00
6.	Resettlement & Rehabilitation Plan	796.73**
7.	Green Belt Development Plan	30.00
8.	Reservoir Rim Treatment Plan	0.00
9	Muck Management Plan	14.00
10.	Landscape and Restoration Plan	4.00
11.	Restoration Plan for Quarry Sites	4.00
12.	Disaster Management Plan	10.00
13.	Water, Air and Noise Management Plan	10.00
14.	Public Health Delivery Plan	17.00
15.	Labour Management Plan	7.00
16.	Sanitation and Solid Waste Management Plan	22.00
17.	Local Area Management Plan	45.00
18.	Environmental Safeguards During Construction Activities	5.00
19.	Energy Conservation Measures	5.00
20.	Environmental Monitoring Plan	8.00
Grand Total		17969.73
Say		17970.00

N.B.:*The cost of works under CAD Scheme has been excluded, as it will be funded under Central Plan with State share in prescribed proportion.

** The cost of works under R&R Plan has been incurred earlier so it is not being included now for avoiding duplicity in provision.