

**IN THE HON'BLE NATIONAL GREEN TRIBUNAL,
SOUTHERN ZONE BENCH, CHENNAI**

**ORIGINAL APPLICATION NO. 56 OF 2023 (SZ) &
I.A. No.58 of 2023 (SZ)
with
MISCELLANEOUS APPLICATION NO. 04 OF 2023 (SZ)
in
ORIGINAL APPLICATION NO. 180 OF 2021 (SZ)**

Baddam Bhaskar Reddy and Ors.

.... Applicant(s)

Versus

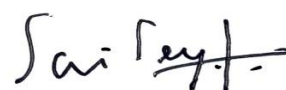
Union of India and Ors.

.... Respondent(s)

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2	14.10.2024	Annexure R-1 Copy of copy of the letter dated 14.10.2024 along with the report of the Ecological Damage Assessment	5

Dated at Chennai this the 14th day of December 2024.



Sai Srujan Tayi
Counsel for MoEF& CC/ 1st Respondent
Contact No: 98414 41438
Mail ID: sai@girisai.com

**IN THE HON'BLE NATIONAL GREEN TRIBUNAL, SOUTHERN ZONE
BENCH, CHENNAI**

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I.A. No.58 of 2023 (SZ)

WITH

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IN THE MATTER OF: -

Baddam Bhaskar Reddy and Ors.

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Versus

Union of India and Others

.... Respondent(s)

COMPLIANCE AFFIDAVIT ON BEHALF OF RESPONDENT NO. 1,
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

MOST RESPECTFULLY SHOWETH:

I, Sh. Tarun Kumar S/o Shyamala Rao, aged about 46 years working as Director/Scientist "F" in the Ministry of Environment, Forest and Climate Change, (MoEFCC) having an office located at Hyderabad, Telangana State do hereby solemnly affirm on oath and state as under:

1. That the Hon'ble Tribunal, vide order dated 04.07.2024, directed the Ministry of Environment, Forest and Climate Change (hereinafter referred to as 'MoEF&CC/Ministry') to conduct project site inspection, damage assessment, calculate the cost required for restoration of the damage (if any)



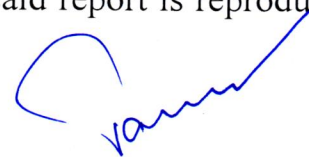
Tarun Kathula
Director/Scientist 'F'
Integrated Regional Office
Ministry of Environment Forest And Climate Change
Aranya Bhavan, Hyderabad. Telangana-500 004.

and also reassess the compensation for the ecological damage. The relevant portion is reproduced below:

" ... 22. In view of the above observations and discussions, we direct the Secretary – MoEF&CC to consider this case as a special case, as the contemnor/violator is the State of Telangana and the task of assessing the damages caused by them should not be entrusted to the State Government officials and take it up on themselves and do the same. Accordingly, we direct the MoEF&CC to inspect the project, assess the nature of damage, calculate the cost required for restoration of the damage (if any) and also reassess the compensation for the ecological damage within a period of 2 (Two) months from today..."

**COMPLIANCE OF DIRECTIONS PASSED BY THE HON'BLE TRIBUNAL
VIDE ORDER DATED 04.07.2024**

2. It is submitted that in compliance of the above mentioned direction of the Hon'ble Tribunal, a two-member committee was constituted comprising of Senior Scientist from the Sub-Office of MoEF&CC at Hyderabad and Ecological Damage Assessment Expert from Central Pollution Control Board (hereinafter referred to as 'CPCB') for conducting Ecological Damage Assessment for illegal construction and expansion of the Gouravelli reservoir and canals at Siddipet District by the Irrigation & CAD Department of State of Telangana. The Committee conducted site visit on 25.09.2024 and 26.09.2024 and vide email dated 25.11.2024; the Sub-Office of MoEF&CC at Hyderabad submitted the report of the Ecological Damage Assessment for the project in question. The relevant extract of the said report is reproduced hereunder:



Tarun Kathula
Director/Scientist 'F'
Integrated Regional Office
Ministry of Environment Forest And Climate Change
Aranya Bhavan, Hyderabad. Telangana-500 004.

“...Based on the above deliberations, the Committee observed that the cost of the Environmental Management Plan (45.32 Cr) with R&R will be paid by the Project Proponent as an obligation to the activities mentioned in the EIA/EMP Report, if and when, Environmental Clearance is granted to the said project. Therefore, the total amount that the Project Proponent shall pay for the ecological damage assessed, due to commencement of construction of project without securing the prior environmental Clearance, as provided hereunder:

- i. Remediation Cost is Rs. 2.06 Cr*
- ii. Environmental Compensation at 1.5% of Project Cost (III) = Rs. 8.1021 Cr*

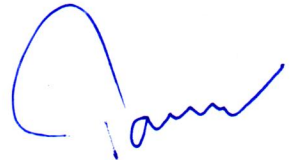
Therefore, based on the calculation using Method II as stated above, the Committee hereby recommends Environmental Compensation of Rs. 10.17 crore, which includes a remediation cost as well.....”

The copy of the email dated 25.11.2024 along with the report of the Ecological Damage Assessment is annexed as **Annexure -1**.

3. Further, it is most humbly submitted that the payment of above-mentioned remediation cost and ecological damage compensation by the Project Proponent shall not be construed as deemed permission to resume construction of the project. It is appropriate to mention that the project proponent has already been directed to stop the project construction work vide ToR letter dated 15.02.2023 issued by the SEIAA, Telangana. The project in question is at the stage of appraisal for grant of Environmental Clearance by the SEIAA under violation category. As the Hon'ble Supreme Court vide order dated 02.01.2024 has stayed the Standard Operating Procedure (SOP)

dated 07.07.2021 read with OM dated 28.01.2022, delineated by the Ministry for considering the projects under violation category, the project in question shall not be allowed to start the project construction work until the vacation of stay on SOP as ordered by the Hon'ble Supreme Court followed by the grant of Environmental Clearance by the SEIAA, Telangana.

4. In light of the aforementioned facts of the matter, the compliance affidavit may kindly be taken on record.
5. It is submitted that the Hon'ble Tribunal may pass appropriate order(s), direction(s) as deemed fit and proper under the facts and circumstances of the present case.



Deponent

Tarun Kathula
Director/Scientist 'F'
Integrated Regional Office
Ministry of Environment Forest And Climate Change
Aranya Bhavan, Hyderabad. Telangana-500 004.

VERIFICATION

I, the above-named deponent do hereby solemnly affirm and state that the contents of the aforesaid are true and correct to my personal knowledge and have been derived from the official records maintained by the Respondent. No part of it is false nor has anything material been concealed therefrom.

Verified at Hyderabad on this 2nd day of December, 2024



Deponent

Tarun Kathula
Director/Scientist 'F'
Integrated Regional Office
Ministry of Environment Forest And Climate Change
Aranya Bhavan, Hyderabad. Telangana-500 004.

भारत सरकार
Government of India
पर्यावरण वन और जलवायु परिवर्तन मंत्रालय
Ministry of Environment, Forest and Climate Change
उप कार्यालय, हैदराबाद
Sub-Office, Hyderabad

अरण्य भवन/Aranya Bhawan
रूम नंबर/Room No. 618, 6th मजला/Floor
सैफाबाद /Saifabad, हैदराबाद/Hyderabad-500004
तेलंगाना /Telangana

F. No. 4-10/2023/IRO-HYD
14.09.2024

Date:

The Member Secretary,
IA – Hydro-Thermal
Ministry of Environment, Forest and Climate
Jor Bagh, New Delhi

Sub: OA. No 56 of 2023 (SZ)b/w Bhaddam Bhaskar Reddy Vs Uoi and others before Hon'ble NGT, Southern Zone at Chennai -reg.

Ref: MoEFCC Email dated 9th September 2024

Sir,

With reference to the above-mentioned subject and email reference, the Ecological Damage Assessment Committee, comprising the undersigned and Dr. R. Rajkumar, Scientist E', CPCB, conducted a field inspection and meetings with the project proponent on 25th and 26th September 2024 to assess the environmental damage for Gouravelli Reservoir, Telangana. The report of the Ecological Damage Assessment for the said project is enclosed herewith for your perusal and further action.

आपका विश्वासी/Yours faithfully,

Signed by

Tarun Kumar Kathula

Date: 14-10-2024 16:44:54

(तरुण कथूला/Tarun Kathula)

वैज्ञानिक 'एफ'/Scientist 'F'

ईमेल/Email: tk.kathula@gov.in

टेलीफोन/Tel: 040-29390051

Encl: as above.

Copy to:

1. Director, Compliance and Monitoring Cell, MoEFCC, New Delhi
2. LMC Division, MoEFCC, New Delhi

-

**ENVIRONMENTAL DAMAGE ASSESSMENT REPORT IN THE MATTER OF
HON'BLE NGT (SZ) O.A No. 56 OF 2023 BADDAM BHASKER REDDY AND ORS.
VS UNION OF INDIA & OTHERS**

1. Background:

Ministry of Environment, Forest and Climate Change, Regional Office, Hyderabad vide letter dated 09.09.2024 requested to nominate an Official from CPCB to be part of the Ecological Damage Assessment Committee for assessing the environmental damage for Gouravelli Reservoir, Telangana, along with the Senior Scientist from the Regional Office, Hyderabad, Telangana, MoEFCC in the matter of **O.A No. 56 OF 2023**.

Subsequently, the Central Pollution Control Board, Regional Directorate-Chennai, has nominated Dr. R. Rajkumar, Scientist-E, to assist MoEFCC, Regional Office, in assessing the environmental damage. Sh. Tarun Kathula, Scientist 'F,' MoEFCC, Sub-Office, Hyderabad, represented MoEFCC.

CPCB and MoEFCC carried out a field visit cum meeting on 25th and 26th September 2024 with the officials of Telangana State Irrigation and Command Area Development Officials and a representative of EPTRI, are accredited environment consultant firm that has conducted a Public Hearing for the said project.

2. Brief about the Project based on the Report of Joint Committee & MOEFCC filed in Hon'ble NGT(SZ), Chennai

The Government of Telangana proposed the Indiramma Flood Flow Canal (FFC) from the Sri Rama Sagar Project (SRSP) along with the expansion of the Gouravelly Reservoir to manage excess floodwaters, which occur approximately once every four years. The FFC project, initially approved by the Central Water Commission (CWC) in 1996, aimed to provide irrigation to 2.2 lakh acres in drought-prone areas of Telangana by diverting 20 TMC of surplus water from the SRSP. The original plan included three reservoirs:

1. Combined Storage Reservoir-I with a capacity of 7.346 TMC to irrigate 32,000 acres.
2. Mid Manair Reservoir with a capacity of 25.873 TMC to irrigate 68,000 acres.
3. Gouravelly Reservoir with a capacity of 1.095 TMC to irrigate 1,20,000 acres.

The total storage capacity of these reservoirs was planned to be 34.314 TMC, with a water utilization of 21.332 TMC. However, due to local resistance against the construction of Combined Storage Reservoir-I, the project was modified in 1997 to bypass this reservoir.

After the formation of Telangana, the government undertook re-engineering of irrigation projects to optimize water usage. To compensate for the lost storage capacity from the dropped reservoir, they proposed increasing the Gouravelly Reservoir's capacity from 1.410 TMC to 8.230 TMC. This expansion received administrative approval in 2017, and 85% of the work was completed by the time a case was filed with the National Green Tribunal (NGT).

The villagers affected by the submergence due to the Gouravelly Reservoir expansion filed case OA No. 180 of 2021 on 10th August 2021 before the Hon'ble National Green Tribunal (NGT), Southern Zone, Chennai. They argued that the Irrigation and CAD Department of the State of Telangana, under its re-engineering proposal, issued orders to expand the Gouravelly Reservoir from 1.410 TMC to 8.230 TMC without obtaining prior Environmental Clearance (EC) from the Ministry.

On 13th August 2021, the NGT constituted a Joint Committee that included representatives from the Integrated Regional Office (IRO) of MoEF&CC, the Godavari River Management Board, and the Central Water Commission, Integrated Regional Office, Hyderabad. The Joint Committee conducted a site visit on 23rd September 2021 and submitted its report to the Tribunal on 29th September 2021, stating that the project's scope had been changed without the approval of MoEFCC. The committee recommended an Environmental Compensation of Rs. 2,05,31,250 (Rs. 2.05 Crores) for the violation.

The NGT disposed of the case on 10th February 2022, with specific observations and directions as follows;

“...3. Since the Ministry of Environment, Forests and Climate Change (MoEF& CC) has come to the conclusion on the basis of the material collected by them that the present project requires a further environmental clearance, the State of Telangana is restrained from proceeding with the project further till the proceedings initiated by the Ministry of Environment, Forests and Climate Change (MoEF& CC) is completed.

4. If the project proponent makes an application for including the change of scope and applies for Environmental Clearance (EC) the same should not be granted by way of an amendment to an existing EC and the entire process will have to be reassessed afresh

5. Ministry of Environment, Forests and Climate Change (MoEF&CC) is also at liberty to conduct a further enquiry regarding the nature of damage caused and also the cost required for restoration of damage caused to the environment and reassessment of the compensation to be recovered from the State of Telangana.

6. The Ministry of Environment, Forests and Climate Change (MoEF&CC) is directed to complete the process of the enquiry as early as possible at any rate within a period of four months and submit the further action taken report before this Tribunal after the expiry of four months has to be fixed by this Tribunal...

Following the NGT's orders, the MoEFCC, New Delhi, held its 29th Expert Appraisal Committee (EAC) meeting on 15th June 2022. During this meeting, the EAC advised the project proponent to submit a fresh proposal under the violation category on the PARIVESH portal for Terms of Reference (ToR).

As per the EIA Notification, 2006, and its subsequent amendment dated 20th April 2022, the proposed project falls under the River Valley category, Schedule 1(c). Irrigation projects involving inter-state issues are to be appraised at the central level without any change in category, regardless of the command area. However, since the proposed project has a total

culturable command area of 2,20,000 acres (89,031 ha) with no interstate boundary, it was considered at the state level. The State Expert Appraisal Committee (SEAC) approved the ToR on 15th February 2023 under the violation category, Ref. No. SIA/TG/RIV/40935/2022, dated 6th December 2022:

- The State Government/SPCB to take action against the project proponent under the provisions of section 19 of the Environment (Protection) Act, 1986, and further no consent to operate to be issued till the project is granted EC (if Credible Action was not initiated).
- The project proponent shall be required to submit a bank guarantee equivalent to the amount of remediation plan and natural and community resource augmentation plan with the SPCB prior to the grant of EC. The quantum shall be recommended by SEAC and finalized by the regulatory authority. The bank guarantee shall be released after successful implementation of the EMP followed by recommendations of the SEAC and approval of the regulatory authority. The proponent also shall pay penalty amount to be levied by SEIAA as per O.M. dated 07.07.2021.
- Assessment of ecological damage with respect to air, water land and other environmental attributes. The collection and analysis of data shall be done by an environmental laboratory duly notified under the Environment (Protection) Act. 1986, or an environmental laboratory accredited by NABL or a laboratory of a Council of Scientific and Industrial Research (CSIR) institution working in the field of environment.
- Preparation of EMP comprising remediation plan and natural and community resource augmentation plants or responding to the ecological damage assessed and economic benefits derived due to violation.
- The remediation plan and the natural and community resource augmentation plan to be prepared as an independent chapter in the ELA report by the accredited consultants.
- Funds shall be allocated for Corporate Environment Responsibility (CER) for various activities therein. The details of fund allocation and activities for CER shall be incorporated in the ELA/EMP report.
- Capacity table (1 meter interval) with graphical representation.
- Details of submergence
- Details of development of greenbelt as per the Report of the Joint Committee constituted by the Hon'ble NGT. Chennai. Compliance of Order dated 10.02.2022 in O.A. No. 180 of 2021 (SZ) of the Hon'ble NGT, Chennai.

Environmental impact assessment (EIA) and environmental management plan (EMP) for Indiramma Flood Flow canal project from SRSP with expansion of Gouravelly Reservoir was carried out by Environment Protection Training & Research Institute (EPTRI), Hyderabad and the report was submitted in May 2024 to SEIAA.

3. Environmental Compensation Calculation

A) Environmental Compensation Calculated as per EIA report

As per the TOR of SEIAA, the cost of the environmental compensation and remediation plan was calculated in the EIA report. The violation cost for the expansion of Gouravelly reservoir is calculated based on the following:

For expansion projects:

- i. **Where operation/production with expanded capacity has not commenced:**
1% of the project cost, attributable to the expansion, incurred up to the application filing date along with EIA/EMP report.
- ii. **Where operation/ production with expanded capacity have commenced:**
1% of the project cost (attributable to the expansion activity) incurred up to the filing date of application along with EIA/EMP report PLUS 0.25% of the total turnover (attributable to the expanded activity/capacity) involved during the period of violation.

Based on the above violation cost, the project falls under the expansion projects section (i), where the operation with expanded capacity has yet to commence. The cost of the project is Rs. 540.14 Crores @ 2017-18.

The violation cost is calculated as:

Project Cost = Rs.540.14 Crores
 Violation cost = 1% of project cost
 = Rs.540.14 x 1% of project cost
 = **Rs.5.4014 Crores**

- iii. The cost for environmental compensation - Remediation Plan and Natural and Community Resource Augmentation by Joint Committee was calculated as **Rs. 2,05,31,250/- (Rounded to Rs.2.06 Crores).**

In view of the above, the environmental compensation (RP&NCRAP) and Violation cost for the Indiramma Flood Flow Canal Project from SRSP with the expansion of Gouravelly Reservoir is **Rs.7.4614 Crores** (i.e.Rs.2.06 Crores for environmental compensation + Rs.5.4014 Crores for Violation cost)

A copy of the EIA report submitted to MOEF&CC is enclosed in **Annexure I.**

B) Environmental Compensation imposed by Hon'ble NGT in similar violation cases

Similar violation cases in respect of Polavaram/ Indira Sagar MIP, Purushothapatnam LIS, Pattiseema LIS, Chintalapudi LIS, and KGPR Linking Project were disposed of by the Hon'ble NGT imposing the environmental compensation in the matters of OA NO. 175/2018 (EARLIER O.A. NO. 125/2017 (SZ)), OA NO. 350/2018, RA NO. 46/2019 IN OA NO. 48/2019, OA NO. 857/2018 (I.A. NO. 133/2021).

In the judgment order dated 02.12.2021, Hon'ble NGT has discussed the environmental compensation calculated by the various committee and has not considered it. The environmental compensation for the violation cases was computed by the Hon'ble NGT on the basis of the cost of the project. **The environmental compensation is imposed at 1.5% of the cost of the project.**

Further, Hon'ble NGT directed MoEFCC to constitute a specialized Committee to determine the appropriate methodology for assessment of Environmental Compensation for loss/damage/degradation to the environment, considering all relevant aspects of the matter, including observations made here above and the principles suggested. The methodology shall be given statutory status by taking appropriate action by MoEFCC so that the element of subjectivity in the matter of determination of Environmental Compensation may be eliminated or at least negated and Statutory Regulators observe a uniform approach in the discharge of their statutory duties.

C. Environmental Compensation Calculation for the present case violation

Based on the detailed analysis of the EIA report, the assessment of environmental impacts, and the recommended remedial measures, it can be concluded that no significant damage to the ecosystem is expected during the construction and operation of the proposed Indiramma Flood Flow Canal Project from SRSP and the expansion of the Gouravelly Reservoir. Instead, the project is anticipated to offer several benefits, such as improved agricultural production, employment generation, and groundwater recharge.

The benefit-cost ratio for the Gouravelly Reservoir is calculated at 1.87, and for the entire project—including the proposed Indiramma Flood Flow Canal and the expansion of the Gouravelly Reservoir—the ratio is 1.328, indicating that the project is economically viable. Additionally, the project is expected to provide intangible benefits like improvements to the general environment and contribute to the area's economic growth by enhancing infrastructure and socio-economic conditions. (reference EIA report Chapter 9, pg no.9.1)

However, the project proponent violated the project without obtaining EC, so the environmental damage assessment was calculated based on the following methods, considering the environmental compensation methods adopted in the previous sections A & B.

Method I: Environmental Compensation = Cost of Environmental Management Plan (I) + Remediation Cost (II)

(or)

Method II: Environmental Compensation = Environmental Compensation at 1.5% of cost of project (III) + Remediation Cost (II)

Method I: Environmental Compensation = Cost of Environmental Management Plan (I) + Remediation Cost (II)

The EIA report (**Annexure 1**) already estimates the cost of the Environmental Management Plan and remediation plan and considers the same for calculation. Since the project was carried out in violation, the price of the Environmental Management Plan is considered for

compensation calculation because there is no evidence of the activities carried out during the project's execution.

(I) Cost of Environmental Management Plan

- Catchment area treatment plan - Rs. 16.72 Crores
- Biodiversity and wildlife conservation and management plan - Rs. 0.76 crores
- Resettlement and Rehabilitation Plan - Rs. 432.19 Cr
- Green belt development plan - Rs. 2.13 Cr
- Reservoir Rim Treatment plan - Rs.3.84 Cr
- Muck Management and Restoration of Quarry Sites - Rs.8.07 Cr
- Water, Air and Noise Management Plan - Rs.0.72 Cr
- Public Health Delivery Plan - Rs. 2.13 Cr
- Sanitation and Solid Waste Management Plan - Rs. 2.96 Cr
- Local Area Development Plan - Rs. 7.23 Cr
- Energy Conservation Plan - Rs. 0.76 C

Therefore, the total cost of the environment management plan is - Rs. 477.51 Cr

The government paid Rs. 432.19 Cr for Resettlement and Rehabilitation, so after deducting this, the Cost of the **Environmental Management Plan with R&R is Rs. 45.32 Cr.** (477.51 Cr - 432.19 Cr)

(II) Remediation Cost (reference EIA report Chapter 13.5, pg no. 13.8)

- Water, Air & Noise Environment and Ecology - Rs. 28,00,000
- Natural Resource Augmentation Plan - Rs. 30,00,000
- Community Resource Development - Rs. 1,48,00,000
- Total - Rs. 2.06 Cr**

*Environmental Compensation Calculated based on the Cost of Environmental Management Plan (I) and Remediation Cost (II) = **Rs. 47.38 Cr (45.32 Crs +2.06 Crs)***

Method II: Environmental Compensation = Environmental Compensation at 1.5% of cost of project (III) + Remediation Cost (II)

(III) Environmental Compensation at 1.5% of cost of project

The cost of the project is Rs. 540.14 Crores @ 2017-18.
Environmental Compensation at 1.5% = **Rs. 8.1021 Cr**

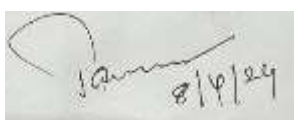
Environmental Compensation Calculated based on 1.5% of Project Cost (III) and Remediation Cost (II) = Rs. 10.1621 Cr (Rounded Off - Rs. 10.17 Cr)

4. Conclusion:

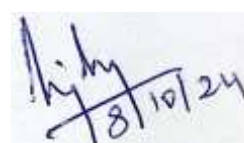
The environmental compensation is calculated by two methods based on the available information & Hon'ble NGT directions in various cases. The total compensation calculated by two methods is given below for consideration:

- i. **Method I:** Environmental Compensation is Calculated based on the Cost of the Environmental Management Plan (I) and Remediation Cost (II), which is **Rs. 47.38 Cr.** This compensation calculation overlaps with the cost of the Environmental Management Plan, which has already been set aside at 45.32 Cr for the environment project in the EIA report.
- ii. **Method II:** Environmental Compensation Calculated based on 1.5% of Project Cost (III) and Remediation Cost (II) = **Rs. 10.1621 Cr (Rounded Off - Rs. 10.17 Cr).**

According to Method I, it is mandatory for the Project Proponent to pay the Environmental Management Plan cost as specified in the EIA report. In addition to Method I, the committee recommends Method II as Environmental Compensation, which includes a remediation cost of Rs. 10.17 crore.



Sh. Tarun Kathula
Scientist 'F'
Ministry of Environment, Forest and
Climate Change
Sub-Office, Hyderabad
Telangana



Dr. R. Rajkumar
Scientist-E
Central Pollution Control Board
Regional Office, Chennai
Tamil Nadu



Photo of field inspection

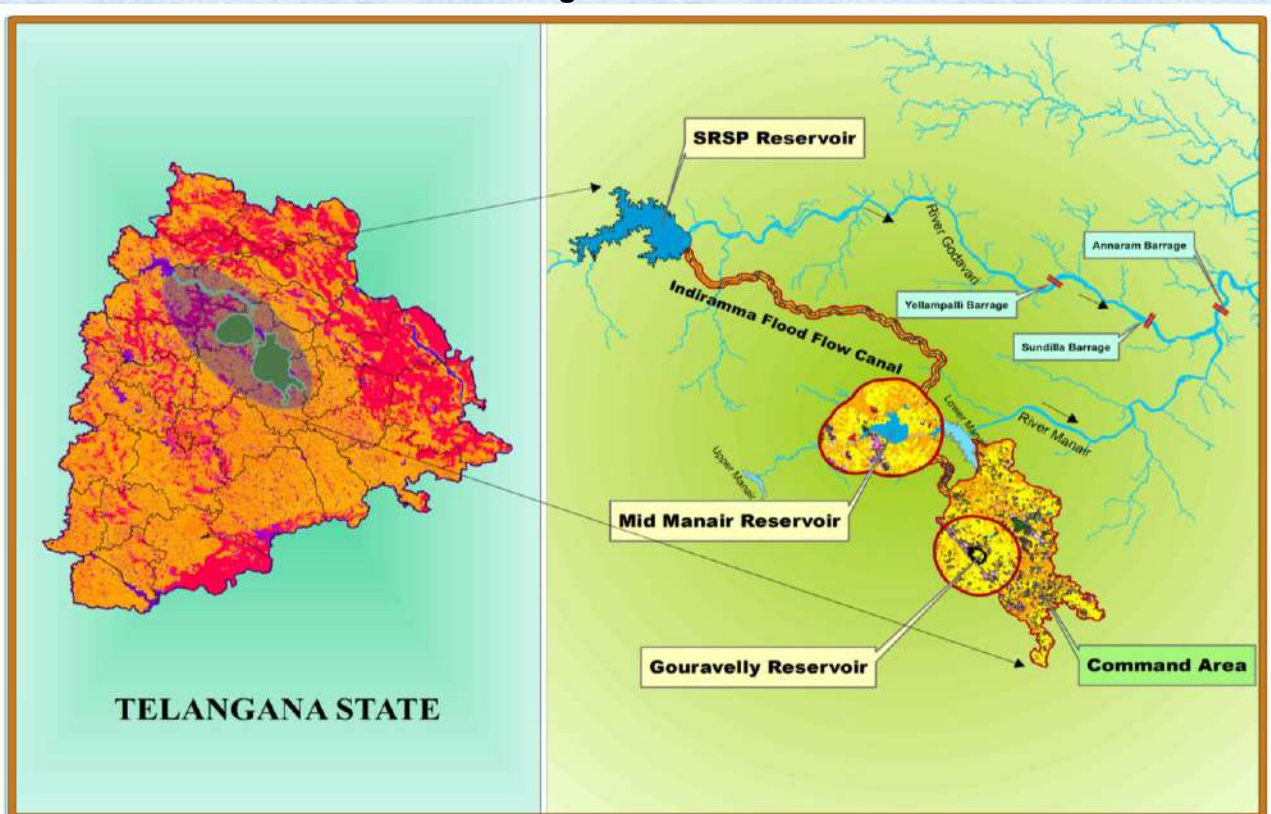
Proposal No. SIA/TG/RIV/409365/2022
ENVIRONMENTAL IMPACT ASSESSMENT (EIA) &
ENVIRONMENTAL MANAGEMENT PLAN (EMP)
 For
INDIRAMMA FLOOD FLOW CANAL PROJECT FROM SRSP WITH
EXPANSION OF GOURAVELLY RESERVOIR
 (1.410 TMC to 8.23 TMC)
 (Project Code: EPTRI/EEM/2022-23/EIA-2349 Rev.No.03)

Baseline Monitoring Period: 01st December 2022 to 30th August 2023

Submitted to



**State Expert Appraisal Committee,
Telangana State**



Submitted by



**I & CAD Department,
Telangana State**

Prepared by



EPTRI

**Environment Protection
Training & Research Institute
Hyderabad**

NABET Accredited Consultant - NABET/EIA/2224/SA 0175

NABL Certified Laboratory - TC-7709

May 2024

**GOVERNMENT OF TELANGANA
IRRIGATION & CAD DEPARTMENT**

From

Sri B. Shankar, B.E., M.B.A.,
Engineer-In-Chief (Irrigation),
I&CADD, LMD Colony,
Karimnagar- District,
Telangana- State,

To

The Chairman,
State Level Environment Impact
Assessment Authority (SEIAA),
Maitri Vihar, Ameerpet,
Hyderabad-500083
Telangana

Lr.No.ENC/Irrigation/KRMR/TS/T1/1003

Date: 29.04.2024

Sir,

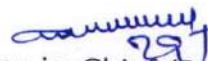
Sub:- I & CAD Dept., - Fresh Environmental Clearance proposal of Flood Flow Canal (FFC) Project from Sri Ram Sagar Project (SRSP) with expansion of Gouravelly Reservoir project from 1.410 TMC to 8.23 TMC in Akkannapet Mandal, Siddipet District under violation category -EIA and EMP report for three seasons prepared for uploading in PARIVESH portal- Undertaking Letter for Owing EIA & EMP Report and other documents - Reg.

Ref:-

1. O.A.No.180/2021 filed by Sri Baddam Raji Reddy before Hon'ble National Green Tribunal, Chennai.
2. SEAC Minutes of 210th Meeting of Telangana state, Dt.03.01.2023.
3. SEIAA order No. SEIAA/TS/OL/SDPT-37/2022, Dt.15.02.2023.

With reference to the subject cited, I am herewith submitting the undertaking for owning the contents and information provided in the Environment impact assessment (EIA) & Environmental Management Plan (EMP) report submitted for Environmental Clearance in respect of "Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir project from 1.410 TMC to 8.23 TMC Gouravelly (V), Akkannapet (M), Siddipet district" of the I&CAD Department of Karimnagar, Telangana State.

Yours faithfully,


29/04/2024
Engineer-in-Chief (Irrigation),
LMD Colony, Karimnagar.

**Declarations by Experts contributing to the EIA/EMP of
Indiramma Flood Flow Canal Project from SRSP with expansion of
Gouravelly Reservoir**

I, hereby, certify that I was a part of the EIA team in the following capacity, developed the EIA/EMP of Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir of the I & CAD Department of Karimnagar, Telangana State.

EIA Coordinator:

Name: Dr. GVA Ramakrishna (Category A)

Signature & Date: 

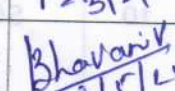
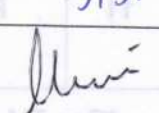
Name: Shaheda Begum (Category A)

Signature & Date:  31/5/24

Period of involvement: September 2022 –Till date

Contact information: Environment Protection Training & Research Institute (EPTRI),
Sy. No. 91/4, Gachibowli, Hyderabad, Telangana State,
PIN: 500032 Ph.No. 040 23451383

Functional Area Experts:

S. No.	Functional areas	Name of the expert/s	Involvement (period and task**)	Signature and date
1	AP*	Mrs. Shaheda Begum (Category A)	Involved in identifying monitoring locations, interpretation of results, identifying impacts and suggesting mitigation measure.	 31/5/24
		Mrs.V.Bhavani (Category B)		 31/5/24
2	WP*	Mrs.V.Bhavani (Category A)	Involved in identifying monitoring locations, interpretation of results, identifying impacts and suggesting mitigation measure.	 31/5/24
		Mr.J.Rahul (Category B)		 31/5/24
3	SW*	Mrs. Shaheda Begum (Category A)	Involved in quantification of solid waste, identifying impacts and suggesting mitigation measure.	 31/5/24
	SHW*	Mr.Shaik Allavalli (Category B)	Involved in quantification of Hazardous waste, identifying impacts and suggesting mitigation measure.	
4	SE*	Mr. Venkatesham Cheruku (Category A)	Involved in socio-economic studies, data analysis, identifying impacts and	

S. No.	Functional areas	Name of the expert/s	Involvement (period and task**)	Signature and date
			suggesting management plan	
5	EB*	Dr. Jyothi (Category A) Dr.D.Veeranjaneyulu (Category A)	Involved in flora & fauna studies by identifying the species. Identifying impacts and suggesting mitigation measure.	K Jyothi 3/5/24 D.V. 3/5/24
6	AQ*	Mrs. Shaheda Begum (Category A) Mrs.V.Bhavani (Category B)	Involved in meteorological studies, identifying air pollution sources, Suggesting mitigation measures.	Shaheda 3/5/24 Bhavani 3/5/24
7	HG*	Mr.G.Ramesh (Category A)	Involved in identifying the drainage pattern and its impacts. Suggesting mitigation measure.	Ramesh 3/5/24
8	Geo*	Dr.GAV Ramakrishna (Category A)	Involved in studying the geology of the area and identifying impacts. Suggesting mitigation measure.	GAV 3/5/24
9	NV*	Raisuddin Khaja (Category A)	Involved in identifying monitoring locations, interpretation of results, identifying impacts and suggesting mitigation measure.	Raisuddin
10	SC*	Mrs. V.Bhavani (Category B)	Involved in identifying monitoring locations, interpretation of results, identifying impacts and suggesting mitigation measure.	Bhavani 3/5/24
10	LU*	V. Narayanarao (Category A)	Involved in processing of satellite imageries for land use classification. Identifying impacts and suggesting mitigation measure.	V.Narayan Rao 3/5/24
11	RH*	Aprup Adwadkar (Category A)	Risk assessment, preparation of risk and disaster management plan.	Aprup 3/5/24

*One TM against each FAE may be shown **Please attach additional sheet if required

***Team Members**

S.No.	Area of Involvement	Experts	Signature of the experts
1.	Assisted to the EIA coordinator for baseline data sampling and Environment management cost estimations.	Mrs.V.Bhavani	<i>Bhavani</i> 3/5/24
2	Assisted to Hazardous waste expert for the quantification of Hazardous waste.	Mrs. Shaheda Begum	<i>Shaheda</i> 3/5/24
3	Assisted Air expert in identification and sampling of water samples and report preparation.	Mr. Rahul Jarupula	<i>Rahul</i> 3/5/24
4	Assisted in solid hazardous waste impacts and mitigation measures	Mr. Rahul Jarupula	<i>Rahul</i> 3/5/24
5	Assisted LU expert in processing of satellite imageries for land use classification.	Mr.G.Ramesh	<i>Ramesh</i> 3/5/24
6	Assisted SE expert in socio-economic studies, data analysis and report preparation	Mr.K.Sanjay Kumar	<i>K. Sanjay</i> 3/5/24
7	Assisted Soil expert in identification of sampling location, interpretation of results and report preparation	Mr.Bandaru Akkanna Patrudu	<i>Bapatrudu</i>
8	Assisted hydrogeology expert in identifying the drainage pattern and its impacts. Suggesting mitigation measure.	Mr.Bandaru Akkanna Patrudu	<i>Bapatrudu</i>
9	Assisted Risk expert in preparation of risk and disaster management plan.	Mr.K Sree Harsha	<i>Harsha</i>
10	Assisted ecology expert in flora & fauna studies by identifying the species. Identifying impacts and suggesting mitigation measure.	Mr. D.Mahammad Shareef	<i>D. Mahammad Shareef</i> 03/05/2024

Declaration by the Head of the Accredited Consultant Organization

I, **N.Raveendhar** hereby confirm that the above mentioned experts prepared the EIA/EMP of Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir.

I also confirm that EIA Coordinator (EC) has gone through the report, and the consultant organization shall be fully accountable for any misleading information.

It is certified that no unethical practices, plagiarism involved in carrying out the work and external data/text has not been used without proper acknowledgement while preparing this EIA report.

N. Raveendhar
Name: **N.Raveendhar** 3/5/2024

Designation: Chief Scientist (R&D) & Head EEM & EQM

Name of the EIA Consultant Organization: Environment Protection Training and Research Institute, Hyderabad, Telangana State

NABET Certificate No. & Issue Date: Certificate No. NABET/EIA/2224/SA 0175, Dated 01.11.2022 and extended till 23rd July 2024.

Details of Abbreviations

S. No.	Functional Area Code	Complete name of the Functional Areas
1.	AP	Air Pollution Prevention, Monitoring & Control
2.	WP	Water Pollution Prevention, Control & Prediction of Impacts
3.	SHW	Solid Waste and Hazardous Waste Management
4.	SE	Socio-Economics
5.	EB	Ecology and Biodiversity
6.	HG	Hydrology, Ground Water & Water Conservation
7.	GEO	Geology
8.	SC	Soil Conservation
9.	AQ	Meteorology, Air Quality Modelling & Prediction
10.	NV	Noise/ Vibration
11.	LU	Land Use
12.	RH	Risk Assessment & Hazard Management

S. No.	Abbreviation	Details
13.	EIA	Environmental Impact Assessment
14.	EMP	Environmental Management Plan
15.	AC	Accreditation Committee
16.	QCI	Quality Council of India
17.	NABET	National Accreditation Board for Education and Training



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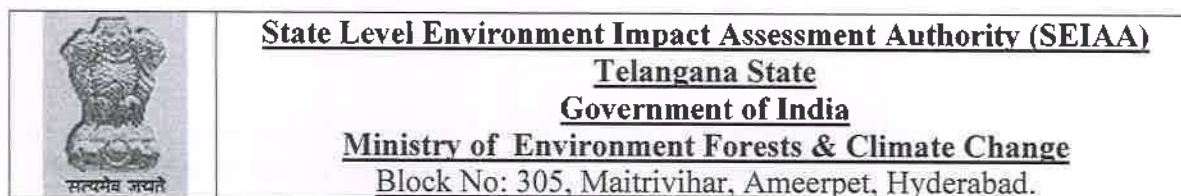
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**Order No. SEIAA/TS/OL/SDPT-37/2022-****Dt:15.02.2023.**

Sub: SEIAA – Indiramma Flood Flow Canal Project from Sri Ramasagar Project with expansion of Gouravelly reservoir from 1.410 TMC to 8.23 TMC, Gouravelly Village, Akkannapet Mandal, Siddipet District – TORs [Violation] with Public Hearing issued – Reg.

* * *

- I. This has reference to your proposal No. SIA/TG/RIV/409365/2022, dt. 06.12.2022 (accepted on **16.12.2022**) submitted to the SEIAA, Telangana seeking Terms of Reference (ToR) in terms of the provisions of Environment Impact Assessment (EIA) Notification, 2006 under the Environment (Protection) Act, 1986. The project is for **Indiramma Flood Flow Canal Project from Sri Ramasagar Project with expansion of Gouravelly reservoir from 1.410 TMC to 8.23 TMC, Gouravelly Village, Akkannapet Mandal, Siddipet District.**
- II. The proposal for grant of Terms of Reference (ToR) to the proposed project was considered by the State level Expert Appraisal Committee (SEAC) in its meeting held on **03.01.2023**. The SEAC observed the following:

The representative of the project proponent Sri Shankar (Engineer in Chief); and Dr. Ramakrishna of M/s. EPTRI, Hyderabad attended and made a presentation before the SEAC.

During presentation, the proponent informed the following:

- Concept of IFFC project from SRSP is:
 - Sri Ramasagar Project (SRSP) reservoir was commissioned in the year 1964-69 with a capacity of 112 TMC at Pochampad (V), Nizamabad district to irrigate an ayacut of 14.08 Lakh acres in Stage-I and Stage-II.
 - Flood Flow Canal project was proposed by the then Government of Andhra Pradesh envisaging diversion of balance surplus water available at SRSP reservoir after meeting the requirement of SRSP Stage-I&II.
 - The Head regulator was provided in the foreshore of SRSP for diversion of water from the said reservoir into the Flood Flow Canal.
 - The main aim of the Flood Flow Canal project is to irrigate an ayacut of 89,031 Ha (2,20,000 acres) in the upland drought prone areas of Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon (erstwhile districts of Karimnagar, Warangal and Nalgonda) districts in Telangana region duly utilising 20 TMC of flood water of Godavari river from the fore shore of SRSP reservoir.
- Background of the project is:
 - The Technical Advisory committee(TAC) of Central Water Commission (CWC) in its 64th meeting on 03.04.1996 approved the project components comprising the following three (3 Nos) reservoirs for an estimated cost of Rs.1331.30 Cr @ Price Level 1992-93.
 - Combined Storage Reservoir-I (Storage Capacity : 7.346 TMC, Ayacut : 32,000 acres)
 - Mid Manair Reservoir (Storage Capacity : 25.873 TMC, Ayacut : 68,000 acres)
 - Gouravelly Reservoir (Storage Capacity : 1.095 TMC, Ayacut : 1,20,000 acres)
 - The then Government of Andhra Pradesh vide G.O. Ms. No. 209 dated 17.11.1997 deleted the combined storage reservoir-I across Peddavagu-II and Korutla vagu near Konaraopet(V), Karimnagar district with a storage capacity of 7.346 TMC to irrigate an ayacut of 12950Ha (32,000 Acres).

- The Environmental clearance for the IFFC Project from SRSP was accorded vide Lr. No.J-12011/26/2000-IA-I, Dt.14.05.2003 to irrigate an ayacut of 2,20,000 acres duly utilizing 20 TMC of Flood water of Godavari river water from foreshore of Sriramsagar project.
 - Mid Manair Reservoir – 25.873 TMC
 - Gouravelly Reservoir – 1.410 TMC
 - The statutory clearance w.r.t. the project are:
 - The **Forest clearances** for canals and reservoirs was accorded vide Lr. Ref. No. 50907/99/F.1, Dt: 14-03-2000 & 14.09.2000 respectively.
 - The **Site clearance for investigation & survey** was accorded vide Lr. No.J-12011/26/2000-IA-I, Dt.24.06.2002.
 - The **Environmental clearance** was accorded vide Lr. No.J-12011/26/2000-IA-I, Dt.14.05.2003.
 - The **Rehabilitation and Resettlement clearance** is received from the Govt. of India vide MOTA Lr. no.20011/4/2003- CP & R, Dt. 02-09-2004.
 - The Planning Commission (water Resources Division) accepted for investment in the State Plan with an estimated cost of Rs 1331.30 crores vide Lr.No.2 (322)/03-WR Dt: 08.12.2005
 - The details of Hon'ble NGT case w.r.t. the project are:
 - The Government of Telangana has accorded administrative approval for the Gouravelly reservoir project with enhanced capacity from 1.410 TMC to 8.23 TMC vide G.O.Ms. No. 533, I&CAD (Projects-IV) Department Dt: 26.05.2017 and 85% of work was completed by the time of NGT Case was filed.
 - The submerging villagers of Gouravelly reservoir had filed the case **OA no 180 of 2021** on 10th August 2021 before the **Hon'ble NGT (SZ), Chennai** on the ground that the irrigation and CAD department of State of Telangana under the Re-engineering proposal issued orders **for expansion of Gouravelly Reservoir from 1.410 TMC to 8.230 TMC without obtaining prior EC from Ministry.**
 - The Joint Committee constituted by the NGT, Chennai was formed on 13th August 2021
 - Joint committee had a **site visit on 23rd September 2021** and submitted a report on **29th September 2021** in which it has reported that **the scope of the project has been changed without approval of MoEF & CC.**
 - The committee has proposed an **Environmental Compensation of Rs.2,05,31,250 (Rs.2.05 Crores)** for Violation.
 - MoEF&CC issued show cause notice to I&CAD Department on **7th January 2022.**
 - I&CAD submitted the replies to show cause notice on **27th January 2022.**
 - NGT has disposed the case on **10th February 2022** duly directing the MoEF&CC to complete the process of enquiry and to submit the report in four months
 - EAC has scheduled a meeting on 15th June 2022 for the replies to show cause.
 - Based on the EAC meeting the committee suggested a fresh proposal under violation category
- 29.4.3 The EAC during deliberations observed that based on fact submitted by the project proponent and report of the Joint Committee, it has been confirmed that the project involves violation and the project will be appraised by the EAC as per the standard Operating Procedure (SoP) for identification and handling of violation cases under EIA Notification, 2006 mentioned in OM dated 07.07.2021.
- The EAC therefore, suggested the project proponent to submit the proposal a fresh at PARIVESH portal for terms of reference (TOR) under violation category.
 - Accordingly, the proponent submitted Form-I for TOR on 02.09.2022 at the MoEF&CC, Gol. But, the Ministry did not consider the proposal as the project becomes Category-B project as per S.O.1886(E), dt.20.04.2022. Hence, the proponent re-submitted the proposal for TOR to the SEIAA, TS on 06.12.2022.

The SEAC noted the details of the project as following:

- The Indiramma Flood Flow Canal Project (IFFC) envisages diversion of flood water from Sri Ramasagar Project (SRSP) .
 - **Ayacut 89,031 ha.**
 - **Drought prone areas** - erstwhile districts of Karimnagar, Warangal and Nalgonda (present districts Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon)
 - **Excess flood** – Once in four years
- The storage facilities for storing such flood plays major role in harnessing and conserving flood water.

The SEAC noted that the project components are:

➤ **Water conveyance system:**

- FFC Canal :122 km
- Reverse lift pump houses: 3 number
- MMR Canals:103.375 km
- Tunnel – 11.98 km
- Pump house – 3 x 32MW(3x19cumecs)
- Gouravelly Canals-63.725 km
- High Level Canals-20.845 Km

➤ **Reservoir:**

- Mid Manair Reservoir : 25.873 TMC
- Gouravelly reservoir : 8.23 TMC

➤ **Distributory network system:**

- MMR Command Area – 40,470 ha (1,00,000 acres)
- Gouravelly Command Area – 48,561 ha (1,20,000 acres) in Karimnagar, Siddipet, Hanumakonda and Jangaon Districts.

The SEAC noted that the command area of 89,031 Ha. falls in the Districts of Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda & Jangaon

During presentation, the proponent informed the following w.r.t. Expansion of Gauravelly Reservoir Project:

- The Sriramsagar project was designed with a **capacity of 112 TMC**. But due to heavy siltation the **effective storage capacity is decreased to 90 TMC**, increasing the untapped flood water. In this context it is also an edge to have more storage capacity for tapping such flood.
- The excess flood as per the data available occurs once in every four years in SRSP. The storage facilities for storing such flood plays major role in harnessing and conserving flood water.
- After formation of Telangana state the Government has reviewed the existing irrigation project and as a part of effective utilisation of water allocation and to compensate the storage lost due to **deletion of Combined Storage Reservoir (7.346 TMC)** near Konaraopet (V), an alternate proposal of increasing the **Gouravelly reservoir capacity from 1.409 TMC to 8.230 TMC** has been proposed.

The SEAC confirmed the project as a case of violation of the EIA Notification, 2006 and the project has to be considered in the terms of provisions of the S.O.No.804 (E) dt.14.03.2017; S.O.1030 (E), dt.08.03.2018; and O.M. dt: 07.07.2021 & O.M. dt: 28.01.2022 issued by the MoEF&CC, Gol w.r.t. SOP for identification and handling of violation cases under EIA Notification., 2006.

After detailed discussions, the proponent is directed to prepare EIA report, as per the Standard Terms of Reference (TORs) issued by the MoEF&CC, Gol for "1 (c) river valley projects" and following Additional TORs along with the Specific Terms of Reference w.r.t. violation as per S.O.No.804 (E) dt.14.03.2017 & S.O.1030 (E), dt.08.03.2018 and OM dt. 07.07.2021 & 28.01.2022 undergo the process of Public Hearings (District wise) in consultation with TSPCB and submit final EIA report along with minutes of Public Hearings & response of the proponent to the issues emerged in the Public Hearings to the SEAC for appraisal.

Additional TORs:

- Capacity table (1 mtr interval) with graphical representation.
- Details of submergence.
- Details of development of greenbelt as per the Report of Joint Committee constituted by the Hon'ble NGT, Chennai.
- Compliance of Order dt.10.02.2022 in OA No.180 of 2021 (SZ) of the Hon'ble NGT, Chennai

III. Accordingly, the proposal along with recommendations of SEAC, Telangana was examined by the State level Environment Impact Assessment Authority (SEIAA) in its meetings held on **04.02.2023** and observed the following:

The SEIAA discussed the recommendations of the SEAC in detail and noted that the proponent has started project activity without obtaining EC and violated EIA Notification, 2006.

However, approved the project for issue of TORs (Violation) with public hearing. The proponent is directed to stop the activity forthwith and shall comply with the MoEF&CC, GoI, OM No22-21./2020-IA.III dt.07.07.2021. The proponent shall prepare EIA report as per the Standard Terms of Reference (TORs) issued by the MoEF&CC, GoI for "I (c) river valley projects" and following Additional TORs.

- Capacity table (1 mtr interval) with graphical representation.
- Details of submergence.
- Details of development of greenbelt as per the Report of the Joint Committee constituted by the Hon'ble NGT, Chennai.
- Compliance of Order dt.10.02.2022 in OA No.180 of 2021 (SZ) of the Hon'ble NGT, Chennai

IV. In view of the above, **the SEIAA, Telangana hereby accords ToRs with public hearing to the project** for preparation of the Environment Impact Assessment (EIA) Report and Environment Management Plan (EMP). The TORs and general guidelines for preparation of EIA & EMP report are as following:

STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR RIVER VALLEY PROJECTS & IRRIGATION PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT.

A. Scope of EIA Study

The EIA Report should identify the relevant environmental concerns and focus on potential impacts that may change due to the construction of proposed project. Based on the baseline data collected for three (3) seasons (Pre-monsoon, Monsoon and Winter seasons), the status of the existing environment in the area and capacity to bear the impact on this should be analysed. Based on this analysis, the mitigation measures for minimizing the impact shall be suggested in the EIA/EMP study

B. Details of the Project and Site

- 1 General introduction about the proposed project
- 2 Details of Project and site giving L-Sections of all U/S and D/S Projects with all relevant maps and figures. Connect such information as to establish the total length of interference of Natural River and the committed unrestricted release from the site of Dam/Barrage into the main river
- 3 A map of boundary of the project site giving details of protected areas in the vicinity of 25 km of project location
- 4 Location details on a map of the project area with contours indicating main project features. The project layout shall be superimposed on a contour map of ground elevation showing main project features (viz. location of dam, Head works, main canal, branch canals, quarrying etc.) shall be depicted in a scaled map
- 5 Layout details and map of the project along with contours with project components clearly marked with proper scale maps of at least 1:50,000 scale and printed at least on A3 scale for clarity
- 6 Existence of National Park, Sanctuary, Biosphere Reserve etc. in the study area, if any, should be detailed and presented on a map with distinct distances from the project components
- 7 Drainage pattern and map of the river catchment up to the proposed project site.

- 8 Delineation of critically degraded areas in the directly draining catchment on the basis of Silt Yield Index as per the methodology of Soil and Land use Survey of India
- 9 Soil characteristics and map of the project area
- 10 Geological and Seismo-tectonic details and maps of the area surrounding the proposed project site showing location of dam site and canal sites
- 11 Remote Sensing studies, interpretation of satellite imagery, topographic sheets along with ground verification shall be used to develop the land use/land cover pattern of the study using overlaying mapping techniques viz. Geographic Information System (GIS), False Color Composite (FCC) generated from satellite data of project area
- 12 Land details including forests, private and other land
- 13 Demarcation of snow fed and rain fed areas for a realistic estimate of the water availability

C. Description of Environment and Baseline Data

- 1 To know the present status of environment in the area, baseline data with respect to environmental components air, water, noise, soil, land and biology & biodiversity (flora & fauna), wildlife, socioeconomic status etc. should be collected within 10 km radius of the main components of the project/site i.e. dam site and power house site. The air quality and noise are to be monitored at such locations which are environmentally & ecologically more sensitive in the study area. The baseline studies should be collected for 3 seasons (Pre-Monsoon, Monsoon and Post Monsoon seasons)
- 2 Flora-Fauna in the catchment and command area should be documented. The study area should comprise of the following:
 - a Catchment area up to the dam/barrage site
 - b Submergence Area
 - c Project area or the direct impact area should comprise of area within 10 km radius of the main project components like dam, canals etc

D. Details of the Methodology

The methodology followed for collection of base line data along with details of number of samples and their locations in the map should be included. Study area should be demarcated properly on the appropriate scale map. Sampling sites should be depicted on map for each parameter with proper legends. For Forest Classification, Champion and Seth (1968) methodology should be followed

E. Methodology for Collection of Biodiversity Data

- 1 The number of sampling locations should be adequate to get a reasonable idea of the diversity and other attributes of flora and fauna. The guiding principles should be the size of the study area (larger area should have larger number of sampling locations) and inherent diversity at the location, as known from secondary sources (e.g. eastern Himalayan and low altitude sites should have a larger number of sampling locations owing to higher diversity).
- 2 The entire area should be divided in grids of 5kmX5km preferably on a GIS domain. There after 25% of the grids should be randomly selected for sampling of which half should be in the directly affected area (grids including project components such as reservoir, dam, powerhouse, tunnel, canal etc.) and the remaining in the rest of the area (areas of influence in 10 km radius from project components). At such chosen location, the size and number of sampling units (e.g. quadrates in case of flora/transects in case of fauna) must be decided by species area curves and the details of the same (graphs and cumulative number of species in a tabulated form) should be provided in the EIA report. Some of the grids on the edges may not be completely overlapping with the study area boundaries. However, these should be counted and considered for selecting 25% of the grids. The number of grids to be surveyed may come out as a decimal number (i.e. it has an integral and a fractional part) which should be rounded to the next whole number.
- 3 The conventional sampling is likely to miss the presence of rare, endangered and threatened (r.e.t.) species since they often occur in low densities and in case of faunal species are usually secretive in behaviour. Reaching the conclusion about the absence of such species in the study area based on such methodology is misleading. It is very important to document the status of such species owing to their high conservation value. Hence likely presence of such species should be ascertained from secondary sources by a proper literature survey for the said area including referring to field guides which are now available for many taxonomic groups in India. Even literature from studies/surveys in the larger landscapes which include the study area for the concerned project must be referred to, since most species from adjoining catchments is likely to be present in the catchments in question. In fact such literature from the entire state can be referred to. Once a listing of possible r.e.t. species from the said area is developed, species specific methodologies should be adopted to ascertain their presence in the study area which

would be far more conclusive as compared to the conventional sampling. If the need be, modern methods like camera trapping can be resorted to, particularly for areas in the eastern Himalayas and for secretive/nocturnal species. A detailed listing of the literature referred to, for developing lists of r.e.t. species should be provided in the EIA reports. The conventional sampling is likely to miss the presence of rare, endangered and threatened (r.e.t.) species since they often occur in low densities and in case of faunal species are usually secretive in behaviour. Reaching the conclusion about the absence of such species in the study area based on such methodology is misleading. It is very important to document the status of such species owing to their high conservation value. Hence likely presence of such species should be ascertained from secondary sources by a proper literature survey for the said area including referring to field guides which are now available for many taxonomic groups in India. Even literature from studies/surveys in the larger landscapes which include the study area for the concerned project must be referred to, since most species from adjoining catchments is likely to be present in the catchments in question. In fact such literature from the entire state can be referred to. Once a listing of possible r.e.t. species from the said area is developed, species specific methodologies should be adopted to ascertain their presence in the study area which would be far more conclusive as compared to the conventional sampling. If the need be, modern methods like camera trapping can be resorted to, particularly for areas in the eastern Himalayas and for secretive/nocturnal species. A detailed listing of the literature referred to, for developing lists of r.e.t. species should be provided in the EIA reports.

- 4 The R.E.T. species referred to in this point should include species listed in Schedule I and II of Wildlife (Protection) Act, 1972 and those listed in the red data books (BSI, ZSI and IUCN).

F. Components of the EIA Study

Various aspects to be studied and provided in the EIA/EMP report are as follows:

I. Physical and Chemical Environment

1 Geological & Geophysical Aspect and Seismo- Tectonics:

- a Physical geography, Topography, Regional Geological aspects and structure of the Catchment
- b Tectonics, seismicity and history of past earthquakes in the area. A site specific study of the earthquake parameters will be done. The results of the site specific earthquake design shall be sent for approval of the NCSDP (National Committee of Seismic Design Parameters, Central water Commission, New Delhi for large dams
- c Landslide zone or area prone to landslide existing in the study area should be examined
- d Presence of important economic mineral deposit, if any
- e Justification for location & execution of the project in relation to structural components (dam /barrage height)
- f Impact of project on geological environment.

2 Meteorology, Air and Noise:

- a Meteorology (viz. Temperature, Relative humidity, wind speed/direction etc.) to be collected from nearest IMD station
- b Ambient Air Quality with parameters viz. Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM) i.e. suspended particulate materials < 10 microns, Sulphur dioxide (SO₂) and Oxides of Nitrogen (NO_x) in the study area at 5-6 Locations
- c Existing Noise Levels and traffic density in the study area at 5-6 Locations.

3 Soil Characteristics:

Soil classification, physical parameters (viz., texture, Porosity, Bulk Density and water holding capacity) and chemical parameters (viz. pH, electrical conductivity, magnesium, calcium, total alkalinity, chlorides, sodium, potassium, organic carbon, available potassium, available phosphorus, SAR, nitrogen and salinity, etc.) at @ one sample/1000 ha of command area.

4 Remote Sensing and GIS Studies:

- a Generation of thematic maps viz, slope map, drainage map, soil map, land use and land cover map, etc. Based on these, thematic maps, an erosion intensity map should be prepared.
- b New configuration map to be given in the EIA Report

5 Water Quality:

- a History of the ground water table fluctuation in the study area.

- b Water Quality for both surface water and ground water for [i] Physical parameters (pH, Temperature, Electrical Conductivity, TSS); [ii] Chemical parameters (Alkalinity, Hardness, BOD, COD, NO₃, PO₄, Cl, So₄, Na, K, Ca, Mg, Silica, Oil & grease, phenolic compounds, residual sodium carbonate); [iii] Bacteriological parameter (MPN, Total coliform); and [iv] Heavy Metals (Pb, As, Hg, Cd, Cr₆, Total Cr, Cu, Zn, Fe) at minimum 10 Locations, however, the sampling numbers should be increased depending on the command area
- c Delineation of sub and micro watersheds, their locations and extent based on the Soil and Land Use Survey of India (SLUSOI), Department of Agriculture, Government of India. Erosion levels in each micro-watershed and prioritization of micro-watershed through Silt Yield Index (SYI) method of SLUSOI

II Water Environment & Hydrology:

- a Hydro-Meteorology of the project viz. precipitation (snowfall, rainfall), temperature, relative humidity, etc. Hydro-meteorological studies in the catchment area should be established along-with real time telemetry and data acquisition system for inflows monitoring
- b Run off, discharge, water availability for the project, sedimentation rate, etc
- c Basin characteristics
- d Catastrophic events like cloud bursts and flash floods, if any, should be documented.
- e For estimation of Sedimentation Rate, direct sampling of river flow is to be done during the EIA study. The study should be conducted for minimum one year. Actual silt flow rate to be expressed in ha-m km² year⁻¹.
- f Set up a G&D monitoring station and a few rain gauge stations in the catchment area for collecting data during the investigation.
- g Flow series, 10 daily with 90%, 75% and 50% dependable years discharges.
- h Environmental flow release should be 20% of the average of the 4 lean months of 90% dependable year (MAF) during the lean season and 30% of Monsoon flow during monsoon season. For remaining months, the flow shall be decided by the Committee based on the hydrology and available discharge.
- i A site specific study on minimum environment flow should be carried out.

III Biological Environment:

1 Flora

- a Characterization of forest types (as per Champion and Seth method) in the study area and extent of each forest type as per the Forest Working Plan.
- b General vegetation profile and floral diversity covering all groups of flora including Bryophytes, Pteridophytes, Lichens and Orchids. A species wise list may be provided
- c Assessment of plant species with respect to dominance, density, frequency, abundance, diversity index, similarity index, importance value index [IVI], Shannon Weiner Index etc. of the species to be provided. Methodology used for calculating various diversity indices along with details of locations of quadrats, size of quadrats etc. to be reported within the study area in different ecosystems
- d Existence of National Park, Sanctuary, Biosphere Reserve etc in the study area, if any, should be detailed.
- e Economically important species like medicinal plants, timber, fuel wood etc.
- f Details of endemic species found in the project area
- g Flora under RET categories should be documented using International Union for the Conservation of Nature and Natural Resources (IUCN) criteria and Botanical Survey of India's Red Data list along with economic significance. Species diversity curve for RET species should be given

2 Fauna:

- a Fauna study and inventorisation should be carried out for all groups of animals including reptiles.
- b and nocturnal animals in the study area. Their present status along with Schedule of the species
- c Information (authenticated) on Avi-fauna and wild life in the study area
- d Status of avifauna their resident/migratory/ passage migrants etc.
- e Documentation of butterflies, if any, found in the area
- f Details of endemic species found in the project area

- g RET species- voucher specimens should be collected along with GPS readings to facilitate rehabilitation. RET faunal species to be classified as per IUCN Red Data list and as per different schedule of Indian Wildlife (Protection) Act, 1972
- h Existence of barriers and corridors, if any, for wild animals
- i Compensatory afforestation to compensate the green belt area that will be removed, if any, as part of the proposed project development and loss of biodiversity
- j For categorization of sub-catchments into various erosion classes and for the consequent CAT plan, the entire catchment (Indian Portion) is to be considered and not only the directly the draining catchment

IV Aquatic Ecology:

- a Documentation of aquatic fauna like macro-invertebrates, zooplankton, phytoplanktons, benthos, periphyton particularly on the rock substratum, so that this could reflect the food and feeding of grazing fish species
- b Fish and fisheries, fish migration, migratory path elimination and seasonal migration pattern and breeding and spawning grounds
- c Fish diversity composition and maximum length & weight of the measured populations and migratory behaviour to be studied for estimation of environmental flow
- d Conservation status of aquatic fauna/fish and benthic communities
- e Sampling for aquatic ecology and fisheries and fisheries must be conducted during three seasons Pre-monsoon (summer), monsoon and winter. Sizes (length & weight) of important fish species need to be collected and breeding and feeding grounds should also be identified along the project site or in vicinity.

V Irrigation and Cropping:

- a Cropping pattern and Horticultural practices in the study area
- b Collection of primary data on agricultural activity, crop and their productivity and irrigation facilities component
- c Component of pressurized/drip irrigation and micro irrigation
- d Details of Conjunctive use of water for irrigation

VI Socio-Economic:

- a Collection of Baseline data on human settlements, health status of the community and existing infrastructure facilities for social welfare including sources of livelihood, job opportunities and safety and security of workers and surrounding population
- b Collection of information with respect to social awareness about the developmental activity in the area and social welfare measures existing and proposed by project proponent
- c Collection of information on sensitive habitat of historical, cultural and religious and ecological importance
- d The Socio-economic survey/profile within 10 Km of the study area for Demographic profile
- e Economic Structure; Development Profile; Agricultural Practices; Infrastructure, education facilities; health and sanitation facilities; available communication network etc.
- f Documentation of Demographic, Ethnographic, Economic structure and development profile of the area
- g Information on Agricultural practices, Cultural and aesthetic sites, Infrastructure facilities etc
- h Information on the dependence of the local people on minor forest produce and their cattle grazing rights in the forest land.
- i List of all the Project Affected Families with their names, education, land holdings, other properties, occupation, source of income, land and other properties to be acquired, etc
- j In addition to Socio-economic aspects of the study area, a separate chapter on socio-cultural aspects based upon study on Ethnography of the area should be provided

G Impact Prediction and Mitigation Measures

The adverse impact due to the proposed project should be assessed and effective mitigation steps to abate these impacts should be described.

- 1 Air Environment
 - a Changes in ambient and ground level concentrations due to total emissions from point, line and area sources
 - b Effect on soils, material, vegetation and human health
 - c Impact of emissions from DG sets used for power during the construction, if any, on air environment
 - d Pollution due to fuel combustions in equipments & vehicles
 - e Fugitive emissions from various sources.
 - f Impact on micro climate
- 2 Water Environment
 - a Changes in surface & ground water quality
 - b Steps to develop pisci-culture and recreational facilities
 - c Changes in hydraulic regime and down stream flow.
 - d Water pollution due to disposal of sewage.
 - e Water pollution from labour colony/camps and washing equipment.
- 3 Land Environment
 - a Changes in land use/land cover and drainage pattern
 - b Immigration of labour population
 - c Quarrying operation and muck disposal.
 - d Changes in land quality including effects of waste disposa
 - e River bank and their stability
 - f Impact due to submergence
 - g Adverse impact on land stability, catchment of soil erosion, reservoir sedimentation and spring flow (if any) [a] due to considerable road construction/widening activity [b] interference of reservoir with the inflowing streams [c] blasting for excavation of canals and some other structures
- 4 Biological Environment
 - a Impact on forests, flora, fauna including wildlife, migratory avi-fauna, rare and endangered species, medicinal plants etc
 - b Pressure on existing natural resources
 - c Deforestation and disturbance to wildlife, habitat fragmentation and wild animal's migratory corridors
 - d Compensatory afforestation -Identification of suitable native tree species for compensatory afforestation & green belt
 - e Impact on fish migration and habitat degradation due to decreased flow of water
 - f Impact on breeding and nesting grounds of animal and fish
- 5 Socio-economic aspects
 - a Impact on local community including demographic profile
 - b Impact on socio-economic status.
 - c Impact on economic status
 - d Impact on human health due to water / vector borne disease
 - e Impact on increases traffic
 - f Impact on Holy Places and Tourism.
 - g Impacts of blasting activity during project construction which generally destabilize the land mass and lead to landslides, damage to properties and drying up of natural springs and cause noise pollution, will be studied. Proper record shall be maintained of the base line information in the post project period
 - h Positive as well as negative impacts likely to be accrued due to the project are to be listed
 - i Positive and negative impacts likely to be accrued due to the project are listed
- H **Environment Impact Analysis**

Environmental Impact Analysis due to the project on the above mentioned components should be carried out for construction and operation phases using qualitative or quantitative methods.
- I **Environmental Management Plan**

Environmental Management Plan aimed at minimizing the negative impacts of the project should be given in detail. The mitigation measures are to be presented for all the likely adverse impacts on the environment. The following suggestive mitigating plans should be included

1 Biodiversity Management Plan

- a Biodiversity and Wild Life Conservation & Management Plan for conservation and preservation of endemic, rare and endangered species of flora and fauna to be prepared in consultation with State Forest Department
- b Compensatory Afforestation in lieu of the forest land required for the project needs to be proposed. Choice of plants should be made in consultation with State Forest Department including native and RET species, if any
- c Fish suitable based passages (Fish passes/Natural bypass) must be included in the plan. This plan must be a scientific based study (seasonal migration) from the Fisheries Research Institute having experience in fish pass studies
- d Fisheries Conservation & Management Plan-Fish fauna inhabiting the affected stretch of river, a specific fisheries management plan should be prepared for river and reservoir
- e Plan for Green Belt Development along the periphery of reservoir, colonies, approach road, canals etc. to be prepared in consultation with the State Forest Department. Local plant species suitable for greenbelt development should be selected
- f Environmental Monitoring Programme with physical & financial details covering all the aspects of EMP. A summary of cost estimate for all the plans, cost for implementing all Environmental Management Plans including the cost for implementing environmental monitoring programme should be given. Provision for an Environmental Management Cell should be made.

2 Disaster Management Plan

- a Catchment Area Treatment (CAT) Plan should be prepared micro-watershed wise. Identification of area for treatment based upon Remote Sensing & GIS methodology and Silt Yield Index (SYI) method of SLUSOI coupled with ground survey. Areas/watersheds falling under 'very severe' and 'severe' erosion categories are required to be treated. Both biological and engineering measures should be proposed in consultation with State Forest Department. Year-wise schedule of work and monetary allocation should be provided. CAT plan is to be completed prior to reservoir impoundment. Mitigations measures to check shifting cultivation in the catchment area with provision for alternative and better agricultural practices should be include
- b Study of Design Earthquake Parameters: A site specific study of earthquake parameters should be done. The results of the site specific earth quake design parameters should be approval by National Committee of Seismic Design Parameters, Central Water Commission (NCSDP), New Delhi
- c Dam Break Analysis and Disaster Management Plan: The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break scenario. Provision for early warning systems should be provided
- d Reservoir Rim Treatment Plan for stabilization of land slide/land slip zones if any, around the reservoir periphery to be prepared. Suitable engineering and biological measures for treatment of the identified slip zones to be provided with physical and financial schedule
- e Muck Disposal Plan- suitable sites for dumping of excavated material should be identified in consultation with the State Pollution Control Board and Forest Department. All Muck disposal sites should be minimum 30 m away from the HFL of river. Plan for rehabilitation of muck disposal sites should also be given. The L-section/ cross section of muck disposal sites and approach roads to be given. Financial out lay for this may be given separately. Detailed muck transportation plan delineating the path ways, number of trucks, quantity of muck to be transported along with monitoring mechanism using latest technology, shall be prepared
- f Plan for Restoration of quarry sites and landscaping of colony areas, working areas, roads, etc.
- g Command Area Development (CAD) Plan giving details of implementation schedule with a sample CAD plan

- h In the EMP, also include a sample CAD plan for a distributary outlet command. Such a plan is to show the alignment of irrigation and drainage channels. The components of the OFD works to be undertaken may be clearly mentioned along with a time schedule for their completion vis-à-vis the progress of irrigation development
- i Mitigating measures for impacts due to Blasting on the structures in the vicinity
- 3 Socio - economic aspects**
 - a A detailed CER plan along with activities wise break up of financial commitment shall be prepared in terms of the provisions OM No. 22-65/2017-IA.III dated 30.09.2020. CER component shall be identified considering need based assessment study and Public Hearing issues. Sustainable income generating measures which can help in upliftment of affected section of society, which is consistent with the traditional skills of the people shall be identified.
 - b While formulating CER schemes it shall be ensured that an in-built monitoring mechanism for the schemes identified are in place and mechanism for conducting annual social audit from the nearest government institute of repute in the region shall be prepared. The project proponent shall also provide Action Plan for the status of implementation of the scheme from time to time and dovetail the same with any Govt. scheme(s). CER details done in the past should be clearly spelt out in case of expansion projects
 - c Resettlement and Rehabilitation (R&R) Plan need to be prepared with due consultation with Project Affected Families (PAFs). The provision of the R&R plan should be according to the National Resettlement and Rehabilitation Policy (NRRP-2007) as well as State Resettlement and Rehabilitation Policy. Detailed budgetary estimates are to be provided. Resettlements sites should be identified
 - d Public Health Delivery Plan including the provisions for drinking water facility for the local community
 - e Local Area Development Plan to be formulated in consultation with the Revenue Officials and Village Panchayats. Local skill development schemes should be given. Details of various activities to be undertaken along with its financial out lay should be provided
 - f Labour Management Plan for their Health and Safety
 - g Sanitation and Solid Waste Management Plan for domestic waste from colonies and labour camps etc
 - h Plan for Land Restoration and Landscaping of project sites.
- 4 Miscellaneous**
 - a Energy Conservation Measures..
 - b Environmental safeguards during construction activities including Road Construction
 - c Ground Water Management Plan
 - d Water and Air Quality & Noise Management Plans to be implemented during construction and post-construction periods.

In the EMP, also include a sample CAD plan for a distributary outlet command. Such a plan is to show the alignment of irrigation and drainage channels. The components of the OFD works to be undertaken may be clearly mentioned along with a time schedule for their completion vis-à-vis the progress of irrigation development

GENERAL GUIDELINES:

- i. The EIA document shall be printed on both sides, as far as possible.
- ii. All documents should be properly indexed, page numbered.
- iii. Period/date of data collection should be clearly indicated.
- iv. Authenticated English translation of all material in Regional languages should be provided.
- v. The letter/application for EC should quote the MOEF&CC file No. and also attach a copy of the letter prescribing the TOR.

- vi. The copy of the letter received from the SEIAA on the TOR prescribed for the project should be attached as an annexure to the final EIA-EMP Report.
- vii. The final EIA-EMP report submitted to the SEIAA must incorporate the issues mentioned in TOR including action plan on the issues emerged during EPH. The index of the final EIA-EMP report, must indicate the specific chapter and page No. of the EIA-EMP Report where the specific TOR prescribed by SEIAA. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.
- viii. Grant of ToR does not mean grant of EC.
- ix. The status of accreditation of the EIA consultant with NABET/QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared.
- x. On the front page of EIA/EMP reports, the name of the consultant/consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed ToRs (ToR proposed by the project proponent and additional ToR given by the MoEF&CC) have been complied with and the data submitted is factually correct (Refer MoEF&CC Office memorandum dated 4th August, 2009).
- xi. While submitting the EIA/EMP reports, the name of the experts associated with/involved in the preparation of these reports and the laboratories through which the samples have been got analysed should be stated in the report. It shall clearly be indicated whether these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF&CC Office Memorandum dated 4th August, 2009). The project leader of the EIA study shall also be mentioned.
- xii. All the ToR points as presented before the State Expert Appraisal Committee (SEAC) shall be covered.

Specific Terms of Reference:

- *The State Government/SPCB to take action against the project proponent under the provisions of section 19 of the Environment (Protection) Act, 1986, and further no consent to operate to be issued till the project is granted EC (if Credible Action was not initiated).*
- *The project proponent shall be required to submit a bank guarantee equivalent to the amount of remediation plan and natural and community resource augmentation plan with the SPCB prior to the grant of EC. The quantum shall be recommended by the SEAC and finalized by the regulatory authority. The bank guarantee shall be released after successful implementation of the EMP, followed by recommendations of the SEAC and approval of the regulatory authority. The proponent also shall pay penalty amount to be levied by SEIAA as per O.M. dt: 07.07.2021.*
- *Assessment of ecological damage with respect to air, water, land and other environmental attributes. The collection and analysis of data shall be done by an environmental laboratory duly notified under the Environment (Protection) Act, 1986, or an environmental laboratory accredited by NABL, or a laboratory of a Council of Scientific and Industrial Research (CSIR) institution working in the field of environment.*
- *Preparation of EMP comprising remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to violation.*
- *The remediation plan and the natural and community resource augmentation plan to be prepared as an independent chapter in the EIA report by the accredited consultants.*
- *Funds shall be allocated for Corporate Environment Responsibility (CER) for various activities therein. The details of fund allocation and activities for CER shall be incorporated in the EIA/EMP report.*

- xiii. The above ToR should be considered for preparation of EIA Report in addition to all the relevant information as per the 'Generic Structure of EIA' given in Appendix III and IIIA in the EIA Notification, 2006 & its subsequent amendments.
- xiv. The consultants involved in preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/ Laboratories including their status of approvals etc., vide Notification dt. 19.07.2013 of the MoEF&CC.
- xv. The project proponent shall submit the detailed final EIA/EMP prepared as per ToRs, to the SEIAA for considering the proposal for Environmental Clearance within 4 years, as per the O.M. No.J-11013/41/2006-IA-11(1) (P) dt. 08.10.2014 of the MoEF&CC, GoI.
- xvi. **The project proponent should stop construction activity forthwith and shall also comply with the terms of the provisions of the S.O.No.804 (E) dt.14.03.2017; S.O.1030 (E), dt.08.03.2018; and O.M. dt. 07.07.2021 issued by the MoEF&CC, GoI w.r.t. SOP for identification and handling of violation cases under EIA Notification., 2006.**
- xvii. The prescribed ToRs would be valid for a period of (5) five years as per the O.M. No.IA3-22/10/2022-IA-III (E 177258) (P) dt. 08.06.2022 of the MoEF&CC, GoI for submission of the EIA/EMP Reports.

Additional TORs:

- Capacity table (1 mtr interval) with graphical representation.
- Details of submergence.
- Details of development of greenbelt as per the Report of Joint Committee constituted by the Hon'ble NGT, Chennai.
- Compliance of Order dt.10.02.2022 in OA No.180 of 2021 (SZ) of the Hon'ble NGT, Chennai

Sd/-
MEMBER SECRETARY
SEIAA, T.S.

Sd/-
MEMBER
SEIAA, T.S.

Sd/-
CHAIRMAN,
SEIAA, T.S.

To
Sri. B. Shankar, Engineer-in-Chief, (Irrigation),
Indiramma Flood Flow Canal Project from
Sri RamaSagar Project with expansion of
Gouravelly Reservoir,
LMD Colony, Karimnagar, Telangana- 505527
Ph.No: +91 90004 69450
Email:enc-knr-icad@telangana.gov.in

Copy to :

1. Prof. Ch. Krishna Reddy, Chairman, SEAC, T.S. for kind information.
2. The Member Secretary, TSPCB for kind information.
3. The EE, RO: SRD-II, TSPCB for information.
4. The IRO, MoEF&CC, GoI, Hyderabad for kind information.
5. The Director of Mines & Geology Dept., Hyderabad for kind information
6. The Secretary, MoEF&CC, GoI, New Delhi for kind information

//T.C.F.B.O.//



JOINT CHIEF ENVIRONMENTAL ENGINEER





COMPLIANCE TO TOR

S.No.	Contents	Replies
Additional TOR		
1	Capacity table (1 m interval) with graphical representation	I&CAD has prepared the 1m interval area capacity map/graphical representation of expanded Gouravelly Reservoir (8.23 TMC) is furnished in chapter-2, Figure 2.6 page no. IV.
2	Details of submergence	Submergence area details furnished in chapter-4, page no. 4.18 and chapter-10 page no. 10.50
3.	Details of development of greenbelt as per the report of joint Committee constituted by Hon'ble NGT, Chennai	Details of greenbelt is given chapter-10 section no. 10.5 page no. 10.50
4	Compliance of order dt. 10.02.2022 in OA No. 180 of 2021 (SZ) of Hon'ble NGT, Chennai.	Agreed with
Standard TOR		
A	Scope of the EIA studies The EIA report should identify the relevant environmental concerns and focus on potential impacts that may change due to the construction of proposed project. Base on the baseline data collected for three (3) season (Pre-monsoon, Monsoon and winter seasons), the status of the existing environment in the area and capacity to bear the impact on this should be analyzed. Based on this analysis, the mitigation measure for minimizing the impact shall be suggested in EIA /EMP study.	Three (3) season studies furnished in chapter-3. Refer page no. 3.1 to 3.98. Environmental impacts furnished in Chapter No. 4. Refer page no. 4.1 to 4.43. Mitigation measure & EMP furnished in Chapter -4 & 10. Refer page no. 4.1 to 4.43 and 10.1 to 10.91.
B	Details of project and site	
1.	General introduction about the proposed project.	Furnished in Chapter- 1, refer page no. 1.1 to 1.7.
2.	Details of Project and site giving L-Sections of all U/S and D/S Projects with all relevant maps and figures. Connect such information as to establish the total length of interference of Natural River and the committed unrestricted release from the site of Dam/Barrage into the main river.	Not applicable. There is no barrage or Dam involved in the project. As the water is withdraw from the SRSP reservoir and storing at Mid Manair and Gouravelly reservoir. The Reservoir bund details given in chapter-10.
3.	A map of boundary of the project site giving details of protected areas in the vicinity of project location.	There is no protected area within the project area.
4.	Location details on a map of the project area with contours indicating main project features. The project layout shall be superimposed on a contour	Furnished in Chapter-1, refer Fig. 1.1 Project area on survey of India Top sheets is given in Fig. 2.2



S.No.	Contents	Replies
	map of ground elevation showing main project features (viz. location of dam, Head works, main canal, branch canals, quarrying etc.) shall be depicted in a scaled map.	page no. II.
5.	Layout details and map of the project along with contours with project components clearly marked with proper scale maps of at least 1:50,000 scale and printed at least on A3 scale for clarity.	Furnished in Chapter-2, Fig. 2.2 Project area on survey of India Top sheets.
6.	Existence of National Park, Sanctuary, Biosphere Reserve etc. in the study area, if any, should be detailed and presented on a map with distinct distances from the project components.	There are no National Park, Sanctuary, Biosphere Reserve within the study area
7.	Drainage pattern and map of the river catchment up to the proposed project site.	The water is takeoff from the SRSP reservoir and storing at Mid Manair and Gouravelly reservoir. Hence the catchment of 2 reservoirs is furnished in chapter-10 section no. 10.1 page no. 10.2. Drainage pattern details are given chapter-2 section no. 2.9 page no. 2-15.
8.	Delineation of critically degraded areas in the directly draining catchment on the basis of Silt Yield Index as per the methodology of Soil and Land use Survey of India.	Furnished in chapter-10, refer page no. 10.2 to 10.25.
9.	Soil characteristics and map of the project area.	Furnished in chapter-3, refer section no. 3.7 and Fig. 3.14 to 3.17
10.	Geological and Seismo-tectonic details and maps of the area surrounding the proposed project site showing location of dam site and canal sites.	Furnished in chapter-2, refer page no. 2.14 and Fig. no. 2.4. Geology details are given chapter-3 section no. 3.2 page no. 3.1.
11.	Remote Sensing studies, interpretation of satellite imagery, topographic sheets along with ground verification shall be used to develop the land use/land cover pattern of the study using overlaying mapping techniques viz. Geographic Information System (GIS), False Color Composite (FCC) generated from satellite data of project area.	Furnished in Chapter-3, refer section No. 3.9, Page no. 3.48 and fig. no. 3.20 to 3.30.
12.	Land details including forests, private and other land.	There is no forest land involved in the project. Land requirement is given in chapter-2. section 2.11 page no. 2.15. Furnished in chapter 10, refer page no. 10.41.
13.	Demarcation of snow fed and rain fed areas for a realistic estimate of the water availability.	Snow fed area is not applicable. Water availability details are given in chapter-2 section no. 2.12 page no. 2.16.



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(C) Description of Environment and Baseline Data		
1	To know the present status of environment in the area, baseline data with respect to environmental components air, water, noise, soil, land and biology & biodiversity (flora & fauna), wildlife, socioeconomic status etc. should be collected within 10 km radius of the main components of the project/site i.e. dam site and power house site. The air quality and noise are to be monitored at such locations which are environmentally & ecologically more sensitive in the study area. The baseline studies should be collected for 3 season (Pre-Monsoon, Monsoon, Post Monsoon season).	Three (3) season studies furnished in chapter-3. Refer page no. 3.1 to 3.109.
2	Flora-Fauna in the catchment and command area should be documented. The study area should comprise of the following:	Given in chapter-3 section no. 3.10 page no. 3.61 to 3.67.
a	Catchment area up to the dam/barrage site.	Furnished as part of CAT Plan in Chapter-10, section 10.1, refer page no. 10.2 to 10.25.
b	Submergence Area.	Submergence area details furnished in chapter-4, page no. 4.18 and chapter-10 page no. 10.40, Table No. 10.13.
c	Project area or the direct impact area should comprise of area within 10 km radius of the main project components like dam, canals etc.	Discussed in Chapter -4.
d	Downstream upto 10 km from the tip of the reservoir.	Discussed in Chapter -4 and chapter-9
D) Details of the Methodology		
1	- The methodology followed for collection of base line data along with details of number of samples and their locations in the map should be included. - Study area should be demarcated properly on the appropriate scale map. - Sampling sites should be depicted on map for each parameter with proper legends. - For Forest Classification, Champion and Seth (1968) methodology should be followed.	Furnished as part of baseline data chapter-3, refer fig. no. 3.2, 3.7, 3.8, 3.9, 3.10, and 3.14.
E) Methodology for Collection of Biodiversity Data		
1	The number of sampling locations should be adequate to get a reasonable idea of the diversity and other attributes of flora and fauna. The guiding principles should be the size of the study area (larger area should have larger number of sampling locations) and inherent diversity at the location, as known from secondary sources (e.g. eastern Himalayan and low altitude sites should	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.61 to 3.67. Annexure-3G



S.No.	Contents	Replies
	have a larger number of sampling locations owing to higher diversity).	
2	The entire area should be divided in grids of 5kmX5km preferably on a GIS domain. There after 25% of the grids should be randomly selected for sampling of which half should be in the directly affected area (grids including project components such as reservoir, dam, powerhouse, tunnel, canal etc.) and the remaining in the rest of the area areas of influence in 10 km radius form project components). At such chosen location, the size and number of sampling units (e.g. quadrates in case of flora/transects in case of fauna) must be decided by species area curves and the details of the same (graphs and cumulative number of species in a tabulated form) should be provided in the EIA report. Some of the grids on the edges may not be completely overlapping with the study area boundaries. However these should be counted and considered for selecting 25% of the grids. The number of grids to be surveyed may come out as a decimal number (i.e. it has an integral and a fractional part) which should be rounded to the next whole number	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
3	The conventional sampling is likely to miss the presence of rare, endangered and threatened (r.e.t.) species since they often occur in low densities and in case of faunal species are usually secretive in behaviour. Reaching the conclusion about the absence of such species in the study area based on such methodology is misleading. It is very important to document the status of such species owing to their high conservation value. Hence likely presence of such species should be ascertained from secondary sources by a proper literature survey for the said area including referring to field guides which are now available for many taxonomic groups in India. Even literature from studies/surveys in the larger landscapes which include the study area for the concerned project must be referred to, since most species from adjoining catchments is likely to be present in the catchments in question. In fact such literature from the entire state can be referred to. Once a listing of possible r.e.t. species from the said area is developed, species specific methodologies should be adopted to ascertain their presence in the study area which would be far more conclusive as compared to the	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G



S.No.	Contents	Replies
	conventional sampling. If the need be, modern methods like camera trapping can be resorted to, particularly for areas in the eastern Himalayas and for secretive/nocturnal species. A detailed listing of the literature referred to, for developing lists of r.e.t. species should be provided in the EIA reports.	
4	The R.E.T. species referred to in this point should include species listed in Schedule I and II of Wildlife (Protection) Act, 1972 and those listed in the red data books (BSI, ZSI and IUCN).	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
(F) Components of the EIA Study		
I.	Various aspects to be studied and provided in the EIA/EMP report are as follows:	As Furnished below
(i) Physical and Chemical Environment		
1	Geological & Geophysical Aspects and Seismo-Tectonics:	Furnished as part of baseline data chapter 3, refer section 3.2, page no. 3.2 to 3.5 Seismo- Tectonics details are given chapter-2 page no. 2.13
a	Physical geography, Topography, Regional Geological aspects and structure of the Catchment.	Furnished as part of baseline data chapter 3, refer section 3.2, page no. 3.2 to 3.5. Catchment details are given chapter 10 page no.10.2. to 10.25
b	Tectonics, seismicity and history of past earthquakes in the area. A site specific study of the earthquake parameters will be done. The results of the site specific earthquake design shall be sent for approval of the NCSDP (National Committee of Seismic Design Parameters, Central water Commission, New Delhi for large dams.	Furnished in chapter-2, section no. 2.8 refer page no. 2.14.
c	Landslide zone or area prone to landslide existing in the study area should be examined.	Not Applicable
d	Presence of important economic mineral deposit, if any.	Not Applicable
e	Justification for location & execution of the project in relation to structural components (dam / barrage height).	Not applicable Dam or barrage is not proposed in the project.
f	Impact of project on geological environment.	Furnished in chapter-4.
(2) Meteorology, Air and Noise:		
a	Meteorology (viz. Temperature, Relative humidity, wind speed/direction etc.) to be collected from nearest IMD station.	Furnished as part of baseline data chapter 3, section number 3.3, page no. 3.2 to 3.4.
b	Ambient Air Quality with parameters viz. Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM) i.e.	Furnished in Chapter-3, refer section no. 3.4, page no. 3.6 to 3.14.



S.No.	Contents	Replies
	suspended particulate materials < 10 microns, Sulphur dioxide (SO ₂) and Oxides of Nitrogen (NO _x) in the study area at 10 Locations.	
c	Existing Noise Levels and traffic density in the study area at 10 Locations.	Furnished in Chapter-3, refer section no. 3.5, page no. 3.14 to 3.19.
(3) Soil Characteristics:		
•	Soil classification, physical parameters (viz., texture, Porosity, Bulk Density and water holding capacity) and chemical parameters (viz. pH, electrical conductivity, magnesium, calcium, total alkalinity, chlorides, sodium, potassium, organic carbon, available potassium, available phosphorus, SAR, nitrogen and salinity, etc.)	Furnished in Chapter-3, refer section no. 3.8.1, page no. 3.42 to 3.48. and Annexure 3F.
(4) Remote Sensing and GIS Studies:		
a	Generation of thematic maps viz, slope map, drainage map, soil map, land use and land cover map, etc. Based on these, thematic maps, an erosion intensity map should be prepared.	Furnished in Chapter-3, refer section no. 3.9, page no. 3.48 to 3.60.
b	New configuration map to be given in the EIA Report.	Furnished in chapter-3, Fig. no. 3.20 to 3.30.
(5) Water Quality		
a	History of the ground water table fluctuation in the study area.	Furnished as part of baseline data chapter 3, refer page no. 3.20 to 3.34
b	Water Quality for both surface water and ground water for [i] Physical parameters (pH, Temperature, Electrical Conductivity, TSS); [ii] Chemical parameters (Alkalinity, Hardness, BOD, COD, NO ₃ , PO ₄ , Cl, SO ₄ , Na, K, Ca, Mg, Silica, Oil & grease, phenolic compounds, residual sodium carbonate); [iii] Bacteriological parameter (MPN, Total coliform); and [iv] Heavy Metals (Pb, As, Hg, Cd, Cr-6, Total Cr, Cu, Zn, Fe) at minimum 10 Locations, however, the sampling numbers should be increased depending on the command area.	Furnished as part of baseline data chapter 3, refer section number 3.6. and page no. 3.20 to 3.28. Detailed water quality results are given Annexure- 3D and 3E
c	Delineation of sub and micro watersheds, their locations and extent based on the Soil and Land Use Survey of India (SLUSOI), Department of Agriculture, Government of India. Erosion levels in each micro-watershed and prioritization of micro-watershed through Silt Yield Index (SYI) method of SLUSOI.	Furnished in chapter-10, refer page no. 10.16, Figure no. 10.4 to 10.7.
II. Water Environment & Hydrology		
a	Hydro-Meteorology of the project viz. precipitation (snowfall, rainfall), temperature, relative humidity, etc. Hydro-meteorological studies in the	Furnished as part of baseline data chapter 3, section number 3.3, page no. 3.2 to 3.5



S.No.	Contents	Replies
	catchment area should be established along-with real time telemetry and data acquisition system for inflows monitoring.	
b	Run off, discharge, water availability for the project, sedimentation rate, etc.	Water availability details are given in chapter-2 section no. 2.11 page no. 2.16.
c	Basin Characteristics	Not applicable
d	Catastrophic events like cloud bursts and flash floods, if any, should be documented.	Not applicable
e	For estimation of Sedimentation Rate, direct sampling of river flow is to be done during the EIA study. The study should be conducted for minimum one year. Actual silt flow rate to be expressed in ha-m km-2 year-1.	Not applicable
f	Set-up a G&D monitoring station and a few rain gauge stations in the catchment area for collecting data during the investigation.	Not applicable
g	Flow series, 10 daily with 90%, 75% and 50% dependable years discharges.	Not applicable
h	Environmental flow release should be 20% of the average of the 4 lean months of 90% dependable year during the lean season and 30% of Monsoon flow during monsoon season. For remaining months, the flow shall be decided by the Committee based on the hydrology and available discharge.	Not applicable
i	A site specific study on minimum environment flow should be carried out.	Not applicable
C	Biological Environment	
1	Flora	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
a	Characterization of forest types (as per Champion and Seth method) in the study area and extent of each forest type as per the Forest Working Plan.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
b	General vegetation profile and floral diversity covering all groups of flora including Bryophytes, Pteridophytes, Lichens and Orchids. A species wise list may be provided.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
c	Assessment of plant species with respect to dominance, density, frequency, abundance, diversity index, similarity index, importance value index [IVI], Shannon Weiner Index etc. of the species to be provided. Methodology used for calculating various diversity indices along with details of locations of quadrats, size of quadrats	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G



S.No.	Contents	Replies
	etc. to be reported within the study area in different ecosystems.	
d	Existence of National Park, Sanctuary, Biosphere Reserve etc in the study area, if any, should be detailed.	NA
e	Economically important species like medicinal plants, timber, fuel wood etc.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
f	Details of endemic species found in the project area.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
g	Flora under RET categories should be documented using International Union for the Conservation of Nature and Natural Resources (IUCN) criteria and Botanical Survey of India's Red Data list along with economic significance. Species diversity curve for RET species should be given.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
(ii)	Fauna	
a	Fauna study and inventorisations should be carried out for all groups of animals including reptiles a	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
b	And nocturnal animals in the study area. Their present status along with Schedule of the species.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
c	Information (authenticated) on Avi-fauna and wild life in the study area.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
d	Status of avifauna their resident/migratory/ passage migrants etc.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
e	Documentation of butterflies, if any, found in the area.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
f	Details of endemic species found in the project area.	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67. Annexure-3G
g	RET species- voucher specimens should be collected along with GPS readings to facilitate rehabilitation. RET faunal species to be classified	Furnished as part of baseline data chapter 3, refer section number 3.10. Page no. 3.60 to 3.67.



S.No.	Contents	Replies
	as per IUCN Red Data list and as per different schedule of Indian Wildlife (Protection) Act, 1972.	Annexure-3G
h	Existence of barriers and corridors, if any, for wild animals.	Not applicable
i	Compensatory afforestation to compensate the green belt area that will be removed, if any, as part of the proposed project development and loss of biodiversity.	Not applicable forest land is not involved in the project
j	Collection of primary data on agriculture activity, crop and their productivity and irrigation facilities components	Furnished as part of baseline data chapter 3, refer section number 3.11, Table no 3.68 page no. 101
IV	Aquatic Ecology	
a	Documentation of aquatic fauna like macro-invertebrates, zooplankton, phytoplanktons, benthos etc.	Furnished as part of baseline data chapter 3, refer section number 3.10 page no. 3.66
b	Fish and fisheries, their migration and breeding grounds.	Furnished as part of baseline data chapter 3, refer section number 3.10 page no. 3.66
c	Fish diversity, composition and maximum length & weight of the measured populations to be studied for estimation of environmental flow.	Furnished as part of baseline data chapter 3, refer section number 3.10 page no. 3.66
d	Conservation status of aquatic fauna.	Furnished as part of baseline data chapter 3, refer section number 3.10 page no. 3.66
e	Sampling for aquatic ecology and fisheries and fisheries must be conducted during three season pre-monsoon (summer), monsoon and winter. Size (length & Weight) of important fish species need to be collected and breeding and feeding grounds should also be identified along the project site or in vicinity	Furnished as part of baseline data chapter 3, refer section number 3.10 page no. 3.66.
V	Irrigation and cropping	
a	Cropping pattern and Horticultural practices in the study area	Given chapter-4, page no. 4.33
b	Collection of primary data on agricultural activity, crop and their productivity and irrigation facilities component	Given chapter-3, section no. 3.11, Table no 3.68 page no. 101
c	Component of pressurized/drip irrigation and micro irrigation	Given chapter-4, page no. 4.33
d	Details of conjunctive used of water for irrigation.	Given chapter-4, page no. 4.11
VI	Socio-Economic	
a	Collection of Baseline data on human settlements, health status of the community and existing infrastructure facilities for social welfare including sources of livelihood, job opportunities and safety and security of workers and surrounding population.	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.



S.No.	Contents	Replies
b	Collection of information with respect to social awareness about the developmental activity in the area and social welfare measures existing and proposed by project proponent.	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.
c	Collection of information on sensitive habitat of historical, cultural and religious and ecological importance.	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.
d	The Socio-economic survey/profile within 10 Km of the study area for Demographic profile; Economic Structure; Development Profile; Agricultural Practices; Infrastructure, education facilities; health and sanitation facilities; available communication network etc.	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.
e	Documentation of Demographic, Ethnographic, Economic structure and development profile of the area.	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.
f	Information on Agricultural practices, Cultural and aesthetic sites, Infrastructure facilities etc	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.
g	Information on the dependence of the local people on minor forest produce and their cattle grazing rights in the forest land.	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.
h	List of all the Project Affected Families with their names, education, land holdings, other properties, occupation, source of income, land and other properties to be acquired, etc.	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.
i	In addition to Socio-economic aspects of the study area, a separate chapter on socio-cultural aspects based upon study on Ethnography of the area should be provided.	Furnished as part of baseline data chapter 3, refer section number 3.11. page no. 3.67 to 3.109.
G	Impact Prediction and Mitigation Measures	
	The adverse impact due to the proposed project should be assessed and effective mitigation steps to abate these impacts should be described.	Furnished in Chapter-4, Page No. 4.1 to 4.43
(1)	Air Environment	
	a) Changes in ambient and ground level concentrations due to total emissions from point, line and area sources b) Effect on soils, material, vegetation and human health c) Impact of emissions from DG sets used for power during the construction, if any, on air environment. d) Pollution due to fuel combustions in equipments & vehicles e) Fugitive emissions from various sources. f) Impact on micro climate.	Furnished in Chapter-4, refer section no. 4.4, Page no. 4.2.
(2)	Water Environment	



S.No.	Contents	Replies
a.	Changes in surface & ground water quality.	Furnished in Chapter-4, Section no. 4.5 page no. 4.9
b.	Steps to develop pisci-culture and recreational facilities.	Furnished in Chapter-4, refer section no. 4.5.2 page no. 4.9
c.	Changes in hydraulic regime and down stream flow.	Furnished in Chapter-4, Section no. 4.5 page no. 4.9
d.	Water pollution due to disposal of sewage.	Furnished in Chapter-4, refer section no. 4.5.4 page no. 4.10
e.	Water pollution from labour colony/camps and washing equipment.	Furnished in Chapter-4, refer section no. 4.5.4 page no. 4.10
(iii)	Land Environment	
	a. Changes in land use/land cover and drainage pattern. b. Immigration of labour population. c. Quarrying operation and muck disposal. d. Changes in land quality including effects of waste disposal e. River bank and their stability f. Impact due to submergence. g. Adverse impact on land stability, catchment of soil erosion, reservoir sedimentation and spring flow (if any) [a] due to considerable road construction/widening activity [b] interference of reservoir with the inflowing streams [c] blasting for excavation of canals and some other structures.	Furnished in Chapter-4, refer section no. 4.7 page no. 4.13
(4)	Biological Environment	
	a. Impact on forests, flora, fauna including wildlife, migratory avi-fauna, rare and endangered species, medicinal plants etc. b. Pressure on existing natural resources c. Deforestation and disturbance to wildlife, habitat fragmentation and wild animal's migratory corridors d. Compensatory afforestation-Identification of suitable native tree species for compensatory afforestation & green belt. e. Impact on fish migration and habitat degradation due to decreased flow of water f. Impact on breeding and nesting grounds of animals and fish	Furnished in Chapter-4, refer section no. 4.14, page no. 4.21
(5)	Socio-economic Aspects	Furnished in Chapter-4, refer section no. 4.11 Page no. 4.25

S.No.	Contents	Replies
	a. Impact on local community including demographic profile. b. Impact on socio-economic status. c. Impact on economic status d. Impact on human health due to water / vector borne disease. e. Impact on increases traffic. f. Impact on Holy Places and Tourism. g. Impacts of blasting activity during project construction which generally destabilize the land mass and lead to landslides, damage to properties and drying up of natural springs and cause noise pollution, will be studied. Proper record shall be maintained of the base line information in the post project period. h. Positive as well as negative impacts likely to be accrued due to the project are to be listed. i. Positive and negative impacts likely to be accrued due to the project are listed.	Furnished in Chapter-4, refer section no. 4.11 Page no. 4.25 Furnished in Chapter-4, section no. 4.11, page no. 4.25
H	Environment Impact Analysis Environmental Impact Analysis due to the project on the above mentioned components should be carried out for construction and operation phases using qualitative or quantitative methods.	Furnished in Chapter-4 page no. 4.1 - 4.43
(I) Environment Management Plan (EMP)		
	Environmental Impact analysis due to the project on the above mentioned components should be carried out for construction and operation phases using qualitative or quantitative methods	Given in chapter-4, page no. 4.39 to 4.43.
1	Biodiversity Management Plan	
a	Biodiversity and Wild Life Conservation & Management Plan for conservation and preservation of endemic, rare and endangered species of flora and fauna to be prepared in consultation with State Forest Department.	Furnished in Chapter-10, refer section no. 10.3 page no. 10.38
b	Compensatory Afforestation in lieu of the forest land required for the project needs to be proposed. Choice of plants should be made in consultation with State Forest Department including native and RET species, if any.	Not applicable
c	Fish suitable based passages (Fish passes/Natural bypass) must be included in the plan. This plan must be a scientific based study (seasonal migration) from the fisheries research institute having experience in fish pass studies.	Not applicable. This project involves construction of storage reservoir Gouravelly.
d	Fisheries Conservation & Management Plan-Fish	Fisheries Conservation &



S.No.	Contents	Replies
	fauna inhabiting the affected stretch of river, a specific fisheries management plan should be prepared for river and reservoir. If any migratory fish species is getting affected then the migratory routes, time/season of upstream and downstream migration, spawning grounds etc will be discussed in details.	Management Plan is given Chapter-10 section no. 10.6 page no. 10.56
e	Plan for Green Belt Development along the periphery of reservoir, colonies, approach road, canals etc. to be prepared in consultation with the State Forest Department. Local plant species suitable for greenbelt development should be selected.	Furnished in Chapter-10, refer section no. 10.5 page no. 10.50
f	Environmental Monitoring Programme with physical & financial details covering all the aspects of EMP. A summary of cost estimate for all the plans, cost for implementing all Environmental Management Plans including the cost for implementing environmental monitoring programme should be given. Provision for an Environmental Management Cell should be made.	Given in chapter-6 page no. 1-10.
2	Disaster Management Plan	
a	Catchment Area Treatment (CAT) Plan should be prepared micro-watershed wise. Identification of area for treatment based upon Remote Sensing & GIS methodology and Silt Yield Index (SYI) method of SLUSOI coupled with ground survey. Areas/watersheds falling under 'very severe' and 'severe' erosion categories are required to be treated. Both biological and engineering measures should be proposed in consultation with State Forest Department. Year-wise schedule of work and monetary allocation should be provided. CAT plan is to be completed prior to reservoir impoundment. Mitigations measures to check shifting cultivation in the catchment area with provision for alternative and better agricultural practices should be included.	Furnished in Chapter-10, refer section no. 10.1 page no. 10.2 to 10.26
b	Study of Design Earthquake Parameters: A site specific study of earthquake parameters should be done. The results of the site specific earthquake design parameters should be approval by National Committee of Seismic Design Parameters, Central Water Commission (NCSDP), New Delhi.	Furnished in Chapter-2, refer section no. 2.8 page no. 2.11 to 2.15.
c	Dam Break Analysis and Disaster Management Plan: The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break	Not applicable. This project is not involved dam or barrage. The Mid Manair reservoir and Gouravelly reservoir are a part of



S.No.	Contents	Replies
	scenario. The action plan will include Emergency Action and Management including measure like preventative action notification, warning procedure and action plan for co-ordination with various authorities.	hard rock terrain of Deccan plateau with coarse grained pink hornblende granite rock formation of proposed structure. The Gouravelly reservoir bund is mostly covered by brownish insitu hummocky granite exposures. Solid to massive sheet rock is exposed on the left bank of the stream. These rocks are intruded by dolerite dykes. Two sets of joints NE-SW and NW-SE trend with vertical to near vertical dips are noticed in the area. The thickness of weathered formation is observed to be of 1m to 2m underlain by moderate to highly weathered granite. The dyke alignment on the left flank has exposed fairly fresh granite rocks, whereas the saddle portion is cultivated.
d	Reservoir Rim Treatment Plan for stabilization of land slide/land slip zones if any, around the reservoir periphery to be prepared. Suitable engineering and biological measures for treatment of the identified slip zones to be provided with physical and financial schedule.	Furnished in Chapter-10, refer section no. 10.7 page no. 10.57
e	Muck Disposal Plan- suitable sites for dumping of excavated material should be identified in consultation with the State Pollution Control Board and Forest Department. All Muck disposal sites should be minimum 30 m away from the HFL of river. Plan for rehabilitation of muck disposal sites should also be given. The L- section/ cross section of muck disposal sites and approach roads to be given. Financial out lay for this may be given separately.	Furnished in Chapter-10, refer section no. 10.8 page no. 10.59
f	Plan for Restoration of quarry sites and landscaping of colony areas, working areas, roads, etc.	Furnished in Chapter-10, refer section no. 10.8 page no. 10.62
g	Command Area Development (CAD) Plan giving details of implementation schedule with a sample CAD plan.	Furnished in Chapter-10, refer section no. 10.2, page no. 26 to 10.37
h	In the EMP, also include a sample CAD plan for a distributaries outlet command. Such a plan is to show the alignment of irrigation and drainage channels. The components of the OFD works to be undertaken may be clearly mentioned along	Refer section no. 10.2 page no. 10.26 to 10.37



S.No.	Contents	Replies
	with a time schedule for their completion vis-à-vis the progress of irrigation development.	
i	Mitigating measures for impacts due to Blasting on the structures in the vicinity.	Furnished in Chapter-10, refer page no. 10.63
3	Socio-Economic aspects	
a	A detailed CER plan along with activities wise break up of financial commitment shall be prepared in terms of the provision OM No.. 22-65/2017-IA.III dated 30.09.2020. CER component shall be identified considering need based assessment study and public hearing issues. Sustainable income generating measures which can help in upliftment of affected section of society, which is consistent with the traditional skills of the people shall be identified.	Agreed with. As per OM dated 30 th September 2020 CER is not included in EIA
b	While formulating CER schemes it shall be ensured that an in-build monitoring mechanism for the schemes it shall be ensured that an inbuild monitoring mechanism for the schemes identified are in place and mechanism for conducting annual social audit from the nearest government institute of repute in the region shall be prepared. The project proponent shall also provide Action plan for the status of implementation of the scheme from time to time and dovetail the same with any Govt. scheme (s). CER details done in the past should be clearly spelt out in case of expansion projects.	Agreed. As per OM dated 30 th September 2020 CER is not included in EIA
c	Resettlement and Rehabilitation (R&R) Plan need to be prepared with due consultation with Project Affected Families (PAFs). The provision of the d R&R plan should be according to the National Resettlement and Rehabilitation Policy (NRRP-2007) as well as State Resettlement and Rehabilitation Policy. Detailed budgetary estimates are to be provided. Resettlements sites should be identified. Land acquisition for the project whose land is to be acquired should be suitably compensated in accordance with the law of the land and prevailing guidelines R&R plan is to be formulated as new Act, 2013 which came into force w.e.f 1.1.2014.	Furnished in Chapter-10, refer section no. 10.4, page no. 10.40 to 10.49
d	Public Health Delivery Plan including the provisions for drinking water facility for the local community.	Furnished in Chapter-10, refer section no. 10.12 and page no. 10.79
e	Local Area Development Plan to be formulated in consultation with the Revenue Officials and Village Panchayats. Local skill development schemes should be given. Details of various	Furnished in Chapter-10, refer section no. 10.14 page no. 10.84



S.No.	Contents	Replies
	activities to be undertaken along with its financial outlay should be provided.	
f	Labour Management plan for their health & Safety	Furnished in Chapter-10, refer section no. 10.9 and page no. 10.63
g	Sanitation and Solid Waste Management Plan for domestic waste from colonies and labour camps etc.	Furnished in Chapter-10, refer section no. 10.13 page no. 10.82
h	Plan for land Restoration and landscaping of project site	Given chapter-10 section no. 10.5
4	Miscellaneous	
a	Energy Conservation Measures.	Furnished in Chapter-10, refer section no. 10.16 page no. 10.89
b	Environmental safeguards during construction activities including Road Construction.	Furnished in Chapter-10, refer section no. 10.15 page no. 10.89
c	Ground Water Management Plan.	Furnished in Chapter-10, refer section no. 10.10 page no. 10.68
d	Water and Air Quality & Noise Management Plans to be implemented during construction and post-construction periods.	Furnished in Chapter-10, refer section no. 10.63



INTRODUCTION

1.1. Purpose of the report

Telangana State is situated in the central stretch of the Indian Peninsula on the Deccan Plateau. It is the 29th state of India and twelfth-largest state in the country with an extent of 114,840 square kilometres and a population of 35.3 million (2011 census). The region is drained by two major rivers namely Godavari and Krishna. The climate in this region is semi-arid and has skewed distribution of rainfall in space and time necessitating water management. The culturable area in the state is 75.21 lakh ha and net irrigated area is 22.89 lakh ha (30.43% of culturable area).

The economy of Telangana is mainly driven by agriculture. About 61.12 % of the total population resides in rural areas and the rest of 38.88 % are residing in urban areas. Thus, the economy of the state is predominantly agrarian with agriculture contributing around 50% of the state's income and employs about 70% of the work force. Since, agriculture is the main activity and has close links with the development in other sectors; it has resulted in overall economic progress of the state. Achieving faster agricultural growth is imperative. Thus, there is an urgent need for increasing food and fibre production to meet the demands of increasing population as well as providing rural employment.

The Indiramma Flood Flow Canal Project (IFFC) envisages diversion of flood water from Sri Rama Sagar Project (SRSP) is conceived with an objective of irrigating 2,20,000 acres (89031 ha) of ayacut in the drought prone areas of erstwhile districts of Karimnagar, Warangal and Nalgonda (present districts Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon) in Telangana region. The excess flood occurs once in every four years as per the existing data. The storage facilities for storing such flood plays major role in harnessing and conserving flood water, hence it is evident that a maximum extent of such flood water can be harnessed provided with maximum storage facilities.

Flood Flow Canal (FFC) project (originally cleared in the 64th TAC of CWC, Dt 30.03.1996) is envisaged irrigation facility to an area of 2.2 lakh acres in the drought-prone areas of Telangana region duly diverting about 20 TMC of surplus water from Sri Rama Sagar Project during the floods. The DPR approved by CWC in 1996 envisaged formation of 3 No's (Three) reservoirs namely (i) Combined Storage Reservoir-I across Peddavagu II and Korutlavaagu near Konaraopet (V), Karimnagar Dist with a storage capacity of 7.346 TMC to irrigate an ayacut of 32,000 Acres. (ii) Mid Manair Reservoir with a storage capacity of 25.873 TMC to irrigate an ayacut of 68,000 Acres. (iii) Gouravelly Reservoir with storage capacity of 1.095 TMC to irrigate an ayacut of 1,20,000 Acres was proposed. The total storage capacity under these three Reservoirs was proposed as 34.314 TMC. The approved water utilization is 21.332 TMC of water.

The then Government of Andhra Pradesh awarded permission to divert and utilize 20.00 TMC of Godavari flood water according to the 64th TAC meeting in 1996. Later owing to huge protests and resistance from the local people against the construction of Combined Storage Reservoir-I across Peddavagu II and Korutlavaagu near Konaraopet (V), Kathalapur (M), Karimnagar Dist at Km 47.60 of FFC, the then Government of Andhra Pradesh vide G.O.Ms.No.209, dated: 17-11-1997 had bypassed the Combined Storage Reservoir-I across Peddavagu-II and Korutlavaagu.

After formation of Telangana State, Government has taken up Re-engineering of Irrigation projects for effective utilization of water allocations made to the state. To compensate the storage lost due to dropping of Combined Storage Reservoir-I across Peddavagu II and



Korutlawaagu near Konaraopet (V), Kathalapur (M), Karimnagar Dist, the Government has proposed to increase the Gouravelly Reservoir capacity from 1.410 TMC to 8.230 TMC. The administrative approval for the Gouravelly reservoir project with enhanced capacity from 1.410 TMC to 8.23 TMC was accorded by the Government of Telangana vide G.O.Ms. No. 533, I&CAD (Projects-IV) Department Dt: 26.05.2017 and 85% of work was completed by the time of NGT Case was filed (**Annexure-1A**).

The submerging villagers of Gouravelly reservoir had filed the case **OA no 180 of 2021** on 10th August 2021 before the **Hon'ble NGT (SZ), Chennai** on the ground that the irrigation and CAD department of State of Telangana under the Re-engineering proposal issued orders **for expansion of Gouravelly Reservoir from 1.410 TMC to 8.230 TMC without obtaining prior Environmental Clearance from Ministry. (Annexure-1B)**.

The National Green Tribunal (SZ), Chennai has constituted a Joint Committee on 13.08.2021 represented by IRO, MoEF&CC, Godavari River Management Board and Central Water Commission, Integrated Regional Office, Hyderabad. The Joint Committee conducted the site visit on 23.09.2021 and filed its report on Dt: 29.09.2021 before the Hon'ble Tribunal wherein it has reported that **the scope of the project has been changed without approval of MoEF&CC**. The committee has proposed an **Environmental Compensation of Rs.2,05,31,250 (Rs.2.05 Crores)** for Violation. (**Annexure-1B**).

The National Green Tribunal disposed the case on 10.02.2022 with the certain observations and directions.

As per the NGT orders, the MoEF &CC, New Delhi has conducted 29th EAC meeting on 15.06.2022 in which, the EAC has suggested the Project Proponent to submit the proposal afresh at PARIVESH portal for Terms of Reference (ToR) under violation category.

As per the EIA notification, 2006 and its subsequent amendment dated 20th April 2022, the proposed project comes under River valley category - schedule 1(c). Irrigation projects involving Inter-State issues shall be appraised at Central level without change in category, irrespective of the command area. The proposed project has the total culturable command area of 2,20,000 acres (89031 ha) with no interstate boundary. So, the proposed project is considered at state level. The SEAC committee approved the ToR on 15th Feb 2023 under violation category Ref. No. SIA/TG/RIV/40935/2022, Dt 06.12.2022.

1.2. Project Proponent

In the process of developing Telangana state, Irrigation & CAD Department is making every effort to harness and utilize all the available water resources for the benefit of Agricultural sector, Industrial Sector and to provide drinking water and sustainable livelihood to its people. The development of Irrigation potential for the parched lands in Telangana State is mostly dependent on Godavari & Krishna Rivers and their tributaries, Tanks & Ponds. I&CAD Department has, therefore, been entrusted with the following task:

- Survey, investigation, planning, designing, construction, maintenance and management of Major, Medium & Minor Irrigation Projects including Lift Irrigation Schemes.
- Central Design Organization of I&CAD Department has been strengthened to take up the designing of all the projects to meet the requirements by re-engineering of the existing projects and additional projects to cater to the demand of the agricultural lands and other needs, including drinking water.
- Research & Training activities in the area of water resources & Management by the formation of Water and Land Management Training & Research Institute (WALAMTARI), the Apex training Institute.



- For optimum utilization of water allocated in Godavari & Krishna basins, I&CAD Department is utilizing the advanced technologies i.e., LIDAR for topographical survey for re-engineering of some of the major projects on Lift Irrigation Schemes.
- Utilizing latest technologies in the field of Water Resources and Information Technology to transform I&CAD as one of the most modern and service driven department.
- GIS wing of the department is equipped to prepare Irrigation maps required for different projects of I&CAD Department.

I&CAD Department has taken up 28 Major, 39 Medium and 46,531 minor Irrigation Projects. I&CAD Department is planning to provide irrigation facilities to one lakh acres in each constituency (other than urban) under different available water sources in the State to protect the agricultural sector from the vagaries of monsoon.

Project Proponent for the proposed Indiramma Flood Flow Canal from Sri Rama Sagar Project (SRSP) with expansion of Gouravelly reservoir is Engineer-in-Chief, (Irrigation), Karimnagar, I&CAD Department of Telangana.

1.3. Brief description about the Project

The Flood Flow Canal Project from SRSP is conceived with an objective of irrigating 2,20,000 acres of ayacut in the drought prone areas of districts of Nizamabad, Jagtial, Karimnagar, Rajanna Siricilla, Siddipet, Janagoan, Peddapally and Hanmakonda (erstwhile Warangal Urban) in Telangana region duly utilizing 20 TMC of flood water of Godavari River from foreshore of Sri Ram Sagar Project. The project is formulated and designed after careful planning and realistic approach. The project consists of various components like:

- (i) Water conveyance system consisting of gravity canals, tunnel and lift schemes :
 - FFC Canal :122 km
 - Reverse lift pump house: 3 number
 - MMR Canal:103.375 km
 - Tunnel – 11.98 km
 - Pump house – 3 x 32MW(3x19cumecs)
 - Gouravelly Canal-63.725 km
 - High Level Canal-20.845 Km
- (ii) Mid Manair reservoir: 25.873 TMC
- (iii) Gouravelly reservoir: 8.23 TMC.
- (iv) Distributary Network System

It is proposed to provide irrigation facilities to the command area of 2,20,000 acre (89031 ha) covering districts of Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon in Telangana. The location map showing project location is given as **Figure.1.1**. The details of the project components are discussed in Chapter-2 of EIA report.

1.3.1. Importance to the region

The economy of the state is predominantly agrarian. Agriculture contributes to about 50% of the state's income and employs about 70% of the work force out of about 73% of the population living in rural area. Therefore, economy of Telangana is mainly driven by agriculture. Agriculture is the main activity, and it has close links with the development in other sectors, for overall economic progress of the state. Achieving faster agricultural growth is, therefore, very important to provide sustainable livelihood to its people. Thus, there is an



urgent need to increase the food production to meet the demands of increasing population as well as for providing rural employment.

In the process of developing Telangana, Irrigation & CAD Department of Telangana State is making every effort to harness and utilize all the available water resources for benefitting of Agricultural sector, Industrial Sector and also providing drinking water. The development of Irrigation in Telangana is mostly dependent on Godavari & Krishna Rivers and their tributaries, Tanks & Ponds.

As per the available data the excess flood occurs once in every four years and the excess flood has to be captured and stored during such year. The storage facilities for storing such flood plays major role in harnessing and conserving flood water. Hence, it is evident that a maximum extent of such flood water can be harnessed, provided with maximum storage facilities. Further, Sri Rama Sagar project was commissioned in the year 1964-69 with a designed capacity of 112 TMC, but due to heavy siltation from Godavari River which is an inherent parameter of Godavari River has reduced the effective storage capacity to less than 90 TMC over the years resulting in increasing the untapped flood water. In this context it is also a reason to have more storage capacity for tapping such flood. Thus, Telangana is utilizing this excess flood flow as a strategic importance and a pressing need towards a more equitable development of water resources for irrigation and other water requirements.

1.4. Scope of the study

As per the approved ToR, the scope of the study for the EIA report includes:

- Collection of baseline data for three (3) seasons (Pre- monsoon, Monsoon and Post - monsoon seasons) within 10 km radius of the project site and based on this the status of the existing environment in the area and capacity to bear the impact on this has been analysed.
- Identification of the relevant environmental concerns and focus on potential impacts that may be encountered during the construction phase of the proposed project and analysis of the capacity to bear the adverse impacts base on the base line data.
- Based on the analysis of adverse impacts and bearing capacity work out the mitigation measures to either fully neutralise the adverse impacts or at least minimizing the impact to be suggested in the EIA/EMP study.

The ToR minutes by EAC and compliance to the approved ToR are enclosed as Appendix I and II respectively. The methodology for carrying out an EIA study involves several key and interlinked activities as illustrated in the flowchart shown in **Figure 1.2**.

1.5 Legal and Regulatory Framework

EIA Notification 2006 is the principal piece of legislation governing EIA in India. Besides this, the Government of India under Environment (Protection) Act 1986 have issued number of notifications related to environmental impact assessment. The MoEF&CC is the nodal agency to set up policy and standards for the protection of environment, along with Central Pollution Control Board (CPCB). This includes air, noise, water and hazardous waste standards. The relevant regulation & standards, which are of significance to this project, are discussed in **Table No.1.1**.

Table No.1.1. Relevant regulation & standards

Name of regulation	Scope and Objective	Operational Agencies / Key Players
Environment Protection Act 1986. Environment Protection Rules	To provide for the protection and improvement of	Central Govt. MoEF&CC, can delegate power to Dept. of Environment



Name of regulation	Scope and Objective	Operational Agencies / Key Players
1989.	environment	
EIA Notification, New Delhi 14 th September 2006 and its amendments.	To provide Guideline for EIA Study	Central Government, Nodal Agencies MoEF&CC, State Governments
EIA - MoEF&CC circular, S.O. No 804 (E), dt.14 th March 2017 on violation of EC	To provide Remediation Plan and Natural and Community Resource Augmentation Plan	Central Government, Nodal Agencies MoEF&CC, State Governments
Water (Prevention and Control of Pollution) Act 1974	To provide for prevention & control of water pollution and enhancing water quality. Permission obtained prior to establishment of operation	Central and State Pollution Control Boards
The Forest (Conservation) Act, 1980	To obtain permission for diversion of forestland for surface rights and underground rights.	MoEF&CC, Forest Conservation Division.
Air (Prevention and Control of Pollution) Act 1981	To provide for the prevention and control of air pollution. Permission obtained prior to establishment of operation	Central and State Pollution Control Boards
Noise Pollution (Prevention & Control) Rules 2000	To control and take measures for abatement of noise and ensure that level does not cross standard	Central Government, nodal agencies MoEF&CC, State governments
Solid Waste Management Rules, 2016	To prescribe procedures for handling and disposal of solid waste	Central Government, nodal agencies MoEF&CC, State governments
Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2016	To impose restrictions and prescribe procedures for management, handling and disposal of hazardous waste	Central and State Pollution Control Boards
Consent for Operation	To issue consent for carrying out the operations	State Pollution Control Board
Consent for Establishment	Permission obtained prior to establishment of operation under the Air & Water act	State Pollution Control Board
Right to Fair Compensation Transparency Land Acquisition Resettlement and Rehabilitation (RFCT LARR) Act, 2013	Compensation for PDF and PAFs	I&CAD and Revenue Department

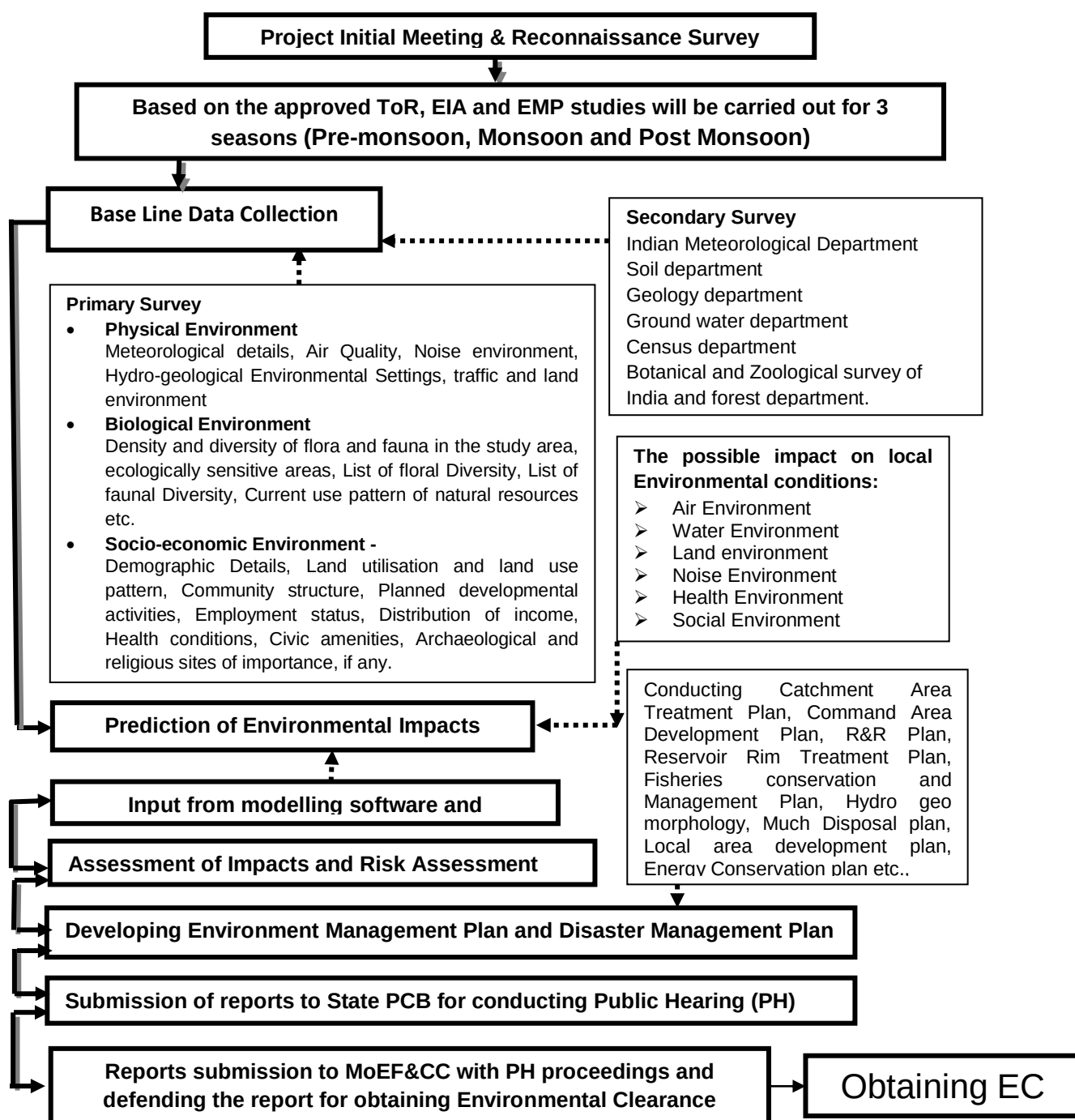


Figure 1.2 Flow Chart

1.6 Structure of EIA report

This EIA / EMP of IFFC from SRSP with expansion of Gouravelly reservoir project is prepared by following the generic structure prescribed in the Appendix-III of the S.O.1533 dated 14.09.2006, EIA Guidance Manual, 2010 posted on the MoEF&CC's website and Standard Terms of Reference (ToR) issued by Ministry of Environment, Forests and Climate Change (MoEF&CC) vide letter no. SEIAA/TS/OL/SDPT-37/2022 dated 15.02.2023 (**Appendix-I**). ToR conditions and their description in the EIA/EMP report are given as reference in **Appendix-IA**.



- **Chapter 1 - Introduction:** Details about the project background, initiatives of Govt., importance of the project and scope of the study.
- **Chapter 2 - Project description:** Depicts the details of project, location and the Eco-Sensitive.
- **Chapter 3 - Description of the environment:** Presents the baseline environmental conditions in the vicinity of the project site within 10 km radius for three seasons (i.e., Pre monsoon, Monsoon and Post Monsoon). Data pertaining to the ambient air quality, water quality, noise, soil quality, land-use pattern, flora – fauna study and socio-economic environment has been presented.
- **Chapter 4 - Anticipated Environmental Impacts & Mitigation measures:** Details of investigated environmental impacts based on project location and activities under the project.
- **Chapter 5 - Analysis of Alternatives (Technologies & Site):** Details about the strengths and opportunities involved in selecting the proposed project site as compared to alternative sites.
- **Chapter 6 - Environmental Monitoring Program:** Technical aspects of monitoring the effectiveness of mitigation measures.
- **Chapter 7 – Public Consultation:** Notification, minutes and responses by the ICAD department for the public opinions on EIA & EMP Report for Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir of Telangana.
- **Chapter 8 - Project Benefits:** Improvements in physical infrastructure, Improvements in social infrastructure, Employment potential, Other tangible benefits to the State both in terms of development of the state and sustainable livelihood to the people along with sustainable environment.
- **Chapter 9 – Cost Benefit Analysis:**
- **Chapter 10 - Environmental Management Plan:** Identification of mitigation measures and Implementation of mitigation plan along with effective monitoring cost for implementation of the plan.
- **Chapter 11 - Summary and Conclusions:** Overall summary of the project and its impact.
- **Chapter 12 - Disclosure of Consultant Engaged:** Disclosure of Consultants engaged in the preparation of EIA/EMP Plan.
- **Chapter 13 - Remediation Plan & Natural and Community Resource Augmentation Plan (NCRAP)**



2

PROJECT DESCRIPTION

2.1. Need for the project

The purpose of the project is to provide irrigation facilities to the chronically drought affected areas of Telangana region by gravity and lift irrigation utilizing the flood flows of Godavari at Sri Ram Sagar Project.

Telangana is situated on the Deccan Plateau, in the central stretch of the eastern seaboard of the Indian Peninsula. It covers 114,800 square kilometres (44,300 m²), which makes it the twelfth largest state of India. In terms of population also, Telangana is the twelfth largest state of India with a population of 35.3 million (2011 Census).

The region is drained by two major rivers, Godavari and Krishna. Between the two rivers Godavari and Krishna, Godavari is the bigger one, in fact the biggest among all the rivers in South India and second largest in the country. Out of the Godavari River catchment area situated in the erstwhile Andhra Pradesh State, about 79% of the catchment area lies within Telangana and 21% lies in Andhra. Similarly, out of the Krishna River catchment area situated in the erstwhile Andhra Pradesh State, about 69% lies within Telangana State and about 31% lies in Andhra. Most of the land in Telangana is semi-arid.

As per the Interstate agreement concluded under Godavari Water Dispute Tribunal Award (GWDTA), Telangana & Andhra Pradesh state (combined state) are having a share of 1480 TMC of water at 75% dependability. On the basis of GWDT award various agencies like WAPCOS, NWDA (National Water Development Agency), erstwhile Andhra Pradesh Government, have calculated the share of the erstwhile Andhra Pradesh Government and it has accepted the figure of 1480 TMC as the net water availability as its share and the same was reflected in various G.O.s while sanctioning the projects.

Telangana is a semi-arid area and has a predominantly hot and dry climate and it has a skewed distribution of rainfall in space and time.

The proposed command area of the project mainly falls under three agro climatic zones:

- **Northern Telangana Agro - Climatic Zone:** Adilabad, Komaram Bheem Asifabad, Nirmal, Mancherla, Nizamabad, Jagtial, Peddapalli, Kamareddy, Rajanna Sircilla and Karimnagar districts
- **Central Telangana Agro-Climatic Zone:** Sangareddy, Medak, Siddipet, Jangaon, Warangal Urban, Warangal Rural, Mahabubabad, Jayashankar Bhupalapally, Bhadradi Kothagudem and Khammam districts.
- **Southern Telangana Agro - Climatic Zone:** Vikarabad, Medchal Malkajgiri, Hyderabad, Yadadri Bhuvanagiri, Rangareddy, Mahabubnagar, Nalgonda, Suryapet, Wanaparthy, Nagarkurnool and Jogulamba Gadwal districts

The proposed cropping pattern for the command area of each agro-climatic zone with water requirement in **Figure 2.1**.

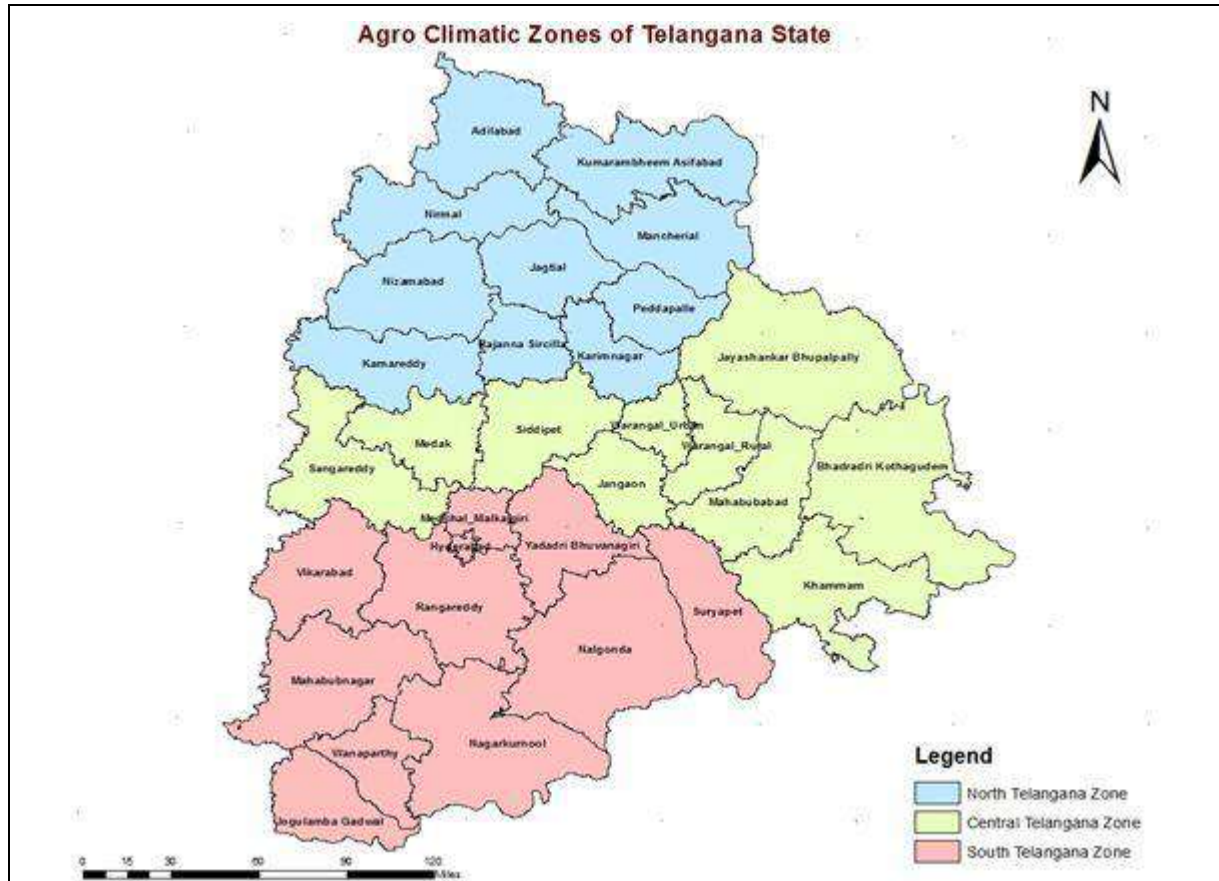


Fig 2.1 Agro-climatic zone

2.2. Location

The Location of proposed IFFC project starts at Foreshore of SRSP, Mupkal (V&M), Nizamabad district to Gouravelly reservoir, Gouravelly (V), Akkannapet (M), Siddipet District, Telangana State.

The Co-ordinates for two reservoirs are:

- Mid Manair reservoir: 18°23'34"N Latitude and 78°57'43"E Longitude
- Gouravelly reservoir: 18°05'15"N Latitude and 79°11'00"E Longitude

The flood water from the SRSP reservoir are proposed to be drawn through an off-take regulator proposed in the fore-shore of SRSP reservoir and to be carried through a flood flow canal and stored in the Mid Manair reservoir, Karimnagar district through link canal. Two irrigation canals are proposed from this storage reservoir to irrigate an extent of 32,374 Ha (80,000 Ac) in Rajanna Sircilla, Karimnagar & Siddipet districts by gravity. The flood water stored in the Mid Manair Reservoir are proposed to be lifted and carried through a lift cum gravity canal into a Gouravelly reservoir proposed at Gouravelly (V) of Siddipet district. Two irrigation canals are proposed from this storage reservoir to irrigate an extent of 48,560 Ha in Karimnagar, Hanumakonda, Siddipet and Janagaon districts by gravity. Toposheet of the project area is enclosed as **Figure 2.2**.

2.3. Size and Magnitude of operation

As per the EIA notification, 2006 and its subsequent amendment dated 20th April 2022, the proposed project comes under River valley category - schedule 1(c). Irrigation projects involving Inter-State issues shall be appraised at Central level without change in category, irrespective of the command area. The proposed project has the total culturable command



area of 2,20,000 acres (89031 ha) with no interstate boundary. So, the proposed project is considered at state level.

2.4. Project description

The Technical Advisory committee (TAC) of central water commission (CWC) in its 64th meeting on 30.03.1996 accorded approval for formation of three (3 Nos) reservoirs namely:

- (1) Combined storage Reservoir-I across Peddavagu-II and Korutla vagu near Konaraopet (V), Karimnagar district with a storage capacity of 7.346 TMC to irrigate an ayacut of 32,000 acres.
- (2) Mid Manair reservoir with a storage capacity of 25.873 TMC to irrigate an ayacut of 68,000 acres.
- (3) Gouravelly reservoir with storage capacity of 1.095 TMC to irrigate an ayacut of 1,20,000 acres duly utilizing 20 TMC of Flood water of Godavari River of foreshore of Sriram Sagar project. The total storage capacity under these three reservoirs is 34.314 TMC.

Later owing to protests and resistance from the local people against the construction of combined storage reservoir-I across Peddavagu-II and Korutla vagu near Konaraopet (V), Kathalapur (M), Karimnagar District, the then Government of Andhra Pradesh vide G.O Ms. No.209, Dt:17.11.1997 had dropped the combined storage reservoir —I across Peddavagu-II and Korutla vagu.

Thus, as a part of effective utilization of water allocation and to compensate the storage lost due to dropping of combined Storage Reservoir-I (7.346 TMC) near Konaraopet (V), an alternative proposal of increasing the Gouravelly reservoir capacity from 1.410 TMC to 8.230 TMC has been proposed.

The project is formulated & designed after careful planning and realistic approach to water requirement for irrigating the dry lands in the command area and drinking water requirements of the villages. The components of the IFFC are executed as follows.

Details of Flood Flow Canal Project components are as below.

- 1) Head Regulator at the foreshore of Sri Ram Sagar Project with approach channel.
- 2) The Flood Flow Canal is excavated from foreshore of SRSP Dam and finishes at the foreshore of MMR. It is excavated to divert flood water of Godavari from foreshore of SRSP with a length of 122 Kms covers erstwhile Nizamabad and Karimnagar Districts. The Technical details of the scheme are as follows:
 - FFC canal length = 122 Km
 - Canal section Bed width of 43 M, F.S.D = 8.50 M and
 - Free board of 1.50 M, with a discharge of 22,000 cusecs.
- 3) Irrigation Canals (4 Nos) from Flood Flow Canal with canal network system to Irrigate an ayacut of 20,000 Acres between Kakatiya Canal and FFC in Peddapally, Jagtial, Rajanna Sirisilla & Karimnagar District.

The following Mandals will be benefitted: Dharmaram, Pegadapalli, Choppadandi, Gangadhara and Ramadugu.

- 4) IFFC from SRSP It is proposed to lift 1.00 TMC of water per day to SRSP reservoir from Kaleshwaram project (via IFFC from 99 Km) with 3 lifts i.e., 1st lift proposed at km 73.00 of FFC at Rampur (V), Mallial (M) of Jagtial District, 2nd lift proposed at km 34.00 of FFC at Rajeswar Rao peta (V), Metapalli (M) of Jagtial District and 3rd Lift proposed at km



0.100 of FFC at Mukpal (V & M) of Nizamabad District including necessary 3 no's cross regulators to SRSP Reservoir for drinking water, stabilization of SRSP ayacut

- Total land acquired for 3 No's Pump Houses is Ac 48-11 ½ Gts.
- Pumps houses: 3 pump house x 8 pumps x each pump with 6.5 MW = 156 MW

5) Mid Manair Reservoir

The Mid Manair Reservoir is a Balancing Reservoir on Flood Flow Canal from SRSP at Km.122.00. This reservoir is proposed across Manair River connecting Manwada(V), Boinpally(M) on left side & Kandikatkur(V), Illanthakunta(M) on right side to impound 25.873 TMC of water to serve an ayacut of 80,000 Acres through L/s & R/s OTs by gravity flow and 1,20,000 Acres by lift irrigation and also caters the drinking water needs of 466 habitations through Mission Bhageeratha Scheme.

Salient Features:

Storage Capacity	:	25.873 TMC
Ayacut benefitted is	:	2,00,000 Acres (80,971.65ha)
Catchment Area	:	4,056.70 SQKM.
Maximum Flood Discharge	:	5,08,000 Cusecs
Submergence Area	:	19,468 acres
FRL	:	+318.000M
TBL	:	+323.000M

- 6) **MMR Canals:** MMR Right Main Canal is having a length of 75.140 Km and the ayacut contemplated under this canal is 80,000 Acres. Out of 75.140 Km, the carrying capacity of the MMR Right Main Canal is 2652 cusecs. Later the carrying capacity was increased to 4200 cusecs by increasing the F.S.D in the canal without changing other parameters.

MMR left canal takes off at Km 1.400 of Mid Manair Reservoir with a discharge of 161 Cusecs to irrigate an ayacut of 10500 Acres in Rajanna Siricilla & Karimnagar District.

Ayacut: Total 80,000 Acres.

The following Mandals will be benefitted (Illanthakunta, Ganneruvaram, Bejjanki, Boinpalli, Ramadugu, Gangadhara, Kotthapalli, Karimnagar, Shankarapatnam, Saidapur, Chigurumamidi, Manakondur and Thimmapur).

7) Lift to Gouravelly Reservoir

Salient Features:

Water supply to Gouravelly Reservoir	57.00 Cumecs
Length of water conductor System.	15.98 Km.(Approach Channel 4.00km + Tunnel11.98Km).
Total Head.	126.52 M
Number of Pumps.	3 Numbers.
Pumps Capacity	3x19 Cumecs



Type of Pumps	Vertical Centrifugal Pumps (Francis Type with adjustable guide vanes) .
Power Requirement	96 MW
Type of Motors	Synchronous Motors (3X32MW).

7) **Gouravelly Reservoir:** Gouravelly Reservoir is initially proposed with a capacity of 1.410 TMC near Gouravelly (V), Akkannapet (M), Siddipet (Dist) and later the Reservoir capacity was enhanced to 8.23 TMC.

Salient Features:

Description	Parameters
Capacity	8.23 TMC
FRL	+415.000 M
TBL	+419.300 M
MDDL	+393.800 M
Live storage	7.822 TMC
Dead storage	0.408 TMC
Ayacut	1,20,000 Acres
Head Regulators	2 No.s
Weir	1 no.
Bund length	Total length 10.567km, hillock portion 2.178Km net length 8.389 KM
Maximum Bund height	41.62 M
Right side OT	@ KM 6.800, sill level +389 M
Left side OT	@ KM 1.900, SL +392 M
Weir	@ KM 9.100, length 115M
Diversion road	10.000 KM
Submergence area	(1814 old+2056 new =3870 acres)
Villages coming under Submergence	Villages–Full Submergence 1) Gudatipally, Gram panchayath Tenugupally, Maddalapally and Kottapalli are H/o Gudatipally Villages- Partial Submergence 1) Gouravelly , 2)Janagoan , 3) Gandipelly 4)Regonda , 5)Nandaram , 6)Ramavaram)
R&R	Structures - 817 No.S (693 old+124 New) & Families – 1122 No.S (937old +185new)

7) Gouravelly Canals:

Gouravelly Right side Canal having a length of 47.725 Km and the contemplated ayacut is 90,000 Acres.



Gouravelly Left side canal is having a length of 16 Km with a contemplated ayacut of 16000 Acres.

High level Canal from Gouravelly Reservoir having a length of 20.845 Km to irrigate an ayacut of 14000 Acres.

Thus, the total ayacut under Gouravelly Reservoir is 1,20,000 Acres.

The line diagram of FFC from SRSP with expansion of Gouravelly reservoir is given in Figure 2.3.

2.4.1 Components of project:

(i) Water conveyance system consisting of gravity canals, tunnel and lift schemes :

- FFC Canal :122 km
- Reverse lift pump houses: 3 number
- MMR Canals:103.375 km
- Tunnel – 11.98 km
- Pump houses – 3 x 32MW(3x19cumecs)
- Gouravelly Canals-63.725 km
- High Level Canals-20.845 Km

(ii) Mid Manair reservoir: 25.873 TMC

(iii) Gouravelly reservoir: 8.23 TMC.

(iv) Distributor Network System

2.5. Command area

The proposed command area 2,20,000 acres (89030.84 Ha) of land will be cultivated in the drought prone districts of Telangana State. The districts covered are Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon. The district wise breakup of the command area is given in the Table 2.1. The map showing the command area is given in **Figure 2.4**. The Canal network in Command area of IFFC Project from SRSP with expansion of Gouravelly Reservoir is shown in **Figure No.2.5**.

Figure 2.3 Line Diagram of Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir

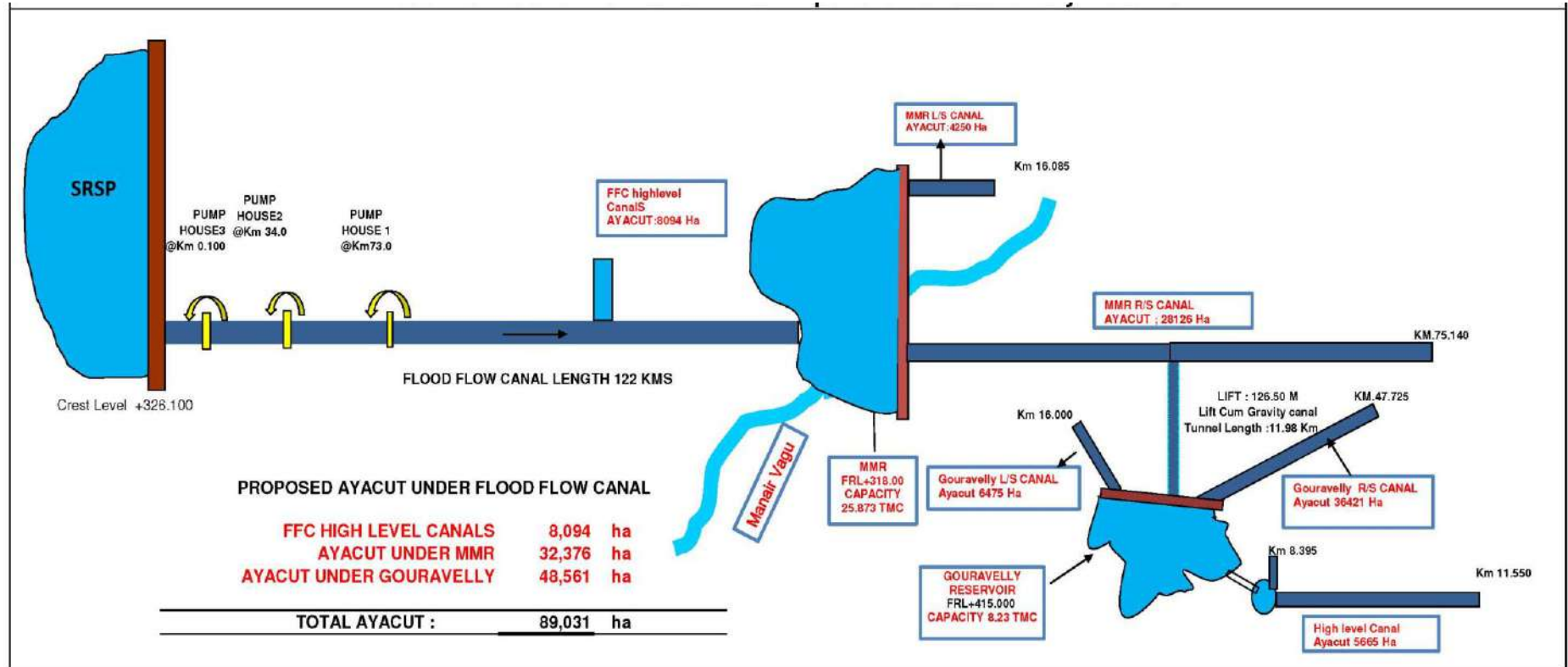


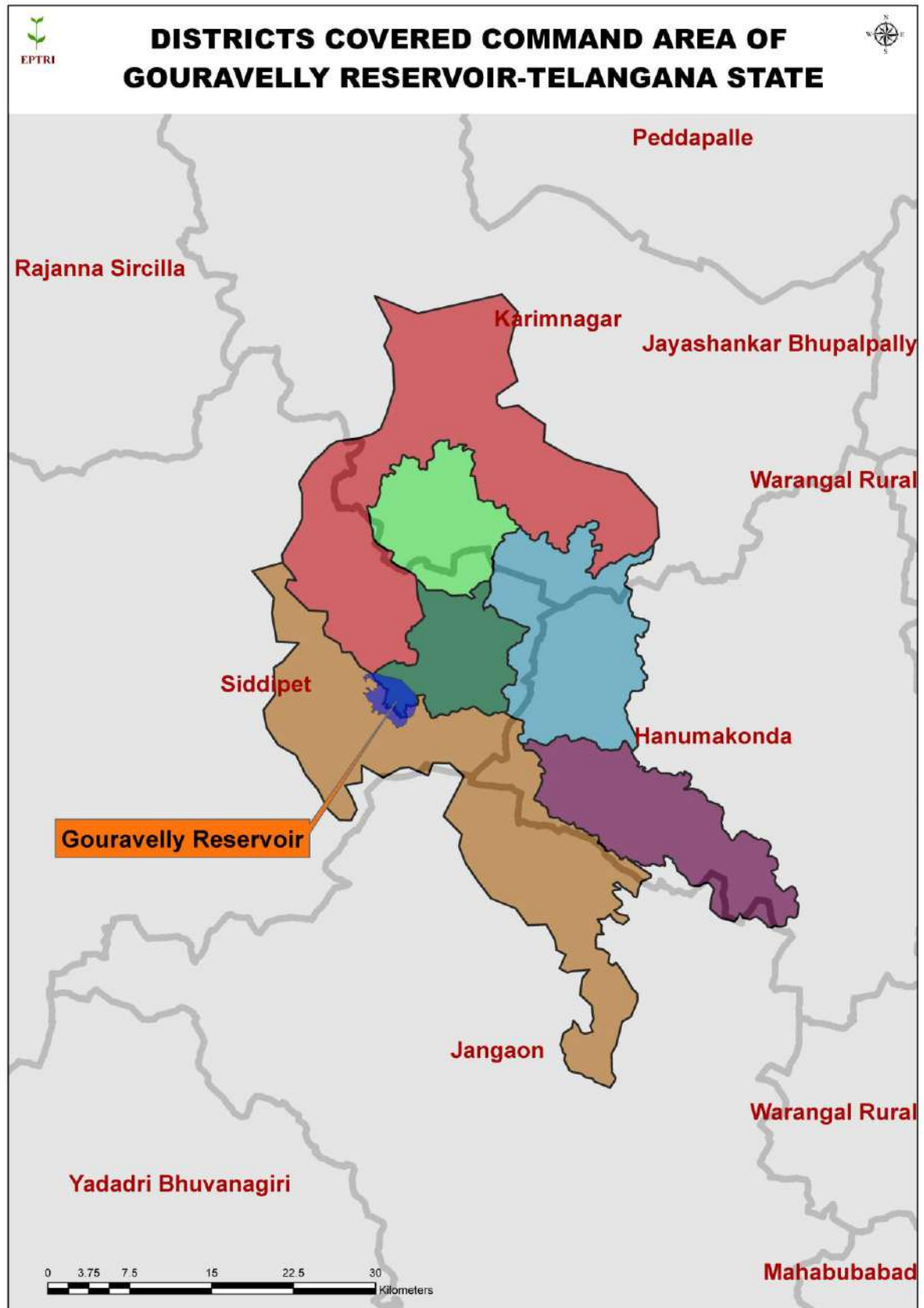


Table 2.1 Command area (Ayacut In acres)

Sl. No	Name of the District	Name of the Mandal	Total
1	Peddapalli	Dharmaram	3000
2	Rajanna Siricilla	Illanthakunta	5872
		Boinpally	3417
		Sub total	9289
3	Jagtial	Pegadapally	1750
4	Karimnagar	Kothapally	6517
		Gangadara	3180
		Choppadandi	5218
		Ramadugu	7493
		Ganneruvaram	10033
		Thimmapur	21759
		Manakondur	6363
		Shankarapatnam	754
		V. Saidapur	21730
		Chigurumamidi	21645
		Sub total	104692
5	Siddipet	Husnabad	10582
		Akkannapeta	16004
		Koheda	11900
		Bejjanki	1903
		Sub total	40389
6	Hanumakonda	Bheemadevarapalli	11852
		Velair	12594
		Dharmasagar	12010
		Kazipet	600
		Sub total	37056
7	Jangoan	Raghunathpally	3885
		Strn.Ghanpur	7223
		Chilpur	11816
		Zafarghad	900
		Sub total	23824
	Grand Total		220000



Figure 2.4 Command area





2.6. Approval And Implementation

The proposed production expansion will be commenced after obtaining Environmental Clearance under Environment (Protection) Act, 1986 from Ministry of Environment and Forests & Climate Change, New Delhi. The details of statutory obligations as specified by MoC / MoEF&CC / DGMS etc. is given in below:

SI No	Description	Status
1.	Site Clearance	The Site clearance for investigation & survey was accorded vide Lr. No.J-12011/26/2000-IA-I, Dt.24.06.2002. Annexure-2A
2.	Environmental clearance	The Environmental clearance for the IFFC project from SRSP was accorded vide Lr. No.J-12011/26/2000-IA-I, Dt.14.05.2003 to irrigate an ayacut of 2,20,000 acres (89068 ha) duly utilizing 20 TMC of flood water of Godavari River from fore shore of SRSP. Annexure-2B
3.	Forest clearances	The Forest clearances for canals and reservoirs was accorded vide Lr. Ref. No. 50907/99/F.1, Dt: 14-03-2000 & 14.09.2000 respectively. Annexure-2C
4.	Rehabilitation and Resettlement clearance	The Rehabilitation and Resettlement clearance is received from the Govt. of India vide MOTA Lr. no.20011/4/2003- CP & R, Dt. 02-09-2004. Annexure-2D
5.	Planning Commission	The Planning Commission (water Resources Division) accepted for investment in the State Plan with an estimated cost of Rs 1331.30 crores vide Lr.No.2 (322)/03-WR Dt: 08.12.2005. Annexure-2E
6.	CFE	CFE obtained on 04-09-2002 enclosed as Annexure-2H
7.	Certified compliance Report	MoEF&CC RO field inspection conducted on 10.04.2024 and CCR enclosed as Annexure-2I .

2.7. Environmental sensitivity

Forests/National parks/Sanctuary/Biosphere Reserve

There are 9 Reserve forests from foreshore of SRSP to Gouravelly reservoir around 1km radius along the canal and 10 km radius from the reservoir. Errapuram RF, Kottur RF, Rajeshwara Rao peta RF, Tatpalli RF, Rasagutta RF, and Pottigutta RF are within 1km radius from the canal. Chendragiri Reserve Forest and Anantharam Reserve Forest are along the FRL line of the Mid Manair Reservoir. Sirisilla RF is within 10 km radius from the reservoir. There is no forest land involved in the submergence due to the increased capacity of the Gouravelly reservoir.

There are no National parks, Sanctuaries and Biosphere Reserves within the study area.

No forest land is involved in Gouravelly reservoir submergence area and canal area. (Enclosed as **Annexure – 2F**)

Archaeological Monuments

There are no known structures of archaeological importance getting submerged or affected due to submergence of formation of new Gouravelly reservoir.

Historical Monuments



There are no known historical monuments getting submerged affected due to the Gouravelly reservoir project.



Tourism Infrastructure

There are no places of tourist importance coming under submergence or getting affected by the construction of the Gouravelly reservoir.

The details of environmental settings of the project are given in Table No. 2.2.

Table 2.2 Details of Environmental Settings

Details	Measurement
Nearest Habitation	Gouravelly village
Road access	Karimnagar (45km)/ Siddipet-Hanmakonda road 9 Km/NH-163 30 Km
Rail network	Nearest Railway Station – Kazipet (50 Km)
Sea Network	Vishakhapatnam and Kakinada
Nearest water source	Yellamma vagu and Husnabad Tank
River/Stream	Yellamma vagu (8Km)
Forest boundary	No Forest Boundary within the project site
Interstate Boundary	Not Applicable

2.8. Hydrology

The Flood Flow Canal Project from SRSP is conceived with an objective of irrigating 2,20,000 acres of ayacut in the drought prone areas of erstwhile districts of Karimnagar, Warangal and Nalgonda in Telangana region duly utilizing 20 TMC of flood water of Godavari River from foreshore of Sri Ram Sagar Project. This project was designed to counter the dearth of irrigation water to the above said uplands geographically coming under the Deccan plateau. The average annual rainfall ranges from 600 mm to 930 mm in the command area of the Flood Flow Canal from Sriram Sagar Project. During the monsoon season it is serving the cultivation for only one crop in a year. The project was formulated to raise the ground water table, provide drinking water, provide irrigation water for two crops to the remote fertile uplands and thereby increasing the land coming under cultivation and the crop productivity, further contributing to the enhancement of living standards of the people inhabited and appending to the GDP increase of India. As the livelihood of the majority people in this area is agrarian based and rainfed crops, the absence of major facilities or projects to capture and store the excessive flood water of Godavari River for future use make this project most significant and essential.

The Detailed Project Report was prepared and presented to the Central Water Commission (CWC), New Delhi in the year 1992-93 by the then State Government of Andhra Pradesh (Combined) and the same was approved by TAC in the year 1996. The CWC has accorded clearance to Flood Flow Canal project from SRSP in its 64th Technical Advisory Committee (TAC) meeting held on 03.04.1996 for an estimated cost of Rs. 1331.30 Crores (S.S.R. 1992-93) and the project was accepted as techno economically viable subject to certain technical observations and clearances from Ministry of Environment and Forests (MoEF) and Ministry of Tribal Affairs (MoTA). The details are as below.

Clearances:

- The Site clearance for investigation & survey was accorded vide Lr. No. J-12011/26/2000-IA-I, Dt.24.06.2002.
- There is no forest land involved in the project. However, forest clearances for canals and reservoirs were accorded vide Lr. Ref. No. 50907/99/F.1, Dt: 14-03-2000 & 14.09.2000 respectively.
- The Environmental clearance was accorded vide Lr. No. J-12011/26/2000-IA-I, Dt.14.05.2003.



- The Rehabilitation and Resettlement clearance is received from the Govt. of India vide MOTA Lr. No.20011/4/2003- CP & R, Dt. 02-09-2004.
- The Planning Commission (water Resources Division) accepted for investment in the State Plan with an estimated cost of Rs 1331.30 crores vide Lr.No.2 (322)/03-WR Dt: 08.12.2005.

History and description of works:

The DPR approved by CWC in 1996 envisages for the formation of 3 Nos. reservoirs namely.

- (i) Combined Storage Reservoir-I across Peddavagu II and Korutlavagu near Konaraopet (V), Karimnagar Dist. with a storage capacity of 7.346 TMC to irrigate an ayacut of 32,000 Ac.
- (ii) Mid Manair Reservoir with a storage capacity of 25.873 TMC to irrigate an ayacut of 68,000 Ac.
- (iii) Gouravelly Reservoir with storage capacity of 1.095 TMC to irrigate an ayacut of 1, 20,000 acres was proposed.

The total storage capacity under these three Reservoirs is 34.314 TMC. These proposals were approved by Technical Advisory Committee (TAC) of Central Water Commission (CWC) in the minutes of 64th meeting conducted on 03.04.1996 and also accorded approval for water utilization as below.

i) Surface water utilization

a)	Annual irrigation utilization	-	335.400 M. Cum (11.853 TMC)
b)	Drinking water supply	-	3.700 M. Cum (0.129 TMC)
c)	Average Annual Evaporation losses	-	226.400 M. Cum (8.00 TMC)
	Sub Total	-	565.500 M. Cum (19.982 TMC)
ii)	Ground water utilization	-	38.200 M. Cum (1.350 TMC)
	Grand Total	-	603.700 M. Cum (21.332 TMC)

Further, from the above required quantity of 21.332 TMC of water, the then Government of Andhra Pradesh state was accorded permission to divert and utilize 20.00 TMC of Godavari flood water according to the 64th TAC meeting in 1996.

Later owing to huge protests and resistance from the local people against the construction of Combined Storage Reservoir-I across Peddavagu II and Korutla vagu near Konaraopet (V), Kathalapur (M), Karimnagar District at Km 47.60 of FFC, the project was forced to have some modifications without changing the actual scope of work. Accordingly, the then Government of Andhra Pradesh vide G.O.Ms.No.209, dated: 17-11-1997 had bypassed the Combined Storage Reservoir-I across Peddavagu-II and Korutlawaagu.

In this context it is to convey that the excess flood as per the data available occurs once in every four years and the excess flood has to be captured and stored during such year, The storage facilities for storing such flood plays major role in harnessing and conserving flood water, hence it is evident that a maximum extent of such flood water can be harnessed provided with maximum storage facilities. If such storage is not available then it will not be possible to harness the excess flood to the maximum extent which defies the basic objective of the project. Further, Sriramasagar project which was commissioned in the year 1964-69 with a designed capacity of 112 TMC. But due to heavy siltation from Godavari river which is a inherent parameter of Godavari river made the effective storage capacity to decrease



to 90 TMC over the years therefore increasing the untapped flood water. In this context it is also an edge to have more storage capacity for tapping such flood.

The water utilisation and allocation is one of the major factor and played phenomenal role in the formation of Telangana state. After formation of Telangana state the Government has reviewed the existing irrigation projects and as a part of effective utilisation of water allocation and to compensate the storage lost due to dropping of Combined Storage Reservoir (7.346 TMC) near Konaraopet (V), an alternative proposal of increasing the Gouravelly reservoir capacity from 1.409 TMC to 8.230 TMC has been proposed. As the already proposed Gouravelly reservoir is bestowed with advantages such as (i) Geographical advantage of the site at which the reservoir was proposed, (ii) minimal submergence of lands for the increased storage capacity and (iii) minimum number of families displacement which are favourable for consideration of enhanced storage capacity of Gouravelly Reservoir.

The Environmental Clearance accorded for Flood Flow Canal Project includes the Gouravelly reservoir with a capacity of 1.095 TMC only. Due to raising FTL of Gouravelly reservoir to increase the capacity from 1.095 TMC to 8.23 TMC, the revised Environmental Clearance for the Gouravelly reservoir is being taken up due to increase in submergence of land in foreshore area of Gouravelly Reservoir. I&CAD has prepared the 1m interval area capacity map/graphical representation of expanded Gouravelly Reservoir (8.23 TMC) is furnished in **Figure 2.6**.

Water Flow

Water level in the Sri Ram Sagar Project, second major irrigation project in Telangana, has slowly but steadily been increasing with heavy rains in the catchment areas of the Godavari. The monthly total water inflow and out flow from Sri Ram Sagar Project from 2011 to 2022 is given in **Annexure-2G**. The water inflow and out flow to Laxmi, Saraswathi, Kakatiya, FFC and lift irrigation scheme from 2011 to 2022 on 31st of May and 1st of June every year is given in Table 2.3

2.9. Earthquake history

Taking into account the history of the past earthquakes in the area, it is surmised that in this area slightly damaging earthquakes are naturally expected, and small shocks are known to have occurred. An earthquake of magnitude 3 was felt on 15.09.1975 at the lower Manair dam site prior to its construction. This epicentre was about 25 kms east of Manwada.

The values of seismic co-efficient assumed in the design of structures are:

- ✓ Horizontal inertia coefficient $H = 0.04$
- ✓ Vertical inertia coefficient $V = 0.02$

No faults are reported in the geotechnical investigation report.

Seismic Zonation

As per the seismic hazard map of India 2000 by the Bureau of Indian Standards (BIS), the project area lies in Seismic Zone II (Least active).

The following are the assumptions made in the design of earthquake resistant structures for seismic analysis:

- Resonance as visualized under steady state sinusoidal excitation will not occur in the structure.
- Earthquake in not likely to occur simultaneously with wind or maximum flood or maximum sea wave conditions.
- The value of elastic modulus of materials, wherever required, may be taken as for static analysis.



Table 2.3 Water inflow & outflow from SRSP (2011 to 2022)

		Opening Storage			Out flow							End of storage		
1st June Year	31st May Year	Level	Capacity	Total Inflow (TMC)	Laxmi	Sara swathi	Kakatiya	Lift Irrigation Scheme	Flow over spillway	Total Out flows	Evaporation & other losses	Level	capacity	Total outflow (TMC)
2011	2012	1061.00	14.653	172.597	2.45	10.18	100.42	23.698	24.05	169.43	10.03	1052.900	7.79	179.461
2012	2013	1052.90	7.789	54.238	2.176	1.767	33.536	6.352	0	46.692	5.09	1056.300	10.2	51.782
2013	2014	1056.3	10.245	233.783	1.556	11.29	90.572	36.634	68.51	207.09	10.627	1068.600	26.3	217.721
2014	2015	1068.6	26.307	14.287	1.116	1.66	15.22	0.104	0	21.893	7.205	1058.000	11.5	29.098
2015	2016	1058.00	11.496	1.971	0	0.162	6.629	0.000	0	6.791	2	1046.700	4.68	8.791
2016	2017	1046.70	4.676	360.49	4.066	8.574	86.975	7.986	203.4	343.99	12.186	1054.600	8.99	356.173
2017	2018	1054.60	8.993	75.318	3.317	3.575	46.074	3.914	0	70.713	7.01	1050.700	6.59	77.723
2018	2019	1050.70	6.588	85.594	3.299	3.523	42.833	3.926	0	68.25	20.275	1049.398	5.88	83.304
2019	2020	1049.398	5.878	168.128	2.497	6.604	52.24	7.51	57.77	126.85	17.43	1070.400	29.7	144.284
2020	2021	1070.40	29.722	371.907	5.675	10.86	76.094	12.702	231.2	361.76	21.053	1064.250	18.8	382.812
2021	2022	1064.25	18.817	682.111	3.158	8.686	77.354	11.815	546.7	661	20.275	1064.801	19.7	681.274



Based on this assumption seismic analysis has been carried out only for pond level conditions. The project area seismic zone map is shown in **Figure 2.7**.

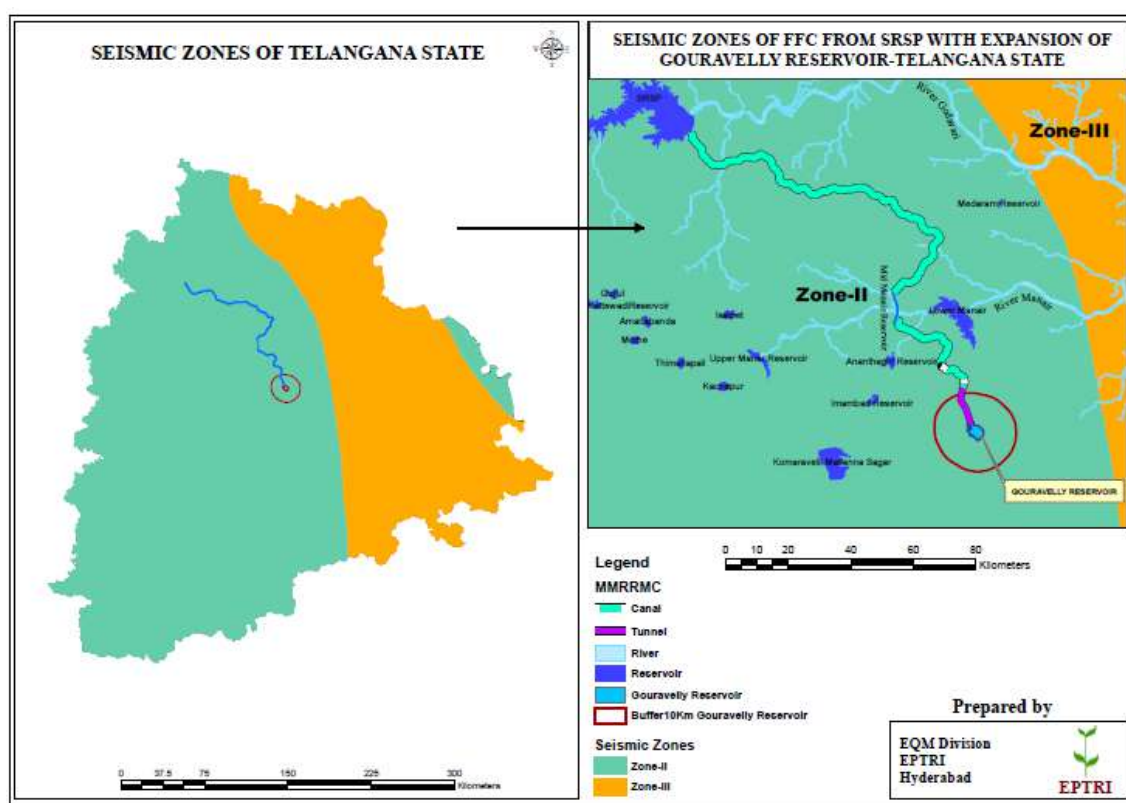


Figure 2.7 Seismic Zone Map

2.10. Drainage

Due to the proposed project, there will be recharge to the groundwater. and it may create water logging and drainage problem in the command area. Therefore, it is suggested that conjunctive use of the ground water may be encouraged in the command area. While making irrigation planning in the present project, water allowance for the cropping pattern will be changed such that there is no excessive groundwater recharge with the introduction of irrigation.

2.11. Land requirement

Most of the area under the command is one of the hard-core chronically drought affected area of the state. The project envisages acquisition of about 16777 ha (41439 acres) of land for various project appurtenances. The details of land acquisition are given in Table No.2.4.

Table 2.4 Details of Land Acquisition

Project component	Land required (Ha)
Flood flow canal from 0.00 km to 122 km	2996
FFC canal network	518
Mid Manair Reservoir	7882
MMR R/s & L/s Canals	1863
Tunnel & Lift scheme	132
Gouravelly Reservoir (including expansion area)	1567
Three Irrigation Canals from Gouravelly Reservoir	1819
Total	16777



2.12. Water Availability

The project envisages to utilize surplus flood water available at Sri Rama Sagar Project over and above the requirement of Sri Rama Sagar Project Stage-I and Stage-II. The surplus flood flows are observed for 37 years from 1950 to 1986. The divertible flood flows are calculated as per capacity of the flood flow canal and appended. The surplus flood flows are varying from (minimum) 215 M.cum (12.123 TMC) to (maximum) 2894 M.cum (721.905 TMC).

Central Water Commission (CWC) in the minutes of 64th meeting conducted on 03.04.1996 and accorded approval for water utilization is given in Table 2.5.

Table 2.5 Water availability calculations

<u>Surface water utilization</u>	
✓ Annual irrigation utilization	= 335.40 M.Cum (11.853 TMC)
✓ Drinking water supply	= 3.70 M.Cum (0.129 TMC)
✓ Average Annual Evaporation losses	= <u>226.40 M.Cum (8.00 TMC)</u>
Sub Total	= 565.500 M.Cum (19.982 TMC)
<u>Ground water utilization</u>	= <u>38.20 M.Cum (1.350 TMC)</u>
Grand Total	= 603.700 M.cum (21.332 TMC)

From the above required quantity of 21.332 TMC of water, the then Government of Andhra Pradesh state was allowed to divert and utilize 20.00 TMC of Godavari flood water according to the 64th TAC meeting in 1996.

Power

The total Power requirement for the Project is 96 MW for three pumps. Power to various lift points is to be availed from the respective power supply authorities. The Power supply shall be met from the DG sets of adequate capacity and shall be installed for putting into service in case of power failure for lighting and colonies.

This project requires 1 No. of lift in Siddipet district. The civil and electrical works of substations near pump house, drawing suitable power lines of 220 /132 /11 KV as per the requirement existing nearby power grids. The total power required for the project is about 96 MW. The Pump house requires power supply at various voltages ranging from 220KV to 11KV.

✓ Number of Pumps	= 3 Numbers
✓ Pumps Capacity	= 3x19 Cumecs
✓ Type of Pumps	= Vertical Centrifugal Pumps (Francis Type with adjustable guide vanes)
✓ Power Requirement	= 96 MW
✓ Type of Motors	= Synchronous Motors (3X32MW)

Electro-Mechanical Equipment

The electro-mechanical equipment consists of pumps, motors, governing system, motor starting equipment, transformers, isolated phase bus ducts, oil pumping system, inlet valve



and other pump house auxiliaries viz. crane, air conditioning and ventilation system, lighting system, fire protecting system etc.

220/132 KV switchgear

The 220/132 KV switchgear is of the conventional outdoor type and include SF circuit breakers, isolators, current transformers, potential transformers, surge arrestors, PLCC equipments, switchyard structures, insulators, hardware, busbars & earth wire, conductors and accessories etc. Connection between the main transformers and the switchyard is by means of overhead conductor.

2.13. Employment Generation

The implementation of Irrigation scheme will create employment opportunities in the project area. The employment is associated with improved farming practices as well as the construction of the irrigation scheme. Temporary labour (about 700) is hired during construction of the project flood flow canal, gravity canals, gravity tunnels, pressure mains/delivery mains and storages. The people will be spread over the entire project area which comprises of flood flow canal and storages system.

With irrigation additional farm labour would also be required as a result of higher cropping intensity through double cropping providing employment opportunities to local people within and outside the vicinity of the project area.

Further establishment of agro, aqua and ancillary industries would give rise to employment to the local people.

2.14. Rehabilitation and Resettlement

A resettlement & Rehabilitation (R&R) Master Plan highlighting the guidelines of land acquisition and provision for rehabilitation measure was formulated. The rehabilitation policies of the state government of Telangana and RFCTLARR Act, 2013, Government of India are used as basis for preparation of the R& R plan for the project affected families.

The details of R&R of the project are given in Table No.2.6

Table 2.6 Details of R&R after enhancement of Gouravelly Reservoir capacity to 8.230 TMC

S.No.	Name of the Reservoir					
		Land Acquisition (Ha)	No. of Villages affected	No. of Houses affected	No. of Families affected	Ayacut (Ha)
1	Flood flow canal from 0.00 km to 122 km	2996	-	-	-	-
2	Combined storage Reservoir 1 across Peddavagu-II & korutla vagu	-	-	-	-	-
3	canals under Combined storage Reservoir	-	-	-	-	-
4	FFC canal network	518	-	-	-	8094
5	Mid Manair Reservoir	7882	Fully- 11 partial- 07	7189	10683	-



S.No.	Name of the Reservoir					
		Land Acquisition (Ha)	No. of Villages affected	No. of Houses affected	No. of Families affected	Ayacut (Ha)
6	MMR R/s & L/s Canals	1863	-	-	-	32358
7	Tunnel & Lift scheme	132	-	-	-	-
8	Gouravelly Reservoir (1.410) TMC	1567	Fully- 04 partial- 06	817	1122	-
9	R/S and L/S Irrigation Canals from Gouravelly Reservoir	1587	-	-	-	42915
10	High Level Canal from Gouravelly Reservoir	232	-	-	-	5666
	Total	16777	Fully- 15 partial- 13	8006	11805	89033

2.15. Project Cost Estimation

It is contemplated to irrigate a command area of 89031 Ha in Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon (erstwhile districts of Karimnagar Warangal and Nalgonda) Districts of Telangana and provide drinking water to enroute villages.

The cost of the project is Rs. 5940.09 Crores @ 2015-16 PL.

The cost estimates are given in Table No.2.7.

Table 2.7 Cost Estimation

S.No.	Item	Amount in Rs. Lakh		
		Unit-I*	Unit-II**	Total
	Direct Charges			
I	Total of I-Work	254696.45	294120.03	548816.48
II	Establishment charges @ 9%&11% of I-work less B land for Unit-I and Unit-II respectively	6072.23	28052.91	34125.13
III	Tool & Plants @ 1 % of cost of I works	-	-	-
IV	Other charges i.e., insurance bankers' charges, VAT, labour welfare cess			
V	3.3% on Buildings	210.82	37.45	248.27
	Total	260557.86	322135.48	582693.34
	Indirect Charges			
a)	Capital value of abatement of land revenue (5% of Culturable land revenue of B –land)	9361.36	1954.68	11316.04
B)	Audit and account charges @ 1% of cost of I – work	-	-	-
	Total indirect Charges (A+B):	9361.36	1954.68	11316.04
	Total direct and indirect charges	269919.22	324090.16	594009.38
	Grand total cost in crores	2699.19	3240.90	5940.09

*Unit – I : Head works – Barrages & Storages

**Unit – II : Canal and distributary network



Gouravelly Reservoir

The estimates are prepared as per the CWC publication "Guidelines for preparation of estimate for river valley projects". Schedule of Rates for the year 2007-08 are followed.

Classification of Units

The project works are grouped into two units:

Unit-I Head-Works including earth bund, OT sluices, Weir and diversion road works.

Unit-II Two irrigation Canals from Gouravelly Reservoir

Minor Heads:

(i) Direct Charges

- (I) Works
- (II) Establishment
- (III) Tools and Plant
- (IV) Suspense.
- (V) Receipts and recoveries on capital account

(ii) Indirect Charges:

- a) Capitalized value of abatement of land revenue, and
- b) Audit and account charges.

The cost of various units is compiled in a tabular form according to the various account's heads in Table 2.8.

Table 2.8 Cost of various units of Gouravelly reservoir

In Lakhs				
S.No	Description of Work	Unit-I Gouravelly Reservoir	Unit-II Gouravelly Canals	Total
	Direct Charges			
I	Works			
A	Preliminaries	293.22	180.49	473.71
B (a)	Land Acquisition	12142.00	5527.72	17669.72
(b)	Rehabilitation & Resettlement	23605.00	0	23605.00
C	Works	55166.02	0	55166.02
D	Regulators	728.80	80.29	809.09
E	Falls	0	26.82	26.82
F	C.D Works	0	1993.79	1993.79
G	Bridges	0.00	680.99	680.99
H	Escapes	0.00	0	0.00
I	Navigation	0	0	0.00
J	Power Plant/appurtances	0	0	0.00
K	Buildings	25.00	0	25.00
L	Earth work and lining		0	0.00
	a) Earth Work	0.00	2368.02	2368.02
	b) Lining	0.00	2149.41	2149.41



S.No	Description of Work	Unit-I	Unit-II	Total
	c) Service Road	0.00	0	0.00
	d) Tunnel	0.00	0	0.00
M	Plantation	0	0	0.00
N	Tanks and Reservoirs	0.00	0	0.00
O	Miscellaneous	60.79	65.22	126.01
P	Maintenance	1166.56	333.76	1500.32
Q	Special tool & Plants	0	0	0.00
R	Communications	973.11	0	973.11
S	Power Plant & Electrical System	0	0	0.00
T	Water Supply	0	0	0.00
U	Distributary System	0	7407.78	7407.78
V	Water Course	0	1480.22	1480.22
W	Drainage	0	0	0.00
X	Environment & Ecological charges	0.00	0	0.00
Y	Losses on stock and unforeseen item 0.25% of cost of works less A,B&Q	0.00	41.4663	41.47
	TOTAL	94160.50	22335.97	116496.47
i	For Technical Agents	0.00	0	0.00
ii	For Insurance	0.00	0	0.00
iii	For Price escalation	25445.50	6423.920834	31869.42
iv	Amount deposited to Railways & NH Department	0	568.86	568.86
v	Additional Item: (Extra Length, New Structure, BT Roads, Extra Depths Etc)	0	0	0.00
	TOTAL of (i) to (v)	25445.50	6992.78	32438.28
	TOTAL Rs.	119606.00	29328.75	148934.76

The administrative approval for the Gouravelly reservoir project with enhanced capacity of 8.23 TMC was accorded by the Government of Telangana for an amount of Rs.1196.06 Crores vide G.O.Ms. No. 533, I&CAD (Projects-IV) Department Dt: 26.05.2017. However, the cost for construction & execution of Gouravelly reservoir with gross capacity of 8.23 TMC water is Rs. 583.277 Crores in which environmental clearance for an amount of Rs.43.133 crores towards 1.41 TMC capacity was already accorded. Hence, the violation cost of Gouravelly reservoir for enhanced capacity is only Rs.540.144 crores.

2.16. Benefit –Cost Ratio

The project being a multi-purpose project, the proportionate cost of project with Irrigation demand and drinking water supply to villages is worked out on proportionate utilization of water quantity.

The Benefit – Cost Ratio works out to be 1.328. (Flood Flow Canal (FFC) project originally cleared in the 64th TAC of CWC, Dt 30.03.1996) and The I&CAD as prepared Benefit – Cost Ratio for expansion of Gouravelly 8.23 TMC and arrived at 1.87. (The detailed B/C ratio calculations are given in Section 9.1 of Chapter-9.)



3

DESCRIPTION OF ENVIRONMENT

3.0 Baseline Data for Environmental Components and Methodology

The establishment of baseline for different environmental components in the study area and at the project site has been done by conducting field monitoring for baseline data generation. The data generation was carried out covering: Ambient Air Quality, Noise Levels, Water Quality, Soil, Terrestrial biodiversity, Ecological study and Socio-economic features through primary data collection.

Besides, above data additional data/information regarding Meteorology, demographic pattern and socio-economic conditions were collected from concerned government departments, census records, and meteorological department.

Baseline Data for Environmental Components

The environmental components - air, water, noise, land and biological studies were monitored in the study area as per the approved ToR by SEIAA vide No. SEIAA/TS/OL/SDPT-37/2022 dated 15th February, 2023 and guidelines of CPCB / MoEF&CC. The sampling stations were chosen in such a manner as to cover the major pollution generating locations such as reservoirs, canal and command area.

3.1 Site and its environs

3.1.1 Physical Geography

The project area covers the part of erstwhile seven districts namely: Adilabad, Karimnagar, Nizamabad, Nalgonda, Rangareddy, Warangal and Medak under Telangana State located in Southern peninsular India. The region is generally hot and dry except during southwest monsoon season and is characterized by periodic deficit rainfall and uneven distribution leading to drought conditions.

3.1.2 Topography

The project area is situated largely in an upland region of the Deccan plateau. Drainage is dominated by the basins of the Godavari River in the north and the Krishna River in the south. Large area is characterized by undulating topography, at place exhibits rugged topography formed by hills and hill ranges. As a result of erosion, the topography of the area consists of graded valleys with red sandy soil and isolated hills.

3.2 Geology

3.2.1 Regional Geology of Study area

Regional Geology gives a broad account of the overall stratigraphy, structural setup surrounding project site and helps in inferring and proper interpretation of geological setup and adverse structural features, if any, that may influence in selecting the site. Regional geology of the area is studied from published geological maps, reports and satellite imagery data of Geological Survey of India.

Site Geology

The Mid Manair reservoir and Gouravelly reservoir are a part of hard rock terrain of Deccan plateau with coarse grained pink hornblende granite rock formation of proposed structure. The Gouravelly reservoir bund is mostly covered by brownish insitu hummocky granite exposures. Solid to massive sheet rock is exposed on the left bank of the stream. These rocks are intruded by dolerite dykes. Two sets of joints NE-SW and NW-SE trend with vertical to near vertical dips are noticed in the area. The thickness of weathered formation is observed to be of 1m to 2m underlain by moderate to highly weathered granite. The dyke

alignment on the left flank has exposed fairly fresh granite rocks, where as the saddle portion is cultivated.

3.3 Meteorology

The quality of air pollutants is influenced by the movements and characteristics of the air mass into which they are emitted. If the air is calm and pollutants cannot disperse then the concentration of these pollutants will build up. Conversely, if a strong, turbulent wind is blowing, pollution generated will be rapidly dispersed into the atmosphere and will result in lower concentrations near the pollution source.

The measurements of wind speed, direction, temperature, humidity, rainfall and solar radiation are important parameters used in the study of air quality monitoring. The measurement of meteorological parameters is important to have an understanding of the impacts of a region's meteorology on air pollutant concentrations and is also used to simulate and predict air quality using computer models.

3.3.1 Description of meteorological station and equipment

As per the CPCB guidelines on methods of monitoring and analysis, an automatic meteorological station was installed in the project impact area for monitoring micro-meteorology. The equipment has sensors to record wind speed, wind direction, rainfall, relative humidity and ambient temperature at predefined intervals ranging from 20 seconds to one hour intervals. The data logger provided in the instrument would facilitate downloading of the meteorological data on to the computer with the help of the software provided.

The meteorological data was recorded on hourly basis for the study period for the parameters of wind direction, wind speed, temperature, relative humidity and rainfall.

3.3.2 Summary of Micro-meteorological data

Winter season December, 2022 - February, 2023 (01.12.2022 to 28.02.2023)

The predominant wind direction is blowing from South West (SW) direction, followed by East-South East (E-SE) winds and Calm conditions prevailed is 16.20% of the time during this period. The maximum wind speed recorded was 13.3m/s. The maximum temperature recorded was found to be 38.5⁰C, while the minimum temperature was 12.3⁰C and the average temperature is 24.9⁰C. The average relative humidity was found to be 62.4%. No rainfall observed during this season.

The summary of monthly micro-meteorological data (wind speed, wind direction, temperature, relative humidity and rainfall) for study period is given in Table 3.1. Summary of micro-meteorological data generated for the study period is given in Table 3.2 and the windrose diagram is shown in Fig.3.1.

Pre-monsoon season March to May 2023

The predominant wind direction is blowing from South East (SE) direction, followed by East-South East (E-SE) winds and Calm conditions prevailed is 20.24% of the time during this period. The maximum wind speed recorded was 6.2m/s. The maximum temperature recorded was found to be 44.3⁰C, while the minimum temperature was 17.9⁰C and the average temperature is 30.1⁰C. The average relative humidity was found to be 45.6%. The total rainfall observed during this study period is found to be 26.2mm.

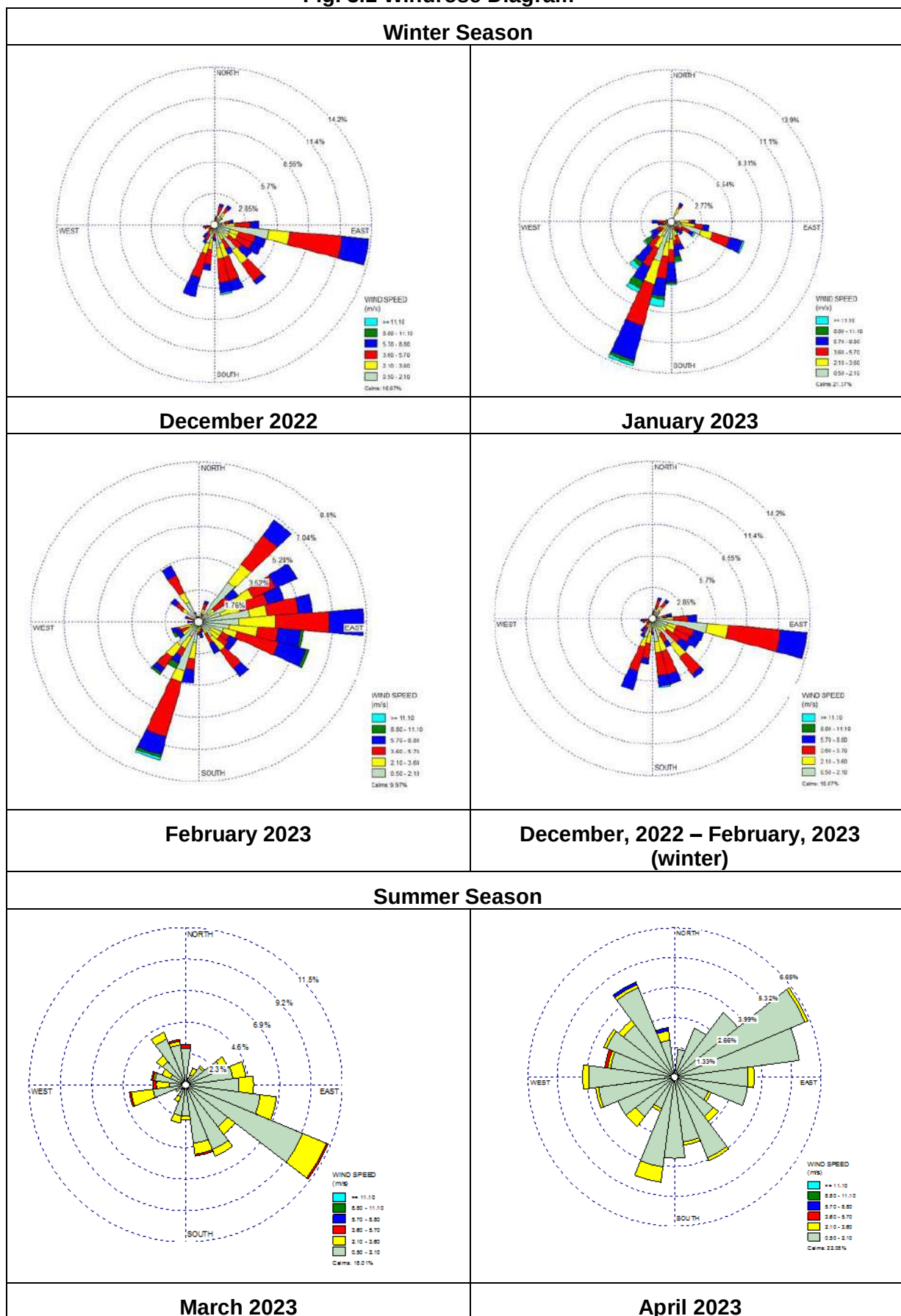
Table 3.1 Summary of monthly Micro-Meteorological data

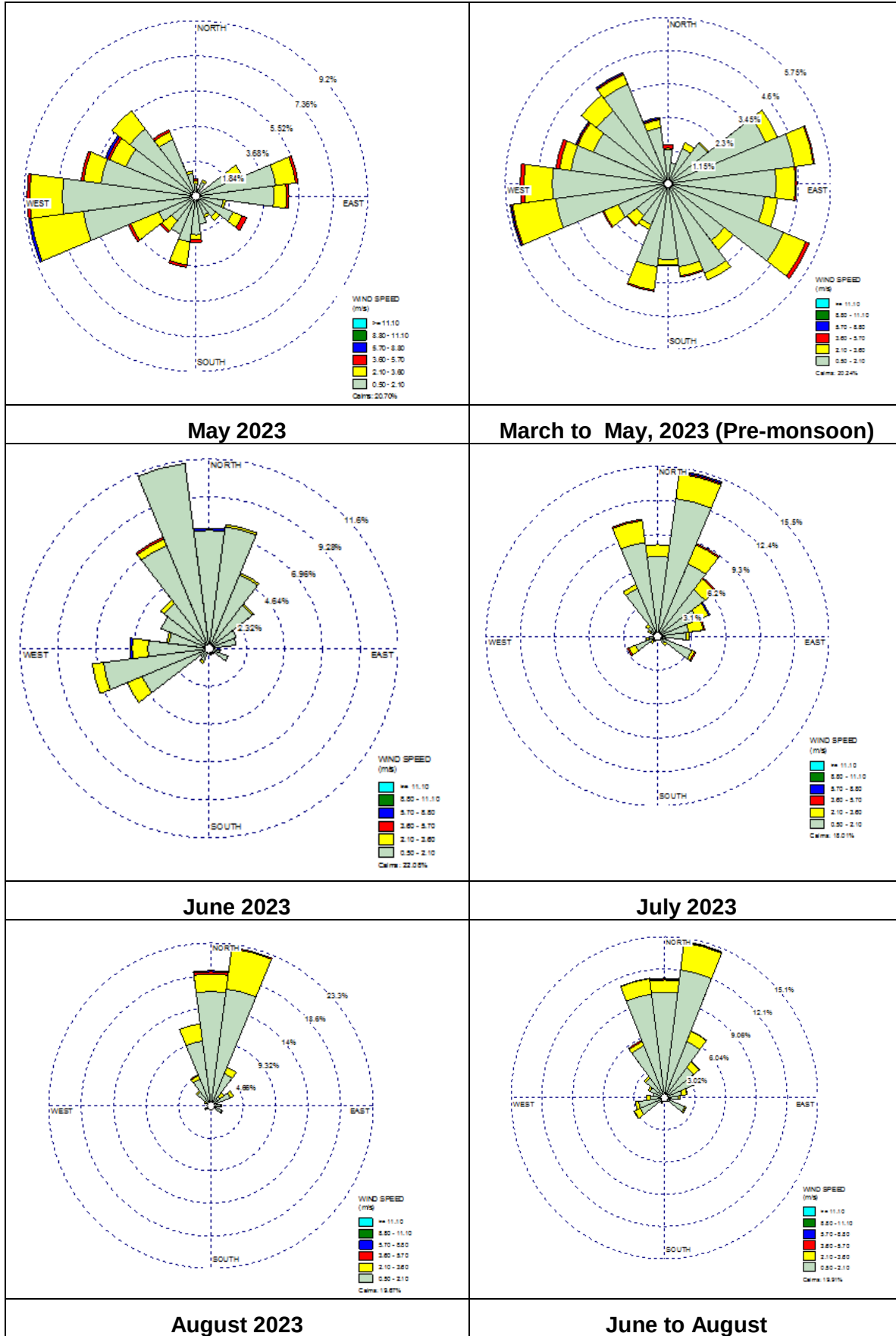
Month	Wind Speed (m/s)			Temperature (°C)			Relative Humidity (%)			Rainfall (mm)	
	Mean	Max	Calm %	Mean	Max	Min	Mean	Max	Min	Total	Hourly highest
December, 2022	1.9	6.1	16.67	25.1	35.6	15.0	89.5	97.8	25.0	0.0	0.0
January, 2023	3.4	13.3	21.37	24.1	33.4	12.3	61.4	87.2	16.4	0.0	0.0
February, 2023	3.4	11.4	9.97	25.5	38.5	13.4	48.3	87.6	12.9	0.0	0.0
March, 2023	1.4	5.5	18.00	28.0	37.8	17.9	45.6	97.0	5.9	12.9	1.0
April, 2023	1.0	6.2	22.08	30.8	41.8	22.1	44.0	90.2	7.7	1.9	0.5
May, 2023	1.4	6.0	20.70	31.6	44.3	22.0	48.1	99.9	5.9	11.4	1.0
June, 2023	1.0	7.5	22.08	32.2	44.0	22.8	60.9	99.9	17.5	85.4	8.0
July, 2023	1.4	6.0	18.01	26.8	35.5	22.6	96.2	99.9	57.1	677.5	19.0
August, 2023	1.4	6.5	19.67	27.7	33.1	22.0	95.3	99.9	57.1	24.9	20.8

Table 3.2 Summary of Micro-Meteorological data generated for the entire study period (3 Seasons)

S.No	Parameter (s)	Min	Max	Mean
1.	Temperature (°C)	12.3	44.3	28.0
2.	Wind Speed (m/s)	18.95	13.3	1.8
3.	Relative Humidity (%)	5.9	99.9	63.6
5.	Total Rainfall (mm)	814.0		

Fig. 3.1 Windrose Diagram





Monsoon season (June to August 2023)

The predominant wind direction is blowing from North East- North (NE-N) direction, followed by North (N) winds and Calm conditions prevailed is 19.91% of the time during this period. The maximum wind speed recorded was 7.5m/s. The maximum temperature recorded was found to be 44.0°C, while the minimum temperature was 22.0°C and the average temperature is 29.0°C. The average relative humidity was found to be 83.6%. The total rainfall observed during this study period is found to be 787.8mm.

3.4 Air Environment

3.4.1 Baseline Status of Air environment with respect to conventional pollutants

The ambient air quality depends upon the emission scenario, meteorological conditions and the background concentrations of the pollutants. The study on baseline ambient air quality status in the study area of the project is an essential and primary requirement for assessing the impacts on air environment due to proposed developmental activity. The study is necessary to identify environmentally significant issues prior to initiation of the proposed activity as well as to estimate/assess the potential critical environmental changes likely to occur when the project is commissioned. The baseline status of air environment includes identification of specific air pollutants expected to have significant impacts on air and assessing their existing levels in ambient air within the study area. The baseline status of air environment with respect to the identified conventional air pollutants can be established through air quality monitoring programme using methodically designed air monitoring network. Micro-meteorological data collection is an indispensable part of any air pollution study. The baseline studies for air environment within the study area were carried out through reconnaissance followed by ambient air quality monitoring programme.

3.4.2 Design of Ambient Air Quality monitoring network

The studies on air environment consist of assessment of existing status of ambient air quality and collection of meteorological data to delineate the baseline status of the region. Representative selection of sampling locations is primarily guided by the topography, micro-meteorology of the region and direction of air movement. A methodically designed ambient air quality monitoring (AAQM) network covering 10 sampling locations were designed using the following criteria:

- Persistence of wind direction and speed
- Representation of regional background

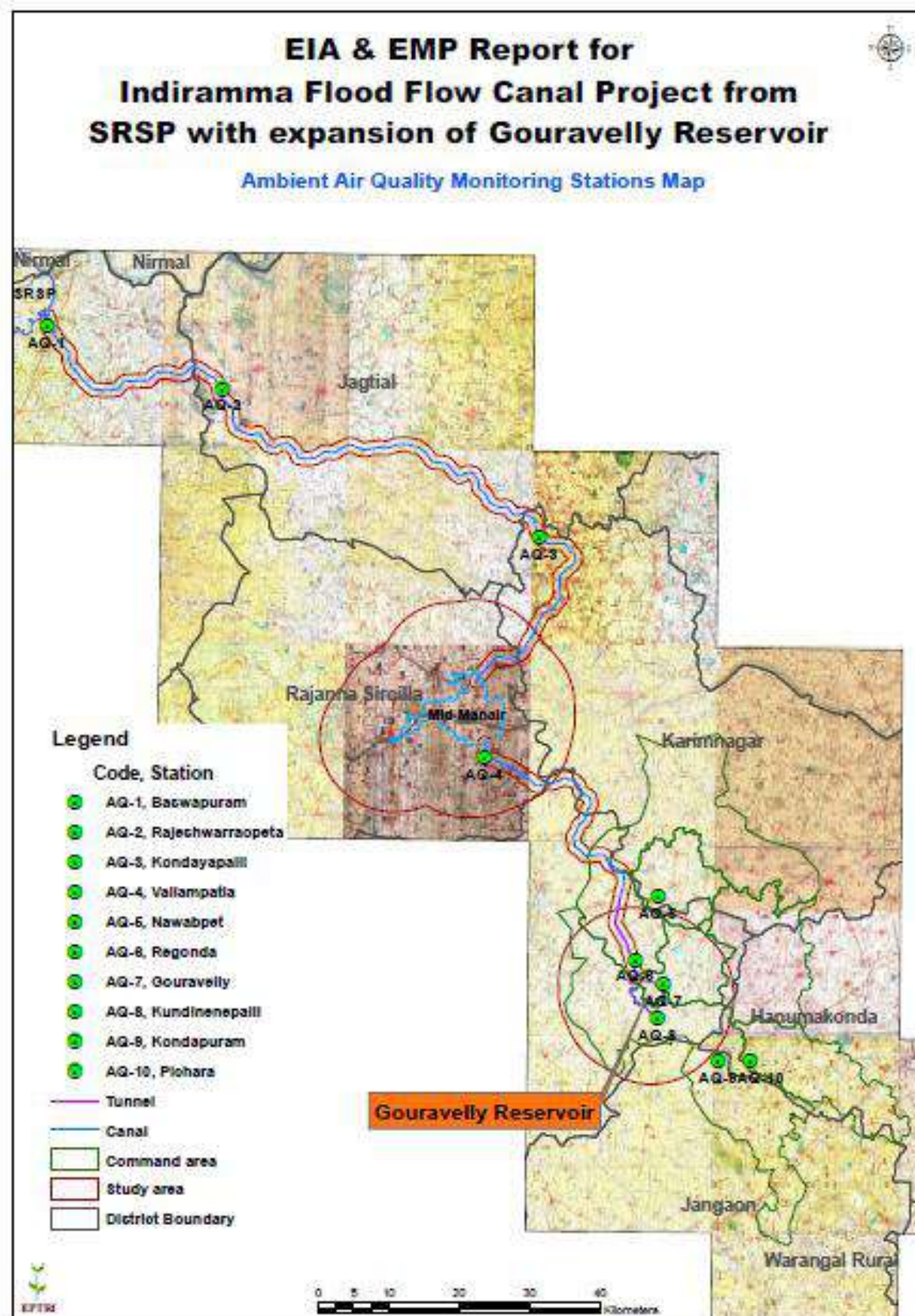
The sampling locations identified are given in Figure 3.2. The directions and distances of these locations with respect to project site are reported in **Table 3.3**.



Table 3.3 Ambient Air Quality monitoring locations

code	Sampling Location	Location coordinates		Direction	Approx. Dist. (m)
				With respect to Proposed Project Site	
A1	Baswapuram	18°54' 9.204" N	78°20' 29.438" E	W	400
A2	Rajeshwarraopeta	18°49' 29.930" N	78°34' 45.596" E	E	50
A3	Kondayapalli	18°38' 23.425" N	79°0' 25.825" E	W	240
A4	Vallampatla	18°21' 22.326" N	78°56' 12.619" E	W	300
A5	Nawabpet	18°10' 54.602" N	79°10' 18.948" E	E	5266
A6	Regonda	18°6' 0.288" N	79°8' 33.121" E	E	450
A7	Gouravelli	18°4' 10.160" N	79°10' 49.771" E	E	650
A8	Kundinenepalli	18°1' 29.378" N	79°10' 24.203" E	S	1000
A9	Kondapuram	17°58' 13.271" N	79°15' 17.032" E	SE	Within command area
A10	Pichara	17°58' 16.622" N	79°17' 52.854" E	SE	With in command area

Figure 3.2 Map showing Ambient Air Quality monitoring locations



Various conventional pollutants such as Particulate Matter-PM₁₀ (Size less than 10 µm), Particulate Matter-PM_{2.5} (Size less than 2.5 µm), Sulphur Dioxide (SO₂) and Oxides of Nitrogen (NO₂) were identified as significant parameters for ambient air quality monitoring. The standard methods used for sampling and analysis of different pollutants are summarized in Table 3.4.

Table 3.4 Techniques Used for Ambient Air Quality monitoring

S.No.	Parameter	Technique	Minimum Detection Limit
1.	Particulate Matter (size less than 10 µm) or PM ₁₀	Respirable Dust Sampler (Gravimetric method)	2.0 µg/m ³
2.	Particulate Matter (size less than 2.5 µm) or PM _{2.5}	Ambient Fine Dust Sampler (PEM-ADS 2.5µm)	2.0 µg/m ³
3.	Sulphur Dioxide (SO ₂)	Improved West and Geake Method	5.0 µg/m ³
4.	Nitrogen Dioxide (NO ₂)	Modified Jacob & Hochheiser	9.0 µg/m ³

3.4.3 Ambient Air Quality survey

The ambient air quality monitoring was carried out for the three seasons (Pre-monsoon season, Monsoon & Post Monsoon) to assess the ambient air quality status in the region. At all these sampling stations PM₁₀, PM_{2.5} as well as gaseous pollutants like SO₂, NO₂ were monitored on 24 hourly bases. Status of ambient air quality for premonsoon, monsoon, post monsoon and summary of all three seasons are given in Table 3.5, 3.6, 3.7 and 3.8. Graphical presentation of PM₁₀, PM_{2.5}, SO₂, and NO₂ are given in Figures 3.3, 3.4, 3.5 and 3.6.

Table 3.5 Status of Ambient Air quality during Winter season

Code	Sampling Location	µg/m ³											
		PM ₁₀			PM _{2.5}			SO ₂			NO ₂		
		Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
A1	Baswapuram	40.0	48.0	43.8	19.7	27.0	22.8	11.2	18.4	14.2	11.0	22.5	18.9
A2	Rajeshwarraopeta	40.0	54.0	47.5	19.8	28.9	23.6	8.6	13.6	11.1	11.8	18.7	15.3
A3	Kondayapalli	41.0	67.0	52.8	22.9	35.4	28.0	8.4	13.6	10.4	11.1	17.3	13.3
A4	Vallampatla	39.0	68.0	52.2	21.9	35.2	28.2	7.6	10.3	9.1	9.8	13.6	11.7
A5	Nawabpet	46.0	67.0	54.8	24.3	34.3	28.8	7.4	11.9	9.5	10.2	18.0	12.5
A6	Regonda	39.0	66.0	48.3	21.9	35.2	26.3	8.1	11.4	9.7	10.8	16.2	13.0
A7	Gouravelli	52.0	69.0	59.5	21.9	35.1	26.8	8.1	12.3	10.0	11.1	15.8	13.1
A8	Kundinenepalli	49.0	79.0	62.7	23.9	39.5	32.3	8.4	12.6	10.5	10.8	15.2	13.5
A9	Kondapuram	40.0	48.0	44.0	19.7	27.0	22.7	8.4	14.2	10.9	11.5	17.0	14.1
A10	Pichara	48.0	76.0	59.8	22.9	38.6	30.8	7.6	11.6	9.5	11.1	15.4	13.1

Table 3.6 Status of Ambient Air quality during Pre-monsoon season

Code	Sampling Location	µg/m³											
		PM ₁₀			PM _{2.5}			SO ₂			NO ₂		
		Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
A1	Baswapuram	40.0	49.0	43.8	19.7	27.0	23.2	8.3	18.4	13.2	11.8	22.5	18.1
A2	Rajeshwarraopeta	40.0	54.0	47.0	20.0	30.0	24.6	7.1	10.7	8.9	11.0	14.0	12.5
A3	Kondayapalli	38.0	66.0	51.2	17.5	35.2	26.8	7.6	13.1	9.5	9.8	13.6	12.0
A4	Vallampatla	39.0	58.0	49.0	21.6	32.0	26.3	6.1	15.7	9.4	10.6	17.1	13.1
A5	Nawabpet	43.0	63.0	54.2	18.4	35.4	28.4	7.8	14.0	9.9	11.1	17.1	13.3
A6	Regonda	38.0	57.0	46.2	19.8	37.5	25.7	7.1	12.2	8.7	10.6	17.2	13.0
A7	Gouravelli	38.0	54.0	44.8	19.8	37.5	26.2	7.1	9.6	8.2	10.1	16.2	12.6
A8	Kundinenepalli	41.0	63.0	52.0	20.1	34.8	29.0	6.2	11.2	8.7	10.3	15.4	12.7
A9	Kondapuram	38.0	52.0	44.6	19.3	27.8	23.3	7.1	10.7	8.8	10.9	14.2	12.1
A10	Pichara	41.0	68.0	56.1	18.5	39.0	28.9	6.9	14.1	10.1	10.7	18.2	14.1

Table 3.7 Status of Ambient Air quality during Monsoon season (June to August 2023)

Code	Sampling Location	$\mu\text{g}/\text{m}^3$											
		PM ₁₀			PM _{2.5}			SO ₂			NO ₂		
		Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
A1	Baswapuram	28.0	51.0	37.9	18.0	27.0	22.3	5.1	10.0	7.9	8.7	13.0	11.1
A2	Rajeshwarraopeta	25.0	50.0	36.1	17.0	27.0	22.0	5.1	11.0	8.0	7.0	13.0	10.3
A3	Kondayapalli	28.0	51.0	38.8	18.9	32.0	23.8	5.8	11.0	8.1	7.0	13.0	9.8
A4	Vallampatla	31.0	54.0	40.6	18.9	32.0	24.0	5.9	10.0	7.8	7.0	15.2	10.8
A5	Nawabpet	25.0	54.0	38.9	18.0	33.9	23.3	5.0	10.0	7.9	7.0	14.0	10.6
A6	Regonda	28.0	52.0	38.6	18.0	27.3	21.2	6.4	13.0	8.6	6.7	14.7	10.0
A7	Gouravelli	29.0	58.0	40.3	19.0	31.8	23.4	5.1	15.2	8.5	7.9	20.8	11.5
A8	Kundinenepalli	30.0	50.0	40.8	20.0	31.0	23.4	5.8	12.1	8.2	9.3	17.2	11.5
A9	Kondapuram	30.0	48.0	38.0	19.7	27.8	22.2	5.8	10.7	7.8	7.4	13.7	10.8
A10	Pichara	30.0	68.0	40.9	18.2	33.8	22.1	5.8	12.0	7.8	9.0	17.4	11.1

Table 3.8 Status of Ambient Air quality during 3 seasons (December 2022 to August 2023)

Code	Sampling Location	$\mu\text{g}/\text{m}^3$											
		PM ₁₀			PM _{2.5}			SO ₂			NO ₂		
		Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
A1	Baswapuram	28	51	41.8	18	27	22.8	5.1	18.4	11.8	8.7	22.5	16.0
A2	Rajeshwarraopeta	25	54	43.5	17	30	23.4	5.1	13.6	9.3	7	18.7	12.7
A3	Kondayapalli	28	67	47.6	17.5	35.4	26.2	5.8	13.6	9.3	7	17.3	11.7
A4	Vallampatla	31	68	47.3	18.9	35.2	26.2	5.9	15.7	8.8	7	17.1	11.9
A5	Nawabpet	25	67	49.3	18	35.4	26.8	5	14	9.1	7	18	12.1
A6	Regonda	28	66	44.4	18	37.5	24.4	6.4	13	9.0	6.7	17.2	12.0
A7	Gouravelli	29	69	48.2	19	37.5	25.5	5.1	15.2	8.9	7.9	20.8	12.4
A8	Kundinenepalli	30	79	51.8	20	39.5	28.2	5.8	12.6	9.1	9.3	17.2	12.6
A9	Kondapuram	30	52	42.2	19.3	27.8	22.7	5.8	14.2	9.2	7.4	17	12.3
A10	Pichara	30	76	52.3	18.2	39	27.3	5.8	14.1	9.1	9	18.2	12.8



Figure 3.3 Graphical representation of PM₁₀

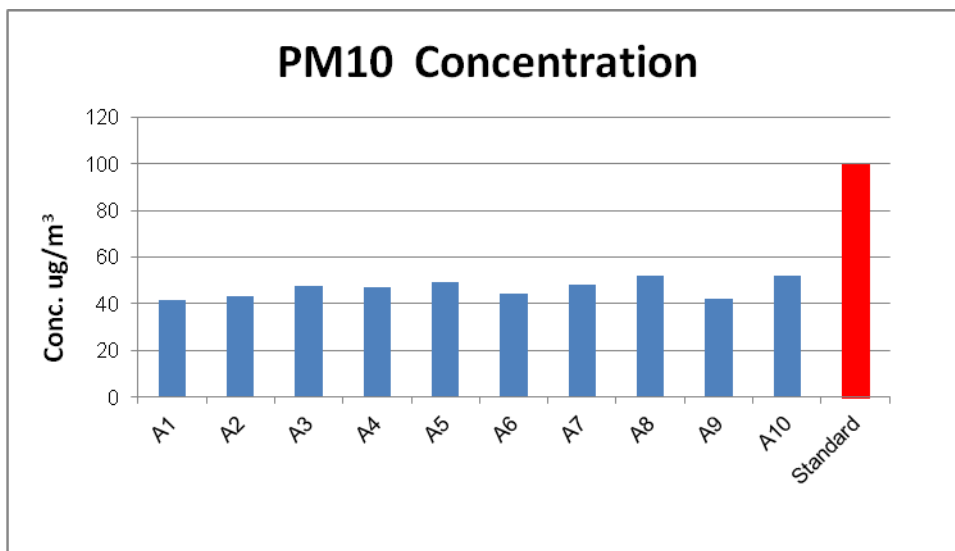


Figure 3.4 Graphical representation of PM_{2.5}

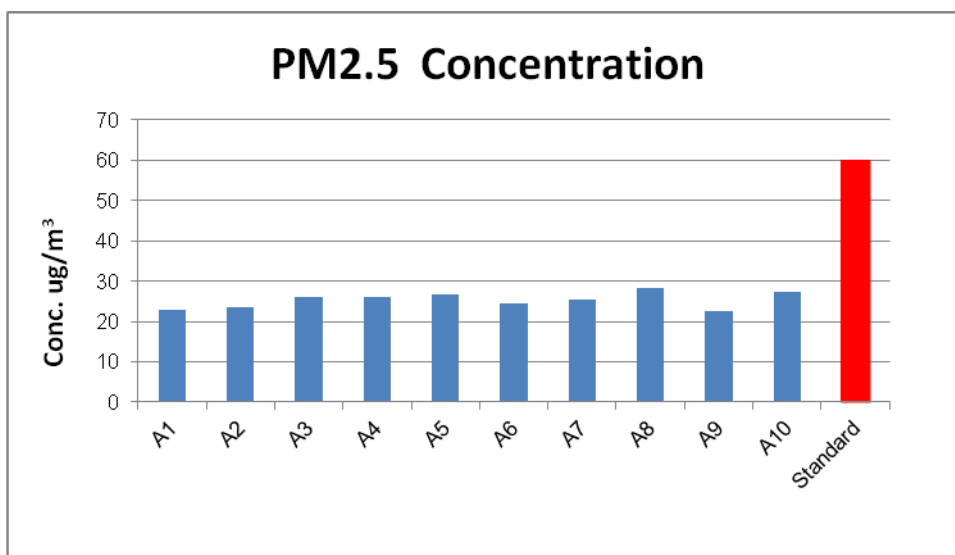


Figure 3.5 Graphical representation of SO₂

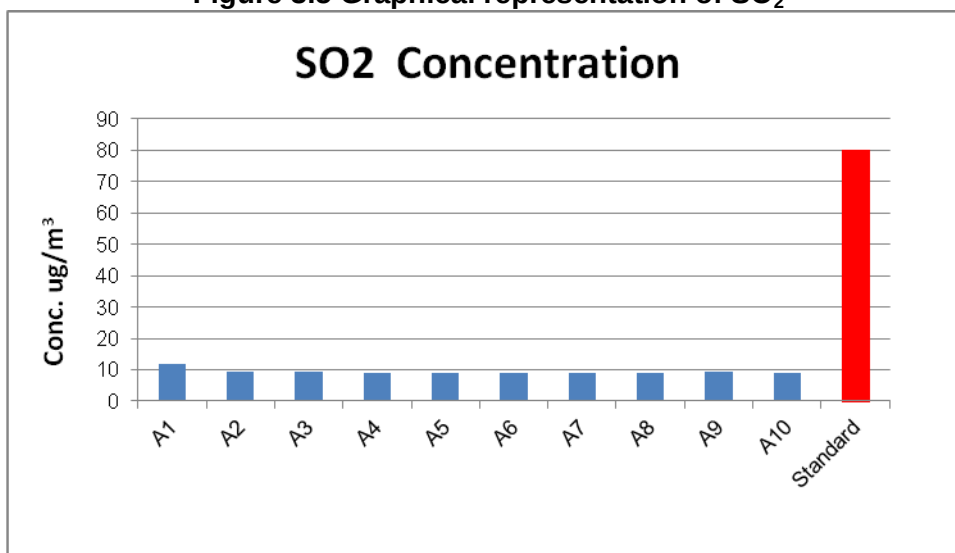
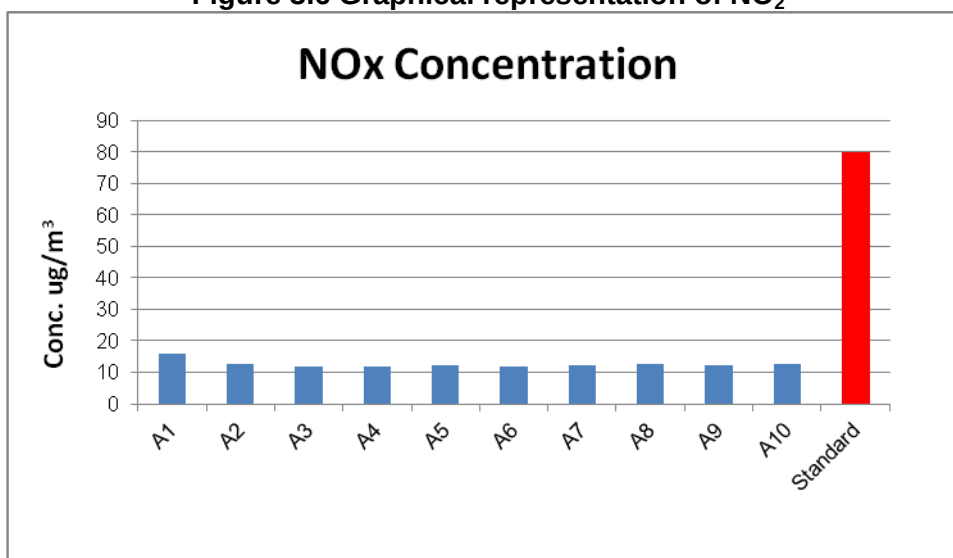




Figure 3.6 Graphical representation of NO₂



3.4.4 Results and discussion on Baseline status of ambient air quality

The ambient air quality status for 10 sampling stations along with statistical interpretation during 3 seasons is reported in Tables 3.5 to 3.8. The average concentration of PM₁₀, PM_{2.5}, SO₂ and NO₂ were compared with ambient air quality standards and were found to be well within the limits. Week wise ambient air quality data for 10 monitoring locations are given in Annexure-3A.

Winter (December 2022 to February 2023)

PM₁₀ concentrations range from 39.0 to 79.0 µg/m³, minimum concentrations were observed at Vallampatla (A4), & Regonda (A6), maximum value was observed at Kundinenepalli (A8). However, all other AAQ observed concentrations in Buffer zone are well within the National Ambient Air Quality Standards (NAAQS).

PM_{2.5} concentrations were in the range from 19.7 to 39.5 µg/m³. The minimum concentrations were observed at Baswapuram (A1), & Kondapuram (A9) and maximum value was observed at Kundinenepalli (A8).

SO₂ concentrations are in the range from 7.4 to 18.4 µg/m³. The minimum concentrations were observed at Nawabpet (A5), and maximum concentration observed at Baswapuram (A1). NO₂ concentrations are in the range from 9.8 to 22.5 µg/m³. The minimum concentration was observed at Vallampatla (A4), and maximum concentration at Baswapuram (A1).

Pre-monsoon (March to May 2023)

PM₁₀ concentrations range from 38.0 to 68.0 µg/m³, minimum concentrations were observed at Kondayapalli (AQ-3), Regonda (AQ-6), & Gouravelly (AQ-7) and maximum value was observed at Pichara (AQ-10). However, all other AAQ observed concentrations in Buffer zone are well within the National Ambient Air Quality Standards (NAAQS).

PM_{2.5} concentrations were in the range from 17.5 to 39.0 µg/m³. The minimum concentrations were observed at Kondayapalli (AQ-3) and maximum value was observed at Pichara (AQ-10).

SO₂ concentrations are in the range from 6.1 to 18.4 µg/m³. The minimum concentrations were observed at Vallampatla (AQ-4), and maximum concentration observed at Baswapuram (AQ-1).



NO₂ concentrations are in the range from 9.8 to 22.5 µg/m³. The minimum concentration was observed at Kondayapalli (AQ-3), and maximum concentration at Baswapuram (AQ-1).

The AAQ study indicates that the observed concentrations in Buffer zone are well within the National Ambient Air Quality Standards (NAAQS) as notified on 18.11.2009 by CPCB.

Monsoon (June to August 2023)

PM₁₀ concentrations range from 25.0 to 68. µg/m³, minimum concentrations were observed at Rajeshwarraopeta (AQ-2), and maximum value was observed at Pichara (AQ-10). However, all other AAQ observed concentrations in Buffer zone are well within the National Ambient Air Quality Standards (NAAQS).

PM_{2.5} concentrations were in the range from 17.0 to 33.9 µg/m³. The minimum concentrations were observed at Rajeshwarraopeta (AQ-2) and maximum value was observed at Nawabpet (AQ-5).

SO₂ concentrations are in the range from 5.0 to 15.2 µg/m³ the minimum concentrations were observed at Nawabpet (AQ-5), and maximum concentration observed at Gouravelly (AQ-7).

NO₂ concentrations are in the range from 6.7 to 20.8 µg/m³ the minimum concentration was observed at Regonda (AQ-6), and maximum concentration at Gouravelly (AQ-7).

The AAQ study indicates that the observed concentrations are well within the National Ambient Air Quality Standards (NAAQS) as notified on 18.11.2009 by CPCB.

3.5 Ambient Noise levels

Noise is often defined as unwanted sound which interferes with various human activities and disturbs physical and mental peace, and sleep, thus, deteriorating quality of human environment. Noise levels were monitored and the baseline noise level study was made for the major sources near reservoirs and canal; similarly, the traffic was monitored for the existing nearby highways and roads.

3.5.1 Methodology and Baseline environmental status

The objective of survey of noise pollution around Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir was to assess the existing levels of noise, and the impact of project on human settlements. Survey was carried out in the following steps:

- Reconnaissance Survey
- Identification and communication of expected noise sources
- Measurement of baseline noise level in the study area
- Present noise exposure of general population
- Measurement of prevailing noise levels due to vehicular movement

The noise levels were measured in residential, locations (Table 3.9) in the study areas and were compared with stipulated Noise Pollution (Regulations and Control) Rules, 2000, as shown in Table 3.10.

A reconnaissance survey was conducted in winter, pre-monsoon and monsoon season with a view to establish the baseline status of the environment with respect to noise levels in the surrounding villages and other centers of human activities.

Noise levels were recorded at selected 10 locations for the 3 seasons with the frequency of twice for working and non-working days. The details of noise levels are given in Table 3.11, 3.12, 3.13, 3.14 and Figure 3.7. The noise standards are given in Table 3.10.



Table 3.9 Noise monitoring stations

Code	Location	Latitude	Longitude	Distance (m)	Direction
N1	Baswapuram	18°54' 9.204" N	78°20' 29.438" E	400	W
N2	Rajeshwarraopeta	18°49' 29.930" N	78°34' 45.596" E	50	E
N3	Kondayapalli	18°38' 23.425" N	79°0' 25.825" E	240	W
N4	Vallampatla	18°21' 22.326" N	78°56' 12.619" E	300	W
N5	Nawabpet	18°10' 54.602" N	79°10' 18.948" E	5266	E
N6	Regonda	18°6' 0.288" N	79°8' 33.121" E	450	E
N7	Gouravelly	18°4' 10.160" N	79°10' 49.771" E	650	E
N8	Kundinenepalli	18°1' 29.378" N	79°10' 24.203" E	1000	S
N9	Kondapuram	17°58' 13.271" N	79°15' 17.032" E	command area	SE
N10	Pichara	17°58' 16.622" N	79°17' 52.854" E	command area	SE



Figure 3.7 Map showing Noise quality monitoring locations

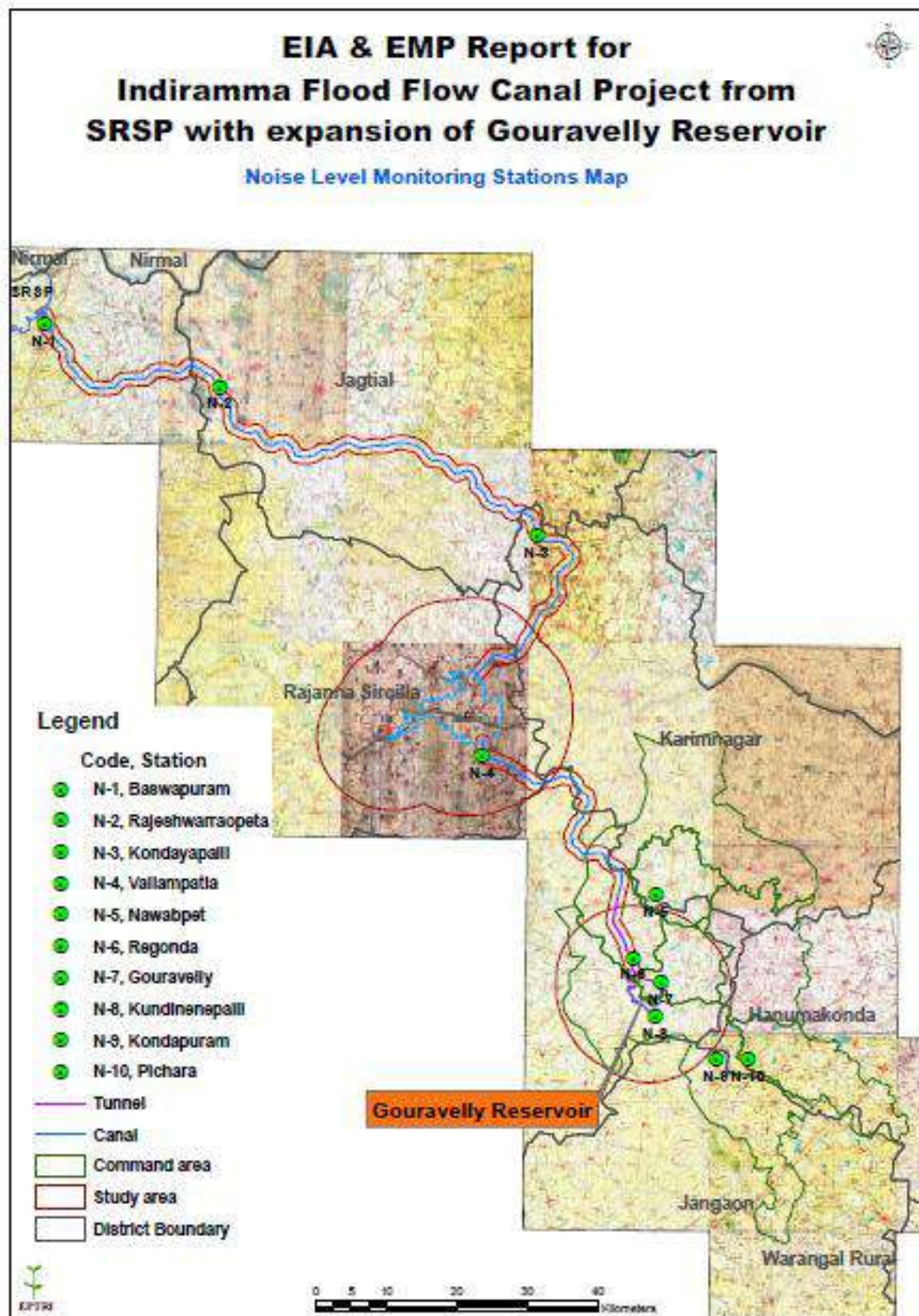




Table 3.10
Noise Standards: Noise pollution
(Regulation and Control) Rules, 2000

Notification: S.O. 123(E), dated 14.2.2000

Schedule (see rule 3(1) and 4(1))

Ambient Air Quality Standards in respect of Noise

Area Code	Category of area	Limits in dB(A)	
		Day time	Night time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence zone	50	40

Note:

1. Day time shall mean from 6.00 am to 10.00 p.m.
2. Night time shall mean from 10.00 p.m to 6.00 a.m.
3. Silence zone is an area comprising not less than 100meters around hospitals, educational institutions, courts, religious places or any other area which is declared as no disturbance zone by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories the Competent Authority.

*dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

“Decibel” is the unit in which level of noise is measured.

“A”, in dB (A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is energy mean of the noise level over a specified period.

3.5.2 Results and discussion of Noise levels monitoring

Noise levels were recorded for 24 hours period at the 10 locations with frequency of seasonally twice on working and non working days. Summary of noise levels for working and non working days during winter, premonsoon and monsoon are given Table 3.5.3 to 3.5.6.

Winter season

The maximum value of Leq Day is 49.2 dB (A) at Baswapuram (N-1), and minimum is 44.6 dB (A) at Kondapuram (N-9) and maximum value of Leq Night is 41.4 dB (A) at Kundinenepalli (N-8), and minimum is 33.4 dB (A) at Baswapuram (N-1).

Increase in Leq Day values at Baswapuram (N-10), (49.2 dB(A)) it is observed due to high vehicular movement heavy truck in connection main road near NH way activities and increase in Leq Night at Kundinenepalli (N-8), (41.4 dB(A)). It is observed due to high vehicular movement such as heavy trucks.



Pre-monsoon

The maximum value of Leq Day is 50.7 dB (A) at Baswapuram (NQ-1), and minimum is 43.4 dB (A) at Pichara (NQ-10) and maximum value of Leq Night is 35.3 dB (A) at Rajeshwarraopeta (NQ-2), and minimum is 31.4 dB (A) at Kondayapalli (NQ-1).

The results shows moderate noise due to vehicular movement and mainly due to residential activities contributing to increase in noise levels, however the noise levels are in terms of Leq (day) and Leq (night) are well within the Noise Pollution (Regulation and Control) Rules, 20

Monsoon

The maximum value of Leq Day is 45.5 dB (A) at Regonda (NQ-6), and minimum is 36.5 dB (A) at Kondayapalli (NQ-3) and maximum value of Leq Night is 31.9 dB (A) at Kondayapalli (NQ-3), and minimum is 26.6 dB (A) at Regonda (NQ-6).

The results shows moderate noise due to vehicular movement and mainly due to residential activities contributing to increase in noise levels, however the noise levels are in terms of Leq (day) and Leq (night) are well within the Noise Pollution (Regulation and Control) Rules, 2000 standards stipulated at all the locations.

It is observed that in all the three season noise levels were found to be well within the Noise Pollution (Regulation and Control) Rules, 2000 standards stipulated at all the locations.

Table 3.11 Summary of Noise level data – (Winter season)

Code	Name of the station with code	Limits in dB (A)		Day time noise levels in dB (A)	Night time noise levels in dB (A)
		Day time	Night time	Day Leq	Night Leq
N1	Baswapuram	55	45	49.2	33.4
N2	Rajeshwarraopeta	55	45	45.3	41.1
N3	Kondayapalli	55	45	46.3	35.6
N4	Vallampatla	55	45	47.7	35.5
N5	Nawabpet	55	45	46.6	37.9
N6	Regonda	55	45	45.8	36.1
N7	Gouravelli	55	45	47.5	38.2
N8	Kundinenepalli	55	45	46.8	41.4
N9	Kondapuram	55	45	44.6	36.5
N10	Pichara	55	45	48.0	33.5

Table 3.12 Summary of Noise level data during Pre-monsoon season

Code	Name of the station with code	Limits in dB (A)		Day time noise levels in dB (A)	Night time noise levels in dB (A)
		Day time	Night time	Day Leq	Night Leq
N1	Baswapuram	55	45	50.7	34.5
N2	Rajeshwarraopeta	55	45	44.5	35.3
N3	Kondayapalli	55	45	47.5	31.4
N4	Vallampatla	55	45	45.5	33.7
N5	Nawabpet	55	45	46.0	32.9
N6	Regonda	55	45	45.9	31.7
N7	Gouravelli	55	45	48.1	32.4
N8	Kundinenepalli	55	45	46.0	33.6
N9	Kondapuram	55	45	44.8	34.3
N10	Pichara	55	45	43.4	32.4



Table 3.13 Summary of Noise level data during Monsoon season

Code	Name of the station with code	Limits in dB (A)		Day time noise levels in dB (A)	Night time noise levels in dB (A)
		Day time	Night time	Day Leq	Night Leq
N1	Baswapuram	55	45	41.2	28.9
N2	Rajeshwarraopeta	55	45	40.6	30.1
N3	Kondayapalli	55	45	36.5	31.9
N4	Vallampatla	55	45	40.2	29.2
N5	Nawabpet	55	45	42.5	28.3
N6	Regonda	55	45	45.5	26.6
N7	Gouravelli	55	45	38.1	28.2
N8	Kundinenepalli	55	45	45.0	26.7
N9	Kondapuram	55	45	37.8	27.2
N10	Pichara	55	45	38.7	27.7

Table 3.14 Summary of Noise level data during 3 Season

Code	Name of the station with code	Limits in dB (A)		Day time noise levels in dB (A)	Night time noise levels in dB (A)
		Day time	Night time	Day Leq	Night Leq
N1	Baswapuram	55	45	47.0	32.3
N2	Rajeshwarraopeta	55	45	43.5	35.5
N3	Kondayapalli	55	45	43.4	33.0
N4	Vallampatla	55	45	44.5	32.8
N5	Nawabpet	55	45	45.0	33.0
N6	Regonda	55	45	45.7	31.5
N7	Gouravelli	55	45	44.6	32.9
N8	Kundinenepalli	55	45	45.9	33.9
N9	Kondapuram	55	45	42.4	32.7
N10	Pichara	55	45	43.4	31.2

3.5.4 Traffic data monitoring

The existing traffic density for different types of vehicles was recorded at 4 locations. This will serve as the baseline for assessing the impact of future traffic load due to the proposed project during the construction phase. The existing traffic was recorded for 24 hours. The latitude and longitude values of the traffic monitoring locations are given in Table 3.15.

Table 3.15 Traffic locations monitored

Code	Location	Latitude	Longitude
T1	Gouravelli sub-station junction	18° 3' 59.650" N	79° 10' 31.170" E
T2	Husnabad Traffic junction	18° 7' 38.042" N	79° 12' 24.688" E
T3	Malcher tanda junction	18° 4' 19.583" N	79° 7' 59.143" E
T4	Chutukunta Tanda Junction	18° 12' 44.628" N	79° 7' 32.154" E



Table 3.16 24 hours traffic details

Codes	Location Names	Two Wheelers	Three Wheelers	Light Motor Vehicles	Heavy Motor Vehicles	Total Vehicles PUC
T1	Gouravelli sub-station junction					
	Working Day	363	129	139	493	2493
	Non-Working Day	389	130	157	460	2411
T2	Husnabad Traffic junction					
	Working Day	1952	805	377	1530	9112
	Non-Working Day	947	244	412	750	4385
T3	Malcher tanda junction					
	Working Day	364	151	119	157	1275
	Non-Working Day	232	92	74	89	761.3
T4	Chutukunta Tanda Junction					
	Working Day	265	135	85	55	757
	Non-Working Day	194	80	57	64	599

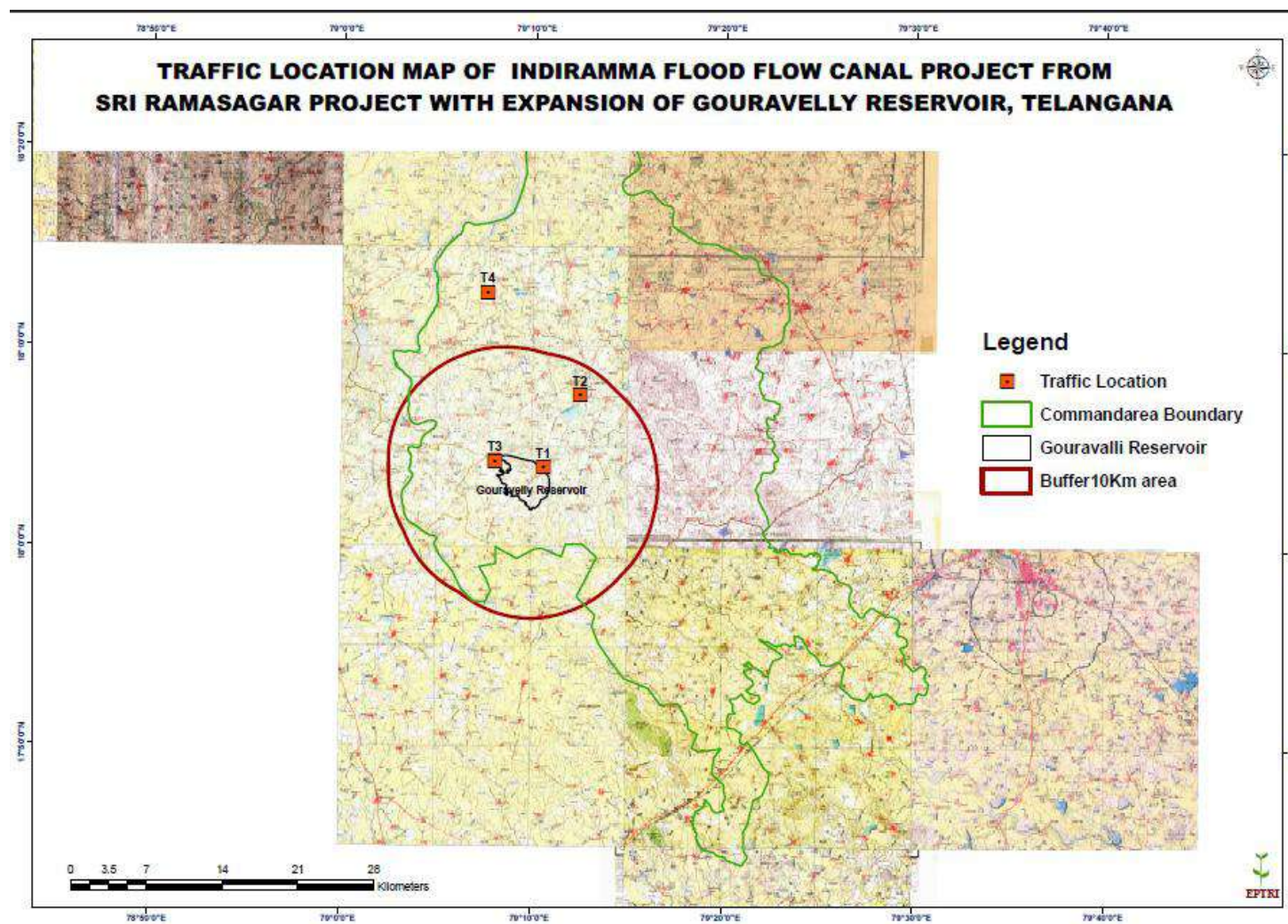
3.6 Water quality monitoring

Surface water and ground water samples were collected and analysed for water quality parameters. The sampling locations were selected considering their proximity to the project sites and command area. A total of 25 water samples i.e., 10 samples of surface, 15 samples of groundwater were collected and analyzed for various physico-chemical and bacteriological parameters.

The groundwater quality results are compared with IS: 10500:2012 and surface water quality is compared with CPCB Water Quality Criteria i.e Class-A (Drinking Water Source without conventional treatment but after disinfection), Class-B (outdoor bathing (organized), Class-C (Drinking Water Source with conventional treatment and after disinfection), Class-D (Propagation of wildlife & fisheries) and Class-E (Irrigation, Industrial cooling, controlled waste disposal).

The details of the surface water, groundwater sampling locations are given in Tables 3.17 and 3.18. The analytical results for surface water, groundwaters are presented in Annexure-3D.

Figure 3.8 Map showing Traffic locations monitored



All the data of groundwater quality results were compared with IS: 10500 and surface water quality with CPCB Water Quality Criteria, Class - A (Drinking Water Source without conventional treatment but after Disinfection), Class – B (outdoor bathing (organized) and Class – C (Drinking Water Source with conventional treatment and after Disinfection, Class – D Propagation of wild life fisheries and Class-E (Irrigation, Industrial cooling, controlled waste disposal).

The details of the surface water, ground water results are given in the annexure 3D.

Table 3.17 Surface water sample locations monitored

S.No.	Sampling Location	Latitude	Longitude
SW-1	Kisannagar	18°53' 42.285" N	78°21' 11.914" E
SW-2	Korutla Vagu	18°44' 49.228" N	78°42' 47.234" E
SW-3	Namilla Cheruvu	18°32' 28.351" N	79°1' 46.382" E
SW-4	Mid Manner Dam	18°23' 24.061" N	78°57' 57.924" E
SW-5	Totapalli Cheruvu	18°15' 44.890" N	79°4' 23.776" E
SW-6	Husnabad Tank	18°7' 3.796" N	79°12' 13.498" E
SW-7	Gouravelli	18°4' 14.483" N	79°10' 31.960" E
SW-8	Peddavagu	18°4' 56.403" N	79°3' 34.911" E
SW-9	Velair Tank	18°0' 32.599" N	79°20' 24.116" E
SW-10	Malkapuram Tank	17°56' 5.950" N	79°17' 45.017" E

Table 3.18 Groundwater sample locations monitored

S.No.	Sampling Location	Latitude	Longitude
GW-1	Baswapuram	18°54' 10.002" N	78°20' 28.415" E
GW-2	Ramalachhmanapeta	18°46' 20.172" N	78°36' 41.638" E
GW-3	Kurmapalli	18°33' 53.440" N	79°2' 13.259" E
GW-4	Desaipalli	18°28' 39.620" N	78°56' 46.225" E
GW-5	Sirsilla	18°23' 30.454" N	78°48' 20.196" E
GW-6	Kandikatkur	18°23' 18.431" N	78°58' 26.995" E
GW-7	Vellampetla	18°21' 23.759" N	78°56' 2.680" E
GW-8	Gunukul Kondapur	18°18' 5.612" N	79°5' 17.631" E
GW-9	Nawabpet	18°10' 46.414" N	79°10' 23.704" E
GW-10	Regutuvani palli	18°3' 39.663" N	79°7' 8.404" E
GW-11	Gouravelli	18°4' 9.297" N	79°10' 42.626" E
GW-12	Akkannapeta	18°2' 3.174" N	79°12' 25.551" E
GW-13	Ramavaram	18°1' 4.879" N	79°7' 52.452" E
GW-14	Kondapuram	17°58' 6.533" N	79°15' 7.768" E
GW-15	Pichara	17°58' 8.519" N	79°17' 46.805" E

Surface water sampling methodology

For the streams, rivers, lakes and other surface waters, samples were collected directly into the sample bottle as per sampling collection SOP of EPTRI, Care is taken to avoid disturbing the substrata. For lakes and other impoundments, samples were collected below the surface at 1 meter depth avoiding surface debris. Samples were collected in 1 litre wide mouth glass bottle for oil & grease analysis with preservation, in a cleaned 300 ml glass bottle for DO with initial fixation, and for metals 1 litre Plastic container with relevant preservation and for pesticides analysis 2.5 litre amber coloured glass bottle is being used. Another 5 litre of water sample was collected in a prewashed plastic container without any preservatives for general parameters. Appropriate preservatives such as Manganese sulphate & Alkali - Iodide – Azide for DO,



Hydrochloric acid for Oil & Grease, Nitric acid for metals and Ascorbic acid for pesticides were added to the samples during sample collection.

Samples for bacteriological analyses were collected in sterilized high-density glass bottles. All the samples were stored in sampling kits maintained at 4°C and brought to the laboratory for detailed physico-chemical and bacteriological analysis.

Groundwater sampling methodology

Hand pumps were pumped for 15 minutes prior to the sampling, to ensure that groundwater to be sampled was representative of groundwater aquifer. Samples were collected for metals in 1 litre Plastic container and for pesticides analysis in 2.5 litre amber coloured glass bottle. 5 litre of water sample was collected in a prewashed plastic container without any preservatives for general parameters. And 300 mL sterilized glass bottle for microbial analysis. Appropriate preservatives such as Nitric acid for metals and Ascorbic acid for pesticides were added to the samples during the collection and were brought to laboratory for analysis. Samples for bacteriological analyses were collected in sterilized high-density glass bottles. All the samples were stored in sampling kits maintained at 4°C and brought to the laboratory for detailed physico-chemical and bacteriological analysis.



Figure 3.9 Map showing Surface water quality locations

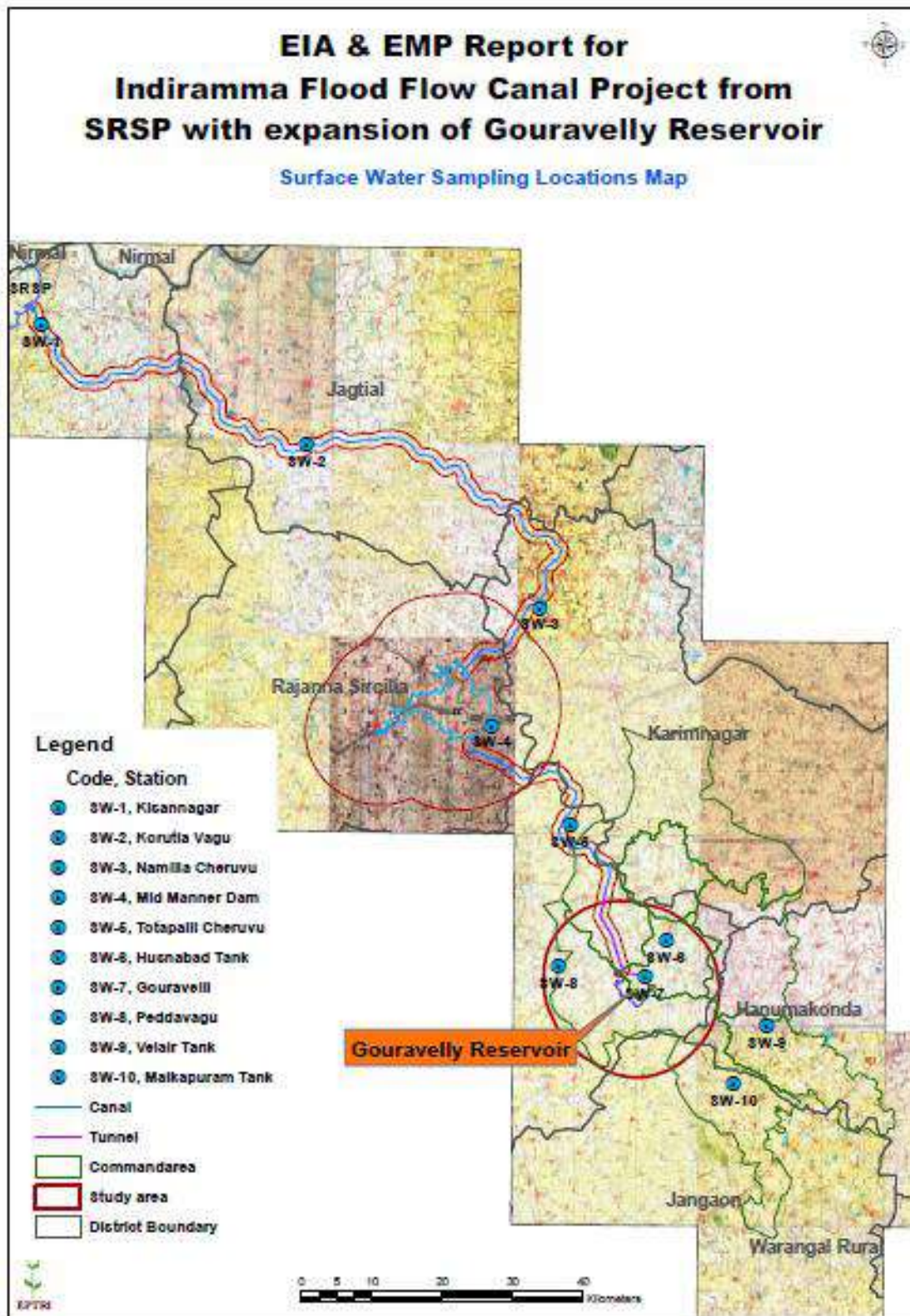
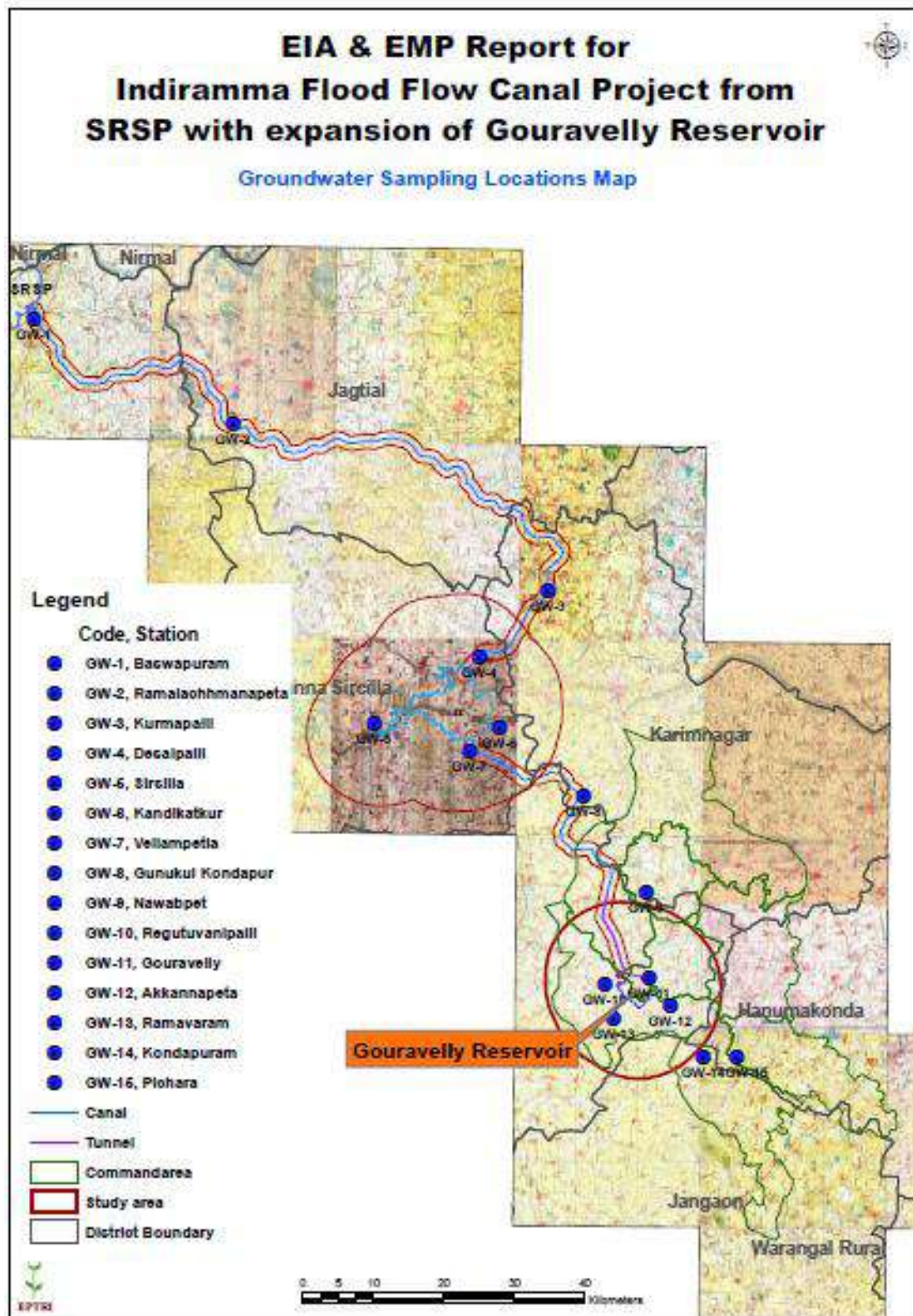


Figure 3.10 Map showing Groundwater quality locations



3.6.1 Summary of water quality monitoring

3.6.1.1 Surface water quality

A) Winter season

pH values were in the range of 7.3 – 7.8. The results of surface water samples were compared as CPCB water quality criteria, prescribes only few parameters.

Total coliforms, fecal coliforms were present in the surface water samples collected in the study area. Presence of Total coliforms, fecal coliforms shows contamination from fecal matter or sewage entry and not suitable for direct drinking purpose and needs chlorination before treatment.

It may be observed that the surface water samples have DO values 5.2 - 6.6 mg/L. BOD is found to be within the limits in all locations. Total coliforms are recorded in the range 110 - 350 MPN/100ml and fecal coliforms are recorded in the range 11 - 33 MPN/100ml in the given samples.

All the surface water samples falls under the CPCB water quality criteria Class-B (Outdoor bathing (Organized)) as the DO is satisfactory and above 5mg/L and BOD is within the limit and Total coliforms are less than 500 MPN/100 ml.

In addition to the CPCB criteria parameters, All the surface water samples were analysed for 31 parameters. Detailed surface water quality results are given annexure-3D.

B) Pre-monsoon

pH values were in the range of 7.9 – 8.5. Total coliforms, fecal coliforms were present in the surface water samples collected in the study area. Presence of Total coliforms, fecal coliforms shows contamination from fecal matter or sewage entry and not suitable for direct drinking purpose and needs chlorination before treatment.

It may be observed that the surface water samples have DO values 5.6 - 6.2 mg/L. BOD is found to be within the limits in all locations. Total coliforms are recorded in the range 70 - 170 MPN/100ml and fecal coliforms are recorded in the range 4 - 23 MPN/100ml in the given samples.

All the surface water samples fall under the CPCB water quality criteria Class-B (Outdoor bathing (Organized)) as the DO is satisfactory and above 5mg/L and BOD is within the limit and Total coliforms are less than 500 MPN/100 ml.

In addition to the CPCB criteria parameters, another 31 parameters were also investigated and there are no abnormalities observed in all samples.

C) Monsoon season

pH values were in the range of 7.1 – 8.1 in SW-1 to SW-10 samples. Total coliforms, fecal coliforms were present in the surface water samples collected in the study area. Presence of Total coliforms, fecal coliforms shows contamination from fecal matter or sewage entry and not suitable for direct drinking purpose and needs chlorination before treatment.

It may be observed that the surface water samples have DO values 5.2 - 6.3 mg/L. BOD is found to be within the limits in all locations found in the range 2.4 – 3mg/L. Total coliforms are recorded in the range 170 - 240 MPN/100ml and fecal coliforms are recorded in the range 17 - 33 MPN/100ml in the given samples.

The surface water samples SW-1 to SW-10 fall under the CPCB water quality criteria Class-B (Outdoor bathing (Organized)) as the DO is satisfactory and above 5mg/L and BOD is within the limit and Total coliforms are less than 500 MPN/100 ml.

In addition to the CPCB criteria parameters, another 31 parameters were also investigated and there are no abnormalities observed in all samples.

3.6.1.3 Groundwater quality

There are 15 groundwater samples were selected to know the existing groundwater quality scenario for 3 seasons.

The analysis results of groundwater samples were compared with IS:10500:2012 of Acceptable and Permissible limits, which are stipulated for water to be fit for drinking purpose with groundwater as source. The results along with the Acceptable and Permissible limits of various parameters as per the IS: 10500, 2012 standards. Seasonal wise Groundwater quality results are given in Annexure 3E.

Winter season

pH values were in the range between 7.1 to 8.4. TDS concentrations are in the range of 322 to 635 mg/L, are within the acceptable limit of 500 mg/L in all locations except GW-3, 4, 5, 14 (635, 552, 564, 518mg/L), are above the acceptable limit but within the permissible limit of 2000mg/L. Magnesium concentrations 31 - 64mg/L, were observed to be above the acceptable limit of 30mg/L but within the permissible limit of 100mg/L at all locations. Fluorides concentrations are observed to be above the acceptable limit of 1.0mg/L but within the permissible limit of 1.5mg/L in GW-3 (1.02mg/L) and within the limit at other locations.

Calcium, Chlorides, Sulphates, Nitrates & Iron concentrations were observed to be within the acceptable limit at all locations. The total alkalinity concentrations 205 to 335 mg/L & Total hardness concentrations 217 to 403mg/L, are above the acceptable limit of 200mg/L but within the permissible limit of 600mg/L at all locations.

The concentrations of heavy metals Cadmium (Cd), Copper (Cu), Lead (Pb), Arsenic (as As), Chromium (Cr), were either below the detection limits or below the permissible limits.

Pre-monsoon

pH values were in the range between 7.1 to 7.6 in the GW-1 to GW-15 samples collected within the study area. TDS concentrations are in the range of 335 - 710mg/L, are above the acceptable limit of 500mg/L but within the permissible limit of 2000mg/L in all locations except GW-3, 4, 8 (390, 335, 477mg/L), are within the acceptable limit. Calcium concentrations are in the range of 47 - 99mg/L, are above the acceptable limit of 75mg/L but within the permissible limit of 200mg/L in all locations except GW-3, 4, 6, 8, 10, 12, 13 (55, 57, 68, 55, 72, 47, 62mg/L), are within the acceptable limit. Magnesium concentrations 30 - 67mg/L were observed to be above the acceptable limit of 30mg/L but within the permissible limit of 100mg/L at all locations.

Chlorides, Sulphates, Nitrates, Fluorides & Iron concentrations were observed to be within the acceptable limit at all locations. The total alkalinity concentrations 220 – 430mg/L & Total hardness concentrations 247 – 524mg/L, are above the acceptable limit of 200mg/L but within the permissible limit of 600mg/L at all locations.

The concentrations of heavy metals Cadmium (Cd), Copper (Cu), Lead (Pb), Zinc (as Zn), Arsenic (as As), Chromium (Cr), were either below the detection limits or below the permissible limits.

Monsoon season

pH values were in the range between 7.1 to 7.6 in the GW-1 to GW-15 samples collected within the study area. TDS concentrations are in the range of 318 - 766mg/L, are above the acceptable limit of 500mg/L but within the permissible limit of 2000mg/L in all locations except GW-5, 7, 8, 9, 11, 13, 14 (458, 335, 318, 352, 326, 408, 363mg/L), are within the acceptable limit. Calcium concentrations are in the range of 48 - 93mg/L, are above the acceptable limit of 75mg/L but within the permissible limit of 200mg/L in locations GW-1, 4, 6, 10, 12, 15 (88, 93, 84, 91, 90, 86mg/L), and within the acceptable limit in other locations. Magnesium concentrations 33 - 64mg/L were observed to be above the acceptable limit of 30mg/L but within the permissible limit of 100mg/L at all locations. Fluorides concentrations are in the range of 0.75 – 1.4mg/L are above the acceptable limit of 1.0mg/L but within the permissible limit of 1.5mg/L in all locations except GW-4, 12, 13 (0.75, 0.98, 0.96mg/L) are within the acceptable limit.

Chlorides, Sulphates, Nitrates & Iron concentrations were observed to be within the acceptable limit at all locations. The total alkalinity concentrations 310 – 475mg/L & Total hardness concentrations 256 – 483mg/L, are above the acceptable limit of 200mg/L but within the permissible limit of 600mg/L at all locations.

The concentrations of heavy metals Cadmium (Cd), Copper (Cu), Lead (Pb), Arsenic (as As), Chromium (Cr), were either below the detection limits or below the permissible limits.

3.6.2 Hydrogeology

Hydrogeomorphological mapping incorporates relationship of geomorphic units with their groundwater potential as interpreted from the landform characteristics (nature of landform occurrence, lithology, structure, inter-relationship with other units etc.) as well as sub-surface geology. The Hydrogeomorphology (HGM) interpretation of the study area and command area has been carried out on 1:50,000 scale with the help of Remote Sensing using False Colour Composite (FCC) imageries. Based on image characteristics of landforms (tone, texture, drainage, size, association etc.), their genesis, occurrence and composition.

Hydrogeomorphology map of the study area of FFC from SRSP, Mid Manair, Gouravelly and Command area are shown in **Figure No.3.11, 3.11a, 3.12 and 3.13** are respectively.

Fig. 3.11a Hydrogeomorphology map of Mid Manair study area

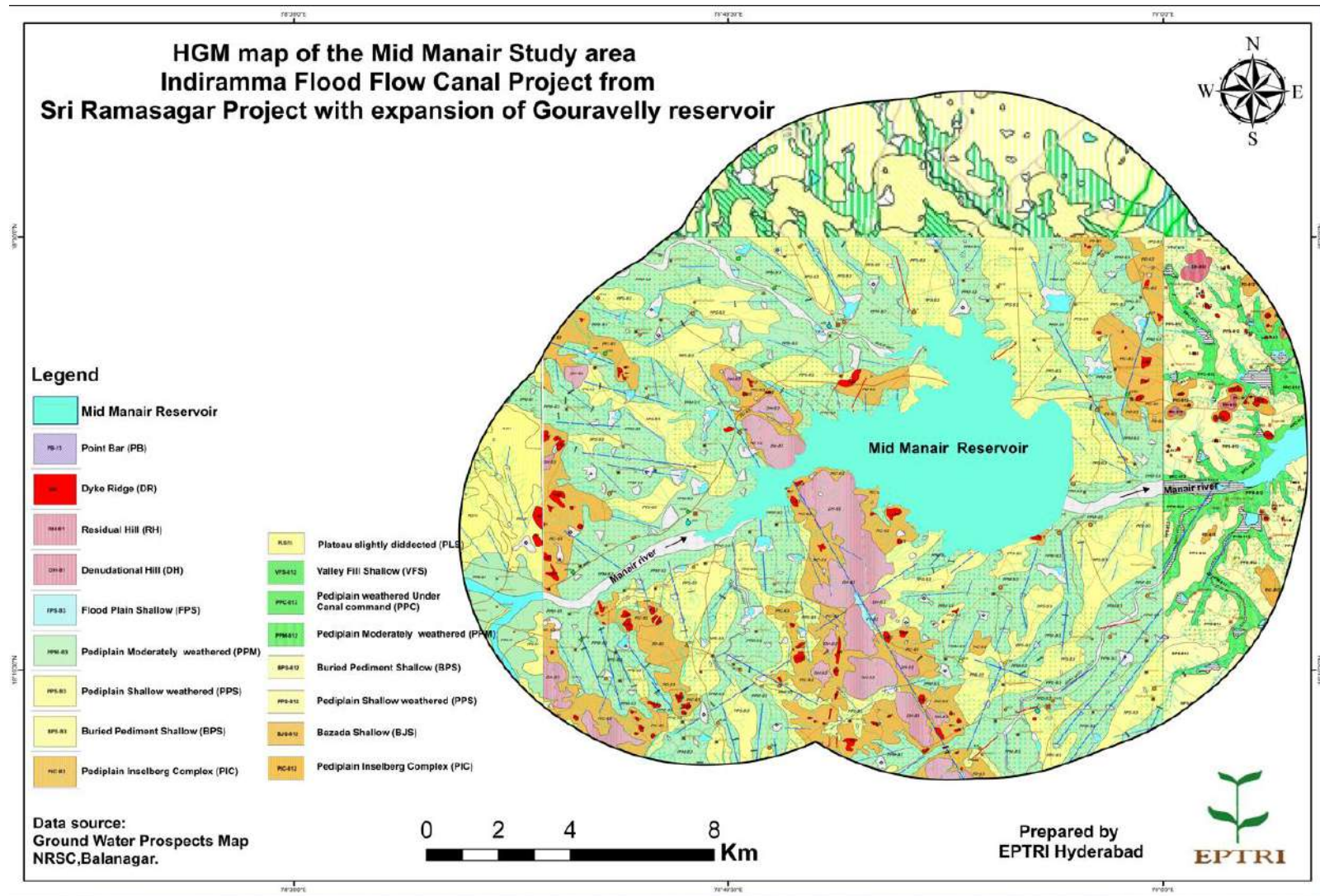


Fig. 3.12 Hydrogeomorphology map of Gouravelly Reservoir study area

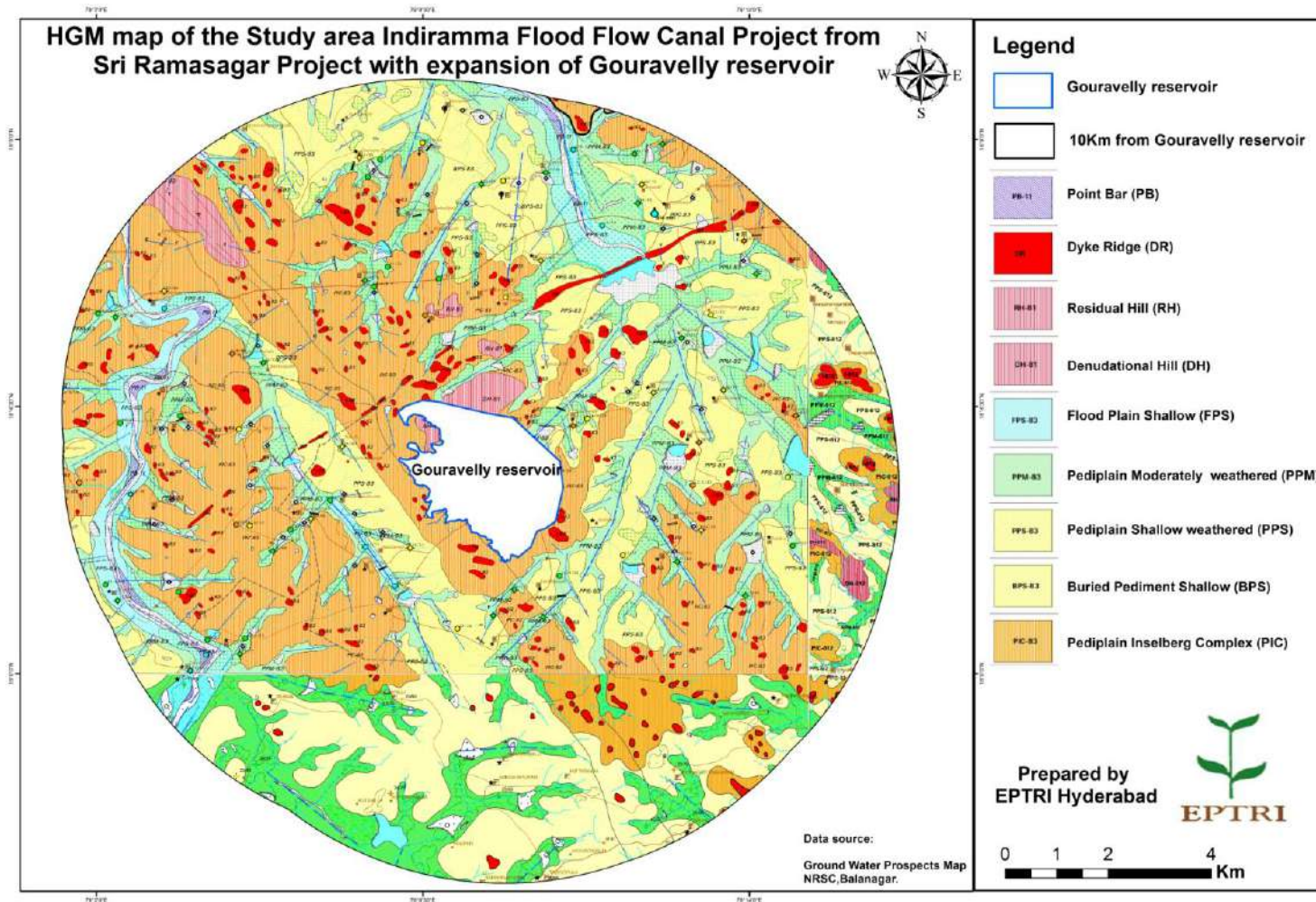
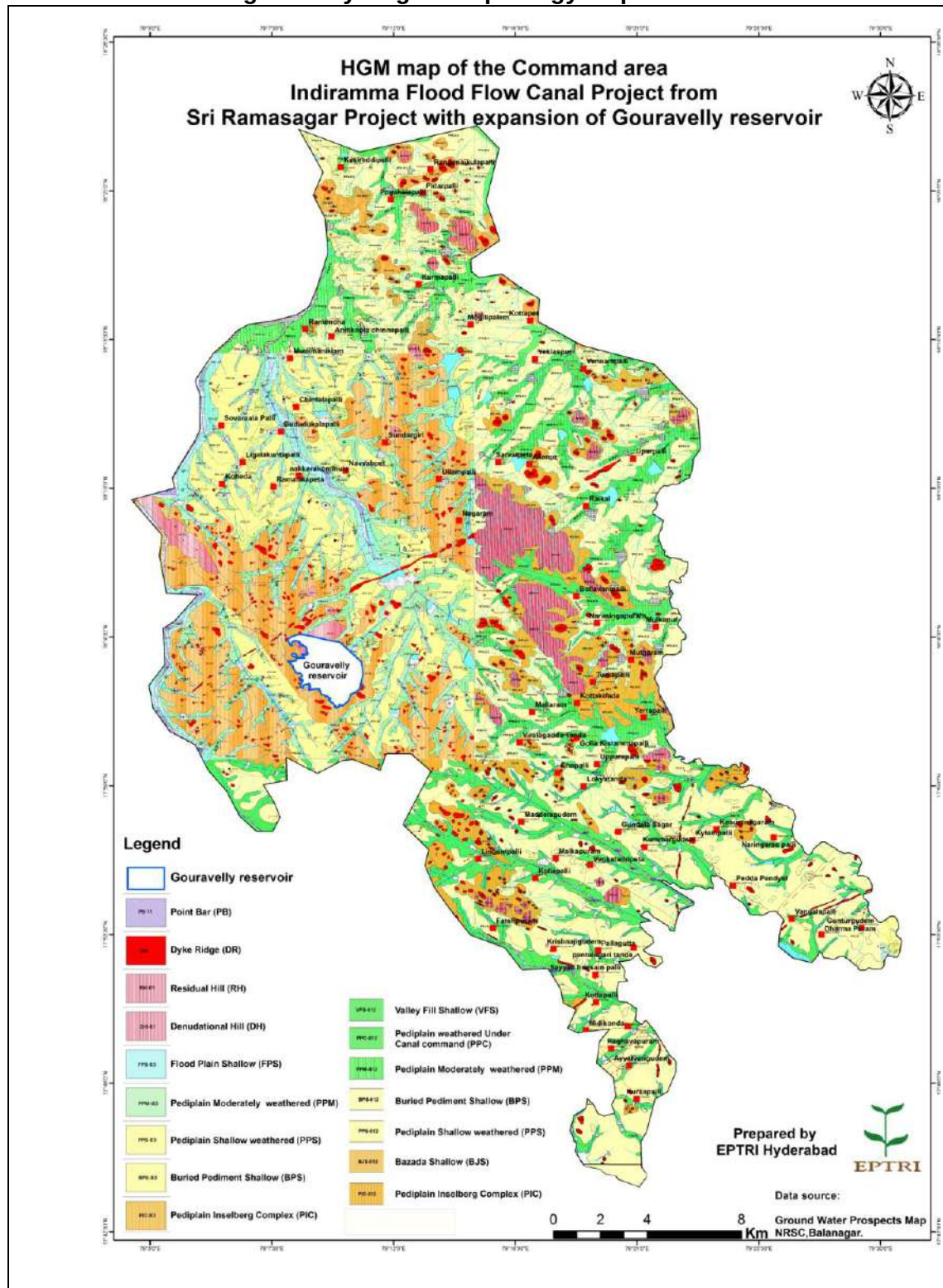


Fig. 3.13 Hydrogeomorphology map of Command Area



The hydrogeomorphic units of the area are classified under fluvial origin, denudational origin and structural origin and their description is as follows:



Map symbol	Hydrogeomorphic unit	Description	Ground water prospects
PB	Point bar	Its an alluvial deposit that forms by accretion inside an expanding loop of a nala/river.	300 to 500 lpm
FP	Flood plain	Its an area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding.	200 to 300 lpm
PPM	Moderately weathered pediplain	Gently sloping land with >15m thickness of weathering	100 to 200 lpm
PPS	Shallow weathered pediplain	Gently sloping land with <15m thickness of weathering	50 to 100 lpm
BPS	Shallow buried pediplain	Gently sloping land with <15m thickness of weathering covered with black soil	50 to 100 lpm
PIC	Pediment inselberg complex	Its a group of isolated rock hill, knob, ridge, that rised abruptly from a gently sloping or virtually level surrounding plain. An inselberg results when a body of rock resistant to erosion, such as granite,	25 to 50 lpm
I	Inselberg	It is a dome-shaped and formed from granite or gneiss, occurring within a body of softer rocks, exposed by differential erosion and lowering of the surrounding landscape.	--
DR	Dyke ridge	It is a sheet of rock that is formed in a fracture of a pre-existing rock body. Dikes are magmatic of origin.	--
RH	Residual hill	Mountains that have been eroded by the agents of degradation such as winds, rain, and running water leaving behind only the hard rock. These hard rocks that are left behind are known as the residual mountains.	--
DH	Denudational hill	Hill formed due to wearing away of landmass by various processes like weathering, mass movement, erosion and transportation. It results in lowering the level of land, rounding exposed rock surfaces and levelling the peaks.	--
	Fracture/fault line valley		150 to 250 lpm

Hydrogeology of the area is concerned primarily with mode of occurrence, distribution, movement and chemistry of ground water occurring in the subsurface in relation to the geological environment. The occurrence and movement of water in the subsurface is broadly governed by geological frameworks i.e., nature of rock formations including their porosity

(primary and secondary) and permeability. and the occurrence and movement of ground water in these rocks is controlled by the degree of interconnection of secondary pores/voids developed by fracturing and weathering. The principal aquifers in the area are granites and gneisses. Ground water is one of the important sources both for domestic and irrigation purposes and is being exploited through large diameter dug wells, dug-cum bore wells and bore wells. The area is underlain by crystalline rocks, namely Granites and Banded Gneissic Complex of Archaean to Proterozoic Archaeans, ground water occurs under phreatic conditions, but it is desaturated and under semi- confined conditions in the fractured zones.

The depth of weathering varies between 5.5 and 15 m bgl. The yield of Extension bores down to a depth of 20 to 30 m in the dug wells, ranges from 0.17 to 0.3 litres per second (lps). The yields of irrigation dug wells range between 40 and 135 cu.m/day sustaining 1 to 5 hrs of pumping in a day. The depth of irrigation bore wells ranges between 20 to 45m yielding 1.5 to 75 cu.m/day. In weathered granite which is mostly dry.

Pre-monsoon depth to water level

The Pre-monsoon depth to water level varies from a minimum of 3.85 m.bgl. to a maximum of 21.00m.bgl. Most of the area is having water levels below 5 mbgl. Water levels ranges from 5-10m and above 10m water levels.

Post-monsoon depth to water level

The Post-monsoon depth to water level during post-monsoon ranges from a minimum of 0.98 m.bgl to maximum of 22.65 m bgl. The water levels of less than 10 m bgl cover the maximum area of the district.

Water Level Fluctuation

The water level fluctuation between pre-monsoon and post-monsoon ranges between 0.00 to 7.88m. The majority of the area shows rise in the range of 2-4m.

Long Term Water Levels Decline in water levels during pre-monsoon is noticed in 75% of the wells while 25% of wells show rise in water levels during the last decade. The decline in water levels varies between 1.06 to 5.19 metres.

The analysis of post-monsoon water level shows that there is a decline in 77% of the wells while 23% show rise in water levels. The water level decline varies from 0.19 to 6.62 m.

Main crop grown is Paddy during khariff and rabi season. Pulses are grown during khariff and Sugarcane is grown during khariff and during rabi. The other crops are Millets and oil seeds.

Assessment Ground Water Resources

Based on the Ground Water Estimation Committee norms ground water assessment was done and the mandala wise details are present in Table 3.19.

Table 3.19 Stage of Ground water Development

Study area around Mid Manair Reservoir

District Name	Mandal Name	Stage of ground water development in %
Rajanna Sircilla	Boinpalle	52 Safe
Rajanna Sircilla	Vemulavada	99 Critical
Rajanna Sircilla	Konaraopeta	107 Over exploited



District Name	Mandal Name	Stage of ground water development in %
Rajanna Sircilla	Yellareddipet	70 Safe
Rajanna Sircilla	Sircilla	95 Critical
Rajanna Sircilla	Ellanthakunta	98 Critical
Karimnagar	Gangadhara	123 Over exploited
Karimnagar	Bejjanki	100 Critical
Karimnagar	Karimnagar	88% Safe

Study area around Gouravelly reservoir and command area

District Name	Mandal Name	Stage of ground water development
Jangaon	Ganpur_stn	114% Over exploited
	Raghunathpalle	104% Over exploited
	Zaffergadh	153% Over exploited
Karimnagar	Chigurumamidi	47% Safe
	Huzurabad	90% Critical
	Manakondur	85% Safe
	Thimmapur	75% Safe
	Bejjanki	66% Safe
	Husnabad	61% Safe
	Koheda	63% Safe
	Nanganur	96% Critical
Warangal Urban	Dharmasagar	90% Semi-critical

3.7 Soil Environment

3.7.1 Soil Resources

The disturbance of soil and land resources during development or other land use activities has the potential for major impacts on the quality of our environment. Soil erosion, stream sedimentation, mass movement, soil pollution and altered hydrological regimes are just some of the associated environmental problems. In addition to the serious environmental degradation caused, these impacts are also associated with high financial cost to both the project proponent and the community as a whole.

Soil systems like most natural systems, are in dynamic equilibrium. Most changes are slow and imperceptible particularly when viewed in the time frame of human lifespan. However, catastrophic events such as high intensity storms can accelerate erosion processes resulting in measurable changes. The changes are mainly in the structure and composition of the material and such changes are referred to as 'structural changes'. Changes are measurable directly or indirectly or may be inferred from behavior of the system. Many of the changes are related to uses of the soil. These 'performance-related changes' are more important as they can be quantified, particularly in economic value terms.

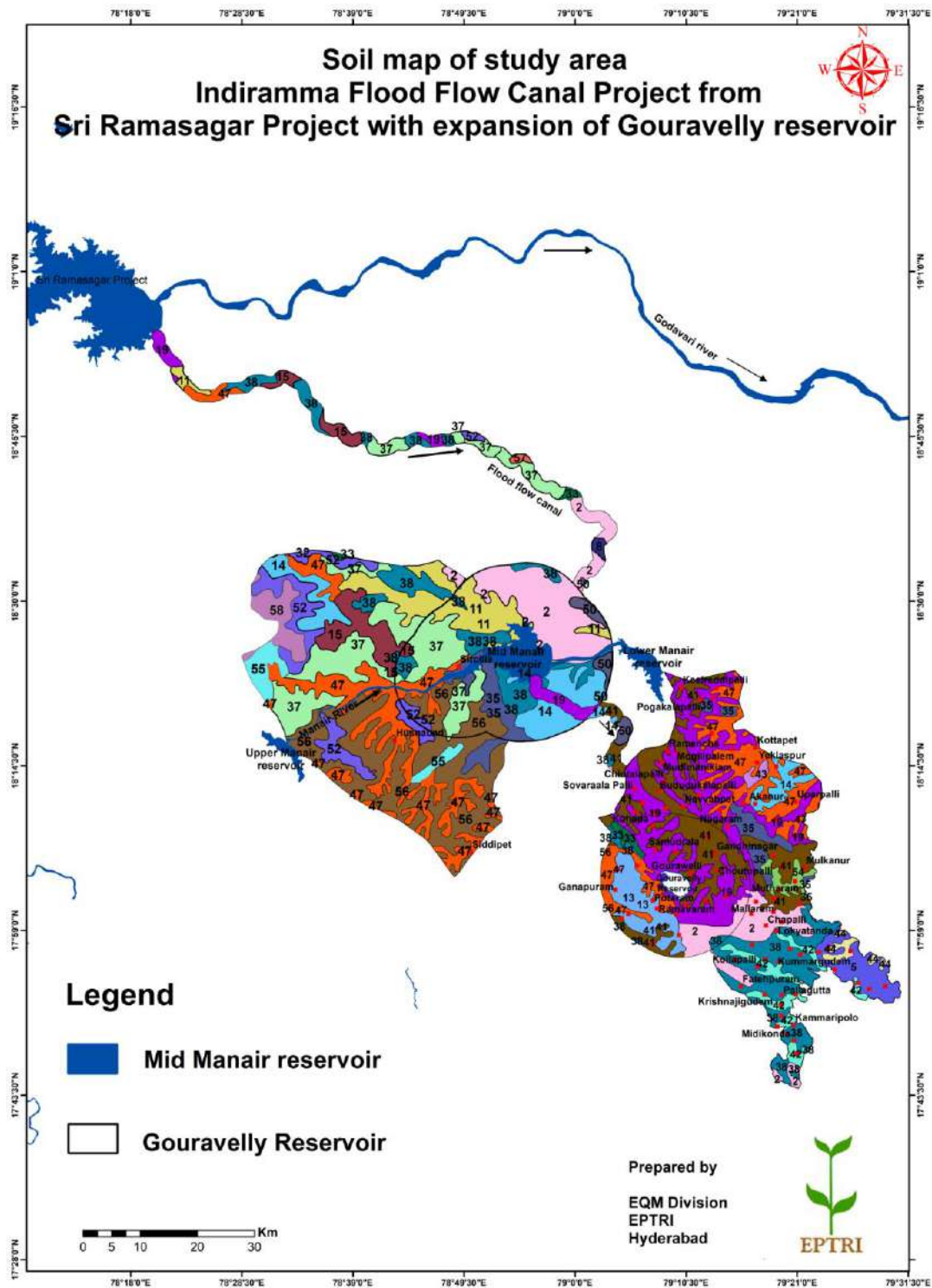
An intimate knowledge of the kind of soils their spatial distribution is a prerequisite in developing rational land use plan for agriculture, irrigation, drainage etc. Soil resource inventory provides an insight into the potentialities and limitation of soil for its effective exploitation. Soil survey



provides an accurate and scientific inventory of different soils, their kind and nature, and extent of distribution so that one can make prediction about their characters and potentialities. It also provides adequate information in terms of land form, terraces, vegetation as well as characteristics of soils (viz., texture, depth, structure, stoniness, drainage, acidity, salinity and so on) which can be utilized for the planning and development.

- The properties of soils that govern their spectral reflectance are color, texture, structure, mineralogy, organic matter, free carbonates, salinity, moisture and the oxides/hydroxides of iron and manganese.
- Using Survey of India top sheets and satellite remote sensing data based on geology, geomorphology, physiographic, slope boundary and land use different soil mapping units using uniform legend have been developed.
- The Pre-field Interpreted map has been used for selection of sample locations for field profiles study, soil sample collection for analysis of physic-chemical parameters, ground trotting and field work followed post field interpretation, validation and finalization maps preparation.

Fig. 3.14 Soil Map



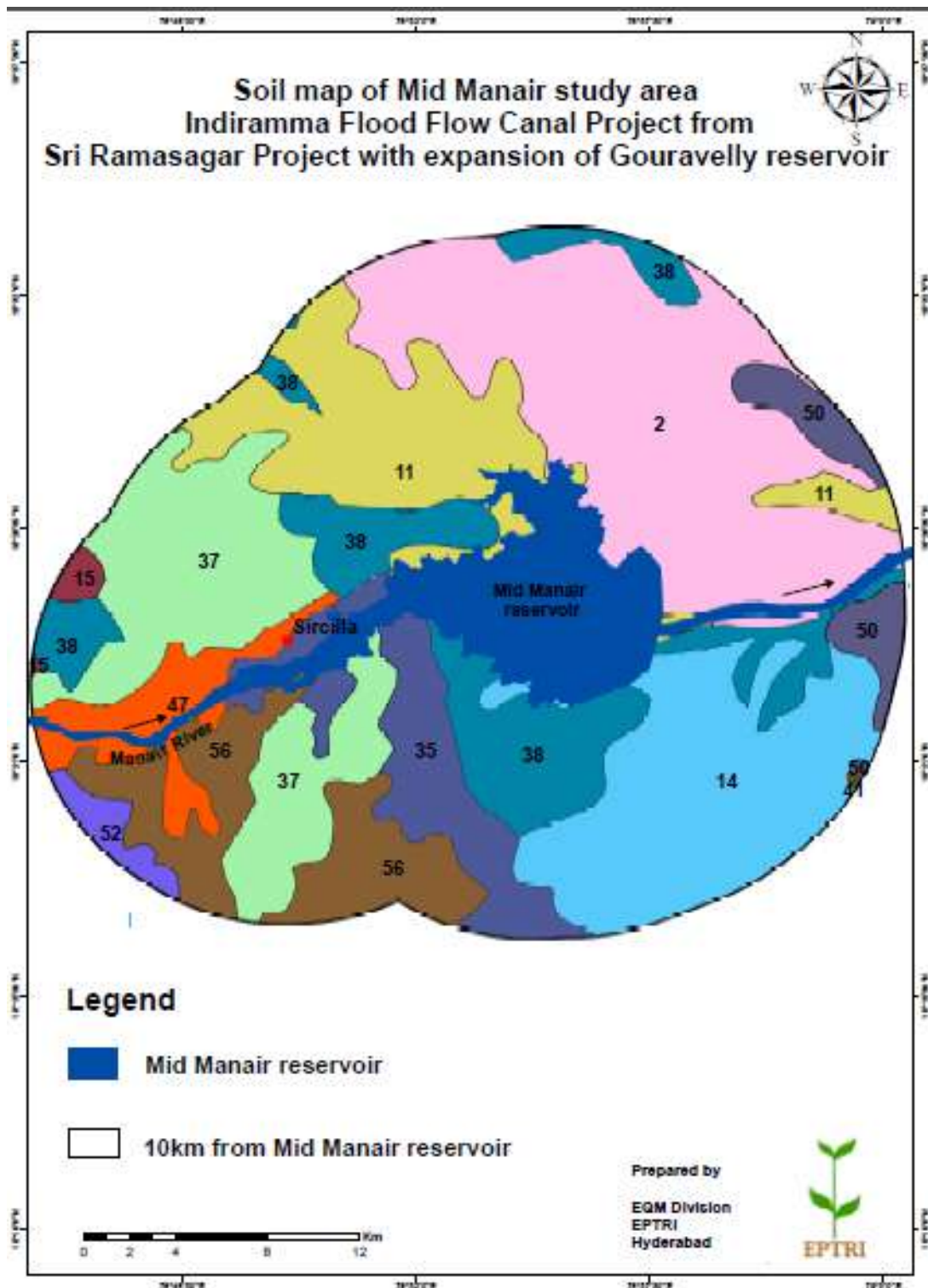


Fig. 3.15 Soil Map of Mid Manair reservoir study area

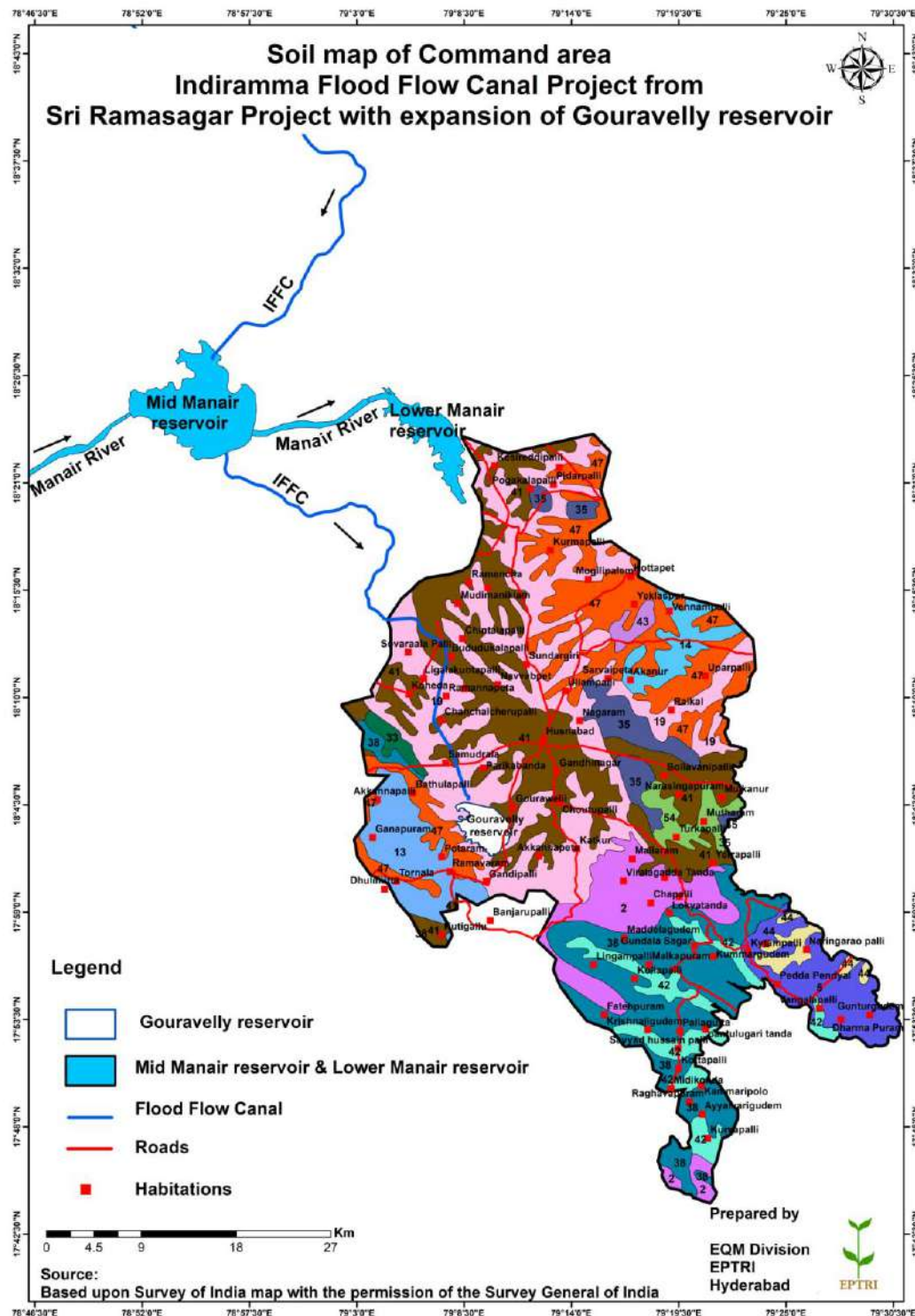


Fig. 3.17 Soil Map of Command Area

The following are the various soil mapping units and their description with taxonomic classification in the project area.

Table 3.20 Legend for Soil resource map

Mappin g unit	Description	Taxonomy
2	Moderately deep, well drained, gravelly loam soils with low AWC, on undulating lands, severely eroded; associated with: Moderately deep, well drained, gravelly clay soils.	Loamy-skeletal, mixed, Rhodicpaleustalfs Clayey: skeletal, mixed, Typic Rhodustalfs
5	Moderately deep, well drained, gravelly clay soils with very low AWC, on gently sloping lands with stony surface, moderately eroded; associated with: Moderately deep, well drained, gravelly clay soils.	Clayey-skeletal, mixed, Rhodicpaleustalfs Clayey-skeletal, mixed Typic Rhodustalfs
10	Moderately deep, well drained, clayey soils with medium AWC, on gently sloping lands, moderately eroded; associated with: Moderately deep, well drained, clayey soils, slightly eroded.	Fine, mixed, Typic Rhodustalfs Fine, mixed, Typic Haplustalfs
11	Moderately shallow, well drained, gravelly loam soils with very low AWC, on very gently sloping plains, moderately eroded; associated with: Moderately shallow, well drained, gravelly clay soils, slightly eroded.	Loamy-skeletal, mixed, Typic Haplustalfs Clayey-skeletal, mixed Typic Ustropepts
13	Moderately deep, well drained, gravelly clay soils with low AWC, on gently sloping lands, moderately eroded; associated with: Moderately deep, well drained, gravelly loam with very low AWC.	Clayey-skeletal, mixed Typic Haplustalfs Loamy-skeletal, mixed, Typic Haplustalfs
14	Moderately shallow, somewhat excessively drained, gravelly clay soils with very low AWC, on undulating lands, severely eroded; associated with: Shallow, somewhat excessively drained, gravelly clay soils, moderately eroded.	Clayey-skeletal, mixed Typic Haplustalfs Clayey-skeletal, mixed, Typic Ustropepts.
15	Moderately shallow, well drained, gravelly clay soils with low AWC, on rolling lands with gravelly surface, moderately eroded; associated with: Rock outcrops.	Clayey-skeletal, mixed Typic Haplustalfs Rock lands
19	Moderately deep, well drained, clayey soils with high AWC, on undulating lands, slightly eroded; associated with: Deep, well drained, gravelly clay soils with low AWC.	Fine, mixed Typic Haplustalfs Fine loamy, mixed, Typic Ustropepts
32	Moderately shallow, somewhat excessively drained, loamy soils with very low AWC on hills and ridges, severely eroded; associated with: Moderately shallow, somewhat excessively drained, gravelly loam soils.	Coarse loamy, mixed, Typic Ustorthents Laomy-skeletal, mixed, Typic Ustorthents
33	Very shallow, somewhat excessively drained, gravelly loamy soils with very low AWC, on hills and ridges with gravelly surface, severely eroded; associated	Loamy-skeletal, mixed Lithic Ustorthents



Mapping unit	Description	Taxonomy
	with: shallow, somewhat excessively drained, gravelly loam soils.	Loamy-skeletal, mixed, Lithic Ustropepts
35	Moderately deep, moderately well drained, loamy, calcareous soils with high AWC, on nearly level valleys, slightly eroded; associated with: Deep well drained, loamy, stratified soils.	Fine loamy, mixed, (calcareous), Typic Ustropepts Coarse loamy, mixed, Typic Ustifluvents
37	Moderately deep, well drained, clayey soils with high AWC, on undulating lands, severely eroded; associated with: Moderately deep, well drained, clayey soils.	Fine, mixed, Typic Ustropepts Fine, mixed, Typic Haplustalfs
38	Deep, well drained, clayey soils with high AWC, on gently sloping lands, slightly eroded; associated with: Deep, well drained, gravelly loams oils with low AWC.	Fine, mixed, Typic Ustropepts Loamy-skeletal, mixed, Typic Ustropepts
41	Deep, imperfectly drained, clayey, calcareous soils with very high AWC, on very gently sloping valleys, lightly eroded; associated with: Very deep, well drained, stratified loamy soils.	Fine, mixed, (calcareous), Aquic Ustropepts Fine, loamy, mixed, Fluventic Ustropepts
42	Very deep, moderately well drained, cracking clay, calcareous soils with very high AWC, on nearly level valleys, salinity in patches; associated with: Deep, well drained, loamy over sandy, calcareous, stratified soils.	Fine, montmorillonitic, (calcareous), Vertic Ustropepts Loamy over sandy, mixed, (calcareous), Typic Ustifluvents
43	Deep, moderately well drained, cracking clay, calcareous soils with very high AWC, on very gently sloping plains, salinity in patches; associated with: Moderately deep, well drained, loamy soils with high AWC.	Fine, montmorillonitic, (calcareous), Vertic Ustropepts Fine loamy, mixed, Typic Ustropepts
44	Moderately deep, moderately well drained, cracking clay, calcareous soils with very high AWC, on very gently sloping valleys, strongly sodic; eroded; associated with: Very deep, moderately well drained, cracking clay soils.	Fine, montmorillonitic, (calcareous), Vertic Ustropepts Fine, montmorillonitic, Chromic Haplusterts
47	Deep, moderately well drained, cracking clay, calcareous soils with very high AWC, on nearly level valleys, salinity in patches; associated with: Very deep, moderately well drained, cracking clay, calcareous soils.	Fine, montmorillonitic, (calcareous), Typic Haplusterts Fine, montmorillonitic, (calcareous), Vertic Ustropepts
48	Very deep, moderately well drained, cracking clay, calcareous soils with very high AWC, on very gently	Fine, montmorillonitic, (calcareous), Typic

Mappin g unit	Description	Taxonomy
	sloping plains, slightly in patches; associated with: Very deep, moderately well drained, cracking clay soils.	Haplusterts Fine, montmorillonitic, (calcareous), VerticUstrophepts
50	Moderately deep, moderately well drained, cracking clay, calcareous soils with very high AWC, on very gently sloping plains, moderately eroded; associated with: Deep, moderately well drained, cracking clay, calcareous soils.	Fine, montmorillonitic, (calcareous), LepticHaplusterts Fine, montmorillonitic, (calcareous), Ustertichaplocambids
52	Rock outcrops on rolling lands; associated with: Moderately shallow, well drained, gravelly clay soils, moderately eroded.	Rock lands Clayey-skeletal, mixed, Typic Rhodustalfs
54	Rock outcrops on hills and ridges; associated with: Shallow, well drained, gravelly clay soils, severely eroded.	Rock lands Clayey-skeletal, mixed, (paralithic) Ustorthents
55	Rock outcrops on undulating lands; associated with: Shallow, somewhat excessively drained, gravelly loam soils with stony surface, severely eroded.	Rock lands Loamy-skeletal, mixed, Lithic Ustorthents
56	Rock outcrops on undulating lands; associated with: Shallow, somewhat excessively drained, gravelly loam soils with stony surface, severely eroded.	Rock lands. Clayey-skeletal, mixed, Lithic Ustrophepts
58	Shallow, well drained, gravelly loam soils with very low AWC, on very gently sloping meses, moderately eroded; associated with: Moderately deep, moderately well drained, cracking clay soils with high AWC.	Loamy-skeletal, mixed (paralithic), Ustorthents Fine, montmorillonitic, VerticUstrophepts

3.8.1 Description of soil profile

The soil depth plays a very important role for selecting suitable cropping pattern and command areas and also for water management practices. The shallow soils which are less than 10 cm depth restrict root distribution and the plants would not take have the uptake of nutrients and moisture. However there is lot of variation among the crops to exploit the sub-surface. Crops like red gram, castor can penetrate their root system with sub surface horizons and extract nutrients and moisture and also improve the physical conditions of the soil. However scissoring of the soils to the depth of 45 cm, application of phosphorus to such depth to encourage the root system to sub-surface layers and able to withstand moisture stress and nutrient supplements will be high.

3.8.2 Texture of soils

Soil Texture is an important physical property of a soil and moderate variation can be achieved by manipulation. The soil texture will indicate bulk density, porosity, pore space, infiltration rate, water holding capacity and hydraulic conductivity. Soil texture will be determined by the relative properties of sand, silt and clay. However soil texture which is the arrangements of soil particles will vary moderately by management practices adopted.

3.8.3 Water holding capacity of soils

The maximum water holding capacity will vary depending on the soil texture. Black and deep black soils will hold water more than 50 cm – 100 cm. Sandy and sandy loam can hold water 30 cm – 100 cm. The available moisture also varies depending on soil depth and texture. The available moisture in sandy loams and sandy clay loams will be around 10 cm – 30 cm depth. However deep black clay and clayey soils will be around 15 cm – 30 cm. The available moisture plays a very important role in irrigation scheduling and plants for deciding of crops in different moisture. It is important factor for deciding Irrigation schedule.

3.8.4 Soil Quality

Fifteen (15) soil samples were collected from the study areas which includes 10 km radius of reservoir, command area and canal 1 km radius of both sites. Location of these places are depicted in Figure 3.18 and summarized in Table 3.21. Representative soil samples from depth (0-15 cm) were collected in 3 seasons (premonsoon, monsoon, and post monsoon) from these locations for estimation of the physic-chemical characteristics of soil.

Table 3.21 List of Soil Sampling Locations

Sampling code	Sampling Location	Latitude	Longitude
S1	Baswapuram	18°54' 10.002" N	78°20' 28.415" E
S2	Ramalachhmanapeta	18°46' 20.172" N	78°36' 41.638" E
S3	Kurmapalli	18°33' 53.440" N	79°2' 13.259" E
S4	Desaipalli	18°28' 39.620" N	78°56' 46.225" E
S5	Sirsilla	18°23' 30.454" N	78°48' 20.196" E
S6	Kandikatkur	18°23' 18.431" N	78°58' 26.995" E
S7	Vellampetla	18°21' 23.759" N	78°56' 2.680" E
S8	Gunukul Kondapur	18°18' 5.612" N	79°5' 17.631" E
S9	Nawabpet	18°10' 46.414" N	79°10' 23.704" E
S10	Regutuvanipalli	18°3' 39.663" N	79°7' 8.404" E
S11	Gouravelli	18°4' 9.297" N	79°10' 42.626" E
S12	Akkannapeta	18°2' 3.174" N	79°12' 25.551" E
S13	Ramavaram	18°1' 4.879" N	79°7' 52.452" E
S14	Kondapuram	17°58' 6.533" N	79°15' 7.768" E
S15	Pichara	17°58' 8.519" N	79°17' 46.805" E

3.8.5.1 Methodology of analysis of soil samples

Standard methods have been followed for the analysis of soil samples are shown in Table 3.22.

Table 3.22 Methods of Soil Sample Analysis

S.No	Parameter (s)	Test Method
1.	Soil Texture	Piper, 1966
2.	Particle size distribution	Piper, 1966
	Sand	
	Silt	
	Clay	
3.	Porosity	Page, 1968
4.	Bulk Density	Blake & Hartge, 1986

S.No	Parameter (s)	Test Method
5.	Water Holding Capacity	Keens cup apparatus
6.	pH	IS: 2720
7.	Electrical Conductivity	IS: 14767
8.	Exchangeable Sodium	M.L. Jackson
9.	Exchangeable Potassium	M.L. Jackson
10.	Exchangeable Calcium	M.L. Jackson
11.	Exchangeable Magnesium	M.L. Jackson
12.	Organic Carbon	IS2720:1972
13.	Total Alkalinity	APHA-2320-B
14.	Chlorides	APHA-4500-Cl-B
15.	SAR	By calculation
16.	Salinity	By calculation
17.	Available Nitrogen	Subbaiah and Asija 1956
18.	Available Phosphorous (P)	Olsen's S.R. Method

3.8.5.2 Soil quality Results and discussion

Winter Season soil Quality

A) Chemical Properties of Soil

The collected soil samples were analyzed for various chemical properties. The parameters selected were pH, electrical conductivity, soluble salts, exchangeable cations, nutrients and organic carbon content. The results are given in Annexure 3F.

pH is an important parameter which indicates the alkaline or acidic nature of soil. Soils collected from the villages in the study area is slightly acidic to slightly alkaline in nature having pH in the range of 6.5 to 7.8.

The EC for the soil samples are in the range of 0.063 – 0.68 mmhos/cm. Cation exchange capacity which was found to be in the range of 4.52 to 21.60 meq%. Organic carbon was found to be in the range of 0.18 to 1.87% i.e. low to high levels needed and difficult for growth and manure to be added.

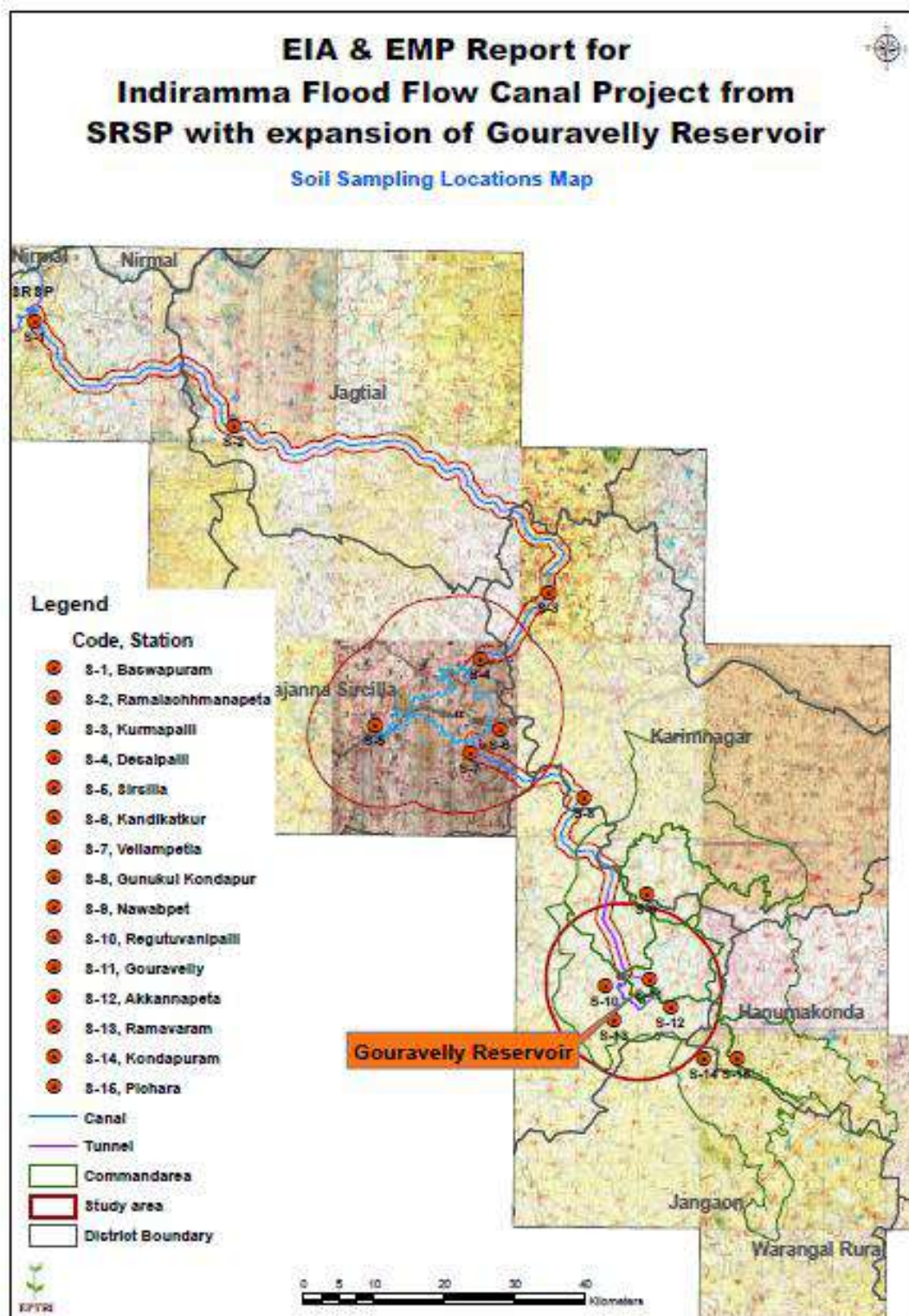
B) Nutrient Status

Organic matter present in the soil influences the soil physical and chemical properties. Organic matter commonly accounts for one third or more of the cation exchange capacity of surface soils. It is also responsible for stability of soil aggregates.

The macro nutrients Nitrogen (N), Phosphorus (P), Potassium (K) were analysed in the study area and compared with *Standard Soil Classification*, published by ICAR (1979), presented in **Table 3.23**.

The Nitrogen values ranged from 94 to 226 kg ha⁻¹ reflecting that the values were observed to be deficient and falls in low category. The minimum value was observed at Desaipalli (S-4) and the maximum value was observed at Ramalachhmanapeta (S-2). The Phosphorus values ranged from 1.2 to 5.3 kg ha⁻¹ indicating that the levels were in low category. The minimum value was observed at Pichara (S-15) and the maximum value was observed at Gouravelly (S-11). The Potassium values ranged from 72 to 296 kg ha⁻¹ indicating that values are observed to be medium to high category. The minimum value was observed at Pichara (S-15) and the maximum value was observed at Gunukul Kondapur (S-8).

Figure 3.18 Map showing soil quality locations





C) Physical Properties of Soil

Air-dried and sieved samples were used for determination of physical properties of soil. Soil characteristics such as the texture of the soil vary from, clay and sandy clay loam in annexure 3F.

The physical characteristics of soils viz., particle size distribution (sand, silt, clay), porosity and water holding capacity are given Annexure-3F. The water holding capacity & porosity were in the range of 31.74 – 49.43% and 42.98 – 56.27% respectively. Particle density range is from 2.29 - 2.86 mg/m³ and Bulk density range is from 1.11 - 1.48 mg/m³.

D) Trace Metals

The trace metals Cd, Cr, Pb, Ni, Cu, Zn, Mn were analysed. Cd levels were below the detection limit of the ICPOES instrument sensitivity levels.

Pre-monsoon Soil Quality

A) Chemical Properties of Soil

pH is an important parameter which indicates the alkaline or acidic nature of soil. Soils collected from the villages in the study area are slightly acidic to slightly alkaline in nature having pH in the range 6.6 to 8.2.

The EC for the soil samples are in the range of 0.114 – 0.333 mmhos/cm. Cation exchange capacity which was found to be in the range of 9.7 to 95.13 meq%. Organic carbon was found to be in the range of 0.12 to 0.93% i.e. low to high levels needed and difficult for growth and manure to be added.

B) Nutrient Status

The Nitrogen values ranged from 104 to 380 kg ha⁻¹ reflecting that the values were observed to be deficient and falls in low – medium category. The minimum value was observed at Desaipalli (S-4) and the maximum value was observed at Regutuvanipalli (S-10). The Phosphorus values ranged from 1.56 to 6.7 kg ha⁻¹ indicating that the levels were in low category. The minimum value was observed at Pichara (S-15) and the maximum value was observed at Gunukul Kondapur (S-8). The Potassium values ranged from 130 to 512 kg ha⁻¹ indicating that values are observed to be medium to high category. The minimum value was observed at Ramavaram (S-13) and the maximum value was observed at Kondapur (S-14).

C) Physical Properties of Soil

The physical characteristics of soils viz., particle size distribution (sand, silt, clay), porosity and water holding capacity are given Annexure-3F. The water holding capacity & porosity were in the range of 32.76 – 49.98% and 44.12 – 58.36% respectively. Particle density range is from 2.35 - 2.90 mg/m³ and Bulk density range is from 1.12 - 1.50 mg/m³.

D) Trace Metals

The trace metals Cd, Cr, Pb, Ni, Cu, Zn, Mn were analysed. Cd levels were below the detection limit of the ICPOES instrument sensitivity levels.



Monsoon Soil Quality

A) Chemical Properties of Soil

pH is an important parameter which indicates the alkaline or acidic nature of soil. Soils collected from the villages in the study area are slightly acidic to slightly alkaline in nature having pH in the range 6.9 to 8.7.

The EC for the soil samples are in the range of 0.081 – 0.302 mmhos/cm. Cation exchange capacity which was found to be in the range of 9.71 to 34.05 meq%. Organic carbon was found to be in the range of 0.12 to 0.93% i.e. low to high levels.

B) Nutrient Status

The Nitrogen values ranged from 113 to 188kg ha- reflecting that the values were observed to be deficient and falls in low – medium category. The minimum value was observed at Gunukul Kondapur (S-8) and the maximum value was observed at Gouravelli (S-11). The Phosphorus values ranged from 1.09 to 3.85 kg ha-1 indicating that the levels were in low category. The minimum value was observed at Kondapuram (S-14) and the maximum value was observed at Baswapuram (S-1). The Potassium values ranged from 209 to 362 kg ha-1 indicating that values are observed to be medium to high category. The minimum value was observed at R Vellampetla (S-7) and the maximum value was observed at Sirsilla (S-5).

C) Physical properties of Soil

The physical characteristics of soils viz., particle size distribution (sand, silt, clay), porosity and water holding capacity are given Annexure-3F. The water holding capacity & porosity were in the range of 31.49 – 48.53% and 43.53 – 58.81% respectively. Particle density range is from 2.21 - 2.88 mg/m³ and Bulk density range is from 1.1 - 1.45 mg/m³.

D) Trace metals

The trace metals Cd, Cr, Pb, Ni, Cu, Zn, Mn were analysed. Cd levels were below the detection limit of the ICPOES instrument sensitivity levels.

Table 3.23 Standard Soil Classification

S. No.	Soil Test	Classification
1	pH	<4.5 Extremely acidic 4.51 – 5.50 Very strongly acidic 5.51 – 6.0 moderately acidic 6.01 – 6.50 slightly acidic 6.51 – 7.30 Neutral 7.31 - 7.80 slightly alkaline 7.81 – 8.50 moderately alkaline 8.51 – 9.0 strongly alkaline 9.01 very strongly alkaline
2	Salinity Electrical Conductivity (mmhos/cm) (1ppm = 640 mmho/cm)	Up to 1.00 Average 1.01 -2.00 harmful to germination 2.01 – 3.00 harmful to crops (sensitive to salts)
3	Organic Carbon	Up to 0.2 : very less 0.21 – 0.4 : less 0.41 – 0.5 : medium 0.51 – 0.8 : on an average sufficient



S. No.	Soil Test	Classification
		0.81 – 1.00 : sufficient > 1.0 more than sufficient
4	Nitrogen (kg ha ⁻¹)	Up to 50 very less 51 – 100 less 101 – 150 good 151 – 300 better >300 sufficient
5	Phosphorus (kg ha ⁻¹)	Up to 15 very less 16 – 30 less 31 – 50 medium 51 – 65 on an average sufficient 66 – 80 sufficient >80 more than sufficient
6	Potash (kg ha ⁻¹)	0 -120 very less 120 – 180 less 181 – 240 medium 241 – 300 average 301 – 360 better >360 more than sufficient

3.9 Land Use and Land cover assessment

Remote Sensing in recent years has been established as most efficient and cost-effective tool for surveying, mapping and monitoring of varied natural and man-made resources. It has become particularly indispensable in mapping and monitoring the dynamic aspects of earth's surface features including land use / land cover.

Although land use at times is abstract, it can admirably be inferred from land cover, which is directly detected by remote sensing sensor and registered on the imagery. Variation in multi-spectral response of the different land cover categories enable detection, identification and categorization of the different land use classes commensurate with the scale of mapping.

Guided by these considerations, land use and land cover assessment of study area was carried out by visual interpretation of Resourcesat 2 LISS 4 MX data acquired during 23rd Oct.2022 and 04th Mar.2023 and ground truth verification.

The major components of land use and land cover assessment methodology are:

- Rapid reconnaissance of core area and the buffer area
- Development of image interpretation key
- Image interpretation with concurrent integration of land use classes
- Field validation
- Land use and land cover map finalization and statistics generation

The various steps involved are diagrammatically illustrated in Figure 3.20

Procedural Steps

The various procedural steps and Land use and Land cover assessment comprise:

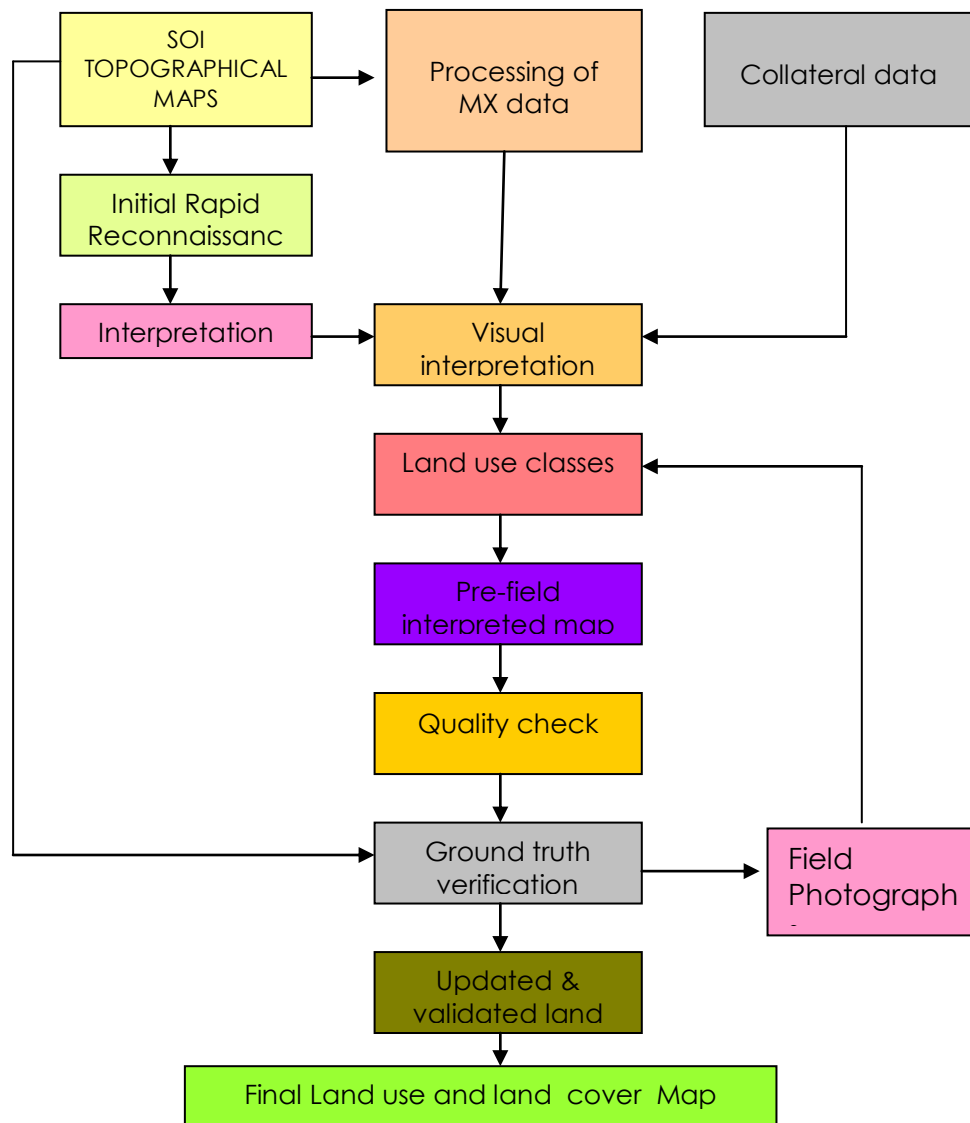
- Systematic image interpretation involving detection, identification, classification and codification of the Land use and Land cover assessment with reference to image interpretation keys and in conjunction with corresponding topographical and other ancillary maps.



- The extracted Land use and Land cover classes include cropland, fallows, plantations, scrub, built-up lands, various wasteland categories and probable perennial water bodies.
- Doubtful area, defining image interpretation keys were marked at each stage of interpretation for ground truth verification and assessment

Ground truth verification

Ground truth verification involved collection, verification and record of the different surface features that create specific spectral signatures / image expressions on FCC. In the study area, doubtful areas identified in course of interpretation of satellite imagery were systematically listed and transferred on to the corresponding Survey of India topographical maps for ground verification. In addition to these, traverses were made with reference to Survey of India topographical maps to verify interpreted land use and land cover classes.



3.20 Methodology of land use and land cover mapping



Collateral data used

Collateral data has been derived from Survey of India topographical maps. Also, local farmers and villager.

Land use Categories

The Land use / Land cover information provides extent and spatial distribution of various Land use and Land cover categories derived by the interpretation of satellite imagery presented in Fig. 3.21 to 3.30.

The following land use categories have been mapped in the area and are presented in Fig. 3.21 to 3.30

- Settlement
- Kharif Crop Land
- Rabi Crop Land
- Double Crop
- Agri.Fallow Land
- Agri.Plantation
- Barren rocky Stony Waste
- Open Scrub
- Dense Scrub
- Gullied ravinous land
- Quarry
- Moderately Dense Forest
- Scrub Forest
- Canal
- River

Fig. 3.21 Satellite image of Indiramma Flood Flow Canal from SRSP with expansion of Gouravelly Reservoir

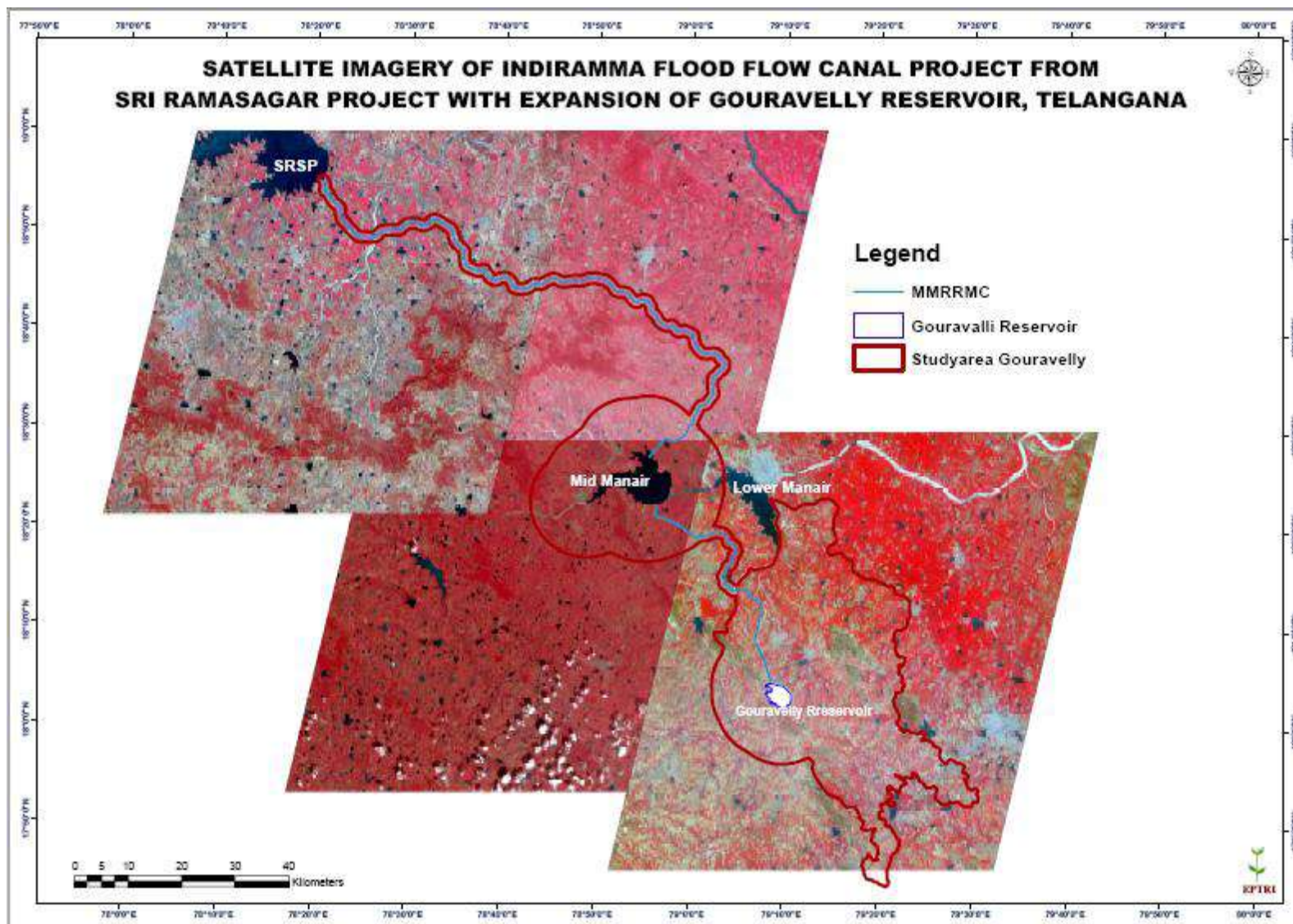


Fig.3.22 Land use and land cover map from SRSP to Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir

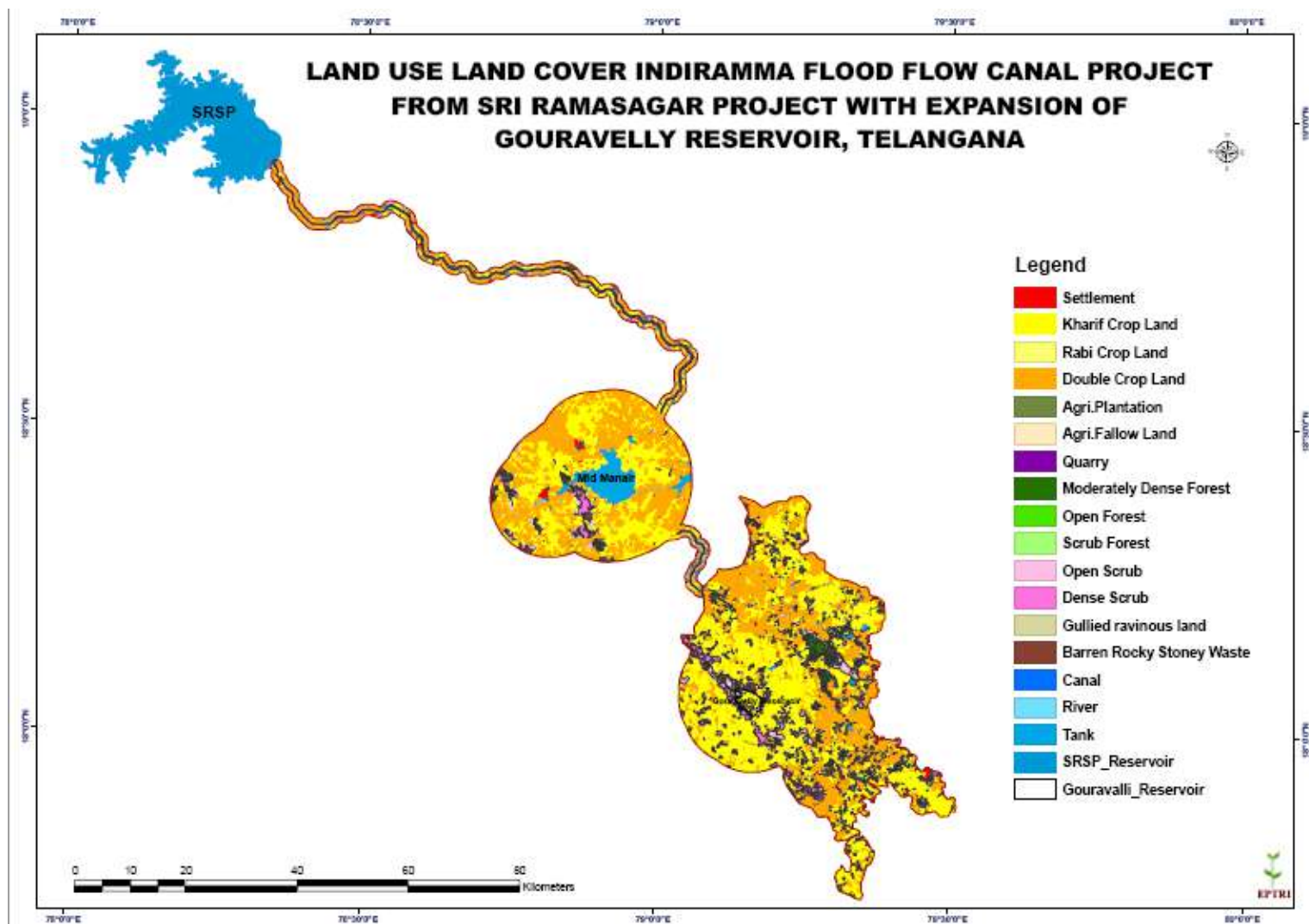




Fig.3.23 Satellite Imagery of Mid Manair (Kharif & Rabi) study area

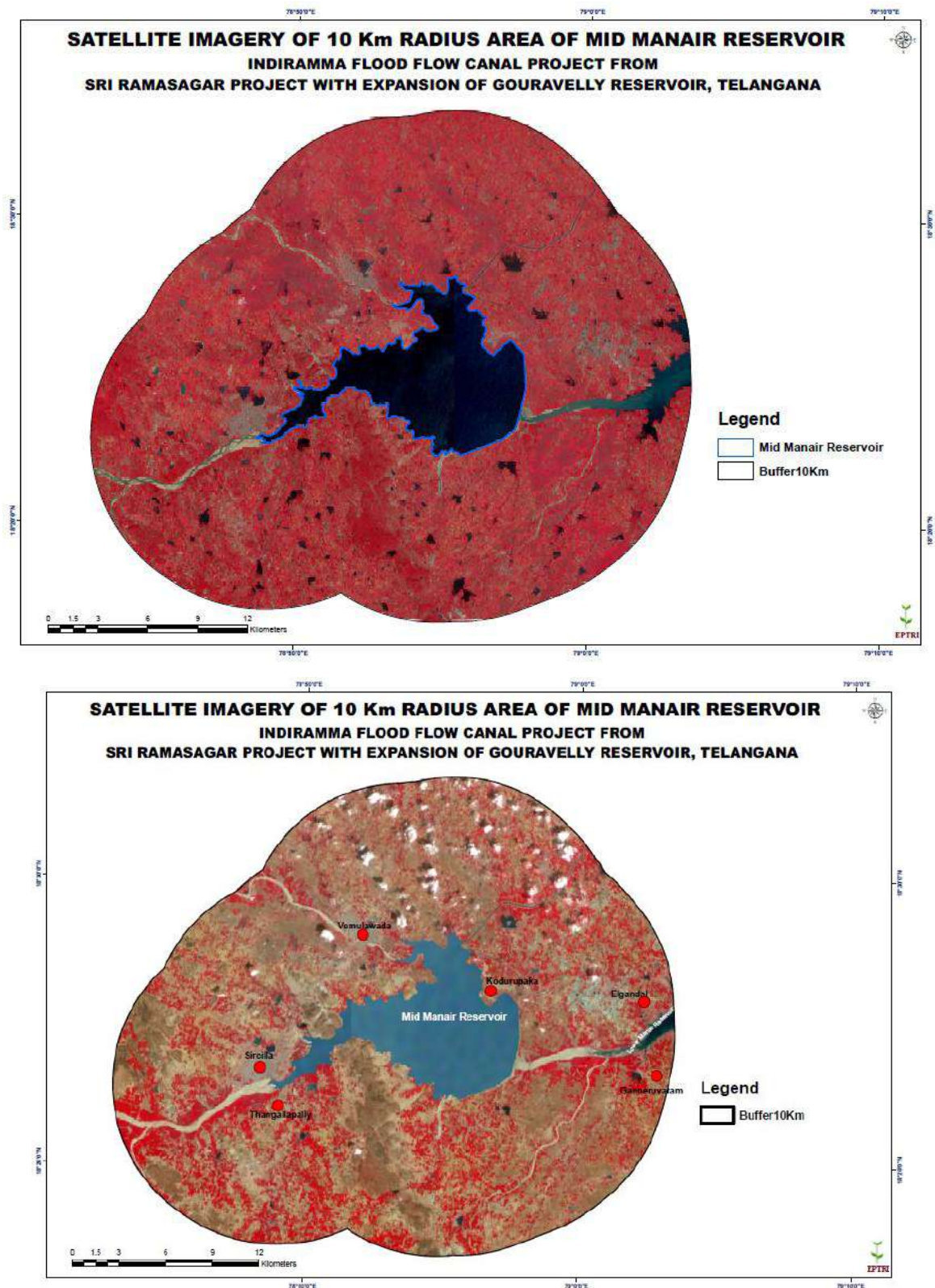




Fig. 3.24 Land Use and Land cover of Mid Manair reservoir study area

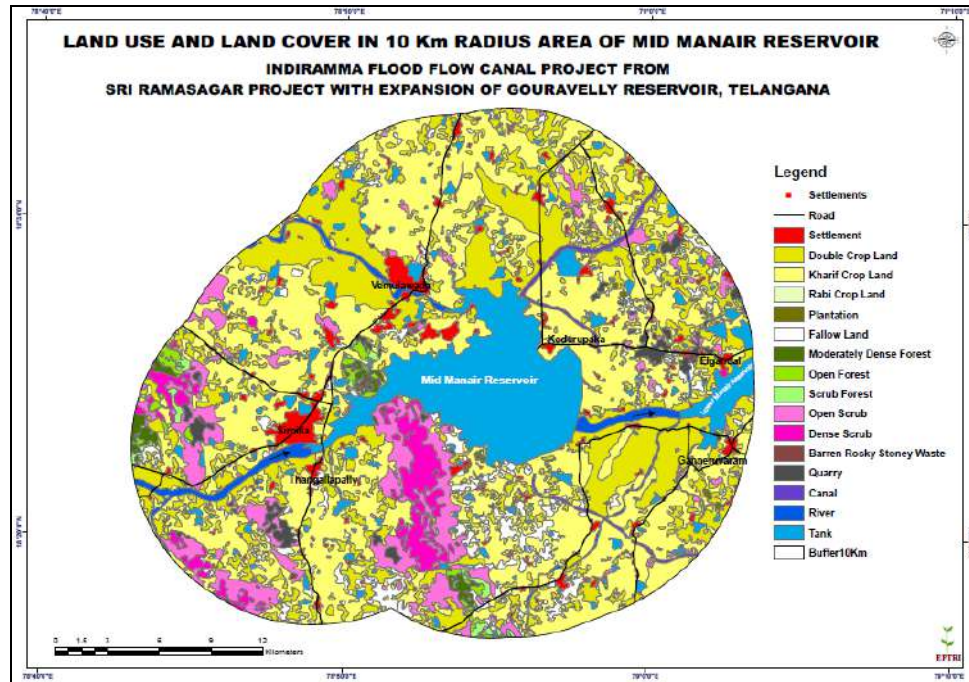


Fig.3.25 Satellite Imagery of Gouravelly Reservoir (Kharif) study area

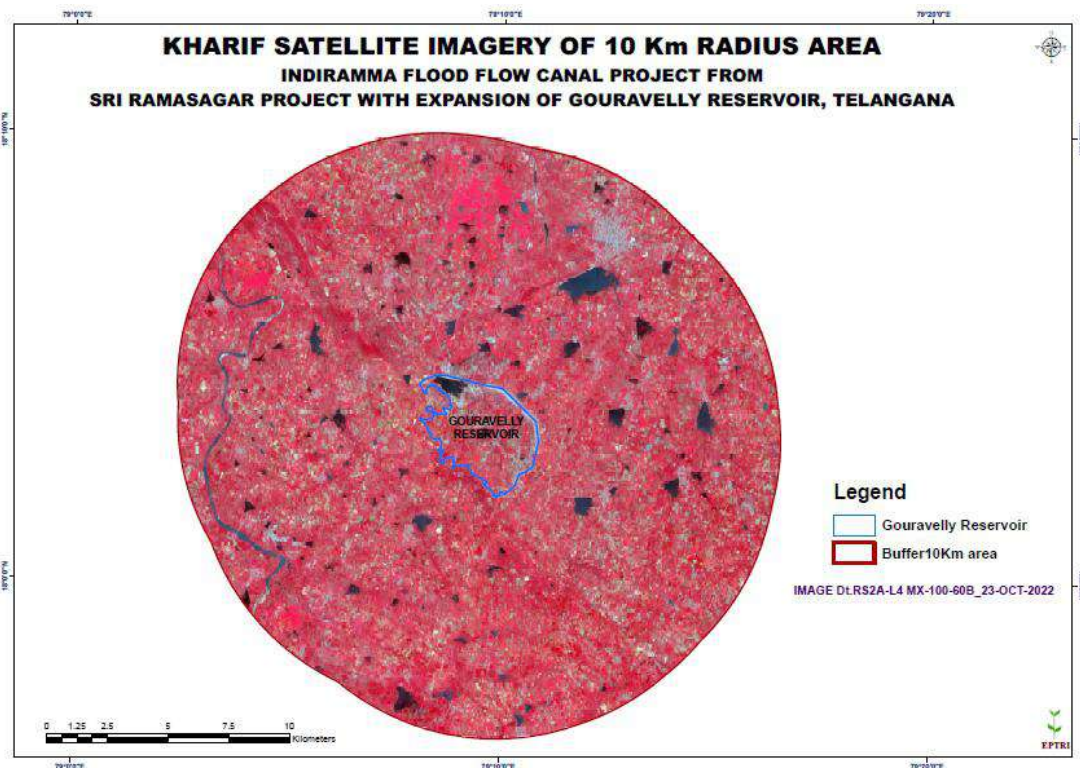




Fig. 26 Satellite Imagery of Grouavelly Reservoir (Rabi) study area

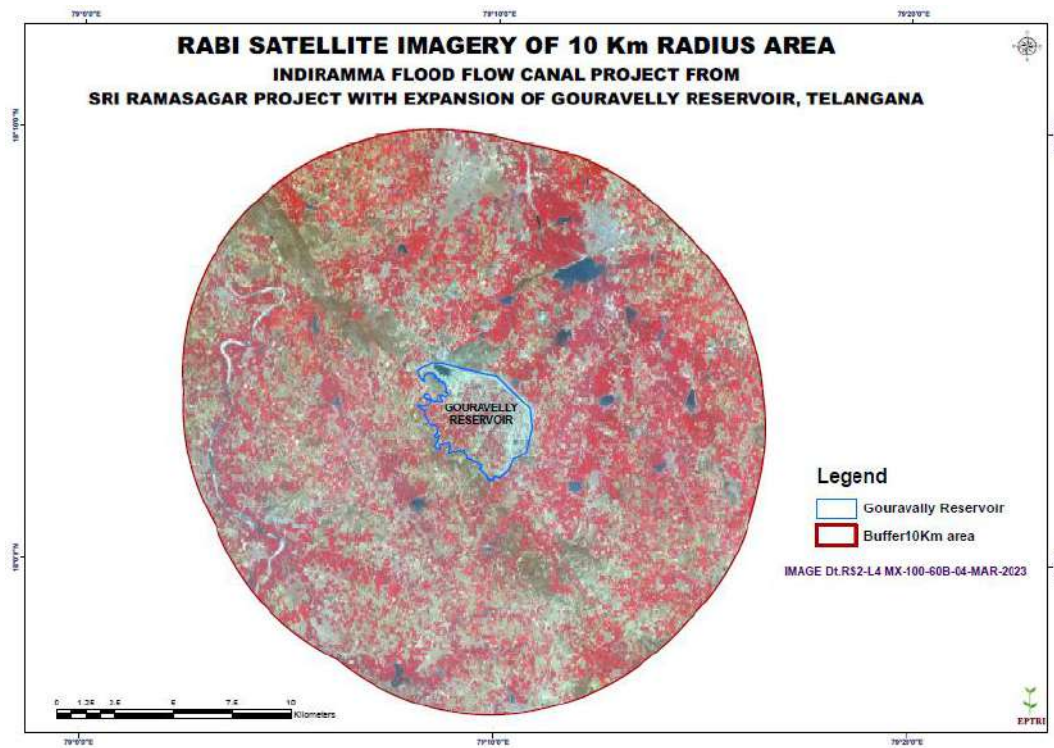


Fig. 3.27 Land Use and Land cover of Grouavelly Reservoir study area

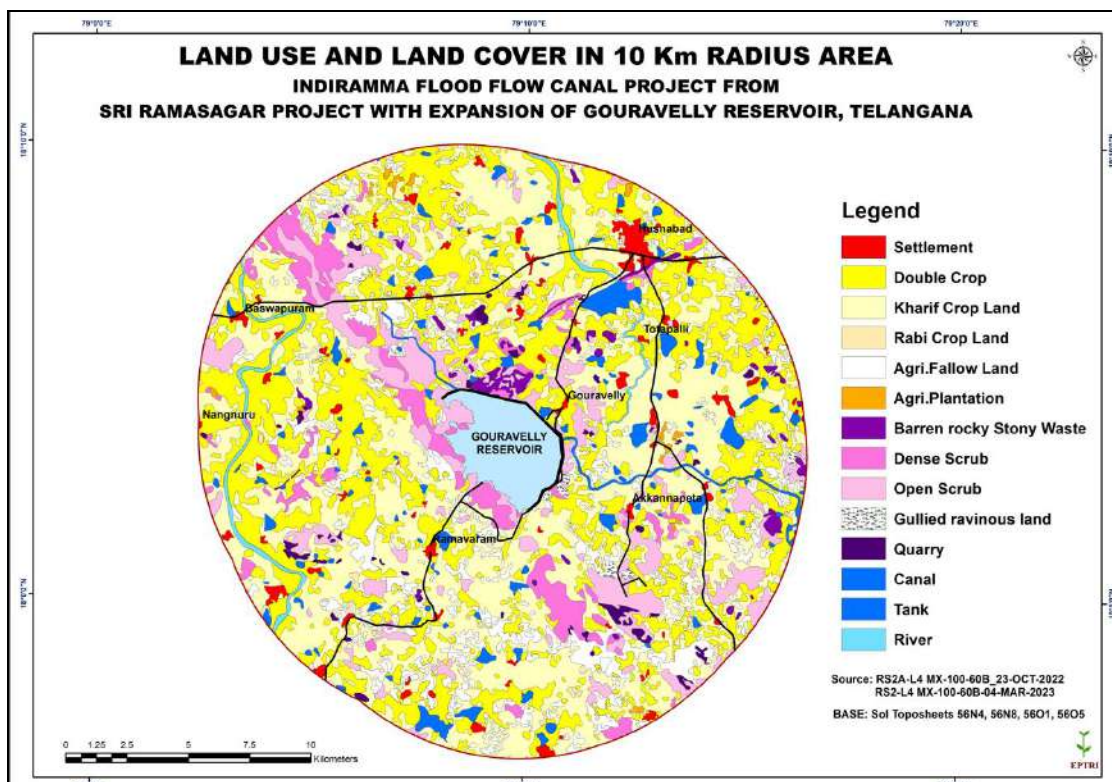




Fig. 3.28 Satellite Imagery of Command Area (Kharif) study area

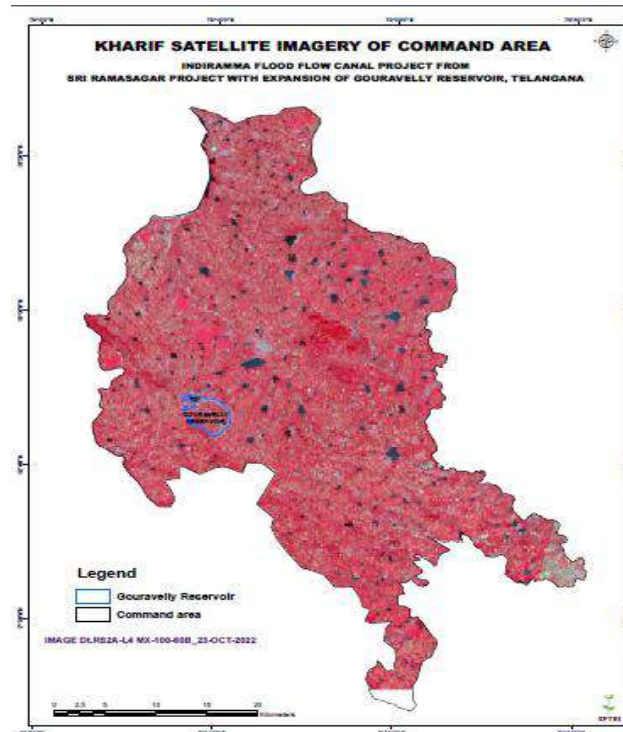


Fig. 3.29 Satellite Imagery of Command Area (Rabi) study area

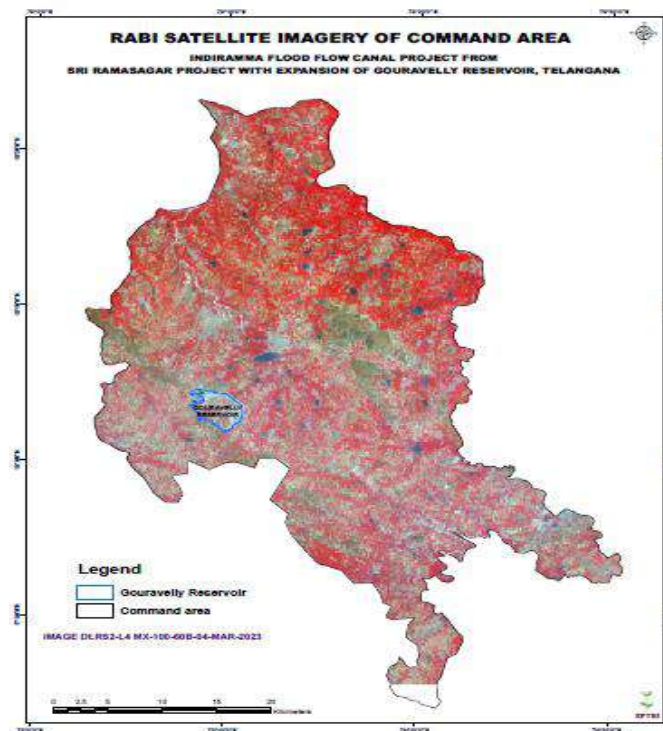




Fig. 3.30 Land use and Land cover map of Command Area

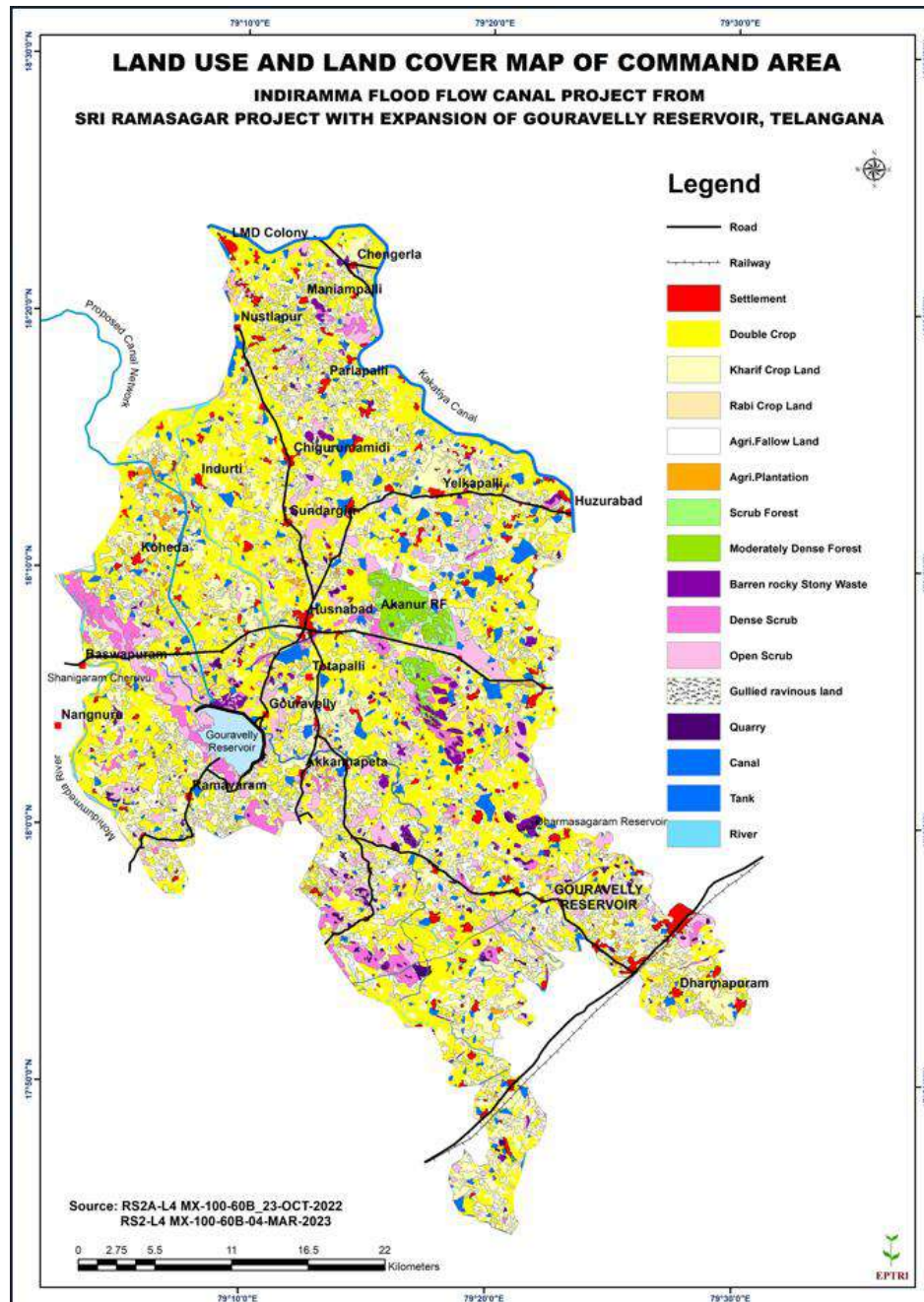
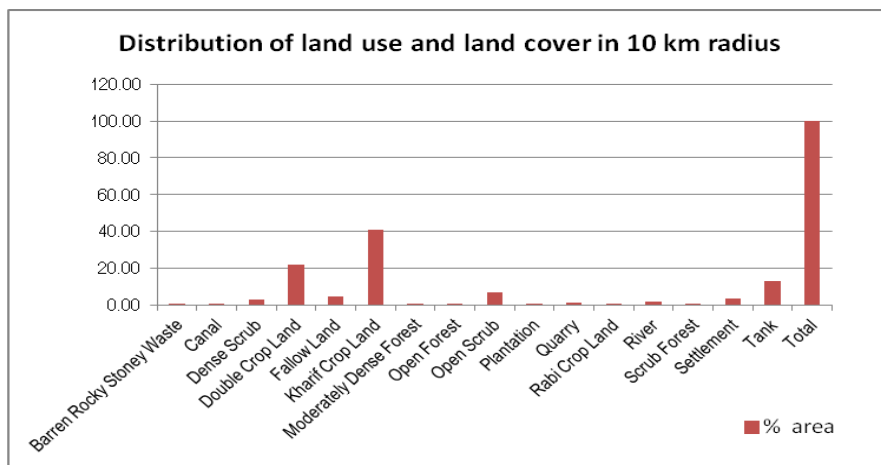


Table 24A Area statistics of Land use and land cover in Mid Manair Reservoir 10km radius area

Land use and land cover	Area (ha)	% area
Barren Rocky Stony Waste	215.20	0.25



Land use and land cover	Area (ha)	% area
Canal	499.92	0.58
Dense Scrub	2291.59	2.68
Double Crop Land	18874.94	22.09
Fallow Land	4020.24	4.70
Kharif Crop Land	34861.34	40.79
Moderately Dense Forest	538.81	0.63
Open Forest	702.58	0.82
Open Scrub	6014.86	7.04
Plantation	182.40	0.21
Quarry	1142.85	1.34
Rabi Crop Land	24.00	0.03
River	1527.86	1.79
Scrub Forest	473.05	0.55
Settlement	3041.07	3.56
Tank	11047.52	12.93
Total	85458.23	100.00



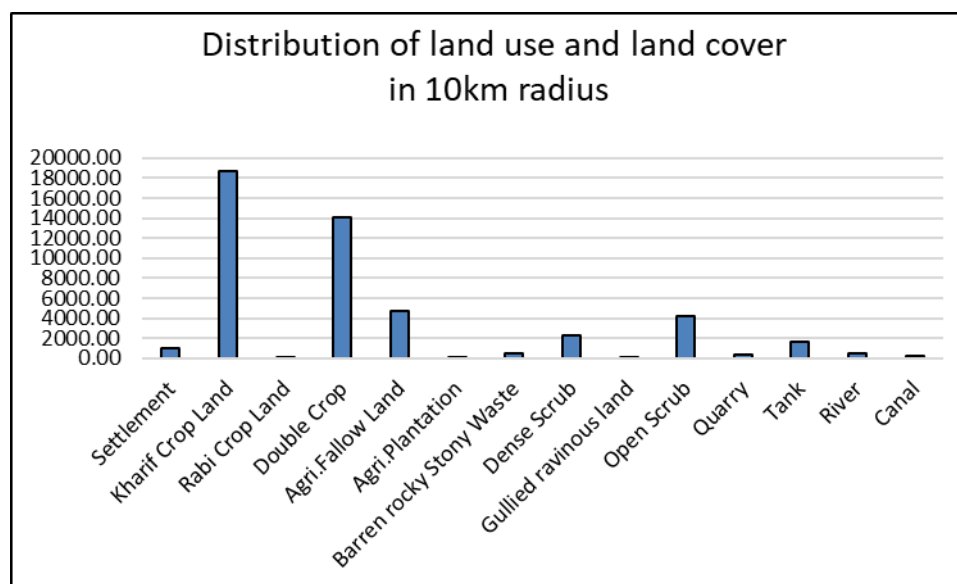
Based on the interpretation of land use and land cover using remotely sensed satellite data it is observed that in the study area the Settlement/builtup areas/ towns and villages occupy 3041.1 ha (3.56%); Kharif Crop Land 34861.34 ha (40.79%); Rabi Crop Land 24 ha (0.03%); Double Crop 18874.94 ha (22.09%); Fallow Land 4020.24 ha (4.70%); Barren rocky Stony Waste 215.20 ha (0.25%); Dense Scrub 2291.56 ha (2.68%); Open Scrub 6014.86 ha (7.04%); Quarry 1142.85 ha (1.34%); Tank 11047.52 ha (12.93%); River 1527.86 ha (1.79%); plantation 182.40 ha (0.21%).



Table 24B Area statistics of Land use and land cover in Gouravelly Reservoir 10km radius area

Land use category	Area (Ha)	% area
Settlement	1003.71	2.06
Kharif Crop Land	18660.63	38.36
Rabi Crop Land	171.99	0.35
Double Crop	14099.04	28.99
Agri.Fallow Land	4712.28	9.69
Agri.Plantation	164.93	0.34
Barren rocky Stony Waste	524.32	1.08
Dense Scrub	2247.49	4.62
Gullied ravinous land	139.77	0.29
Open Scrub	4161.05	8.55
Quarry	402.10	0.83
Tank	1704.10	3.50
River	468.07	0.96
Canal	180.46	0.37
Total	48639.4	100

Area statistics of Land use and land cover in Gouravelly Reservoir 10km radius area



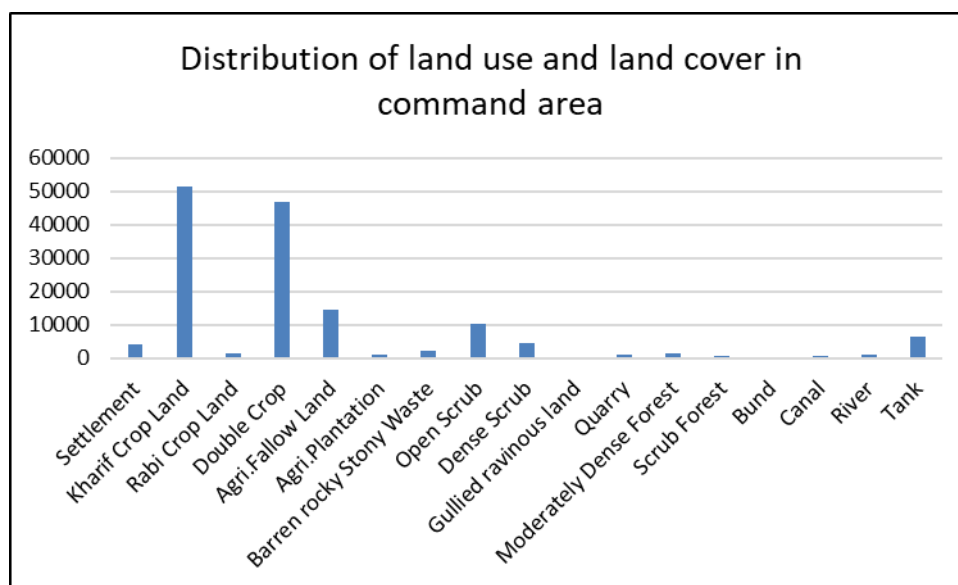
Based on the interpretation of land use and land cover using remotely sensed satellite data it is observed that in the study area the Settlement/builtup areas/ towns and villages occupy 1003.71 ha (2.06%) which include Baswapuram, Husnabad, Totapally, Gouravelly, Nangnuru, Ramavaram, Akkannapets ; Kharif Crop Land 18660.63 ha (38.36%); Rabi Crop Land 171.99 ha (0.35%); Double Crop 14099.04 ha (28.99%); Agri.Fallow Land 4712.28 ha (9.69%); Agri.Plantation 164.93 ha (0.34%); Barren rocky Stony Waste 524.32 ha (1.08%); Dense Scrub 2247.49 ha (4.62%); Gullied ravinous land 139.77 ha (0.29%); Open Scrub 4161.05 ha (8.55%);



Quarry 402.10 ha (0.83%); Tank 1704.10 ha (3.50%); River 468.07 ha (0.96%); Canal 180.46 ha (0.37%).

Table 2.24C Statistics of Land use and land cover in command area

Land use and land cover category	Area (Ha)	% area
Settlement	4314.8	2.9
Kharif Crop Land	51680.9	34.6
Rabi Crop Land	1391.1	0.9
Double Crop	46954.8	31.5
Agri.Fallow Land	14644.1	9.8
Agri.Plantation	989.9	0.7
Barren rocky Stony Waste	2126.5	1.4
Open Scrub	10317.1	6.9
Dense Scrub	4646.1	3.1
Gullied ravinous land	298.8	0.2
Quarry	1282.4	0.9
Moderately Dense Forest	1541.9	1.0
Scrub Forest	891.3	0.6
Bund	61.7	0.0
Canal	601.9	0.4
River	1080.3	0.7
Tank	6416.1	4.3
Total	149239.6	100



Based on the interpretation of land use and land cover using remotely sensed satellite data it is observed that in the command area Settlements/builtup areas/ towns and villages occupy 4314.79 ha (2.89%) of area which include LMD Colony, Chengeral, Maniampalli,Parlapalli,



Chigurumamidi, Koheda, Yelkapalli, Huzurabad, Husnabad, Totapally, Gouravelly, Akkannapet, Ramavaram, Baswapuram, Dharmapuram etc., and Kharif Crop Land is observed in 51680.86 ha (34.63%) of area; Rabi Crop is cultivated in 1391.06 ha (0.93%); Double Crop is cultivated in 46954.79ha (31.46%); Agri.Fallow Land is observed in 14644.14 (9.81%); Agri.Plantation 989.93 ha (0.66%); wastelands like Barren rocky Stony Waste observed in 2126.52 ha (1.42%); Open Scrub in 10317.13 ha (6.91%); Dense Scrub in 4646.10ha (3.11%); Gullied ravinous land is observed in 298.83ha (0.20%); Granite Quarries occupy 1282.37ha (0.86%) of area; Moderately Dense Aknur reserved forest is observed in 1541.85ha (1.03%) of area; Scrub Forest in 891.25ha (0.60%); Canal 601.91ha (0.40%); River 1080.26 ha (0.72%) and Tanks 6,416.09ha (4.30%).

3.10 Biological Environment

Before start of any Environmental Impact Assessment study, it is necessary to identify the baseline levels of relevant environmental parameters which are likely to be affected as a result of the proposed project. A similar approach has been adopted for conducting the EIA study with respect to biological environment for the proposed Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir project. This Chapter outlines the ecological aspects of flora and fauna. The chapter is based on primary data collection for three seasons and review of secondary data. The study is mainly to assess the impacts and to avoid or mitigate any loss caused by the proposed project.

3.10.1 Field Studies

As a part of the study, a detailed ecological survey was conducted at different sites in the project area for various seasons. The seasons covered are listed as below:

Post-monsoon season (Winter) : February 2023
 Pre-monsoon season (Summer) : May 2023
 Monsoon season : August 2023

Study area

The study area has been selected with respect to various project appurtenances following 10 km radius criterion for reservoirs (Mid manair and Gouravelli Reservoirs) and command area along the main canal route and distributory networks. The project is from Sriramsagar project to (with expansion of) Gouravelli reservoir, Gouravelli village, Akkannapet mandal, Siddipet district. The command area falls in the districts of Peddapalli, Rajanna, Sircilla, Jagitial, Karimnagar, Siddipet, Hanumakonda and Jangoan.. Moreover, there is no forest land involved, and they are no notified ecologically sensitive areas, wildlife ecosystems falling in the submergence due to the increased capacity of the Gouravelly reservoir for the enhanced 8.23 TMC capacity.

3.10.2 Objective :

Table 3.25 Indicators and parameters assessed for Baseline data Studies

S. No.	Indicators to be assessed	Objective
I.	Ecology & Biodiversity	Floristic and faunal composition
		Biodiversity index (species diversity – Important Value Index Simpson's Index, , (IVI), Shannon-Weiner Index)
		Top 10 dominant families



		Major Agricultural crops
		Scheduled species as per Indian Wildlife Protection Act (1972) and Threatened and Endangered species as per International Union for Conservation of Nature (IUCN) redlist.
		Rare and endemic species
II.	Protected Areas	Ecologically sensitive areas like National Park, Sanctuaries, Biosphere Reserves, Tiger Reserves and Wildlife corridors, if any
III.	Impacts & Mitigation measures	Suggest anticipated impacts and suitable mitigation measures

3.10.3 Methodology

Assessment of Floral diversity

I. Selection of sample plots and laying

The study area was marked on the topographical map of 1:50,000 scale.

The selection of quadrats was done on a random basis to cover the entire vegetation status of the study area.

Taking the Latitude and Longitude of the centre of each quadrat as the centre of the plot, it was located on the ground with the help of GPS. A plot of 31.62 x 31.62 m was laid taking the centre of the selected quadrat as the centre of the plot for the study of vegetation.

Within the sample plot, 5 x 5 m plots were laid at the four corners and at the center to study the shrub layer and regeneration of tree species.

Within the each 5 x 5 m sample plots, 1 x 1 m size plot was laid at the centre of the plot to study the information on ground layer including herbaceous species.

II. Enumeration of Data

The primary data recorded on number of individuals in a species were utilized to derive secondary attributes like density, frequency and abundance following standard phytosociological methods of Misra (1968).

Important Value Index (IVI) was estimated following the formula developed by Cottam and Curtis (1956) taking into consideration of Relative Frequency and Relative Density. For Trees IVI value is calculated using Relative Dominance (RDom.)+Relative Frequency (RF)+Relative Density (RD) and for Shrubs and Herbs IVI is calculated using (Relative Abundance) RA+RD+RF.

Species diversity indices like Simpson's Index (λ) and Shannon-Wiener Index (H') were calculated as per Magurran (1988).

Simpson Index (Simpson, 1949)

The species dominance was measured by using Simpson's index. It is a measure of dominance since it weighted towards the abundances of commonest species. It is estimated by using formula:

$$Cd = \sum (ni/N)^2$$

Shannon - Wiener Index (Shannon and Weaver, 1963)

Shannon's index of diversity is the measure of the average degree of uncertainty in predicting to what species individuals chosen at random from a collection of 'S' species and 'N' individuals will belong. This average uncertainty increases as the number of species increases and as the



distribution of individuals among the species becomes even. Thus, $H'=0$ when all species are represented by the same number of individuals. It is estimated by using the formula:

The species diversity was determined by Shannon - Wiener index

$$H' = - \sum (n_i/N) \log (n_i/N)$$

where, n_i = number of individuals belonging to the i th species

N = Total number of individuals in the sample

3.10.4 Assessment of Faunal Diversity

- For mammals and reptiles, intensive survey was conducted by using transect method in all major habitats and recorded the species through direct and indirect evidences.
- For amphibians, survey was conducted both in aquatic and terrestrial areas by searching under the logs and stones, digging through litter and soil, searching below the ground vegetation, tree hollows and under fallen barks.
- For sampling butterflies, line transect of variable length was used widely. Generally, 500 m to 1000 m transect were laid in all the habitats.
- Butterflies seen within 5 m on either side of this transect were recorded.
- Birds were sampled in two ways - line transects and point counts. Line transect: In this method, a straight line of 1 km or less (if the habitat is small) was laid. In this line, all birds seen or heard within 25 m on either side of transect were recorded. Point counts: In this method, at one-point birds seen or heard within 50m radius for 5 minutes were recorded. After a gap of 10 minutes, it was repeated and the observations made were recorded. In the same manner, repeated the observation in another point and recorded different species of birds. Photographs were also taken for evidences, wherever possible.

3.10.5 Threat Assessment Criteria

Indian Wild Life Protection Act, 1972, IUCN Database, Red Data Book, ENVIS Database, etc. were referred.

3.10.6 Source of Secondary Information and validity

Secondary information on flora, fauna and their distribution was collected from Forest Department. Faunal availability was also verified from the local people. Conservation status of the flora and fauna were cross checked under IUCN Redlist and Indian Wildlife Protection Act (IWPA) 1972 and further Amendments through published literature and online as well.

3.10.7 Results

The studies were carried out in two zones: core zone [Activity Area of the project] and buffer zone [10 km surrounding the core zone]. The core zone of the project is the expansion of Gouravelli reservoir. In the core zone, there is no forest land involved however at the boundary of the core zone falls under buffer zone about 22.76 ha area allotted for Compensatory afforestation (NFL) under Kaleshwaram Lift irrigation project in the year 2019-2020 at gandipally village falls under Aknur beat 1 of Husnabad section and range of Siddipet district. Planted nearly 1200 plant species which include *Ficus benghalensis*, *Ficus racemosa*, *Ficus mollis*, *Holoptelea integrifolia*, *Ficus virens*, *Cassia fistula*, *Bamboo* spp., *Wrightia arborea*, *Wrightia tinctoria*, *Butea monosperma*, *Ailanthus excelsa*, *Azadirachta indica*, *Lannea coromandelica*, *Albizia amara*, *Celastrus paniculatus*, etc. Agricultural fields and human settlements were acquired and road diverted for the expansion of Gouravelli reservoir. The buffer zone of the



project area comprised with human settlements, agricultural fields roadside/commercial plantations, scrub lands etc. The biodiversity present in the buffer area of the project is in the form of scrub/degraded land biodiversity, agro-biodiversity, urban vegetation (natural and planted), and aquatic life in the water bodies.

3.10.7.1 Floral Diversity

The list of floral species was prepared based on primary survey and through review of site literatures and secondary data available with various government offices was referred. The available vegetation is basically tropical dry deciduous forest and shrub type as per Champion and Seth Classification's revised forest types of India (1968). The plant species names were also verified with plantsoftheworld.org

Season-I: A total of 359 plant species belonging to 244 genera and 73 families were documented in the study area. Among 359 species listed: 93 species are trees, 42 shrubs, 10 lianas, 24 climbers, 155 herbs, aquatic herbs 33, aquatic shrub and aquatic climber each with 1 species as shown in figure -3.31.

Season-II: A total of 364 plant species belonging to 248 genera and 74 families were documented in the study area. Among 361 species listed: 93 species are trees, 42 shrubs, 10 lianas, 24 climbers, 156 herbs, aquatic herbs 37, aquatic shrub and aquatic climber each with 1 species as shown in figure 3.31.

Season-III: A total of 399 plant species belonging to 253 genera and 74 families were documented in the study area. Among 399 species listed: 93 species are trees, 42 shrubs, 10 lianas, 24 climbers, 187 herbs, aquatic herbs 41, aquatic shrub and aquatic climber each with 1 species as shown in figure 3.31.

Plant species of trees, shrubs, lianas, climbers and herbs documented during the field survey in the study area are shown in the Annexure-3G.

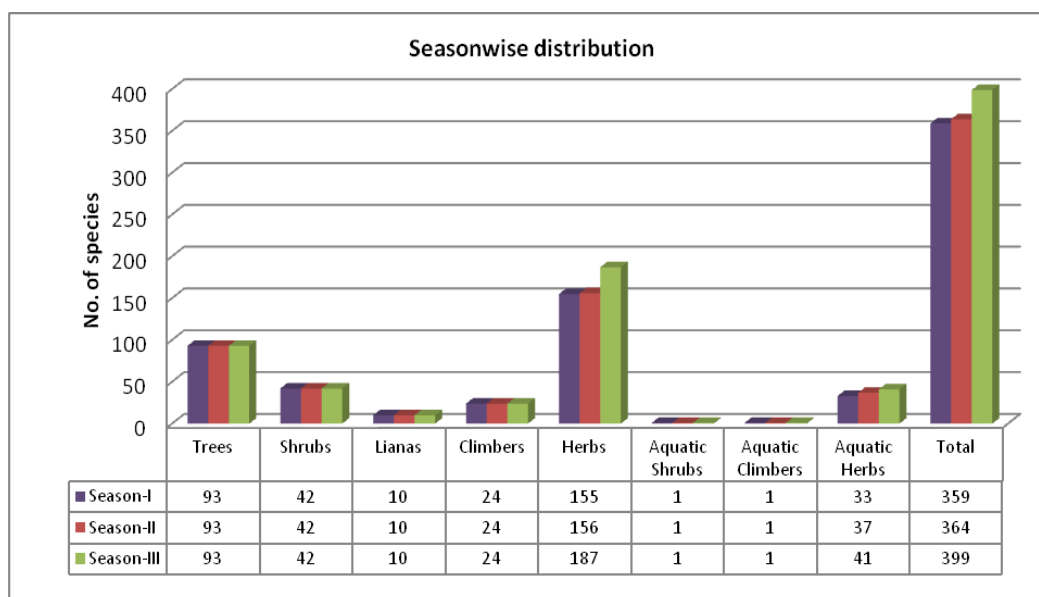


Fig. 3.31 Season wise Vegetation Analysis



Among families, Fabaceae is the most dominant family represented by 60 species of 33 genera followed by Poaceae (39/24), Cyperaceae (31/7), Malvaceae (20/13), Asteraceae (19/18), Acanthaceae (19/15), Apocynaceae (17/14), Lamiaceae (12/8), Rubiaceae (11/8) and Amaranthaceae (10/7). The remaining 64 families shares 161 species.

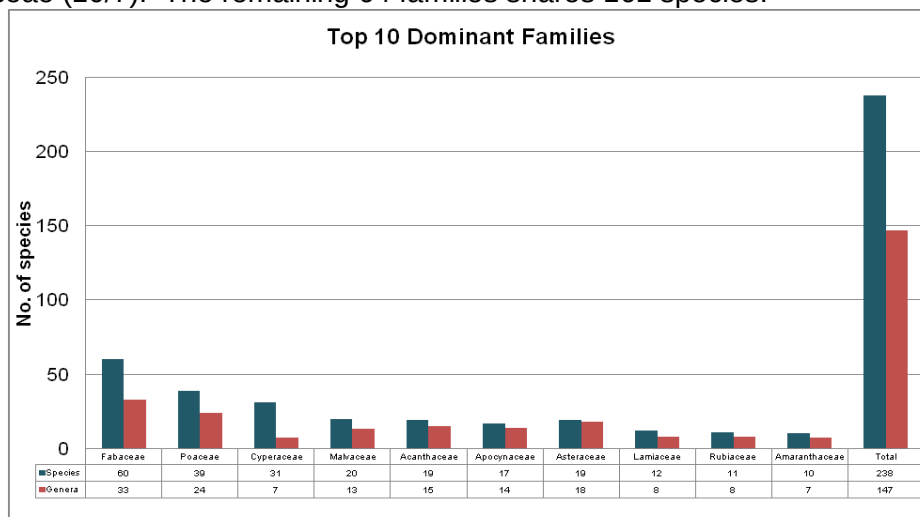


Fig. 3.32 Distribution of top ten families

S.No.		
1	Crops	Predominant crops are <i>Vari (Oryza sativa)</i> , <i>Mokkajonna (Zea mays)</i> , <i>Patthi (Gossypium spp.)</i> , <i>Kandulu (Cajanus cajan)</i> , <i>Jonnalu (Sorghum bicolor)</i> , <i>Poddutirugudu (Helianthus annus)</i> , mango orchards and vegetables
2	Fruit Trees	Major trees include <i>Mamidi (Mangifera indica)</i> , <i>Sapota (Manilkara zapota)</i> , <i>Eetha (Phoenix sylvestris)</i> , <i>guava (Psidium guajava)</i> and <i>Danim ma (Punica granatum)</i> .

Buffer Zone

Phyto-sociological features of trees, shrubs and herbs observed in core zone are shown in Annexure-II. Dominant species IVI for trees, shrubs and herbs are discussed below:

A. Trees - From Importance Value Index (IVI), it is inferred that for trees the dominant species is *Wrightia tinctoria* with 36.02 IVI followed by *Cleistanthus collinus* (34.46), *Bridelia montana* (31.35), *Chloroxylon swietenia* (27.61) and *Butea monosperma* (26.68). Simpson's Index value (0.10) and Shannon Wiener Index value (1.10).

B. Shrubs – *Senna auriculata* is identified as dominant species as it possess high IVI value of 36.12 followed by *Ehretia microphylla* with 27.55, *Grewia hirsuta* (26.79), *Canthium coromandelicum* (24.13) and *Dodonaea viscosa* with 21.89. Simpson's Index value is 0.08 and the Shannon Wiener Index value is 1.12.

C. Under herbs *Chromolaena odorata* is identified abundant with 55 IVI followed by *Andrographis paniculata* with 47.31, *Justicia glauca* (43.38), *Triumfetta rhomboidea* (34.81) and *Spermacoce articularis* with 30.41. Simpson's Index value is 0.14 and the Shannon Wiener Index value is 0.89.



3.10.7.2 Rare, Endemic and Threatened Flora as per IUCN category of the study area

During our survey observed the presence of *Pterocarpus santalinus* and *Tectona grandis* which falls under endangered category as per IUCN list, *Jacaranda mimosifolia*, *Chloroxylon swietenia* and *Dalbergia latifolia* falls under vulnerable category where as *Aegle marmelos* and *Swietenia mahagoni* falls under near threatened category but all these species are planted species.

3.10.7.3 Fauna of the study area:

As per the secondary data and primary data collected, a total of 77 faunal species belonging to 69 genera of 50 families were listed in the study area. Among all Avifauna is dominated with 44 species followed by Herpetofauna (14), Butterflies (7), Mammals and Fishes each with 6 species.

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Mammals: In the study area, a total of 6 species of mammals distributed in 6 genera of 6 families belonging to 5 orders were recorded. The common species include Common Mongoose, Wild Boar, Bat, Indian Hare, and Indian Palm Squirrel.

Herpetofauna: It is represented with 14 species belonging to 2 orders of 11 families; it includes reptiles and amphibians consisting of two major orders namely Squamata and Anura, of which 8 species of reptiles belonging to order Squamata and 5 species of amphibians belonging to order Anura.

Avi-fauna: A total of 44 bird species belongs to 14 orders and 27 families were recorded. Among them, order Passeriformes represented with high number of species (13 species distributed in 12 genera of 11 families), followed by Pelecaniformes (7/6/2); Coraciiformes (5/4/3); Columbiformes (3/1/1); Ciconiiformes, Cuculiformes, Gruiformes and Galliformes each with 2 species belong to 2 genera of 1 family, Charadriiformes and Suliformes (2/2/2), Accipitriformes, Anseriformes, Psittaciformes, Strigiformes and each represented with 1 species belong to 1 genera of 1 family respectively.

Butterflies: Butterflies under the order Lepidoptera represented with 7 species belonging to 6 genera of 2 families. Common butterflies include Plain Tiger, Tawny Coster, Common Jezebel and Common Evening Brown.

Fishes: A total of 6 species belonging to 6 genera of 4 families. The species documented are Jella, Bommidai, Korrameenu, Seelavathi and Perkalu.

3.10.7.1 Scheduled species as per Wildlife Protection Act, 1972

- Schedule-I species include Indian Peafowl, Indian Chameleon, Indian Rat Snake, Indian Cobra, Shikra, Grey Junglefowl and Barn owl owl
- A total of 43 species fall under Schedule -II category of which some of them include are Common mongoose, Indian hare, Red-wattled Lapwing, Doves, Kingfisher, etc., and Wild Boar under Schedule-III.
- A total of 5 faunal species falls under schedule-IV, 20 species under not-listed category and one species is listed under Schedule V category.



The list of faunal diversity along with their status as per IWPA, 1972 and IUCN Red list are shown in Annexure – 3G.

3.10.8 Aquatic Ecology

Plankton communities are broadly classified into two basic categories such as phytoplankton and zooplankton. Plankton occurs in all natural water, reservoirs, rivers, irrigation canals, lakes, ponds and tanks. The phytoplanktons are of minute microscopic plants floating in water. They are the primary producers in the aquatic food web. Zooplankton and other animals that graze on the phytoplankton are the primary consumers. The composition of phytoplankton and zooplankton of a particular aquatic ecosystem are indicators of environmental stress.

3.10.8.1 Methodology

Phytoplankton

- Plankton net (mesh size 25 µm) was swept on surface water and plankton was collected and transferred in to plastic container and fixed in Lugol's solution
- Then plankton samples were centrifuged at 1500-2000 rpm for 10-12 min. The phytoplanktons settled were diluted to a desirable concentration in such a way that they could be easily counted individually under compound binocular microscope and phytoplanktons were measured and multiplied with the dilution factors, using Sedgwick Rafter cell APHA (2005). Pearson correlation matrix was used to establish the relationship among various environmental variables and phytoplankton density.

Zooplankton

- Zooplankton net (158µm) was swept on surface water and plankton was collected and transferred in to plastic container and fixed in 5% neutralized formalin solution.
- Then plankton samples were centrifuged at 1500-2000 rpm for 10-12 min. The Zooplankton settled were diluted to a desirable concentration in such a way that they could be easily counted individually under compound binocular microscope and Zooplankton were measured and multiplied with the dilution factors, using Sedgwick Rafter cell APHA (2005). Pearson correlation matrix was used to establish the relationship among various environmental variables and Zooplankton density.

3.10.8.2 Results

The phytoplanktonic community of water body during seasonal variations such as winter, premonsoon, and Monsoon seasons of the present study was represented by four groups namely Chlorophyceae, Bacillariophyceae, Myxophyceae and Euglenophyceae. As evident from the study, Euglenophyceae is completely absent during premonsoon season. Chlorophyceae dominated over Bacillariophyceae followed by Myxophyceae.

3.11 SOCIO- ECONOMIC ENVIRONMENT

The socio-economic assessment of the sample villages is considered to know the socio-economic status. The project proponent is committed to take up the socio-economic development initiatives not only to minimize the negative impact on the population but also to improve the socio-economic status of population living in 10 km radius of the project as its sustained efforts as part of its Corporate Social Responsibility-CSR.

3.11.1 Methodology adopted

The methodology adopted for the study is review of published secondary data (District Census Statistical Handbooks - 2011 and Primary Census Abstract of Census - 2011) on population,



sex ratio and average household size, density of population, social stratification, literacy rate and occupational structure of villages covered in Mid Manair study area, Gouravelly reservoir study area and Command area.

Villages falling within the study area were visited to have first-hand assessment of the socio-economic conditions of the people living in these villages. The information gathered during the interactions with communities and Participatory Rural Appraisal (PRA)/ Rapid Rural Appraisal (RRA) and Focused Group Discussions covered different aspects of socio-economic indicators to evaluate the present quality of life of the people living in the area and to know the people's perceptions on the proposed expansion project.

3.11.1.1 Review of Demographic and Socio-Economic Profile-2011 of Mid Manair reservoir (MMR) study area

The village wise demographic data of Mid Manair Reservoir study area has 84 locations belong to erstwhile Karimnagar district.

- 12 villages of Boinpalle mandal,
- 12 villages and one urban location of Vemulavada mandal,
- 4 villages of Konaraopeta mandal,
- 2 villages of Yellareddipet mandal,
- 1 urban ward and 14 villages of Sircilla mandal,
- 17 villages of Ellanthakunta mandal,
- 2 villages of Bejjanki mandal,
- 2 villages of Gangadhara mandal and
- 6 villages of Karimnagar mandal

However, after reorganisation of districts these mandals are part of belongs to Rajanna Sircilla and Karimnagar districts, Telangana. Detailed demographic information of 10 kms radius villages and urban wards are presented in **Annexure-A**. The salient features of the demographic and socio-economic conditions are analyzed and described in the following sections.

3.11.1.2 Distribution of population of Mid Manair Reservoir (MMR) study area

As per 2011 census, the study area consisted of 2,84,338 persons inhabited in the study area. The distribution of Population in the study area is shown in **Table - 3.27**

Table 3.27 Distribution of Population in Mid Manair reservoir (MMR) study area

Sr. No	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	No.of households	28768	18651	24540	71959
2	Male Population	57077	37141	47172	141390
3	Female Population	57432	37823	47693	142948
4	Total Population	114509	74964	94865	284338
5	Male population (0-6yrs)	5530	3336	4012	12878
6	Female population (0-6yrs)	5233	3177	3834	12244
7	Total Population (0-6yrs)	10763	6513	7846	25122
8	Average household size	3.98	4.02	3.87	3.95
9	% of 0-6yrs to the total Population	9.40	8.69	8.27	8.84
10	% of males to the total Population	49.84	49.55	49.73	49.73



11	% of female to the total Population	50.16	50.45	50.27	50.27
12	Sex ratio	1006	1018	1011	1011
13	Child Sex ratio (0-6yrs)	946	952	956	951
14	Density of Population	821	406	418	516

Source: Census of India 2011

Average household size at Mid Manair Reservoir (MMR) study area

The study area of MMR has a household size of 3.95 as per 2011 census.

Population density of Mid Manair Reservoir (MMR) study area

The density of population reveals that the study area has an overall density of 516 persons per square kilometre. The Karimnagar district density of population is 319 and the Telangana state's density of population is 312 as per 2011 census reports.

Sircilla and Vemulawada towns are part of study area around MMR. Population density of Mid Manair Reservoir study area density is (516) which is higher than the district and state.

Sex Ratio of Mid Manair Reservoir study area

The configuration of male and female indicated that males constitute to about 49.73% and females to 50.27% of the total population as per 2011 census records. The study area on an average has 1011 females per 1000 males as per 2011 census reports. In comparison to the Karimnagar district (1008) and Telangana's (sex ratio 988) the study area has recorded good sex ratio.

Child Sex Ratio of Mid Manair Reservoir study area

In the study area the child sex ratio is 951 female children for 1000 male children. In comparison to the adult sex ratio, the child sex ratio is less in the study area. However, the study areas child sex ratio is little Higher than the Telangana (932) child sex ratio.

Rural and urban population of Mid Manair Reservoir study area

Out of total population (2,84,338) in the Mid Manair Reservoir study area, the rural population (112392) consists of 60.47% and the urban population (171946) consists of 39.53 % these belong to Boinpalle, Vemulawada, Konaraopeta, Yellareddipet, Sircilla, Ellanthakunta, Bejjanki, Gangadhara and Karimnagar mandals of Karimnagar district of Telangana. The urban and rural population details and the proportion of population of Mid Manair Reservoir study area is presented in **Table-3.28 and 3.29** respectively.

Table-3.28 Rural and urban Population In Mid Manair Reservoir study area

S.No	Mandal	District	Total Urban wards	Total Urban population	% of Urban Population	Total Rural Villages	Total Rural population	% of Rural Population	Total urban wards and Rural villages	Total urban and Rural population
1	Boinpalle	Karimnagar	0	0	0.00	12	29578	100.00	12	29578



S.No	Mandal	District	Total Urban wards	Total Urban population	% of Urban Population	Total Rural Villages	Total Rural population	% of Rural Population	Total urban wards and Rural villages	Total urban and Rural population
2	Vemulawada	Karimnagar	1	33706	58.88	11	23538	41.12	12	57244
3	Konaraopeta	Karimnagar	0	0	0.00	4	6075	100.00	4	6075
4	Yellareddipet	Karimnagar	0	0	0.00	2	3911	100.00	2	3911
5	Sircilla	Karimnagar	13	78686	65.51	14	41425	34.49	27	120111
6	Ellanthakunta	Karimnagar	0	0	0.00	17	36852	100.00	17	36852
7	Bejjanki	Karimnagar	0	0	0.00	2	7233	100.00	2	7233
8	Gangadhara	Karimnagar	0	0	0.00	2	9007	100.00	2	9007
9	Karimnagar	Karimnagar	0	0	0.00	6	14327	100.00	6	14327
		Total	14	112392	39.53	70	171946	60.47	84	284338

Source: Census of India 2011 and observations

Table - 3.29 Proportion of urban and rural population in Mid manair reservoir study area

S No	Particulars	0 -2 Kms	2 -5 Kms	5 -10 Kms	0 -10 Kms
1	Urban Wards	13	1	0	14
2	Rural Villages	11	16	43	70
3	Total villages	24	17	43	84
4	Proportion Total villages	28.57	20.24	51.19	100.00
5	Urban population	78686	33706	0	112392
6	Proportion of Urban Population	27.67	11.85	0	39.53
7	Rural population	35823	41258	94865	171946
8	Proportion of Rural Population	12.60	14.5	33.4	60.47
9	Total Population	114509	74964	94865	284338
10	% Urban and Rural Population	40.27	26.36	33.36	100.00

Source: Census of India 2011

Review of Demographic and Socio-Economic Profile-2011 of Gouravelly Reservoir Study area and Command Area

As a part of Gouravelly Reservoir 10 kms study area village wise demographic data analysed for 43 villages comprise of

- 2 villages of Bheemadevarapalle mandal of Karimnagar district,
- 20 villages of Husnabad mandal of Karimnagar district,
- 4 villages of Koheda mandal of Karimnagar district,
- 5 villages of Nangnoor mandal of Medak district,



- 1 village of Ghanpur (Station) mandal of Warangal District,
- 4 villages of Narmetta mandal of Warangal District,
- 7 villages of Maddur mandal of Warangal District.

After reorganisation of districts by state administration, these locations are now part of Husnabad and Akkannapet mandals of Siddipet district, Telangana. The location wise demographic detailed information of villages in 10 kms radius are presented in **Annexure-H**. The salient features of the demographic and socio-economic conditions are analyzed and described in the following sections.

Distribution of population of Gouravelly Reservoir study area

As per 2011 census, the study area consists of 1,31,185 persons inhabited in the study area. The distribution of population in the study area is shown in **Table - 3.30**

Table 3.30 Distribution of population at Gouravelly reservoir study area

Sr. No	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	No.of households	1532	8160	23183	32875
2	Male Population	2947	16182	46543	65672
3	Female Population	2918	16117	46478	65513
4	Total Population	5865	32299	93021	131185
5	Male population (0-6yrs)	293	1537	4424	6254
6	Female population (0-6yrs)	280	1429	4163	5872
7	Total Population (0-6yrs)	573	2966	8587	12126
8	Average household size	3.83	3.96	4.01	3.99
9	% of 0-6yrs to the total Population	9.77	9.18	9.23	9.24
10	% of males to the total Population	50.25	50.10	50.03	50.06
11	% of female to the total Population	49.75	49.90	49.97	49.94
12	Sex ratio	990	996	999	998
13	Child Sex ratio (0-6yrs)	956	930	941	939
14	Density of Population	260	227	289	269

Source: Census of India 2011

Average Household Size at Gouravelly Reservoir study area

The study area has a household size of 3.99 as per 2011 census.

Population Density of Gouravelly Reservoir study area

The density of population reveals that the study area has an overall density of 269 persons per square kilometre. The Karimnagar district density of population is 319 and the Telangana state's density of population is 312 as per 2011 census reports.

The Husnabad municipality is a Part of study area. Population density of Gouravelly Reservoir Study area density is (269) which is lesser than the district and state.

Sex Ratio at Gouravelly Reservoir study area



The configuration of male and female indicated that males constitute to about 50.06% and females to 49.94% of the total population as per 2011 census records. The study area on an average has 998 females per 1000 males as per 2011 census reports. In comparison to the Karimnagar district and Telangana's (Karimnagar district 935 and the Telangana State sex ratio is 988) sex ratio the study area has recorded good sex ratio and it is good sign of sex ratio. However, the sex ratio in the study area directly and indirectly reveals certain geographical and sociological aspects in relation to female.

Child Sex Ratio at Gouravelly Reservoir study area

In the study area the child sex ratio is 939 female children for 1000 male children. In comparison to the adult sex ratio, the child sex ratio is less in the study area. However, the study areas child sex ratio is almost Equal to Karimnagar district (935) child sex ratio, and also little good than the Telangana (932) states child sex ratio.

Rural and Urban Population at Gouravelly Reservoir study area

Out of total population (1,31,185) in the study area, the rural population consists of 100.00% these belong to Beemadevarapalle, Husnabad and Koheda mandals of Karimnagar District, Nangnoor mandal of Medak district and Ganpur station, Narmetta and Maddur mandals of Warangal district of Telangana state as per 2011 census. There is no urban population in the study area as per census of 2011. However, the total area is falling under Husnabad and Akkannapet mandals of Siddipet district Telangana State after districts reorganisation. In the study area the proportion of population is presented in **Table-3.31**.

Table 3.31 Proportion of Urban And Rural Population at Gouravelly Reservoir study Area

Particulars	0 -2 Kms	2 -5 Kms	5 -10 Kms	0 -10 Kms
Urban Wards	0	0	0	0
Rural Villages	2	12	29	43
Total villages	2	12	29	43
Urban population	0	0	0	0
Rural population	5865	32299	93021	131185
Total Population	5865	32299	93021	131185
%Total Population	4.47	24.62	70.91	100.00
% of Rural Population	4.47	24.62	70.91	100.00
% of urban Population	0.00	0.00	0.00	0.00

Source: Census of India 2011

Demographic and Socio-Economic Profile-2011 of Command Area

The Gouravelly command area consists of 24 mandals of Siddipet, Karimnagar, Janagoan and Hanumakonda districts of Telangana as per the state government bifurcation of districts.

As per census 2011, the village wise demographic data of 239 villages (both urban and rural) of which

- Ghanpur (Station) (CT) WARD and Shivunipalle (CT) WARD 2 urban locations and 25 villages of Ghanpur Station mandal of Warangal district,
- 19 villages of Raghunathpalle mandal of Warangal district,
- 18 villages of Zaffergadh mandal of Warangal district,



- (Unikicherla (OG) Ward) one urban location and 19 villages of Dharmasagar mandal of Karimnagar district,
- 18 villages of Wardhannapet mandal of Karimnagar district,
- 11 villages of Chigurumamidi mandal of Karimnagar district,
- 12 villages of Huzurabad mandal of Karimnagar district,
- 18 villages of Manakondur mandal of Karimnagar district,
- 17 villages of Shankarapatnam mandal of Karimnagar district,
- (Alugunur (OG) Ward) one urban location and 14 villages of Timmapur (LMD Colony) mandal of Karimnagar district,
- 14 villages of Saidapur mandal of Karimnagar district,
- 23 villages of Benjanki mandal of Karimnagar district,
- 4 villages of Husnabad mandal of Karimnagar district,
- 12 villages of Koheda mandal of Karimnagar district,
- 15 villages of Bheemadevarpalle mandal of Karimnagar district

The location wise demographic detailed information of Gouravelly command area villages is presented in **Annexure-H**. The salient features of the demographic and socio-economic conditions are analyzed and described in the following sections.

As per 2011 census, the study area consists of 8,07,683 persons inhabited in the study area. The distribution of population in Gouravelly Command Area is presented in **Table - 3.32**

Table 3.32 Distribution of Population in Command Area

Sr. No	Particulars	Command Area
1	No. of households	209285
2	Male Population	403876
3	Female Population	403807
4	Total Population	807683
5	Male population (0-6yrs)	36654
6	Female population (0-6yrs)	34066
7	Total Population (0-6yrs)	70720
8	Average household size	3.9
9	% of 0-6yrs to the total Population	9
10	% of males to the total Population	50.00
11	% of female to the total Population	50.00
12	Sex ratio	999.83
13	Sex ratio 0-6yrs	929
14	Density of Population	290.30

Source: Census of India 2011

Average Household Size in command area

The study of Gouravelly project command area has a household size of 3.90 as per 2011 census.

Population Density of command area

The density of population reveals that the command area has an overall density of 290.30 persons per sq.km. The Telangana state's density of population is 312 as per 2011 census reports. In comparison to Telangana (312) the command areas density is less than the state.



Sex Ratio of command area

The configuration of male and female indicated that males constitute to about 50.00% and females to 50.00% of the total population as per 2011 census records. The study area on an average has 1000 females per 1000 males as per 2011 census reports. In comparison to the Telangana's (Telangana State sex ratio is 988) sex ratio the command area has recorded equal sex ratio and it is good sign of both sex ratio. However,

Child Sex Ratio of command area

The command areas child sex ratio is 929 female children for 1000 male children. In comparison to the adult sex ratio, the child sex ratio is less in the command area.

Rural and Urban Population of command area

Out of total population (8,07,683) in the Gouravelly command area, the rural population consists 96.52% these belong to Ghanpur Station mandal, Raghunathpalle mandal, Zaffergadh mandal, Dharmasagar mandal, Wardhannapet mandal of Warangal district, Chigurumamidi mandal, Huzurabad mandal, Manakondur mandal, Shankarapatnam mandal, Timmapur (LMD Colony), Saidapur mandal, Benjanki mandal, Husnabad mandal, Koheda mandal and Bheemadevarpalle mandal of Karimnagar district of Telangana state as per 2011 census which are falling in Gouravelly Command area. There are 4 urban locations consists of 3.48% of population in command area, one urban location (Unikicherla (OG) WARD) of Dharmasagar mandal and two urban locations (Ghanpur (Station) (CT) WARD and Shivunipalle (CT) WARD) of Ghanpur station of Warangal district one urban location (Alugunur (OG) WARD) in Timmapur (LMD Colony) of Karimnagar district Telangana state population in the Gouravelly command area as per census of 2011. The Gouravelly command areas urban and rural population is presented in **Table-3.33** and the proportion of population in study is presented in **Table-3.34**.

Table 3.33 Rural And Urban Population in Command Area

Sr. No	Mandal	District	Total Urban wards	Total Urban population	% of Urban Population	Total Rural Villages	Total Rural population	% of Rural Population	Total urban wards and Rural villages	Total urban and Rural population
1	Ghanpur (Station)	Warangal	2	18963	20.54	23	73340	79.46	25	92303
2	Raghunathpalle	Warangal	0	0	0.00	19	53374	100.00	19	53374
3	Zaffergadh	Warangal	0	0	0.00	18	45899	100.00	18	45899
4	Dharmasagar	Warangal	1	2953	4.01	18	70640	95.99	19	73593
5	Wardhannapet	Warangal	0	0	0.00	18	76873	100.00	18	76873
6	Chigurumamidi	Karimnagar	0	0	0.00	11	41859	100.00	11	41859
7	Huzurabad	Karimnagar	0	0	0.00	12	74721	100.00	12	74721
8	Manakondur	Karimnagar	0	0	0.00	18	67854	100.00	18	67854



Sr. No	Mandal	District	Total Urban wards	Total Urban population	% of Urban Population	Total Rural Villages	Total Rural population	% of Rural Population	Total urban wards and Rural villages	Total urban and Rural population
9	Shankarapatnam	Karimnagar	0	0	0.00	17	45302	100.00	17	45302
10	Timmapur (LMD Colony)	Karimnagar	1	6164	12.57	13	42862	87.43	14	49026
11	Saidapur	Karimnagar	0	0	0.00	14	40801	100.00	14	40801
12	Bejjanki	Karimnagar	0	0	0.00	23	53945	100.00	23	53945
13	Husnabad	Karimnagar	0	0	0.00	4	5663	100.00	4	5663
14	Koheda	Karimnagar	0	0	0.00	12	30584	100.00	12	30584
15	Bheemadevarpalle	Karimnagar	0	0	0.00	15	55886	100.00	15	55886
		Total	4	28080	3.48	235	779603	96.52	239	807683

Source: Census of India 2011

Table 3.34 proportion of urban and rural population at command area

Sr. No	Particulars	Command Area
1	Urban Wards	4
2	Rural Villages	235
3	Total villages and urban locations	239
4	Proportion Total villages	100.00
5	Urban population	28080
6	Proportion of Urban Population	3.5
7	Rural population	779603
8	Proportion of Rural Population	96.5
9	Total Population	807683
10	% Urban and Rural Population	100.00

Source: Census of India 2011

Social Structure at Mid Manair Reservoir Study area

In the study area, as per 2011 census, there is 16.07% Scheduled Castes (SC) population in the study area. 0.93% population belongs to Scheduled Tribes (ST). The proportion of study areas SC population is lesser than the Karimnagar district population (Karimnagar district SC's proportion 18.80%) as per 2011 census. However, the overall data of social stratification reveals that the SC and ST percentage put together to the total population of the study area is more than 17.00%. The SC and ST communities are marginalized, and they are considered at low level of social strata. The distribution of population by social structure is presented in **Table-3.35**



Table- 3.35 Distribution of Population by social structure In Mid Manair reservoir study area

Sr. No	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	Schedule caste	10900	14690	20100	45690
2	% of SC	9.52	19.60	21.19	16.07
3	Schedule Tribes	1038	953	647	2638
4	% of ST	0.91	1.27	0.68	0.93
5	Total SC & ST	11938	15643	20747	48328
6	% of total SC & ST	10.43	20.87	21.87	17.00
7	Total Population	114509	74964	94865	284338

Source: Census of India 2011

Social Structure of Gouravelly Reservoir study area

In the study area, as per 2011 census, there is 17.33% Scheduled Castes (SC) population in the study area. 13.25% population belongs to Scheduled Tribes (ST). The proportion of study area SC population (17.33%) is lesser than the Karimnagar district population (Karimnagar district SC's proportion 18.80%) as per 2011 census. However, the overall data of social stratification reveals that the SC and ST percentage put together to the total population of the study area is more than 30.57%. The SC and ST communities are marginalized, and they are considered at low level of social strata. The distribution of population by social structure is presented in **Table-3.36**

Table 3.36 Distribution of Population by Social Structure in Gouravelly Reservoir study Area

Particulars	0-2 km	2-5 km	5-10 km	0-10 km
Schedule caste	523	4665	17541	22729
% of SC	8.92	14.44	18.86	17.33
Schedule Tribes	1247	4525	11605	17377
% of ST	21.26	14.01	12.48	13.25
Total SC & ST	1770	9190	29146	40106
% of total SC & ST	30.18	28.45	31.33	30.57
Total Population	5865	32299	93021	131185

Source: Census of India 2011

Social Structure in Command Area

In the Command area, as per 2011 census, there is 22.73% Scheduled Castes (SC) population in the command area. 4.6% population belongs to Scheduled Tribes (ST). However, the overall data of social stratification reveals that the SC and ST percentage put together to the total population of the command area is more than 27.30%. The SC and ST communities are marginalized, and they are considered at low level of social strata. The distribution of population by social structure is presented in **Table-3.37**

Table- 3.37 Distribution of Population by Social Structure In Command Area

Sr. No	Particulars	Command Area



1	Schedule caste	183548
2	% of SC	22.73
3	Schedule Tribes	36940
4	% of ST	4.6
5	Total SC & ST	220488
6	% of total SC & ST	27.30
7	Total Population	807683

Source: Census of India 2011

Literacy Levels in Mid Manair Reservoir Study area

The data of the Mid Manair Reservoir study area reveals that literacy rate is 66.54. %. The distribution of literacy rate in the study area is presented in **Table-3.38**

Table 3.38 Distribution of Population by Literacy rate In Mid Manair Reservoir study area

Sr. No	PARTICULARS	0-2 km	2-5 km	5-10 km	0-10 km
1	Total Population Literates	74072	45363	53056	172491
2	% of Population Literates	71.40	66.27	60.97	66.54
3	Male Literates	42267	25680	31048	98995
4	% of Male Literates	82.00	75.97	71.94	77.03
5	Female Literates	31805	19683	22008	73496
6	% of Female Literates	60.93	56.81	50.18	56.23
7	Total Population Illiterates	40437	29601	41809	111847
8	% of Population Illiterates	38.98	43.24	48.05	43.15
9	Male illiterates	14810	11461	16124	42395
10	% of Male Illiterates	28.73	33.90	37.36	32.99
11	Female Illiterates	25627	18140	25685	69452
12	% of Female Illiterates	49.09	52.36	58.56	53.14
13	Total Population	114509	74964	94865	284338

Source: Census of India 2011

The male literacy i.e., the percentage of literate males to the total males of the study area works out to be 77.03%. The female literacy rate, which is an important indicator for social change is observed to be 56.23% in the study area as per 2011 census records excluding illiterate percentage.

Literacy Levels of Gouravelly Reservoir Study area

The data of the Gouravelly Reservoir study area reveals that literacy rate is 60.56.%. The distribution of literacy rate in the study area is presented in **Table-3.39**

Table 3.39 Distribution of Population by Literacy rate at Gouravelly Reservoir study area

PARTICULARS	0-2 km	2-5 km	5-10 km	0-10 km
Total Population Literates	2902	16949	52253	72104
% of Population Literates	54.84	57.78	61.89	60.56
Male Literates	1727	9913	30180	41820



% of Male Literates	65.07	67.69	71.65	70.38
Female Literates	1175	7036	22073	30284
% of Female Literates	44.54	47.90	52.16	50.78
Total Population Illiterates	2963	15350	40768	59081
% of Population Illiterates	55.99	52.33	48.28	49.62
Male illiterates	1220	6269	16363	23852
% of Male Illiterates	45.97	42.81	38.85	40.14
Female Illiterates	1743	9081	24405	35229
% of Female Illiterates	66.07	61.83	57.67	59.07
Total Population	5865	32299	93021	131185

Source: Census of India 2011

The male literacy i.e., the percentage of literate males to the total males of the study area works out to be 70.38%. The female literacy rate, which is an important indicator for social change is observed to be 50.78% in the study area as per 2011 census records excluding illiterate percentage.

Literacy Levels Gouravelly Project Command area

The data of the command area reveals that literacy rate is 62.24.%. The distribution of literacy rate in the command area is presented in **Table-3.40**

Table 3.40 Distribution of population by literacy rate in command area

Sr. No	Particulars	Command Area
1	Total Population Literates	458714
2	% of Population Literates	62.24
3	Male Literates	264807
4	% of Male Literates	72.1
5	Female Literates	193907
6	% of Female Literates	52.4
7	Total Population Illiterates	348969
8	% of Population Illiterates	47
9	Male illiterates	139069
10	% of Male Illiterates	38
11	Female Illiterates	209900
12	% of Female Illiterates	57
14	Total Population	807683

Source: Census of India 2011

The male literacy i.e. the percentage of literate males to the total males of the command area works out to be 72.1%. The female literacy rate, which is an important indicator for social change is observed to be 52.4% in the command area as per 2011 census records excluding illiterate percentage.

Occupational Structure in Mid Manair Reservoir study area



The occupational structure of residents in the study area is studied with reference to main workers, marginal workers and non-workers. The main workers include 10 categories of workers defined by the Census Department consisting of cultivators, agricultural laborers, those engaged in live-stock, forestry, fishing, mining and quarrying; manufacturing, processing and repairs in household industry; and other than household industry, construction, trade and commerce, transport and communication and other services.

The marginal workers are those workers engaged in some work for a period of less than six months during the reference year prior to the census survey. The non-workers include those engaged in unpaid household duties, students, retired persons, dependents, etc.; institutional inmates or all other non-workers who do not fall under the above categories.

Total work participation in the Mid Manair Reservoir study area is 51.90% and the non-workers constitute 47.10% of the total population respectively. The distribution of workers by occupation indicates that the main workers are the predominant population in the study area. The main workers to the total workers are 86.92% and the marginal workers constitute to 13.08% to the total workers. The occupational structure of the study area is presented in **Table-3.41**

Table 3.41 Distribution of Population by Occupational Structure In Mid Manair Reservoir study area

Sr. No	Particulars	0-2 km	2-5 km	5-10 km	0-10 km
1	Total Population	114509	74964	94865	284338
2	Total Worker	59232	38859	52324	150415
3	Work participation rate (%)	51.73	51.84	55.16	52.90
4	Total main workers	52011	34140	44593	130744
5	% of main worker to total workers	87.81	87.86	85.22	86.92
6	Marginal workers	7221	4719	7731	19671
7	% of marginal workers to total workers	12.19	12.14	14.78	13.08
8	Non workers	55277	36105	42541	133923
9	% of Non workers to total Population	48.27	48.16	44.84	47.10

Source: Census of India 2011

Occupational Structure at Gouravelly Reservoir study area

Total work participation in the Gouravelly Reservoir study area is 51.90% and the non-workers constitute 48.10% of the total population respectively. The distribution of workers by occupation indicates that the main workers are the predominant population in the study area. The main workers to the total workers are 86.96% and the marginal workers constitute to 13.04% to the total workers. The occupational structure of the study area is presented in **Table-3.42**

Table 3.42 Distribution of population by occupational structure at Gouravelly reservoir study area

Particulars	0-2 km	2-5 km	5-10 km	0-10 km
Total Population	5865	32299	93021	131185
Total Worker	3291	17804	46985	68080
Work participation rate (%)	56.11	55.12	50.51	51.90
Total main workers	3027	14806	41372	59205
% of main worker to total workers	91.98	83.16	88.05	86.96



Marginal workers	264	2998	5613	8875
% of marginal workers to total workers	8.02	16.84	11.95	13.04
Non workers	2574	14495	46036	63105
% of Non workers to total Population	43.89	44.88	49.49	48.10

Source: Census of India 2011

Occupational Structure in Command area

Total work participation in the project command area is 51.85% and the non-workers constitute 48.15% of the total population respectively. The distribution of workers by occupation indicates that the main-workers are the predominant population in the command area. The main workers to the total workers are 82.55% and the marginal workers constitute to 17.45% to the total workers. The occupational structure of the command area is presented in **Table-3.43**

Table 3.43 Distribution of Population by Occupational Structure In command area

Sr. No	Particulars	Command Area
1	Total Population	807683
2	Total Worker	418793
3	Work participation rate (%)	51.85
4	Total main workers	345729
5	% of main worker to total workers	82.55
6	Marginal workers	73064
7	% of marginal workers to total workers	17.45
8	Non workers	388890
9	% of Non workers to total Population	48.15

Source: Census of India 2011

Infrastructure at Mid Manair Reservoir study area

Mobile communication, black topped roads and postal services are good in the study area. Public bus services are available in the study area, banks and agricultural societies need to be improved. Women self-help groups are very active, majority of the women are formed into groups, all these women self-help groups are being supported by state through District Rural Development Agency (DRDA) and public distribution system (PDS) is good supporting the food security to communities in the study area. The details of the infrastructure facilities are presented in **Table-3.44**.

Table 3.44 Infrastructure Facilities In Mid Manair Reservoir study area

(In Kilometres)

Sr. No	Infrastructure Facilities	2011				2022 (December, 2022)			
		0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10
1	Post Office	1	2	2	5	1	2	2	5
2	Mobile Phone Coverage	12	17	43	72	13	22	49	84
3	Public Bus Service	11	15	42	68	13	19	48	80
4	Black Topped (pucca) Road	12	16	41	69	13	19	44	76
5	Commercial Bank	2	3	2	7	4	5	2	11



6	Cooperative Bank.	1	2	2	5	1	2	2	5
7	Self - Help Group	12	17	43	72	355	594	610	1559
8	Agriculture Credit Societies	3	4	3	10	3	4	3	10
9	Public Distribution System	12	17	41	70	12	17	41	70

Source: Census of India 2011 and primary observation

Infrastructure in Gouravelly Reservoir study area

Mobile communication, black topped roads and postal services are good in the study area. public bus services are available in the study area, banks and agricultural societies need to be improved. Women self-help groups are very active, majority of the women are formed into groups, all these women self-help groups are being supported by state through District Rural Development Agency - DRDA and public distribution system is good at the study area villages and supporting the food security to communities in the study area. The details of the infrastructure facilities are presented in **Table-3.45**

Table 3.45 Infrastructure Facilities At Gouravelly Reservoir study area

(In Kilometres)

Infra structure Facility	2011				2022 (December, 2022)			
	0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10
Post Office	0	0	9	9	1	3	13	17
Mobile Phone Coverage	2	12	29	43	2	12	29	43
Public Bus Service	2	12	28	42	2	12	28	42
Black Topped (pucca) Road	2	12	29	43	2	12	29	43
Commercial Bank	0	1	5	6	0	1	6	7
Cooperative Bank.	0	0	2	2	0	0	2	2
Self - Help Group	2	12	29	43	2	12	29	43
Agriculture Credit Societies	0	1	5	6	0	1	5	6
Public Distribution System	2	12	29	43	2	12	29	43

Source: Census of India 2011 and primary observation

Infrastructure in Command area

Mobile communication, Black topped roads and postal services are good in the study area. Public Bus Services are available in the study area, Banks and agricultural societies need to be improved. Women self-help groups are very active, majority of the women are formed into groups, all these women self-help groups are being supported by state through District Rural Development Agency - DRDA and public distribution system is good at the command area villages and supporting the food security to communities in the command area. The details of the infrastructure facilities are command area are presented in **Table-3.46**.

Table 3.46 Infrastructure Facilities In Command area

S. No	Infrastructure Facilities	2011	2022 (December)
		Command Area	Command Area
1	Post Office	74	94
2	Mobile Phone Coverage	237	321



3	Public Bus Service	217	315
4	Black Topped (pucca) Road	235	319
5	Banks	90	44
6	Self - Help Group	242	2589
7	Agriculture Credit Societies	48	57
8	Public Distribution System	235	313

Source: Census of India 2011 and observations

Demographic and Socio-Economic Profile of primary data of sample villages of Gouravelly Reservoir Project

The primary data was generated through formal scheduled interview with the respondents covering 485 households in 14 villages in the study area.

Keeping in view the objectives of the baseline study and the research model for the study, the following parameters were considered in the interview schedule to elicit the baseline information from the respondents residing within 5km radius of the project area. The survey village's location is marked in the topo map is presented in **Annexure -I**.

Basic household profile: age, gender, marital status, religion, caste, occupation, sources of income, family size, and educational status

- Occupation
- Annual income from various sources
- Information on family budget
- Savings
- Family assets
- Communication status/Recreation status
- Existing social infrastructure facilities
- Quality of life
- Health status
- Cultural and aesthetic attributes
- Project awareness

The baseline information has been presented by aggregating the findings of all the respondents from the project area in the form of tables, graphs and pie diagrams.

Socio-Economic Profile of the study area (As per sample primary survey)

This section contains the socio-economic analysis of 14 villages and the analysis of 485 sample households based on the primary data generated through field survey. The sample villages covered in this study are presented in **Table-3.47**. The primary survey photographs are presented in **Annexure I**.

Table 3.47 Details of sample villages during field study at Gouravelly reservoir project

S.No	Village names	Number of Samples
1	Gouravelly	62
2	Nandaram	15
3	Jangaon	39
4	Choutapalle	19



5	Anthakkapeta	37
6	Akkannapeta	55
7	Gandipalle	45
8	Ramavaram	25
9	Potharam (J)	12
10	Gatlamallial	34
11	Kondamrajpalle	15
12	Dongala Dharmaram	14
13	Samudrala	57
14	Regonda	55
Total		485

Source: Primary Survey

Demography and Socio-Economics of sample villages at Gouravelly Reservoir Project

Any developmental intervention will have impact on the socio-economic conditions and the quality of life of the population residing in the region. The sample Socio-Economic survey helps to get an idea of changes in social, economic and cultural status of consequences due to the project operations

The idea is to ensure that every effort should be made to ensure there is no adverse impact on the villagers in the study area due to the project and corrective measures must be taken to mitigate any adverse impact on the people due to the project.

Field survey was carried out in different aspects of socio-economic indicators to determine the quality of life of the people living in the area. Quality of life in any area depends on availability of and accessibility to quality of social infrastructure.

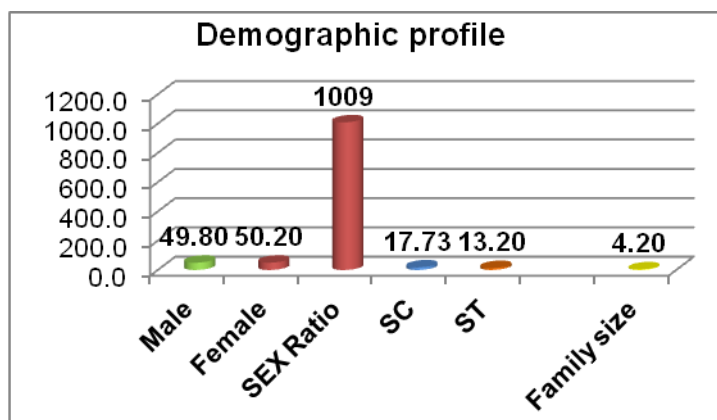
The primary study was conducted to know the perception of the people about the project and its implication on the socio-economic condition.

- Background information on the family: total number of members, age, sex, educational and occupational status, etc.
- Agricultural land: Total landholding, type of land,
- Agricultural equipments and Household amenities
- Animal wealth and associated income
- Crops: Various crops grown, income from crops

Demographic Status based on Primary Survey

- The detailed description of the socio-economic profile is highlighted in the following subsections, which give an overall summary of the socio-economic conditions of the people residing in the project area.

Family Status, Size and Sex composition





The demographic profile of the primary survey constitutes about 49.80% male and 50.20% female and average sex ratio, i.e. the number of females per 1000 males is 1009. Average family size of the total 485 sample households is 4.20 persons. The average sex ratio as per census 2011 in the study area is 998. The sex ratio (1009) of the present sample villages is higher than the study (998) areas sex ratio of 2011 census.

Age-wise distribution at sample villages of Gouravelly Reservoir Project

The age-sex structure of a population is an important demographic characteristic, since it reflects past fertility, mortality and migration trends as well as current birth and death rates. The age wise details of the sample villages are presented in **Table-3.48**.

Table 3.48 Age-Wise distribution at sample villages

Age	Male	Female	Sex Ratio	Total	% of Total Population
0-14	120	124	1033	244	11.97
15-20	177	167	944	344	16.87
21-30	191	203	1063	394	19.32
31-40	180	191	1061	371	18.20
41-50	160	154	963	314	15.40
51-64	106	109	1028	215	10.54
Above 65	81	76	938	157	7.70
Total	1015	1024	1009	2039	100.00

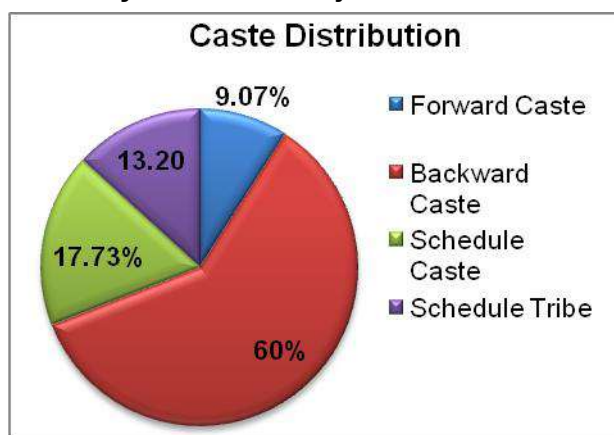
Source: Primary Survey

The proportion of dependents, children and old age people, were found to be 36.54% in the sample villages. About 63.46% population are of working-age and supporting the other 36.54% population in the sample villages, which is fair ratio.

[* Dependency ratio is a measure showing the number of dependents (aged 0-14 and over the age of 61) to the total population (aged 15-60). Calculated by: $\text{Number of Dependents} / \text{population(ages 15-60)} \times 100$]

Caste Distribution at sample villages of Gouravelly Reservoir Project

Caste-wise distribution is an important social structure in the Indian society. Out of the 485 families surveyed, the majority 291 families or 60% belong to backward class, 86 families or 17.73% belong to schedule caste and the 64 families or 13.20% were from Scheduled Tribes. There are only 44 families 9.07% was from forward caste.



Educational Profile at sample villages

Educational profile among the surveyed population as collected through the primary survey. It was observed that 60.29% people are literates and nearly 33.44% of the surveyed population were illiterate.



Amongst the literate population, persons educated up to or pursuing the primary and secondary school level is about 44.87% of the total surveyed population. Others pursued/pursuing the Higher Secondary, Graduation are 12.36% and 6.03% professional degree and remaining 0 to 6 years of age constitute is about 5.98% as per the primary survey. The results shows literacy rate is more over illiteracy rate and among literates, males are more literate than females.

Almost all the school age children were enrolled in respective schools. It indicates that everyone knows the importance of education. The sample villages population educational profile is presented in **Table-3.50** and educational facilities in the Mid Manair reservoir Study rural area urban area is presented respectively in **Table-3.49** and **Table-3.50**.

Table 3.49 Educational Profile At Sample Villages of Gouravelly reservoir study area

Education	Male	Female	Total	%
Illiterate	242	385	627	30.75
Below 0-6yrs	59	63	122	5.98
Primary	124	113	237	11.62
Secondary	382	296	678	33.25
Higher Secondary and Graduation	138	114	252	12.36
Professional	70	53	123	6.03
Total	1015	1024	2039	100.00

Source: Primary Survey

Table 3.50 Educational Facilities at Mid Manair reservoir study area

Sr No	RURAL EDUCATIONAL FACILITIES	2011				2022			
		0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10
1	Govt Primary School (No)	33	35	89	157	35	38	91	164
2	Private Primary School (No)	4	4	17	25	6	7	19	32
3	Govt Middle School (No)	17	19	34	70	17	19	34	70
4	Private Middle School (No)	4	2	12	18	4	2	12	18
5	Govt Secondary School (No)	7	8	21	36	7	8	21	36
6	Private Secondary School (No)	3	1	11	15	3	1	11	15
7	Govt Senior Secondary School (No)	0	0	1	1	3	3	4	10
8	Private Senior Secondary School (No)	0	0	1	1	2	1	2	5
9	Govt Arts & Science Degree College (No)	0	0	0	0	1	1	0	2
10	Private Arts & Science Degree College (No)	0	0	0	0	0	0	0	0
11	Govt Engineering College (No)	0	0	0	0	0	0	0	0
12	Private Engineering College (No)	0	0	0	0	0	0	0	0
13	Govt Medicine College (No)	0	0	0	0	0	0	0	0
14	Private Medicine College (No)	0	0	0	0	0	0	0	0
15	Govt Management Institute (No)	0	0	0	0	0	0	0	0
16	Private Management Institute (No)	0	0	0	0	0	0	0	0



17	Govt Polytechnic (No)	0	0	0	0	0	0	0	0
18	Private Polytechnic (No)	0	0	0	0	0	0	0	0
19	Govt Vocational Training School/ITI (No)	0	0	0	0	0	0	0	0
20	Private Vocational Training School/ITI (No)	1	0	0	1	1	0	0	1
21	Government School For Disabled (No)	0	0	0	0	0	0	0	0
22	Private School For Disabled (No)	0	0	0	0	0	0	0	0

Table 3.51 Educational Facilities at Mid Manair Reservoir study area

S. No	URBAN EDUCATIONAL FACILITIES	2011				2022			
		0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10
1	Govt Primary School (No)	16	9	0	25	16	9	0	25
2	Private Primary School (No)	25	4	0	29	27	5	1	33
3	Govt Middle School (No)	14	5	0	19	14	5	0	19
4	Private Middle School (No)	16	4	0	20	16	4	0	20
5	Govt Secondary School (No)	6	5	0	11	6	5	0	11
6	Private Secondary School (No)	10	4	0	14	11	5	1	17
7	Govt Senior Secondary School (No)	2	1	0	3	2	1	0	3
8	Private Senior Secondary School (No)	5	4	0	9	6	4	0	10
9	Govt Arts & Science Degree College (No)	0	0	0	0	0	0	0	0
10	Private Arts & Science Degree College (No)	0	0	0	0	1	0	0	1
11	Govt Engineering College (No)	0	0	0	0	0	0	0	0
12	Private Engineering College (No)	1	0	0	1	1	0	0	1
13	Govt Medicine College (No)	0	0	0	0	0	0	0	0
14	Private Medicine College (No)	0	0	0	0	0	0	0	0
15	Govt Management Institute (No)	0	0	0	0	0	0	0	0
16	Private Management Institute (No)	0	0	0	0	0	0	0	0
17	Govt Polytechnic (No)	1	0	0	1	1	0	0	1
18	Private Polytechnic (No)	0	0	0	0	0	0	0	0
19	Govt Vocational Training School/ITI (No)	0	0	0	0	0	0	0	0
20	Private Vocational Training School/ITI (No)	0	0	0	0	0	0	0	0
21	Government School For Disabled (No)	0	0	0	0	0	0	0	0
22	Private School For Disabled (No)	0	0	0	0	0	0	0	0

The Gouravelly Reservoir Study rural areas and educational facilities is presented respectively in **Table-3.52** and Gouravelly Reservoir Project Command Areas Rural and Urban Educational facilities respectively in **Table-3.53** and **Table-3.54**

Table 3.52 Educational Facilities at Gouravelly Reservoir study area

S. No	RURAL EDUCATIONAL FACILITIES	2011				2022			
		0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10



S. No	RURAL EDUCATIONAL FACILITIES	2011				2022			
		0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10
1	Govt Primary School (No)	6	40	68	114	6	40	68	114
2	Private Primary School (No)	2	7	27	36	2	7	30	39
3	Govt Middle School (No)	3	15	33	51	3	15	33	51
4	Private Middle School (No)	1	4	20	25	1	4	20	25
5	Govt Secondary School (No)	1	10	17	28	1	10	17	28
6	Private Secondary School (No)	0	1	18	19	0	1	18	19
7	Govt Senior Secondary School (No)	0	2	2	4	0	2	2	4
8	Private Senior Secondary School (No)	0	1	5	6	0	1	5	6
9	Govt Arts & Science Degree College (No)	0	0	2	2	0	0	2	2
10	Private Arts & Science Degree College (No)	0	0	5	5	0	0	5	5
11	Govt Engineering College (No)	0	0	0	0	0	0	0	0
12	Private Engineering College (No)	0	0	0	0	0	0	0	0
13	Govt Medicine College (No)	0	0	0	0	0	0	0	0
14	Private Medicine College (No)	0	0	0	0	0	0	0	0
15	Govt Management Institute (No)	0	0	0	0	0	0	0	0
16	Private Management Institute (No)	0	0	0	0	0	0	0	0
17	Govt Polytechnic (No)	0	0	0	0	0	0	0	0
18	Private Polytechnic (No)	0	0	0	0	0	0	0	0
19	Govt Vocational Training School/ITI (No)	0	0	0	0	0	0	0	0
20	Private Vocational Training School/ITI (No)	0	0	1	1	0	0	1	1
21	Government School For Disabled (No)	0	0	0	0	0	0	0	0
22	Private School For Disabled (No)	0	0	0	0	0	0	0	0

Source: Source: Census of India 2011 and Primary Observation

Table 3.53 Educational Facilities In Rural Gouravelly Project Command area

Sr No	RURAL EDUCATIONAL FACILITIES	2011	2022
		Command Area	Command Area
1	Govt Primary School (No)	625	816
2	Private Primary School (No)	107	146
3	Govt Middle School (No)	250	335
4	Private Middle School (No)	90	215
5	Govt Secondary School (No)	168	212
6	Private Secondary School (No)	72	105
7	Govt Senior Secondary School (No)	10	17
8	Private Senior Secondary School (No)	20	42
9	Govt Arts & Science Degree College (No)	1	3



10	Private Arts & Science Degree College (No)	10	18
11	Govt Engineering College (No)	0	0
12	Private Engineering College (No)	4	6
13	Govt Medicine College (No)	0	0
14	Private Medicine College (No)	0	0
15	Govt Management Institute (No)	0	0
16	Private Management Institute (No)	2	2
17	Govt Polytechnic (No)	0	0
18	Private Polytechnic (No)	1	1
19	Govt Vocational Training School/ITI (No)	0	0
20	Private Vocational Training School/ITI (No)	1	2
21	Government School For Disabled (No)	0	0
22	Private School For Disabled (No)	0	0

Source: Census of India 2011 and observations

Table 3.54 Educational Facilities In Gouravelly Project In Urban Command area

Sr No	URBAN EDUCATIONAL FACILITIES	2011	2022
		Command Area	Command Area
1	Govt Primary School (No)	172	9
2	Private Primary School (No)	264	9
3	Govt Middle School (No)	149	4
4	Private Middle School (No)	227	8
5	Govt Secondary School (No)	118	4
6	Private Secondary School (No)	270	9
7	Govt Senior Secondary School (No)	63	1
8	Private Senior Secondary School (No)	98	2
9	Govt Arts & Science Degree College (No)	4	1
10	Private Arts & Science Degree College (No)	1	1
11	Govt Engineering College (No)	1	0
12	Private Engineering College (No)	10	0
13	Govt Medicine College (No)	1	0
14	Private Medicine College (No)	1	0
15	Govt Management Institute (No)	1	0
16	Private Management Institute (No)	5	0
17	Govt Polytechnic (No)	4	2
18	Private Polytechnic (No)	0	0
19	Govt Vocational Training School/ITI (No)	0	0
20	Private Vocational Training School/ITI (No)	3	0
21	Government School For Disabled (No)	3	0
22	Private School For Disabled (No)	3	0



Source: Census of India 2011 and observations

The above table shows that comparison of education facilities in the study area is fair up to Middle school to Senior Secondary school, whereas the senior secondary college and Degree college education facilities are moderate in the study. .

Living Conditions and Infrastructure Facilities at sample villages

The information collected over housing status from the households has been presented in **Table-55**. It was observed that 184 families (37.94%) are residing in Pucca houses who has above 3 rooms and 125 families (25.77%) are residing 1 to 2 rooms and about 154 families (31.75%) are residing in semi pucca houses, 22 (4.54%) families are in living in kutcha house structures.

Table 3.55 Housing status at sample villages

Type of House	Number	%
Pucca-above 3 rooms	184	37.94
Pucca- 1 to 2 room	125	25.77
Semi pucca	154	31.75
Kutcha	22	4.54
Total	485	100.00

Source: Primary survey

Source of Drinking Water in sample villages

Majority of the respondents (88.87%) were dependent on the water from rural water supply (Mission Bhageeratha). Other source of water supply are- bore wells is about 7.22% and open wells is about 3.30% and about 3 families 0.62% are depending over the water tankers. Thus, potable drinking water facility through rural water supply (Mission Bhageeratha Scheme) is available in the sample villages. The drinking water sources is presented in **Table-3.56**

Table 3.56 Sources of Drinking Water at sample villages

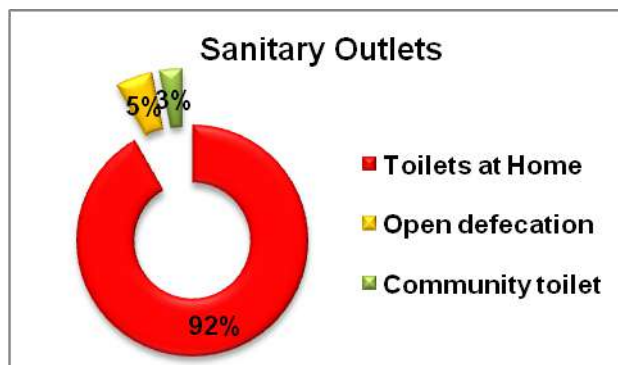
Source of drinking water	Number	Percentage
Bore Well	35	7.22
Open well	16	3.30
RWS (Mission Bhageeratha)	431	88.87
Water tanker	3	0.62
Total	485	100.00

Source: Primary Survey

Sanitation at sample villages

Sanitary conditions of the villages are good, majority 91.75% respondents

(445) having Septic tanks at their premises. Only 5.15% respondents (25) are not using the toilets and opted to go for open defecation. There are 3.09% (15) families are using the community toilet





facility. The construction of toilets was taken-up under the Swatch Bharat scheme that is still under implementation to reach 100% sanitation facilities and zero open defecation in the villages with the completion of ongoing programme.

Household Cooking Sources at sample villages

About 91.34% of the sample households were using LPG connection and 6.60% households were using firewood for cooking purpose, as they are not having gas connection. 2.06% of the Households are using Kerosene/coal as cooking fuel in the sample households due to high cost. The details are presented in **Table 3.57**.

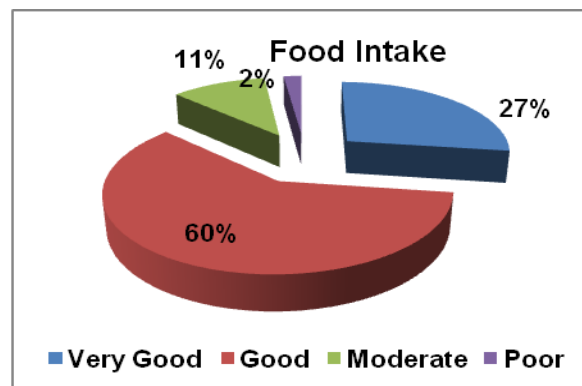
Table 3.57 Cooking sources of the households of sample villages

Type of Fuel	No's	%
Gas	443	91.34
Wood	32	6.60
Kerosene	10	2.06
Coal/Wood	0	0.00
Total	485	100.00

Source: Primary Survey

Food Intake of Households of Sample villages

In the study area, 10.93% of the respondents were found consuming the moderate food, 59.79% consuming very good food and 27.22% of the respondents consume very good food. There are 2.06% of respondents are consuming poor category of food. Thus, overall, the consumption of food intake in the study area can be said as "Moderate".



Occupational Status of Households of sample villages

There are around 60.30% of work force were found in the sample villages and these are supporting the 30.70% population in the study area. Gender disparity is not extensive in the overall participation rate. It was observed that, more women were restricted to household works. An overall, overwhelming majority of the working women are engaged in agriculture and daily labourers, the percentage engaged in organized sector is much higher among men workers. However, there are agricultural labour are more dominant in the study area as per 2011 census. The occupational structure is presented in **Table-3.58**

Table 3.58 Occupational structure househods of sample villages

Non- working population	Male	Female	Total	%
Below 5 years	59	63	122	11.33
Above 65 years	81	76	157	14.58
Students	263	220	483	44.85
House wife	0	315	315	29.25
Total	403	674	1077	100.00
Working population	Male	Female	Total	%
Farming	94	20	114	11.85



AI/FL	118	55	173	17.98
Daily Labour	213	205	418	43.45
Business	46	15	61	6.34
Crafts	26	5	31	3.22
Govt Services	35	17	52	5.41
Private employee	80	33	113	11.75
Total	612	350	962	100.00
Grand Total	1015	1024	2039	

Source: Primary Survey

Agricultural scenario of households of sample villages

Sample household survey reveals that only 69.63% farmers have their own agricultural lands. They were classified as marginal (below 1.00 ha) 33.18%, smallholdings (1-2 ha) 19.63%, small-medium holdings (2 – 4 ha) 7.01%, medium holding (4 to 10 ha) 5.61%. The remaining 30.37% does not possess any land, as shown in below **Table 3.59**. The major crops cultivated in the study area include Paddy, cotton and secondary crop is Maize and millets.

Table 3.59 Agriculture landholding of households of sample villages

S.No	Agriculture land Size Group	Farmers	%
1	Marginal (below 1.00ha/2.5ac)	161	33.18
2	Small (1.00ha/2.5ac- 2.00ha/5ac)	95	19.63
3	Small-Medium (2.00ha/5ac-4.00ha/10ac)	34	7.01
4	Medium (4.00ha/10 ac-10.00ha/25ac)	27	5.61
5	Large (10.00ha/25ac & above)	20	4.21
6	Not Having	147	30.37
Total		485	100.00

Source: Primary Survey

Besides land, both in absolute acreage and quality, the ownership of plough bullocks, tractors, and other farm equipments significantly affects the agricultural income. There are very less farmers possess agricultural related items like tractor and plough. Even though most of them do not possess agricultural related items but they have access to these services through payment/rental basis.

Livestock population status at villages

Livestock is an important component of economic activities in the rural areas. Livestock includes sheeps, goats etc... These livestock provides additional income to families in addition to meat and milk. The livestock population details at the sample villages is presented in **Table-3.60**

Table-3.60 Livestock population details at sample villages

S.No.	Name of the Village	Buffalos / Cows	Goats / Sheeps	Total
1	Gouravelly	67	88	155
2	Nandaram	35	56	91
3	Jangaon	78	54	132
4	Choutapalle	25	42	67



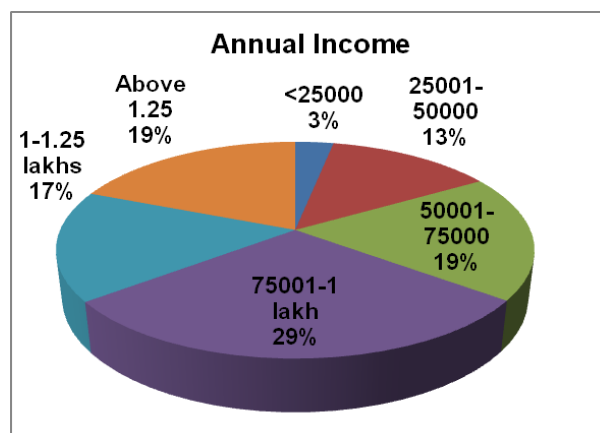
S.No.	Name of the Village	Buffalos / Cows	Goats / Sheep	Total
5	Anthakkapeta	52	52	104
6	Akkannapeta	78	62	140
7	Gandipalle	72	58	130
8	Ramavaram	87	91	178
9	Potharam (J)	52	93	145
10	Gatlamallial	75	52	127
11	Kondamrajapalle	79	86	165
12	Dongala Dharmaram	84	85	169
13	Samudrala	92	96	188
14	Regonda	26	92	118
Total		902	1007	1909

Source: Primary Survey

A total of 485 households have 902 Buffalo's/cows and 1007 have Goat/Sheep. As per census 2011 data the study area, have 12 veterinary hospitals.

Income and Expenditure pattern of households of sample villages

A study was made to understand the economic status of the households by understanding their income and expenditure pattern for the last one year. The assessment of income and expenditure of the respondents in the study area have been categorized into five groups taking into account 2022-23 as the base year. The income groups are (i) less than Rs 25,000, (ii) Rs 25,001 to 50,000, (iii) Rs 50,001 to 75,000 (iv) Rs 75,001 to 1,00,000 lakh (v) 1,00,001 to 1,25,000 (vi) Above 1,25,000. The respondents were interviewed to indicate their sources of income during the survey.



Out of the total 485 respondents in the sample villages, only 3.09% respondents are earning below Rs.25000. 13.40% had an income between Rs.25001-50000 per annum and another 18.76% of the of the respondents are within the range of Rs.50001 to 75000, 29.28% of the respondent are within the range of Rs.75001 to 1.lakh, 16.49% of the respondent are within the range of Rs.1 to 1.25 lakhs and 18.97% of the respondent are above Rs.1.25 lakh annual income. The sources of annual income were assessed that, the annual income of the households is gradually increasing in the sample villages, and it is clearly indicating the project has impact over the annual income of the families.

Consumption standard

To get an idea over the consumption standard of the sample households, various consumer durables in their possession were collected during the survey. Considering the transportation, it was observed that, 21.03% of the households do not possess any vehicles, 54.64% possess two wheelers and 15.26% of them possessed cycles and 9.07% has four wheelers facility.

The respondents having durables consisting of television, refrigerator and mobile phones were surveyed. About 87% of sample households possess television for their basic entertainment, 96% mobile phone for their communication purpose and only 51% of the household is having



refrigerator. It shows the study area population is the basic entertainment and communication durables. The households who has vehicles is presented in **Table-3.61**

Table3.61 Vehicles details of households of sample villages

Vehicle	Number	Percentage
None	102	21.03
Cycle	74	15.26
Two Wheeler	265	54.64
4 Wheeler	44	9.07
Total	485	100.00

Source: Primary Survey

Transport Facilities at Gouravelly reservoir study area

Transport system comprises several modes including Road, Rail, etc. As per the primary survey, the transport facilities are available to all the villages in the study area. These include auto, tempo and bus facilities. These are very frequent RTC busses available to the study area to Husnabad, Akkannapet and Gouravelly other major village/locations. The villagers are using, their own two wheelers and bullock carts and sometimes hired vehicles during emergencies.

Recreational Facilities at Gouravelly Reservoir study area

There are recreational facilities available in major town such as Husnabad which is in the study area and Karimnagar, Siddipet and Kazipet locations, which are 50 to 60 Kms from the Gouravelly area. Villagers have to go to these places to avail such facility

Health and medical facilities at Mid Manair Reservoir Project, Gouravelly Reservoir study area and command area

As regards the health and medical facilities in the villages, it was observed that most of the villages and Husnabad CHC, Akkannpet PHC have the ANM's (Auxiliary Nurse Mid wife). In case of any serious health issues, the respective ANM's refer to the nearest private and government hospitals, which are available at Siddipet, Karimnagar and Kazipet district hospitals and urban health centres. There are several private hospitals accessible to public in Siddipet, Karimnagar and Kazipet town which are 50 to 60 Kms away from study area.

Health facilities available in the Mid Manair Reservoir study area, Gouravelly Reservoir Study area and Gouravelly Reservoir Project Command Area as per 2011 & 2022 amenities are shown is presented respectively in **Table-3.62**, **Table-3.63** and **Table-3.66**.

Table 3.62 Health Facilities at Mid Manair Reservoir study area

Sr. No	HEALTH FACILITIES STUDY AREA	2011				2022			
		0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10
1	Community Health Centre (No)	0	0	0	0	0	2	1	3
2	Primary Health Centre (No)	1	1	3	5	1	3	4	8
3	Primary Health Sub Centre (No)	6	8	18	32	6	15	22	43
4	Maternity And Child Welfare Centre (No)	0	0	0	0	0	2	1	3
5	TB Clinic (No)	0	0	0	0	0	1	0	1
6	Hospital Allopathic (No)	1	2	0	3	1	3	1	4



Sr. No	HEALTH FACILITIES STUDY AREA	2011				2022			
		0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10
7	Hospital Alternative Medicine (No)	1	0	0	1	1	1	0	2
8	Dispensary (No)	3	1	1	5	3	3	2	8
9	Veterinary Hospital (No)	2	4	5	11	2	4	5	11
10	Mobile Health Clinic (No)	1	4	13	18	3	4	13	20
11	Family Welfare Centre (No)	0	1	0	1	1	2	0	3

Table-3.63 Health Facilities In the at Gouravelly study area

Sr. No	Health Facilities in Study Area	2011				2022			
		0-2	2-5	5-10	0-10	0-2	2-5	5-10	0-10
1	Community Health Centre (No)	0	0	1	1	0	0	1	1
2	Primary Health Centre (No)	0	0	1	1	0	0	2	2
3	Primary Health Sub Centre (No)	1	7	17	25	1	7	21	29
4	Maternity And Child Welfare Centre (No)	0	0	0	0	0	0	0	0
5	TB Clinic (No)	0	0	0	0	0	0	0	0
6	Hospital Allopathic (No)	0	0	0	0	0	0	1	1
7	Hospital Alternative Medicine (No)	0	0	0	0	0	0	1	1
8	Dispensary (No)	0	0	0	0	0	0	1	1
9	Veterinary Hospital (No)	0	5	7	12	0	5	7	12
10	Mobile Health Clinic (No)	0	2	6	8	0	2	6	8
11	Family Welfare Centre (No)	0	0	1	1	0	0	1	1

Source: Census of India 2011 and Primary Observation

Table-3.64 Health Facilities in Command area

Sr. No	Health Facilities in command area	2011	2022
		Command Area	Command Area
1	Community Health Centre (No)	3	4
2	Primary Health Centre (No)	25	32
3	Primary Health Sub Centre (No)	140	204
4	Maternity And Child Welfare Centre (No)	2	0
5	TB Clinic (No)	2	0
6	Hospital Allopathic (No)	4	2
7	Hospital Alternative Medicine (No)	9	4
8	Dispensary (No)	9	4
9	Veterinary Hospital (No)	77	92
10	Mobile Health Clinic (No)	81	101
11	Family Welfare Centre (No)	2	1

Source: Census of India 2011

The field survey over the health data revealed that large numbers of respondents are affected by general health problems like fever, allergies, headache, knee pains, joint pains, body pains, diabetic and Blood pressure.



Public health profile of the Gouravelly IFFC expansion project study area

SI No	Diseases	2020	2021	2022
1	Malaria	4	5	7
2	Cholera	0	0	0
3	Dengue	17	17	15
4	Chikungunya	14	13	11
5	Acute Diarrhea	36	40	25
6	Typhoid	31	36	53
7	Hepatitis	7	17	11
8	Tuberculosis	96	106	98
9	HIV Cases	11	1	6
10	Cancer	30	24	19
11	Heart attack & Cardiac arrest	35	19	21
12	Diabetes /Blood Sugar	962	883	998
13	Kidney diseases	61	55	48
14	Accidents	23	18	30
15	Infant Mortality Incidents	8	8	15

Source: Concerned Primary Health Centres of 10 Kms Radius

The above table is clearly indicating that the seasonal diseases are frequently occurring in the study area such as Malaria, Dengue, Chikungunya, Acute Diarrhea. The tuberculosis and Hepatitis issues are constantly taking place. There is no evidence of Cholera in the study area. The HIV, Heart attacks or cardiac arrest and Cancer cases are gradually decreasing. However, the Diabetes/Blood sugar patients are gradually increasing the study area due to various community lifestyles and food habits. The incidents of infant mortality is taking place in the study area. Hence, it is suggested to further focus on the above health issues through effective community participation, so that the communities can be protected well through their active involvement and ensure that they are free from health issues.

3.11.2 Quality of life at sample villages of Gouravelly study area

The Quality-of-Life index (QOL) has been computed for the sample households following the methods adopted by Saxena et al. (1998). The index has been modified to suit to the present study because of the variation present in the data. The parameters taken into consideration for the assessment of Quality of Life-QoL of the respondents have been listed in **Table 3.65**. The scores used to assess the Quality of Life have been presented in **Annexure J**.

Table 3.65 Quality of life index parameters

1	Housing (Type & Number of room)	8	Transport and communication facilities
2	Source of Water used	9	Fuel and energy availability
3	Sanitary facilities Available	10	Assets possessed
4	Food and nutrition intake	11	Own transportation means
5	Health and safety status	12	Per-capita income
6	Educational status	13	Recreational facilities
7	Medical facilities		



The minimum desired level of score for the above parameters for a fair living condition was defined with a value of 0.5 on a scale of 0 to 01. All the parameters have been given an equal weightage and the total score of QoL Index is 13.

The classification based on total score used for analysis is as follows:

1. <3 -Very poor
2. >3-5-Poor
3. >5-7-Fair
4. >7-10-Good and
5. >10-13-Very good

On the basis of the value functions stated above the QoL of different sample households were computed and the average QoL for all the sample households village wise was presented in **Table No. 3.66** and **Figure No.3.33**.

Table-.3.66 Average quality of life at sample villages of Gouravelly reservoir project

S.No	Name of the Village	Average Quality of Life	Classification
1	Gouravelly	7.4	Good
2	Nandaram	7.3	Good
3	Jangaon	6.9	Fair
4	Choutapalle	5.8	Fair
5	Anthakkapeta	6.4	Fair
6	Akkannapeta	7.3	Good
7	Gandipalle	7.2	Good
8	Ramavaram	7.7	Good
9	Potharam (J)	7.9	Good
10	Gatlamallial	7.6	Good
11	Kondamrajapalle	7.0	Good
12	Dongala Dharmaram	7.1	Good
13	Samudrala	6.8	Fair
14	Regonda	7.3	Good
Average		7.1	Good

Source: Primary Survey

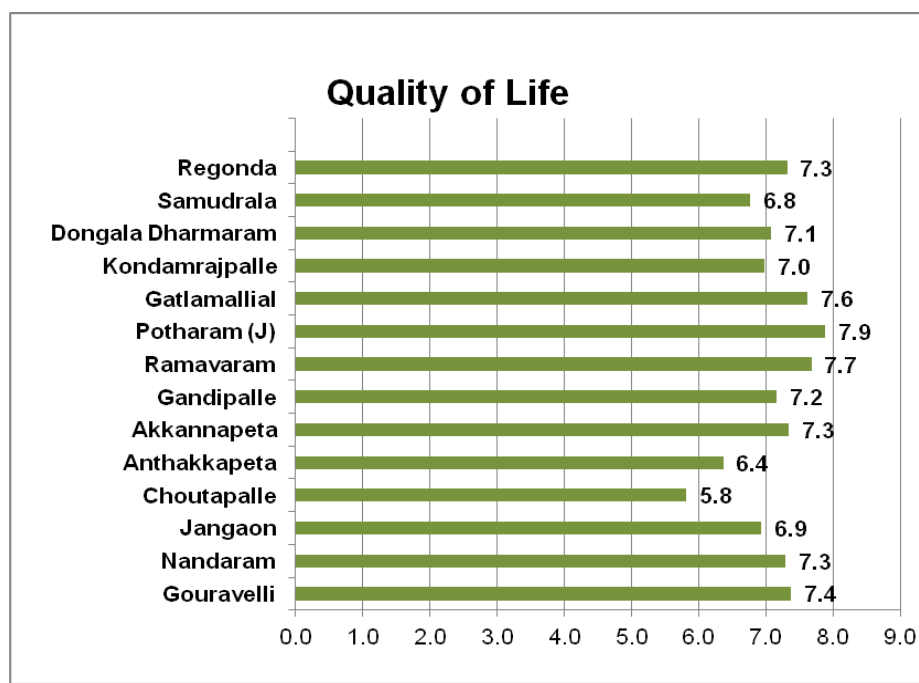


Figure 3.33. Quality of life graph

While the QoL for the sample households in village wise found from 5.8 to 7.9. The average quality is highest (Good 7.9, 7.7) in Potharam (J) and Ramavaram villages, which indicate basic amenities like RWS, Road with RTC bus, and Autos, Bank, Hospital and Post office are present in the villages. Where lowest is in Choutapalle village (5.8) is in fair status as shown in Figure.

It may be noted that the Quality of Life index broadly representing the status of the sample households is overall average (as per the gradation of scores mentioned earlier), indicating that living conditions and infrastructural facilities are present in the region and also the individual resource base resulted in fair Quality of Life index.

3.11.3 Project Awareness about Gouravelly Reservoir

The main aim of this study is to find out the level of awareness among the respondents about the existing and proposed reservoir in the study area. The 485 families were interviewed to know about their awareness about the proposed expansion of Gouravelly Reservoir from 1.409 TMC's to 8.230 TMC's.

It is found that, the all the respondents are aware of the proposed expansion of Gouravelly Reservoir from 1.409 TMC's to 8.230 TMC's in the study area. Some of the villagers indicated their apprehension that the proposed reservoir would adversely affect their identity due land acquisition. However, the respondents said that the agricultural productivity will be increased due to frequent supply of canal water in the study area. The study areas population is expecting the proposed expansion of Gouravelly Reservoir from 1.409 TMC's to 8.230 TMC's be completed soon, and the expected agricultural yielding be realised at the earliest through community participation.

3.11.4 Focus Group discussion (FGD) and Need Based Assessment

The FGD with relevant stakeholders are an important aspect in this EIA exercise to obtain the perceptions and views of the stakeholders on social and environmental concerns pertaining to



the local areas both during this assessment and this will continue during implementation too. The objective of Focus Group Discussion is to minimize the negative impacts in the study area and to make them feel that they are the ultimate program participants of the project. The opinions of the stakeholders are analyzed and presented in this chapter. The primary goal of such discussions was to understand and exchange views among the participants on key social issues, concerns and impacts. The target participants included the sarpanch, ward members and representatives of community based organisations – CBO's and other key informant people in the villagers. The village wise key issues raised by the participants during the FGD's are as follows:

However, all villagers are expecting some employment opportunities in the project and development activities through CSR activities and promote effective community participation.

Focus Group Discussions

A focus group discussion involves gathering people from similar backgrounds or experiences together to discuss a specific topic of interest. It is a form of qualitative research where questions are asked about their perceptions attitudes, beliefs, opinion or ideas.

Focus group discussions are defined in semi structured group discussions, which yield qualitative data on the community level by facilitating interaction between participants.

The aim of the FGD is to facilitative interaction and there by produce, via snowballing of thoughts deeper insights.

FGD provides information on a group/community level. Perspectives of individuals or households are not part of the focus. The strength of an FGD is the forum it creates for discussions between participants thus eliciting new ideas and explanations, which would not have come up during an individual or a household interview.

- 👍 FGD is carefully planned discussion, designed to obtained perceptions on a defined area of interest in a permissive, non-threatening environment; like a small, temporary community.
- 👍 Discussion is “focused” by the goals of the study.
- 👍 Individuals involved are mostly homogenous – not typically meant for representativeness or generalization but for in-depth information.
- 👍 Doesn't assume people have set of opinions.

- 👍 As a socially oriented research method, it captures real-life data in a social setting.
- 👍 It is flexible.
- 👍 It has high face validity, meaning that it measures what it is intended to measure.
- 👍 It generates quick results.

Group dynamics often bring out aspects of the topic or reveal information about the subjects that may not have been anticipated by the researcher or emerged from individual interviews.

Identified needs of the sample villages

The respondents expressed the following needs to be addressed and the expecting the ICAD to implement the different community based interventions with community participation, the different needs identified during the primary survey is presented in **Table-3.68**



Table 3.67 Village wise needs identified at sample villages

VILLAGE NAME	NEEDS IDENTIFIED
1. Gouravelly	Sewage side drainage channels required Sports kits & scholarship to encourage school children and Training programmes for women and youth. And CC roads at the village and need renovation of Anganwadi centres for better attention of children. Required warehouse facilities to store the grains produced by the farmers
2. Nandaram	CC Roads, street lights, Training programmes for women, Sports kit for youth, and School amenities (compound wall, Toilets, Drinking water, lighting).and Gram
3. Jangaon	Sewage side drainage channels, internal CC roads, Medical health camp, library at high school, community hall, separate toilet facility to both boys and girls. Required warehouse facilities to store the grains produced by the farmers
4. Choutapalle	Sewage side drainage channels, Bore wells, additional classrooms with basic amenities, Skill development training programmes for women and medical camp.
5. Anthakkapeta	Sewage side drainage channels, CC roads, street lights, Employment opportunities to local people, Skill training programmes for women and additional classrooms at the school and a separate toilet facility at school for girls and boys
6. Akkannapeta	Required frequent medical camps at the village, Sewage side drainage channels, income generation activities such as training courses (Tailoring and beautification) to women, Remedial classes to the students through qualified teachers support and safe drinking water, electricity and toilet facilities at School and need renovation of Anganwadi centres. Required warehouse facilities to store the grains produced by the farmers
7. Gandipalle	Frequent Medical camps, Sewage side drainage channels and Training programmes for women and youth. Street lights, Library at school and required bore well. Required warehouse facilities to store the grains produced by the farmers
8. Ramavaram	Sewage side drainage channels and Training programmes for women and youth. Street lights, Library at school, required bore well., Required warehouse facilities to store the grains produced by the farmers
9. Potharam (J)	Required CC roads at the colonies, establishment of library, and street lights at the village Training programmes for women, Sports kit for youth, and School amenities (compound wall, Toilets, Drinking water, lighting).
10. Gatlamallial	Required Street lights, Skill development trainings to local youth and provide suitable employment, additional classrooms at school accordingly and youth are expecting contract works in the project operations



11. Kondamrajpalke	Required internal CC roads and additional classroom's at school and livelihoods activities at the villages and need renovation of Anganwadi centres
12. Dongala Dharmaram	Required CC roads and additional classroom's at the school
13. Samudrala	Sewage side drainage channels, required Sports kits & scholarship to encourage schoolchildren, streetlights and Training programmes for women and youth to promote the livelihoods to community and required warehouse facilities to store the grains produced by the farmers
14. Regonda	Required CC roads at the colonies, establishment of library, and street lights at the village Training programmes for women, Sports kit for youth, and School amenities (compound wall, Toilets, Drinking water, lighting).. Required warehouse facilities to store the grains produced by the farmers

Source: Primary Survey

Agricultural Produce In Command area

The major agricultural crops grown are Paddy, Maize, Cotton and chilly. Horticulture crops of Mango, Tomato, Onion and spices like turmeric, cauliflower and chillies etc., are being grown in many parts of Karimnagar, Siddipet, Janagoan and Warangal Urban District is having abundant natural resources. The district wise (Hanumakonda, Karimnagar, Siddipet and Janagoan) past agricultural produce from 2018 to 2022 is presented **Table-3.68**

Table 3.68 Past agricultural produce during 2018-19 to 2021-22 In Gouravelly project command area

Crop & District wise Productivity from 2018-19 to 2021-22						
					(Yield in Kgs/acre)	
Agri_year	Dcode	Dname	Crop	crop_code	YIELD KHARIF	YIELD RABI
2021-22	12	Hanumakonda	Paddy	10100	2002	2384
2021-22	12	Hanumakonda	Jowar	10201	200	769
2021-22	12	Hanumakonda	Maize	10203	2314	3350
2021-22	12	Hanumakonda	Greengram	10502	37	391
2021-22	12	Hanumakonda	Blackgram	10503	375	527
2021-22	12	Hanumakonda	Redgram	10504	253	282
2021-22	12	Hanumakonda	Bengalgram	10505	201	199
2021-22	12	Hanumakonda	Chillies	10702	1194	2041
2021-22	12	Hanumakonda	Cotton	20100	542	-
2021-22	12	Hanumakonda	Groundnut	20301	867	307
2021-22	12	Hanumakonda	Seasamum (Gingelly)	20302	111	314
2021-22	12	Hanumakonda	Sunflower	20304	550	552
2021-22	12	Hanumakonda	Soyabean	20307	693	700
2021-22	12	Hanumakonda	Castor	20401	218	
2021-22	12	Hanumakonda	Tobacco Total	20700	1125	1217
2018-19	13	Karimnagar	Paddy	10100	2301	2236
2018-19	13	Karimnagar	Maize	10203	2293	2814
2018-19	13	Karimnagar	Greengram	10502	255	384



Crop & District wise Productivity from 2018-19 to 2021-22						
					(Yield in Kgs/acre)	
2018-19	13	Karimnagar	Blackgram	10503	343	607
2018-19	13	Karimnagar	Redgram	10504	262	
2018-19	13	Karimnagar	Bengalgram	10505		634
2018-19	13	Karimnagar	Chillies	10702	1738	
2018-19	13	Karimnagar	Cotton	20100	486	
2018-19	13	Karimnagar	Groundnut	20301	1036	1094
2018-19	13	Karimnagar	Sunflower	20304		857
2018-19	13	Karimnagar	Soyabean	20307	650	
2018-19	13	Karimnagar	Tobacco Total	20700	2000	2117
2019-20	13	Karimnagar	Paddy	10100	2042	2373
2019-20	13	Karimnagar	Jowar	10201	500	
2019-20	13	Karimnagar	Maize	10203	2523	2477
2019-20	13	Karimnagar	Greengram	10502	319	386
2019-20	13	Karimnagar	Blackgram	10503	421	737
2019-20	13	Karimnagar	Redgram	10504	392	-
2019-20	13	Karimnagar	Bengalgram	10505	-	620
2019-20	13	Karimnagar	Chillies	10702	2173	-
2019-20	13	Karimnagar	Cotton	20100	674	-
2019-20	13	Karimnagar	Groundnut	20301	1110	676
2019-20	13	Karimnagar	Seasamum (Gingelly)	20302	-	375
2019-20	13	Karimnagar	Sunflower	20304	-	1000
2019-20	13	Karimnagar	Tobacco Total	20700	1201	-
2020-21	13	Karimnagar	Paddy	10100	1826	2627
2020-21	13	Karimnagar	Jowar	10201	328	1018
2020-21	13	Karimnagar	Maize	10203	1854	3094
2020-21	13	Karimnagar	Greengram	10502	168	383
2020-21	13	Karimnagar	Blackgram	10503	302	760
2020-21	13	Karimnagar	Redgram	10504	318	318
2020-21	13	Karimnagar	Bengalgram	10505	-	675
2020-21	13	Karimnagar	Chillies	10702	2436	2423
2020-21	13	Karimnagar	Cotton	20100	652	-
2020-21	13	Karimnagar	Groundnut	20301	639	646
2020-21	13	Karimnagar	Seasamum (Gingelly)	20302	38	274
2020-21	13	Karimnagar	Sunflower	20304	1083	1083
2020-21	13	Karimnagar	Castor	20401	147	-
2020-21	13	Karimnagar	Tobacco Total	20700	1465	1457
2021-22	13	Karimnagar	Paddy	10100	1894	2273
2021-22	13	Karimnagar	Jowar	10201	143	786
2021-22	13	Karimnagar	Maize	10203	2060	2790
2021-22	13	Karimnagar	Greengram	10502	170	89



Crop & District wise Productivity from 2018-19 to 2021-22						
					(Yield in Kgs/acre)	
2021-22	13	Karimnagar	Blackgram	10503	320	519
2021-22	13	Karimnagar	Redgram	10504	376	279
2021-22	13	Karimnagar	Bengalgram	10505	-	345
2021-22	13	Karimnagar	Chillies	10702	1447	2000
2021-22	13	Karimnagar	Cotton	20100	668	-
2021-22	13	Karimnagar	Groundnut	20301	860	946
2021-22	13	Karimnagar	Seasamum (Gingelly)	20302	85	312
2021-22	13	Karimnagar	Sunflower	20304	-	547
2021-22	13	Karimnagar	Soyabean	20307	1000	500
2021-22	13	Karimnagar	Castor	20401	218	622
2021-22	13	Karimnagar	Tobacco Total	20700	1218	1219
2018-19	18	Siddipet	Paddy	10100	2004	1451
2018-19	18	Siddipet	Jowar	10201	375	
2018-19	18	Siddipet	Maize	10203	1049	1769
2018-19	18	Siddipet	Greengram	10502	255	383
2018-19	18	Siddipet	Blackgram	10503	333	615
2018-19	18	Siddipet	Redgram	10504	288	-
2018-19	18	Siddipet	Bengalgram	10505	-	913
2018-19	18	Siddipet	Chillies	10702	1727	2571
2018-19	18	Siddipet	Cotton	20100	381	-
2018-19	18	Siddipet	Groundnut	20301	1013	916
2018-19	18	Siddipet	Seasamum (Gingelly)	20302	-	284
2018-19	18	Siddipet	Sunflower	20304	-	793
2018-19	18	Siddipet	Soyabean	20307	646	-
2018-19	18	Siddipet	Castor	20401	306	318
2019-20	18	Siddipet	Paddy	10100	2271	2303
2019-20	18	Siddipet	Jowar	10201	480	-
2019-20	18	Siddipet	Maize	10203	1744	2217
2019-20	18	Siddipet	Greengram	10502	319	384
2019-20	18	Siddipet	Blackgram	10503	380	765
2019-20	18	Siddipet	Redgram	10504	384	-
2019-20	18	Siddipet	Bengalgram	10505	-	565
2019-20	18	Siddipet	Chillies	10702	2162	2500
2019-20	18	Siddipet	Cotton	20100	760	-
2019-20	18	Siddipet	Groundnut	20301	1110	730
2019-20	18	Siddipet	Seasamum (Gingelly)	20302	-	265
2019-20	18	Siddipet	Sunflower	20304	-	903
2019-20	18	Siddipet	Soyabean	20307	732	-
2019-20	18	Siddipet	Castor	20401	539	519
2020-21	18	Siddipet	Paddy	10100	1984	2587
2020-21	18	Siddipet	Jowar	10201	328	1018



Crop & District wise Productivity from 2018-19 to 2021-22						
					(Yield in Kgs/acre)	
2020-21	18	Siddipet	Maize	10203	1812	3060
2020-21	18	Siddipet	Greengram	10502	168	383
2020-21	18	Siddipet	Blackgram	10503	302	760
2020-21	18	Siddipet	Redgram	10504	258	-
2020-21	18	Siddipet	Bengalgram	10505	-	481
2020-21	18	Siddipet	Chillies	10702	2436	2423
2020-21	18	Siddipet	Cotton	20100	670	-
2020-21	18	Siddipet	Groundnut	20301	639	576
2020-21	18	Siddipet	Seasamum (Gingelly)	20302	38	274
2020-21	18	Siddipet	Sunflower	20304	1083	1083
2020-21	18	Siddipet	Soyabean	20307	608	-
2020-21	18	Siddipet	Castor	20401	147	147
2021-22	18	Siddipet	Paddy	10100	2100	2538
2021-22	18	Siddipet	Jowar	10201	263	786
2021-22	18	Siddipet	Maize	10203	1544	2120
2021-22	18	Siddipet	Greengram	10502	342	391
2021-22	18	Siddipet	Blackgram	10503	286	519
2021-22	18	Siddipet	Redgram	10504	267	300
2021-22	18	Siddipet	Bengalgram	10505	443	433
2021-22	18	Siddipet	Chillies	10702	1104	2038
2021-22	18	Siddipet	Cotton	20100	584	-
2021-22	18	Siddipet	Groundnut	20301	441	925
2021-22	18	Siddipet	Seasamum (Gingelly)	20302	77	314
2021-22	18	Siddipet	Sunflower	20304	636	606
2021-22	18	Siddipet	Soyabean	20307	576	607
2021-22	18	Siddipet	Castor	20401	228	632
2021-22	18	Siddipet	Tobacco Total	20700	-	769
2018-19	19	Jangaon	Paddy	10100	1883	1699
2018-19	19	Jangaon	Jowar	10201	400	650
2018-19	19	Jangaon	Maize	10203	2312	2105
2018-19	19	Jangaon	Greengram	10502	210	382
2018-19	19	Jangaon	Blackgram	10503	359	587
2018-19	19	Jangaon	Redgram	10504	316	300
2018-19	19	Jangaon	Bengalgram	10505	-	634
2018-19	19	Jangaon	Chillies	10702	3154	-
2018-19	19	Jangaon	Cotton	20100	486	-
2018-19	19	Jangaon	Groundnut	20301	1013	585
2018-19	19	Jangaon	Seasamum (Gingelly)	20302	92	267
2018-19	19	Jangaon	Castor	20401	286	-
2018-19	19	Jangaon	Tobacco Total	20700	2117	2130



Crop & District wise Productivity from 2018-19 to 2021-22						
					(Yield in Kgs/acre)	
2019-20	19	Jangaon	Paddy	10100	1940	2152
2019-20	19	Jangaon	Jowar	10201	480	863
2019-20	19	Jangaon	Maize	10203	2225	3201
2019-20	19	Jangaon	Greengram	10502	363	393
2019-20	19	Jangaon	Blackgram	10503	378	762
2019-20	19	Jangaon	Redgram	10504	374	364
2019-20	19	Jangaon	Bengalgram	10505	-	620
2019-20	19	Jangaon	Chillies	10702	1703	2400
2019-20	19	Jangaon	Cotton	20100	640	-
2019-20	19	Jangaon	Groundnut	20301	1110	597
2019-20	19	Jangaon	Seasamum (Gingelly)	20302	-	286
2019-20	19	Jangaon	Castor	20401	520	-
2019-20	19	Jangaon	Tobacco Total	20700	1211	1223
2020-21	19	Jangaon	Paddy	10100	1698	2303
2020-21	19	Jangaon	Jowar	10201	328	1018
2020-21	19	Jangaon	Maize	10203	2046	3331
2020-21	19	Jangaon	Greengram	10502	13	383
2020-21	19	Jangaon	Blackgram	10503	302	760
2020-21	19	Jangaon	Redgram	10504	218	218
2020-21	19	Jangaon	Bengalgram	10505	-	675
2020-21	19	Jangaon	Chillies	10702	1033	2423
2020-21	19	Jangaon	Cotton	20100	534	-
2020-21	19	Jangaon	Groundnut	20301	639	549
2020-21	19	Jangaon	Seasamum (Gingelly)	20302	38	274
2020-21	19	Jangaon	Sunflower	20304	-	1083
2020-21	19	Jangaon	Soyabean	20307	608	-
2020-21	19	Jangaon	Castor	20401	147	-
2020-21	19	Jangaon	Tobacco Total	20700	1458	598
2021-22	19	Jangaon	Paddy	10100	1947	1935
2021-22	19	Jangaon	Jowar	10201	240	805
2021-22	19	Jangaon	Maize	10203	1822	2861
2021-22	19	Jangaon	Greengram	10502	224	390
2021-22	19	Jangaon	Blackgram	10503	261	520
2021-22	19	Jangaon	Redgram	10504	166	370
2021-22	19	Jangaon	Bengalgram	10505	-	215
2021-22	19	Jangaon	Chillies	10702	1501	2058
2021-22	19	Jangaon	Cotton	20100	490	-
2021-22	19	Jangaon	Groundnut	20301	711	533
2021-22	19	Jangaon	Seasamum (Gingelly)	20302	90	314
2021-22	19	Jangaon	Sunflower	20304	-	556



Crop & District wise Productivity from 2018-19 to 2021-22						
					(Yield in Kgs/acre)	
2021-22	19	Jangaon	Soyabean	20307	609	700
2021-22	19	Jangaon	Castor	20401	222	622
2021-22	19	Jangaon	Tobacco Total	20700	1228	1225

Source: Directorate of Economics & Statistics **Government of Telangana Dated 30/06/2023**

Horticultural produce in the command area

Horticulture has been identified as one of the “focus sectors” for development of the State. Horticulture gained commercial importance and became important component of Agriculture. Horticulture crops provide better alternative for diversification of Agriculture in view of higher returns. The diversification of Agriculture is recognized as an important strategy to overcome the emerging challenges in Agriculture. Horticulture sector commands a large employment potential by way of supporting a series of direct and indirect activities related to area development, nurseries, cultivation and farming, crop maintenance, products, post-harvest management, trading, storage, processing, transportation, marketing and distribution of Horticulture commodities and products. Growth in Horticulture sector is expected to provide fillip to employment to the needy. The fruit and vegetable crops play an important role in improving nutritional sufficiency as well poverty alleviation. Horticulture crops play a unique role in State Economy by improving income of the rural people. Cultivation of these crops is labour intensive and as such they generate lot of employment opportunities for the rural population. Not only this, available wastelands dwindling water and energy sources necessitated for diversion from field crops to Horticulture crops which will have lesser demand on water and other inputs as required by field crops. There are different types of Orchard fruits which are perennial is Mango, Sweet Orange, Acid Line, Guava, Banana and Pomegranate. The annual fruit crops are Watermelon, Muskmelon in these 24 mandals. The open cultivated Vegetables are Onion, Potato, Bendi, Beans, Leafy vegetables, Gourds, Beetroot, Cabbage, Capsicum, Carrot, Cauliflower, Fenugreek, Radish, etc... The Spices are Red Chillies, Turmeric, Ajwain and Ginger. The mandal wise (24 mandals of Gouravelly Command Area) past Horticultural produce of Hanumakonda, Karimnagar, Siddipet and Janagoan districts from 2019 to 2022 is presented in **Table-3.69**

Table-3.69 Past horticultural produce during 2019 to 2022 in Gouravelly project command area

DISTRICT	MANDAL	YEAR 2019-20		YEAR 2020-21		YEAR 2021-22	
		Acres	Produce	Acres	Produce	Acres	Produce
Janagoan	Chilpur	1229.24	6139.06	1302.29	7083.82	1495.48	8051.05
	Ghanpur(stn)	1808.84	8308.74	1140.73	5625.83	1237.70	4896.82
	Raghunatha palle	2144.83	12011.54	1061.18	5327.26	1261.49	4450.71
	Tharigoppula	385.97	2604.54	384.34	2087.07	444.65	1949.49
	Zaffergadh	741.23	4510.34	1255.18	5998.48	1130.88	3296.79
	TOTAL	6310.11	33574.22	5143.72	26122.47	5570.19	22644.86
Karimnagar	Chigurumamidi	1133.59	6417.31	1235.22	6882.48	1338.31	6700.65
	Ganneruvaram	896.97	5777.83	758.15	5979.44	853.80	5697.79



	Huzurabad	234.61	1352.62	205.76	1369.99	218.28	1076.48
	Manakondur	1473.94	6315.34	1260.87	5150.86	1190.56	4616.55
	Shankarapatnam	137.97	586.60	117.71	562.09	119.26	454.29
	Thimmapur	1750.91	12569.57	1586.99	13171.28	1340.72	8751.94
	V.saidapur	0.00	0.00	373.28	2886.01	491.96	3060.81
	TOTAL	5627.99	33019.27	5537.98	36002.17	5552.89	30358.51
Siddipet	Akkannapet	1393.60	6822.69	1158.87	5101.37	1126.54	5192.50
	Bejjanki	549.87	3092.58	595.21	4467.08	720.66	3568.03
	Husnabad	1002.77	5373.28	785.42	4157.47	736.74	3252.01
	Koheda	1778.40	9138.52	1564.18	8342.26	1595.79	6449.65
	Maddur	1917.33	12646.63	1582.96	7714.70	1909.58	7974.81
	Nanganoor	3928.14	25936.06	2803.66	16172.20	3240.03	14638.04
	TOTAL	10570.11	63009.76	8490.30	45955.09	9329.32	41075.05
Warangal urban	Bheemadevarpalle	1318.68	7143.00	1061.29	6539.63	1198.34	5496.13
	Dharmasagar	1396.65	8351.00	1467.63	9836.70	1321.60	7215.13
	Elkathurthi	982.84	6352.00	846.76	6203.21	858.31	4606.91
	Inavolu	2710.68	16052.00	2197.61	13235.66	1664.48	7804.16
	Khazipet	639.85	3285.00	577.35	3881.30	711.69	3354.51
	Velair	630.51	4251.00	618.31	3522.14	449.26	1934.97
	TOTAL	7679.21	45434.00	6768.95	43218.64	6203.66	30411.80
GRAND TOTAL		30187.42	175037.26	25940.95	151298.37	26656.05	124490.22

Source: Department of Horticulture Government of Telangana Dated 27/06/2023
Fishries Production In Command area

Leasing of Departmental tanks to the fisherman co-operative societies, Organization of Fishermen / Women co-operative societies, Enrolment of new members into existing fisherman / women co-operative societies, Fish diseases diagnosis and remedies, Technical support in Fish and Prawn Culture, implementation state Government schemes such as Integrated fisheries development schemes (IFDS), Supply of Fish seed / Prawn seed on 100% subsidy, Fisheries development schemes (FDS) (Construction of Community Halls, Markets & Marketing facilities to the Fisherman), implementation of Group accident insurance scheme and Central Government schemes such as Pradhan Mantri Matsya Sampada Yojana (PMMSY) and Central sponsored schemes(CSS). The mandal wise (24 mandals of Gouravelly Command Area) past Fisheries produce of Hanumakonda, Karimnagar, Siddipet and Janagoan districts with available information from the respective department from 2018 to 2023 is presented in **Table-3.70**



Table 3.70 Details of Past Fish Produce of Command area (2018 to 2023)

District	Mandal	YEAR	CATLA	ROHU	MRIGAALA	CATFIS H	TOTAL
Janagoan	Chilpur	2018- 2019	85.50	127.20	27.50	39.00	279.20
	Ganpur_stn		134.70	174.10	43.70	53.00	405.50
	Raghunathpalle		154.30	204.90	35.00	53.20	447.40
	Tharigoppula		20.10	37.70	5.40	13.30	76.50
	Zaffergadh		87.05	144.70	23.70	50.80	306.25
Total			481.65	688.60	135.30	209.30	1514.8 5
Janagoan	Chilpur	2019- 2020	106.88	159.00	34.38	48.75	349.00
	Ganpur_stn		168.38	217.63	54.63	66.25	506.88
	Raghunathpalle		192.88	256.13	43.75	66.50	559.25
	Tharigoppula		25.13	47.13	6.75	16.63	95.63
	Zaffergadh		108.81	180.88	29.63	63.50	382.81
Total			602.06	860.75	169.13	261.63	1893.5 6
Janagoan	Chilpur	2020- 2021	133.59	198.75	42.97	60.94	436.25
	Ganpur_stn		210.47	272.03	68.28	82.81	633.59
	Raghunathpalle		241.09	320.16	54.69	83.13	699.06
	Tharigoppula		31.41	58.91	8.44	20.78	119.53
	Zaffergadh		136.02	226.09	37.03	79.38	478.52
Total			752.58	1075.9 4	211.41	327.03	2366.9 5
Janagoan	Chilpur	2021- 2022	173.67	258.38	55.86	79.22	567.13
	Ganpur_stn		273.61	353.64	88.77	107.66	823.67
	Raghunathpalle		313.42	416.20	71.09	108.06	908.78
	Tharigoppula		40.83	76.58	10.97	27.02	155.39
	Zaffergadh		176.82	293.92	48.14	103.19	622.07
Total			978.35	1398.7 2	274.83	425.14	3077.0 4
Janagoan	Chilpur	2022- 2023	225.77	335.89	72.62	102.98	737.26
	Ganpur_stn		355.69	459.73	115.40	139.95	1070.7 7
	Raghunathpalle		407.45	541.06	92.42	140.48	1181.4 2
	Tharigoppula		53.08	99.55	14.26	35.12	202.01
	Zaffergadh		229.87	382.10	62.58	134.14	808.69
Total			1271.8 6	1818.3 3	357.28	552.68	4000.1 5

Source: Department of Fisheries, Government of Telangana June 2023



2022-23						
District	Mandal	Catla	Rohu	Mrigala / Common Corp	Cat fish	Total
Hanumakonda	Bheemadevarapally	44.10	44.10	37.80	0.00	126.00
	Elkathurthy	58.91	58.91	50.49	0.00	168.30
	Dharmasagar	227.22	227.22	194.76	0.00	649.20
	Inavole	119.66	119.66	102.56	0.00	341.88
	Velair	55.13	39.59	47.25	0.00	141.96
Total		505.01	489.47	432.86	0.00	1427.34

Source: Department of Fisheries, Government of Telangana June 2023

3.11.5. Conclusion

As per the primary survey and observation, 43 census villages/wards surround the proposed expansion of Gouravelly Reservoir from 1.409 TMC's to 8.230 TMC's project and it also includes 20 urban wards belong to Husnabad Municipal Council, which are falling in the 10 km radius of the study area. The study areas Schedule caste (SC) population is 17.23% and the Schedule Tribe (ST) population is 13.25%. Literacy rate in the project area is 60.56%. Educational status has improved from generation to generation in this region. The required Schools and colleges are available. The working participation rate is 51.90% and the non-working population is 48.10%. Infrastructure facilities such as the Road network, self-help groups, public distribution system, and communication facilities are good.

A sample survey of 485 household's survey was conducted in 14 villages of the study area. The number of females per 1000 males is 1009, showing healthy ratio of female population. Among the surveyed total population (excluding 0 to 6 years of age), 63.26% people were literate and 30.75% were illiterate. This shows that the educational facilities have gradually improved in the sample villages and some of the educational infrastructure is still in progress.

The more than half the population(69.64%) in the study area is having the land ranging from below hectare to more than 10 hectares. These farmers are cultivating paddy and other rain fed crops such as maize and millets. The remaining farmers are growing fodder for their cattle. About 70.17% population involved in other occupations petty trading, private wage employment and daily wage labourer works.

With reference to drinking water sources, majority 88.87% families were using water from rural water supply (Mission Bhageeratha Scheme and using bore wells. The sanitary status was good in the villages as 91.75% have sanitation facilities in their own premises. However, the drainage facilities in the study area needs to be further improved through community participation.

Health and medical amenities are there in the study area as most of the villages were covered by the state with Primary and Community Health Centre at Husnabad and Akkannapet and its supporting sub-centres and in addition to this the Rural Medical Practitioners (RMPs) are also available in the study area.

During the Focus group discussion & need-based assessment, the respondents requested some important facilities from the project proponent. These are Cement and concrete (CC)



roads, Drainage and sanitation, Need based skill-training programmes to promote the livelihoods of the communities is required. The additional classrooms at schools and sports kits to the school, Need renovation for Anganwadi centres and regular medical camps.

The findings from the primary survey indicate that medical facilities & other infrastructure facilities are average in the study area. The quality of the life in the region is good having the basic amenities in the surrounding areas, needs to be further improved through Corporate Social Responsibility initiatives promoting the community participation. Since the expansion of the Gouravelly reservoir which expect the paddy cultivation needs warehouse facilities to store the grains produced by the farmers.

With the proposed expansion of Gouravelly Reservoir Project from 1.409 TMC to 8.230 TMC at Gouravelly village of Akkannapet mandal of Siddipet district of Telangana State is expected to increase the Agricultural, Horticultural and Fisheries production year by year and enhance the income of the farmers and its allied sections or service sector in 24 mandals of command area. The proposed project is anticipated to boost the different sectors such as education, health. Transportation, fisheries, agro industries and infrastructure and will be part of developed state as a whole.

4

ANTICIPATED IMPACTS & MITIGATION MEASURES

Developmental project that meets the needs of the present generation without compromising the requirements of future generations is considered as sustainable development project. All projects are, therefore, planned and executed to make it sustainable project. The IFFC project from Sri Ramasagar Project with expansion of Gouravelly reservoir has been formulated to meet the drinking water and irrigation requirement of Telangana State, therefore, should meet the criteria for sustainable development. The project also should not cause any adverse impact on the environment. If the project benefits for the well being of the larger population outweigh the adverse impacts which are inevitable in the successful execution of the project, adequate mitigation measures should be adopted either to completely mitigate the adverse impacts and if not, possible it should be minimized to the extent possible to make the project sustainable.

Prediction of impacts, both positive and negative, is, therefore, considered as the most important component in the environmental impact assessment studies. Several scientific techniques and methodologies are available to predict impacts of project developmental activities on environment. Such predictions are superimposed over the existing baseline status of environmental quality to derive the ultimate (post-project) scenario of environmental conditions. While the prediction of positive impacts of the project are necessary for a developmental project for the benefit of the larger population and make it an economically viable project, the prediction of adverse impacts helps to prepare the Environmental Management Plan (EMP) to mitigate the hardship to the people and adverse impacts. If it is not possible to completely mitigated the adverse impacts the management plan should aim at minimizing it to the maximum extent possible to make the project sustainable.

4.1. Impact assessment of the IFFC project from Sri Ramasagar Project with expansion of Gouravelly reservoir project

The Gouravelly Reservoir project aims at 48,561 ha (1,20,000 acres) in Karimnagar, Siddipet, Hanumakonda and Jangaon Districts. This would have a very positive impact on a very large population that has been suffering.

The climate change had added to the uncertainty of receiving timely and well distributed rain during the monsoon season resulting in repeated crop failure. The failure of crop had resulted in mounting debt and pressure of repayment has forced many to take extreme step endangering their life. The farmers and farm labourers had to resort to migration to feed the family leaving the old members in the village to fend for themselves. The farming community is waiting for the day when the project would deliver the water to their fields that was the promise given by the Telangana government at the time of the formation of the new State.

The major environmental and ecological impact of project mainly pertains to the areas of reservoir, canal, and the command area. The impacts have both spatial and temporal aspects. For example, the impacts can be upstream or downstream of the project sites, and it can be during and after construction. The impacts that are expected of any river valley project can be broadly classified into three groups. They are:

- Environmental aspects related to atmosphere, terrestrial and aquatic.
- Physico – chemical aspects related to land, surface water and ground water.
- Issues related to human population such as health, socio-economic, aesthetics and livelihood.



4.2. Identification and Assessment of Impacts

Impact assessment describes identification and appraisal of various impacts due to the proposed project. "Environmental Impact" can be defined as any alteration of environmental conditions or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration. Baseline data of the quality of various components of environment such as air, water, soil, noise, forest, biodiversity, etc. are measured and recorded to compare it with possible future scenario to deal with the impact and take necessary action for its mitigation.

The environmental impacts due to the proposed project have been identified on the basis of available secondary data from the various Government Agencies and collection of primary data for three seasons. The construction of the canals, tunnels and storage of water in the reservoirs, including release of water for drinking and irrigation, will create different types of impacts, both positive and negative. The impact on environment during the construction phase is, however, generally temporary in nature but all adverse impacts have to be recorded and addressed to safeguard the long-term interest of the people and for environmental stability. The operational phase impacts are long-term and needs to be carefully examined and adequate mitigation measures have to be formulated in the environment management plan.

4.3. Impacts during the construction and operation period.

During the construction phase the following are the anticipated impacts:

1. The project will need 3870 acres of land for the construction of reservoir. Villages such as Gudatipally Gram panchayath, Tenugupally, Maddalapally and Kothapalli are H/o Gudatipally get fully Submerged; and villages like Gouravelly, Janagoan, Gandipelly, Regonda, Nandaram, Ramavaram get partially submerged. About 817 Nos. of structures and 1122 Nos. of families get affected due to the reservoir.
2. The submergence of the above make it obligatory to give them rehabilitation and resettlement benefits. Hence all land issues have to be carefully examined, their impact assessed, and management plans formulated to mitigate the adverse impacts.
3. Site clearance, construction of sheds and other facilities for camp labour and project functionaries, providing camping facilities such as water, electricity, sanitation, cooking gas, etc. Approach road to the identified construction locations for the movement of men and machinery, transportation of construction material at different sites will all have to be assessed for their impact.
4. Excavation of earth for the construction of canals, approach road to tunnel and tunnelling activities, digging for pump house, etc. will generate lot of muck that has to be assessed for its impact and method of safe disposal has to be found.
5. The impact on the command area during the operational phase, especially on the soils, has to be assessed as providing irrigation for sustainable crop production is the major objective of the project.

A detailed discussion on impacts due to the project is given in the following paras:

4.4. Air Environment

Sources of air pollution affecting the project area are mainly from vehicular traffic, dust arising from unpaved roads and domestic fuel burning. The air environment around project site is free from any significant pollution. Therefore, ambient air quality is quite good in and around the project area. Vehicular movement, quarrying and running of construction equipment will impact air quality at the construction site. The burning of municipal solid waste from the labour colonies will also affect air quality.

4.4.1 Changes in ambient and ground level concentrations due to total emissions from point, line and area sources:

During construction phase there will be an increase in the vehicular movement as Construction vehicles/equipments are brought in and out. Excavator, Backhoe loader, Wheel Loader, Tipper, Trailer, Tower Crane, Bulldozers Batching Plant, Concrete Mixer, Concrete pumps, Boom Placer,

Motor Graders Crusher, Vibrator Soil Compactor, Tata Lebrari Soil Compactor, Sheep Foot Roller Vibrator Plate Compactor, Water Tanker, Diesel Tanker, Welding Machine, DG Sets, Tractor, Compressor, Electrical Motor water pumps, Oil Engine, Reverse Drum Mixer, Wet Mix plant (pug mill) Drum, Centering Material, Pin/Pan Vibrators, Road Bending Machine, Red cutter and Drillers. However, all these heavy construction equipment are not used simultaneously. It is expected that about 316 equipment/vehicles and 5 DG sets will be operated at various places of project area. The air pollution generation has been computed based on use of these vehicles / equipments.

Based on the above emission sources, air modeling was done using AERMOD model to predict the Ground Level Concentrations (GLCs) of criteria pollutants: SPM, SO₂, NO_x and CO that are emitted from the DG stack, vehicles and equipment. The results are given.

Maximum ground level concentration of particulate matter, Sulphur dioxide, Nitrogen oxides and carbon monoxide were found to be 15.8, 0.351, 11.8 and 404 ug/m³ respectively as shown in Fig. 4.1, 4.2, 4.3 and 4.4.

The maximum incremental GLCs due to the proposed project construction activities for PM₁₀, SO₂, NO₂ and CO are superimposed on the average baseline for PM₁₀, SO₂, NO₂ and CO concentrations recorded during the study period to arrive at the likely resultant concentrations during the construction phase. The cumulative concentrations (baseline + incremental) during the construction phase are tabulated in Table 4.1.

As the construction actives of the canal and Mid Manair is completed in the year 2018 and hence expansion of Gouravelly Reservoir construction activities is considered for the modeling.

Table 4.1 Predicted Ground level concentration during Construction phase

Code	Sampling Location	$\mu\text{g}/\text{m}^3$			$\mu\text{g}/\text{m}^3$			$\mu\text{g}/\text{m}^3$		
		Max. Conc.			Predicted conc.			Total		
		PM ₁₀	SO ₂	NO ₂	PM ₁₀	SO ₂	NO ₂	PM ₁₀	SO ₂	NO ₂
A1	Baswapuram	49.0	18.4	22.5	0	0	0	49	18.4	22.5
A2	Rajeshwarraopeta	54.0	10.7	14.0	0	0	0	54	10.7	14
A3	Kondayapalli	66.0	13.1	13.6	0	0	0	66	13.1	13.6
A4	Vallampatla	58.0	15.7	17.1	0	0	0	58	15.7	17.1
A5	Nawabpet	63.0	14.0	17.1	0	0	0	63	14	17.1
A6	Regonda	57.0	12.2	17.2	4.429	0.084	2.682	61.429	12.284	19.882
A7	Gouravelly	54.0	9.6	16.2	6.871	0.163	5.904	60.871	9.763	22.104
A8	Kundinenepalli	63.0	11.2	15.4	2.106	0.064	3.165	65.106	11.264	18.565
A9	Kondapuram	52.0	10.7	8.8	0	0	0	52	10.7	8.8
A10	Pichara	68.0	14.1	10.1	0	0	0	68	14.1	10.1

Fig. 4.1 Ground level concentration of Particulate Matter

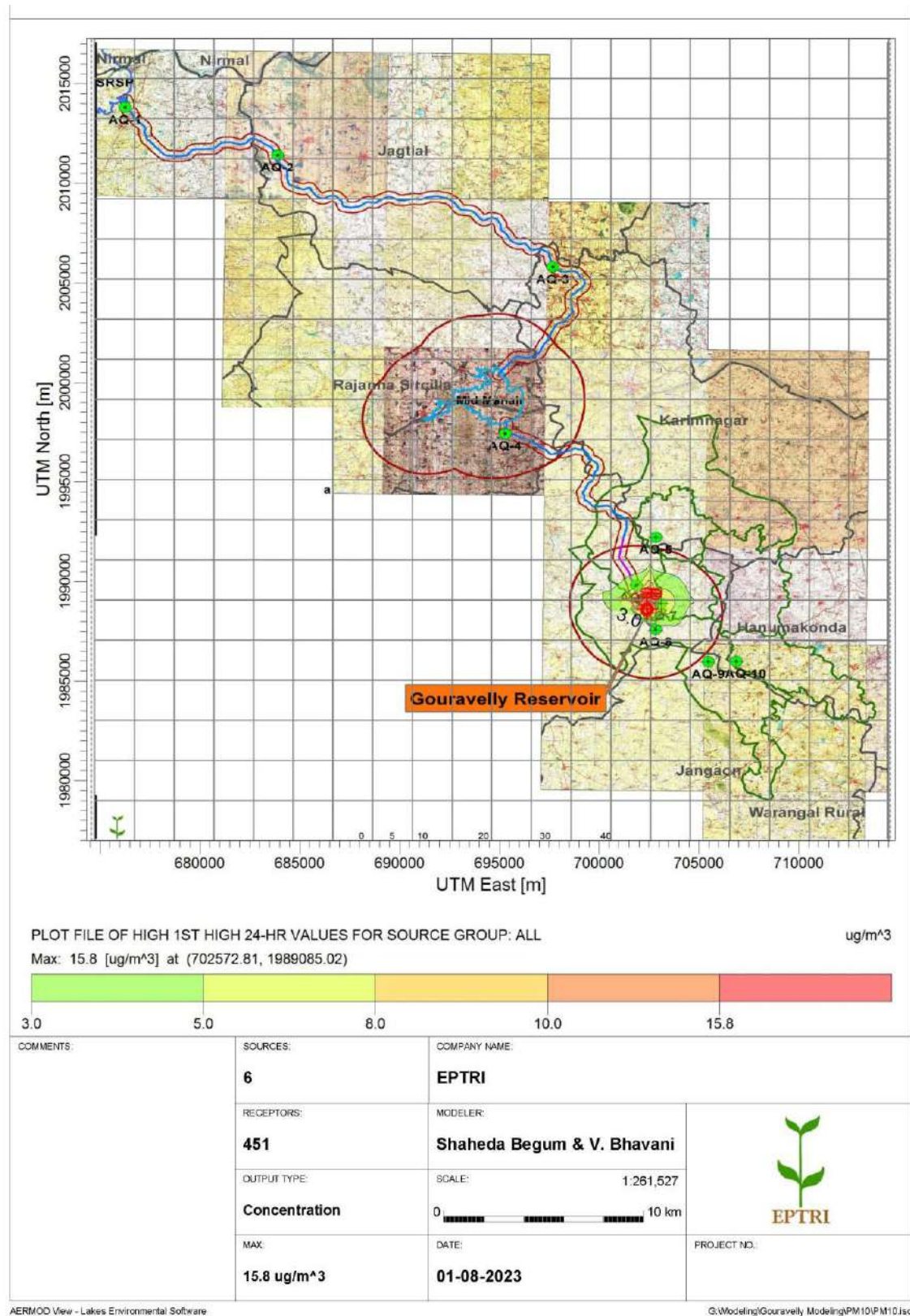


Fig. 4.2 Ground level concentration of Sulphur dioxide

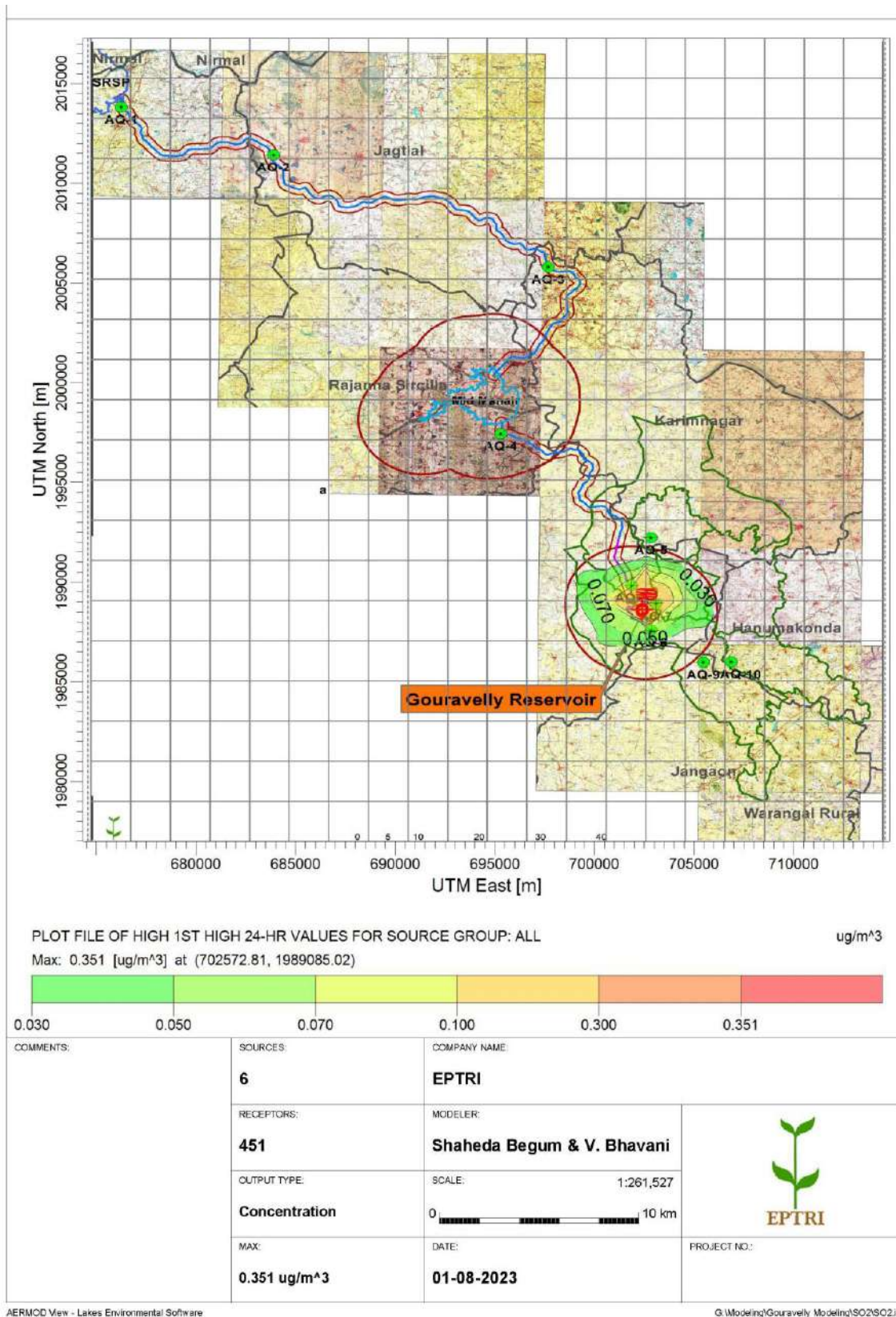


Fig. 4.3 Ground level concentration of Nitrogen dioxide

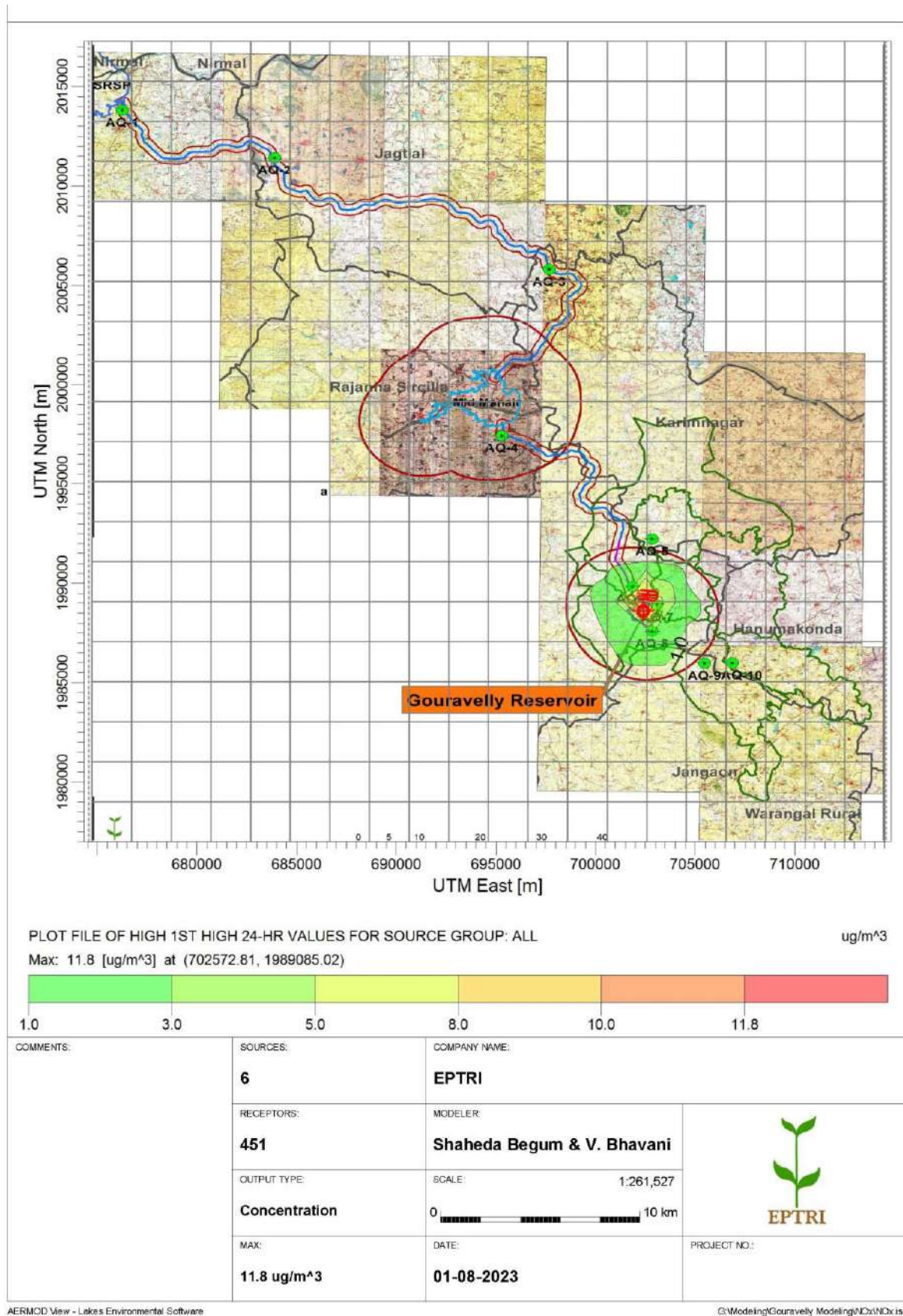
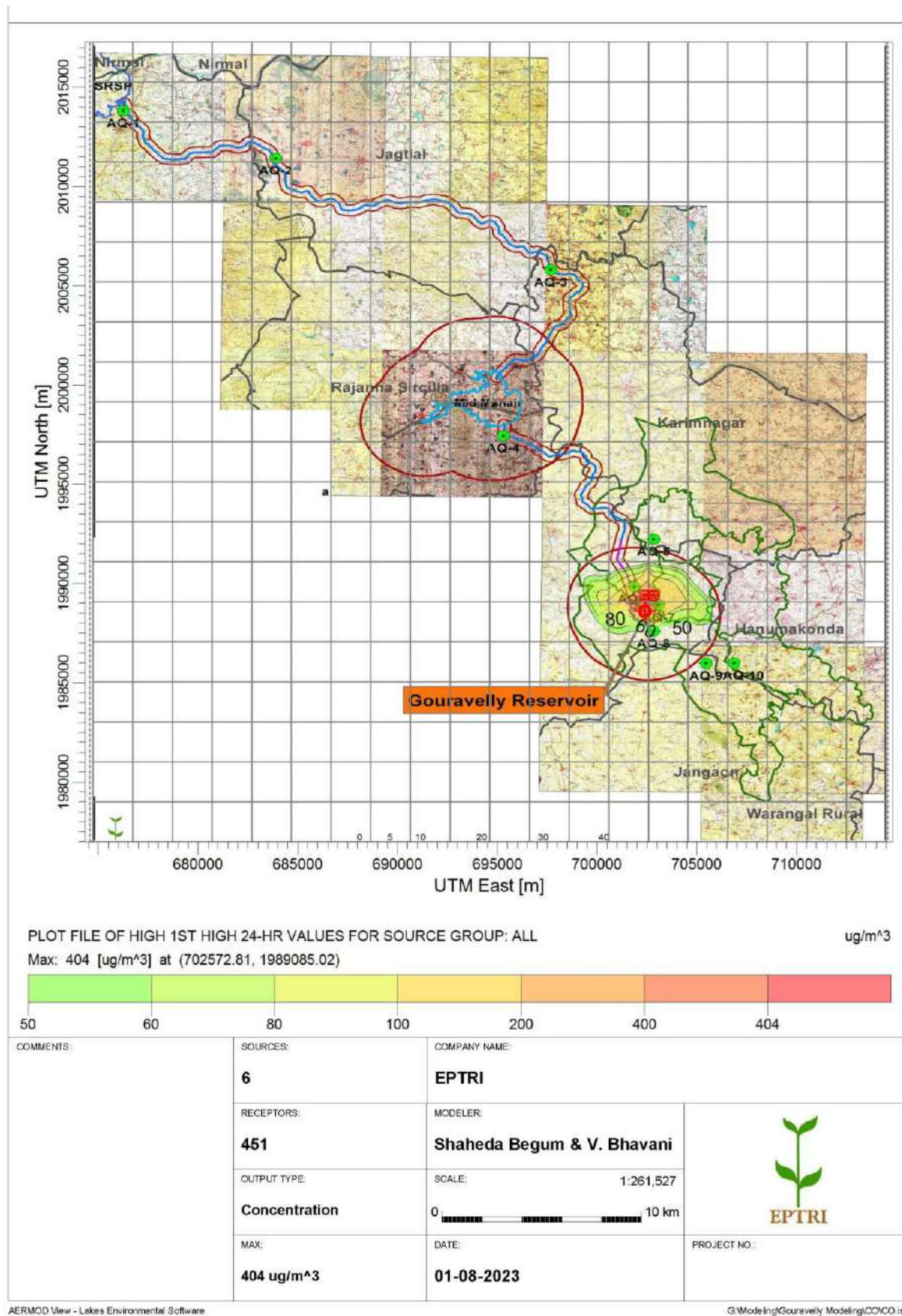


Fig. 4.4 Ground level concentration of Carbon Monoxide



**Inference:**

The modeling was done to understand the extent of emissions during construction phase from vehicles and from DG Sets that contributes to the ambient air pollutant.

The cumulative concentration from both baseline and predicted is maximum of $68 \mu\text{g}/\text{m}^3$, $18 \mu\text{g}/\text{m}^3$ and $22.5 \mu\text{g}/\text{m}^3$ which are within the prescribed NAAQ standards.

As the Gouravelly reservoir construction activities are considered for the prediction of air quality pollutants hence the incremental rise is observed at Regonda, Gouravelli and Kundinenepalli locations which are near to the Gouravelly reservoir.

It can be concluded that the air quality values recorded in and around the project site are below the prescribed standards of CPCB. The air dispersions from DG set emissions and vehicular emissions shows that maximum intensity is present within the construction site from the source and less impact on the surrounding habitations.

4.4.2 Effect on soil, material, vegetation and human health

The air emissions from the proposed project during construction and operation phase will not have any major adverse effect on the soil, vegetation and human health during operation phase. However, there may be some effect during construction of reservoir and digging of canals due to dust emission from the site, fugitive emissions from vehicles and equipments.

4.4.3 Impact of emissions on air environment from DG set used for power generation during the construction.

The DG sets need diesel as fuel. The major pollutants which are emitted as a result of fuel combustion are SO_2 , NO_x and SPM. The gaseous emissions from DG sets will cause minor increase in gaseous pollutants at the project sites. Hence these would have some temporary impacts on the ambient air quality in the area, though these are not anticipated to have any significant impact on the people.

4.4.4 Pollution due to fuel combustion in equipment and vehicles

The construction impacts on air quality from fugitive dust around the construction site due to construction operations will cause short term emissions of air pollutants originating as fugitive dust (as excavation and grading of the site occur) and as a by-product of fuel combustion from construction equipments. Fugitive emissions will also be generated from the vehicles as well as the construction materials.

Mitigation measures to limit these emissions include the use of properly maintained Construction equipment, the use of trap cover on trucks transporting construction materials to and from the site, the wetting of unpaved roadways and the prohibition of any open burning of construction waste products on-site. Fugitive dust would be further minimized by taking up tree plantations, growing grass where soil depth is limited and with least damage to the existing vegetation in and around the construction sites.

4.4.5 Fugitive emissions from various sources

The vehicular movement, handling and storage of construction materials are prime sources for fugitive emissions. Since the project area is spread over a vast area the emissions are also spread over a large area. There may not be any concentrated emission posing danger to human health. The impact of the vehicle movements and running of various machines has already been studied by modelling and it was found to be negligible.

4.4.6 Impact on micro-climate

There will not be any significant impact on microclimate due to the proposed project as the work is spread over a vast area and some of the major polluting activities are underground such as tunnel. Proper canal bank plantations and plantations along the rim of the reservoir shall be raised. The usage of large quantities of concrete, cement and asphalt absorb the sun's energy and the heat is radiated in the ambient air. Thus, during the construction phase ambient air quality

would be adversely affected to some extent in small pockets. This impact on micro-climate is of low intensity and for short duration without making any significant impact on the health of the surrounding population.

During operation phase the reservoir with large open surface facilitate water loss by evaporation. This will increase the humidity in the air around the reservoir affecting the micro-climate. The impounding of water in the reservoir will cool the local atmosphere. Further, the increased vegetation around the reservoir will also cool the local atmosphere. These impacts on micro-climate occur during the operational phase of the project and are long term in nature.

4.4.7 Mitigation Measures:

- The contractor should be mandated for proper functioning / maintenance of construction equipment to minimize emissions.
- Unnecessary idling of construction vehicles to be prohibited.
- Effective traffic management to be undertaken to avoid accidents and in and around the project area.
- Damaged roads due to project activities should be promptly repaired.
- Kachha roads should be kept wet by sprinkling water to reduce dust pollution.
- Location of DG sets and other emission generating equipment should be decided keeping in view the predominant wind direction so that emissions do not affect nearby residential areas and stack height of DG sets to be kept in accordance with CPCB norms.
- Dust pollution can be controlled by identification of construction limits, excavated spoils should be removed as the contractor proceeds along the length of the activity, stockpiling of excavated material should be covered or stacked at offsite location with muck being delivered as needed during the course of construction, excessive soil on paved areas should be sprayed (wet) and/or swept and unpaved areas should be sprayed and/or mulched - use of petroleum products or similar products for such activities should be strictly prohibited.
- Stockpiled soils and trucks hauling soil, sand and other loose materials should be covered.
- Batch mix plants shall be located away from the settlements and water bodies.
- Dust generated at the construction sites shall be controlled by sprinkling water on haulage roads twice in a day.
- Emission from fossil fuel burning can be avoided by provision of alternate cooking fuel such as kerosene or LP gas.

4.5. Water Environment

The environmental consequences due to construction of reservoir, and includes direct impacts to the biological, chemical and physical properties of rivers and riparian environments.

4.5.1. Changes in surface and ground water quality

During construction, some residual contamination might occur, but this is deemed as having short-term effect on the water quality. Long-term consequences of water quality are low due to the fresh water interweaving across the reservoir.

The total quantity of water required during construction period is 1550 KLD. It is mainly for the construction activity and domestic purpose. The water will be used from the nearby available sources.

Water Logging and soil salinity development can occur due to heavy losses of water due to seepage from canal, distributaries and water courses.

- Inadequate drainage and poor maintenance of existing drainage system and outlets - inadequate farm water management - lack of conjunctive use of surface and ground waters can result in poor application efficiencies.



- Water quality may be affected by aquatic weeds and biomass decay, turbidity and pollution from agricultural, industrial and human waste.

4.5.2. Steps to develop pisci-culture and recreational facilities

As there are no river/ streams passing through the proposed area of the reservoir, the presence of migratory fish doesn't arise. However, it is suggested to plan fish ladders near the weir/ flood gates of the project to prevent loss of fishery wealth.

The management of reservoirs is based on the stocking–cum capture fishery technique. The formation of fish population in reservoir is basically from the parental population of the inundated river and watershed areas. It is usually characterised by strengthening of lacustrine species and decline in riverine species as a result of change from riverine to lacustrine condition which do not favour them. The management techniques involve introduction of selected varieties of carps from extraneous sources, so as to develop a carp dominated fishery through self-propagation as well as regular stocking, a rational system of exploitation based on the concept of fishing effort and population dynamics of the fish stock, conservation measures e.g., regulation of mesh size, imposition of size limits, observance of closed season, ban on destructive methods of fishing, preservation, transport and marketing of fresh fish.

4.5.3. Impacts of Stocking

Stocking in the medium and large reservoirs could be considered as successful only when the stocked fish are recaptured. Indian experience of stocking medium and large reservoirs suggests that by and large, the stocking becomes effective only when the stocked fishes propagate themselves. Moreover, this breeding population can be built-up only if the stocking is resorted to during the early phase of the reservoir formation.

4.5.4. Water pollution due to disposal of sewage/labour camps and washing requirement.

- Developmental activities such as construction of reservoir, canal, tunnel, etc. can result in chocking of natural drainage.
- During construction phase sewage discharge from the labour camps or colonies nearby construction site will have an impact.
- Pollution due to runoff from construction sites and impacts due to discharge of effluent from the crusher can be anticipated.
- Due to the construction of reservoir and online storages - impoundment, damming, culverting, realignment changes to the hydrology of watercourses or aquifers are possible.
- Proliferation of water weeds can increase disease vectors, affect water quality, fisheries and clog irrigation structures.

4.5.5. Mitigation Measures

- Adequate drainage channels shall be provided with suitable slopes on the roadway sloping away from the canal side. No rainwater shall be allowed to flow or percolate towards the canal slope behind the lining.
- Sewage treatment plant shall be constructed near the construction site for treating the sewage to avoid surface and ground water contamination. In the places where STP cannot be installed soak pits designed and constructed as per IS 2470 Part-I & Part-II shall be provided.
- Increased mosquito breeding places will result in increased vector mosquitoes. To deal with the problems, it is necessary to educate the labour and other personnel engaged in the various works of the project about disease control and introduce anti-malaria measures like distribution of oral medicines and mosquito nets. Educating the people for maintaining hygienic living conditions etc. during the construction phase is also important.

4.6. Impact on hydrogeological environment

The Indiramma Flood flow canal project from Sri Ramasagar Project with expansion of Gouravelly reservoir project is in a semi-arid area and has a predominantly hot and dry climate. It has a

skewed distribution of rainfall in space and time. Due to long failure to harness the water resources potential the area remained as dry agriculture lands with people resorting to exploitation of groundwater for their irrigation needs. The use of groundwater cannot provide a lasting solution because there is already over exploitation of groundwater. The borewells in the area have not only gone deeper and deeper, but huge resources of electrical energy are required to be employed for tapping the ground water.

The transfer of water through lift schemes and conveying it to water deficient, upland regions is thus of strategic importance and a pressing need toward a more equitable development of water resources for irrigation and other water requirements.

4.6.1 Anticipated impacts on groundwater and mitigation measures

Groundwater development in the area is found to be through dug cum borewells down to a depth of 20 to 30 m in the dug wells, ranges from 0.17 to 0.3 liters per second. The yields of irrigation dug wells range between 40 and 135 cu.m/day sustaining 1 to 5 hrs of pumping in a day. The depth of irrigation bore wells ranges between 20 to 45m yielding 1.5 to 75 cu.m/day. The Pre-monsoon depth to water level varies from a minimum of 3.85 m.bgl. to a maximum of 21.00m.bgl. Most of the area is having water levels below 5 mbgl. Water levels ranges from 5-10m and above 10m water levels. The Post-monsoon depth to water level during post-monsoon ranges from a minimum of 0.98 m.bgl to maximum of 22.65 m bgl. The water levels of less than 10 m bgl. Long Term Water Levels Decline in water levels during pre-monsoon is noticed in 75% of the wells while 25% of wells show rise in water levels during the last decade. The decline in water levels varies between 1.06 to 5.19 m. The analysis of post-monsoon water level shows that there is a decline in 77% of the wells while 23% show rise in water levels. The water level decline varies from 0.19 to 6.62 m.

Impact of Mid Manair Reservoir (MMR) on ground water in downstream area:

The Lower Manair Dam built across Manair river at Manvada village near Sircilla. Mid Manair Reservoir has a capacity of 25.873 TMC. Provides drinking water to Sircilla, Karimnagar towns and the NTPC power plant at Ramagundam. It has a capacity to irrigate 2,00,000 acres (80,971.65 ha). The project was completed in April 2018.

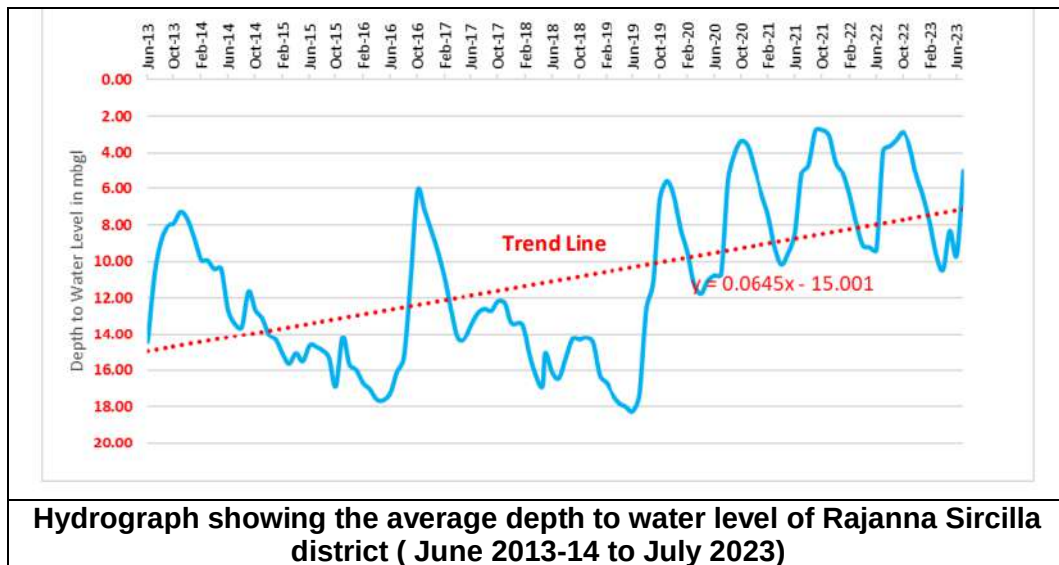
Telangana State Ground water department, Rajanna Sircilla district has been monitoring the change in ground water regime every month through a network of 37 functioning piezometers in the district in various hydrogeological and geomorphic units from commonly developed aquifers. Depth To Water Level is the index of cumulative effect occurred in the Ground water regime.

Statement of monthly average depth to water level in Rajanna Sircilla district (June 2013-14 to July 2023)

S.No	Water Year/ Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Annual Average DTWL
1	2013-14	14.43	10.79	8.83	8.06	7.91	7.29	7.68	8.72	9.90	9.93	10.42	10.39	9.53
2	2014-15	12.65	13.40	13.59	11.63	12.64	13.11	14.02	14.32	15.12	15.63	15.06	15.50	13.89
3	2015-16	14.63	14.70	14.89	15.31	16.87	14.17	15.67	15.97	16.70	17.01	17.58	17.62	15.93
4	2016-17	17.24	16.08	15.30	10.86	6.15	7.19	8.29	9.50	10.97	12.69	14.26	14.30	11.90
5	2017-18	13.51	12.85	12.58	12.69	12.17	12.26	13.36	13.44	15.06	16.22	16.88	15.06	13.84
6	2018-19	16.11	16.42	15.30	14.25	14.31	14.18	14.48	16.28	16.68	17.30	17.78	17.98	15.92
7	2019-20	18.23	17.37	12.65	11.15	6.56	5.61	6.36	8.18	9.48	11.19	11.75	11.07	10.80
8	2020-21	10.75	10.69	5.54	3.98	3.35	3.70	4.99	6.30	7.50	9.14	10.15	9.57	7.14
9	2021-22	8.46	5.20	4.69	2.80	2.76	3.06	4.52	5.16	6.38	7.83	9.11	9.22	5.77
10	2022-23	9.37	3.91	3.64	3.27	2.89	3.67	5.27	6.43	7.94	9.64	10.44	8.33	6.23
11	2023-24*	9.64	4.99											7.32
Decadal Monthly Average DTWL		13.18	11.49	10.70	9.40	8.56	8.42	9.46	10.43	11.57	12.66	13.34	12.90	11.09

Source: Telangana State Ground water department

The analysis of Depth to Water Level for the last 10 years has shown a rising trend as a cumulative response of consistent rainfall occurrence, impact of Mid Manair Reservoir and ground water recharge. as depicted in the figure below.



Source: Telangana State Ground water department

The above Hydrograph shows the DTWL has been increased with a tune of 0.0645 m or 6.45 cm per month during this decade (for 122 months) that results in overall built up of 7.74m in the decade which corresponds to an increase of 40215 Ha m (Hectare Meters) of ground water resource in the district. The following observation are made by details analysis of the DTWL for the past 10 years

- Shallowest DTWL has been observed to be 2.76 mbgl during October 2021
- Deepest DTWL has been observed to be 18.2 mbgl during June 2019
- The average DTWL has been observed to be 11.03 mbgl.
- Trend of DTWL has been observed to be rising in nature with a tune of 6.45 cm per month.

The hydrograph shows the impact of Mid Manair Reservoir on depth to water level and ground water recharge observed from June 2019.

Gouravelly Reservoir: It with a storage capacity of 8.230 TMC is proposed to irrigate an ayacut of 1.20 Lakh acres (48561 Ha) in Karimnagar, Siddipet, Hanumakonda and Jangaon Districts. The project helps to restore the groundwater level by recharge, a very positive impact in overexploited mandals with very large population that has been suffering.

4.6.2 Scope for conjunctive use of surface and groundwater

The stage of ground water development in 10km radius of Mid Manair reservoir indicated that Boinpally mandal (52%), Yellareddypet (70%); and Karimnagar (88%) come under the SAFE category. And mandals like Akkannapet (64%), Bejjanki (58%) and Husnabad (62%), Nanganur (54%) of Siddipet district, Boinpalle (69%) and Vemulawada (69%) of Rajanna Sircilla, Huzurabad (49%), Kothapalle (60%) and Manakondur (33%), Shankarapatnam (34%), Thimmapur (57%) of Karimnagar district and Khazipet (44%), Dharmasagar (67%) of Warangal Urban district with in 10km radius from Gouravelli reservoir and in the command area of the project are all in SAFE category where conjunctive use of surface and ground water is suggested for irrigation.

Therefore, it is suggested that conjunctive use of the groundwater may be encouraged in the SAFE mandals of command area. While making irrigation planning in the present project, it has been kept in mind that cropping pattern and water allowance is such that there is no excessive groundwater recharging with the introduction of irrigation.



Economically viable crops and medicinal plants with low water requirement should be introduced in the command area. In addition, horticulture / floriculture crops, which require little water after initial growth and establishment are to be given priority. Plantation and other perennial crops have low water requirement and usually require life saving irrigation in summer season, which can be provided by tanks or groundwater.

Fruit crops can also be promoted as these crops survive on consumptive use of ground water after establishment in initial years. Paddy nursery transplanting should be raised 2-3 weeks early, through groundwater irrigation. Thus, the nursery will be ready for transplanting in early July immediately on the onset of monsoon.

Agro-climatic conditions of the project area can support the crops throughout the year. Judicious use of water resources for Rabi crops is made by early sowing to make best possible use of conserved residual soil moisture, growing crops with low water requirement like pulses and adoption of efficient methods of irrigation. There is considerable loss of water through flooding method of irrigation. It is advised that more efficient methods should be adopted to minimize wastage of irrigation water. Use of pipes in place of open channels can save water loss through leaching. Also, improvised methods can be adopted for irrigation of wide spaced and plantation crops. The availability of water from tanks or groundwater is limited in Rabi season. This limited quantity of water can be efficiently used to cover maximum cropped area by adopting sprinkler method for narrowly spaced crops and drip irrigation for widely spaced and plantation crops. The water storage capacity should be increased by increasing the number of tanks and / or increasing the capacity of existing tanks. Development of agriculture-based income for small and marginal farmers by accelerating the development of minor irrigation infrastructure, strengthening community-based irrigation management and adopting a comprehensive programme for restoration of tanks is a part of project taken up by Govt. of Telangana. Desilting of tanks, repair of dilapidated sluice weirs, weak bunds, deweeding of defunct feeder channels/canals are taken up under this project called Mission Kakatiya.

Maximizing the water use efficiency in Rabi Season: Paddy is the most important crop occupying the maximum area both in Kharif and Rabi seasons. Paddy cultivation in Rabi season as irrigated crop is a wasteful practice where irrigation water can be more economically and effectively used for cultivation of more remunerative crops than paddy.

4.7. Land Environment

4.7.1. Adverse impact on land stability, catchment of soil erosion, reservoir sedimentation

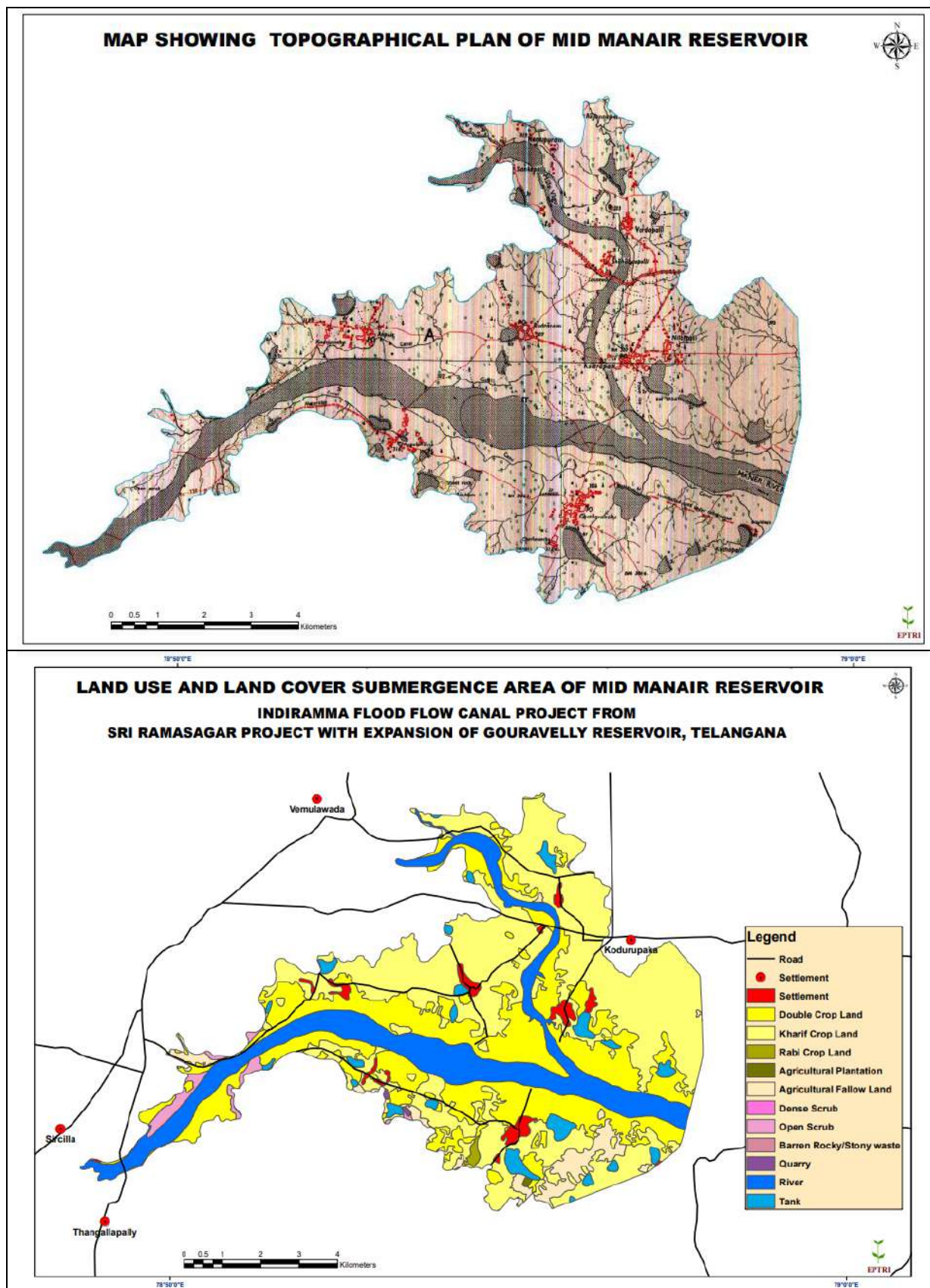
The catchment area delineated for the Gouravelly reservoir is 505.83 ha. Based on the soil erosion intensity, slope of terrain and land use setting adopting SLUSI methodology of sediment yield index estimation and watershed prioritisation has been suggested for catchment area treatment to reduce reservoir sedimentation and is discussed in chapter 10.1.

4.7.2. Change in Land use / land cover due to reservoir submergence:

Using remotely sensed satellite data RS2 L4 MX dated acquired on 04 March 2023 and 23 Oct. 2023 the land use and land cover mapping of Gouravelly submergence area is carried out. The following are the satellite imageries and the interpreted land use and land cover map of Mid Manair and Gouravelly reservoirs submergence area.

Mid Manair Reservoir

Mid Manair Reservoir is a major irrigation project across the Manair river. The Mid Manair reservoir is constructed downstream of confluence of Mulavagu with Manair river at Manwada Village, Boinpalli Mandal, Rajanna Sircilla district, Telangana. It has a capacity of 25.873 TMC with 25 radial gates. It has a capacity to irrigate 80971.65 ha. The Mid Manair Reservoir is a Balancing Reservoir on Flood Flow Canal from SRSP at km122.00. The project was completed in April 2018. Out of total 7882 ha of submergence area of Mid Manair reservoir, the Manair river occupy 1191.50 ha. The remaining land use and land cover categories occupy 6690.50 ha as shown in the land use and land cover map of submergence area.





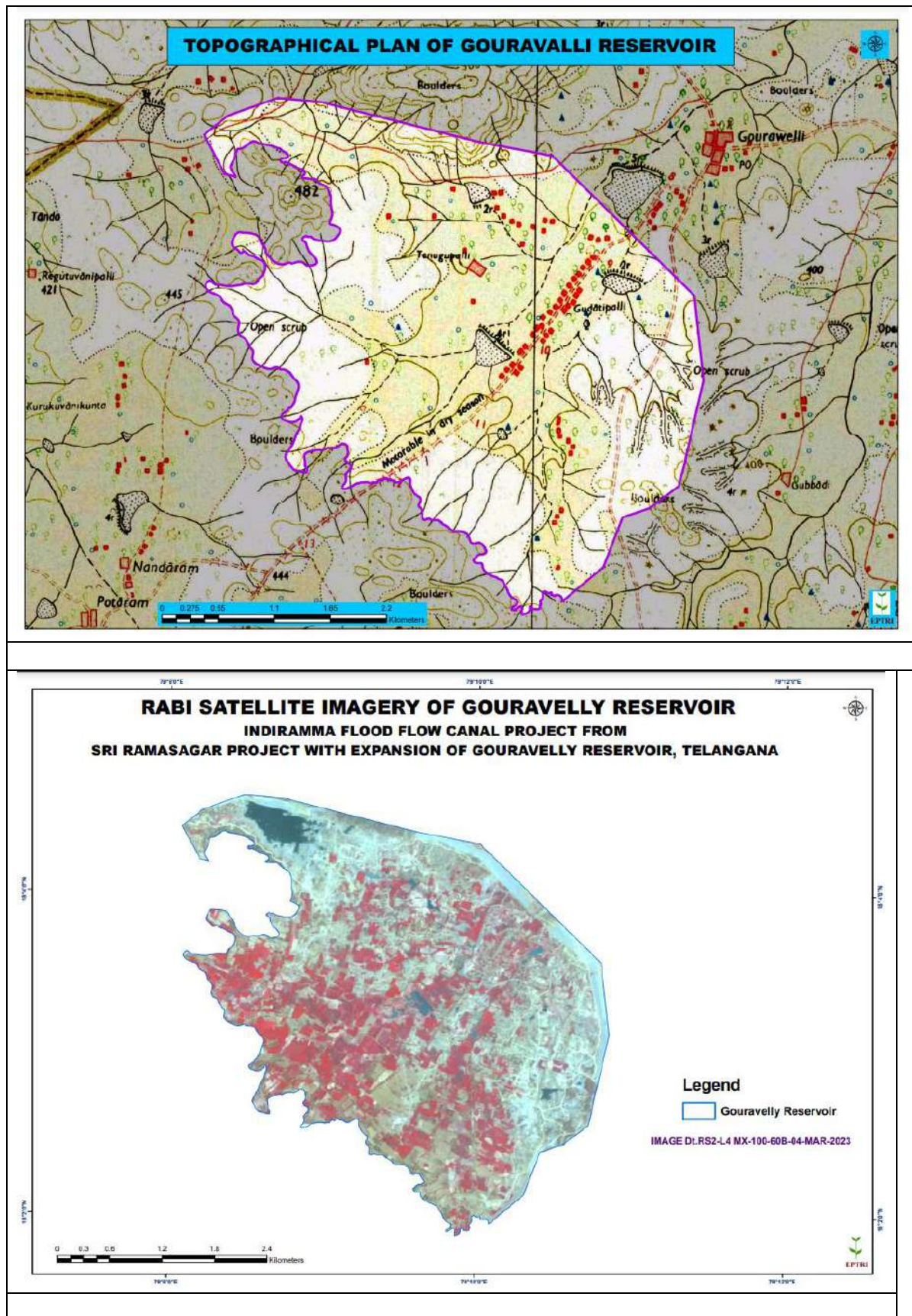
Land use and land cover	Area in ha	% area
Settlement	154.49	1.96
Kharif Crop Land	3480.69	44.16
Rabi Crop Land	17.34	0.22
Double Crop Land	2312.58	29.34
Agricultural Fallow Land	266.41	3.38
Agricultural Plantation	4.73	0.06
Barren Rocky/Stony waste	0.79	0.01
Dense Scrub	0	0.00
Open Scrub	101.68	1.29
Quarry	7.09	0.09
River	1289.5	16.36
Tank	245.92	3.12
Total	7882	

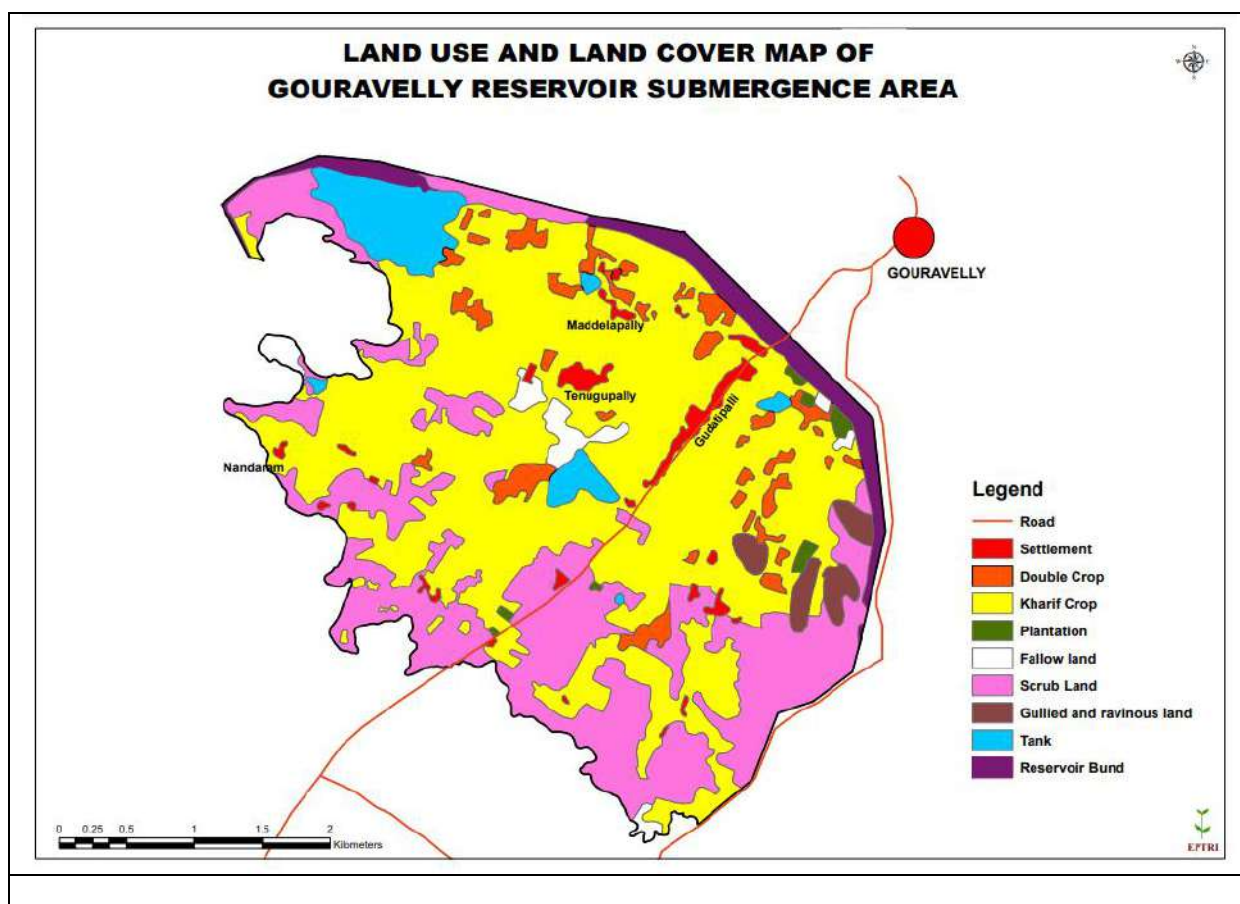
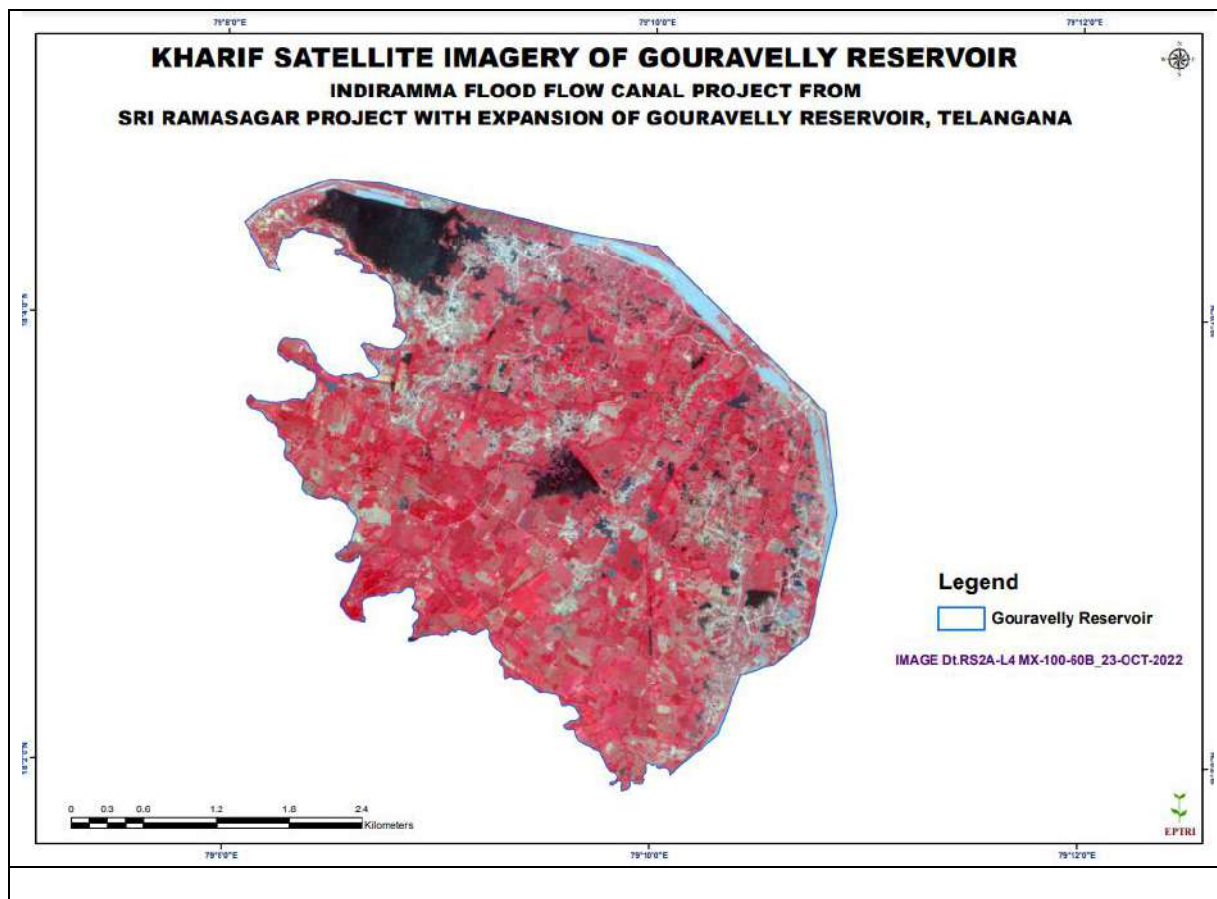
About 7882 ha of land has been submerged due to the construction of Mid Manair Reservoir and permanently changed the land use of the area as given below:

- i. Anupuram (722 houses), Kodimunja (255 houses), Rudravaram (903 houses), Sankapalli (156 houses), Arepalli (18 houses), Cheerlavancha (1825 houses), Chintatana (710 houses), Kodurpaka and Neelojpalli (1665 houses), Varadavalli (582 houses), Shabaspalli (236 houses) and Gurrampalli (117 houses) are among the fully submerged villages which are all shifted. Munuwada, Kandikatkoor & Kothapeta are among the partially submerged villages occupy 154.49 ha (1.96%)
- ii. Kharif Crop land observed in 3480.69 ha (44.16%)
- iii. Rabi Crop land is found in 17.34 ha (0.22%)
- iv. Double Crop land observed in 2312.58 ha (29.34%)
- v. Agricultural fallow land occupies 266.41 ha (3.38%)
- vi. Agricultural plantation area is in 4.73 ha (0.06%)
- vii. Barren Rocky/Stony waste occupy 0.79 ha (0.01%)
- viii. Dense Scrub observed to cover 0 ha.
- ix. Open Scrub occupy 101.68 ha (1.29%)
- x. Granite quarries are in 7.09 ha (0.09%) and
- xi. Minor irrigation tanks occupy 245.92 ha (3.12%)

There is no forest area involved in the submergence.

In addition to the above land use and land cover submergence, 2.70 km length of State highway No.11 connecting Sircilla with Karimnagar town came under submergence. To avoid connectivity between these two towns, the Govt. of Telangana has constructed 2.70 km length bridge across Mula vagu.

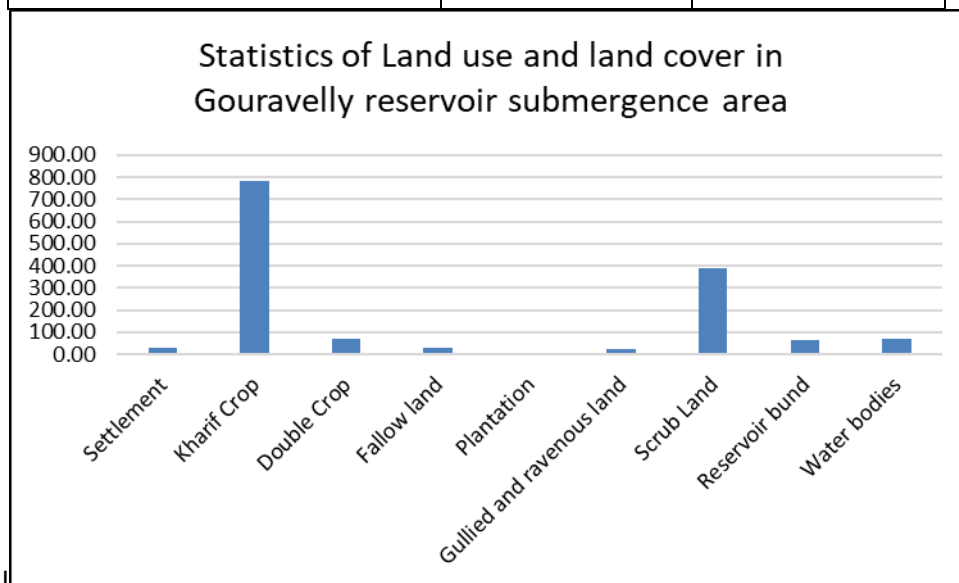






Area statistics of land use and land cover in Gouravelly submergence area

Land use and land cover	Area in ha	% area
Settlement	32.91	2.10
Road	66.44	4.24
Kharif crop	836.93	53.41
Scrub land	417.61	26.65
Waterbodies / tanks	75.22	4.80
Double crop area	72.08	4.60
Agricultural fallow lands	29.46	1.88
Agriculture plantations	8.62	0.55
Gullied ravenous lands	27.74	1.77
Total	1567	



It is observed that the Gouravelly reservoir will permanently submerge an area of 1567 ha. The details of land use in submergence area are as follows:

- Habitations / built-up areas such as Maddalapalli, Tenugupally and Gudatipalli occupying an area 32.31 ha (2.10%) of submergence area.
- Road for 10 Km an area 66.44 ha (4.24%) of submergence area.
- Kharif crop of 836.93ha (53.41% of submergence area)
- Scrub land of 417.61ha (26.65% of submergence area)
- Water bodies / tanks of 75.22 ha(4.80% of submergence area)
- Double crop area of 72.08 ha (4.60% of submergence area)
- Agricultural fallow lands of 29.46ha (1.88% of submergence area)
- Agriculture plantations of 8.62ha (0.55%)
- Gullied ravenous lands of 27.74ha (1.77% of submergence area)



4.7.3. Current land use and anticipated impacts in command area:

Based on the interpretation of land use and land cover using remotely sensed satellite data it is observed that in the command area with the intervention of the project due to the availability of additional water it is anticipated that there would be change in land use of the area. Rabi Crop land cultivated in 1391.06 ha, and Agri.fallow lands in 14644.14 ha gets converted to double crop area; wastelands in 10317.13 ha area gets converted to kharif irrigated lands. Thus about 26,352.33ha of area will have change of land use.

4.7.4. Immigration of labour population

It is proposed that labour (about 700) will be hired during construction of reservoir, gravity canals, gravity tunnels, pressure mains/delivery mains etc. The people will be spread over the reservoir spread and 13km of canal construction.

Any municipal solid waste generated in the project complex / project colony / labour colony, shall be managed and handled in accordance with SWM Rules, 2016. For domestic waste management, septic tanks followed by soak pits are proposed.

4.7.5. Quarrying operation and muck disposal

Indiramma Flood flow canal project from Sri Ramasagar Project with expansion of Gouravelly reservoir envisages construction of several components of works such as construction of tunnels, approach canal, reservoir and command area canal systems. These activities invariably lead to generation of huge muck causing degradation of land and loss of biomass. The approximate quantities of muck likely to be generated based on the line estimates is assessed for earthwork excavation is 708910 m³.

Out of the above, some quantity is utilizable for the construction activities. The remaining quantity of muck is to be disposed at suitable locations and treatment measures to be undertaken as per the Environment Management Plan. The details of muck disposal and its management is given in section 10.8 Chapter-10 of EIA.

4.7.6. Change in land quality including effects of waste disposal.

- Generally, construction phase involves site cleaning, excavation, construction, erection or installation of equipment & machinery, transportation, material handling etc. which causes subsurface compaction.
- Construction material like cement, stone, gravels etc. will be acquired from the nearest available source as per the project requirement.
- Dust generated due to heavy vehicles and construction activity from the site causes health hazard in the neighbourhood habitation.
- Alteration of topography of site is anticipated due to stockpiling of soil, building material debris and waste material. Overburden and construction waste, if not stacked properly leads to soil pollution.
- Degradation and loss of topsoil due to construction activities as well as surface and storm water runoff can lead to soil erosion.
- Unplanned disposal of construction debris in surrounding areas, disposal of solid waste from labour camps not only affects the soil quality but also will have a negative visual impact.
- Temporary sites will be used for construction works like storing of material, parking of machines & vehicles and temporary sheds for workers and personnel.

4.7.7. Impact due to submergence

The following are the details of villages and area of submergence due to ponding. The detail of submergence for Gouravelly reservoir is given in table 4.2.

Table 4.2 Villages submerged Gouravelly Reservoir

Villages –Full Submergence	Gudatipally (Gram Panchayath) Tenugupally, Maddelapally and Kottapalli are hamlets of Gudatipally
Villages- Partial Submergence	1) Gouravelly, 2) Jangaon, 3) Gandipelly 4) Regonda, 5) Nandaram, 6) Ramavaram
R&R	Structures - 817 Nos (693 old+124 New) & Families – 1122 Nos (937old +185new)

4.7.8. Loss of Protected area/Sensitive/Archaeological / Cultural Heritage sites

- There are no areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related values exist in and around the project area.
- Areas which are important or sensitive for ecological reasons such as wetlands, coastal zone and biospheres are not present in and around the project area.
- There are no submergence of archaeological monuments, historical monuments and tourism infrastructure.
- There is no National Park and Wildlife sanctuary within the 10 km buffer.

4.7.9. Other impacts

- Land especially undeveloped or agricultural land will be acquired for construction of various project components including reservoir, canal networks etc.
- There will be closure and diversion of existing transport routes or infrastructure leading to changes in traffic movements. A short-term diversion will be provided during construction of the project and subsequent after completion of the work the original routes will be restored.
- Apart from the change in land use pattern within the submergence area no adverse impact on surrounding land use is envisaged due to this project.
- The proposed project envisages construction of Tunnel – 11.98 km; Pump house – 3 x 32MW(3x19cumecs); Gouravelly Canals-63.725 km; High Level Canals-20.845 Km and Gouravelly reservoir of 8.23 TMC.
- The construction of the project is expected to lead to generation of huge muck causing environmental degradation. Appropriate action therefore shall have to be taken for safe muck disposal to avoid hazards and mitigate adverse impact on the environment.
- There are no defense installations existing in and around the project area.
- Impact on areas occupied by sensitive man-made land uses hospitals, schools, places of worship, community facilities is not anticipated.

4.7.10. Mitigation Measures

- It is proposed that compensation shall be paid for project affected families as per RFCTLARR Rules 2016.
- Frequent irrigation, deep tillage and chiselling shall be adopted for improving the subsurface soil compaction.
- Measures will be taken to securely store the excavated material and to reuse it as early as possible in construction or for land filling during landscaping of project site.



- Construction and demolition waste are handled as per Construction and Demolition rules, 2016.
- Periodic water sprinkling shall be done every day for suppression of dust.
- All site disturbances must be limited to the areas where structures will be constructed.
- All stockpiles must be restricted to designated areas and should be restricted to reasonable height.
- The contractor must be limited to clearly defined access routes to ensure that sensitive and undisturbed areas are not affected during the construction phase.
- Minimise the clearance of vegetation to avoid exposure of soil.
- Protect areas susceptible to erosion with mulch or a suitable alternative.
- Large-scale plantation of trees shall be undertaken in all the available vacant spaces to enhance aestheticism and provide visual comfort.
- The excavated soil and rubble emanating from the construction of online storages, tunnels etc. will be utilized for filling of low-lying areas and also as revetment, riprap & filters of the earthen dam, if found suitable and also for green belt development.
- Based on the soil erosion intensity, slope of terrain and land use setting adopting SLUSI methodology of sediment yield index estimation and watershed prioritisation has been suggested for catchment area treatment to reduce reservoir sedimentation.
- In order to mitigate the adverse impact of land erosion on either side of the river and to strengthen the riverbanks, guide bunds are proposed.

4.8. Biological Environment

4.8.1 Impact on forests, flora, fauna including wildlife, migratory avi-fauna, rare and endangered species, medicinal plants etc.

During our third season survey, it was observed that Gouravelly reservoir construction has been completed which is located at Gouravelly (V), Akkannapet (M), Siddipet District, Telangana State. Moreover, there is no forest land involved and there are no notified ecologically sensitive areas, wildlife ecosystems falling in the submergence due to the increased capacity of the Gouravelly reservoir for the enhanced 8.23 TMC capacity. They are hillocks present which fall under revenue department. The area is mostly occupied with agricultural lands and with sparse vegetation. Among planted species, IUCN category species are *Pterocarpus santalinus*, *Chloroxylon swietenia*, *Tectona grandis*, *Jacaranda mimosifolia*, *Dalbergia latifolia*, *Aegle marmelos* and *Swietenia mahagoni* are listed but there will be no impact on these species as they are located in the buffer zone of the proposed Gouravelli project. The existing trees within the Gouravelly reservoir will be submerged. The schedule 1 species recorded in the buffer area are Indian Peafowl, Shikra, Grey Junglefowl, Barn owl, Indian Chameleon, Indian Rat Snake and Indian Cobra.

4.8.2 Mitigation Measures

Plantation on the banks of reservoir: On the banks of the reservoir plantation activities shall be taken up to improve the biological environment of the region. Along the banks, native plant species, shade tolerant perennial shrubs and soil binders shall be planted such as Bamboo, *Tectona grandis*, *Dalbergia sissoo*, *Azadirachta indica*, *Tamarindus species*, *Phoenix spp.*, *Pithecellobium dulce*, *Jatropha curcas*, *Parkinsonia aculeate*, *Terminalia catappa*, *Mallotus spp.*, *Dalbergia spp.*, *Withania somnifera*, *Agave americana*, legumes and perennial grasses.

IUCN Listed Species: The seedlings and saplings of these IUCN species may be raised and protected. These saplings may also be taken up by Forest department in their nurseries and shall plant in open areas in order to increase their population. It is suggested to conduct

periodic monitoring of the area to ensure that above mentioned plant populations are still thriving to protect their long term existence and habitat restoration can be done by removing weeds at frequent intervals.

Drinking water facility: Provision of drinking water facility for the wildlife may be done by constructing small ponds / saucer pits and tanks at frequent intervals.

To draw attention of Birds - Plant fruit bearing trees to attract avifauna which will also be useful for roosting, breeding and hiding cover for migratory birds etc.

Fit wooden nesting boxes to the bark of the tree or hang to the strongest branch of the tree. The nesting boxes should possess proper entry hole, ventilation holes at the top and drainage hole at the below.

Erection of iron stands at the pond located in the study area will facilitate the birds to arrange their nests and preventing death of their chicks and also welcoming migratory birds for breeding and roosting.

To attract butterflies grow butterfly friendly flowering, nectar and host plant species like *Anogeissus acuminata*, *Calotropis gigantea*, *Butea monosperma*, *Bombax ceiba*, *Aegle marmelos*, *Chloroxylon swietenia*, *Citrus aurantiifolia*, *Dendrophthoe falcate*, *Limonia acidisma*, *Murraya koenigii*, *Nerium oleander*, *Citrus spp.*, *Pongamia pinnata*, *Hemidesmus indicus*, *Bombax ceiba*, *Ricinus communis*, *Waltheria indica*, *Cocos nucifera*, *Caryota urens*, *Flacourtia indica*, *Ficus benghalensis*, *F. racemosa*, *F. religiosa*, *Streblus asper*, *urena lobata* and grasses to attract butterflies by completely protecting from the anthropogenic activities.

For reptiles – Develop open habitat with low levels of tree cover which provide a greater variety of ground temperatures; they also provide shelter from the wind and shade on very hot days. Grow plants densely with tall grasses, thick ground covers, with full of leaf litter or other debris to attract insects eaten by snakes.

Conducting awareness program will educate local people and school and college students about the importance of biodiversity and celebration of wildlife week by arranging nature camps, etc.

4.8.3 Conservation Measures Of Schedule-I Species (IWPA-1972)

A. Conservation plan for Avifauna

Adjacent to the reserve forest tracks artificial water holes shall be created along the natural drained canals which can provide sufficient drinking water throughout the year.

Habitat improvement program shall be undertaken through the plantation of suitable trees, shrubs, and grass species in the surrounding villages adjacent to the reserve forest block.

While selecting the tree/ shrub species care shall be provided for fruit-bearing which attracts these birds for roosting.

During the summer period, local villagers shall be encouraged to use the old earthen pots to fill with water for drinking these birds.

Some local tree species such as *Vepa* (*Azadirachta indica*), *Chinta* (*Tamarindus indica*), *Mamidi* (*Mangifera indica*), *Usiri* (*Phyllanthus emblica*), *Koramanu* (*Bridelia retusa*), *Gumpena* (*Lannea coromandelica*), *Buruga* (*Bombax ceiba*), *Pala* (*Manilkara hexandra*), *Garugudu* (*Garuga pinnata*), *Rela* (*Cassia fistula*), *Marri* (*Ficus benghalensis*), *Raavi*





(*Ficus religiosa*), *Neredu* (*Syzygium cumini*), *Paldata* (*Ehretia aspera*), *Moduga* (*Butea monosperma*), *Ullintha* (*Diospyros chloroxylon*), *Buddadharimi* (*Careya arborea*) etc. and shrub species like *Sinduri* (*Searsia mysorensis*), *Grewia flavescens*, *Carissa spinarum* etc., shall be planted for roosting.

Some provision of rewards to informers shall be made for the control of poaching and illegal trade in avifauna and other wildlife to control the species.

The massive awareness development shall be initiated on the importance of birds, its benefits, ecosystem services provided, cultural and religious values through schools, panchayat meetings, awareness on Sundays by conducting seminars, workshops, meeting etc.

B. Conservation plan for reptiles

- Recommend to increase the tree cover in the study area which will provide shelter and tree roots are suitable hibernation sites for reptiles. This can be achieved by growing plants densely with tall grasses, thick ground covers, with full of leaf litter or other debris to attract insects eaten by reptiles.
- It is suggested to encourage local for plantation of some local species such as *Azadirachta indica* (Neem), *Phyllanthus emblica* (usiri), *Ficus benghalensis* (Marri), *Ficus racemosa* (Medi), *Ficus religiosa* (Raavi); *Albizia lebbbeck* (Dirisena), *Butea monosperma* (Moduga), etc., at degraded places and vacant places all along the road side, at school premises, in their courtyard, etc., for prevention of habitat loss.
- Creation of water holes in the habitation area and making arrangement for making water available in them.
- To conduct awareness program to local people not to kill reptiles immediately after seeing it and to educate them about the importance of reptiles and ecological food chain
- It is suggested to prevent hunting and Habitat degradation.
- Recommend to strengthen anti-poaching team.
- Giving cash rewards to the people/ informers who provide information about the poaching of Red Sand Boa and get the poachers arrested.
- Create community-managed conservation of reptiles and other associated wildlife populations.
- Trainings shall be provided to the driver to ensure that they drive carefully in the habitat area. Sign boards with pictures regarding speed limits shall be displayed at key points, such as turnings, crossings, etc
- Reduction of speed of vehicles for animals to cross the road would help reduce the mortality of reptiles caused by vehicle traffic.
- It is suggested to promote conservation of habitats in the consultation with forest department.

4.9. Pressure on existing Natural Resources

The project involves construction of various facilities like canals, reservoir, pump house, roads and labor camps requiring 16777 ha which passes through large stretches of land having natural resources such as water bodies, waste land with a scrub, agricultural land, grasslands, streams, etc. The construction activities, including movement of vehicles, men and material, camping places for the labour, storage of construction waste, etc will have direct impact on the existing natural resources.

Greenbelt

The need for proper green belt is essential for the fulfillment of ecological functions as well as for aesthetic purposes. Green belt is essential to restrict the siltation of reservoir and canal. It will

also improve the ambient air quality and improve the absorption of water in the subsoil. The improvement of greenery in and around the reservoir will improve the scenic beauty and it can promote tourism by adding boating in the reservoir and providing other facilities for the tourist.

Species suitable for canal bank plantations are Bamboo, teak and fruit yielding plants. Species suitable at the periphery of the reservoir should be water and high humidity loving plants like ferns (*Pteridium* sp., *Dryopteris* sp., *Adiantum* sp., *Polystichum* sp.) *Albizia odoratissima*, *Oroxylum indicum*, etc. More details on greenbelt development plan are furnished in chapter-10.5.

Suggested Mitigation Measures to prevent air pollution:

- On Canal bank and on the periphery of reservoir green belt shall be raised to improve the biological environment of the region. Native plant species, shade tolerant perennial shrubs and soil binders such as *Prosopis juliflora*, *Lawsonia inermis*, *Jatropha curcas*, *Parkinsonia aculeate*, *Terminalia catappa*, *Cascabela thevetia*, *Withania somnifera*, *Ipomoea pes-caprae* and *Agave americana* and perennial grasses shall be planted. These plantations will provide nesting places for the birds that may be disturbed during the construction phase.
- The dust pollution will be reduced by sprinkling of water on the roads used for vehicular movement for construction activity. The speed of vehicles can also be controlled to avoid excessive dust pollution. Proper maintenance of the vehicles shall be mandated to reduce pollution. Wherever possible the roads can be paved where heavy vehicles frequently ply.
- Water in the reservoir and canal will be useful to improve the sub soil moisture that will encourage the growth of the plants and provide improved environmental conditions. This will attract the avi-faunal population and improve ecological conditions of the area.
- An amount of Rs.86,42,950/- is invested toward financial provision for Safeguard measures.

		from Jan-2018 to Mar 2020				
Sl. No	Package No.	No. of Nose masks provided	Amount spent on nose masks in Rs	No. of water tankers for sprinkling	Amount spent on water tankers. in Rs.	No. of employees engaged for regulating traffic
1	Provided by the agency at site of Gouravelli Reservoir Project	215000	537500	12	2450450	8
TOTAL			537500		2450450	

		from Jan-2018 to Mar 2020					
Sl. No	Package No.	Amount spent for traffic management. in Rs.	No. of sweepers	Amount spent on sweepers in Rs.	No. of vehicles used	No. of vehicles with PUC certificate	Amount spent on vehicle pollution check in Rs
1	Provided by the agency at site of Gouravelli Reservoir Project	1944000	15	3645000	110	110	66000
TOTAL		1944000		3645000			66000

Safeguard measure followed as part of dust suppression.



4.10. Noise Environment

The possible impacts due to project proposal on noise environment are little, the main impacts would be during the construction, excavation, and tunneling activities. If the excavators are used for removing the topsoil and drilling and blasting is done to clear the rocky area, then the following equipments used will generate noise levels given against them.



S No.	Equipment or Machinery	Noise Levels Generated in dB (A)
1	Excavator	70-90
2	Tippers	70-85
3	Drill	85-95
4	Compressor	75-90
5	Tunneling equipment	75-90

Maximum permissible exposure to sound intensities is as follows:

Sound level dB(A)	Maximum exposure hours
90	8.000
93	4.000
96	2.000
99	1.000
102	0.500
105	0.250
108	0.125
Source : BIS Standards	

It is inferred from the above table that maximum exposure level is 8 hrs for noise level of 90 dB (A) while for 108 dB (A) it is only 0.125 hrs.

4.10.1 Anticipated Impacts on Noise Environment

- During construction phase, noise will be generated as a result of operation of construction equipment such as engines, ventilation plant, crushers.
- Noise during construction stage will be increased due to excavation works, machines / equipments operation and vehicular movement.
- During construction phase - due to blasting, drilling and piling activity there will be increase in noise and vibration. However, it is suggested to have controlled blasting wherever the canal alignment is passing adjacent to habitations and provision of personal protective equipments to the personnel.
- Noise generation due to vehicular movement for transportation of construction materials.

4.10.2 Mitigation measures to prevent noise pollution

- To reduce noise pollution the construction equipment should use available noise suppression devices and mufflers, staging of construction equipment, unnecessary idling within noise sensitive areas to be avoided.
- Notification describing noise abatement measures be given to residents within 100 m of major noise generating activities. Monitoring of noise levels to check exceeding of pre-determined acceptable noise levels to stop work and remedy the situation.
- Controlled blasting should be done as per the provisions of Indian Explosives Act.
- Blasting should not be undertaken in night hours.
- Workers at blasting sites should be provided with proper earplugs and helmets.

4.11. Socio-Economic Environment

4.11.1 Impact on local community including demographic profile.

The most significant beneficial impact due to the project will be more employment generation, promotion of agro-based industry and subsequent development of the area. The increase in crop yield provided in the project benefits chapter will add to food security and fodder availability for the cattle in the area. Skilled and semiskilled categories workers will have job opportunities which will uplift the present status of the people. Because of operation and maintenance of heavy earth moving equipments and transportation vehicles etc. potential for temporary employment of skilled categories of workers such as mechanics, turners, fitters helpers in the workshops will increase besides improvement of business activities. This there will be a positive impact of the project.



The addition of migrant population in the project area will lead to enhanced demand for local produce which will generate additional avenues of income generation for local population. Not only the local produce will find market, but it could also lead to employment generation in these marginal activities needed for the migrant population. The locals would also be beneficiaries of all the infrastructural facilities like schools, roads, hospitals, etc. provided by the project authorities.

The major purpose of irrigated agriculture is to increase agricultural production and consequently improve the economic and social well-being of the people in the command area of the project. The proposed IFFC project from Sri Ramasagar Project with expansion of Gouravelly reservoir Project will thus achieve the objective of improving the social and economic structure of the project area.

The project may have an impact on agricultural land, homestead land or residential structures because of land acquisition for the project purpose although all such persons affected by the project will be suitably compensated as per the policy of State Government.

- R&R issues are critical outcomes of submergence effect. Details are provided in the Chapter 10 of EMP under Resettlement and Rehabilitation Plan.
- Displacement of population and their resettlement attracts major significance amongst negative impacts.

4.11.2 Regional Development

With the assured water supply in other seasons and timely rainfall, the command areas are capable of yielding more crops and thus increase agricultural productivity of grains as well as cash crops and thus boost economic prosperity of the region. With the financial benefits this increase in agricultural production will also boost the industrial activity especially of agro based industries. These will in turn lead to the increase of development activities which will take place centering the mother unit. Several large, medium and small industrial complexes will also come up in this area to support the need of machineries and other spare parts of the agro based industries. The trading of agro-based products will also help to develop the economic scenario of the study area. Thus, the proposed project will have great beneficial impact and contribute towards the regional development of the State.

4.11.3 Temporary labor camps

- Temporary labour camps built during the construction period become potential site of insanitation and health hazards unless the labor is systematically housed and provided with free health check up, free medicine against Malaria and other endemic disease.
- The project authorities will ensure maintaining safeguard measures like free supply of fuel for cooking.
- Community toilets were provided by the contractor.
- An amount of Rs. 106.54 lakhs are invested for STP/soak pits.
- Health camps were conducted. Some the photographs of labor camps facilities are as follows:





4.11.4 Pisciculture

- Fishing is not a major source of livelihood in the study area in the absence of large water impoundments at present. With the commissioning of this project, fishing will be greatly promoted because of creation of Gouravelly reservoir in the project. The commercially

important varieties of fish like Katla, Rohu, etc will be suitable for pisciculture in local ponds.

4.11.5 Impacts of displacement:

Among the most significant adverse social impacts of reservoir are those that result from forceful or involuntary displacement of human populations from their homes, fields, towns and regions. Local people directly depend on land for their sustenance. People depending on natural resources for agriculture, and other goods and services will be affected. Another impact is likely to be on the culture and identity of the local people, which is mainly due to influx of outsiders.

This has many specific impacts, such as rehabilitation packages and Resettlement of PAP's. A distinction was made between 'displacement', which is the uprooting of people from their homes, 'resettlement', which is their shifting to new sites of habitation, and 'rehabilitation', which is the provision of all that is required to rebuild their lives to a minimum acceptable level.

4.11.6 Impact on human health due to water /vector borne diseases.

Diseases related to water have been classified as water borne diseases. Even water resources have environmental health impacts e.g., chemicals added to control agricultural pest. These chemicals cause toxic effect in human beings. The greatest health hazards are spread of Malaria since the Anopheline mosquito vector has potential to proliferate in the reservoir. Cholera, gastroenteritis and Filariasis are endemic. Health risk includes potential disease hazards due to lack of hygiene/sanitation (water supply and human waste disposal), vector and water borne diseases. Incidences of Malaria, diarrhea, dysentery etc are occasionally reported in and around the project area. With the development of project, potential health risks would also grow if left unchecked.

Mitigation measures include proper sanitary health care and human waste disposal facilities. Sanitation facilities are included in the project estimate to take care of cost to be borne towards human waste disposal facilities. In Telangana State all the districts have medical centers equipped with staff and beds and vehicles. There is civil hospital at district level and there are many medical practitioners in the districts. It is planned to increase public health awareness among the people and enhance facilities and services in the reservoir surrounding area.

4.11.7 Agro-forestry income to Local People:

Agro-forestry is defined as a sustainable land management system which increases the yield of the land, combines the production of crops, including trees, and forest plants or animals or both. The basic objective of growing forestry is to increase biomass, soil conservation, and agro based industries. The plantation of Neem (*Azadirachta indica*), Mango (*Mangifera indica*) and Babul (*Acacia arabica*) can be taken up with the help of women's self-help groups.

4.11.8 Positive Impacts

1. The main aim of the Flood Flow Canal project is to irrigate an ayacut of 89,031 Ha (2,20,000 acres) in the upland drought prone areas of Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon (erstwhile districts of Karimnagar, Warangal and Nalgonda) districts in Telangana region duly utilising 20 TMC of flood water of Godavari River from the fore shore of SRSP reservoir.
2. Dependable Irrigation facilities will be extended by this project to a command area of about 89,031 Ha (2,20,000 acres) hitherto depending upon the erratic, untimely and undependable rainfall and other petty water resources putting farmers in unpredictable distressed cultivation.
3. The project enhances recharge of groundwater thus helping the cultivation done by other resources such as minor irrigation tanks, small lift irrigation schemes in the vicinity of the project command area.
4. The yield of the crops will enormously increase, and the cultivation becomes a profitable one.
5. It gives employment for the agricultural labour and other labour who are directly or indirectly depending upon the agricultural activities.

6. It effects positively on other allied occupations such as transport, livestock, marketing, loans etc.
7. By providing irrigation facilities the total cropped area will increase cultivable land which was hitherto left barren and uncultivable will be brought under cultivation thereby increasing the efficiency of land utilization.
8. The livelihood of SC and ST population existing in the command area will increase with the project during construction stage and more so after the completion of this project.
9. There will be all-round development of the people in literacy, per-capita income, and employment with this proposed project.
10. The proposed project improves the livelihood of the people by providing irrigation water, drinking water for the en-route villages; Thus, the project will have a positive effect on the welfare of people e.g., by improving the living conditions.
11. There are no National parks, Sanctuaries and Biospheres within the study area. There is no submergence of Archaeological monuments, historical monuments and tourism infrastructure.

4.11.9 Negative Impacts

1. The total land requirement for the Gouravelly project has been assessed as 1567 ha.
2. The project may have a minimal effect on the vulnerable group of people like hospital patients, children, the elderly etc.,

4.11.10 CSR activities

I&CAD has invested the amount Rs.2696.8 lakhs as CSR activities for road repairs and Rs. 1.5938 lakhs for sanitation facilities.at the time of COVID 65,753 no. of vaccinations administered in the project area and, 2,43,986 of COVID kits.

Health camps were conducted at Akkannapet Mandal and Husnabad Mandal as part of CSR activities.

An amount of Rs. 64,97,400/- LED bulbs, solar streetlights were provided in Akkannapet Mandal and Husnabad Mandal.

An amount Rs. 69,59,393/- was spent toward drilling of bore wells for drinking water supply in Project Area, provided safety shoes, caps, drinking water bottles, torch lights for safety at nights, sweaters, helmets to the labor and shelter with required amenities etc. are provided by agency.





4.12. Solid and Hazardous Waste

- The total Power requirement for the project is 96 MW. Power to various lift points will be availed from the respective power supply authorities. In case of power failure, the power supply required for the lighting, temporary housing and site offices etc. will be met from the DG sets of adequate capacity.
- During the construction phase, the oil/lubricants used for DG sets and other equipments will be collected in leak proof drums / barrels. The same shall be sent for reuse or disposed as per the norms of TSPCB - Hazardous Waste Management Rules).
- Hazardous waste like used oil generated from the equipments used during the construction stage of the project shall be collected and stored in leak-proof drums/ barrels. Thus, the collected oil spillage or hazardous materials need to be sent to authorize re-processors or disposed as per the TSPCB guidelines.
- Construction and demolition waste will be handled as per construction demolition rules 2016. Excavated soil or earth will be generated in the project and the same will be used for laying service roads and filling low lying areas.
- Project leads to soil excavation and rubble emanating from the construction of reservoir and tunnels etc. they are proposed to be utilized for filling of low-lying areas and also as revetment, riprap and filters of the earthen dam, if found suitable and also for green belt development. All these construction sites would be properly leveled. The leveling or reclamation of these sites will be mandatory for the contractor, involved in the construction.

- The construction of various structures like reservoir, pump house, tunnel, canal, labour sheds, site offices, formation of earth bund require excavation. The generated muck would be partly used for concreting and the remaining will be disposed off in designated muck disposal areas.
- The domestic and commercial waste generated during construction is estimated at about 210 kg/day and it will be managed & handled in accordance with Solid Waste Management Rules, 2016.
- Sewage sludge or other sludge from wastewater treatment plant may be used as manure.
- During the construction phase, the toilets in labour colonies will be provided with septic tanks followed by soak pits.

4.13. In the Catchment Area

The catchment area delineated for the Gouravelly reservoir is found to be 2500 ha. Based on the soil erosion intensity, slope of terrain and land use setting adopting SLUSI methodology of sediment yield index estimation and watershed prioritisation has been suggested for catchment area treatment to reduce reservoir sedimentation, and is discussed in chapter 10 In order to mitigate the adverse impact of land erosion on either side of the river and to strengthen the bunds are proposed and are discussed in detail in chapter 10.1.

Amount spent on the construction of check Dams as part of Catchment area treatment plan of Mid Manair and Gouravelly Reservoirs since 2003 to 2018 is 1315.92 lakhs. Similarly, plantation details along the canal/bunds and in and around areas of Mid Manair and Gouravelly Reservoirs is Rs. 10,03,30,054/-.

Plantation, gully plugs as part of the Catchment Treatment Plan in Mid Manair and Gouravelly Reservoir







4.14. In the command area

Soil conservation programme for the command area is based on problems, which are different from that of the rainfed areas of the catchment. Some of the problems which have to be attended in the command area are:

- A good system of water courses to carry water to each irrigable tract or field without excessive losses and flooding.
- An effective drainage system to prevent damage due to accumulation of water and seepage from canals.
- Establishing proper size of fields, water courses, drains, farm roads etc.
- Land levelling and shaping the fields to provide a proper slope so as to use the water effectively.

The main objective of the command area development is to provide adequate and optimum irrigation at suitable interval to keep the soils healthy and fit for sustained and productive agricultural use.

4.14.1 Command Area Development (CAD) Plan

Any water resources development project submerges land and property, may displace people, change the flow regime of rivers / streams, has an impact on the local flora and fauna and in extreme cases induce natural phenomena not observed earlier (such as Earthquake). The project must be planned and implement to ensure that adverse impacts are properly addressed. Water resources development is a must, to meet the water, food and energy needs of the ever-

increasing population, control floods and droughts to avoid loss of life and properties and enhance the environmental conditions to provide better standards of living.

4.14.2 Factors and constraints affecting choice of cropping pattern

The existing cropping practice, type of soil, habits of cultivators and also the availability of water during the cropping season are the governing factors in choosing the cropping pattern for post – project period. Intensity of cropping could possibly be increased but this will result in restriction of command area, and distribution of benefits among lesser number of people, which will not be acceptable from the socio - economic point of view. Thus, the factors determining the cropping pattern are.

- Existing cropping system and agricultural practices
- Adaptation to irrigated conditions by the farmers.
- Local needs of the population
- Policy of the government – regarding intensive and extensive irrigation
- Water availability
- Percolation and drainability condition
- Soil suitability
- Marketing facility and socio- economics of the region

4.14.3 Proposed cropping pattern.

The details of the proposed cropping pattern were arrived at considering various alternative patterns. The proposed cropping pattern is arrived at minimizing the water consumed and assessing the aspirations of local farmers. The actual area under these crops depends on the monsoon runoff distribution and the storage available. Rabi irrigation extent depends totally on the amount of water that can be stored.

4.14.4 Water requirement of crop

Crop water requirement (CWR) in practice is governed not only by the agro-climatic conditions (temperature, humidity, wind velocity and bright sunshine hours) and crop physiology i.e., crop coefficients (KC values) but also on effective rooting depth and soil moisture condition i.e., water depletion level during the growth period. The CWR was accordingly computed using Kc factor values for particular crops and the ETo values as computed by Penman – Montith method.

The crop water requirement of each of the proposed crops in different growth periods is computed as the product of the standard crop evapotranspiration (ETo) and the crop coefficient (Kc) corresponding to the crop calendar and the period. The crop water requirement for surface and drip system was computed based on the individual crop and are presented in **Table 4.5** for North and South Telangana region respectively.

Table 4.5 Crop Water Requirement for North Telangana Agroclimatic Zone

Crop	Crop duration (in days)	Total requirement at plant root (mm)	Total requirement (including surface & Drip system)			
			Croping intensity (in %)	Area under crop ha	Total requirement at plant root (including surface & Drip system) MCM	Total requirement at canal head (including surface & Drip system) MCM
Hybrid Maize	100	8.9	0.0	0	0.0	0.0
Paddy	135	540.0	13.7	60945	329.1	557.8
Hybrid Sorghum	105	5.5	0.0	0	0.0	0.0
Pigeon Pea	130	59.9	2.5	10970	6.6	12.2
Ground nut	120	59.8	12.7	56417	33.7	61.9
Cotton	160	214.1	14.4	64077	137.2	250.0
Chillies	150	196.3	13.0	57983	113.8	207.1
Tomato	120	82.6	0.0	0	0.0	0.0
Onion	120	60.6	0.0	0	0.0	0.0
Soyabean	100	24.3	13.7	60945	14.8	27.4
Turmeric	210	350.1	11.7	52230	182.9	338.6



Vegetables	120	102.7	19.3	85870	88.2	140.4
Green gram	70	0.0	0.0	0	0.0	0.0
Black gram	80	0.0	0.0	0	0.0	0.0
Castor	130	168.0	0.0	0	0.0	0.0
II. Rabi						
Hybrid maize	105	260.4	1.3	5786	15.1	27.9
Hybrid Sorghum	110	213.4	2.0	8817	18.8	34.8
Chickpea	100	187.0	0.0	0	0.0	0.0
Pigeon Pea	160	400.5	0.0	0	0.0	0.0
Ground nut	120	350.2	3.8	16934	59.3	85.7
Chillies	150	344.0	1.9	8266	28.4	52.7
Vegetables	120	392.9	1.4	6333	24.9	44.1
Coriander	110	241.6	0.8	3582	8.7	16.0
Fenu greek	110	232.5	0.0	0	0.0	0.0
Green gram	75	115.4	8.2	36369	42.0	77.7
Black gram	85	128.5	8.2	36369	46.7	86.5

4.14.5 Net Irrigation requirement (NIR)

For computing net irrigation requirement (NIR), effective rainfall using as calculated by USBR method is accounted for and ten daily net irrigation requirements for all 13 crops has been worked out as given in **Annexure 6.3** for North Telangana region.

This is obtained by deducting the effective precipitation in each period from the crop water requirement (ETC= KC Eto) in the corresponding period.

$$\text{NIR} = \text{ETC} - \text{Effective rainfall}$$

Gross irrigation requirement (GIR)

$$\text{GIR} = \text{NIR} / \text{overall system efficiency.}$$

The computations of GIR for individual crops for the season are worked out for 20 years.

Irrigation efficiency

For the purpose of cropping pattern optimization and evaluation of alternative project configuration, the following efficiencies are taken into consideration. System efficiency and recommended efficiencies of canal system are given in table 4.6 and 4.7.

Table 4.6 System Efficiency

Items	Surface Irrigation	Drip Irrigation
	(Ponded)	(Non-Ponded)
1. Conveyance efficiency (From canal head to outlet head)	90%	90%
2. Field channel efficiency (From outlet head to field gate)	85%	98%
3. Field application efficiency	79%	96%
Overall Efficiency	54%	80%

Table: 4.7 Recommended efficiencies of canal system

Sl. No	Efficiency	Wholly lined down to 8 ha			Lined down to 40 ha			Wholly unlined system		
		Paddy	Other Kharif	Rabi	Paddy	Other Kharif	Rabi	Paddy	Other Kharif	Rabi
1.	Field application efficiency (Efa)	0.90	0.68	0.84	0.90	0.68	0.84	0.90	0.68	0.84
2.	Field channel efficiency (Efc)	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.80
3.	Seepage	0.90	0.90	0.90	0.88	0.88	0.88	0.70	0.70	0.70

	efficiency (Es)									
4.	Operational efficiency (Eo)	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
5.	Project efficiency $E_p = E_f \times E_c$	0.69	0.52	0.65	0.68	0.51	0.64	0.48	0.36	0.45

It is proposed to adopt lined canal system for entire canal network systems of project. Water is sufficient for irrigating the entire area in Rabi season and with the balance water few areas of Kharif also will be planned to be irrigated.

4.14.6 Waterlogging and salinity aspects

- The water holding capacity of the soils of the command area is low to medium and the water table levels in the command area on an average are well below the ground surface, there is no need to take any special efforts to lower down the sub-soil water table in the areas under normal conditions. Groundwater found in these areas is free from salinity problems.
- The groundwater table is expected to rise, due to the reservoir impoundment in the submerged area. The groundwater regime in the canal alignment would generally remain unaffected as the canal is proposed to be wholly lined with cement concrete. However, the groundwater regime in the command areas of the link canal project would increase due to the application of irrigation water, in due course of time. Action may be taken to promote conjunctive use of water along with the adequate selection of cropping patterns for the region.

4.14.7 Water consumed for proposed irrigation

The amount of water consumed is dependent on the actual area that can be brought under irrigation in each season. The Rabi irrigation extent is totally dependent on the amount of water that can be stored. Thus, the water consumed for different alternatives is a function of the extent of area under each crop.

Siltation due to sediment load

- By trapping sediment in reservoirs interrupt the continuity of sediment transport through rivers, resulting in loss of reservoir storage and reduced usable life, and depriving downstream reaches of sediments essential for channel form and aquatic habitats. There are proven techniques to pass sediment through or around reservoirs, to preserve reservoir capacity and to minimize downstream impacts, but they are not applied in many situations where they would be effective.
- Where geometry is favorable it is often possible to bypass sediment around the reservoir, which avoids reservoir sedimentation and supplies sediment to downstream reaches with rates and timing similar to pre-dam conditions. Sluicing (or drawdown routing) permits sediment to be transported through the reservoir rapidly to avoid sedimentation during high flows; it requires relatively large capacity outlets.
- No matter what estimate is used, sediment trapping by reservoirs is now of primary global importance. This has significant consequences, both for the channels downstream, and for the sustainability of the reservoirs and thus future water supplies. There is increasing evidence of channel erosion and ecosystem impacts resulting from sediment starvation to downstream often termed hungry water.
- Sediment trapped behind reduces reservoir capacity, and in some high-profile cases, reservoirs have already filled with sediment, not only impairing functions and/or rendering useless the reservoir infrastructure but posing safety hazards as well.
- Thus, we can think of the sediments accumulating in reservoirs (with negative consequences there) as “resources out of place,” because these same sediments are desperately needed by the downstream river system to maintain its morphology and ecology, as well as replenishing vital land at the coast.



4.14.8 Other Impacts:

The blasting activities will be carried out as per Indian Explosives Act 1884. All precautions as required at site shall be taken. The first aid center with well qualified medical practitioner and one ambulance will be provided to cater to the emergencies in work zone.

Effect of project on climatological changes

- No major climatological changes are expected because of the implementation of the project. Microclimatological changes may be expected where the soil moisture govern the soil biota.
- The climate records say that till now there are no major cyclone damages in the region. Thus, the areas are not susceptible to natural hazard which could cause the project to present environmental problems such as earthquakes, subsidence, landslides, erosion, flooding or adverse climatic conditions.

4.15. Cumulative Impact

There is no risk of long-term buildup of pollutants in the environment. No cumulative impacts that effect due to proximity to other existing or planned projects with similar effects are anticipated due to the project. No adverse cumulative impact due to the other existing or planned activities such as supporting infrastructure (roads, power supply, waste or wastewater treatment, etc.) extractive industries, supply industries, housing development, others envisaged in the region.

The project does not involve use of substances or materials, which are hazardous (as per MSIHC rules) in nature to human health or the flora and fauna. Thus, no harmful materials which could cause harm to human health, or the environment will be used, stored, transported and handled.

4.16. Beneficial Impacts

Water is a critical natural resource without which life cannot survive. The advantages of the proposed project are as below:

- Major benefits of the reservoir are enhanced water availability, improvement of vegetation, improvement of micro climatic conditions and ecological security.
- The reservoir and rim plantations will become places of tourist attraction the department of tourism can further develop the area for the promotion of tourism as already done in many other places where water is available for the enjoyment of the people.
- With the availability of water in reservoir the possibility of improving the fish production for the benefit of the local fisheries communities will be very high. Fingerlings can be released in all the water bodies, as it is already being done by the fisheries department, to improve the fish production.
- The reservoir will act to contain the flood water by its storage.
- The roads constructed to reach various construction sites can be further improved to enhance the mobility of the villagers living on either side of these roads.
- In areas that are water deficient, the provision of surface water and the enhancement of groundwater because of canal can significantly improve water availability, sanitation and hygiene. Therefore, improved access to clean water is a major benefit of the project.
- By repairing and laying of new roads the local population can get immense advantages directly or indirectly due to increase in transport facilities. Due to which, it is possible there shall be some industrial growth such as agriculture produce processing and cottage industries will also develop.
- The project sets a precedent for subsequent development in the form of improved agriculture and its allied activities in the region.
- The project will generate direct employment during construction phase as preference shall be given to local population. It will also generate indirect employment in sectors like transportation, hospitality, automobile etc.
- Adequate supply of water for irrigation and household consumption during dry spells



- Lead to development in horticulture, animal husbandry, extension of Agriculture, Veterinary and Improved pisci-culture
- Recreation like fishing, camping and water sporting in the reservoirs.
- Improvement in overall quality of life
- Prevention of flooding during rainy season.
- The most important benefit from the project is providing irrigation facility for a command area. The farming community which has suffered the crop failure year after year due to drought and irregular monsoon rains will be able to grow Kharif crop and to some extent Rabi crop in a sustainable manner.
- In addition to the command area, the general water table outside the command area will also improve. The improvement in ground water availability and government promise of supply of electricity 24x7 will make it possible to use the pumps and raise agriculture crop profitably in a much larger area can improve the economic condition of the farming community. During the construction phase large number of local people, both skilled and unskilled will get employment. Part of them will also be engaged during the operational period of the irrigation system.
- In addition to agriculture there will be improvement in horticulture plantations providing more income to the people.
- The water availability will also improve the fodder production and boost animal husbandry activities.
- In general, the project will improve the socio-economic condition of the people and bring a marked improvement in the life of the people benefited from the project.
- The agricultural laborers will be immensely benefited due to improvement in Kharif and rabi crop cultivation and the hardship faced by them due to paucity of work forcing them to migrate in search of work will stop.

4.17. Impacts evaluation Matrix

In case of irrigation project major activities occurs in the construction phase. Major impacts are anticipated in the construction phase only. Some of the impacts are short term during the construction phase and some of impacts are long terms. All the impacts and its magnitude are quantified.

Qualitative impact is assessing the impact due short term, long terms, reversible and irreversible for is given in the Table 4.8. Impacts identification and significance assessment is given in the Table 4.9.

Table 4.8 Nature of Likely Impacts

Item	Adverse					
	ST	LT	R	IR	L	W
Submergence		X		X	X	
Fisheries		X			X	
Forests						
Terrestrial wildlife				X	X	
Rare and Endangered species				X		X
Surface water hydrology			X			
Surface water quality			X			
Groundwater						
Soil	X					
Air quality	X					
Land Transportation	X			X		
Agriculture	X			X		
Socioeconomic	X					
Aesthetic	X					

Beneficial			
ST	LT	SI	N
			X
	X		
	X	X	
X			X
X			X
X			

X	Indicates potential for type of impact
R	Denotes Reversible
W	denotes wide
ST	Denote short term
IR	Denotes Irreversible
SI	Denotes significant
LT	denotes long term
L	Denotes local
N	Denote Normal



Table 4.9 ASPECT-IMPACT IDENTIFICATION AND SIGNIFICANCE ASSESSMENT

S.N o.	Activity/Products/ Services	Aspect	N/ AB/ E	Impact	Legisl ative	Conce rn of	Significance				
					Conce rn	Interes ted	Assessment				
						Party					Total
					(Yes/N o)	(Yes/N o)	X	Y	Z	F	Score
1	Land clearing and grading	Dust emission and Soil erosion	N	Air, land and soil environment	No	No	1	0	1	1	3
2	Construction of temporary sheds approach roads (if required), sanitary facilities	Dust emission and change in traffic intensity	N	Air and land environment	No	No	1	0	1	2	4
3	Earth work comprising of excavation and trenches	Huge quantity of Muck generation, Soil erosion, run off, increase in traffic, dust emission	N	Air, Noise, Land and Biological environment	No	No	1	1	2	1	5
4	Foundation work, piling and construction of Water Conductor System	Dust, visual and noise pollution	N	Air, Noise, Biological environment	No	No	1	1	1	2	5
5	Dumping of waste and transportation	Dust, noise and visual	N	Air, Noise, Biological environment	No	No	1	1	2	2	6
6	Impounding of water	Submergence of land which includes forest, homesteads, buildings, structures and agricultural	N	Land and Biological environment	No	No	2	1	2	1	6
7	construction of online storages, canals, tunnels, etc.	chocking of natural drainage	N	Hydrogeological Impact	No	No	1	2	1	1	5
8	Construction of labor camps	effluents discharge					1	1	2	1	5
9	heavy losses of water due to seepage from canals, distributaries and water courses	Water logging and soil salinity	N	Water Environment	No	No	1	1	1	1	4
10	excessive usage of Pesticides and Fertilizers	Seepage of pollutions and contamination of ground water	N	Soil Environment	No	No	1	2	2	2	7
11	operation of crushers, concrete batch plants, construction work and movement of vehicles along unpaved road	generate dust & gaseous and fugitive emission	N	Ground water and Hydrogeological Impact	No	No	2	1	2	2	7



S.N o.	Activity/Products/ Services	Aspect	N/ AB/ E	Impact	Legisl ative	Conce rn of	Significance				
					Conce rn	Interes ted	Assessment				
						Party					Total
					(Yes/N o)	(Yes/N o)	X	Y	Z	F	Score
12	usage of DG sets	Emission of SO ₂	N	Air, Water and Biological environment	No	No	1	1	1	1	4
13	blasting, drilling and piling activity	Generate loud sounds, dust and scare the fauna	N	Air, Water and Biological environment	No	No	2	1	1	1	5
14	construction, operational and decommissioning on river	change in both the physical processes and water quality	N	Air, Noise and Biological environment	No	No	2	1	1	1	5
15	Submergence	Dust generation, noise, Change in land use	N	effects on plants and animals	No	No	2	2	3	1	8
16	Much dumping	Dust , noise generation Change in land use	N	Air pollution and land environment	No	No	2	1	2	1	6
17	Road construction	Dust generation and change in land use	N	Air, noise pollution and land environment	No	No	2	1	2	2	7
18	Diversion	Dust generation Change in land use	N	Air, noise pollution	No	No	2	2	1	2	7
19	Vehicular movement	Dust and gaseous generation	N	Air, noise pollution	No	No	2	1	2	1	6
20	Canal	fugitive emission	N	Air, noise pollution	No	No	1	2	1	1	5
21	Colony & R&R	people loss the livelihood	N	Air, noise pollution	No	No	2	2	1	2	7
22	Population Migration	Socio condition changes	N	Socio economic	Yes	No	1	2	2	1	6
23	Command area development	--	N	Socio economic	No	No	2	2	1	3	8
24	Common development	--	N	Soil Environment	No	No	1	2	1	2	6

Legend : X - Area, Y - Severity, Z - Duration, F – Frequency
N - Normal, AB - Abnormal, E – Emergency

5

ANALYSIS OF ALTERNATIVES

5.1 Introduction

The quality of a decision depends on the quality of alternatives from which to choose. The IFFC water will be stored in two reservoirs viz., Mid Manair Reservoir and Gouravelly Reservoir. As a part of this project under Re-engineering of IFFC from SRSP project, the storage capacity of Gouravelly reservoir is increased from 1.410 TMC to 8.23 TMC. The project is formulated and designed after careful planning and realistic approach. The proposed Gouravelly reservoir for 1.410 TMC capacity is bestowed with advantages such as

- (i) Geographical advantage of the site at which the reservoir was proposed,
- (ii) Minimal submergence of lands for the increased storage capacity and
- (iii) Minimum number of families' displacement which favoured the consideration of enhanced storage capacity for Gouravelly Reservoir.

Moreover, detailed investigations such as Geographical, Topographical, Archeological, Hydrological, Meteorological, geotechnical studies were already done in the same site at the time of initial approval during May 2003 vide Lr. No.J-12011/26/2000-IA-I. Even though the capacity of the Gouravelly reservoir is increased to 8.230 TMC, there is no change in the water utilization and the contemplated ayacut under the IFFC project from SRSP as a whole. Moreover, there is no forest land involved in the submergence due to the increased capacity of the Gouravelly reservoir project and there are no notified ecologically sensitive areas, wildlife ecosystems falling in the 10KM radius area and the submergence earlier i.e., for 1.410 TMC capacity reservoir or now i.e., for the enhanced 8.23 TMC capacity.

Therefore, there is a scope to increase the reservoir capacity and owing to the prominent benefactors like geographical site advantage, minimal submergence of lands and less displacement of families, rise in ground water table, drinking water for the surrounding villages and livestock and to supplement to the deleted storage capacity, is the primary reason for enhancement of Gouravelly reservoir capacity.

5.2 Alternate site analysis for Gouravelly reservoir

The construction of Gouravelly reservoir at Gouravelly village of Akkannapet Mandal, Siddipet District in Telangana State, is 85% completed. The detailed project report for the whole IFFC project was prepared and Gouravelly reservoir project is a part of it. The objective of the Flood Flow canal is to irrigate 2,20,000 acres of ayacut in the drought prone areas of Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon (erstwhile districts of Karimnagar, Warangal and Nalgonda) districts of Telangana state with the objective of utilizing 20 TMC of Flood water of Godavari River from the foreshore of Sriramsagar project.

The water utilization and allocation are one of the major factors and played phenomenal role in the formation of Telangana state. After formation of Telangana state, the Government has

reviewed the existing irrigation projects and as a part of effective utilization of water allocation and to compensate the storage lost due to dropping of Combined Storage Reservoir-I (7.346 TMC) near Konaraopet (V), the following alternative proposals were studied.

5.2.1 Increasing the Mid Manair Reservoir capacity

The Mid Manair Reservoir is a part of the Flood Flow Canal project from SRSP proposed across Manair River with a storage capacity of 25.873 TMC of water with a submergence area of 1771.52 ha. During the investigation it is observed that the Rajanna Sirisilla district head quarter Sirisilla town, the famous pilgrimage Sri Raja Rajeswara Swamy temple at Vemulavada and the R&R colonies formed for outsees of MMR are very nearer to the FRL line (+318.000M) of the Mid Manair Reservoir. All these places will be submerged even slight increase i.e., 2 to 3 TMC in the capacity of the reservoir. Also observed that the Chendragiri Reserve Forest and Anantharam Reserve Forest are along the FRL line of the Mid Manair Reservoir may also come under the submergence with increase of reservoir capacity. Hence the proposal is not considered.

5.2.2 Increasing the Gouravelly reservoir capacity

The Gouravelly reservoir is a part of Flood Flow Canal project from SRSP proposed at Gouravelly village of Akkannapet Mandal, Siddipet District with a storage capacity of 1.410 TMC of water. During the investigation it is observed that due to increase in the Gouravelly reservoir capacity to 8.230 TMC the submergence of lands is too minimal (7283.54 ha) when compared to MMR and Combined storage Reservoir-1. Further the 60% to 70% of submerged lands are barren lands. No other village habitations than 1.410 TMC are submerging with enhanced capacity. Further there is no forest land involved in the submergence due to the increased capacity of the Gouravelly reservoir project. The following various factors were compared in the consideration of the proposal for enhancement of the Gouravelly reservoir capacity.

The detailed investigations such as Geographical, Topographical, Archeological, Hydrological, Meteorological, Geotechnical studies were carried in the same site at the time of initial approval. Even though the capacity of the Gouravelly reservoir is increased to 8.230 TMC, there is no change in the water utilization & the contemplated ayacut under the FFC project from SRSP as a whole. Moreover, there is no forest land involved in the submergence due to the increased capacity of the Gouravelly reservoir project and there are no notified ecologically sensitive areas, wildlife ecosystems falling in the submergence earlier i.e, for 1.410 TMC capacity reservoir or now i.e., for the enhanced 8.23 TMC capacity.

Further the following various alternatives were compared between deleted Combined Storage Reservoir-I of 7.346 TMC, Mid Manair Reservoir of 25.873 TMC and Gouravelly reservoir of 8.23 TMC.



S. No	Description	Alternative site - I Combined Storage Reservoir -1 (7.346 TMC)	Alternative site - II Mid Manair Reservoir (25.873TMC)	Alternative site - III Gouravelly Reservoir 8.23 TMC	Advantages for proposing the enhancement of Gouravelly Reservoir capacity
1	Land acquisition (Ha)	3753	7882	1567	Submerged area is reduced by about 2186 Ha & 6315 Ha
2	No. of Villages submerged (No.s)	Fully - 06 Partially - 07	Fully - 11 Partially - 07	Fully - 04 Partially - 6	Number of villages submerged are reduced by Fully-02 & 07 and partially-01 & 01
3	No. of Houses coming under Submergence (No.s)	4165	7189	817	Number of houses under submergence are reduced by 3348 No.s & 6372 No.s
4	No. of families effected (No.s)	PDF - 4275	PDF - 10683	PDF - 1122 PAF - 49	Number of PDFs reduced by 3153 No.s & 9561No.s
5	Ecological sensitive areas or important places affected	Nil	Rajanna Sirisilla district head quarter Sirisilla town, the famous pilgrimage Vemulavada and the R&R colonies formed for outsees of MMR will be submerged even slight increase in the existing capacity of the reservoir	Nil	
6	Forest Land	Nil	Chendragiri Reserve Forest and Anantharam Reserve Forest may also come under the submergence even slight increase of. 2 to 3 TMC in the existing capacity of the reservoir	Nil	



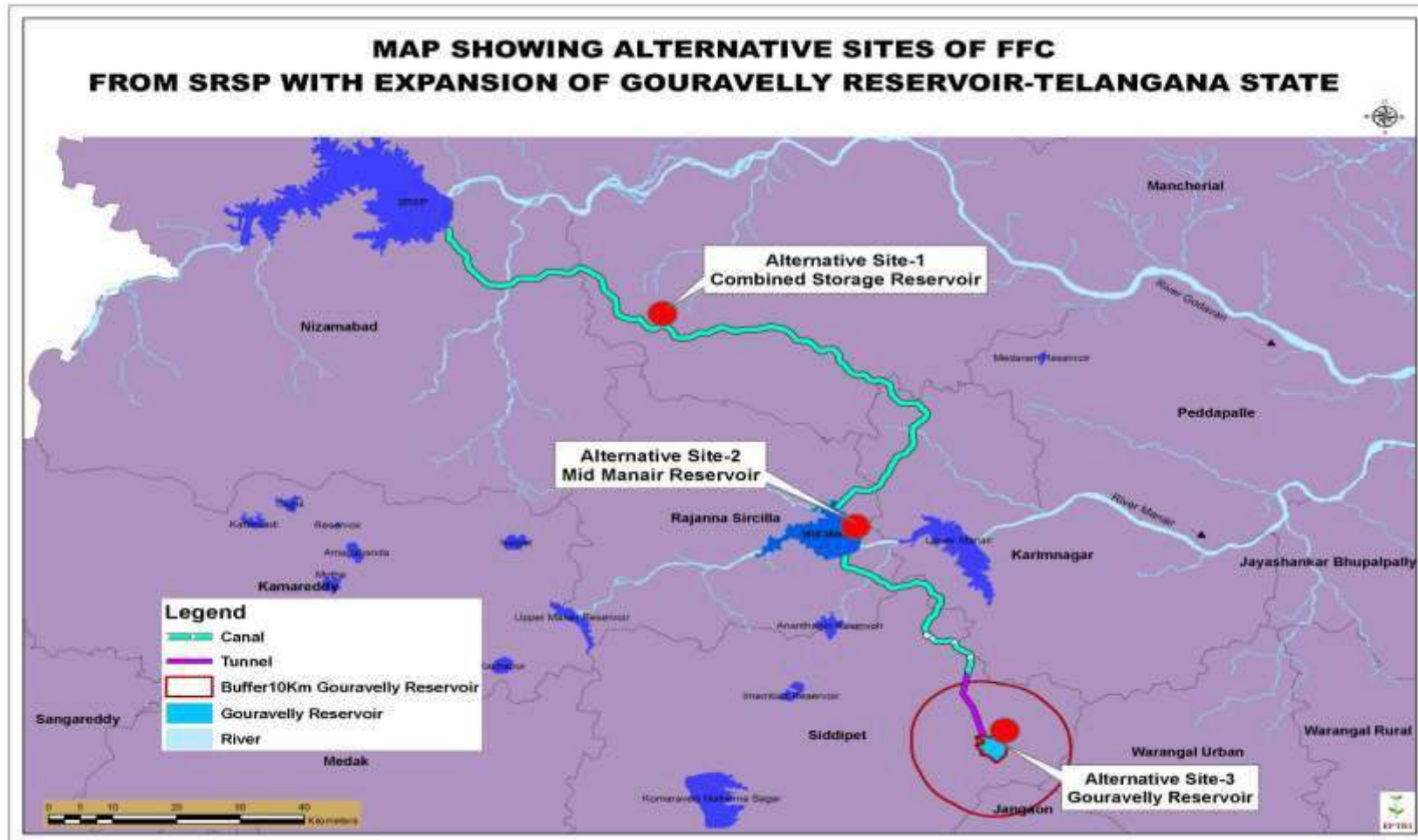
The one most important factor which makes the enhancement of Gouravelly reservoir capacity is, out of the total ayacut 2.20 Lakh acres of IFFC, more than half of the ayacut i.e., 1.20 Lakh acres is coming under Gouravelly reservoir. To supply water to the contemplated ayacut of 1.20 Lakh acres with the gross storage capacity of 1.410 TMC, it requires 12 fillings continuously through lift scheme, almost to a height of 123.90 m, in 120 days and if any technical defect arises in the lift system it will be toilsome to serve water for drinking and irrigation purpose until the restoration of the lift system. Now, with the enhanced capacity of 8.23 TMC in the Gouravelly reservoir, water will be supplied continuously for drinking & irrigation purposes with only 3 fillings through lift scheme during the restoration of the lift system, if any technical defect arises.

As there is a scope to increase the reservoir capacity and owing to the prominent benefactors like geographical site advantage, minimal submergence of lands and less displacement of families, rise in ground water table, drinking water for the surrounding villages and livestock and to supplement to the deleted storage capacity, it may be substantiated to the purposefulness of the enhancement of Gouravelly reservoir capacity.

The storage capacity was enhanced from 1.410 TMC to 8.23 TMC with a meager difference in Land acquisition, Number of Villages in submergence, Houses and Families.

The Comparative statement regarding Land acquisition, number of families affected, number of villages submerged before and after the enhanced capacity of the Gouravelly reservoir is as follows:

S. No	Description	Requirement for 1.410 TMC	Additional Requirement for 8.230 TMC	Total
1	Land acquisition (Ha)	769.25	797.5	1566.8
2	No. of Villages submerged	Fully – 04 Partially- 02	Partially- 04	Fully – 04 Partially-06
3	No. of Houses coming under submergence	693	124	817
4	No. of families effected	PDF – 937 PAF – 49	PDF – 185 PAF – 0	PDF – 1122 PAF – 49





5.3 Head regulator in the foreshore of Sri Ram Sagar project reservoir to draw a discharge of 436 Cumes during flood days.

There are 3 alternative sites surveyed for location of the regulator

1. location in the foreshore of the SRSP reservoir Nagpur village, Nizamabad district
2. location in the foreshore of the SRSP reservoir near Eumapur village Nizamabad district
3. location on the Right flank of the earthen dam near Mupkal village , Nizamabad district.

The location 3 of the head regulator is finalized Right flank of the earthen dam near Mupkal village of Nizamabad district which facilities to have a flood flow canal for shorter length compared to the other site. Thus, it is reducing the cost of the flood flow canal.

6

ENVIRONMENTAL MONITORING PROGRAM

6.1 General

Monitoring is an essential component for sustainability of any developmental project. It is an integral part of any environmental assessment process. Any development project introduces complex inter-relationships between the project affected people and the environment. It is very difficult to predict with complete certainty the exact post-project environmental scenario. Hence, monitoring of critical parameters is essential in the post-project phase so that timely action is initiated to safeguard the livelihood of the affected people.

Monitoring of environmental indicators signal potential problems and facilitate, timely prompt implementation of effective remedial measures. It will also allow for validation of the assumptions and assessments made in the present study. Monitoring becomes essential to ensure that the mitigation measures planned for environmental protection function effectively during the entire period of projects operation. The data so generated also serves as a data bank for prediction of post-project scenarios in similar projects.

Environmental monitoring is the repetitive and systematic measurement of the characteristics of environmental components to test specific hypotheses of the effects of human activity on the environment. The post project environmental monitoring program serves as the key tool to keep track on performance of mitigation measures implemented to prevent impacts associated with various operations of the project.

Thus, environmental monitoring is the effective observation of site conditions and work activities, and identification of potential non-compliance situations and initiation of corrective or remedial actions. Monitoring is as important as that of control of pollution, since the efficiency of control measures can only be determined by monitoring.

6.2 Objective of Environment Monitoring Program

The basic objective of the environment monitoring program is:

- Planning a survey and sampling program for systematic data/information collection
- Conducting survey and sampling program
- Analysis of sample data/information collected, interpretation of data, evaluation of the results and prescribing methods to neutralize the adverse impacts.
- To ensure implementation of mitigation measures during project implementation.
- To provide feedback to the decision makers about the effectiveness of their actions.
- Environmental monitoring is carried out throughout project operation to detect changes in the key environmental quality parameters, which can be attributed to the project.
- To determine the project's actual environmental impacts so that modifications can be made to mitigate the impacts.
- To identify the need for enforcement action before irreversible environmental damage occurs
- To provide scientific information about the response of an ecosystem to a given set of human activities and mitigation measures.
- Preparation of reports for submitting to management and statutory Authorities.
- Assist in detecting the development of any unwanted environmental situation, and thus, provides opportunities for adopting appropriate Control measures.

- Define the responsibilities of the project proponents, contractors and environmental monitors and provides means of effectively communicating environmental issues among them.
- Evaluate the performance and effectiveness of mitigation measures proposed in the Environment Management Plan (EMP) and suggest Improvements in management plan, if required,
- Identify training requirement at various levels.

6.3 Environmental Monitoring Program

Monitoring of the following aspects is important to keep a constant check on the environmental performance of the project and the environmental quality of the area.

- Ambient Air Quality (construction phase)
- DG set monitoring (construction phase)
- Water Quality (construction phase and operational phase)
- Noise Level (construction phase)
- Plantation Condition (Operation phase)
- Soil analysis

6.4 Implementation and Monitoring

The various components of the environment need to be monitored on regular basis as per the requirements of regulating agencies as well as for trend monitoring of the pollutants levels in various environmental matrices. Environmental management cell will be established to maintain the proper EMP.

The environmental monitoring plan for the proposed project has been developed in view of the irrigation purpose, waste management and residential issues pertaining to the project. For developing the monitoring plan, appropriate Value Ecosystem Components (VEC's) which are likely to be affected have been identified. For each component, suitable measurable environmental indicators which are appropriate to the impact mechanism and scale of disturbance and have a low natural variability, broad applicability and an existing data series have been defined. As per the MoEF&CC guidelines, environmental monitoring shall be required during construction and operational phases.

6.4.1 Construction Phase

Environmental monitoring during the construction phase shall comprise checking: Appropriate permits, certificates, authorizations and compliance with the EMP and governmental regulations. This can be ensured through use of checklists for Site Establishment, Weekly Audit, Monthly Audit, and Site Closure checklist as given in Table 6.1. Environmental Management Plan implementation monitoring during the construction phase is given in Table 6.2.

Table 6.1 Monitoring Checklists

Environmental Aspects	Yes / No	Comments
Site Establishment Check List		
Personnel on site are environmental aware of various issues of interest		
Telephone numbers of emergency services are available on site		
Solid waste management system has been established at both construction site and labour camp		
Wastewater management system has been established at both construction site and labour camp		
Necessary firefighting equipment is available and in good working order.		



Weekly Checklists		
Construction camp is neat and tidy, and the labour facilities are of the acceptable standard.		
Waste collection and removal system is being monitored.		
Sufficient firefighting equipment is available at the construction site and is in good working order.		
All construction vehicles are in good working order and have a valid PUC certificate.		
Dust control measures (wherever necessary) are in place and are in working efficiently.		
Noise control measures (wherever necessary) are in place and are effective in controlling erosion.		
Monthly Checklist		
Environmental management is reviewed in monthly review project review meeting at site		
All new personnel on site are imparted training on Environmental awareness.		
Construction activities are undertaken according to the approved method statements.		
Fuel flammable material storage areas comply with general fire safety requirements.		
Public complaints have been recorded and dealt with the satisfactory manner.		
Site Closure Checklist		
Contractor has cleared everything not forming the part of the permanent works.		
Re-vegetation has been satisfactorily completed.		
All areas disturbed during construction have been brought back to the near original condition in accordance with the conditions.		

6.4.2 Operation Phase

The schedule for monitoring ambient air quality, ambient noise quality, ground water quality, and wastewater quality both during the construction and operation phases of the project is the same as given in Table 6.2.



Table 6.2 Environmental Monitoring Plan

Environmental Parameters	Stage/ Phase	Parameters to be monitored	Frequency	Location	Implementation or supervision	Cost Rs.
Water quality	Construction	Physico-chemical and bacteriological parameters of ground and surface water (Pre and post Monsoon)	Monthly	10	Contractor	49430
	Operational		Six months once	25	I&CAD	135250
Aquatic Life	Construction	NA	NA	NA	NA	NA
	Operational	Phyto & zooplanktons and Fish	Yearly once	3 at 2 reservoirs	I&CAD	150000
Soil quality	Construction	Irrigation properties including physical and chemical properties	Quarterly	5	Contractor	27350
	Operational		Six months once	15	I&CAD	82050
Ambient Air quality	Construction	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂	Monthly	5	Contractor	22500
	Operational	NA	NA	NA	NA	NA
Noise quality	Construction	Leq, Lday, Lnight	Monthly	5	Contractor	9000
	Operational	NA	NA	NA	NA	NA
Health Camps	Construction	Physical fitness test - Lung function, Eye Test, Blood test	Six months once	--	Contractor	200000



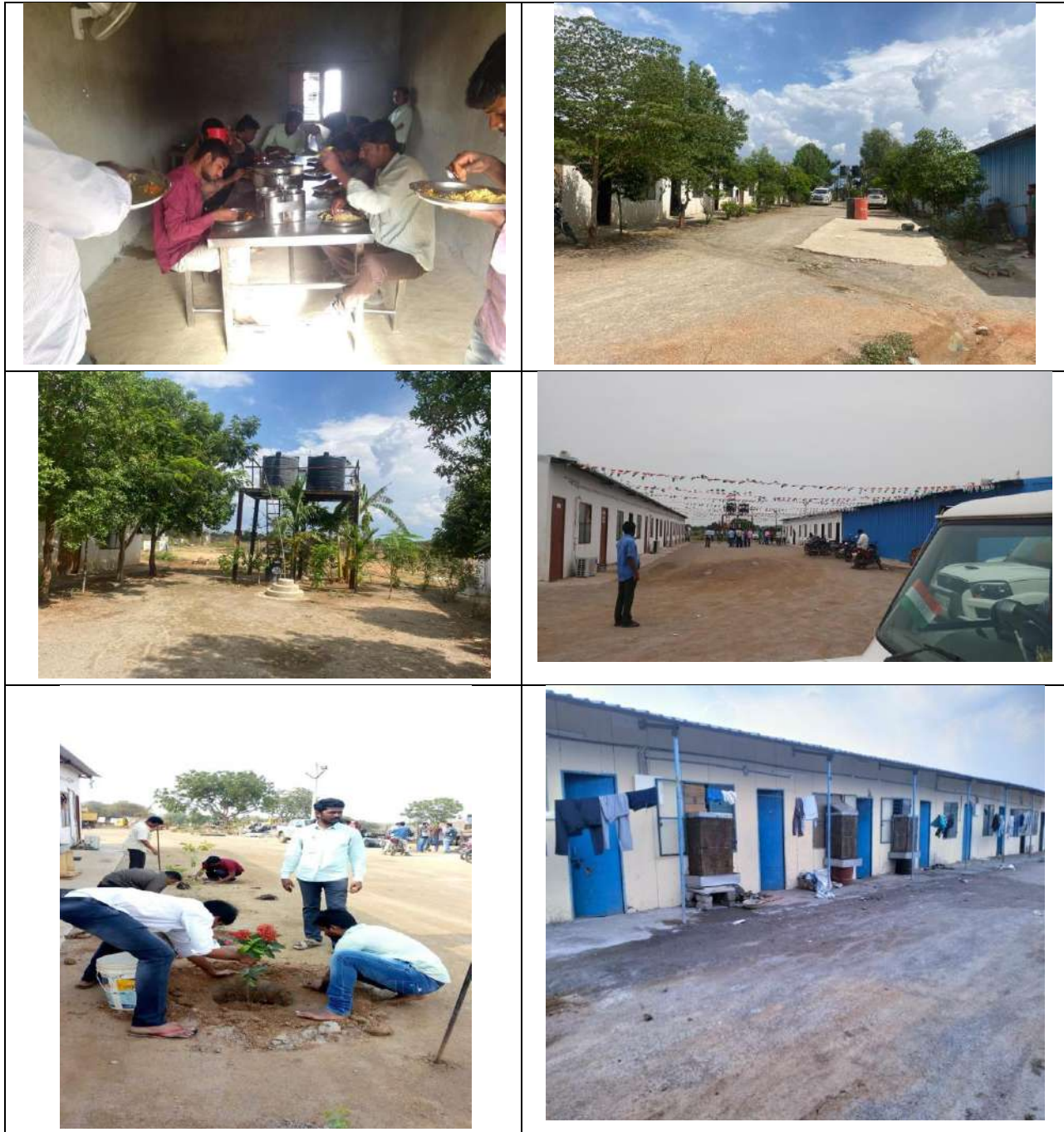
As a part of post project monitoring the following facilities were provided in the labour camps.

Photographs of Health camps during the construction phase





Photos of the labour camp facilities





Labour Safety meeting



Labour training photos





**Details of the provision given to labour like Sanitation facilities, kerosene/wood/LPG, Medical facilities and other facilities in the labour camps**

Sl. No	Package No.	From 2018 to 2022							
		Community toilets in the project area		Sewage Treatment Plants (STPs)/ Soak pits		Supply of LPG at Labour camp		Disposal of Solid waste at Labour camp	
		Nos	Cost in Rs	Nos.	Cost in Lakhs	Nos.	Cost in Rs	Method (Dumping at yard/ Recycled)	Cost (cost of transport waste to dumping yard - vehicle+labour) in Rs
Covered in Gouravelly Reservoir and Nearby Mandals									
1	Husnabad Mandal (till 2021)	-	-	766	48.24	-	-	Dumping at yard -17 No's	9792000
	Husnabad Mandal (2021-22)	-	-	11	0.70	-	-		
2	Akkannapet Mandal	2	3.975	0	0	-	-	-	-
3	Provided by agency at Site	28	476000	NIL	NIL	216	237600	Dumping at Yard	2835000
Covered in Mid Manair Reservoir and Nearby Mandals									
4	Boinpalle	10728	NA	65.00	34.63	-	-	-	-
5	Chandurthi	11538	NA	71.00	8.31	-	-	-	-
6	Ellanthakunta	12856	NA	79.00	27.80	-	-	-	-
7	Gambhiraopet	10609	NA	59.00	24.44	-	-	-	-
8	Konaraopeta	12678	NA	64.00	6.81	-	-	-	-
9	Mustabad	10081	NA	72.00	13.65	-	-	-	-
10	Rudrangi	NA	NA	15.00	0.71	-	-	-	-
11	Thangallapally	NA	NA	77.00	8.42	-	-	-	-
12	Veernapally	NA	NA	16.00	2.31	-	-	-	-
13	Vemulawada	10838	NA	0.00	0.19	-	-	-	-
14	Vemulawada Rural	NA	NA	15.00	0.84	-	-	-	-
15	Yella Reddi Peta	13269	NA	85.00	13.06	-	-	-	-
16	Sircilla	15275	NA	NA	NA	-	-	-	-



Sl. No	Package No.	From 2018 to 2022							
		Community toilets in the project area		Sewage Treatment Plants (STPs)/ Soak pits		Supply of LPG at Labour camp		Disposal of Solid waste at Labour camp	
		Nos	Cost in Rs	Nos.	Cost in Lakhs	Nos.	Cost in Rs	Method (Dumping at yard/ Recycled)	Cost (cost of transport waste to dumping yard - vehicle+labour) in Rs
Magic Soak Pits in the mandals									
17	Boinpalli	-	-	309	NA	-	-	-	-
18	Ellanthakunta	-	-	569	NA	-	-	-	-
19	Vemulawada	-	-	132	NA	-	-	-	-
20	Thangallapally	-	-	44	NA	-	-	-	-
	Vemulawada PHC area	from 2003 -2022							
21	Rudravaram	786		4				Tractor	2
22	Sankepally	486						Tractor	1
23	Arepally	113						Tractor	1
24	Anupuram	583						Tractor	1
25	Kodumunja	254						Tractor	1
	TOTAL	2222							6
26	Koheda Mandal (till 2021)	0	0	2746	1.263	0	0	0	0
	Koheda Mandal (2021-22)	0	0	89	0.04	0	0		



ADDITIONAL STUDIES

7.0 Introduction

As per the Terms of Reference (ToR) issued by MoEF&CC for Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir and also as per the prescribed Generic Structure of the EIA/ EMP Document. The following additional studies are to be conducted.

- Social Impact Assessment (SIA) & Rehabilitation and Resettlement
- Risk Assessment and Disaster Management Plan
- Public Consultation

7.1 Social Impact Assessment

The Government has given exemption to the Flood Flow Canal Project from SRSP from the application of the provisions of Chapter-II & III (Socio Impact Assessment) of RFCTLA&RR-2013 vide G.O.Ms.No.41, Dt.22.07.2017. There is no forest land involved in the FFC project from SRSP.

Socio-economic survey was carried out to know the infrastructural activities amenities available within 10 km radius from Gouravelly reservoir. The information regarding facilities available and the opinion of the people was sought by floating questionnaires and interaction with the people. This is done for observing the impact due to the project with reference to social aspects so that proper actions / measures could be taken up for the benefit of the people (economically and with respect to quality of life) and the project. As described in the previous chapters the proposed Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir. The capital investments and the CSR activities has been already development this area to an extent.

Conclusion

As per the primary survey and observation, 43 census villages/wards surround the proposed expansion of Gouravelly Reservoir from 1.409 TMC's to 8.230 TMC's project and it also includes 20 urban wards belong to Husnabad Municipal Council, which are falling in the 10 km radius of the study area. The study areas Schedule caste (SC) population is 17.23% and the Schedule Tribe (ST) population is 13.25%. Literacy rate in the project area is 60.56%. Educational status has improved from generation to generation in this region. The required Schools and colleges are available. The working participation rate is 51.90% and the non-working population is 48.10%. Infrastructure facilities such as the Road network, self-help groups, public distribution system, and communication facilities are good.

A sample survey of 485 household's survey was conducted in 14 villages of the study area. The number of females per 1000 males is 1009, showing healthy ratio of female population. Among the surveyed total population (excluding 0 to 6 years of age), 63.26% people were literate and 30.75% were illiterate. This shows that the educational facilities have gradually improved in the sample villages and some of the educational infrastructure is still in progress.



The more than half the population(69.64%) in the study area is having the land ranging from below hectare to more than 10 hectares. These farmers are cultivating paddy and other rain fed crops such as maize and millets. The remaining farmers are growing fodder for their cattle. About 70.17% population involved in other occupations petty trading, private wage employment and daily wage labourer works.

With reference to drinking water sources, majority 88.87% families were using water from rural water supply (Mission Bhageeratha Scheme and using bore wells. The sanitary status was good in the villages as 91.75% have sanitation facilities in their own premises. However, the drainage facilities in the study area needs to be further improved through community participation.

Health and medical amenities are there in the study area as most of the villages were covered by the state with Primary and Community Health Centre at Husnabad and Akkannapet and its supporting sub-centres and in addition to this the Rural Medical Practitioners (RMPs) are also available in the study area.

During the Focus group discussion & need-based assessment, the respondents requested some important facilities from the project proponent. These are Cement and concrete (CC) roads, Drainage and sanitation, need based skill-training programmes to promote the livelihoods of the communities is required. The additional classrooms at schools and sports kits to the school, Need renovation for Anganwadi centres and regular medical camps.

The findings from the primary survey indicate that medical facilities & other infrastructure facilities are average in the study area. The quality of the life in the region is good having the basic amenities in the surrounding areas, needs to be further improved through Corporate Social Responsibility initiatives promoting the community participation. Since the expansion of the Gouravelly reservoir which expect the paddy cultivation needs warehouse facilities to store the grains produced by the farmers.

Thus, Social Impact Assessment study is mandatory to assess the impacts on affected population and plan for the resettlement and rehabilitation of the displaced population in the project area as per, existing policies and rules. However Economic opportunities would also increase both directly as well as indirectly. Infrastructure facilities are likely to increase.

7.1.1 Rehabilitation and Resettlement Plan

The Rehabilitation and Resettlement clearance is received from the Govt. of India vide MOTA Lr. No.20011/4/2003- CP & R, Dt. 02-09-2004. (Enclosed as **Annexure 7A.**) A resettlement & rehabilitation (R&R) Master Plan highlighting the guidelines of land acquisition and provision for rehabilitation measures are formulated.

Mid Manair Reservoir

The Mid Manair Reservoir is a part of the Flood Flow Canal project from SRSP proposed across Manair River with a storage capacity of 25.873 TMC of water with a submergence area of 7881.78 ha. The construction of reservoir is completed and under operation.



Anupuram (722 houses), Kodimunja (255 houses), Rudravaram (903 houses), Sankapalli (156 houses), Arepalli (18 houses), Cheerlavanha (1825 houses), Chintatana (710 houses), Kodurpaka and Neelojpalli (1665 houses), Varadavalli (582 houses), Shabaspalli (236 houses) and Gurrampalli are among the fully submerged villages which are all shifted. Munuwada, Kandikatkoor & Kothapeta (117 houses) are among the partially submerged villages occupy 142.63 ha (1.96%)

Gouravelly reservoir:

The rehabilitation policies of the state government of Telangana and RFCTLARR Act, 2013, Government of India is the basis for preparation of the R & R plan for the project affected families. **(Annexure -7B)**

- Total 937 PDF's and 49 PAF's are coming under the submergence of 1.41 TMC of storage capacity.
- The compensation towards R&R was paid to 937 PDFs @ 8.00 Lakhs/PDF as one time settlement as per the G.O MS. No. 23 Irrigation & CAD (LAR&R/A2) department, dt18.04.2017. total 49 PAF's were paid as per GO Ms.No.68, Irrigation & CAD (PW.LA IV) Department , Dr.08.04.2005.
- Additional 185 PDFs are coming under the enhanced capacity of 8.23 TMC. The compensation towards R&R is proposed as per the LARR Act 2013. The 185 PDFs accepted the proposal and the same is under process for final settlement.

Land Acquisition and R&R of FFC Project from SRSP are given in Table 7.1. The submergence of Gouravelly reservoir is given in Table 7.1

Table 7.1 Land Acquisition and R&R of FFC Project from SRSP

S.No.	Name of the Reservoir	Details after enhancement of Gouravelly Reservoir capacity to 8.230 TMC				
		Land Acquisition (Ha)	No. of Villages affected	No. of Houses affected	No. of Families affected	Ayacut (Ha)
1	Flood flow canal from 0.00 km to 122 km	2996	-	-	-	-
2	FFC canal network @ km98	518	-	-	-	8094
3	Mid Manair Reservoir	7882	Fully- 11 partial- 07	7189	10683	-
4	MMR R/s & L/s Canals	1863	-	-	-	32358
5	Tunnel & Lift scheme	132	-	-	-	-
6	Gouravelly Reservoir (1.410) TMC	1567	Fully- 04 partial- 06	817	1122	-
7	Three Irrigation Canals from Gouravelly Reservoir	1819	-	-	-	48581
8	Total	16777	Fully- 15 partial- 13	8006	11805	89033



Table 7.2 Submergence of Gouravelly reservoir

Villages –Full Submergence	Gudatipally (Gram Panchayath) Tenugupally, Maddelapally and Kottapalli are H/o Gudatipally
Villages- Partial Submergence	1) Gouravelly, 2) Janagoan, 3) Gandipelly 4) Regonda, 5) Nandaram, 6) Ramavaram
R&R	Structures - 817 No.S (693 old+124 New) & Families – 1122 No.S (937old +185new)

Land Acquisition (LA)

- Total of 1814 acres ½ guntas (769.25 ha) is coming under the submergence for 1.409 TMC of storage capacity. The compensation was paid as per old Land Acquisition Act, 1894.
- Additional extent of Acres 2055-17 guntas (797.55 ha) is coming under the submergence for 8.230 TMC of storage capacity. The compensation for an extent of Ac 2055-17 guntas was paid as per LARR Act, 2013 (Telangana Amendment Act 2016)

The LA details are given in Table 7.3

Table 7.3 LA of Gouravelly reservoir

Description	Total	Acquired	Balance
Land (Acre - guntas)	3870-00	3870 -00	0
Structures (No's)	817	817	0
PDF's (No's)	1122	1122	0
PAF's (No's)	49	49	0

The R&R given to the PDF's and PAF's of the project is given in Annexure -7C.

7.2 Risk Assessment & Disaster Management

The disaster management plan has been prepared as an emergency preparedness measure to protect the life of the employees and others present on-site, that of the public in the vicinity of the project, company property and environment. The plan defines roles & responsibilities of persons at different levels in the event of emergency at the Pump house of Gouravelly project.

Purpose of the Plan

Basic purpose of this disaster management plan is to develop, implement and maintain an integrated emergency management system for protection of people, property and the environment in the event of on-site emergency as well as off-site emergency caused.

Ultimate goal is to reduce vulnerability of the project area due to emergency situation to save lives and protect property by developing capabilities that mitigate effects of, prepare for, respond to and recover from emergency situation that could affect the project area.

Scope of the Plan

The Disaster Management Plan covers technological emergencies arising out of construction accidents and covers the following:

The Electro-mechanical equipment installed in the pump house at Gouravelly reservoir consists of pumps, motors, governing system, motor starting equipment, transformers, bus ducts, oil pumping system, HOPD Valves, HS Lubrication systems and other pump house auxiliaries viz. crane, air conditioning and ventilation system, lighting system, fire protection system etc.

Emergency Scenarios: Emergency scenarios arising out of project and that anticipated in the immediate future expressed by I&CAD of the concerned risks as envisaged.



Emergencies Scenarios

The emergency scenarios are classified into 3 categories:

- Natural calamities such as Flood, Landslide and Earthquake
- Man-made disaster such as Fire and Explosion
- Security related disasters such as Terrorist / Bomb threat attack Sabotage

Flood

Flood can occur due to Heavy rain fall, Cloud burst in the upstream of pump house; More and sudden water released into IFFC.

Earthquake

The project area and agency fall in Zone II (Least active zone) of earthquake vulnerability map. Seismologists have predicted the earthquake of major magnitude may occur at any moment and therefore all precautions are required to be taken prior to earthquake.

Apart from some of the counter measures to be taken in foreseeable cases, emergency recovery plans shall be considered by the emergency management team as per the situation and site conditions.

- a) Structural failure
- b) Collapse of structures inside the tunnel
- c) General alignment

Fire and Explosion

Following are areas where fire or explosion may take place due to improper maintenance or mishandling.

- a) Switchyard area
- b) Transformer and switchgear room area

Terrorist / Bomb threat attack

Terrorism is the deadliest form of emergency/disaster in terms of loss of life and damage to property. Project sites could not be ruled out of the possibility of terrorism as these sites are vital nation assets. The terrorist-related aspects could be dealt with by making use of advancement of the technology in the areas of surveillance and proper intelligence network.

Following are the vulnerable areas where the terrorists can strike.

- a) Reservoir
- b) Pump House
- c) Tunnel
- d) Offices

Factors to control Emergency

1. Reporting of Incident
2. Key Persons
3. Emergency Management Teams
4. Responsibilities
5. Emergency Communication Organization
6. Emergency Control Centre (ECC)
7. Declaration of Emergency
8. Termination of Emergency
9. Siren System
10. Communication System



11. Role of Employees after declaration of Emergency
12. Resources on-site
13. Assembly Points

Reporting of Incident

Any person (employee of I&CAD or contracting agency or Security) who sees the incident shall inform/report to the ECC through the nearest office (I&CAD, contracting agency/any security point) through telephone/mobile or by shouting.

Key Persons

Following positions & names of key persons are to be included.

1. Chief Incident Controller (CIC)
2. Works Incident Controller (WIC)
3. Site Incident Controller (SIC)

Project Manager of the site contracting agency assumes the role of IC in case of any emergency. For silent hours (nighttime or on holidays) the senior security person will handle the emergency with the help of other security personnel till arrival of the seniors.

7.2.1 Safety Measure:

As a part of Environmental Management Plan, safety measures for the following aspects included-

- Traffic management during construction phase
- Measures to be taken during excavation of earth.
- Safety practices

Traffic Management during Construction Phase

Temporary diversions will be constructed with the approval of the Engineer. Detailed Traffic Control Plans will be prepared and submitted to the Engineer for approval, at least 5 days prior to commencement of works on any section of road. The traffic control plans shall contain details of temporary diversions, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, safety measures for transport of hazardous material and arrangement of flagmen. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. He shall inform local community of changes to traffic routes, conditions and pedestrian access arrangements. The temporary traffic detours will be kept free of dust by frequent application of water.

Measures to Be Taken during Excavation of Earth

While planning or executing excavation the contractor shall take all adequate precautions against soil erosion, water pollution etc and take appropriate drainage measures to keep the site free of water, through use of mulches, grasses, slope drains and other devices. The contractor shall take adequate protective measures to see that excavation operations do not affect or damage adjoining structures and water bodies. The recommended measures are –

- Ensure unobstructed natural drainage through proper drainage channels/ structures.
- Dispose surplus excavated earth at identified sites. Ensure minimum hindrance to locals.
- All excavations will be done in such a manner that the suitable materials available from excavation are satisfactorily utilized as decided upon beforehand. The excavations shall



conform to the lines, grades, side slopes and levels shown in the drawings or as directed by the engineer.

Safety Practices during Construction Phase

The Contractor is required to comply with all the precautions as far as possible for safety of the workers. The contractor will supply all necessary safety appliances such as masks, ear plugs, etc., to the workers and staff. The contractor shall comply with all regulation regarding, working platforms, excavations, trenches and safe means of entry and egress. In order to guarantee construction safety, efficient lighting and safety signs shall be installed on temporary roads during construction and adequate traffic regulations shall be adopted and implemented for temporary roads.

Fire Protection in Labour Camp and Staff Colonies

It has been envisaged that the fire protection planning shall be taken up in Construction of Camps. and placement of fire protection equipment. It has been planned that all facilities to be constructed shall be fully equipped with the fire protection equipment as per IS standards. The analysis of fire hazard in the construction of labour camps, colonies and other facilities along with management measures is summarized in Table 7.4.

Table 7.4 Analysis of fire hazard in labour camps, colonies and other facilities

Stage	Potential hazard	Remedial Measures
Construction of Camp	• Fire prevention and firefighting not considered in design. • In adequate fire protection measures during construction	• While construction of Field hostels, Guest House/office and other facilities owned by I&CAD, Dept, Govt. of Telangana • The project proponent shall provide the fire protection system as per IS Standards for Fire code. • Proper housekeeping will also be ensured and maintained during these facilities to protect them from any fire related incidents. • It will be ensured that the firefighting equipment are placed at common place also including workplace preferably within 15 meters of workplace.
		By Contractor • Clear term of reference will be given to contractor at tendering stage for incorporating fire code as per IS Standard. • Fire fighting equipment will be placed at all common places (within 15 meters of workplace)

During construction, it has been envisaged to set up fully fledged Environment Health & Safety (EHS) department reporting directly to Head of Project. This department shall also take care of



the adequacy of Fire Safety measures set up in all facilities created either owned by I&CAD of Govt of Telangana or any of its Con

Table 7.5 Responsibility of EHS team

Stage	Potential hazard	Remedial measures
During Occupation	<u>Occupation</u> Fire incident due to electrical short circuit/LPG Leakage/ Improper handling of flammable liquids/lack of precaution. Improper access to and from the location. Inadequate fire fighting arrangements • Lack of communication • Lack of Knowledge on fighting fire and handling fire equipment • Inadequate Emergency response.	• Residential complex will be constructed as per the approved design and will be checked for completeness on fire aspect before allotment to residents. • Each Block Colony/ camp will be provided with rated estimated trip off circuit braker will be installed on each block. • All residents are made aware of fire hazard by training, regular campaigns and by placing posters and signs. • LPG Cylinders/Flammable liquids will be stored at designated storage area. The storage will be well protected, ventilated with adequate provision of fire equipment. • Each bloc of the colony will be provided with 10 kg DCP fire extinguishers. • Additionally, fire point containing fire buckets, CO2 extinguishers, DCP Extinguisher will be provided at the common place covering four residential blocks in labour Camp. • Placement of written posters of preventive measures in each accommodation block
		• Regular EHS inspection of the camp site • Placement of placard of emergency numbers to be contacted in case of Emergency. • Dedicated phone line will be provided in labour camps for effective communication. • Ensure proper access is maintained around and to the residential blocks. • Identification of emergency Muster points at safe distance



7.2.2 Emergency Control Center (ECC)

The Emergency Control Center is the focal point in case of an emergency from where the operations to handle the emergency are directed / co-ordinated by the Works Incident Controller (WIC) under the guidance of Chief Incident Controller (CIC). The entire project site is divided into 3 major sites.

- Pumphouse and its components
- Tunnel
- Reservoir

Hence, from the viewpoint of convenience and to effectively handle the emergency each of the two major sites should function from either of 2 separate ECCs – Main and alternate.

Contents of the ECC

Main ECC is a place normally manned 24x7 basis e.g., Security Office. A board displaying “Emergency Control Center” / “Emergency Control Center - Alternate.”

- Display of Telephone/Mobile numbers of key persons working on-site
- Display of Telephone/Mobile numbers of selected key officials
- A copy of Emergency Action Plan
- Land-line telephone instrument for receiving calls only.
- A booklet of blank ‘Incident Information Summary’ sheets
 - Site Map showing Storage of safety equipment.
 - Firefighting system and additional source of water
 - Site entrance, roadway and emergency exits.
 - Truck parking area
 - Surrounding location
- Area map showing sensitive areas such as hospitals & nursing homes, laboratories, offices of key government officials.
- Black / white board
- Intercom
- Mobile Phone / walky-talky
- Selected PPE storage
- Meeting Room with chairs only
- TV and Radio sets
- Record Book
- Desktop computer containing required data and printer.
- Notebook, Pad and Pencil/pen

Manning

At least one person should man ECC round the clock during peace time who can receive and record information. During an emergency, it should be manned by the emergency management staff, including the highest-ranking personnel in-charge of the whole operation.

Declaration and Termination of Emergency

The WIC is authorized to declare and terminate the emergency. The sequence is given below:

- After receiving information about an incident, SIC would rush to incident site immediately.
- SIC, if found beyond his control, informs the ECC attendant, who in turn informs all concerned key persons.
- CIC & WIC would then rush to ECC.
- CIC then contacts other key persons on-site, establishes communication set up with WIC & SIC to know more about the situation.



- After communication with WIC/SIC if it is beyond the control, CIC would give clearance to Security to declare Emergency.
- The CIC contacts WIC & WIC then contacts SIC to know more about the incident.
- The Engineering Services Team approaches the incident site to attend emergency.
- Other plant In-charges occupy their offices to receive instructions from CIC.
- Other teams carry out their respective functions.
- CIC is in continuous interaction with the WIC & SIC and other senior persons in each site.
- SIC in consultation with the other team leaders' updates CIC & WIC
- After handling emergency situation successfully i.e., after cessation of emergency, WIC would declare termination of emergency in consultation with the CIC.

Siren System

- **Declaration of emergency:** Wailing sound for 30 seconds, break for 30 seconds repeated 3 times.
- **Termination of Emergency:** All Clear Signal will be a continuous siren for 2 minutes repeated twice.
- Apart from sounding siren, emergency message shall be communicated to all the workers over Public Address system in and around the emergency site in Hindi, English & Local language.

Communication Systems

Landline and mobile telephones

All key personnel are provided with landline and mobile telephones at office as well as at their residences. Landline and mobile telephones are also provided at selected locations in the project areas.

- Wireless communication
- CUG Mobile Phones – Close User Group (CUG) mobile phones are also provided to all key personnel and site personnel.
- Walky-Talky – Legalized Walky-Talky connections are provided to key personnel at sites.

Role of Contracting Agencies & Employees after declaration of Emergency

The contracting agencies have their own on-site Emergency Management Plan. The Contracting agencies implement their plan after declaration of emergency. General guidelines they should follow as given below:

- ✓ On getting the information of declaration of emergency on the site, the Project Managers of Associates shall immediately report at site and shall act as per their emergency plan.
 - Ensure that the immediate response is provided to protect health and safety of persons in the immediate area.
 - Appoint responsible persons to account for their agency's personnel and report to the Work Incident Controller of the site.
 - Appoint emergency rescue team to locate the missing persons.
 - Ensure that their personnel are housed in a secure place, till further instructions from WIC.
 - Provide to their trained personnel and equipment for respective emergency actions.
 - Any other responsibility as assigned by CIC/WIC/SIC



Role of Employees after declaration of Emergency

After hearing the emergency siren message, all the employees including workers of associates shall stay on their worksites. Those employees who are required to help in handling the emergency either for responding to emergency directly or support the emergency actions as per this emergency action plan or that of the agency should act accordingly.

Those employees who are not required to handle the emergency either directly or as support, should wait for instructions from their superiors to gather at designated Assembly Points.

Resources on-site (Own and those of Contracting Agencies)

i. Fire Equipment

The following fire equipment are to be made available:

- Fire Tender: 1 no
- Water mist and CAF high pressure backpack fire extinguishers: 2 nos.

ii. Portable Fire Extinguishers

Trained Emergency Responders

- ✓ Fire fighters,
- ✓ First-aiders,
- ✓ Medical & Para-medical staff.
- ✓ Rescue persons,
- ✓ Security & Traffic Control staff

Emergency Equipment & Supplies

- ✓ Medical Equipment,
- ✓ Rescue Equipment,
- ✓ Antidotes,
- ✓ Equipment for attending to leakages (e.g., de-watering pumps)
 - Vehicles for Transporting People
 - Ambulance with drivers

Assembly Points

- 132/11KV SWITCHGEAR
- 11KV Switchgear
- Main Transformers
- Control, Monitoring and Protection System
- A.C Auxiliary Power System - D.C Supply System
- Communication System, Lighting System, Grounding System and Fire Alarm System
- Motor Control Centre

Response Functions

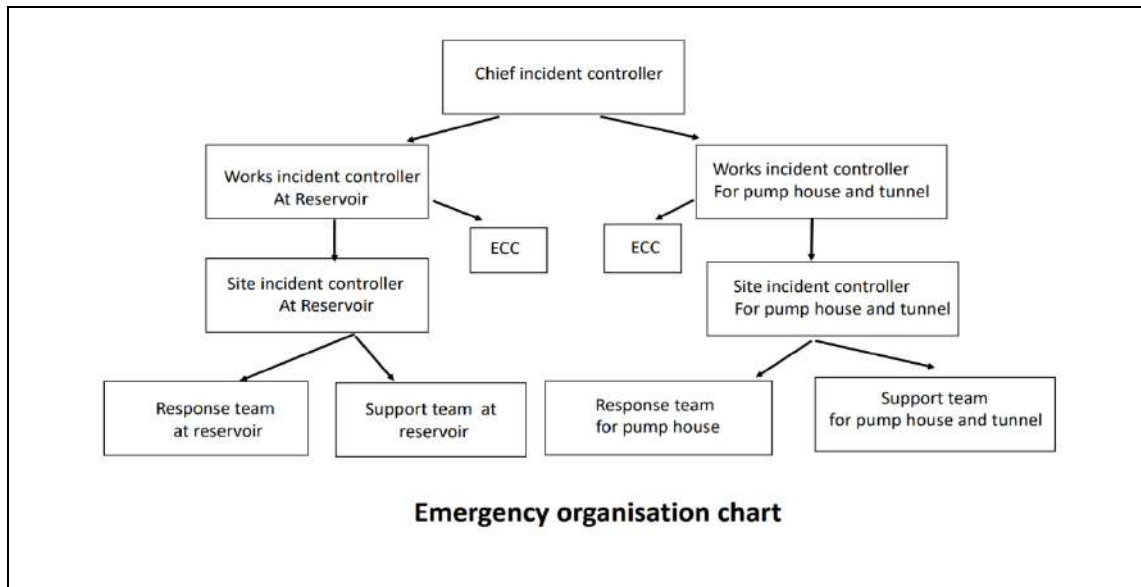
- ✓ Emergency in Tunnel
- ✓ Firefighting
- ✓ Rescue
- ✓ First-aid & Medical Response
- ✓ Security & Traffic Control
- ✓ Communication
- ✓ Evacuation

Emergencies in the tunnel can arise from

- ✓ Fire inside the Tunnel (Ignition of inflammable gases)
- ✓ Tunnel Collapse or Failure of Works resulting in persons been trapped.
- ✓ Sudden release of toxic and inflammable gases



- ✓ Sudden flooding (Inrush from above/from underground water source)



Fire at other construction sites

Fire would be extinguished with the help of own resources of trained firemen, available portable fire extinguishers, Fire equipment. However, if it is beyond own capabilities, help from nearby city fire brigade/mutual aid partners would be taken.

Treatment and Evacuation of injured person

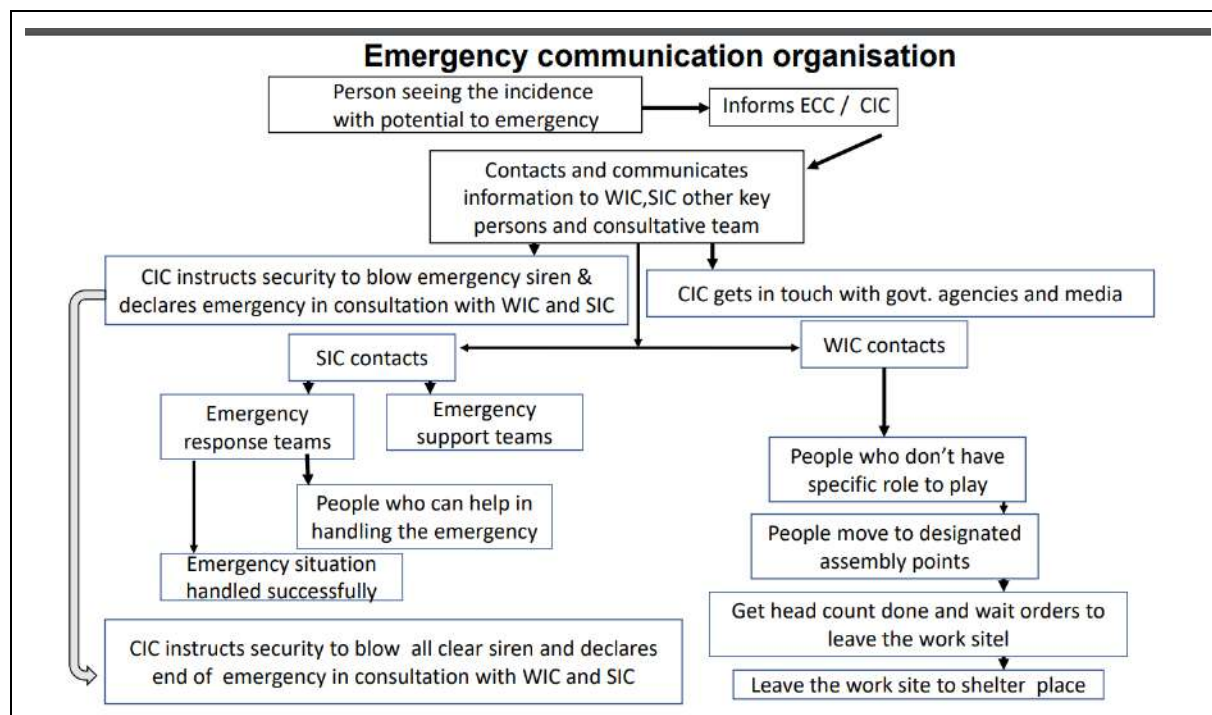
A minor injury is one that causes no immediate danger to the life of the person who has suffered the injury; the injury party is conscious and is capable of walking unaided or with the support of a fellow worker. In general, cuts, bruises and minor burns are classified as minor injuries. Injured shall be escorted to First Aid Room, treatment be given worker should rest and returns to work when feeling better.

After treatment at the First Aid Room, if the First Aider thinks more treatment is required e.g., stitches to a deep cut or a check-up after any head injury, or worker complains of feeling ill or dizzy, then the First Aider arranges transport for the injured party to be taken to the Doctor.

The pump house lighting will comprise of interior and exterior light as required. A separate emergency lighting system fed from the emergency power supply (DG set) will be provided for essential locations, e.g., control room, 11KV switchgear room, machine hall etc.

Responsibilities of Emergency Teams

The responsibilities of various emergency teams viz. Chief Incident Controller (CIC), Works Incident Controller (WIC), Site Incident Controller (SIC), Resource Manager, Fire Team etc.



7.2.3 Emergency Response Plan

The Emergency Response Plan to be followed during the emergency is give in Table.7.6.

**Table No. 7.6 Emergency Response Plan**

Emergency	Action
Fire	✓ On noticing the fire or smoke, associates will call security at Extension. number or inform to rescue team. In case the telephone is not accessible then the person will rush to the security to inform. ✓ Using the Panic Alarm, the security at the gate will sound a short 5 second alarm. ✓ On Hearing the short Alarm, the ERT & security guard will contact security at Gate & get to know where the emergency is & rush to the spot. ✓ On the spot assessment is done by the ERT member & if the fire is of the magnitude that requires external help, then they will call security at main gate to sound the panic alarm continuously which is a signal for evacuation. ✓ On Hearing the Alarm all associates to stop the work they are doing. Switch off the computers/machines & move in orderly fashion to Evacuation spots Le. Gate. ✓ Security personnel at gate will take head count & tally it with the incoming personnel register. ✓ ERT along with Security officer & security guards will mean while continue control measures. ✓ The security supervisor will call up the fire station for help. ✓ In case of any injury Security supervisor to inform Doctor & call for Ambulance. ✓ Security Supervisor will inform project Manager
Flood	✓ Switch Off Power Supply ✓ Open all drain doors. ✓ Remove obstruction of drains ✓ Inform the external crisis Management Team
Fall from heights	✓ immediately after first aid Personnel. ✓ In case of fall from height. Do not attempt to move the person. improper handling may cause permanent damage like paralysis, ✓ Get the victim to talk & ask him to move the fingers & toes of his legs. If he is able to do so, make arrangements to shift him to hospital. If he is unable to move his fingers & toes, do not move him. Call for trained medical help like a doctor immediately. ✓ Get a stretcher & keep parallel to the victim. Now with 3 persons gently lift him by g_ 10 inches above the ground & transfer him to the stretcher. Make sure his head, neck Spine is properly supported & kept straight. ✓ Take him to hospital in the Ambulance.
Electrical Shocks	✓ Disconnect all power connections Electrical Shocks ✓ Do not touch the victims' body with bare hands, using rubber gloves move the body away from the live conductor. If required using a wooden handle raise the body & pull away any wires below the body. An additional precaution that may also be taken is.to stand on a thick newspaper. ✓ Check if the person is breathing or not 4. Send for medical help immediately. ✓ If breathing is stopped then lay the victim on the floor face down, preferably on dry floor. Turn the face to one side & keep arm stretched above his head. ✓ Promote artificial resuscitation
Earthquake	✓ Switch off the main power system if possible 2. Stay where you are and cover your head for protection. Stay where you are it cause less likely
Bomb Threat & Explosion	✓ Inform Plant TOP Management available at the time. ✓ Inform Police and ensure that they reach office premises.



	✓ Inform security agency & immediately strengthen security & patrolling. ✓ inform Emergency Management Team ✓ Don't touch any suspicious material
Information & data tampering	✓ Whenever an important data is lost or tampered, inform the respective HOD. ✓ identify the availability of the back-up supports from EDP
Lightning strike & Cyclone	If Indoors: ✓ Get inside a home, building, or hardtop vehicle. Although injuries may occur if a vehicle is struck, a person is much safer inside the vehicle than outside it. ✓ Avoid showering or bathing as metal bathroom plumbing and fixtures can conduct electricity causing shock or electrocution g. ✓ Use a corded phone only for emergencies - cordless and cellular telephones are not safe to use. ✓ Unplug appliances and other electrical items such as computers, stereos, televisions and air conditioners etc. power surges can cause serious damage. ✓ Use a battery-operated radio for weather updates. If outdoors: ✓ Avoid objects that can act as a lightning rod. ✓ Seek shelter in a low-lying area such as a ravine or valley. ✓ Be alert to the possibility of flash floods. ✓ Remember that when hair stands on end (anywhere on the body) it is an indication that Lightning is about to strike - when this happens, squat down minimizing contact with the ground. ✓ Do not lie flat on the ground. Cyclone: ✓ Monitor local broadcast media for emergency information and instructions. ✓ Do not drive into flooded areas I. If floodwaters rise around a vehicle, abandon it.
Workplace Violence	In the event that a situation@ more persons threatens anyone with any type of weapon (i.e., knife, firearm, club, etc.) the following actions should be taken: ✓ Contact Security and state the nature and location of the situation and the number of people involved. ✓ DO NOT sound the fire alarm. ✓ Evacuate the immediate area as soon as possible without exposing anyone to any danger. ✓ Do not attempt to confront or disarm.
Thefts	✓ identify the Property and place. ✓ Contact Security and in-charge of workplace/office and to the Project Manager. ✓ Complaint to the police
Burst of LPG Pipeline	✓ The trained operator staff or gas supply company staff arriving at the scene of an emergency first shall take immediate action to protect people and property These immediate actions may include the following: 1. Determine the scope of the emergency in order to ensure proper reaction, ✓ Cordoning off the area where required. ✓ Preventing accidental ignition. ✓ Reporting to the appropriate supervisor on the situation, and requesting further Instructions or assistance where needed, and ✓ Shutting off LPG supply to the area (e.9. by closing isolation valves where the affected area is downstream of the valves) ✓ When tackling a fire or a leak, the personnel shall approach the fire or the leak from the upwind position.



Gas Leakage in LPG Installations Without Fire	✓ Trained personnel should only carryout the Job ❖ When the extent of gas leak is minimal i.e., no vapor cloud has already been formed, the following actions shall be taken: ✓ Locate the source of leakage. The detection may be made by visual inspection, soap test, smell, noise or refrigeration (hoarfrost) at leak source; never use naked flame. ✓ When leak source is ascertained, whenever possible, isolate, close or plug the leak by non-flammable means. Care shall be taken not to generate any spark during the operation. ❖ When the leak cannot be controlled or where a vapor cloud has already been formed such that it is unsafe to enter the compound or store to locate and stop the leak, the following actions shall be taken: ✓ When safe, remove all ignition hazards in the vicinity, extinguish fires and naked light, switched off (remote from source of leakage) electrical equipment and vehicle engines. In the affected areas, telephone shall not be used. ✓ isolate the area around the gas leakage and inform the police to evacuate all persons from the area. ✓ When a fire fighting water spray system is available, the personnel on site shall actuate the system to disperse the gas cloud. ✓ When LPG Road tanker is in the LPG compound, stop all operation, close all valves and remove the road tanker where situation allows. ✓ For cylinder stores where the leaks are from cylinders, the leaking cylinders shall be identified. Where the leakage cannot be stopped by closing the cylinder valve, remove the cylinder to a safe place where the contents may disperse to the atmosphere. ✓ Any LPG cylinder wagon next to cylinder store should be removed in a safe manner.
Burst of LPG Pipeline	Gas Leakage in LPG Installations with Fire ❖ Where there is a small fire, the first person on site shall then take the following actions: ✓ For LPG fire, extinguish the fire by isolating or shutting off the gas supply to the fire. ✓ Do not put out a leaking LPG fire without cutting off the gag supply to the fire. ✓ For fire that does not involve LPG. extinguish the fire-by-fire extinguishers or other means. ✓ Where the fire is severe, cannot be extinguished or is not appropriate to extinguish, call "100" and then try to tackle the fire. ✓ Actuate the water spray system, where available. To cool the equipment such as vessels or vaporizers. ✓ Where there is a sign of possible rupture of vessels, all personnel shall be evacuated immediately. Signs of possible rupture include sudden increase of noise and sudden increase in flow rate of vented LPG or flame. ✓ Special attention shall be given to direct flame on vessels, as this will increase the pressure and at the same time weaken the metal. ✓ Every effort shall be made to extinguish the source of flame impingement. In all cases of exposure, copious supply of water in the form of spray or fog shall be applied in order to' keep the vessel cool to minimize the danger of rupture, and also to regulate the rate of gas generation, so reducing the intensity of fire. ✓ For cylinder stores, where bursting of cylinders is not imminent, they shall be removed to a place of safety or, alternatively, where such an action is not possible, ✓ Cylinders shall be kept cool by applying I adequate quantities of water by jet or spray.
Terrorist Attack	✓ Don't be panic. ✓ Stay Calm and quiet. ✓ Shelter in the safe place ✓ Security personnel/ Working Staff have to inform to the police (If possible only



7.3 Issues raised in the public consultation along with action plan and commitment of the project proponent

The project is proposed to provide irrigation facilities to the command area of 2,20,000 acre (89031 ha) covering districts of Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon in Telangana state. In this connection the environmental public hearing for EIA & EMP Report for Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir from 1.410 TMC to 8.23 TMC was conducted at eight districts on 16.10.2023 & 17.10.2023 at 11.00 am in the different premises of 8 districts in Telangana state. The venue and date of Public Hearing conducted in eight district is in given in Table 7.7

Table 7.7 Venue and Dates of Public Hearing

Sl.No.	Date	District	Public Hearing Location
1	16.10.2023	Siddipet	11:00AM, Shubham Gardens, Potharam (V) Husnabad (M), Siddipet District.
2		Peddapally	11:00AM, Gram Panchayath Office premises, Pattipaka (v), Dhramaram(M), Peddapalli District
3		Nizamabad	10:30AM, Pump house premises of Mupkal(v), Balkonda(M) of Nizamabad District
4		Hanumakonda	11:00AM, SS Function hall, Shodaspalli(v), Velair(M), Hanumakonda District
5	17.10.2023	Karimnagar	11:00AM, Sri Venkateshwara kalyna mandapam, Timmapur (M), Karimnagar District
6		Jangaon	11:00AM, Raythuvedika, Chagal (v) Station Ghanpur(M), Jangaon District
7		Jagtial	11:00AM, Rampur pump house, Malyal (M), Jagtial District
8		Sircilla	11:00AM, Rythuvedika, kodurupaka(v), Boipalli(M), RajannaSircilla District

The press notification indicating the date and venue of the Public hearing was published by Environmental Engineer, T.S. Pollution Control Board, Regional Office, of respective districts in the prominent newspapers like Telugu Daily Newspaper and English Daily Newspaper. The detail of date of PH notification, newspaper published is given in Table 7.8. (The copies of the notification in Telugu and English Daily is enclosed as **Annexure 7D** and public hearing minutes as **Annexure 7E**) with project details inviting suggestions, views, comments and objections from the public regarding the FFC from SRSP with expansion of Gouravelly Reservoir from 1.410 TMC to 8.23 TMC of I&CAD department..

Table 7.8 Date of PH notifications, newspaper published

Districts	Date of PH notification	Telugu and English newspaper
Siddipet	13.09.2023	Eenadu and The Hans India
Peddapally	13.09.2023	Namaste Telangana & Time of India
Nizamabad	14.09.2023 & 15.09.2023	Namaste Telangana & The Hindu



Districts	Date of PH notification	Telugu and English newspaper
Hanumakonda	13.09.2023 & 15.09.2023	Eenadu and The Hans India
Karimnagar	13.09.2023	Eenadu and The Hindu
Jangaon	13.09.2023	Sakshi & The Pioneer
Jagtial	13.09.2023 & 16.09.2023	Sakshi & The New Indian Express
Sircilla	13.09.2023	Namaste Telangana & Telangana Today

Public hearing issues and proponent replies are given in **Annexure 7F**. Public hearing is photos given in **Annexure-7G**. Public hearing meeting was convened by respective 8 Districts, Environmental Engineer, T.S. Pollution Control Board, Regional Office, and Chaired by Additional Collector/ Additional Magistrate/ District Magistrate of respective 8 Districts of Telangana State. The Detail of Chairman of Public hearing and Environmental Engineer are given in Table 7.9.

Table 7.9 Detail of Chairman of Public hearing and Environmental Engineer

Districts	Representative of District	Representative of TSPCB
Siddipet	Sri.P.Srinivas Reddy, Additional Collector & Additional district magistrate	Sri.Kumar Pathak, Environmental Engineer
Peddapally	Sri.Ch.Madhu Mohan, Revenue Divisional Officer	Sri.B.Bhikshapathi, Environmental Engineer
Nizamabad	Sri.P.Yadi Reddy Additional Collector	Sri.G.Laxman Prasad Environmental Engineer
Hanumakonda	Sri. Ch.Mahender Ji, Additional Collector & Additional district magistrate	Smt.R.Sunitha, Environmental Engineer
Karimnagar	Sri.P.Pavan Kumar, District Revenue Officer	Sri.B.Rajender, Environmental Engineer
Jangaon	Sri.Rohit Singh, Additional Collector & Additional district magistrate	Smt.R.Sunitha, Environmental Engineer
Jagtial	Smt.B.S.Latha, Additional Collector	Sri.B.Bhikshapathi, Environmental Engineer
Sircilla	Sri.Kheemya Naik, Additional Collector	Sri. D.Narender, Senior Environmental Engineer

The respondents from nearby residents, representatives of NGO's, Corporator, Sarpanch, ZPTC, MPP, Gram Panchayat members, Local leaders etc. have expressed their view and opinion in the public hearing. Major issues raised during the Public hearing process along with the timelines and monetary provisions are given below in **Table No. 7.10**.



Table 7.10 Major issues raised during the Public hearing

S.No	Issues Raised during public hearing	Clarifications given by the project proponent	Time Lines	Monetary provision in Rs. lakhs
1	Employment			
	To provide employment opportunities to those who lose their lands	By implementation of this project agriculture productivity is increased. There by job opportunities and self-employment will be created in all the fields related to agriculture	--	
2	Land Acquisition			
	To provide suitable compensation to land losers	The land compensation was paid to land losers as per the LA Act, 1894, LARR Act, 2013, Telangana amendment act, 2016 from time to time	---	
3	Water supply & Drinking			
	To prevent water scarcity in their villages and control mosquitos from seepage of water from reservoir due to which people are facing lot of health problems	The mosquito problems can be resolved through fogging and other sanitation precautions. However, at present the state Government is also conducting sanitation drives in the Gram Panchayats to control the diseases caused by mosquitoes.	Frequently	
4	Environmental measures			
	To control pollution	I&CAD will be taking up all the pollution control measures in order to minimize the pollution during construction & operation phase as per EMP.	Regularly	--
5	CSR Funds			
	The village should be adopted and the youth should be encouraged through CSR funding, and jobs should be given	CSR activities will be taken in near villages	Every Year	As per CSR policy of the company



7.4 Status of any litigation /court cases

The present proposal is expansion of Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir. In this proposed project Gouravelly Reservoir was expanded from 1.410 TMC to 8.230 TMC without prior environmental clearance and attracted violation under E(P) Act 1986, as per the MoEF&CC S.O 804(E), dated 14.03.2017 and in the ToR granted for the proposed project SEIAA advised the State Government/SPCB to take action against the project proponent under the provisions of section 19 of the Environment (Protection) Act, 1986. The statement showing the details of Pending WPs Pertaining to Gouravelly Reservoir in Husnabad Division is enclosed as **Annexure -7H**.

The SEIAA has initiated the process of credible action plan and sent a letter to EF&ST, Government of Telangana. Enclosed as **Anenxure-7I**.

8

PROJECT BENEFITS

8.0 Introduction

The Indiramma Flood Flow Canal Project from SRSP is conceived with an objective of irrigating 2,20,000 acres of ayacut in the drought prone areas of districts of Nizamabad, Jagtial, Karimnagar, Rajanna Sircilla, Siddipet, Janagoan, Peddapally and Hanmakonda (erstwhile Karimnagar and Warangal districts) in Telangana region duly utilizing 20 TMC of flood water of Godavari River from foreshore of Sri Ram Sagar Project

Providing assured irrigation is the only sustainable solution to improve the health of the agricultural industry. Irrigation to the dry agriculture lands should ensure successful farming to save the poor farmers from the past agony and improve their livelihood. By providing irrigation the government should be in a position to fulfil the promise made to the people of Telangana and also improve the State GDP. It should not only be a boon to the farmers but also provide gainful employment to the farm labourers who were compelled to migrate to far off places to earn their bread, leaving the old and the young members of the family to face the hardship.

In addition to irrigation there should be improvement in the availability of drinking water which has assumed a major problem to the people due to drying of water bodies and failure of tube wells in the present conditions. The recharge of ground water should improve the availability of ground water and consequential benefits with the improvement of water potential in the command area there is going to be improvement in the quality and quantity of water resulting in improvement in the production of fish that should improve the fish intake of the poor and also commercial viability to the fisherman community. Improving the income of individual farmers and others should provide economic stability to districts in the command area and contribute to the economic and social objectives of the Telangana State.

The proposed command area 89031 ha of land should be cultivated in the drought prone districts of Telangana State. District wise breakup of the command area is given in the following table.

Table 8.1 District wise breakup of command area

S.No.	District	Command area	
		hectares	acres
1	Peddapally	1214	3000
2	Rajanna Sircilla	3759	9289
3	Jagtial	708	1750
4	Karimnagar	42368	104692
5	Siddipet	16345	40389
6	Hanumakonda	14996	37056
7	Jangoan	9641	23824
	Total	89031	220000

8.1 Project benefits

The project provides both direct and indirect benefits contributing to overall area development in its command.

8.1.1 Direct benefits

1. Incremental Crop Production

The development of proposed project would allow intensive farming of 89031 ha of area. Irrigation will also allow full use of the land which is not cultivated under current farming

practices. The incremental production of crops from the developed land would be the benefit to the society. In addition, extra production will contribute to local food grains supplies and reduce regional and national food grains deficits.

Benefits without and with project

Item	Without Project	With Project
Cropped area in Ha	81000	93567
Net value of Produce in lakhs	11819	116894

2. Increased Employment

The implementation of Irrigation scheme will create employment opportunities in the project area. The construction phase of proposed project would require deployment of massive machinery/equipment and thus need a large number of skilled, semi-skilled and unskilled workers. During operation stage of the project, manpower will be required to operate the gates during flood as also during normal operation, to manage toll plazas and approach road of barrage and road over flood protection embankment. An assured water supply for irrigation will also require semi-skilled and unskilled workers.

The employment is associated with improved farming practices of the irrigation scheme. With irrigation additional farm labour would also be required as a result of higher cropping intensity through double cropping providing employment opportunities to local people within and outside the vicinity of the project area.

3. Increase in ground water recharge

The recharging of minor irrigation sources, filling of desilted tanks under Mission Kakatiya, filling up of the reservoirs under the project and flow of water through the canals would recharge the ground water and raise the ground water level. With the government assurance to provide uninterrupted power supply for agriculture it will give boost to additional cultivation area under bore wells.

4. Increase in fish production

Reservoir will provide an excellent opportunity for development of fisheries which ultimately leads to financial up-lift of people of command area. The filling of water bodies will give boost to Pis-ciculture and improve the economy of the fishing community. Telangana has the third largest inland water resource base in India for fisheries with 77 large, medium and minor reservoirs and about 24,189 tanks with 5.7 lakh ha water spread area suitable for fisheries. Aquaculture is in more than 1000 ha area. A rich human resource pool of 27.14 lakh population comprising of fishermen communities who are organized into about 4000 Fishermen societies with about 3 lakh members spread over the entire state.

To utilize the available water resources by stocking with quality fish seed in all reservoirs, tanks and ponds, upgrading the skills of fishers & fish farmers, providing back ward & forward linkages and creation of infrastructure.

Growing visibility of fisheries sector due to enhanced water resources on construction and completion of irrigation project is expected to lay a strong foundation for aquaculture in the canal fed areas besides emerging as an attractive investment option and a lucrative business activity.

5. Drinking water facility

In addition to giving water to command area (part of 7 districts) under the project it will also supply drinking water to the villages.

8.1.2 Indirect Benefits

1. Poverty Eradication/Food security

Improved crop production through the commissioning of the proposed irrigation scheme will increase farm income in the project area. Food supply will increase and there will be cash income available for food or other purchases.

2. Risk benefits

Project Districts Administration vis-a-vis State Govt. risks are considerably reduced through irrigation and the higher cropping intensities will protect the authorities against shortfall in crop production. With the existing population structure and its rapid growth in the project area, the long-term benefits from irrigation are even more important. Reliable water supplies along with improved package of agricultural practices may encourage farmers to go for round the year crop production to take advantage of market conditions.

3. Transfer of Technology

Project Districts Agricultural Departments will be in a sound position to introduce modern agricultural technology and farming practices to retain the fertility status of the soil with the installation of the irrigation scheme. This may also serve as a demonstration to other farmers in the region.

4. Health and Nutrition

Increased cash income resulting from increased crop production and employment opportunities would result in higher per capita consumption of a greater variety of food items. This in turn will improve the nutrition levels of the people in the project area.

5. Environmental Facility

The irrigation scheme will improve the overall environmental and ecological situations in the project area which in turn will reduce the health hazard. The proposed project is expected to provide employment for local people in different activities such as construction, transportation and plantation activities during construction phase and subsequently in agro, aqua and ancillary industries. The total manpower requirement for the construction period is 700. Skilled persons will be hired on the basis qualification and experience.

6. Tourist Place:

All the reservoirs constructed will provide excellent picnic spots resulting in the development of tourism. Tree plantation can be taken up extensively all along the boundary of the reservoir as well as in the catchment areas of the reservoirs to arrest the flow of silt and prevent the breaking up of land all along the banks of the reservoirs due to water thrust.

The filling of water bodies, availability of fishing facilities and improvement in forest vegetation combinedly will give boost to tourism opening another source of employment to the youth and improvement in rural economy. In addition to the scenic beauty the reservoir can provide plenty of fish that can add to the satisfaction of tourist who eat fish.

8.1.3 Other Benefits:

- Community wise professional resources increases (like toddy trees etc.).
- Increased crop production will increase employment in import industry (backward linkage) and output processing industry (forward linkage).
- Water availability will increase farm forestry, the fodder production giving boost to animal husbandry and will make the government programme of sheep distribution successful.

- The water will also be made available for industrial sector giving scope to set up industries that were starved of water. Industrial development in the district will provide employment to the frustrated youth and improve their economy.
- Apart from this there would be improvement in flora and fauna and successful implementation of the government programme of Hartitha Haaram due to availability of water to the young plants. With this air and environmental quality will improve.
- With the above advantages the livelihood of the people will improve. The children will be able to go to school. With better water and food, the health of the people will improve. There will be economical and social transformation in the villages fulfilling the government objective of forming the State of Telangana.

The project is therefore, economically viable.

9

COST BENEFIT ANALYSIS

9.0 Introduction

The purpose of the economic analysis is to assess the real costs and benefits without distortions due to subsidies, quotas or other factors influencing the value of the products and services. The financial analysis is based not on economic values or shadow prices but on the prices observed in the market. In the analytical system followed for this project, the “with” and “without” situations are compared based on constant prices at current levels.

Project analysis has been carried out to cover the total project period from the year of the start of the construction of the project. The year wise net incremental return in the “with project situation over without project situation” has been computed.

The benefit-cost (B.C.) ratio has been assessed on the basis of the annual benefits from enroute irrigation and water supply for domestic use against the annual apportioned cost of the water consumed enroute the link, inclusive of the transmission losses.

9.1 Estimation of Annual Benefits

The CWC has accorded clearance to Flood Flow Canal project in its 64th Technical Advisory Committee (TAC) meeting held on 30.03.1996 for an estimated cost of Rs. 1331.30 Crores (S.S.R. 1992-93). The value of agricultural production in the area to be irrigation under pre project conditions is estimated as Rs.1320 Lakhs . The value of agricultural production in the area after completion of the project is estimated as Rs.36,546 lakhs.

The above estimation is based on the yield per acre of crops price as furnished by Agricultural Department.

The above figures are value of the produce. After deducting the inputs, the net value of production before the project is Rs.466 lakhs and after the project is Rs.22, 290 lakhs giving a net benefit of Rs.21,698 lakhs as given in BC ratio calculation. The Benefit cost ratio is computed is given in Table 9.1.

Table 9.1 Estimation of Benefit Cost Ratio for Total project

I	Annual Building:	
i	Value of produce with project	22,290.00
ii	Value of produce without project	(-) 466.00
iii	Loss in agricultural production in the cultivated portion of the project area due to submergence on the balancing reservoir and canal system for 44000 acres for gross value of produce on	(-) 126.00
A	Total (i+ii+iii)	21698.00
II	Annual Cost:	
i	Interest at the rate of 10% on the estimated cost of project including the cost of land development and cost of bore wells, dug wells for exploration of ground water	13,873
ii	Depreciation of project at 1% of civil works	1308.00
iii	Depreciation of pump sets @ 6.2/3% on cost of bore well - 177/2 lakhs	59.00
iv	Working expenses on pumping system	850.00
v	Annual maintenance and operational charges @ Rs.180 per hectare for 89020 ha	160.00
vi	Maintenance of head works @ 1% of cost on 35877 ha	359.00



vii	Repair and replacement charges @ Rs.200 per pump for 5697 pumps used for ground water exploration	11.00
viii	Charges for power @Rs.100 per hectare for 12644 ha (Ground nut)	13.00
B	Total	16633.00
III	Benefit/cost ratio A/B	=1.328

The Benefit – Cost Ratio works out to 1.328 as per DPR.

Flood Flow Canal (FFC) project originally cleared in the 64th TAC of CWC, Dt 30.03.1996.

The area benefitted by way of providing irrigation facilities under the scheme is 89,031 hectares (2.20 lakh acres) in parts of drought prone areas of districts of Nizamabad, Jagtial, Karimnagar, Rajanna Siricilla, Siddipet, Janagoan, Peddapally and Hanmakonda (erstwhile Warangal Urban) districts which are chronically drought affected and backward.

The benefits cost ratio works out to 1.328 against the minimum of one required for projects in drought affected areas to be economically viable.

The Benefit – Cost Ratio for Gouravelly Reservoir

The I&CAD as prepared Benefit – Cost Ratio for expansion of Gouravelly 8.23 TMC and arrived at 1.87. (Which need to be approved by competent authority). The B.C. Ratio is calculated based on the net agricultural benefit.

	Project cost in Cr	1639.08	
	BENEFIT COST RATIO (BCR)	Prop. Command Area : 48561 Ha	
S.No	Description	Before Irrigation(With out Project)	After Irrigation (With Project)
		Amount in Lakhs	
A.	GROSS RECEIPT		
1	Gross value of farm produce	24453.30	84201.86
2	Dung receipts (as 30% of the fodder expenditure)	1100.00	2526.06
3	Total (A) : Gross Receipt (1+2)	25553.30	86727.92
B	EXPENSES :		
1	Expenditure on seeds	809.58	8194.67
2	Expenditure on manure etc	12171.68	3819.32
3	Expenditure on hired labour (human and bullock)	4218.14	9760.76
	Without Project with Project		
4	Fodder expenses 15% of Item A.1 10% of Item A.1	3667.990	8420.190
5	Depreciation on implements 2.7% of Item A.1 2.7% of Item A.1	660.000	2273.450
6	Share and Cash rent 5% of Item A.1 3% of Item A.1	1222.700	2526.060
7	Land Revenue 2% of Item A.1 2% of Item A.1	489.070	1684.040
8	Total (B) : Expenses (1 to 7)	23239.16	36678.49



C	NET VALUE OF PRODUCE		
1	Total Gross receipts (Total A.3)	25553.296	86727.920
2	Total expenses (Total B.8)	23239.16	36678.49
3	Net Value of Produce (C) : (1-2)	2314.14	50049.428
D	ANNUAL AGRICULTURAL BENEFITS		
1	Net value with project (C.3)	50049.43	
2	Net value without project (C.3)	2314.14	
3	Net Annual Benefits (D) : (1-2)	47735.29	
E	(i) from Fish production	0.00	
	(ii) from Power production	0.00	
	(iii) from Water Supply		
	a) Domestic	0.00	
	b) Industrial	0.00	
F	Total Net Annual Benefits (D.3 + E) in Lakhs	47735.289	
G	ANNUAL COSTS :		
	(i) Total cost of the project	163908	
	(ii) Land Development Cost @Rs 20000 per Ha	9712	
1	Interest on capital @ 10% estimated cost of the project with Land Development cost		17362
2	Depreciation Cost at 1% on estimated cost of the project		1639.00
3	Annual operation and maintenance charges @ Rs.1175 per ha of CCA /Annual Irrigation ,whichever is more		570.59
4	Maintenance of the head works @ 1% of its H/W less Land		1483.64
5	Depreciation of the pumping system @ 8.33% of the Estimate Cost of the Pumping System the life of the system as 12 years (Applicable to lift irrigation)		0.00
6	Depreciation of the raising system @ 3.33% of the Estimate Cost of the Pumping System the life of the system as 30 years (Applicable to lift irrigation)		0.00
7	Power charges @ Rs.6.30 per KVAH for 704 MW		4499.71
8	Total(G) : Annual Costs (1 to 7)		25554.97
	BENEFIT COST RATIO = (Annual Benefits / Annual Costs) =	<u>47735.289</u>	1.87

The project is therefore, **economically viable**.



ENVIRONMENTAL MANAGEMENT PLAN (EMP)

10.0 Introduction

The Environmental Management Plan (EMP) covers the design, construction, commissioning, operation maintenance phases of each project component. The EMP identifies the key environmental issues across the project provides strategies and plans for managing them effectively. It also defines the legal requirements for the project and identifies the regulatory permits and licences required for construction activities. It mainly deals to ensure that the project is implemented in an environmentally sustainable manner where all contractors and subcontractors, including consultants, understand the potential environmental risks arising from the proposed project and take appropriate actions to properly manage that risk by taking appropriate mitigative actions to reduce adverse environmental impacts during its life cycle.

The EMP outlines existing and potential problems that would impact the environment and recommends corrective measures where required on the following lines:

Aspects of Environmental Management Plan

- i. Catchment Area Treatment Plan,
- ii. Command Area Development Plan,
- iii. Biodiversity Conservation & Management Plan,
- iv. Resettlement & Rehabilitation,
- v. Green Belt Development Plan,
- vi. Fisheries Conservation and Management Plan,
- vii. Reservoir Rim treatment Plan,
- viii. Muck management and restoration of quarry sites,
- ix. Water, Air and Noise Management Plans
- x. Groundwater Management Plan
- xi. Agricultural Improvement Plan
- xii. Public health delivery Plan,
- xiii. Sanitation and Solid waste Management plan,
- xiv. Local Area Development plan.
- xv. Environment safeguards during construction activities including road construction,
- xvi. Energy conservations Measures



10.1

CATCHMENT AREA TREATMENT (CAT) PLAN

10.1.1 Introduction:

It is a well-established fact that reservoirs formed on rivers are subjected to sedimentation. The process of sedimentation embodies the sequential processes of erosion, transportation, deposition and compaction of sediment. The study of erosion and sediment yield from catchments is of utmost importance as the deposition of sediment in reservoir reduces its capacity, and thus affecting the water availability for the designated use. The removal of top fertile soil from catchment adversely affects the agricultural production. Thus, a well-designed Catchment Area Treatment (CAT) Plan is essential to ameliorate the above-mentioned adverse process of soil erosion leading to subsequent reservoir sedimentation.

The **SriramSagar Project** (SRSP) is also known as the Pochampadu Project is a flood-flow project on the Godavari. The Pochampadu site was located 54.50 km below the entry point of Godavari River into Telangana. The foundation was laid on 26 July 1963 by late Jawaharlal Nehru, first Prime Minister of India. Construction of the Sriram Sagar Project (SRSP) on River Godavari was started in 1957 and completed in 1977 to irrigate 5.7 Lakh Acres (2,30,769.23 ha) up to Manair valley under right bank canal named as Kakatiya Canal.

It also provides drinking water to Warangal city. There is a hydroelectric plant working at the dam site, with 4 turbines each with 9 MW capacity generating 36 MW.

The Pochampadu project was renamed as Sriram Sagar Project(SRSP), The Reservoir was first filled to its fill capacity i.e. (+)1091 ft in the year 1983.

SRSP project with a storage capacity of 112 TMC serves Kakatiya Canal, Laxmi Canal, Saraswati Canal, and Flood flow canal. Most of the catchment area upstream of SRSP is a part of Maharashtra. During the last four decades SRSP reservoir catchment area treatment was not implemented. A survey conducted in 1983 revealed that the storage capacity had reduced to 90 TMC due to the accumulation of silt in the reservoir. During 2014 the hydrological investigation revealed that the storage capacity has reduced to 80 TMC. The study, which was conducted by the irrigation department, revealed that silt had accumulated from flows received from Maharashtra. The CWC conducted studies on the SRSP and found results regarding its storage capacity to be alarming. Catchment area treatment is the only action to prevent further silt accumulation into SRSP. There is an immediate need for the implementation of catchment treatment and remove the silt to bring back the contemplated storage capacity. Ultra-modern dredging machines need to be used to have the silt removed and improve the storage capacity of SRSP reservoir. Govt. of Telangana has initiated efforts to restore the project by launching the SRSP Rejuvenation Project.

The Catchment Area Treatment (CAT) plan highlights the management techniques to control erosion in the catchment area. Life span of a reservoir in case of a seasonal storage reservoir is greatly reduced due to erosion in the catchment area. Therefore, for sustainable life of irrigation projects with least negative impact on the environment, watershed management plays a pivotal role.

In order to minimise the siltation of Mid Manair reservoir and the Gouravelly reservoir, the watershed management programme involving extensive soil conservation measures in the catchment area need to be undertaken. Watershed management initially involves collection of information on a wide range of parameters of static and dynamic nature related to

- geology,
- hydrology,



- soil,
- geomorphology,
- topography,
- drainage conditions,
- land use / land cover,
- climate, etc. required for formulation of detailed and comprehensive Catchment Area Treatment (CAT) Plan.

The Catchment Area Treatment (CAT) Plan mainly focuses on:

- Mitigation measures for the erosion of the catchment and landslip hazards resulting from the irrigation project activities.
- The problem of silt and debris load to river from the susceptible areas of the catchment.
- Checking the sediment load from the tributaries directly discharging into the reservoir.
- Protecting the directly draining catchment from scouring / sloughing and slips.

The catchment area of Mid Manair reservoir and Gouravelly reservoir receives precipitation in the form of rainfall. Generally, the factors responsible for siltation are slope of the land together with the surface run-off, underlying rock/soil characteristics, vegetation aspects, etc. There are some dense vegetated areas in the catchment area of Mid Manair reservoir.

In order to formulate the treatment plan, it is essential to identify areas prone/vulnerable to erosion and estimate the extent of soil erosion that is taking place in the catchment area. Various factors that are responsible for soil erosion have been studied for the formulation of the catchment area treatment plan.

10.1.2 Drainage

The drainage system is the prime transport channel for the sediments as well as an important natural factor causing land degradation. IFFC project from Sri Ramsagar Project (SRSP) with expansion of Gouravelly reservoir is to irrigate an ayacut of 89,031 Ha (2,20,000 acres) in the upland drought prone areas of Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon (erstwhile districts of Karimnagar, Warangal and Nalgonda) districts in Telangana region duly utilising 20 TMC of flood water of Godavari River from the fore shore of SRSP reservoir.

IFFC project from Sri Ramsagar Project (SRSP) consists of

- FFC Canal :122km.
- Reverse lift pump houses: 3 number.
- MMR Canals:103.375km.
- Tunnel – 11.98 km.
- Pump house: 3 x 32MW(3x19cumecs).
- Gouravelly Canals:63.725 km.
- High Level Canals:20.845 Km
- Mid Manair Reservoir: 25.873 TMC; catchment area is 1,78,490.25 ha(1784 Sq.Km).
- MMR Command Area: 40,470 ha (1,00,000 acres).
- Gouravelly reservoir: 8.23 TMC; Command Area: 48,561 ha (1,20,000 acres) in Karimnagar, Siddipet, Hanumakonda and Jangaon Districts and catchment area is 505.83 ha.

The State of Telangana is blessed with major rivers and their tributaries, but occurrence of drought is causing tremendous adverse impact on food production besides yielding substantial loss of fertile topsoil wealth.



Watershed is a natural hydrologic entity that encompasses a specific area stretch of land surface where rainfall runoff flows into a specific defined drain be it a channel/nala, small stream or a river. The Watershed Atlas of India (2014) published by Soil and Land Use Survey of India (SLUSI) has been used for delineation of watersheds in the catchment area of Mid Manair reservoir and Gouravelly reservoir.

For example, 4E2A1/1 connotes:

- 4: Region (rivers flowing into Bay of Bengal)
- E: Basin (Godavari)
- 2: Catchment
- A: Sub catchment
- 1: Watershed
- 1/1 Sub-watershed

The Manair river is a tributary to the Godavari River in Telangana. The Lower Manair Dam built across this river provides drinking water to Karimnagar, Telangana and also to the NTPC power plant at Ramagundam. Mid Manair Dam was constructed at Manwada village near Sircilla, and upper Manair Dam was constructed during Nizam period near Narmala village in Gambhiraopet mandal of Rajanna Sircilla district.

Mid Manair Reservoir is a major irrigation project across the Manair river at Manwada Village, Boinpalli Mandal, Rajanna Sircilla district, Telangana. It has a capacity of 25.873 TMC with 25 radial gates. It has a capacity to irrigate 2,00,000 acres (80,971.65 ha). The project was completed in April 2018.

The assessment of erosion and sediment yield from Mid Manair Reservoir catchment is of utmost importance as the deposition of sediment in reservoir reduces its capacity, thus affecting the water available for the designated use at Gouravelly reservoir. Thus, a well-designed Catchment Area Treatment (CAT) Plan for Mid Manair Reservoir is essential to ameliorate the above including process of soil erosion. The catchment area of Mid Manair Reservoir is 1,78,490.25 ha (1784 Sq.Km) approx.

The total catchment area of the Gouravelly reservoir is 505.83 ha. The direct draining catchment comprises of two sub-watersheds (4E2B1/2 and 4E2B1/3) upstream of Gouravelly reservoir. The catchment area and watershed maps are given in **Figure 10.1 (a&b)**.

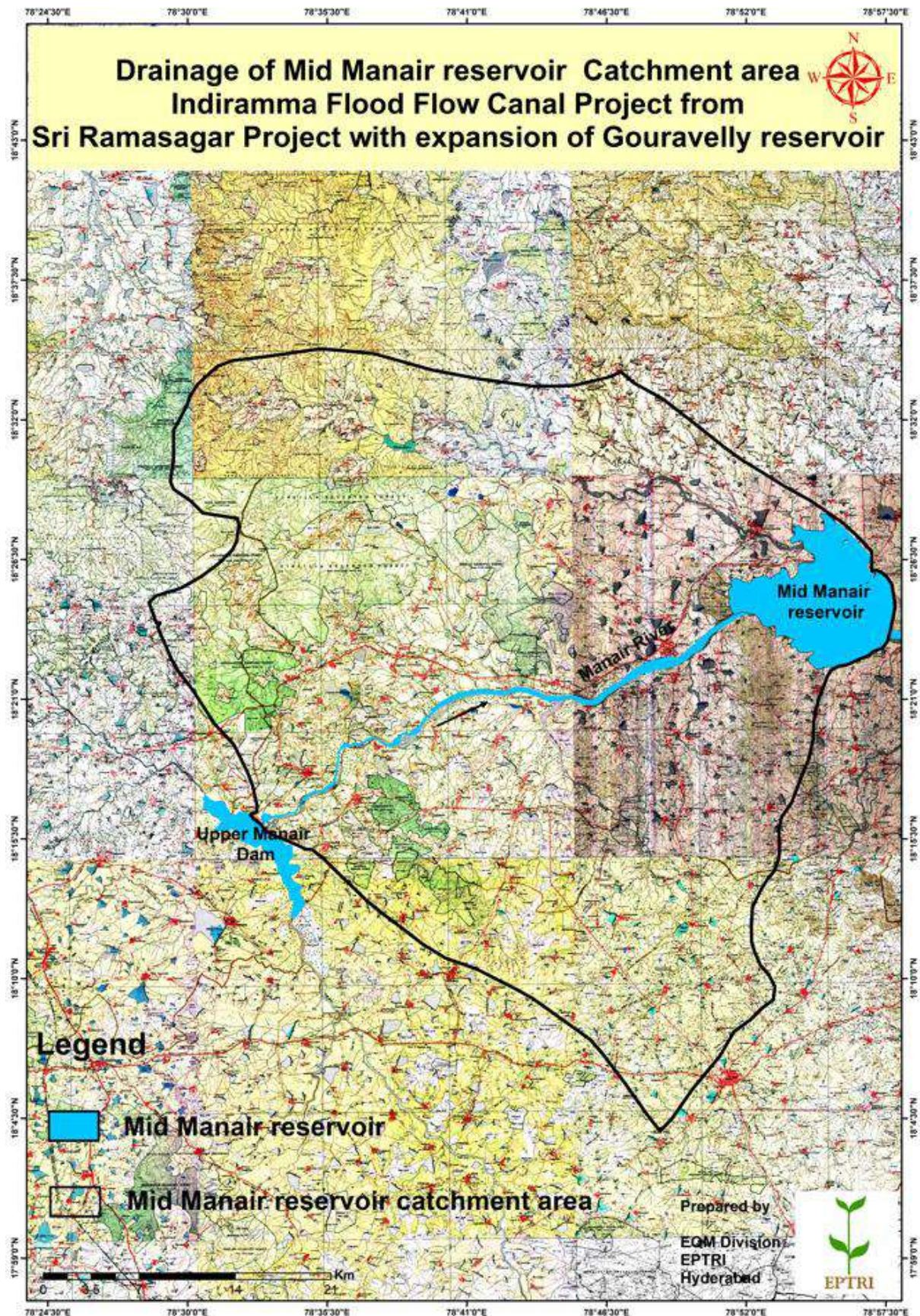


Fig 10.1 (a) Catchment area and watershed map of Mid Manair Reservoir

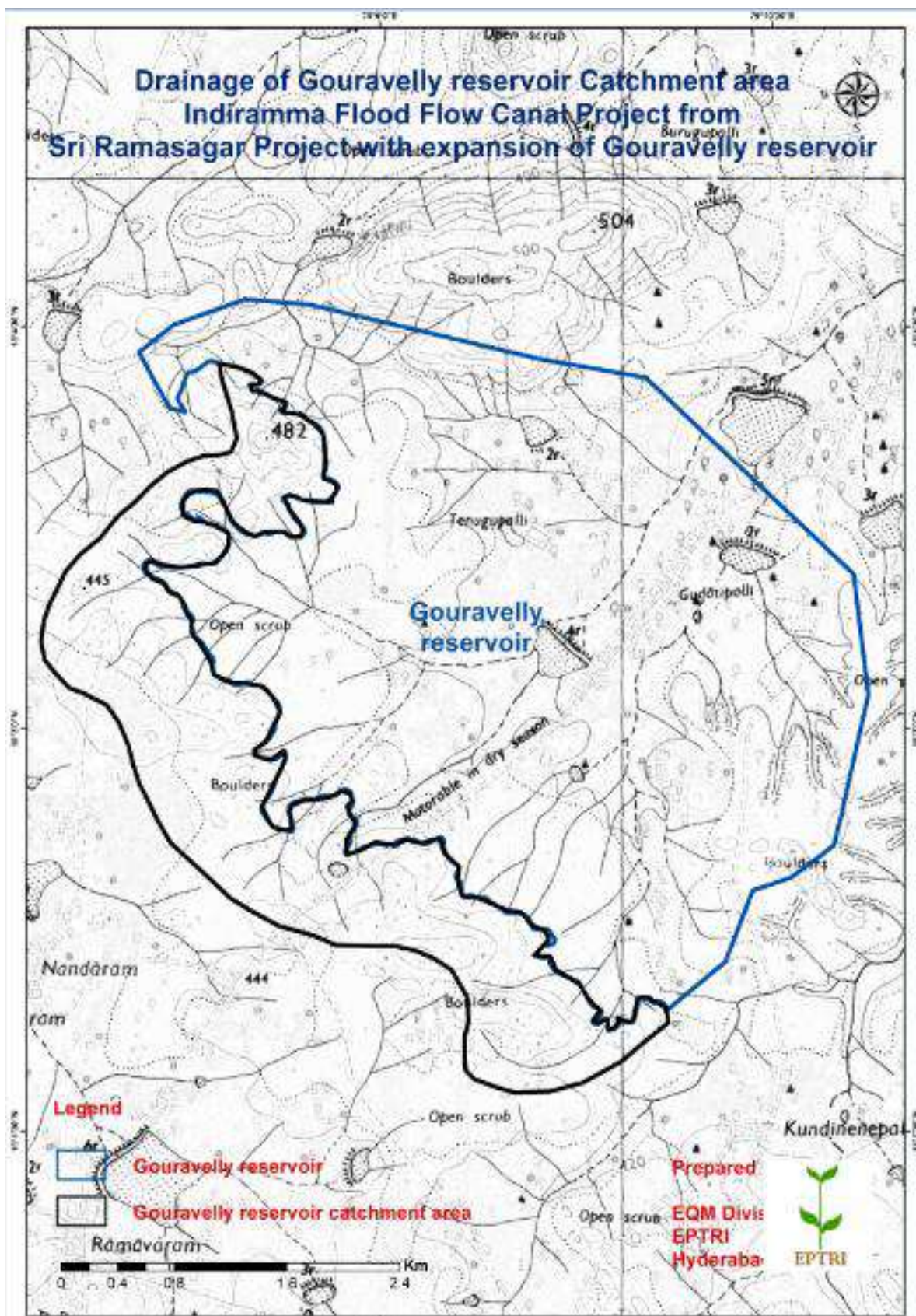


Fig 10.1 (b) Catchment area and watershed map of Gouravelly Reservoir



The slope plays a great role for the loss of soil and water from an area and thereby influences its land use capability. Together with the nature and texture of soil, it also determines the erodibility of the soils. In the directly draining catchment the following slope categories were identified

- Gentle (0 to 15 degrees),
- Moderate (16 to 30 degrees),
- Moderately steep (31 to 45 degrees),
- Steep (46 to 60 degrees), and
- Very steep (> 60 degrees).

The LULC of Mid Manair & Gouravelly reservoir is shown in **Figure 10.2** and give in **Table 10.1 & 10.3**

Watersheds were then overlaid on the drainage map and land use map for determining drainage and land use details. All the thematic maps of catchment, viz., base map, drainage map and land use / land cover map, etc., were then transferred to Geographic Information System (GIS) for further overlay analysis. The watershed wise land use and land cover statistics in Mid Manair Reservoir catchment are given in **Table 10.2**.

Table 10.1 LULC of Mid Manair reservoir

Land use and land cover	Area (Ha)	% area
Settlement	4478.15	2.51
Kharif Crop Land	61699.92	34.57
Rabi Crop Land	56.12	0.03
Double Crop	35797.86	20.06
Agri.Fallow Land	6064.94	3.40
Agri.Plantation	246.95	0.14
Barren rocky Stony Waste	806.21	0.45
Canal	92.23	0.05
Dense Scrub	8514.21	4.77
Gullied ravinous land	104.38	0.06
Scrub Forest	17039.55	9.55
Moderately Dense Forest	17348.74	9.72
Open Scrub	9532.93	5.34
Quarry	996.02	0.56
River	2381.81	1.33
Tank	13330.23	7.47
Total area	178490.25	100.0

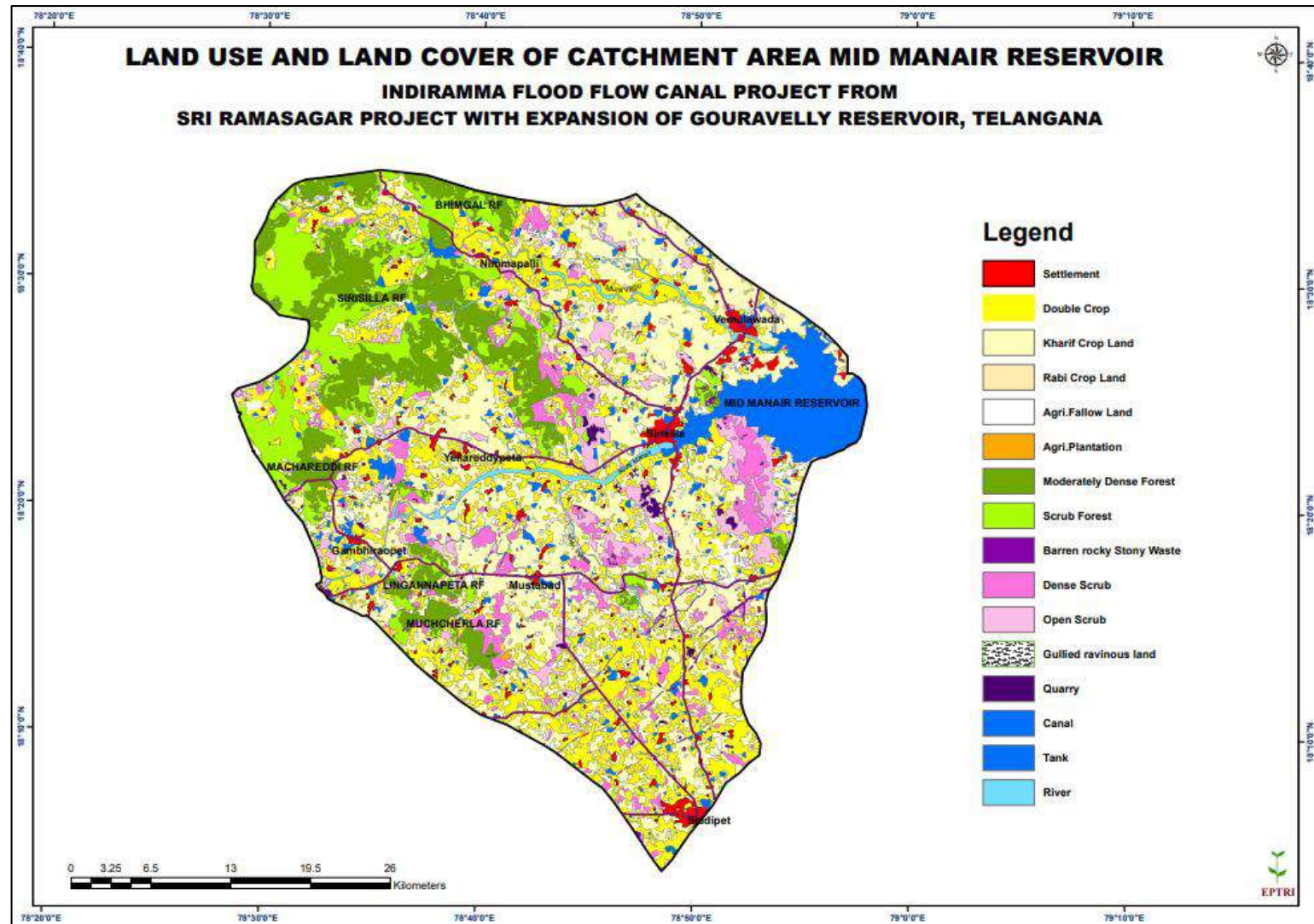


Fig 10.2 Land use and land cover statistics of catchment area of Mid Manair Reservoir

**Table 10.2 Watershed wise land use and land cover statistics in Mid Manair Reservoir catchment**

Land use and land cover	4E2B5/1	4E2B5/2	4E2B5/3	4E2B5/4	4E2B6/1	4E2B6/2	4E2B6/3	4E2B6/4
Agri.Fallow Land	243.66	1635.13	117.20	1019.67	1030.55	691.5243	866.3547	460.844
Agri.Plantation		15.35		22.38	85.10			
Dense Scrub	206.08	1316.45	232.62	1683.26	923.95	1957.00	1826.26	529.91
Double Crop	3088.77	5405.11	1927.07	3821.21	4880.68	4416.903	9005.626	3282.485
Moderately Dense Forest	5390.80	566.39	3883.63	163.58	4782.31	1673.481	108.5911	779.9582
Kharif Crop Land	2266.61	14707.31	1105.71	11531.60	6463.21	9993.437	9496.979	6131.903
Rabi Crop Land	7.16			11.42	5.71	0.031196	19.474	12.33605
Open Scrub	266.43	3304.14	408.02	2403.03	623.22	851.4959	934.473	742.1212
Quarry	10.35	549.25	3.20	49.99	40.32	56.07565	209.9286	76.90036
River	239.27	441.06	100.37	581.71	274.99	159.3555	100.659	484.3875
Scrub Forest	6289.32	915.55	2311.37	210.75	5568.14	510.7675	292.0597	941.5976
Settlement	218.52	1197.76	90.28	1011.69	392.53	373.8376	850.5267	343.0123
Tank	385.76	1639.25	275.12	8376.11	733.84	463.4461	759.7186	665.0149
Gullied ravinous land	72.86			23.36	8.16			
Barren rocky Stony Waste		327.14	2.33	75.29	15.57	63.01564	285.6343	68.08971

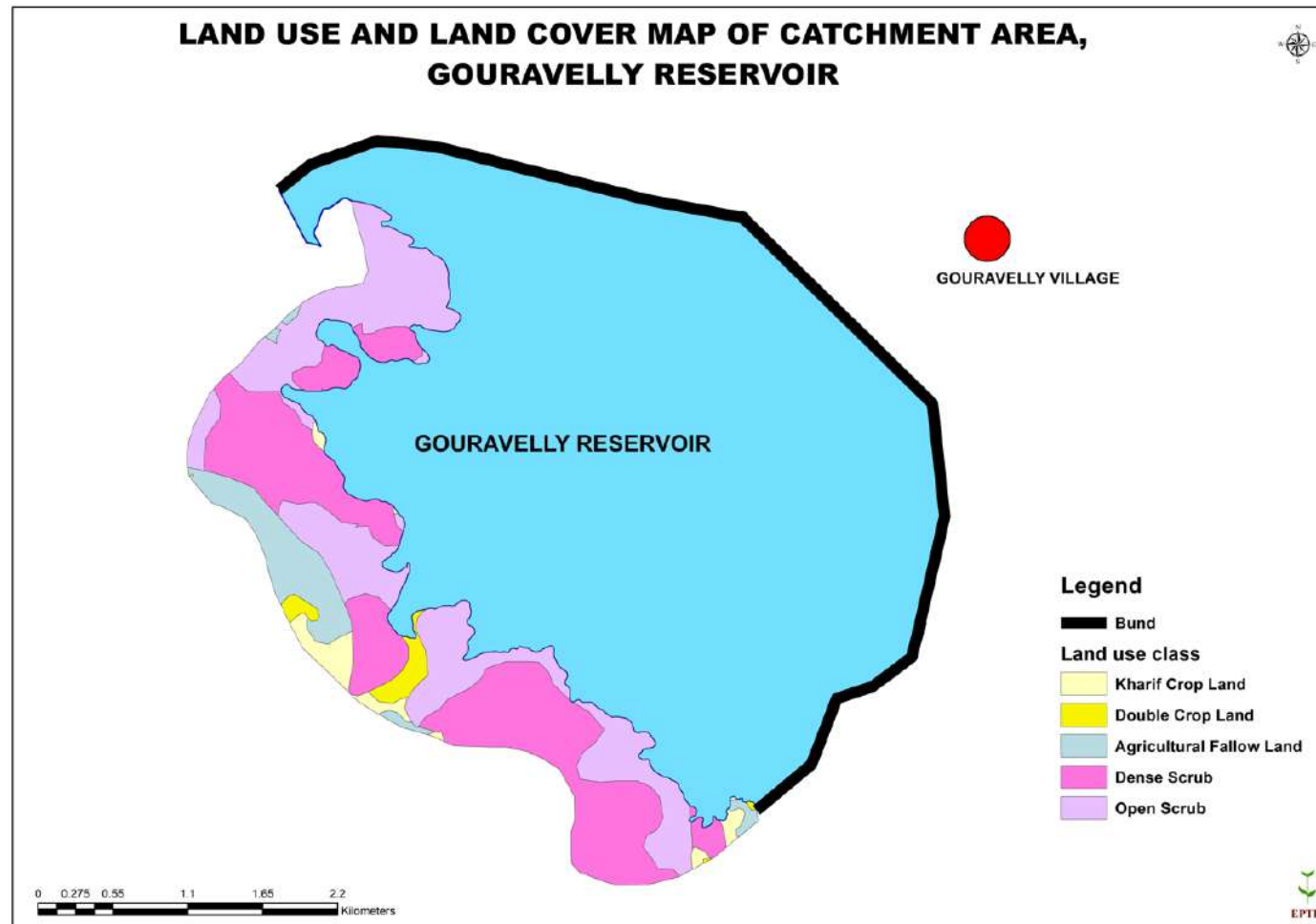


Fig 10.3 Land use and land cover statistics of catchment area of Gouravelly Reservoir



Table 10.3 Watershed wise Land use details of Gouravelly Catchment

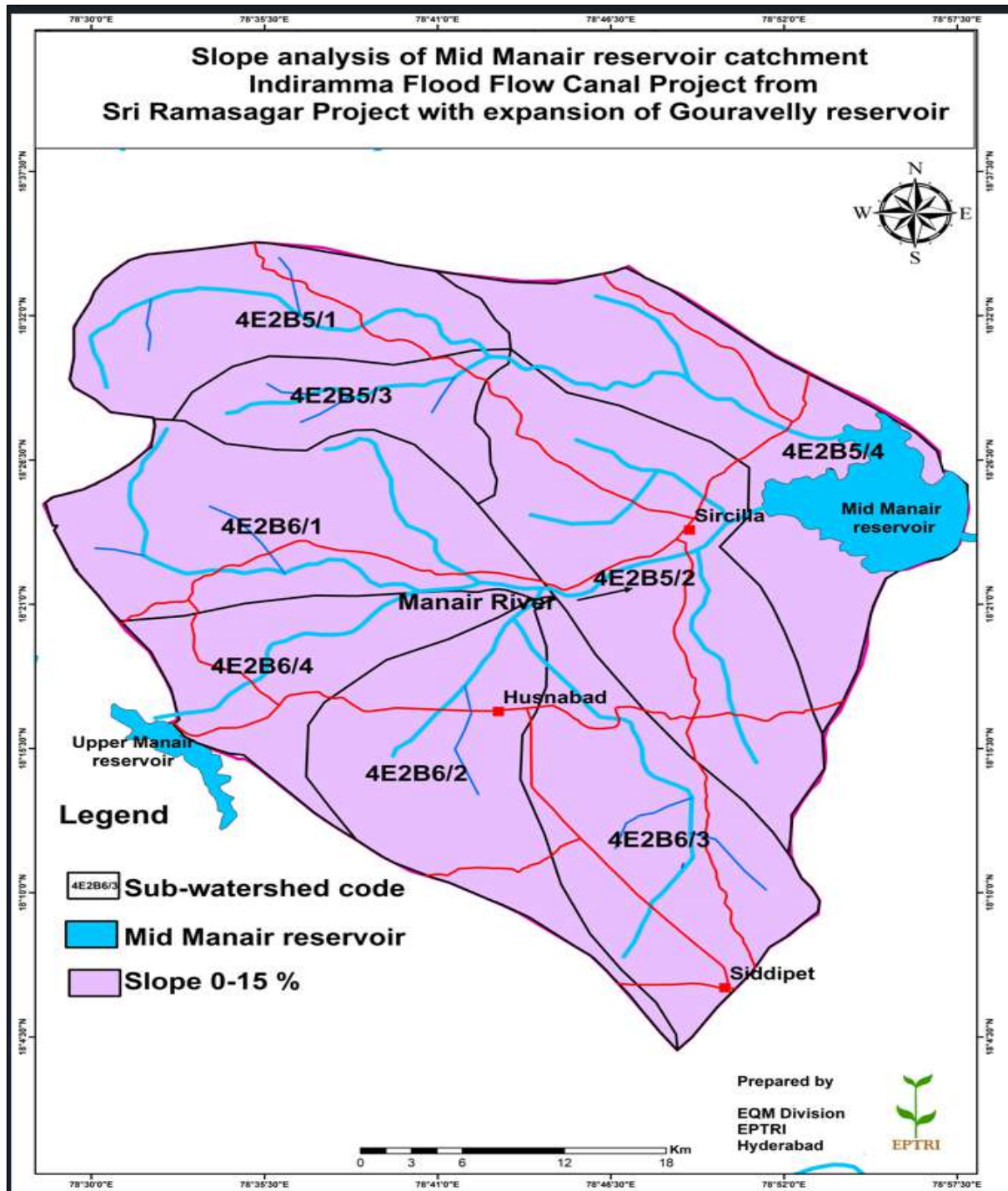
Land use and land cover	Watershed code	
	4E2B1/2	4E2B1/3
Double Crop Land	9.81	3.32
Kharif Crop land	13.02	7.00
Agricultural Fallow land	8.82	39.99
Dense scrub land	167.58	60.47
Open scrub land	154.60	43.12
Grand Total	353.83	153.90

The statistics of land use and land cover in catchment area of Gouravelly reservoir shows that in

- 4E2B1/2 has 91.05% waste land in the form of dense scrub land (47.36%) and open scrub (43.69%).
- 4E2B1/3 has 67.13% wasteland in the form of dense scrub (39.29%); open scrub (28.01%); 32.69% of agriculture land in the form of agriculture fallow land (25.98%), Kharif unirrigated land (4.54%) and double crop land (2.17%).



Fig 10.4 Soil Analysis of Mid Manair reservoir



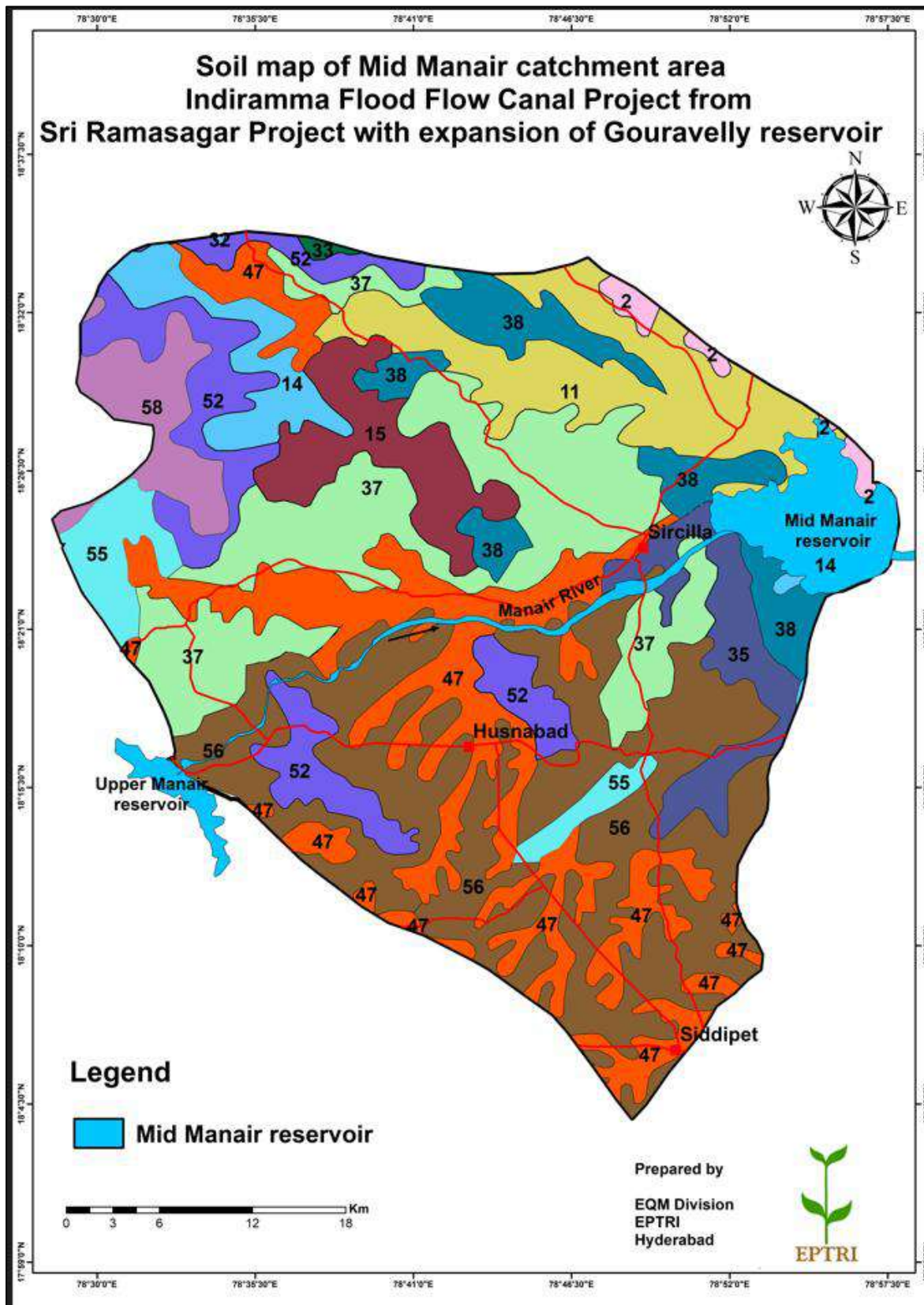
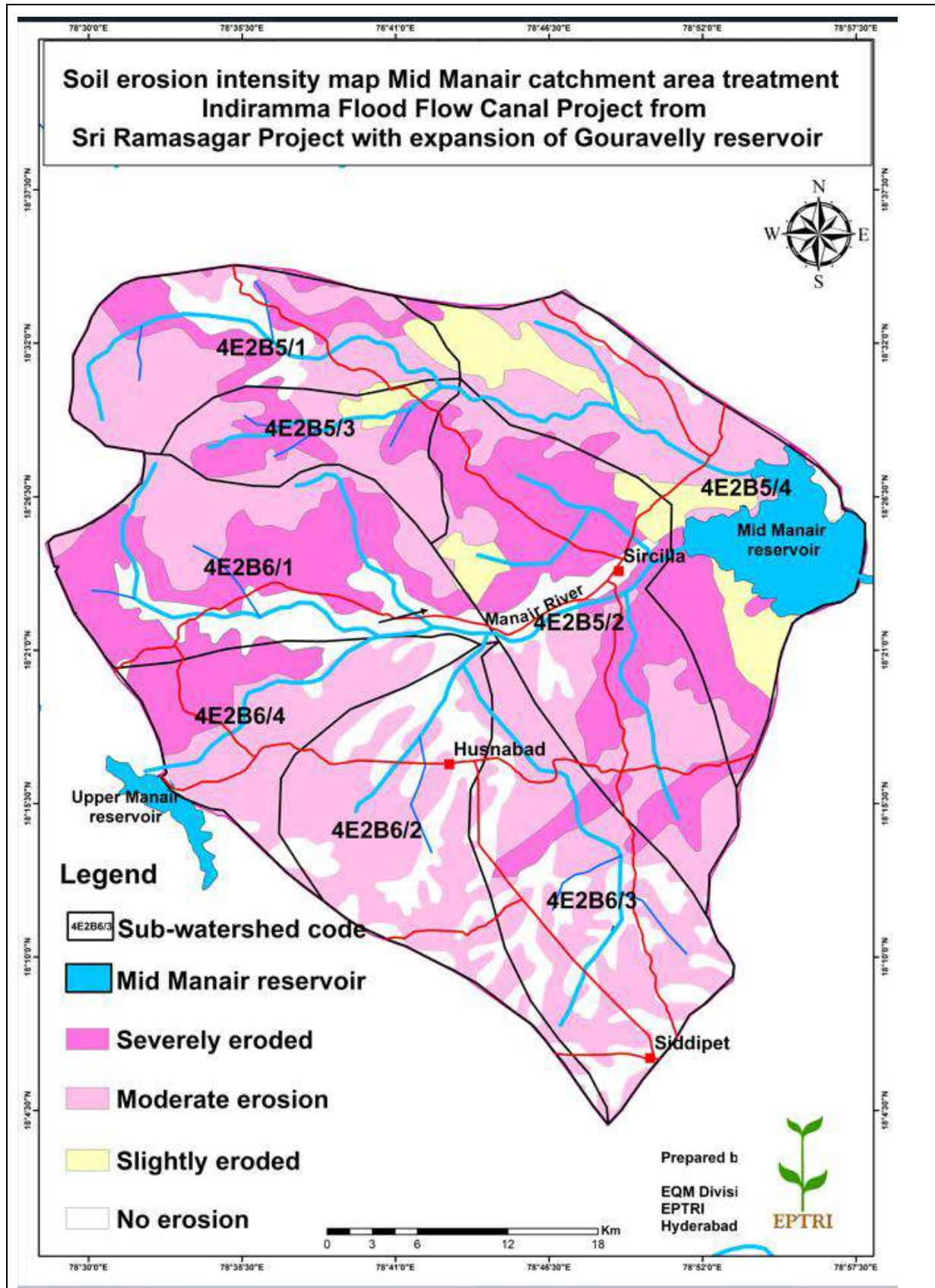
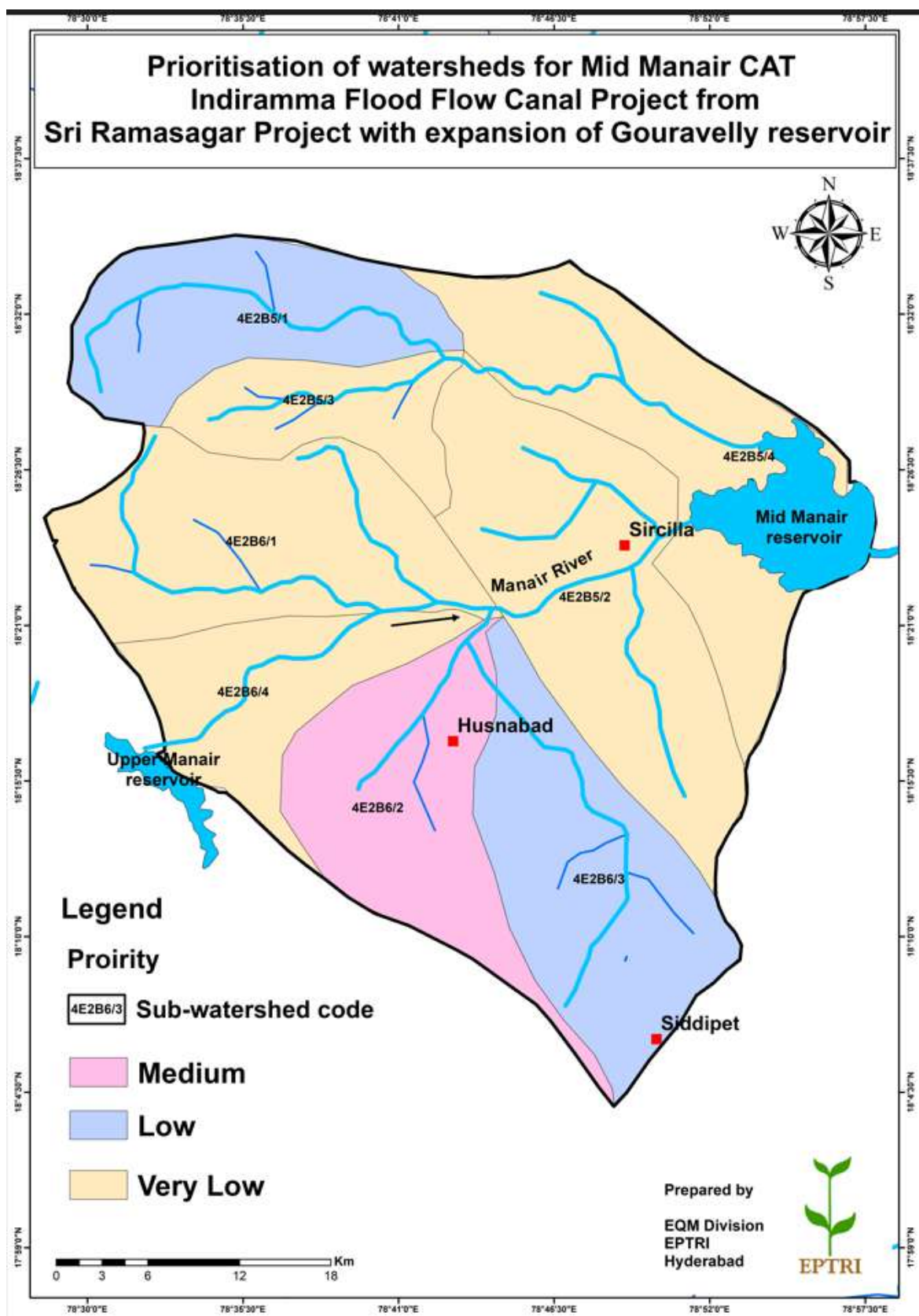


Fig 10.5 Soil map of Mid Manair reservoir



10.6 Soil erosion intensity map of Mid Manair reservoir



10.7 Prioritization of Mid Manair reservoir



10.1.3 Sediment Yield Index Model (SYI)

The SYI model considering sedimentation as product of erosivity, erodibility and areal extent was conceptualized in the All-India Soil & Land Use Survey (AISLUS) as early as 1969 and has been in operational use since then to meet the requirements of prioritization of smaller hydrologic units within River Valley Projects catchment areas.

The model conceptualizes sediment delivery from a hydrologic unit into a reservoir as a multiplicative function of the potential soil detachment representing the erosivity factor; the transportability of the detached material (delivery ratio) and the area of the hydrologic entity.

This can be expressed as:

$$\text{Sediment yield} = f (\text{Erosivity of soil} \times \text{delivery ratio} \times \text{area of hydrologic unit})$$

The erosivity is simulated with the sediment yield weightage value which is based on assessment of the composite effect of assemblage of erosivity determinants whereas, the delivery ratio is adjudged by the likely delivery of the eroded material into the reservoir.

Sediment Yield Weightage Value

The erosivity determinants are the soil and land attributes that have direct or reciprocal bearing on the unit of the detached soil material. The relationship can be expressed as

Soil erosivity = f (slope, soil parameters, land use / land cover)

The functional behaviour of each of the attributes is discussed below:

- **Slope:** As the slope becomes steeper, the runoff coefficient increases, the kinetic energy and carrying capacity of the surface flow becomes greater, soil stability as well the slope stability decreases and splash erosion increases.
- **Land use / land cover:** Covers including plant canopy, plant residues, mulches or dense growing plants greatly modify the effect of rainfall and thus affect soil erosion. The plant canopy intercepts raindrops and the water dripping of the leaves is less erosive than unhindered raindrops. Moreover, the detachment of sediments does not occur on the portion of the covered soil surface because the drops are intercepted and there is no fall distance for drops to regain energy. The surface cover also slows down the run-off thus increasing flow depth which further decreases detachment by cushioning the impact of raindrops and reducing their hydrodynamic impact forces.
- **Soil parameters:** The soil properties influencing erodibility include particle size distribution, organic matter content, its association with different morphological features and effective soil depth. Infiltration rate and soil permeability, which is function of soil texture, coarse fragments, effective soil depth, etc. determine the quantity of surface flow. Soil erodibility is also governed by the active surface area of the soil particles. Soil structure or aggregate stability is another important factor offering resistance to soil detachment.
- **Delivery Ratio:** Delivery ratio refers to the percent of the soil material detached from the source area reaching the reservoir through surface flow or travelling through drainage courses. Since the transport phenomenon involves suspension of the soil material and its movement over the land surface of the hydrologic unit, the delivery ratio is governed both by the soil factors affecting the dispersion value of the soils and the watershed attributes determining the flow mechanism. The transport of the suspended material is governed by number of parameters namely shape and size of the watershed, physiography and relief, drainage pattern, drainage density, stream gradient, proximity of the eroded area to the active stream or reservoir and the presence or absence of silt traps within the watershed.



- **Sediment Yield Index:** The sediment Yield Index (SYI) is defined as the Yield per unit area and SYI Value for hydrologic unit is obtained by taking the weightage arithmetic mean of the products of the weightage value and delivery ratio over the entire area of the hydrologic unit by using suitable empirical equation.

10.1.4 Prioritization of Sub-watersheds

The prioritization of the hydrologic units within the vast catchments is based on the Sediment Yield Indices (SYI) of the smaller units. The sub-watersheds are subsequently rated into various categories corresponding to their respective values.

Methodology of prioritisation

The various steps involved in the application of model are.

- Preparation of a framework of sub-watersheds through systematic delineation and codification
- Rapid reconnaissance surveys leading to the generation of a map indicating erosion-intensity mapping units (EIMUs).
- Assignment of weightage values to various mapping units based on relative silt-yield.
- Assignment of maximum delivery ratios to various erosion intensity mapping units and assessment of adjusted delivery ratios for different sub-watersheds
- Computing Silt-Yield Index for individual sub-watersheds.
- Grading of sub-watersheds into very high, high, medium, low and very low priority categories based on erosion intensity.

10.1.5 Assignment of erosivity weightage value

The composite erosion-intensity mapping units were assigned relative erosivity values adjudged to be indicative of the combined effect of dynamic inter-relationship of the factors in terms of active erosivity of the units. The erosivity values were assessed as resultant of combined and reciprocal influence of a set of the factors viz., slope, land use and cover conditions, and soil characteristics.

For comparing different erosivity determinants attributed to various mapping units a statement on differentiating characteristics of the units was prepared and the relative values assigned to different units in a rational manner. A factor k , rated as an inertia factor signifying equilibrium between erosion and sedimentation was assigned erosivity value of 10 and was taken as a standard reference for comparison and proportional additions or subtractions from this basic value in discrete numbers were made assessing the collective effect of different attributes corresponding to potential sediment yield. Any addition to this factor is indicative of erosion roughly in proportion to the added factor whereas the subtraction is suggestive of the deposition possibilities. The erosivity values ranging from 8 ($k-2$) to 30 ($k+20$) have so far been assigned to various watersheds.

10.1.6 Assignment of delivery ratios (DRs)

The delivery ratios were adjusted suitably for individual watersheds to account for the deposition of the detached material enroute the reservoir site. The distance of watershed from the reservoir site was considered as the major factor for adjusting the DR values. The criteria adopted for assigning the delivery ratio are mentioned in Table 10.3.

Table 10.3a Delivery Ratio (DR)

Distance from nearest stream (km)	DR Values
0.00-0.50	0.95
0.51-1.00	0.90
1.01-1.50	0.85
1.51-2.00	0.75
2.00-2.50	0.65



Distance from nearest stream (km)	DR Values
2.51-3.00	0.55
3.01-3.50	0.40

Based on the above criterion of AISLUS following priority categories in Table 10.4 have been assigned to the sub-watersheds of directly draining catchment. The maps showing the sub-watershed prioritisation is given in Figure 10.8.

Table 10.4 Criteria for erosion intensity rate

Priority categories	SYI Values
Very high	> 1300
High	1200-1299
Medium	1100-1199
Low	1000-1099
Very Low	<1000

10.1.7 Computation of Silt Yield Index

The area of each of the mapping units is computed on GIS platform and silt yield indices of individual watersheds were calculated using the following equation:

$$SYI = \sum (A_i \times W_i \times D_i) \times 100/A_w; i= 1 \text{ to } n$$

Where SYI = Sediment Yield Index

A_i = Area of i th mapping unit

W_i = Weightage value of i th mapping unit

D_i = Adjusted delivery ratio assigned to i th mapping unit

N = No. of mapping units

A_w = Total area of watershed

10.1.8 Prioritisation of watersheds

The gradation and assignment of priority ratings to the watersheds are based on the descending values of SYI values. As per the methodology of priority delineation of AISLUS the priority categories that have been classified based on the SYI values for mid manair and Gouravelly reservoirs are given in Tables 10.5& 10.6.

Table 10.5 Priority categories in Mid Manair Reservoir catchment area

Sub-Watershed code	Sediment yield index (SYI)	Priority
4E2B6/2	1123.1	Medium
4E2B6/3	1049.8	Low
4E2B5/1	1018.8	Low
4E2B5/3	940.7	Very low
4E2B5/4	817.8	Very Low
4E2B5/2	797.5	Very low
4E2B6/4	787.6	Very Low
4E2B5/3	707.2	Very low
4E2B6/4	637.8	Very Low
4E2B5/1	304.7	Very low



Sub-Watershed code	Sediment yield index (SYI)	Priority
4E2B6/1	294.3	Very low
4E2B5/2	809.7	Very low
4E2B5/4	224.5	Very Low
4E2B6/1	202.0	Very low
4E2B5/2	187.5	Very low
4E2B5/1	148.1	Very low
4E2B5/4	143.4	Very Low
4E2B6/3	230.1	Very low
4E2B6/3	27.6	Very low

Table 10.6 Priority categories in Gouravelly Reservoir catchment area

Sub-Watershed code	Sediment yield index (SYI)	Priority
4E2B1/2	955.1	Very low
4E2B1/3	826.4	Very low
4E2B1/3	63.1	Very low

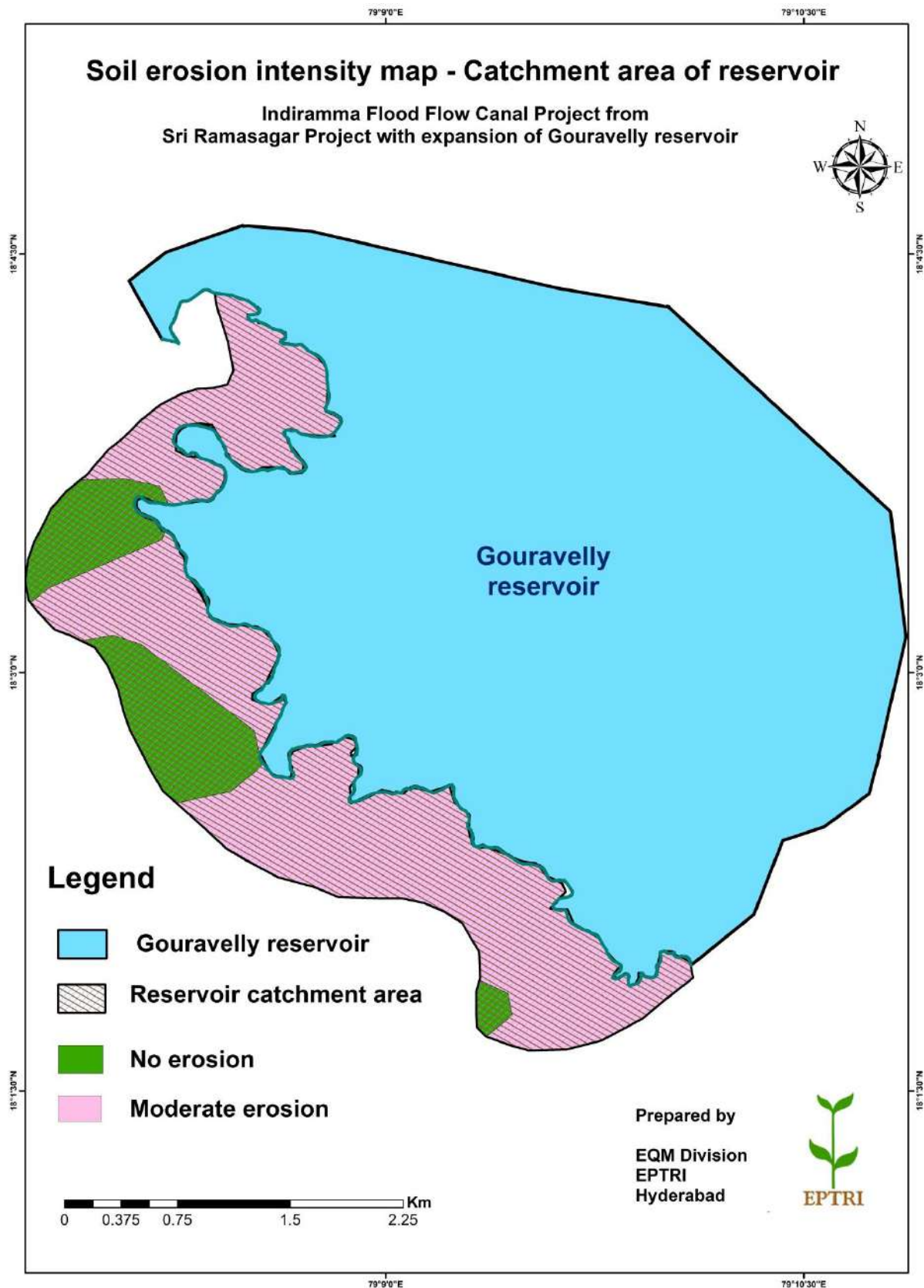


Fig 10.8 Soil erosion intensity of Gouravelly Reservoir



10.1.9 Area identified for Catchment area treatment

The catchment area of Gouravelly reservoir is 505.83 ha.

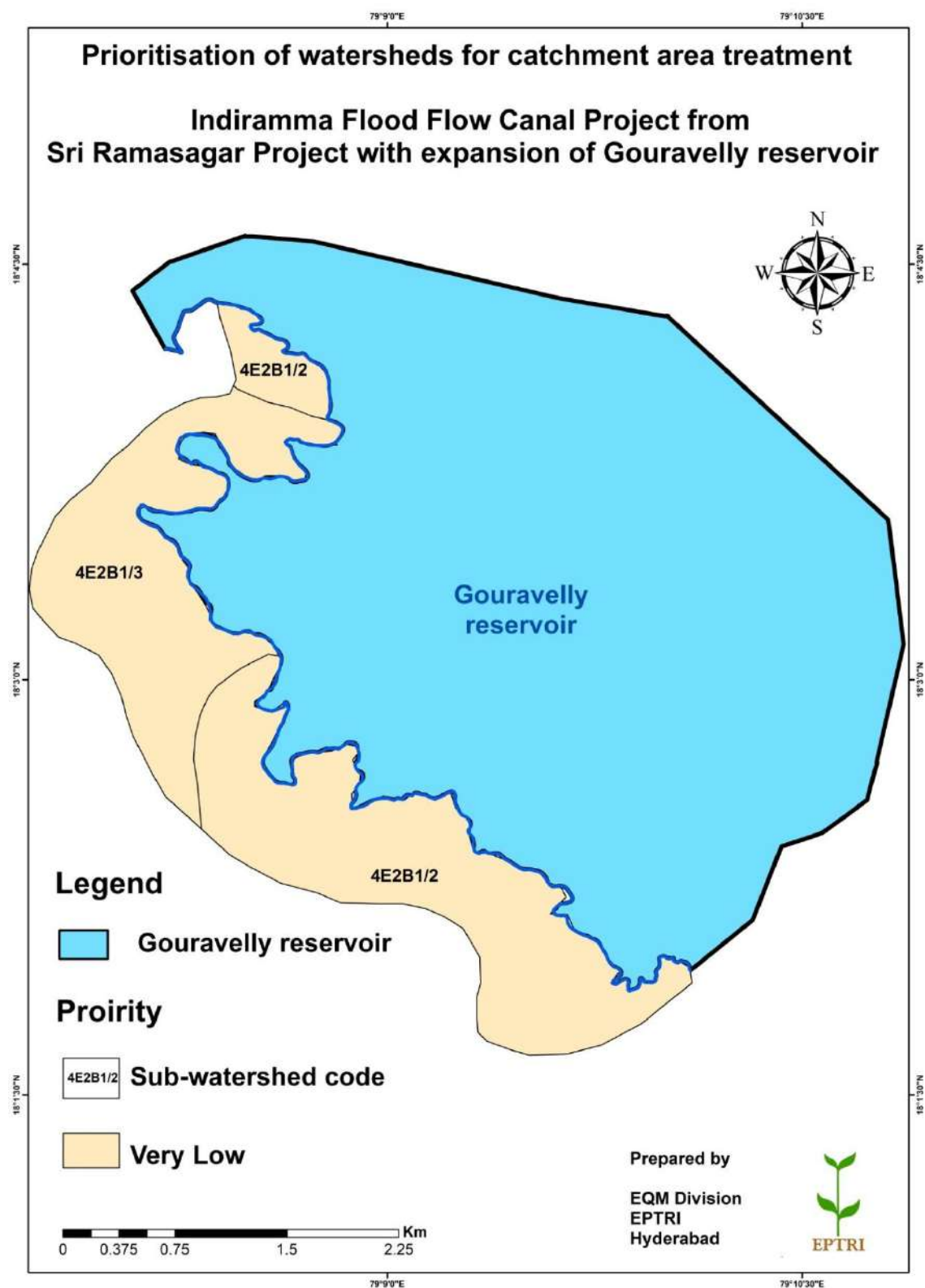


Fig 10.9 Prioritisation of Gouravelly Reservoir



In addition, biological measures like plantation of shrubs and trees are also suggested for these areas.

- Bush cutting in the plantation site.
- Interlacing of thorny bushes in barbed wire,
- Preparation of inspection path 60 cm wide,
- Layout of pits, digging of pits, filling of pits,
- Planting of naked root plants
- Soil and moisture conservation works.

Barbed wire fencing which has been found quite useful particularly in plantation of the areas. On the other hand, provision has been made for engagement of watchers (local persons) for cattle watching during the formative stages of the plantations. Provision had been made for undertaking various necessary soil and moisture conservation measures in these areas.

10.1.10 Details of Treatment Measures with Unit Cost Estimate

Various engineering and biological measures as proposed above are elaborated below. The details of cost as well as the type of work along with rate, quantity, etc. are given in Tables 10.7 and 10.8

10.1.11 Brushwood dams and gully plugging

Gullies are mainly formed on account of physiography, soil type and heavy biotic interferences in an area. The scouring of streams at their peak flows and sediment laden run-off cause gullies. Narrow gully can be treated with brush wood check dams or plots to control gully erosion. Brushwood will be available locally in abundance. The construction will be faster, and the catchment can be protected from gully erosion. Subsequently this will help in reducing sedimentation in the reservoir.

The sides of the gully at the selected sites are slopped to 1:1.5 and the gully bottom, for the whole length of the dam, is lowered by about 15 cm. Also, 15 cm excavations are carried up into the bank as high as required to give the necessary notch capacity for discharging the run-off. The country wood stakes, about 10 cm to 13 cm in diameter are driven 0.90 m apart in two rows to go at least 0.90 m to 1.2 metre into the hard bed of gully. The distance between the rows will be 0.9 m. The tops of the stakes are kept at such a height as to form a distinct depression in the middle to form a notch of the required waterway to enable the maximum run-off to discharge. The first layer of straw and brushwood is laid across the gully between two rows of wood stakes. Over its long branches of specially selected species are laid lengthwise of the gully and well pressed. The process is repeated till the required height is obtained. The brush is anchored on to the stakes by means of galvanised iron wire. Intermediate stakes of shorter lengths are driven, and the brush is anchored on to them to prevent lifting from bed by water.

Contour bunding and Plantation: Contour bunding cost is calculated based on the extend of rainfed agriculture area in the catchment. Plantation development (i.e. about 2500 plants per hectare) cost is suggested in open scrub and scrub forest areas.

10.1.12 Biological Measures

In order to help reduce the erosion of soil and its transport to the reservoir it is suggested to undertake plantation of shrubs as well as trees, wherever the soil characteristics permit.

The best policy would be to use following local shrubs and trees, especially *Rosa webbiana*, *Macaragadenticulata*, *Salix sp.*, *Populus sp.*, *Prunusarmenacia*, *Ailanthus grandis*, *Altingiaexcelsa*, *Manglietia insignis*, *Amoorawallichii*, *Syzygium sp.* *Terminaliamyriocarpa*, *Duabangagrandidiflora*, *Toonafebrifuga* etc.

During Ecology and biodiversity study it is observed that the presence of *Dalbergialatifolia* though falls under vulnerable category is occasional in occurrence where as *Pterocarpus*



marsupium under near threatened category and *Pterocarpus santalinus* under endangered category as per IUCN list, but these are planted species.

Apart from the above the I&CAD Department has already constructed / renovated about 57 check dams in and around the Gouravelly reservoir with a cost of Rs.1,315 lakhs.(Enclosed as Annexure-10A).

10.1.13 Period and Schedule of Implementation

The plan needs to be implemented in a phased manner so as to attain the goals set successfully. Keeping in view the local topography and climate, it is proposed to complete the CAT programme in five years. The year wise break-up of the CAT work in different sub-watersheds is given in Table 9.1.9.

The prioritization of sub-watersheds for treatment measures has been done with particular reference to the silt yield index and proximity with the reservoir rim. Shrubs and trees to be planted under biological interventions have to be reared in the nursery. The cost estimates for the creation and maintenance of the plant nursery are given in the budget estimate for the Biodiversity Conservation Plan.

Administrative Charges

A lump sum amount of Rs 0.97 crores for Mid Manair Reservoir and Rs. 0.09 crores for Gouravelly reservoir shall be required towards salary and related activities like engagement of staff on contractual basis to perform activities like salary, draftman ship etc for five years.

Administrative Setup

The catchment area treatment project involves intensive and highly technical operations, which require the expertise of technical personnel. It is therefore recommended that the existing agriculture department staff may look after all the works to be carried out under the CAT plan including plantation and maintenance.

Contingency Charges

This Component will take care of future wage hike, unseen expenses, overflow of other components and other contingencies during implementation. An amount of 1% on sub total has been kept for this purpose.

Monitoring, Evaluation and Maintenance

Monitoring and evaluation will be done as an inbuilt part of the project management. It is most important for assessing the works carried out and the results achieved vis-à-vis eco-restoration, etc. Annual work plan for each range would be prepared well in advance specifying physical and financial targets, sites, locations and beneficiaries of each component of the project activity. Month-wise work schedule of various items of each component for the financial year would also be prepared in advance and its timely implementation would be ensured. The monitoring committee would monitor the quality and quantity of works carried out under the CAT program. An amount of 2% on subtotal has been kept for this purpose.

Table 10.7 Break-up of cost estimate for the implementation of the Mid Manair Reservoir catchment area treatment Plan

Sub-Watershed	No. of Rock filled dams	Cost for Rock filled dams @Rs. 12,000	No. of Brush wood dam	Cost for Brush wood dam @ Rs.5,000	No. of gully plugging	Cost for gully plugging @ Rs.5,000	No. of Loose boulder check dam	Cost for Loose boulder check dam @ Rs.14,000 each	Contour Bunding @ Rs.15000 per ha	Plantation @ Rs.39000 ha
4E2B6/2	177	2124000	106	530000	71	355000	590	8260000	74950800	53128272.60
Total CAT Plan cost lakhs Rs.				Rs.13,93,48,057.00 Rounded to Rs.13.93 Crores						

Table 10.8 Sub-watershed-wise break-up of cost estimate for the implementation of the CAT Plan of Gouravelly reservoir

Sub Watershed	No. of Brush wood dams	Cost for Brush wood dams @ Rs.5,000	No. of gully plugging	Cost for gully plugging @ Rs.5,000	Plantation @ Rs.39000 ha
4E2B1/2	163	8,15,000	109	5,45,000	60,29,400
4E2B1/3	430	21,50,000	287	14,35,000	16,81,680.00
Total	593	29,65,000	396	19,79,125	77,11,080
Total CAT plan cost lakhs Rs.	Rs.1,26,56,080/ Rounded to Rs.1.27 crores				



A sum of Rs. 0.3003 crores will be required for both the reservoirs for monitoring and evaluation. Under this component, independent agencies /consultants will be engaged to make base line survey, mid-term survey and end of the project survey to find out effectiveness of CAT plan activities in the catchment area. Silt load and run-off rate also will be monitored at practically feasible strategic points.

Cost Estimate

The total expenditure on the catchment area treatment plan to be implemented over a period of five years is estimated to be Rs. 1.37 Crores in respect of Gouravelly reservoir. The details are of cost are presented in Tables10.9.

Table 10.9 Total cost of Catchment Area Treatment

S. No	Particulars	Cost Rs. Crores	
		Mid Manair	Gouravelly
1	CAT Measures	13.93	1.27
2	Administrative charge, salaries etc. for 5 years	0.97	0.09
3	Sub total	14.90	1.36
4	Contingency charges 1% above	0.15	0.014
5	Monitoring & Evaluation including maintenance for 5 years	0.30	0.0003
Grand Total		15.35	1.37



10.2

COMMAND AREA DEVELOPMENT (CAD) PLAN

10.2.1 Introduction:

The crop water requirement and its retention in the soil depends on the properties of soil and plant. Soil provides the room for water to be used by plants through the roots present in the same medium and water, which is the carrier of large amount of nutrients, is required in a large measure for successful growth of plants. Application of additional water to soil, for the growth of plants, becomes essential due to inadequate and uneven distribution of rainfall, especially during the growth period of the plant.

Needless to state that the irrigation is one of the most important factors for assured crop production. It helps and permits better utilisation of all other production factors. The command area development, therefore, plays an important role in a comprehensive irrigation development programme. The important aspects:

- Integrated development of water resources
- Judicious method of water applications
- Proper soil and crop management practice and
- Scientific scheduling of irrigation according to development plan

Efficient water management requires a thorough study of plant – water relationships, climate, agronomic practices and economic assessment besides the physio-chemical properties of soils occurring in the area.

Command area treatment is aimed at development of an effective irrigation system which will ensure controlled and uniform application of water to crop lands in time with minimum cost to produce optimum yields without waste of water and without any adverse effect on soil in the form of soil salinity and waterlogging problems.

The following environmental problems may crop up in command area, if proper care and required measures are not taken up.

10.2.2 Soil erosion

In the upland area along the canal alignment soil erosion is noticed. Since the soils are having fairly sufficient soil depth, the erosion could be controlled by adopting suitable conservation measures like levelling and bunding. This is necessary in case of irrigated dry crops.

The land development or land shaping involves smoothening, grading, forming earth bunds and land levelling.

The main aim of the Flood Flow Canal project is to irrigate an ayacut of 89,031 Ha (2,20,000 acres) in the upland drought prone areas of Peddapalli, RajannaSircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon (erstwhile districts of Karimnagar, Warangal and Nalgonda) districts in Telangana region duly utilising 20 TMC of flood water of Godavari River from the fore shore of SRSP reservoir.

Land shaping, land levelling, land smoothening, land grading and earth bunds:

The land shaping/levelling largely depends upon the method of irrigation used. The irrigation methods depend on the types of lands and crops. Any method adopted for irrigation must ensure uniform distribution of water in the crop root zone and high-water application efficiency. Land levelling should be done as far as possible concurrently with field channels



and drains so that efficient water management practices are introduced at the outlet from the beginning.

Before undertaking grading or levelling of the lands, the depth of soil, infiltration rate, slope of land and erosion characteristics of soils should be thoroughly examined.

The land after development should be able to carry run – off due to rainfall, and irrigation water without causing erosion of the soil.

The earth movement needed for land grading/levelling should be kept minimum and the depth of cut should be such that the soil cover of the developed land will be sufficient to support the root zone for the crops proposed to be grown. Also, it should not be excessive (more than 30 cms) since, it would require the land a long period to build up their normal level of productivity. Earth work can be substantially reduced if the plots are demarcated between contours, by aligning the graded bunds parallel or little inclined to the contours, and width of plots are reduced especially in steep sloping areas.

In the top portion of the developed land, the removal of top of soil would cause reduction in crop yield because the subsoil contains less nutrients than the topsoil. If the cut areas are ploughed deep before grading the filled areas grading topsoil can be retained to a great extent.

In shallow soils where the initial cover of the soil is not greater than 22 cm, land smothering and promotion of ridges and furrows for irrigation will be the main items of the farm development after water courses and field drains are provided. Development of shallow lands with steep slopes is difficult since deep cut could substantially reduce soil cover after farm development and render it to shallow to support production of any crop. Ridge and furrow method of irrigation with ridges and deep furrows provide a workable solution for development of such lands for growing crops.

When the lands are sufficiently flat (less than 0.6%) they need not be levelled. What is needed is only planning of the land surface without changing the general topography, small irregularities in the land surface should be removed so that the finished surface from the water channel to the drain has one uniform grade.

The maximum longitudinal slope and land after development should not exceed 0.6%. The maximum length of land strip is governed by the grade, erosion characteristics of the soil and the infiltration rate.

10.2.3 On – Farm Development Works (OFD)

The on-farm water management is related to water delivery system and allied works in the command area below the distribution network, to distribute the water to each farm. The items of works pertaining to on farm water management are termed as “On farm development works (OFD)”.

The On-farm development (OFD) works comprise of the following:

- Creation of field channel below the outlets of distribution network
- Land levelling and realignment of field boundaries
- Improvement in farm drainage system
- Reclamation of waterlogged farm areas
- Construction of farm roads

A. Creation of field channel below the outlets of distribution network:

The purpose of the OFD works is to provide timely and adequate supplies of water to each holding, by avoiding seepages, leakages and stagnation of water which trigger problems like waterlogging.



Ground Survey for OFD Works

- i) The procedure followed presently is to have a grid survey with block levels on 15m X 15m grid. From these, contour maps with an interval of 0.2 m to 0.3 m can be prepared. The procedure is adequate for the design of OFD works.
- ii) The survey should however be carried out for the entire chak system. The closing of the benchmarks with reference to the outlet sill levels is most important. The design should not proceed unless this factor is satisfied. From this survey, contour maps with a contour interval of 0.2 m to 0.3 m should be prepared. However, taking into consideration the requirement of scale for the contour map of the chak and the contour map of the chak system, plotting for these two maps will be separately done as under:
 - ✓ For the map of the chak system the grid levels at 30 m. interval (omitting alternate levels) will be plotted on a scale of 1: 2000 or 1: 2500 and the contours drawn with 0.3 m interval.
 - ✓ If the command is big the map of chak system may be prepared to the scale of 1: 4000 or 1: 8000 and contours of 0.4 m or 0.6 m interval.
 - ✓ For the contour map required for the individual chak, the entire grid levels will be considered (at 15 m interval) and contour map will be prepared with 0.2 m to 0.3 m contour interval to a scale of 1: 1000 or 1: 1250.
 - ✓ The above maps should be superimposed on village maps with survey nos. and following aspects be marked on it.
 - a) Alignment of Distributory / Minor / Sub minor
 - b) Location of outlets with sill level and other structures on Distributory / Minor / Sub minor
 - c) Uncommanded portion
 - d) Type of soil (numberwise)
 - e) Ridges, valleys, nalas, depressions or ponds, hillocks etc.
 - f) Location of existing wells
 - g) Trees and permanent structures.
 - h) After the survey, a tracing of the contour map of the chak / chak system should be prepared thereon.

The following aspects need to be considered in designing the field channels.

- ✓ Ideally the maximum length of field channel should be less than 1 km, to avoid conveyance losses and complaints from tail end farmers.
- ✓ Number of farmers to be served should be less than 15, to have better understanding and cooperation.
- ✓ Water level in the field channel to be kept 15 cm higher than ground.
- ✓ Field channels should be constructed including related structures such as drops and distribution boxes, culverts etc.
- ✓ Field channels should be planned for construction co-terminus with the distribution system.
- ✓ Field channels should be aligned along the ridges or contours or field boundaries as the case may be.
- ✓ Alignment of Field channel is determined by both topographic and cadastral considerations.
- ✓ Desirably, the field channel should run on the ridge as per practicability.
- ✓ Field channel to be aligned as far away from the minor as possible, to avoid cross bunding by the farmers.
- ✓ Field channels in wet localized areas shall be up to the commanding point of each survey number or 5 ha limit, whichever is less and for ID localized areas, up to each individual holding.



- ✓ The minimum capacity of the field channel may be ranging between 30 to 70 litres/sec.
- ✓ The Field channel should normally be in full cutting to avoid breaches or half cut and half fill situation.
- ✓ The execution of OFD works should be done only in places where canal water has actually reached.

B. Land levelling and realignment of field boundaries:

The following land forming techniques are adopted:

i) Land Smoothing:

It is the process of forming uniform slope in the direction of irrigation without changing the natural land slope. The soils at elevated spots or mounds are cut and put in the depressions to make uniform slopes. This technique is mainly used for straight furrow irrigation.

ii) Land Grading:

It is process of developing desired land slope in the direction of irrigation by changing natural land slope. It is used for both furrow and border irrigation.

iii) Land Levelling:

It is the process of giving zero slope in the direction of irrigation as well as across. This technique is mainly used for basin irrigation where low land paddy is grown.

10.2.4 Procedure for on-farm development

For development of command area under project, a scaled cadastral plan of the command area is prepared by land survey with landmarks and field boundaries of each farmer. Then topographical survey is done and contours with one foot or 0.30 m interval are drawn to know the relief of land, usually a scale of 1" =110' or 1: 10,000 is adopted. Based on the topography of the command area, the irrigation channels aligned with drop structures to maintain the grade of channel bed and distribution boxes are provided at junction boxes so that every plot is connected by irrigation and drainage channels. The width and the length of plots depend on type of soil, land slope and crops to be raised. The recommended specifications for the width and lengths of plots for different land slopes and different soil types are given hereunder for border strip and furrow irrigation. Soil types in command area in Table 10.10.

Table 10.10 Soil types in command area

Sl. No	Soil type	Rate in filtration cm/hr	Gradient	Length of plot in m
1	Clay	0.508	0.1	150-210
2	Clay loam	1.270	0.15	135 -180
3	Silt Loam	2.540	0.20	120-150
4	Silt	3.810	0.25	90-135
5	Sandy loam	7.620	0.30	60-90
6	Sandy	12.70	0.50	60

Width of the plot (strip) depends upon the slope of land. The width of the plot found suitable for different land slopes is as follows:

Percentage of land slope	Suitable width of plot (m)	Percentage of land slope	Suitable width of plot (m)
0-1	30	2-3	15
1-2	20	Above 3	10



A bund of 0.18 sq.mt is provided across the slope of the land with the suitable gradient to form the plots of recommended width.

Specifications

Bund	Top width (m)	0.20
	Height/ Depth (m)	0.30
	Bottom width	0.30
	Section (m ²)	0.18
	Average length/ha with 20 m spacing earth work (m)	500
	Rate per 10 cubic meters	Rs.560/-
	Cost of bund formation per ha	Rs.5040/-
Field Channel	Top width (m)	0.90
	Height/ Depth (m)	0.30
	Bottom width (m)	0.30
	Section (m ²)	0.18
	Average length/ha (m)	25
	Earth work (m ³)	4.5
	Rate per 10 cubic meters	Rs.560/-
	Cost of bund formation per ha	Rs.252/-
Irrigation Channel	Top width (m)	0.45
	Height/ Depth (0.15 m below ground level) (m)	0.30
	Bottom width (m)	0.15
	Section (m ²)	0.09
	Average length/ha (m)	50
	Earth work (m ²)	4.5
	Rate per 10 cubic meters	Rs.560/-
	Cost of bund formation	Rs.252/-
Drainage Channel	Top width (m)	0.90
	Height/ Depth (m)	0.40
	Bottom width (m)	0.30
	Section (m ²)	0.24
	Average length per ha	50
	Earth work (m ²)	12
	Rate per 10cum	Rs.560/-
	Cost of bund formation per ha	Rs.672 /-

Summarised Per hectare cost of on-farm development for irrigated crops

S. No	In command area	Amount Rs. Per hectare
1	Topographical and cadastral survey mapping and plotting	1000/-
2	Soil survey, collection of soil samples from different depth for physical and chemical analysis of soil @ 10 samples per hectare and Rs.2000/-per sample	2000/-
3	Layout of farm roads and path	2000/-
4	Earth work (cut & fill) for plot levelling/grading	2000/-
5	Formation of 0.18 sq.mt section bund with 20 m spacing. Average bund length/ha 500m x 0.18 = 90 m ³ @ Rs.560/- per 10 cubic meters	5040/-
6	Formation of field channels 0.18 m ² section from pipe outlet to farmers fields about 50% bund length 25 m per ha -4.50 cum @ Rs.560/-per 10 cum	252/-
7	Irrigation channel for 0.09 m ² section connecting every field of pipe of command area. About 10% of bund length i.e., 50 m/ha -	252/-



S. No	In command area	Amount Rs. Per hectare
	4.5 m ³ @ Rs. 560/- per 10 –cum	
8	Formation of drainage channel of 0.24 m ² section Average length per hectare about 10% of bund length -50 m -12 m ³ @ Rs.560/- per 10 cum	672/-
9	Distribution boxes at ¼ no per hectare	1000/-
10	Drop structure FC/ICs	500/-
11	Crossing for irrigation channel @1/2No/per ha	500/-
12	Crossing for drainage channel @1/2No/per ha	500/-
13	Crossing for drainage channels and outlets	1000/-
	Total	16,716/-

Water logging

Surface and groundwater belong to the same hydrological cycle and are interdependent. In any area or region, where both surface and ground waters are present, irrigation is based usually on the use of former or both the sources. However, in most cases it is done without proper planning for co-ordinated development and optimum benefits. When due consideration is not given for a balanced and harmonised development of the two sources, the environment gets affected and problems such as water logging in certain areas will prevail. It is necessary to take up mitigative measures to avoid water logging. It is therefore, suggested that conjunctive use and also necessary drainage system be developed to overcome the problem of water logging.

Drainage

The removal of excess water (free or gravitational/standing or stagnant water) from surface or below surface of the soil so as to create favourable soil conditions for plant growth, is termed as soil drainage. The excess water leads to water logging and salt imbalance; thus, rendering the land productive to less productive and problematic.

Most of the area under IFFC project from Sri Ramsagar Project is level to gently sloping the flow of water may not be that rapid under sub-soil conditions. With stabilization of irrigation and assured water supply, the sub-soil drainage conditions will have to be improved. Thus, the conditions warrant provision of sub-surface drainage system to avoid waterlogged conditions and other ill-effect of poor drainage. The ill-effects of poor drainage are enumerated below:

10.2.5 Improvement in farm drainage system

Drainage of irrigated lands is the removal of excess rainwater or irrigation water either from the soil surface or from the subsoil strata.

The Need for Drainage

- ✓ Removal of excess rainwater without causing soil erosion
- ✓ Providing balanced environment of soil, air and water to the plant to obtain good crop yield.
- ✓ To provide workable soil conditions for farm operations.
- ✓ To leach out undesirable salts from the soil profile.
- ✓ To prevent waterlogging, soil salinity and health hazards.
- ✓ To minimize plant diseases, which are more active under high water table conditions. Fungus growth is particularly prevalent.
- ✓ To avoid accumulation up of salt in the root zone which may convert productive land into unproductive land.
- ✓ Preventive and curative measures are taken to tackle drainage problems. The preventive measures are cheaper and cost effective than the curative measures.



Preventive Measures:

1. Provide adequate natural drainage facilities to prevent soil erosion.
2. Land formation for efficient irrigation
3. Adopt contour strip cropping.
4. Lining the irrigation canals to prevent seepage and waterlogging.
5. Use groundwater for irrigation.

Mitigation Measures:

1. Provide adequate surface drainage network.
2. Provide adequate subsurface drainage network.
3. Provision of Interceptor drains and pumping of ground water, tree plantation etc.

Surface Drainage:

Surface drainage is the orderly removal of excess water from land surface, through constructed or improved natural channels (field drains and link drain) and supplemented by proper grading of land surfaces.

Trapezoidal section is designed for the drains. The field drains are constructed with the formation of bund.

Sub-Surface Drainage:

The soils may be well drained and not saline under "natural conditions" i.e., under "rainfed agriculture". These soils, however, may not have adequate drainage properties to cater for "irrigated agriculture". When the rainfed lands are brought under irrigation, it is necessary to establish good drainage system for additional subsoil water and soluble salts which come along with canal irrigation water, extensive use of fertilizers and intensive cropping. If this fact is not recognized in on-farm water management, the ground water table rises from a considerable depth to within a few meters from ground, encompassing the root zone in a short span of time after commencement of canal irrigation. During early years of development of irrigation project, water is frequently plentiful and there is tendency to use it in excess. This hastens the rise of water table and creates conditions conducive to waterlogging. Waterlogging gives rise to salinity.

As the water table rises and the waterlogging conditions are evident, salts concentrated beneath the root zone are dissolved and carried to the root zone or to the surface at sometimes through water by capillary action. The irrigable soils, thus, become waterlogged and become saline either partially or fully. The application of irrigation water may contribute to problem of salinity, because sometimes canal irrigation waters have more concentration of salts than natural rainwater. To avoid waterlogging and salinity, in irrigated area, need of subsurface drainage is evident.

Preventive Measures:

- Timely maintenance of water distribution system and OFD works, drainage schemes in existence and natural drainage channels in association with land formation.
- Crop and water management

It is necessary to connect the borrow pits, alongside of main canal and distributaries, to nearby natural nala. This would avoid continuous addition of seepage water into agricultural lands nearby and prevent waterlogging.



Effects of Poor drainage:

- a) Lack of air space in the soil for proper root growth wherein availability of O₂ is limited.
- b) Some of the toxic substances are produced including H₂S, boric acid in the presence of which even paddy crop is affected. This injury is similar to sulphide injury.
- c) Natural vegetation like plantation and orchards will be affected due to water logging.
- d) Standing water for a long period will give rise to may soil health problems.
- e) Fertilizers applied will percolate to lower zone or lost due to faster infiltration.

Factors responsible for poor drainage:

a) Soil Type

In clayey and heavy soil, the infiltration capacity is low and prone to waterlogged conditions and needs drainage. The mandals coming under the command of IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir Project have negligible area under black cotton soils and heavy soils.

Slope

In areas within adequate slope and flat areas, the movement of water is slow and results in poor drainage. The command area of the IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project is mostly levelled to gently sloping, therefore warrants proper drainage is selected areas as per need.

High Rainfall:

The excess rainfall received in the absence of proper drains will create water logging. All the districts under the project fall under high rainfall zone limit. The IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir Project benefitting mandals are in the uplands area therefore, problems of water logging due to rainfall are not anticipated.

High water table

In the absence of drains where water table is high due to lack of sub-soil drainage, waterlogged conditions or ill drained conditions are created. Under the IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project, such situations may prevail in some parts of the command. To overcome this problem, conjunctive use of surface and ground water and creating suitable sub-soil drainage is planned.

Advantages of drainage

Suitable drainage system has to be provided in the vulnerable areas under IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project area localized for I.D crops. The advantages of proper drainage area as follows:

- Proper drainage makes the entire field more uniform in soil moisture (elimination of wet patches) and results in more effective tillage and harvesting.
- Removal of surplus water from the field increases aerobic microbial activity by permitting air to replace water in more soil pore space. As result the bio-micro-organisms will increase which will decompose more organic matter and thus more potential plant nutrients are made available. Proper drainage decreases potential losses of nitrogen.
- Drainage reduces the building up of toxic substances in soil.
- Wider varieties of crops and more valuable crops can be raised in well drained soils.
- Drainage permits deeper penetration by plant roots thereby increasing the availability of nutrients to growing plants resulting in higher crop yields. Deep roots make plant more resistant to lodging.



10.2.6 Provision of drainage in command

Surface Drainage

Surface drainage is the removal of excess water from rainfall or seepage or irrigation from the surface of lands. Both areas localized for wet and ID, crops need surface drainage system. For designing drainage system, the following factors are to be considered.

- Intensity of rainfall 1 day, 2-day, 3-day rainfall with certain frequencies (5 years, 10 years)
- Infiltration rate of soil
- Evaporation rate
- Crops grown during rainy season or at times of heavy rainfall.
- Landscape
- Gradient that can be given to the drainage channels
- Outfall conditions

Fine textured imperfectly drained soils require provision of sub-surface drainage to remove excess water.

Main Drains

In the IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project command there are natural drains existing as major gullies. The velocity of flow is low, and some time is taken to drain the water to outfalls. Hence in the command, all these main drains are to be strengthened to the extent possible, deepened and wherever required blanks are stabilized. Until and unless these gullies which will serve as main drains are in a condition to receive and discharge the rainfall or water from excessive irrigation in shorter period, the drainage system cannot give any good results.

All field drains draining into subsidiary drains are to be constructed at right angles to natural drains. The size of these drains should be sufficient to take the excess water of the field drains dropped into it. The field boundaries can be made use of in digging these subsidiary drains.

Field drains

These drains are to be constructed by the individual farmers with proper size so that the excess water from their fields is drained into intermediate drains. Field drains or ditches should be at least 30 cm deep with side slopes ranging between 4:1 and 8:1. These should be constructed considering the low spots which collect water from adjoin higher areas. Ditches should be as straight as possible. The cross-section of the field drain should be trapezoidal shape.

10.2.7 Rain water harvesting and Groundwater recharge

Based on ground water resources estimation in the command area of the project the Bheemaverapalli, Velair mandals of Hanumakonda district and Ragunathapalli mandal of Jangoan district, Chigurumamidi, Gangadhara, Ganneruvaram and Shankarpatnam mandals of Karimnagar district, Akkannapet, Mudhoor, Nanganur mandals of siddipet district are all having over exploited stage of groundwater extraction.

Hence rain water harvesting and groundwater recharge need to be taken up on priority for improving the hydrogeological conditions.

Soil fertility status

In areas where soils are low in nitrogen and available P_2O_5 , K_2O status is low to high. The fertility level of soils in respect of nitrogen and phosphorus has to be improved by adequate application of fertilisers as well as organic manure after soil test. The regular extension staff



of Agriculture department generally cater to the needs of the farmer. The recommended doses of fertilisers for rice and pulses are given below.

Crops	Fertiliser dose in kgs / ha			
	N	P	K	Remarks
Kharif irrigated	60-80	30-40	30	N in 2 to 3 splits
Rabi	100-120	30-40	30	-
Kharifrainfed	60	30-40	30	-
Groundnut	40	40	60	-
Jowar	80	40	40	-
Chillies	60	30	50	-
Black gram (ID crop)	20	50	As per soil test	-
Green gram	20	50	-	-
Bengal gram	20	50	-	-

Crop loans are distributed which covers the cost of fertilisers too. Keeping in view the above measures, no provisions for this purpose have been made.

Command Area and Crop water requirements (CWR) / (NIR)

The details of GCA, CCA, Net CCA for the North Telangana Agro-Climatic Zone are given hereunder:

Zone	Gross Command Area (ha)	CCA (ha)	Surface Irrigation	Total Service Area (Net CCA)
			Ayacut under proposed canal	
NorthTelangana (Adilabad, Nizamabad, Siddipet,, Warangal, part of Medak Districts)	1,68,985	1,31,876	89,032	89,032
Total	1,68,985	1,31,876	89,032	89,032

Irrigation Efficiencies

For the purpose of cropping pattern optimization and evaluation of project configuration, the following efficiencies are taken into consideration.

Items	System Efficiency	
	Surface Irrigation	Drip Irrigation
	(Ponded)	(Non-Ponded)
Conveyance efficiency (from canal head to outlet head)	90%	90%
Field channel efficiency (from outlet head to field gate)	85%	98%
Field application efficiency	79%	96%
Overall Efficiency	54%	80%

Water availability

The CWC has made studies on the water availability report furnished by the project authorities. As per the studies made, the yield at 75% dependability has been estimated as



415 TMC and after accounting for the upstream utilizations and other committed utilization the net yield at 75% dependability has been estimated as 282 TMC. It is proposed to divert 180 TMC.

10.2.8 Water Management

Participatory Irrigation Management Practices

Government of Telangana has enacted a law on Participatory Irrigation Management Practices (PIM). WUAs are already functioning for utilisation of water from various tanks in the command and hence the local community is already aware of the modern practices and same can be implemented in the IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir command also.

Existing and Proposed Facilities in the Command Area

Agriculture is one of the most important sectors of the Siddipet, Karimnagar, Jangaon and Hanamkonda districts economy. The main agricultural season is normally from June to Oct / Nov of the year known as Kharif and the Rabi - second season starts from Oct / Nov and continues up to March / April.

Before project in the proposed command area under the minor irrigation tanks paddy is irrigated in an area of 10029.95 Ha. The rest of the culturable command area has Paddy, Cotton and Jowar cultivated under rain fed.

The command area of the project is not covered by any major irrigation schemes in the vicinity namely, ShripadYellampalli Project, Sri Ram Sagar Project Stage I, Nizamsagar canal project. Means out of the total irrigated area 86% is by rainfed and the balance 14% only is fed by minor irrigation sources. Due to less and undependable rainfall in the area and the general geo-hydrological set up of the area, the command does not have any dependable existing irrigation facilities.

The present land use is mainly rainfed cultivation and Crops are grown in two cropping seasons namely, Kharif (June to September) and Rabi (October to March). Paddy, Groundnut, Jowar, Chillies are the major crop in Kharif season. Harvesting period is from 110 to 1400 days.

Use of Improved implements and seeds

Farmers in the command area are habituated to use high yielding varieties of crops and improved bullock drawn and tractor drawn agriculture implements. Each village is having tractors for different primary and secondary tillage purposes. These tractors are also use for transportation purposes.

Suggested Cropping Pattern

The cropping pattern in a particular area is governed by its climate including rainfall and its distribution, minimum and maximum temperatures, humidity, sunshine hours etc., types of soils and topography, availability of irrigation water, supply of agricultural inputs like fertilizers, seeds, pesticides etc. and marketing support for the produce. The availability of irrigation water through this project is likely to create perceptible change in the existing cropping pattern. At present, Kharif crops contribute about 70-80% of the total cropped area because Kharif crops are grown as rainfed crops in rainy season. For Rabi crops, irrigation is the main deciding factor because scanty rains in winter cannot support crop growth and productivity. Therefore, there is ample scope to increase the area of Rabi crop to the extent of 2 to 3fold. At present, the cropping intensity in all the command area is estimated at less than 130% which can easily enhance to 200% with irrigation. Thus, the total cropped area can be increased by more than 50% with major contribution of Rabi crops. During rainy season, soils are recharged with moisture and a crop can be raised. Irrigation may be



required in rainy season only when there is a long drought spell. Rabi crops on the other hand, have high and assured irrigation requirement. Sometimes crops cannot be grown in absence of irrigation and a life-saving irrigation becomes a must. The success of Rabi crop thus depends on availability of irrigation water. Keeping all the parameters affecting cropping pattern in view, the strategy has been developed on cropping pattern in the project.

Proposed out lay

The total cost of the culturable command area development programme is estimated for an amount Rs. 17,494 per hectare is shown in Table 10.11.

Table 10.11 Total cost of command area development

S. No	Particulars	Rs. Per ha
1	On farm development for irrigated crops (per ha)	16,716
2	Drainage	1,138
3	Conjunctive use of ground water	95
	Total	17,494

10.2.9 Stages of Command area Development

The total ayacut contemplated under the project is 2.20 lakh acres (89,031 ha). The extent of ayacut lies under the Gouravelly Reservoir which is proposed to be irrigated after a lift of about 126.52 meters. The extent of ayacut proposed under lift irrigation is 1.20 Lakh acres (48,562ha). Under Flood Flow Canal project all the work components upto Gouravelly reservoir is also completed and about 90 % of the Gouravelly Reservoir works were completed.

The following is the program towards development of ayacut under Gouravelly reservoir is as follows.

1 st year of Construction	-	10,000 Acres (4,048.58ha)
2 nd year of Construction	-	30,000 Acres (12,145.74ha)
3 rd year of Construction -	-	60,000 Acres (24,291.48 ha)
4 th year of Construction -	-	90,000 Acres (36,437.22 ha)
5 th year of Construction -	-	1,20,000 Acres (48,562.27 ha)



10.3

BIODIVERSITY CONSERVATION & MANAGEMENT PLAN

10.3.1. Biodiversity and Wildlife Conservation & Management Plan

Biodiversity is defined as the variability among the living organisms which include plants, animals, micro-organisms, their genetic material and by-products and includes diversity within the species and between the species and among ecosystem in which they live in. The major threats associated with biodiversity conservation are by giving less importance for conservation of living natural resources, due to over exploitation of living natural resources for monetary gain, causing habitat destruction, pollution and species introductions, inadequate knowledge about the values of species and ecosystems, unplanned urbanization and uncontrolled industrialization due to which fragmentation of large contiguous populations into isolated, small and scattered ones due to anthropogenic activities.

The biotic interference has a marked effect on the vegetation leading to the extinction of valuable and rare species. However, due to various anthropogenic factors and natural catastrophes, there is a perceptible decline in the population of many valuable trees, making them rare and threatened.

In the proposed project significant impacts are anticipated as a result of construction and operation of the proposed irrigation project. The impacts are likely to arise as a result of construction of tunnel, reservoir, canal, pump house, etc resulting in dumping of excavated material/muck on land and biological resources. Thus, Biodiversity Conservation and Management plan for proposed project area has been proposed.

10.3.2. Biodiversity Management Plan

Biodiversity plays a major role as it provides the fundamental building blocks for the many goods and services which provide a healthy environment to lead our life. It includes fundamental things to our health like fresh water, clean air and food products, as well as the many other products and also serves as cultural, recreational, and spiritual nourishment that play an important role in maintaining our personal life as well as social life. Increase in biodiversity increases in varieties of species in plants and animals that are necessary for future research in finding material for the benefit of the mankind. The knowledge of biodiversity is limited, and biodiversity provides a vast area to find various material for the benefit of the mankind and lot of research on biodiversity must be maintained as the future of the mankind becomes dangerous.

As per section 41 of the Biological Diversity Act 2002 and Telangana State Biodiversity Rules 2015, every local body shall constitute a Biodiversity Management Committee (BMC) within its area for the purpose of promoting conservation of biological diversity.

For the promotion of the conservation and preservation the following measures are proposed for the IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir Project.

10.3.3. Improvement of Habitats:

Owing to Habitat fragmentation on account of construction or reservoir, canal, pump house, etc. It is imperative to protect, restore, manage and maintain representative biodiversity along with ecological processes and conservation of wild gene pool. The other measures recommended for improvement of habitats are:



- Provision of drinking water facility for the by constructing small ponds / tanks.
- Plantation of fruit bearing trees to attract avifauna which will also be useful for roosting, breeding and hiding cover for migratory birds etc.
- Removal of weeds.

The cost for habitat improvement for avi-fauna is given in Table 10.12

Table 10.12 Cost of Habitat improvement for avi-fauna

S No.	Particulars	Cost in (Rs. Crore)
Non-recurring Cost		
1	Cost of nests of different sizes (10"x10" to 20"x20"; average cost Rs. 1000 per wooden box) and installation of 1000 wooden boxes	0.10
2	Repair and maintenance of the nests	0.04
Recurring Cost (for 5 years)		
3.	Salary for 7 skilled persons @ Rs. 11190 per month for implementation and data collection for 5 years	0.47
4.	Contingencies (including avifaunal biodiversity awareness programme for the local inhabitants)	0.15
	Total	0.76

10.3.4. Budget for Biodiversity Conservation and Management Plan

A total provision of **Rs.0.76 Crore** has been earmarked for Biodiversity Conservation Management Plan consisting of Habitat Improvement and measures to Improve Habitat of Avifauna.



10.4

REHABILITATION AND RESETTLEMENT (R&R) PLAN

10.4.1. Introduction

IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir Project envisages the

- Construction of FFC Canal :122 km.
- Reverse lift pump houses: 3 number.
- MMR Canals:103.375km.
- Tunnel – 11.98 km.
- Pump house – 3 x 32MW(3x19cumecs).
- Gouravelly Canals-63.725 km.
- High Level Canals-20.845 Km.
- Mid Manair Reservoir: 25.873 TMC.
- Gouravelly reservoir: 8.23 TMC to serve the command area of 48,561 ha (1,20,000 acres) in Karimnagar, Siddipet, Hanumakonda and Jangaon Districts make agriculture remunerative and give relief to the farming community that has suffered terrible losses due to uncertainty of monsoon rains.

The construction and operation of IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir

- Total land required is 3870 acres (1566.80 Ha) and the same was acquired .
- Villages with Full Submergence including Gudatipally Gram panchayath, Tenugupally, Maddelapally and Kottapalli are H/o Gudatipally.
- Partial Submergence Villages Gouravelly, Janagoan, Gandipelly, Regonda, Nandaram, Ramavaram.
- Affected Structures - 817 Nos& 1122 Nos families.

The project impacted the social and human environments in the project area. Similarly, when the lands of the local people are acquired for the project it not only adversely affects the livelihood of the landowners but also the population that were dependent on that land to earn their daily wages. The purpose of Rehabilitation and Resettlement plan (R&R) is, therefore, to ensure that all Project Affected Persons (PAPs) are identified, all adverse impacts are fully investigated, and an R&R plan drawn to provide adequate compensation and relief to all PAPs to re-establish their livelihoods.

10.13 Details of submergence area of Gouravelly reservoir

Name of habitation	No. of PDFs
SevyanaikThanda	50
BondiyanaiThanda	16
JalbaiThanda	41
ChintalThanda	50
TirumalnaikThanda	28
Total	185

There are 10 villages coming under submergence of the Gouravelly reservoir that need to be shifted, affecting 1104 families. In addition, total land required for the project is 3870 acres(1,566.80ha).Thus, the project would affect a large population and a proper R&R plan is necessary so that rural people already under economical stress are not subjected to



additional hardship because of the project that is supposed to bring relief and prosperity to the suffering masses.

Adequate effort has been made to identify all the Project Affected Families (PAFs) both due to shifting of the villages and land acquisition as per the prescribed Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, 2013 (Act No. 30/2013) of Government of India and G.O.Ms.No.120 -The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (Central Act No.30 of 2013) – Amendment by the Telangana Amendment Act, 2016 (Act No.21 of 2017). The Resettlement and Rehabilitation Plan has been prepared to comprehensively address the issues arising out of shifting of villages with the assessment of different assets of each PAF such as house, cattle -shed, garden, trees, etc. For the individual PAFs the extent of land to be acquired, the type of land and payment of adequate compensation as per the Act and Rules mentioned above so that due to loss of land the affected people are not put to any disadvantageous position in terms of income. The estimation of extent of loss and compensation is offered in line with (RFCTLARR) Act, 2013 of Gol and State R & R Rules, keeping in view of the following objectives:

- To compensate families whose lands are acquired, and other assets are lost because of the shifting of the village for the project,
- To create better living conditions and to improve by and large the quality of life of people residing in the project area,
- To ensure the overall development of the project affected families and
- To create good rapport with the local people for long-term relationship and mutual benefits.

10.4.2. Land requirement

As discussed above, total land requirement for the project has been assessed as 3870 acres (1,566.80ha).

On finalization of the project layout, the project proponent had given the requisition for the land requirement for the various components involved in the project implementation such as construction of reservoir, pump house, tunnel, gravity canal, etc. The District collector with the help of Commissioner R&R and revenue officers in the district have identified the landowners and structures coming under acquisition.

The R & R package and compensation for the land required for the project was decided by the district collector as per the provisions made in the RFCTLARR rules, 2013 of Gol and in accordance with the provisions contained in Sec.10(A) of the Telangana Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013. Though GO.Ms 120 of Telangana State the Social Impact Assessment and Social impact Management Plan is exempted, but in order to know the impact of the affected families on the proposed project a Socio economic survey of the project affected families /owner was conducted by carrying out door to door survey covering families out of to know the socio economic conditions of the PAFs and PDFs. Survey was based on the questionnaire. Data was collected on the various parameters on Quality of life, income patterns, demographic profile, etc. The existing socio-economic profile of the project-affected area and PAFs have been given in the baseline Chapter 3 of the EIA report. Discussions were held with the project affected families. Most of the families expressed their willingness to comply with the project requirement keeping in view of its ultimate usefulness in improving the agriculture, drinking water, fisheries and ground water. It was understood by the people in the project area that with the filling of reservoir and supply of irrigated water in the command area even the land adjoining to the reservoir and command area would have sufficient ground water to cultivable their dry lands by tapping the ground water with pumps sets as government has promised to supply free electricity for 24 hours a day and input cost of Rs 4000 per crop season. However, some of the land losers are bargaining for better



compensation and some are politically motivated to oppose. The government is looking for an amicable settlement where no one will be a loser and the project would bring a major change in improving the economy in general and to agriculture in particular for all.

10.4.3. Resettlement and Rehabilitation Plan

The process of R&R involves the physical relocation of the affected population (displaced) to a new residential site. Rehabilitation on the other hand means assisting the affected population so that every individual can get a better deal to improve his/her life and socio-economic status. Imparting skills and/or vocational training to the persons among eligible PAFs is one of the important components of the rehabilitation plan.

Resettlement and Rehabilitation involves the following interventions:

- Provide adequate compensation to PAFs whose land is acquired so that they can lead a better life and in no case, they should be a loser in the bargain.
- To create good rapport with the local people for long-term relationship and mutual benefits.

The Resettlement and Rehabilitation (R&R) benefits shall be extended to all the Project Affected Families (PAF's) and Project Displaced Families (PDF's) with special care for the families belonging to below poverty line (BPL) in accordance with the RFCTLARR Act, 2013 of GoI and G.O.Ms.No.120 -The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (Central Act No.30 of 2013) – Amendment by the Telangana Amendment Act, 2016 (Act No.21 of 2017) in its application to the State of Telangana – The Telangana State Land Acquisition (Consent Award, Voluntary Acquisition and Lump-sum Payment towards Rehabilitation and Resettlement) Rules, 2017 – Notification dated 30.06.2017. The Entitlement matrix for the R & R benefits is provided in Table 10.14.

Table 10.14 Entitlement Matrix

S. No	Elements of R & R Entitlements	Entitlement Provision as per the RFCTLARR, Act 2013	Rehabilitation and Resettlement lump sum package under the RFCTLARR (Telangana Amendment) Act, 2016 (Act No.21 of 2017)
1.	Provision of housing units in case of displacement	(1) If a house is lost in rural areas, a constructed house shall be provided as per the Indira AwasYojana specifications. If a house is lost in urban areas, a Constructed house shall be provided, which will be not less than 50 sq.m in plinth area. (2) The benefits listed above shall also be extended to any affected family which is without homestead land, and which has been residing in the area continuously for a period of not less than three years preceding the date of notification of the affected area and which has been involuntarily displaced	Rs.5.04 lakhs (equivalent to a house as per the two-bed room housing policy of the State Government) will be paid in case of displacement of a family living together. Or Rs. 1.25 lakhs will be paid to single family (equivalent to Indira AwasYojana, IAY) (Family includes a person, widow / widower, his or her spouse, minor children, minor brothers and minor sisters dependent on him / her)



S. No	Elements of R & Entitlements	Entitlement Provision as per the RFCTLARR, Act 2013	Rehabilitation and Resettlement lump sum package under the RFCTLARR (Telangana Amendment) Act, 2016 (Act No.21 of 2017)
		from such area: Provided that any such family in urban areas which opts not to take the house offered, shall get a one-time financial assistance for house construction, which shall not be less than one lakh fifty thousand rupees: Provided further that if any affected family in rural areas so prefers, the equivalent cost of the house may be offered in lieu of the constructed house: Provided also that no family affected by acquisition shall be given more than one house under the provisions of this Act. <i>Explanation.</i> —The houses in urban areas may, if necessary, be provided in multi-storied building complexes.	
2.	Choice of Annuity or Employment	The appropriate Government shall ensure that the affected families are provided with the following options: (a) where jobs are created through the project, after providing suitable training and skill development in the required field, make provision for employment at a rate not lower than the minimum wages provided for in any other law for the time being in force, to at least one member per affected family in the project or arrange for a job in such other project as may be required: or (b) onetime payment of five lakhs rupees per affected family; or (c) Annuity policies that shall pay not less than two thousand rupees per month per family for twenty years, with appropriate	(a) Onetime payment of Rs. 5.00 lakhs for the affected family. OR (b) Rs.3,000/- per month as annuity will be paid for an affected family in case of SC and ST for a period of 20 years. OR (c) Rs.2,500/- per month as annuity will be paid for an affected family in case of other than SC and ST for a period of 20 years. (d) The annuities mentioned above will be with appropriate Indexation to the consumer price index.



S. No	Elements of R & Entitlements	Entitlement Provision as per the RFCTLARR, Act 2013	Rehabilitation and Resettlement lump sum package under the RFCTLARR (Telangana Amendment) Act, 2016 (Act No.21 of 2017)
		indexation to the Consumer Price Index for Agricultural Labourers.	
3.	Subsistence grant for displaced families for a period of one year	Each affected family which is displaced from the land acquired shall be given a monthly subsistence allowance equivalent to three thousand rupees per month for a period of one year from the date of award. In addition to this amount, the Scheduled Castes and the Scheduled Tribes displaced from Scheduled Areas shall receive an amount equivalent to fifty thousand rupees. In cases of displacement from the Scheduled Areas, as far as possible, the affected families shall be relocated in a similar ecological zone, so as to preserve the economic opportunities, language, culture and community life of the tribal communities.	A total of Rs.40,000/- will be paid per family as a subsistence grant for one year. In addition to above, an amount of Rs.60,000/- as a one-time grant will be paid for the affected family belonging to SC and ST in the scheduled Areas.
4.	Transportation cost for displaced families	Each affected family which is displaced shall get a onetime financial assistance of fifty thousand rupees as transportation cost for shifting of the family, building materials, belongings and cattle.	Rs.60,000/- as a onetime transport grant will be paid to each affected family in case of displacement.
5.	Cattle shed/petty shops cost	Each affected family having cattle or having a petty shop shall get one-time financial assistance of such amount as the appropriate Government may, by notification, specify subject to a minimum of twenty-five thousand rupees for construction of cattle shed or petty shop as the case may be.	Rs.25,000/- as a onetime financial assistance will be paid for each affected family having cattle or a petty shop for construction of cattle shed or petty shop as the case may be.
6.	One time grant to artisan, small traders and certain others	Each affected family of an artisan, small trader or self-employed person or an affected family which owned non-	Rs.30,000/- as a onetime grant will be paid to artisans, small trader or self-employed person or an affected family which



S. No	Elements of R & R Entitlements	Entitlement Provision as per the RFCTLARR, Act 2013	Rehabilitation and Resettlement lump sum package under the RFCTLARR (Telangana Amendment) Act, 2016 (Act No.21 of 2017)
		agricultural land or commercial, industrial or institutional structure in the affected area, and which has been involuntarily displaced from the affected area due to land procurement, shall get onetime financial assistance of such amount as the appropriate Government may, by notification, specify subject to a minimum of twenty-five thousand rupees.	owned non-agricultural land or commercial, industrial or institutional structure in the affected area.
7.	One-time Resettlement Allowance	Each affected family shall be given a one-time "Resettlement Allowance" of fifty thousand rupees only.	Rs.60,000/- will be paid to each affected family as one time resettlement assistance.
8.	Fishing rights	In cases of irrigation or hydel projects, the affected families may be allowed fishing rights in the reservoirs, in such manner as may be prescribed by the appropriate Government.	Fishing rights for the affected families if storage tanks are created and fishing is feasible.
9.	Stamp duty And registration fee	(1) The stamp duty and other fees payable for registration of the land or house allotted to the affected families shall be borne by the Procuring Agency. (2) The land for house allotted to the affected families shall be free from all encumbrances. (3) The land or house allotted may be in the joint names of wife and husband of the affected family.	(1) The stamp duty and other fees payable for registration of the land or house allotted to the affected families shall be borne by the Procuring Agency. (2) The land for house allotted to the affected families shall be free from all encumbrances. (3) The land or house allotted may be in the joint names of wife and husband of the affected family.
10.	Financial assistance in lieu of specified benefits		Rs.7,50,000/-. An option will be given in case a joint family with all members living together decides to set up a self - financed scheme or an enterprise based on their own choice or for any other income generating activity. Such a family will be paid a lump sum amount of Rs.7.5 lakhs towards



S. No	Elements of R & Entitlements	Entitlement Provision as per the RFCTLARR, Act 2013	Rehabilitation and Resettlement lump sum package under the RFCTLARR (Telangana Amendment) Act, 2016 (Act No.21 of 2017)
			financial assistance in lieu of the specified benefits listed in Items 2-7 above.

In general, the State of Telangana has proposed a better compensation for the PAFs as compared to the Central Act.

10.4.4. Basic amenities to be provided at resettlement centre for the Project displaced families.

While shifting the population of the affected zone to the Resettlement zone, the Administrator for R&R may as far as possible, ensure that:

- In case the entire population of the Village / area to be shifted belongs to a particular community, such population/ families may be resettled together in a compact area so that socio- cultural relations (social harmony) amongst shifted families are not disturbed.

Lump Sum payment towards Rehabilitation and Resettlement

The Authorized Officer shall finalize the details of the families affected due to land acquisition after conducting detailed enquiry duly giving a prior notice and submit a scheme to the District Collector for approval.

The District Collector shall offer options to the affected families to choose either entitlements as per the RFCTLARR Act, 2013 or R&R Lump-sum Package under RFCTLARR (Telangana Amendment) Act, 2016 as per the Schedule to these rules. The District Collector shall make an award for payment in lump sum or otherwise depending on the choice of project affected families towards Rehabilitation & Resettlement as per the Schedule provided that the lump sum payment shall be higher than what could have been arrived under the provisions of sections 30 and 31 of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 read with rules 26 to 28 of the Telangana State Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2014.

As per the Act, the market value will be decided by the District Level Land Procurement Committee (DLLPC) along with the land loser and then they will finalize the rate for per acre and further they will decide on compensation for structure, wells, trees etc. which will be paid after the assessment of the concerned authorities. The Project affected families list is given in Table 10.15.



Table 10.15 Project affected families

Sl. No.	Name of reservoir	Name of village submerged	No. of villages shifted	No. of houses	No. of PAFs	No. of PDFs	STATUS OF STRUCTURE PAYMENT			STATUS OF R&R PACKAGE			Location of R&R colony	Name the facilities in R&R colony (for ex: Drinking water, Electricity, Roads, Schools, Drainage, Commnuity halls etc)
							Total Nos proposed	Payments made From 2003 to 2022 (Nos)	Amount paid From 2003 to 2022 Rs. In cr	Total Nos proposed	Cheques issued (Nos) From 2003 to 2022	Amount paid From 2003 to 2022 Rs. In cr		
FULLY SUBMERGED VILLAGES OF GORAVELLY RESERVOIR														
1	Gouravelly Reservoir	Fully Submerged - Gudatipally (V), Akkannapet (M), Husnabad Division, Siddipet District.	-	817	49	1122	817	817	93.94	1122 (937+185)	1122	147.55	Instead of R&R Colony One time settlement of Rs. 8.0 L per PDF was made for 937 PDFs coming under 1.410 TMC submergence vide ref I & CAD Dept. Govt. Of Telangana G.O Ms. No. 23, Dt. 18.04.2017	R&R Colony for 185 PDFs is Under progress



FULLY SUBMERGED VILLAGES OF MID MANAIR RESERVOIR														
2	Mid Manair Reservoir	Anupuram	1		0	1109	722	(722) 103.14	103.14	(1109 PDFs) 217108375/-	-	21.35	Nampalli Village	Drinking water, Electricity, Roads, Schools, Drainage, Community halls are established
		Kodimunja	1		0	375	255	(255) 40.67	40.67	(375 PDFs) 80101750/-	-	7.70	Nampalli Village	
		Rudravaram	1		0	1171	903	(903) 102.23	102.23	(1171 PDFs) 229555470/-	-	22.62	Nampalli-Sankapalli Village	
		Sankapalli	1		0	641	156	(156) 18.15	18.15	(641 PDFs) 124306625/-	-	10.84	Sankapalli Village	
		Arepalli	1		0	73	18	(18) 0.81	0.81	(73 PDFs) 14405625/-	-	13.99	Nampalli Village	
		Cheerlavancha	1		0	2605	1825	(1825) 152.26	152.26	(2605 PDFs) 506061750/-	-	49.69	Cheerlavancha (Block- I) Marupaka-Thettakunta (Block - II)	
		Chinthaltana	1		0	1229	710	(710) 98.95	98.95	(1229 PDFs) 213318500/-	-	19.99	Chinthaltana Village (Block - I) Nampalli Village (Block-II)	
		Kodurupaka	1		0	1467	1665	(1665) 209.87	209.87	(1467 PDFs) 237583750/-	-	23.04	Kodurupaka Village	
		Neelojipalli	1		0	599				(599 PDFs) 110403750/-	-	10.72	Kodurupaka - Narsingapoor Village	
		Vardavelli	1		0	881	582	(582) 62.95	62.95	(881 PDFs) 170208625/-	-	16.46	Vardavelli Village (Block-I) Rajannapeta (Block-II)	
		Shabashpalli	1		0	316	236	(236) 31.62	31.62	(316 PDFs) 37785000/-	-	37.78	Nampalli Village	
		Gurramvanipalli H/o. Kandikatkoor	1		0	217	117	(117) 10.5	10.5	(217 PDFs) 25016000/-	-	25.01	Marupaka Village	



PARTIALLY SUBMERGED VILLAGES														
3	Mid Manair Reservoir	Manuwada	-		608	0	-	-	-	(608 One Time Settelement) 258400000/-	-	23.75	-	
		Kandikatkoor	-		159	0	-	-	-	(159 PAFs) 19928125/-	-	1.70	-	
		Kothapeta	-		75	0	-	-	-	(75 PAFs) 7984375/-	-	0	-	

The I&CAD department has estimated about Rs.284.64 crores as compensation to the project effected families of the partially and fully submerged villages in the submergence area of Mid Manair reservoir. Accordingly the Government of Telangana has released the compensation amount as per the prevailing R&R act.

The Siddipet district administration has estimated an amount of Rs.147.55 crores as compensation to the project effected families in the submergence area of Gouravelly reservoir for the expansion area. Accordingly the Government of Telangana has released the compensation amount as per the RFCTLARR Act of 2013 of GoI and TSRFCTLARR Rules 2016. Govt. of Telangana has fulfilled its commitment to the PAFs to provide the best possible deal so that all would be benefited and none would be a loser.



10.5

GREENBELT DEVELOPMENT PLAN

10.5.1 Green Belt Development Plan

Green belt development plays a crucial role in river valley projects. Once the project commence, emanates a lot of dust due to excavation works, crushing of material, etc. In addition to that air pollution also takes place due to vehicular movement during construction and operation phases. The need for green belt is most essential, not only for aesthetic purposes but also for the fulfilment of ecological functions. The main objective of having greenbelt development is to mitigate dust pollution, fugitive emissions, to control noise pollution and to improve landscape and local ecosystem and also to arrest soil erosion.

Species Selection

The species selected for green belt include the native species which are indigenous, economically important, soil binding in nature and can thrive well under high humidity and flood conditions shall be planted to maintain species diversity, rational utilization of nutrients and also to maintain health of the trees. Greenbelt shall develop a favourable microclimate to support different micro-organisms in the soil of which soil quality will improve further. The selected species comply with the requirements of MoEF&CC guidelines (CPCB (2000) *Guidelines for Development of Greenbelts* Published by CPCB, Delhi).

Criteria for Selection of Species for Greenbelt

The plant species suitable for greenbelt development are selected based on the following characteristics.

- Species with thick canopy cover.
- Species identified will be efficient in absorbing pollutants without significantly affecting their growth.
- Species preferably would be indigenous and native of the area.
- Species with fast growing.
- Species with large leaf area index
- Species selected would be of perennial and evergreen.
- Species which attracts birds and insects
- Species selected would be able to attenuate noise generated within the area.

Guidelines for Plantation

The plant species identified for greenbelt development should be planted using pitting technique. The pit size should be either 45 cm x 45 cm x 45 cm or 1 m x 1 m x 1 m for trees and 30 cm x 30 cm x 30 cm for shrubs. The selected native plants should be grown as per normal horticulture practice with adequate nutrients with proportionate earth, sand, silt and manure for saplings and maintaining under favourable conditions of climate and drainage with proper provision of waters for the protection of the saplings.

The selected species has the potentiality to respond to pollution, act as wind breakers, helps in noise attenuation and arrest the soil erosion besides having an aesthetic appeal. Planting should be done as per the CPCB Guidelines.



Precautions for Plantations

Some important precautions are to be taken during the plantation. Variety of plant species mentioned should be planted in large numbers, so as to provide direct benefit like fruits or medicines, extraction of fodder to people living around, etc.

Green Belt around periphery of Reservoir and Canals

The green belt at the periphery of the reservoir is to reduce the sedimentation, control soil erosion, dust and siltation and to ensure protection of the reservoir area from any other human activity that could result in the reservoir catchment damage. The green belt shall start from the immediate vicinity of the reservoir rim for 110.020 ha. The proposed list of species selected at the periphery of the reservoir site are provided in annexure. Water and high humidity loving plants like ferns (*Pteridium* sp., *Dryopteris* sp., *Adiantum* sp., *Polystichum* sp.) *Albizia odoratissima*, *Oroxylum indicum* including shrubs and herbs for plantation in the bottom layer.

Along the FRL

- FRL length: 13 KM
- No. of Rows: 3 rows
- Out of 3 rows, 2 rows are proposed inside of FRL and 1 row is proposed along the FRL.
- Total length: $3 \times 13000 = 39000\text{M}$
- Proposed spacing between each plant 3M.
- No. of plants $39000 / 3 = 13000$ Nos.

Along the D/s of the Bund

- Gouravelly Bund length: 10.60 KM
- Bund length after deleting the structure portion: 1,00,00m.
- Buffer zone: 50m
- Proposed spacing: 5m
- No. of Rows: $50/5 = 10$ rows
- Total length: $10 \times 10000 = 1,00,000\text{m}$
- Proposed spacing between each plant: 5m
- No. of plants: $1,00,000 / 5 = 20,000$ Nos.

Diversion Road

- Diversion Road length = 10 KM
- No. of Rows = 2 rows
- 2 rows on both sides of Diversion Road are proposed.
- Proposed spacing between each plant = 5m
- No. of plants = $10,000 \times 2 \times 2/5 = 8,000$ Nos.

Main Canal

- Length of Gouravelly RMC and LMC = 65 KM
- No. of Rows = 2
- 1 row on both sides of main canal is proposed.
- Proposed spacing between each plant = 5m
- No. of plants = $65,000 \times 2/5 = 26,000$ Nos.



Distributaries'

- Length of distributaries = 160 KM
- Length of distributaries after deleting the Structures = 135 KM
- No. of Rows = 21 row on both sides of each distributary is proposed.
- Proposed spacing between each plant = 5M
- No. of plants $135000 \times 2/5 = 54000$ Nos.

- **Total number of plants proposed for green belt in respect of Gouravelly project.**
= $(20,000+13,000+8,000+26,000+54,000) = 1,21,000$.

$$\begin{aligned}
 \text{Area proposed for green belt} &= (10,000 \times 50) + (13,000 \times 3 \times 3) + (10,000 \times 2 \times 5) + \\
 &\quad (65,000 \times 5) + (1,35,000 \times 5) \\
 &= 5,00,000 + 1,17,000 + 1,00,000 + 3,25,000 + 6,75,000 \\
 &= 17,17,000 \text{ Sq.m} = 171.70 \text{ Ha. Say } 172 \text{ Ha.}
 \end{aligned}$$

Technical Specification for Plantation of Trees

- Height of the plant : Not less than 2m
Age of the plant : Not less than 3 years

Canal bank plantations

Due to irrigation projects, the canals are dug up and the excavated earth is heaped on both the sides, these banks are poor in their fertility. They need to be protected from erosion. Tree growth protects the bank and also prevents evaporation of the water in the canal. Canal bank plantation also serves as shelter belts to many fields adjoining the canals. Species suitable for canal bank plantations are Bamboo, teak and fruit yielding plants. They are of high economic value. Bamboo can be harvested after every 3 to 4 years. If the soil is stony and gravel, Agave species can be raised to considerable extent on canal bank plantations. Apart from that cover crops are also excellent plants for erosion control. Among cover crops, legumes and grasses are extensively used to control soil erosion.

Budget

The cost is worked out by adopting present F.S.R. OF 2023-24, Government of Telangana, Forest Department. It is proposed to afforest about 13 km of land at periphery of the Reservoir with bund length of 10.60 km and Diversion road of 10 km, Main canal 65 km, distributaries 160 km plantations on either side as a part of greenbelt development plan. Total number of plants proposed for green belt in respect of Gouravelly project is 1,21,000. The total cost works out to Rs. 2.13 Crores. The estimated cost for plantation along periphery of reservoir and canals for IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project (2023-24 to 2028-2029) is given in Table 10.16.

Table 10.16 Proposed plantation cost

No. of plants	Cost per plant* Rs.	Total Cost
121000	176	2,12,96,000.00 Rounded to 2.13 Crores

*This include plantation of tree, maintenance, salary of care taker etc. to improve the survival rate of the plant.



10.6

FISHERIES CONSERVATION AND MANAGEMENT PLAN

10.6.1. Introduction

A water resources project may have adverse or beneficial effects on the fish fauna, depending upon the particular situation and the fish fauna inhabiting the concerned river. Similarly, it has various impacts on the people, the livelihood of which depends on the fish.

The construction of the Gouravelly reservoir leads to submergence of the following water bodies/tanks and the members of the fishing society are eking out their lively hood by culturing fish in these water bodies. Catla, Rohu, Mrigaala are the prominent species being reared in these tanks.

- Kanarani Cheruvu
- Yelapuramkunta
- Edulakunta
- Kukkalonikunta
- Kondrganikunta
- Thirumallakunta

As there are no river/ streams passing through the proposed area of the reservoir, the presence of migratory fish doesn't arise. However, it is suggested to plan fish ladders near the weir/ flood gates of the project to prevent loss of fishery wealth. (Enclosed as Annexure-10A)

Sustenance& Enhancement of Fisheries Potential

The management of reservoirs is based on the stocking–cum capture fishery technique. The formation of fish population in reservoir is basically from the parental population of the inundated river and watershed areas. It is usually characterised by strengthening of lacustrine species and decline in riverine species as a result of change from riverine to lacustrine condition which do not favour them. The management techniques involve:

- Introduction of selected varieties of carps from extraneous sources, so as to develop a carp dominated fishery through self-propagation as well as regular stocking.
- A rational system of exploitation based on the concept of fishing effort and population dynamics of the fish stock.
- Conservation measures e.g., regulation of mesh size, imposition of size limits, observance of closed season, ban on destructive methods of fishing etc.
- Preservation, transport and marketing of fresh fish.

10.6.2. Impacts of Stocking

Stocking in the medium and large reservoirs could be considered as successful only when the stocked fish are recaptured. Indian experience of stocking medium and large reservoirs suggests that by and large, the stocking becomes effective only when the stocked fishes propagate themselves. Moreover, this breeding population can be built-up only if the stocking is resorted to during the early phase of the reservoir formation.



10.6.3. Stocking Density

Decision regarding number of fingerlings to be stocked in any impoundment are vital and depends upon the potential of the biotope. A number of methods are in vogue for calculating.

the stocking rates. Huet (1960) provided a general stocking formula, which can be applied universally irrespective of the size of the reservoir. The fish yield can be estimated from the primary productivity studies or trophodynamic models. While estimating the percentage loss, chances of survival of the stocked fish in the light of predator pressure, escapement through the outlets and overfishing are to be taken into consideration:

$$\text{Stocking rate (No./ha)} = \frac{\text{Total Yield (in kg. /ha + Loss \%}}{\text{Individual growth of fish in kg}}$$

A desired balance between the stocking rate, population density and growth are to be maintained with enough flexibility so as to swing it to suit the changes in the environmental factors.

10.6.4. Fish Seed Requirement

Based upon experience gained in the past, a stocking rate of 300 fingerlings per ha. (Above 100 mm.) for reservoir has been proposed in the initial years of development. The total requirement of advanced fingerlings will thus be 4.7 lakh (100 mm.). The submergence area of IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir Irrigation Project is 9449 ha. In order to attain this target, the requirements of fish seed of different sizes have been worked out as under:

Requirement of advanced fingerlings: Stocking @ 300 advanced fingerlings / ha. (100 mm.)
1567ha x 300 = 4,70,100.

Requirement of standard fingerlings (50 mm.) at 80% survival = 3.76 Lakhs

Requirement of fry (25 mm.) at 60% survival = 2.26 Lakhs

Requirement of spawn at 40% survival = 90259

Requirement of rearing space

Nursery area: 2 ha.

Rearing area for fry to standard fingerlings (50 mm.)

@ of 3.76 lakhs/ha/year. Thus, requirement for 3.76/year

Brood Stock Ponds: Adequate provision for maintenance of brood stock should also be made, preferably in close vicinity of the hatchery. In addition to the above rearing space, for raising advanced fingerlings, 3.06 ha of advance fingerling ponds would be needed. These grow out ponds should be managed and operated as far as possible with people's participation preferably by the outsees for which necessary technical expertise will be provided by State Fisheries Department. Some of the village ponds situated along the periphery of the reservoir could also be used for raising advanced fingerlings. This will generate additional income to the oustees.

10.6.5. Management of Habitat

The initial trophic burst stage is the most critical stage of management. The reservoir is amenable for stock manipulation or correction during these initial crucial years by selective



stocking with greater emphasis on fishes of short food chain (phytophagous) and close to primary producers like Indian major carps viz, Catla, Rohu and Mrigal, it is not proposed to introduce any exotic species like Grass carp, silver carp, etc. into the reservoir. This ecological consideration is of vital importance as once the predatory and carnivorous cat fishes have taken a foot hold in the reservoir, it will be difficult to establish carp fishery through stock manipulation. It is also stated that if the trophic burst stage is not utilized, the optimum production from the reservoir would be lost forever.

The Indian major carps are stocked as they find the environment suitable for growth and production, and their compatibility and non-cannibalistic trait, high fecundity and breeding success, etc. For better utilization of the unutilized fraction of food (phytoplankton, zooplankton, benthos, periphyton, detritus etc.) stocking of *L. calbasu*, *L. fimbriates*, *L. bata*. It is proposed to stock some of the tanks in the command area with fisheries. It is proposed to develop hatcheries to provide fingerlings in the ponds.

10.6.6. Organisation of Fishermen and Training

Fishermen in India, belong to the lower socio-economic segment of the population, are mostly illiterate and chronically indebted to the middlemen. Hence, socio-economic reforms for 'welfare of Fishermen' are an essential aspect for the all-round development of fisheries in India. Under this programme strengthening of existing cooperatives and organization of new ones are envisaged. Under the existing cooperative structure, the primary societies are at the base or village level affiliated to Matsya Mahasangh, The primary societies are basically producer societies engaged in fishing activities. The apex body will provide credit and supplies to the primaries and market their catch. They will also arrange for the infrastructures needed for storage, transportation of fish, welfare of the fishermen etc. and distribute bonus / dividend to the primaries in addition to payment of catching charges of fish.

These fishermen will be imparted training in fishing techniques and operation of boats, handling, storage and transport of fish etc. They will also be provided with productive assets to pursue their vocation.

Various components for enhancement of fisheries can be achieved through-

- **Seed production**
Establishment of freshwater fish seed hatcheries, Fish seed rearing units, Construction of New Fish Seed Farms, Captive fish seed rearing ponds, Strengthening of Fish Seed Farms and Pen culture
- **Fish production**
Construction of new fish ponds/ tanks and rearing cost, Re-circulatory Aquaculture System, Integrated Development of Reservoir fisheries, Stocking of Fish Seed in tanks and reservoirs Stocking of Juvenile prawn (wild/scampi) in tanks and reservoirs
- **Harvesting Support**
Crafts and Nets and Drag nets
- **Marketing Support**
Plastic fish crates (unit of 5 crates), Portable fish vending Kiosks, Mobile Fish Outlets, Vending unit with Moped, Vending unit with Luggage Auto, Hygienic Transport Vehicle (Four wheeler), Insulated trucks, Marketing assistance to Fisherwomen Cooperative Societies
- **Infrastructure development**
Construction of Retail Fish Markets, Construction of Wholesale Fish Markets, Construction of Landing Centers, Establishment of Ice Plants, Establishment of fish feed mills (small), Establishment of large formulated pellet feed plant, Net Mending



and Putti fabrication units, Fish Processing units, Infrastructure for District Training cum demo centres for skill development

- **Encouraging innovative projects**

Establishment of Ornamental Fish Units, Aqua Tourism units, Other innovative projects (Eg: Integrated fish culture)

- **Capacity building**

Training of beneficiaries, Society and staff of Federation and department, Exposure Visits (within & outside the country), Preparation of brochures, pamphlets, training materials, etc, Managerial Assistance to Federation - PMU constitution for coordination, MIS and online monitoring, Technical Consultancy/ Consultations/ commissioning thematic & research studies

10.6.7. Conservation and Management Fisheries Rules

It is proposed to formulate reservoir fishing rules, which would include regulation of mesh size, restrictions on catching of major carps below certain size and weight, observance of closed season etc.

Closed Season

Under the existing rules fishing is restricted from 16 June to 15 August each year which is the breeding season of major carps and also certain cat fishes.

Regulation Of Mesh Size

Regulation of mesh size will be enforced to protect destruction of spawners and juveniles particularly during closed season. Restrictions on minimum size of important fishes like Catla, Rohu, etc. will also be imposed.

Motivation and Awareness

During the last decade or so, it has been observed that the conservation rules for Natural Resource Management (NRM) could be enforced properly with peoples' participation and emphasis is laid on community conserved Biodiverse Areas. For this, apart from Motivation and Awareness creation involvement of fishing community in the fishery development process is essential.

10.6.8. Cost Estimates

Based on the Department of Fisheries, Government of Telangana the cost estimate for fisheries management in seven districts of IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project is prepared. After the completion of the project with water spread area of 1214 ha approx. the estimated production of fish is 455.2 tonnes per annum. The total cost for fish management is **Rs.24.778 Crores**.

Major objectives:

1. Year round fishing activity & supply of local fish in Telangana.
2. Saturation approach in fish rearing in water bodies.
3. Diversification of fish rearing activities.
4. Improved livelihood & enhanced incomes
5. Increasing production and productivity by providing backward and forward linkages
6. Achieving self-sufficiency in production of fish seed
7. Fish to consumers at an affordable price and in hygienic condition



10.7

RESERVOIR RIM TREATMENT PLAN

10.7.1. Reservoir Rim Treatment Plan

The construction of the Gouravelly reservoir will result in ponding of water. The rim length of reservoir is given in Table 10.18

Table 10.18 Rim length of reservoir

S.No	Reservoir	RIM-Length
1	Mid Manair	37.6 km
2	Gouravelly	12.56km

The reservoir rim treatment plan is formulated to mitigate the geo-environmental hazards in the project areas especially reservoir area. Geo-environment hazards are extreme events induced by geological setup of the region, which exceed the tolerable magnitude within or beyond certain time limits, make adjustment difficult, result in catastrophic losses of property, income and lives.

Biological and Engineering remedial measures for protection of the reservoir rim to check the sedimentation in the reservoir caused by the loose debris on critical slopes for stabilizing the foundations of the dwelling structures along the Reservoir Rim in due course of time - check sedimentation in the reservoir, and therefore to mitigate the effects of debris flows - prevent land degradation / soil erosion, prevent the structure / settlements from subsidence and to provide stability, augment the life on the reservoir by reducing siltation and stabilize the landslip zones around the reservoir.

The inflow of water to the above mentioned reservoirs is through an approach channel, gravity channel and or a tunnel.

10.7.2. Mitigation measures

The foremost step in fixing the existing landslips is a comprehensive assessment of factors that led to the initial and subsequent down-slope movements of the land mass. The assessments involve detailed field investigations of geologic, soils, hydrologic, topographic, factors which collectively produce the landslip.

Control measures such as filling and compacting the fill in all open cracks and crevices, which could be entered by surface water. This particularly concerns deep cracks which develop during slope movement and which reach down to the slide plane; The water would be captured and drainage of surface water flowing into the slide area or emerging in the head scarp area are suggested.

The mitigations measures should be avoided in monsoon season so that work would be finished in a single schedule.

Engineering measures such as the toe of land slips if they are in the rill form - rock fill dams are proposed in the rills. A total of 10 check dams are proposed in the rills of landslide. Soil erosion control measures need to be implemented all along the reservoir periphery for slope stabilization.

Biological measures such as vegetation cover is an important factor which would minimize the magnitude of landslip. Biological measures plays very important role in stabilizing the loose soils and controls the hydrological and mechanical effects on the soils and slopes.



Biological measures need to be done with netting. The seed of locally available plants having soil arresting capacity are suggested.

Green belt around the reservoir is suggested to check soil erosion around the reservoir, check landslips or slips around the reservoir, develop the habitat particularly for birds and butterflies. Planting of trees, shrubs and other plant species would definitely improve the environment of the area besides checking the soil erosion.

Total budget for Mid Manair reservoir rim treatment would be Rs.3,28,21,670/- and Gouravelly reservoir rim treatment plan would be Rs. 55,71,870/-. The breakup of cost estimate is given Table 10.19

Table 10.19 Breakup of cost estimation

Measures	Unit cost	Area in sqm	Amount in Rs.	Total in Rs.
Mid Manair reservoir				
Coir geo-textile bags work	Rs. 42/m ²	753400	3,16,42,800	3,28,20,907
Maintenance (Per Annum)	11,78,107		11,78,107	
Gouravelly reservoir				
Coir geo-textile bags work	Rs. 42/m ²	127900	53,71,800	55,71,800
Maintenance (Per Annum)	2,00,000		2,00,000	
Total Cost				3,83,92,707
In Crores				3.84

Coir geo-textile bags are filled with sand and commonly adopted for hydraulic protection works. These geotextile bags are produced from either woven or non-woven polypropylene geotextile or non-woven polyester geotextile.

The higher elevations are characterized by steep, rocky, slope wash deposits cover the slopes with a few rock exposures on the gentle slopes. The reservoir rim treatment plan is formulated to mitigate the geo-environmental hazards in the project areas especially reservoir area. Geo-environment hazards are extreme events induced by geological setup of the region, which exceed the tolerable magnitude within or beyond certain time limits, make adjustment difficult, result in catastrophic losses of property, income and lives. Biological and Engineering remedial measures for protection of the reservoir rim to check the sedimentation in the reservoir caused by the loose debris on critical slopes for stabilizing the foundations of the dwelling structures along the Reservoir Rim in due course of time - check sedimentation in the reservoir, and therefore to mitigate the effects of debris flows - prevent land degradation / soil erosion, prevent the structure / settlements from subsidence and to provide stability, augment the life on the reservoir by reducing siltation and stabilize the landslip zones around the reservoir.

The inflow of water to the above mentioned reservoir is through an approach channel, gravity channel and or a tunnel.



10.8

MUCK MANAGEMENT & RESTORATION OF QUARRYSITES

10.8.1. Introduction

Dumping of muck and its rehabilitation is a real challenge in the river valley projects as a huge quantity of muck is excavated from different structural units. All ancillary activities of muck dumping like excavation, transportation, relocation and rehabilitation have adverse impacts on the life support system and landscapes. Therefore, among all mitigation measures, relocation and rehabilitation of muck are addressed primarily in EIA studies. The nature of excavated muck varies significantly from the natural soils; therefore, its unsound disposal is considered to contaminate not only the water quality, air quality, soils and vegetation of surrounding areas. A muck management plan would take the calculation of muck to be generated, swelling factors, reutilization of muck, dumping areas and their characteristics, mitigation measures including engineering and biological and their uses, if possible, into account.

About 7,08,910 cum of muck is anticipated to be disposed at suitable locations in respect of IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project. It is suggested that the muck be disposed in a planned way in a least possible space and is not hazardous to the environment.

This shall achieve the objectives.

- to protect the muck dumping area from flood water during monsoon and
- to create inspection paths.

A sizeable portion of the muck generated by excavation of canal, tunnel, shall be recycled for production of the aggregate. The remaining quantity of excavated muck will have to be disposed in a proper manner to avoid any spillage into the river and to minimize damage to air and water environment. The dumping sites need to be rejuvenated with the help of suitable engineering and biological measures.

Rejuvenating muck dumping sites include:

- utilize the maximum quantity of muck for different project activities.
- protect the dumping sites from soil erosion.
- develop muck dump sites as parks, with greenery, etc. in harmony with the landscape of the project area.

All along the canal and at the entry and exist points of the tunnel, the muck management areas are being identified in the name of spoil banks parallel on either side of canal. The spoil banks are designed at Trapezoidal sections within 1.5:1 and outer slope 2:1. The Figure 9.9.1 shows the sample cross section of canal and its appurtenances.

Based on the geological nature of the rocks and engineering properties of the soil, a major part of the muck is proposed to be used as construction material. However, the balance requires being suitably disposed. The excavated soil and rubble emanating from the construction of barrage, online storages, tunnels etc. will be utilized for filling of low-lying areas and also as revetment, riprap & filters of the earthen dam. The location of the muck management sites is shown in Figure 9.9.2.

All possible alternate sites were inspected and examined before rejecting or selecting any site. All the dumping sites are:



- i) With out forest cover
- ii) Village habitation areas are away from the identified dump sites.

Along the tunnels the dumping sites have been selected as close as possible to the project area to avoid long distance transport of muck. The sites are free from active landslips or creep and care has been taken that the sites do not have a possibility of toe erosion and slope instability. The dumping sites are either at higher level than the flood level or are away from the river/water bodies so that the possibility of muck falling into the river/water body is avoided. The sites are far away from human settlement areas. There is no active channel or stream flowing through the dumping sites.

The process of muck dumping, and restoration of these muck management sites are to

- protect and control soil cover and muck erosion.
- create greenery in the muck management areas.
- improve and develop the sites into recreational sites.
- ensure maximum utilization of muck for the construction purpose.
- develop the muck management sites/ dumping yards to blend with the surrounding landscape.
- minimise damages due to the spoilage of muck in the project area.

The following precautionary measures need to be followed during the dumping of muck:

- All dumpers will be well maintained to avoid any chances of loose soil from being falling during the transportation.
- All routes will be periodically wetted with the help of sprinklers prior to the movement of dump trucks.
- Dumping would be avoided during the high-speed wind, so that suspended particulate matters (SPM) level could be maintained. Further, the dumping will be avoided during heavy traffic.
- A retaining wall need to be constructed prior to dumping of muck. The height of wall is proposed to be of 5m. Loose muck should be compacted layer-wise.
- The muck brought by dumpers will be spread in layers behind the wire crate walls and then compacted by rollers till the top level is achieved.
- The retaining/sausage wall shall be laid with proper berm and the muck dumped behind it in layers and compacted by rollers.
- The process shall be repeated up to 50 cm level below the desired height which shall be laid with good soil for providing grass cover.
- At a regular vertical interval of 1.5 m and 3.0 m c/c masonry drains (catch water drains) shall be provided to drain off the rainwater.
- Proper fencing of the entire area is to be done.
- The balance muck management area has to be ultimately covered with fertile soil and suitable plants have to be planted adopting suitable bio-technological measures.
- Remaining utilizable soils are proposed for sharing with other agencies on royalty/seignories charges as per norms. The project proponent has to ensure for the stabilization of dumped materials various engineering and Phyto-remedial measures are proposed in the management plan.
- The afforestation with suitable plant species of high ecological and economic value, which can adapt to local habitat, will be undertaken as a part of Haritha Haram.

10.8.2. Biological Measures

Top surfaces and slopes of all dumping areas need to be treated for the purpose of plantation. Vegetation cover controls the hydrological and mechanical effects on soils and slopes. Therefore, biological measures to stabilize the loose slope are essential. In order to



implement the biological measures in dumping areas the following activities would be taken into account. The biological measures include the following:

Soil treatment: Muck dumped at various sites is not considered to be nutrient rich as it is excavated from tunnels and other structures. In order to make it suitable for the plantation it will be provided bio treatment. The work plan will be formulated for re-vegetation of the dumping sites through Integrated Biotechnological Approach.

Plantation: The selected species will be planted after their nurseries have been developed. The dumping areas are very small; therefore, separate nursery would not be required. The nurseries developed for the implementation of CAT plan can be used for the rehabilitation of dumping areas. Nearly 1- 2 years old saplings would be used for the plantation. The plantation can be carried out in lines across the slopes. Grass and herb species would be used in the inter space of tree species. They will help in providing the continuous chain of support in retaining debris, reinforcing soil and increasing the infiltration capacity of the area. In order to stabilise the stacked dumped material, vegetation cover would be provided to hold dumped material over a period of time.

- Plantation of suitable tree species and soil binding using bio-fertilizer technology.
- Turfing of the exposed area and improvement of environment with ornamental species.
- Protection with mechanical support.
- Social fencing through mass public awareness.

The work plan formulated for re-vegetation of the dumping sites through.

- I. Evaluation of dumped material for their physical and chemical properties to assess the nutrient status to support vegetation.
- II. Formulation of appropriate blends of organic waste and soil to enhance the nutrient status of rhizosphere.
- III. Isolation and screening of specialized strains of mycorrhizal fungi, rhizobium, azotobacter and phosphate solubilizers (biofertilizers inoculum) suitable for the dumped material.
- IV. Mass culture of plant specific biofertilizer and mycorrhizal fungi. Plantation of dumping sites using identified blend and biofertilizer inoculum.

The afforestation with suitable plant species of high ecological and economic value which can adapt to local habitat will be undertaken with 400-600 plants per hectare depending upon the canopy cover required. Major tree species which would be planted are *Albizia odoratissima*, *Albizia procera*, *Altingia excelsa*, *Brassaiopsis aculeata*, *Bischofia javanica*, *Castanopsis armata*, *Kydia calycina*. The shrubs are planted in between the trees are *Actinidia callosa*, *Boehmeria macrophylla*, *Cinnamomum glaucescens*, *Debregeasia longifolia*, *Eupatorium odoratum*, *Leea asiatica*. The herbaceous layer is also helpful for the soil binding it reduces soil erosion due to rain. Herbs and grasses suggested for plantation is *Aporosa myriantha*, *Ageratum conyzoides*, *Athyrium angustum*, *Begonia nepalensis*, *Bidens bipinnata*, *Digitaria ciliaris*, *Fragaria nubicola*, *Mikania macaranta*, and *Pteris cretica*. This cost includes the cost of turfing of slopes, preparation of ground, spreading of manure, etc., providing 5 cm of soil cover and transportation and carriage. It also includes the cost of fencing, irrigation, watch and ward, etc. The cost for muck management is given in Table 10.20.



Table 10.20 Cost Estimate for Muck management

S. No	Item of work	Unit cost Rs.	Quantity	Cost in Rs.
Along the Canal				
1	Muck management on spoil bank, levelling and sloping (m ³)	766.5	1,05,288 Cum	8,07,03,252
2	Jute geotextile as a part of bio-engineering and biological measures (m ²)			
3	Plantation per hectare			
4	Watering and maintenance for 44 weeks for seven years per hectare			
5	Watch and Ward for 4 persons per link for 4 years (except monsoon)			
Total Cost in Crores – Rs. 8.07				

10.8.3. Restoration and Landscaping of Project Sites

The construction of the proposed Barrages, approach/gravity canal, tunnels including their appurtenances would disturb the existing topography and physiography. Although no major alteration of the area is anticipated, it is proposed to landscape the area so that it integrates with the natural surroundings and in restoring the beauty of the area.



10.9

WATER,AIR AND NOISE MANAGEMENT PLAN

10.9 Water, Air and Noise Management Plans

Air and water are two major environmental factors that are directly affected by any kind of construction activity. Different anthropogenic activities especially the developmental works add suspended particulate matter and obnoxious gaseous pollutants to air. During construction period generation and release of effluents from adits at tunnel, sewage disposal from labour camp, blasting and other land clearing activities, washing of oil, grease and other chemical from diesel generator sets, vehicles and other machinery etc. cause water pollution and affect the quality of surface as well ground water.

The major air pollutants, which could be generally, released during various construction activities and vehicular movements are SPM, SO_x and NO_x. In addition to that the construction activities also generate noise due to the use of heavy machinery, heavy vehicles, blasting, etc. has impacts on humans as well as on the environment of the area.

10.9.1 Control of water pollution during construction phase

During project construction phase, sufficient measure needs to be implemented to ameliorate the problem of water pollution from various sources. The sewage generated from various labour camps shall be diverted to septic tank followed by soak pits. However, efforts shall be made to discharge the treated effluent only in these water bodies, which are not used for meeting domestic water requirement.

The construction activities would require a crusher for large lumps of rocks to the requisite size for coarse as well as fine aggregates. The effluent generated from these crushers will have high suspended solids. The effluent needs to be treated before disposal.

The runoff from construction site will contain high suspended solid which require treatment prior to disposal. Settling tanks of appropriate size for treatment of effluent from various crushers shall be provided. The sludge from the various settling tanks can be collected once in 15 days and disposed at the site designed for disposal of municipal solid wastes from the labour camp. The sludge after drying could also be used as cover material for landfill disposal site.

Facilities in Labour Camps

The aggregation of large number of workers in the project area during the construction phase is likely to put considerable stress on the prevailing biotic and abiotic environment of the area. The aim of the EMP is to minimize these stresses. The construction activities are likely to be concentrated at various location along the link channel, canal alignment, pump house, etc.

It has been observed during the construction phase of many of the earlier water resources projects that workers generally live in slum type conditions, with inadequate facilities for potable water and sanitation. Such conditions, coupled with lack of hygiene make the labour population prone to increased incidence of various water-borne and vector-borne diseases. It is proposed that it should be made mandatory for the contractor involved in the construction activities to provide adequate facilities for water supply and sanitation. It is recommended that the contractor provides living units of 30-40 m² to each of the labour family involved in the construction activities. The unit should have proper ventilation.



Water supply

Appropriate water supply sources need to be identified. Proper infrastructure for storage and if required treatment e.g., disinfection or other units, should also be provided.

Sewage treatment

The labour population is proposed to be situated in project colony established by the Contractor. One community toilet needs to be provided for 20 persons. All the community toilets need to be connected to septic tank followed by soak pits

10.9.2 Air Pollution Control

In a water resources project, air pollution occurs mainly during project construction phase.

The major sources of air pollution during construction phase are:

Fuel combustion in various construction equipment, e.g., crushers, drillers, hydraulic excavators, diesel generating vehicles, etc.

Impacts due to vehicular movement Control of Emissions

Minor air quality impacts will be caused by emissions from construction vehicles, equipment and DG sets, and emissions from transportation traffic. Frequent truck trips will be required during the construction period for removal of excavated material and delivery of select concrete and other equipment and materials.

The following measures are recommended to control air pollution:

- The contractor should be responsible for maintaining proper functioning of construction equipment to minimize exhaust.
- Construction equipment and vehicles should be turned off when not used for extended periods of time.
- Unnecessary idling of construction vehicles to be prohibited.
- Effective traffic management to be undertaken to avoid significant delays in and around the project area.
- Road damage caused by sub -project activities should be promptly attended to with proper road repair and maintenance work.

Air Pollution Control due to DG sets

The Central Pollution Control Board (CPCB) has issued emission limits for generators up to 800 KW and the same are outlined in Table 10.21

Table 10.21 Emission limits by CPCB

Parameter	Emission limits (gm/kwhr)
Nox	9.2
HC	1.3
CO	2.5
PM	0.3
Smoke limit**	0.7

Note: **Light absorption coefficient at full load (m^{-1})

The above standards need to follow by the contractor while operating the DG sets. The other measures are recommended as below:



Location of DG sets and other emission generating equipment should be decided keeping in view the predominant wind direction so that emissions do not affect nearby residential areas.

Stack height of DG sets to be kept in accordance with CPCB norms, which prescribes the minimum height of stack to be provided with each generator set to be calculated using the following formula:

$$H = h + 0.2 \times \sqrt{\text{KVA}}$$

H = Total height of stack in metre

h = Height of the building in metres where the generator set is installed

KVA = Total generator capacity of the set in KVA

Dust Control

The project authorities should work closely with representatives from the community living in the vicinity of project area to identify areas of concern and to mitigate dust-related impacts effectively (e.g., through direct meetings, utilization of construction management and inspection program, and/or through the complaint response program). To minimize

issues related to the generation of dust during the construction phase of the project, the following measures have been identified:

- Identification of construction limits (minimal area required for construction activities).
- When practical, excavated spoils should be removed as the contractor proceeds along the length of the activity.
- When necessary, stockpiling of excavated material should be covered or staged offsite location with muck being delivered as needed during the course of construction.
- Excessive soil on paved areas should be sprayed (wet) and/or swept and unpaved areas should be sprayed and/or mulched. The use of petroleum products or similar products for such activities should be strictly prohibited.
- Contractors should be required to cover stockpiled soils and trucks hauling soil, sand, and other loose materials (or require trucks to maintain at least two feet of freeboard).
- Contract or shall ensure that there is effective traffic management at site. The number of trucks/vehicles to move at various construction sites to be fixed.
- Dust sweeping -The construction area and vicinity (access roads and working areas) shall be swept with water sweepers on a daily basis or as necessary to ensure there is no visible dust.

10.9.3 Noise Control Measures

The contractors should be required to maintain properly functioning equipment and comply with occupational safety and health standards. The construction equipment should be required to use available noise suppression devices and properly maintained mufflers.

- Vehicles to be equipped with mufflers recommended by the vehicle manufacturer.
- Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided whenever possible.
- Notification should be given to residents within 100 m of major noise generating activities. The notification should describe the noise abatement measures that should be implemented.
- Monitoring of noise levels should be conducted during the construction phase of the project. In case of exceeding of pre-determined acceptable noise levels



by the machinery should require the contractor(s) to stop work and remedy the situation prior to continuing construction.

The following Noise Standards for DG sets are recommended for the running of DG sets during the construction:

- Maximum permissible sound pressure level for new diesel generator sets with rated capacity up to 1000 KVA shall be 75 dB(A) at 1 m from the enclosure surface.
- Noise from the DG set shall be controlled by providing an acoustic enclosure or by treating the enclosure acoustically.
- Acoustic Enclosure should be made of CRCA sheets of appropriate thickness and structural/ sheet metal base. The walls of the enclosure should be insulated with fire retardant foam so as to comply with the 75 dB(A) at 1m sound levels specified by CPCB, Ministry of Environment & Forests.
- Acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB(A) Insertion Loss or for meeting the ambient noise standards, whichever is on the higher side.
- DG set should also be provided with proper exhaust muffler.
- Proper efforts to be made to bring down the noise levels due to the DG set, outside its premises, within the ambient noise requirements by proper siting and control measures.
- A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

Noise Generation from Controlled Blasting Operations.

- Controlled blasting should be done as per the provisions of Indian Explosives Act.
- Blasting should not be undertaken in night hours.
- Workers at blasting sites should be provided with proper earplugs and helmets.
- Explosive used for controlled blasting should be kept in safest custody under lock and key as per the provisions of Indian Explosives Act

Noise due to crushers Based on literature review, noise generated by a crusher is in the range of 79 -80 dB(A) at a distance of 250 ft or about 75 m from the crusher. Thus, noise level at a distance of 2 m from the crusher shall be of the order of 110 dB(A). The exposure to labour operating in such high noise areas shall be restricted up to 30 minutes on a daily basis. Alternatively, the workers need to be provided with earmuffs or plugs, so as to attenuate the noise level near the crusher by at least 15 dB(A). The exposure to noise level in such a scenario to be limited up to 4 hours per day.

It is known that continuous exposure to noise levels above 90 dB(A) affects the hearing of the workers/operators and hence has to be avoided. Other physiological and psychological effects have also been reported in literature, but the effect on hearing acuity has been specially stressed. To prevent these effects, it has been recommended by international specialist organizations namely Occupational Safety and Health Administration (OSHA) that the exposure period of affected persons be limited as specified in Table 10.22

Table 10.22 Maximum exposures periods specified by OSHA.

Maximum equivalent continuous noise level dB(A)	Unprotected exposure period per day for 8 hrs/day and 5 days/week
90	8
95	4
100	2



105	1
110	$\frac{1}{2}$
115	$\frac{1}{4}$
120	No exposure permitted at or above this level

10.9.4 Control of water pollution during operation phase

All the community toilets need to be connected to septic tank followed by soak pits

10.9.5 Implementing Agency

Various management measures need to be implemented for Control of Various pollution control need to be included in the Tender Document for the Contractor involved in construction activities. The same shall be monitored on a regular basis by the project proponents. The cost estimate for air pollution management is given in Table 10.23

Table 10.23 Air Pollution Management cost

S.No.	Component	Rs.	Total in Rs.	Cost in Crores
1	Nose masks 1500 No's - Rs. 5/- each for 9 months	5	67500	0.007
2	Road wetting (Periphery of Rim 13 km, 5 tanks @ Rs.600 per tanker @ of two times a day per month for three years	600	7020000	0.702
3	Vehicle emission checking (10 No. of vehicles) for every six months (approx. each Rs. 100) for three years	100	60000	0.006
	Total Cost			0.715



10.10

GROUNDWATER MANAGEMENT PLAN

10.10 Groundwater Management Plan

Due to the availability of irrigation facilities to farmers the drawl of groundwater is likely to decrease, and considerable areas will be put to use for cultivation. The crop acreage is increased substantially. As such the groundwater levels will increase and further exploitation will be minimized. After a few years the monitoring programme should be envisaged to study the potential of groundwater and conjunctive management can be planned.

The ground water management strategy should be such that there is optimal utilisation of ground water resource, and it should also take into consideration the well spacing norms. Based on the well spacing of 250 m on an average for shallow bore wells in hard rocks and sedimentary rocks, the optimal well density per sq.km comes to 16, whereas presently the well density in the area is 19 per sq. km leaving little scope for further development of the groundwater. Based on the above norm ground water development is possible only in 22 mandals of the project area which are falling under safe category.

In view of this situation conjunctive use of surface and groundwater is the only alternative available. Ground water development in the command area through construction of dug wells/bore wells may be taken up for utilization of ground water resource available and use it in conjunction with surface water to increase the irrigation potential.

It is necessary to augment the ground water resource by taking up artificial recharge to ground water on a large-scale to sustain the existing ground water extraction structures. Further construction of bore wells needs to be stopped by strictly implementing APWALTA act. There is an urgent need in this area to motivate the farmer's for changing the cropping pattern. Less water consuming crops and modern irrigation methods are to be encouraged in the area in lieu of the present practice of double crop of paddy and flood irrigation.

10.10.1 Water Conservation and Artificial Recharge

In recent past suicide cases are reported due to failure of bore wells, mostly in semi-critical area of the district. In these areas, the success rate of bore wells is reported to be 40-60% and about 80% of the failures of bore wells are accounted to selection of sites on non-scientific lines like water divining methods.

Ground water conservation and artificial recharge works have to be taken up on a large scale as a part of watersheds, RIDF and other programmes by District Watershed Management Agency under IWDP. Check dams, percolation tanks, mini percolation tanks, contour trenches and farm ponds are to be constructed. These artificial recharge structures improve the ground water storage and to improve yields of wells. Construction of artificial recharge structures in critical and over-exploited mandals should be taken up. The works should be taken up on watershed basis after careful assessment of the available surface run off and after meeting the needs of the existing structures. The site conditions like availability of unsaturated zone to accept recharge, permeability of soils, etc. have to be carefully studied before venturing for construction of artificial recharge structures. Roof top harvesting both in urban and rural areas should be made mandatory to enhance the ground water recharge.



10.10.2 Water Management

Participatory Irrigation Management Practices (PIMP)

Government of Telangana has enacted a law on PIM. WUAs are already functioning for utilisation of water from various tanks in the command and hence the local community is already aware of the modern practices and same can be implemented in the IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir command also.

Existing and Proposed Facilities in the Command Area

The command area of the project is not covered by any major irrigation schemes in the vicinity namely, Sripada Rao Project, Sri Ram Sagar Project Stage I, or Nizam Sagar canal project.

Suggested cropping pattern in command area

The cropping pattern in a particular area is governed by its climate including rainfall and its distribution, minimum and maximum temperatures, humidity, sunshine hours etc., types of soils and topography, availability of irrigation water, supply of agricultural inputs like fertilizers, seeds, pesticides etc. and marketing support for the produce. The availability of irrigation water through this project is likely to bring about perceptible change in the existing cropping pattern in command area. At present, Kharif crops contribute about 70-80% of the total cropped area because Kharif crops are grown as rainfed crops in rainy season. For Rabi crops, irrigation is the main deciding factor because scanty rains in winter cannot support crop growth and productivity. Therefore, there is ample scope to increase the area of Rabi crop to the extent of 2 to 3-fold. At present, the cropping intensity in the command area is estimated at less than 130% which can be easily enhanced to 200% with irrigation. Thus, the total cropped area can be increased by more than 50% with major contribution of Rabi crops in this increase. During rainy season, soils are recharged with moisture and a crop can be raised. Irrigation may be required in rainy season only when there is a long drought spell. Rabi crops on the other hand, have high and assured irrigation requirement. Sometimes crops cannot be grown in absence of irrigation and a life-saving irrigation becomes a must. The success of Rabi crop thus depends on availability of irrigation water. Keeping all the parameters affecting cropping pattern in view, the strategy has been developed about cropping pattern in the command area.

The Ground nut crop suits the agro-climate, socio economic conditions and other factors (Table 10.24).

Table 10.24 Proposed cropping pattern under the command area of Gouravelly reservoir.

S.no	Season	Crop	% of CCA
			Gouravelly Reservoir Project
A)	Kharif	Ground nut	100

Crop calendar for proposed Gouravelly Reservoir Project.

Cropping System	Crop	Duration (Days)	Sowing time	Harvesting time	Remarks
	Ground nut	120	16-June	15-Oct	-

Crop water requirements

Crop water requirement is defined as the depth of water needed to meet the water loss through evapotranspiration of crop growing in large fields under non-restricting soils, water



and nutrient availability and achieving full production potential under the given growing environment.

The amount of water required to compensate the evapotranspiration loss from the cropped field is defined as crop water requirement. Although the values for Crop evapotranspiration under standard conditions (ET_c) and crop water requirement are identical, crop water requirement refers to the amount of water that needs to be supplied, while crop evapotranspiration refers to the amount of water that is lost through evapotranspiration.

The success of this project depends on matching the water availability at river source with the quantum of water required for various crops in the command area for sustainable agricultural production. Keeping in view the above object, crop water requirements have been computed using Modified Penman method.

The following are the main factors which play an important role in determining crop water requirements.

Climate or the ambient environment enveloping the plant determines the evaporative demand. For instance, in sunny and hot climate, crops need more water per day than in cloudy and cool climate, having large leaf area need more water than crops having smaller leaf area like beans and wheat,

The crops which are fully grown need more water than crops that have just been planted and, On the whole, surface climatology including temperature, sunshine duration, wind velocity relative humidity and rainfall has substantial effect.



10.11

AGRICULTURE IMPROVEMENT PLANNING

10.11.1. Introduction

The best farming practices with only 30-35% of the applied fertilizers are used by the crop and the balance finds their way into the aquatic environment through drainage runoff. The soil productivity is also at threat due to continuous overdosing of fertilizers besides eutrophication of neighbouring water bodies through washing down of fertilizers and organic matter rich in nutrients from the surrounding agricultural fields. Integrated plant and nutrient management are done through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. The Integrated plant and nutrient management approach is useful for building soil productivity and improving crop yields.

The following are few benefits of the integrated plant and nutrient management.

- Highest production is achieved per unit of investment through reduction in unavoidable losses because of leaching and volatilization.
- Reduce toxicity due to excessive use of single nutrients.
- Improves quality production besides enhancement of Cost Benefit (B/C) ratio.
- Provides natural safeguard against biotic and abiotic stresses.
- Soils exhibit declining productivity per unit of plant nutrient used.
- Major nutrients (NPK) results in deficiencies of micro and secondary nutrients.
- Useful to maintain soil health through organic matter and results in better fertilizer use efficiency.
- Organic manures and plant residues are available locally and thus if managed properly are cost effective.

Maximum use of organic manure and recycling of organic waste along with chemical fertilizers and bio-fertilizers in an integrated manner is environmentally sound and cost-effective alternative.

Pest control using biological methods.

The primary components of integrated plant and nutrient management in increasing order are use of agro chemicals. Testing of soil for nutrients – fixing fertilized dose and the type of crop, use of organic manure, crop rotation-mulching is some of the measure suggested to prevent pollution and adverse impacts.

Land conservation measures suggested as a part of CAT Plan are effective in controlling erosion by surface runoff.

10.11.2. Control of weeds on agriculture lands

Measures against weeds comprise cultivation and mowing, cultural or cropping, biological and chemical means. Mechanical methods such as cultivation and mowing with hand weeding are the most efficient method, but it is back-breaking, time-consuming and costly. Further, high wages paid to the hired labour narrow down the profits of the cultivator. Cultural or cropping method of farming practices are capable of changing the condition in such a way as to enable the crop plants to compete with weeds successfully. Seeds with good germination will give the crop a vigorous and close stand and thus enable it to steal a march on the weeds.

Chemical method of controlling of weeds in the growing crops with weedicides increases their yields and ensures the efficient use of irrigation.



10.11.3. Integrated pest management

Integrated pest management is a system that, in the context of the associated environment and population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains pests' populations at levels below those causing economically unacceptable damage or loss (FAO). It is an ecologically based strategy that focuses on long term solution of pests through a combination of techniques such as use of resistant varieties, biological control, modification of agronomic practices and habitat manipulation. Pesticides are carefully selected and applied to minimize the risks to the human health, beneficial and non-target organisms and environment. (Table 10.25)

Table 10.25 Recommended integrated pest management measures for insect pests

S. No	Stage	Insect pests	IPM Measures
1	Nursery	Stem borer, gall midge, thrips, root knot nematode, root nematode and white tip nematode	Apply carbofuran 3G @ kg/ ha or phorate 10 G @ 12.5 kg/ha or fipronil 0.3 G @ 33 kg/ ha of nursery, 5 to 7 days before pulling the seedlings for transplanting. In stem borer endemic areas, install pheromone traps with 5 mg lure @ 8 traps/ ha for pest monitoring
2	Planting to panicle initiation stage	Stem borer	Clipping of leaf tips of the seed lings at the time of transplantation will help in destruction of egg masses of stem borer. Removal of excess nursery and incorporation into soil Clean cultivation and destruction of stubbles Apply carta 4 G @ 25 kg / ha or rynaxypyr 0.4 G @ 10 kg / ha or carbofuran 3 G @ 25 kg / ha or phorate 10 G @ 10 kg / ha or fipronil 0.3 G @ 25 kg / ha or spray cartap hydrochloride 50 WP/SP @ 1000 g / ha or spray cartap hydrochloride 50 WP/SP @ 1000g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chlorpyrifos 20 EC @ 2000 ml / ha or triazophos 40 EC @ 1250 ml / ha. Install pheromone traps with 5 mg lure @ 8 traps / ha for pest monitoring or 20 traps / ha for direct control through mass trapping. Inundative release of egg parasitoid, trichogramma japonicum five to six times @ 1,00,000 adults / ha starting from 15 days after transplanting
3		Gall midge	Growing of resistant varieties as mentioned in table 1 depending on the prevailing biotype in a particular location. Apply carbofuran 3 G @ 25 kg / ha or phorate 10 G @ 10 kg / ha or fipronil 0.3 kg / ha
4		Leaf folder	Spray cartap hydrochloride 50 WP / SP @ 1000



S. No	Stage	Insect pests	IPM Measures
			g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chloropyriphos 20 EC @ 2000 ml / ha or triazophos 40 EC @ 1250 ml / ha Inundative release of egg parasitoid, trichogrammajaponicum five to six times @ 1,00,000 adults / ha starting from 15 days after transplanting
5		Hispa	Spray triazophos 40 EC @ 400 ml / ha or quinalphos 25 EC @ 1200 ml / ha or chloropyriphos 20 EC @ 1500 ml / ha or monocrotophos 36 WSC @ 850 ml / ha
6		Whorl maggot	Apply carbofuran 3 G @ 25 kg / ha or Fipronil 0.3 G @ 25 kg / ha or spray monocrotophos 36 WSC @ 850 ml / ha or chloropyriphos 20 EC @ 1500 ml / ha
7		Case worm	Drain water from the field and spray monocrotophos 36 WSC @ 850 ml / ha or quinalphos 25 EC @ 1200 ml / ha or Carbaryl 50 WP @ 900 g / ha
8	Panicle initiation to booting	Stem borer	Spray cartap hydrochloride 50 WP / SP @ 1000 g / ha or rynaxypyr 20 SC @ 150 ml / ha or monocrotophos 36 WSC @ 1100 ml / ha or chloropyriphos 20 EC @ 2000 ml / ha or acephate 75 SP @ 950 g / ha
9		Brown plant hopper, white backed plant hopper, green leaf hopper	Spray buprofezin 20 SC @ 1000 ml / ha or dinotefuran 20 SG @ 200 g / ha or imidacloprid 200 SL @ 125 ml / ha or thiamethoxam 25 WG @ 100 g / ha or clothianidin 50 WDG @ 30 g / ha or ethofenprox 10 EC @ 500 ml / ha or acephate 50 WP @ 750 g / ha or monocrotophos 36 WSC @ 850 ml / ha or BPMC 5- EC @ 600 ml / ha. Repeat application if hopper population persists beyond a week after application. If 2 to 3 applications are needed, alternate the recommended insecticides. Do not use the same insecticide repeatedly. Note: While spraying, nozzle should be directed at basal portion of the plants. Application should be done preferably with powder sprayer that too during evening hours
10		Cut worm	Spray thoroughly with chloropyriphos 20 EC @ 2500 ml / ha or dichlorvos 100 EC @ 600 ml / ha or endosulfan 35 EC @ 1500 ml / ha or monocrotophos 36 EC 1500 ml / ha or acephate 50 WP @ 1200 g / ha or Fipronil 5 SC



S. No	Stage	Insect pests	IPM Measures
			@ 1000 ml / ha during afternoon hours.
11		Gundhi bug	Spray monocrotophos 36 WSC @ 1500 ml / ha or carbaryl 50 WP @ 1500 g / ha during afternoon hours. Dust malathion or carbaryl @ 30 kg of the formulation / ha

WG = Water soluble granules, WDG = Water dispersible granules, EC = Emulsifiable concentrate, WP = Wettable powder, WSC = Water soluble concentrate, G = Granules to be broadcast in standing water.

Strategy

It is proposed to make most effective use of water from SRSP for irrigation of standing crops and also to store excess water for future use in tanks in the command area. The water stored in tanks will be used when supply of water is not adequate for meeting the requirement of standing crops, especially in Rabi and Summer seasons. It is also proposed to make effective use of soil moisture preserved from rainfall by advancing the planting of Rabi crops in such a way that the seeds of Rabi crops germinate before the soil moisture is lost through soil evaporation. To meet the above objectives, the following strategies are proposed for adoption:

(a) To maximize Kharif crop area

An attempt will be made to utilize rainwater in Kharif season. For this, there is a need to conserve soil moisture and then use it in all the command areas. Proper conservation and utilization of rainwater will result in increase in the area of Kharif crops. Here, the crops with low water requirement should be preferred over paddy.

(b) Promoting cash crops in Kharif season to maximize the use of available water

In Kharif season, the cultivation of vegetables will be given priority. In addition, crops like Groundnut, Jowar and Chillies etc. which are highly responsive to irrigation should be adopted. On the other hand, the traditional crops like paddy, jowar, bajra, should be reduced in area owing to their high-water requirement and / or low productivity. Attempts should be made to advance the planting of these crops so that crops make better use of rainwater which is not feasible at germination stage. If crops are well-established before the onset of monsoon, they can consume water more efficiently.

(c) Supplementary irrigation to paddy crop

There is considerable area under wet irrigated lands where a traditional crop of paddy is grown. In these areas, paddy is a productive and low risk crop which also provides necessary staple food to the people. Due to uneven rainfall, it sometimes becomes essential to provide irrigation to paddy crop. Paddy is a well-established crop of the area and farmers cannot replace it with other crops in the near future. It is also desirable that farmers should be encouraged to grow improved varieties/ hybrids of paddy crop along with intensive plant protection measures and judicious use of inputs like fertilizers and water.

(d) Emphasis on high value crops and plantation crops

High value crops like tobacco, sapota and aromatic & medicinal plants with low water requirement should be introduced in the command area. In addition, plantation crops, which require little water after initial growth and establishment are to be given priority. Tobacco and annatto are important crops of the state which have commercial use and supplement the income of the farmers. Plantation and other perennial crops have low water requirement and usually require lifesaving irrigation in summer season, which can be provided by tanks or



ground water. Fruit crops can also be promoted after considering their marketing facilities, processing and local consumption.

(e) Advancement of planting of Kharif crops

Nursery for paddy transplanting should be raised 2-3 weeks early, through groundwater irrigation. Thus, the nursery will be ready for transplanting in early July immediately on the onset of monsoon. The crop thus transplanted early has been proved to give higher yield with consumption of the same quantity of water as compared to late planted crop. Similarly, other Kharif crops like Groundnut, Jowar and Chillies also perform better if the crops have established themselves in the field before actual start of the rainy season.

(f) Early planting of Rabi crops to make use of residual moisture.

Advancement of Rabi sowing to September-October should be emphasized so that seeds may germinate with residual moisture in the soil and the crop can be grown with one or two irrigations in Rabi season. At initial germination stage, moisture is required in the top layer of the soil which has to be provided by one pre-sowing irrigation under late sown condition. Thus, one irrigation can be saved by early sowing on residual soil moisture. If a crop germinates satisfactorily, the plants can withstand adverse conditions at later stages of growth.

(g) Efficient use of late rains, tank and ground water for Rabi season crops

Agro-climatic conditions in the project area can support the crops throughout the year. In general, the yield potential of crops is higher in Rabi season as compared to Kharif season. But the cultivation in Rabi crop season mainly depends on irrigation from tanks or ground water plus winter rains and conserved moisture from rainy season. To make judicious use of water resources for Rabi crops, the following strategy is proposed:

- I. Early sowing to make best possible use of conserved residual soil moisture.
- II. Growing crops having low water requirement like pulses: After harvesting of Kharif crops, pulses like Bengal gram, black gram and green gram can be sown on residual moisture. It will make double cropping feasible, thereby increasing the income of farmers. Pulses (legumes) not only work as water savers but also improve soil fertility by fixing atmospheric nitrogen in the soil through their roots.
 - I. Attempts are therefore, to be made to maximize area under pulses in Rabi season.
 - II. Adoption of efficient methods of irrigation for better use of tanks and ground water resources. There is considerable loss of water through open flood method of irrigation. It is advised that more efficient methods should be adopted to minimize wastage of irrigation water. Use of pipes in place of open channels can save water loss through leaching. Also, improvised methods can be adopted for irrigation of wide spaced and plantation crops. In field crops, ridge and furrows, contour or rings method of irrigation can be adopted depending upon the crop and field conditions.

Judicious use of water resources through pressurized irrigation systems:

The availability of water from tanks or ground water is limited in Rabi season. This limited quantity of water can be efficiently used to cover maximum cropped area by adopting sprinkler method for narrowly spaced crops and drip irrigation for widely spaced and plantation crops. Crops like groundnut, Chillies, vegetables, flowers etc. can be successfully irrigated by sprinkler method, while crops like fruits and vegetables can be grown with drip irrigation. Sprinkler and drop methods save a significant amount of irrigation water without adversely affecting productivity and quality of produce.

Augmenting water storage capacity of tanks: Tanks are important source of irrigation water in the state. It is, therefore, proposed that water storage capacity should be increased by increasing the number of tanks and / or increasing the capacity of existing tanks. Tanks



not only supply irrigation water in Rabi season, but also recharge soil moisture level in the surrounding fields.

Cultivation of high yield potential crops in Rabi season: Remunerative crops like maize, tobacco, chillies, vegetables and fruits should be given priority over other crops. Turmeric and flowers may be other remunerative crops for which marketing facilities and demand exists.

Allied enterprises: Where irrigation water is available. Non-conventional activities like flower cultivation, cultivation of medicinal and aromatic plants can also be adopted to supplement the income of farmers.

10.11.4. Agriculture Planning-Basic Premises

Some of the basic points that have been kept in view while developing the agricultural plan for the project command area are mentioned below.

1. Maximising the water use efficiency in Rabi Season

Paddy is the most important crop occupying the maximum area. both in Kharif and Rabi season Cultivation of paddy is justified in Kharif season due to availability of vast area under wetlands where paddy is predominantly grown as a rainfed crop. But paddy cultivation in Rabi season as irrigated crop is a wasteful practice where irrigation water can be more economically and effectively used for cultivation of more remunerative crops than paddy.

2. Capitalizing on already established cash crop

Efforts should be made to improve the productivity of existing cash crop. To achieve the objective, efforts should be made to maximize area under Groundnut, Jowar and Chillies, vegetables and fruits. For such crops, farmers are familiar with production technology, processing, input management and market facilities. Farmers are always apprehensive about introducing any new crops and are not willing to take any risks, particularly where 80 of the farmers are small and marginal.

3. Support on seed production, input supply and water saving devices

For introducing new crops and covering large area under high value crops, it is essential that planting material should be locally available and input support is timely guaranteed. For this purpose, nurseries should be established for aromatic and medicinal plants, vegetables, flower and fruits. The production and distribution of seed of important crop should be ensured at reasonable prices. The climate and soil of the command area are quite suitable for production of seed and planting material of various crops. At present, water is the limiting factor, and this constraint will cease to exist with availability of irrigation water through SSP. These devices need to be promoted and made available at subsidized prices to the farmers.

4. Financial support to enhance purchasing capacity of farmers.

It is clear from the information available on the composition of farmers in the command area that majority of farmers are small and marginal. An estimated 60%farmers have land holding of less than 1 ha. While 20% have between 1 and 2 ha. About 30-60% population belongs to scheduled castes and scheduled tribes. These resource- poor farmers can adopt proposed agricultural plan through financial assistance from Govt. banks and other financial institutions at subsidized and low interest rates. These institutions have to be coaxed into supporting farmers as per their needs.

5. Agro-Processing and market support

Value addition for farm produce through processing and marketing has to be ensured for their success and adopting at least at an early stage. At harvesting stage, some of the perishable farm produce may face glut situation and hence processing of farm produce to value added products by agro-processing units has to be taken up as per need of the area.



For example, where maize is the major crop, units to make cornflakes, corn oil, starch etc., should be established. To exploit proximity to the Hyderabad International Airport, a cold chain can be developed for marketing and of flowers, vegetables and fruits. For success and adopting of high value crops, market tie-ups have to be developed as insurance against losses to the farmers. These poor farmers cannot adopt high value crops, if once faced with losses due to lack of market tie-ups.

6. Aggressive extension campaigning

Agricultural extension machinery of the state has to be tuned up to educate and support farmers at village and mandal level. Extension workers should guide and advise farmers at each and every step of adoption of new technology. Wherever there are no extension workers posted or are working under Panchayati Raj system it is to be ensured that they are in place to be organized campaigns as per the needs of new plan depends on known how and dedication of agricultural field workers at village and mandals level.

7. Rational crop plan with appropriate crop rotation with due share of legumes and cash crops

A sustainable and diversified cropping pattern has to be developed depending on agriculture scenario. Keeping in view the soil fertility aspects, pulse crops have to be incorporated in the crop rotation. Also, cash crops should find a place wherever feasible, to improve farmers conditions and inculcate interest in farmers in the new cropping plan. At present, there is a very limited area under pulse and cash crops. Therefore, crops like green gram, black gram, groundnut, soybean etc should be incorporated to cover sizeable area in the command area. The crops should be rotated in each field from year to year and monoculture or same rotation in the same field should be avoided. The rotations should be based on established principles. Some of the rotations that can be adopted in the project command area listed below:

- Paddy –Bengal gram/Maize-Green gram
- Maize/Jowar/Bajra-Bengal gram –Chilies
- Paddy –Red gram Groundnut – Vegetables
- Soybean – Maize – Vegetables
- Groundnut+Bajra- Maize – Vegetables
- Red gram +Groundnut- Vegetables – Chilies
- Vegetables – Bengal gram
- Cotton – Vegetables – Green gram
- Turmeric – Green gram/Black gram
- Castor/Tobacco-Vegetables/Fruits/Flowers
- Green gram – Maize – Sugarcane
- Maize – Black gram – Mentha

Potential Crops and Cropping Pattern

The potential of a crop depends on its inherent genotype, agro-climate, soil conditions, socio-economic acceptability, input availability, market support, processing of produce and value addition possibilities.

For maintaining sustainability of crop rotations, it is essential that principles of scientific crop rotations be followed. One of the main criteria for scientific crop rotations is inclusion of leguminous crop, in crop rotations with cereals and other leguminous crops like groundnut, soybean and sun hemp may be included to maintain soil fertility.

Oilseeds is therefore proposed that area under oilseeds like groundnut, soybean, castor, sesamum etc. should be increased.



Groundnut: Ground nut is a high value cash crop which can be grown in light soils in Kharif season with very little water requirement. It needs one irrigation at pegging stage if rains fail this stage. It can be grown as a pure crop or as intercrop with red gram, bajra, sesamum etc.



10.12

PUBLIC HEALTH DELIVERY PLAN

10.12 Public health Delivery plan

About 700 labour and technical staff are likely to be deployed during the peak construction phase. In the command area of project, there are hospitals with adequate health camp facilities. However, it is suggested to conduct health camps manned by a doctor each and support staff is recommended during construction phase. The health camp has to be located such that they are close to all construction sites at reservoir and command area. The details of staff, infrastructure requirement for these first-aid posts is given as below:

The doctors employed in the dispensary, come from the adjacent towns to the dispensary. The para-medical staff required for assistance to these doctors is given in Table-10.26

Table 10.26 Details in a health camp team

Team	Number
Doctor	1
Auxiliary Nurse	2
Helper	1

A temporary accommodation may be constructed for each health camp. These camps will have.

- Essential medicines including ORS packets. - First aid appliances, splints and dressing material - Stretcher, wheelchair etc.

The doctor posted at the health camp should also coordinate with the anti-malarial campaign under his immediate personal supervision. A systematic campaign is suggested to be conducted in the months of March and September which are the breeding months of mosquito.

Malaria could be the major vector-borne disease in the area. The main breeding seasons of the anopheline mosquito are the months of September and March. The preferred habitat is stagnant or slow-moving fresh water open to sunshine or moderate shade. The anti-malarial operations can be coordinated by various primary health centers in the command area villages and the district hospitals located within the command area. All the private doctors in the area to be provided with chloroquine tablets and arrangements for collection blood samples. Some of the Primary Health Centres need to have Static Malaria Laboratory. Regular check-up, surveillance and immunization of mobile populations need to be in place.

One male multi-purpose health worker at the dispensary will visit the labour camp and surrounding areas once a fortnight and enquire whether there is a case of fever in the house, whether there was a case of fever in the house between his previous visit and the present visit. There shall be regular fumigation and sprays of insecticides in the areas where water is likely to be stagnant, to prevent the growth of malarial larvae. The project proponents have to seek an expert opinion before selecting the appropriate insecticide for malaria control. The frequency of monitoring could be once in 15 days. Reduce exposure to mosquitoes, encourage prevention of mosquito-borne disease by helping people by reducing their exposure to mosquitoes during the day and at night. Work with the malaria control programme in the project area in order to popularize the use of bed net programme, conduct community education on the proper use of bed nets and how to avoid dawn to dusk mosquito bites, regular spray of insecticides and implementation of various management measures for vector control (drainage, filling, of breeding, sites) as outlined in the earlier section. Vector control is still one of the major measures to control malaria in endemic area.



Anti-adult measures such as residual spraying with insecticides, space application of insecticides in the form of a fog or mist. The method has proved economical due to ultra-low volume dispersion of pesticides in air, prevention of man-vector contacts by use of repellents, protective clothing, bed nets, etc. Anti-larval measures such as use of larvicides at regular intervals, reduction of mosquitoes breeding sites by drainage or filling, deepening or flushing, management of water level, intermittent irrigation, etc, and introduction of fish species in permanent water bodies which feed on mosquito larvae.

Health Extension Activities such as need to be carried out in the villages situated within the command area. It is important to inculcate hygienic habits of environmental sanitation specially with respect to water pollution by domestic wastes. There would be possibility of the transmission of communicable diseases due to migration of labour population from other areas at the construction site. The doctors from the dispensary constructed as a part of the project and other dispensaries in various command area villages will make regular visits to the villages and organize health promotional activities with the active participation of the local village leaders, NGOs and available local health functionaries.

The health functionaries would undertake the following tasks as a part of health promotional activities such as to collect water samples to ascertain the potability of water from different sources so as to monitor regular disinfection of drinking water sources. Maintain close surveillance on incidence of communicable diseases in these villages. Maintain close liaison with the community leaders and health functionaries of different departments, so that they can be mobilized in case of an emergency.

In order to control of water-borne diseases, it is recommended that details of incidence of various water-borne disease in the command areas blocks be collected and analysed to detect any particular trend. A detailed water quality monitoring programme be designed and implemented. In areas showing incidence of water-borne diseases, intensive water quality monitoring shall be done. (Table 10.27)

Table 10.27 Estimated Cost of Public health centre in command area

Designation	Districts	Salaries per month in Rs.	Total per year in Rs.
Doctors	7	50,000/-	42,00,000/-
Nurses	7	36,750/-	30,87,000
Attendants	7	17,800/-	14,95,200
		Total	87,82,200
In Crores			0.87

Recurring Expenditure on Material and Supplies

Cost for medicines and other medical contingences during three years of construction period is Rs.50,000/- per month per district.

Total for 7 districts = Rs.3,50,000 /- per month

Per year Rs. 3,50,000*12*3 = Rs. 1,26,00,000 or Rs.1.26 crores



10.12.1 Bio-medical waste Disposal

Dispensaries use a variety of drug including antibiotic, cytotoxics, corrosive chemical etc. a part of which is generated as a solid waste. With greater emphasis on disposable, the quantum of solid waste generated in a hospital is quite high.

The bio-medical waste must be segregated in accordance with the guidelines laid under Schedule-I of Bio-medical Waste Management and Handling rules notified by Ministry of Environment and Forests.

Budget For Public Health Delivery System

The total budget earmarked for Public Health delivery system shall be **Rs. 2.13 crore**.



10.13

SANITATION AND SOLID WASTE MANAGEMENT PLAN

10.13 Construction phase

Facility in Labour Camp

The construction activities are likely to be concentrated at reservoir, pump house, tunnel/canal alignment and command area. About 700 workers are anticipated to be stationed for a period of 3 years, which can have an impact on biotic and abiotic environments.

Workers generally live in slum type conditions, with inadequate facilities for potable water and sanitation. Such unhygienic conditions make the labour population prone to increased incidence of various water-borne and vector-borne diseases. It is suggested that the construction company have it as a mandate to provide adequate facilities of water supply and sanitation. It is proposed that the contractor provides living units of 40-50m² to each of the labour family involved in the construction activities. The unit should have proper ventilation.

Appropriate water supply sources need to be identified. Proper infrastructure for storage and if required treatment e.g., disinfection or other units, should also be provided.

The labour population is proposed to be situated in project colony established by the Contractor. On an average one toilet need to be provided for 25 persons. It is expected that about 700 such labour camps need to be provided with sanitation facilities.

Table 10.28 Cost estimate for sanitation facilities in labour camps

Item	Unit	Unit cost Rs.	Total cost Rs.
Community toilet for 700 labours	1 toilet for every 25 labours @ Rs.17000 each	17000/-	4,76,000/-
Community Soak pits	618	22,815	1,41,99,670
Total			2,74,28,000

The total cost estimated for sanitation facilities in labour camps is Rs. **2,74,28,000/-**. (Rs.2.74 Crores)

10.13.1 Solid waste management

Substantial amount of solid waste is expected to be generated from labour camps. In view of the conditions that normally in the labour exist camps of such projects. The solid wastes are likely to contain vegetable matters followed by paper cans and glasses. About 700 labours are likely to reside during the construction phase at various construction sites resulting in generation of about 0.35 tonnes/day. Proper facilities for collection and conveyance of solid waste generated to the disposal site need to be developed.

Solid waste collection trolleys need to be positioned/operated at thrice in a week. These trolleys need to be covered while transporting the solid waste from the labour camps to the disposal site.



Irrespective of number of houses in a labour colony – on the average every 100 families are provided a common garbage bin. Two such garbage bins are suggested to be provided such that one bin is used for degradable waste and the other for non-degradable waste. About three garbage collection vehicles should be entrusted with the responsibility of collection and disposal of solid waste.

The degraded portion of the solid waste would be disposed of at the disposal sites. The non degradable portion such as plastic bottles, can, etc. shall be segregated and disposed of at separate sites and recycling opportunities would be explored in consultation with local area municipal administration.

The total cost arrived for solid waste management is Rs. 0.192 Crores. The details are given in Table10.29

Table10.29 Cost estimate for solid waste management

S No.	Detail of Expenditure	Cost Rs. in Lakhs
1	Land value per ha	2.00
2	Hired vehicle cost for conveyance of solid waste to landfill site (Rs.1500/- per trip @ 30 trips per month for 3 years)	16.20
3	Dumping yard maintenance	1.00
	Total cost in Lakhs	19.20

Environmental Management in Labour Camps

The total expenditure required for implementation of various environmental measures (Table 10.30)

Table 10.30 Budget for Environmental Management in Labour Camps

S No	Head of Expenditure	Cost in Rs. Crores
1	Sanitation facilities	2.74
2	Provision of LPG & Kerosene	0.0237
3	Solid Waste Management	0.192
	Total in Crores.	2.96

Budget

The total budget for sanitary and solid waste management plan is **Rs.2.96 Crores.**



10.14

LOCAL AREA DEVELOPMENT PLAN

10.14.1 Infrastructure Development and Public utilities

In addition to the provisions under R & R benefits for the Project Affected Families, project proponent would aim at the improvement in the livelihood standards of inhabitants in the project area. Project helps to develop infrastructure in the area. The infrastructure development will be other than rightful compensation to the project affected families.

Skill Development Programme

The eligible youth from project affected families shall be imparted education and training through relevant institutes in various trades such as mechanic, electrician, draughtsman, surveyor, plumber, welding and fabrication etc., Local youth need to get skill development training. To generate income among the project affected families, tailoring and embroidery centre establishments be taken up in consultation with the concerned.

Computer training centers at appropriate places in consultation with mandal administration offices be opened to train eligible male and female candidates to help them to get job opportunities.

Sports and Recreational Activities

The project authorities would construct and establish club/playground in the area. These would have facilities for indoor games and exercises as well as for outdoor games. Sports competitions and sports meets would be organized between the local players and project employees who would ensure the local participation. These facilities would go a long way in honing and nurturing the local talent in the field of sports and competitive games.

Free power to affected families.

Free power in line with National Power Policy shall be provided to the project affected families.

Encouragement of Horticultural and Agricultural Activities

A sustainable and diversified cropping pattern has to be developed depending on agriculture scenario. Keeping in view the soil fertility aspects, pulse crops have to be incorporated in the crop rotation. Also, cash crops should find a place wherever feasible, to improve farmers conditions and inculcate interest in farmers in the new cropping plan. At present, there is a very limited area under pulse and cash crops. Therefore, crops like Groundnut, Jowar and Chillies green gram, black gram, groundnut, soybean etc should be incorporated to cover sizeable area in the command area. The crops should be rotated in each field from year to year and monoculture or same rotation in the same field should be avoided. The project authorities propose to provide all the necessary infrastructures and support to such programmes.

Assistance for Self Help Groups

Sponsoring the SHGs would increase the quality of life of PAFs. Besides, the promotion of savings, this will also enhance the marketability of local products such as local handicrafts, fruits, etc. All SHGs will be provided up to Rs 2 lakhs seed money for a group of 10-20 PAFs.



Assistance for Cooperative Irrigation Facilities

Project will provide support in creating cooperative irrigation facility @ up to Rs. 2.00 lakhs for a group of 5 PAFs.

Upgradation of Educational Facilities

As part of the local area development plan, it is proposed to upgrade the schools, sanitary facilities, roads and parks in 7 district of the proposed IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project. The activities proposed under local area development plan activity are upgradation of both primary and secondary school infrastructure, sanitation, road repair works and maintenance of parks in 26 mandals in 7 districts of the proposed IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project command area. The cost for upgradation of facilities is given in Table 10.31.

Table 10.31 Upgradation of Infrastructure facilities

Components	Cost per unit Rs. Lakhs	No. of mandals	Total cost Rs. Lakhs
Primary school	1,50,000	26	39,00,000
Secondary School	2,50,000	26	65,00,000
Sanitation	1,00,000	26	26,00,000
Road repairs	3,00,000	26	78,00,000
Maintenance of parks	20000	26	5,20,000
Total cost in lakhs			2,13,20,000
In Crores			2.13

- Up-gradation of school in terms of furniture and equipment, purchase of school vans etc. Is given in Table 10.32

Table 10.32 Breakup of cost required for up-gradation of existing schools.

S. No	Particulars	Amount Rs.in Lakhs/school	No. of mandals	Amount in lakhs
1	Furniture and equipment	2.5	26	65
Total cost in Crores				0.65

Scholarships to students in primary and higher secondary schools:

Scholarships are proposed to school children studying between Class-I to Class-XII To primary school children, an amount of Rs. 2000 per year for a period of 5 years and Rs. 10,000 Per year for secondary school student may be extended to 26 mandals in seven



districts. A total amount of Rs. 0.03 Crores is suggested to earmark for providing scholarships as given in Table 10.33.

Table 10.33 Details of scholarships

S. No	Activities	Amount in Rs.
1	Scholarship for students (5 students x Rs. 2000 per year for 5 years)	50,000
2	Scholarship to merit students / higher secondary education (@ Rs. 10000--/year x 5 students x 5 years)	2,50,000
	Total in Crores	3,00,000

Improvement of Public Health Facilities

Health care facilities need upgradation / renovation of existing structures. Provision of new or latest gadgets and instruments, such as furniture and beds. Laboratory equipment, computers, beds, furniture, renovation of floorings and ceilings, construction of toilets, proper illumination with LED fittings, refrigerators, essential medicines, provision of drinking water facilities, etc. It is suggested to purchase an ambulance fitted with lifesaving medicines, which will function as a mobile clinic. It is further suggested to attach these mobile clinics to any of the above mentioned PHCs from where these mobile units will operate. A total amount of Rs. 4.42 Crores is being earmarked for extending health facilities under local area development plan. The details are provided in Table 10.34

Table 10.34 Cost of up-gradation of Primary Health Centres

S.No	Item	No.of PHCs	Unit cost in Rs. Lakhs	Total cost in Rs. Lakhs
1	Beds and other Furniture	26	5.00	130.00
2	Laboratory equipment	26	2.00	52.00
3	Renovation of operation theatre	26	10.00	260.00
				442.00
Total in Crores				4.42

Total budget for Local area development plan

An amount of **Rs. 7.23 Crores** is being made for implementation of activities; local area development plan as shown in Table 10.35

Table 10.35 Budget for implementation of Local Area Development Plan

S. No	Item	Cost in Crores
1	Upgradation of Infrastructure facilities	2.13
2	Up-gradation of existing schools	0.65
3	Scholarships to students in the Study Area	0.03
4	Budget for up-gradation of PHCs	4.42
	Total	7.23



10.15

ENVIRONMENTAL SAFEGUARDS

10.15.1. Environment safeguards during construction activities including road construction.

Environmental Management in Road Construction

The project construction phase would entail significant vehicular movement for transportation of large construction material, heavy construction equipment. Some of the existing roads in the project area, would require widening. This should provide adequate means of communication in the construction period and maintenance of works during project operation phase.

10.15.2. Impacts due to construction of roads

The construction of roads can lead to the following impacts.

- Removal of trees on slopes and re-working of the slopes in the immediate vicinity of roads can encourage erosion gullies, etc.
- Construction of new roads increases the resulting in greater human interferences and subsequent adverse impacts on the ecosystem.
- Increased air pollution during construction phase

10.15.3. Management Measures

The approach roads should have to be constructed as a part of the access to the construction site. The various aspects to be considered while making the project roads are as follows.

Construction

Area for clearing and grubbing shall be kept minimum subject to the technical requirements of the road. The clearing area shall be properly demarcated to save desirable trees and shrubs and to keep tree cutting to minimum.

The method of balanced cut and fill formation shall be adopted to avoid large difference in cut and fill quantities.

Excavated material should not be thrown haphazardly but dumped duly dressed up in a suitable form at appropriate places where it cannot get easily washed away by rain, and such spoil deposits may be duly trapped or provided with some vegetative cover.

Drainage

Drainage of the water from hill slopes and road surface is very important. All artificial drains shall be linked with existing natural drainage system.

Surface drains shall have gentle slopes. Where fall in levels is to be negotiated, check dams with silting basins shall be constructed and that soil is not eroded and carried away by high velocity flows.

Location and alignment of culverts should also be so chosen to avoid severe erosion at outlets and siltation at inlets.



Grassing and Planting

Tree felling for road construction /work should be kept bare minimum and strict control must be exercised. Equivalent number of new trees should be planted as integral part of the project within the available land and if necessary, separate additional land may be acquired for this purpose.

Depending on the availability of land and other resources, avenue plantation along roadside land should be carried out to a sufficient distance on either side of the road.



10.16

ENERGY CONSERVATION PLAN

10.6.1. Introduction

The total Power requirement for the Project is 96 MW for three pumps. Power to various lift points is to be availed from the respective power supply authorities. The Power supply shall be met from the DG sets of adequate capacity and shall be installed for putting into service in case of power failure for lighting and colonies.

The civil and electrical works of substations near pump house, drawing suitable power lines as per the requirement existing nearby power grids. The total power required for the project is about 96 MW. The Pump house requires power supply at various voltages ranging from 220KV to 11KV.

10.6.2. Energy Conservation Measures

Various construction and other activities of the proposed project would lead to increased demand in fuel wood in the project area and its vicinity and would therefore exert pressure on areas located around the project. One of the sources of energy in the villages of the project area is fuel wood, acquirement of which is one of the main causes of ecological degradation and human drudgery. It is estimated that during construction of the project, which would last for about 3 years, around 700 labours should be working.

To provide an alternate for the energy requirement of the workers, contractor/s should be made responsible to provide subsidized kerosene/LPG to their workers which should in turn discourage them from illegal tree felling and removal of fuel wood and timber from the adjoining areas. Further, community kitchen facilities would also be provided to the labourers by the contractors. In addition to above, efforts would be made towards energy conservation by installing non-conventional energy sources as discussed in the subsequent paragraphs.

Energy conservation measures would be implemented to ensure that the use of non-renewable resources is minimised. A key component of achieving energy conservation would be the development of an Energy Management Action Plan.

The Energy Management Action Plan would be consistent with the energy conservation measures during both construction and operation phase.

10.6.3. Energy Conservation during Construction Phase

The following energy conservation measures would be undertaken during construction works:

- Efficient work scheduling and methods that minimize equipment idle time and double handling of material.
- Throttling down and switching off construction equipment when not in use
- Switching off truck engines while they are waiting to access the site and while they are waiting to be loaded and unloaded.
- Switching off site office equipment and lights and using optimum lighting intensity for security and safety purposes
- Careful design of temporary roads to reduce transportation distance.
- Regular maintenance of equipment to ensure optimum operations and fuel efficiency.
- The specification of energy efficient construction equipment



10.6.4. Energy Conservation during Operational Phase

The following energy conservation measures would be undertaken during operational phase:

- Use of LED lights upto maximum possible extent
- Awareness about the use of LED lights by locals
- Employing renewable energy sources such as day lighting and passive solar heating
- Maximizing the use of solar power for signage and pedestrian lighting
- Designing roads on site to reduce transportation distances.

The total Power requirement for the Project is 96 MW for three pumps. Power to various lift points is to be availed from the respective power supply authorities. The Power supply shall be met from the DG sets of adequate capacity and shall be installed for putting into service in case of power failure for lighting and colonies.

This project requires 1 No. of lift in Siddipet district. The civil and electrical works of substations near pump house, drawing suitable power lines of 220 /132 /11 KV as per the requirement existing nearby power grids. The total power required for the project is about 96 MW. The Pump house requires power supply at various voltages ranging from 220KV to 11KV.

The cost of pumps operation would be Rs. 0.76 Crores. To reduce the power requirement, it is suggested to opt for alternative source like solar energy which is economically and environmentally viable.



10.17 Environmental Management Plan

10.17.1 Environmental Management Plan Cost:

The consolidated cost for environmental management plan is about Rs.502.29 Crores which includes cost of CAT plan, CAD plan, Biodiversity Management Plan, R&R plan, Greenbelt Development Plan, Fisheries Conservation and Management Plan, Reservoir Rim Treatment Plan, Muck management plan and restoration & Quarry sites, Water, Air, Noise Management Plan, Public Health Delivery Plan, Sanitation & Solid waste Management Plan and Local Area Development Plan is given in Table 10.36.

Table 10.36 Consolidated Cost for EMP

Components	Total Cost (Rs. Crores)
Catchment area treatment plan	16.72
Command Area Development plan	---**
Biodiversity Conservation and Management Plan	0.76
Greenbelt Development plan	2.13
Fisheries Conservation and Management plan	24.78
Reservoir Rim Treatment plan	3.84
Muck management plan	8.07
Water, Air, Noise Management plan	0.72
Public Health Delivery plan	2.13
Sanitation & Solid waste Management plan	2.96
Local Area Development plan	7.23
Energy Conservation Plan	0.76
Total (a)	70.10
Resettlement & Rehabilitation plan (b)	432.19
Grand Total	502.29

It is suggested to form a multi sectoral team of experts for effective implementation of Environmental Management Plan.

****Command Area Development plan is estimated to Rs.17,494/- per hectare.**

11

SUMMARY AND CONCLUSION

11.1 Project Background

Water resources are sources of water that are potentially useful to all living bodies and for sustainable environment. Demand for water includes: drinking water, agricultural, industrial, household, recreational, and many more. Though fresh water is a renewable resource yet the supply of fresh water is steadily decreasing adding misery to the people, especially during the summer period. Water demand already exceeds supply in many parts of the country and with the increasing population the gap between supply and demand is widening.

Access to water and water resource management is, therefore, a major challenge for the government. Since a substantial quantum of water available in the rivers remain unutilised and finally flows into the sea, the most feasible method would be to find ways and means to utilise the surplus water for the various purposes such as drinking, irrigation, power generation, industrial use and so on throughout the year in a regulated manner. Therefore, construction of dams and reservoirs across the major rivers provides a viable solution in the water management system.

Government of Telangana has, therefore, proposed the proposed Indiramma Flood Flow Canal from Sri Rama Sagar Project (SRSP) with expansion of Gouravelly reservoir with the main objective is to the excess flood occurs once in every four years as per the existing data.

Flood Flow Canal (FFC) project (originally cleared in the 64th TAC of CWC, Dt 30.03.1996) is envisaged irrigation facility to an area of 2.2 lakh acres in the drought-prone areas of Telangana region duly diverting about 20 TMC of surplus water from Sri Rama Sagar Project during the floods. The DPR approved by CWC in 1996 envisaged formation of 3 No's (Three) reservoirs namely (i) Combined Storage Reservoir-I across Peddavagu II and Korutlavaagu near Konaraopet (V), Karimnagar Dist with a storage capacity of 7.346 TMC to irrigate an ayacut of 32,000 Acres. (ii) Mid Manair Reservoir with a storage capacity of 25.873 TMC to irrigate an ayacut of 68,000 Acres. (iii) Gouravelly Reservoir with storage capacity of 1.095 TMC to irrigate an ayacut of 1,20,000 Acres was proposed. The total storage capacity under these three Reservoirs was proposed as 34.314 TMC. The approved water utilization is 21.332 TMC of water.

The then Government of Andhra Pradesh awarded permission to divert and utilize 20.00 TMC of Godavari flood water according to the 64th TAC meeting in 1996. Later owing to huge protests and resistance from the local people against the construction of Combined Storage Reservoir-I across Peddavagu II and Korutlavaagu near Konaraopet (V), Kathalapur (M), Karimnagar Dist at Km 47.60 of FFC, the then Government of Andhra Pradesh vide G.O.Ms.No.209, dated: 17-11-1997 had bypassed the Combined Storage Reservoir-I across Peddavagu-II and Korutlavaagu.

After formation of Telangana State, Government has taken up Re-engineering of Irrigation projects for effective utilization of water allocations made to the state. To compensate the storage lost due to dropping of Combined Storage Reservoir-I across Peddavagu II and Korutlavaagu near Konaraopet (V), Kathalapur (M), Karimnagar Dist, the Government has proposed to increase the Gouravelly Reservoir capacity from 1.410 TMC to 8.230 TMC. The administrative approval for the Gouravelly reservoir project with enhanced capacity from 1.410 TMC to 8.23 TMC was accorded by the Government of Telangana vide G.O.Ms. No.



533, I&CAD (Projects-IV) Department Dt: 26.05.2017 and 85% of work was completed by the time of NGT Case was filed.

The submerging villagers of Gouravelly reservoir had filed the case OA no 180 of 2021 on 10th August 2021 before the Hon'ble NGT (SZ), Chennai on the ground that the irrigation and CAD department of State of Telangana under the Re-engineering proposal issued orders for expansion of Gouravelly Reservoir from 1.410 TMC to 8.230 TMC without obtaining prior EC from Ministry.

The National Green Tribunal (SZ), Chennai has constituted a Joint Committee on 13.08.2021 represented by IRO, MoEF&CC, Godavari River Management Board and Central Water Commission, Integrated Regional Office, Hyderabad. The Joint Committee conducted the site visit on 23.09.2021 and filed its report on Dt: 29.09.2021 before the Hon'ble Tribunal wherein it has reported that the scope of the project has been changed without approval of MoEF&CC. The committee has proposed an Environmental Compensation of Rs.2,05,31,250 (Rs.2.05 Crores) for Violation.

The National Green Tribunal disposed the case on 10.02.2022 with the certain observations and directions.

As per the NGT orders, the MoEF &CC, New Delhi has conducted 29th EAC meeting on 15.06.2022 in which, the EAC has suggested the Project Proponent to submit the proposal afresh at PARIVESH portal for Terms of Reference (ToR) under violation category.

As per the EIA notification, 2006 and its subsequent amendment dated 20th April 2022, the proposed project comes under River valley category - schedule 1(c). Irrigation projects involving Inter-State issues shall be appraised at Central level without change in category, irrespective of the command area. The proposed project has the total culturable command area of 2,20,000 acres (89031 ha) with no interstate boundary. So, the proposed project is considered at state level. The SEAC committee approved the ToR on 15th Feb 2023 under violation category Ref. No. SIA/TG/RIV/40935/2022, Dt 06.12.2022.

11.2 Project Objective

The Indiramma Flood Flow Canal Project (IFFC) envisages diversion of flood water from Sri Rama Sagar Project (SRSP) is conceived with an objective of irrigating 2,20,000 acres (89031 ha) of ayacut in the drought prone areas of erstwhile districts of Karimnagar, Warangal and Nalgonda (present districts Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon) in Telangana region. The project consists of various components like:

(i) Water conveyance system consisting of gravity canals, tunnel and lift schemes :

- FFC Canal :122 km
- Reverse lift pump house: 3 number
- MMR Canal:103.375 km
- Tunnel – 11.98 km
- Pump house – 3 x 32MW(3x19cumecs)
- Gouravelly Canal-63.725 km
- High Level Canal-20.845 Km

(ii) Mid Manair reservoir: 25.873 TMC

(iii) Gouravelly reservoir: 8.23 TMC.

(iv) Distributary Network System



11.3 Salient Features

Table 11.1 Salient Features

S.No	Items	Features
1	Name of the project	Indiramma Flood Flow Canal Project from SriRamaSagar Project with expansion of Gouravelly reservoir from 1.410 TMC to 8.23 TMC
2	Location	Gouravelly (V), Akkannapet (M), Siddipet (Dist)
	River Basin	Godavari
	State	Telangana
	Reservoir	Mid Manair Reservoir, Gouravelly Reservoir
	Head work	Siddipet, Akkannapet (M),
	Latitude	18° 05' 15" N
	Longitude	79° 11' 00" E
	Command area	Peddapalli, Rajanna Siricilla, Jagtial, Karimnagar, Hanumakonda, Siddipet and Janagaon
	Sol toposheet	56J/5, 56J/9, 56J/10, 56J/13, 56J/14, 56J/15, 56N/2, 56N/3, 56N/4, 56N/7, 56N/8
3	Access to the project	
	a) Air port	Hyderabad Airport at 145 km
	b) Rail head	Nearest Railway Station – Kazipet, 50 Kms
	c) Road Head	Karimnagar (40km)
	d) Sea port	Vishakhapatnam and Kakinada
4	Irrigation (ha.)	
	A) New CCA	2,20,000 Acres (89030.84 Ha)
5	Water Supply	Drinking water requirement of command area
6	Total proposed utilisation by the project	Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir project envisages diversion of 20 TMC of flood water from Sriramasagar Project.
7	Water conveyance system consisting of gravity canals, tunnel and lift schemes	
	• FFC Canal	122 km
	• Reverse lift pump houses	3 number
	• MMR Canals	103.375 km
	• Tunnel	11.98 km
	• Pump houses	3 x 32MW(3x19cumecs)
	• Gouravelly Canals	63.725 km
	• High Level Canals	20.845 Km
8	Reservoir	Mid Manair reservoir: 25.873 TMC Gouravelly reservoir: 8.23 TMC.
9	Gouravelly Reservoir	
	Water supply to Gouravelly Reservoir	57.00 Cumecs
	Length of water conductor System.	15.98 Km.(Approach Channel 4.00km + Tunnel11.98Km).
	Total Head.	126.52 M
	Number of Pumps.	3 Numbers.
	Pumps Capacity	3x19 Cumecs
	Type of Pumps	Vertical Centrifugal Pumps (Francis Type with adjustable guide vanes) .
	Power Requirement.	96 MW
	Type of Motors	Synchronous Motors (3X32MW).



S.No	Items	Features
	Capacity	8.23 TMC
	FRL	+415.000 M
	TBL	+419.300 M
	MDDL	+393.800 M
	Live storage	7.822 TMC
	Dead storage	0.408 TMC
	Ayacut	1,20,000 Acres
	Head Regulators	2 No.s
	Weir	1 no.
	Bund length	Total length 10.567km, hillock portion 2.178Km net length 8.389 KM
	Maximum Bund height	41.62 M
	Right side OT	@ KM 6.800, sill level +389 M
	Left side OT	@ KM 1.900, sill level +392 M
	Weir	@ KM 9.100, length 115M
	Diversion road	10.000 KM
	Submergence area	(1814 old+2056 new) =3870 acres
	Villages coming under Submergence	Villages–Full Submergence 1) Gudatipally, Gram panchayath Tenugupally, Maddelapally and Kottapalli are H/o Gudatipally Villages- Partial Submergence 1) Gouravelly , 2)Janagoan , 3) Gandipelly 4)Regonda , 5)Nandaram , 6)Ramavara
	R&R	Structures - 817 No.S (693 old+124 New) & Families – 1122 No.S (937old +185new)
9	Power requirement	96 MW
10	Forest land	No Forest Land
11	Cost of IFFC project	Rs. 5940.09 Crores @PL 2015-16. Rs.1196.06 Crores for Gouravelly Reservoir enhancement (8.23 TMC) and Rs.540.14 Crores for Construction and Execution of Gouravelly Reservoir
12	B – C Ratio	1:10

As per the EIA notification, 2006 and its subsequent amendment dated 20th April 2022, the proposed project comes under River valley category - schedule 1(c). Irrigation projects involving Inter-State issues shall be appraised at Central level without change in category, irrespective of the command area. The proposed project has the total culturable command area of 2,20,000 acres (89031 ha) with no interstate boundary. So, the proposed project is considered at state level. The SEAC committee approved the ToR on 15th Feb 2023 under violation category Ref.No.SIA/TG/RIV/40935/2022, Dt 06.12.2022.

11.4 Baseline Environmental Status

The environmental components - air, water, noise, land and biological studies were monitored in the study area as per the approved ToR by SEIAA vide No. SEIAA/TS/OL/SDPT-37/2022 dated 15th February, 2023 and guidelines of CPCB / MoEF&CC. The sampling stations were chosen in such a manner as to cover the major pollution generating locations such as barrage sites, reservoirs and command area.

11.4.1 Meteorological Data:

Winter season December, 2022 - February, 2023 (01.12.2022 to 28.02.2023)

The predominant wind direction is blowing from South West (SW) direction, followed by East-South East (E-SE) winds and Calm conditions prevailed is 16.20% of the time during this period. The maximum wind speed recorded was 13.3m/s. The maximum temperature recorded was found to be 38.5⁰C, while the minimum temperature was 12.3⁰C and the average temperature is 24.9⁰C. The average relative humidity was found to be 62.4%. No rainfall observed during this season.

Pre-monsoon season March to May 2023

The predominant wind direction is blowing from South East (SE) direction, followed by East-South East (E-SE) winds and Calm conditions prevailed is 20.24% of the time during this period. The maximum wind speed recorded was 6.2m/s. The maximum temperature recorded was found to be 44.3⁰C, while the minimum temperature was 17.9⁰C and the average temperature is 30.1⁰C. The average relative humidity was found to be 45.6%. The total rainfall observed during this study period is found to be 26.2mm.

Monsoon season (June to August 2023)

The predominant wind direction is blowing from North East- North (NE-N) direction, followed by North (N) winds and Calm conditions prevailed is 19.91% of the time during this period. The maximum wind speed recorded was 7.5m/s. The maximum temperature recorded was found to be 44.0⁰C, while the minimum temperature was 22.0⁰C and the average temperature is 29.0⁰C. The average relative humidity was found to be 83.6%. The total rainfall observed during this study period is found to be 787.8mm.

11.4.2 Air Environment:

The ambient air quality at ten different locations was monitored during the study period. The monitoring was carried out simultaneously at three to four locations each day for 24 hours on two consecutive days every week. The analysis was carried out as per the method described in the NAAQ Standards.

Winter Season

PM₁₀ concentrations range from 39.0 to 79.0 µg/m³, minimum concentrations were observed at Vallampatla (A4), & Regonda (A6), maximum value was observed at Kundinenepalli (A8). PM_{2.5} concentrations were in the range from 19.7 to 39.5 µg/m³. The minimum concentrations were observed at Baswapuram (A1), & Kondapuram (A9) and maximum value was observed at Kundinenepalli (A8).

SO₂ concentrations are in the range from 7.4 to 18.4 µg/m³. The minimum concentrations were observed at Nawabpet (A5), and maximum concentration observed at Baswapuram (A1). NO₂ concentrations are in the range from 9.8 to 15.4 µg/m³. The minimum concentration was observed at Vallampatla (A4), and maximum concentration at Baswapuram (A1).

Pre-monsoon Season

PM₁₀ concentrations range from 38.0 to 68.0 µg/m³, minimum concentrations were observed at Kondayapalli (AQ-3), Regonda (AQ-6), & Gouravelly (AQ-7) and maximum value was observed at Pichara (AQ-10). PM_{2.5} concentrations were in the range from 17.5 to 39.0 µg/m³. The minimum concentrations were observed at Kondayapalli (AQ-3) and maximum value was observed at Pichara (AQ-10). SO₂ concentrations are in the range from 6.1 to 18.4 µg/m³. The minimum concentrations were observed at Vallampatla (AQ-4), and



maximum concentration observed at Baswapuram (AQ-1). NO₂ concentrations are in the range from 9.8 to 22.5 µg/m³. The minimum concentration was observed at Kondayapalli (AQ-3), and maximum concentration at Baswapuram (AQ-1).

Monsoon Season

PM₁₀ concentrations range from 25.0 to 68. µg/m³, minimum concentrations were observed at Rajeshwarraopeta (AQ-2), and maximum value was observed at Pichara (AQ-10). PM_{2.5} concentrations were in the range from 17.0 to 33.9 µg/m³. The minimum concentrations were observed at Rajeshwarraopeta (AQ-2) and maximum value was observed at Nawabpet (AQ-5). SO₂ concentrations are in the range from 5.0 to 15.2 µg/m³ the minimum concentrations were observed at Nawabpet (AQ-5), and maximum concentration observed at Gouravelly (AQ-7). NO₂ concentrations are in the range from 6.7 to 20.8 µg/m³ the minimum concentration was observed at Regonda (AQ-6), and maximum concentration at Gouravelly (AQ-7).

The AAQ study indicates that the observed concentrations in all the three seasons are well within the National Ambient Air Quality Standards (NAAQS) as notified on 18.11.2009 by CPCB.

11.4.3 Noise Environment

Noise levels were recorded for 24 hours period at the 10 locations with frequency of seasonally twice on working and non working days.

Winter season

The maximum value of Leq Day is 49.2 dB (A) at Baswapuram (N-1), and minimum is 44.6 dB (A) at Kondapuram (N-9) and maximum value of Leq Night is 41.4 dB (A) at Kundinenepalli (N-8), and minimum is 33.4 dB (A) at Baswapuram (N-1).

Pre-monsoon season

The maximum value of Leq Day is 50.7 dB (A) at Baswapuram (NQ-1), and minimum is 43.4 dB (A) at Pichara (NQ-10) and maximum value of Leq Night is 35.3 dB (A) at Rajeshwarraopeta (NQ-2), and minimum is 31.4 dB (A) at Kondayapalli (NQ-1).

Monsoon season

The maximum value of Leq Day is 45.5 dB (A) at Regonda (NQ-6), and minimum is 36.5 dB (A) at Kondayapalli (NQ-3) and maximum value of Leq Night is 31.9 dB (A) at Kondayapalli (NQ-3), and minimum is 26.6 dB (A) at Regonda (NQ-6).

The results shows moderate noise due to vehicular movement and mainly due to residential activities contributing to increase in noise levels, however, the noise levels in terms of Leq (day) and Leq (night) are well within the Noise Pollution (Regulation and Control) Rules, 2000 standards stipulated at all the locations in all the three seasons.

11.4.3.1 Traffic data:

The existing traffic density for different types of vehicles was recorded at 4 locations i.e. Gouravelly sub-station junction, Husnabad Traffic junction, Malcher tanda junction and Chutukunta Tanda Junction. The existing traffic was recorded for 24 hours. The maximum vehicular PUC is at Husnabad Traffic junction during both working (9112 PUC) and non-working day (4385 PUC).

11.4.4 Water Environment

A total of 25 water samples i.e., 10 surface water and 15 groundwater were collected and analyzed for various physico-chemical and bacteriological parameters.

11.4.4.1 Surface Water:

A) Winter season

Total coliforms, faecal coliforms were present in the surface water samples collected in the study area. Presence of Total coliforms, faecal coliforms shows contamination from faecal matter or sewage entry and not suitable for direct drinking purpose and needs chlorination before treatment. It may be observed that the surface water samples have DO values 5.2 - 6.6 mg/L. BOD is found to be within the limits in all locations. Total coliforms are recorded in the range 110 - 350 MPN/100ml and faecal coliforms are recorded in the range 11 - 33 MPN/100ml in the given samples.

B) Pre-monsoon

pH values were in the range of 7.9 – 8.5. Total coliforms, faecal coliforms were present in the surface water samples collected in the study area. Presence of Total coliforms, faecal coliforms shows contamination from faecal matter or sewage entry and not suitable for direct drinking purpose and needs chlorination before treatment. It may be observed that the surface water samples have DO values 5.6 - 6.2 mg/L. BOD is found to be within the limits in all locations. Total coliforms are recorded in the range 70 - 170 MPN/100ml and faecal coliforms are recorded in the range 4 - 23 MPN/100ml in the given samples.

Monsoon season

pH values were in the range of 7.1 – 8.1 in SW-1 to SW-10 samples. Total coliforms, faecal coliforms were present in the surface water samples collected in the study area. Presence of Total coliforms, faecal coliforms shows contamination from faecal matter or sewage entry and not suitable for direct drinking purpose and needs chlorination before treatment. It may be observed that the surface water samples have DO values 5.2 - 6.3 mg/L. BOD is found to be within the limits in all locations found in the range 2.4 – 3mg/L. Total coliforms are recorded in the range 170 - 240 MPN/100ml and faecal coliforms are recorded in the range 17 - 33 MPN/100ml in the given samples.

The surface water samples SW-1 to SW-10 in all the three seasons fall under the CPCB water quality criteria Class-B (Outdoor bathing (Organized)) as the DO is satisfactory and above 5mg/L and BOD is within the limit and Total coliforms are less than 500 MPN/100 ml. In addition to the CPCB criteria parameters, another 31 parameters were also investigated and there are no abnormalities observed in all samples.

11.4.4.2 Ground Water

Winter season

pH values were in the range between 7.1 to 8.4. TDS concentrations are in the range of 322 to 635 mg/L, are within the acceptable limit of 500 mg/L in all locations except GW-3, 4, 5, 14 (635, 552, 564, 518mg/L), are above the acceptable limit but within the permissible limit of 2000mg/L. Magnesium concentrations 31 - 64mg/L, were observed to be above the acceptable limit of 30mg/L but within the permissible limit of 100mg/L at all locations. Fluorides concentrations are observed to be above the acceptable limit of 1.0mg/L but within the permissible limit of 1.5mg/L in GW-3 (1.02mg/L) and within the limit at other locations.

The total alkalinity concentrations 205 to 335 mg/L & Total hardness concentrations 217 to 403mg/L, are above the acceptable limit of 200mg/L but within the permissible limit of 600mg/L at all locations.

Pre-monsoon season

pH values were in the range between 7.1 to 7.6 in the GW-1 to GW-15 samples collected within the study area. TDS concentrations are in the range of 335 - 710mg/L, are above the

acceptable limit of 500mg/L but within the permissible limit of 2000mg/L in all locations except GW-3, 4, 8 (390, 335, 477mg/L), are within the acceptable limit. Calcium concentrations are in the range of 47 - 99mg/L, are above the acceptable limit of 75mg/L but within the permissible limit of 200mg/L in all locations except GW-3, 4, 6, 8, 10, 12, 13 (55, 57, 68, 55, 72, 47, 62mg/L), are within the acceptable limit. Magnesium concentrations 30 - 67mg/L were observed to be above the acceptable limit of 30mg/L but within the permissible limit of 100mg/L at all locations.

The total alkalinity concentrations 220 – 430mg/L & Total hardness concentrations 247 – 524mg/L, are above the acceptable limit of 200mg/L but within the permissible limit of 600mg/L at all locations.

Monsoon season

pH values were in the range between 7.1 to 7.6 in the GW-1 to GW-15 samples collected within the study area. TDS concentrations are in the range of 318 - 766mg/L, are above the acceptable limit of 500mg/L but within the permissible limit of 2000mg/L in all locations except GW-5, 7, 8, 9, 11, 13, 14 (458, 335, 318, 352, 326, 408, 363mg/L), are within the acceptable limit. Calcium concentrations are in the range of 48 - 93mg/L, are above the acceptable limit of 75mg/L but within the permissible limit of 200mg/L in locations GW-1, 4, 6, 10, 12, 15 (88, 93, 84, 91, 90, 86mg/L), and within the acceptable limit in other locations. Magnesium concentrations 33 - 64mg/L were observed to be above the acceptable limit of 30mg/L but within the permissible limit of 100mg/L at all locations. Fluorides concentrations are in the range of 0.75 – 1.4mg/L are above the acceptable limit of 1.0mg/L but within the permissible limit of 1.5mg/L in all locations except GW-4, 12, 13 (0.75, 0.98, 0.96mg/L) are within the acceptable limit. The total alkalinity concentrations 310 – 475mg/L & Total hardness concentrations 256 – 483mg/L, are above the acceptable limit of 200mg/L but within the permissible limit of 600mg/L at all locations.

Chlorides, Sulphates, Nitrates, Fluorides & Iron concentrations were observed to be within the acceptable limit at all locations. The concentrations of heavy metals Cadmium (Cd), Copper (Cu), Lead (Pb), Arsenic (as As), Chromium (Cr), were either below the detection limits or below the permissible limits.

11.4.4.3 Hydrogeology

Pre-monsoon depth to water level

The Pre-monsoon depth to water level varies from a minimum of 3.85 m.bgl. to a maximum of 21.00m.bgl. Most of the area is having water levels below 5 mbgl. Water levels ranges from 5-10m and above 10m water levels.

Post-monsoon depth to water level

The Post-monsoon depth to water level during post-monsoon ranges from a minimum of 0.98 m.bgl. to maximum of 22.65 m bgl. The water levels of less than 10 m bgl cover the maximum area of the district.

Water Level Fluctuation

The water level fluctuation between pre-monsoon and post-monsoon ranges between 0.00 to 7.88m. The majority of the area shows rise in the range of 2-4m.

Long Term Water Levels Decline in water levels during pre-monsoon is noticed in 75% of the wells while 25% of wells show rise in water levels during the last decade. The decline in water levels varies between 1.06 to 5.19 metres.

The analysis of post-monsoon water level shows that there is a decline in 77% of the wells while 23% show rise in water levels. The water level decline varies from 0.19 to 6.62 m.

Main crop grown is Paddy during khariff and rabi season. Pulses are grown during khariff and Sugarcane is grown during khariff and during rabi. The other crops are Millets and oil seeds.

11.4.5 Soil Environment

Fifteen (15) soil samples were collected from the study areas which includes 10 km radius of reservoir, command area and canal 1 km radius of both sites.

Winter Season

The porosity and water holding capacity were in the range of 42.98 – 56.27% and 31.74 – 49.43% respectively. Bulk density range is from 1.11 - 1.48 mg/m³. Soils collected from the villages in the study area are slightly acidic to slightly alkaline in nature having pH in the range of 6.5 to 7.8. The EC for the soil samples are in the range 0.108 – 0.27 mmhos/cm. Organic carbon was found to be in the range 0.18 to 1.87%.

The Nitrogen values ranged from 94 to 226 kg ha⁻¹ reflecting that the values were observed to be low category. The Phosphorus values ranged from 1.2 to 5.3 kg ha⁻¹ indicating that the values were in low category. The Potassium values ranged from 72 to 296 kg ha⁻¹ indicating that values are observed to be medium to high category.

Pre-monsoon Season

The porosity and water holding capacity were in the range of 44.12 – 58.36% and 32.76 – 49.98% respectively. Bulk density range is from 1.12 - 1.50 mg/m³. Soils collected from the villages in the study area are slightly acidic to slightly alkaline in nature having pH in the range 6.6 to 8.2. The EC for the soil samples are in the range 0.114 – 0.333 mmhos/cm. Organic carbon was found to be in the range 0.12 to 0.93%.

The Nitrogen values ranged from 104 to 380 kg ha⁻¹ reflecting that the values were observed to be low category. The Phosphorus values ranged from 1.56 to 6.7 kg ha⁻¹ indicating that the values were in low category. The Potassium values ranged from 130 to 512 kg ha⁻¹ indicating that values are observed to be medium to high category.

Monsoon Season

The porosity and water holding capacity were in the range of 31.49 – 48.53% and 43.53 – 58.81% respectively. Bulk density range is from 1.1 - 1.45 mg/m³. Soils collected from the villages in the study area are slightly acidic to slightly alkaline in nature having pH in the range 6.9 to 8.7. The EC for the soil samples are in the range 0.081 – 0.302 mmhos/cm. Organic carbon was found to be in the range 0.12 to 0.93%.

The Nitrogen values ranged from 113 to 188 kg ha reflecting that the values were observed to be low category. The Phosphorus values ranged from 1.09 to 3.85 kg ha⁻¹ indicating that the values were in low category. The Potassium values ranged from 209 to 362 kg ha⁻¹ indicating that values are observed to be medium to high category.

11.4.6 Land Environment:

The area required for the construction of the project involves submergence of 7879 ha of submergence area of Mid Manair reservoir the out of which Manair river occupy 1191.50 ha and submerge of Gouravelly reservoir is an area of 1567 ha. The land use and land cover assessment of study area was carried out by visual interpretation of Resources at 2 LISS 4 MX data acquired during 23rd Oct.2022 and 04th Mar.2023 and ground truth verification. Rabi Crop land cultivated in 1391.06 ha, and Agri.fallow lands in 14644.14 ha gets converted to double crop area; wastelands in 10317.13 ha area gets converted to kharif irrigated lands. Thus about 26,352.33 ha of area will have change of land use.



Sensitive Environment: The study area does not have any sensitive environment within its command area. There is no, national park and historical monuments in the study area.

11.4.7 Socio-economic environment

As per the primary survey and observation, 43 census villages/wards surround the proposed expansion of Gouravelli Reservoir from 1.41 TMC's to 8.230 TMC's project and it also includes 20 urban wards belong to Husnabad Municipal Council, which are falling in the 10 km radius of the study area. The study areas Schedule caste (SC) population is 17.23% and the Schedule Tribe (ST) population is 13.25%. Literacy rate in the project area is 60.56%. Educational status has improved from generation to generation in this region. The required Schools and colleges are available. The working participation rate is 51.90% and the non-working population is 48.10%. Infrastructure facilities such as the Road network, self-help groups, Public distribution system, and communication facilities are good.

A sample survey of 485 household's survey was conducted in 14 villages of the study area. The number of females per 1000 males is 1009, showing healthy ratio of female population. Among the surveyed total population (excluding 0 to 6 years of age), 63.26% people were literate and 30.75% were illiterate. This shows that the educational facilities have gradually improved in the sample villages and some of the educational infrastructure is still in progress.

The more than half the population(69.64%) in the study area is having the land ranging from below hectare to more than 10 hectares. These farmers are cultivating paddy and other rain fed crops such as maize and millets. The remaining farmers are growing fodder for their cattle. About 70.17% population involved in other occupations petty trading, private wage employment and daily wage labourer works.

With reference to drinking water sources, majority 88.87% families were using water from rural water supply (Mission Bhageeratha Scheme and using bore wells). The sanitary status was good in the villages as 91.75% have sanitation facilities in their own premises. However, the drainage facilities in the study area needs to be further improved through community participation.

Health and medical amenities are there in the study area as most of the villages were covered by the state with Primary and Community Health Centre at Husnabad and Akkannapet and its supporting sub-centres and in addition to this the Rural Medical Practitioners (RMPs) are also available in the study area.

During the Focus group discussion & need-based assessment, the respondents requested some important facilities from the project proponent. These are Cement and concrete (CC) roads, Drainage and sanitation, Need based skill-training programmes to promote the livelihoods of the communities is required. The additional classrooms at schools and sports kits to the school, Need renovation for Anganwadi centres and regular medical camps.

The findings from the primary survey indicate that medical facilities & other infrastructure facilities are average in the study area. The quality of the life in the region is good having the basic amenities in the surrounding areas, needs to be further improved through Corporate Social Responsibility initiatives promoting the community participation. Since the expansion if the Gouravelli reservoir which expect the paddy cultivation needs warehouse facilities to store the grains produced by the farmers.

11.5 Impact Assessment and Mitigation Measures

During the construction phase the following are the anticipated impacts:

1. The project will need 3870 acres of land for the construction of reservoir. Villages such as Gudatipally Gram panchayath, Tenugupally, Maddalapally and Kottapalli are H/o Gudatipally get fully Submerged; and villages like Gouravelly , Janagoan, Gandipelly,

Regonda, Nandaram, Ramavaram get partially submerged. About 817 Nos. of structures and 1122 Nos. of families get affected due to the reservoir.

2. The submergence of the above make it obligatory to give them rehabilitation and resettlement benefits. Hence all land issues have to be carefully examined, their impact assessed, and management plans formulated to mitigate the adverse impacts.
3. Site clearance, construction of sheds and other facilities for camp labour and project functionaries, providing camping facilities such as water, electricity, sanitation, cooking gas, etc. Approach road to the identified construction locations for the movement of men and machinery, transportation of construction material at different sites will all have to be assessed for their impact.
4. Excavation of earth for the construction of canals, approach road to tunnel and tunnelling activities, digging for pump house, etc. will generate lot of muck that has to be assessed for its impact and method of safe disposal has to be found.
5. The impact on the command area during the operational phase, especially on the soils, has to be assessed as providing irrigation for sustainable crop production is the major objective of the project.

Quarrying operation and muck disposal

Indiramma Flood flow canal project from Sri Ramasagar Project with expansion of Gouravelly reservoir envisages construction of several components of works such as construction of tunnels, approach canal, reservoir and command area canal systems. These activities invariably lead to generation of huge muck causing degradation of land and loss of biomass. The approximate quantities of muck likely to be generated based on the line estimates is assessed for earthwork excavation is 1483 m³.

Out of the above, some quantity is utilizable for the construction activities. The remaining quantity of muck is to be disposed at suitable locations and treatment measures to be undertaken as per the Environment Management Plan.

11.5.1 Air Environment

Construction phase: The principal impacts on ambient air quality will be due to emissions of fugitive dust from the construction materials and solid waste handling as well as construction activities. The generation of fugitive dust will reduce drastically as soon as the construction activities cease. The changes in ambient air quality due to emissions from heavy equipment and material handling machineries and transportation vehicles will not be of permanent nature.

Operation phase: Impacts to air quality during operation phase will be mainly due to vehicular traffic movement, connecting network of roads with various project components. All the earthmoving equipment and transportation machineries will be regularly maintained and only PUC certified vehicles will be used to reduce the impact due to SO₂ and NO_x.

11.5.2 Noise Environment

Construction phase: Major sources of noise generation during construction phase will be due to movement of earth-moving machineries, movement of heavy vehicles and excavation activities. However, this will be restricted to project site only. It is expected that construction activities will involve noise generation below 90-dB (A). According to the CPCB guidelines there should not be any construction activity during the night. Overall, the impact of generated noise on the environment is likely to be insignificant, reversible and localized in nature and mainly confined to the day hours.

Operation phase Impact due to Noise level during operation phase will be mainly due to vehicular movement, and by the operation of pumps for lifting the water for various uses. The noise level produced during operation of the pumps will be slightly higher than the general noise level. However, State of art technologies will be used in the pumping system

to keep the noise level at a bare minimum limit. The personnel working in the noise prone zone will be provided with suitable safety gears like ear muffs etc.

11.5.3 Water Environment

During construction phase: It is anticipated that there will be significant impact on water quality due to escape of suspended solids from various construction activities like land excavation, temporary diversions, road construction etc. Further, incidences of soil erosion will deteriorate quality of water downstream if allowed unchecked. Similarly, wastewater discharge from the domestic and construction activities can pose significant impact, if discharged untreated. Further, it is anticipated that sewage will be generated from the labour colony. The wastewater, if discharged untreated, will have significant impact on water quality downstream. Therefore, it warrants treatment of waste water before it is discharged for which sewage treatment plant is proposed to be installed.

During operation phase:

- Water Logging and soil salinity development can occur due to water seepage from distributaries and water courses to the adjoining fields.
- Inadequate drainage and poor maintenance of existing drainage system and outlets - inadequate farm water management - lack of conjunctive use of surface and ground waters combinedly can result in poor water application efficiencies.
- The barrage structure blocks fish migration which, in some cases and for some species, completely separate spawning habitats from rearing habitats. The barrage also traps sediments, which are critical for maintaining physical processes and habitats downstream of the barrage.
- Due to the construction of barrages and online storages realignment changes to the hydrology of watercourses or aquifers is possible.
- Proliferation of water weeds can increase disease vectors, affect water quality, fisheries and clog irrigation structures.
- During construction phase waste discharged from the labour camps/colonies nearby construction site will have an adverse impact if not properly treated. A small wastewater treatment plant shall be constructed at the labour camps.
- To deal with the mosquito breeding places it is proposed to - introduce anti - malaria measures for maintaining hygienic living conditions etc.
- Adequate drainage channels shall be provided with suitable slopes near the labour camps for safe disposal of water.

11.5.3.1 Impacts on Hydrology

The transfer of water through lift schemes and conveying it to water deficient, upland regions is thus of strategic importance and a pressing need toward a more equitable development of water resources for irrigation and other water requirements.

During the last 4 years the DTWL monitored carried out by Telangana State ground water Department showed increase of 0.0645m or 6.45cm per month ground water downstream of Mid Manair Reservoir in Rajanna Sircilla district.

11.5.3.2 Scope for conjunctive use of surface and groundwater

The stage of ground water development in 10km radius of Mid Manair reservoir indicated that Boinpally mandal (52%), Yellareddypet (70%); and Karimnagar (88%) come under the SAFE category. And mandals like Akkannapet (64%), Bejjanki (58%) and Husnabad (62%), Nanganur (54%) of Siddipet district, Boinpalle (69%) and Vemulawada (69%) of Rajanna

Sircilla, Huzurabad (49%), Kothapalle (60%) and Manakondur (33%), Shankarapatnam (34%), Thimmapur (57%) of Karimnagar district and Khazipet (44%), Dharmasagar (67%) of Warangal Urban district with in 10km radius from Gouravelly reservoir and in the command area of the project are all in SAFE category where conjunctive use of surface and ground water is suggested for irrigation.

Therefore, it is suggested that conjunctive use of the groundwater may be encouraged in the SAFE mandals of command area. While making irrigation planning in the present project, it has been kept in mind that cropping pattern and water allowance is such that there is no excessive groundwater recharging with the introduction of irrigation.

11.5.3.3 Water logging

Water Logging and soil salinity development can occur due to heavy losses of water due to seepage from canal, distributaries and water courses.

- Inadequate drainage and poor maintenance of existing drainage system and outlets - inadequate farm water management - lack of conjunctive use of surface and ground waters can result in poor application efficiencies.
- Water quality may be affected by aquatic weeds and biomass decay, turbidity and pollution from agricultural, industrial and human waste.

Efficient use of water for Rabi season crops:

Paddy is the most important crop occupying the maximum area both in Kharif and Rabi seasons. Paddy cultivation in Rabi season as irrigated crop is a wasteful practice where irrigation water can be more economically and effectively used for cultivation of more remunerative crops than paddy.

11.5.3.4 Impact on fish fauna

Fishing is not a major source of livelihood in the study area in the absence of large water impoundments at present. With the commissioning of this project, fishing will be greatly promoted because of creation of Gouravelly reservoir in the project. The commercially important varieties of fish like Katla, Rohu, etc will be suitable for pisciculture in local ponds.

11.5.4 Impacts on Socio –economic environment

The most significant beneficial impact due to the project will be more employment generation, promotion of agro-based industry and subsequent development of the area. The increase in crop yield provided in the project benefits chapter will add to food security and fodder availability for the cattle in the area. Skilled and semiskilled categories workers will have job opportunities which will uplift the present status of the people. Because of operation and maintenance of heavy earth moving equipments and transportation vehicles etc. potential for temporary employment of skilled categories of workers such as mechanics, turners, fitters helpers in the workshops will increase besides improvement of business activities. This there will be a positive impact of the project.

The addition of migrant population in the project area will lead to enhanced demand for local produce which will generate additional avenues of income generation for local population. Not only the local produce will find market, but it could also lead to employment generation in these marginal activities needed for the migrant population. The locals would also be beneficiaries of all the infrastructural facilities like schools, roads, hospitals, etc. provided by the project authorities.

The major purpose of irrigated agriculture is to increase agricultural production and consequently improve the economic and social well-being of the people in the command area of the project. The proposed IFFC project from Sri Ramasagar Project with expansion of Gouravelly reservoir Project will thus achieve the objective of improving the social and economic structure of the project area.



11.5.4.1 CSR activities

I&CAD has invested the amount Rs.2696.8 lakhs as CSR activities for road repairs and Rs. 1.593 lakhs for sanitation facilities. At the time of COVID 65,753 no. of vaccinations administered in the project area and, 2,43,986 of COVID kits.

Health camps were conducted at Akkannapet Mandal and Husnabad Mandal as part of CSR activities.

An amount of Rs. 64,97,400/- LED bulbs, solar streetlights were provided in Akkannapet Mandal and Husnabad Mandal.

An amount Rs. 69,59,393/- was spent toward drilling of bore wells for drinking water supply in Project Area, provided safety shoes, caps, drinking water bottles, torch lights for safety at nights, sweaters, helmets to the labor and shelter with required amenities etc. are provided by agency.

Potential seismic impact due to barrage loading

As per Bureau of Indian standards [IS-1893- part -1: 2002], the study area falls under seismic zone II and III. However, there is no record of earthquake reported in the region. The designs of the barrages and other structures are suitably made considering seismic effects as per code of practice.

11.5.5 Solid and Hazardous Waste

- During the construction phase, the oil/lubricants used for DG sets and other equipments will be collected in leak proof drums / barrels. The same shall be sent for reuse or disposed as per the norms of TSPCB - Hazardous Waste Management Rules, 2016).
- Construction and demolition waste will be handled as per construction demolition rules 2016.
- Rubble emanated from the construction of barrages - online storages and tunnels etc. proposed to be utilized for filling of low lying areas and also as revetment, riprap and filters of the earthen dam, if found suitable and also for green belt development.
- The generated muck would be partly used for concreting and the remaining will be disposed off in designated muck disposal areas.
- Sewage sludge or other sludge from waste water treatment plant may be used as manure

11.6 Analysis of Alternatives

The IFFC water will be stored in two reservoirs viz., Mid Manair Reservoir and Gouravelly Reservoir. As a part of this project under Re-engineering of IFFC from SRSP project, the storage capacity of Gouravelly reservoir is increased from 1.410 TMC to 8.23 TMC. The project is formulated and designed after careful planning and realistic approach. The proposed Gouravelly reservoir for 1.410 TMC capacity is bestowed with advantages such as

- (i) Geographical advantage of the site at which the reservoir was proposed,
- (ii) Minimal submergence of lands for the increased storage capacity and
- (iii) Minimum number of families' displacement which favoured the consideration of enhanced storage capacity for Gouravelly Reservoir.

Three alternative sites were identified Combined Storage Reservoir-I of 7.346 TMC, Mid Manair Reservoir of 25.873 TMC and Gouravelly reservoir of 8.23 TMC.



The detailed investigations such as Geographical, Topographical, Archeological, Hydrological, Meteorological, Geotechnical studies were carried in the same site at the time of initial approval. Even though the capacity of the Gouravelly reservoir is increased to 8.230 TMC, there is no change in the water utilization & the contemplated ayacut under the FFC project from SRSP as a whole. Moreover, there is no forest land involved in the submergence due to the increased capacity of the Gouravelly reservoir project and there are no notified ecologically sensitive areas, wildlife ecosystems falling in the submergence earlier i.e, for 1.410 TMC capacity reservoir or now i.e., for the enhanced 8.23 TMC capacity.

Considering all the parameters, Gouravelly reservoir is enhanced from 1.410 TMC to 8.23 TMC capacity.

11.7 Environmental Monitoring Programme

Monitoring of the following aspects is important to keep a constant check on the environmental performance of the project and also the environmental quality of the area.

- Ambient Air Quality (construction phase)
- DG set monitoring (construction phase)
- Water Quality (construction phase and operational phase)
- Noise Level (construction phase)
- Plantation Condition (Operation phase)
- Soil analysis

At the government level, the I & CAD will set up a cell for Environment and Safety. This cell will have the following key functions.

- Setting up appropriate institutional arrangements at the project site to oversee implementation of social and environment mitigation action plans.
- Appointing an independent Monitoring and Evaluation agency
- Regular compliance of stipulated conditions by the regulatory agencies and reporting of the same as per the specified period
- Undertake mid term corrective actions, if required.

11.8 Project benefits

Direct Benefits

- Increase Crop productivity - The development of proposed project would allow intensive farming of 89031 ha of area. Irrigation will also allow full use of the land which is not cultivated under current farming practices. The incremental production of crops from the developed land would be the benefit to the society. In addition, extra production will contribute to local food grains supplies and reduce regional and national food grains deficits.
- Increase employment - The implementation of Irrigation scheme will create employment opportunities in the project area.
- Increase ground water recharge -The recharging of minor irrigation sources, filling of desilted tanks under Mission Kakatiya, filling up of the reservoirs under the project and flow of water through the canals would recharge the ground water and raise the ground water level
- Increase fish production -Reservoir will provide an excellent opportunity for development of fisheries which ultimately leads to financial up-liftment of people of command area. The filling of water bodies will give boost to Pisciculture and improve the economy of the fishing community
- Drinking water facility - In addition to giving water to command area (part of 7 districts) under the project it will also supply drinking water to the villages.

Indirect Benefits

- Poverty Eradication/Food security - Improved crop production through the commissioning of the proposed irrigation scheme will increase farm income in the project area. Food supply will increase and there will be cash income available for food or other purchases.
- Transfer of technology - Project Districts Agricultural Departments will be in a sound position to introduce modern agricultural technology and farming practices to retain the fertility status of the soil with the installation of the irrigation scheme. This may also serve as a demonstration to other farmers in the region.-
- Health & Nutrition - Increased cash income resulting from increased crop production and employment opportunities would result in higher per capita consumption of a greater variety of food items. This in turn will improve the nutrition levels of the people in the project area.
- Environmental facilities -The irrigation scheme will improve the overall environmental and ecological situations in the project area which in turn will reduce the health hazard.
- Tourist place - All the reservoirs constructed will provide excellent picnic spots resulting in the development of tourism.
- The filling of water bodies, availability of fishing facilities and improvement in forest vegetation combined will give boost to tourism, opening another source of employment to the youth and improvement in rural economy.
- Apart from this there would be improvement in flora and fauna and successful implementation of the government programme of Hartitha Haaram due to availability of water to the young plants. With this air and environmental quality will improve.
- With the above advantages the livelihood of the people will improve. The children will be able to go to school. With better water and food, the health of the people will improve. There will be economical and social transformation in the villages fulfilling the government objective of forming the State of Telangana.

11.9 Environmental Management Plan

The Environmental Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmental sustainable manner where all contractors and subcontractors, including consultants, understand the potential environmental risks arising from the proposed project and take appropriate actions to properly manage that risk. EMP also ensures that the project implementation is carried out in accordance with the design by taking appropriate imitative actions to reduce adverse environmental impacts during its life cycle. The plan outlines cost required for implementation of various management measures with estimated cost as a part of the study. The EMP includes following:

11.9.1 Catchment area treatment plan

The Catchment Area Treatment (CAT) plan highlights the management techniques to control erosion in the catchment area. The total catchment area of the project for the proposed Gouravelly reservoir is 505.83 ha. The directly draining catchment comprises of 3 sub-watersheds around the proposed project area. Sediment yield index calculations area used to for prioritization with very high and high erosion intensity. For minimizing the erosivity Mechanical Treatment measures like contour bunding, rock fill dams, brushwood check dam and gully plugging are identified and for biological measures like plantation and social forestry are suggested. The total cost for CAT plan is **Rs. 16.72 Crores**.



11.9.2 Command Area Treatment Plan:

Command area treatment is aimed at development of an effective irrigation system which will ensure controlled and uniform application of water to crop lands in time with minimum cost to produce optimum yields without waste of water and without any adverse effect on soil in the form of soil salinity and waterlogging problems. On farm water management measures are suggested. Command Area Development plan is estimated to Rs.17,494/- per hectare.

11.9.3 Biodiversity and wildlife conservation & management plan

The need for conservation and management of biodiversity arises because of threats to natural terrestrial and aquatic ecosystems by anthropogenic activities. This includes measures to improve avi-fauna and anti-poaching. The total is estimated as **Rs. 0.76 crores**

11.9.4 Resettlement and Rehabilitation Plan

The I&CAD department has estimated about Rs.284.64 crores as compensation to the project effected families of the partially and fully submerged villages in the submergence area of Mid Manair reservoir. Accordingly the Government of Telangana has released the compensation amount as per the prevailing R&R act.

The Siddipet district administration has estimated an amount of Rs.147.55 crores as compensation to the project effected families in the submergence area of Gouravelly reservoir for the expansion area. Accordingly the Government of Telangana has released the compensation amount as per the RFCTLARR Act of 2013 of GoI and TSRFCTLARR Rules 2016. Govt. of Telangana has fulfilled its commitment to the PAFs to provide the best possible deal so that all would be benefited and none would be a loser.

11.9.5 Green belt development plan:

Green belt development plays a crucial role in river valley projects. The main objective of having greenbelt development is to mitigate dust pollution, fugitive emissions, to control noise pollution and to improve landscape and local ecosystem and also to arrest soil erosion. The green belt at barrage and at reservoir periphery is to reduce the sedimentation, control soil erosion, dust and siltation and to ensure protection of the reservoir area from any other human activity that could result in the reservoir catchment damage. Due to irrigation projects, the canals are dug up and the excavated earth is heaped on both the sides, these banks are poor in their fertility. They need to be protected from erosion. Tree growth protects the bank and also prevents evaporation of the water in the canal. Canal bank plantation also serves as shelter belts to many fields adjoining the canals.

The cost is worked out by adopting present F.S.R. OF 2023-24, Government of Telangana, Forest Department. It is proposed to afforest about 13 km of land at periphery of the Reservoir, 225 km of land for canal bank plantations on either side as a part of Greenbelt Development Plan. The total cost works out to **Rs. 2.13 Crores.**

11.9.6 Fisheries conservation and Management plan

A water resources project may have adverse or beneficial effects on the fish fauna, depending upon the particular situation and the fish fauna inhabiting the concerned river. The management of reservoirs is based on the stocking-cum capture fishery technique. Based on the Department of Fisheries, Government of Telangana the cost estimate for fisheries management in seven districts of IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir project is prepared. After the completion of the project with water spread area of 1214 ha approx. the estimated production of fish is 455.2 tonnes per annum. The total cost for fish management is **Rs.24.78 Crores.**

11.9.7 Reservoir Rim Treatment plan:

The construction of the reservoir at dam at gouravelly reservoir will result in ponding of water.

Green belt around the reservoir is suggested to check soil erosion around the reservoir, check landslips or slips around the reservoir, develop the habitat particularly for birds and butterflies. Planting of trees, shrubs and other plant species would definitely improve the environment of the area besides checking the soil erosion. Total budget for Mid Manair reservoir rim treatment would be Rs.3,28,21,670/- and Gouravelly reservoir rim treatment plan would be Rs. 55,71,870/- (**Rs.3.84 Crores**)

11.9.8 Muck Management & Restoration of Quarry Sites

The muck generated from at the project will be around 1480 lakhs m³. The quantity of muck generated needs proper disposal, so that the disposed muck would not cause any ecological damage in the dumping area. All along the canal and at the entry and exist points of the tunnel, the muck disposal areas are being identified in the name of spoil banks parallel on either side of canal. The cost estimated is around **Rs.8.07 Crores** is estimated.

11.9.9 Water, Air and Noise Management Plan

Air and water are two major environmental factors that are directly affected by any kind of construction activity. The major air pollutants, which could be generally, released during various construction activities of hydroelectric projects and vehicular movements are SPM, SO_x and NO_x. The cost for implementation for management is **Rs.0.72 Crores**.

11.9.10 Ground water management

The ground water management strategy should be such that there is optimal utilisation of ground water resource and it should also take into consideration the well spacing norms. Ground water conservation and artificial recharge works have to be taken up on a large scale as a part of watersheds, RIDF and other programmes by District Watershed Management Agency under IWDP. Government of Telangana has enacted a law on PIM. WUAs are already functioning for utilisation of water from various tanks in the command and hence the local community is already aware of the modern practices and same can be implemented in the IFFC project from Sri Ramsagar Project with expansion of Gouravelly reservoir command also.

11.9.11 Agricultural improvement plan

It is proposed to make most effective use of water form SRSP for irrigation of standing crops and also to store excess water for future use in tanks in the command area to improve the economy of Agri-based system of drought prone areas of part of Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon districts of Telangana.

The potential of a crop depends on its inherent genotype, agro-climate, soil conditions, socio-economic acceptability, input availability, market support, processing of produce and value addition possibilities.

For maintaining sustainability of crop rotations, it essential that principles of scientific crop rotations be followed. One of the main criteria for scientific crop rotations is inclusion of leguminous crop, in crop rotations with cereals and other leguminous crops like groundnut, soybean and sun hemp may be included to maintain soil fertility.

11.9.12 Public Health Delivery Plan

As a part of public health delivery plan the following facilities are proposed to project workers, project affected families and local people, especially during construction phase in particular and after commissioning of the project are as below

- Development of medical facilities - distribution of medicines
- Periodical health check up camps - vaccination camps
- Control of water-borne diseases
- Health awareness programmes especially on women and child health
- Adequate medical facilities to the labour i.e., medical aid post and provide ambulance service
- Adequate first aid boxes installed at all construction sites.
- Bio medical waste disposal

The total budget earmarked for Public Health delivery system shall be **Rs. 2.13 crores**.

11.9.13 Sanitation and Solid waste Management Plan

The labour colonies will generate substantial amount of municipal waste. In view of the conditions that normally in the labour exist camps of such projects, the solid waste is likely to contain mainly vegetable matters followed by paper cans and glasses. About 700 persons likely to congregate during the construction phase at various construction sites resulting in generation of about 350 kg of solid waste/day. Adequate facilities for collection and conveyance of municipal waste generated to the disposal site shall be developed. At each labour camp, covered trailers to collect the solid waste from the common collection point and transfer it to the disposal site need to be put to service.

The total expenditure required for implementation of various environmental measures in labour camps shall be **Rs. 2.96 Crores**.

11.9.14 Local Area Development Plan

In addition to the R & R benefits for the Project Affected Families, project developer would aim at the improvement in the living standards of inhabitants in the project area by being a catalyst for development but also will develop infrastructure in the area. The infrastructure development will be other than rightful compensation to the project affected families. The following activities were considered based on the requirement in the surrounding villages of the project area such as skill development programme, sports and recreational facilities, assistance to Self help groups, assistance to co-operative irrigation facilities and upgradation of irrigation facilities.

An amount of **Rs. 7.23 Crores** is being made for implementation of the Local area development plan activities.

11.9.15 Environmental Safe guards

The project construction phase would entail significant vehicular movement for transportation of large construction material, heavy construction equipment. Some of the existing roads in the project area, would require widening. There should be a proper planning and management plan during construction and operational phase. During construction, it has been envisaged to set up fully fledged Environment Health & Safety (EHS) department reporting directly to Head of Project. This department shall also take care of the adequacy of Fire Safety measures set up in all facilities created either owned by I&CAD of Govt of Telangana or any of its Contractors. EHS Department is responsible for providing required training. Budget Implementation of this plan will be mandatory for all contractors. Requirements of this plan will be part of contract agreement.

11.9.16 Energy Conservation Plan

Various construction and other activities of the proposed project would lead to increased demand in fuel wood in the project area and its vicinity and would therefore exert pressure on forest areas located around the project. One of the source of energy in the villages of the project area is fuel wood, acquirement of which is one of the main causes of ecological



degradation and human drudgery. It is estimated that during construction of the project, which would last for about 3 years, around 700 labourers should be working.

To provide an alternate for the energy requirement of the workers, contractor/s should be made responsible to provide subsidized kerosene/LPG to their workers which should in turn discourage them from illegal tree felling and removal of fuel wood and timber from the adjoining forests. Further, community kitchen facilities would also be provided to the labourers by the contractors. In addition to above, efforts would be made towards energy conservation by installing non-conventional energy sources. An amount of **Rs. 0.76 Crores** is estimated for Energy Conservation Plan

Total Cost for the Environmental Management Plan is Rs. 502.29 crores.

11.10 Environmental Damage, Remediation Plan and Natural & Community Resource Augmentation plan

The cost for environmental compensation - Remediation Plan & Natural & Community Resource Augmentation is calculated as i.e., Rs. 2,05,31,250/- (Rounded to Rs.2.06 Crores).

The environmental compensation (RP&NCRAP) and Violation cost for Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir is Rs.7.4614 Crores (i.e.Rs.2.06 Crores for environmental compensation + Rs.5.4014 Crores for Violation cost) .

11.11 Conclusion

From the detailed analysis of the environmental impacts and the remedial measures suggested / recommended, it can be concluded that no significant deterioration in the ecosystem is likely to occur due to measures to be taken up during construction and operation of the proposed Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir project. On the other hand the project is likely to have several benefits like Improvement in Agriculture Production and employment generation, groundwater recharge etc., The benefit accrued from the project the benefit cost analysis comes to 1.87 for Gouravelly Reservoir and the cost benefit analysis for total project i.e. proposed Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir project is 1.328. Hence the project is economically viable in addition to the intangible improvement in the general environment. The project will also help to boost the economic growth of the area, by way of improved infrastructure and better socio- economic conditions.



12

DISCLOSURE OF CONSULTANT ENGAGED

12.1 Environment Protection Training & Research Institute (EPTRI)

Environment Protection Training and Research Institute [EPTRI] a premier agency in India, provides training, consultancy, applied research services and extends advocacy in the area of environment protection to industries, regulatory bodies, Government Organizations and NGOs and works towards bringing about change for a more balanced development. It is involved in various activities covering environmental issues such as protected areas and biodiversity, urban agglomeration, environmental awareness, Human Resource Development, Capacity Building and Research.

12.2 EPTRI Is Recognized by The Respective Authorities

- **Environmental Impact Assessment (EIA) Consultant Organization** since 2008 according to the National Accreditation Board for Education and Training (NABET), Quality Council of India (QCI).
- Empanelled **Training Institute of Government of India** for imparting training under the **Technical Cooperation Scheme of the Colombo Plan**.
- **Centre for Climate Change** and Nodal Agency for **Clean Development Mechanism**.
- **Technical Consultant** of Municipal Solid Waste Management.
- **'Empanelled agency'** to provide technical support to States / ULBs to carryout investigation, design and thereafter to prepare the DPRs to help structure and manage schemes/ programmes in the field of municipal solid waste management.
- **National Host Institute** for preparation of **State of Environment Reports**.
- Centre of Excellence in **Spatial Environmental Planning**.
- **Environmental Information System (ENVIS)** Centres for Ecology of Eastern Ghats and State of Environment Report & related issues.
- **Key Resource Centre** for Rural Water and Sanitation.
- Member in the 'Awareness and Capacity Building Committee of Telangana State Bio-diversity Board'

12.3 Consultancy Services

- Facilitating Environmental Clearances from MOEF&CC, New Delhi
- Obtaining Consent for Establishment and consent for Operation from state pollution Control Boards Preparing of Environmental Impact Assessment Reports.
- Environmental Audits to help industries to recycle and reuse resources and plan for low polluting technologies.
- Risk Assessment Studies for hazardous chemical storage & Process in order to devise viable onsite and offsite emergency plans.
- Environmental management strategies to mitigate adverse impacts arising out of developmental activities.
- Effluent treatment plant design after thorough review of process, reaction mass balance and treatability studies of effluents
- Post project monitoring network design
- Consultancy Services for setting up environmental laboratories.



- Design of Sewage treatment plants
- Design of Waste treatment plants
- Health and socio- economic surveys
- Resettlement and rehabilitation plans
- Systems development for ISO:9000, OSHAS 18000, NABL, ISO 17025 Standards

12.4 NABET Accredited EIA Consultant Organization

EPTRI has registration as EIA Consultant Organisation with the National Accreditation Board for Education and Training (NABET) under Quality Council of India (QCI). NABET certificate is enclosed. The scope of EIA consultancy under NABET registration covers below mentioned sectors.

1. Mining of minerals including Open cast/ Underground mining
2. River Valley, Hydel, Drainage and Irrigation projects
3. Industrial estates/ parks/ complexes/ Areas, export processing zones (EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes
4. Common Municipal Solid Waste Management Facility (CMSWMF)
5. Building and construction projects
6. Townships and Area Development projects
7. Thermal Power Plants
8. Coal washeries
9. Ports, harbours, jetties, marine terminals, break water and dredging

Apart from this EPTRI has carried out various projects in some of the following areas:

- Design, commissioning and stabilisation of Effluent Treatment Plants (ETPs), Common Effluent Treatment Plants (CETPs) and Sewage Treatment Plants (STPs).
- Upgradation and performance evaluation studies of existing ETPs, CETPs, STPs.
- In-plant studies for water conservation and reduction of pollution load.
- Design and evaluation of air pollution control equipment.
- Providing overall environmental management for townships in terms of water supply, sewerage, STPs and solid waste management.
- Developing standards for categorising wastes and techniques for their means of disposal.
- Integrated Environment Audit and Risk Assessment studies for Petroleum Sites which includes – Storage Depots, Seaports, Filling Stations etc. EPTRI has undertaken a similar project in Madagascar (World Bank sponsored Project) covering about 250 petroleum sites spread across the country.
- Integrated EIA Studies along with Risk Assessment & Analysis, HAZOP studies etc., particularly for units handling Petroleum Products.

12.5 Recognitions And Accreditations of EPTRI Laboratory

- **NABL** (National Accreditation Board for Testing and Calibration Laboratories) in the fields of **Chemical and Biotechnology**.
- **Scientific and Industrial Organisation (SIRO)** – recognised by Department of Scientific Research, Government of India.
- **Environmental Laboratory** under the Environment Protection Act, 1986.
- **State Laboratory** under the Water (Prevention & Control of Pollution) Act, of 1974.
- EPTRI is certified **ISO 14001: 2015** valid upto September 2024 (Certificate No.E9186414039).
- EPTRI is certified **ISO 9001: 2015** valid upto September 2024 (Certificate No. Q91864141051).



- EPTRI is certified **ISO 45001: 2018** valid upto September 2024 (Certificate No. OHSAS9186414028).

12.5.1 Laboratory services

- Analysis of air samples for ambient air quality and those collected from industrial sources for both routine and industry specific pollutants.
- Water and wastewater analysis for all parameters as for standard methods, including pesticides and poly hydrocarbons.
- Solid and hazardous waste analysis including TCLP tests.
- Monitoring of noise levels at source and in ambient air
- Development of new methods and quality assurances of results obtained.
- Design and settings of laboratories

12.5.2 Instruments

- Inductively Coupled Plasma Optical Emission Spectrophotometer (ICPOES)
- GC-MS/MS
- Continuous Flow Analyzer
- Flame Photo Meter
- HPLC / IC for Ion selective electrodes.
- FT-IR
- Particle size analyser
- Total Organic Carbon Analyser
- X-ray fluorescence.
- UV-VIS spectrophotometers
- Graphite Furnace Atomic Absorption Spectrophotometer (GFAAS).
- Flame Atomic Absorption Spectrophotometer (FAAS).
- Continuous stack and ambient air analysers
- Automatic weather stations
- Mercury analyser
- Flash Point Apparatus
- TCLP Extractor
- Microbial Analysis

12.6 Experts Involved in Preparation EIA / EMP

The following approved experts of EPTRI by QCI/NABET have involved in preparation of EIA & EMP Report for Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir.

Sl. No.	Functional Area	Name of Expert
1.	EIA Coordinator	Dr.G.V.A. Rama Krishna (A - Category)
		Shaheda Begum (A - Category)
		V.Bhavani Team Member
2.	Air Pollution	Shaheda Begum (A - Category)
		V.Bhavani (B - Category)
		Rahul Jarupula Team Member
3.	Air Quality Modeling	Shaheda Begum (A - Category)
		V.Bhavani (B - Category)



Sl. No.	Functional Area	Name of Expert
4.	Water Pollution	V.Bhavani (A - Category)
		J.Rahul (B - Category)
5.	Ecology & Biodiversity	Dr.K.Jyothi (A - Category)
6.	Noise & Vibration	B.Bhaskara Rao (A - Category)
		V.Gopi Krishna (Team member)
7.	Socio Economics	Ch Venkatesham (A - Category)
		K.Sanjay Kumar (Team Member)
8.	Hydrology & Ground Water	G.Ramesh (A - Category)
9.	Geology	Dr.GVA Ramakrishna (A - Category)
10.	Soil Conservation	V.Bhavani (B - Category)
		Dr.J.Swaraj (Team Member)
11.	Hazardous Waste Mngt	Shaik Allavalli (B - Category)
12.	Risk Assessment & Hazards Management	Aprup Anant Adawadkar (A - Category)
		K.Sree Harsha (Team Member)
13.	Solid Waste	Shaheda Begum, (A - Category)
		Shaik Allavalli (B - Category)
		Rahul Jarupula (Team Member)
14.	Land Use	Dr.J.Swaraj (A - Category)
		G.Ramesh (Team Member)



12.7 NABET Accreditation Certificate


**QUALITY COUNCIL
OF INDIA**
Creating an Ecosystem for Quality



**National Accreditation Board
for Education and Training**



Certificate of Accreditation

**Environment Protection Training and Research Institute
(EPTRI)**
 91/4, Gachibowli, Hyderabad – 500032

The organization is accredited as Category-A under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including opencast/ underground mining	1	1 (a) (i)	A
2	River Valley Projects	3	1 (c)	A
3	Thermal power plants	4	1 (d)	B
4	Coal washeries	6	2 (a)	A
5	Industrial estates/ parks/ complexes/areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	31	7 (c)	A
6	Ports, harbours, jetties, marine terminals, break waters and dredging	33	7 (e)	A
7	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	B
8	Building and construction projects	38	8 (a)	B
9	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SAAC minutes dated Oct 4, 2022 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACQ/22/2372 dated October Nov 1, 2022. The accreditation needs to be renewed before the expiry date by Environment Protection Training and Research Institute, following due process of assessment.


Sr. Director, NABET
 Dated: November 1, 2022

Certificate No.
 NABET/EIA/2224/SA 0175

Valid up to
Jan 21, 2024

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.



12.8 Extension letter - NABET Accreditation



National Accreditation Board for Education and Training



QCI/NABET/ENV/ACO/24/3206

April 24, 2024

To

Environment Protection & Training Research Institute (EPTRI)
Sy. No. 91/4, Gachibowli, Hyderabad - 500032

Sub.: Extension of Validity of Accreditation till July 23, 2024-- regarding
Ref.. 1. Certificate no NABET/EIA/1922/RA 0197
2. Request e-mail dated April 24, 2024

Dear Sir/Madam

This has reference to the accreditation of your organization under the QCI-NABET EIA Scheme, the validity of Environment Protection & Training Research Institute (EPTRI) is hereby extended to July 23, 2024, or completion of the assessment process, whichever is earlier.

The above extension is subject to the submitted documents/required information with respect to your application and timely submission and closure of NC/Obs during the process of assessment.

You are requested not to use this letter after the expiry of the above-stated date.

With best regards.

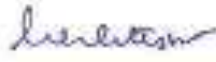
(A K Jha)
Sr. Director, NABET

NABET

Institute of Town Planners India, 6th Floor, 4-A, Ring Road, I.P Estate, New Delhi-110 002, India
Tel. : +91-11-233 23 416, 417, 418, 419, 420, 421, 423 E-mail : ceo.nabet@qcin.org Website : www.qcin.org



12.8 NABL Accreditation Certificate

 		National Accreditation Board for Testing and Calibration Laboratories	
CERTIFICATE OF ACCREDITATION			
ENVIRONMENT PROTECTION TRAINING & RESEARCH INSTITUTE (EPTRI)			
has been assessed and accredited in accordance with the standard ISO/IEC 17025:2017			
"General Requirements for the Competence of Testing & Calibration Laboratories"			
for its facilities at 91/4, GACHIBOWLI, HYDERABAD, RANGA REDDY, TELANGANA, INDIA			
in the field of TESTING			
Certificate Number:	TC-7709	Valid Until:	24/08/2025
Issue Date:	25/08/2023		
This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL. (To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)			
Name of Legal Entity: ENVIRONMENT PROTECTION TRAINING & RESEARCH INSTITUTE (EPTRI)			
Signed for and on behalf of NABL			
		 N. Venkateswarann Chief Executive Officer	



12.9 CPCB RECOGNITION FOR LAB



केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE GOVT. OF INDIA
Dated: 01.12.2021

F. No. LB/99/7/2021-INST LAB-HO-CPCB-HO/ Gvt-144 19265

Speed Post

To,

The Director General
Environment Protection Training and Research Institute (EPTRI)
Gachibaowli, Hyderabad, Survey Number 91/4,
Andhra Pradesh-500032.

Subject: Recognition of M/s Environment Protection Training and Research Institute (EPTRI), Hyderabad, Andhra Pradesh as Environmental laboratory under the Environmental (Protection) Act, 1986-reg.

Sir,

I am directed to refer to your application, Dated 20.01.2021 for the recognition of your laboratory Environmental (Protection) Act, 1986. Based on the recommendations of the expert committee for recognition of Environmental laboratories in its 65th meeting held on 07.04.2021 and your acceptance of the revised terms and conditions at Annexure-III & IV of the guidelines for recognition of environmental laboratories, CPCB approves the renewal of recognition of M/s Environment Protection Training and Research Institute (EPTRI), Hyderabad, Andhra Pradesh, shall be notified in the Gazette of India. Considering the current validity of mandatory accreditation/certifications of the laboratory, this recognition shall be valid up to 09.05.2026.

2. As sought in your aforementioned application M/s Environment Protection Training and Research Institute (EPTRI) Andhra Pradesh may undertake the following tests:

- Physical Tests**-Conductivity, Colour, pH, fixed & volatile solids, Total Solids, Total Dissolved solids, Total Suspended Solids, Turbidity, temperature, Velocity & Discharge measurement of industrial effluent stream, Odour, Salinity, Settleable solids and Sludge Volume Index (SVI).
- Inorganic (General and non-metallic)**: Acidity, Alkalinity, Ammoniacal Nitrogen, Chloride, Chlorine residual, Dissolved Oxygen, Fluoride, Total hardness, Total Kjeldahl Nitrogen (TKN), Nitrite Nitrogen, Nitrate Nitrogen, Phosphate, Sulphate, Silica, Cyanide and Sulphide.
- Inorganic (Trace metals)**: Boron, Cadmium, Calcium, Chromium Total, Chromium Hexavalent, Copper, Iron, Lead, Magnesium, Mercury, Nickel, Potassium, Sodium, Sodium Absorption Ratio, Zinc, Arsenic, Aluminium, Beryllium, Barium, Lithium, Manganese, Selenium, Silver, Strontium, Tin, Antimony, Cobalt and Vanadium.
- Organics (General) and trace organics**: Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil and grease, Phenol, Pesticide (each) (Organo-chlorine and Organo nitrogen-phosphorus), Total organic carbon (TOC), Surfactants, Poly chlorinated biphenyl (PCBs) each, Polynuclear aromatic hydrocarbons (PAHs) each, Organic Carbon (in solid) and Carbon/Nitrogen ratio.
- Microbiological test**: Total Coliform, Faecal Coliform, Faecal Streptococci, E. coli, and Total Plate Count.
- Toxicological Tests**: Bioassay method for evaluation of toxicity using fish, Measurement of toxicity using Daphnia or other organism and measurement of toxicity factor using zebra fish (dimensionless toxicity test).
- Biological Tests**: Benthic organism identification and count, Planktonic identification count, measurement of various diversity index, Saprobity index and Chlorophyll.

Contd.

'परिवेश भवन' पूर्वी अर्जुन नगर, दिल्ली-110032
Parivesh Bhawan, East Arjun Nagar, Delhi-110032
दूरभाष/Tel : 43102030, 22305792, वेबसाइट/Website : www.cpcb.nic.in



- viii. **Characterization of Hazardous waste:** Preparation of leachate (TCLP/Water extract), Corrosivity, Reactivity, Toxicity and measurement of heavy metals/ pesticides in the waste and leachate.
 - ix. **Soil/sludge/Sediment and solid waste:** Boron, Cation Exchange Capacity (CEC), Electrical Conductivity, Nitrogen (available), organic Carbon/matter (Chemical method), pH, Phosphate (available), Phosphate (ortho), Phosphate (total), Potassium, SAR in soil extract, Sodium, Soil moisture, TKN, Ammonia, bicarbonate, calcium, calcium carbonate, Chloride, Colour, Exchangeable Sodium Percentage (ESP), Heavy metals, Magnesium, Nitrate, Nitrite, PAH, Pesticide, Potash (Available), Sulphates, Sulphur, TOC and Total water soluble salt.
 - x. **Ambient Air/ fugitive emissions:** Nitrogen Dioxide (NO₂), Sulphur Dioxide (SO₂), Total Suspended Particulate Matter, Respirable Suspended Particulate Matter PM₁₀, Ammonia, Chlorine, Lead, Ozone, Benzene Toluene Xylene (BTX), Polycyclic aromatic hydrocarbon (PAH) Benzo-a-pyrene and others and PM_{2.5}.
 - xi. **Stack gases/ source emission:** Particulate Matter, Sulphur Dioxide, Velocity & flow, Carbon dioxide, Carbon monoxide, Temperature, Oxygen, Oxides of Nitrogen, Ammonia, Fluoride (particulate), Fluoride (Gaseous), Hydrogen sulphide and Carbon disulphide.
 - xii. **Noise level:** Noise level measurement (20-140 dba) and Ambient noise and source specific Noise.
 - xiii. **Meteorological:** Ambient temperature, Wind direction, Wind speed, Relative Humidity, Solar radiation and Rainfall.
3. Further, the following analysts have been approved for recognition as government Analysts.
 - i. Sh. N. Raveendhar,
 - ii. Dr. J. Sesha Srinivas,
 - iii. Sh. U. Sateesh,
 - iv. Sh. Khaja Raisuddin,
 - v. Sh. K. Vamei Krishna
 4. The laboratory shall compulsorily participate in the Analytical Quality Exercise conducted by the Central Pollution Control Board (CPCB) to ascertain the capability of the laboratory and analysis carried out and shall submit quarterly progress report to CPCB.
 5. The periodic surveillance of the recognized environment laboratory will be undertaken by CPCB to assess its proper functioning systematic operation and reliability of data generated at the laboratory.
 6. It is also mandatory for the laboratory to have requisite accreditations of the **ISO: 17025 (NABL)** and **ISO:45001 (OH&SMS)** and its renewal as per accreditation rules. This recognition is subject to such accreditations and renewals as applicable. **The laboratory may approach CPCB for further extension of validity of recognition after renewal of the mandatory accreditations / certifications concerned.**
 7. The laboratory should compulsorily follow the accepted terms and conditions. In case of serious non-compliance of any of the terms and conditions, the laboratory may be black listed for a minimum period of two years and civil/criminal proceedings, as applicable, may be initiated for performing functions on behalf of the Government in an unauthorized manner.

Yours faithfully,

Namita Mishra
11/11/2024

(Namita Mishra)
Scientist-D & Divisional Head
Instrumentation laboratory

13

REMEDIATION PLAN & NATURAL & COMMUNITY RESOURCE AUGMENTATION PLAN (NCRAP)

13.1 Introduction

The Indiramma Flood Flow Canal Project (IFFC) envisages diversion of flood water from Sri Rama Sagar Project (SRSP) is conceived with an objective of irrigating 2,20,000 acres (89031 ha) of ayacut in the drought prone areas of erstwhile districts of Karimnagar, Warangal and Nalgonda (present districts Peddapalli, Rajanna Sircilla, Jagtial, Karimnagar, Siddipet, Hanumakonda and Jangaon) in Telangana region.

13.2 Brief Details of Violation

The excess flood occurs once in every four years as per the existing data. The storage facilities for storing such flood plays major role in harnessing and conserving flood water, hence it is evident that a maximum extent of such flood water can be harnessed provided with maximum storage facilities. The flood flow canal will be stored in two reservoirs viz., Mid Manair Reservoir and Gouravelly Reservoir as a part of this project under Re-engineering of IFFC from SRSP project, the storage capacity of Gouravelly reservoir is increased from 1.410 TMC to 8.23 TMC. The project is formulated and designed after careful planning and realistic approach.

The most important factor which makes the enhancement of Gouravelly reservoir capacity is, out of the total ayacut 2.20 Lakh acres of IFFC, more than half of the ayacut i.e., 1.20 Lakh acres is coming under Gouravelly reservoir. To supply water to the contemplated ayacut of 1.20 Lakh acres with the gross storage capacity of 1.410 TMC, it requires 12 fillings continuously through lift scheme, almost to a height of 123.90 m, in 120 days and if any technical defect arises in the lift system it will be toil some to serve water for drinking and irrigation purpose until the restoration of the lift system. Now, with the enhanced capacity of 8.23 TMC in the Gouravelly reservoir, water will be supplied continuously for drinking & irrigation purposes with only 3 fillings through lift scheme during the restoration of the lift system, if any technical defect arises.

As there is a scope to increase the reservoir capacity and owing to the prominent benefactors like geographical site advantage, minimal submergence of lands and less displacement of families, rise in ground water table, drinking water for the surrounding villages and livestock and to supplement to the deleted storage capacity, it may be substantiated to the purposefulness of the enhancement of Gouravelly reservoir capacity. The storage capacity was enhanced from 1.410 TMC to 8.23 TMC with a meagre difference in Land acquisition, Number of Villages in submergence, Houses and Families.

The Comparative statement regarding Land acquisition, number of families affected, number of villages submerged before and after the enhanced capacity of the Gouravelly reservoir is as follows:



S.No	Description	Requirement for 1.410TMC	Additional Requirement for 8.230 TMC	Total
1	Land acquisition (Ha)	769.25	797.5	1566.8
2	No. of Villages submerged	Fully – 04 Partially- 02	Partially- 04	Fully – 04 Partially-06
3	No. of Houses coming under submergence	693	124	817
4	No. of families effected	PDF – 937 PAF – 49	PDF – 185 PAF – 0	PDF – 1122 PAF – 49

As per the EIA notification, 2006 and its subsequent amendment dated 20th April 2022, the proposed project comes under River valley category - schedule 1(c). Irrigation projects involving Inter-State issues shall be appraised at Central level without change in category, irrespective of the command area. The proposed project has the total culturable command area of 2,20,000 acres (89030.84 ha) with no interstate boundary. So, the proposed project is considered at state level. The committee approved the ToR on 15th Feb 2023 under violation category.

13.3 Introduction to Damage Assessment

The Objective of Damage Assessment report is to comply with violation notification S.O. 804 (E), dated 14.03.2017 and prepare assessment report of Environmental Damage, Remediation Plan and Natural & Community Resource Augmentation plan. Thus, in this chapter data has been collected and analyzed for relevant environmental parameters. For identification of overall impact due to mining activity during operation, the air, water, noise, soil, land environment and other relevant data has been assessed.

13.3.1 Remediation Plan

The objectives of remediation plan are to identify mitigation and control measures and its cost.

13.3.2 Natural and Community Resource Augmentation Plan

Augmentation plan includes various activities which will be done for augmentation of Natural Resources like water, land, vegetative cover, etc. Activities considered for augmentation of community resources has been mentioned below:

- It may be physical structure or place –as a school, hospital, library or recreation center or others.
- It may be a community service that makes life better for majority of community members - public transportation, early childhood education center, community recycling facilities, cultural organization, etc. (or)
- It may be an activity that provides jobs and supports the local economy.

Impact Assessment Pathway is shown in Figure No.13.1

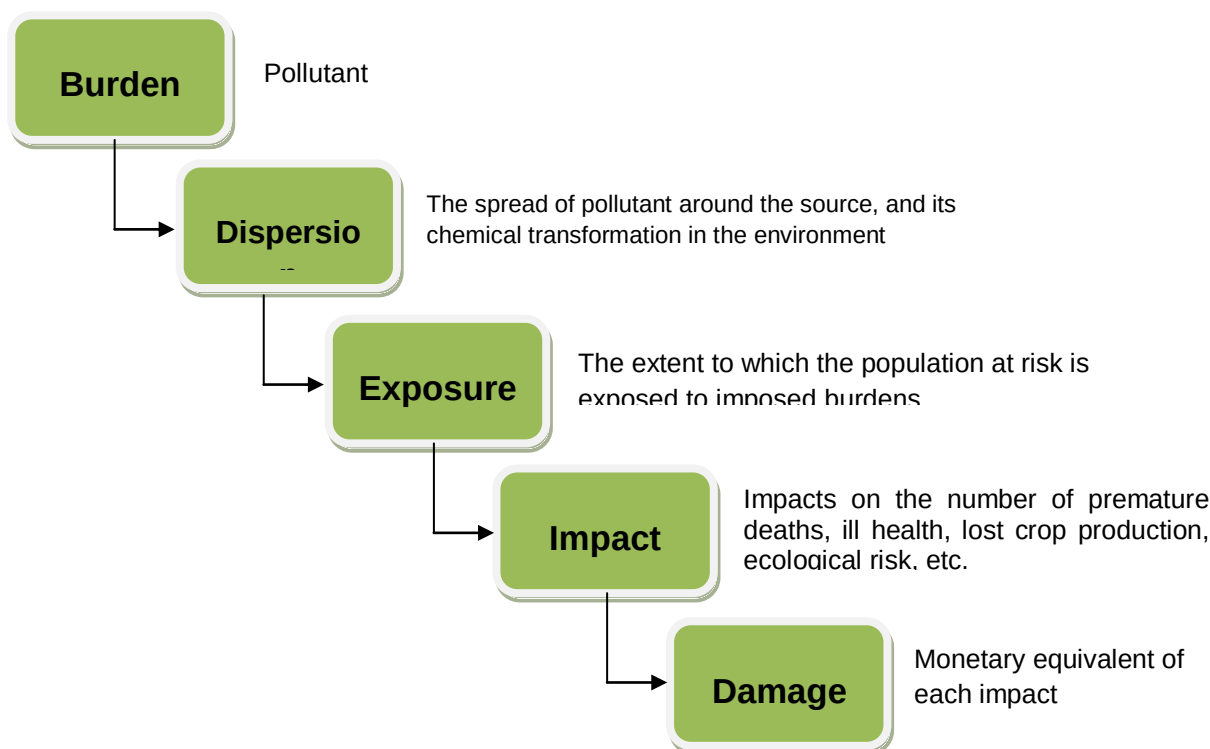


Fig 13.1 Impact Assessment Pathway

13.3.3 Economic Benefits

Irrigation & CAD Department of Telangana State is making every effort to harness and utilize all the available water resources for the benefit of Agricultural sector, Industrial Sector and also providing drinking water for overall development.

The main objective of Irrigation Department in Telangana is to create irrigation potential in the drought prone areas, upland areas and upkeep of the existing projects to enhance the agriculture productivity per unit of water with increased water use efficiency.

All the irrigation projects are classified based on the irrigated ayacut under the projects as below:

Sl.No	Project Classification	Ayacut	No. of Projects
1	Major Irrigation Projects	Above 25000 Acres (10,000 ha.)	28
2	Medium Irrigation Projects	Above 5000 Acres (2,000 ha.) & up to 25000 Acres (10,000 ha.)	39
3	Minor Irrigation Projects	Up to 5000 Acres (2,000 ha.)	46,531

In addition, the Department is also in charge of command area development works, Flood Control works in the State.

For the early completion of ongoing projects and to modernize the existing Irrigation Projects in the state, financial assistance is being taken from Rural Infrastructure Development Fund (RIDF) (NABARD), JICA (Japan International Co-operation Agency), GOI accelerated irrigation benefit programme (AIBP) and World bank assistance in addition to the Normal State plan.

Main Functions of the Department

1. Hydrological assessment of availability of water in the river basins including water allocation to the Irrigation and other purposes
2. Planning & design of Irrigation systems.
3. Construction of new projects to create irrigation potential for economic development of the state.
4. Stabilization of existing ayacut by rehabilitation of the age-old projects.
5. Modernization of age-old Major & Medium Irrigation projects.
6. Improve water management and water use efficiency by integrated and coordinated efforts by all line departments.
7. Preparation and implementation of operation and maintenance plans for existing Irrigation projects.
8. Flood management.
9. Restoration and maintenance of flood banks.
10. Irrigated area assessment and assessment of water royalty charges for industrial and other utilization.
11. Presentation of data & analysis on water availability, utilization of Interstate River basins, presenting the information to the respective tribunals.
12. Exploration of new project commands.

Considering above functions, it can be concluded that Irrigation & CAD Department is facilitator in addressing problems of drinking water and irrigation water supply to the state of Telangana without any profit.

13.3.4 Remediation Plan & Natural and Community Resource Augmentation Plan

Environmental compensation is a policy instrument for the protection of the environment which works on the Polluter Pay Principal. Environmental compensation has already been implemented in various countries, although limited in scope. Experiences from these implementations are mixed and tend to stress the importance of certain principles in order to achieve the overall objective of protection of the environment.

The Hon'ble National Green Tribunal through its various judgments has empowered the Central Pollution Control Board to lay down the methodology to assess and recover compensation for damage to the environment and utilize such amount in terms of an action plan for protection of the environment.

As per the Hon'ble NGT suggestion, CPCB has invited comments of 3 expert institution, namely, Centre for Science and Environment (CSE), Institute of Economic Growth (IEG) and The Energy Research Institute (TERI). The CPCB in-house committee on Environmental Compensation has deliberated on the comments and finalized the report accordingly.

It was deliberated for developing a formula for imposing environmental compensation on industrial units for violation of directions issued by regulatory bodies and this is the first attempt made. The committee discussed that environmental compensation should be based on "Polluter Pay Principle". The Committee decided to list the instances for taking cognizance of cases fit for violation and levy environmental compensation.



13.4 Guidelines issued by the Central Pollution Control Board (CPCB) for calculating environmental compensation.

CPCB has published guidelines for categorization of industries into Red, Orange, Green and White based on concept of Pollution Index (PI). After considering various factors including the policy implementation issues, Committee has come up with following formula for levying the Environmental Compensation in instances as mentioned at a, b and c including non-compliance of the environmental standards / violation of directions.

The Environmental Compensation shall be based on the following formula:

$$EC = PI \times N \times R \times S \times LF$$

Where,

EC is Environmental Compensation in ₹

PI = Pollution Index of industrial sector

N = Number of days of violation took place

R = A factor in Rupees (₹) for EC

S = Factor for scale of operation

LF = Location factor

The formula incorporates the anticipated severity of environmental pollution in terms of Pollution Index, duration of violation in terms of number of days, scale of operation in terms of micro & small/medium/large industry and location in terms of proximity to the large habitations.

Note:

- The industrial sectors have been categorized into Red, Orange and Green, based on their Pollution Index in the range of 60 to 100, 41 to 59 and 21 to 40, respectively. It was suggested that the average pollution index of 80, 50 and 30 may be taken for calculating the Environmental Compensation for Red, Orange and green categories of industries, respectively.
- N, number of days for which violation took place is the period between the day of violation observed/due date of direction's compliance and the day of compliance verified by CPCB/SPCB/PCC.
- R is a factor in Rupees, which may be a minimum of 100 and maximum of 500. It is suggested to consider R as 250, as the Environmental Compensation in cases of violation.
- S could be based on small/medium/large industry categorization, which may be 0.5 for micro or small, 1.0 for medium and 1.5 for large units.
- LF, could be based on population of the city/town and location of the industrial unit. For the industrial unit located within municipal boundary or up to 10 km distance from the municipal boundary of the city/town, following factors (LF) may be used:

Location Factor Values

Sr. No.	Population (Million)	Location Factor (LF)
1.	Less than 1	1.0
2.	1 to <5	1.25
3.	5 to <10	1.5
4.	10 and above	2.0



*Population of the city/town as per the latest Census of India.

#LF will be 1.0 in case unit is located >10km from municipal boundary.

LF is presumed as 1 for city/town having population less than one million.

For notified Ecologically Sensitive areas, for beginning, LF may be assumed as 2.0. However, for critically Polluted Areas, LF may be explored in future.

13.4.1 Environmental Compensation for the proposed project.

The Hon'ble National Green Tribunal (NGT) Southern Bench, Chennai has constituted Joint Committee in O.A. of 180 of 2021 of NGT(SZ). The members of the committee as per the order for O.A. 180 of 2021 (date of hearing: 13.08.2021) para 7 are as follows:

1. Sr. Officer, MoEF & CC, GoI, Integrated Regional Office, Chennai or its subsidiary office at Hyderabad, if any.
2. Sr. Officer from Godavari River Management Board.
3. Sr. Officer, Central Water Commission, Integrated Regional Office, Hyderabad.

It is observed that in proceeding with the construction without seeking extension of the Environmental Clearance granted for start of the construction work for Flood flow canal of which Gouravelly Reservoir which is 85% complete as on date, is a part, environmental laws have been violated.

The Joint committee is opined that non-compliance of environmental clearance conditions may lead to environmental damages. The observation on prima facie evidence by Joint committee is mentioned below:

- Proponent did not submit any six-monthly compliance report to Ministry since the grant of Environmental clearance letter.
- Compliance of specific conditions of environmental clearance issued to project authority has not been complied so far.
- Dumping of Over Burden and stabilisation are not carried out properly.
- Ambient air, fugitive emission, water (surface & ground water), and noise level have not been monitored so far.
- Generation and Disposal of wastes, mucks, hazardous wastes are not monitored and submitted.
- Vehicle movements and emissions were not monitored.
- Water sprinkling to control fugitive emission and green belt are not provided.
- Details of DG sets emissions are not submitted.
- Facility of STP and ETP are not provided.
- The labourers to be engaged for construction works shall be thoroughly examined by health personnel and adequately treated before issuing them work permit.
- Medical facilities as well as recreational facilities shall also be provided to the labourers' adequate arrangements for providing free fuel like kerosene/wood/LPG shall be made at the project cost for the labour engaged in the construction work so that indiscriminate felling of trees is prevented.

As directed by Hon'ble NGT, the environmental compensation and immediate restoration measures are given below.

Environmental compensation: The environmental compensation is calculated based on following formula of CPCB.

$$E=PI \times N \times R \times S \times LF$$

$$E=50 \times 1095 \times 250 \times 1.5 \times 1$$

E=Rs. 2,05,31,250/-

E=Environmental compensation

PI=Pollution index of industrial sector (average PI of 50 is taken for orange category)

N=Number of days violation took place (three years = 1095 days)

R= A factor in Rupees for EC (250 is considered for environmental compensation for violation)

S = Factor for scale of operation (medium scale of 1 is considered)

LF = Location factor (1 is considered for less one million population)

Therefore, it is submitted that an amount of Rs. 2,05,31,250/- (rounded to Rs.2.06 Crores) is calculated as environmental compensation.(Annexure -1B).

Remedial measures to restore the damage caused to the environment:

Recommendations for Immediate Remedial measures for restoration of environment are given below for implementations:

1. A separate environment cell needs to establish. Allocations budget and implementations of environment management protection measures to be maintained in separate account.
2. Restoration of construction area including dumping sites of excavated materials shall be ensured by levelling, filling up of borrow pits, landscaping etc. The area should be properly treated with suitable plantation.
3. Environmental parameters shall be monitored, and six-monthly monitoring reports shall be submitted to the concerned Regional Office of the Ministry and to Ministry
4. Water sprinkling arrangements shall be made to suppress the fugitive emissions.
5. Dump stabilisation, catch drains, green belt and desilting are to be carried out properly.
6. Used drums, vehicles, scraps, pipes and other materials have to be disposed of with TSPCB authorised vendor.
7. The proposed green belt development around various project appurtenances, colony rows with ornamental plants in consultation with State Forest Department shall be strictly adhered to. The green belt development shall be taken along with the construction of dam so that the rim is stabilized at the time of impounding.
8. Occurrence of stagnant pools/slow moving water channels during construction and operation of the project providing breeding source for vector mosquitoes and other parasites. The river should be properly channelized so that no smell pools and puddles are allowed to be formed.
9. Longitudinal connectivity ensuring hydraulic compatibility at bed level is to be provided to ensure non-disruptive biota movement and sediment transportation. For this necessary feature may be incorporated in design of dam
10. The equipment likely to generate high noise levels during the construction period or otherwise shall meet the ambient noise level standards as notified under the Noise Pollution(Regulation and Control) Rules, 2000, as amended in 2010 under the Environment Protection Act (EPA), 1986
11. Permission shall be obtained from forest department if, cutting of trees is involved in the submergence area.
12. Approval shall be obtained from TSPCB for stone crushing unit and Ready-Mix Plant are installed at the site.

Given the above facts and circumstances, the Hon'ble NGT may pass order as deemed fit.

13.5 REMEDIATION PLAN AND COST: Remediation plan along with the action plan with a budget of Rs. 28,00,000 is given in **Table 13.19**

S.No.	Component Remediation	Remediation Proposed	Description	Locations	Unit Rate	Total Qty.	Total Cost (Rs.)	Year I	Year II	Year III
a.	Air & Noise Environment and Ecology	Avenue Plantation	Plantation of 5200 Nos native plants at Rs.250 per sapling, including maintenance for 3 years.	Gouravelly Reservoir site	Rs.250	5200	13,00,000	2000	3200	--
b	Water Environment	Supply of potable water in surrounding villages.	RO plants of 250 LPH capacity with installation and 3 years maintenance in nearby village @ 7,50,000 per plant in the village	1.Gouravelly Village 2. R&R colony near Ramavaram	Rs.7,50,000	2	15,00,000	1	1	--
Total							28,00,000			

13.5.1 Natural & Community Resource Augmentation: Natural Resources Augmentation specific to the region along with action plan with a budget of Rs.30,00,000 is given in Table No.13.20

S.No	Component	Activity Proposed	Description	Locations	Unit Rate	Total Qty.	Total Cost (Rs.)	Year I	Year II	Year III
a	Natural Resource Augmentation Plan	Construction of Rain Water Harvesting structures.	Construction of RWHS-15 Nos @ 2,00,000/per in the surrounding three villages.	Gouravelly Akkannapet Ramavaram	Rs.2,00,000	15	30,00,000	5	5	5
Total							30,00,000	5	5	5



13.5.2 Community Resource Development (augmentation) Plan: The community resources development plan specific to the region along with action plan with a budget of Rs 1,48,00,000 is given in **Table No.13.21**

S.No	Component	Activity Proposed	Description	Locations	Rate	Total Qty.	Total Cost (Rs.)
b	Community Resource Development	Development of infrastructure	Construction of School building	R&R colony	75,00,000	1	75,00,000
			Construction of Sceptic tank		43,00,000	1	43,00,000
			Construction of Sewage lines		30,00,000	1	30,00,000
Total							1,48,00,000
Total cost for Environmental Compensation- Remediation plan & Natural and Community Resource Augmentation Plan (RP & NCRAP)							2,06,00,000



13.6 Violation Cost

After formation of Telangana State, Government has taken up Re-engineering of Irrigation projects for effective utilization of water allocations made to the state. To compensate the storage lost due to dropping of Combined Storage Reservoir-I across Peddavagu II and Korutlawaagu near Konaraopet (V), Kathalapur (M), Karimnagar Dist, the Government has proposed to increase the Gouravelly Reservoir capacity from 1.410 TMC to 8.230 TMC. The administrative approval for the Gouravelly reservoir project with enhanced capacity from 1.410 TMC to 8.23 TMC was accorded by the Government of Telangana vide G.O.Ms. No. 533, I&CAD (Projects-IV) Department Dt: 26.05.2017 and 85% of work was completed by the time of NGT Case was filed **(Annexure-1A)**.

The submerging villagers of Gouravelly reservoir had filed the case **OA no 180 of 2021** on 10th August 2021 before the **Hon'ble NGT (SZ), Chennai** on the ground that the irrigation and CAD department of State of Telangana under the Re-engineering proposal issued orders **for expansion of Gouravelly Reservoir from 1.410 TMC to 8.230 TMC without obtaining prior Environmental Clearance from Ministry.** **(Annexure-1B)**.

The National Green Tribunal (SZ), Chennai has constituted a Joint Committee on 13.08.2021 represented by IRO, MoEF&CC, Godavari River Management Board and Central Water Commission, Integrated Regional Office, Hyderabad. The Joint Committee conducted the site visit on 23.09.2021 and filed its report on Dt: 29.09.2021 before the Hon'ble Tribunal wherein it has reported that **the scope of the project has been changed without approval of MoEF&CC.**

Considering this the violation cost was calculated as per the OM F.No. 22-21/2020-IA.III dated 7th July 2021 and OM 22-21/2020-IA.III (E 138949) dated 28th January 2022 **(Annexure 13A)**. The penalty provision for violation cases and application for new projects and expansion projects has to be calculated based on the project cost and turnover during the period of violation.

The proposed project Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir obtained ToR under Violation category for increasing the Gouravelly reservoir capacity against the Environmental Clearance obtained in 2003.

The cost for construction of Gouravelly reservoir with gross capacity of 1.410 TMC water including construction of H.C Weir, forming earth dam, Head regulators on left and right side, formation of diversion road including construction of DLR bridge is Rs.43,13,30,686 /- (i.e.Rs.43.13 Crores) as per agreement no.2/FFCC-III/2008-09, dated :30.05.2008 for which environmental clearance is already accorded. **(Annexure-13B)**.

The administrative approval for the Gouravelly reservoir project with enhanced capacity from 1.410 TMC to 8.23 TMC was accorded by the Government of Telangana for an amount of Rs.1196.06 Crores vide G.O.Ms. No. 533, I&CAD (Projects-IV) Department Dt: 26.05.2017.

After Re-engineering the capacity of Gouravelly reservoir with enhanced capacity from 1.410 TMC to 8.23 TMC water including construction of H.C Weir, forming earth dam, Head regulators on left and right side, formation of diversion road including construction of DLR bridge. The revised cost for the enhanced capacity is Rs.540,14,41,361/- (i.e.Rs.540.14 Crores) as per supplemental agreement no.17/IFFCC-III/2017-18, dated :29.12.2017. **(Annexure-13C)**.

Considering this the violation cost is calculated for Gouravelly reservoir of 8.23 TMC i.e. Rs. 540.14 Crores.



The violation cost for expansion of Gouravelly reservoir is calculated based on the following:

For expansion projects:

- i. **Where operation/production with expanded capacity has not commenced:**
1% of the project cost, attributable to the expansion, incurred up to the date of filing of application along with EIA/EMP report.
- ii. **Where operation/ production with expanded capacity have commenced:**
1% of the project cost (attributable to the expansion activity) incurred up to the date of filing of application along with EIA/EMP report PLUS 0.25% of the total turnover (attributable to the expanded activity/capacity) involved during the period of violation.

Based on the above violation cost, the project falls under expansion projects section (i) where the operation with expanded capacity has not commenced. The cost of the project is Rs. 540.14 Crores @ 2017-18.

The violation cost is calculated as: *

$$\begin{aligned}\text{Project Cost} &= \text{Rs.540.14 Crores} \\ \text{Violation cost} &= 1\% \text{ of project cost} \\ &= \text{Rs.540.14} * 1\% \text{ of project cost} \\ &= \text{Rs.5.4014.Crores} .\end{aligned}$$

The violation cost for Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir is estimated as Rs.5.4014 Crores as per the OM F.No. 22-21/2020.IA.III dated 7th July 2021 and OM 22-21/2020-IA.III (E 138949) dated 28th January 2022 (**Annexure 13A**)

The cost for environmental compensation - Remediation Plan & Natural & Community Resource Augmentation is calculated as i.e., Rs. 2,05,31,250/- (Rounded to Rs.2.06 Crores).

The environmental compensation (RP&NCRAP) and Violation cost for Indiramma Flood Flow Canal Project from SRSP with expansion of Gouravelly Reservoir is Rs.7.4614 Crores (i.e.Rs.2.06 Crores for environmental compensation + Rs.5.4014 Crores for Violation cost) .

The activities proposed for Remediation plan, Natural Resource Augmentation Plan and Community Resource Augmentation plan will be reviewed as per the issues raised in the Public Hearing for the project and revised activities will be incorporated, if found necessary. The activities for violation cost will be proposed based on the issues raised in the Public Hearing. After approval of the RP&NCRAP activities in the State Expert Appraisal Committee during grant of EC for the IFFC from SRSP with expansion of Gouravelly reservoir, the RP&NCRAP activities will be taken up.
