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### GOVERNMENT OF INDIA MINISTRY OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION CENTRAL GROUND WATER BOARD

# PLAN ON ARTIFICIAL RECHARGE TO GROUNDWATER AND WATER CONSERVATION IN PEDDAPAPPUR MANDAL, ANANTAPUR DISTRICT, ANDHRA PRADESH

SOUTHERN REGION HYDERABAD AUGUST-2016

# PLAN ON ARTIFICIAL RECHARGE TO GROUNDWATER AND WATER CONSERVATION IN PEDDAPAPPUR MANDAL, ANANTAPUR DISTRICT, ANDHRA PRADESH

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Name of the Mandal	PEDDAPAPPUR
District	ANATHAPUR
State	ANDHRA PRADESH
Total Area (Sq.kms)	215
Area suitable for Artificial Recharge (Sq.kms)	193.56
Latitude and Longitude	14.788860 to 15.021700 and 77.776290 to 77.916650
Average Annual Rainfall (mm)	468
Geology	Lime stones, Shales
Average Depth To Water Level (Decadal) (Pre Monsoon)	16.00
Average Depth To Water Level (Decadal) (Post Monsoon)	13.00
Ground Water Reso	urces (2011)
Annual Replenishable Ground Water Resources (MCM/yr)	9.81
Net Annual Ground Water Availability(MCM)/yr	8.83
Net Annual Ground Water Draft(MCM)/yr	23.91
Projected Demand for Domestic and Industrial Use(MCM)/yr	1.94
Stage of Ground Water Development (%)	271
Surface runoff available (MCM)/yr	8.62
Total Storage Created in the Mandal by Various Agencies (MCM)/yr	2.30
Artificial Recharge/Conse	ervation Measures
Recharge Structures Proposed (No.s)	Percolation Tanks: 0, Check Dams: 0 Farm ponds: 400, Recharge Shafts: 163
Improving Water use Efficiency	Micro Irrigation System: 2000 ha
Tentative Total Cost in Lakhs (Rs.)	1476.3
Expected Recharge/Savings (MCM)/yr	7.845

AT A GLANCE

### 1. INTRODUCTION

Peddapapur Mandal is one of the over-exploited mandal in Anantapur district, Andhra Pradesh State, which is economically backward and chronically drought affected. The mandal has 17 inhabited villages with 20 gram panchayats.

### 2. LOCATION

The mandal lies between north latitudes 14.788860 to 15.021700 and between east longitudes 77.776290 to 77.916650. The mandal occupies the northeast part of the Anantapur district and is bounded on the north by Yadiki Mandal, on the east by Tadipatri mandal, on the south by Narpala mandal and west by Singanamala mandal. (Fig.1) The geographical area of the mandal is 215 sq.km.

### 3. PHYSIOGRAPHY AND DRAINAGE:

The area is drained by streams which are tributaries of Pennar river. The streams are mostly ephemeral in nature. The drainage pattern is dendritic, rectangular to sub rectangular due to the influence of geological structures. (Fig.2)

### 4. RAINFALL

The average rainfall in the mandal is 468 mm. The rainfall during the South-west monsoon season i.e., June-September accounts for about 85% of the total rainfall.

### 5. LAND USE PATTERN

Out of the total geographical area of 215 sq.km, the area covered by forest is 24.67 sq.km and the net area sown is 120.36 sq.km. Barren and uncultivable land is 25.3 sq.km. The land for non agricultural use accounts for 20.63 sq.km. (Fig.3)

### 6. HYDROGEOLOGY

The area is underlain by Lime stones and Shales of Archaean age (Fig.4). Ground water occurs in weathered and fractured zones under water table and semi- confined conditions. The weathered zone thickness as per the GEC report is 9 m. The weathered zone has been extensively tapped by dug and dug cum bore wells up to 20 m depth. Ground water occurs in fractured rocks down to a depth of 200 m bgl. However, the potential fractures are encountered between 50-100 m bgl. The cumulative yield varies from 2-5 lps.

### 7. GROUND WATER LEVEL SCENARIO

The depth to water level during pre and post-monsoon varies from 5 to 20 m bgl. The average depth to water level (decadal) during pre and post monsoon is 16 and 13 m bgl respectively. The depth to water levels maps for pre and post monsoon period (2014) are shown in (Figs 5 & 6. respectively.) and the decadal mean water level trend during post monsoon is depicted in the Fig.7.

### 8. DYNAMIC GROUND WATER RESOURCES

The Ground water availability, Utilization and stage of Development in Peddapappur Mandal, Anantapur District is given in Table-1.

Table-1: Ground water resources of Peddapappur Mandal, Anantapur District.

Annual Replenishable Ground water resources (MCM)	9.81
Net Annual Ground water Availability. (MCM)	8.83
Net Annual Ground Water Draft(MCM)/yr	23.91
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	1.94
Stage of Ground water development (%).	271
Whether notified or not with year of notification.	No

### 9. NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION METHODS

The ground water withdrawal is more than the recharge with a stage of development above hundred percent. The long term water level trend mostly shows a declining trend and the water levels are very deep ranging up to 20m bgl. The sustainability of bore wells has become questionable as many bore wells are either drying up or have recorded reduced yields. There is no surface water irrigation facility in the area. All these factors indicate that there is an urgent need for artificial recharge and water conservation.

## 10. JUSTIFICATION OF THE ARTIFICIAL RECHARGE PROJECT

Peddapappur Mandal falls under high stage of ground water development i.e., 271 % and with sufficient amount of uncommitted surface runoff. The area is completely dependent on ground water for domestic, industrial and irrigation purposes. During the monsoons runoff quickly flows out of the area without natural recharge to ground water. It is necessary to apply artificial recharge techniques to allow more and more recharge through check dams, PTs, MPTs, farm ponds, recharge shafts to cope up with the withdrawal pattern and also to improve ground water situation through various interventions including on farm activities and micro irrigation systems (Sprinkler-Drip-HDPE).

# 11. AVAILABILITY OF SURPLUS, SURFACE WATER FOR ARTIFICIAL RECAHRGE OR CONSERVATION

The runoff was calculated by taking into account of normal rainfall of the mandal and corresponding runoff yield from Strangers table. The existing storage created by various artificial recharge structures constructed by the State Government, if any, was deducted for calculating the runoff yield to recommend new AR structures.

Total Geographical area (Sq.kms)	215
Hilly Area (Sq.kms)	21.44
Area suitable for Artificial Recharge (sq.km.)	193.56
Runoff Yield in MCM/yr	8.62
Existing No. of Check Dams	275
Storage created MCM/yr	1.95
Existing No. of Percolation Tanks	49
Storage created MCM/yr	0.35
Total Existing Storage Created	2.30

### 12. FEASIBLE ARTIFICIAL RECHARGE STRUCTURES

Since the mandal is categorized as over exploited, there is an immediate need for improving ground water scenario and to ensure sustainability of ground water sources. It is also suggested to create additional storage capacity of surface water bodies which would result in supplementing irrigation thereby reducing the ground water draft. The run off available in the mandal has been assessed as 6.32 MCM/yr, which could be considered for further planning of artificial recharge. However, the number of artificial recharge structures feasible has been recommended in areas, by considering the utilizable yield, number of existing structures, land use, drainage pattern and also where the post monsoon water levels (decadal mean) are more than 5 m bgl., and or decadal trends are either falling or showing insignificant raising trend.

### A) Check dams and Percolation Tanks

The area is covered by seasonal nalas – drains, which carry discharge during monsoon period debauched into the water bodies within a short duration. It is proposed to identify such nalas for construction of check dams/Percolation tank with recharge shafts, so as to harness ground water and to increase soil moisture content.

- The site selected for check dam/Percolation Tank should have sufficient thickness of permeable soils or weathered material to facilitate recharge of stored water within a short span of time. The water stored in these structures is mostly confined to the stream course and height is normally less than 2m.
- These are designed based on stream width and excess water is allowed to flow over the crest wall. In order to avoid scouring from excess runoff water cushions are provided on the downstream side. To harness maximum runoff in the stream, a series of such check dams can be constructed to have recharge on a regional scale.
- Considering the annual monsoon rainfall of 468 mm, sufficient rain water can be harnessed. This will improve ground water regime as well as delaying the instant flow into the main river.
- The flow in these seasonal rivers can be sustained up to about 2 to 3 months after monsoon.

• Recharge trenches can also be constructed along upstream side of the check dam/Percolation Tank in the impoundment area for enhancing the ground water recharge rate.

It is not recommended to construct Check dams and Percolation tanks as there is no surplus runoff in the mandal.

## B). Recharge Shafts

The existing check dams and percolation tanks lose their storage capacity as well as recharge capacity due to siltation. Hence, Recharge shafts are recommended in the existing Check dams and Percolation tanks to enhance the ground water recharge. During the heavy downpours, there will be sufficient accumulation of runoff, which can also effectively be utilized for recharge by constructing recharge shafts. Hence, it is proposed to construct 138 and 25 recharge shafts of 165 mm dia with 30 m depth in the existing check dams and percolation tanks respectively.

### C). Farm Ponds

A farm pond is a large dug out in the earth, usually square or rectangular in shape, which harvests rain water and stores it for future use. It has an inlet to regulate inflow and an outlet to discharge excess water. The pond is surrounded by a small bund, which prevents erosion on the banks of the pond. The size and depth depend on the amount of land available; the type of soil water from the farm pond is conveyed to the fields manually, by pumping, or by both methods.

### Advantages of Farm Ponds

- They provide water to start growing crops, without waiting for rain to fall.
- They provide irrigation water during dry spells between rainfalls. This increases the yield, the number of crops in one year, and the diversity of crops that can be grown.
- Bunds can be used to raise vegetables and fruit trees, thus supplying the farm household with an additional source of income and of nutritious food.
- Farmers are able to apply adequate farm inputs and perform farming operations at the appropriate time, thus increasing their productivity and their confidence in farming.
- They check soil erosion and minimize siltation of waterways and reservoirs.
- They supplies water for domestic purposes and livestock.
- They promote fish rearing.
- They recharge the ground water.
- They improve drainage.

• The excavated earth has a very high value and can be used to enrich soil in the fields, levelling land, and constructing farm roads.

As per the Land use classification, majority of the area is covered by the agricultural field. Hence, it is proposed to construct 400 farm ponds in 20 villages of the Mandal @ 20 farm ponds in each village.

### D). Micro Irrigation System (Sprinkler /drip/HDPE pipes)

Micro irrigation is defined as the frequent application of small quantities of water directly above and below the soil surface; usually as discrete drops, continuous drops or tiny streams through emitters placed along a water delivery line. In flood/furrow irrigation method more than 50% of applied water is wasted through seepage to deeper level, localized inundation causes loss through evaporation and it leaches out the nutrients from the plant. While through drip & sprinkler irrigation wastages of irrigational water could be minimized. The studies on different crops, has revealed that irrigation water is saved drastically. The conveyance losses (mainly seepage & evaporation) can be saved up to 25 to 40% through utilization of HDPE pipes. Initially the scheme is proposed to be implemented in worst affected areas showing deepest water levels and significant declining trends. It is proposed to take up micro irrigation system in 2000 ha @ 100 ha per village.

# 13. TENTATIVE COST ESTIMATES (PEDDAPAPPUR MANDAL)

S.No.	Feasible Artificial Recharge & Water Conservation structures/	No. of Structures/ Quantity	Total Volume (MCM)	Tentative unit cost (in Rs lakh)	Total tentative cost (in Rs Lakh)	Expected Annual GW recharge/savings (MCM)
1	Proposed Masonry Check dams Crest Length -10-15 m, Height-1-2 m) (0.007 MCM*4 fillings)	0	0	5	0	0
2	Recharge shaft in Check dam (50% of the existing Check dams)	138	1.518	0.5	69	1.518
3	Proposed Percolation Tanks (100*100*2.5)* 4 fillings)	0	0	15	0	0
4	Renovation Desilting, Repairs and installation of Recharge Shafts in existing PTS (50% of the existing PTS)	25	0.275	1	25	0.275
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	400	0.0576	0.25	100	0.05184
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	2000	12	0.6	1200	6
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	20	0	0.6	12	0
8 (i)	Total (No. of AR Structures)	583	1.85		206	1.845
8 (ii)	Total (ha)	2000			1200	6
	Total $(8(i) + 8(ii))$				1406	7.845
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				70.3	
	Grand Total				1476.3	

\*(Expected annual GW Recharge/Savings MCM - CDS& PTS: 75%, Farm ponds - 90%, Sprinklers-50%, Recharge shafts in existing CDS and PTS-100%)

Note: The type, number and cost of structure may vary according to site, after the ground truth verification.

### 14. TIME SCHEDULE

Steps	Quarters							
	1st	$2^{nd}$	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>
Identification of line department/implementing agency and preparation of DPR								
Approval of Scheme and releases of sanction of funds								
Implementation of ARS								

Phase = one quarter or 3 months or equivalent to financial quarter

## A). Operation and Maintenance

In all projects impact assessment has to be carried out to ensure that project is economically viable, socially equitable and environmentally sustainable by inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. Accordingly it is proposed to have impact assessment as well as operation & Maintenance at the rate of 5% of the total cost of the project for 5 years from the completion of artificial recharge project.

## **B). Expected Benefits**

The benefits of the project are:

- 1. The implementation of the project would result in additional recharge/Ground water savings to the tune of 7.845 MCM.
- 2. Ground water recharge will help in arresting the rapid decline in ground water resources and will also ensure improvement in quality of ground water by dilution.
- Proposed structures and measures will also enhance the ground water potential and would ensure sustainability of ground water resources. It is estimated that the stage of ground water development may likely to be reduced from the present 271% to 143% (128%)
- 4. It will also help in controlling soil erosion.

## Acknowledgements

The data received from the Director Ground Water Department Andhra Pradesh in respect of the basic inputs is duly acknowledged. The information on existing Artificial Recharge Structures has been taken from the EMUSTER, Department of Rural Development, Government of AP.

### EXISTING ARTIFICIAL RECHARGE STRUCTURES PEDDAPAPPUR MANDAL, ANANTAPUR DISTRICT, AP

S.no	Gram Panchayat	Habitation	Structure Type	Longitude	Latitude	Scheme
1	Ammaladinne	Ammaladinne	Check Dam	77.8927	14.8803	NREGS
2	Ammaladinne	Ammaladinne	Check Dam	77.8930	14.8796	NREGS
3	Ammaladinne	Ammaladinne	Check Dam	77.8906	14.8729	NREGS
4	Ammaladinne	Ammaladinne	Check Dam	77.8903	14.8688	NREGS
5	Ammaladinne	Ammaladinne	Check Dam	77.8931	14.8890	NREGS
6	Ammaladinne	Ammaladinne	Check Dam	77.8942	14.8866	NREGS
7	Ammaladinne	Ammaladinne	Check Dam	77.9064	14.8747	NREGS
8	Ammaladinne	Ammaladinne	Check Dam	77.9027	14.8806	NREGS
9	Ammaladinne	Ammaladinne	Check Dam	77.9014	14.8845	NREGS
10	Ammaladinne	Ammaladinne	Check Dam	77.8997	14.8867	NREGS
11	Ammaladinne	Ammaladinne	Check Dam	77.8945	14.8845	NREGS
12	Ammaladinne	Ammaladinne	Check Dam	77.8947	14.8826	NREGS
13	Ammaladinne	Ammaladinne	Check Dam	77.8912	14.8799	NREGS
14	Ammaladinne	Ammaladinne	Check Dam	77.8974	14.8887	NREGS
15	Ammaladinne	Ammaladinne	Check Dam	77.9109	14.8738	NREGS
16	Ammaladinne	Ammaladinne	Check Dam	77.9075	14.8745	NREGS
17	Cheemulavagupalli	CheemulavaguPalli	Check Dam	77.9116	14.9785	NREGS
18	Cheemulavagupalli	CheemulavaguPalli	Check Dam	77.9013	14.9984	NREGS
19	Cheemulavagupalli	CheemulavaguPalli	Check Dam	77.8992	15.0030	NREGS
20	Cheemulavagupalli	CheemulavaguPalli	Check Dam	77.8978	15.0061	NREGS
21	Cheemulavagupalli	CheemulavaguPalli	Check Dam	77.8963	15.0085	NREGS
22	Chikkepalli	Chikkepalli	Check Dam	77.8736	14.8893	NREGS
23	Chikkepalli	Chikkepalli	Check Dam	77.8376	14.8923	NREGS
24	Chikkepalli	Chikkepalli	Check Dam	77.8626	14.8890	NREGS
25	Chikkepalli	Chikkepalli	Check Dam	77.8624	14.8861	NREGS
26	Muchukota	Muchukota	Check Dam	77.8612	14.8424	NREGS
27	Muchukota	Muchukota	Check Dam	77.8731	14.8555	NREGS
28	Muchukota	Muchukota	Check Dam	77.8735	14.8527	NREGS
29	Muchukota	Muchukota	Check Dam	77.8731	14.8555	NREGS
30	Muchukota	Muchukota	Check Dam	77.8750	14.8584	NREGS
31	Muchukota	Muchukota	Check Dam	77.8750	14.8584	NREGS
32	Muchukota	Muchukota	Check Dam	77.8866	14.8362	NREGS

33	Muchukota	Muchukota	Check Dam	77.8722	14.8473	NREGS
34	Muchukota	Muchukota	Check Dam	77.8689	14.8543	NREGS
35	Muchukota	Muchukota	Check Dam	77.8496	14.8462	NREGS
36	Muchukota	Muchukota	Check Dam	77.8772	14.8304	NREGS
37	Muchukota	Muchukota	Check Dam	77.8799	14.8335	NREGS
38	Varadayapalli	VaradayaPalli	Check Dam	77.8670	14.8696	NREGS
39	Varadayapalli	VaradayaPalli	Check Dam	77.8686	14.8699	NREGS
40	Varadayapalli	VaradayaPalli	Check Dam	77.8715	14.8707	NREGS
41	Varadayapalli	VaradayaPalli	Check Dam	77.8526	14.8708	NREGS
42	Varadayapalli	VaradayaPalli	Check Dam	77.8609	14.8718	NREGS
43	Varadayapalli	VaradayaPalli	Check Dam	77.8765	14.8597	NREGS
44	Varadayapalli	VaradayaPalli	Check Dam	77.8867	14.8577	NREGS
45	Varadayapalli	VaradayaPalli	Check Dam	77.8801	14.8635	NREGS
46	Varadayapalli	VaradayaPalli	Check Dam	77.8896	14.8665	NREGS
47	Varadayapalli	VaradayaPalli	Check Dam	77.8883	14.8636	NREGS
48	Varadayapalli	VaradayaPalli	Check Dam	77.8868	14.8621	NREGS
49	Varadayapalli	VaradayaPalli	Check Dam	77.8858	14.8600	NREGS
50	Varadayapalli	VaradayaPalli	Check Dam	77.8854	14.8761	NREGS
51	Varadayapalli	VaradayaPalli	Check Dam	77.8878	14.8762	NREGS
52	Varadayapalli	VaradayaPalli	Check Dam	77.8901	14.8687	NREGS
53	Varadayapalli	VaradayaPalli	Check Dam	77.8925	14.8646	NREGS
54	Varadayapalli	VaradayaPalli	Check Dam	77.8791	14.8611	NREGS
55	Varadayapalli	VaradayaPalli	Check Dam	77.8789	14.8685	NREGS
56	Varadayapalli	VaradayaPalli	Check Dam	77.8803	14.8725	NREGS
57	Varadayapalli	VaradayaPalli	Check Dam	77.8845	14.8759	NREGS
58	Peddapappur	Peddapappur	Check Dam	77.8664	14.9361	NREGS
59	Peddapappur	Peddapappur	Check Dam	77.8543	14.9203	NREGS
60	Sommanapalli	J.Kothapalli	Check Dam	77.8964	14.8900	NREGS
61	Sommanapalli	J.Kothapalli	Check Dam	77.8938	14.8922	NREGS
62	Sommanapalli	J.Kothapalli	Check Dam	77.8927	14.8944	NREGS
63	Sommanapalli	J.Kothapalli	Check Dam	77.8908	14.8966	NREGS
64	Sommanapalli	SomannaPalli	Check Dam	77.8901	14.9104	NREGS
65	Sommanapalli	SomannaPalli	Check Dam	77.8898	14.9123	NREGS
66	Sommanapalli	SomannaPalli	Check Dam	77.8891	14.9155	NREGS
67	Sommanapalli	SomannaPalli	Check Dam	77.8898	14.9178	NREGS

68	Sommanapalli	SomannaPalli	Check Dam	77.8894	14.9196	NREGS
69	Sommanapalli	SomannaPalli	Check Dam	77.8890	14.9209	NREGS
70	Sommanapalli	SomannaPalli	Check Dam	77.8904	14.9192	NREGS
71	Sommanapalli	SomannaPalli	Check Dam	77.8957	14.9365	NREGS
72	Sommanapalli	SomannaPalli	Check Dam	77.8985	14.9398	NREGS
73	Tabjula	Tabjula	Check Dam	77.8388	14.8879	NREGS
74	Tabjula	Tabjula	Check Dam	77.8359	14.8925	NREGS
75	Tabjula	Tabjula	Check Dam	77.8349	14.8940	NREGS
76	Tabjula	Tabjula	Check Dam	77.8311	14.8945	NREGS
77	Tabjula	Tabjula	Check Dam	77.8287	14.8950	NREGS
78	Tabjula	Tabjula	Check Dam	77.8278	14.8713	NREGS
79	Tabjula	Tabjula	Check Dam	77.8272	14.8733	NREGS
80	P.cherlopalli	P.Cherlopalli	Check Dam	77.8256	14.9638	NREGS
81	P.cherlopalli	P.Kondapuram	Check Dam	77.8220	14.9390	NREGS
82	Namanankapalli	NamanankaPalli	Check Dam	77.8838	14.9033	NREGS
83	Namanankapalli	NamanankaPalli	Check Dam	77.8819	14.9021	NREGS
84	Namanankapalli	NamanankaPalli	Check Dam	77.8829	14.9030	NREGS
85	Garladinne	Garladinne	Check Dam	77.8381	14.9522	NREGS
86	Garladinne	Garladinne	Check Dam	77.8620	14.9495	NREGS
87	Garladinne	Garladinne	Check Dam	77.8607	14.9476	NREGS
88	Garladinne	Garladinne	Check Dam	77.8565	14.9472	NREGS
89	Garladinne	Garladinne	Check Dam	77.8534	14.9438	NREGS
90	Garladinne	Garladinne	Check Dam	77.8546	14.9483	NREGS
91	Garladinne	Garladinne	Check Dam	77.8588	14.9463	NREGS
92	Jutur	Jutur	Check Dam	77.9174	14.9338	NREGS
93	Jutur	Jutur	Check Dam	77.9132	14.9378	NREGS
94	Jutur	Jutur	Check Dam	77.9137	14.9360	NREGS
95	Jutur	Jutur	Check Dam	77.9072	14.9385	NREGS
96	Jutur	Jutur	Check Dam	77.9040	14.9390	NREGS
97	Jutur	Jutur	Check Dam	77.9027	14.9396	NREGS
98	Jutur	Jutur	Check Dam	77.9177	14.9377	NREGS
99	Jutur	Jutur	Check Dam	77.9139	14.9221	NREGS
100	Jutur	Thimmanacheruvu	Check Dam	77.8978	14.9396	NREGS
101	Jutur	Thimmanacheruvu	Check Dam	77.8984	14.9400	NREGS
102	Jutur	Thimmanacheruvu	Check Dam	77.8958	14.9364	NREGS

103	Jutur	Thimmanacheruvu	Check Dam	77.8968	14.9329	NREGS
104	Chinnayekkuluru	Chinnayekkaluru	Check Dam	77.8004	14.9213	NREGS
105	Devanuppalapadu	Devanuppalapadu	Check Dam	77.7660	14.9018	NREGS
106	Devanuppalapadu	ReddiPalli	Check Dam	77.7797	14.9317	NREGS
107	Dharmapuram	Chinapappur	Check Dam	77.8734	14.9423	NREGS
108	Dharmapuram	Chinapappur	Check Dam	77.8664	14.9361	NREGS
109	Dharmapuram	ChinthalaPalli	Check Dam	77.8803	14.9541	NREGS
110	Dharmapuram	Dharmapuram	Check Dam	77.8871	14.9198	NREGS
111	Kummetha	Athiralladinne	Check Dam	77.8587	14.9909	NREGS
112	Kummetha	Athiralladinne	Check Dam	77.8558	14.9978	NREGS
113	Kummetha	Athiralladinne	Check Dam	77.8561	15.0000	NREGS
114	Kummetha	Athiralladinne	Check Dam	77.8526	14.9945	NREGS
115	Kummetha	Athiralladinne	Check Dam	77.8492	14.9949	NREGS
116	Kummetha	Athiralladinne	Check Dam	77.8438	14.9885	NREGS
117	Narasapuram	Narasapuram	Check Dam	77.8992	14.9621	NREGS
118	Narasapuram	Narasapuram	Check Dam	77.8998	14.9618	NREGS
119	Narasapuram	Narasapuram	Check Dam	77.9003	14.9614	NREGS
120	Narasapuram	Narasapuram	Check Dam	77.8953	14.9638	NREGS
121	Narasapuram	Narasapuram	Check Dam	77.8882	14.9659	NREGS
122	Narasapuram	Narasapuram	Check Dam	77.9088	14.9820	NREGS
123	Narasapuram	Narasapuram	Check Dam	77.9047	14.9865	NREGS
124	Pasalur	KammavariPalli	Check Dam	77.8285	14.9635	NREGS
125	Pasalur	KottalaPalli	Check Dam	77.8582	14.9622	NREGS
126	Pasalur	KottalaPalli	Check Dam	77.8429	14.9657	NREGS
127	Pasalur	KottalaPalli	Check Dam	77.8435	14.9634	NREGS
128	Pasalur	KottalaPalli	Check Dam	77.8509	14.9608	NREGS
129	Pasalur	KottalaPalli	Check Dam	77.8543	14.9613	NREGS
130	Pasalur	KottalaPalli	Check Dam	77.8431	14.9625	NREGS
131	Pasalur	Sunkesulapalli	Check Dam	77.8730	14.9636	NREGS
132	Pasalur	Sunkesulapalli	Check Dam	77.8753	14.9649	NREGS
133	Pasalur	Sunkesulapalli	Check Dam	77.8707	14.9640	NREGS
134	Pasalur	Sunkesulapalli	Check Dam	77.8687	14.9643	NREGS
135	Pasalur	Sunkesulapalli	Check Dam	77.8672	14.9652	NREGS
136	Pasalur	Sunkesulapalli	Check Dam	77.8664	14.9646	NREGS
137	Ammaladinne	Ammaladinne	Check Dam	77.9109	14.8738	IWMP

138	Ammaladinne	Ammaladinne	Check Dam	77.9075	14.8745	IWMP
139	Ammaladinne	Ammaladinne	Check Dam	77.9064	14.8747	IWMP
140	Ammaladinne	Ammaladinne	Check Dam	77.9027	14.8806	IWMP
141	Ammaladinne	Ammaladinne	Check Dam	77.9014	14.8845	IWMP
142	Ammaladinne	Ammaladinne	Check Dam	77.8997	14.8867	IWMP
143	Ammaladinne	Ammaladinne	Check Dam	77.8927	14.8803	IWMP
144	Ammaladinne	Ammaladinne	Check Dam	77.8930	14.8796	IWMP
145	Ammaladinne	Ammaladinne	Check Dam	77.8906	14.8729	IWMP
146	Ammaladinne	Ammaladinne	Check Dam	77.8903	14.8688	IWMP
147	Ammaladinne	Ammaladinne	Check Dam	77.8974	14.8887	IWMP
148	Ammaladinne	Ammaladinne	Check Dam	77.8931	14.8890	IWMP
149	Ammaladinne	Ammaladinne	Check Dam	77.8942	14.8866	IWMP
150	Ammaladinne	Ammaladinne	Check Dam	77.8945	14.8845	IWMP
151	Ammaladinne	Ammaladinne	Check Dam	77.8947	14.8826	IWMP
152	Ammaladinne	Ammaladinne	Check Dam	77.8912	14.8799	IWMP
153	Chikkepalli	Chikkepalli	Check Dam	77.8736	14.8893	IWMP
154	Chikkepalli	Chikkepalli	Check Dam	77.8376	14.8923	IWMP
155	Chikkepalli	Chikkepalli	Check Dam	77.8626	14.8890	IWMP
156	Chikkepalli	Chikkepalli	Check Dam	77.8624	14.8861	IWMP
157	Muchukota	Muchukota	Check Dam	77.8496	14.8462	IWMP
158	Muchukota	Muchukota	Check Dam	77.8772	14.8304	IWMP
159	Muchukota	Muchukota	Check Dam	77.8866	14.8362	IWMP
160	Muchukota	Muchukota	Check Dam	77.8866	14.8362	IWMP
161	Muchukota	Muchukota	Check Dam	77.8722	14.8473	IWMP
162	Muchukota	Muchukota	Check Dam	77.8689	14.8543	IWMP
163	Muchukota	Muchukota	Check Dam	77.8612	14.8424	IWMP
164	Muchukota	Muchukota	Check Dam	77.8731	14.8555	IWMP
165	Muchukota	Muchukota	Check Dam	77.8735	14.8527	IWMP
166	Muchukota	Muchukota	Check Dam	77.8731	14.8555	IWMP
167	Muchukota	Muchukota	Check Dam	77.8750	14.8584	IWMP
168	Muchukota	Muchukota	Check Dam	77.8750	14.8584	IWMP
169	Varadayapalli	VaradayaPalli	Check Dam	77.8765	14.8597	IWMP
170	Varadayapalli	VaradayaPalli	Check Dam	77.8791	14.8611	IWMP
171	Varadayapalli	VaradayaPalli	Check Dam	77.8789	14.8685	IWMP
172	Varadayapalli	VaradayaPalli	Check Dam	77.8803	14.8725	IWMP

173	Varadayapalli	VaradayaPalli	Check Dam	77.8670	14.8696	IWMP
174	Varadayapalli	VaradayaPalli	Check Dam	77.8686	14.8699	IWMP
175	Varadayapalli	VaradayaPalli	Check Dam	77.8715	14.8707	IWMP
176	Varadayapalli	VaradayaPalli	Check Dam	77.8867	14.8577	IWMP
177	Varadayapalli	VaradayaPalli	Check Dam	77.8801	14.8635	IWMP
178	Varadayapalli	VaradayaPalli	Check Dam	77.8526	14.8708	IWMP
179	Varadayapalli	VaradayaPalli	Check Dam	77.8609	14.8718	IWMP
180	Varadayapalli	VaradayaPalli	Check Dam	77.8925	14.8646	IWMP
181	Varadayapalli	VaradayaPalli	Check Dam	77.8896	14.8665	IWMP
182	Varadayapalli	VaradayaPalli	Check Dam	77.8883	14.8636	IWMP
183	Varadayapalli	VaradayaPalli	Check Dam	77.8868	14.8621	IWMP
184	Varadayapalli	VaradayaPalli	Check Dam	77.8858	14.8600	IWMP
185	Varadayapalli	VaradayaPalli	Check Dam	77.8845	14.8759	IWMP
186	Varadayapalli	VaradayaPalli	Check Dam	77.8854	14.8761	IWMP
187	Varadayapalli	VaradayaPalli	Check Dam	77.8878	14.8762	IWMP
188	Varadayapalli	VaradayaPalli	Check Dam	77.8901	14.8687	IWMP
189	Peddapappur	Peddapappur	Check Dam	77.8664	14.9361	IWMP
190	Peddapappur	Peddapappur	Check Dam	77.8543	14.9203	IWMP
191	Sommanapalli	J.Kothapalli	Check Dam	77.8964	14.8900	IWMP
192	Sommanapalli	J.Kothapalli	Check Dam	77.8938	14.8922	IWMP
193	Sommanapalli	J.Kothapalli	Check Dam	77.8927	14.8944	IWMP
194	Sommanapalli	J.Kothapalli	Check Dam	77.8908	14.8966	IWMP
195	Sommanapalli	SomannaPalli	Check Dam	77.8901	14.9104	IWMP
196	Sommanapalli	SomannaPalli	Check Dam	77.8898	14.9123	IWMP
197	Sommanapalli	SomannaPalli	Check Dam	77.8891	14.9155	IWMP
198	Sommanapalli	SomannaPalli	Check Dam	77.8898	14.9178	IWMP
199	Sommanapalli	SomannaPalli	Check Dam	77.8894	14.9196	IWMP
200	Sommanapalli	SomannaPalli	Check Dam	77.8890	14.9209	IWMP
201	Sommanapalli	SomannaPalli	Check Dam	77.8904	14.9192	IWMP
202	Sommanapalli	SomannaPalli	Check Dam	77.8957	14.9365	IWMP
203	Sommanapalli	SomannaPalli	Check Dam	77.8985	14.9398	IWMP
204	Namanankapalli	NamanankaPalli	Check Dam	77.8819	14.9021	IWMP
205	Namanankapalli	NamanankaPalli	Check Dam	77.8829	14.9030	IWMP
206	Namanankapalli	NamanankaPalli	Check Dam	77.8838	14.9033	IWMP
207	Garladinne	Garladinne	Check Dam	77.8620	14.9495	IWMP

208	Garladinne	Garladinne	Check Dam	77.8607	14.9476	IWMP
209	Garladinne	Garladinne	Check Dam	77.8588	14.9463	IWMP
210	Garladinne	Garladinne	Check Dam	77.8381	14.9522	IWMP
211	Garladinne	Garladinne	Check Dam	77.8534	14.9438	IWMP
212	Garladinne	Garladinne	Check Dam	77.8546	14.9483	IWMP
213	Garladinne	Garladinne	Check Dam	77.8565	14.9472	IWMP
214	Jutur	Jutur	Check Dam	77.9174	14.9338	IWMP
215	Jutur	Jutur	Check Dam	77.9177	14.9377	IWMP
216	Jutur	Jutur	Check Dam	77.9139	14.9221	IWMP
217	Jutur	Jutur	Check Dam	77.9132	14.9378	IWMP
218	Jutur	Jutur	Check Dam	77.9137	14.9360	IWMP
219	Jutur	Jutur	Check Dam	77.9072	14.9385	IWMP
220	Jutur	Jutur	Check Dam	77.9072	14.9385	IWMP
221	Jutur	Jutur	Check Dam	77.9027	14.9396	IWMP
222	Jutur	Thimmanacheruvu	Check Dam	77.8978	14.9396	IWMP
223	Jutur	Thimmanacheruvu	Check Dam	77.8984	14.9400	IWMP
224	Jutur	Thimmanacheruvu	Check Dam	77.8958	14.9364	IWMP
225	Jutur	Thimmanacheruvu	Check Dam	77.8968	14.9329	IWMP
226	Dharmapuram	Chinapappur	Check Dam	77.8734	14.9423	IWMP
227	Dharmapuram	Chinapappur	Check Dam	77.8664	14.9361	IWMP
228	Dharmapuram	ChinthalaPalli	Check Dam	77.8803	14.9541	IWMP
229	Dharmapuram	Dharmapuram	Check Dam	77.8871	14.9198	IWMP
230	Kummetha	Athiralladinne	Check Dam	77.8587	14.9909	IWMP
231	Kummetha	Athiralladinne	Check Dam	77.8558	14.9978	IWMP
232	Kummetha	Athiralladinne	Check Dam	77.8561	15.0000	IWMP
233	Kummetha	Athiralladinne	Check Dam	77.8526	14.9945	IWMP
234	Kummetha	Athiralladinne	Check Dam	77.8492	14.9949	IWMP
235	Kummetha	Athiralladinne	Check Dam	77.8438	14.9885	IWMP
236	Pasalur	KammavariPalli	Check Dam	77.8285	14.9635	IWMP
237	Pasalur	KottalaPalli	Check Dam	77.8431	14.9625	IWMP
238	Pasalur	KottalaPalli	Check Dam	77.8429	14.9657	IWMP
239	Pasalur	KottalaPalli	Check Dam	77.8435	14.9634	IWMP
240	Pasalur	KottalaPalli	Check Dam	77.8509	14.9608	IWMP
241	Pasalur	KottalaPalli	Check Dam	77.8543	14.9613	IWMP
242	Pasalur	KottalaPalli	Check Dam	77.8582	14.9622	IWMP

243	Pasalur	Sunkesulapalli	Check Dam	77.8730	14.9636	IWMP
244	Pasalur	Sunkesulapalli	Check Dam	77.8753	14.9649	IWMP
245	Pasalur	Sunkesulapalli	Check Dam	77.8707	14.9640	IWMP
246	Pasalur	Sunkesulapalli	Check Dam	77.8687	14.9643	IWMP
247	Pasalur	Sunkesulapalli	Check Dam	77.8672	14.9652	IWMP
248	Pasalur	Sunkesulapalli	Check Dam	77.8664	14.9646	IWMP
249	Cheemulavagupalli	CheemulavaguPalli	Check Wall	77.9096	14.9844	NREGS
250	Cheemulavagupalli	CheemulavaguPalli	Check Wall	77.9091	14.9845	NREGS
251	Peddayekkuluru	Peddayakkuluru	Check Wall	77.8232	14.9357	NREGS
252	Varadayapalli	VaradayaPalli	Check Wall	77.8874	14.8560	NREGS
253	Varadayapalli	VaradayaPalli	Check Wall	77.8889	14.8625	NREGS
254	Varadayapalli	VaradayaPalli	Check Wall	77.8852	14.8576	NREGS
255	Varadayapalli	VaradayaPalli	Check Wall	77.8903	14.8670	NREGS
256	Varadayapalli	VaradayaPalli	Check Wall	77.8924	14.8660	NREGS
257	Varadayapalli	VaradayaPalli	Check Wall	77.8802	14.8634	NREGS
258	Varadayapalli	VaradayaPalli	Check Wall	77.8800	14.8648	NREGS
259	Peddapappur	Peddapappur	Check Wall	77.8590	14.9179	NREGS
260	Peddapappur	Peddapappur	Check Wall	77.8580	14.9218	NREGS
261	Devanuppalapadu	Devanuppalapadu	Check Wall	77.7660	14.9005	NREGS
262	Devanuppalapadu	Devanuppalapadu	Check Wall	77.7737	14.9164	NREGS
263	Dharmapuram	ChinthalaPalli	Check Wall	77.8800	14.9516	NREGS
264	Pasalur	Pasalur	Check Wall	77.8626	14.9629	NREGS
265	Varadayapalli	VaradayaPalli	Check Wall	77.8802	14.8634	IWMP
266	Varadayapalli	VaradayaPalli	Check Wall	77.8800	14.8648	IWMP
267	Varadayapalli	VaradayaPalli	Check Wall	77.8852	14.8576	IWMP
268	Varadayapalli	VaradayaPalli	Check Wall	77.8874	14.8560	IWMP
269	Varadayapalli	VaradayaPalli	Check Wall	77.8889	14.8625	IWMP
270	Varadayapalli	VaradayaPalli	Check Wall	77.8903	14.8670	IWMP
271	Varadayapalli	VaradayaPalli	Check Wall	77.8924	14.8660	IWMP
272	Peddapappur	Peddapappur	Check Wall	77.8590	14.9179	IWMP
273	Peddapappur	Peddapappur	Check Wall	77.8580	14.9218	IWMP
274	Dharmapuram	ChinthalaPalli	Check Wall	77.8800	14.9516	IWMP
275	Pasalur	Pasalur	Check Wall	77.8626	14.9629	IWMP
276	Chagallu	Chagallu	MPT	77.8432	14.9108	NREGS
277	Peddapappur	Peddapappur	MPT	77.8592	14.9158	NREGS

278	Tabjula	Tabjula	MPT	77.8350	14.8824	NREGS
279	Tabjula	Tabjula	MPT	77.8362	14.8837	NREGS
280	Tabjula	Tabjula	MPT	77.8326	14.8846	NREGS
281	Tabjula	Tabjula	MPT	77.8344	14.8853	NREGS
282	Narasapuram	Jodidharmapuram	MPT	77.9176	14.9644	NREGS
283	Narasapuram	VengamPeta	MPT	77.9086	14.9647	NREGS
284	Peddapappur	Peddapappur	MPT	77.8592	14.9158	IWMP
285	Chagallu	Chagallu	PT	77.8406	14.9227	NREGS
286	Chagallu	Chagallu	PT	77.8477	14.9049	NREGS
287	Chikkepalli	Chikkepalli	PT	77.8417	14.8895	NREGS
288	Chikkepalli	Chikkepalli	PT	77.8547	14.8891	NREGS
289	Chikkepalli	Chikkepalli	PT	77.8511	14.8834	NREGS
290	Chikkepalli	Chikkepalli	PT	77.8669	14.8827	NREGS
291	Muchukota	Muchukota	PT	77.8622	14.8559	NREGS
292	Muchukota	Muchukota	PT	77.8450	14.8497	NREGS
293	Sommanapalli	SomannaPalli	PT	77.9025	14.9221	NREGS
294	Sommanapalli	SomannaPalli	PT	77.9135	14.9123	NREGS
295	Sommanapalli	SomannaPalli	PT	77.9023	14.9124	NREGS
296	Namanankapalli	NamanankaPalli	PT	77.8802	14.8972	NREGS
297	Garladinne	Garladinne	PT	77.8367	14.9499	NREGS
298	Garladinne	Garladinne	PT	77.8411	14.9541	NREGS
299	Garladinne	Garladinne	PT	77.8413	14.9360	NREGS
300	Jutur	Jutur	PT	77.9065	14.9237	NREGS
301	Devanuppalapadu	Devanuppalapadu	PT	77.7639	14.9058	NREGS
302	Devanuppalapadu	Devanuppalapadu	PT	77.7650	14.9111	NREGS
303	Kummetha	Kummetha	РТ	77.8880	14.9701	NREGS
304	Narasapuram	Narasapuram	PT	77.9040	14.9859	NREGS
305	Narasapuram	Narasapuram	PT	77.8924	14.9701	NREGS
306	Pasalur	KottalaPalli	PT	77.8388	14.9589	NREGS
307	Pasalur	KottalaPalli	PT	77.8276	14.9595	NREGS
308	Chikkepalli	Chikkepalli	PT	77.8417	14.8895	IWMP
309	Chikkepalli	Chikkepalli	PT	77.8547	14.8891	IWMP
310	Chikkepalli	Chikkepalli	PT	77.8511	14.8834	IWMP
311	Chikkepalli	Chikkepalli	PT	77.8669	14.8827	IWMP
312	Muchukota	Muchukota	PT	77.8450	14.8497	IWMP

313	Muchukota	Muchukota	РТ	77.8622	14.8559	IWMP
314	Sommanapalli	SomannaPalli	PT	77.9025	14.9221	IWMP
315	Sommanapalli	SomannaPalli	РТ	77.9135	14.9123	IWMP
316	Sommanapalli	SomannaPalli	PT	77.9023	14.9124	IWMP
317	Namanankapalli	NamanankaPalli	РТ	77.8802	14.8972	IWMP
318	Garladinne	Garladinne	PT	77.8367	14.9499	IWMP
319	Garladinne	Garladinne	PT	77.8411	14.9541	IWMP
320	Garladinne	Garladinne	PT	77.8413	14.9360	IWMP
321	Jutur	Jutur	PT	77.9065	14.9237	IWMP
322	Kummetha	Kummetha	PT	77.8880	14.9701	IWMP
323	Pasalur	KottalaPalli	PT	77.8388	14.9589	IWMP
324	Pasalur	KottalaPalli	PT	77.8276	14.9595	IWMP









Fig.5





