Groundwater Governance through Panchayat Raj Institutions in Andhra Pradesh

Progress Report

1st July to **30th September 2016**

Bharati Integrated Rural Development Society (BIRDS)

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1. Introduction

The 'Groundwater Governance through Panchayat Raj Institutions in Andhra Pradesh' pilot project is being implemented in five districts of Andhra Pradesh (Anantapur, Chittoor, Kadapa, Kurnool, and Prakasam), where FAO-APFAMGS successfully demonstrated the impact of demand-side water management in managing groundwater distress. In the pilot phase, the project aims to refurbish all groundwater monitoring infrastructure and establish linkages with Gram Panchayat for improved governance of this key resource. This initiative is co-funded by FAO and the Government of Andhra Pradesh. It is expected that the pilot initiative will develop a model for upscaling the project to cover all areas in these five districts.

The pilot project's duration is one year. The project has two major components. The first focuses on revitalizing the GMCs and HUNs formed under APFAMGS in 518 villages of the five districts. Additionally, it invests in repairing the PHM monitoring equipment to ensure that data collection is restored and done regularly. APFAMGS promoted Groundwater Monitoring Committees (GMCs) and Hydrologic Unit Networks (HUNs) are taking lead in technical data generation, water budgeting, crop planning and crop adoption. The second component focuses on initiating groundwater governance through Gram Panchayats in 72 villages of Kurnool district. This includes elements of water sharing to improve equity and access to water and thereby control new drilling and unsustainable water-use.

This pilot is being implemented in close collaboration with the groundwater and agriculture departments both for design of data collection formats and also for data validation. Additional inputs will be drawn from the departments of Groundwater, Rural Water Supply department, District Water Management Agency (DWMA), Micro Irrigation, Agriculture, Horticulture, Forestry, Soil Conservation, and Animal Husbandry in these districts as required.

BIRDS, the lead NGO in the erstwhile FAO-supported project is responsible for the project implementation. Improved groundwater governance involves coordination with the six partner agencies in implementing project activities such as, PHM data collection, data computerisation, data analysis, conduct of water-audit workshops, develop Demand-side Water Management (DSWM) plans, adoption of DSWM plan, capacity building of GP representatives, formation of farmer interest groups and farmer producer groups.

Activity Wise Progress Report *(July –September 2016)*

Project Staff Training

Not planned any staff training in this quarter.

Component 1: Participatory Hydrological Monitoring

Outcome 1: Hydrological Unit Networks (HUNs) in five districts make informed decisions on agriculture livelihoods taking into account water availability.

Two Outputs were envisaged to occur as a result of the implementation of the activities under Component 1, discussed in the following section.

Output 1.1: Local monitoring systems of hydrological monitoring operating

Target values and dates for realization of Output 1.1 were: a) Database of GP monitored data on groundwater levels, surface flow, rainfall and other meteorological parameters; in addition to secondary data on evapotranspiration for all land uses, drinking water and irrigation water usage, etc. for the 52 Hydrological Units spread over 5 districts. b) Soil moisture and soil organic carbon content improved in 52 HUs. c) Demand-side Water Management (DSWM)Plans using water balance/accounting and water audits prepared for 52 HUs facilitated through GPs.

Progress is: a) Orientation of Gram Panchayat (GP) office bearers meeting on water governance is progressing. b) Grama Jalamandali meetings have been conducted in 495 villages in each and every month. c) 198 WMC (GP Jalamandali) meetings and follow-up meetings have been conducted. d) 81 HUN meetings have been conducted in 52 HUNs (Last quarter balance HUN meetings 29 and this quarter meetings 52). e) Repair/Replace PHM equipment and display boards is yet to be initiated as the Department of Agriculture, Government of Andhra Pradesh is yet to complete the procurement of the equipment. f) PHM data and dissemination is being done in 463 wells that are presently functional; g) Data classification and entry is ongoing; h) Maintenance of PHM equipment is ongoing, however equipment for dysfunctional wells needs to be procured. The procurement specifications have been provided to the Department of Agriculture. We continue to follow up with the DoA on the procurement process. i) Benchmarking of soil moisture status using bio-indicators is progressing. j) Water –balance and accounting conducted 52 HU by using PHM data k) 52 Water Audit workshop conducted with the PHM indicators (Water Audit Report is enclosed as Annex 1).

Activities Planned October-December 2016: a) Orientation Gram Panchayat (GP) office bearers. b) Water Management Committees (WMC) follow up meetings c) Repair/Replace PHM equipment and display boards d) PHM data collection and dissemination e) Data classification and entry f) Maintenance of PHM equipment g) Crop Adoption Survey

Output 1.2: PHM data disseminated

Target values and dates for realization of Output 1.2 were: GPs and Farmers in 52 HUs have access to PHM data for improving water-use efficiency and reducing water pumping.

Progress is: a) Designed data applications for dissemination of PHM data in 198 GPs (rainfall and water level data); b) Designed applications for analyzing PHM data in 198 GPs (rainfall and water level data); and c) Dissemination of PHM data is ongoing.

Activities Planned October-December 2016: a) Dissemination of PHM data; and b) Analysis of PHM data in 198 GPs will continue.

Component 2: Water Governance

Outcome 2: Gram Panchayats of 11 HUs in Kurnool district actively manage water resources, including problem solving of issues related to drinking and irrigation water, through improved water monitoring and ensure adherence to demand-side management plan

Output 2.1: Gram Panchayats of 11 HUs in Kurnool district take lead in water governance

Target values and dates for realization of Output 2.1 were: GPs of 11 HUs have DSWM plans in place

Progress is: a) Developed water sharing norms b) Design water sharing arrangements for one GP**.**

Activities Planned October-December 2016: a) GP Survey (each NGO 3 GPs) b) PRI Office bearers promote linkages with Government programmes.

Water Sharing: Rain fed agriculture covers about 60% of the net sown area and accounts for 40% of the total food production. Empirical evidences suggest that assured or protective irrigation encourages farmers to invest more in farming technology and inputs leading to productivity enhancement and increased farm income. Objective is aimed at securing crops through providing irrigation.

Water sharing activity has been initiated in **Kotakandukuru GP** of **BIRDS**

Norms developed

- Farmers having good yielding bore well has to share water with adjacent rain fed farmers and also with whose bore well become defunct
- Farmers getting water should not drill separate bore well
- Priority given for irrigating bore well owner's field
- Attention to be given towards irrigating Crop of the farmer who receive water without disrupting the agreement
- Rs.1000/- has to be paid for one irrigation per acre to bore well owner

Water Sharing Arrangements

- 6 Farmers came forward to share water with other farmers
- 9 Farmers are getting water to irrigate the crop

Water sharing can be treated as a big step towards "**Revitalization of Rural Agriculture**"

Component 3: Farmer Producer Organizations (FPOs)

Outcome 3: Farmer Producer Organizations improve individual farmers' access to agriculture inputs, markets, and technology for judicious crop-water management

Output 3.1: Farmer Producer Organizations operational in Kurnool district

Target values and dates for realization of Output 3.1 were: a) List of HUNs registered as FPOs b) Market plans of 11 FPOs operational.

Progress is: a) FPOs meet regularly to discuss functioning of PHM data collection and dissemination in the FIG meetings. b) FPO Registered as "Ahobila Rythu Utpathidarula Sangam" Company Ltd. c) FPO farmers established a bakery.

Activities Planned October-December 2016: a) FIG training b) FPO training c) FPOs meet regularly to discuss functioning of PHM data collection and dissemination d) FPOs undertake market survey e) FPOs prepare a market plan.

FPO established with the objective of making available the good quality inputs seed, manure, plant protection material, etc., at one place and see that farmers get good price for the produce.

In pursuit of achieving the objectives of FPO, bakery is established

- Biscuits are being produced in bakery presently
- Millets cultivated locally are used in the preparation of biscuits
- FPO farmers are involved in the total process, right from production to marketing
- Marketing facility locally available for the farm produce and value addition made possible with the establishment of bakery
- Nutritive food become available to local people, especially children
- Bakery became the income generating source for the farmers, particularly the women farmers and FPO

GP Level Household survey: A household survey on water related issues was conducted in 14 GPs. 21 more GPs survey is planned in the next quarter.

The objectives of the survey were:

- To know the number of families belonging to various socio groups and the water consumption by them
- Various types of water consumption and their proportions
- Identifying issues related to water and sanitation, involving GP to solve those constraints.
- To assess the gap between supply and consumption at house hold level. Putting efforts to enhance the water use efficiency.
- To know the acceptance status of water from various sources

NGO wise GP Survey details

Sno	Name of the Grama Panchayathi(GP)	Name of the Mandal	District	PNGO
1	Kotakandukur	Allagadda	Kurnool	BIRDS
2	Madduru	Chagalamarri	Kurnool	BIRDS
3	Kethagudipi	Tarlupadu	Prakasam	CARVE
4	Bodapadu	Markapur	Prakasam	CARVE
5	Anumulapalli	Racherla	Prakasam	DIPA
6	Gowthavaram	Racherla	Prakasam	DIPA
7	Peddakurapalle	Ramasamudram	Chittoor	GVS
8	Elevanellore	Ramasamudram	Chittoor	GVS
9	Pendlimarri	Kalasapadu	Kadapa	PARTNER
10	Kondrajulapalli	Sakn	Kadapa	PARTNER
11	Mohiddinpuram	Ardhaveedu	Prakasam	SAFE
12	Bogolu	Ardhaveedu	Prakasam	SAFE
13	Dharmapuram	Gooty	Anantapur	SYA
14	Virupapuram	Peddavaduguru	Anantapur	SYA

Information collected from household survey shared in the Jalamandali meeting by exhibiting the data through posters which was headed by Sarpanch.

Visits: DHAN Foundation team members visited on 2nd July 2016

- Visited with the purpose of knowing how farmers of BIRDS adapted PHM concept and making use this in their project area
- Field visit on PHM at R. Krishnapuram : Visited OB well, RG station, Data display boards and interacted with volunteers

Review meeting: held at PMO Hyderabad on July 22nd 2016 by Dr. K.A.S Mani & Dr. C. KondaReddy Participants are: S. Abdulkhadar Project Coordinator, N. Rambabu Admi. & Doc. officer, S. Madhavi HF, R. Lakshmi NFE

- Reviewed the materials developed out of the GPs survey
- Discussed regarding the documentation of GPs survey
- Developed the spread sheets for the CWB package of GwG Project
- Discussed about the interventions to be carried in GPs regarding "Water Governance"

Activity wise Progress and Plan

Activity code	Activity	Achievement Up to September 2016	Plan Oct – Dec. 2016
	Project Inception Workshop	1	
	Project Staff Training	6	
Component 1: Participatory Hydrological Monitoring			
Activity 1.1.1:	Orient Gram Panchayat (GP) office bearers		
	a) Intimation to GP office bearers		
	b) Preparatory work for orientation		
Activity 1.1.2:	GMC meetings	495	On going
Activity 1.1.3:	Federate Gram Panchayats at the Hydrological Unit (HU) level (HUN meetings)		
	a) formation of WMC at GP level	198	
	b) Formation to GP level WMC members at HUN level Meeting	52	
Activity 1.1.4:	Repair/Replace PHM equipment and display boards		
	a) Procurement of PHM Equipment		
	b) Preparing the details of PHM (OB wells, RGs etc) repairs and replacements		
Activity 1.1.5:	PHM data collection and dissemination	On going	On going
Activity 1.1.6:	Data classification and entry	On going	On going
Activity 1.1.7:	Maintenance of PHM equipment	On going	On going
Activity 1.1.8:	Data collection on PHM impact (Average crop yields, water harvested, water saved, etc.)		
Activity 1.1.9:	Benchmarking of soil moisture status using bio-indicators		
Activity 1.1.10:	Soil nutrient analysis		
	a) Collection of Soil Samples		
Activity 1.1.11:	Collect crop plans for the upcoming season	52	
Activity 1.1.12:	Conduct Water Audit workshops	52	
Activity 1.1.13:	Develop DSWM Plans for each HU		
Activity 1.1.14:	Conduct DSWM adoption survey		52
Activity 1.2.1:	Design data applications for dissemination of PHM data	2	
Activity 1.2.2:	Design applications for analyzing PHM data	2	
Activity 1.2.3:	Disseminate PHM data	On going	On going
Component 2: Groundwater Governance			
Activity 2.1.1:	Vision building workshops	2	
	a) Intimation to WMC members for Workshop		
Activity 2.1.2:	PRI Office bearers promote DSWM through linkages with government programmes		1
Activity 2.1.3:	Develop water sharing norms	1GP	
Activity 2.1.4:	Design water sharing arrangements	1GP	
Activity 2.1.5:	Develop DSWM plan for each GP and consolidate it at HU-		

Activity code	Activity	Achievement Up to September 2016	Plan Oct – Dec. 2016
	level		
Activity 2.1.6:	Implement DSWM plan		
Component 3: Farmer Producer Organizations (FPOs)			
Activity 3.1.1:	Formation of FIGs	33	
	a) Preparatory meetings for FIGs formation		
Activity 3.1.2:	FIGs Training	1	1
	a) Intimation for FIGs training		
Activity 3.1.3:	11 HUNs in Kurnool district reorganized as FPOs		
Activity 3.1.4:	11 FPOs Orientation Training	1	1
Activity 3.1.5:	FPOs meet regularly to discuss functioning of PHM data collection and dissemination	1	Ongoing
Activity 3.1.6:	FPOs – District level functionaries workshops		
Activity 3.1.7:	FPOs undertake market survey		1
Activity 3.1.8:	FPOs prepare a market plan		1
Activity 3.1.9:	FPOs undertake market operations of agriculture produce		

Annex - 1

Water Audit Report

Summary

Water Audit workshops are conducted in 52 Hydrological Units at 7 PNGOs for 2016-17 Hydrological Year. We prepared report for 1 Hydrological Unit from each PNGO. 496 Farmers participated in 7 workshops. 12.5 MCM of ground water recharged into ground, of that 9.3 MCM recharged through direct rainfall and 3.2 MCM recharged through secondary recharge sources. Average projected rainfall for the Kharif season (June to September) is 340.3 mm. 17.8 MCM of groundwater is used for Rabi crops as well as 10.2 MCM of groundwater is required for survival of Kharif crops. Planned kharif crops are Rice, Sweet orange, groundnut, cotton, chilly, sunflower, Maize, Redgram, Blackgram, Citrus, Turmeric, Flowers and tomato under Bore wells and Green gram, Red gram, Bengal gram, Black gram, Jowar, Foxtile millet ,Maize and Bajra are the rain fed crops in the Kharif season. Average pumping hours in the project area is 5; Average bore well discharge in kharif season is 20,028 litters; 2,666 bore wells and are to be utilized in the projected kharif season.

Water Audit workshop is one of the key activity in PHM implementation accomplished under Component 1 ; outcome 1; Output 1.1, indicator c. 52 Water Audit workshops were conducted in 52 hydrological units in the months of August and September 2016. Table 1: illustrate the rendezvous of the crop water budget workshops in 7 Hydrological units.

Table 1: Dates of Water Audit workshops organised in the Seven Hydrological Units

Sno	PNGO	HU Name	Water Audit Workshop Date	Participants		WMC (Jalamandali) Members	
				Male	Female	Male	Female
1	BIRDS	Peddavagu	31.08.2016	85	17	28	4
2	CARVE	Yadalavagu	21.9.2019	45	22	11	8
3	DIPA	Rallavagu	17.09.2016	33	23	14	8
4	GVS	Diguvetigadda	18.09.2016	48	7	9	5
5	PARTNER	Bokkineru	24.09.2016	39	13	6	3
6	SAFE	Jampaleru vagu	15.09.2016	30	52	20	32
7	SYA	Upparavanka	29.08.2016	61	21	58	21

52 HUs Water Audit workshops Dates and farmers' participations

S.No	HU Name	Water Audit Workshop Date	Participants		WMC (Jalamandali) Members	
			Male	Female	Male	Female
BIRDS						
1	Peddavagu	31-08-2016	85	17	28	4
2	Chinneru	07-19-2016	85	38	63	21
3	Yerra vanka	08-09-2016	63	29	23	14
4	Lothu vagu	10-09-2016	34	25	9	16
5	Ralla vagu	14-09-2016	75	23	51	11

S.No	HU Name	Water Audit Workshop Date	Participants		WMC (Jalamandali) Members	
			Male	Female	Male	Female
6	Koneti vanka	15-09-2016	63	33	36	8
7	Bhavanasi	16-09-2016	76	27	44	12
8	Chandra vagu	17-09-2016	57	26	16	8
9	Buchamma koneti vanka	19-09-2016	48	19	4	3
10	Thundla vagu	20-09-2016	59	28	35	8
11	Pedda vanka	21-09-2016	65	26	15	11
CARVE						
12	Yadalavagu	21/9/2019	45	22	11	8
13	Chinnauppuvagu	22/9/2016	48	27	13	11
14	Naidupalli	23/9/2016	52	34	21	16
15	P.Nagulavaram	24/9/2016	55	27	18	12
16	S.N.Varam	24/9/2016	45	29	23	11
17	M.M.Palli	25/9/2016	40	32	12	9
18	Tarlupadu	25/9/2016	40	24	17	11
19	Lingojipalli	26/9/2016	43	27	16	13
20	Mekaleru	26/9/2016	50	30	12	9
21	Bodicherla	27/9/2016	57	33	16	14
22	Erravagu	27/9/2016	43	29	14	11
23	Kanugulavagu	28/9/2016	48	32	9	6
24	Pulivagu	28/9/2016	52	23	13	6
DIPA						
25	Rallavagu	17.09.2016	33	23	14	8
26	Peeturuvu	19.09.2016	38	25	24	16
27	Narsireddypallivagu	23.09.2016	37	20	18	13
28	Palamotuvagu	24.09.2016	38	18	19	14
29	Uppuvagu	28.09.2016	37	19	21	13
GVS						
30	Diguvetigadda	18-09-2016	48	7	9	5
31	Nakkillavagu	19-09-2016	28	17	5	4
32	Rommonivagu	20-09-2016	35	8	7	5
PARTNER						
33	Erravanka	16.09.2016	38	16	6	3
34	Taduku	18.09.2016	46	12	8	4
35	Erravagu	21.09.2016	34	7	5	3
36	Mulabandala	22.09.2016	42	14	7	5
37	Bokkineru	24.09.2016	39	13	6	3
38	Thandrasila	27.09.2016	31	8	4	3
SAFE						
39	Jampaleru vagu	15.09.2016	30	52	20	32
40	Vemuleru vagu	17.09.2016	40	44	32	30
41	Kakarla (Pedda) vagu	20.09.2016	34	40	22	28

S.No	HU Name	Water Audit Workshop Date	Participants		WMC (Jalamandali) Members	
			Male	Female	Male	Female
42	Bogolu vagu	23.09.2016	30	35	13	12
43	Sudhakuruva vagu	26.09.2016	35	38	14	13
44	Singarayakonda vagu	27.09.2016	40	45	36	42
45	Chavata vagu	29.09.2016	39	51	25	28
SYA						
46	Gooty Maruvananka	20/08/2016	47	29	38	24
47	Bellamvanka	21/08/2016	39	23	36	20
48	Maruvavanka	22/08/2016	48	22	45	19
49	Vajralavanka	23/08/2016	44	25	42	24
50	Maynapuram vanka	24/08/2016	37	31	35	28
51	Peddavanka	26/08/2016	45	27	41	22
52	Upparavanka	29/08/2016	61	21	58	21
			2421	**1350**	**1129**	**695**

Key activities in Water Audit Workshop: Key activities in Water Audit can be divided into i) pre-Water Audit activities, ii) Water Audit workshop and iii) post Water Audit activities.

i) Pre Water Audit activities:

- Habitation level WMC meetings in all habitations and HU level HUN meeting
- Consolidation of rainfall for June to September
- Well censes data collection
- Consolidation of water level and discharge data
- Inventory of secondary sources
- Calculation of projected rainfall for June to September.
- Farmer's Kharif crop plan data collection
- Data entry in Water Audit spread sheets and generation of results
- Sharing Water Audit results with WMC members
- Water Audit workshop schedule preparation
- Invite CBO leaders, officers and scientist to the workshop

ii) Water Audit Workshop

- Conduct Water Audit workshop

iii) Post Water Audit activities

- Farmer's crop adaption data collection
- Consolidation of actual rainfall data during June to September2016
- Generate final crop water budget results at the end of September 2016
- Sharing the final results with WMC.

Data required for Water Audit workshop

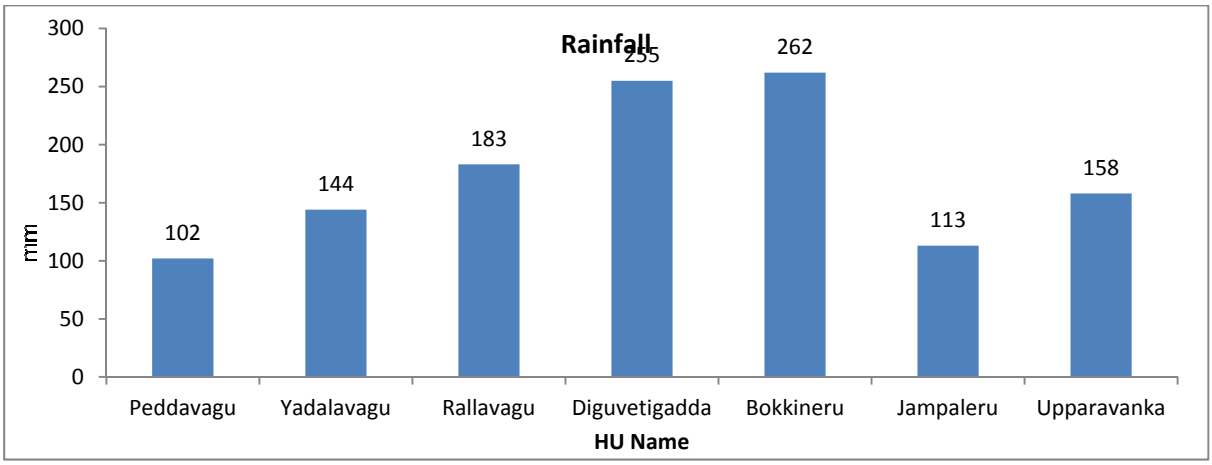
- HU area, Geology of the HU and received rainfall
- Projected rainfall for June to September
- Pumping bore wells/dug well/dug cum bore wells in the HU; average well pumping days; average pumping hours and average well discharge.
- Type and number of secondary water resources lies in the hydrological unit; no. of fillings days happened in the water resources due rainfall; average depth of water column in the water resources; average water submerged areas; and average no. of days water availability (water storage) in the secondary resources.
- Farmer's crop plan data in the hydrological unit

HU and WMC village level meetings: Hydrological Unit level WMC meeting is the first activity to gear up in the process of the Crop Water Budget workshop. In the meeting HU – WMC had prepared detailed plan for the Water Audit workshop. It was send to all habitation level WMC committees to seek required actions at village level like collection of necessary data which is mentioned in the above paragraph for generation of crop water balance and enlistment of community to Water Audit workshop. In the project area in the 7 hydrological units, 7 HU level WMC meetings and 496 habitation level WMC meetings were conducted as per plan.

Received Rainfall during November to May: Rainfall is the key factor in the process of computing groundwater recharge. Figure: 2 shows the amount of rainfall received in 7 hydrological units. Highest rainfall (262 mm) was received in Bokkineru hydrological unit and followed by Diguvetigadda (255mm); Rallavagu (183 mm); Upparavanka (158mm); Yadalavagu (144 mm):Jampaleru (113mm) and Peddavagu (102 mm) which was surrounded by Nallamalai forest of Kurnool, Prakasam, Kadapa and Chittoor districts respectively. Peddavagu (Kurnool) received lowest rainfall about 143 mm.

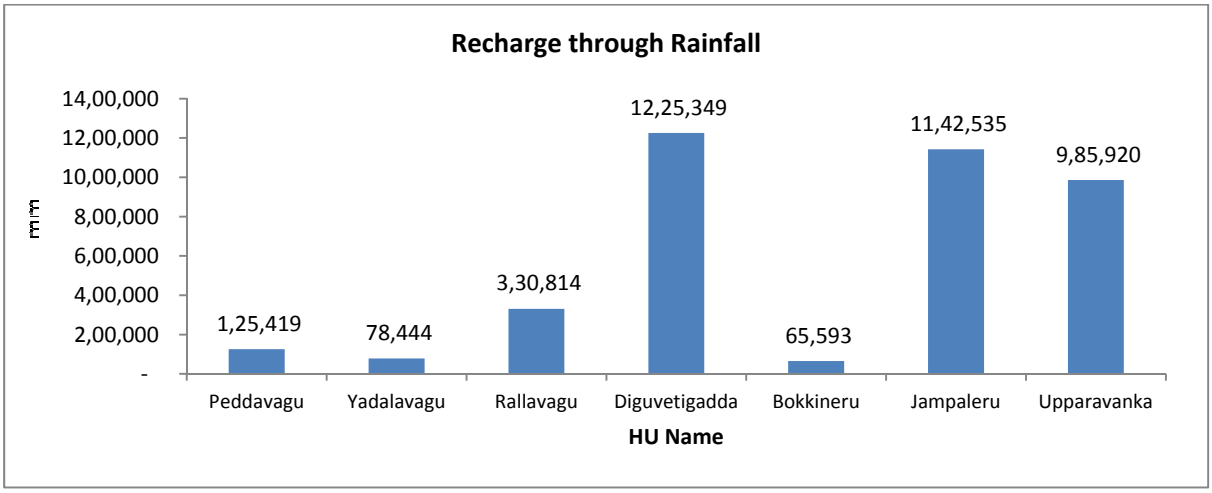
Across the project average received rainfall during November - May in the project area is 173 mm. Three hydrological units via, Bokkineru, Diguvetigadda, Rallavagureceived more than average rainfall, whereas Upparavanka, Yadalavagu, Jampaleru and Peddavagu received less than average rainfall.

Figure 2: Ground water recharge during November – May 2016



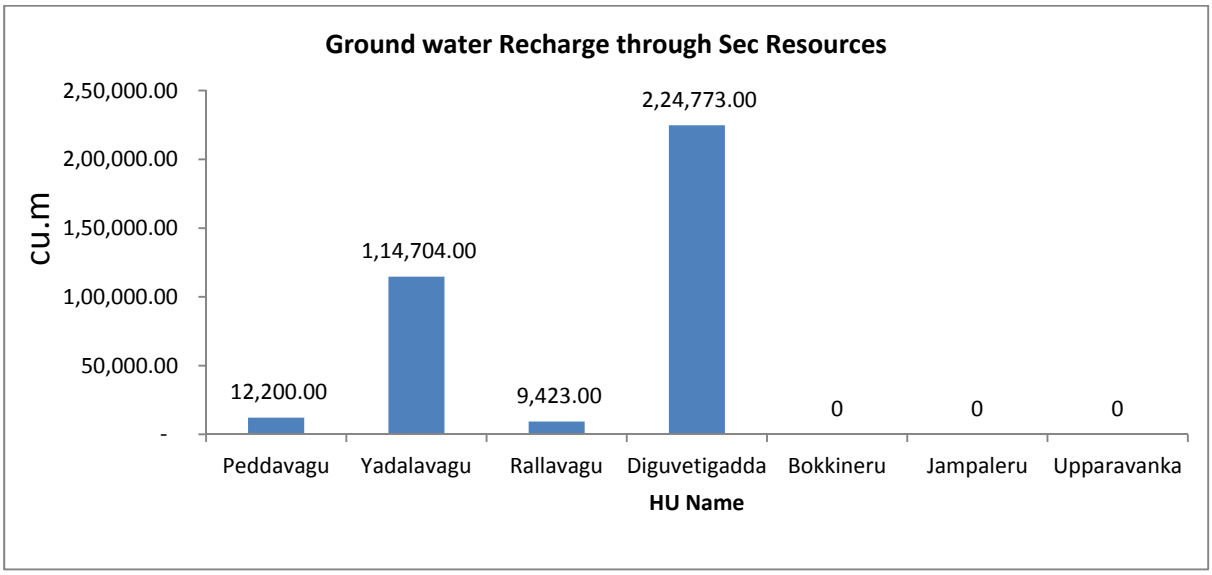
Groundwater Recharge during November to May: Amount of groundwater recharge depends on the geology of the area, amount of rainfall received and rate of recharge of each geological formation of the hydrological unit. Based on these parameters highest groundwater recharge (12,25,349 Cu.m) was happened in the Diguvetigadda hydrological unit, followed by Jampaleru (1142535 Cu.m), Uppaavanka (985920Cu.m), Rallavagu (330814Cu.m), Peddavagu (12549Cu.m), Yadalavagu (78444 Cu.m),) and Bokkineru received (78444). Figure 3 shows the ground water recharge in different hydrological units.

Figure 3: Groundwater Recharge during Rain fall November –May 2016.



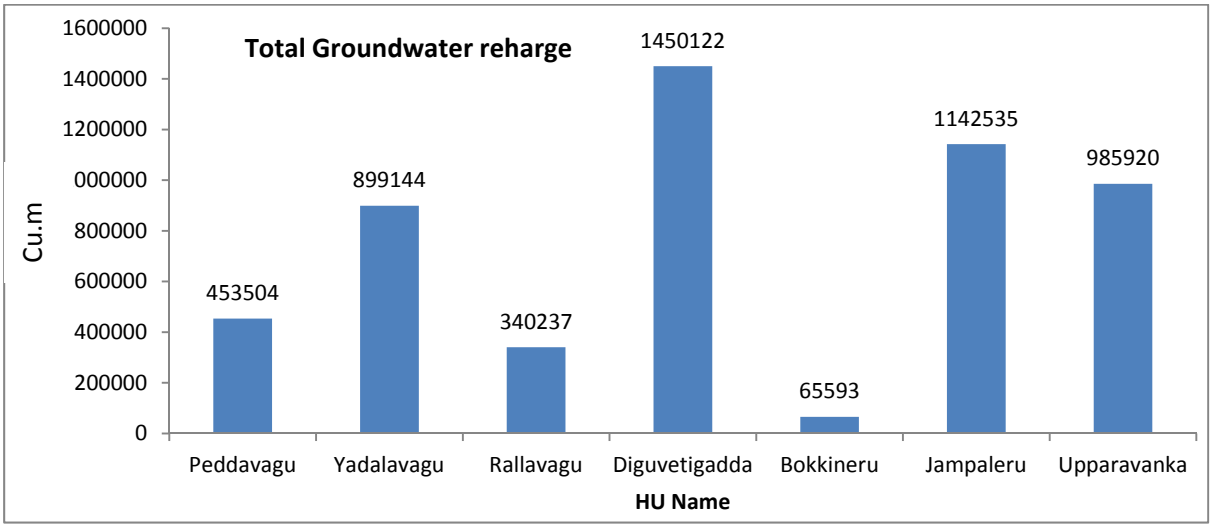
Groundwater Recharge Secondary Resources during November to May: Amount of groundwater recharge depends on the geology of the area, amount of Secondary Resources received and rate of recharge of each geological formation of the hydrological unit. Based on these parameters highest groundwater recharge (224773Cu.m) was happened in the Diguvetigadda hydrological unit, followed by Yadalavagu (114704 Cu.m), Pedavagu (12200 Cu.m), Rallavagu (9423 Cu.m), Upparavanka, Jampaleru and Bokkineru (0 Cu.m)). Figure 4 shows the ground water recharge Secondary resources in different hydrological units

Figure 4: Ground water Recharge secondary Resources November –May 2016



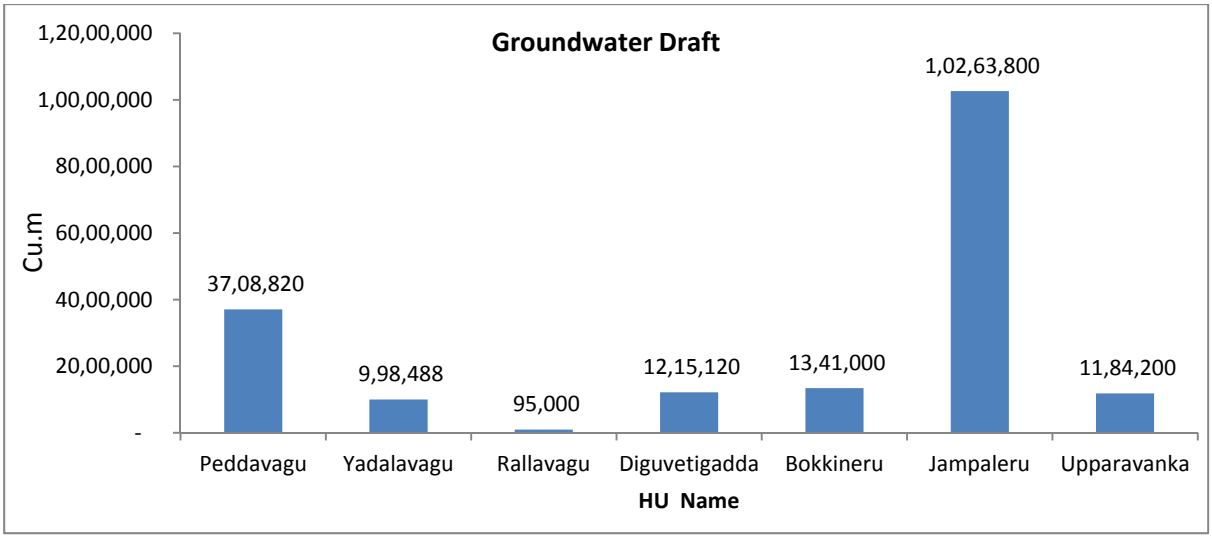
Total Groundwater Recharge during November to May: Amount of groundwater recharge depends on the geology of the area, amount of rainfall received and Secondary resources of each geological formation of the hydrological unit. Based on these parameters highest groundwater recharge (1450122 Cu.m) was happened in the Diguvetigadda hydrological unit, followed by Jampaleru (1142535 Cu.m), Upparavanka (985920 Cu.m), Yadalavagu (899144 Cu.m), Peddavagu (453504 Cu.m), Rallavagu (340237 Cu.m), and Bokkaneru received (65593 Cu.m). Figure 5 shows the ground water recharge in different hydrological units.

Figure 5: Total Groundwater Recharge November –May 2016



Groundwater draft during November to May : During November to May(10263800 Cu.m) of groundwater was lifted from wells in Jampaleru hydrological unit, followed by Peddavagu (3708820 Cu.m), Bokkineru (13410000 Cu.m), Diguveti vanka (1215120 Cu.m), Upparavanka(1184200 Cu.m), Yadalavagu (998488 Cu.m), and lowest draft recorded in Rallavagu (95000 CU.M). Figure 6: shows the ground water draft during November to May, 2016 in the project area.

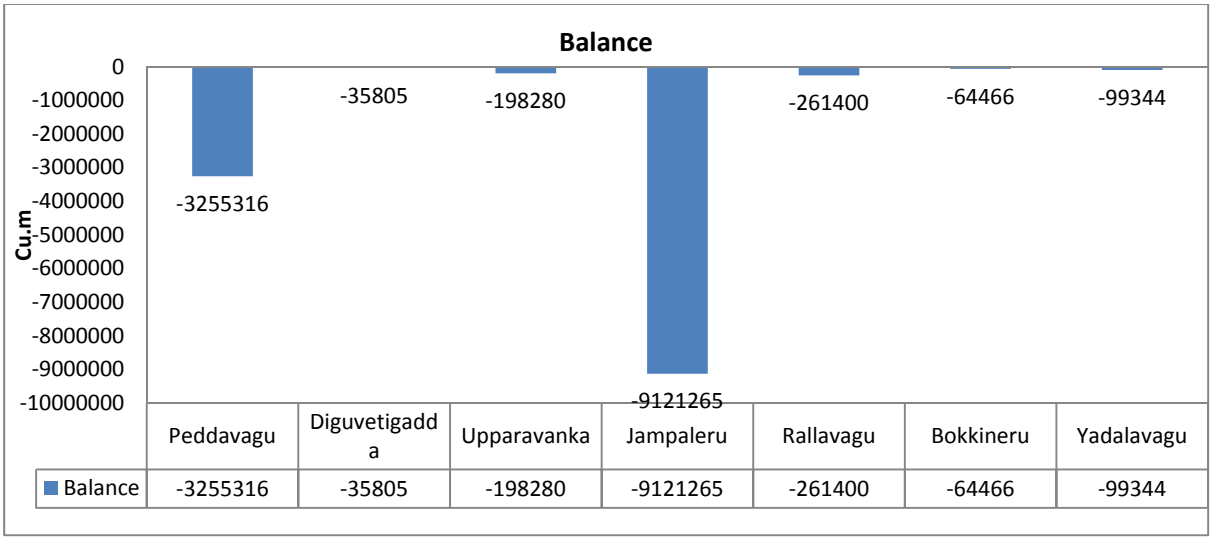
Figure 6: Groundwater Draft November –May 2016



Groundwater Balance: Balance means discrepancy between groundwater recharge to draft. Out of the 7 hydrological UnitsPedda vagu, Diguveti gadda, Upparavanka, Jampaleru Rallavagu, Bokkineru, Yadlavagu hydrological units groundwater balance in the period of November to May. where as seven hydrological units named shows deficit ground water balance.

Deficit ground water balance shows in seven hydrological units. Of the five highest groundwater deficit (-6.3 MCM) recorded in Nathiganicheruvu hydrological unit, lowest deficit (-0.1 MCM) available in Rommonivagu hydrological Unit. Bokkineru, Narsirerddypallivagu and Yadalavagu hydrological units shows the deficit groundwater balance of -3.3 MCM, -2.0 MCM and -0.2 MCM respectively. Figure 7: shows the ground water balance during June to October in the project area.

Figure 7: Groundwater Balance November –May 2016



Projected Kharif June to September 2016-2017

Projected Rainfall during June to September: Rainfall is the key factor in the process of computing groundwater recharge. Figure: 8 shows the amount of rainfall received in 7 hydrological units. Highest rainfall (513 mm) was received in Peddavagu hydrological unit and followed by Bokkineru (442mm); Yadalavagu (415): Diguvetigadda (402 mm); Rallavagu (393.3 mm); Upparavanka (303.7 mm): and Jampaleru (143 mm) which was surrounded by Nallamalai forest of Kurnool, Prakasam, Kadapa and Chittoor districts respectively. Jampaleru (Prakasam) received lowest rainfall about 143 mm.

Across the project average received rainfall during June to September in the project area is 340 mm. Four hydrological units via, Peddavagu, Diguvetigadda, Bokkineru, Rallavagu received more than average rainfall; whereas Upparavanka, Yadalavagu, Jampaleru received less than average rainfall.

Figure 8: Rainfall received during June –September 2016 Projection

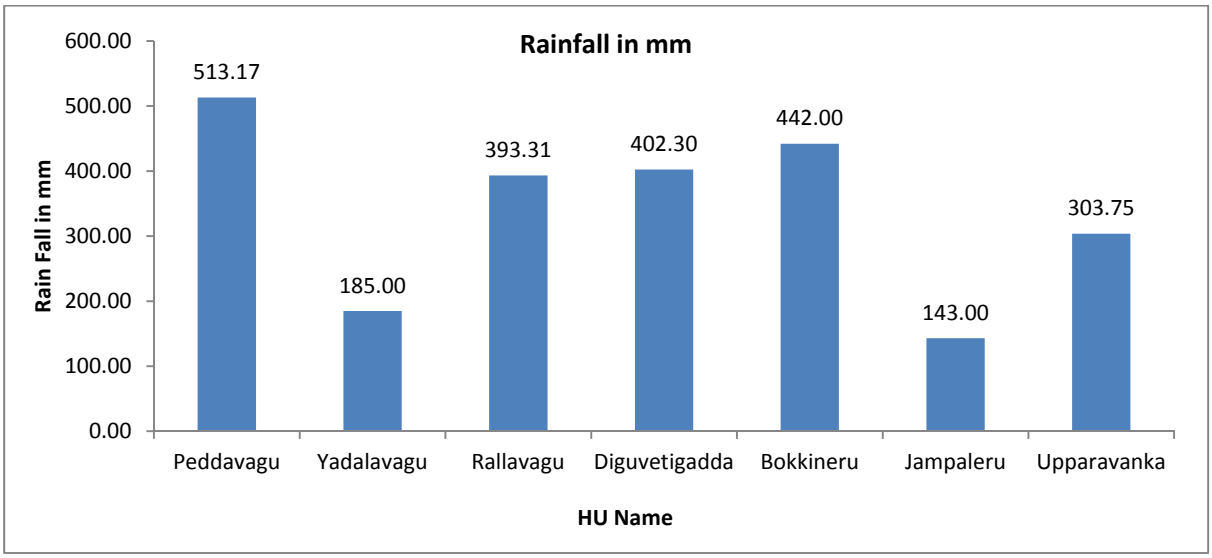


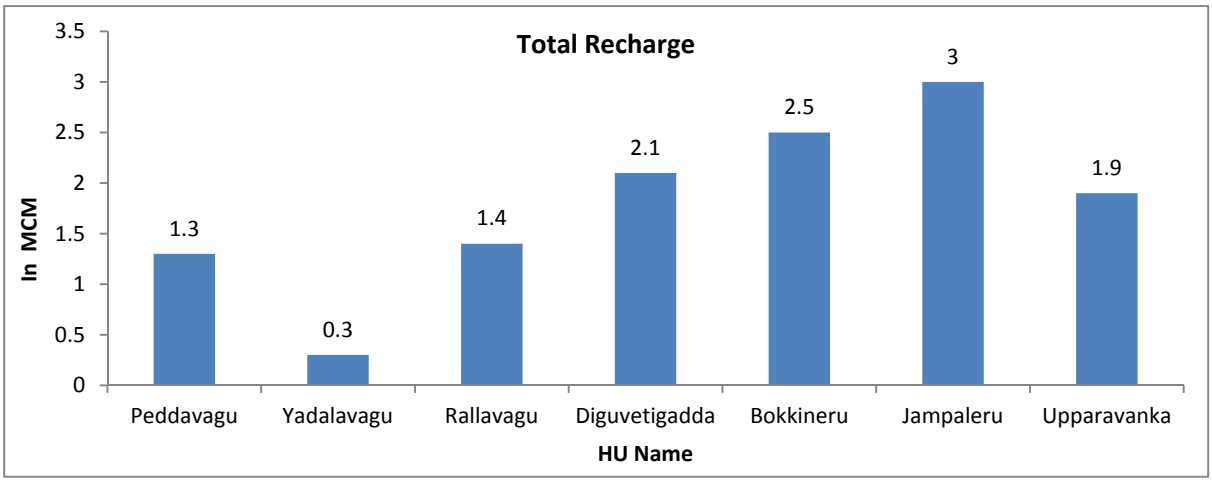
Table: Area of each geological formations and recharge rates estimated by GEC, 97

S.No	HU Name	PNGO	Rock type	Recharge rate (%)	Area in Hector
1	Peddavagu	BIRDS	Massive pudly fractured rock	1	276
			phyllites and shales	4	659
			Consolidate sand stone quartzite, lime stone	6	1564
2	Yadalavagu	CARVE	Phylites and shales	4	13618.75
3	Rallavagu	DIPA	Phyllites and shales	4	3567.50
			Consolidate sandstone, quartzite, limestone (except cavernous)	6	3807.25
4	Diguvetigadda	GVS	Weathered Garnet, Gneiss, and Schist with significant clay content	8	156.5
			Weathered Granet, Gneiss,and Schist with Low clay content	11	4256
5	Bokkineru	PARTNER	Quartzite	1	6325
			Shale	4	7669
6	Jampaleru	SAFE	Massive poorly fractured rock	1	28,984
			Phyllites and shales	4	18,144
7	Upparavanka	SYA	Weathered Granite, Gneiss, and Schist with significant clay content	8	7800

Projected Total Groundwater Recharge during June to September: Amount of groundwater recharge depends on the geology of the area, amount of rainfall received and rate of recharge of each geological formation of the hydrological unit. Based on these parameters highest groundwater recharge (3.4MCM) was happened in the Yadalavagu hydrological unit, followed by Jampaleru (3.0 MCM) Bokkineru (2.5MCM), Diguveti gadda (2.1MCM), Upparavanka (1.9MCM), Rallavagu (1.4

MCM), Peddavagu (1.3 MCM), and Yadalavagu received (0.3MCM). Figure 9 shows the ground water recharge in different hydrological units

Figure 9: Total Recharged during June –September 2016 Projection



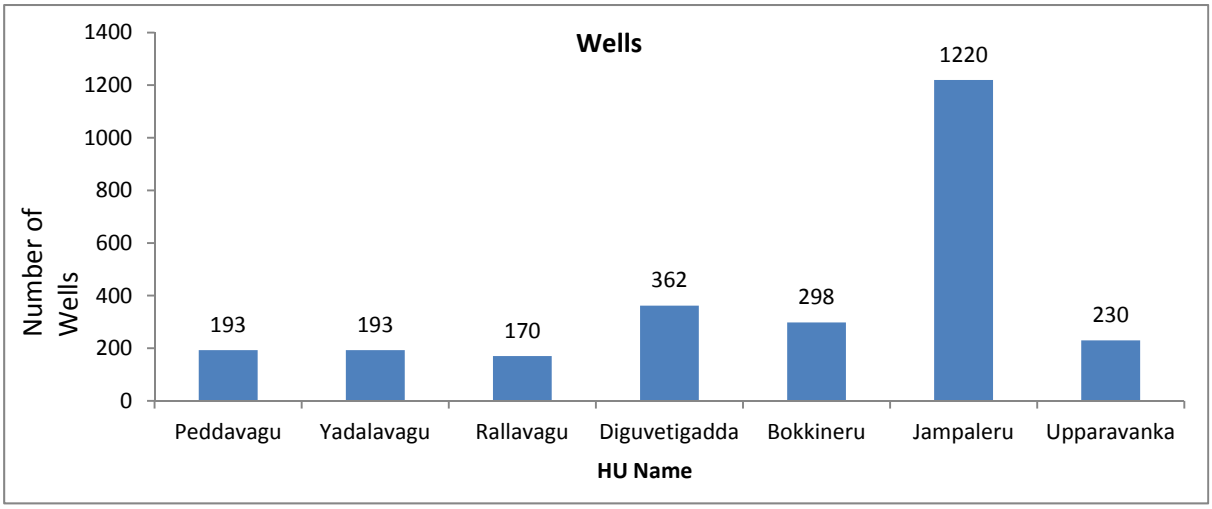
Projected Groundwater draft during June to September: Groundwater draft can be calculated by using the parameters like a) no. of functioning wells in the hydrological unit, b) number of pumping hours in a day, c) no. of pumping days during the kharif season and d) average bore well discharge in the hydrological unit. Table 4: shows the details of the above parameters employed in the project area.

Table4: Parameters employed for groundwater draft in the project area during June to September

S.NO	HU Name	PNGO	WELLS	Pumping hours	Pumping days	well Discharge in Liters /Hour
1	Peddavagu	BIRDS	193	5	25	40000
2	Yadalavagu	CARVE	193	4	28	13200
3	Rallavagu	DIPA	170	5	25	40000
4	Diguvetigadda	GVS	362	5	115	9000
5	Bokkineru	PARTNER	298	5	45	20000
6	Jampaleru	SAFE	120	5	90	6000
7	Upparavanka	SYA	230	6	85	12000

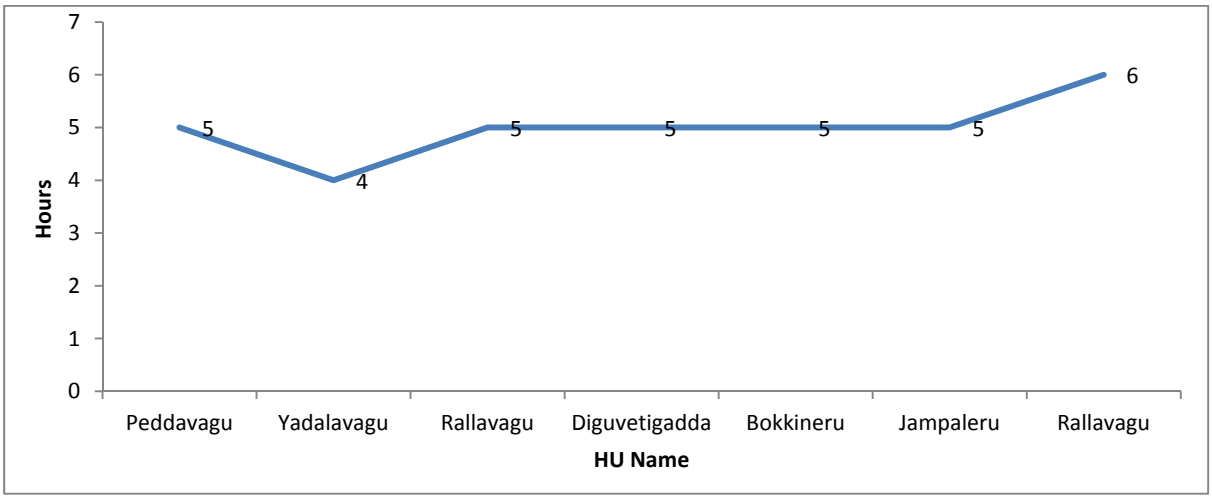
Functining wells during June to September – Projected: 1,220 bore wells are used during June to September in Jampaleru hydrological unit of Prakasam district. 435bore wells are employed in the Yadalavagu hydrological unit of prakasam district. 362 bore wells are used for groundwater exploitation in Diguvetigadda of Chittoor district. 298bore wells are bringing to use in Bokkineru Hydrological Unit of Kadapa district. Upparavanka farmers used 230 borewells followed by Peddavagu193 borewells and 170 bore wells functioned at Rallavagu Hydrological Unit. Figure 10: shows the number of wells employed in the project area during June to Sept.

Figure 10: Wells employed in the project area during June to September 2016



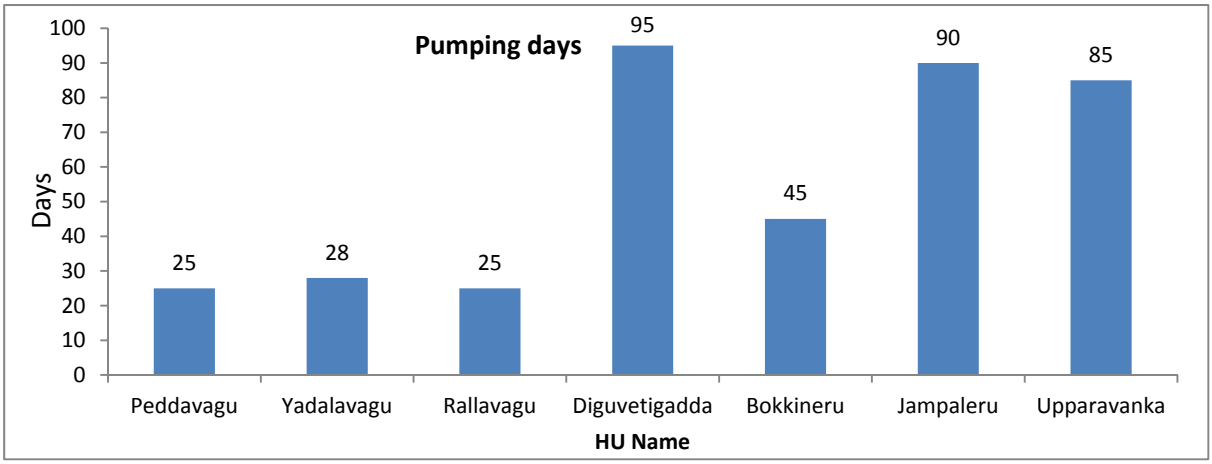
Pumping hours during June to September – Projected: At project level average pumping hours is 5 hours. Six hours is the height pumping hours in a day recorded in Upparavanka hydrological unit of Ananthapur district. Five hours a day was recorded in six hydrological units named as Peddavagu of Kurnool district, Diguvetigadda of Chittoor district, Yadalavagu, Jampaleru and Rallavagu of Prakasam district respectively. Figure 11: shows the pumping hours in a day in the project area during June to October.

Figure 11: Pumping hours in the project area during June to September.



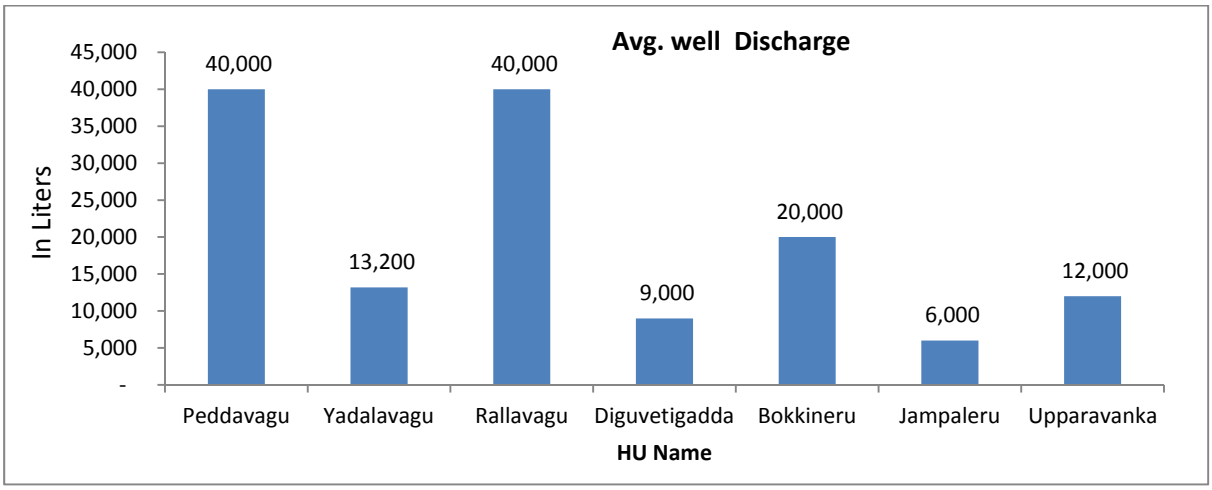
Pumping days during June to September – Projected: Possible maximum pumping days during June to September is 120. Height pumping days (115) are recorded in Diguvetigadda of Chittoor district and lowest (25) is recorded in Peddavagu and Rallavagu hydrological units. HUs falling in between is Jampaleru 90 days, Upparavanka 85 days, Yadalavagu 65 days, Bokkineru 45 days. Figure 12: shows the pumping days in the project area

Figure 12: Pumping days in the project area during June to October



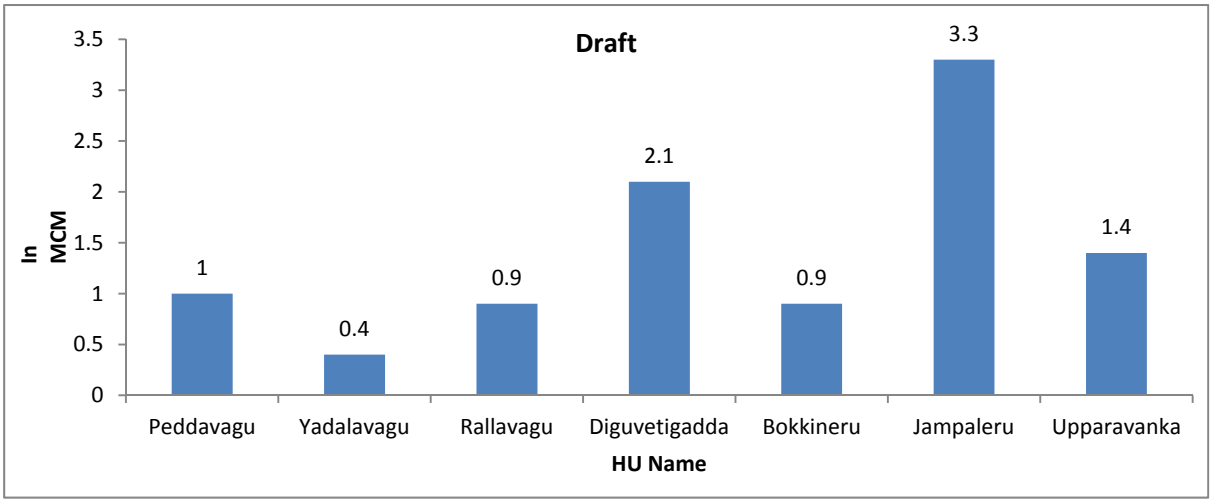
Well discharge during June to September – Projected: Discharge is defined as average amount of water (liters) comes out from the bore well in an hour in the hydrological unit. Highest well discharge (40,000 liters) was recorded in Peddavagu and Rallavagu Hydrological Unit whereas lowest recorded in Jampaleru (6,000 liters). HUs falling in between is Bokkineru (20000 liters), Yadalavagu (12857 liters), Upparavanka (12,000 liters), Diguvetigada (9,000 liters). Figure 13: shows the average amount of water discharged from the wells during June to September in the project area

Figure 13: Wells discharge in the project area during June to September



Projected Groundwater draft during June to September: During June to September 3.3 MCM of groundwater was lifted from wells in Jampaleru hydrological unit, followed by Diguveti gadda (2.1 MCM), Yadalavagu (1.8 MCM), upparavanka (1.4 MCM), Peddavagu (1.0 MCM), and lowest draft recorded in Rallavagu and Bokkineru (0.9 MCM). Figure 14: shows the ground water draft during June to September, 2016 in the project area.

Figure 14: Projected kharif draft in the project area during June to September



Projected Groundwater Balance: Balance means discrepancy between groundwater recharge to draft. Out of the seven hydrological units Seven HUs via, Yadalavagu, Rallavagu, Jampaleru, Upparavanka, Peddavagu, Bokkineru and Diguvetigadda Hydrological Unit poses surplus groundwater balance in the estimation period of June to September.

Surplus groundwater balance is available in the seven hydrological units. Of this highest surplus groundwater balance (17,31,758 cu.m) happened in the Yadalavagu hydrological unit, followed by Rallavagu (621792cu.m), Jampaleru (5,47,251cu.m), Upparavanka (4,02,864cu.m), Peddavagu (3,78,536Cu.m), Bokkineru (1,39,422cu.m) and lowest surplus balance (19,271cu.m) available in Diguvetigadda. Figure 15: shows the ground water balance during June to September in the project area.

Figure 15: Projected Kharif Balance in the project area during June to September

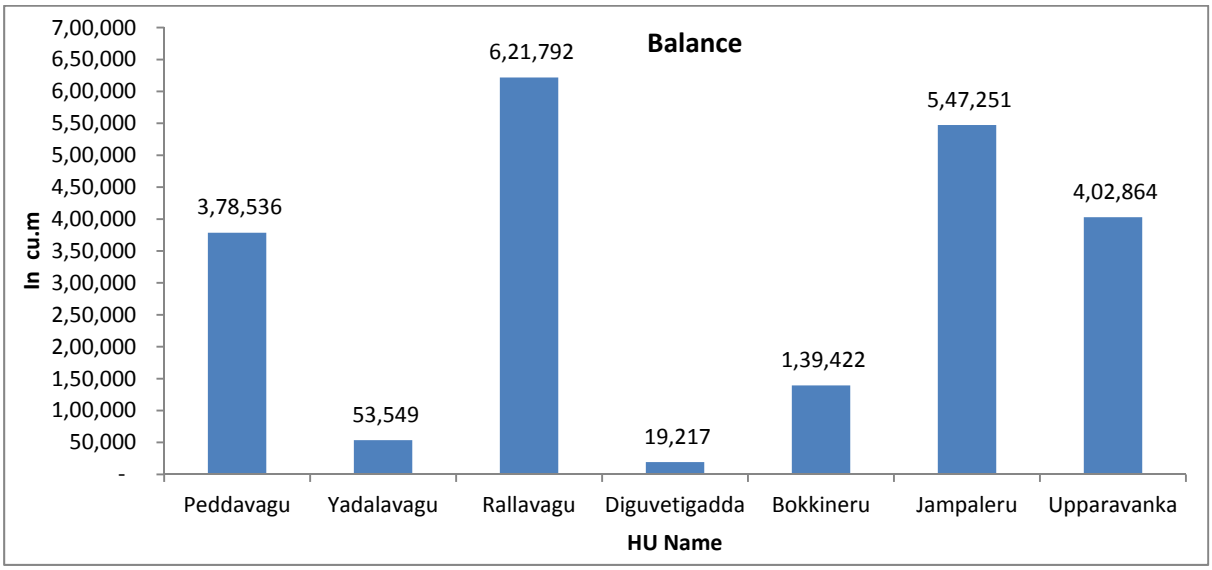


Table 5: Surface Water Tanks employed for secondary recharge in the project area

S. No	PNGO	Hydrological unit	No. of Structures	Water Sub mergence area in acres	Avg Depth of water column in meters	Avg. Days of Water Storage	G W Recharge in cu.m
1	BIRDS	Peddavagu	1	50		35	5880
2	CARVE	Yadalavagu	3	83	1	27	4707
3	DIPA	Rallavagu	2	2	5	60	403.2
4	GVS	Diguvetigadda	8	32.75	2.7	45	83706
5	PARTNER	Bokkineru	3	111	5.5	35	901212.12
6	SAFE	Jampaleru	5	105.5	2	78	25,466
7	SYA	Upparavanka	3	773		6	5194.56

Table 6: Percolation tanks and farm ponds Tanks employed for secondary recharge in the project area

S. NO	PNGO	Hydrological unit	No. of Structures	Water Sub mergence area in acres	Avg Depth of water column in meters	Avg Days of Water Storage	G W Recharge in cu.m
1	BIRDS	Peddavagu	16	75.2	21.5	55	622950
2	CARVE	Yadalavagu	8	221.75	1	3	1244000
3	DIPA	Rallavagu	12	0.89	0.75	6	8027.6
4	GVS	Diguvetigadda	12	24.5	1.25	37	80000
5	PARTNER	Bokkineru	0	0	0	0	0
6	SAFE	Jampaleru	66	127	2.77	60	937900
7	SYA	Upparavanka	6	8.5	2.3	6	6400

Table 7: Checkdams employed for secondary recharge in the project area

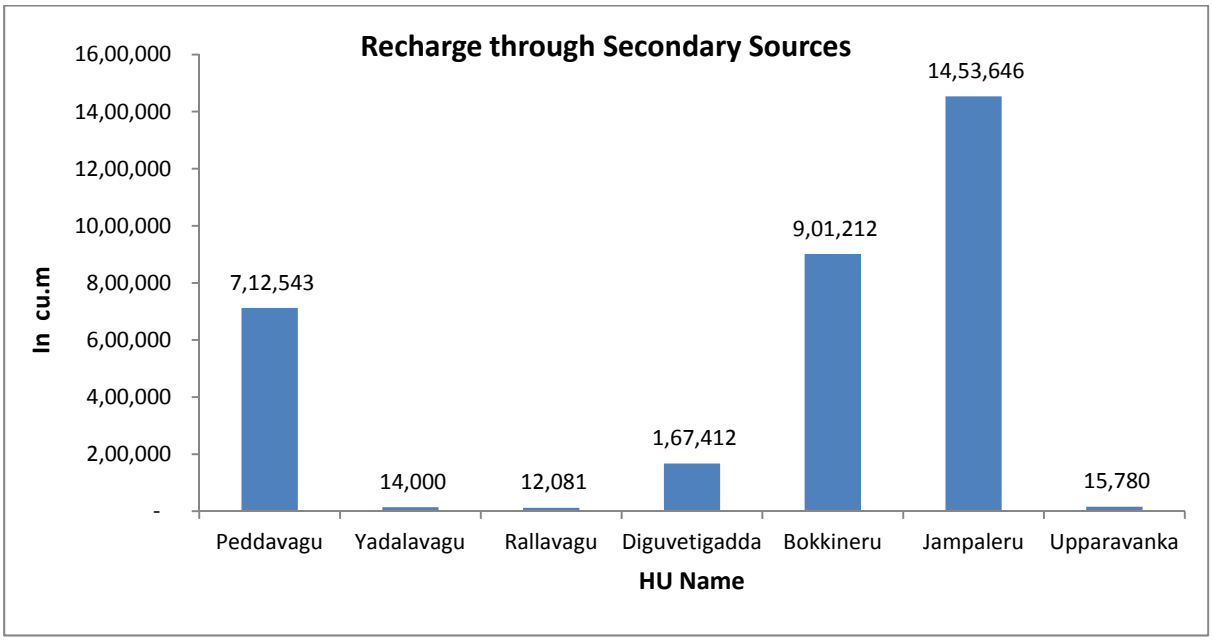
S. NO	PNGO	Hydrological unit	No. of Structures	Water Sub mergence area in acres	Avg Depth of water column in meters	Avg Days of Water Storage	G W Recharge in MCM
1	BIRDS	Peddavagu	8	5.1	4.5	23	15962.5
2	CARVE	Yadalavagu	0	0	0	0	0
3	DIPA	Rallavagu	9	0.16	1.75	6	3650
4	GVS	Diguvetigadda	9	9.25	1.5	25	3706
5	PARTNER	Bokkineru	0	0	0	0	0
6	SAFE	Jampaleru	33	88.5	6.12	60	1427500
7	SYA	Upparavanka	31	9.7	1.45	7	4185

Table 8: Canals employed for secondary recharge in the project area

S. No	PNGO	Hydrological unit	No. of Structures	Water Sub mergence area in acres	Avg. Depth of water column in meters	Avg. Days of Water Storage	G W Recharge in MCM
1	BIRDS	Peddavagu	4	14.5	2	24	67750
2	CARVE	Yadalavagu	1	50	2	2	40000
3	DIPA	Rallavagu	0	0	0	0	0
4	GVS	Diguvetigadda	0	0	0	0	0
5	PARTNER	Bokkineru	0	0	0	0	0
6	SAFE	Jampaleru	0	0	0	0	0
7	SYA	Upparavanka	0	0	0	0	0

Highest amount of groundwater recharge (1453646 cu.m) through secondary sources occurred in the Jampaleru hydrological unit. 901212.1 cu.m of groundwater recharged in Bokkineru Hydrological Unit. 712543 cu.m of groundwater recharged into subsurface through secondary recharge structures in Peddavagu Hydrological unit. Diguvetigadda (167412 cu.m) Upparavanka (15780cu.m) Yadalavagu (14000 cu.m)and Rallavagu has 12081 cu.m of groundwater through secondary sources. Figure 16: shows the groundwater recharge through secondary recharge sources in the project area

Figure 16: Groundwater recharge through secondary sources in the project area



Rain fed Crops-Projected Kharif 2016-2017

PNGO	Name of the Crops	Acres	Water Require (Cu.M)
BIRDS	Green gram	91	36400
	Bengal gram	257	132800
	black gram	286.5	159900
	Jowar	555.5	444400
	Red gram	308	184800
	Sesamum	5	3000
	Other Cropes	5	5000
CARVE	Redgram	650	3,90,000
	Cotton	250	2,50,000
	Greengram	120	48,000
	Bajra	85	1,36,000
	Ragi	58	2,32,000
DIPA	Redgram	436.5	261900
	Onion	9	7200
	Bean	14.5	23200
	Greengram	35	14000
	Blackgram	43.25	25950
	Bajra	70.75	113200
	Mulberry	9.5	45600
	Sesamum	80.6	48360
	Millets	39	85800
PARTNER	Red Gram,	131	350-600
	Bajra	112	350-400
SAFE	Sorghum	66	1,45,200
	Redgram	1269	5,07,600
	Greengram	24	28,800
	Blackgram	25	30,000
	Bajra	841	13,45,600
	Korra	1124	20,23,200
	Castor	1348	18,87,200
	Gingelly	40	72,000
SYA	Sorghum	606	484800
	Redgram	4010	2406000
	Groundnut	4042	8892400
	Cotton	238	238000
	Blackgram	27	16200
	Sunflower	4	8800
	Bajra	1002.5	1604000
	Korra	97.1	155360
	Castar	444	710400

Water Audit Recharge, Draft and Balance Details 2016-17

No	HU Name	In Cubic Meters 2016-2017					
		Kharif Recharge	Kharif Draft	Kharif balance (+ Or -)	Rabi Recharge	Rabi Draft	Rabi Balance (- or +)
BIRDS							
1	Peddavagu	1343536	965000	378536	137619	378820	-241201
2	Yerravanka	1309598	1273950	35648	223180	1616440	-1393260
3	Lothuvagu	501852	319200	182652	107370	325640	-218270
4	Rallavagu	3205527	3191125	14402	492658	6059640	-5566982
5	Konetivanka	1074544	926100	148444	111314	2363060	-2251746
6	Bavanasi	5304608	4257900	1046708	731820	6975920	-6244100
7	chandravagu	997193	945000	52193	139996	3195980	-3055984
8	B.K. Vanka	384640	371700	12940	63837	1338000	-1274163
9	Peddavanka	3210196	3006000	204196	821844	4588000	-3766156
10	Chinneru	8485310	4501000	3984310	578434	3771000	-3192566
11	Thundlavagu	5047101	4924800	122301	578	7684080	-7683502
CARVE							
12	Erravagu	422680	369131	53549	899144	998488	-99344
13	Yadalavagu	18285108	1817658	16467450	950	150200	-149250
14	Naidupalli vagu	6670546	3455125	3215421	8500	143500	-135000
15	M.M.Pallivagu	651298	615824	35474	85900	191500	-105600
16	P.Nagulavaram	191000	154600	36400	103200	110200	-7000
17	Mekaleru vagu	376225	260800	115425	65000	94000	-29000
18	Pulivagu	189989	145375	44614	58400	203000	-144600
19	Chinnauppuvagu	642643	362500	280143	36500	48000	-11500
20	Lingojipalli vagu	381306	283750	97556	5300	103000	-97700
21	Bodicherlavagu	151226	128113	23113	6200	51000	-44800
22	Tarlupadu	3722400	1950000	1772400	34000	110000	-76000
23	Kanugulavagu	2657151	1119350	1537801	3500	157000	-153500
24	S.N.Varam	192350	131164	61186	10000	54500	-44500
DIPA							
25	Rallavagu	1471792	850000	621792	340237	95000	-261400
26	Peeturuvagu	1804696	1710000	94696	1793029	2480000	-686971
27	Narsireddypallivagu	2677344	1512875	1164469	1119083	2520000	-1400917
28	Palamotuvagu	1791680	1476000	315680	498243	2880000	-2381757
29	Uppuvagu	3289880	2220000	1069880	9416522	3825000	-2941803
GVS							
30	Diguvetigadda	2096768	2077551	19217	1179315	1215120	-35805
31	Rommonivagu	816898	1289665	-472767	6883	265939	-259056
32	Nakkillavagu	579450	415676	163774	677512	776382	-98870
PARTNER							
33	Erravanka	1786806	1526040	260766	465593	807313	-341720
34	Taduku	2274870	880650	1394220	715825	830250	-114425

No	HU Name	In Cubic Meters 2016-2017					
		Kharif Recharge	Kharif Draft	Kharif balance (+ Or -)	Rabi Recharge	Rabi Draft	Rabi Balance (- or +)
35	Erravagu	1328941	954720	374221	427050	1234800	-807750
36	Bokkineru	1329756	134100	1195656	1276535	1341000	-64465
37	Mulabandala	8847998	5532840	3315158	1076075	1952640	-876565
38	Thandrasila	1061638	967200	94438	327600	760500	-432900
SAFE							
39	Jampaleru vagu	3841251	3294000	547251	1142535	10263800	-9121265
40	Vemuleru vagu	1582209	1395900	186309	1207544	10289640	-9082096
41	Kakarla (Pedda) vagu	2284612	2002209	282403	1073475	4849600	-3776125
42	Chavatavagu	164564	151200	13364	89936	2602320	-2512384
43	Bogoluvagu	153268	129600	23668	43403	614440	-571037
44	Singarayakonda vagu	105910	84000	21910	50337	1318920	-1268583
45	Sudhakuruva vagu	216173	189000	27173	127492	421200	-293708
SYA							
46	Gooty Maruvavanka	369386	69120	300266	238464	53800	184664
47	Bellam vanka	1169679	702720	466959	641962	237000	404962
48	Maruvavanka	1407165	1404000	3165	843480	885900	-42420
49	Vajralavanka	2403781	1309680	1094101	1279632	580000	699632
50	Maynapuram vanka	532931	514080	18851	207152	181200	25952
51	Peddavanka	1741743	1407600	334143	589133	1215400	-626267
52	Upparavanka	1810464	1407600	402864	985920	1184200	-198280

Outcome of the Water Audit for better Water Governance

- Surplus is projected at the end of Sept 16. Even though surplus was more last Sept, experienced drastic water scarcity during Rabi and summer. Certain habitations faced difficulty in obtaining water for drinking and domestic purpose. In this context high water consumption crops not to be encouraged and ID crops are to be taken.
- Measures are to be implemented for the enhancement of "Crop Water use Efficiency".
- Services of line departments are to be utilised to procure drip sprinkler Raingun equipment.
- Farmers came forward to share water with neighbouring rained farmers and defunct bore well formers.
- Drinking and domestic water needs of entire villagers came in the discussion of water consumption by crops.