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Central Ground Water Board

Ministry of Water Resources, River Development and Ganga

Rejuvenation

Government of India

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Saundatti Taluk, Belgaum District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

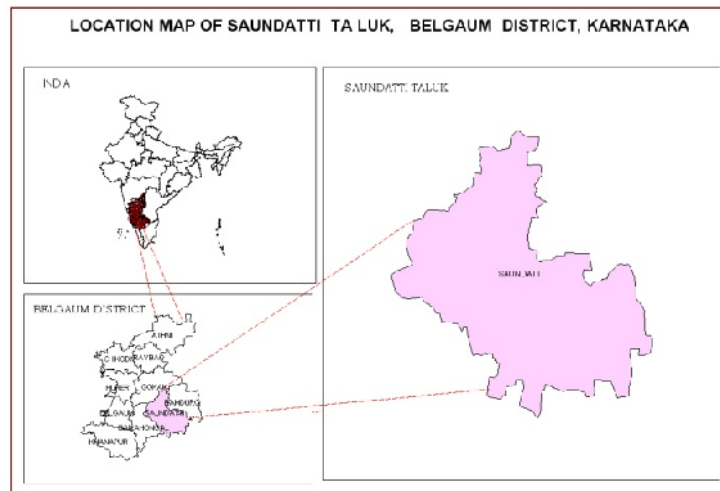
South Western Region, Bengaluru

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Government of India
Ministry of Water Resources,
River Development & Ganga Rejuvenation
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**SAUNDATTI TALUK AQUIFER MAPS AND MANAGEMENT PLANS,
BELGAUM DISTRICT,
KARNATAKA STATE**



By

T. RAJENDIRAN
Scientist 'D'

Central Ground Water Board
South Western Region
Bangalore
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BELGAUM DISTRICT, KARNATAKA STATE**

CONTENTS

Sl. No.	Chapter Title	Page Nos.
1	Salient Information	1
2	Aquifer Disposition	6
3	Ground Water Resource, Extraction, Contamination and other Issues	8
4	Ground Water Resource Enhancement	9
5	Demand Side Interventions	10

AQUIFER MANAGEMENT PLAN OF SAUNDATTI TALUK, BELGAUM DISTRICT, KARNATAKA STATE

1.0 SALIENT INFORMATION

Name of the taluk: SAUNDATTI

District: Belgaum

State: Karnataka

Area: 1574 sq.km.

Population: 3,52,929

Annual Normal Rainfall: 515 mm

1.1 Aquifer management study area

Aquifer mapping studies have been carried out in Saundatti taluk, Belgaum district of Karnataka, covering an area of 1574 sq.kms under National Aquifer Mapping Project. Saundatti taluk of Belgaum district is located between north latitude $15^{\circ} 36' 33.1''$ and $16^{\circ} 09' 22.5''$ & east longitude $74^{\circ} 48' 9.7''$ and $75^{\circ} 19' 6.2''$, and is covered in parts of Survey of India Toposheet Nos. 47L/16, 48 I/13, 48 I/14, 48 P/4, 48 M/1, 48 M/2, 48 M/5 and 48 M/6. Saundatti taluk is bounded by Gokak taluk of on north, Dharwad and Navalgund taluks of Dharwad district on south, Ramdurg and Nargund taluks of Gadag district on eastern side and Bailhongal taluk on west. Location map of Saundatti taluk of Belgaum district is presented in Fig-1.

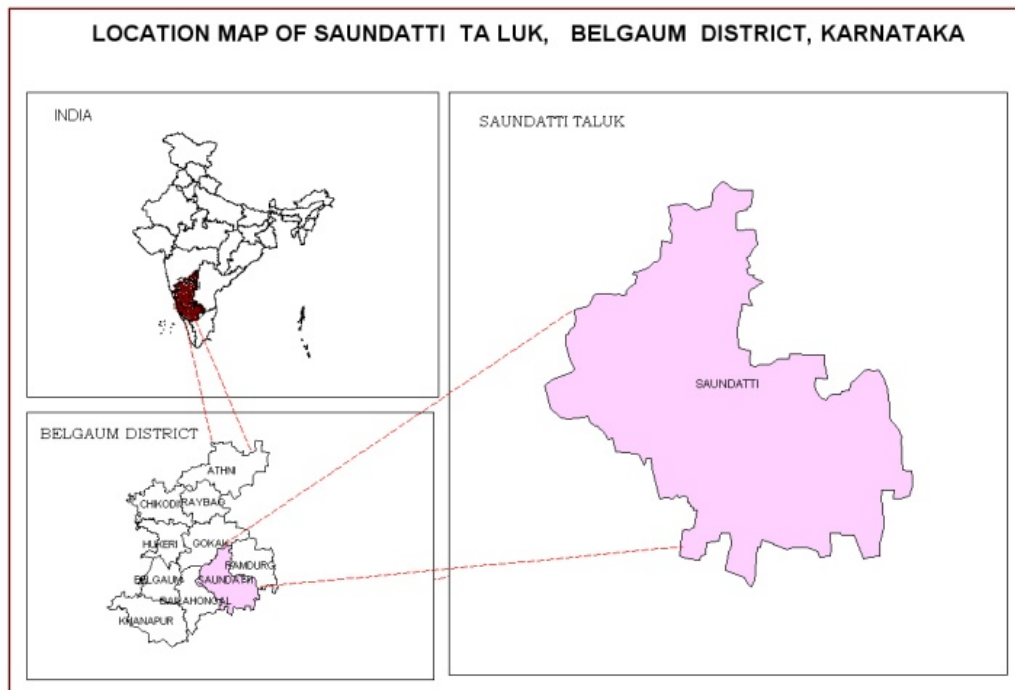


Fig.1: Location map of Saundatti taluk

Taluk administration of Saundatti taluk consists Saundatti as taluk head quarter and there are two town municipalities in this taluk. There are 121 inhabited and 15 uninhabited villages in Saundatti taluk.

1.2 Population

According to 2011 census, the population in Saundatti taluk is 3,52,929, out of which 3,11,714 constitute the rural population and 41,215 constitute the urban population. The study area has an overall population density of 224 persons per sq.km. The decadal variation in population from 2001-2011 is 13.23% in Saundatti taluk.

1.3 Rainfall

Saundatti taluk enjoys semi-arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Northern Dry agro-climatic zone of Karnataka state and is categorized as drought prone.

The climate of the study area is quite agreeable and free from extremes. The year is usually divided into four seasons: summer from March to May; rainy season or south-west monsoon season from June to September; post-monsoon season covering the months of October and November and dry or winter Season from December to February.

There is one rain gauge station located in Saundatti taluk (Table 1.3.1). The data in respect of this station from the year 1981 to 2010 is analysed and presented in table-1. The data pertaining to this raingauge is of long-term nature and are well maintained. It is presumed that it is representative of the taluk and the same is used for analysis. Normal annual rainfall in Saundatti taluk for the period 1981 to 2010 is 515 mm.

Table-1: Raingauge location in Saundatti taluk

Sl. No	Station	Latitude	Longitude	Altitude
1	Saundatti	15° 45'	75° 07'	763

Computations were carried out for the 30 year blocks of 1981- 2010 on Mean, Standard deviation and coefficient of variation of each month pre-monsoon, monsoon, post-monsoon and annual and are shown in Table-2.

Table 2: Statistical Analysis of Rainfall Data of Saundatti Taluk, Belgaum District, Karnataka for the Period 1981 to 2010

STATION		JAN	FEB	MAR	APR	MAY	PRE	JUN	JUL	AUG	SEP	SW	OCT	NOV	DEC	NE	Annual
Raibag	NRM	1	1	11	17	55	85	85	58	49	108	301	94	31	3	129	515
	STDEV	3	6	29	18	54	58	55	35	27	73	141	80	42	8	84	177
	CV%	336	548	270	108	97	68	64	61	54	68	47	85	134	223	66	34

The mean monthly rainfall at Saundatti taluk is ranging between 1mm during January and February to 108 mm during September. The Coefficient of Variation (CV) for pre-monsoon, monsoon and post monsoon season is 68, 47 and 68 percent respectively. Annual CV at this station works out to be 34 percent.

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Saundatti taluk. Major Kharif crops are jowar, maize, bajra, tur and vegetables. Main crops of Rabi season are maize, horse gram, groundnut, and sunflower (Table-3). Water intensive crops like sugarcane is grown in 15.35 % of total crop area. Jowar is grown in 31.15%, maize is grown in 21.07% and oil seeds in 17.28% of total crop area of taluk. Bajra account 2.2% of total crop area.

Table-3: Cropping pattern in Saundatti taluk 2014-2015 (Ha)

Year	Paddy	Maize	Bajra	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
	Area under cultivation (in ha)									
2014-15	0	14445	1511	21357	35999	260	7216	11846	10525	15978

It is observed that net sown area accounts 43.55% and area sown more than once is 41.03% of total geographical area in Saundatti taluk (Table-4). Area not available for cultivation and Fallow land cover 10.57% & 35.06% of total geographical area respectively. 16.11% of the net area irrigated is through canals, 30.44% of the net area is irrigated through dug wells, 46.07% of net area irrigated is from borewells and 1.49% from lift irrigation (Table-5)

Table-4: Details of land use in Saundatti taluk, 2014-15 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
Saundatti	157400	13432	16634	55193	68553	64581

Source: District at a Glance 2014-15, Govt. of Karnataka

Table-5: Irrigation details in Saundatti taluk (in ha)

Source of Irrigation	Net area irrigated (Ha)	% of area
Canals	7875	16.11
Tanks	0	0
Wells	14886	30.44
Bore wells	22527	46.07
Lift Irrigation	730	1.49
Other Sources	2876	5.88
Total	48894	

Source: District at a Glance 2014-15, Govt. of Karnataka

1.5 Geomorphology, Physiography and Drainage

Saundatti taluk is a plateau region and southern parts of the taluk is plains. In Saundatti taluk, hills with elevations between 686 and 783bm a msl are present (Fig.2). The famous Yellamma temple is located in one of these isolated hills. The taluk is drained by Malaprabha, a tributary of River Krishna. The drainage in the taluk is dendritic to sub-dendritic in nature. The drainage density varies from 0.80 to 3.4 km/sq.km (Fig.3).

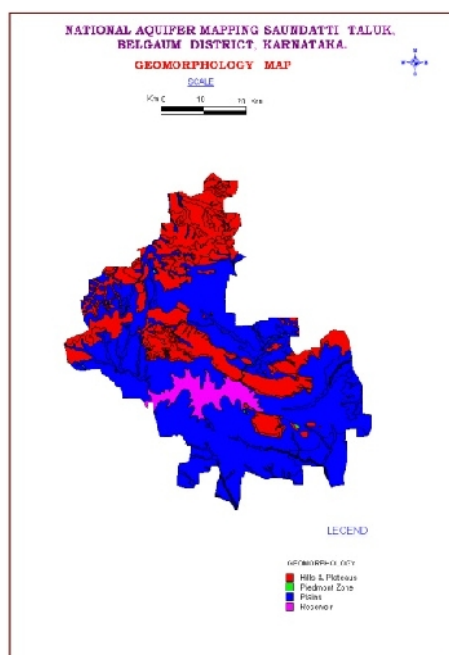


Fig.2: Geomorphology

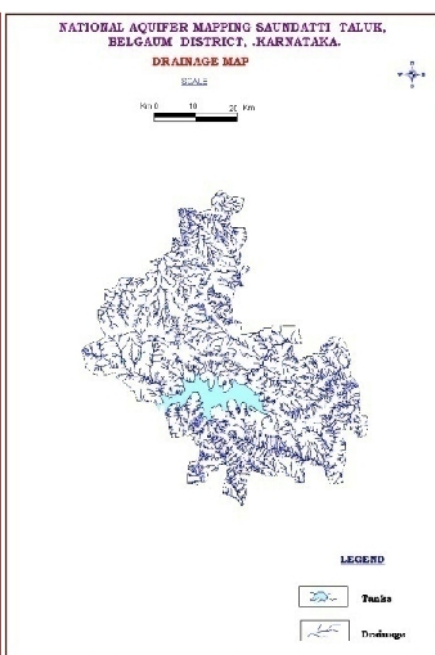


Fig.3: Drainage

1.6 Soil

The soils of Saundatti taluk can broadly be classified into red soils and black soils. These soils vary in depth and texture, depending on the parent rock type, physiographic settings and climatic conditions. By and large, black soils predominates the Deccan Trap terrain and the red soils are found in the gneissic terrain.

1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth is given in Table-6 below.

Table-6: Total Ground Water Resources (2013) in Ha m

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200 m)	Dynamic + Phreatic in-storage + fractured
Saundatti	6845	9054	2678	18577

1.8 Existing and future water demands (as per GEC-2013)

- Net ground water availability for future irrigation development : 799 Ha m
- Domestic (Industrial sector) demand for next 25 years : 619 Ha m

1.9 Water level behavior

(a) Depth to water level

Aquifer - I

- Pre-monsoon: 0.42 – 14.25 m bgl (Fig.4)
- Post-monsoon: 4.10 – 13.66 m bgl (Fig.5)

Aquifer - II

- Pre-monsoon: 14.32 m bgl (Fig.6)
- Post-monsoon: 11.23 m bgl (Fig.7)

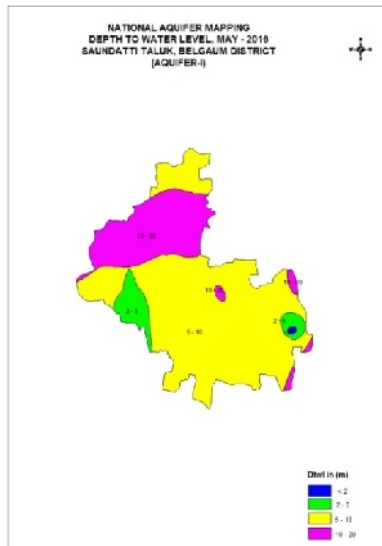


Fig 4: Pre-monsoon DTW (Aq-I)

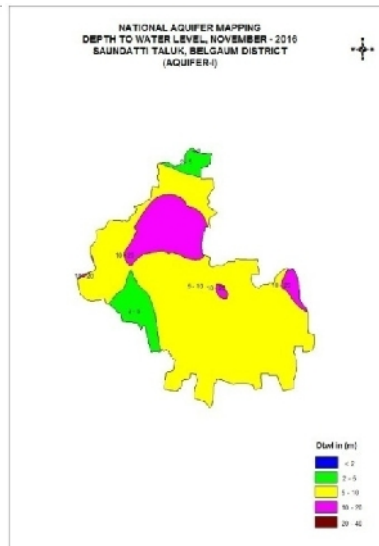


Fig 5: Post-monsoon DTW (Aq-I)

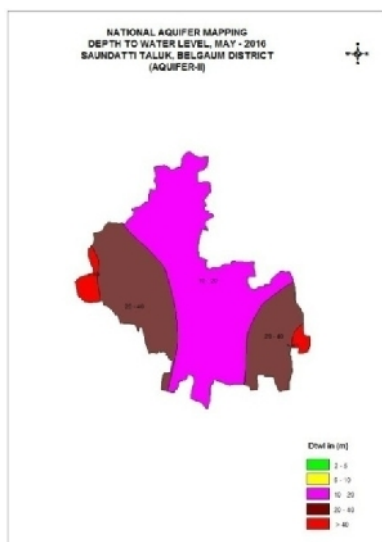


Fig 6: Pre-monsoon DTW (Aq-II)

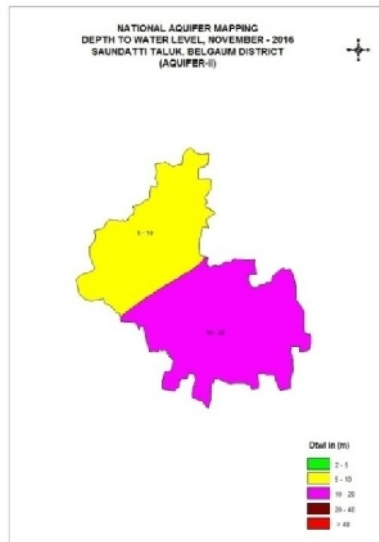


Fig 7: Post-monsoon DTW (Aq-II)

(b) Water level fluctuation

Aquifer-I (Fig.8)

- Seasonal Fluctuation: Rise ranges 0 to 1.85 m;
Fall ranges 0.25 to 0.80 m

Aquifer-II (Fig.9)

- Seasonal Fluctuation: Rise shows 3.09 m;

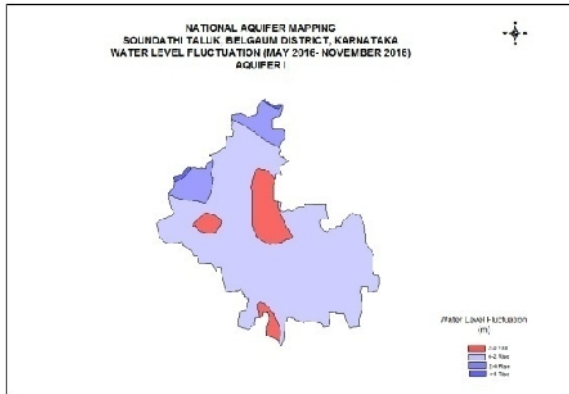


Fig 8: Pre-monsoon DTW fluctuation (Aq-I)

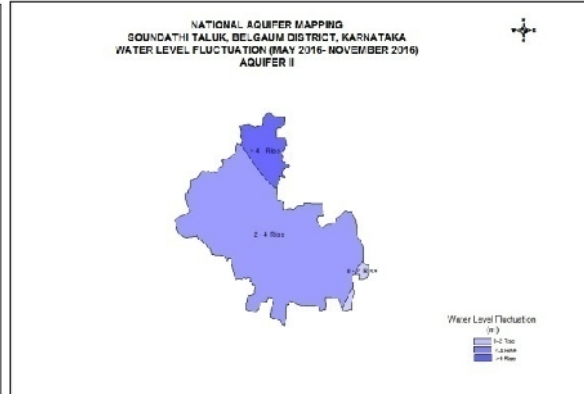


Fig 9: Post-monsoon DTW fluctuation (Aq-II)

2.0 AQUIFER DISPOSITION

2.1 Number of aquifers: In Saundatti taluk, there are mainly two types of aquifer systems;

- Aquifer-I (Phreatic aquifer)** comprising Weathered gneiss, schist, limestone, sandstone and basalt
- Aquifer-II (Fractured aquifer)** comprising Fractured gneiss, schist, limestone, sandstone and basalt

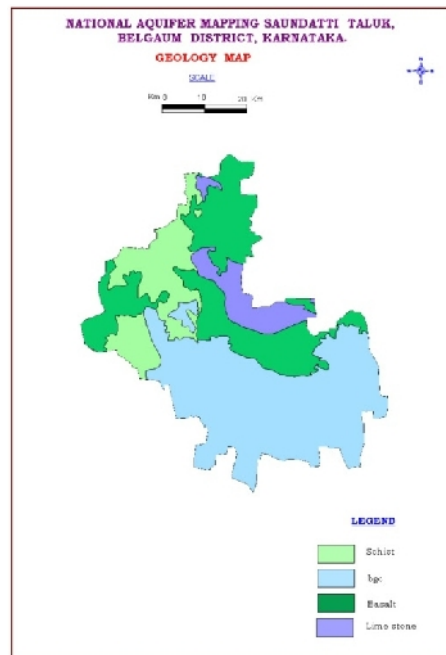


Fig.10: Geology

The taluk is underlain by gneisses, schist, limestone, sandstone and basalts. Ground water occurs both in weathered and fractured zones. Ground water occurs in all weathered formations of the taluk under phreatic conditions and in fractured and jointed formations under semi-confined conditions. In gneisses and schist, weathered zone varies from 7 to 12 m and water-bearing zones extend down to 161 m. In limestone, solution cavities are considered to be more potential than weathered and fractured ones. Deccan basalts act as a multilayer aquifers having low to medium permeability. In Deccan basalts that comprise different flows, fractures and interstitial pore spaces of vesicular zones, are good repositories of ground water. Geology of Saundatti taluk is given in Fig.10.

In Saundatti taluk bore wells were drilled from a minimum depth of 40.65 m bgl to a maximum of 200 m bgl under ground water exploration (Table-7). Ground water exploration reveals that aquifer-II fractured formation was encountered between the depths of 31 to 161 mbgl. Yield ranges from 0.4 to 4.08 lps.

Table-7: Details of Ground water Exploration

Sl. No.	Site	Depth drilled (m)	Fractures encountered (m bgl)	SWL (m bgl)	Discharge (lps)	Transmissivity (m ² /day)
1	Hosur	61	31-32, 44-45, 58-59	15.66	0.5	4
2	Inam Hongal	200	19-22, 50-51, 160-161	6.72	0.8	10
3	Kitturnahalli	82		6.31	Negligible	
4	Mallur	67	17-27	7.5	0.66	1
5	Mangli	68.25	18-23, 28-38, 57-68	9.65	4	58
6	Murgod	60	39-41, 50-52	17	0.4	25
7	Shivapuri	82		4.47	Negligible	
8	Sirangi	200	40-41, 48-49, 60-61	10.34	0.7	2
9	Saundatti Pz	40.65	35.5-35.7	16.74	1.05	11
10	Yargatti Pz	40.65			DRY	

3.0 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

a. Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2013) in ha m

Taluk	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for Irrigation (Ham)	Existing Gross Ground Water Draft For Domestic and Industrial Water Supply (Ham)	Existing Gross Ground Water Draft for all Uses (Ham)	Allocation For Domestic and Industrial Use for Next 25 Years (Ham)	Net Ground Water Availability for Future Irrigation Development (Ham)	Existing Stage Of Ground Water Development (%)	Category
Saundatti	6845	6931	469	7400	948	799	108	Over-Exploited

(b) Present total Ground Water Resource in ha m

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of GW resource
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Saundatti	6845	9054	2678	18577

(c) Comparison of ground water availability and draft scenario in Raibag taluk

Taluk	GW Availability (Ha m)	GW Draft (H am)	Stage of GW Development	GW Availability (Ha m)	GW Draft (Ha m)	Stage of GW Development	GW Availability (Ha m)	GW Draft (Ha m)	Stage of GW Development
	2009			2011			2013		
Saundatti	9178	14651	160	6657	7205	108	6845	7400	108

Interpretation from Chemical Analysis results of ground water from phreatic aquifer in Saundatti taluk is mentioned as under:

ELECTRICAL CONDUCTIVITY: In general, EC values range from 330 to 670 μ /mhos/cm at 25°C which are within the permissible limit.

FLUORIDE: Fluoride concentration in ground water is of geogenic origin and F value ranges in general between 0.15 – 0.30 mg/l

NITRATE: Nitrate value ranges between 8 to 12 mg/l which are within the permissible limit of 45 mg/l.

In general ground water quality in Saundatti taluk is good for drinking purpose. Ground water samples have also been tested and found suitable for agriculture & irrigation purposes.

4.0 GROUND WATER RESOURCE ENHANCEMENT

4.1 Aquifer wise space available for recharge and proposed interventions

Recharge dry **phreatic aquifer (Aq-I)** in the taluk, through construction of artificial recharge structures, viz; check dams, percolation tanks & point recharge structures (Table-8). The choice of recharge structures should be site specific and such structures need to be constructed in areas already identified as feasible for artificial recharge.

Table-8: Quantity of non-committed surface runoff & expected recharge through AR structures

Artificial Recharge Structures Proposed	Saundatti taluk
Non committed monsoon runoff available (MCM)	9.13
Number of Check Dams	56
Number of Percolation Tanks	4
Number of Point Recharge structures	6
Tentative total cost of the project (Rs. in lakhs)	220.19
Expected recharge (MCM)	4.29
Expected rise in water level (m)	0.23
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.26

4.2 Improvement in GW availability due to Recharge, Saundatti taluk

Taluk	Net annual ground water availability	Existing gross ground water draft for all uses	Existing stage of ground water development	Expected recharge from proposed Artificial Recharge Structures	Additional potential from proposed irrigation development schemes through inter-basin transfer	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of ground water development
	HAM	HAM	%	HAM	HAM	HAM		%
Saundatti	6845	7400	108	517	0	7362	101	7

After implementation of Artificial Recharge structures the annual ground water availability will increase from 6845 to 7362 ha m and the expected improvement in stage of development is 7% i.e., from 108% to 101%.

5.0 DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices

By adopting the below mentioned techniques will contribute in ground water resource enhancement in the long run in the areas irrigated through bore wells and dug wells.

- Efficient irrigation practices like Drip irrigation & sprinkler needs to be adopted by the farmers in the existing 37,413 ha of gross irrigated area by bore wells and dug wells.
- Irrigation draft is 6931 ha m.
- Efficient irrigation techniques will contribute in saving ground water by 1419 ha m and thus will improve stage of development by 17% from 101% to 84% (Table-9).

5.2 Change in cropping pattern

Water intensive crop like sugarcane are grown in 15.35% of total cropped area by surface water in the Saundatti taluk. Hence, change in cropping pattern has not been suggested.

Table-9: Improvement in GW availability due to saving by adopting water use efficiency

Taluk	Cumulative annual ground water availability after implementing AR Structures	Existing gross ground water draft for all uses	Stage of ground water development after implementing AR structures & proposed irrigation development schemes through inter-basin transfer	Saving due to adopting WUE measures	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of ground water development
	HAM	HAM	%	HAM	HAM		%
Saundatti	7362	7400	101	1419	8781	8781	84

5.3 Regulation and Control

- Saundatti taluk has been categorized as **Over-Exploited**, since the Stage of ground water development has reached 108% (GE March 2013). Hence, there should not be any further ground development.
- Ground water recharge component needs to be made mandatory in the non-command area of the taluk.

5.4 Other interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Roof top rain water harvesting.
- Micro irrigation.

5.5 Summary

The summary of Management plan of Saundatti taluk is given in Table-10.

Table-10: Summary of Management plan of Saundatti taluk

Saundatti taluk is over-exploited & present stage of GW Development (2013)	108%
Net Annual Ground Water Availability (MCM)	6845
Existing Gross Ground Water Draft for all uses	7400
Groundwater development feasibility	7.99
Total GW Resources (Dynamic & Static upto the depth of 200 mbgl) (MCM)	185.77
Expected additional recharge from monsoon surplus runoff (MCM)	9.13
Change in Stage of GW development (%)	108 to 101
Expected Saving due to adopting WUE measures (MCM)	14.19
Change in Stage of GW development (%)	101 to 84

