भारत सरकार

जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

केन्द्रीय भूमि जल बोर्ड

GOVERNMENT OF INDIA

MINISTRY OF WATER RESOURCES, RIVER DEVELOPMENT & GANGA REJUVENATION

CENTRAL GROUND WATER BOARD

Artificial Recharge Plan for the Over Exploited Deola Taluka of Nashik District

मध्य क्षेत्र, नागपुर

CENTRAL REGION, NAGPUR

जुलाई - 2016 /July - 2016

ARTIFICIAL RECHARGE PLAN AT A GLANCE

1.	Total Geographical Area of the Deola Block (Taluka)	579.50 km^2			
	❖ Area occupied by Hard Rock (Basalt)	579.50 km^2			
	❖ Area occupied by Soft Rock (Alluvium)	-			
2.	Major land use pattern	Agriculture			
3.	Average Annual Rainfall (mm)	570 mm			
4.	Major Drainage	Girna River			
5.	Area identified for Artificial Recharge *(considering average decadal (2005-14) post-monsoon water level more than 5 m bgl, long term post-monsoon water level trend, depth of weathering and lineaments)*	358.74 km^2			
6.	Overall quality of groundwater	Suitable for domestic, industrial and irrigation use			
7.	Availability of Surplus surface runoff (MCM)	8.564 MCM			
8.	Surplus runoff considered for planning (MCM) *(70% of surplus surface runoff)*	6.00 MCM			
9.	Runoff for RWH in Urban Household	0.070 MCM			
10.	Sub-surface storage potential available (MCM)	58.72 MCM			
11.	Proposed Artificial Recharge & Water Conservation Plan				
	Item	**Percolation Tank**	**Check Dam**	**Water Conser-vation Structure**	**Roof Top Rain Water Harvesting (for 10% houses)**
	❖ Proportionate Allocation of surplus runoff MCM)	4.20	1.50	0.30	0.070
	❖ Feasible number of structures	21	50	20	2887
	❖ Unit cost of structures (crores)	0.70	0.07	0.0025	0.0008
	❖ Estimated Cost (Crores)	14.70	3.50	0.05	2.30
	❖ Expected Recharge (MCM) (considering 85 % efficiency)	3.57	1.275	0.255	0.059
12.	Total estimated cost (Crores)	20.55 crores			

Artificial Recharge Plan for the Over Exploited Deola Taluka of Nashik District

1. INTRODUCTION

Groundwater being most dependable source of water supply is under tremendous stress to meet the ever increasing demand of irrigation, industrial and domestic sector. The over exploitation of this resource has resulted in to decline in water levels in many part of the Country and many of the water assessment units are thus categorised as over-exploited blocks. The state of Maharashtra also faces the problem of groundwater over- development in some of the areas. Many talukas have been identified as Critical / Over-Exploited based on the ground water resources estimation based on GEC-97 Methodology. As per the latest groundwater resource assessment as on March 2011, 10 talukas have been identified as Over-Exploited.

Immediate remedial measures are therefore required to be taken up for converting these talukas into Critical / Semi-critical / Safe categories. The present artificial recharge plan has been prepared for the Deola taluka of Nashik district which will form the base for the future strategy.

2. LOCATION

The Deola Taluka is situated in the northern part of Nashik district and lies between North latitude 20° 23'45" to 20°25'38" and East longitude 74°07'29" to 74°21'27" and it is spread over an area of 577.46 sq.km. (**Fig.1a and 1b)**.There are 50 villages and the population of the taluka is 1,44,522 persons as per 2011 census. The Deola taluka is known for grapes cultivation.

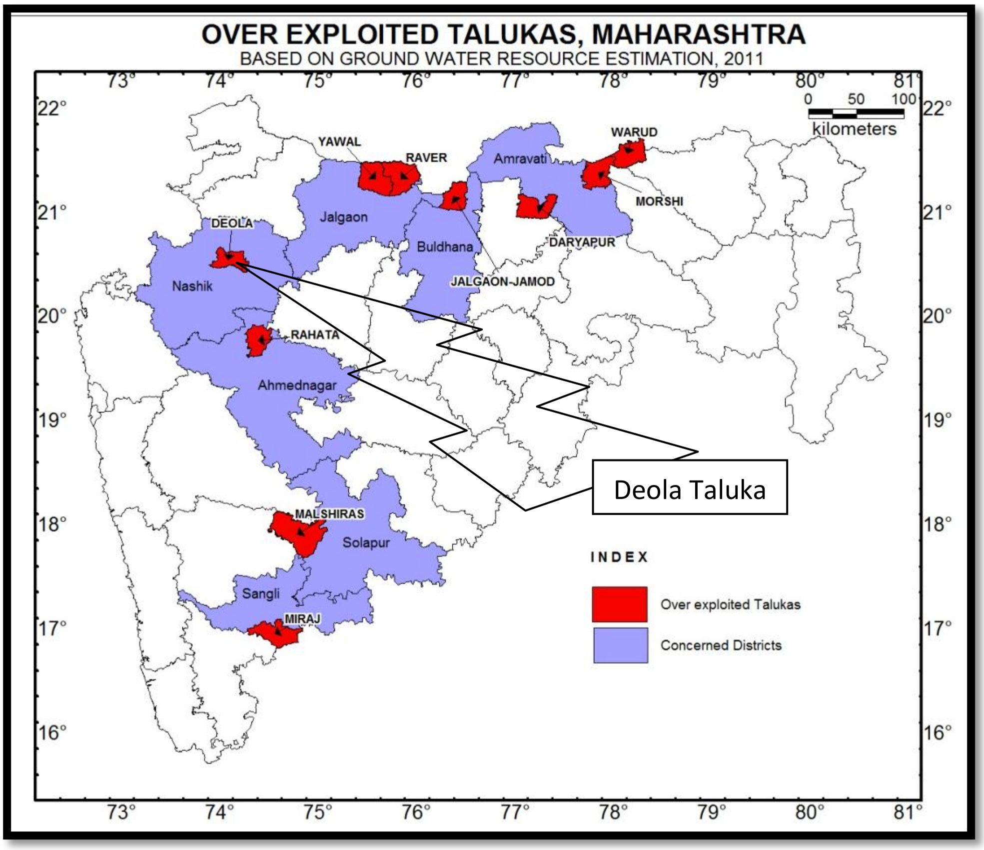


Figure1a: Location of Deola Taluka, Nashik District, Maharashtra

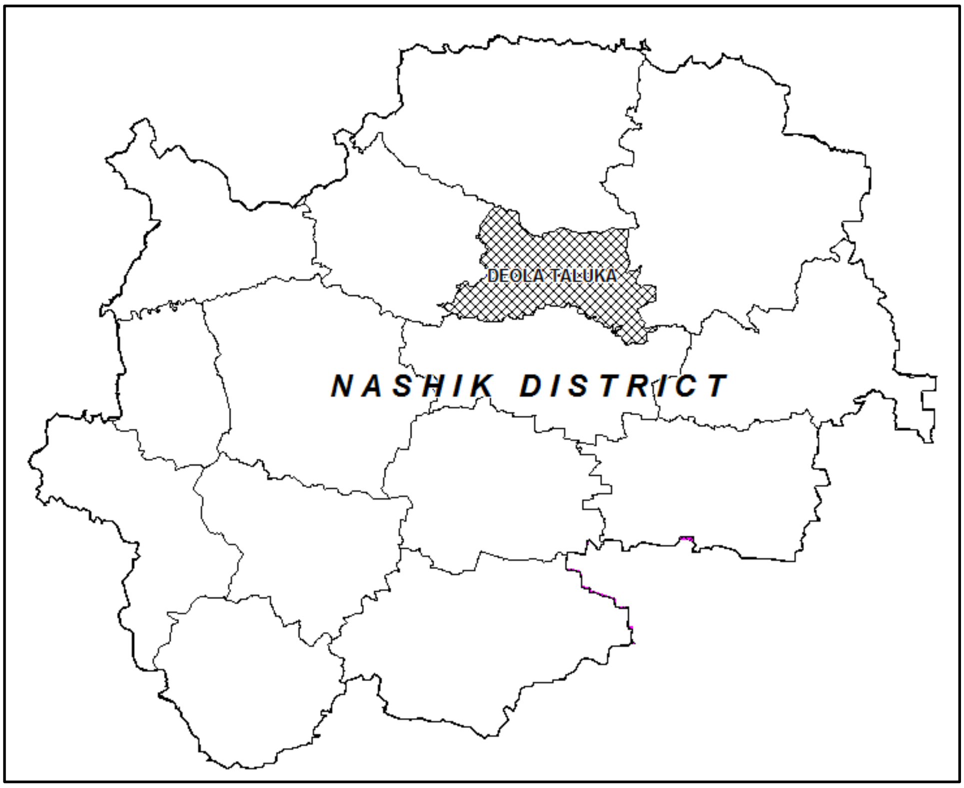


Figure1b: Location of Deola taluka, Nashik district

3. PHYSIOGRAPHY & DRAINAGE

The taluka can be broadly divided into two physiographic units i.e., the Hill range and the plain area. The hills are part of the Western Ghat hill ranges. The major part of the taluka is falling in plain area with thick soil cover and thick weathered zone; while hills with exposed rock and thin soil cover noticed in the southern area of the taluka. It has a general topographic slope is from SW to NE direction. The topographic elevation ranges from about 900 m above MSL in SW part to about 400 m above MSL in NE part of the taluka (**Fig. 2a**).

The taluka is having a plain to undulating topography and drained mainly by the Girna river which is a tributary of Tapi river. The Sub-dendritic to dendritic drainage pattern is observed in the taluka. The drainage is mainly controlled by the physiographic and geomorphic setup the taluka. A digital elevation model of Deola taluka indicating the village boundaries is shown in **Fig. 2b**.

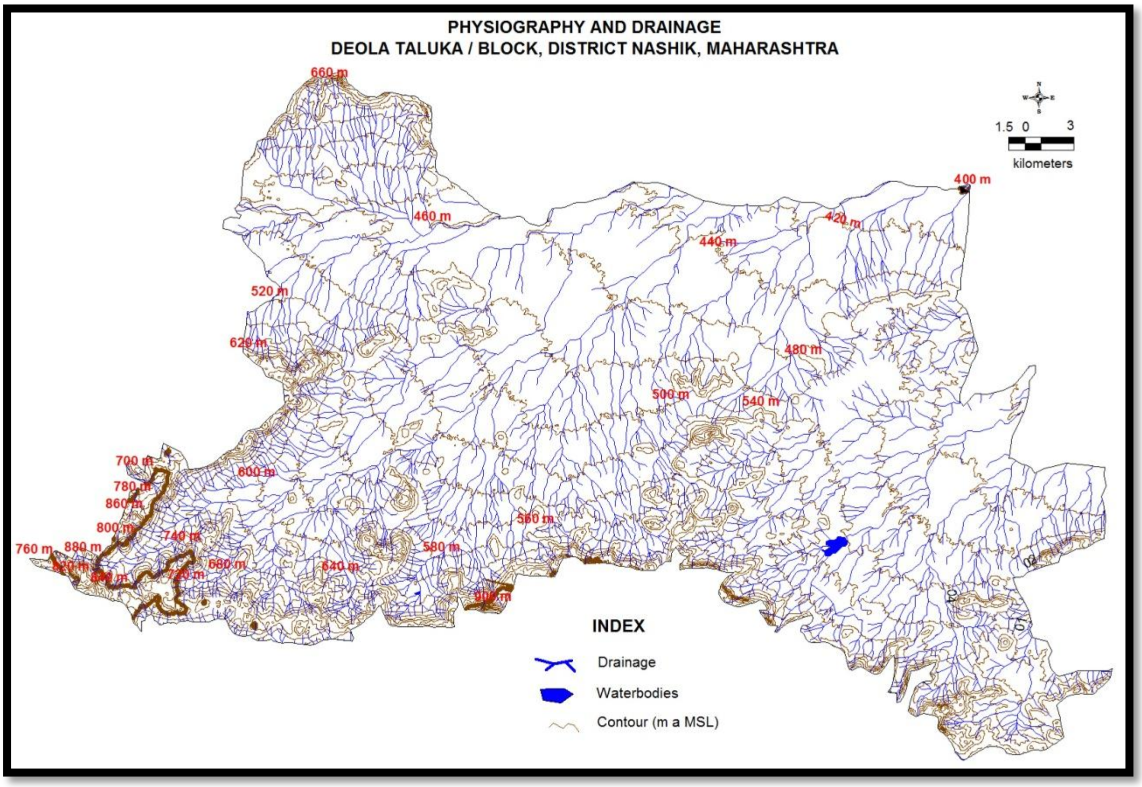


Figure 2a: Physiography and Drainage, Deola Taluka

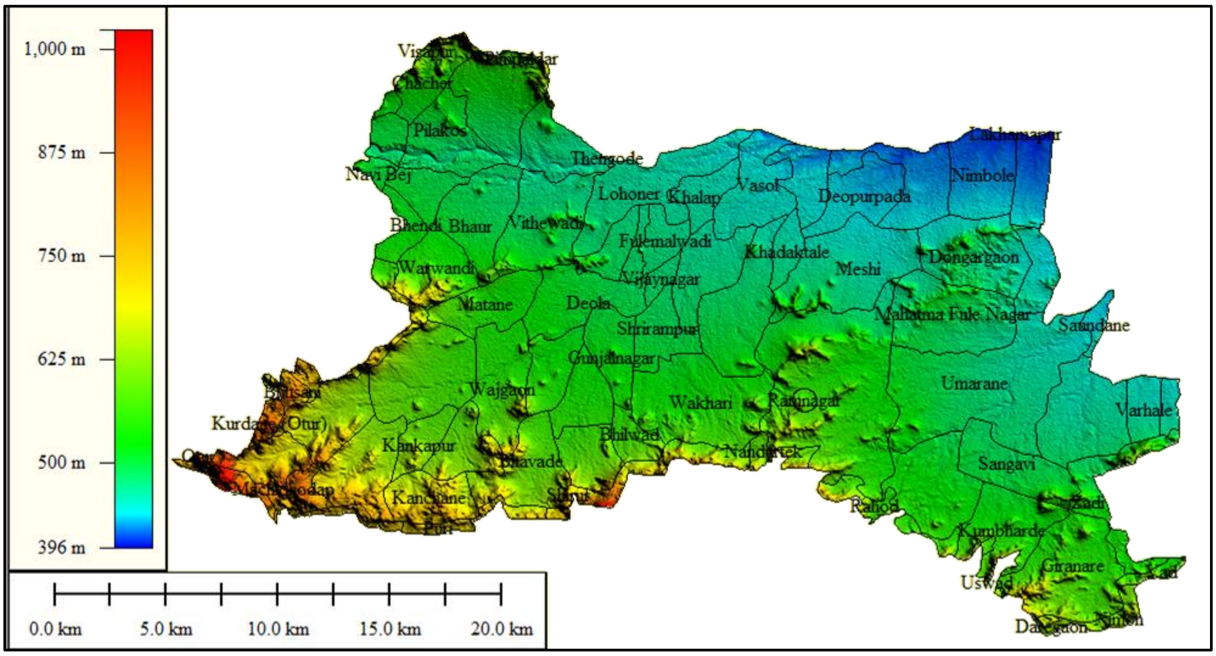


Figure2b: Digital Elevation Model, Deola Taluka

4. RAINFALL

The area receives rainfall due to the south-west monsoon and about 90% of the rainfall takes place during the months of June to September. The taluka is located toward the east of Western Ghats and falls in the rain-shadow region of the Sahyandri ranges and receives erratic rainfall ranging from 320 to 517, the average annual rainfall being 570 mm.

5. LAND USE PATTERN

The land use of the area prominently reflects significance of agriculture activity, with isolated scattered patches of notified forest area and unmodified hilly forest. The double-crop (Kharif and Rabi) area is evenly distributed in the entire taluka.

6. HYDROGEOLOGY

Deola taluka is covered by the Deccan Trap Basalt belonging to upper Cretaceous to lower Eocene age comprising pahoehoe and aa lava flows of basaltic composition occurs in the entire taluka where the ground water potential is not uniformly distributed due to inherent heterogeneity of the formation. The ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 20-25 m depth **(Fig 3)**.

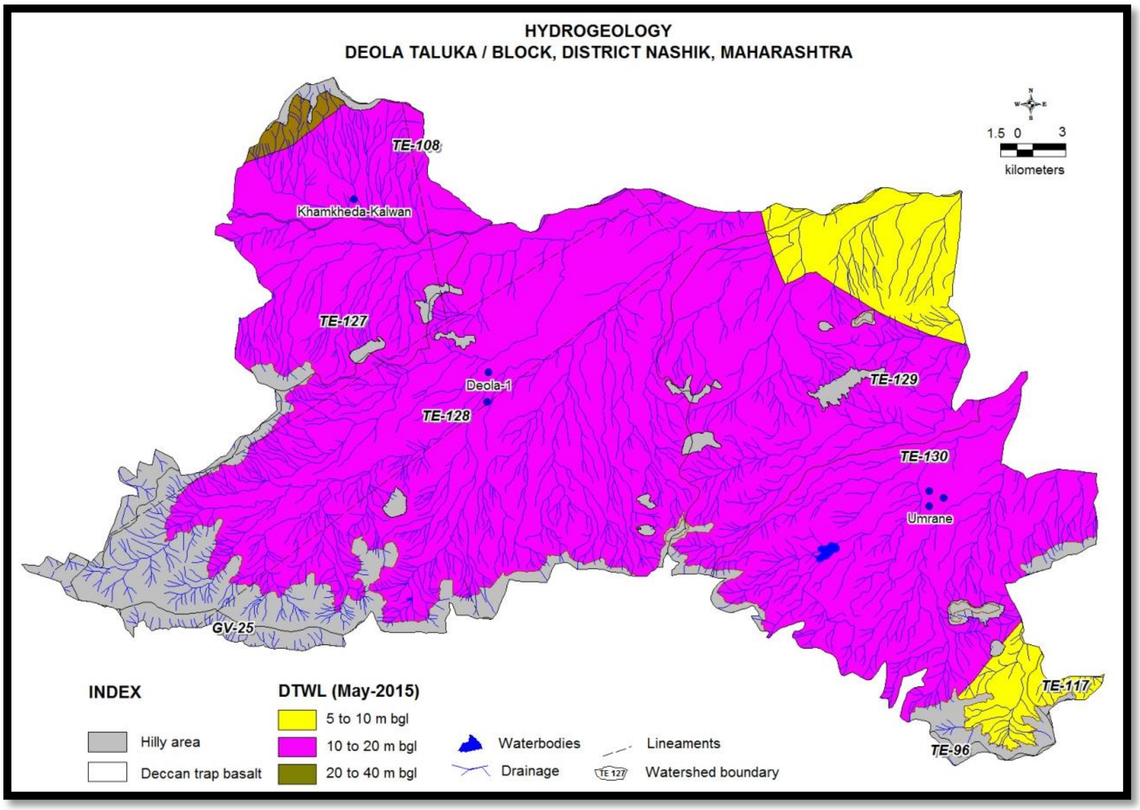
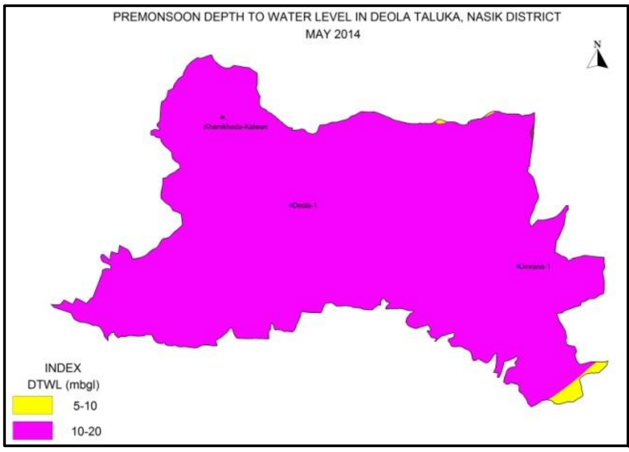


Figure 3: Hydrogeology, Deola Taluka

The southern part of the taluka is hilly and rugged terrain where basalt does not form potential aquifer due to limited thickness of weathered mantle. Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 15-20 m depth. At places potential zones are encountered at deeper levels in the form of fractures and inter-flow zones. The upper weathered and fractured parts form phreatic aquifer and ground water occurs under water table (unconfined) conditions. At deeper levels, the ground water occurs under semi-confined conditions.

7. GROUND WATER LEVEL SCENARIO

CGWB regularly monitors ground water levels in the taluka 4 times in a year during May, August, November and January through its network of Ground Water Monitoring Wells (GWMW). The water levels recorded during the pre-monsoon season in May (2014), ranging from 14.10 to 16.40 m bgl. The entire taluka is marked by the presence of moderately deeper water levels between 10-20 m (**Fig 4**). The water levels recorded in post-monsoon season (Nov. 2014) are ranging from 9.20 to 13.5 m bgl. Moderately deeper water levels between 10-20 m are observed in SE and western parts of taluka area (**Fig 5**).



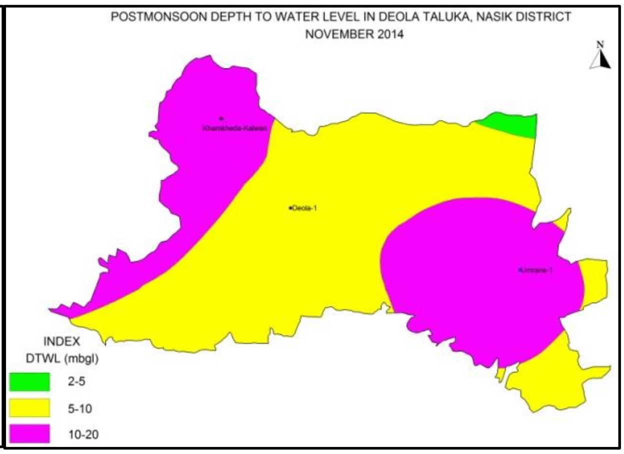


Fig 4 and 5: Pre and Post-monsoon (2014) Depth to Water Level, Deola Taluka

8. DYNAMIC GROUND WATER RESOURCE

Ground Water Resources Assessment for the year 2011 indicates Net Annual Ground Water Availability of 5522.95ham, draft for all uses is 5684.84 ham with irrigation being the major consumer withdrawing 5561.10 ham and stage of ground water development is also high about 102% **(Table 1)**. The taluka is categorised as Over Exploited. The comparison of 2009 and 2011 ground water resource assessment indicates that the stage of ground water development has increases from 95.51% in 2009 to 102.93% in 2011. So far the taluka has been not been notified by CGWA/SGWA for ground water regulation.

Table 1: Dynamic Ground Water Resources of Deola Taluka (As on March 2011)

Sl. No	Particulars	GW Resources (Ha.m)
1.	Net Annual Ground Water Availability	5522.95
2.	Existing Gross Ground Water Draft for irrigation	5561.10
3.	Existing Gross Ground Water Draft for domestic and industrial water supply	123.75
4.	Existing Gross Ground Water Draft for All uses	5522.95
5.	Provision for domestic and industrial requirement supply to 2025	195.08
6.	Net Ground Water Availability for future irrigation development	614.19
7.	Stage of Ground Water Development {13/10 * 100}%	102.93 %
8.	Category of the Assessment Unit	Over Exploited

9. NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION MEASURES

Deola taluka is major grapes growing area in Nashik district of Maharashtra. For cultivation of grapes, huge amount of groundwater is required. The taluka is already in 'rain shadow' region of the Sahyandri ranges. This has led to over-exploitation of groundwater resources from both the shallow and deeper aquifers in the taluka. These practices are being continued since last few decades and stage of groundwater development in the taluka even exceeded more than 100 % of its natural recharge which lead to heavy depletion of ground water level. The over development of ground water has brought the taluka in over exploited category. Therefore there is an urgent need for taking up various artificial recharge and water conservation measures in the area.

10. JUSTIFICATION OF THE ARTIFICIAL RECHARGE PROJECT

The various State Government Agencies like department of Agriculture, Irrigation, Forest have already taken up some water conservation / artificial recharge measures in Deola taluka. However, a robust consolidated plan for artificial recharge measures are also required for converting the entire Over-Exploited Deola taluka into Critical / Semi-critical / Safe category.

11. FEASIBLE AREA FOR ARTIFICIAL RECHARGE OR CONSERVATION

The feasible area for artificial recharge to groundwater in Deola taluka has been identified based on the following criteria's.

1. Long term average decadal post-monsoon depth to water level (2005-2014)
2. Long term post-monsoon water level trend (2005-14)
3. Depth of weathering in the taluka
4. Lineaments in the area

Thematic layers are prepared for all the above mentioned four criteria's and are superimposed on one another to generate the integrated map for identification of the feasible area for artificial recharge.

The long term post monsoon depth to water level data for the period 2005-14 reveals the deepest water level of 13.00 m bgl. Water level contour map is prepared wherein 2 categories of observed water levels are made i.e., 5 to 10 m bgl and 10 to 20 m bgl **(Fig 6)**.

It has been observed from the Depth to Water level (DTWL) map of the Deola taluka that, 50.66 sq.km area has DTWL between 5 and 10 m bgl and 448 sq.km area has DTWL between 10 and 20 m bgl. Thus, excluding the hilly area, an area of about 398.66 sq.km out of the total geographical area of 579.50 sq.km of Deola taluka is having depth to water level of more than 5 m bgl.

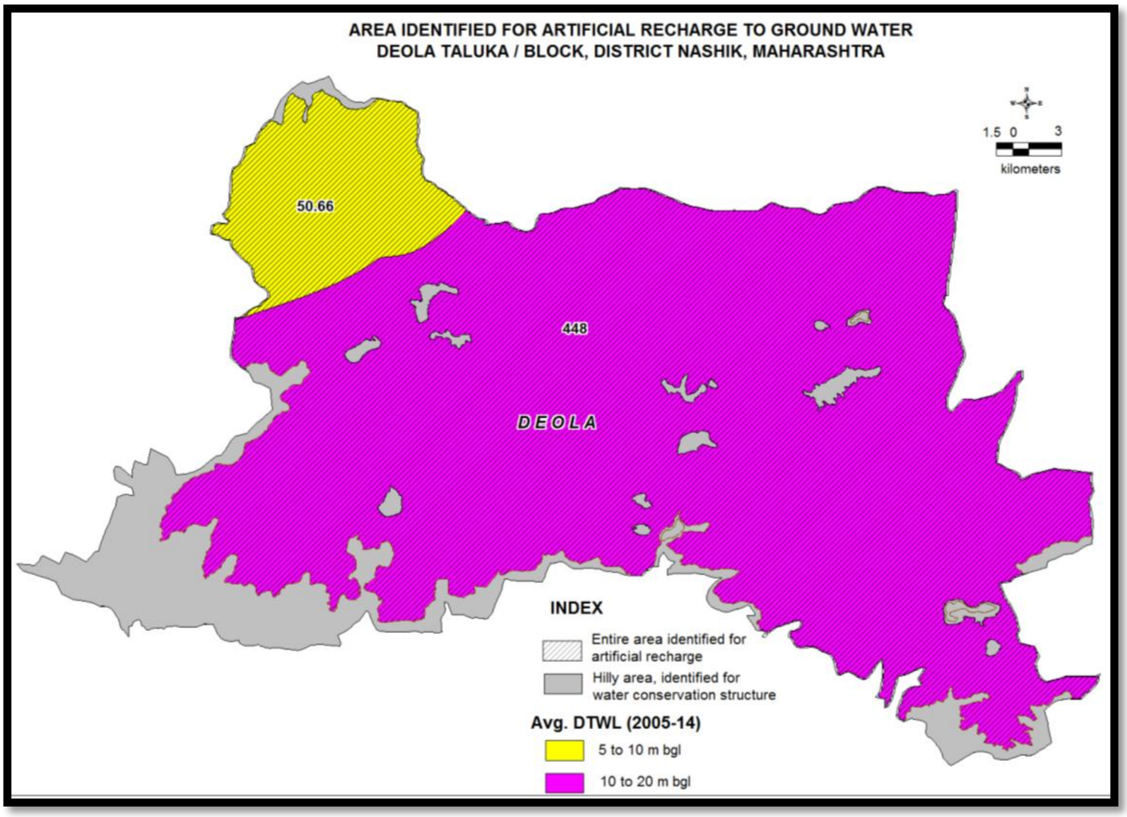


Fig 6: Average Decadal Post-monsoon depth to water level, Deola Taluka

The long term water level trend map for the period 2005-2014 has been prepared and is shown in **Figure 7**. Both the rising water level trend of 0.0 to 0.2 m/year and falling water level trend between 0.0 and 0.6 m/year are observed in the area. The area showing rising water trend has been excluded for taking up artificial recharge measures in the area and the area showing falling water level trend is only considered and recommended for artificial recharge to groundwater in Deola taluka **(Fig 7).**

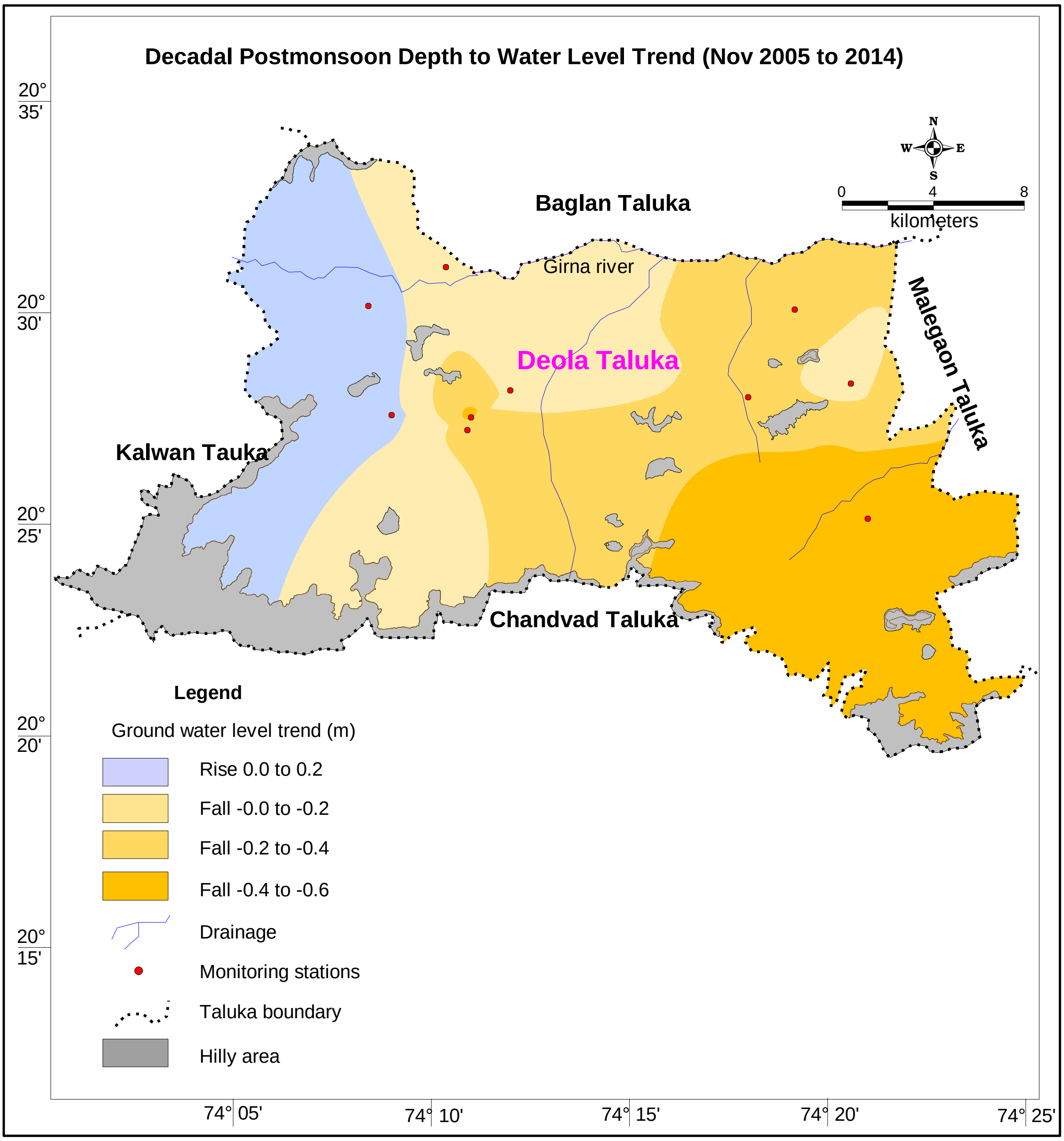


Figure 7: Map showing long term post monsoon water level trend (2005-14)

Based on the data available on depth of weathering form key wells established during the various hydrogeological studies in the area and also groundwater exploration data, a map showing area under various categories of depth of weathering has been prepared and considered for preparation of artificial recharge plan **(Fig. 8)**. The map reveals that most of the area of Deola taluka is having sufficient thickness of weathered zone varying from 10 to 35 m and therefore found feasible for artificial recharge to groundwater. Some of the area of

Deola taluka in its northern part is also traversed by few lineaments (**Figure 9)** indicating promising scope for artificial recharge in that area.

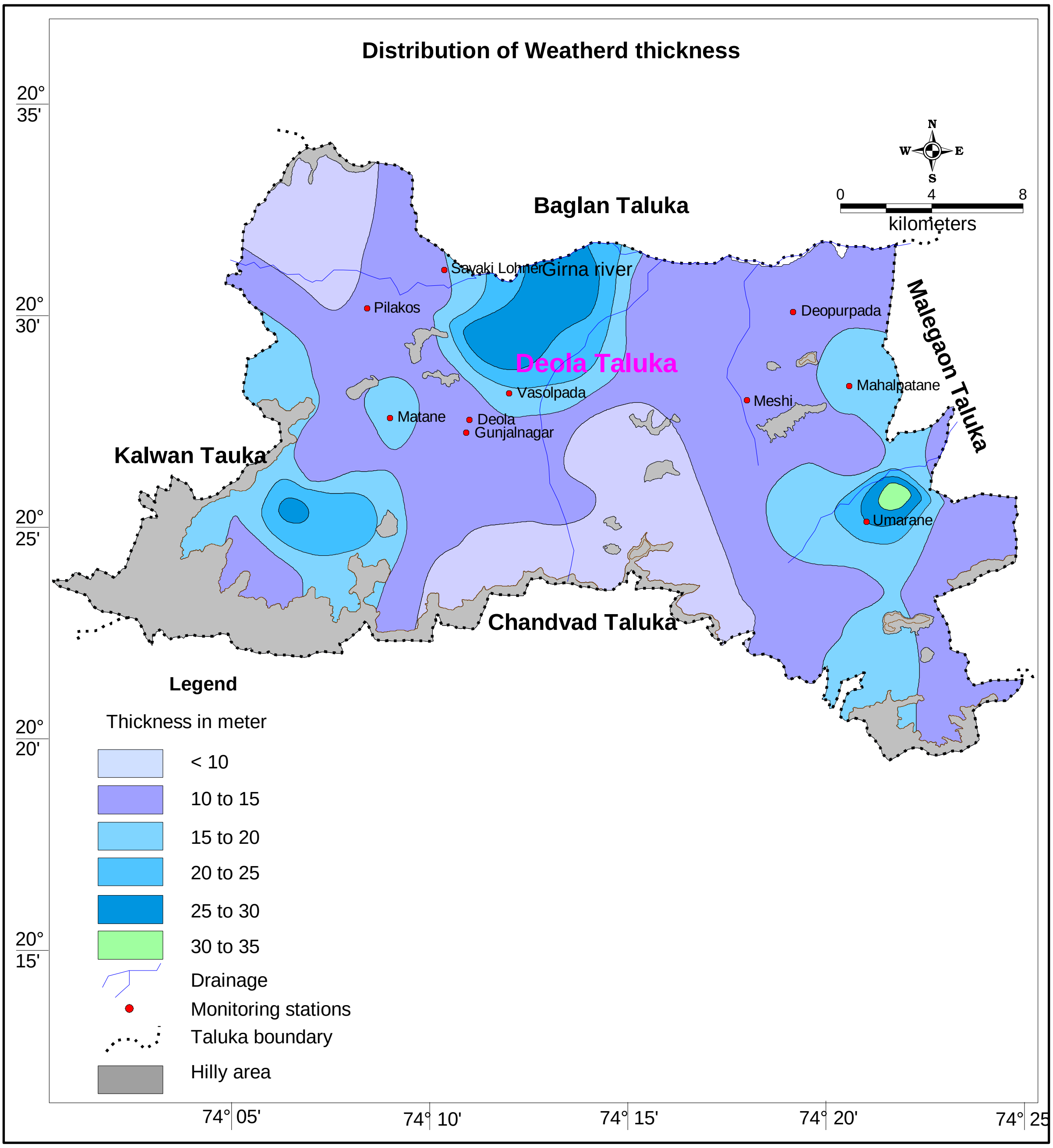


Figure 8: Map showing weathered thickness in Morshi taluka

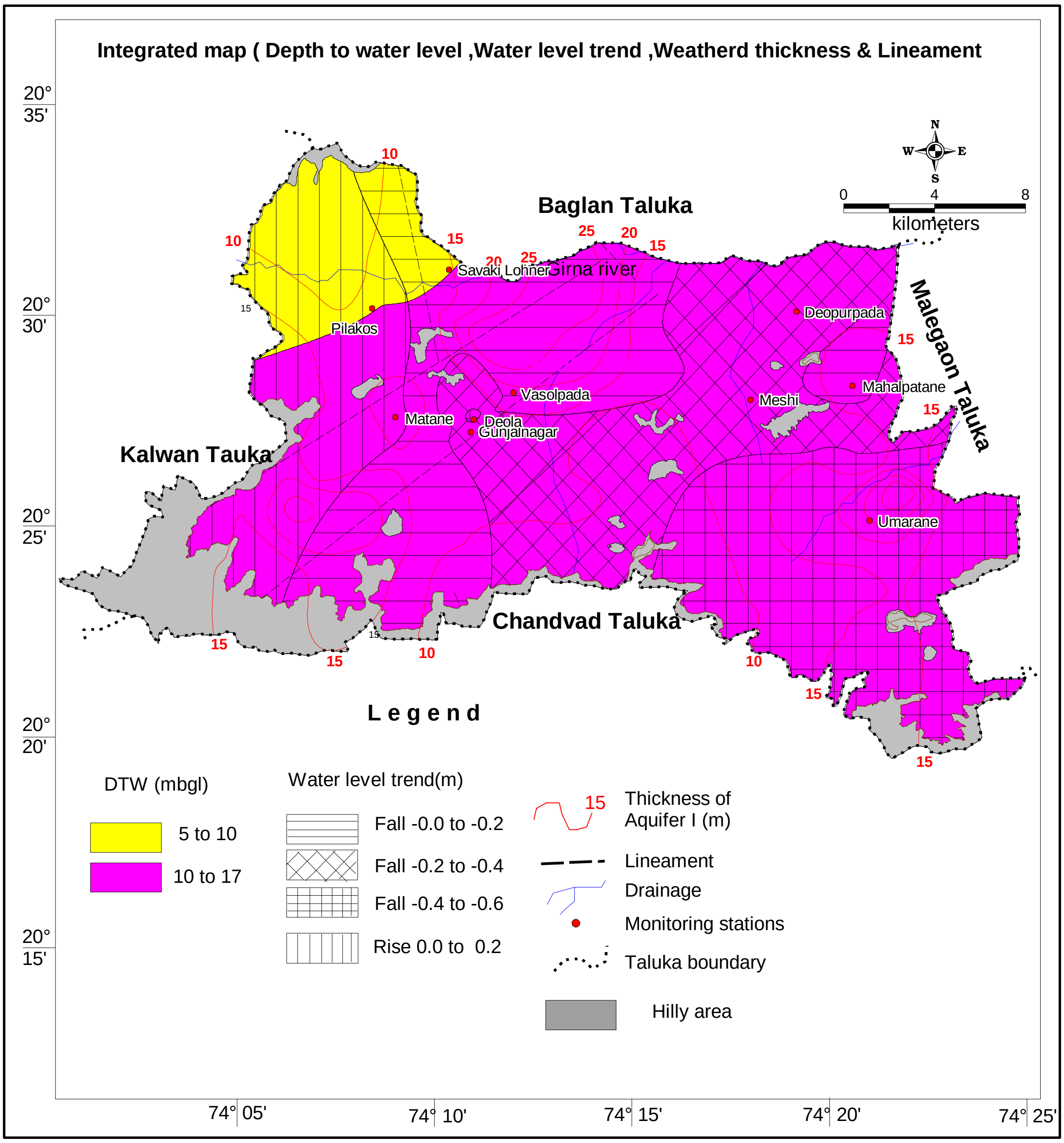


Figure 9: Integrated Map showing feasible area for artificial recharge to groundwater in Morshi taluka

An integrated map containing all the layers i.e. depth to water level, water level trend and weathered thickness, lineaments is prepared and is shown in **Figure 9**. Based on the map, an area of 358.74 sq.km is identified for artificial recharge to groundwater.

12. AVAILABILITY OF SURPLUS SURFCE WATER FOR ARTIFICIAL RECHARGE OR CONSERVATION

The availability of non-committed surplus runoff as source water is one of the main requirements for any artificial recharge scheme. In India in general and Maharashtra in particular, the monsoon rainfall is the chief source of water which can be utilized for artificial recharge. Normally the surplus / non-committed monsoon runoff can be utilized as source water for artificial recharge scheme.

The rainfall received during northwest monsoon between June and September is the principal source of water in the state of Maharashtra. The actual availability of surface water in the area depends upon the rainfall incidences, climate, Physiography, land use and hydrogeology. These components vary drastically in space and time and is not uniform in the state of Maharashtra. Therefore basin and sub-basin wise availability of water and its utilization status is considered to depict the realistic scenario of source water availability. For this purpose the hydrological data available with the state government was collected and compiled basin wise for Godavari, Krishna and Tapi basins.

Deola taluka of Nashik district falls in Tapi river basin. The total geographical area of Tapi basin is 51,940 sq.km and it has the surplus surface runoff of 1240 MCM. The per sq.km availability in the Tapi basin comes out to be 0.0269 MCM. Thus the proportionate surplus surface water availability for Deola taluka which forms part Tapi basin comes out to be 8.564 MCM. For estimation of volume of water to be utilised for recharge, 70% of surplus water availability has been considered. Thus about 6.00 MCM surplus surface water can be considered for preparation and implementation of master plan for artificial recharge in the over-exploited Deola taluka and for estimation of number of structures required for augmentation of groundwater resource in the area. The estimated availability on surplus surface runoff in Deola taluka is finalised in consultation with the State Government and hence confirmed for taking up artificial recharge measures in the taluka.

13. FEASIBLE ARTIFICIAL RECHARGE / CONSERVATION STRUCTURES

Hydrogeology, Physiography, climatic conditions and source water availability are the major factors which affect the selection of site, dimension of the artificial recharge scheme. The surface spreading techniques consisting of percolation tanks and cement plug/bund/check dam are most appropriate techniques in areas occupied by hard rocks. In alluvial areas i.e. alluvial part of Tapi and Purna basin, the percolation tanks in mountain fronts and recharge shaft in alluvial/bazada zone are the most feasible structures. Accordingly these structures have been recommended for artificial recharge to groundwater. Other structures like continuous contour trenches, gabion structures, nala bunds, village ponds etc. may also be taken up side by side which would be more appropriate for soil and moisture conservation. The underground bandharas or sub surface dykes are ground water conservation structures and hence can be taken up a site specific location to conserve the ground water. Beside this roof top rain water harvesting and storm water harvesting in public parks, play grounds are the most appropriate techniques as in urban areas most of the nala / river carries domestic sewage and non-availability of land for submergence.

Various artificial recharge studies on carried out by CGWB so far in the State of Maharashtra and the findings of the artificial recharges schemes implemented under Central Sector Scheme are highly helpful is preparation of plan for artificial recharge for any given area. The findings of these studies / schemes are considered in formulating the artificial recharge plan and are mentioned below.

- A percolation tank of 100 Thousand Cubic Metre (TCM) capacity (single filling) will actually store 200% more due to multiple fillings during monsoon. This will have gross storage capacity of 200 TCM. However, desilting of percolation tank on regular basis in 1-2 year before the onset of monsoon should be carried out for effective infiltration of stored water into the sub-surface.
- A check dam / cement plug of 10 TCM capacity (single filling) will actually store 300 % more due to multiple fillings in monsoon. This will provide gross storage of 30 TCM for check dam. However, it is also required to be desilted to maintain the storage capacity and recharge efficiency.
- Unlike various water conservation schemes, percolation tank and check dam provide 85% recharge to ground water out of total storage.
- With regard to the amount of surface water considered for planning the artificial recharge, it can be considered that 70 % storage would be through percolation tank and remaining by check dam and other structures.

The number of recharge structures required to store and recharge the ground water reservoir have been worked out as follows

$$\text{No. Of structures} = \frac{\text{Total surface water considered}}{\text{Average gross capacity of Percolation Tank/Check Dam (considering multiple fillings)}}$$

Based on the above field findings, it is proposed to allocate about 70 % of the surplus water for construction of percolation tanks, about 25% surplus water for construction of check dam. The remaining 5% surplus available water is proposed for allocation for construction of various water conservation structures like loose boulder structures, gabbion structures etc. The average recharge efficiency of artificial recharge structure is considered as 85%.

The tentative locations of proposed artificial recharge structures are shown in **Figure 10** and the location of sites are listed in **Annexure – I**. The design of percolation tank and check dam are presented as Annexure-II. However, the final design of the individual structures will be site specific and will be prepared based on the hydrogeological survey in consultation with the implementing agency.

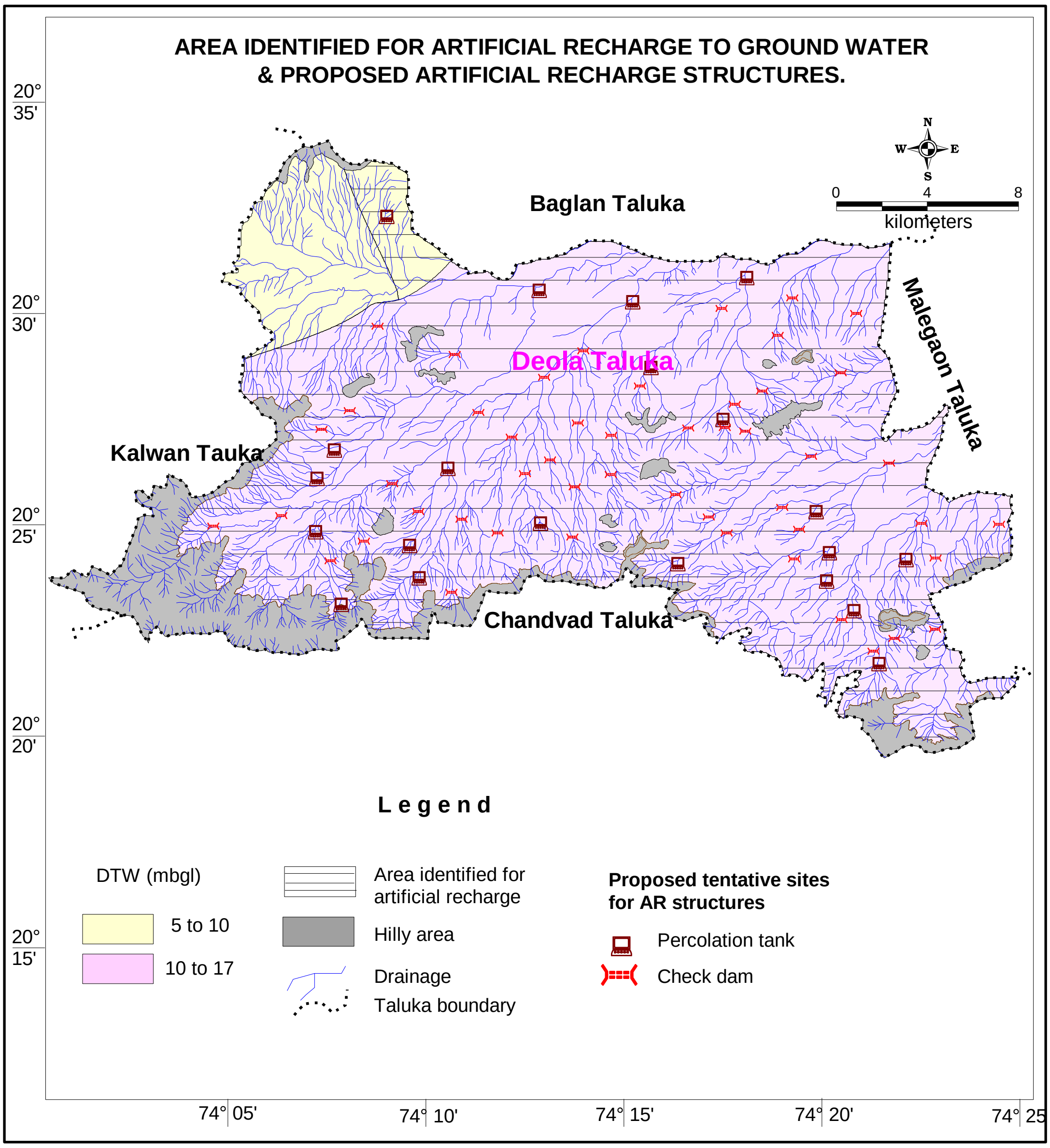


Fig 10: Tentative sites of percolation tanks, check dams and Water Conservation Structures, Deola Taluka

14. TENTATIVE COST ESTIMATES

For estimating the tentative cost for construction of various types of artificial recharge and water conservation structures, schedule of rates **(**SOR) of Government of Maharashtra available for the year 2011 have been considered. In the state of Maharashtra, SOR of each district vary marginally from each other. It is estimated that the total expenditure to be incurred for construction of various water conservation and recharge structures will be

Rs. 20.55 crores (As per 2011 SOR). However, it is likely that the actual cost will vary depending upon the actual period of construction and location of sites which will be finalised after detailed hydrogeological consultation and survey by the implementing agencies.

Percolation Tanks

It is estimated that surplus water available for recharge through percolation tank is 4.20 MCM. Thus about 21 percolation tanks will be required to be constructed in Deola taluka. Considering the recharge efficiency of 85%, it is expected that about 3.57 MCM of surface water shall be recharged .As per the SOR available for the year 2011, it is estimated that for construction of one percolation tank with average gross capacity of 200 TCM, Rs. 70 lakh will be required. Therefore, the total expenditure involved for construction of 21 percolation tanks will be Rs. 14.70 crores.

Check Dams

It is estimated that about 1.50 MCM of surplus was can be made available for recharge through check dams. Hence, it is estimated that about 50 check dam can be constructed to recharge the proportionate allocated surplus water of 1.50 MCM. Considering the recharge efficiency of 85%, it is expected that about 1.275 MCM of surface water shall be recharged into sub-surface. The SOR available for the year 2011 indicate that for construction of one check dam with average gross capacity of 30 TCM, Rs. 7 lakh will be required. Therefore, the total expenditure involved for construction of 50 check dam will be Rs. 3.50 crores.

Water Conservation Structures

After the allocation of surplus runoff water for the major structures like percolation tanks and check dams, the remaining quantum of surplus water can be conserved by means of feasible water conservation structures for soil and water conservation. Thus, about 0.30 MCM of surplus water can be made available for water conservation structures. The feasible water conservation structures in the area are loose boulder structure and gabbion structures. It is estimated that about 20 number water conservation structures will be required to tap the 0.30 MCM of surplus runoff water. Considering the efficiency of 85%, these structures can conserve and recharge about 0.255 MCM of runoff water. These structures can be constructed on lower order streams i.e. streams of 1^{st} and 2^{nd} order. As per the SOR 2011, an approximate expenditure of Rs. 25,000 will be required for construction of one water conservation structure. Therefore the total expenditure involved for construction of 6 water conservation structure will be Rs. 0.05 crores.

Roof Top Rain Water Harvesting

In this first phase, it is proposed to take up roof top rain water harvesting measures in the urban households of Deola Taluka. As per census 2011, there are about 28865 households in Deola taluka. It is assumed that about 10 % of the households i.e. 2887 households may have the average roof area of about 50 sq.m. Therefore, considering the average annual rainfall of 570 mm, average roof area of 50 sq.m and the runoff coefficient of 0.85, the total rainwater harvesting potential generated in the urban households of Deola taluka is about 0.070 MCM.

For taking up roof top rain water harvesting and artificial recharge through individual household, it is proposed to recharge roof top runoff through a recharge pit having dimension of size 1m X 1m and having a depth of 1.50 m. The top 0.6 m portion of the pit will be open for pouring the harvested rainwater whereas the bottom portion of 0.90 m depth shall be filled with boulder, gravel and sand each having a thickness of about 0.30 m.

It is anticipated that about 85% of the harvested water shall be recharged. Thus about 0.059 MCM shall be recharged through adoption of rainwater harvesting in the urban households.

15. TIME SCHEDULE

After the release of funds, the proposed plan can be implemented within a stipulated time of 2-3 years by the implementing agency of concerned State Department, Government of Maharashtra.

Time schedule	Activity to be carried out
0 To 3 months	Finalization of sites for construction of artificial recharge / water conservation structures by the Implementing Agency
4 To 6 months	Finalization of designs / specifications and budget Estimation as per the Schedule of Rates by the Implementing Agency
7 To 20 months	Implementation of the project by the Implementing Agency
20 To 24 months	Preparation of report and report submission
25 To 36 months	Impact Assessment

Annexure - I

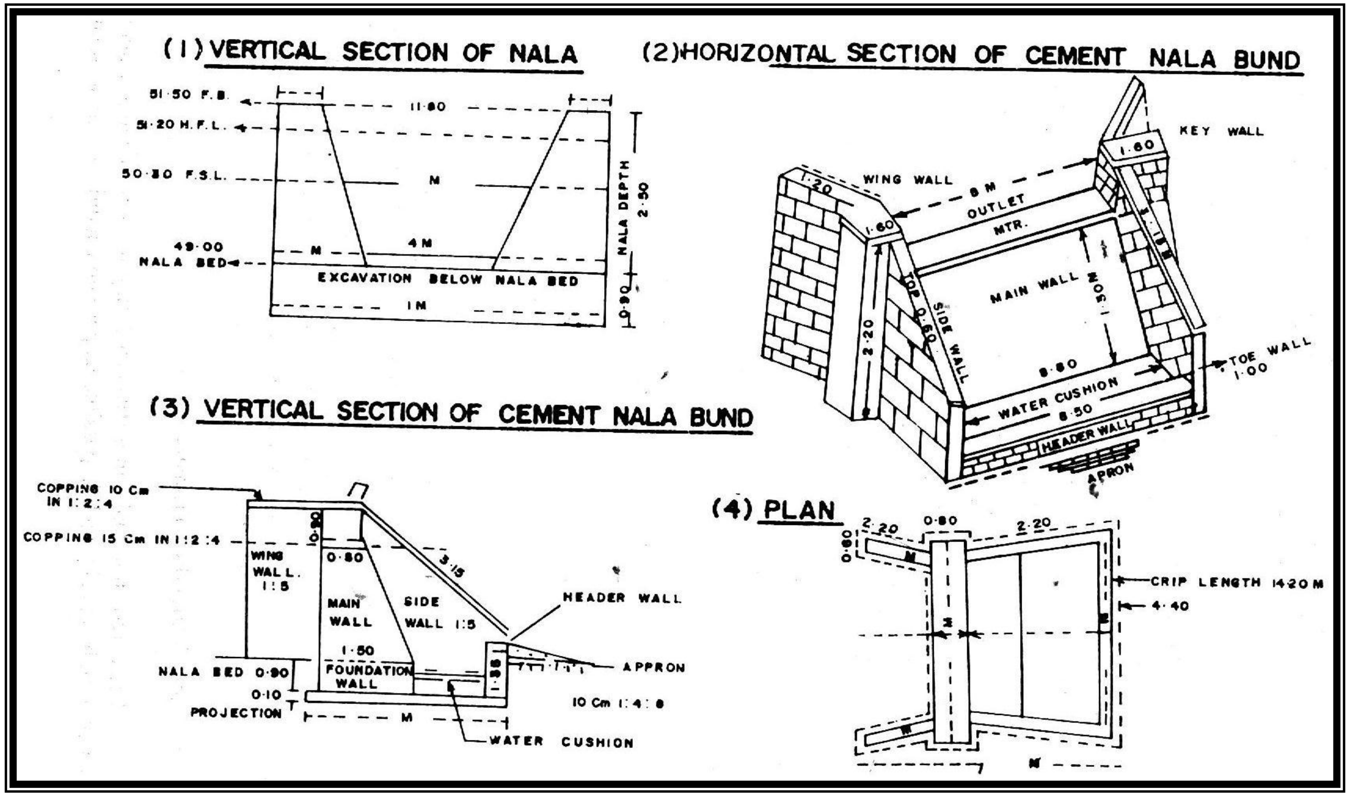
Tentative Locations of Proposed Artificial Recharge Structure in Deola Taluka, Nashik District

S. No.	Village	Longitude	Lattitude	Type of structure
1	Khamkhede	74.122	20.5454	Percolation tank
2	Khamkhede	74.1315	20.5377	Percolation tank
3	Pilakos	74.1092	20.5176	Percolation tank
4	Bagadu	74.1131	20.5035	Percolation tank
5	Bhaur	74.123	20.5025	Percolation tank
6	Kankapur	74.12	20.4152	Percolation tank
7	Bhavade	74.1308	20.3865	Percolation tank
8	Kharde (wakhari)	74.1206	20.4361	Percolation tank
9	Bhavade	74.1596	20.4097	Percolation tank
10	Matane	74.1279	20.4473	Percolation tank
11	Kapashi	74.1637	20.3969	Percolation tank
12	Wakhari	74.2147	20.4186	Percolation tank
13	Giranare	74.3571	20.3631	Percolation tank
14	Tisgaon	74.3684	20.4042	Percolation tank
15	Sangavi	74.3465	20.3839	Percolation tank
16	Sangavi	74.3351	20.3956	Percolation tank
17	Sangavi	74.3363	20.4068	Percolation tank
18	Dahiwad	74.2725	20.4025	Percolation tank
19	Umarane	74.3306	20.4229	Percolation tank
20	Dahiwad	74.2916	20.4594	Percolation tank
21	Khadaktale	74.2612	20.4798	Percolation tank
22	Dahiwad	74.2935	20.4133	Check Dam
23	Kumbharde	74.3553	20.3666	Check Dam
24	Kumbharde	74.3642	20.3718	Check Dam
25	Zadi	74.3812	20.3753	Check Dam
26	Pimpalgaon	74.2295	20.4315	Check Dam
27	Shirsondi	74.4081	20.4168	Check Dam
28	Tisgaon	74.3754	20.417	Check Dam
29	Tisgaon	74.3813	20.4034	Check Dam
30	Umarane	74.324	20.4147	Check Dam
31	Dahiwad	74.286	20.4197	Check Dam
32	Dahiwad	74.272	20.4285	Check Dam
33	Wajgaon	74.1407	20.41	Check Dam
34	Rameshwar	74.1636	20.4217	Check Dam
35	Kapashi	74.1777	20.39	Check Dam
36	Subhashnagar	74.1818	20.4187	Check Dam
37	Wakhari	74.2286	20.4116	Check Dam
38	Shrirampur	74.219	20.4421	Check Dam
39	Dahiwad	74.2446	20.4363	Check Dam
40	Wakhari	74.197	20.4133	Check Dam

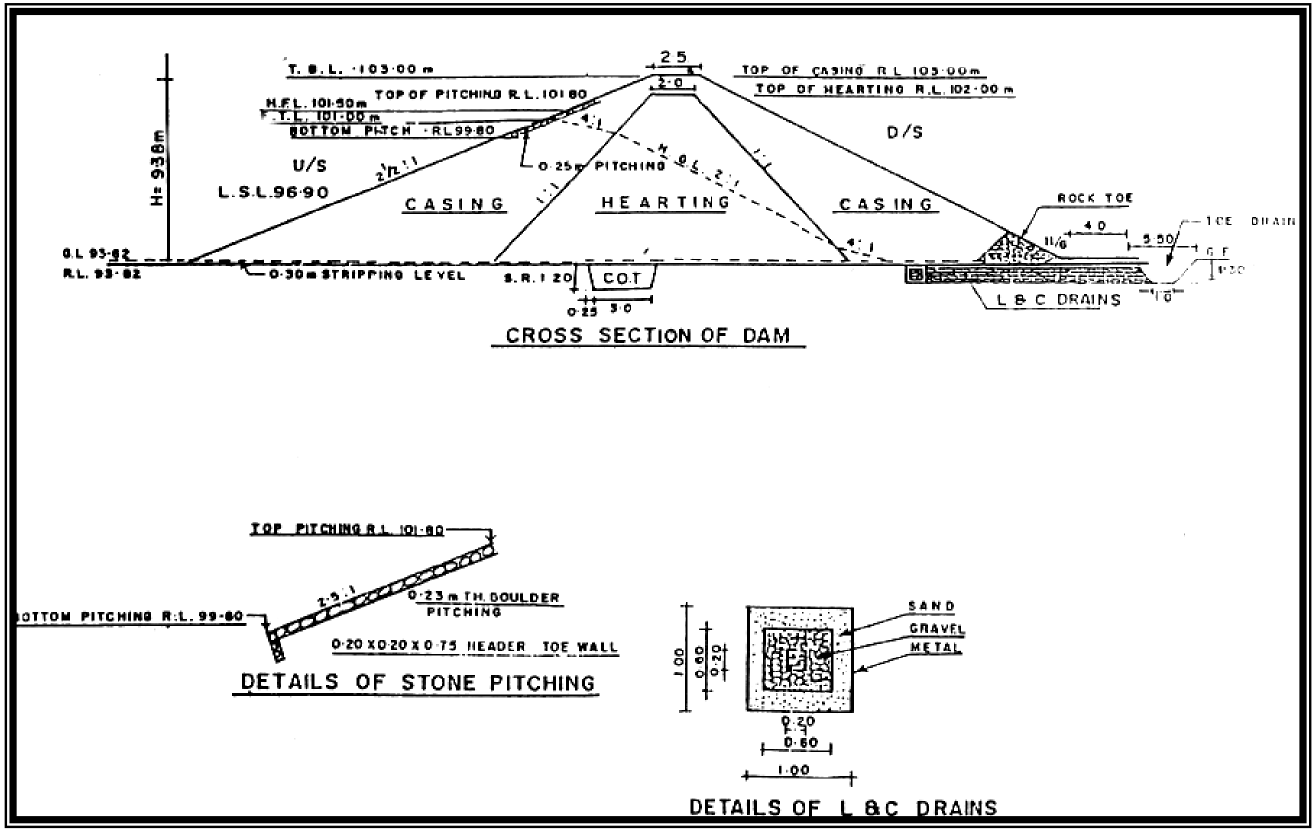
41	Pimpalgaon	74.2448	20.4518	Check Dam
42	Deola	74.189	20.4608	Check Dam
43	Vithewadi (lohoner)	74.1465	20.4948	Check Dam
44	Lohoner	74.179	20.4837	Check Dam
45	Matane	74.123	20.4542	Check Dam
46	Matane	74.1349	20.4615	Check Dam
47	Chinchavad	74.348	20.4998	Check Dam
48	Mahalpatane	74.3211	20.506	Check Dam
49	Dahiwad	74.2969	20.4641	Check Dam
50	Dongargaon	74.3149	20.4912	Check Dam
51	Meshi	74.2569	20.4712	Check Dam
52	Dahiwad	74.2773	20.4547	Check Dam
53	Dahiwad	74.2927	20.4548	Check Dam
54	Shrirampur	74.203	20.451	Check Dam
55	Rameshwar	74.1527	20.4328	Check Dam
56	Umarane	74.3169	20.4233	Check Dam
57	Pimpalgaon	74.2309	20.4566	Check Dam
58	Dongargaon	74.3413	20.4765	Check Dam
59	Mahatma Fule Nagar	74.3083	20.4693	Check Dam
60	Mahatma Fule Nagar	74.3013	20.4534	Check Dam
61	Chinchave (nimbait)	74.3219	20.4031	Check Dam
62	Kumbharde	74.3418	20.3791	Check Dam
63	Wadali Wakhari	74.1267	20.4023	Check Dam
64	Deopurpada	74.2913	20.5019	Check Dam
65	Khuntewadi	74.2331	20.4851	Check Dam
66	Kharde (wakhari)	74.106	20.4202	Check Dam
67	Warshi	74.0775	20.416	Check Dam
68	Mahatma Fule Nagar	74.3289	20.4435	Check Dam
69	Umarane	74.3618	20.4409	Check Dam
70	Shrirampur	74.2086	20.4366	Check Dam
71	Khuntewadi	74.2166	20.4747	Check Dam

Annexure-II

Design of Check Dam

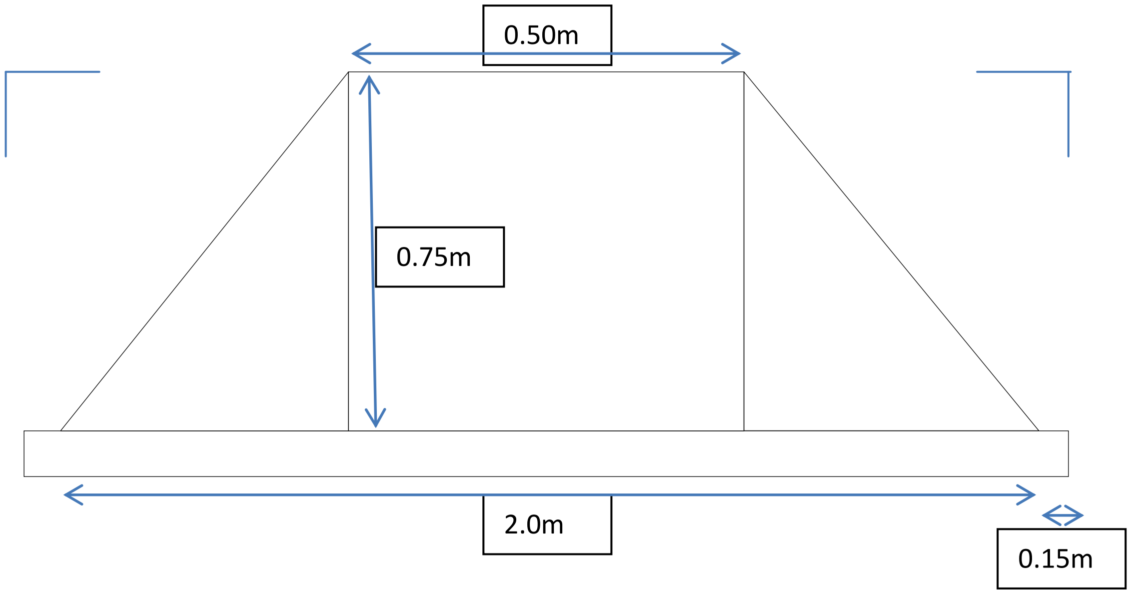


Design of Percolation Tank



DESIGN OF WATER CONSERVATION STRUCTURES

Cross Section of Loose Boulder Structure



Cross Section of Gabbion Structure